

Simulation of Class Based Weighted Fair Queue Algorithm on an IP Router Using OPNET

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Abstract

Network traffics and congestion control are becoming complex and critical issue due to the emergence of modern multimedia internet applications. Industries and universities are facing the critical challenges of providing the required internet services demanded by the users. Global and rapid internet access slows down the network performance and degrades quality of service. Efficient scheduling mechanism plays a significant role in the sharing of network resources effectively during the period of congestion. Generally, as part of resource allocation algorithm, each router must implement certain scheduling algorithm that governs the order of packets transmission in a network. In this paper a class-based weighted fair queuing (CBWFQ) algorithm is proposed and simulated along side with first-in-first-out (FIFO) and custom queue (CQ) scheduling algorithms on an IP router using OPNET simulation software. The arrivals and service rate of the applications traffics classes are modelled to follows the poisons and exponential distribution based on Markov-Chain queuing model. The HTTP, FTP, video and voice application traffics are configured in the network environment using the applications and profiles configuration objects. Additionally, discrete event simulations statistic is collected and recorded. Simulations graphs of various scenarios are studied and analyzed critically. Results revealed the efficient performance improvement of the proposed class-based weighted fair queue algorithm compared with the selected traditional queuing scheduling algorithms. In general, in terms of packets loss and queuing delay, the proposed algorithm demonstrated an excellent performance with a very low probability of dropping packets and minimal queuing delay. Overall the study contributed on the use of scheduling algorithm on network router for proper traffic control and management.

Keywords: Algorithm, Markov-Chain, Packets scheduling, Traffic management, OPNET simulator

1. Introduction

Due to the emergence of modern multimedia applications, internet traffics growth instantly. Thus, applications and services are introduced rapidly in the internet that changes the nature of the global internet traffics increase. As predicted by Cisco virtual networking index (Sanjose, 2013) forecast white paper, in the year 2017, there will be almost 3.6 billion internet users in the world; and an estimated of 1.4 zettabytes global internet traffic growth. Network traffic control becomes a critical challenge for enterprises and universities to provide an efficient internet service that satisfies users.

Differentiated services packet-switched network provides quality of service guarantees to different traffic classes in the internet in a scalable manner. In a high-speed network, packet scheduling algorithms controlled congestion by routing traffic to their destinations. Various numbers of researches have been done in the area of quality of service, packet scheduling discipline and computer modelling and simulation (Vijayakumar et al., 2013; Balogh and Medvecky, 2010; Zakariyya and A.Rahman,

2015; Shalangwa, 2014; Kassim and Ismail, 2011; Mohammed et al., 2013).

An implementation of queuing algorithm in multipath dynamic routing studied by (Vijayakumar et al., 2013) contributed in securing voice over IP (VoIP) data transfer. Moreover, simulation of priority based queuing disciplines and their comparison by (Balogh & Medvecky, 2010) using network simulator 2 (NS2) is presented and also explored the impacts of packets scheduling mechanism in maintaining network resources.

Zakariyya (2015) demonstrated the used of scheduling algorithm in providing applications bandwidth guaranteed. The simulated graphical results shows that applications traffic classes are met with their minimum bandwidth requirements. The study by (Mohammed et al., 2013) explained the details implementations of different queuing algorithm using OPNET simulation software. Performance evaluation is presented clearly and investigated. According to the study by (Kassim and Ismail, 2011), details explanation of the important of internet bandwidth is presented. In addition, different techniques and methods