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A Study for the High Performance of TCP/IP Congestion Controls

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1 Backgroud and Purpose

TCP which achieves the stream delivery with reliability on the network makes the role important with the development of the internet in recent years.

The improvement of the forwarding performance is measured by doing flow control of the packet in TCP. The foundation is self-clocking mechanism by which the arrival of acknowledgment (ACK) of the transmitted data is assumed to be timing of a new transmission.

Sink mounts delay acknowledgment (Delayed ACK) mechanism which sends the transmission of the packet of the ACK until the timer until a new data transmission happens to reduce the trouble of the forwarding ability of the data as much as possible is started.

However, this mechanism negatively affected the crowding control and a kind of dilemma in the sending side.

Then, the mechanism which controls this Delayed ACK from the sending side is proposed by newly adding the control flag to the TCP header.

2 Evil of Delayed Acknowledgement

"Slow start" , "congestion avoidance" , "Fast Retransmit" and "Fast Recovery" are achieved in the flow and congestion control of present TCP by the research of Jacobson. These confirm the ACK of the transmitted packet, control the congestion window of the sending side, and adjust the amount of the transmission.

Delay acknowledgment (Delayed ACK) of sink is the one that the ability improvement of an original data transfer. That idea was measured by decreasing the transmission of the packet of acknowledgment of the reception of the data as much as possible.

However, compatibility is bad with flow control by which the arrival of the ACK is made a radical. because this Delayed ACK deliberately delays the reply of the ACK,

- added the error to the measurement value of Round Trip Time , it is difficult to detect to condition of that networks.

- delay to TCP's self-clocking mechanism, and makes congesting easy to cause own ACK packets.

- get out of order of algorithm of congestion control, the transfer rates is not increased.

These evil influence is exerted and the improvement of the forwarding performance of TCP is disturbed.

3   Control from sender

Then, I was designed and was implimented new CDL control mechanism to operate Delayed ACK of sink from the sending side.

When the CDL control mechanism is used, the sending side transmits the packet which checks only the CDL flag (without ACK flag). Sink by which the CDL-only flag is received packet as the acknowledgment. The CDL flag and the ACK flag are checked and sink sends the ACK packet back without the delay.

The sending side by which the packet which adheres both CDL-ACK flags is received,it is confirmed that the packet was shuttled without the delay.

I experimented on performance evaluation of the CDL control mechanism by using the customized kernel. The result can control the reply of the reception response from the sending side and the forwarding performance has been improved in case of the case to use a past congestion control algorithm.

It is important that the policy of the sending side puts up the CDL flag. The packet of acknowledgment increases when the CDL control mechanism is used more than the necessity and forwarding the data is hindered reversely. It was confirmed that the forwarding performance was improved by experimenting by the difference of the policy and using the CDL flag when "slow-start" state of sending side.

4   Measurement of accurate Round Trip Time

If the CDL flag is used when RTT is measured, because the influence of Delayed ACK is not included, the measurement value becomes the one that state of network was purely shown.

The grain size in the timer (500ms) on past TCP is too rough. Even if the influence of Delayed ACK is removed by CDL control, an accurate RTT measurement cannot be

used for flow control. Then, the application to a finer congestion control was proposed by measuring more precise milliseconds timer with a clock of the accuracy which the oparating system offered.

5 Past influence on control algorithm

A past flow control algorithm is the one always designed in consideration of Delayed ACK. However, the necessity of a new design was clarified by getting rid of the influence of Delayed ACK by adopting this control mechanism.

6 Conclusion and future plan

In this thesis, it is able to control the Delayed ACK of sink from the sending side.
As a result,

- Removing the influence of Delayed ACK which caused sending side on the congestion control of TCP, it became possible and the forwarding ability was able to be improved.

- Removing the influence of Delayed ACK becoming possible by using this mechanism when RTT was measured and measuring more accurate state of network became possible.

As a problem in the future,

- The influence on the forwarding ability by the operation policy of the control mechanism is analyzed in detail.

- The influence given to past control algorithm and the traffic characteristic is analyzed.

- State of network is observed and the congestion control by which it is reflected in the amount of the transmission is examined.