Enhancing Window-Based Congestion Control Algorithm for the Internet

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Certification

This is to certify that Matthew Ojo AYEMOWA with matriculation number LCU/PG/001006 carried out this research work titled "Enhanced Window-Based Congestion Control Algorithm for the Internet" in the Department of Computer Science, Faculty of Engineering and Technology, Lead City University Ibadan, Oyo State for the award of Masters of Science in Computer Science and that this has been previously submitted.

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Dr. A.A Waheed
(Supervisor)

Date

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Dr. Sakpere
(Head of the Department)

Date

Dedication

This Project is dedicated to my Creator for His mercy upon my life, without Him in my life am nothing and to my wonderful Children.

Acknowledgement

I will like to express my deepest gratitude to the Management of Lead City University for given me the opportunity to study in their conducive environment.

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"Even though the above-mentioned Institution and persons have assisted in the process of this research work, I alone stand responsible for the errors, if any, found in the work"

Abstract

The Transmission Control Protocol (TCP) or Internet Protocol (IP) has gone through a number of changes. There have been numerous ideas to alter the mechanisms of TCP congestion control in order to improve its performance. Many research had been done on congestion avoidance and control; however, previous studies on window-based congestion control were mostly based on the starting network, adaptive congestion, and end-to-end mechanisms; however, network overloading will be avoided, and packet losses should be minimized by using the PERC Algorithm. The goal of this study is to develop a Proactive Explicit Rate Control (PERC) algorithm for max-min fair rates that avoids network overcrowding and packet losses through sharing. For max-min fair rates, we devised the PERC algorithm, which can prioritize short flows as needed.

Motivated by the need for fast congestion control, this thesis focuses on a different class of congestion control algorithms, called proactive explicit rate-control (PERC) algorithms, which decouple the rate calculation from congestion signals in the network. The switches and Network Interface Cards(NICs) exchange control messages to run a distributed algorithm to pick explicit rates for each flow. PERC algorithms proactively schedule flows to be sent at certain explicit rates. They take as input the set of flows and the network link speeds and topology, but not a congestion signal. As a result, they converge faster and their convergence time depends only on fundamental" dependency chains," essentially couplings between links that carry common flows, that are a property of the traffic matrix and the network topology. We argue that congestion control should converge in a time limited only by fundamental dependency

Our main contribution is to use PERC Algorithm to control Network Overloading and to equally control packet loss In simulation and on a P4 programmed FPGA hardware test bed, s-PERC converges an order of magnitude faster than reactive schemes such as TCP, DCTCP, and RCP.

Keywords: Congestion Control, Congestion Window, Network Overloading, Network Protocols, Packet Losses.

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