Utility-based Scheduling Frameworks to Provide Efficient Quality-of-Service Differentiation in a Mixture of Real-time and Non-real-time Traffics

Article *in* Journal of Computer Science · July 2015

DOI: 10.3844/jcssp.2015.845.854

CITATIONS
0

READS
92

4 authors:

Olalekan Bello
Blackburn College
6 PUBLICATIONS **7** CITATIONS
SEE PROFILE

Hushairi Zen
University Malaysia Sarawak
58 PUBLICATIONS **159** CITATIONS
SEE PROFILE

Al-Khalid Othman
University Malaysia Sarawak
45 PUBLICATIONS **193** CITATIONS
SEE PROFILE

Khairuddin Ab Hamid
University College of Technology Sarawak
72 PUBLICATIONS **213** CITATIONS
SEE PROFILE

Journal of Computer Science

Original Research Paper

Utility-based Scheduling Frameworks for Efficient Quality-of-Service Differentiation in a Mixture of Real-time and Non-real-time Traffics

[1]Olalekan Bello, [1]Hushairi Zen, [1]AL-Khalid Othman and [2]Khairuddin Abdul Hamid

[1]Department of Electrical and Electronics Engineering, University of Malaysia, Sarawak, Malaysia
[2]University Malaysia of Computer Science and Engineering, Putrajaya, Malaysia

Article history
Received: 28-07-2015
Revised: 17-09-2015
Accepted: 23-09-2015

Corresponding Author:
Olalekan Bello
Department of Electrical and Electronics Engineering, University of Malaysia, Sarawak, Malaysia
Email: lekkibel@yahoo.com

Abstract: This paper proposes a utility-based scheduling framework for efficient differentiation of users' Quality-of-Service (QoS) in a broadband wireless access system involving heterogeneous mixed traffic flows. The utility-based scheduling framework, called Maximum QoS Satisfaction (MQS), is based on three novel Radio Resource Allocation (RRA) techniques; delay-based scheduling policy for Real-Time (RT), minimum-rate-based scheduling policy for Non-Real-Time (NRT) and a throughput-based scheduling policy for Best-Effort (BE) services. Simulation study shows that MQS achieves superior performances in terms of average system throughput and user satisfaction both in single and heterogeneous mixed traffic scenarios, when compared to some existing ones.

Keywords: BWASs, QoS, Utility, Throughput, User Satisfaction

Introduction

Broadband Wireless Access Systems (BWASs) have experienced incredible development in recent decades. Some of the popular networks in this category include the High-Speed Downlink Packet Access (HSDPA) (Forkel *et al.,* 2005), Worldwide Interoperability for Microwave Access (WiMAX) (IEEE Computer Society and Society, 2005) and Long-Term Evolution (LTE) (Dahlman *et al*., 2007) which are all based on Third Generation (3G) and Fourth Generation (4G) technologies.

Although these 3G and 4G technologies are attractive and efficient, they present some challenging issues; one, the wireless channel is characterized by fast-fading due to user mobility, two it must support a wide range of multimedia applications with diverse Quality of Service (QoS) requirements. To overcome the issue of channel fading, orthogonal frequency division multiplexing (OFDM) and orthogonal frequency division multiple access (OFDMA) have been adopted by network standards as the physical layer technology of choice (Rodrigues and Casadevall, 2009).

The need for supporting various traffics in end-to-end transmission makes it inevitable for networks to guarantee the satisfactory provision of the quality of services in wireless links. In resource allocation problems, it is widely accepted that the higher the data arrival rate of a traffic flow, invariably the higher is its average throughput. But in a mixture of diverse traffics, the amount of sharable resources that the users get depends not only on their data arrival rates but also on their QoS constraints. However, when arrival rates are same or slightly different the traffic with the higher priority QoS requirement must be satisfied more. Therefore, a heterogeneous traffic scheduling algorithm must consider the specific QoS requirement of each application in allocating the common network resources. In this study, we propose a Maximum QoS Satisfaction (MQS) utility-based scheduling to allocate common network resources to a mixture of RT and NRT data traffics simultaneously. To achieve this, we designed MQS comprising of three different novel utility functions: a sigmoidal-type utility function for RT, and a diminishing marginal utility function for NRT and BE traffic flows. Each utility function incorporates an appropriate QoS metric (e.g., delay, throughput...) and QoS requirement (e.g., maximum delay, minimum throughput…) in order to ensure each user's QoS satisfaction. The rest of this paper is organized as follows. In section 2, we present some related works. In section 3 the system model and assumptions are discussed. Section 4 proposes a novel scheduling framework based on sigmoid-type utility functions. In section 5, we present the system performances such as average system throughput and user satisfaction. In section 6, we summarize our work.