UNIVERSITI TEKNOLOGI MARA

AN FPGA IMPLEMENTATION OF EXP-BET SCHEDULING ALGORITHM IN LTE NETWORKS

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ABSTRACT

Scheduling mechanism is the process of dynamically allocating radio resources (time and frequency) to User Equipment (UE) that transmits different flows at the same time. It is performed by the scheduling algorithm implemented in the Long Term Evolution (LTE) base station, Evolved Node B. Since the implementation of scheduling algorithm is an open issue in LTE, many packet scheduling algorithms have been proposed by researchers. For instance, various scheduling algorithms which offer several techniques in handling resources to the users have been developed such as Modified Largest Weighted Delay First (MLWDF), Proportional Fairness (PF) and Maximum Rate. This thesis investigates the implementation of the Exponential and Blind Equal Throughput (EXP-BET) scheduling algorithm on the FPGA platform. MATLAB Simulink and System Generator are the tools used for the prototyping. The design using Simulink and System generator can greatly reduce the process cycle from the algorithm to hardware. The metric equation of the EXP-BET algorithm is modelled and simulated using the MATLAB Simulink environment and System Generator tool provided by Xilinx. This design has utilized only 10% of available resources on Virtex-6 device. Then, it is tested on the FPGA using the properties of hardware co-simulation method. The system verification is performed by simulating the hardware co-simulation for the metric value of the EXP-BET metric algorithm and compared against the manual calculation.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

LTE which is denoted as Long Term Evolution was a project started in 2004 by telecommunication organization known as the Third Generation Partnership Project (3GPP) [1]. System Architecture Evolution (SAE) is the resultant of the development of the Third Generation (3G) packet core network evolution known as the Universal Mobile Telecommunication System (UMTS). Whereas UMTS is the evolution from the Global System for Mobile Communications (GSM). LTE is designed for a high speed wireless communication for mobile devices which is up to 10 times the speed of 3G networks. The objectives of LTE are to reduce latency, advanced user data rates, improved system capacity and coverage, better battery lifetime and reduced cost for the operator [1]. Basically, LTE offers greatly improved data rates, 100 Mbps for downlink and 50 Mbps for uplink while operating in different bandwidths ranging from 1.25 MHz up to 20 MHz [2]. Current studies have shown that in first quarter of 2016, the number of LTE subscriptions reached 7 billion and it is predicted to reach 3.5 billion by the end year of 2020 which founds about 35 per cent of the total mobile subscriptions [3].

The demand towards real-time services such as video messaging, audio and video streaming, mobile TV and gaming and non-real-time service such as web browsing, E-mail and file downloading is significantly increasing these days especially in wireless networks. As presented in the report by CISCO [4] starting 2016, the annual global IP traffic will exceed the zeta bytes (1000 exabytes) and by 2020, it will reach 2.3 zeta bytes per year.

Quality of Service (QoS) is the most important parameter in order to determine the service quality of the wireless network. Fulfilling the QoS requirements in wireless network is more challenging as compared to the wired networks. This is due to limited radio resources, the time-varying channel conditions and resource distribution among multiple users. Most mobile devices today support multimedia services and legacy mobile services such as voice, short messaging service (SMS) and multimedia messaging service (MMS). The availability of voice and data services now