Title	Improvement of Reno's Performance using Conversion Technique into HighSpeed TCP
Author(s)	磯垣, 順
Citation	
Issue Date	2005-03
Type	Thesis or Dissertation
Text version	author
URL	http://hdl.handle.net/10119/1912
Rights	
Description	Supervisor:井口　寧, 情報科学研究科, 修士

Improvement of Reno's Performance using Conversion Technique into HighSpeed TCP

Jun ISOGAKI (310007)

School of Information Science,
Japan Advanced Institute of Science and Technology

February 10, 2005

Keywords: TCP, Socket, Buffer, Flow, RED, Dummynet, HighSpeed TCP, Reno, Performance Enhancing Proxies, Explicit Congestion Notification, Latency, Throughput.

1 Background

Recently, deployment of high-speed network is progressing. In the Internet, TCP/IP which provides a reliable communication and autonomous congestion control is used. TCP/IP used today is based on 4.3 BSD Reno. In Reno's congestion control, operating system applies equation $w = w + (1/w)$ when each packet was acknowledged and applies $w = 0.5w$ when the three duplicate acknowledgement packet was received, where left side of w is next congestion window size, right side of w is current congestion window size. This increasing rate is constant and too small for high-speed network.

Thus, HighSpeed TCP specified on RFC3649 has been proposed for large-bandwidth high-latency network. HighSpeed TCP uses modified equation; increases the congestion window bigger when the packet has been acknowledged and decreases the congestion window smaller when the packet has been dropped. HighSpeed TCP can achieve high-throughput in long-fat-pipe network.

Deployment of HighSpeed TCP has two problem. First problem is that, although deployment of HighSpeed TCP has to replace a host operating system, the replacement needs many costs. Second problem is fairness by simultaneous use. Reno's throughput will be stolen by HighSpeed TCP's flow. Hence, flow conversion mechanism is required for effective operation. In this paper, we propose the proxy conversion mechanism which converts the flow from Reno to HighSpeed TCP and implemented and evaluated this mechanism.

2 Mechanism, Evaluation and Results

The conversion mechanism implemented on this appliance is that sends back premature ACKs, fills up the buffer and send packets on receiver.

We implemented this mechanism onto Supermicro SuperServer 5013G-I with Linux-2.4.20(+altAIMD0.3+web100-2.2.3). To evaluate this mechanism, we used SuperSINET NanoTech VPN which is 1Gbps and RTT 28ms.

In this network, Reno's throuhghput subjected to ten HighSpeed TCP's flow is 70.7Mbps. By inserting conversion mechanism, we observed that the performance of Reno's flow has been improved to 93.0Mbps.

3 Investigation of High-Latency

The mechanism raises the latency. To solve this problem, we analyzed the socket buffer system and Explicit Congestion Notification, ECN system, so we will report on the some experiment and proposed scheme. Although the scheme couldn't improve the latency, we obtain the important analysis to achieve better performance.

Firstly, we supposed that high-latency caused by deep queue and socket buffer. So we tested relation between socket buffer size and latency. Latency is increasing proportion to socket buffer size.

Secondly, we extended ECN mechanism which can notify the ECE signal by application for the operating-system API to limit in-socket packets. Then we inserted ECE signal at certain interval in burst-transfer and we observed that latency is suppressed without throughput decreasing.

Thirdly we limited the appliance's in-socket packet by ECE signal. We tried two methods, first method is sending ECE signal at over limit as DTlike, second method is sending ECE signal at over threshold in proportion to remaining buffer as RED-like. As a result, both in both mechanism, throughput is decreasing and latency is increasing. The reason is that decreasing too large and the number of in-socket packets is 0, then slow-start phase has been started.

So far, we have seen that ad-hoc buffer limitation have no effect to decrease latency and more reliable buffer management mechanism such as per-communication queuing is required.

4 Summary

Firstly, we propose and evaluate the appliance which converts the flow from Reno to HighSpeed TCP. By this appliance, communication throughput using Reno subjected to ten HighSpeed TCP's flow in SuperSINET NanoTech VPN is 32% faster than original Reno'sperformance. Secondly, we analyze the high-latency problem and find out the solution.