

[MS-SDP-Diff]:

Session Description Protocol (SDP) Extensions

Intellectual Property Rights Notice for Open Specifications Documentation

- **Technical Documentation.** Microsoft publishes Open Specifications documentation (“this documentation”) for protocols, file formats, data portability, computer languages, and standards as well as overviews of the interaction among each of these technologies support. Additionally, overview documents cover inter-protocol relationships and interactions.
- **Copyrights.** This documentation is covered by Microsoft copyrights. Regardless of any other terms that are contained in the terms of use for the Microsoft website that hosts this documentation, you maycan make copies of it in order to develop implementations of the technologies that are described in the Open Specifications-~~this documentation~~ and maycan distribute portions of it in your implementations usingthat use these technologies or in your documentation as necessary to properly document the implementation. You maycan also distribute in your implementation, with or without modification, any schema, IDL'sschemas, IDLs, or code samples that are included in the documentation. This permission also applies to any documents that are referenced in the Open Specifications-documentation.
- **No Trade Secrets.** Microsoft does not claim any trade secret rights in this documentation.
- **Patents.** Microsoft has patents that maymight cover your implementations of the technologies described in the Open Specifications-documentation. Neither this notice nor Microsoft's delivery of thethis documentation grants any licenses under those patents or any other Microsoft patents. However, a given Open Specification maySpecifications document might be covered by the Microsoft Open Specifications Promise or the Microsoft Community Promise. If you would prefer a written license, or if the technologies described in the Open Specifications>this documentation are not covered by the Open Specifications Promise or Community Promise, as applicable, patent licenses are available by contacting iplg@microsoft.com.
- **Trademarks.** The names of companies and products contained in this documentation maymight be covered by trademarks or similar intellectual property rights. This notice does not grant any licenses under those rights. For a list of Microsoft trademarks, visit www.microsoft.com/trademarks.
- **Fictitious Names.** The example companies, organizations, products, domain names, e-mailemail addresses, logos, people, places, and events that are depicted in this documentation are fictitious. No association with any real company, organization, product, domain name, email address, logo, person, place, or event is intended or should be inferred.

Reservation of Rights. All other rights are reserved, and this notice does not grant any rights other than as specifically described above, whether by implication, estoppel, or otherwise.

Tools. The Open Specifications documentation does not require the use of Microsoft programming tools or programming environments in order for you to develop an implementation. If you have access to Microsoft programming tools and environments, you are free to take advantage of them. Certain Open Specifications documents are intended for use in conjunction with publicly available standardstandards specifications and network programming art, and assumes, as such, assume that the reader either is familiar with the aforementioned material or has immediate access to it.

Revision Summary

Date	Revision History	Revision Class	Comments
5/11/2007	0.1	<u>New</u>	Version 0.1 release
8/10/2007	0.2	Minor	Clarified the meaning of the technical content.
9/28/2007	0.3	Minor	Clarified the meaning of the technical content.
10/23/2007	0.4	Minor	Clarified the meaning of the technical content.
11/30/2007	0.5	Minor	Clarified the meaning of the technical content.
1/25/2008	0.5.1	Editorial	Changed language and formatting in the technical content.
3/14/2008	0.5.2	Editorial	Changed language and formatting in the technical content.
5/16/2008	0.5.3	Editorial	Changed language and formatting in the technical content.
6/20/2008	0.5.4	Editorial	Changed language and formatting in the technical content.
7/25/2008	0.5.5	Editorial	Changed language and formatting in the technical content.
8/29/2008	0.6	Minor	Clarified the meaning of the technical content.
10/24/2008	0.6.1	Editorial	Changed language and formatting in the technical content.
12/5/2008	0.6.2	Editorial	Changed language and formatting in the technical content.
1/16/2009	0.6.3	Editorial	Changed language and formatting in the technical content.
2/27/2009	0.6.4	Editorial	Changed language and formatting in the technical content.
4/10/2009	0.6.5	Editorial	Changed language and formatting in the technical content.
5/22/2009	0.6.6	Editorial	Changed language and formatting in the technical content.
7/2/2009	0.6.7	Editorial	Changed language and formatting in the technical content.
8/14/2009	0.6.8	Editorial	Changed language and formatting in the technical content.
9/25/2009	0.7	Minor	Clarified the meaning of the technical content.
11/6/2009	0.7.1	Editorial	Changed language and formatting in the technical content.
12/18/2009	0.7.2	Editorial	Changed language and formatting in the technical content.
1/29/2010	0.8	Minor	Clarified the meaning of the technical content.
3/12/2010	0.8.1	Editorial	Changed language and formatting in the technical content.
4/23/2010	0.8.2	Editorial	Changed language and formatting in the technical content.
6/4/2010	0.8.3	Editorial	Changed language and formatting in the technical content.
7/16/2010	0.8.3	None	No changes to the meaning, language, or formatting of the technical content.
8/27/2010	0.8.3	None	No changes to the meaning, language, or formatting of the technical content.
10/8/2010	0.8.3	None	No changes to the meaning, language, or formatting of the

Date	Revision History	Revision Class	Comments
			technical content.
11/19/2010	0.8.3	None	No changes to the meaning, language, or formatting of the technical content.
1/7/2011	0.8.3	None	No changes to the meaning, language, or formatting of the technical content.
2/11/2011	0.8.3	None	No changes to the meaning, language, or formatting of the technical content.
3/25/2011	0.8.3	None	No changes to the meaning, language, or formatting of the technical content.
5/6/2011	0.8.3	None	No changes to the meaning, language, or formatting of the technical content.
6/17/2011	0.9	Minor	Clarified the meaning of the technical content.
9/23/2011	0.9	None	No changes to the meaning, language, or formatting of the technical content.
12/16/2011	0.9	None	No changes to the meaning, language, or formatting of the technical content.
3/30/2012	0.9	None	No changes to the meaning, language, or formatting of the technical content.
7/12/2012	0.9	None	No changes to the meaning, language, or formatting of the technical content.
10/25/2012	0.9	None	No changes to the meaning, language, or formatting of the technical content.
1/31/2013	0.9	None	No changes to the meaning, language, or formatting of the technical content.
8/8/2013	0.9	None	No changes to the meaning, language, or formatting of the technical content.
11/14/2013	0.9	None	No changes to the meaning, language, or formatting of the technical content.
2/13/2014	0.9	None	No changes to the meaning, language, or formatting of the technical content.
5/15/2014	0.9	None	No changes to the meaning, language, or formatting of the technical content.
6/30/2015	1.0	Major	Significantly changed the technical content.
10/16/2015	1.0	No ChangeNone	No changes to the meaning, language, or formatting of the technical content.

Table of Contents

1	Introduction	5
1.1	Glossary	5
1.2	References	6
1.2.1	Normative References	6
1.2.2	Informative References	7
1.3	Overview	7
1.4	Relationship to Other Protocols	7
1.5	Prerequisites/Preconditions	7
1.6	Applicability Statement	7
1.7	Versioning and Capability Negotiation	8
1.8	Vendor-Extensible Fields	8
1.9	Standards Assignments	8
2	Messages	9
2.1	Transport	9
2.2	Message Syntax	9
3	Protocol Details	11
3.1	User Agent Details	11
3.1.1	Abstract Data Model	11
3.1.2	Timers	11
3.1.3	Initialization	11
3.1.4	Higher-Layer Triggered Events	11
3.1.5	Message Processing Events and Sequencing Rules	11
3.1.5.1	Audio and Video	11
3.1.5.2	Data Collaboration	11
3.1.5.2.1	Application Sharing and Whiteboarding	11
3.1.5.3	Instant Messaging	12
3.1.5.4	Data Collaboration Encryption	12
3.1.5.4.1	Application Behavior	13
3.1.5.4.2	Negotiation Failure and Error Messages	14
3.1.5.4.3	Renegotiation of Data Collaboration Encryption	14
3.1.5.5	Audio/Video Encryption	14
3.1.5.5.1	Encryption Algorithms	15
3.1.5.5.2	Application Behavior	15
3.1.5.5.3	Negotiation Failure and Error Messages	16
3.1.5.5.4	Interaction Between Audio and Video Encryption Negotiation	16
3.1.5.5.5	Renegotiation of Audio/Video Encryption	17
3.1.5.5.6	Interaction Between Audio/Video and Data Encryption Negotiation	17
3.1.6	Timer Events	17
3.1.7	Other Local Events	17
4	Protocol Examples	18
4.1	Peer Clients Require Encryption	18
4.2	Client Requires Encryption but Peer Does Not Allow It	19
5	Security	21
5.1	Security Considerations for Implementers	21
5.2	Index of Security Parameters	21
6	Appendix A: Product Behavior	22
7	Change Tracking	23
8	Index	24

1 Introduction

This document describes a Microsoft extension protocol, Session Description Protocol (SDP) Extensions. The base protocol, which is the Session Description Protocol (SDP), is specified in [RFC4566]. This document describes the **session description** that is used to negotiate **instant messaging, audio/video**, and **data collaboration sessions**, and notes the extensions used. This document also describes how encryption for audio/video and data collaboration sessions is negotiated.

Of paramount importance is the protection of data against security threats related to the privacy of RTC media communications between **clients**. Microsoft has extended the Session Description Protocol to meet this challenge by providing encryption of data collaboration (DC) and audio/visual (A/V).

This encryption functionality is only for the **Session Initiation Protocol (SIP)** service provider, as specified in [RFC3261], and does not extend to other kinds of traffic. Microsoft strongly recommends that these extensions be used with Transport Layer Security (TLS) to protect the encryption key when it is passed in SIP/SDP signaling.

Sections 1.5, 1.8, 1.9, 2, and 3 of this specification are normative ~~and can contain the terms MAY, SHOULD, MUST, MUST NOT, and SHOULD NOT as defined in [RFC2119]. Sections 1.5 and 1.9 are also normative but do not contain those terms.~~ All other sections and examples in this specification are informative.

1.1 Glossary

~~The~~This document uses the following terms ~~are specific to this document:~~

200 OK: A response to indicate that the request has succeeded.

audio/video (AV) session: A **session** involving exchange of audio and video data between participants in real time.

client: A computer on which the remote procedure call (RPC) client is executing.

data collaboration (DC) session: A **session** involving sharing of applications and/or whiteboard between participants in real time.

Data Encryption Standard (DES): A specification for encryption of computer data that uses a 56-bit key developed by IBM and adopted by the U.S. government as a standard in 1976. For more information see [FIPS46-3].

domain controller (DC): The service, running on a server, that implements Active Directory, or the server hosting this service. The service hosts the data store for objects and interoperates with other **DCs** to ensure that a local change to an object replicates correctly across all **DCs**. When Active Directory is operating as Active Directory Domain Services (AD DS), the **DC** contains full NC replicas of the configuration naming context (config NC), schema naming context (schema NC), and one of the domain NCs in its forest. If the AD DS **DC** is a global catalog server (GC server), it contains partial NC replicas of the remaining domain NCs in its forest. For more information, see [MS-AUTHSOD] section 1.1.1.5.2 and [MS-ADTS]. When Active Directory is operating as Active Directory Lightweight Directory Services (AD LDS), several AD LDS **DCs** can run on one server. When Active Directory is operating as AD DS, only one AD DS **DC** can run on one server. However, several AD LDS **DCs** can coexist with one AD DS **DC** on one server. The AD LDS **DC** contains full NC replicas of the config NC and the schema NC in its forest. The domain controller is the server side of Authentication Protocol Domain Support [MS-APDS].

instant messaging: A method of real-time communication over the Internet in which a sender types a message to one or more recipients and the recipient immediately receives the message in a pop-up window.

instant messaging (IM) session: A **session** involving exchange of text-based instant messages between participants in real time.

INVITE: A **Session Initiation Protocol (SIP)** method that is used to invite a user or a service to participate in a session.

MD5: A one-way, 128-bit hashing scheme that was developed by RSA Data Security, Inc., as described in [RFC1321].

Real-Time Transport Control Protocol (RTCP): A network transport protocol that enables monitoring of Real-Time Transport Protocol (RTP) data delivery and provides minimal control and identification functionality, as described in [RFC3550].

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].

server: A computer on which the remote procedure call (RPC) server is executing.

session: A collection of multimedia senders and receivers and the data streams that flow between them. A multimedia conference is an example of a multimedia session.

session description: A well-defined format for conveying sufficient information to discover and participate in a multimedia **session**.

Session Initiation Protocol (SIP): An application-layer control (signaling) protocol for creating, modifying, and terminating sessions with one or more participants. **SIP** is defined in [RFC3261].

T.120: An ITU standard for real-time data conferencing, including application sharing and whiteboarding.

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-SIP] Microsoft Corporation, "Session Initiation Protocol 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>

[RFC3261] Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston, A., Peterson, J., Sparks, R., Handley, M., and Schooler, E., "SIP: Session Initiation Protocol", RFC 3261, June 2002, <http://www.ietf.org/rfc/rfc3261.txt>

[RFC3550] Schulzrinne, H., Casner, S., Frederick, R., and Jacobson, V., "RTP: A Transport Protocol for Real-Time Applications", STD 64, RFC 3550, July 2003, <http://www.ietf.org/rfc/rfc3550.txt>

[RFC3605] Huitema, C., "Real Time Control Protocol (RTCP) Attribute in Session Description Protocol (SDP)", RFC 3605, October 2003, <http://www.ietf.org/rfc/rfc3605.txt>

[RFC3611] Friedman, T., Ed., Caceres, R., Ed., and Clark, A., Ed., "RTP Control Protocol Extended Reports (RTCP XR)", RFC 3611, November 2003, <http://www.ietf.org/rfc/rfc3611.txt>

[RFC4566] Handley, M., Jacobson, V., and Perkins, C., "SDP: Session Description Protocol", RFC 4566, July 2006, <http://www.ietf.org/rfc/rfc4566.txt>

1.2.2 Informative References

None.

1.3 Overview

The Session Description Protocol (SDP), as specified in [RFC4566], describes multimedia **sessions** for a variety of purposes associated with sessions.

Only the Microsoft extensions to this protocol are documented in this document. SDP Extensions define additional SDP primitives to negotiate various types of sessions and also to negotiate encryption. These extensions include the following:

- Extensions to negotiate an **instant messaging session**: SDP Extensions defines a new media name x-ms-message used to indicate instant messaging media.
- Extensions to negotiate audio/video encryption: SDP Extensions defines a new SDP attribute a=encryption that can be used to negotiate whether encryption is required, optional, or rejected for an audio or video media stream. This attribute is used in conjunction with k= SDP field, which can be used to carry the encryption key if one is needed.
- Extensions to negotiate data collaboration encryption: SDP Extensions that support encryption for data collaboration are similar to the extensions for negotiating audio/video encryption. The a=encryption attribute is used to indicate whether encryption is required, optional, or rejected. However, no k= field is used by SDP Extensions for data collaboration encryption because the key is exchanged by a separate mechanism that uses the **T.120** stream for data collaboration.

These extensions are described in detail in section 3.

1.4 Relationship to Other Protocols

The Session Description Protocol (SDP) Extensions depend on SDP, as specified in [RFC4566], and upon the Session Initiation Protocol (SIP), as specified in [RFC3261]. SDP Extensions defines additional SDP primitives needed to negotiate encryption parameters for data collaboration and audio/video sessions.

1.5 Prerequisites/Preconditions

This protocol assumes that both clients support SDP [RFC4566] and Session Initiation Protocol (SIP) [RFC3261].

1.6 Applicability Statement

The Session Description Protocol (SDP) Extensions allow negotiation of whether the media ~~should be~~is encrypted and if so, what encryption key ~~should be~~is used.

The encryption negotiation enhancements to SDP can be used when the application wants to encrypt audio/video and data collaboration media on the wire. These enhancements ~~should be~~are used in

conjunction with Transport Layer Security (TLS) to protect the encryption key if the key is passed in the SIP/SDP signaling.

1.7 Versioning and Capability Negotiation

The Session Description Protocol (SDP) Extensions do not have protocol versioning.

1.8 Vendor-Extensible Fields

There are no vendor-extensible fields specific to the Session Description Protocol (SDP) Extensions. Session Initiation Protocol (SIP) [RFC3261] and SDP [RFC4566] can be used by vendors as needed.

1.9 Standards Assignments

The attributes and fields defined by SDP Extensions have not been registered with IANA. SDP by itself is specified in [RFC4566].

2 Messages

2.1 Transport

Microsoft extensions to SDP do not introduce a new transport to exchange messages. SDP messages are carried inside SIP messages. The content type MUST be specified as application/sdp for SIP messages carrying SDP, and the session description ~~should be~~are included in the body of the SIP message.

SIP messages can be transported over UDP, TCP, or TLS. Microsoft strongly recommends that these enhancements SHOULD be used in conjunction with Transport Layer Security (TLS) to protect the encryption key if the key is passed in the SIP/SDP signaling.

2.2 Message Syntax

The Session Description Protocol (SDP) Extensions do not introduce a new message format and rely on SIP and SDP message formats. The SIP message format is specified in [RFC3261] section 7. The SDP format is specified in [RFC4566]. The extensions are defined as custom SDP fields and attributes.

The following example shows a standard SDP packet and the extensions.

```
v=0
o=username 0 0 IN IP4 157.59.134.89
s=session
c=IN IP4 157.59.134.89
b=CT:1000
t=0 0
m=audio 56472 RTP/AVP 97 111 112 6 0 8 4 5 3 101
k=base64:bhdsfsd78f7dssdfssfsd7sdfssa
a=rtpmap:97 red/8000
a=rtpmap:111 SIREN/16000
a=fmtp:111 bitrate=16000
a=rtpmap:112 G7221/16000
a=fmtp:112 bitrate=24000
a=rtpmap:6 DVI4/16000
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:4 G723/8000
a=rtpmap:5 DVI4/8000
a=rtpmap:3 GSM/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=encryption:required
m=video 33792 RTP/AVP 34 31
k=base64:bhdsfsd78f7dssdfssfsd7sdfssa
a=rtcp:33801
a=rtpmap:34 H263/90000
a=rtpmap:31 H261/90000
a=encryption:required
m=application 1503 tcp msdata
a=sendonly
a=encryption:required
```

For all media description blocks, notice the a=encryption:required attribute, which is an SDP Extensions extension to indicate that encryption is required for these media. Other possible values for the a=encryption attribute are a=encryption:optional and a=encryption:rejected. The a=encryption extension is described in detail in section 3.

The following example shows SDP for an instant messaging session.

```
v=0
o=- 0 0 IN IP4 172.27.174.212
s=session
c=IN IP4 172.27.174.212
t=0 0
m=x-ms-message 5060 sip null
```

Notice the `m=x-ms-message` line, which shows the SDP Extensions extension for a new media name `x-ms-message` that is used to negotiate instant messaging.

Except for the noted extensions in the two examples, the rest of the session description is standard SDP.

3 Protocol Details

3.1 User Agent Details

SDP is used to negotiate session description between user agents. There is no **server** role that is relevant for the Session Description Protocol (SDP) Extensions.

3.1.1 Abstract Data Model

Not applicable.

3.1.2 Timers

No timers are required by Session Description Protocol (SDP) Extensions beyond those that are required by Session Initiation Protocol Extensions, as specified in [MS-SIP].

3.1.3 Initialization

Not applicable.

3.1.4 Higher-Layer Triggered Events

The following is a recommendation on how the higher layer exposes protocol-based events.

There are no new higher-layer events beyond those that would be triggered for SIP sessions. It is recommended that the higher layer receive an event for an incoming session. For SDP Extensions, this event includes the encryption setting requested by the caller. When a session is established successfully, it is recommended that the higher layer receive an event indicating this success. If session negotiation fails, the higher layer can alternatively receive an event indicating the failure. If the session negotiation failed due to incompatible encryption settings, the event can indicate the incompatibility.

3.1.5 Message Processing Events and Sequencing Rules

There are no new message processing events or sequencing rules defined by SDP Extensions beyond those defined by SIP/SDP.

3.1.5.1 Audio and Video

The Session Description Protocol (SDP) for an audio/video session is standard (according to RFC) with one exception: negotiation of encryption of the audio/video session uses additional extensions, which are specified in section 3.1.5.5.

3.1.5.2 Data Collaboration

3.1.5.2.1 Application Sharing and Whiteboarding

An application-sharing or whiteboarding session is identified by the following media information in SDP.

```
m=application 1503 tcp msdata
a=encryption:required
```

The **media** field extension conveys capability for application sharing or use of a whiteboard. The "tcp" value is valid for the **proto** subfield.

Port 1503 is the standard port used for T.120 and is implemented by the underlying Microsoft NetMeeting client. See section 3.1.5.4 for additional details about encryption of application sharing and whiteboarding.

3.1.5.3 Instant Messaging

The SDP signaling for an instant messaging session using the previous RTC 1.2 APIs is shown in the following.

```
v=0
o=- 0 0 IN IP4 172.27.174.212
s=session
c=IN IP4 172.27.174.212
t=0 0
m=x-ms-message 5060 sip null
```

Note The target of the instant messaging session in this case is carried in the To header of the **INVITE** request.

The SDP signaling for an instant messaging session using the RTC 1.3 APIs is shown in the following.

```
v=0
o=- 0 0 IN IP4 157.56.66.71
s=session
c=IN IP4 157.56.66.71
t=0 0
m=message 5060 sip sip:peer@tradewind.com
```

The SIP URI present in the SDP signaling is the SIP URI of the peer user with whom a user wants to establish an IM session. This ~~should match~~ matches the SIP URI in the To header of the INVITE request. The port indicates the listening port of the client for direct connections if that is supported. The port SHOULD be ignored if the clients are connected through a server. The 1.3 client can also accept the older 1.2 format (which has null for the SIP URI and uses x-ms-message as the media type).

3.1.5.4 Data Collaboration Encryption

For data collaboration sessions, the initiating and receiving parties MUST negotiate support for encryption by using a new SDP attribute. <2>

The new SDP encryption attribute can be implemented in any of the following ways:

- If encryption is required, the SDP signaling MUST carry a media-level attribute as shown in the following.

```
m=application 1503 tcp msdata
a=encryption:required
```

- If encryption is supported but not required, the SDP signaling MUST carry a media-level attribute as shown in the following.<3>

```
m=application 1503 tcp msdata
a=encryption:optional
```

- If encryption is not allowed, the SDP signaling MUST carry a media-level attribute as shown in the following:

```
m=application 1503 tcp msdata
a=encryption:rejected
```

3.1.5.4.1 Application Behavior

If data collaboration (DC) encryption is required at the initiating side, the application calls the application API (such as NetMeeting) to create a secured T.120 session. If encryption is not required, the initiating application can simply call the application API to create an unsecured T.120 session.<4>

In the absence of an application-supplied policy, the default policy is "allowed," meaning encryption is allowed but not required.

The logic for negotiation of support for encryption of T.120 DC sessions can be described in terms of application-level policy. Behavior is determined by the setting (required, optional, or not allowed) on both the initiator and receiver sides.

Initiator setting	Receiver setting	Result
Required	Required	DC encrypted
Required	Allowed	DC encrypted
Required	Not allowed	Failure
Allowed	Required	DC encrypted
Allowed	Allowed	DC not encrypted
Allowed	Not allowed	DC not encrypted
Not allowed	Required	Failure
Not allowed	Allowed	DC not encrypted
Not allowed	Not allowed	DC not encrypted

In the preceding table, two circumstances yield a result of Failure:

- In the first case, the session initiator sends encryption:required.

If the receiver understands the encryption attribute, it responds with a 488 response (described below), and the session setup fails. It is the responsibility of the initiator to display an error message to the user stating that encryption could not be negotiated.

If the receiver does not understand the encryption attribute, the receiver responds with a **200 OK** (with no encryption attribute). The initiator acknowledges (ACK) the response. The T.120 session setup, however, fails, and it is the responsibility of the initiator to display an error message to the user and immediately send a BYE to tear down the SIP signaling session.

- In the second case, the session initiator sends encryption:rejected.

The receiver responds with a 488 error response, and the session setup fails. It is the responsibility of the initiator to display an error message to the user stating that encryption could not be negotiated.

3.1.5.4.2 Negotiation Failure and Error Messages

If the initiator requires encryption and then receives a 488 error response to INVITE, it is recommended that the application display a new error message in the user interface (UI) that explains to the user that the encryption cannot be negotiated.

The 488 error response SHOULD contain a Warning header to indicate that encryption levels are incompatible. The following is an example of a 488 error response.

```
SIP/2.0 488 Encryption Levels Incompatible
Warning: 308 ms.com "Encryption Levels Incompatible"
```

3.1.5.4.3 Renegotiation of Data Collaboration Encryption

It is theoretically possible to renegotiate the encryption level in a session by sending a reINVITE message that has a different encryption level from what was negotiated when the session was created. However, renegotiation of the encryption level is not supported by the Session Initiation Protocol Extensions, and any such reINVITE SHOULD be rejected.

3.1.5.5 Audio/Video Encryption

For audio/video sessions, the initiating and receiving parties MUST negotiate support for encryption by using a new SDP attribute.

To implement the new SDP encryption attribute, <5> two pieces of information are required for audio/video encryption. The first is to determine whether encryption is required, and the second is to determine what the encryption key will be. This can be implemented in any of the following ways:

- If encryption is required, SDP signaling MUST carry a media-level attribute as shown in the following.

```
m=audio 49170 RTP/AVP 0
a=encryption:required
```

- If encryption is supported but not required, SDP signaling MUST carry a media-level attribute as shown in the following:

```
m=audio 49170 RTP/AVP 0
a=encryption:optional
```

- If encryption is not allowed, SDP signaling MUST carry a media-level attribute as shown in the following.

```
m=audio 49170 RTP/AVP 0
a=encryption:rejected
```

The encryption key to use MUST be carried in a media-level key parameter, as shown in the following example.

```
m=audio 49170 RTP/AVP 0
a=encryption:required
k=base64:bhdsfsd78f7dssdfssfsd7sdfssa
```

The encryption key is not encrypted. The only transformation of the key is the base64 encoding for transport in the textual session description (SDP). Clients MUST send the key in base64 encoded form and MUST decode the key that is received from the other endpoint before using it to decrypt audio/video. Protection of the encryption key is provided by the TLS transport over which SIP signaling is carried. The encryption key is used to encrypt traffic that is sent by the supplier of the key and also to decrypt traffic at the recipient. The keys used in each direction are independent and are typically different.

If SDP indicates that encryption is required or optional, an encryption key MUST also be supplied. In the case of optional encryption, the encryption key **may** go unused. It is highly recommended that a new encryption key be generated and used for every new INVITE request. However, when an INVITE is reused, it typically uses the same encryption key.

For information about SIP, see [RFC3261].

3.1.5.5.1 Encryption Algorithms

The RTC API uses **MD5** as the default key generation method.

There are also several possible encryption algorithms:

- **DES**
- 3DES
- RC2
- RC4
- AES

The RTC API uses DES as the default encryption algorithm, but it is recommended that a more secure algorithm, such as AES, be used as recommended in [RFC3550].

The RTC API uses MD5 as the default key generation method, but any suitable technique can be used for this purpose.

Encryption of an **RTP** stream can involve encryption of just the RTP packets or encryption of both the RTP and **Real-Time Transport Control Protocol (RTCP)** packets. The RTC API only supports encryption of both RTP and RTCP (as specified in [RFC3605] and [RFC3611]) packets.

3.1.5.5.2 Application Behavior

The following table summarizes the application behavior based on the audio/video encryption policy at both the initiator and the receiver. This behavior applies to both an initial INVITE (as specified in [RFC3261]) and a reINVITE. Failure of a reINVITE does not result in the existing session being torn down.

The default policy in the absence of an application-supplied policy is "allowed," meaning encryption is allowed but not required.

Initiator setting	Receiver setting	Result
Required	Required	A/V encrypted
Required	Allowed	A/V encrypted
Required	Not allowed	Failure
Allowed	Required	A/V encrypted
Allowed	Allowed	A/V not encrypted
Allowed	Not allowed	A/V not encrypted

Initiator setting	Receiver setting	Result
Not allowed	Required	Failure
Not allowed	Allowed	A/V not encrypted
Not allowed	Not allowed	A/V not encrypted

In the preceding table, two circumstances yield a result of Failure:

- In the first case, the session initiator requires encryption, but the receiver setting is to not allow encryption. As a result, the call setup fails.

The receiver responds with a 488 error response, and the session setup fails. The initiator ~~should display~~ displays an error message to the user stating that encryption could not be negotiated. Note that the user at the receiving client ~~may~~ might not get an indication of the call because the call is automatically rejected.

- In the second case, the initiator does not allow encryption, but the receiver requires encryption due to policy. Again, the call fails because of incompatible encryption policies at the two endpoints.

The receiver responds with a 488 error response, and the session setup fails. The initiator ~~should display~~ displays an error message to the user stating that encryption could not be negotiated. Note that the user at the receiving client ~~may~~ might not get an indication of the call because the call is automatically rejected.

3.1.5.5.3 Negotiation Failure and Error Messages

If the caller requires encryption but receives a 488 error response from the callee, the application ~~should display~~ displays a new error message in the user interface (UI) explaining to the user that the encryption could not be negotiated.

The 488 error response ~~should contain~~ contains a Warning header to indicate that encryption is required. The following is an example of a 488 error response.

```
SIP/2.0 488 Encryption Levels Incompatible
Warning: 308 ms.com "Encryption Levels Incompatible"
```

3.1.5.5.4 Interaction Between Audio and Video Encryption Negotiation

Because the audio and video components of an audio/video call are represented as separate streams in SDP, it is technically possible for the audio and video components to request different encryption settings; however, specifying different encryption settings for an audio/video call is not supported.

The audio and video streams MUST specify the same encryption attribute. Although setting encryption as is shown in the following code sample is technically possible, it is not supported. The following example is provided for reference purposes only to show how different encryption settings could be requested for audio and video components.

```
m=audio 49170 RTP/AVP 0
a=encryption:required
k=base64:bhdsfsd78f7dssdfssfsd7sdfssa

m=video 49171 RTP/AVP 25
a=encryption:optional
k=base64:bhdsfsd78f7dssdfssfsd7sdfssa
```


If different encryption settings are used and a conflict occurs, a 488 error response with an appropriate Warning header SHOULD be returned, as shown in the following example.

```
SIP/2.0 488 Encryption Levels not compatible
Warning: 308 ms.com "Encryption Levels not compatible"
```

3.1.5.5.5 Renegotiation of Audio/Video Encryption

It is theoretically possible to renegotiate the encryption level in a session by sending a reINVITE message that has a different encryption level from what was negotiated when the session was created. However, renegotiation is not supported by the Session Initiation Protocol Extensions, and any such reINVITE SHOULD be rejected.

3.1.5.5.6 Interaction Between Audio/Video and Data Encryption Negotiation

Although data collaboration and audio/video encryption are negotiated separately and controlled through separate registry settings at the client, in a session that involves both **DC** and audio/video, both parties can negotiate encryption for one type but not for the other.

The following example shows how different encryption settings could be requested for audio/video and data collaboration; however, in this example, the session **should fail**.

```
m=audio 49170 RTP/AVP 0
a=encryption:required
k=base64:bhdsfsd78f7dssdfssfsd7sdfssa

m=video 49171 RTP/AVP 25
a=encryption:required
k=base64:bhdsfsd78f7dssdfssfsd7sdfssa

m=application 1503 tcp msdata
a=encryption:rejected
```

For the session to succeed, encryption must be successfully negotiated for all media types in that session.

For reINVITEs, failure to negotiate encryption does not result in failure of the existing session. As with any 4xx or 5xx response to a reINVITE, the client reverts to the previous session description, including any encryption parameters that were negotiated at that time.

3.1.6 Timer Events

No new timer events are defined by the Session Description Protocol (SDP) Extensions beyond those defined by SIP/SDP.

3.1.7 Other Local Events

No new local events are defined by the Session Description Protocol (SDP) Extensions beyond those defined by SIP/SDP.

4 Protocol Examples

4.1 Peer Clients Require Encryption

Alice sends Bob an INVITE request for an audio call requesting encryption by including the `a=encryption:required` attribute and the SDP field `k=` with a suitable key.

Bob accepts the call with a 200 OK with the `a=encryption:required` attribute and the `k=` field.

Alice sends an ACK.

Alice and Bob start sending media encrypted with the keys negotiated using the `k=` field.

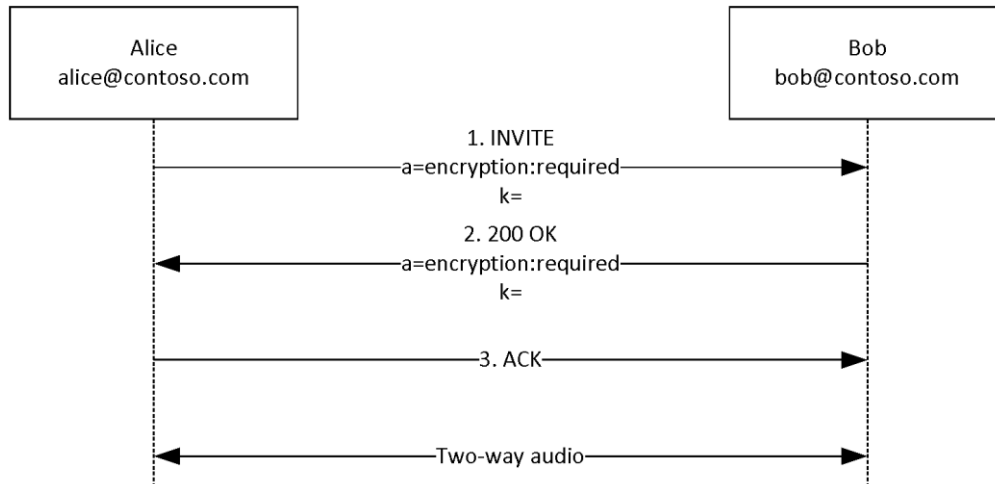


Figure 1: Audio call requesting encryption

The following is an example of SDP signaling in an SIP INVITE request that is sent across the wire.

```
v=0
o=- 0 0 IN IP4 11.22.33.44
s=session
c=IN IP4 11.22.33.44
b=CT:1000
t=0 0
m=audio 5050 RTP/AVP 97 111 112 6 0 8 4 5 3 101
k=base64: Y6UN8SAFnqNTI61uN+1II3dqRk0spxbtqfuv5EYSYSM
a=rtpmap:97 red/8000
a=rtpmap:111 SIREN/16000
a=fmtp:111 bitrate=16000
a=rtpmap:112 G7221/16000
a=fmtp:112 bitrate=24000
a=rtpmap:6 DVI4/16000
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:4 G723/8000
a=rtpmap:5 DVI4/8000
a=rtpmap:3 GSM/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=encryption:required
m=video 5036 RTP/AVP 34 31
k=base64: Y6UN8SAFnqNTI61uN+1II3dqRk0spxbtqfuv5EYSYSM
a=rtpmap:34 H263/90000
a=rtpmap:31 H261/90000
a=encryption:required
```

The following is an example of SDP signaling in the 200 OK response that is received across the wire in response to the INVITE.

```
v=0
o=- 0 0 IN IP4 11.22.33.55
s=session
c=IN IP4 11.22.33.55
b=CT:1000
t=0 0
m=audio 5050 RTP/AVP 97 111 112 6 0 8 4 5 3 101
k=base64: h6KmQIeIFj3rz4iiMAsYQju5EEitwAiveVu7RuHhev8
a=rtpmap:97 red/8000
a=rtpmap:111 SIREN/16000
a=fmtp:111 bitrate=16000
a=rtpmap:112 G7221/16000
a=fmtp:112 bitrate=24000
a=rtpmap:6 DVI4/16000
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:4 G723/8000
a=rtpmap:5 DVI4/8000
a=rtpmap:3 GSM/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=encryption:required
m=video 5036 RTP/AVP 34 31
k=base64: h6KmQIeIFj3rz4iiMAsYQju5EEitwAiveVu7RuHhev8
a=rtpmap:34 H263/90000
a=rtpmap:31 H261/90000
a=encryption:required
```

4.2 Client Requires Encryption but Peer Does Not Allow It

Alice sends Bob an INVITE for an audio/video call requesting encryption by including an `a=encryption:required` attribute and the SDP `k=` field with a suitable key.

- Because Bob does not allow encryption, he rejects the INVITE with a "488 Encryption Levels not compatible" response.
- Alice sends an ACK. The call is not established.

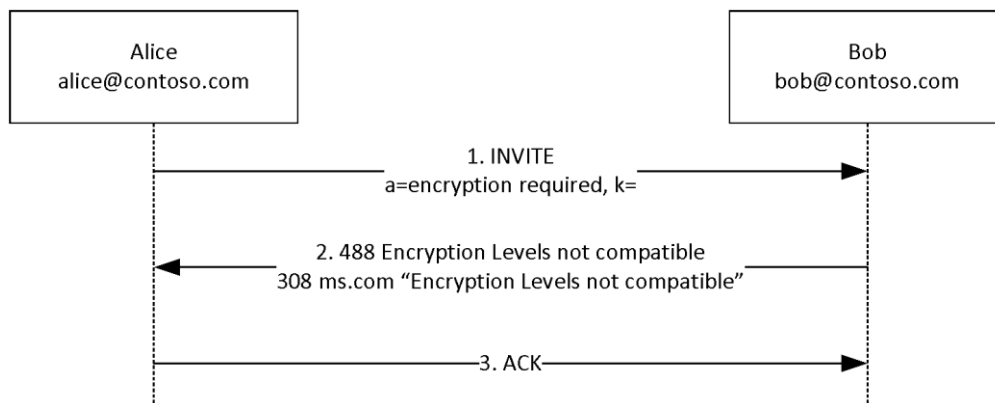


Figure 2: Alice requires encryption

An example of SDP signaling in the INVITE that is sent across the wire is as follows.

```

v=0
o=- 0 0 IN IP4 11.22.33.44
s=session
c=IN IP4 11.22.33.44
b=CT:1000
t=0 0
m=audio 5050 RTP/AVP 97 111 112 6 0 8 4 5 3 101
k=base64: Y6UN8SAFnqNTI61uN+1II3dqRk0spxbtqfuv5EYSYSM
a=rtpmap:97 red/8000
a=rtpmap:111 SIREN/16000
a=fmtp:111 bitrate=16000
a=rtpmap:112 G7221/16000
a=fmtp:112 bitrate=24000
a=rtpmap:6 DVI4/16000
a=rtpmap:0 PCMU/8000
a=rtpmap:8 PCMA/8000
a=rtpmap:4 G723/8000
a=rtpmap:5 DVI4/8000
a=rtpmap:3 GSM/8000
a=rtpmap:101 telephone-event/8000
a=fmtp:101 0-16
a=encryption:required
m=video 5036 RTP/AVP 34 31
k=base64: Y6UN8SAFnqNTI61uN+1II3dqRk0spxbtqfuv5EYSYSM
a=rtpmap:34 H263/90000
a=rtpmap:31 H261/90000
a=encryption:required
  
```

An example of the SIP error response is as follows.

```

SIP/2.0 488 Encryption Levels not compatible
Via: SIP/2.0/TCP 11.22.33.44:4934
From: "Alice" <sip:alice@contoso.com>;tag=b8c543e1-ffb3-4b5a-880c-4d78f37643bb
To: <sip:bob@contoso.com>;tag=27221d0e-26d4-410f-9363-6ad3337cf152
Call-ID: 01a465dd-dafd-461d-a6ef-99c2c7df0e27@11.22.33.44
CSeq: 2 INVITE
Warning: 308 ms.com "Encryption Levels not compatible"
Content-Length: 0
  
```

5 Security

5.1 Security Considerations for Implementers

RTC APIs use the following security algorithms:

- MD5 is used for key generation.
- DES is used to encrypt the audio/video traffic.

The Session Description Protocol (SDP) Extensions do not require the preceding algorithms to be used; other key generation and encryption algorithms can be used. However, if interoperability with RTC API clients is required, DES musthas to be used for encryption.

5.2 Index of Security Parameters

Security parameter	Section
Encryption algorithms	3.1.5.5.1

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 released service packs.

- Windows 2000 operating system Service Pack 4 (SP4)
- Windows XP operating system
- Windows Server 2003 operating system

Exceptions, if any, are noted below. If a service pack or Quick Fix Engineering (QFE) number appears with the product version, behavior changed in that service pack or QFE. The new behavior also applies to subsequent service packs of the product 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.

<1> Section 1: Encryption is not supported in Windows 2000 operating system and the associated protocol extensions are not used.

<2> Section 3.1.5.4: In Windows, the encryption key to use is actually generated by the underlying Microsoft NetMeeting application and, as a result, does not need to be exchanged between the RTC clients through the SIP/SDP signaling. This is handled within the T.120 stream itself, so no k= (key) line for the T.120 media will be present.

<3> Section 3.1.5.4: If the encryption attribute is not present in the SDP signaling, as will be the case for older Windows XP clients, encryption is considered to be supported but is not required.

<4> Section 3.1.5.4.1: When interoperating with a Windows XP client, the policy of the client can be considered as allowed. The Windows XP client does not send any encryption attribute in the SDP signaling of its INVITE or INVITE response, as described in [RFC3261].

<5> Section 3.1.5.5: If the encryption attribute is not present in SDP signaling, as is the case for older Windows XP clients, encryption is not supported. This is different from the DC case because audio/video encryption requires a key exchange through SDP signaling.

7 Change Tracking

No table of changes is available. The document is either new or has had no changes since its last release.

8 Index

A

- A/V
 - encryption 14
 - encryption negotiation (section 3.1.5.5.4 16, section 3.1.5.5.6 17)
 - encryption renegotiation 17
 - message processing 11
- Abstract data model 11
- Algorithms - encryption 15
- Applicability 7
- Application behavior
 - A/V 15
 - data collaboration 13
- Application sharing 11
- Audio
 - encryption 14
 - encryption negotiation (section 3.1.5.5.4 16, section 3.1.5.5.6 17)
 - encryption renegotiation 17
 - message processing 11

C

- Capability negotiation 8
- Change tracking 23
- Collaboration 11

D

- Data collaboration 11
- Data collaboration encryption 12
- Data encryption negotiation 17
- Data model - abstract 11

E

- Encryption negotiation
 - audio (section 3.1.5.5.4 16, section 3.1.5.5.5 17, section 3.1.5.5.6 17)
 - data 17
 - renegotiation 14
 - video (section 3.1.5.5.4 16, section 3.1.5.5.5 17, section 3.1.5.5.6 17)
- Encryption requirement example
 - not required 19
 - required 18
- Error messages
 - A/V 16
 - data collaboration 14
- Examples (section 4 18, section 4.1 18)

F

- Fields - vendor-extensible 8

G

- Glossary 5

H

- Higher-layer triggered events 11

I

- Implementer - security considerations 21
- Implementers - security considerations 21
- Index of security parameters 21
- Informative references 7
- Initialization 11
- Instant messaging 12
- Introduction 5

L

- Local events 17

M

- Message processing 11
- Messages
 - error - A/V 16
 - error - data collaboration 14
 - syntax 9
 - transport 9

N

- Negotiation failure
 - A/V 16
 - data collaboration 14
- Normative references 6

O

- Overview 7
- Overview (synopsis) 7

P

- Parameters - security 21
- Parameters - security index 21
- Peer clients example
 - not required 19
 - required 18
- Preconditions 7
- Prerequisites 7
- Product behavior 22
- Product behavior 22

R

- References 6
 - informative 7
 - normative 6
- Relationship to other protocols 7
- Renegotiation - encryption 14

S

- Security 21
 - implementer considerations 21
 - parameter index 21
- Sequencing rules 11
- Standards assignments 8
- Syntax - message 9

T

- Timer events 17
- Timers 11
- Tracking changes 23
- Transport 9
- Transport - message 9
- Triggered events - higher-layer 11

U

- User agent overview 11

V

- Vendor-extensible fields 8
- Versioning 8
- Video
 - encryption 14
 - encryption negotiation (section 3.1.5.5.4 16, section 3.1.5.5.6 17)
 - encryption renegotiation 17
 - message processing 11