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DTLS Encapsulation of SCTP Packets
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Abstract

The Stream Control Transmission Protocol (SCTP) is a transport protocol originally defined to run on top of the network protocols IPv4 or IPv6. This document specifies how SCTP can be used on top of the Datagram Transport Layer Security (DTLS) protocol. Using the encapsulation method described in this document, SCTP is agnostic about the protocols being used below DTLS, explicit IP addresses can not be used in the SCTP control chunks. As a consequence, the SCTP associations are single homed.

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[1.](#) Overview

The Stream Control Transmission Protocol (SCTP) as defined in [\[RFC4960\]](#) is a transport protocol running on top of the network protocols IPv4 [\[RFC0791\]](#) or IPv6 [\[RFC2460\]](#). This document specifies how SCTP is used on top of the Datagram Transport Layer Security (DTLS) protocol defined in [\[RFC4347\]](#). This encapsulation is used for example within the WebRTC protocol suite (see [\[I-D.ietf-rtcweb-overview\]](#) for an overview) for transporting non-SRTP data between browsers. The architecture of this stack is described in [\[I-D.ietf-rtcweb-data-channel\]](#).

Please note that the procedures defined in [\[RFC6951\]](#) for dealing with the UDP port numbers do not apply here. When using the encapsulation defined in this document, SCTP is agnostic about the protocols used below DTLS.

[2.](#) Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [\[RFC2119\]](#).

3. Encapsulation and Decapsulation Procedure

When an SCTP packet is provided to the DTLS layer, the complete SCTP packet, consisting of the SCTP common header and a number of SCTP chunks, MUST be handled as the payload of the application layer protocol of DTLS. When the DTLS layer has processed a DTLS record containing a message of the application layer protocol, the payload MUST be given up to the SCTP layer. The SCTP layer expects an SCTP common header followed by a number of SCTP chunks.

4. General Considerations

An implementation of SCTP over DTLS MUST implement and use a path maximum transmission unit (MTU) discovery method that functions without ICMP to provide SCTP/DTLS with an MTU estimate. An implementation of "Packetization Layer Path MTU Discovery" [[RFC4821](#)] either in SCTP or DTLS is RECOMMENDED.

5. DTLS Considerations

The DTLS implementation MUST support DTLS 1.0 [[RFC4347](#)] and SHOULD support the most recently published version of DTLS, which is DTLS 1.2 [[RFC6347](#)] as of November 2014. In the absence of a revision to this document, the latter requirement applies to all future versions of DTLS when they are published as RFCs. This document will only be revised if a revision to DTLS or SCTP makes a revision to the encapsulation necessary.

SCTP performs segmentation and reassembly based on the path MTU. Therefore the DTLS layer MUST NOT use any compression algorithm.

The DTLS MUST support sending messages larger than the current path MTU. This might result in sending IP level fragmented messages.

If path MTU discovery is performed by the DTLS layer, the method described in [[RFC4821](#)] MUST be used. For probe packets, the extension defined in [[RFC6520](#)] MUST be used.

If path MTU discovery is performed by the SCTP layer and IPv4 is used as the network layer protocol, the DTLS implementation SHOULD allow the DTLS user to enforce that the corresponding IPv4 packet is sent with the Don't Fragment (DF) bit set. If controlling the DF bit is not possible, for example due to implementation restrictions, a safe value for the path MTU has to be used by the SCTP stack. It is RECOMMENDED that the save value does not exceed 1200 bytes. Please note that [[RFC1122](#)] only requires end hosts to be able to reassemble fragmented IP packets of reassembled size of 576 bytes.

The DTLS implementation SHOULD allow the DTLS user to set the Differentiated services code point (DSCP) used for IP packets being sent (see [[RFC2474](#)]). This requires the DTLS implementation to pass the value through and the lower layer to allow setting this value. If the lower layer does not support setting the DSCP, then the DTLS user will end up with the default value used by protocol stack. Please note that only a single DSCP value can be used for all packets belonging to the same SCTP association.

Using explicit congestion notifications (ECN) in SCTP requires the DTLS layer to pass the ECN bits through and its lower layer to expose access to them for sent and received packets (see [[RFC3168](#)]). The implementation of DTLS and its lower layer should provide this support. If this is not possible, for example due to implementation restrictions, ECN can't be used by SCTP.

6. SCTP Considerations

This section describes the usage of the base protocol and the applicability of various SCTP extensions.

6.1. Base Protocol

This document uses SCTP [[RFC4960](#)] with the following restrictions, which are required to reflect that the lower layer is DTLS instead of IPv4 and IPv6 and that SCTP does not deal with the IP addresses or the transport protocol used below DTLS:

- o A DTLS connection MUST be established before an SCTP association can be set up.
- o Multiple SCTP associations MAY be multiplexed over a single DTLS connection. The SCTP port numbers are used for multiplexing and demultiplexing the SCTP associations carried over a single DTLS connection.
- o All SCTP associations are single-homed, because DTLS does not expose any address management to its upper layer. Therefore it is RECOMMENDED to set the SCTP parameter `path.max.retrans` to `association.max.retrans`.
- o The INIT and INIT-ACK chunk MUST NOT contain any IPv4 Address or IPv6 Address parameters. The INIT chunk MUST NOT contain the Supported Address Types parameter.
- o The implementation MUST NOT rely on processing ICMP or ICMPv6 packets. This applies in particular to path MTU discovery when performed by SCTP.

- o If the SCTP is notified about a path change by its lower layers, SCTP SHOULD retest the Path MTU and reset the congestion state to the initial state. In case of a window based congestion control like the one specified in [\[RFC4960\]](#), this means setting the congestion window and slow start threshold to its initial values.

[6.2.](#) Padding Extension

The padding extension defined in [\[RFC4820\]](#) MUST be supported and used for probe packets when performing path MTU discovery as specified in [\[RFC4821\]](#) by the SCTP layer.

[6.3.](#) Dynamic Address Reconfiguration Extension

If the dynamic address reconfiguration extension defined in [\[RFC5061\]](#) is used, only wildcard addresses MUST be used in ASCONF chunks.

[6.4.](#) SCTP Authentication Extension

The SCTP authentication extension defined in [\[RFC4895\]](#) can be used with DTLS encapsulation, but does not provide any additional benefit.

[6.5.](#) Partial Reliability Extension

Partial reliability as defined in [\[RFC3758\]](#) can be used in combination with DTLS encapsulation. It is also possible to use additional PR-SCTP policies.

[6.6.](#) Stream Reset Extension

The SCTP stream reset extension defined in [\[RFC6525\]](#) can be used with DTLS encapsulation. It is used to reset SCTP streams and add SCTP streams during the lifetime of the SCTP association.

[6.7.](#) Interleaving of Large User Messages

SCTP as defined in [\[RFC4960\]](#) does not support the interleaving of large user messages that need to be fragmented and reassembled by the SCTP layer. The protocol extension defined in [\[I-D.ietf-tsvwg-sctp-ndata\]](#) overcomes this limitation and can be used with DTLS encapsulation.

[7.](#) IANA Considerations

This document requires no actions from IANA.

8. Security Considerations

Security considerations for DTLS are specified in [[RFC4347](#)] and for SCTP in [[RFC4960](#)], [[RFC3758](#)], and [[RFC6525](#)]. The combination of SCTP and DTLS introduces no new security considerations.

SCTP should not process the IP addresses used for the underlying communication since DTLS provides no guarantees about them.

It should be noted that the inability to process ICMP or ICMPv6 messages does not add any security issue. The processing of these messages for SCTP carried over a connection-less lower layer like IP, IPv6 or UDP is required to protect nodes not supporting SCTP. Since DTLS provides a connection-oriented lower layer, this kind of protection is not necessary.

9. Acknowledgments

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