Comparison of Packets Loss and Packets Delay of TCP and SCTP Using NS2 over Linux Platform

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***Abstract*— Stream Control Transmission Protocol (SCTP) is first designed by IETF as a reliable transport protocol to transport SS7 signalling messages over IP networks. But its advanced features which are not provided by TCP or UDP show that SCTP is able to support a wider range of applications than just for signalling transport. As with TCP, SCTP is a reliable transmission protocol with congestion control and flow control; it is also a connection-oriented protocol with selective acknowledgement. Besides, it is a protocol which improves overall protocol security with four-way handshake association establishment to reduce vulnerability to DOS attacks; it provides framing mechanism and unordered service as UDP to preserve message boundaries; it also provides heartbeat mechanism to keep track of endpoint status and reach ability to detect network error more quickly; especially it is also a multi-homing protocol to improve robustness to failure, its multi-streaming feature or also called partial ordering can provide higher data rate, reduce delay by eliminating the Head-Of-Line blocking problem at the receiver in TCP. The objective of this research are to measure the performance of both TCP and SCTP over a wired network in term of packet loss rate and packet delay in a network environment that has SCTP with TCP traffic, and then compare SCTP and TCP performance results. All experiments have been done through the network simulation NS2. The result indicates that the SCTP traffic had a lowest packet loss rate than TCP traffic under similar conditions. SCTP is best effort because its multi homing and multi association but its packet delivery acknowledgement is time consuming so that SCTP would be more advantages over TCP.**

***Keywords*— *SCTP, TCP, UDP, HTTP, Multihoming, Multistreaming*.**

I. Introduction

This Wired network is a computer network that is used to share data, audio, video and image files among the computers. It is also used to share network resources like printer. The reason of using wired network because it is easy to understand for all new users. The NS2 simulator for designing and studying the wired scenario. NS2 is an open source and freely distributed simulator for the new researcher.

NS2 (Network Simulator, version 2) is a set of object-oriented network simulator, developed by UC Berkeley. It can simulate the real network structure and characteristics in the network structure, there are router, link with the end point in the network's characteristics, have packet delay or packet drop. Put simply, NS2 is a OTcl script interpreter, it is a script written by the user (OTcl Script, describes the simulated network) to interpret, produce simulation results, thus analysis of the results, or through the NAM tool program to simulate the process of visual show, to simulate the situation to gain a better understanding.

II. Transport layer Protocols

SCTP was developed by IETF SIGTRAN Working Group to carry telephony signals on IP from networks like SS7. The main propose of design consideration was to beat the limitations of TCP and SCTP as signaling carrier. Since its close similarities with TCP in clogging and flow control it has undergone a lot of studies and investigations in terms of performance evaluation and judgment with TCP. UDP provides unreliable and untrustworthy datagram service, and relies on the application layer for error control, detection of message repetition, duplication, and retransmission of lost messages. On the other side, TCP gives error and flow control. However, its strict byte order delivery creates performance issues. It also suffers from other downsides as mentioned in. SCTP overcomes some of the limitations of TCP and SCTP also provides a reliable datagram transport mechanism.

SCTP also provides features such as multi stream message passing for performance, cookie mechanism for security, and multi homing for fault tolerance and high availability. The selection of protocols is influenced by the fact that SCTP, TCP and its all variants form one category of protocols (reliable, have flow and congestion control, connection oriented) whereas UDP is a protocol without connection orientation, without flow and congestion control. Thus UDP has minimum of overhead, but retransmissions have to be implemented in application layer which could be a major disadvantage.

So the objective of this research is to measure the performance of both TCP and SCTP over a wired network in term of packet loss rate and packet delay in a network environment.

III. Transmission Protocols Simulations

A. Simulation Setup & Results

To conducting the experiments, a simple simulation has been designed using NS-2 Network simulator. NS-2 is a free software simulator that is very suitable for the protocol simulation. NS-2 is a discrete-time simulator whose development began in 1989 with the development of REAL Network Simulator Probably one of the main reasons for its success is the fact that the distribution has General Public License (GPL) condition that drives the free development of the same. For this work, the latest version a network simulation was NS2-35 installed on Ubuntu 10.10.

AWK is a command/tool available in all the Linux/Unix flavors to do text filtering, manipulation etc. This tool is mainly meant for processing text files and reporting. AWK can be treated as a programming language due to its capabilities such as Arithmetic operations, Binary operations, conditions, loops, functions etc. AWK is an interpreter language.

When using trace-all in NS2, a trace string is created in a trace file.Fig.1 represents the trace file format.

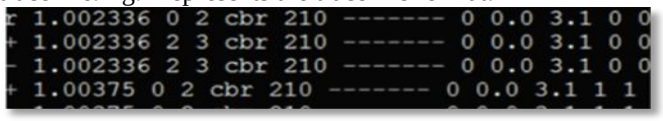

Figure 1: Represent the trace file format.

B. Simulation Scenarios

i. Packets Loss

1. TCP

Network consists of 4 nodes (n0, n1, n2, n3).The duplex links between n0 and n2, and n1 and n2 have 2 Mbps of bandwidth and 10 ms of delay.

The duplex link between n2 and n3 has 1.7 Mbps of bandwidth and 20 ms of delay. Each node uses a DropTail queue, of which the maximum size is 10. Then got the results and generate the graphs shown in fig 2.

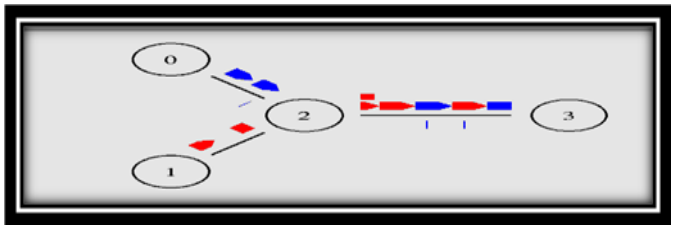

Figure 2: Simulation Topology with TCP Nodes.

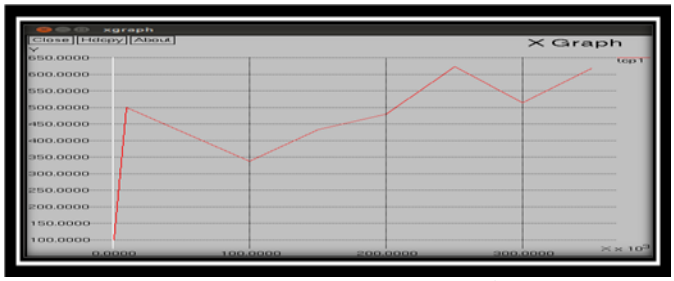

Figure 3: Drop Packet comparison of TCP.

Above x graph represent the Y as packet transmit and X as packet drop in TCP protocol. It respects to increase in TCP data packets, the packet drop ratio also increases.

2. SCTP

Demonstrates Multihoming. One endpoint is single homed while the other is multihomed. They are connected through a router. Shows that can be combined.

The sender is multihomed. The sender has the HEARTBEAT mechanism turned off. In the middle of the association, the sender does a "force-source", which means that the sender forces the source interface used for out going traffic. Then got the results and generate the graphs shown in fig 4.

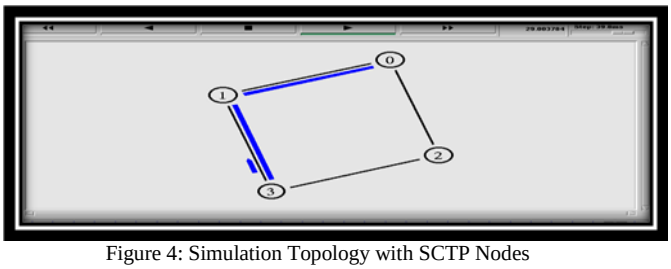

Figure 4: Simulation Topology with SCTP Nodes

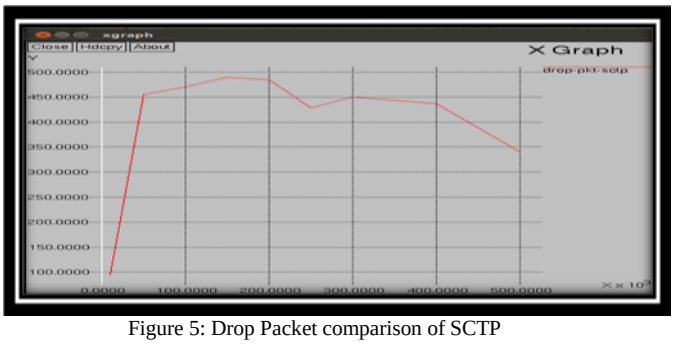

Figure 5: Drop Packet comparison of SCTP

Above x graph represent the Y as packet transmit and X as packet drop in SCTP protocol. It respect to increase the SCTP packets, the packet drop ratio is decrease.

ii. Packets

1. TCP

The packet size is 1000 byte and channel capacity is 2 Mb. The tcl script runs over ns and It create a .trace file and a nam file.

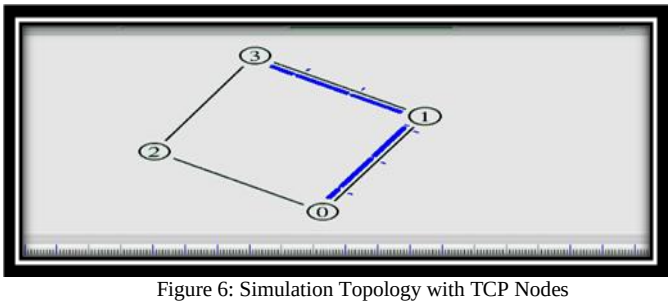

Figure 6: Simulation Topology with TCP Nodes

2. SCTP

The packet size is 1000 byte and channel capacity is 2 Mb. The tcl script runs over ns and the .trace file and nam file is generate then added some .awk script.

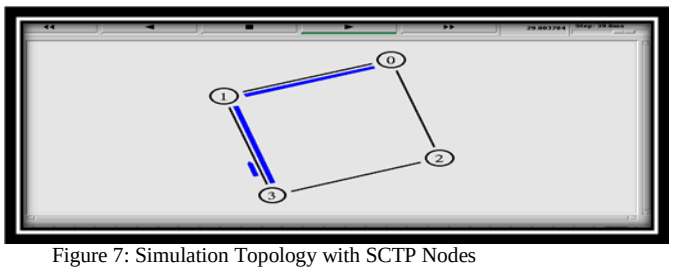

Figure 7: Simulation Topology with SCTP Nodes

IV. Comparison Of TCP And SCTP

This study focused on the SCTP protocol by measuring its performance in the best-effort network, where the network has other protocols like TCP in term of packet loss rate. The packet loss rate of TCP increases as the number of packets in the network was increased with variance of loss rate.

However, SCTP shows more stability as a variance of loss rate per nodes under similar conditions the TCP has.

Figure 8: Show the graphically Drop Packet comparison of TCP and SCTP protocol in Xgraph , that is generate from trace file(.tr).

Following table describe the send, receive packet loss, avg.delay and throughput of TCP and SCTP protocol.

Protocol	Send	Receive	Packet loss	Avg. Delay	Throughput (%)
TCP	712	673	63	1.78	97.33
SCTP	750	693	19	0.67	91.6

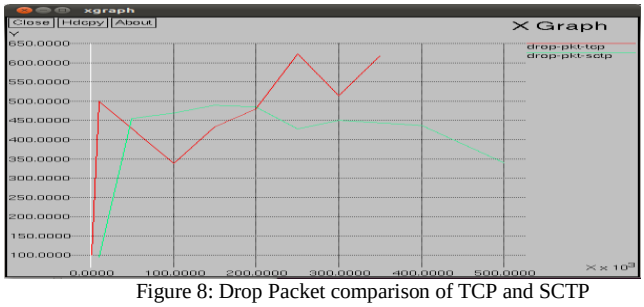

Figure 8: Drop Packet comparison of TCP and SCTP

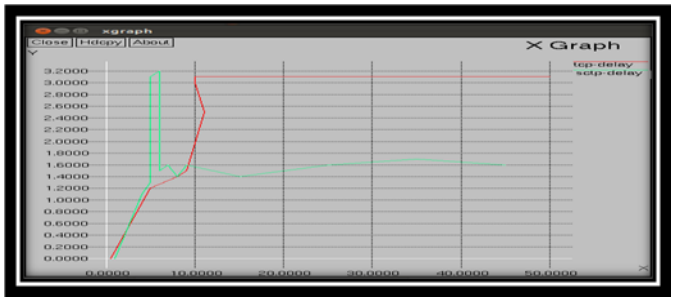

Figure 9: Packet Delay comparison of TCP and SCTP

The above simulations were conducted to compare the performance of TCP and SCTP with traffic analysis the packet size of 1000 bytes and run the simulation with constant bit rates over all transport protocols and the channel capacity 2 Mb.

Figure 9: Show the graphically Packet Delay comparison of TCP and SCTP protocol in Xgraph, that is generate from trace file(.tr).

In TCP Protocol packet delay result is increase but SCTP looks better in this manner.

SCTP is best effort because its multi homing and multi association but its packet delivery acknowledgement is time consuming so that SCTP would be more advantages over TCP.

V. Conclusion

As shown in figure 8, on comparing the results it can be seen that TCP is performing the less good with number of packet loss as compared to that of SCTP.

SCTP is best effort because its multi homing and multi association but its packet delivery acknowledgement is time consuming and researches are required to be done in future so that SCTP would be more advantages over TCP.

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VI. Reference

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