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SDP Descriptors for FLUTE
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Abstract

This document specifies the use of SDP to describe the parameters required to begin, join, receive data from, and end FLUTE sessions.

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1. Introduction

The Session Description Protocol (SDP) [6] provides a general-purpose format for describing multimedia sessions in announcements or invitations. SDP uses an entirely textual data format (the US-ASCII subset of UTF-8 [9]) to maximize portability among transports. SDP does not define a protocol, but only the syntax to describe a multimedia session with sufficient information to participate in that session. Session descriptions may be sent using arbitrary existing application protocols for transport (e.g. FLUTE [1], SAP [13], SIP [14], RTSP [18], HTTP [15], email etc.).

SDP defines two protocol identifiers that represent unreliable connectionless protocols. These are RTP/AVP and UDP. These are appropriate choices for multimedia streams. [16] defines protocol identifiers for connection-oriented reliable transports: TCP and TCP/TLS. RFC 3266 [7] describes SDP support for IPv6.

This document defines a new protocol identifier for File Delivery over Unidirectional Transport (FLUTE) protocol [1] and other required SDP attributes for initiating a FLUTE session. The formal ABNF syntax [5] is used for the attributes.

2. Conventions Used in This Document

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 [RFC 2119](#) [2].

3. FLUTE Descriptors

The FLUTE specification [[1](#)] describes the optional and required parameters for a FLUTE session. This document specifies the SDP parameters for FLUTE sessions that can be used for the discovery of FLUTE download and/or service announcement sessions.

The required parameters are:

- o The source IP address
- o The number of channels in the session
- o The destination IP address and port number for each channel in the session
- o The Transport Session Identifier (TSI) of the session
- o The start time and end time of the session

Optionally, the following parameters may be associated with the session:

- o FEC Object Transmission Information
- o Some information that tells receiver in the first place, that the session contains files that are of interest
- o Bandwidth specification

The description of these parameters in SDP is presented in the following sections. Note also that "v=", "o=" and "s=" lines are mandatory for SDP descriptions [[6](#)].

3.1 FLUTE Protocol Identifier

The following is the ABNF syntax for an "m=" line, as specified by [RFC 2327](#) [[6](#)]:

```
media-field = "m=" media SP port ["/" integer] SP
              proto 1*(SP fmt) CRLF
```

We define a new value for the "proto" sub-field: FLUTE/UDP. The FLUTE/UDP protocol identifier specifies that the session being described will use the FLUTE [[1](#)] protocol on top of a UDP connection. The default behaviour of a host shall be to group all media of a

single SDP with the FLUTE/UDP protocol identifier as belonging to the same single FLUTE session. Each complete SDP session description will describe only one FLUTE session.

Note, describing multiple FLUTE sessions per SDP is not considered useful and so is outside the scope of this document.

The fmt list of FLUTE "m=" lines SHOULD contain a single "*" character, like [17]. Use of any other parameters in a FLUTE fmt list is out of scope of this specification. "0" is known to be used in the fmt list to represent the same, in a non standard way, and so implementors may take this into account. An example of FLUTE/UDP protocol identifier is shown in [section 4](#).

FLUTE is a general file delivery protocol and so it is not considered necessary to identify a list of media types per FLUTE session or channel in the session description.

[3.2](#) Source IP Address

The Asynchronous Layered Coding (ALC) [3] and the Layered Coding Transport (LCT) [4] specifications require that all the channels of a single ALC/LCT session are from the same source IP address. Hence, there MUST be exactly one source IP address per FLUTE session, and therefore one source IP address per each complete SDP description of a FLUTE session.

The source IP address MUST be defined according to the source-filter attribute ("a=source-filter") [8], with the following exceptions:

- o A source-filter attribute MUST be included in any SDP describing FLUTE.
- o The source-filter attribute MUST be in the session part of the session description and MUST NOT be given per media. Note, the requirement that there must not be more than a single source-filter attribute in the session part is inherited from [8].
- o Exactly one source address is specified by this attribute. Exactly one source address MUST be given in an inclusive-mode "src-list". Exclusive-mode MUST NOT be used.
- o The "*" value MUST be used for the "dest-address" sub-field, even when the FLUTE session employs only a single channel (e.g. a multicast group).

An example of the use of this attribute is:

```
a=source-filter: incl IN IP6 * 2001:210:1:2:240:96FF:FE25:8EC9
```

This example uses the source-filter attribute to describe an IPv6 source address.

[3.3](#) Transport Session Identifier

The combination of the TSI and the source IP address identifies a FLUTE session. Each TSI MUST uniquely identify a FLUTE session for a given source IP address during the time that the session is active and also for a large time before and after the active session time. This requirement is also specified by [\[4\]](#). The TSI MUST be described by the "flute-tsi" attribute. There MUST be exactly one occurrence of the "flute-tsi" attribute in a complete FLUTE session SDP description and it MUST appear at the session-level.

The syntax for the attribute in ABNF is given below:

```
flute-tsi-line = "a=flute-tsi:" tsi CRLF
tsi = 1*DIGIT
```

[3.4](#) Session Timing Parameters

The SDP timing field "t=" [\[6\]](#) MUST be used to indicate the FLUTE session start and end times.

[3.5](#) Channelisation Descriptors

This section specifies the description of the channel(s) used within a FLUTE session. The required parameters for channelisation description are:

- o Number of channels
- o Destination IP address and port number for channels

[3.5.1](#) Number of Channels

The FLUTE specification allows the use of multiple channels (e.g. multicast groups) to transport the files of a single FLUTE session. This is referred to as FLUTE session channelisation in this document. A FLUTE channel is equivalent to an ALC/LCT channel. An ALC/LCT channel is defined by the combination of a sender and an address associated with the channel by the sender. FLUTE session channelisation is defined according to a new SDP attribute at

session-level as specified in this document. Details of each channel are defined by SDP media-level information also described in this document.

The "flute-ch" attribute describes the number of channels used by the source to transmit. It MAY also be used to check that right amount of channel descriptions exists in the session description. For example, if the value of this attribute is 2, then there should be 2 channels specified by the "m=" line(s) and the "c=" line(s). An example is given in [section 4](#).

The syntax for the attribute in ABNF is given below:

```
flute-channel-line = "a=flute-ch:" ch CRLF
ch = integer
;integer is as defined in [6].
```

value is the number of channels used by the source to transmit data in a FLUTE session.

In the absence of this attribute, a receiver MUST understand that exactly one channel is used for the FLUTE session.

[3.5.2](#) Destination IP Address and Port Number for Channels

SDP media-level information describes one or more channels. The channel parameters MUST be given per channel and are:

- o Destination IP address
- o Destination port number

The destination IP address MUST be defined according to the connection data field ("c=") of SDP [\[6\]](#). The destination port number MUST be defined according to the "port" sub-field of the media description field ("m=") of SDP [\[6\]](#).

A "c=" line can describe multiple addresses by using "number of addresses" sub-field, and also an "m=" line can describe multiple ports by using "number of ports" sub-field. So multiple channels can be described by using one "c=" line and one "m=" line (slash notation).

Exactly one destination port MUST be used per channel. When more than one channel is used in a multicast session, it is RECOMMENDED that the channels are differentiated based on destination IP address, and channel differentiation based on destination port with the same

destination address is considered unnecessary, complex and potentially harmful. When more than one channel is used in a unicast session, the channels have to be differentiated based on destination ports.

In the case (always with a unicast session) where the same destination IP address is used for all the channels of the session and only the destination port number differentiates channels, the destination IP address MAY be given by the connection data field at session-level for all channels (if so, the connection data field MUST NOT be used at media-level).

In the case where each channel have different destination IP address, the destination IP addresses MUST be given at media-level, i.e. following an "m=" line.

The sequence of multiple channels MUST be determined by the order in which their media descriptions are defined in the session description (i.e. the first media description gives the first channel in the sequence). In the case of the slash notation usage for specifying multiple destination addresses or ports, the order of the channel sequence MUST be lowest value first and highest last; and in the case of slash notation for both destination address and port of a media-level description the channel sequence MUST be from the lowest address value and incremented through the range.

Also we need to indicate the presence of a FLUTE session on a certain channel. This is done by using the "m=" line in the SDP description as shown in the following example:

```
m=application 12345 FLUTE/UDP *  
c=IN IP6 FF1E:03AD::7F2E:172A:1E24
```

In the above SDP attributes, the "m=" line indicates the media used and the "c=" line together with "m=" line's "port" sub-field indicates the corresponding channel's address and port respectively. Thus, in the above example, the media is transported on a channel that uses FLUTE over UDP. Further, the "c=" line indicates the channel's address, which, in this case, is an IPv6 address, and "m=" line indicates the channel's port (12345).

3.6 FEC Object Transmission Information

An SDP description for a FLUTE session MAY include FEC Object Transmission Information (FEC-OTI) [12]. FEC parameters can be placed either at session-level or at media-level, although it is RECOMMENDED to place them at session-level. If FEC declarations on both session and media level use the same reference number (fec-ref)

then the media level declaration takes precedence for that media component. FEC parameters include:

- o FEC Encoding ID
- o FEC Instance ID (for FEC Encoding IDs 128-255)

Where FEC-OTI is given, FEC parameters MUST be described in a "FEC-declaration" attribute. Multiple instances of this attribute MAY exist both at session-level and media-level. If an instance exists at session-level, a reference to it MAY be used at media-level, and an attribute "FEC" MUST be defined for this purpose. The absence of both a "FEC-declaration" and a "FEC" attribute at media-level MUST be interpreted as the default FEC (Compact No-Code FEC [[11](#)] for FLUTE).

The "FEC-declaration" attribute provides general FEC-OTI information in FEC Encoding ID and FEC Instance ID values. This may be extended using a "FEC-OTI-extension" attribute, depending on the needs of the FEC code used and the lack of an alternative means to signal the extended OTI information. The purpose of extended FEC-OTI information define FEC code/instance-specific OTI required for receiver FEC payload configuration. The contents of such an extension would be FEC code-specific and exact specification, beyond adherence to the ABNF below, needs to be specified by any FEC code using this attribute, and hence is outside the scope of this document.

A "FEC-OTI-extension" attribute must be immediately preceded by its associated "FEC-declaration" attribute and so the full FEC-OTI, including extension, will be found in two neighbouring attribute lines. The fec-ref value binds a "FEC-OTI-extension" and "FEC-declaration attribute" pair.

The syntax for the attributes in ABNF is given below:

```
fec-declaration-line = "a=FEC-declaration:" fec-ref SP
                        fec-enc-id [";" SP fec-inst-id] CRLF
fec-ref = 1*3DIGIT
;value is the SDP-internal identifier for FEC-declaration

fec-enc-id = "encoding-id=" enc-id
enc-id = 1*DIGIT
;value is the FEC Encoding ID used

fec-inst-id = "instance-id=" inst-id
inst-id = 1*DIGIT
;value is the FEC Instance ID used

fec-line = "a=FEC:" fec-ref CRLF

fec-oti-extension-line = "a=FEC-OTI-extension:" fec-ref SP
                        oti-extension CRLF
oti-extension = base64
base64 = *base64-unit [base64-pad]
base64-unit = 4base64-char
base64-pad = 2base64-char "==" / 3base64-char "="
base64-char = ALPHA / DIGIT / "+" / "/"
```

Examples of FEC-OTI are shown in [section 4](#).

The FEC parameters are for capabilities description for the session. (Note, any "FDT-like" fuller description of files in the session could give the FEC parameters per file). FLUTE's FDT syntax (and codepoint header field usage) allows complete specification of these FEC parameters in-band with FLUTE (per file). Thus machine configuration can be performed using FLUTE alone.

There are five main reasons that the FEC Encoding and Instance IDs are optional capabilities descriptions:

1. It is not always necessary to explicitly describe the FEC capabilities in advance of the session - e.g. for simple (and short) sessions it can be more elegant to discover this from the session (FDT) itself (even when some mechanism for machine-readable session parameters, such as IP addresses and ports, is wanted in advance).
2. There may be some other out-of-band discovery of FEC capability requirements (e.g. well known-FEC/standardised capabilities for a certain application, verbal agreement between a group, etc.) that provides the FEC capability information. This document does not want to prevent this, and in this case repeating the information

in SDP would be unnecessary and wasteful (and probably result in implementations not following the flute-sdp specification).

3. FLUTE defaults to Compact No-Code FEC [11] and support for this is mandatory for FLUTE anyway so it is a given (capability requirement) which does not need to be described by the SDP. In cases where only Compact No-Code FEC is required, there is no use in specifying any FEC Encoding (+Instance) IDs in the SDP (though it is allowed).
4. In cases where a FLUTE session description (SDP file) is not defined once for all time, it is possible that the FEC usage is not known in advance and the FEC capabilities would only be added to the SDP in a later version of that SDP file when the FEC codes have been selected (e.g. a larger audience may suggest stronger FEC to make FLUTE delivery more reliable, whereas additional bi-directional messages may be scalable for smaller groups).
5. Also, in cases where a FLUTE session description (SDP file) is very static (e.g. once for all time for that session), it is possible that the FEC usage is not known in advance and it needs to be left to some other mechanism (e.g. FDT) to discover any FEC capability requirements set closer to the session transmission - with the same examples as in (4).

Also, in a complex case of very many FEC codes being used in the session giving a full list in SDP is not seen as being reasonable (but this is likely to be a rare case anyway).

<The description of layered media and identification of any congestion control (CC) instance related to them is orthogonal to the FEC declarations and other aspect of this document. Hence, the authors assume layering and CC descriptions are not in scope of this document. This assumption is subject to further study.>

3.7 Content Description Pointer

The syntax of the information that tells receiver, in the first place, that the session contains files that are of interest is out of scope of this document. However, the SDP MAY include a content description pointer at the session-level to enable efficient linkage to such information.

The content description pointer attribute describes to the receiver(s) the URI where the content description is stored. The content description pointer MUST be defined according to the "content-desc" attribute.

The syntax for the attribute in ABNF is given below:

```
content-desc-line = "a=content-desc:" URI-reference CRLF  
;URI-reference is as defined in [10].
```

An example of content description pointer is shown in [section 4](#).

[3.8](#) Bandwidth Specification

The specification of bandwidth (data rate) is optional and where included in the SDP it shall adhere to the following rules. The maximum bit-rate required by this FLUTE session shall be specified using the "AS" bandwidth modifier [[6](#)] on session level. The maximum bit-rate required by a particular FLUTE media-line (one or more FLUTE channels, depending on the usage or IP address and port ranges) shall be specified using the "AS" bandwidth modifier [[1](#)] on media level. The Application Specific (AS) bandwidth shall be the largest sum of the sizes of all packets transmitted during any one second long period of the session or media-line, depending on which level it is being used, expressed as kilobits. The size of the packet shall be the complete packet, i.e. IP, UDP and FLUTE headers, and the data payload.

4. SDP Syntax Examples

This section gives examples of the use of SDP attributes to describe a FLUTE session.

```
v=0
o=user123 2890844526 2890842807 IN IP6 2201:056D::112E:144A:1E24
s=File delivery session example
i=More information
t=2873397496 2873404696
a=source-filter: incl IN IP6 * 2001:210:1:2:240:96FF:FE25:8EC9
a=flute-tsi:1
a=flute-ch:2
a=FEC-declaration:0 encoding-id=0
a=FEC-declaration:1 encoding-id=128; instance-id=0
a=content-desc:http://www.example.com/flute-sessions/session001
m=application 12345 FLUTE/UDP *
c=IN IP6 FF1E:03AD::7F2E:172A:1E24
a=FEC:0
m=application 12346 FLUTE/UDP *
c=IN IP6 FF1E:03AD::7F2E:172A:1E25
a=FEC:1
```

Figure 1: An SDP for FLUTE Session with Two Channels

Figure 1 shows an example SDP description for FLUTE session with two channels.

The attribute defined in the line "a=source-filter: incl IN IP6 * 2001:210:1:2:240:96FF:FE25:8EC9" describes a source filter. In this example the source indicates that the receiver(s) should include the given IP address (2001:210:1:2:240:96FF:FE25:8EC9) into the session. It should be noted that although other possibilities may be used, in this case only the incl and * attributes may be used in the above attribute.

The attribute defined in the line "a=flute-tsi:3" describes the Transport Session Identifier for the session. The pair made of the source IP address and the TSI together uniquely identifies a FLUTE session.

The source indicates in the above example that it will transmit data in the FLUTE session on two channels (a=flute-ch:2). The source then specifies the channels.

The "a=FEC-declaration" lines describes two different FEC schemes used in the FLUTE session.

The "a=content-desc" line describes the URI where the content description is stored.

The line "m=application 12345 FLUTE/UDP *" indicates the media used for the channel. In this example, there are two "m=" lines for the two channels described.

The destination addresses for the channels are given in the "c=" lines. These also show to the receiver(s) that the channels are two (maybe more in other cases) consecutive channels.

The "a=FEC" lines at media-level reference FEC declarations at session-level ("a=FEC-declaration").

```
v=0
o=user123 2890844526 2890842807 IN IP6 2201:056D::112E:144A:1E24
s=File delivery session example
i=More information
t=2873397496 2873404696
a=source-filter: incl IN IP6 * 2001:210:1:2:240:96FF:FE25:8EC9
a=flute-tsi:2
a=flute-ch:1
m=application 12345 FLUTE/UDP *
c=IN IP6 FF1E:03AD::7F2E:172A:1E24
a=FEC-declaration:0 encoding-id=128; instance-id=0
```

Figure 2: An SDP for FLUTE Session with One Channel

Figure 2 shows an example SDP description for FLUTE session with one channel.

[5.](#) Security Considerations

See [\[6\]](#) for security considerations specific to the Session Description Protocol in general. See also [\[8\]](#) for security consideration related to source address filters.

[6.](#) IANA Considerations

[6.1](#) Transport Protocol

The "proto" sub-field of the media description field ("m=") describes the transport protocol used. This document registers one value: "FLUTE/UDP" is a reference to FLUTE [\[1\]](#) running over UDP/IP.

[6.2](#) Attribute Names

As recommended by [\[6\]](#), the new attribute names "flute-tsi", "flute-ch", "FEC-declaration", "FEC", "FEC-OTI-extension" and "content-desc" should be registered with IANA, as follows:

The following contact information shall be used for all registrations included here:

Contact: Rod Walsh
E-Mail: rod.walsh (at) nokia.com

SDP Attribute ("att-field"):

Attribute name: flute-tsi
Long form: FLUTE Transport Session Identifier
Type of name: att-field
Type of attribute: Session level
Subject to charset: No
Purpose: See this document
Reference: This document
Values: See this document

SDP Attribute ("att-field"):

Attribute name: flute-ch
Long form: Number of Channels in a FLUTE Session
Type of name: att-field
Type of attribute: Session level
Subject to charset: No
Purpose: See this document
Reference: This document
Values: See this document

SDP Attribute ("att-field"):

Attribute name: FEC-declaration
Long form: Forward Error Correction Declaration
Type of name: att-field
Type of attribute: Session level or media level
Subject to charset: No
Purpose: See this document
Reference: This document

Values: See this document

SDP Attribute ("att-field"):

Attribute name: FEC
Long form: A Reference to FEC Declaration
Type of name: att-field
Type of attribute: Media level
Subject to charset: No
Purpose: See this document
Reference: This document
Values: See this document

SDP Attribute ("att-field"):

Attribute name: FEC-OTI-extension
Long form: FEC Object Transmission Information extension
Type of name: att-field
Type of attribute: Session level or media level
Subject to charset: No
Purpose: See this document
Reference: This document
Values: See this document

SDP Attribute ("att-field"):

Attribute name: content-desc
Long form: Content Description Pointer
Type of name: att-field
Type of attribute: Session level
Subject to charset: No
Purpose: See this document
Reference: This document
Values: See this document

[7.](#) Acknowledgements

The authors would like to thank all the people who gave feedback on this document.

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