

[MS-SIPCOMP]: Session Initiation Protocol (SIP) Compression Protocol Specification

Intellectual Property Rights Notice for Open Specifications Documentation

- **Technical Documentation.** Microsoft publishes Open Specifications documentation for protocols, file formats, languages, standards as well as overviews of the interaction among each of these technologies.
- **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 may make copies of it in order to develop implementations of the technologies described in the Open Specifications and may distribute portions of it in your implementations using these technologies or your documentation as necessary to properly document the implementation. You may also distribute in your implementation, with or without modification, any schema, IDL's, or code samples that are included in the documentation. This permission also applies to any documents that are referenced in the Open Specifications.
- **No Trade Secrets.** Microsoft does not claim any trade secret rights in this documentation.
- **Patents.** Microsoft has patents that may cover your implementations of the technologies described in the Open Specifications. Neither this notice nor Microsoft's delivery of the documentation grants any licenses under those or any other Microsoft patents. However, a given Open Specification may be covered by Microsoft [Open Specification Promise](#) or the [Community Promise](#). If you would prefer a written license, or if the technologies described in the Open Specifications 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 may be covered by trademarks or similar intellectual property rights. This notice does not grant any licenses under those rights.
- **Fictitious Names.** The example companies, organizations, products, domain names, e-mail addresses, logos, people, places, and events 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 specifically described above, whether by implication, estoppel, or otherwise.

Tools. The Open Specifications do 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 are intended for use in conjunction with publicly available standard specifications and network programming art, and assumes that the reader either is familiar with the aforementioned material or has immediate access to it.

Revision Summary

Date	Revision History	Revision Class	Comments
04/04/2008	0.1		Initial version
04/25/2008	0.2		Updated based on feedback
06/27/2008	1.0		Updated based on feedback
08/15/2008	1.01		Updated based on feedback
12/12/2008	2.0		Updated with latest template bug fixes (redlined)
02/13/2009	2.01		Updated with latest template bug fixes (redlined)
03/13/2009	2.02		Updated with latest template bug fixes (redlined)
07/13/2009	2.03	Major	Revised and edited the technical content
08/28/2009	2.04	Editorial	Revised and edited the technical content
11/06/2009	2.05	Editorial	Revised and edited the technical content
02/19/2010	2.06	Editorial	Revised and edited the technical content
03/31/2010	2.07	Major	Updated and revised the technical content
04/30/2010	2.08	Editorial	Revised and edited the technical content
06/07/2010	2.09	Editorial	Revised and edited the technical content
06/29/2010	2.10	Editorial	Changed language and formatting in the technical content.
07/23/2010	2.10	No change	No changes to the meaning, language, or formatting of the technical content.
09/27/2010	3.0	Major	Significantly changed the technical content.
11/15/2010	3.0	No change	No changes to the meaning, language, or formatting of the technical content.
12/17/2010	3.0	No change	No changes to the meaning, language, or formatting of the technical content.
03/18/2011	3.0	No change	No changes to the meaning, language, or formatting of the technical content.
06/10/2011	3.0	No change	No changes to the meaning, language, or formatting of the technical content.
01/20/2012	3.1	Minor	Clarified the meaning of the technical content.
04/11/2012	3.1	No change	No changes to the meaning, language, or formatting of the technical content.

Date	Revision History	Revision Class	Comments
07/16/2012	3.1	No change	No changes to the meaning, language, or formatting of the technical content.
10/08/2012	3.2	Minor	Clarified the meaning of the technical content.

Table of Contents

1 Introduction	6
1.1 Glossary	6
1.2 References	6
1.2.1 Normative References	6
1.2.2 Informative References	7
1.3 Overview	7
1.3.1 Message Flow	7
1.4 Relationship to Other Protocols	8
1.5 Prerequisites/Preconditions	8
1.6 Applicability Statement	8
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
2.2.1 NEGOTIATE Request Message Format	9
2.2.2 Response to NEGOTIATE Request	9
2.2.3 Compression SIP Header Field Syntax	9
2.2.4 Compression Packet Header Format	10
3 Protocol Details	11
3.1 Compression Negotiation 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
3.1.4.1 Initiating Compression Negotiation	11
3.1.5 Message Processing Events and Sequencing Rules	11
3.1.5.1 Sending NEGOTIATE Request from the Client	11
3.1.5.2 Processing NEGOTIATE Request in the Server	11
3.1.5.3 Processing Response of NEGOTIATE Request in the Client	12
3.1.6 Timer Events	12
3.1.7 Other Local Events	12
3.2 Compression Transport Details	12
3.2.1 Abstract Data Model	13
3.2.2 Timers	13
3.2.3 Initialization	13
3.2.4 Higher-Layer Triggered Events	13
3.2.5 Message Processing Events and Sequencing Rules	13
3.2.5.1 Compressing Data	14
3.2.5.1.1 Setting the Compression Flags	15
3.2.5.2 Decompressing Data	16
3.2.6 Timer Events	17
3.2.7 Other Local Events	18
4 Protocol Examples	19
4.1 NEGOTIATE Request for Compression Negotiation	19
4.2 OK to the NEGOTIATE Request	19

5 Security	20
5.1 Security Considerations for Implementers.....	20
5.2 Index of Security Parameters	20
6 Appendix A: Product Behavior	21
7 Change Tracking	22
8 Index	24

1 Introduction

The Session Initiation Protocol (SIP) Compression Protocol is the protocol for SIP signaling traffic compression. This protocol has two phases. The negotiation phase which advertises and exchanges compression capabilities, and the compression phase that deals with encoding and decoding of the payload. This protocol is used by both the protocol client and the proxy.

Sections 1.8, 2, and 3 of this specification are normative and can contain the terms MAY, SHOULD, MUST, MUST NOT, and SHOULD NOT as defined in RFC 2119. Sections 1.5 and 1.9 are also normative but cannot contain those terms. All other sections and examples in this specification are informative.

1.1 Glossary

The following terms are defined in [\[MS-GLOS\]](#):

Augmented Backus-Naur Form (ABNF)

The following terms are defined in [\[MS-OFCGLOS\]](#):

200 OK
proxy
Request-URI
Session Initiation Protocol (SIP)
Transport Layer Security (TLS)

The following terms are specific to this document:

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

1.2 References

References to Microsoft Open Specifications documentation do not include a publishing year because links are to the latest version of the technical documents, which are updated frequently. References to other documents include a publishing year when one is available.

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. Please check the archive site, <http://msdn2.microsoft.com/en-us/library/E4BD6494-06AD-4aed-9823-445E921C9624>, as an additional source.

[MS-CONMGMT] Microsoft Corporation, "[Connection Management Protocol Specification](#)".

[RFC2118] Pall, G., "Microsoft Point-To-Point Compression (MPPC) Protocol", RFC 2118, March 1997, <http://www.ietf.org/rfc/rfc2118.txt>

[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>

[RFC4346] Dierks, T., and Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.1", RFC 4346, April 2006, <http://www.ietf.org/rfc/rfc4346.txt>

[RFC5234] Crocker, D., Ed., and Overell, P., "Augmented BNF for Syntax Specifications: ABNF", STD 68, RFC 5234, January 2008, <http://www.rfc-editor.org/rfc/rfc5234.txt>

1.2.2 Informative References

[MS-GLOS] Microsoft Corporation, "[Windows Protocols Master Glossary](#)".

[MS-OFCGLOS] Microsoft Corporation, "[Microsoft Office Master Glossary](#)".

[MS-SIPAE] Microsoft Corporation, "[Session Initiation Protocol \(SIP\) Authentication Extensions](#)".

1.3 Overview

This protocol provides a way to perform compression between the protocol client and its first hop **Session Initiation Protocol (SIP) proxy**. This protocol defines the usage of a modified form of the Microsoft® Point-to-Point Compression (MPPC) protocol to perform compression of SIP data. This protocol also defines the protocol for negotiating compression capability. The protocol client and server can operate as the sender of compressed data.

1.3.1 Message Flow

The following figure shows the message flow for a typical compression session for this protocol.

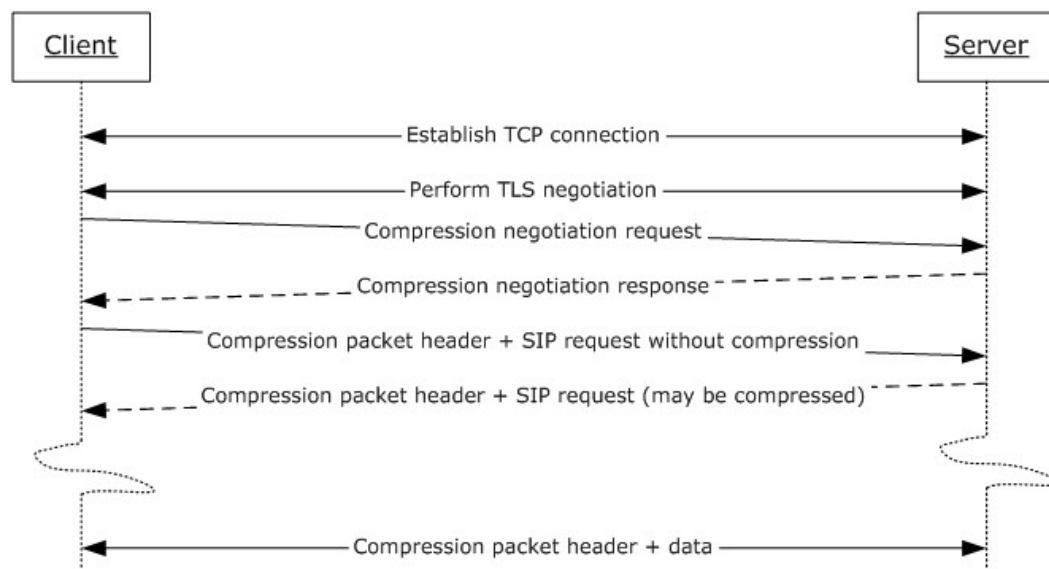


Figure 1: Typical message flow for this protocol

This protocol begins immediately following **Transport Layer Security (TLS)** negotiation. A protocol session has a negotiation phase and a transport phase. In the negotiation phase, the protocol client

and server exchange a compression negotiation request and a compression negotiation response. In the transport phase, the protocol client and server exchange compression packet headers and data.

1.4 Relationship to Other Protocols

This protocol depends on the Microsoft Point-to-Point Compression (MPPC) protocol described in [\[RFC2118\]](#) for encoding and decoding compressed data. The compressed data is transported over a TLS channel.

The negotiation phase of the session determines whether data is compressed using this protocol or is sent uncompressed.

The following figure shows the logical relationship among the various protocols.

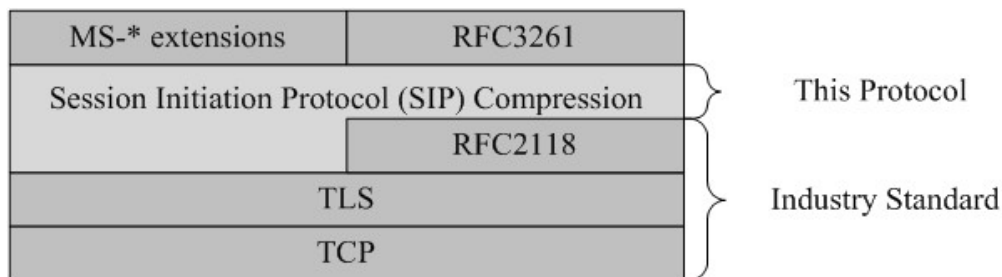


Figure 2: This protocol in relation to other protocols

1.5 Prerequisites/Preconditions

The TLS channel has to be established before this protocol starts the compression negotiation. In addition, the protocol client and server cannot have sent any SIP traffic on this connection before the compression negotiation.

1.6 Applicability Statement

This protocol is applicable when both the protocol client and the server support SIP and will use the enhancement offered by this protocol.

1.7 Versioning and Capability Negotiation

Protocol clients and servers supporting this protocol negotiate compression capability using the new **NEGOTIATE** method specified in section [2.2.1](#). The compression algorithm is negotiated using the **Compression** header field specified in section [2.2.3](#).

1.8 Vendor-Extensible Fields

None.

1.9 Standards Assignments

None.

2 Messages

2.1 Transport

The negotiation messages and payload for this protocol MUST be transported over an established TLS channel.

2.2 Message Syntax

All of the message syntax specified in this document is described in both prose and an **Augmented Backus-Naur Form (ABNF)**, as defined in [\[RFC5234\]](#).

2.2.1 NEGOTIATE Request Message Format

This protocol extends [\[RFC3261\]](#) in defining a new SIP method for negotiation of compression. The capitalized **NEGOTIATE** token is an extension-method conforming to the method and extension-method grammar specified in [\[RFC3261\]](#) section 25.1 as follows:

```
Method           = INVITEm / ACKm / OPTIONSm / BYEm
                  / CANCELm / REGISTERm
                  / extension-method
extension-method = token
```

The **NEGOTIATE** request MUST include the **CSeq**, **Via**, **Call-ID**, **From**, and **To** header fields constructed as specified in [\[RFC3261\]](#).

The **NEGOTIATE** request MUST [<1>](#) have a **Max-Forwards** header field value of 0. The **NEGOTIATE** method is not intended to be proxied beyond the first hop proxy.

The **NEGOTIATE** request MUST also include the **Compression** header field specified in section [2.2.3](#).

The **NEGOTIATE** request SHOULD NOT contain a **Content-Type** header field and it SHOULD NOT contain a message body.

2.2.2 Response to NEGOTIATE Request

The response for a **NEGOTIATE** request is constructed following the steps specified in [\[RFC3261\]](#) section 8.2.6.

In addition, the **200 OK** response for the **NEGOTIATE** request MUST contain a **Compression** header field, as specified in section [2.2.3](#).

2.2.3 Compression SIP Header Field Syntax

This protocol defines a new **Compression** SIP header field.

```
Compression      = "Compression" HCOLON compression-value
compression-value = "LZ77-8K" / token
```

The **Compression** header field is used to exchange the compression algorithm to be used. Currently, "LZ77-8K" is the only supported value.

2.2.4 Compression Packet Header Format

Once compression capability is negotiated, a **Compression Packet** header MUST precede a data segment to be sent over the compression negotiated TLS channel, as specified in [\[RFC4346\]](#).

The size of the **Compression Packet** header MUST be 6 bytes. The **Compression Packet** header has the following format.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
flags				type				reserved																							
Uncompressed size																Data (variable, not part of the header)															
...																															

flags (4 bits): The size of the flags MUST be 4 bits. The value is produced by performing a logical **OR** of the values in **PACKET_FLUSHED**, **PACKET_AT_FRONT**, and **PACKET_COMPRESSED**. The use of this value is further specified in section [3.2.5.1.1](#).

Name	Value	Description
PACKET_FLUSHED	0x8	If this flag is set, the data is not compressed and the receiver MUST reset the history buffer state. This flag MUST NOT be used in conjunction with PACKET_COMPRESSED .
PACKET_AT_FRONT	0x4	If this flag is set, uncompressed data is set at the beginning of the history buffer.
PACKET_COMPRESSED	0x2	If this flag is set, it indicates that the data is compressed. This flag MUST NOT be used in conjunction with PACKET_FLUSHED .
Undefined	0x1	This flag is not used. This flag MUST NOT be set.

type (4 bits): A 4-bit value used for the type of compression used. This value MUST be set to zero for this protocol. The server and client SHOULD ignore this value.

reserved (3 bytes): Three bytes that are not used. All bits MUST be set to zero by the sender, and MUST be ignored by the receiver.

Uncompressed size (2 bytes): The uncompressed size MUST be a 16-bit unsigned value containing the size of the original data before compression. An incorrect size MAY cause decompression to fail.

Data (variable): The data for the packet. This is not part of the header.

3 Protocol Details

3.1 Compression Negotiation Details

Both the protocol client and the server can operate as senders of compressed data. The protocol client and server advertise their compression capability and algorithm using the mechanism specified in this section.

3.1.1 Abstract Data Model

None.

3.1.2 Timers

After the protocol client sends the NEGOTIATE request, the protocol client MUST set timer F for the non-INVITE protocol client transaction, as specified in [\[RFC3261\]](#) section 17.1.2.2. However, instead of setting timer F to $T1 * 64$ seconds (with T1 having a default of 500ms as specified in [\[RFC3261\]](#) section 17.1.1.1), the protocol client SHOULD set timer F to 5 seconds. This smaller timer F value forces compression negotiation to complete within 5 seconds and shortens the maximum transport establishment delay between protocol client and server.

3.1.3 Initialization

The protocol client participating in this protocol MUST obtain the IP address of the first hop SIP proxy and the remote port with which the protocol client established the TCP connection and successfully negotiated the TLS channel. The first hop SIP proxy IP address and port is used to construct the **Request-URI** of the NEGOTIATE request.

3.1.4 Higher-Layer Triggered Events

3.1.4.1 Initiating Compression Negotiation

To participate in compression, a protocol client MUST send the compression negotiation request to the first hop SIP proxy after TLS negotiation is successfully finished and before sending any data on the TLS channel.

3.1.5 Message Processing Events and Sequencing Rules

This protocol uses the NEGOTIATE SIP non-INVITE transaction to negotiate compression capability. The NEGOTIATE request communicates the request to start compression. The NEGOTIATE is always sent from the protocol client to the server. The server MUST NOT start compression negotiation by sending a NEGOTIATE request to the protocol client.

3.1.5.1 Sending NEGOTIATE Request from the Client

The protocol client participating in compression MUST construct a NEGOTIATE message, as specified in section [2.2.1](#).

3.1.5.2 Processing NEGOTIATE Request in the Server

The server can receive a NEGOTIATE request after a TCP connection to a protocol client is established and TLS negotiation completes successfully. To participate in compression, the server MUST [<2>](#) inspect the **Compression** header field and match the value "LZ77-8K". If the

Compression header field does not contain "LZ77-8K", the server MUST respond to the NEGOTIATE request with a failure response code greater than or equal to 400.

If the server is unable to support compression negotiation for any reason, including internal causes such as resource limitations, the server MUST respond to the NEGOTIATE request with a failure response code greater than or equal to 400.

If the server receives a NEGOTIATE request with a **Max-Forwards** header field value greater than 0, it MUST [<3>](#) respond to the NEGOTIATE request with a failure response code greater than or equal to 400.

If the server receives a NEGOTIATE request with a **Content-Type** header field, it SHOULD ignore the header field.

If the server receives a NEGOTIATE request with a message body, it SHOULD ignore the message body. To proceed with compression negotiation, the server MUST construct a 200 OK response to the NEGOTIATE request, as specified in section [2.2.2](#).

The server MUST send a response to the NEGOTIATE request within 5 seconds, to prevent timer F in the protocol client from expiring.

3.1.5.3 Processing Response of NEGOTIATE Request in the Client

When the protocol client receives a response for the NEGOTIATE request, the protocol client MUST cancel the pending timer F. The protocol client then inspects the response code. Any response code other than 200 is treated as compression declined, and the protocol client and server MUST NOT start the transport phase of this protocol. If the response code is 200, the protocol client MUST inspect the **Compression** header field. If the header field value does not match "LZ77-8K", the server supports a compression algorithm that is different from the one used in this protocol. In this case, the protocol client MUST fail compression negotiation and tear down the TCP connection. If the header field value matches the expected value, the negotiation phase is successfully finished. This protocol then moves into the transport phase.

3.1.6 Timer Events

The protocol client's timer F for the NEGOTIATE non-INVITE transaction fires when the protocol client does not receive a response to the NEGOTIATE request. This is treated as compression declined, and the protocol client MUST reject any compressed data sent by the server, and MUST NOT start the transport phase of this protocol.

3.1.7 Other Local Events

If the established TCP connection is torn down on either the protocol client side or the server side, the negotiation phase is aborted and the connection is torn down, as specified in [\[MS-CONMGMT\]](#).

3.2 Compression Transport Details

Once the compression capability and algorithm are negotiated successfully, this protocol enters the transport phase. This protocol uses a modified form of the Point-to-Point Compression (MPPC) protocol specified in [\[RFC2118\]](#). Unlike MPPC, instead of assuming an unreliable transport, this protocol compressed data is carried over a TLS channel on top of a TCP connection, which guarantees in-order transport.

Each data packet MUST include the compression packet header specified in section [2.2.4](#) when transporting over a connection on which this protocol has been successfully negotiated.

3.2.1 Abstract Data Model

This section describes a conceptual model of data organization that an implementation can maintain to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This document does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this protocol.

The shared state necessary to support the transmission and reception of compressed data between a protocol client and server requires a history buffer and a current offset into the history buffer (**HistoryOffset**). The size of the history buffer is 8 kilobytes. While compressing data, the sender inserts the uncompressed data that does not exceed 8 kilobytes at the position in the history buffer given by the **HistoryOffset**. After insertion, the **HistoryOffset** is advanced by the length of data added. If the data does not fit into the history buffer (the sum of the **HistoryOffset** and the size of the uncompressed data exceeds the size of the history buffer), the **HistoryOffset** MUST be reset to the start of the history buffer (offset 0).

As the receiver endpoint decompresses the data, it inserts the decompressed data at the position in the history buffer given by its local copy of **HistoryOffset**. If a reset occurs, the sender must notify the target receiver by setting the `PACKET_FLUSHED` flag in the compression packet header so it can reset its local state. After the data is decompressed, the receiver's history buffer and **HistoryOffset** are identical to the sender's history buffer and **HistoryOffset**.

Because the protocol client and server can send and receive compressed data, the protocol client and server must maintain two sets of state, one for sending and the other for receiving. Thus, the server maintains a history buffer and a **HistoryOffset** to send data to the protocol client, and a history buffer and a **HistoryOffset** to receive data from the protocol client. Similarly, the protocol client maintains a history buffer and a **HistoryOffset** to send data to the server, and a history buffer and a **HistoryOffset** to receive data from the server.

Both the protocol client and server SHOULD also maintain output buffers to store the output for compression and decompression operation.

3.2.2 Timers

None.

3.2.3 Initialization

The history buffer and **HistoryOffset** MUST both start initialized to zero.

3.2.4 Higher-Layer Triggered Events

None.

3.2.5 Message Processing Events and Sequencing Rules

The protocol server MAY start sending compressed data immediately after enters the transport phase. The protocol server SHOULD start sending compressed data only after it validates client identity to avoid committing memory and other resources for clients that were not yet validated. The server SHOULD use an authentication mechanism for client identity validation, such as the one those which are described in [\[MS-SIPAE\]](#) and MAY use any other mechanism of its choice.

The protocol client MUST NOT start compression before it receives the first compressed data from the server. The protocol client SHOULD start sending compressed data after it receives first compressed data from the server.

3.2.5.1 Compressing Data

The uncompressed data is first inserted into the local history buffer at the position indicated by the sender's **HistoryOffset**. The compressor then searches the uncompressed data for repeated series of characters, and produces output that is comprised of a sequence of literals (bytes to be sent uncompressed) and copy-tuples. Each copy-tuple represents a series of repeated characters, and consists of a <copy-offset, length-of-match> pair.

The copy-offset component of the copy-tuple is an index into the history buffer (counting backwards from the current byte towards the start of the buffer) to the most recent match of the data represented by the copy-tuple. The length-of-match component of the copy-tuple is the length of that match in bytes.

For example, consider the following string:

```
0           1           2           3           4
012345678901234567890123456789012345678901234567890
for whom the bell tolls, the bell tolls for thee.
```

The compressor produces the following:

```
for whom the bell tolls,<16,15> <40,4><19,3>e.
```

The <16,15> tuple is the compression of ".the.bell.tolls" and <40,4> is "for.", <19,3> gives "the".

The period (.) values indicate space characters.

After all data in the buffer is compressed into a sequence of literals and copy-tuples, it is then encoded using the MPPC protocol encoding scheme specified in [\[RFC2118\]](#) section 4.1 and section 4.2.

The tuple is constructed with the offset followed by the length-of-match.

According to [\[RFC2118\]](#), the offset in the tuple is to be encoded as follows:

- If the offset value is less than 64, the offset is encoded as 1111 followed by the lower 6 bits of the offset value.
- If the offset value is between 64 and 320, the offset is encoded as 1110 followed by the lower 8 bits of the offset value.
- If the offset value is between 320 and 8191, the offset is encoded as 110 followed by the lower 13 bits of the offset value.
- The offset value cannot be great than 8191 because the size of the history buffer is only 8 kilobytes.

According to [\[RFC2118\]](#), the length-of-match is to be encoded as follows:

- Bytes of a match of length less than 3 are encoded as literals.
- Length of 3 is encoded with bit 0.
- Length values from 4 to 7 are encoded as 10 followed by lower 2 bits of the value.
- Length values from 8 to 15 are encoded as 110 followed by lower 3 bits of the value.

- Length values from 16 to 31 are encoded as 1110 followed by lower 4 bits of the value.
- Length values from 32 to 63 are encoded as 11110 followed by lower 5 bits of the value.
- Length values from 64 to 127 are encoded as 111110 followed by lower 6 bits of the value.
- Length values from 128 to 255 are encoded as 1111110 followed by lower 7 bits of the value.
- Length values from 256 to 511 are encoded as 11111110 followed by lower 8 bits of the value.
- Length values from 512 to 1023 are encoded as 111111110 followed by lower 9 bits of the value.
- Length values from 1024 to 2047 are encoded as 1111111110 followed by lower 10 bits of the value.
- Length values from 2048 to 4095 are encoded as 11111111110 followed by lower 11 bits of the value.
- Length values from 4096 to 8191 are encoded as 111111111110 followed by lower 12 bits of the value.

To use the preceding example, the <16,15> tuple is encoded as 1111010000110111 where the higher 10 bits 1111010000 represents the offset (16) and the lower 6 bits 110111 represents the length of match (15).

If the resulting data after encoding is greater than the original bytes (that is, expansion instead of compression results), this results in a flush and the data is sent uncompressed to avoid sending more data than the original uncompressed bytes.

3.2.5.1.1 Setting the Compression Flags

The sender **MUST** always specify the compression flags associated with a compressed payload. These flags **MUST** be set in the flags field in the compression packet header.

The compression flags are produced by performing a logical OR of the values in `PACKET_FLUSHED`, `PACKET_AT_FRONT`, and `PACKET_COMPRESSED`.

PACKET_FLUSHED: Indicates that the history buffer **MUST** be reinitialized. This value corresponds to the MPPC protocol bit A, as specified in [\[RFC2118\]](#) section 3.1. This flag **MUST** be set without setting any other flags.

This flag **MUST** be set if the compression generates an expansion of the data and the flag indicates to the decompressor that it should reset its history buffer, reset its **HistoryOffset** value, and then restart the reception of the next batch of compressed bytes. If this condition occurs, the data **MUST** be sent in uncompressed form.

PACKET_AT_FRONT: Indicates that the decompressed data **MUST** be placed at the beginning of the local history buffer. This value corresponds to the MPPC protocol bit B, as specified in [\[RFC2118\]](#) section 3.1. This flag **MUST** be set in conjunction with the `PACKET_COMPRESSED` (0x2) flag.

The following conditions on the compressor side generate this scenario:

- This is the first packet to be compressed.
- The data to be compressed will not fit at the end of the history buffer but, instead, needs to be placed at the start of the history buffer.

PACKET_COMPRESSED: Indicates that the data is compressed. This value corresponds to the MPPC protocol bit C, as specified in [RFC2118] section 3.1. This flag **MUST** be set when the data is compressed.

The following figure shows the general operation of the compressor and the production of the various flag values.

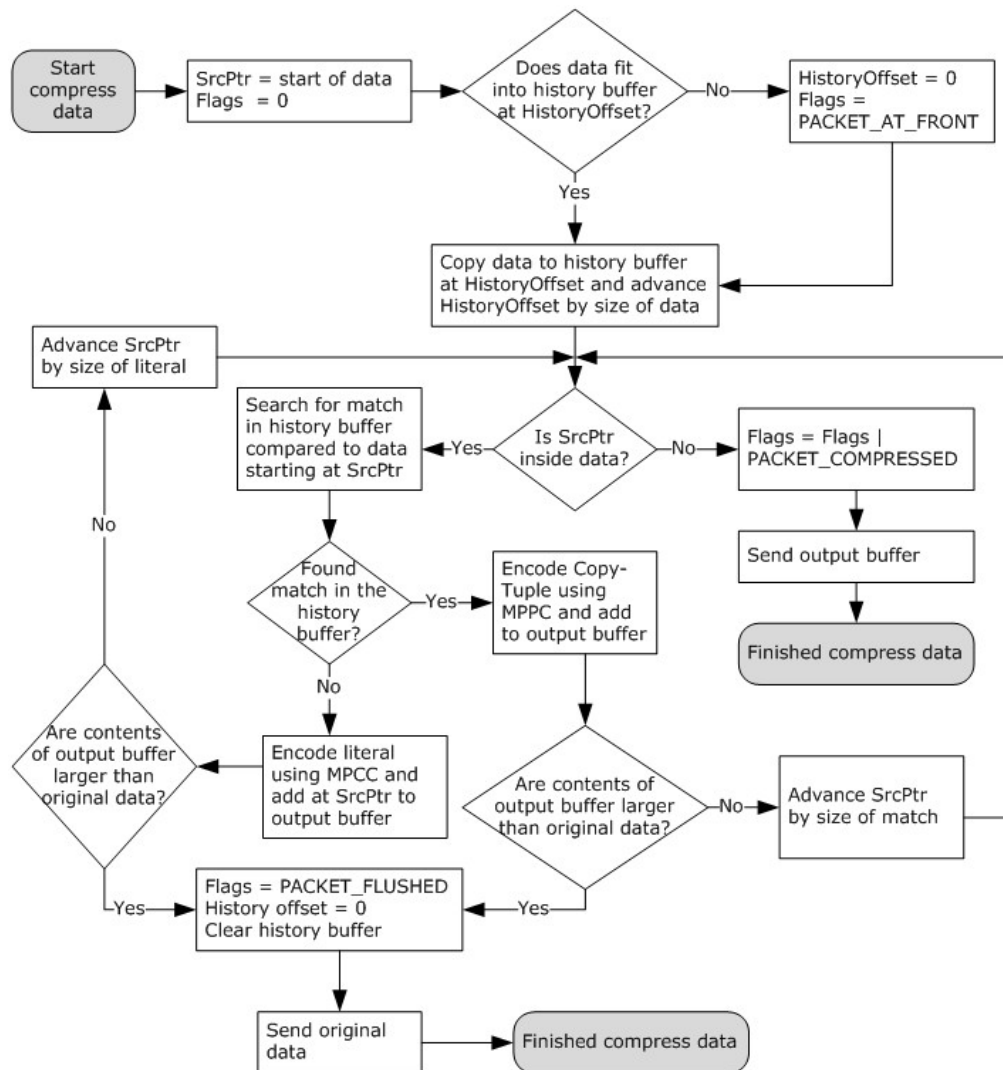


Figure 3: Compression flowchart

3.2.5.2 Decompressing Data

An endpoint which receives compressed data **MUST** decompress the data and store the resultant data at the end of the history buffer. The order of actions depends on the compression flags associated with the compressed data.

PACKET_FLUSHED: If this flag is set, the decompressor **MUST** reset its state by clearing the history buffer and resetting the **HistoryOffset** to 0.

PACKET_AT_FRONT: If this flag is set, the decompressor MUST start decompressing to the start of the history buffer, by resetting the **HistoryOffset** to 0. Otherwise, the decompressor MUST append the decompressed data to the end of the history buffer.

PACKET_COMPRESSED: If this flag is set, the decompressor MUST decompress the data, appending the decompressed data to the history buffer and advancing the **HistoryOffset**.

If the compression flags associated with the compressed data are inconsistent, the decompressor has reached an undefined state, and the receiving endpoint MUST tear down the TCP connection. Compression flags are inconsistent when PACKET_FLUSHED is set while PACKET_COMPRESSED is set.

The following diagram shows the general operation of the decompressor.

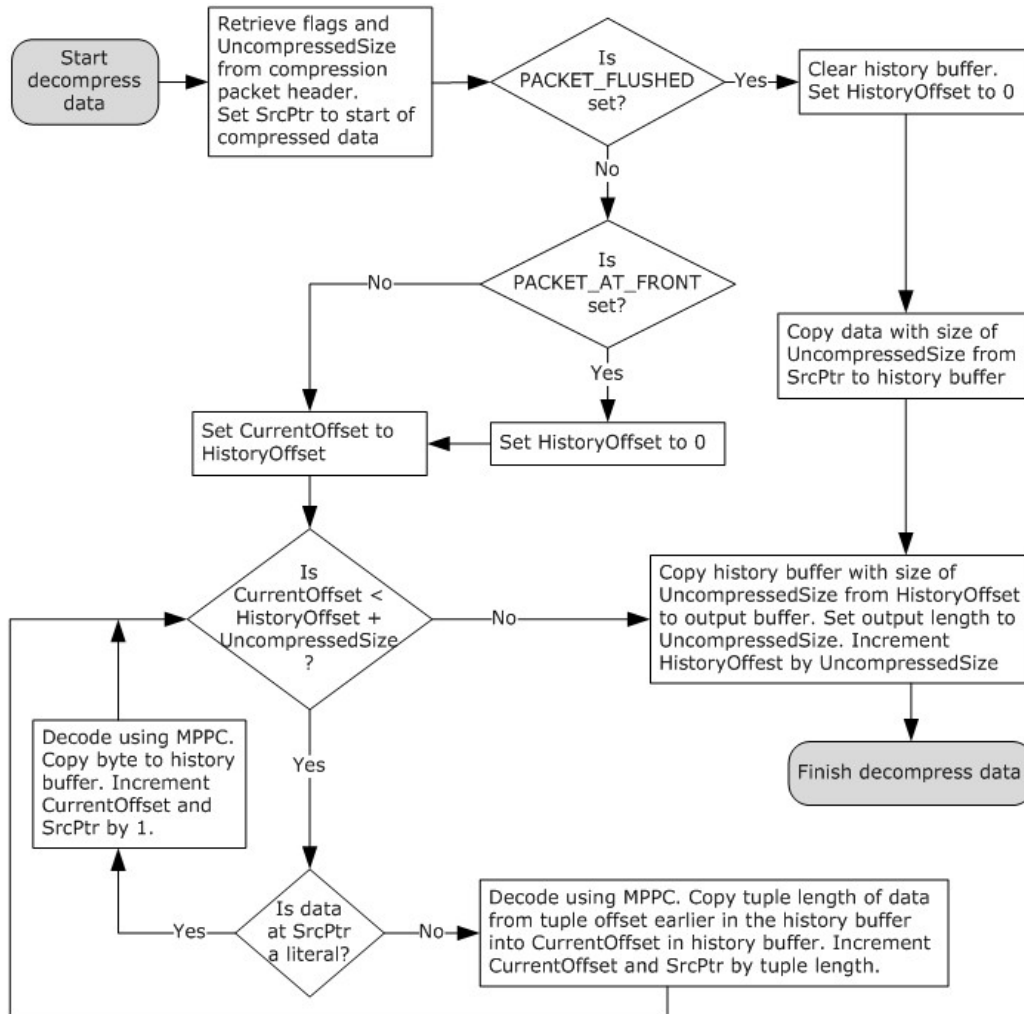


Figure 4: Decompression flowchart

3.2.6 Timer Events

None.

3.2.7 Other Local Events

None.

4 Protocol Examples

4.1 NEGOTIATE Request for Compression Negotiation

```
NEGOTIATE sip:192.0.0.1:5061 SIP/2.0
Via: SIP/2.0/TLS 192.0.0.2:2616
CSeq: 1 NEGOTIATE
Call-ID: 8d8b20f87c9c4221a732f3a70f57e9b8
From: <sip:192.0.0.2:2616>;tag=984721fb59b64e45b469c91aba8a9f8f
To: <sip:192.0.0.1:5061>
Compression: LZ77-8K
Max-Forwards: 0
Content-Length: 0
```

4.2 OK to the NEGOTIATE Request

```
SIP/2.0 200 OK
Compression: LZ77-8K
From: <sip:192.0.0.2:2616>;tag=984721fb59b64e45b469c91aba8a9f8f
To: <sip:192.0.0.1:5061>;tag=D76F601D7239923FBE84D78BF8821C85
Call-ID: 8d8b20f87c9c4221a732f3a70f57e9b8
CSeq: 1 NEGOTIATE
Via: SIP/2.0/TLS 192.0.0.2:2616;ms-received-port=2616;ms-received-cid=545400
Content-Length: 0
```

5 Security

5.1 Security Considerations for Implementers

None.

5.2 Index of Security Parameters

None.

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:

- Microsoft® Office Communications Server 2007
- Microsoft® Office Communicator 2007
- Microsoft® Office Communications Server 2007 R2
- Microsoft® Office Communicator 2007 R2
- Microsoft® Lync® 2010
- Microsoft® Lync® Server 2010
- Microsoft® Lync® 2013
- Microsoft® Lync® Server 2013

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 2.2.1:](#) Office Communications Server 2007 R2, Office Communicator 2007 R2: The **NEGOTIATE** request SHOULD have a **Max-Forwards** header field value of 0. The **NEGOTIATE** method is not intended to be proxied beyond the first hop proxy. The server MAY accept a **NEGOTIATE** request that does not have any **Max-Forwards** header, which is different from the specifications in [\[RFC3261\]](#) section 8.1.1.

[<2> Section 3.1.5.2:](#) Office Communications Server 2007 R2, Office Communicator 2007 R2: To participate in compression, the server MUST inspect the Compression header field and search for the value "LZ77-8K" within the field.

[<3> Section 3.1.5.2:](#) Office Communications Server 2007 R2, Office Communicator 2007 R2: If the server receives a NEGOTIATE request with a Max-Forwards header field value greater than 0, it SHOULD ignore the header field value.

7 Change Tracking

This section identifies changes that were made to the [MS-SIPCOMP] protocol document between the July 2012 and October 2012 releases. Changes are classified as New, Major, Minor, Editorial, or No change.

The revision class **New** means that a new document is being released.

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 or functionality.
- An extensive rewrite, addition, or deletion of major portions of content.
- The removal of a document from the documentation set.
- Changes made for template compliance.

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 **Editorial** means that the language and formatting in the technical content was changed. Editorial changes apply to grammatical, formatting, and style issues.

The revision class **No change** means that no new technical or language changes were introduced. The technical content of the document is identical to the last released version, but minor editorial and formatting changes, as well as updates to the header and footer information, and to the revision summary, may have been made.

Major and minor changes can be described further using the following change types:

- New content added.
- Content updated.
- Content removed.
- New product behavior note added.
- Product behavior note updated.
- Product behavior note removed.
- New protocol syntax added.
- Protocol syntax updated.
- Protocol syntax removed.
- New content added due to protocol revision.
- Content updated due to protocol revision.
- Content removed due to protocol revision.
- New protocol syntax added due to protocol revision.

- Protocol syntax updated due to protocol revision.
- Protocol syntax removed due to protocol revision.
- New content added for template compliance.
- Content updated for template compliance.
- Content removed for template compliance.
- Obsolete document removed.

Editorial changes are always classified with the change type **Editorially updated**.

Some important terms used in the change type descriptions are defined as follows:

- **Protocol syntax** refers to data elements (such as packets, structures, enumerations, and methods) as well as interfaces.
- **Protocol revision** refers to changes made to a protocol that affect the bits that are sent over the wire.

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

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
1.3 Overview	Removed glossary reference for term "server" for clarity.	N	Content updated.
1.3 Overview	Changed the name from 'Protocol Overview (Synopsis)' to read 'Overview'.	N	Content updated for template compliance.

8 Index

A

Abstract data model
[compression negotiation](#) 11
[compression transport](#) 13
[Applicability](#) 8

C

[Capability negotiation](#) 8
[Change tracking](#) 22
Compression negotiation
[abstract data model](#) 11
[higher-layer triggered events](#) 11
[initialization](#) 11
[local events](#) 12
[message processing](#) 11
[process NEGOTIATE request](#) 11
[process response to NEGOTIATE request](#) 12
[send NEGOTIATE request](#) 11
[overview](#) 11
[sequencing rules](#) 11
[process NEGOTIATE request](#) 11
[process response to NEGOTIATE request](#) 12
[send NEGOTIATE request](#) 11
[timer events](#) 12
[timers](#) 11
[Compression Packet Header Format message](#) 10
[Compression SIP Header Field Syntax message](#) 9
Compression transport
[abstract data model](#) 13
[higher-layer triggered events](#) 13
[initialization](#) 13
[local events](#) 18
[message processing](#) 13
[compress data](#) 14
[decompress data](#) 16
[overview](#) 12
sequencing rules
[compress data](#) 14
[decompress data](#) 16
[timer events](#) 17
[timers](#) 13

D

Data model - abstract
[compression negotiation](#) 11
[compression transport](#) 13

E

Examples
[200 OK to NEGOTIATE request](#) 19
[NEGOTIATE request](#) 19

F

[Fields - vendor-extensible](#) 8

G

[Glossary](#) 6

H

Higher-layer triggered events
[compression negotiation](#) 11
[compression transport](#) 13

I

[Implementer - security considerations](#) 20
[Index of security parameters](#) 20
[Informative references](#) 7
Initialization
[compression negotiation](#) 11
[compression transport](#) 13
[Introduction](#) 6

L

Local events
[compression negotiation](#) 12
[compression transport](#) 18

M

[Message flow](#) 7
Message processing
[compression negotiation](#) 11
[process NEGOTIATE request](#) 11
[process response to NEGOTIATE request](#) 12
[send NEGOTIATE request](#) 11
[compression transport](#) 13
[compress data](#) 14
[decompress data](#) 16

Messages

[Compression Packet Header Format](#) 10
[Compression SIP Header Field Syntax](#) 9
[NEGOTIATE Request Message Format](#) 9
[Response to NEGOTIATE Request](#) 9
[transport](#) 9

N

[NEGOTIATE request 200 OK example](#) 19
[NEGOTIATE request example](#) 19
[NEGOTIATE Request Message Format message](#) 9
[Normative references](#) 6

O

[Overview \(synopsis\)](#) 7

P

[Parameters - security index](#) 20
[Preconditions](#) 8
[Prerequisites](#) 8
[Product behavior](#) 21
Protocol overview
 [message flow](#) 7

R

[References](#) 6
 [informative](#) 7
 [normative](#) 6
[Relationship to other protocols](#) 8
[Response to NEGOTIATE Request message](#) 9

S

Security
 [implementer considerations](#) 20
 [parameter index](#) 20
Sequencing rules
 [compression negotiation](#) 11
 [process NEGOTIATE request](#) 11
 [process response to NEGOTIATE request](#) 12
 [send NEGOTIATE request](#) 11
 compression transport
 [compress data](#) 14
 [decompress data](#) 16
[Standards assignments](#) 8

T

Timer events
 [compression negotiation](#) 12
 [compression transport](#) 17
Timers
 [compression negotiation](#) 11
 [compression transport](#) 13
[Tracking changes](#) 22
[Transport](#) 9
Triggered events
 [compression negotiation](#) 11
 [compression transport](#) 13

V

[Vendor-extensible fields](#) 8
[Versioning](#) 8