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Enhancements to RTP Payload Formats for EVRC Family Codecs

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Abstract

This document updates the Enhanced Variable Rate Codec (EVRC) RTP payload formats defined in RFC 3558 with several enhancements and extensions. In particular, it defines support for the header-free and interleaved/bundled packet formats for the EVRC-B codec, a new compact bundled format for the EVRC and EVRC-B codecs, as well as discontinuous transmission (DTX) support for EVRC and EVRC-B-encoded speech transported via RTP. Voice over IP (VoIP) applications operating over low bandwidth dial-up and wireless networks require such enhancements for efficient use of the bandwidth.

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1. Introduction

This document defines support for the header-free and interleaved/bundled packet formats for the EVRC-B codec, a new compact bundled format for the EVRC and EVRC-B codecs, as well as discontinuous transmission (DTX) support for EVRC and EVRC-B-encoded speech transported via RTP. Voice over IP (VoIP) applications operating over low bandwidth dial-up and wireless networks require such EVRC RTP payload capabilities for efficient use of the bandwidth.

1.1. Support of EVRC-B Codec

EVRC-B [3] is an extension to EVRC [2] developed in the Third Generation Partnership Project 2 (3GPP2). EVRC-B [3] compresses each 20 milliseconds of 8000Hz, 16-bit sampled speech input into output frames of one of the four different sizes: Rate 1 (171 bits), Rate 1/2 (80 bits), Rate 1/4 (40 bits), or Rate 1/8 (16 bits). In addition, there are two zero-bit codec frame types: null frames and erasure frames, similar to EVRC [2]. One significant enhancement in EVRC-B is the use of 1/4-rate frames that were not used in EVRC. This provides lower average data rates (ADRs) compared to EVRC, for a given voice quality.

Since speech frames encoded by EVRC-B are different from those encoded by EVRC, EVRC-B and EVRC codecs do not interoperate with each other. At the initiation of an RTP session, the RTP sender and receiver need to indicate (e.g., using MIME subtypes that are separate from those of EVRC) that EVRC-B is to be used for the ensuing session.

1.2. Compact (Header-free) Bundled Format

The current interleaved/bundled packet format defined in RFC 3558 allows bundling of multiple speech frames of different rates in a single RTP packet, sending mode change requests, and interleaving. To support these functions, a Table of Contents (ToC) is used in each RTP packet, in addition to the standard RTP header. The size of the ToC varies depending on the number of EVRC frames carried in the packet [4].

The current header-free packet format defined in RFC 3558 is more compact and optimized for use over wireless links. It eliminates the need for a ToC by requiring that each RTP packet contain only one speech frame (of any allowable rate), i.e., bundling is not allowed. Moreover, interleaving and mode change requests are not supported in the header-free format [4].

The compact bundled format described in this document presents the user an alternative to the header-free format defined in RFC 3558. This format allows bundling of multiple EVRC or EVRC-B frames without the addition of extra headers, as would be in the case of the interleaved/bundled format. However, in order to use this compact bundled format, only one EVRC/EVRC-B rate (full rate or 1/2 rate) can be used in the session. Similar to the header-free format defined in RFC 3558, interleaving and mode change requests are not supported in the compact bundled format.

1.3. Discontinuous Transmission (DTX)

Information carried in frames of EVRC and EVRC-B codecs varies little during periods of silence. The transmission of these frames across the radio interface in a wireless system is expensive, in terms of capacity; therefore, suppression of these frames is desirable. Such an operation is called DTX, also known as silence suppression.

In general, when DTX/silence suppression is applied, the first few frames of silence may be transmitted at the beginning of the period of silence to establish background noise. Then, a portion of the stream of subsequent silence frames is not transmitted, and is discarded at the sender. At the receiver, background or comfort noise may be generated by using the previously received silence frames.

The full detail of DTX/silence suppression operation can be found in DTX [8] as well as in RFC 3551 [9], and in RFC 3558 [4]. This document only defines the additional optional MIME parameters (silencesupp, dtxmax, dtxmin, and hangover) for setting up a DTX/silence suppression session, where "silencesupp" is for indicating the capability and willingness of using DTX/silence suppression; "dtxmax" and "dtxmin", for indicating the desired range of DTX update interval; and "hangover", for indicating the desired number of silence frames at the beginning of each silence period to establish background noise at the receiver (see Section 6.1 for detailed definition).

The EVRC and EVRC-B codecs, in variable-rate operation mode, send 1/8-rate frames during periods of silence, while in single-rate operation mode (see Section 4), silence is encoded and sent in frames of the same rate as that of speech frames. The DTX parameters defined in this document apply to 1/8-rate frames in the variable-rate mode and to silence frames in the single-rate operation mode.

For simplicity, in the rest of this document the term "silence frame" refers either to an 1/8-rate frame in variable-rate operation or a frame that contains only silence in the signal-rate operation.

2. Conventions

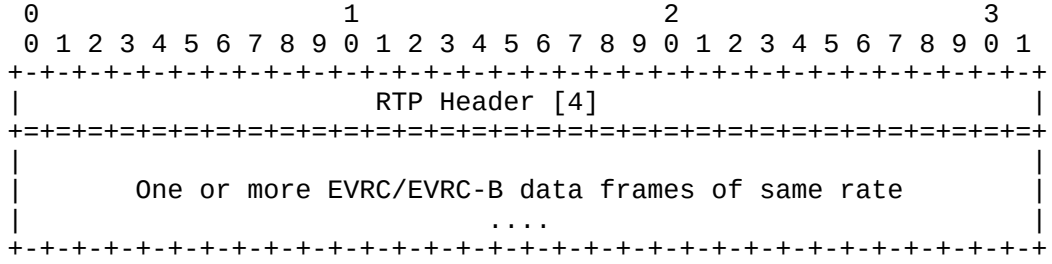
The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [1].

3. EVRC-B Codec

Three RTP packet formats are supported for the EVRC-B codec: the interleaved/bundled packet format, the header-free packet format, and the compact bundled packet format. For the interleaved/bundled and header-free packet formats, the operational details and capabilities, such as ToC, interleaving, and bundling, of EVRC-B, are exactly the same as those of EVRC, as defined in RFC 3558 [4], except that the mode change request field in the ToC MUST be interpreted according to the definition of the RATE_REDUC parameter in EVRC-B [3]. The compact bundled packet format for EVRC-B is defined in Section 4 of this document.

4. Compact Bundled Format

A packet in the compact bundled format consists of an RTP header, followed by a sequence of one or more consecutive EVRC/EVRC-B codec data frames of the same rate, as shown below:



The codec data frames MUST be generated from the output of the codec following the procedure described in Section 5.2 in RFC 3558 [4], and all MUST be of the same rate and size.

4.1. Single-Rate Operation

As mentioned earlier, in order to use the compact bundled format, all the EVRC/EVRC-B data frames in the session MUST be of the same rate. This packet format may carry only full or half-rate frames.

For a session that uses the compact bundled format, the rate for the session can be determined during the session setup signaling, for example, via Session Description Protocol (SDP) exchanges. See Section 6 below for more details.

5. Storage Format for EVRC-B Codec

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

The file begins with a magic number to identify the vocoder that is used. The magic number for EVRC-B corresponds to the ASCII character string:

```
"#!EVRC-B\n"
(or 0x2321 0x4556 0x5243 0x2d42 0x0a in hexadecimal).
```

Note that the "\n" is an important part of both this magic number and the "#!EVRC\n" magic number defined in Section 11 of RFC 3558, and the "\n" MUST be included in any comparison of either magic number, since, otherwise, a prefix of the EVRC-B magic number could be mistaken for the EVRC magic number.

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, as defined in Section 5.1 of [4], 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.

Speech frames lost in transmission and non-received frames MUST be stored as erasure frames to maintain synchronization with the original media.

6. Media Type Definitions

6.1. Registration of Media Type EVRC1

Type name: audio

Subtype names: EVRC1

Required parameters: none

Optional parameters:

ptime: See RFC 4566 [7].

maxptime: The maximum amount of media that can be encapsulated in each packet, expressed as time in milliseconds. The time MUST be calculated as the sum of the time the media present in the packet represents. The time SHOULD be a multiple of the duration of a single codec data frame (20 msec). If not signaled, the default maxptime value MUST be 200 milliseconds.

fixedrate: Indicates the EVRC 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: Permissible values are 0 and 1. A value of 1 indicates that the sender of this parameter: a) is capable of receiving silence-suppressed speech using DTX, AND b) is capable of and will send out silence-suppressed speech using DTX, unless the other end indicates that it does not want to receive silence-suppressed speech using DTX.

A value of 0 indicates that the sender of this parameter: a) does NOT want to receive silence-suppressed speech using DTX, AND b) will NOT send out silence-suppressed speech using DTX.

If this parameter is not present, the default value 1 MUST be assumed. If the RTP receiver indicates through the use of SIP signaling or other means that it is incapable of or unwilling to use silence suppression using DTX, silence suppression using DTX as specified in this document MUST NOT be used for the session.

dtxmax: Permissible values are from 0 to 255. Indicates the maximum DTX update interval in number of frames. During DTX, the RTP sender occasionally updates the RTP receiver about the change in background noise characteristics, etc., by sending a new silence frame to the RTP receiver. The RTP receiver may use 'dtxmax' to indicate to the RTP sender the maximum interval (in number of frames) between any two DTX updates it expects to receive from the RTP sender.

If this parameter is not present in a session that uses DTX, the default value 32, as specified in [8], MUST be assumed. This parameter MUST be ignored if silence suppression using DTX is not used for the session.

Note also that if the RTP receiver elects to detect DTX using dtxmax, the dtxmax parameter will affect the amount of delay the RTP receiver sees before detecting DTX in the stream.

dtxmin: Permissible values are from 0 to 255. Indicates the minimum DTX update interval in number of frames. The RTP receiver may use 'dtxmin' to indicate to the RTP sender the minimal interval (in number of frames) between any two DTX updates it expects to receive from the RTP sender.

If this parameter is not present, the default value 12, as specified in [8] MUST be assumed. This parameter MUST be ignored if silence suppression using DTX is not used for the session.

hangover: Permissible values are from 0 to 255. Indicates the number of consecutive silence frames transmitted at the end of an active speech interval but before the DTX interval begins. When setting up an RTP session that uses DTX, an RTP receiver can use this parameter to signal the number of silence frames it expects to receive before the beginning of DTX. While hangover=0 is allowed, it is RECOMMENDED that hangover be set to 1 or greater since the presence of silence frames at the end of an active speech can help the RTP receiver to identify the beginning of the DTX period.

If this parameter is not present for a session that uses DTX, the default value 1, as specified in [8] MUST be assumed. This parameter MUST be ignored if silence suppression using DTX is not used for the session.

Encoding considerations:
This media type is framed binary data (see RFC 4288, Section 4.8) and is defined for transfer of EVRC-encoded data via RTP, using the compact bundled format as described in RFC 4788.

Security considerations: See Section 9 of RFC 4788.

Interoperability considerations: none

Published specification:
The EVRC vocoder is specified in 3GPP2 C.S0014 [2]. Transfer method with compact bundled RTP format is specified in RFC 4788.

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:
Qiaobing Xie <Qiaobing.Xie@motorola.com>

Intended usage: COMMON

Restrictions on usage:
This media type depends on RTP framing; hence, it is only defined for transfer via RTP (RFC 3550 [5]). Transfer within other framing protocols is not defined at this time.

Author:
Qiaobing Xie

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

6.2. Registration of Media Type EVRCB

Type name: audio

Subtype names: EVRCB

Required parameters: none

Optional parameters:

ptime: see RFC 4566 [7].

maxptime: The maximum amount of media that can be encapsulated in each packet, expressed as time in milliseconds. The time MUST be calculated as the sum of the time the media present in the packet represents. The time SHOULD be a multiple of the duration of a single codec data frame (20 msec). If not signaled, the default maxptime value MUST be 200 milliseconds.

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 for definition. If this parameter is not present, the default value 1 MUST be assumed.

dtxmax: see Section 6.1

dtxmin: see Section 6.1

hangover: see Section 6.1

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 [4].

Security considerations: See Section 9 of RFC 4788.

Interoperability considerations: none

Published specification:
The EVRC-B vocoder is specified in 3GPP2 C.S0014-B [3]. Transfer method with Interleaved/Bundled packet format via RTP is specified in RFC 3558.

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 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:
Qiaobing Xie <Qiaobing.Xie@motorola.com>

Intended usage: COMMON

Restrictions on usage:
This media type may be used with RTP framing (RFC 3550 [5]) and as a storage format. When used with RTP, the procedures in Section 3 MUST be followed. In all other contexts, the storage format defined in Section 5 MUST be used.

Author:
Qiaobing Xie

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

6.3. Registration of Media Type EVRCB0

Type name: audio

Subtype names: EVRCB0

Required parameters: none

Optional parameters:

silencesupp: see Section 6.1 for definition. If this parameter is not present, the default value 1 MUST be assumed.

dtxmax: see Section 6.1

dtxmin: see Section 6.1

hangover: see Section 6.1

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 [4].

Security considerations: See Section 9 of RFC 4788.

Interoperability considerations: none

Published specification:
The EVRC-B vocoder is specified in 3GPP2 C.S0014-B [3]. Transfer method with Header-Free packet format via RTP is specified in RFC 3558 and RFC 4788.

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:
Qiaobing Xie <Qiaobing.Xie@motorola.com>

Intended usage: COMMON

Restrictions on usage:
This media type depends on RTP framing; hence, it is only defined for transfer via RTP (RFC 3550 [5]). Transfer within other framing protocols is not defined at this time.

Author:
Qiaobing Xie

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

6.4. Registration of Media Type EVRCB1

Type name: audio

Subtype names: EVRCB1

Required parameters: none

Optional parameters:

ptime: see RFC 4566 [7].

maxptime: The maximum amount of media that can be encapsulated in each packet, expressed as time in milliseconds. The time MUST be calculated as the sum of the time the media present in the packet represents. The time SHOULD be a multiple of the duration of a single codec data frame (20 msec). If not signaled, the default maxptime value MUST be 200 milliseconds.

fixedrate: Indicates the EVRC-B 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 for definition. If this parameter is not present, the default value 1 MUST be assumed.

dtxmax: see Section 6.1

dtxmin: see Section 6.1

hangover: see Section 6.1

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 compact bundled format as described in RFC 4788.

Security considerations: See Section 9 of RFC 4788.

Interoperability considerations: none.

Published specification:
The EVRC-B vocoder is specified in 3GPP2 C.S0014-B [3]. Transfer method with compact bundled RTP format is specified in RFC 4788.

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:
Qiaobing Xie <Qiaobing.Xie@motorola.com>

Intended usage: COMMON

Restrictions on usage:
This media type depends on RTP framing; hence, it is only defined for transfer via RTP (RFC 3550 [5]). Transfer within other framing protocols is not defined at this time.

Author:
Qiaobing Xie

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

6.5. Updated Registration of Media Type EVRC

(The definition is from RFC 3558, added with the optional DTX parameters, and updated with the new template specified in [10].)

Type name: audio

Subtype names: EVRC

Required parameters: none

Optional parameters:

ptime: Defined as usual for RTP audio (see RFC 4566).

maxptime: The maximum amount of media that can be encapsulated in each packet, expressed as time in milliseconds. The time SHALL be calculated as the sum of the time the media present in the packet represents. The time SHOULD be a multiple of the duration of a single codec data frame (20 msec). If not signaled, the default maxptime value SHALL be 200 milliseconds.

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 SHALL be 5.

silencesupp: see Section 6.1 for definition. If this parameter is not present, the default value 1 MUST be assumed.

dtxmax: see Section 6.1

dtxmin: see Section 6.1

hangover: see Section 6.1

Encoding considerations:
This media type is framed binary data (see RFC 4288, Section 4.8), and is defined for transfer of EVRC-encoded data via RTP using the Interleaved/Bundled packet format specified in Sections 4.1, 6, and 7 of RFC 3558. It is also defined for other transfer methods using the storage format specified in Section 11 of RFC 3558.

Security considerations: See Section 14, "Security Considerations", of RFC 3558.

Interoperability considerations:
The DTX parameters are receiver options. Existing RFC 3558 implementations will not send any of the DTX parameters in their SDP and will ignore any DTX parameters they receive. The adaptive DTX behavior of DTX-capable EVRC codecs (as detailed in [8], Section 4.3.5) ensures interoperability with non-DTX EVRC codecs.

Published specification:
The EVRC vocoder is specified in 3GPP2 C.S0014 [2]. Transfer methods are specified in RFC 3558.

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 storage format only.

Magic number: #!EVRC\n (see Section 11 of RFC 3558)
File extensions: evc, EVC
Macintosh file type code: none
Object identifier or OID: none

Person & email address to contact for further information:
Qiaobing Xie <Qiaobing.Xie@motorola.com>

Intended usage: COMMON

Restrictions on usage:
This media type may be used with RTP framing (RFC 3550 [5]) and as a storage format. When used with RTP, the procedures in RFC 3558, Section 4.1, MUST be followed. In all other contexts, the storage format defined in RFC 3558, Section 11, MUST be used.

Author:
Adam Li/Qiaobing Xie

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

6.6. Updated Registration of Media Type EVRC0

(The definition is from RFC 3558, added with the optional DTX parameters, and updated with the new template specified in [10].)

Type name: audio

Subtype names: EVRC0

Required parameters: none

Optional parameters:

silencesupp: see Section 6.1 for definition. If this parameter is not present, the default value 1 MUST be assumed.

dtxmax: see Section 6.1

dtxmin: see Section 6.1

hangover: see Section 6.1

Encoding considerations:
This media type is framed binary data (see RFC 4288, Section 4.8) and is only defined for transfer of EVRC-encoded data via RTP using the Header-Free packet format specified in Section 4.2 of RFC 3558.

Security considerations: See Section 14, "Security Considerations", of RFC 3558.

Interoperability considerations:
The DTX parameters are receiver options. Existing RFC 3558 implementations will not send any of the DTX parameters in their SDP and will ignore any DTX parameters they receive. The adaptive DTX behavior of DTX-capable EVRC codecs (as detailed in [8], Section 4.3.5) ensures interoperability with non-DTX EVRC codecs.

Published specification:
The EVRC vocoder is specified in 3GPP2 C.S0014 [2]. Transfer methods are specified in RFC 3558.

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:
Qiaobing Xie <Qiaobing.Xie@motorola.com>

Intended usage: COMMON

Restrictions on usage:
This media type depends on RTP framing; hence, it is only defined for transfer via RTP (RFC 3550 [5]). Transfer within other framing protocols is not defined at this time.

Author:
Adam Li/Qiaobing Xie

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

6.7. Mapping MIME Parameters into SDP

The information carried in the MIME media type specification has a specific mapping to fields in the Session Description Protocol (SDP) [7], which is commonly used to describe RTP sessions. When SDP is used to specify sessions employing the compact bundled format for EVRC/EVRC-B-encoded speech, the mapping is as follows:

- The MIME type ("audio") goes in SDP "m=" as the media name.
- The MIME subtype ("EVRC", "EVRC0", "EVRC1", "EVRCB", EVRCB0", or "EVRCB1") goes in SDP "a=rtpmap" as the encoding name.
- The optional parameters "ptime" and "maxptime" (for subtypes EVRC, EVRC1, EVRCB, and EVRCB1) go in the SDP "a=ptime" and "a=maxptime" attributes, respectively.
- The optional parameter "maxinterleave" (for subtypes EVRC and EVRCB) goes in the SDP "a=fmtp" attribute by copying it directly from the MIME media type string as "maxinterleave=value".
- The optional parameter "fixedrate" (for subtypes EVRC1 and EVRCB1) goes in the "a=fmtp" attribute by copying it directly from the MIME media type string as "fixedrate=value".
- The optional parameters "silencesupp", "dtxmax", "dtxmin", and "hangover" go in the "a=fmtp" attribute by copying it directly from the MIME media type string as "silencesupp=value", "dtxmax=value", "dtxmin=value", and "hangover=value", respectively.

Example of usage of EVRC1:

```
m=audio 49120 RTP/AVP 97
a=rtpmap:97 EVRC1/8000
a=fmtp:97 fixedrate=0.5
a=maxptime:120
```

Example of usage of EVRCB:

```
m=audio 49120 RTP/AVP 97
a=rtpmap:97 EVRCB/8000
a=maxptime:120
```

Example of usage of EVRCB0:

```
m=audio 49120 RTP/AVP 97
a=rtpmap:97 EVRCB0/8000
```

Example of usage of EVRCB1:

```
m=audio 49120 RTP/AVP 97
a=rtpmap:97 EVRCB1/8000
a=fmtp:97 fixedrate=0.5
a=maxptime:100
```

Example of usage of EVRC with DTX with silencesupp=1:

```
m=audio 49120 RTP/AVP 97
a=rtpmap:97 EVRC/8000
a=fmtp:97 silencesupp=1 dtxmax=32 dtxmin=12 hangover=1
```

Example of usage of EVRC with DTX with silencesupp=0:

```
m=audio 49120 RTP/AVP 97
a=rtpmap:97 EVRC/8000
a=fmtp:97 silencesupp=0
```

6.8. Usage in Offer/Answer

All SDP parameters in this payload format are declarative, and all reasonable values are expected to be supported. In particular, when DTX is supported, the RTP sender implementation SHOULD support hangover, dtxmin, and dtxmax values from 0 to 255. Thus, the standard usage of Offer/Answer, as described in RFC 3264 [6], SHOULD be followed.

In addition, the following rules MUST be followed while negotiating DTX parameters:

1. If any DTX parameter is not present in either offer and/or answer, the default value of the DTX parameter MUST be assumed.

2. If silencesupp is present and set to 0 in either offer or answer, the values of all received DTX parameters other than silencesupp SHOULD be ignored.

3. In an offer or answer, the value of dtxmax SHOULD always be larger than or equal to the value of dtxmin, regardless of whether the values are indicated explicitly or implicitly by default. Moreover, if the indicated value of dtxmin is larger

than that of dtxmax, an RTP sender MUST ignore the indicated values and MUST fall back on using the default dtxmin and dtxmax values.

7. Backward Compatibility with RFC 3558

This document adds new optional DTX parameters to the original EVRC payload subtypes "EVRC" and "EVRC0" defined in RFC 3558. Since the new DTX parameters are receiver options, we expect that the existing RFC 3558 implementations will not send any of the DTX parameters in their SDP and will ignore any DTX parameters they receive. The adaptive DTX behavior of DTX-capable EVRC codecs (as detailed in [8], Section 4.3.5) ensures the backward interoperability between the DTX-capable EVRC codec and non-DTX EVRC codecs.

8. IANA Considerations

Four (4) new MIME subtype registrations - "EVRC1", "EVRCB", "EVRCB0", and "EVRCB1" - are defined in this document (see Section 6.1 - Section 6.4) for EVRC-B and compact bundled payload format support.

For all the EVRC and EVRC-B RTP payload formats defined in RFC 3558 [4] and RFC 4788, four additional optional parameters - "silencesupp", "dtxmax", "dtxmin", and "hangover" - are defined and used in DTX.

The MIME subtype registrations "EVRC" and "EVRC0", originally defined in RFC 3558 [4], are updated with the optional DTX parameters (see Sections 6.5 and 6.6).

9. Security Considerations

Implementations using the payload defined in this specification are subject to the security considerations discussed in RFC 3558 [4], RFC 3550 [5], and any appropriate profile (for example, RFC 3551 [9]). This payload does not specify any different security services.

10. Acknowledgements

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11. References

11.1. Normative References

[1] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[2] "Enhanced Variable Rate Codec, Speech Service Option 3 for Wideband Spread Spectrum Digital Systems", 3GPP2 C.S0014, January 1997.

[3] "Enhanced Variable Rate Codec, Speech Service Option 3 and 68 for Wideband Spread Spectrum Digital Systems", 3GPP2 C.S0014-B v1.0, May 2006.

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[5] Schulzrinne, H., Casner, S., Frederick, R., and V. Jacobson, "RTP: A Transport Protocol for Real-Time Applications", RFC 3550, July 2003.

[6] Rosenberg, J. and H. Schulzrinne, "An Offer/Answer Model with the Session Description Protocol (SDP)", RFC 3264, June 2002.

[7] Handley, M., Jacobson, V., and C. Perkins, "SDP: Session Description Protocol", RFC 4566, July 2006.

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11.2. Informative References

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