IMPROVING ADAPTIVE QUALITY OF SERVICE FOR MULTIMEDIA WIRELESS NETWORKS USING HIERARCHICAL NETWORKS APPROACH

By

SARAVANAN KANDASAMY

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

March 2004

To my Parents Mr.Kandasamy and Mrs.Allamalu Kandasamy,
and
my love and best friend Miss Renuga Nagarajan

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

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Chairman : Professor Borhanuddin Mohd Ali, Ph.D

Faculty : Engineering

Multimedia traffic is expected to populate the next generation wireless networks. As in wireline networks, the wireless network must able to provide a guaranteed quality of service (QoS) over the lifetime of mobile connections. Some challenging problems such as user mobility, limited frequency spectrum and shortage of bandwidth, influence the QoS provisioning for the users.

This thesis examines into the issue of delivering a guaranteed quality of service (QoS) for multimedia services in wireless environment. A PhD candidate, Prihandoko have proposed an Adaptive QoS (AdQoS) model to guarantee the delivery of multimedia services. That work have been adopted and extended by means of a hierarchical network approach, calling it as Improved AdQoS model.

The main objective that the Improved AdQoS framework tries to accomplish is to reduce the New Call Blocking Probability (NCBP) and Handoff Call Dropping Probability (HCDP). The key feature of this framework is the integration of the hierarchical network together with the modified Call Admission Control (CAC) algorithm and the bandwidth reallocation scheme. These schemes are developed to control the bandwidth operation of ongoing connections when the system is overloaded depending on the movement speed of a particular user assuming the speed of a mobile user would not be changed throughout the duration of a connection.

The performance of the system is evaluated through simulations of a cellular environment under three different scenarios. Scenario A represents an area with 80% slow speed users and 20% fast speed users, Scenario B represents an area with a population of 40% slow speed users and 60% fast speed users while Scenario C represents an area with 20% slow speed users and 80% fast speed users.

When compared with the scheme proposed Prihandoko in the literature, the simulation results show that our proposed scheme reduces the new call blocking probabilities, the handoff dropping probabilities and reduces significantly the probability of terminating calls.

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

KUALITI PERKHIDMATAN ADAPTIF YANG DIPERBAIKI BAGI RANGKAIAN WAYARLES MULTIMEDIA DENGAN PENDEKATAN RANGKAIAN BERHIERARKI

Oleh

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Trafik multimedia dijangkakan akan digunakan di dalam rangkaian wayarles generasi masa depan. Sebagaimana dalam rangkaian berwayar, rangkaian wayarles juga harus berupaya untuk menyediakan Kualiti Perkhidmatan terjamin sepanjang hayat penyambungan mudahalih. Beberapa masalah yang mencabar di dalam rangkaian tidak berwayar seperti kemudahalihan pengguna, spektrum frekuensi yang terhad dan kekurangan lebar jalur mempengaruhi penyediaan Kualiti Perkhidmatan kepada pengguna.

Dalam tesis ini, isu-isu penyediaan Kualiti Perkhidmatan yang terjamin telah dikaji di dalam rangkaian tanpa wayar bagi perkhidmatan multimedia. Seorang calon Ph.D, Prihandoko telah mencadangkan satu kerangka Kualiti Perkhidmatan Adaptif (AdQoS) bagi menjamin kualiti perkhidmatan penyampaian multimedia. Model tersebut telah digunnakan dan dimajukan

dengan menggunakan pendekatan rangkaian berhierarki serta menamakannya sebagai model Kualiti Perkhidmatan Adaptif yang Diperbaiki (Improved AdQoS).

Objektif utama yang cuba dicapai oleh kerangka kerja Kualiti Perkhidmatan Adaptif yang Diperbaiki ialah bagi mengurangkan kebarangkalian halangan panggilan baru dan mengurangkan kebarangkalian pengguguran pindah-sel yang minimum. Ciri utama kerangka kerja ini ialah pengintegrasian rangkaian berhierarki dengan kawalan penerimaan panggilan yang diperubah serta skim pengagihan semula lebar jalur.

Skim ini dibangunkan untuk mengawal operasi lebar jalur panggilan semasa apabila sistem mengalami lebihan beban bergantung kepada halaju pergerakkan seseorang pengguna dengan tanggapan halaju sesuatu pengguna itu tidak akan berubah sepanjang jangkamasa sambungan.

Prestasi sistem tersebut dikaji melalui simulasi persekitaran selular di bawah tiga situasi yang berbeza. Situasi A menggambarkan sesuatu tempat yang mempunyai 80% pengguna yang berhalaju rendah dan 20% pengguna yang berhalaju tinggi. Situasi B menggambarkan sesuatu tempat yang mempunyai populasi 40% pengguna yang berhalaju rendah dan 60% pengguna yang

berhalaju tinggi dan Situasi C menggambarkan sesuatu tempat yang mempunyai 20% pengguna yang berhalaju rendah dan 80% pengguna yang berhalaju tinggi.

Apabila dibandingkan dengan skim yang dicadangkan oleh Prihandoko, keputusan simulasi menunjukkan skim Kualiti Perkhidmatan Adaptif yang Diperbaiki yang dicadangkan telah berjaya mengurangkan kebarangkalian halangan panggilan baru dan kebarangkalian pengguguran pindah-sel serta berjaya mengurangkan dengan jelas kebarangkalian penamatan panggilan.

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I certify that an Examination Committee met on 8th March 2004 to conduct the final examination of Saravanan Kandasamy on his Master of Science thesis entitled "Improving Adaptive Quality of Service for Multimedia Wireless Networks Using Hierarchical Network Approach" 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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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.

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