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AN EFFICIENT SECURITY IN STREAM CONTROL TRANSMISSION PROTOCOL

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Abstract-- The general-purpose transport layer protocol is the SCTP (Stream Control Transmission Protocol) which is providing a service similar to TCP and a set of advanced attributes to employ the enhanced capabilities of the modern IP networks and to assist the increased application requirements. In the current situation, there are SCTP implementations for all major operating systems. The SCTP was standardized as an Request For Comments Request For Comments (RFC) before a decade, there is still momentous ongoing work within the Internet Engineering Task Force (IETF) to standardize advance features in the form of protocol extensions. Here, we introduce the SCTP base protocol and its standardized extensions. After that, we focus on the SCTP standardization progress in the Internet Engineering Task Force and gives an overview of activities and challenges in the areas of security and concurrent multi-way transport.

Keywords*— RFC, IETF, SCTP,TLS,Security Policy Database (SPD).*

I. INTRODUCTION

The SCTP is a connection-oriented general-purpose transport protocol that preserves message boundaries. An SCTP connection is also called as an SCTP association and can be used on top of IPv4 and IPv6. One of the main design goals was efficient transportation of small messages in a network fault-tolerant way and for transport signaling messages. Add-on to that the other feature is TCP impartial. SCTP behave in a impartial way when it competes with TCP traffic. This helps for deploying the SCTP in networks with the traffic in the TCP transportation. Therefore, SCTP adopts the congestion and flow control from the Transmission Control protocol. An SCTP packet consists of a common header and a number of large indefinite quantity. The common header has a fixed length and contains the port numbers, a verification tag, and a checksum. SCTP uses the port number concept similar as the UDP and TCP. The verification tag is used to protect an SCTP Connection against a third party attacker. In the association setup the random number is selected and be given in each and every message of the association. Thus, a third party attacker has to guess this number. The checksum is a 32-bit cyclic redundancy check (CRC32C), which protects the packet against corruption. It is much stronger than the checksum used for UDP and TCP. Modern Ethernet cards provide hardware assist for the computation of the CRC32C in the SCTP packet. A glob has a variable length and consists of a type field, some flags, a length tract, the actual value, and possibly padding which ensures that the total length in bytes of a glob is a multiple of four. Since this generic format is used by all large indefinite Quantity, a receiver can parse a received packet even if it does not assist some of the received glob types. Since how to handle unknown large indefinite Quantity is also defined, the packet format is extensible. User messages are put into DATA large indefinite Quantity, and the other large indefinite Quantity, so-called control large indefinite Quantity, are used for SCTP control information. Small user messages are put into their own DATA-glob, and multiple DATA-large indefinite Quantity are put into one packet. The bundling of user messages allows the multiple messages to send within one SCTP packet. SCTP also assists the fragmentation and reassembly of user messages. If a user message is too large to fit into a single link layer packet, it is fragmented, and several DATA-large indefinite Quantity are sent in different packets to the receiver, which is finally reassemble the message of the user and delivers it.

An SCTP connection is typically set up using a four-way handclasp. The first packet contains an INIT-glob is responded to a packet that contains an INIT-ACK-glob. It is crystal clear that the receiver of the INIT-glob does not change any state of the transmission or does not reserve any resources. Instead it puts all required information in a cookie, which is part of the INIT-ACK-glob. The receiver of the INIT-ACK-glob extracts the cookie and sends it back in a packet which contains a COOKIE-glob. Finally a COOKIE-ACK-glob finishes the four-way handclasp. The use of this handclasp makes the server resilient against the flooding attacks. This handclasp is protected against the message loss by using a timer-based re-transmission scheme. During this handclasp several parameters are negotiated and the verification tags will be requested by each endpoint, the addresses used by each endpoints are,the number of streams, the assisted protocol extensions, and so on. The format of the INIT and INIT-ACK a large indefinite Quantity is also extensible. An SCTP association of SCTP connections are normally terminated by a three way message exchange based on SHUTDOWN, SHUTDOWN-ACK, and SHUTDOWN-COMPLETE-glob. This is the reliable form of an association tear down.

It ensures that all the user messages are received. In some situations where this is not possible, an SCTP packet with an ABORT-glob is sent, which terminates the association immediately, taking message loss into account.

During the association setup, each SCTP endpoint provides a list of its addresses in the INIT and INIT-ACK-glob to the peer. For security reasons each endpoint first has to verify that the remote addresses really belong to the peer. This path verification uses so-called HEARTBEAT and HEARTBEAT-ACK in large indefinite Quantity. These large indefinite Quantity are also used to monitor remote addresses when no user traffic is sent to them to check their reach-ability. The base protocol used in the multiple remote addresses only for redundancy. This means that it typically sends all user messages to one remote address which is the primary address . If messages have to be re-transmitted due to timeouts, other remote addresses are used for the re-transmission. After a numerous number of consecutive message loss occurs for a particular remote address, this address is considered as unreachable and is not used for user message transport any more until it is reachable again. This simultaneous use of multiple paths for data transfer was a feature that was considered during the initial phase of the SCTP specification. However, there was no known way to realize this in a TCP friendly way at that time.

An SCTP association has a number of unidirectional channels in each direction. Such channels are called as stream. The number in both directions does not need to be the same and can be vary between 1 and 216 [1]. It is negotiated during the process of association setup. SCTP provides in-sequence of delivery for messages only within each stream and not across different streams. If a message of a particular stream is lost, messages of the other streams do not need to be delayed at the receiver until the lost message has been re-transmitted and finally received. Therefore, multiple streams can be used to minimize head-of-line blocking. Multiple DATA-large indefinite Quantity containing messages from the same or different streams can be bundled into a single packet.

II. RELATED WORK

Several approaches are there to provide authentication and encryption for SCTP. The first approach is Request For Comments (RFC) 3436, describing the use of Transport Layer Security (TLS) over SCTP. Despite TLS originally developed for TCP, it can also be used with the SCTP, although there are some limitations, since TLS requires a reliable and in-order transfer. This requires a TLS connection per bidirectional pair of streams with ordered transfer, while unordered transfer as well as PR-SCTP cannot be used. Internet Protocol Security (IP security) is also a possible solution to secure SCTP. Standard implementations of IP security should be able to handle SCTP just as they handles the transport protocols. A modification is described in Request For Comments (RFC) 3554, is required for SCTP's multi-homing features, because the Security Policy Database (SPD) is based on tuples of port numbers and addresses of which an SCTP association would have multiple, one for every path. There have been other suggestions such as secure SCTP and SS-SCTP, but due to difficulties in practical realization, detailed in , the standardization of these approaches is rather unlikely. The latest approach, the SCTP aware the Datagram Transport Layer Security (DTLS) is specified in the Request For Comments (RFC) 6083 [8]. Datagram Transport Layer Security (DTLS) is an version of TLS used for undependable transport protocols. This includes changes in the calculation of the hash based message authentication code (HMAC) allowing each message to be verified independently, and thus tolerate message loss and reordering. Therefore, wayward to TLS over SCTP, with DTLS multiple streams as well as unordered transfer and PR-SCTP are usable. Even so, some adaptations are necessary, because the DTLS cannot protect SCTP's control the large indefinite Quantity, which would be a target for attacks. An attacker could interfere with headers to modify the order of messages or use fake PR-SCTP information to intercept and drop packets unnoticed. To avoid this, SCTP-AUTH has to be used to assure the integrity of exposed information, that is, the DATA large indefinite Quantity containing the DTLS messages and the FORWARD-TSN large indefinite Quantity of PR-SCTP.

III. CONGESTION AND FLOW CONTROL

The SCTP has adopted the mechanisms for congestion and flow control from TCP. Again, the message orientation of SCTP has momentous impact on the implementation of the algorithms. In case of congestion control, the amount of data sent is calculated as the difference between the congestion window and the number of outstanding bytes (the data that has been sent, but not yet acknowledged). The way these outstanding bytes are counted (whether the DATA-glob header is included or not) is not specified in the Request For Comments (RFC) 4960 [1]. In [6], we analyzed the impact of these options on the unbiased towards TCP. Simulation results shown that the DATA-glob headers definitely considered to avoid unbiased toward TCP. Comparing the flow control behavior of various implementations shown that the sending of small messages might exhaust the receiver window before the advertised receiver window in the SACK-glob is reduced to zero, which results in spurious re-transmissions. This is caused by the storing of additional information for each incoming DATA-glob, which is not announced in the advertised receiver window. Reference shows that this discrepancy can be overcome by"telling the truth," that is, matching the size of the advertised receiver window with the real receive buffer.

IV. PROPOSED APPROACH

SCTP conserves message limitations because it is a connection oriented Transport Protocol. The SCTP association can be used in IPv4 and IPv6. The design goals was, efficient transport of small messages in a network fault tolerant way, important for transporting signaling messages. SCTP should behave in a impartial way when it competes with TCP traffic. This is essential for deploying SCTP in networks with TCP-based traffic. Consequently, SCTP adopts the congestion control and flow control from TCP, which is described in more detail later. An SCTP packet consists of a common header and a number of large indefinite Quantity. The common header has a fixed length, port numbers, a verification tag, and a checksum.SCTP uses the port number concept similar as the UDP and TCP. The verification tag is used to protect an SCTP Connection against a third party attacker. User messages are put into DATA large indefinite Quantity, and the other large indefinite Quantity, so-called control large indefinite Quantity, are used for SCTP control information. Small user messages are put into their own DATA-glob, and multiple DATA-large indefinite Quantity are put into one packet. The bundling of user messages allows the multiple messages to send within one SCTP packet. SCTP also assists the fragmentation and reassembly of user messages. If a user message is too large to fit into a single link layer packet, it is fragmented, and several DATA-large indefinite Quantity are sent in different packets to the receiver, which is finally reassemble the message of the user and delivers it.

A. Design of SCTP protocol

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B. Implementation of MD5 algorithm

The MD5 is also known as Message Digest Algorithm. The Message Digest Algorithm is one of the widely used types for the Cryptographic Hash Function. The value produced by it is the 128 bit hash value. But it is expressed in the 32 digit hexadecimal number. It is used to provide security to the networks and its functions. The arbitrary length of a message is taken as the input and the required output is produced. This algorithm is mainly designed for the Digital Signature Algorithms. A huge message is encrypted and then set with a private key with any of the functions such as the RSA.

Sample MD5 key:

0xf4292244	0x432aff97	0xab9423a7	0xfc93a039
0x655b59c3	0x8f0ccc92	0xffeff47d	0x85845dd1
0x6fa87e4	0xfe2ce6e0	0xa3014314	0x4e0811a1
0xf7537e82	0xbd3af235	0x2ad7d2bb	0xeb86d391

C. Congestion control perspective

The congestion control perspective, CMT-SCTP handles each path like an independent TCP flow. While this is useful under the assumption that all paths are disjoint, it introduces impartial process to competing non-CMT flows when multiple paths share a common link breaks. Resource pooling (RP) by handling multiple paths like one big path and applying congestion control accordingly. That is, the congestion window of a path P is adapted with the additive increase, multiplicative decrease (AIMD) behavior of TCP like congestion control, but proportionally to P's share on the total capacity of all paths. A path's capacity is indicated by its current slow start threshold. Multipath TCP applies a similar approach.

D.Performance analysis

- Packet drop ratio
- Reroute transmission

V. THE EXPERIMENTAL DESIGN

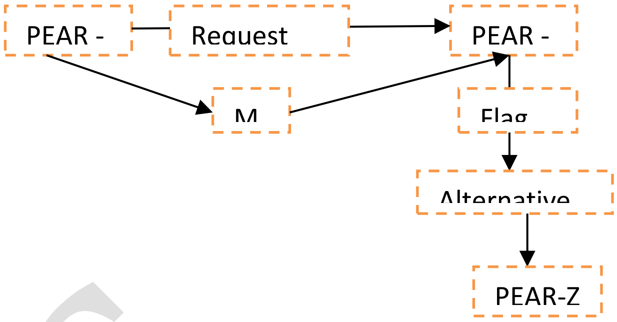

Fig: 1 System's Architecture Diagram

VI. EXPERIMENTAL EVALUATION

The SCTP unordered payload throughput of a scenario with dissimilar paths is depicted in Fig. 4. The setup consists of two paths, A and B, path A with a bandwidth of ρ*A* = 10 Mb/s and path B with a bandwidth of ρ*B* varying from 0.1 to 20 Mb/s; 100-kbyte send buffer, 50-kbyte receive buffer, and 1 ms delay on each path are assumed. The results show the average of 24 OMNeT++/INET simulation runs. Clearly, standard SCTP achieves a throughput of around ρ*A* = 10 Mb/s for using primary path A (curve 1) or ρ*B* Mb/s for using primary path B (curve 2). For plain CMT-SCTP, the expected throughput of around 20 Mb/s is reached at ρ*B* = 10 Mb/s (curve 3; i.e., in the case of similar paths), but the performance highly differs from the expected rate in dissimilar cases. To reach the expected case (i.e. scaling linearly with ρ*B*), two optimizations are necessary:

• Non-revocable selective acknowledgments (NR-SACK) [11] allow a receiver to nonrevokably gap-acknowledge incoming large indefinite Quantity. That is, the sender can remove them from its buffer, although they are not yet covered by a cumulative acknowledgment. This leads to a momentous reduction of the required send buffer size, mitigating transmission blocking due to a full buffer.

• Buffer splitting [12] subdivides send and receive buffers into per-path sections. This mechanism solves blocking issues where certain paths can block the removal of large indefinite Quantity due to waiting for a retransmission. When applying both mechanisms, the achieved payload throughput meets the expectation of ρ*A* + ρ*B* Mb/s (curve 4). From the congestion control perspective, CMT-SCTP handles each path like an independent TCP-like flow. While this is useful under

VII. CONCLUSION

In this paper, we have given an overview of the recent advances in the Internet Engineering Task Force (IETF) standardization process of the SCTP protocol and its extensions. While the core SCTP protocol, including the extensions for partial reliability, glob authentication, and dynamic address reconfiguration, already completed standardization within the Internet Engineering Task Force (IETF) SIGTRAN WG and TSVWG some time ago, there is still a momentous amount of ongoing work within the TSVWG and BEHAVE WG to standardize further enhancements like SACK immediately, stream reset, the socket API, and an SCTP-aware NAT. Also, there is clear interest in CMT with SCTP, which is currently under development by multiple research groups and is expected to dominate SCTP standardization activities in the coming years.

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