SCTP Sendbuffer Advertisement

A Thesis

submitted by

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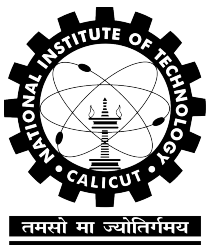
in partial fulfilment for the award of the degree of

Bachelor of Technology
in
Computer Science and Engineering

under the guidance of

Dr. Vinod Pathari



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April 20, 2016

Abstract

TODO: UPDATE Advertising sendbuffer, i.e. the amount of backlogged data present in the sender's buffer has been proposed for TCP and experiments show improvements in application limited flows. This project proposes to advertise the same in SCTP.

Contents

List of Figures

List of Tables

Chapter 1

Introduction

Stream Control Transport Protocol (SCTP) is a reliable transport protocol designed to transport Public Switched Telephone Network (PSTN) signaling messages over IP networks, but is capable of broader applications. Unlike TCP, SCTP offers sequenced delivery of user messages within multiple unidirectional logical channels called streams. Each SCTP endpoint is represented as a set of destination transport addresses, one of which is the primary address. If the primary address becomes unreachable SCTP chooses another destination transport address to route the messages thereafter. This provides network-level fault tolerance and is called multi-homing. It also employs a security cookie mechanism during association initialization to provide resistance to flooding and masquerade attacks.

TODO: Revise this paragraph. Advertising the amount of backlogged data present in the sender's buffer can help network operators evaluate the end-to-end performance of a connection in a better way than that with the existing passive measurements. This information can also be used to infer whether a connection is limited by the network or the application.

1.1 Problem Statement

TODO: Update. To propose a scheme to advertise sendbuffer occupancy information in SCTP, implement it in the Linux kernel and study the performance and security implications of the same.

1.2 Literature Survey

RFC 3286 [7] provides a high level introduction to the capabilities supported by SCTP, while RFC 4960 [8] describes the complete protocol. Agache and Raiciu

[1] propose a scheme to advertise sendbuffer occupancy in TCP. [4] was used to study the state machine employed in the Linux SCTP implementation. It was also used to understand the SCTP packet flow within the kernel. [5] provided with an overview of the traffic control and routing mechanisms in the Linux kernel, along with the userspace tools available for shaping and controlling the traffic.

Chapter 2

Design

2.1 Prerequisite terms

- **SCTP packet** is the unit of data that is passed on to the lower layer protocol. It is composed of a common header followed by one or more chunks.

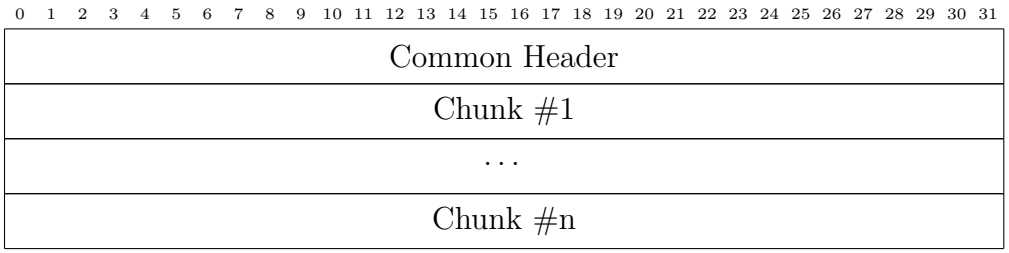

Figure 2.1: SCTP Packet Format

- **SCTP Chunk** is a unit of information within an SCTP packet, containing either control information or user data. It consists of the following fields:

  - **Chunk Type** identifies the type of information contained in the Chunk Value field. The chunk type values 16–62, 64–126, 129, 131, 133–190, 194–254 are currently unassigned[3].

    The highest-order 2 bits of this 8-bit field specify the action that must be taken if the processing endpoint does not recognize the Chunk Type.

    `00` - Stop processing this SCTP packet and discard it.

    `01` - Stop processing this SCTP packet and discard it and report the unrecognized chunk in an 'Unrecognized Chunk Type'.

    `10` - Skip this chunk and continue processing.

`11` - Skip this chunk and continue processing, but report in an ERROR chunk using the 'Unrecognized Chunk Type' cause of error.

– **Chunk Flags** usage depends on the Chunk Type.

– **Chunk Length** represents the size of the chunk in bytes, including the Chunk Type, Chunk Flags, Chunk Length, and Chunk Value fields.

– **Chunk Value** contains the actual information to be transferred in the chunk.

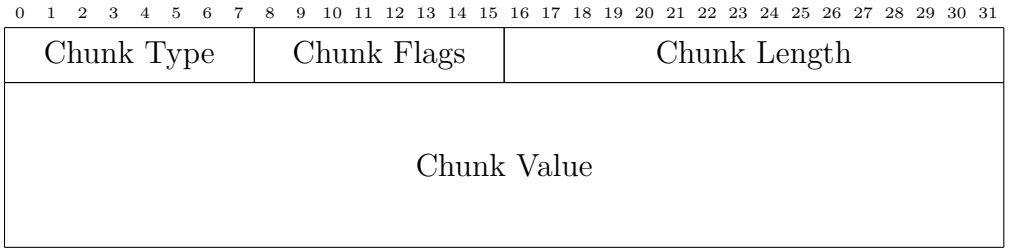

Figure 2.2: SCTP Chunk Format

2.2 Proposed Modification

For advertising the sendbuffer occupancy, we propose to add a new Chunk Type, with a 32-bit Chunk Value field containing the size of the sendbuffer.

To ensure that hosts running an unmodified SCTP stack skip this chunk without returning an ERROR chunk, the highest-order 2 bits of the Chunk Type of this chunk should be `10` (as explained in section 2.1). This limits the choice of the Chunk Type value between 128 and 190.

The total size of this chunk is 8 bytes, which is 0.53% of a typical 1500 byte packet.

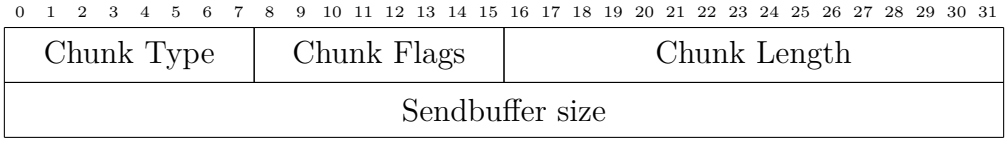

Figure 2.3: Proposed Chunk for sendbuffer advertisement

2.3 Test bed design

A dumbbell shaped network topology is created with 2 routers in the center, and multiple hosts connected to each of the routers.

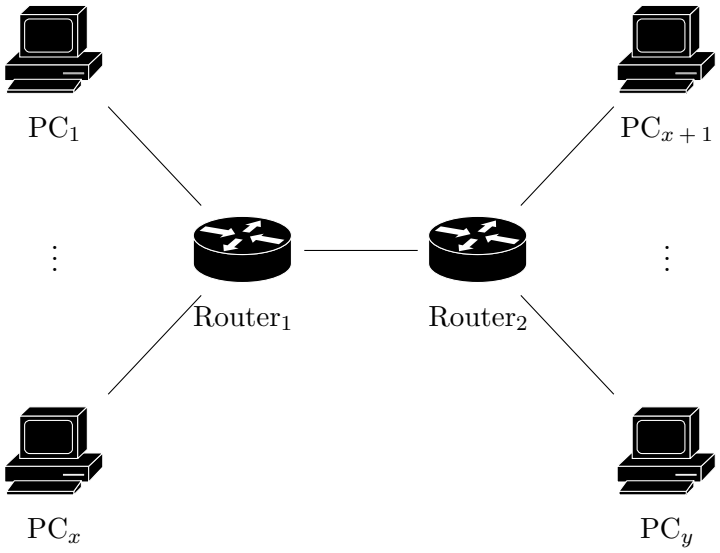

Figure 2.4: Test bed topology

Chapter 3

Implementation

3.1 Kernel Modification

3.2 Test bed Implementation Details

Chapter 4

Results

4.1 Use Case Description

4.2 Test Results

4.3 Explaination of Test Results

Chapter 5

Conclusions

5.1 Possible Quantitative Predictions

Bibliography

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