MICRO-MOBILITY ENHANCEMENT IN MULTICAST MOBILE IPv6 WIRELESS NETWORKS

By
YONG CHU EU

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science
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Dedicated to
My Loving Parents, My dear sisters and my dear suey lee for their endless care and comfort,
Thank You

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

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Faculty : Engineering

Mobile Internet Protocol version 6 (MIPv6) has been proposed to solve the problem of mobility in the new era of Internet. Mobile IPv6 allows mobile devices always addressable by its home address wherever it is located. Previous research has shown that MIPv6 only defines a means of managing global mobility (macro-mobility) but does not address local mobility (micro-mobility) separately. Instead, it uses the same mechanism in both cases. This involves long handover delay and a lot of signaling.

In this thesis, focus is given on a micro-mobility based test-bed evaluation experiment with improved handover scheme. This proposed handover scheme is the enhancement of the existing Mobile IPv6 protocol, it integrates hierarchical concept and multicast function. Hierarchical design was used to totally shield the micro mobility from macro mobility in order to reduce location update signal and signaling traffic within micro level network while multicasting is used to send packets to Mobile Node (MN) through base stations that are near to MN. This will reduce handover delay that causes packet lost when MN is roaming.

The test-bed is comprised of hardware and software and network analyzer tool to monitor the handover operation. The hardware consists of 5 personal computers to perform the job of one Multicast Router (MR), 2 Access Points (AP), one Home Agent (HA) and one Correspondent Node (CN). A notebook is used as the Mobile Node (MN) This test-bed is used to analyze the Mobile IPv6 handover delay, packet delay and packet loss in real wireless environment. Since results were gathered from real environment, so wired and wireless media delay were taken into account in our performance evaluation entities. Prior to the test-bed performance measurement, time synchronization of CN (packet generator) and MN (packet receiver) is done with Network Time Protocol (NTP) to ensure the accuracy of the collected data. Two scenarios were measured, which are Mobile IPv6 handover and Enhanced

Mobile IPv6 with multicast function and hierarchical design respectively. Finally, it was shown that the proposed handover scheme reduces the handover delay, packet delay, packet lost and increases the throughput and overall throughput during handover. This gives advantages of zero packet lost and lower handover delay which can significantly improve micro mobility performance on 3rd and 4th Generation mobile telephony and beyond.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

MIKRO BERGERAK PERNAMBAHAN PADA MULTI PENGHANTAR RANGKAIAN TANPA WAYAR PROTOKOL INTERNET VERSI 6 BERGERAK

Oleh

YONG CHU EU

March 2005

Pengerusi : Sabira Khatun, PhD

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Protokol Internet bergerak versi ke-6 (MIPv6) telah dianjurkan untuk menyelesaikan masalah berhubung-kait dengan kebolehgerakan pada protokol Internet versi ke-6. MIPv6 membolehkan peranti bergerak dan boleh dicapai dengan alamat rumahnya tidak kira di mana peranti bergerak itu berada. Kajian lepas menunjukkan bahawa MIPv6 hanya memberi manfaat pada kobolehgerakan makro tetapi tidak pada kobolehgerakan mikro. Ini kerana MIPv6 menggunakan cara yang sama untuk kedua-dua keadaan seperti di atas. Ini mengakibatkan masa pengambilalih yang tinggi dan banyak proses pemberian isyarat. Dalam tesis ini, kami fokus pada kobolehgerakan mikro dengan cara perkembangan dan penghasilan sistem rangkaian eksperimen berdasarkan skema pengambilalih baru. Pengambilalih skema baru ini adalah pengubahsuaian dan perkembangan daripada protokol MIPv6. Skema ini mengintegrasikan konsep hirarki dan fungsi multi penghantar. Kami menggunakan kaedah hirarki untuk menghindarkan kobolehgerakan mikro daripada kobolehgerakan makro untuk mengurangkan lokasi pemberian isyarat dan trafik isyarat pada tahap mikro rangkaian. Multi penghantar digunakan untuk menghantarkan paket kepada titik bergerak (Mobile Node) melalui titik capaian tanpa wayar (Access Point) berdekatan semasa titik bergerak berlayar.

Sistem eksperimen mengandungi perkakasan dan perisian termasuk empat komputer peribadi dan satu komputer riba. Komputer riba digunakan sebagai titik bergerak manakala 2 komputer peribadi sebagai titik capaian tanpa wayar. Tiga buah komputer peribadi yang lain sebagai rangkaian asal (Home Agent), titik pengirim (Correspondence Node) dan multi penghantar penghala (Multicast Router). Sistem ini digunakan untuk menganalisa pengambilalih MIPv6 pada masa pengambilalih, masa paket tiba dan kehilangan paket dalam keadaan tanya wayar sebenar.

Memandangkan kami mengambil keputusan secara eksperimen, oleh itu masa kelambatan wayar dan tanpa wayar diambilkira dalam pengiraan prestasi pemgambilalih kami. Sebelum membuat pengiraan prestasi, masa di titik pengirim (penghasil paket) dan titik bergerak diselarikan dengan Protokol Rangkaian Masa (Network Time Protocol) supaya maklumat yang diambil adalah tepat. Kami mengkaji kedua-dua senario, iaitu pengambilalih MIPv6 and MIPv6 dengan konsep hirarki dan fungsi multi penghantar. Kesimpulannya, skema pengambilalih baru ini dapat mengurangkan masa pengambilan, masa ketibaan paket serta kehilangan paket dan menambahkan daya pemprosesan secara keseluruhan. Ini memberi manfaat dengan sifar kehilangan paket dan masa pengambilalih yang rendah di mana boleh digunakan untuk memperkembangkan prestasi kobolehgerakan mikro pada teknologi telefon bergerak pada generasi ketiga and keempat atau seterusnya.

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I certify that an Examination Committee has met on 10th March 2006 to conduct the final examination of Yong Chu Eu on his Master of Science thesis entitled "Micro-Mobility Enhancement in Multicast Mobile IPv6 Wireless Network" 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:

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

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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.

YONG CHU EU
Date: 15 March 2006

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