[MS-DTMF]:

RTP Payload for DTMF Digits, Telephony Tones, and Telephony Signals Extensions

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Revision Summary

Date	Revision History	Revision Class	Comments
4/4/2008	0.1	New	Initial version
4/25/2008	0.2	Minor	Updated based on feedback
6/27/2008	1.0	Major	Updated based on feedback
8/15/2008	1.01	Minor	Updated based on feedback
12/12/2008	2.0	Major	Updated with latest template bug fixes (redlined)
2/13/2009	2.01	Minor	Updated with latest template bug fixes (redlined)
3/13/2009	2.02	Minor	Updated with latest template bug fixes (redlined)
7/13/2009	2.03	Major	Revised and edited the technical content
8/28/2009	2.04	Editorial	Revised and edited the technical content
11/6/2009	2.05	Editorial	Revised and edited the technical content
2/19/2010	2.06	Editorial	Revised and edited the technical content
3/31/2010	2.07	Major	Updated and revised the technical content
4/30/2010	2.08	Editorial	Revised and edited the technical content
6/7/2010	2.09	Editorial	Revised and edited the technical content
6/29/2010	2.10	Editorial	Changed language and formatting in the technical content.
7/23/2010	2.10	None	No changes to the meaning, language, or formatting of the technical content.
9/27/2010	3.0	Major	Significantly changed the technical content.
11/15/2010	3.0	None	No changes to the meaning, language, or formatting of the technical content.
12/17/2010	3.0	None	No changes to the meaning, language, or formatting of the technical content.
3/18/2011	3.0	None	No changes to the meaning, language, or formatting of the technical content.
6/10/2011	3.0	None	No changes to the meaning, language, or formatting of the technical content.
1/20/2012	3.1	Minor	Clarified the meaning of the technical content.
4/11/2012	3.1	None	No changes to the meaning, language, or formatting of the technical content.
7/16/2012	3.1	None	No changes to the meaning, language, or formatting of the technical content.
10/8/2012	4.0	Major	Significantly changed the technical content.
2/11/2013	4.0	None	No changes to the meaning, language, or formatting of the technical content.

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Date	Revision History	Revision Class	Comments
7/30/2013	4.0	None	No changes to the meaning, language, or formatting of the technical content.
11/18/2013	4.0	None	No changes to the meaning, language, or formatting of the technical content.
2/10/2014	4.0	None	No changes to the meaning, language, or formatting of the technical content.
4/30/2014	4.1	Minor	Clarified the meaning of the technical content.
7/31/2014	4.1	None	No changes to the meaning, language, or formatting of the technical content.
10/30/2014	4.1	None	No changes to the meaning, language, or formatting of the technical content.
3/30/2015	5.0	Major	Significantly changed the technical content.
6/30/2015	5.0	None	No changes to the meaning, language, or formatting of the technical content.
9/4/2015	5.0	None	No changes to the meaning, language, or formatting of the technical content.
11/19/2015	6.0	Major	Significantly changed the technical content.
7/15/2016	6.0	None	No changes to the meaning, language, or formatting of the technical content.
9/14/2016	6.0	None	No changes to the meaning, language, or formatting of the technical content.
9/15/2017	7.0	Major	Significantly changed the technical content.

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Table of Contents

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1 Introduction

This document specifies the RTP Payload for DTMF Digits, Telephony Tones, and Telephony Signals Extensions. This protocol, which consists of a set of proprietary extensions to the protocol described in [RFC4733], specifies the payload format needed to carry **dual-tone multi-frequency (DTMF)** digits, tones, and signals in **Real-Time Transport Protocol (RTP)** packets over a network transport.

Any behavior not explicitly defined in this document is described in [RFC4733].

Sections 1.5, 1.8, 1.9, 2, and 3 of this specification are normative. All other sections and examples in this specification are informative.

1.1 Glossary

This document uses the following terms:

dual-tone multi-frequency (DTMF): In telephony systems, a signaling system in which each digit is associated with two specific frequencies. This system typically is associated with touch-tone keypads for telephones.

Real-Time Transport Protocol (RTP): A network transport protocol that provides end-to-end transport functions that are suitable for applications that transmit real-time data, such as audio and video, as described in [RFC3550].

RTP packet: A data packet consisting of the fixed RTP header, a possibly empty list of contributing sources, and the payload data. Some underlying protocols may require an encapsulation of the RTP packet to be defined. Typically one packet of the underlying protocol contains a single RTP packet, but several RTP packets can be contained if permitted by the encapsulation method. See [RFC3550] section 3.

RTP payload: The data transported by **RTP** in a packet, for example audio samples or compressed video data. For more information, see [RFC3550] section 3.

RTP session: An association among a set of participants who are communicating by using the **Real-Time Transport Protocol (RTP)**, as described in [RFC3550]. Each RTP session maintains a full, separate space of Synchronization Source (SSRC) identifiers.

Session Description Protocol (SDP): A protocol that is used for session announcement, session invitation, and other forms of multimedia session initiation. For more information see [MS-SDP] and [RFC3264].

MAY, SHOULD, MUST, SHOULD NOT, MUST NOT: These terms (in all caps) are used as defined in [RFC2119]. All statements of optional behavior use either MAY, SHOULD, or SHOULD NOT.

1.2 References

Links to a document in the Microsoft Open Specifications library point to the correct section in the most recently published version of the referenced document. However, because individual documents in the library are not updated at the same time, the section numbers in the documents may not match. You can confirm the correct section numbering by checking the Errata.

1.2.1 Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dochelp@microsoft.com. We will assist you in finding the relevant information.

[MS-RTPRADEX] Microsoft Corporation, "RTP Payload for Redundant Audio Data Extensions".

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[MS-RTP] Microsoft Corporation, "Real-time Transport Protocol (RTP) Extensions".

[MS-SDPEXT] Microsoft Corporation, "Session Description Protocol (SDP) Version 2.0 Extensions".

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997, http://www.rfc-editor.org/rfc/rfc2119.txt

[RFC4733] Schulzrinne, H., and Taylor, T., "RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals", RFC 4733, December 2006, http://www.ietf.org/rfc/rfc4733.txt

1.2.2 Informative References

None.

1.3 Overview

This protocol extends the protocol described in [RFC4733], which describes a mechanism for the transmission of in-band and out-of-band telephony signals.

An in-band telephony signal is where the events or tones are mixed directly into the media stream (typically, audio data). An out-of-band telephony signal is where the events or tones are transmitted through a separate band.

Telephony tones represent the **DTMF** tones mixed into the audio signal of the media stream. Telephony events represent the different call control events (such as an off-hook event or a specific digit being dialed).

The scope of this protocol is limited to telephony signals using out-of-band transmission. The in-band transmission of digits and tones is not supported by this protocol.

1.4 Relationship to Other Protocols

This protocol relies on **RTP**, as described in [MS-RTP], as its transport mechanism. This protocol can be used to communicate signaling **DTMF** telephony events between clients and gateways using the **RTP payload**.

1.5 Prerequisites/Preconditions

This protocol is a payload of the **RTP**; therefore, a valid **RTP session** is established between the client and the gateway.

Furthermore, because of the dynamic payload typing of the telephony events, some form of out-of-band negotiation to bind the payload type of the **RTP payload** to the telephony events is required.

1.6 Applicability Statement

This protocol is applicable wherever telephony digits, tones, or signals need to be sent or consumed either by remote clients or through gateways.

1.7 Versioning and Capability Negotiation

This document covers versioning issues in the following areas:

- **Supported Transports:** This protocol is sent using the **RTP** transport mechanism.

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- **Protocol Versions:** This protocol, as a format of an **RTP payload**, does not provide versioning information within the scope of the protocol itself. However, as a part of the RTP payload, any versioning information about the RTP level applies.
- **Security and Authentication Methods:** This document does not describe any security or authentication methods. Security and authentication is dependent on the security method, authentication method, or both methods used by the RTP version 2 protocol and is beyond the scope of this document.

1.8 Vendor-Extensible Fields

None.

1.9 Standards Assignments

None.

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2 Messages

2.1 Transport

This protocol MUST be sent by using **RTP**, as specified in [MS-RTP], as its transport. This protocol assumes that a successful **RTP session** has been established with valid payload information.

The **SDP** MUST be used to negotiate the payload type information, as specified in [MS-SDPEXT] section 3.1.5.3 and [MS-SDPEXT] section 3.1.5.5.

2.2 Message Syntax

The structure and syntax of this protocol is specified in [RFC4733] section 2.3.

2.2.1 DTMF Telephony Event

The DTMF telephony event is specified in the **event** field, as specified in [RFC4733] section 2.3.1, of the DTMF message. In addition to events 0 through 15 (as defined in [RFC4733]), event 16, which is reserved (as defined in [RFC4733]), is also supported. The following is an example of an SDP invite that specifies DTMF event type 0-16 at the end:

```
v=0
o=- 0 1 IN IP4 10.131.32.127
s=session
c=IN IP4 10.131.32.127
b=CT:99980
t=0 0
a=x-devicecaps:audio:send,recv;video:send,recv
m=audio 50006 RTP/AVP 117 114 9 112 111 0 8 116 115 97 13 118 101
a=x-ssrc-range:727739136-727739136
a=rtcp-fb:* x-message app send:dsh recv:dsh a=rtcp-rsize a=label:main-audio a=x-source:main-
audio a=ice-ufrag:6Gjo a=ice-pwd:NvUIAlyBYxK0xQ+VCXYRc2L/
a=candidate:1 1 UDP 2130706431 10.131.32.127 50006 typ host
a=candidate:1 2 UDP 2130705918 10.131.32.127 50007 typ host
a=x-candidate-ipv6:2 1 UDP 2130705919 2001:4898:1:12:6d0f:ce6a:35a9:c5e0 50002 typ host
a=x-candidate-ipv6:2 2 UDP 2130705406 2001:4898:1:12:6d0f:ce6a:35a9:c5e0 50003 typ host
a=x-candidate-ipv6:3 1 UDP 2130705407 2001:4898:0:fff:0:5efe:10.131.32.127 50012 typ host
a=x-candidate-ipv6:3 2 UDP 2130704894 2001:4898:0:fff:0:5efe:10.131.32.127 50013 typ host
a=candidate:4 1 TCP-PASS 174455295 131.107.1.53 58849 typ relay raddr 10.131.32.127 rport
50016
a=candidate:4 2 TCP-PASS 174454782 131.107.1.53 58849 typ relay raddr 10.131.32.127 rport
50016
a=candidate:5 1 UDP 184547327 131.107.1.53 58555 typ relay raddr 10.131.32.127 rport 50004
a=candidate:5 2 UDP 184546814 131.107.1.53 59208 typ relay raddr 10.131.32.127 rport 50005
a=x-candidate-ipv6:6 1 UDP 184546815 2001:4898:9000:6000:fe:1311:700:1053 54003 typ relay
raddr 10.131.32.127 rport 50004
a=x-candidate-ipv6:6 2 UDP 184546302 2001:4898:9000:6000:fe:1311:700:1053 52204 typ relay
raddr 10.131.32.127 rport 50005
a=candidate:7 1 TCP-ACT 174846975 131.107.1.53 58849 typ relay raddr 10.131.32.127 rport
50016
a=candidate:7 2 TCP-ACT 174846462 131.107.1.53 58849 typ relay raddr 10.131.32.127 rport
50016
a=x-candidate-ipv6:8 1 TCP-PASS 174453247 2001:4898:9000:6000:fe:1311:700:1053 50226 typ
relay raddr 10.131.32.127 rport 50016
a=x-candidate-ipv6:8 2 TCP-PASS 174452734 2001:4898:9000:6000:fe:1311:700:1053 50226 typ
relay raddr 10.131.32.127 rport 50016
a=x-candidate-ipv6:9 1 TCP-ACT 174845951 2001:4898:9000:6000:fe:1311:700:1053 50226 typ relay
raddr 10.131.32.127 rport 50016
a=x-candidate-ipv6:9 2 TCP-ACT 174845438 2001:4898:9000:6000:fe:1311:700:1053 50226 typ relay
raddr 10.131.32.127 rport 50016
a=candidate:10 1 TCP-ACT 1684794879 10.131.32.127 50016 typ srflx raddr 10.131.32.127 rport
50016
```


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```
a=candidate:10 2 TCP-ACT 1684794366 10.131.32.127 50016 typ srflx raddr 10.131.32.127 rport
50016
a=cryptoscale:1 client AES_CM_128_HMAC_SHA1_80
inline:sW8VgUkKL9a0xVLoRWctybbka87hwg16KknLeyY7|2^31|1:1
a=crypto:2 AES_CM_128_HMAC_SHA1_80 inline:f29SH3+v3rWEj0hgb3+2a5/a1LG9cW1Yyjma24f3|2^31|1:1
a=crypto:3 AES CM 128 HMAC SHA1 80 inline:a3n9t4OaoJLkwtu9F69U691Xtw8y5fRZikREQlQb|2^31
a=maxptime:200
a=rtpmap:117 G722/8000/2
a=rtpmap:114 x-msrta/16000
a=fmtp:114 bitrate=29000
a=rtpmap:9 G722/8000
a=rtpmap:112 G7221/16000
a=fmtp:112 bitrate=24000
a=rtpmap:111 SIREN/16000
a=fmtp:111 bitrate=16000
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:116 AAL2-G726-32/8000
a=rtpmap:115 x-msrta/8000
a=fmtp:115 bitrate=11800
a=rtpmap:97 RED/8000
a=rtpmap:13 CN/8000
a=rtpmap:118 CN/16000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
```


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3 Protocol Details

3.1 Common Details

This protocol conforms more to the "sender-receiver" paradigm, rather than the classic "client-server" paradigm. More specifically, it is appropriate to discuss in terms of the receiver of the telephony signals and the sender of the telephony signals.

This section covers the common details between the sender and receiver. Subsequent sections provide the specifics for the sender and the receiver.

Out-of-band negotiation of telephony signal information is required to establish a session as specified in [RFC4733]. During this negotiation, both payload types and the clock rate of the telephony signals are negotiated as specified in [RFC4733] section 2.5.1.1 using **SDP** for out-of-band negotiation. While dynamic payload type binding is required, both the sender and receiver of message blocks conforming to this protocol MUST fix the telephony signaling information at 8000 Hertz. Dynamic negotiation of the clock frequency of the **DTMF** payload MUST NOT be used.

Multiple payload type binding for different telephony events MUST NOT be used. There MUST be only one telephony event binding for a payload type. The payload type binding MUST be symmetrical. This means the received payload type and sent payload type MUST be the same. Asymmetrical payload type information MUST NOT be used.

This protocol supports only the out-of-band telephony event. An in-band telephony tone transmission MUST NOT be used.

3.1.1 Abstract Data Model

None.

3.1.2 Timers

None.

3.1.3 Initialization

None.

3.1.4 Higher-Layer Triggered Events

None.

3.1.5 Message Processing Events and Sequencing Rules

None.

3.1.6 Timer Events

None.

3.1.7 Other Local Events

None.

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3.2 Receiver Details

Redundant payload support, as specified in [MS-RTPRADEX], MUST NOT be used.

Multiple events per **RTP** block MUST NOT be used.

3.2.1 Abstract Data Model

None.

3.2.2 Timers

None.

3.2.3 Initialization

None.

3.2.4 Higher-Layer Triggered Events

None.

3.2.5 Message Processing Events and Sequencing Rules

None.

3.2.6 Timer Events

None.

3.2.7 Other Local Events

None.

3.3 Sender Details

Implementation for this protocol MUST NOT generate redundant blocks, as specified in [MS-RTPRADEX].

The sender MUST NOT pack multiple **DTMF** payloads into a single **RTP packet**.

The sender MUST NOT generate a DTMF event whose duration exceeds the maximum expressible duration, as specified in [RFC4733] section 2.3.5.

The sender MUST NOT generate a DTMF event payload with a zero duration.

3.3.1 Abstract Data Model

None.

3.3.2 Timers

None.

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3.3.3 Initialization

None.

3.3.4 Higher-Layer Triggered Events

None.

3.3.5 Message Processing Events and Sequencing Rules

None.

3.3.6 Timer Events

None.

3.3.7 Other Local Events

None.

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4 Protocol Examples

Examples of the **DTMF** telephony signal blocks are as described in [RFC4733] section 5.

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5 Security

5.1 Security Considerations for Implementers

None.

5.2 Index of Security Parameters

None.

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6 Appendix A: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include updates to those products.

- Microsoft Office Communications Server 2007
- Microsoft Office Communications Server 2007 R2
- Microsoft Lync Server 2010
- Microsoft Lync Server 2013
- Microsoft Office Communicator 2007
- Microsoft Office Communicator 2007 R2
- Microsoft Lync 2010
- Microsoft Lync Client 2013/Skype for Business
- Microsoft Skype for Business 2016
- Microsoft Skype for Business Server 2015
- Windows 10 v1511 operating system
- Windows Server 2016 operating system
- Windows Server operating system

Exceptions, if any, are noted in this section. If an update version, service pack or Knowledge Base (KB) number appears with a product name, the behavior changed in that update. The new behavior also applies to subsequent updates unless otherwise specified. If a product edition appears with the product version, behavior is different in that product edition.

Unless otherwise specified, any statement of optional behavior in this specification that is prescribed using the terms "SHOULD" or "SHOULD NOT" implies product behavior in accordance with the SHOULD or SHOULD NOT prescription. Unless otherwise specified, the term "MAY" implies that the product does not follow the prescription.

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7 Change Tracking

This section identifies changes that were made to this document since the last release. Changes are classified as Major, Minor, or None.

The revision class **Major** means that the technical content in the document was significantly revised. Major changes affect protocol interoperability or implementation. Examples of major changes are:

- A document revision that incorporates changes to interoperability requirements.
- A document revision that captures changes to protocol functionality.

The revision class **Minor** means that the meaning of the technical content was clarified. Minor changes do not affect protocol interoperability or implementation. Examples of minor changes are updates to clarify ambiguity at the sentence, paragraph, or table level.

The revision class **None** means that no new technical changes were introduced. Minor editorial and formatting changes may have been made, but the relevant technical content is identical to the last released version.

The changes made to this document are listed in the following table. For more information, please contact dochelp@microsoft.com.

Section	Description	Revision class
6 Appendix A: Product Behavior	Added product to the applicable products list.	Major

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