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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' and 'SCTP/DTLS' 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. RFC4145 [RFC4145] specifies a general mechanism for describing and establishing TCP (Transmission Control Protocol) streams. RFC 4572 [RFC4572] extends RFC4145 [RFC4145] for describing TCP-based media streams that are protected using TLS (Transport Layer Security) [RFC5246].

This document defines a new protocol identifier, 'SCTP', to describe SCTP-based [RFC4960] media streams. 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.

Additionally this document defines a new protocol identifier, 'SCTP/DTLS', to establish secure SCTP-based media streams over DTLS (Datagram Transport Layer Security) [RFC4347], as specified in [RFC6083], using SDP. 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 realible, 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].

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 two new values for the 'proto' field: 'SCTP' and 'SCTP/DTLS'.

The 'SCTP' protocol identifier is similar to both the 'UDP' and 'TCP' protocol identifiers in that it only describes 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].

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

An 'm' line that specifies 'SCTP/DTLS' MUST further provide a certificate fingerprint. 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. 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.

5. 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 MUST 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.

6. 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 [I-D.tuexen-sctp-udp-encaps] 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.

7. Examples

The following examples show the use of the 'setup' and 'connection' SDP attributes. As discussed in Section 4, 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).

7.1. 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=image 54111 SCTP *
c=IN IP4 192.0.2.2
a=setup:actpass
a=connection:new
```

Figure 1

The endpoint at 192.0.2.1 responds with the following description:

```
m=image 54321 SCTP *
c=IN IP4 192.0.2.1
a=setup:passive
a=connection:new
```

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.

7.2. Existing Connection Reuse

Subsequent to the exchange in Section 7.1, 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:new
```

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 9 SCTP *
c=IN IP4 192.0.2.2
a=setup:active
a=connection:new
```

Figure 4

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

7.3. SDP description for DTLS Connection

An offerer at 192.0.2.2 signals the availability of a T.38 fax session over SCTP/DTLS.

```
m=image 54111 SCTP/DTLS t38
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
```

Figure 5

8. 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.

9. IANA Considerations

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

The SDP specification, [RFC4566], states that specifications defining

new proto values, like the SCTP and SCTP/DTLS proto values defined in this RFC, must define the rules by which their media format (fmt) namespace is managed. For the SCTP protocol, new formats SHOULD have an associated MIME registration. 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.

10. References

10.1. Normative References

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10.2. Informative References

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