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RTP Payload Format for IP-MR Speech Codec [draft-ietf-avt-rtp-ipmr-02.txt](#)

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Abstract

This document specifies the payload format for packetization of SPIRIT IP-MR encoded speech signals into the Real-time Transport Protocol (RTP). The payload format supports transmission of multiple frames per payload and introduced redundancy for robustness against packet loss.

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1.	Introduction	

This document specifies the payload format for packetization of SPIRIT IP-MR encoded speech

signals into the Real-time Transport Protocol (RTP). The payload format supports transmission of multiple frames per payload and introduced redundancy for robustness against packet loss.

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. IP-MR Codec Description

The IP-MR codec is scalable adaptive multi-rate wideband speech codec designed by SPIRIT for use in IP based networks. These codec is suitable for real time communications such as telephony and videoconferencing.

The codec operates on 20 ms frames at 16 kHz sampling rate and has an algorithmic delay of 25 ms.

The IP-MR supports six wide band speech coding modes with respective bit rates ranging from about 7.7 to about 34.2 kbps. The coding mode can be changed at any 20 ms frame boundary making possible to dynamically adjust the speech encoding rate during a session to adapt to the varying transmission conditions.

The coded frame consists of multiple coding layers-base (or core) layer and several enhancement layers which are coded independently. These enhancement layers can be omitted and remaining base layer can be meaningfully decoded without artifacts. This making bit stream scalable and allows reduce bit rate during transmission without re-encoding.

This memo specifies an optional form of redundancy coding within RTP for protection against packet loss. It is based on commonly known scheme when previously transmitted frames are aggregated together with new ones. Each frame is retransmitted once in the following RTP payload packet. $f(n-2) \dots f(n+4)$ denote a sequence of speech frames, and $p(n-1) \dots p(n+4)$ a sequence of payload packets:

```
--+-----+-----+-----+-----+-----+-----+-----+-----+
| f(n-2) | f(n-1) | f(n)  | f(n+1) | f(n+2) | f(n+3) | f(n+4) |
--+-----+-----+-----+-----+-----+-----+-----+-----+
```

```

<---- p(n-1) ---->
    <----- p(n) ----->
        <---- p(n+1) ---->
            <---- p(n+2) ---->
                <----- p(n+3) ----->
                    <----- p(n+4) ----->

```

But because of scalable nature of IP-MR codec there is no need to duplicate a whole previous frame - only core layer may be retransmitted. This reduces redundancy overhead while keeping efficiency. Moreover, the speech bits encoded in core layer are divided on six classes (from A to F) of perceptual sensitivity to errors. Using these classes as introduced redundancy make possible to adjust trade-off between overhead and robustness against packet loss.

The mechanism described does not really require signaling at the session setup. The sender is responsible for selecting an appropriate amount of redundancy based on feedback about the channel conditions.

The main codec characteristics can be summarized as follows:

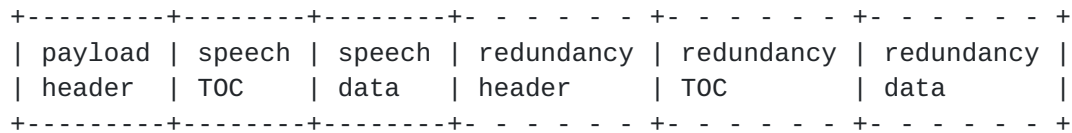
- * Wideband, 16 kHz, speech codec
- * Adaptive multi rate with six modes from about 7.7 to about 34.2 kbps
- * Bit rate scalable
- * Variable bit rate changing in accordance with actual speech content
- * Discontinuous Transmission (DTX), silence suppression and comfort noise generation
- * In-band redundancy scheme for protection against packet loss

3. Payload Format

3.1. Payload Format Structure

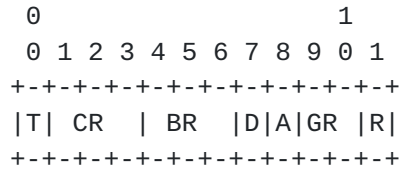
The IP-MR payload format consists of a payload header with general information about packet, a speech table of contents (TOC), and speech data. An optional redundancy section follows after speech data. The redundancy section consists of redundancy header, redundancy TOC and redundancy data payload.

The following diagram shows the standard payload format layout:



3.2. Payload Header

The payload header has the following format:



* T (1 bit): Reserved compatibility with future extensions. SHOULD be set to 0.

* CR (3 bits): coding rate of frame(s) in this packet, as per the following table:

CR	avg. bitrate
0	7.7 kbps
1	9.8 kbps
2	14.3 kbps
3	20.8 kbps
4	27.9 kbps
5	34.2 kbps
6	(reserved)
7	NO_DATA

The CR value 7 (NO_DATA) indicates that there is no speech data (and speech TOC accordingly) in the payload. This MAY be used to transmit redundancy data only. The value 6 is reserved. If receiving this value the packet SHOULD be discarded.

* BR (3 bits): base rate for core layer of frame(s) in this packet. Values in the range 0-5 indicate bitrates for core layer, same as for CR. Values 6 and 7 are reserved. If one of these values is received the packet SHOULD be discarded. The base rate is the lowest rate for scalability, so speech payload can be scaled down not lower than BR value. If a received packet has BR > CR then during decoding it will be assumed that BR = CR.

* D (1 bit): indicates if the DTX mode is allowed or not.

* A (1 bit): byte-aligned payload. If A=1 then all speech frames MUST be

byte-aligned.

This mode speeds up speech data access. The A=0 value specifies bandwidth-efficient mode with no byte alignment (including end of header).

* GR (2 bits): number of frames in packet (grouping size). Actual grouping size is GR + 1, thus maximum grouping supported is 4.

* R (1 bit): redundancy presence bit. If R=1 then the packet contains redundancy information for lost packets recovery. In this case after speech data the redundancy section is present.

3.3. Speech Table of Contents

The speech TOC contains entries for each frame in packet (grouping size in total). Each entry contains a single field:

```
0
+--+
|E|
+--+
```

* E (1 bit): frame existence indicator. If set to 0, this indicates the corresponding frame is absent and the receiver should set special LOST_FRAME flag for decoder. This can be followed by the lost frame itself or by empty frames generated by the encoder during silence intervals in DTX mode.

Note that if CR flag from payload header is 7 (NO_DATA) then speech TOC is empty.

3.4. Speech Data

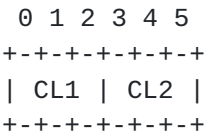
Speech data of a payload contains one or more speech frames or comfort noise frames, as specified in the speech TOC of the payload.

Each speech frame represents 20 ms of speech encoded with the rate indicated in the CR and base rate indicated in BR field of the payload header. The length of the speech frame is variable due to the nature of the codec and can be calculated after decoding.

3.5. Redundancy Header

If a packet contains redundancy (R field of payload header is 1) the speech

data is followed by
redundancy header:

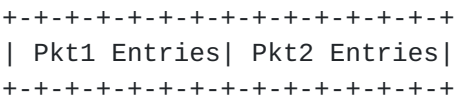


Redundancy header consists of two fields. Each field contains class specifier for amount of redundancy partly taken from the preceding packet (CL1) and pre-preceding packet (CL2), e.g. distant from the current packet by 1 and 2 packets accordingly. The values are listed in the table below:

CL	amount redundancy
0	NONE
1	CLASS A
2	CLASS B
3	CLASS C
4	CLASS D
5	CLASS E
6	CLASS F
7	(reserved)

Each specifier takes 3 bits, thus the total redundancy header size is 6 bits.

3.6. Redundancy Table of Contents



The redundancy TOC contains entries for redundancy frames from preceding and pre-preceding packets. Each entry takes 1 bit like speech TOC entry (3.3):



* E (1 bit): frame existence indicator. If set to 0, this indicates the corresponding frame is absent.

* For each preceding and pre-preceding packet the number of entries is equal to the

[illegible]

5. Media Type Registration

This section describes the media types and names associated with this payload format.

5.1. Registration of media subtype audio/ip-mr_v2.5

Type name: audio

Subtype name: ip-mr_v2.5

Required parameters: none

Optional parameters:

* ptime: Gives the length of time in milliseconds represented by the media in a packet.

Allowed values are: 20, 40, 60 and 80.

Encoding considerations:

This media type is framed binary data (see [RFC 4288, Section 4.8](#)).

Security considerations:

See [RFC 3550](#)

Interoperability considerations: none

Published specification:

RFC XXXX

Applications that use this media type:

Real-time audio applications like voice over IP and teleconference, and multi-media streaming.

Additional information: none

Person & email address to contact for further information:

Elena Berlizova
berlizova@spiritdsp.com

Intended usage: COMMON

Restrictions on usage:

This media type depends on RTP framing, and hence is only defined for transfer via RTP ([RFC 3550](#)).

Author:

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Change controller:

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

5.2. Mapping Media Type Parameters into SDP

The information carried in the media type specification has a specific mapping to fields in the Session Description Protocol (SDP) [[RFC4566](#)], which is commonly used to describe RTP sessions. When SDP is used to specify sessions employing the IP-MR codec, the mapping is as follows:

- * The media type ("audio") goes in SDP "m=" as the media name.
- * The media subtype (payload format name) goes in SDP "a=rtpmap" as the encoding name. The RTP clock rate in "a=rtpmap" MUST 16000.
- * The parameter "ptime" goes in the SDP "a=ptime" attributes.

Any remaining parameters go in the SDP "a=fmtp" attribute by copying them directly from the media type parameter string as a semicolon-separated list of parameter=value pairs.

Note that the payload format (encoding) names are commonly shown in upper case. Media subtypes are commonly shown in lower case. These names are case-insensitive in both places.

6. Security Considerations

RTP packets using the payload format defined in this specification are subject to the security

considerations discussed in the RTP specification [[RFC3550](#)], and any appropriate RTP profile.
This implies that confidentiality of the media streams is achieved by encryption. Encryption may be performed after compression so there is no conflict between the two operations.

This payload format does not exhibit any significant non-uniformity in the receiver side computational complexity for packet processing, and thus is unlikely to pose a denial-of-service threat due to the receipt of pathological data.

[7.](#) IANA Considerations

One media type has been defined and needs registration in the media types registry.

[8.](#) Normative References

- [1] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), RFC 2119, March 1997.
- [2] Schulzrinne, H., Casner, S., Frederick, R., and V. Jacobson, "RTP: A Transport Protocol for Real-Time Applications", STD 64, [RFC 3550](#), July 2003.
- [3] Handley, M., Jacobson, V., and C. Perkins, "SDP: Session Description Protocol", RFC 4566, July 2006.

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[10.](#) Expiration date

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