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RTP Payload Format for SPIRIT IP-MR Speech Codec Software
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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, introduced redundancy for robustness against packet loss, and payload format extension for future versions compatibility.

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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, introduced redundancy for robustness against packet loss, and payload format extension for future versions compatibility.

2. IP-MR RTP Payload Formats

The payload has two formats: standard optimized for current use-cases and extended for future versions compatibility. The payload format is

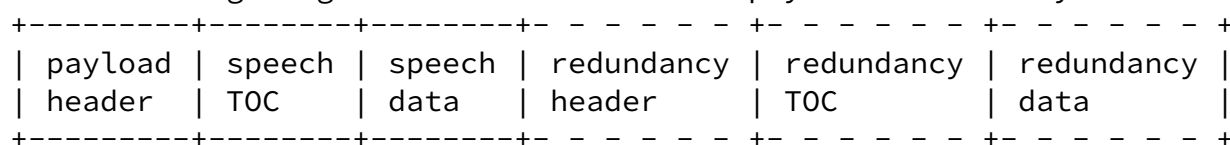
defined by first bit of header. Both of these formats will be described bellow.

2.1. Standard Payload Format

2.1.1. Payload Format Structure

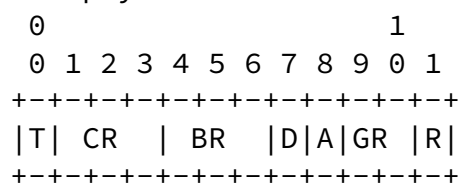
The standard payload consists of a payload header with general information about packet, a speech table of contents (TOC), and speech data. An optional redundancy section follows after speech data. The redundancy section consists of redundancy header, redundancy TOC and redundancy data payload.

The following diagram shows the standard payload format layout:



2.1.2. Payload Header

The payload header has the following format:



- o T (1 bit): Reserved compatibility with future extensions. Should be set to 0.

- o 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

Table 1 Coding rates of IP-MR codec

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.

- o 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.
- o D (1 bit): indicates if the DTX mode is allowed or not.
- o 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).
- o GR (2 bits): number of frames in packet (grouping size). Actual grouping size is GR + 1, thus maximum grouping supported is 4. If greater grouping size is required the extended payload format (sec. 2.2) MAY be used.

- o R (1 bit): redundancy presence bit. If R=1 then the packet contains redundancy information for lost packets recovery. In this case after speech TOC redundancy flags and TOC sections are present. If R=0 then speech TOC is the last section of payload header.

[2.1.3. 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|
+--+
```

- o E (1 bit): frame existence indicator. If set to 0, this indicates the corresponding frame is absent and the receiver should set the teRxFrType to LOST_FRAME. 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 field from coding flags is 7 (NO_DATA) then speech

TOC is empty.

[2.1.4. 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 or by using GetFrameInfo function detailed in [1].

[2.1.5. Redundancy Header](#)

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

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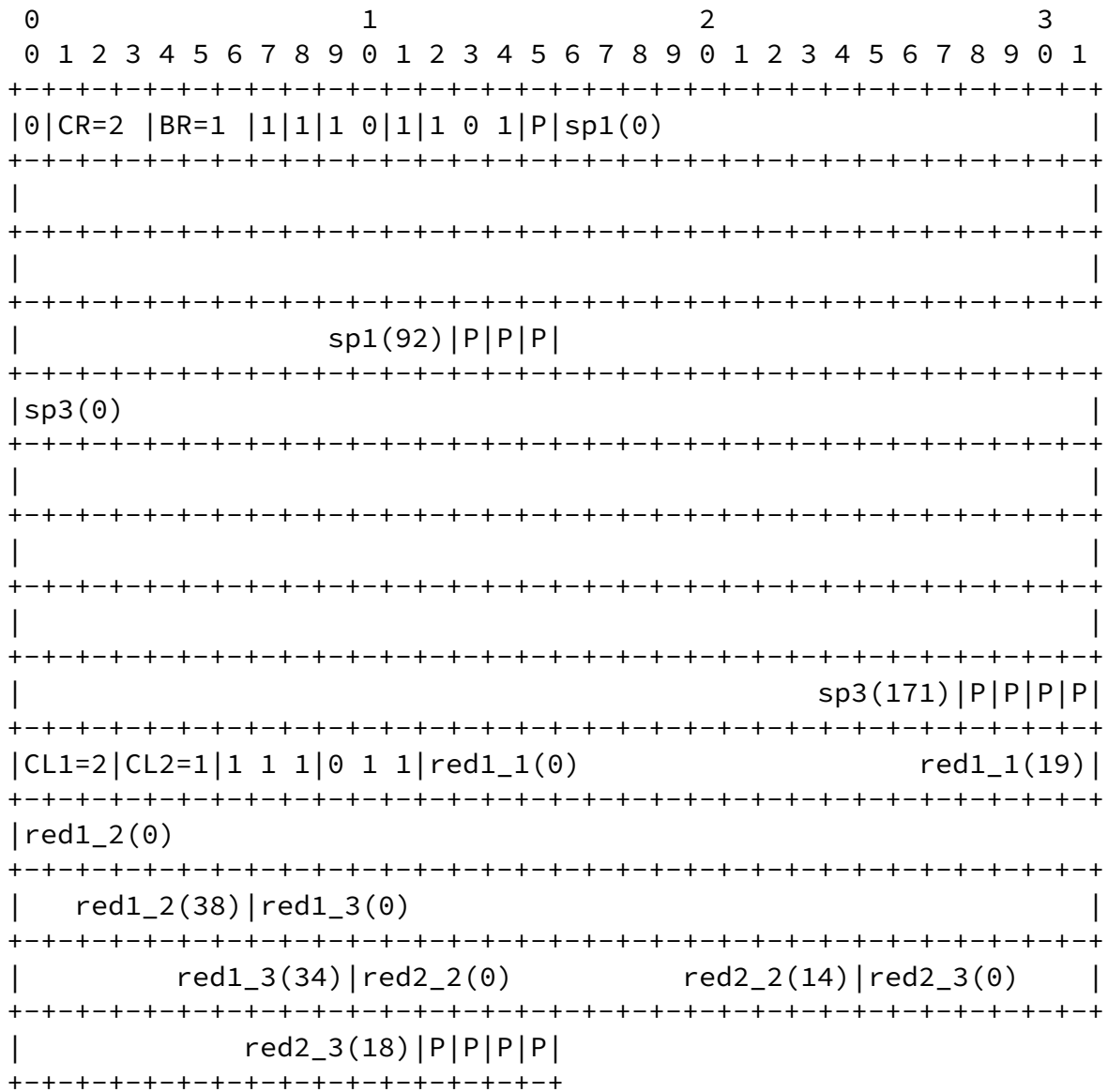
```
0 1 2 3 4 5
+---+---+---+---+
| CL1 | CL2 |
+---+---+---+---+
```

Redundancy header consists of two fields. Each field contains class specifier for 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)

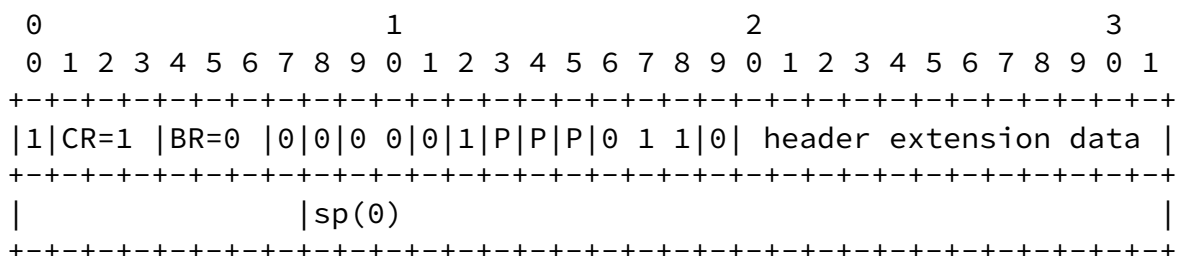
Each specifier takes 3 bits, thus the total redundancy header size is 6 bits. In case of redundancy usage followed by preceding (or pre-preceding) packet loss the receiver sets the special flag for decoder with CL class specifier.

[2.1.6. Redundancy Table of Contents](#)



2.2.3. Extended Payload Carrying a Single Frame

The following diagram shows an extended IP-MR payload carrying a single speech frame without redundancy:



Audio and video streaming and conferencing tools.

Additional information: none

Person & email address to contact for further information:
Andrey Setsko <Setsko@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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[3.2](#). 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:

- o The media type ("audio") goes in SDP "m=" as the media name.
- o The media subtype (payload format name) goes in SDP "a=rtpmap" as the encoding name. The RTP clock rate in "a=rtpmap" MUST 16000.
- o The parameters "ptime" and "maxptime" go in the SDP "a=ptime" and "a=maxptime" attributes, respectively.

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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.

[4](#). 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.

5. Acknowledgments

This document was prepared using 2-Word-v2.0.template.dot.

6. Normative References

- [1] SPIRIT IP-MR v2.5 User Guide, website <http://spiritdsp.com>
- [2] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [3] Schulzrinne, H., Casner, S., Frederick, R., and V. Jacobson, "RTP: A Transport Protocol for Real-Time Applications", STD 64, [RFC 3550](#), July 2003.
- [4] Handley, M., Jacobson, V., and C. Perkins, "SDP: Session Description Protocol", [RFC 4566](#), July 2006.

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