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Real-Time Transport Protocol (RTP) Payload Format for the Variable-Rate Multimode Wideband (VMR-WB) Extension Audio Codec

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Abstract

This document is an addendum to RFC 4348, which specifies the RTP payload format for the Variable-Rate Multimode Wideband (VMR-WB) speech codec. This document specifies some updates in RFC 4348 to enable support for the new operating mode of VMR-WB standard (i.e., VMR-WB mode 4). These updates do not affect the existing modes of VMR-WB already specified in RFC 4348.

The payload formats and their associated parameters, as well as all provisions, restrictions, use cases, features, etc., that are specified in RFC 4348 are applicable to the new operating mode with no exception.

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1. Introduction

This document is an addendum to RFC 4348 [2] and contains the necessary updates for the support of the new operating mode of 3GPP2 VMR-WB standard [1]. The new mode of VMR-WB standard (VMR-WB mode 4), although operating at a lower data rate, has similar characteristics and functionalities compared to the existing modes of VMR-WB already included in RFC 4348 (e.g., variable bit rate, narrowband/wideband input/output speech/audio processing capability, continuous and discontinuous transmission, etc.). Therefore, all provisions and restrictions specified in RFC 4348 are applicable to all modes of the VMR-WB standard including the new mode, which is specified in this document. As a result, no new media type registration is required.

The VMR-WB file format for transport of VMR-WB speech data in storage mode applications is specified in [1,4] and includes support for the new mode of operation.

The following sections provide the necessary updates to RFC 4348 to enable support of VMR-WB mode 4.

2. Conventions and Acronyms

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 [3].

The following acronyms are used in this document:

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3GPP2  - Third Generation Partnership Project 2
CDMA   - Code Division Multiple Access
VMR-WB - Variable-Rate Multimode Wideband
CMR    - Codec Mode Request
DTX    - Discontinuous Transmission
RTP    - Real-Time Transport Protocol
MIME   - Multipurpose Internet Mail Extensions
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3. The Variable-Rate Multimode Wideband (VMR-WB) Extension

VMR-WB is the wideband speech-coding standard developed by the Third Generation Partnership Project 2 (3GPP2) for encoding/decoding wideband/narrowband speech content in multimedia services in 3G CDMA cellular systems [1]. VMR-WB is a source-controlled variable-rate multimode wideband speech codec. It has a number of operating modes, where each mode is a trade-off between voice quality and average data rate. The operating mode in VMR-WB (as shown in Table 2) is chosen based on the traffic condition of the network and the desired quality

of service. The desired average data rate (ADR) in each mode is obtained by encoding speech frames at permissible rates (as shown in Tables 1 and 3) compliant with CDMA2000 system depending on the instantaneous characteristics of input speech and the maximum and minimum rate constraints imposed by the network operator.

The capabilities of the VMR-WB codec were extended through the addition of a new mode operating at lower average data rates, resulting in improved system capacity in IP and non-IP networks [1].

As a result of this extension, certain reserved table entries in RFC 4348 are used to include support for the new operating mode. VMR-WB mode 4 is compliant with all applicable provisions and restrictions specified in RFC 4348 [2]. Note that the existing table entries of RFC 4348 remain unchanged (e.g., frame types) and the original modes of VMR-WB are not affected by these updates.

The existing flexibility in RFC 4348 for future extensions allows the addition of the new mode without any impact on the interoperability with earlier implementations of RFC 4348.

The following sections provide the necessary updates that are required to be made in RFC 4348.

The provisions and considerations for implementation, congestion control, and security remain identical to those specified in RFC 4348.

4. The Necessary Updates in RFC 4348

Table 1 of RFC 4348 is updated as follows:

Frame Type	Bits per Packet (Frame Size)	Encoding Rate (kbps)
Full-Rate	266	13.3
Full-Rate	171	8.55
Half-Rate	124	7.2
Half-Rate	80	4.0
Quarter-Rate	54	2.7
Quarter-Rate	40	2.0
Eighth-Rate	20	1.0
Eighth-Rate	16	0.8
Blank	0	-
Erasure	0	-
Full-Rate with Bit Errors	171	8.55

Table 1: CDMA2000 system permissible frame types and their associated encoding rates

Note that the new permissible rates correspond to CDMA2000 rate-set I and have been added to the table.

Table 2 of RFC 4348 is updated as follows to include VMR-WB mode 4 and VMR-WB mode 4 with maximum half-rate similar to that described in Section 2.4 of the revised VMR-WB specification [1].

CMR	VMR-WB Operating Modes
0	VMR-WB mode 3 (AMR-WB interoperable mode at 6.60 kbps)
1	VMR-WB mode 3 (AMR-WB interoperable mode at 8.85 kbps)
2	VMR-WB mode 3 (AMR-WB interoperable mode at 12.65 kbps)
3	VMR-WB mode 2
4	VMR-WB mode 1
5	VMR-WB mode 0
6	VMR-WB mode 2 with maximum half-rate encoding
7	VMR-WB mode 4
8	VMR-WB mode 4 with maximum half-rate encoding
9-14	(reserved)
15	No Preference (no mode request is present)

Table 2: List of valid CMR values and their associated VMR-WB operating modes

Note that CMR values 7 and 8 replace the reserved values in Table 2 of RFC 4348.

Table 3 of RFC 4348 is updated as follows to include new frame types (FTs) associated with VMR-WB mode 4.

Note that the sizes of the frames are unique and different, allowing for the use of header-free payload format for all modes of operations [2].

FT	Encoding Rate	Frame Size (Bits)
0	Interoperable Full-Rate (AMR-WB 6.60 kbps)	132
1	Interoperable Full-Rate (AMR-WB 8.85 kbps)	177
2	Interoperable Full-Rate (AMR-WB 12.65 kbps)	253
3	Full-Rate 13.3 kbps	266
4	Half-Rate 6.2 kbps	124
5	Quarter-Rate 2.7 kbps	54
6	Eighth-Rate 1.0 kbps	20
7	Full-Rate 8.55 kbps	171
8	Half-Rate 4.0 kbps	80
9	CNG (AMR-WB SID)	35
10	Eighth-Rate 0.8 kbps	16
11	(reserved)	-
12	(reserved)	-
13	(reserved)	-
14	Erasure (AMR-WB SPEECH_LOST)	0
15	Blank (AMR-WB NO_DATA)	0

Table 3: VMR-WB payload frame types for real-time transport

Note that the new FT types associated with VMR-WB mode 4 replace the reserved entries 7, 8, and 10 in Table 3 of RFC 4348 and there are no changes in the existing entries of Table 3 of RFC 4348.

The 'mode-set' MIME parameter value 4 is defined to indicate that VMR-WB mode 4 is supported and used. Note that the active modes of operation are negotiated and agreed by the IP terminals through the offer/answer model provided in Section 9.3 of RFC 4348 [2].

5. Security Considerations

Same as RFC 4348.

6. Public Specification

The VMR-WB speech codec including the new mode is specified in following 3GPP2 specification C.S0052-A version 1.0. Transfer methods are specified in RFC 4348.

7. IANA Considerations

This document updates the media type registered in [2]. IANA has added this document as reference to that media type registration and has modified the optional parameter mode-set in the registration. Section 9.1 of RFC 4348 [2] reads:

> Currently, this list includes modes 0, 1, 2, and 3 [1], but MAY be extended in the future. If such mode-set is specified during session initiation, the encoder MUST NOT use modes outside of the subset. If not present, all operating modes in the set 0 to 3 are allowed for the session.

IANA will change "modes 0, 1, 2 and 3 [1]" to "modes 0, 1, 2, 3, and 4 [1] [2]", and change "modes in the set 0 to 3" to "modes in the set 0 to 4". [1] will be the IANA's reference to the original VMR-WB document (3GPP2 C.S0052-A v1.0) and [2] will be IANA's reference to this document (RFC 4424).

8. References

8.1. Normative References

[1] 3GPP2 C.S0052-A v1.0 "Source-Controlled Variable-Rate Multimode Wideband Speech Codec (VMR-WB) Service Options 62 and 63 for Spread Spectrum Systems", 3GPP2 Technical Specification, April 2005, http://www.3gpp2.org/.

[2] Ahmadi, S., "Real-Time Transport Protocol (RTP) Payload Format for the Variable-Rate Multimode Wideband (VMR-WB) Audio Codec", RFC 4348, January 2006.

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

8.2. Informative References

[4] 3GPP2 C.S0050-A v1.0 "3GPP2 File Formats for Multimedia Services", 3GPP2 Technical Specification, October 2005, http://www.3gpp2.org/.

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