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RTP Payload Format for the Enhanced Variable Rate Wideband Codec (EVRC-WB) and the Media Subtype Updates for EVRC-B Codec

Status of This Memo

Abstract

This document specifies Real-time Transport Protocol (RTP) payload formats to be used for the Enhanced Variable Rate Wideband Codec (EVRC-WB) and updates the media type registrations for EVRC-B codec. Several media type registrations are included for EVRC-WB RTP payload formats. In addition, a file format is specified for transport of EVRC-WB speech data in storage mode applications such as email.

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1. Introduction

This document specifies the payload formats for packetization of EVRC-WB encoded speech signals into the Real-time Transport Protocol (RTP). It defines support for the header-free, interleaved/bundled, and compact bundle packet formats for the EVRC-WB codec as well as discontinuous transmission (DTX) support for EVRC-WB encoded speech transported via RTP. The EVRC-WB codec offers better speech quality than the EVRC and EVRC-B codecs. EVRC-WB belongs to the EVRC family of codecs. This document also updates the media type registrations for the EVRC-B codec.

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 RFC 2119 [1].

3. Background

EVRC-WB is a wideband extension of the EVRC-B [4] speech codec developed in the Third Generation Partnership Project 2 (3GPP2) with support for discontinuous transmission (DTX). It provides enhanced (wideband) voice quality.

The EVRC-WB codec operates on 20-ms frames, and the default sampling rate is 16 kHz. Input and output at an 8-kHz sampling rate are also supported. The EVRC-WB codec can operate in three modes (0, 4, and 7) defined in [5]. EVRC-WB modes 4 and 7 are interoperable with EVRC-B. EVRC-WB mode 4 uses full-rate, 1/2-rate, and 1/8-rate frames. EVRC-WB mode 7 uses only 1/2 rate and 1/8 rate frames. Mode change results in codec output bit-rate change but do not cause any decoding problems at the receiver. For successful decoding, the decoder does not need to know the encoder’s current mode of operation. EVRC-WB provides a standardized solution for packetized voice applications that allow transitions between narrowband and wideband telephony. The most important service addressed is IP telephony. Target devices can be IP phones or Voice over IP (VoIP) handsets, media gateways, voice messaging servers, etc.

4. EVRC-WB Codec

The EVRC-WB codec operates on 20-ms frames. It produces output frames of one of the three different sizes: 171 bits, 80 bits, or 16 bits. In addition, there are two zero-bit codec frame types: blank (null) frames and erasure frames. The default sampling rate is 16 kHz. Input and output at an 8-kHz sampling rate are also supported.

The frame type values and sizes of the associated codec data frames are listed in the table below:

Value	Rate	Total codec data frame size in bytes (and in bits)
0	Blank	0 (0 bit)
1	1/8	2 (16 bits)
2	1/4	5 (40 bits)
3	1/2	10 (80 bits)
4	1	22 (171 bits; 5 bits padded at the end)
5	Erasure	0 (SHOULD NOT be transmitted by sender)

5. RTP Header Usage

The format of the RTP header is specified in RFC 3550 [6]. The EVRC-WB payload formats (Section 6) use the fields of the RTP header in a manner consistent with RFC 3550 [6].

EVRC-WB also has the capability to operate with 8-kHz sampled input/output signals. The decoder does not require a priori knowledge about the sampling rate of the original signal at the input of the encoder. The decoder output can be at 8 kHz or 16 kHz regardless of the sampling rate used at the encoder. Therefore, depending on the implementation and the electro acoustic audio capabilities of the devices, the input of the encoder and/or the output of the decoder can be configured at 8 kHz; however, a 16-kHz RTP clock rate MUST always be used. The RTP timestamp is increased by 320 for each 20 milliseconds.

The RTP header marker bit (M) SHALL be set to 1 if the first frame carried in the packet contains a speech frame that is the first in a talkspurt. For all other packets, the marker bit SHALL be set to zero (M=0).

6. Payload Format

Three RTP packet formats are supported for the EVRC-WB codec -- the interleaved/bundled packet format, the header-free packet format, and the compact bundled packet format. For all these formats, the operational details and capabilities, such as Table of Contents (ToC), interleaving, DTX, and bundling, of EVRC-WB are exactly the same as those of EVRC-B, as defined in [3], except that the mode change request field in the ToC MUST be interpreted according to the definition of the RATE_REDUC parameter as defined in EVRC-WB [5]. The media type audio/EVRCWB maps to the interleaved/bundled packet format, audio/EVRCWB0 maps to the header-free packet format, and audio/EVRCWB1 maps to the compact bundled packet format.

7. Congestion Control Considerations

Congestion control for RTP SHALL be used in accordance with RFC 3550 [6], and with any applicable RTP profile, e.g., RFC 3551 [11].

Due to the header overhead, the number of frames encapsulated in each RTP packet influences the overall bandwidth of the RTP stream. Packing more frames in each RTP packet can reduce the number of packets sent and hence the header overhead, at the expense of increased delay and reduced error robustness.

8. Storage Format for the EVRC-WB Codec

The storage format is used for storing EVRC-WB encoded speech frames, e.g., as a file or email attachment.

The file begins with a magic number to identify the vocoder that is used. The magic number for EVRC-WB corresponds to the ASCII character string "#!EVCWB\n", i.e., "0x23 0x21 0x45 0x56 0x43 0x57 0x42 0x0A".

The codec data frames are stored in consecutive order, with a single ToC entry field, extended to one octet, prefixing each codec data frame. The ToC field is extended to one octet by setting the four most significant bits of the octet to zero. For example, a ToC value of 4 (a full-rate frame) is stored as 0x04. See Section 4 for the mapping from frame type to ToC value.

Speech frames lost in transmission and non-received frames MUST be stored as erasure frames (ToC value of 5) to maintain synchronization with the original media.

9. IANA Considerations

This document updates the audio/EVRCB and audio/EVRCB0 media types defined in RFC 4788 [3] and adds new EVRC-WB 'audio' media subtypes.

9.1. Media Type Registrations

Following the guidelines in RFC 4855 [9] and RFC 4288 [10], this section registers new 'audio' media subtypes for EVRC-WB and updates the audio/EVRCB and audio/EVRCB0 media type registrations contained in RFC 4788 [3].

9.1.1. Registration of Media Type audio/EVRCWB

Type name: audio

Subtype name: EVRCWB

Required parameters: None

Optional parameters:

These parameters apply to RTP transfer only.

mode-set-recv: A subset of EVRC-WB modes. Possible values are a comma-separated list of modes from the set {0,4,7} (see Table 2.5.1.2-1 in 3GPP2 C.S0014-C). A decoder can use this attribute to inform an encoder of its preference to operate in a specified subset of modes. Absence of this parameter signals the mode set {0,4,7}.

sendmode: A mode of the EVRC-WB codec. An encoder can use this to signal its current mode of operation. Possible values are 0,4,7 (see Table 2.5.1.2-1 in 3GPP2 C.S0014-C). Absence of this parameter signals mode 0.

ptime: See RFC 4566.

maxptime: See RFC 4566.

maxinterleave: Maximum number for interleaving length (field LLL in the Interleaving Octet)[0..7]. The interleaving lengths used in the entire session MUST NOT exceed this maximum value. If not signaled, the maxinterleave length MUST be 5.

silencesupp: See Section 6.1 in RFC 4788.

dtxmax: See Section 6.1 in RFC 4788.

dtxmin: See Section 6.1 in RFC 4788.

hangover: See Section 6.1 in RFC 4788.

Encoding considerations:

This media type is framed binary data (see RFC 4288, Section 4.8) and is defined for transfer of EVRC-WB encoded data via RTP using the interleaved/bundled packet format specified in RFC 3558.

Security considerations: See Section 18 of RFC 5188.

Interoperability considerations: None

Published specification:

The EVRC-WB vocoder is specified in 3GPP2 C.S0014-C. The transfer method with the interleaved/bundled packet format via RTP is specified in RFC 3558 and RFC 5188.

3GPP2 C.S0050-B, 3GPP2 File Formats for Multimedia Services.

3GPP2 specifications are publicly accessible at http://www.3gpp2.org

Applications that use this media type:

It is expected that many VoIP applications (as well as mobile applications) will use this type.

Additional information:

The following applies to stored-file transfer methods:

Magic number: #!EVCWB\n (see Section 8 of RFC 5188)

File extensions: evw, EVW

Macintosh file type code: None

Object identifier or OID: None

EVRC-WB speech frames may also be stored in the file format "3g2" defined in 3GPP2 C.S0050-B, which is identified using the media types "audio/3gpp2" or "video/3gpp2" registered by RFC 4393.

Person & email address to contact for further information:

Harikishan Desineni <hd@qualcomm.com>

Intended usage: COMMON

Restrictions on usage:

When this media type is used in the context of transfer over RTP, the RTP payload format specified in Section 4.1 of RFC 3558 SHALL be used. In all other contexts, the file format defined in Section 8 of RFC 5188 SHALL be used.

Author:

Harikishan Desineni

Change controller:

IETF Audio/Video Transport working group delegated from the IESG.

9.1.2. Registration of Media Type audio/EVRCWB0

Type name: audio

Subtype name: EVRCWB0

Required parameters: None

Optional parameters:

These parameters apply to RTP transfer only.

mode-set-recv: A subset of EVRC-WB modes. Possible values are a comma-separated list of modes from the set {0,4,7} (see Table 2.5.1.2-1 in 3GPP2 C.S0014-C). A decoder can use this attribute to inform an encoder of its preference to operate in a specified subset of modes. Absence of this parameter signals the mode set {0,4,7}.

sendmode: A mode of the EVRC-WB codec. An encoder can use this to signal its current mode of operation. Possible values are 0,4,7 (see Table 2.5.1.2-1 in 3GPP2 C.S0014-C). Absence of this parameter signals mode 0.

ptime: See RFC 4566.

silencesupp: See Section 6.1 in RFC 4788.

dtxmax: See Section 6.1 in RFC 4788.

dtxmin: See Section 6.1 in RFC 4788.

hangover: See Section 6.1 in RFC 4788.

Encoding considerations:

This media type is framed binary data (see RFC 4288, Section 4.8) and is defined for transfer of EVRC-WB encoded data via RTP using the header-free packet format specified in RFC 3558.

Security considerations: See Section 18 of RFC 5188.

Interoperability considerations: None

Published specification:

The EVRC-WB vocoder is specified in 3GPP2 C.S0014-C. The transfer method with the header-free packet format via RTP is specified in RFC 3558 and RFC 5188.

3GPP2 C.S0050-B, 3GPP2 File Formats for Multimedia Services.

3GPP2 specifications are publicly accessible at http://www.3gpp2.org

Applications that use this media type:

It is expected that many VoIP applications (as well as mobile applications) will use this type.

Additional information: None

Person & email address to contact for further information:

Harikishan Desineni <hd@qualcomm.com>

Intended usage: COMMON

Restrictions on usage:

This media type depends on RTP framing and hence is only defined for transfer via RTP [6]; the RTP payload format specified in Section 4.2 of RFC 3558 SHALL be used. This media type SHALL NOT be used for storage or file transfer using the file format defined in Section 8 of RFC 5188; instead, audio/EVRCWB SHALL be used.

Author:

Harikishan Desineni

Change controller:

IETF Audio/Video Transport working group delegated from the IESG.

9.1.3. Registration of Media Type audio/EVRCWB1

Type name: audio

Subtype name: EVRCWB1

Required parameters: None

Optional parameters:

These parameters apply to RTP transfer only.

mode-set-recv: A subset of EVRC-WB modes. Possible values are a comma-separated list of modes from the set {0,4,7} (see Table 2.5.1.2-1 in 3GPP2 C.S0014-C). A decoder can use this attribute to inform an encoder of its preference to operate in a specified subset of modes. A value of 0 signals the support for wideband fixed rate (full or half rate, depending on the value of the 'fixedrate' parameter). A value of 4 signals narrowband fixed full rate. A value of 7 signals narrowband fixed half rate. Absence of this parameter signals mode 0.

sendmode: A mode of the EVRC-WB codec. An encoder can use this to signal its current mode of operation. Possible values are 0,4,7 (see Table 2.5.1.2-1 in 3GPP2 C.S0014-C). 'sendmode' with value 0 signals wideband fixed-rate operation (full or half rate, depending on the value of the 'fixedrate' parameter). 'sendmode' with value 4 signals narrowband fixed full-rate operation. 'sendmode' with value 7 signals narrowband fixed half-rate operation. The 'fixedrate' parameter MUST NOT be present when the 'sendmode' value is 4 or 7. Absence of this parameter signals mode 0.

ptime: See RFC 4566.

maxptime: See RFC 4566.

fixedrate: Indicates the EVRC-WB rate of the session while in single-rate operation. Valid values include 0.5 and 1, where a value of 0.5 indicates the 1/2 rate while a value of 1 indicates the full rate. If this parameter is not present, 1/2 rate is assumed.

silencesupp: See Section 6.1 in RFC 4788.

dtxmax: See Section 6.1 in RFC 4788.

dtxmin: See Section 6.1 in RFC 4788.

hangover: See Section 6.1 in RFC 4788.

Encoding considerations:

This media type is framed binary data (see RFC 4288, Section 4.8) and is defined for transfer of EVRC-WB encoded data via RTP using the compact bundle packet format specified in RFC 4788.

Security considerations: See Section 18 of RFC 5188.

Interoperability considerations: None

Published specification:

The EVRC-WB vocoder is specified in 3GPP2 C.S0014-C. The transfer method with the compact bundled packet format via RTP is specified in RFC 4788 and RFC 5188.

3GPP2 C.S0050-B, 3GPP2 File Formats for Multimedia Services.

3GPP2 specifications are publicly accessible at http://www.3gpp2.org

Applications that use this media type:

It is expected that many VoIP applications (as well as mobile applications) will use this type.

Additional information: None

Person & email address to contact for further information:

Harikishan Desineni <hd@qualcomm.com>

Intended usage: COMMON

Restrictions on usage:

This media type depends on RTP framing and hence is only defined for transfer via RTP [6]; the RTP payload format specified in Section 4 of RFC 4788 SHALL be used. This media type SHALL NOT be used for storage or file transfer using the file format defined in Section 8 of RFC 5188; instead, audio/EVRCWB SHALL be used.

Author:

Harikishan Desineni

Change controller:

IETF Audio/Video Transport working group delegated from the IESG.

9.1.4. Updated Registration of Media Type audio/EVRCB

Type name: audio

Subtype name: EVRCB

Required parameters: None

Optional parameters:

These parameters apply to RTP transfer only.

recvmode: A mode of the EVRC-B codec. A decoder can use this attribute to inform an encoder of its preference to operate in a specified mode. Possible values are 0..7 (see the encoder operating point column in Table 2-6 of 3GPP2 C.S0014-B).

sendmode: A mode of the EVRC-B codec. An encoder can use this to signal its current mode of operation. Possible values are 0..7 (see encoder operating point column in Table 2-6 of 3GPP2 C.S0014-B).

ptime: See RFC 4566.

maxptime: See RFC 4566.

maxinterleave: Maximum number for interleaving length (field LLL in the Interleaving Octet). The interleaving lengths used in the entire session MUST NOT exceed this maximum value. If not signaled, the maxinterleave length MUST be 5.

silencesupp: See Section 6.1 of RFC 4788 for a definition. If this parameter is not present, the default value 1 MUST be assumed.

dtxmax: See Section 6.1 of RFC 4788.

dtxmin: See Section 6.1 of RFC 4788.

hangover: See Section 6.1 of RFC 4788.

Encoding considerations:

This media type is framed binary data (see RFC 4288, Section 4.8) and is defined for transfer of EVRC-B encoded data via RTP using the interleaved/bundled packet format specified in RFC 3558.

Security considerations: See Section 9 of RFC 4788.

Interoperability considerations: None

Published specification:

The EVRC-B vocoder is specified in 3GPP2 C.S0014-B. The transfer method with the interleaved/bundled packet format via RTP is specified in RFC 3558, RFC 4788, and RFC 5188.

Applications that use this media type:

It is expected that many VoIP applications (as well as mobile applications) will use this type.

Additional information: The following information applies for the storage format only.

Magic number: #!EVRC-B\n (see Section 5 of RFC 4788)

File extensions: evb, EVB

Macintosh file type code: None

Object identifier or OID: None

Person & email address to contact for further information:

Harikishan Desineni <hd@qualcomm.com>

Intended usage: COMMON

Restrictions on usage:

When this media type is used in the context of transfer over RTP, the RTP payload format specified in Section 4.1 of RFC 3558 SHALL be used. In all other contexts, the file format defined in Section 5 of RFC 4788 SHALL be used.

Author:

Qiaobing Xie / Harikishan Desineni

Change controller:

IETF Audio/Video Transport working group delegated from the IESG.

9.1.5. Updated Registration of Media Type audio/EVRCB0

Type name: audio

Subtype name: EVRCB0

Required parameters: None

Optional parameters:

These parameters apply to RTP transfer only.

recvmode: A mode of the EVRC-B codec. A decoder can use this attribute to inform an encoder of its preference to operate in a specified mode. Possible values are 0..7 (see the encoder operating point column in Table 2-6 of 3GPP2 C.S0014-B).

sendmode: A mode of the EVRC-B codec. An encoder can use this to signal its current mode of operation. Possible values are 0..7 (see the encoder operating point column in Table 2-6 of 3GPP2 C.S0014-B).

silencesupp: See Section 6.1 of RFC 4788 for a definition. If this parameter is not present, the default value 1 MUST be assumed.

dtxmax: see Section 6.1 of RFC 4788.

dtxmin: see Section 6.1 of RFC 4788.

hangover: see Section 6.1 of RFC 4788.

Encoding considerations:

This media type is framed binary data (see RFC 4288, Section 4.8) and is defined for transfer of EVRC-B encoded data via RTP using the header-free packet format specified in RFC 3558.

Security considerations: See Section 9 of RFC 4788.

Interoperability considerations: None

Published specification:

The EVRC-B vocoder is specified in 3GPP2 C.S0014-B. The transfer method with the header-free packet format via RTP is specified in RFC 3558, RFC 4788, and RFC 5188.

Applications that use this media type:

It is expected that many VoIP applications (as well as mobile applications) will use this type.

Additional information: None

Person & email address to contact for further information:

Harikishan Desineni <hd@qualcomm.com>

Intended usage: COMMON

Restrictions on usage:

When this media type is used in the context of transfer over RTP, the RTP payload format specified in Section 4.2 of RFC 3558 SHALL be used.

This media type depends on RTP framing and hence is only defined for transfer via RTP [6]; the RTP payload format specified in Section 4.2 of RFC 3558 SHALL be used. This media type SHALL NOT be used for storage or file transfer using the file format defined in Section 5 of RFC 4788; instead, audio/EVRCB SHALL be used.

Author:

Qiaobing Xie / Harikishan Desineni

Change controller:

IETF Audio/Video Transport working group delegated from the IESG.

10. SDP Mode Attributes for EVRC-WB and EVRC-B

'sendmode' can be used by a sender (EVRC-WB or EVRC-B) to announce its encoder's current mode of operation. A sender can change its mode anytime, and this does not cause any decoding problems at the receiver.

'recvmode' is defined for use with EVRC-B. A decoder can use this attribute to inform an encoder of its preference to operate in a specified mode. The receiver will continue to decode properly even if the sender does not operate in the preferred mode.

'mode-set-recv' is defined for use with EVRC-WB. A decoder can use this attribute to inform an encoder of its preference to operate in a specified subset of modes. The receiver will continue to decode properly even if the sender does not operate in one of the preferred modes. A set has been defined so that several modes can be expressed as a preference in one attempt. For instance, the set {4,7} signals that the receiver prefers the sender to operate in narrowband modes of EVRC-WB.

11. EVRC-B Interoperability with Legacy Implementations (RFC 4788)

This document adds new optional parameters "recvmode" and "sendmode" to the original EVRC-B media types "audio/EVRCB" and "audio/EVRCB0" defined in RFC 4788 [3]. Existing RFC 4788 [3] implementations will not send these parameters in the Session Description Protocol (SDP) and will ignore them if they are received. This will allow

interoperability between RFC 4788 [3] and RFC 5188 implementations of EVRC-B. For an example offer-and-answer exchange, see Section 17.

12. Mapping EVRC-WB Media Type Parameters into SDP

Information carried in the media type specification has a specific mapping to fields in the Session Description Protocol (SDP) [8], which is commonly used to describe RTP sessions. When SDP is used to specify sessions employing EVRC-WB encoded speech, the mapping is as follows.

- The media type ("audio") goes in SDP "m=" as the media name.
- The media subtype ("EVRCWB", "EVRCWB0", or "EVRCWB1") goes in SDP "a=rtpmap" as the encoding name.
- The optional parameters ’ptime’ and ’maxptime’ (for subtypes EVRCWB, EVRCWB1) go in the SDP "a=ptime" and "a=maxptime" attributes, respectively.
- Any remaining parameters (for subtypes EVRCWB, EVRCWB0, and EVRCWB1) go in the SDP "a=fmtp" attribute by copying them from the media type string as a semicolon-separated list of parameter=value pairs.

13. Mapping EVRC-B Media Type Parameters into SDP

The new optional parameters ’recvmode’ and ’sendmode’ (for ’audio’ subtypes EVRCB and EVRCB0) go in the SDP "a=fmtp" attribute by copying them directly from the media type string.

For all other media type parameters, the specification in Section 6.7 of RFC 4788 [3] still applies.

14. Offer-Answer Model Considerations for EVRC-WB

The following considerations apply when using the SDP offer-answer procedures of RFC 3264 [7] to negotiate the use of EVRC-WB payload in RTP:

- Since EVRC-WB is an extension of EVRC-B, the offerer SHOULD announce EVRC-B support in its "m=audio" line, with EVRC-WB as the preferred codec. This will allow interoperability with an answerer that supports only EVRC-B.

Below is an example of such an offer:

```
m=audio 55954 RTP/AVP 98 99
a=rtpmap:98 EVRCWB0/16000
a=rtpmap:99 EVRCB0/8000
a=fmtp:98 mode-set-recv=0,4;sendmode=0
a=fmtp:99 recvmode=0 sendmode=4
```

If the answerer supports EVRC-WB, then the answerer can keep the payload type 98 in its answer and the conversation can be done using EVRC-WB. Else, if the answerer supports only EVRC-B, then the answerer will leave only the payload type 99 in its answer and the conversation will be done using EVRC-B.

An example answer for the above offer is the following:

```
m=audio 55954 RTP/AVP 98
a=rtpmap:98 EVRCWB0/16000
a=fmtp:98 mode-set-recv=4;sendmode=4
```

- 'mode-set-recv' is a unidirectional receive-only parameter.

- 'sendmode' is a unidirectional send-only parameter.

- Using 'sendmode', a sender can signal its current mode of operation. Note that a receiver may receive RTP media well before the arrival of SDP with a (first-time, or updated) 'sendmode' parameter.

- An offerer can use 'mode-set-recv' to request that the remote sender's encoder be limited to the list of modes signaled in 'mode-set-recv'. A remote sender MAY ignore 'mode-set-recv' requests.

- The parameters 'maxptime' and 'ptime' will in most cases not affect interoperability; however, the setting of the parameters can affect the performance of the application. The SDP offer-answer handling of the 'ptime' parameter is described in RFC 3264 [7]. The 'maxptime' parameter MUST be handled in the same way.

- For a sendonly stream, the 'mode-set-recv' parameter is not useful and SHOULD NOT be used.

- For a recvonly stream, the 'sendmode' parameter is not useful and SHOULD NOT be used.

- When using EVRCWB1, the entire session MUST use the same fixed rate and mode (0-Wideband or 4,7-Narrowband).

- For additional rules that MUST be followed while negotiating DTX parameters, see Section 6.8 in [3].

- Any unknown parameter in an SDP offer MUST be ignored by the receiver and MUST NOT be included in the SDP answer.

15. Offer-Answer Model Considerations for EVRC-B

See Section 6.8 of [3] for offer-answer usage of EVRC-B. The following are several additional considerations for EVRC-B.

- 'recvmode' is a unidirectional receive-only parameter.

- 'sendmode' is a unidirectional send-only parameter.

- Using 'recvmode', a receiver can signal the remote sender to operate its encoder in the specified mode. A remote sender MAY ignore 'recvmode' requests.

- Using 'sendmode', a sender can signal its current mode of operation. Note that a receiver may receive RTP media well before the arrival of SDP with a (first-time, or updated) 'sendmode' parameter.

- For a sendonly stream, the 'recvmode' parameter is not useful and SHOULD NOT be used.

- For a recvonly stream, the 'sendmode' parameter is not useful and SHOULD NOT be used.

16. Declarative SDP Considerations

For declarative use of SDP in the Session Announcement Protocol (SAP) [12] and the Real Time Streaming Protocol (RTSP) [13], the following considerations apply:

- Any 'maxptime' and 'ptime' values should be selected with care to ensure that the session's participants can achieve reasonable performance.

- The payload format configuration parameters are all declarative, and a participant MUST use the configuration(s) that is provided for the session. More than one configuration may be provided if necessary by declaring multiple RTP payload types; however, the number of types should be kept small. For declarative examples, see Section 17.

17. Examples

Some example SDP session descriptions utilizing EVRC-WB and EVRC-B encodings follow. In these examples, long a=fmtp lines are folded to meet the column width constraints of this document. The backslash ("\") at the end of a line and the carriage return that follows it should be ignored. Note that media subtype names are case-insensitive. Parameter names are case-insensitive both in media types and in the mapping to the SDP a=fmtp attribute.

Example usage of EVRCWB:

```
m=audio 49120 RTP/AVP 97 98
a=rtpmap:97 EVRCWB/16000
a=rtpmap:98 EVRCB0/8000
a=fmtp:97 mode-set-recv=0,4;sendmode=0
a=fmtp:98 recvmode=0 sendmode=0
a=maxptime:120
```

Example usage of EVRCWB0:

```
m=audio 49120 RTP/AVP 97 98
a=rtpmap:97 EVRCWB0/16000
a=rtpmap:98 EVRCB0/8000
a=fmtp:97 mode-set-recv=0,4;sendmode=0
a=fmtp:98 recvmode=0 sendmode=0
```

Example SDP answer from a media gateway requesting a terminal to limit its encoder operation to EVRC-WB mode 4:

```
m=audio 49120 RTP/AVP 97
a=rtpmap:97 EVRCWB0/16000
a=fmtp:97 mode-set-recv=4;sendmode=4
```

Example usage of EVRCWB1:

```
m=audio 49120 RTP/AVP 97 98
a=rtpmap:97 EVRCWB1/16000
a=fmtp:97 mode-set-recv=4;sendmode=4
a=maxptime:100
```

Example usage of EVRCWB with DTX with silencesupp=1:

```
m=audio 49120 RTP/AVP 97 98
a=rtpmap:97 EVRCWB/16000
a=rtpmap:98 EVRCB0/8000
a=fmtp:97 silencesupp=1;dtxmax=32;dtxmin=12;hangover=1 \
mode-set-recv=0,4; sendmode=0
a=fmtp:98 recvmode=0 sendmode=0
a=maxptime:120
```

Example usage of EVRCWB with DTX with silencesupp=0:

```
m=audio 49120 RTP/AVP 97 98
a=rtpmap:97 EVRCWB/16000
a=rtpmap:98 EVRCB0/8000
a=fmtp:97 silencesupp=0;dtxmax=32;dtxmin=12;hangover=1 \
mode-set-recv=0,4;sendmode=0
a=fmtp:98 recvmode=0 sendmode=0
a=maxptime:120
```

Example usage of EVRCB:

```
m=audio 49120 RTP/AVP 97
a=rtpmap:97 EVRCB/8000
a=fmtp:97 recvmode=0 sendmode=4
a=maxptime:120
```

Example usage of EVRCB0:

```
m=audio 49120 RTP/AVP 97
a=rtpmap:97 EVRCB0/8000
a=fmtp:97 recvmode=0 sendmode=4
```

Example offer-answer exchange between EVRC-WB and legacy EVRC-B (RFC 4788):

Offer:

```
m=audio 55954 RTP/AVP 98 99
a=rtpmap:98 EVRCWB0/16000
a=rtpmap:99 EVRCB0/8000
a=fmtp:98 mode-set-recv=0,4;sendmode=0
a=fmtp:99 recvmode=0 sendmode=0
```

Answer:

```
m=audio 55954 RTP/AVP 99
a=rtpmap:99 EVRCB0/8000
```

Example offer-answer exchange between EVRC-WB and updated EVRC-B (RFC 5188):

Offer:

```
m=audio 55954 RTP/AVP 98 99
a=rtpmap:98 EVRCWB0/16000
a=rtpmap:99 EVRCB0/8000
a=fmtp:98 mode-set-recv=0,4; sendmode=0
a=fmtp:99 recvmode=0 sendmode=0
```

Answer:

```
m=audio 55954 RTP/AVP 99
a=rtpmap:99 EVRCB0/8000
a=fmtp:99 recvmode=0 sendmode=4
```

In the above example, note that the answerer has chosen to send in mode 4 even though the offerer was willing to receive in mode 0. 'recvmode' is a receiver's preference, but the sender can send in a different mode.

Example offer-answer exchanges for interoperability between legacy (RFC 4788) and updated EVRC-B (RFC 5188) implementations:

Offer from an offerer that supports updated EVRC-B (RFC 5188) implementation:

```
m=audio 55954 RTP/AVP 99
a=rtpmap:99 EVRCB0/8000
a=fmtp:99 recvmode=0 sendmode=4
```

Answer from an answerer that supports only legacy EVRC-B (RFC 4788) implementation:

```
m=audio 55954 RTP/AVP 99
a=rtpmap:99 EVRCB0/8000
```

Offer from an offerer that supports only legacy EVRC-B (RFC 4788) implementation:

```
m=audio 55954 RTP/AVP  99
a=rtpmap:99 EVRCB0/8000
```

Answer from an answerer that supports updated EVRC-B (RFC 5188) implementation:

```
m=audio 55954 RTP/AVP 99
a=rtpmap:99 EVRCB0/8000
a=fmtp:99 recvmode=0 sendmode=4
```

18. Security Considerations

Since compression is applied to the payload formats end-to-end, and the encodings do not exhibit significant non-uniformity, implementations of this specification are subject to all the security considerations specified in RFC 3558 [2]. Implementations using the payload defined in this specification are subject to the security considerations discussed in RFC 3558 [2], RFC 3550 [6], and any appropriate profile (for example, RFC 3551 [11]).

19. Changes to RFC 4788

This document updates RFC 4788 [3], and the updates are summarized below:

- Added new media type attribute "sendmode" to media subtypes EVRCB and EVRCB0. This attribute can be used to signal the EVRC-B encoder’s current mode of operation.

- Added new media type attribute "recvmode" to media subtypes EVRCB and EVRCB0. This attribute can be used to signal the EVRC-B decoder’s preferred operating mode to a remote sender.

20. References

20.1. Normative References

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