UNIVERSITI TEKNOLOGI MARA

ADAPTIVE RESOURCE ALLOCATION ALGORITHMS WITH QOS SUPPORT BASED ON NETWORK CONDITIONS USING FUZZY LOGIC SYSTEM FOR IEEE 802.11N NETWORKS

BAKEEL HUSSEIN NAJI MAQHAT

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and the result is of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Bakeel Hussein Naji Maqhat
Student I.D No	:	2010488096
Programme	:	Doctor of Philosophy (Electrical Engineering) – EE990
Faculty	:	Electrical Engineering
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Signature of Student : .....

Date : September 2016

ABSTRACT

In wireless local area network (WLAN), the primary concern is Quality of Service (QoS) support that aims to satisfy the diverse service requirements and to guarantee higher data rates allocation for different service classes. However, IEEE 802.11n standard does not specify a scheduling algorithm to guarantee QoS. The performance benefits of existing solutions in MAC layers often fall short of providing the QoS support, particularly, it is still experiencing additional access latency and bandwidth allocation disorder where errors occur, that leads flows backlogged. The aim of this thesis is to develop a fair and efficient packet scheduling and adaptive bandwidth allocation algorithms to support QoS for a diverse service class for A-MSDU aggregation in IEEE 802.11n network. This thesis presents four main contributions for QoS provisioning that are robust, scalable, and can be successfully implemented in WLAN networks. The first contribution is the AMS scheduling algorithm. The aim is to satisfy QoS requirements for time sensitive applications by exploiting the A-MSDU attributes and adopting the idea of enabling selective retransmission in our scheduling algorithm to obtain aggregation with small size to support time-sensitive applications and enable prioritization according to the QoS requirements of the traffic classes. The second contribution is an efficient bandwidth allocation algorithm for A-MSDU aggregation called Adaptive Scheduling based Embedded Fuzzy (ASEF) system. ASEF system is fully dynamic with fuzzy logic based approach and adaptive deadline-based scheme for various service class traffics. The algorithm employs fuzzy logic control which is embedded in the scheduler. The function is to control and dynamically update the bandwidth required by the various service classes according to their respective priorities, maximum latency, and throughput. The third contribution is to handle the influence of network channel conditions for the transmission process called Dynamic Sensing Mechanism based embedded Fuzzy (DSMF) expert system. The DSMF is an intelligent based system approach to support selective retransmission process and to enhance the performance by means of sensing the network channel conditions and updating the transmission decision. The final contribution is an efficient selection mechanism scheme for contending stations to access the channel called an Access Channel Selection based Fuzzy (ACSF) expert system for WLAN. ACSF can guarante QoS requirements by allowing the real-time station to occupy the medium channel ahead of the non-real-time. The simulation results show the AMS algorithm significantly improves the performance over RSA-MSDU and the standard for real-time traffic in terms of reducing average delay and packet loss up to 56% and 24% respectively. Improving AMS scheduling by introducing ASEF scheme to allocate bandwidth between real time and non real-time traffics.The simulation results show the ASEF algorithm significantly improves the performance of AMS algorithm for about 67% for non real-time traffic and about 10% for real time traffic in term of reducing packet loss ratio; and improve the system throughput up to 54%. The results obtained by ACNF shows that by taking into account the network condition and channel access in building the scheme would increase the performance by reducing the packet loss by 80% on average and increase the system throughput by 15% on average as compared to ASEF.

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