



UNIVERSITI PUTRA MALAYSIA

**A RELIABLE UNICAST ROUTING PROTOCOL FOR
MOBILE AD HOC NETWORK**

HADI SARGOLZAEY

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MOBILE AD HOC NETWORK**

By

HADI SARGOLZAEY

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfilment of the Requirements for the Degree of
Doctor of Philosophy**

September 2013

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment
of the requirement for the degree of Doctor of Philosophy

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September 2013

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Faculty: Engineering

Mobile Ad Hoc Network (MANET) is a special and attractive type of new wireless networks. It is an autonomous system that can dynamically be set up anywhere and anytime without using any pre-existing network infrastructure and its mobile hosts are free to move randomly. Host mobility in MANETs causes failure of wireless links between nodes and breaks all the routes that use these links. Consequently, route reconstructions are needed, which is one of the most crucial issues for this type of wireless networks. There are two common solutions to this problem which increase the route reliability (lifetime) in MANETs; increasing the reliability of the links by using more reliable links and multipath route discovery.

In this thesis, both these schemes are used to develop a reliable unicast routing protocol for MANETs. As the first step, an efficient cross layer link reliability metric is proposed for reliable link selection. Simulation results show that by using this link reliability metric in route discovery, route reliability is increased with higher efficiency in comparison to other link reliability metrics. Next a reliable position based clustering routing protocol is designed. In this protocol the mobile nodes form disjoint sets of clusters, and for increasing the stability of these clusters, the aforementioned cross layer link reliability metric is used for cluster formation. A route is constructed and represented by a sequence of clusters and more reliable links are selected for data transfer inside and between the clusters. Because of the multiple links which usually exist between the clusters, multipath route scheme is used in this routing protocol in addition to the reliable link selection. Simulation results show that by using this protocol the lowest number of route reconstructions is achieved in comparison with the other related protocols and we have 79% to 86% reductions in route reconstruction number in different network conditions. It is also shown that the algorithm contributed greatly to reducing control overhead and although we have extra control packets overhead due to the cluster formation and maintenance, we see 27% to 38% control packets overhead reduction in different network conditions.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**A PROTOKOL PENGHALAAN UNIKAST BOLEH PERCAYA UNTUK
RANGKAIAN AD HOK BERGERAK**

Oleh

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Pengerusi: Professor Borhanuddin Mohd Ali, PhD

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Rangkaian Ad Hok Bergerak (MANET) adalah satu jenis rangkaian tanpa wayer baharu yang menarik.. Ia adalah satu sistem berautonomi yang boleh ditubuhkan secara dinamik di mana-mana sahaja dan bila bila masa tanpa menggunakan mana-mana prasarana rangkaian sedia ada dan hos bergerak adalah bebas untuk bergerak secara rawak. Pergerakan hos dalam MANET menyebabkan kegagalan kepada pautan tanpa wayer di antara nod dan menghapuskan kesemua hala yang menggunakan pautan ini. Justeru itu, pembentukan semula halaan adalah diperlukan, ini merupakan salah satu isu kritikal untuk jenis rangkaian tanpa wayer ini.

Terdapat dua penyelesaian lazim untuk masalah ini, yang meningkat kemantapan hala (jangka hayat) dalam MANET; meningkatkan kemantapan pautan dengan menggunakan pautan mantap dan penemuan hala berbilang laluan. Dalam tesis ini,

kedua-dua skema ini digunakan untuk membangunkan protokol penghalaan unikast mantap untuk MANET. Sebagai langkah pertama, pengukuran mantap pautan lapisan bersilang berkesan adalah dicadangkan untuk memilih pautan boleh dipercaya. Hasil simulasi menunjukkan bahawa dengan menggunakan pengukuran boleh dipercaya pautan dalam penemuan hala, kebolehpercayaan hala meningkat dengan keberkesanan yang lebih tinggi berbanding dengan pengukuran kebolehpercayaan pautan lain. Kemudian sebuah protokol penghalaan boleh percaya berasaskan kedudukan adalah direka. Dalam protokol ini, nod bergerak membentuk set kluster tak bersambung, dan untuk meningkatkan kestabilan kluster ini, metrik kebolehpercayaan bersilang lapisan pautan digunakan untuk pembentukan kluster. Suatu hala dibentuk dan diwakilkan dengan jujukan kluster dan pautan yang lebih boleh dipercaya dipilih untuk memindah data di dalam dan di antara kluster. Oleh kerana pelbagai pautan yang lazimnya wujud di antara kluster, skim berbilang hala digunakan dalam protokol penghalaan ini di samping pemilihan pautan boleh percaya. Keputusan simulasi menunjukkan bahawa dengan menggunakan protokol ini bilangan terendah pembinaan semula laluan dicapai dalam perbandingan dengan protokol lain yang berkaitan dan kita mempunyai 79% kepada 86% pengurangan dalam bilangan pembinaan semula laluan dalam keadaan rangkaian yang berbeza. Ia juga menunjukkan bahawa algoritma menyumbang kepada mengurangkan kawalan atas dan walaupun kita ada paket kawalan tambahan atas kerana pembentukan kelompok dan penyelenggaraan, kita lihat 27% kepada 38% kawalan paket pengurangan overhead dalam keadaan rangkaian yang berbeza.

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I certify that a Thesis Examination Committee has met on 11 June 2013 to conduct the final examination of Hadi Sargolzaey on his thesis entitled "A Reliable Unicast Routing Protocol for Mobile Ad Hoc Network" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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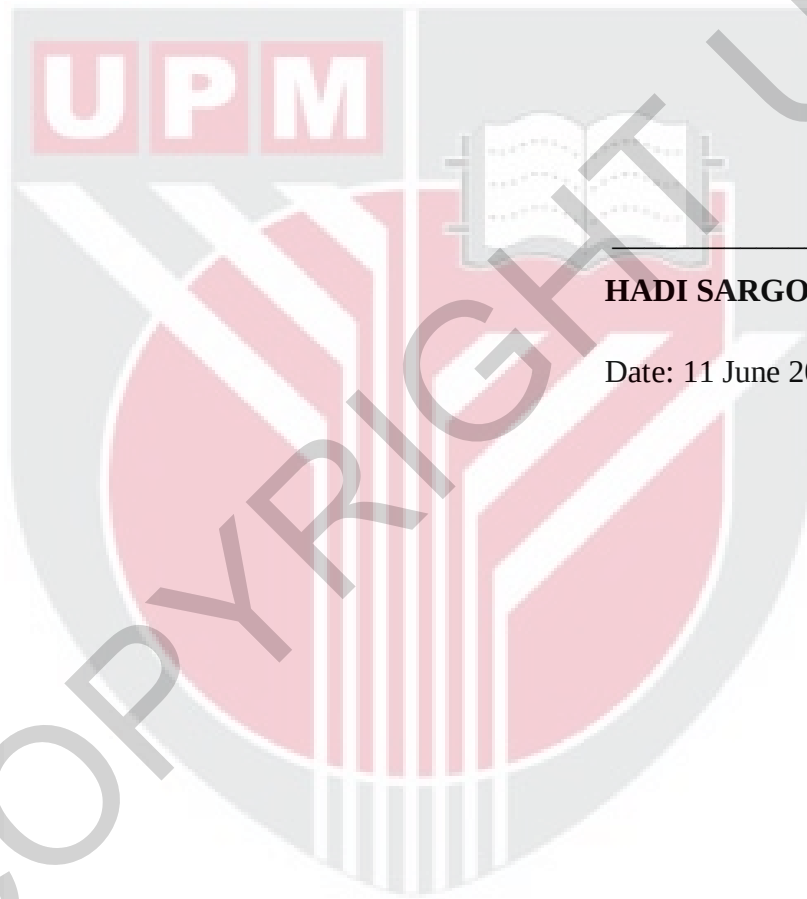
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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



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Date: 11 June 2013

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