UNIVERSITI PUTRA MALAYSIA

TRANSIENT BEHAVIOR OF CHOKE ON VARYING UDP ARRIVAL RATE

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,

in Fulfilment of the Requirements for the Master of Computer Science

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DEDICATIONS

This thesis is dedicated to:

My late father and mother Allahyarham Salleh B. Ismail and Allahyarhamah Bidah Bt. Dollah. To my beloved wife, Pia Dorra Bt Mohamed Kassim and my lovely kids.

Thank you for the support, encouragement and constant love.

Also to my supervisor, Dr. Kweh Yeah Lun

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ABSTRACT

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Master of Computer Science

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Supervisor : Dr. Kweh Yeah Lun

Faculty : Faculty of Computer Science and Information Technology

Abstract: The Transmission Control Protocol (TCP) is the most widely used in the Internet. It provides an end-to-end reliable transmission of packets and works. However, nowadays many of application used User Datagram Protocol (UDP) as their transport protocols. This is because, UDP more suitable for streaming like video and audio and suited for delay sensitive applications and they are just keeping sending packets the packet even though congestion occur. Presence of UDP in internet, lead to congestion occurs when the aggregated demands for a resource exceeds the available capacity of the resource and create a long delay in data delivery, packet loss and queues overflow. Hence, Active Queue Management (AQM) come into this picture in order to resolve these problems. CHOKe is the best scheme to achieve fair share of bandwidth among flows by penalizing unresponsive flows. Most researchers had done analysis on this scheme under steady state and use constant traffic rate and claim that CHOKe is able to bound both bandwidth share and buffer share of UDP traffic on a link. Therefore,

this research going to test CHOKe schemes under transient state by apply UDP traffic rate change over the time. Besides that, a modified CHOKe was developed to enhance a shortcoming of existing CHOKe. A modified CHOKe has shown a 95% confidence interval (CI) under transient state found the results of modified CHOKe are able to reduce 5.16% of capacity link bandwidth utilization compared to original CHOKe.

ABSTRAK

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah sarjana Sains Komputer

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Fakulti : Fakulti Sains Komputer dan Teknologi Maklumat

Abstrak: *Transmission Control Protocol* (TCP) adalah protokol yang paling banyak digunakan secara meluas di Internet. Ia boleh dipercayai dan menjamin penghantaran paket dijalankan dengan baik dari sumber sehingga ke destinasi. Walau bagaimanapun, kebanyakan aplikasi atas talian kini menggunakan *User Datagram Protocol* (UDP) sebagai protokol pengangkutan utama mereka. Ini kerana, UDP lebih sesuai kerana trafik seperti video dan audio memerlukan aplikasi yang mempunyai ciri-ciri seperti *delay sensitive,* kerana mereka hanya terus menghantar paket-paket walaupun berlaku kesesakan pada jalur lebar. Kehadiran UDP di internet, menjurus berlakunya kesesakan yang luar biasa kepada jalur lebar berikutan kadar permintaan dari satu sumber melebihi kapasiti tersedia jalur lebar. Ekoran dari itu, ia akan mewujudkan berlakunya kelewatan penghantaran data, kehilangan paket dan limpahan giliran. Maka, *Active Queue Management* telah dibangunkan untuk menyelesaikan masalah-masalah ini. CHOKe adalah skim terbaik untuk mencapai kesamarataan jebar jalur dapat

dikongsi bersama, disamping dapat menyekat aliran trafik dari sumber tidak responsif. Kebanyakan penyelidik telah melakukan analisis di skim ini di bawah *steady state* dan menggunakan kadar trafik tetap dan mendakwa bahawa CHOKe berkeupayaan untuk memberi berkongsi kesamarataan lebar jalur di antara semua aliran trafik dan *buffer memory*. Lantarannya, kajian ini akan merangka dan menguji CHOKe di bawah *transient state* dengan mengadaptasikan tukaran kadar trafik UDP yang berlainan pada setiap masa. Selain itu, Modified-CHOKe dibangunkan untuk menambahbaik kekurangan sedia ada pada CHOKe. Modified-CHOKe telah membuktikan *confidence interval* (CI) 95% di bawah *transient state* mampu mengurangkan 5.16% penggunaan lebar jalur berbandingan CHOKe asal.

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CHAPTER 1

INTRODUCTION

1.1 Background

Nowadays, internet user has increase rapidly and approximately around 2,802,478,934 users entirely until 31 Dec 2013 as reported by Miniwatts Marketing Group (2014) as shown in Figure 1.1.

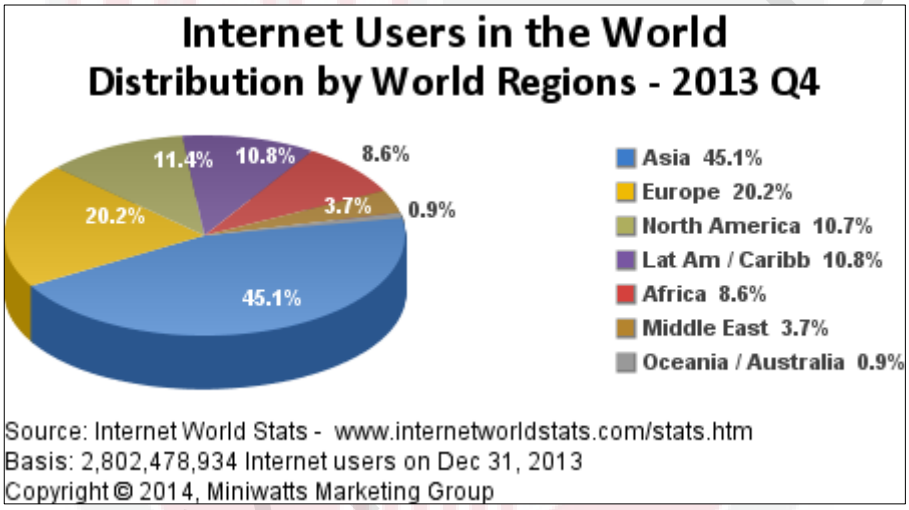

Figure 1.1 Number of Internet Users

Users might experience slow responses from transaction on the internet, but they do not really care what protocol running behind their transaction. On the other hand, programmers have to know what protocol suitable for them in order to ensure their application running smoothly. In General, it has two major protocols over the internet which is UDP and TCP. Most of internet today are based on TCP as reported by Center for Applied Internet Data Analysis (2013), Tsai and Lai, (2008) and Mondal and Luqman, (2007).

Nowadays a lot of applications used UDP as their transport protocol. This is because UDP is well suited for delay sensitive applications and they just keep sending the packet even though congestion occurs. Hence, the number of UDP flows will increase faster, and then extreme unfairness

situation exists among the TCP/UDP flows. These problem lead to congestion occurs when the aggregated demand for a resource exceeds the available capacity of the resource and cause to a long delays in data delivery, packet loss and queues overflow.

In order to resolve the congestion problem, there are two possible approaches. The first approach is end-to-end protocol which is implemented at layer 4. This approach requires all user embed congestion control algorithm in their application. However, because lack of knowledge on how to use this congestion control algorithms and most of real-time application do not need congestion control algorithms then, second approach was proposed.

The second approach is a network mechanism in layer 3. This approach consists of two different techniques which are per-flow fair queuing and active queue management (AQM). Per-flow fair queueing have a complex structure queue and require to stored flow-level state compared to AQM. Besides that, Braden, Isi, Clark, Lcs, and Crowcroft (1998) via RFC 2309 made a recommendation to the Internet community to deploy AQM in router to improve the Internet performance. The Fairness and protection among the flows also very important to ensure traffic flow in a good condition. Throughout this study, we only focus on AQM scheme.

Hence, in this research, AQM will be chosen in order to resolve the congestion problem.

1.2 Problem Statement

CHOKe was introduced by R. Pan, B. Prabhakar (2000) to controls unresponsive flows and Tang, Wang, and Low (2004) was proved that CHOKe able to bound UDP bandwidth and buffer on a link with traffic rate of the UDP flow is assumed constant. However, this assumption is too restrictive, limiting more in-depth understanding of CHOKe. If, this assumption changes to non-constant UDP traffic rate, it is unclear whether CHOKe able to control UDP flows or not.

1.3 Research Objectives

The primary objective of this research is to obtain UDP utilization on congested link and proposed a modified CHOKe schemes. The detailed objectives are as follows:

i. To obtain UDP link utilizations when dynamically changing arrival rate over time using CHOKe.
ii. To improve CHOKe scheme with new approach by introduce new perimeter Average Per Flow called APF for comparing incoming packet with random selected packet from queue.

1.4 Research Scope

This research will focus on existing queue management which is CHOKe scheme with well known queue scheduler FIFO. This research will be conducted in transient state in order to know CHOKe behavior besides to achieve research objectives as mention above.

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