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Stream Control Transmission Protocol (SCTP)-Based Media Transport in the
Session Description Protocol (SDP)
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Abstract

SCTP (Stream Control Transmission Protocol) is a transport protocol used to establish associations between two endpoints. This document describes how to express media transport over SCTP in SDP (Session Description Protocol). This document defines the 'SCTP', 'SCTP/DTLS' and 'DTLS/SCTP' protocol identifiers for SDP.

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1. Introduction

SDP (Session Description Protocol) [[RFC4566](#)] provides a general-purpose format for describing multimedia sessions in announcements or invitations. TCP-Based Media Transport in the Session Description Protocol (SDP) [[RFC4145](#)] specifies a general mechanism for describing and establishing TCP (Transmission Control Protocol) streams. Connection-Oriented Media Transport over the Transport Layer Security (TLS) Protocol in the Session Description Protocol (SDP) [[RFC4572](#)] extends [RFC4145](#) [[RFC4145](#)] for describing TCP-based media streams that are protected using TLS (Transport Layer Security) [[RFC5246](#)].

This document defines three new protocol identifiers:

SCTP : to describe SCTP-based [[RFC4960](#)] media streams.

SCTP/DTLS : to describe media streams transported using the Datagram Transport Layer Security (DTLS) [[RFC4347](#)] protocol over SCTP, as specified in [[RFC6083](#)]. DTLS over SCTP provides communications privacy for applications that use SCTP as their transport protocol.

DTLS/SCTP : to describe media streams transported using SCTP on top of the Datagram Transport Layer Security (DTLS) protocol, as defined in [[I-D.tuexen-tsvwg-sctp-dtls-encaps](#)].

The authentication certificates are interpreted and validated as defined in [RFC4572](#) [[RFC4572](#)]. Self-signed certificates can be used securely, provided that the integrity of the SDP description is assured as defined in [RFC4572](#) [[RFC4572](#)].

TLS is designed to run on top of a byte-stream oriented transport protocol providing a reliable, in-sequence delivery like TCP. Since no-one so far has implemented SCTP over TLS, due to some serious limitations described in [[RFC6083](#)], this document does not make use of TLS over SCTP as described in [RFC3436](#) [[RFC3436](#)].

Additionally, this document specifies the use of the 'setup' and 'connection' SDP attributes to establish SCTP associations. These attributes were defined in [RFC4145](#) [[RFC4145](#)] for TCP. This document discusses their use with SCTP.

2. Terminology

In this document, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as

described in [BCP 14](#), [RFC 2119](#) [[RFC2119](#)] and indicate requirement levels for compliant implementations.

3. Protocol Identifier

The following is the format for an 'm' line, as specified in [RFC4566](#) [[RFC4566](#)]:

```
m=<media> <port> <proto> <fmt> ...
```

This document defines three new values for the 'proto' field: 'SCTP', 'SCTP/DTLS' and 'DTLS/SCTP'.

The 'SCTP', 'SCTP/DTLS' and 'DTLS/SCTP' protocol identifiers are similar to both the 'UDP' and 'TCP' protocol identifiers in that they only describe the transport protocol and not the upper-layer protocol.

Media described using an 'm' line containing the 'SCTP' protocol identifier are carried using SCTP [[RFC4960](#)].

The 'SCTP/DTLS' protocol identifier indicates that the media described will use the Datagram Transport Layer Security (DTLS) [[RFC4347](#)] over SCTP as specified in [[RFC6083](#)].

The 'DTLS/SCTP' protocol identifier indicates that the media described will use SCTP on top of the Datagram Transport Layer Security (DTLS) protocol as specified in [[I-D.tuexen-tsvwg-sctp-dtls-encaps](#)]. The actual layer below DTLS can be plain UDP or what ICE agrees on (in the case ICE is used to negotiate the actual transport flow). The lower layer used is identified from the elements present inside the m= line block.

An 'm' line that specifies 'SCTP' or 'SCTP/DTLS' or 'DTLS/SCTP' MUST further qualify the application-layer protocol using an fmt identifier.

An 'm' line that specifies 'SCTP/DTLS' or 'DTLS/SCTP' MUST provide a certificate fingerprint only if the endpoint supports, and is willing to use, a cipher suite with an associated certificate. An SDP attribute (an 'a' line) is used to transport and exchange end point certificate. The authentication certificates are interpreted and validated as defined in [[RFC4572](#)].

4. Media Formats

The SDP specification, [RFC4566], states that specifications defining new proto values, like the SCTP, SCTP/DTLS and DTLS/SCTP proto values defined in this RFC, must define the rules by which their media format (fmt) namespace is managed. Use of an existing MIME subtype for the format is encouraged. If no MIME subtype exists, it is RECOMMENDED that a suitable one is registered through the IETF process [RFC4288] [RFC4289] by production of, or reference to, a standards-track RFC that defines the transport protocol for the format.

4.1. Media Descriptions

The media description change slightly depending on the actual <proto>.

If the <proto> sub-field is 'SCTP' or 'SCTP/DTLS'

the <port> is the SCTP transport port and follows the same active/passive offer/answer model described in [Section 4.1 of \[RFC4145\]](#);

the <fmt> sub-field carries the same port number value specified in the <port> and the mandatory SDP "sctpmap" attribute contains the actual media format within the protocol parameter.

```
m=application 54111 SCTP/DTLS 54111
a=sctpmap:54111 t38 1
```

Running SCTP over DTLS make possible to have multiple SCTP associations on top of the same DTLS connection; each SCTP association make use of a distinct port number that is mainly used to demultiplex the associations.

If the <proto> sub-field is 'DTLS/SCTP'

the <port> is the UDP transport port;

the <fmt> sub-field carries the SCTP port number and the mandatory SDP "sctpmap" attribute contains the actual media format within the protocol parameter. The SCTP port number is the UA chosen port to use on the DTLS channel.

When a list of SCTP port number identifiers is given, this implies that all of these associations MUST run on top of the same DTLS

connection. For the payload type assignments the "a=sctpmap:" attribute (see [Section 5.1](#)) SHOULD be used to map from a port number to a media encoding name that identifies the payload format transported by the association or the actual application protocol running on top of it.

```
m=application 54111 DTLS/SCTP 5000
c=IN IP4 79.97.215.79
a=sctpmap:5000 webrtc-datachannel max-message-size=100000 streams=16
```

5. Media attributes

5.1. sctpmap Attribute

The sctpmap attribute maps from a port number (as used in an "m=" line) to an encoding name denoting the payload format to be used on top of the SCTP association or the actual protocol running on top of it.

The sctpmap MUST include the app parameter indicating the application running on top of the association.

The sctpmap line should also contain the max-message-size parameter indicating the maximum message size, in bytes, the endpoint is willing to accept.

The peer should assume that larger message will be rejected by the endpoint, though it is up to the endpoint decide the appropriate behaviour.

A parameter with value of '0' will signal a best effort attempt, subject to the current endpoint memory capacity, to handle messages of any size.

If the parameter is not present, the implementation should provide a default, with a suggested value of 64K.

It may also provide the stream parameter to specify the initial number of incoming streams to be supported by each side of the association.

If this parameter is not present, the implementation should provide a default, with a suggested value of 16.


```
sctpmap-attr      = "a=sctpmap:" sctpmap-number  
                   app [max-message-size] [streams]  
sctpmap-number    = 1*DIGIT  
app               = token  
max-message-size  = "max-message-size" EQUALS 1*DIGIT  
streams           = "streams" EQUALS 1*DIGIT"
```

For the "a=sctpmap:" attribute line in the offer, there MUST be a corresponding "a=sctpmap:" attribute line in the answer.

Any offered association MAY be rejected in the answer, for any reason. If an association offer is rejected, the offerer and answerer MUST NOT establish an SCTP association for it. To reject an SCTP association, the SCTP port number in the "a=sctpmap:" attribute line in the answer MUST be set to zero.

Any offered association with an "a=sctpmap:" attribute line providing an incoming stream number of zero or larger than 65535 MUST be rejected in the answer. An offered association answered with an "a=sctpmap:" attribute line providing an incoming stream number of zero or larger than 65535 MUST NOT be established.

6. The Setup and Connection Attributes and Association Management

The use of the 'setup' and 'connection' attributes in the context of an SCTP association is identical to the use of these attributes in the context of a TCP connection. That is, SCTP endpoints MUST follow the rules in Sections 4 and 5 of [RFC 4145](#) [[RFC4145](#)] when it comes to the use of the 'setup' and 'connection' attributes in offer/answer [[RFC3264](#)] exchanges.

The management of an SCTP association is identical to the management of a TCP connection. That is, SCTP endpoints MUST follow the rules in [Section 6 of RFC 4145](#) [[RFC4145](#)] to manage SCTP associations. Whether to use the SCTP ordered or unordered delivery service is up to the applications using the SCTP association.

7. Multihoming

An SCTP endpoint, unlike a TCP endpoint, can be multihomed. An SCTP endpoint is considered to be multihomed if it has more than one IP address. A multihomed SCTP endpoint informs a remote SCTP endpoint about all its IP addresses using the address parameters of the INIT or the INIT-ACK chunk (depending on whether the multihomed endpoint is the one initiating the establishment of the association).

Therefore, once the address provided in the 'c' line has been used to establish the SCTP association (i.e., to send the INIT chunk), address management is performed using SCTP. This means that two SCTP endpoints can use addresses that were not listed in the 'c' line but that were negotiated using SCTP mechanisms.

During the lifetime of an SCTP association, the endpoints can add and remove new addresses from the association at any point [[RFC5061](#)]. If an endpoint removes the IP address listed in its 'c' line from the SCTP association, the endpoint SHOULD update the 'c' line (e.g., by sending a re-INVITE with a new offer) so that it contains an IP address that is valid within the SCTP association.

In some environments, intermediaries performing firewall control use the addresses in offer/answer exchanges to perform media authorization. That is, policy-enforcement network elements do not let media through unless it is sent to the address in the 'c' line.

In such network environments, the SCTP endpoints can only exchange media using the IP addresses listed in their 'c' lines. In these environments, an endpoint wishing to use a different address needs to update its 'c' line (e.g., by sending a re-INVITE with a new offer) so that it contains the new IP address.

It is worth to underline that when using SCTP on top of DTLS, only single homed SCTP associations can be used, since DTLS does not expose any address management to its upper layer.

8. Network Address Translation (NAT) Considerations

SCTP specific features (not present in UDP/TCP), such as the checksum (CRC32c) value calculated on the whole packet (not just the header) or its multihoming capabilities, present new challenges for NAT traversal. [[I-D.ietf-behave-sctpnat](#)] describes an SCTP specific variant of NAT, which provides similar features of Network Address and Port Translation (NAPT).

Current NATs do not typically support SCTP. As an alternative to design SCTP specific NATs, Encapsulating SCTP into UDP [[RFC6951](#)] makes it possible to use SCTP in networks with legacy NAT and firewalls not supporting SCTP.

At the time of writing, the work on NAT traversal for SCTP is still work in progress. Additionally, no extension has been defined to integrate ICE (Interactive Connectivity Establishment) [[RFC5768](#)] with SCTP and its multihoming capabilities either. Therefore, this specification does not define how to describe SCTP-over-UDP streams

in SDP or how to establish and maintain SCTP associations using ICE. Should these features be specified for SCTP in the future, there will be a need to specify how to use them in an SDP environment as well.

9. Examples

The following examples show the use of the 'setup' and 'connection' SDP attributes. As discussed in [Section 6](#), the use of these attributes with an SCTP association is identical to their use with a TCP connection. For the purpose of brevity, the main portion of the session description is omitted in the examples, which only show 'm' lines and their attributes (including 'c' lines).

9.1. Actpass/Passive

An offerer at 192.0.2.2 signals its availability for an SCTP association at SCTP port 54111. Additionally, this offerer is also willing to initiate the SCTP association:

```
m=application 54111 SCTP 54111
c=IN IP4 192.0.2.2
a=setup:actpass
a=connection:new
a=sctpmap:54111 t38 1
```

Figure 1

The endpoint at 192.0.2.1 responds with the following description:

```
m=application 54321 SCTP 54321
c=IN IP4 192.0.2.1
a=setup:passive
a=connection:new
a=sctpmap:t54321 t38 1
```

Figure 2

This will cause the offerer (at 192.0.2.2) to initiate an SCTP association to port 54321 at 192.0.2.1.

9.2. Existing Connection Reuse

Subsequent to the exchange in [Section 9.1](#), another offer/answer exchange is initiated in the opposite direction. The endpoint at 192.0.2.1, which now acts as the offerer, wishes to continue using the existing association:


```
m=application 54321 SCTP *  
c=IN IP4 192.0.2.1  
a=setup:passive  
a=connection:existing
```

Figure 3

The endpoint at 192.0.2.2 also wishes to use the existing SCTP association and responds with the following description:

```
m=application 54111 SCTP *  
c=IN IP4 192.0.2.2  
a=setup:active  
a=connection:existing
```

Figure 4

The existing SCTP association between 192.0.2.2 and 192.0.2.1 will be reused.

9.3. SDP description for SCTP over DTLS Connection

This example shows the usage of SCTP over DTLS.

An offerer at 192.0.2.2 signals the availability of a webrtc-DataChannel session over SCTP/DTLS. The DTLS connection runs on top of port 54111.

```
m=application 54111 DTLS/SCTP 5000  
c=IN IP4 192.0.2.2  
a=setup:actpass  
a=connection:new  
a=fingerprint:SHA-1 \  
    4A:AD:B9:B1:3F:82:18:3B:54:02:12:DF:3E:5D:49:6B:19:E5:7C:AB  
a=sctpmap:5000 webrtc-DataChannel max-message-size=100000 streams=16
```

Figure 5

The endpoint at 192.0.2.1 responds with the following description:


```
m=application 62442 DTLS/SCTP 5001
c=IN IP4 192.0.2.1
a=setup:actpass
a=connection:new
a=fingerprint:SHA-1 \
    4A:AD:B9:B1:3F:82:18:3B:54:02:12:DF:3E:5D:49:6B:19:E5:7C:AB
a=sctpmap:5001 webrtc-DataChannel max-message-size=100000 streams=16
```

Figure 6

10. Security Considerations

See [RFC 4566](#) [[RFC4566](#)] for security considerations on the use of SDP in general. See [RFC 3264](#) [[RFC3264](#)], [RFC 4145](#) [[RFC4145](#)] and [RFC 4572](#) [[RFC4572](#)] for security considerations on establishing media streams using offer/answer exchanges. See [RFC 4960](#) [[RFC4960](#)] for security considerations on SCTP in general and [[RFC6083](#)] for security consideration using DTLS on top of SCTP. This specification does not introduce any new security consideration in addition to the ones discussed in those specifications.

11. IANA Considerations

This document defines three new proto values: 'SCTP', 'SCTP/DTLS' and 'DTLS/SCTP'. Their formats are defined in [Section 3](#). These proto values should be registered by the IANA under "Session Description Protocol (SDP) Parameters" under "proto".

11.1. sctpmap attribute

This document defines a new SDP session and media-level attribute:

'sctpmap'. Its format is defined in [Section 5.1](#). This attribute should be registered by IANA under "Session Description Protocol (SDP) Parameters" under "att-field" (both session and media level)".

The 'sctpmap' attribute also

'sctpmap'. Its format is defined in [Section 5.1](#). This attribute should be registered by IANA under "Session Description Protocol (SDP) Parameters" under "att-field" (both session and media level)".

The sctpmap also specifies tree parameters:

The mandatory 'app' parameter indicating the application running on top of the association.

The optional max-message-size parameter indicating the maximum message size, in bytes, the endpoint is willing to accept.

The optional streams parameter indicating the maximum message size, in bytes, the endpoint is willing to accept.

The 'stream' attribute indicating the initial number of incoming streams supported by each side of the association.

```
sctpmap-attr      = "a=sctpmap:" sctpmap-number  
                   app [max-message-size] [streams]  
sctpmap-number    = 1*DIGIT  
app               = token  
max-message-size  = "max-message-size" EQUALS 1*DIGIT  
streams           = "streams" EQUALS 1*DIGIT"
```

[Open Issue] This specification has to create a new IANA registry named "SCTP Application" to register all the possible values of the 'app' parameter and register as first value "webrtc-datachannel" for [draft-ietf-rtcweb-data-channel](#).

12. Acknowledgments

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