

# [MS-OXSMTP]: Simple Mail Transfer Protocol (SMTP) Mail Submission Extensions

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## Revision Summary

Date	Revision History	Revision Class	Comments
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08/06/2008	1.01		Revised and edited technical content.
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07/15/2009	3.0	Major	Revised and edited for technical content.
11/04/2009	3.1.0	Minor	Updated the technical content.
02/10/2010	3.2.0	Minor	Updated the technical content.
05/05/2010	3.3.0	Minor	Updated the technical content.
08/04/2010	4.0	Major	Significantly changed the technical content.

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# 1 Introduction

This document specifies the Simple Mail Transport Protocol (SMTP) Message Submission extensions, which conform to and extend SMTP standards to support the transfer of mail between a client and a server.

These extensions conform to the core SMTP specification and the following SMTP extensions:

- SMTP Service Extensions [\[RFC1869\]](#): Enables a server to notify a client about the extensions that the server supports.
- 8bit-MIME transport [\[RFC1652\]](#): Enables a server to use SMTP Service Extensions to inform a client that the server supports Multipurpose Internet Mail Extensions (MIME) transport, and allows the client to send 8-bit MIME messages.
- Transmission of Large and Binary MIME Messages [\[RFC3030\]](#): Enables a server to use SMTP Service Extensions to inform a client that the server supports large binary MIME messages, and allows the client to send large binary MIME messages.
- Message Size Declaration [\[RFC1870\]](#): Enables a server to use SMTP Service Extensions to inform a client that the server supports client message size declarations, and allows the client to declare a message size and the server to provide the maximum message size that it will accept.
- Delivery Status Notifications [\[RFC1891\]](#): Enables a server to use SMTP Service Extensions to inform a client that the server supports delivery status notifications, and allows the client to indicate how it wants delivery status notifications to be sent to it.
- Returning Enhanced Error Codes [\[RFC2034\]](#): Enables a server to use SMTP Service Extensions to inform a client that the server supports enhanced error codes.
- Authentication [\[RFC2554\]](#): Enables a server to use SMTP Service Extensions to tell a client which authentication mechanisms the server supports, and allows a client to use the authentication extension.
- Command Pipelining [\[RFC2920\]](#): Enables a server to use SMTP Service Extensions to tell a client whether it implements SMTP command pipelining, and allows a client to use command pipelining.
- Secure SMTP over Transport Layer Security [\[RFC3207\]](#): Enables a server to use SMTP Service Extensions to tell a client whether it implements transport layer security, and allows a client and server to use transport layer security.
- Message Submission for Mail [\[RFC4409\]](#): Enables a server to use SMTP Service Extensions for message submission, and allows a client, specifically a message submission agent, to submit mail to a server.

## 1.1 Glossary

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

**conditions**  
**Mail User Agent (MUA)**  
**NTLM**  
**port**  
**Simple Mail Transfer Protocol (SMTP)**  
**Transmission Control Protocol (TCP)**

The following terms are specific to this document:

**Message Submission Agent (MSA):** A process that accepts messages from a **Mail User Agent (MUA)** and either delivers it or acts as a **Simple Mail Transfer Protocol (SMTP)** client to submit the messages to a **Message Transfer Agent (MTA)**.

**Message Transfer Agent (MTA):** An **SMTP** server that accepts mail from a **Mail Submission Agent (MSA)** or another **MTA** and delivers the mail or relays it to another **MTA**.

**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

### 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](mailto: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.

[RFC791] Postel, J., Ed., "Darpa Internet Program Protocol Specification", RFC 791, September 1981, <http://www.ietf.org/rfc/rfc791.txt>

[RFC1652] Klensin, J., Freed, N., Ed., Rose, M., et al., "SMTP Service Extension for 8bit-MIMEtransport", RFC 1652, July 1994, <http://www.rfc-editor.org/rfc/rfc1652.txt>

[RFC1869] Klensin, J., Freed, N., Ed., Rose, M., et al., "SMTP Service Extensions", STD 10, RFC 1869, November 1995, <http://www.rfc-editor.org/rfc/rfc1869.txt>

[RFC1870] Klensin, J., Freed, N., Ed., Moore, K., "SMTP Service Extension for Message Size Declaration", STD 10, RFC 1870, November 1995, <http://www.rfc-editor.org/rfc/rfc1870.txt>

[RFC1891] Moore, K., "SMTP Service Extension for Delivery Status Notifications", RFC 1891, January 1996, <http://www.rfc-editor.org/rfc/rfc1891.txt>

[RFC2034] Freed, N., "SMTP Service Extension for Returning Enhanced Error Codes", RFC 2034, October 1996, <http://www.rfc-editor.org/rfc/rfc2034.txt>

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

[RFC2460] Deering, S., and Hinden, R., "Internet Protocol, Version 6 (IPv6) Specification", RFC 2460, December 1998, <http://www.ietf.org/rfc/rfc2460.txt>

[RFC2554] Myers, J., "SMTP Service Extension for Authentication", RFC 2554, March 1999, <ftp://ftp.rfc-editor.org/in-notes/rfc2554.txt>

[RFC2920] Freed, N., "SMTP Service Extension for Command Pipelining", STD 60, RFC 2920, September 2000, <http://www.rfc-editor.org/rfc/rfc2920.txt>

[RFC3030] Vaudreuil, G., "SMTP Service Extensions for Transmission of Large and Binary MIME Messages", RFC 3030, December 2000, <http://www.rfc-editor.org/rfc/rfc3030.txt>

[RFC3207] Hoffman, P., "SMTP Service Extension for Secure SMTP over Transport Layer Security", RFC 3207, February 2002, <http://www.rfc-editor.org/rfc/rfc3207.txt>

[RFC4409] Gellens, R., and Klensin, J., "Message Submission for Mail", RFC 4409, April 2006, <ftp://ftp.rfc-editor.org/in-notes/rfc4409.txt>

[RFC5321] Klensin, J., "Simple Mail Transfer Protocol", RFC 5321, October 2008, <http://www.ietf.org/rfc/rfc5321.txt>

[RFC5322] Resnick, P., Ed., "Internet Message Format", RFC 5322, October 2008, <ftp://ftp.rfc-editor.org/in-notes/rfc5322.txt>

## 1.2.2 Informative References

[MS-OXGLOS] Microsoft Corporation, "[Exchange Server Protocols Master Glossary](#)", April 2008.

## 1.3 Overview

The SMTP Mail Submission extensions conform to [\[RFC5321\]](#) and the standard extensions that interoperate with [\[RFC5321\]](#).

## 1.4 Relationship to Other Protocols

These extensions, which are based on [\[RFC5321\]](#) and other related extensions, use **TCP** version 4 [\[RFC791\]](#) and TCP version 6 [\[RFC2460\]](#) for message transfer.

## 1.5 Prerequisites/Preconditions

The SMTP Mail Submission extensions need to be enabled in order to operate. The mechanisms for enabling and disabling those extensions are beyond the scope of this document.

The **SMTP** server can be configured to accept connections at zero or more bindings. A binding is a combination of an IPv4 and IPv6 address and a TCP port number.

## 1.6 Applicability Statement

These extensions are applicable to scenarios where clients will be submitting e-mail messages directly to a server. This specification does not cover how SMTP transport agents affect or alter messages on the server.

## 1.7 Versioning and Capability Negotiation

These extensions introduce no new versioning mechanisms beyond those that exist in SMTP, as described in [\[RFC5321\]](#).

Negotiation of SMTP options is described in [\[RFC1869\]](#) section 4. The EHLO response, as described in section [3.2.5](#), indicates what capabilities are present on the server.

## 1.8 Vendor-Extensible Fields

None.

## 1.9 Standards Assignments

Parameter	Value	Reference
Server port	Port 25	Internet Assigned Numbers Authority
Server port	Port 587	Internet Assigned Numbers Authority

Port mapping is configurable so that non-default values can be used.

## 2 Messages

### 2.1 Transport

The transport of the protocol that these extensions extend is specified in [\[RFC5321\]](#) section 1.1. Specifically, these extensions use TCP over IPv4 [\[RFC791\]](#) and TCP over IPv6 [\[RFC2460\]](#).

### 2.2 Message Syntax

The syntax of the messages that are exchanged between the client and the server is specified in [\[RFC5321\]](#). Some optional message strings and codes that are based on the SMTP standard are implemented by these protocol extensions. These message strings and codes are specified in section [3](#).

#### 2.2.1 Namespaces

None.



## 3 Protocol Details

### 3.1 Client Details

The client role conforms to [\[RFC5321\]](#) for the exchange of messages with the server. The client can implement the SMTP extensions that are specified by the following: [\[RFC1652\]](#), [\[RFC1869\]](#), [\[RFC1870\]](#), [\[RFC1891\]](#), [\[RFC2034\]](#), [\[RFC2554\]](#), [\[RFC2920\]](#), [\[RFC3207\]](#), [\[RFC4409\]](#), and [\[RFC5322\]](#). If the client does not support all or part of the SMTP extensions, the server can service clients with the most basic SMTP implementations.

#### 3.1.1 Abstract Data Model

The client state model is specified in [\[RFC5321\]](#). The client state model MUST reflect the server state model. This set of protocol extensions fully complies with the state transitions specified in [\[RFC5321\]](#).

#### 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

The client conforms to [\[RFC5321\]](#) for all message processing events and sequencing rules.

#### 3.1.6 Timer Events

None.

#### 3.1.7 Other Local Events

None.

### 3.2 Server Details

These protocol extensions are compliant with the specifications listed in section [1.2.1](#). Extensions to the specifications listed in section [1.2.1](#) for the server role are specified in this section.

#### 3.2.1 Abstract Data Model

The server state model is specified in [\[RFC5321\]](#). These extensions are fully compliant with the state transitions that are specified in [\[RFC5321\]](#).

### 3.2.2 Timers

**ConnectionTimer:** A timer that identifies how much time has elapsed since a session was initiated. If the **ConnectionTimer** lapses, the server MUST transition to the initial state, which is the equivalent of clearing the state tables and buffers, as specified in [\[RFC5321\]](#) section 2.3.6.

**ConnectionInactivityTimer:** A timer that identifies how much time has elapsed since a client provided input. If the **ConnectionInactivityTimer** lapses, the server MUST transition to the initial state, which is the equivalent of clearing the state tables and buffers, as specified in [\[RFC5321\]](#) section 2.3.6.

### 3.2.3 Initialization

The **ConnectionTimer** timer, as specified in section [3.2.2](#), is initialized when a session is initiated.

The **ConnectionInactivityTimer** timer, as specified in section [3.2.2](#), is initialized when the client and server start a session. The **ConnectionInactivityTimer** timer is restarted when the client sends input to the server.

### 3.2.4 Higher-Layer Triggered Events

None.

### 3.2.5 Message Processing Events and Sequencing Rules

The server role is compliant with the message processing and sequencing rules that are specified in [\[RFC5321\]](#).

The server is fully compliant with [\[RFC1869\]](#) section 4 for the **EHLO** command. The server MUST use the following **EHLO** extension responses:

- 250-fqdn "Hello" [ip address] CRLF [\[RFC5321\]](#).
- 250-SIZE [\[RFC1870\]](#).
- 250-DSN [\[RFC1891\]](#).
- 250-ENHANCEDSTATUSCODES [\[RFC2034\]](#).

The server role by default MUST return the following codes in response to an **EHLO** command. The following codes can optionally be returned if the server changes the default configuration:

- 250-PIPELINING [\[RFC2920\]](#). If enabled, the server MUST be fully compliant with [\[RFC2920\]](#).
- 250-STARTTLS [\[RFC3207\]](#). If enabled, the server MUST be fully compliant with [\[RFC3207\]](#).
- 250-AUTH NTLM [\[RFC2554\]](#). If enabled, the server MUST be fully compliant with [\[RFC2554\]](#).
- 250-8BITMIME [\[RFC1652\]](#). If enabled, the server MUST be fully compliant with [\[RFC1652\]](#).
- 250-BINARYMIME [\[RFC3030\]](#). If enabled, the server MUST be fully compliant with [\[RFC3030\]](#).
- 250-CHUNKING [\[RFC3030\]](#). If enabled, the server MUST be fully compliant with [\[RFC3030\]](#).

The following table lists the error code extensions to [\[RFC4409\]](#) section 4.1 that MUST be returned if the error condition is met.

Command	Error condition	Response code	Extended status code	Response text
<b>MAIL</b>	No initial <b>EHLO</b> command issued.	503	5.5.2	Send hello first
<b>MAIL</b>	<b>MAIL</b> command issued after <b>BDAT</b> command.	503	5.5.1	Bad sequence of commands
<b>MAIL</b>	A <b>STARTTLS</b> command must be issued first.	451	5.7.3	Must issue a <b>STARTTLS</b> command first
<b>MAIL</b>	A second <b>MAIL From</b> field is specified.	503	5.5.2	Sender already specified
<b>MAIL</b>	The <b>From</b> field is specified without a ":" character.	501	5.5.4	Unrecognized parameter
<b>MAIL</b>	System resources are not available.	452	4.3.1	Insufficient system resources
<b>MAIL</b>	Invalid extension.	501	5.5.4	Invalid arguments
<b>RCPT</b>	No initial <b>EHLO</b> command issued.	503	5.5.2	Send hello first
<b>RCPT</b>	<b>RCPT</b> command issued after <b>BDAT</b> command.	503	5.5.1	Bad sequence of commands
<b>RCPT</b>	<b>RCPT</b> command issued after <b>XECH50</b> command.	503	5.5.1	Bad sequence of commands
<b>RCPT</b>	Command format is missing a ":" character.	501	5.5.4	Unrecognized parameter
<b>RCPT</b>	Invalid address.	501	5.1.3	Invalid address
<b>RCPT</b>	The maximum number of recipients has been exceeded.	452	4.5.3	Too many recipients
<b>RCPT</b>	A null reverse path is given as the address.	501	5.1.3	Invalid address
<b>RCPT</b>	A relay is not available for the recipient.	550	5.7.1	Unable to relay

The following table lists the error code extensions to [\[RFC4409\]](#) section 4.2 that MUST be returned if the error condition is met.

Command	Error condition	Response code	Extended Status Code	Response text
<b>MAIL</b>	Invalid address.	501	5.1.7	Invalid address
<b>MAIL</b>	Invalid address.	501	5.1.7	Invalid address

The following table lists the error code extensions to [\[RFC4409\]](#) section 4.3 that MUST be returned if the error condition is met.

Command	Error condition	Response code	Extended Status Code	Response text
MAIL	Session was not authenticated using SMTP AUTH.	530	5.7.1	Not authenticated
MAIL	Session was not authenticated using SMTP AUTH.	530	5.7.1	Client was not authenticated

The following table lists the error code extensions to [\[RFC4409\]](#) sections 3.2, 4.2, and 5.1 that SHOULD be returned if the error condition is met.

Command	Error condition	Response code	Extended Status Code	Response text
MAIL	MSA is not able to determine a return path to the submitting user, from a valid MAIL FROM, a valid source IP address, or based on authenticated identity, then the MSA SHOULD immediately reject the message.	550	5.7.1	Client does not have permissions to submit to this server
MAIL, RCPT, or DATA	If domain expansion fails.	501	5.5.4	Invalid arguments
MAIL or RCPT	Improper address.	501	5.1.7	Invalid address

The following table contains error code extensions to [\[RFC4409\]](#) sections 6.1 and 6.2 that MAY be returned if the error condition is met.

Command	Error condition	Response code	Extended Status Code	Response text
MAIL	The address in the FROM field has insufficient submission rights.	550	5.7.1	Client does not have permissions to submit to this server
RCPT	The recipient does not have sufficient privileges.	550	5.7.1	Unable to relay

### 3.2.6 Timer Events

**ConnectionTimeout timer event:** Occurs when the **ConnectionTimer**, as specified in section [3.2.2](#), exceeds the connection timer limit. The connection timer limit MUST be 5 minutes, as specified in [\[RFC5321\]](#) section 4.5.3.2.7, for a gateway server. The connection timer limit MUST be 10 minutes for a relay server. The SMTP response that is sent after this event occurs MUST be "421 4.4.1 Connection timed out". The server MUST end the session as specified in [\[RFC5321\]](#) section 3.8.

**ConnectionInactivityTimeout timer event:** Occurs when the **ConnectionInactivityTimer**, as specified in section [3.2.2](#), exceeds the connection inactivity timer limit. The connection inactivity timer limit MUST be 1 minute for an gateway server. The connection inactivity timer limit MUST be 5 minutes for a relay server. The SMTP response that is sent after this event occurs MUST be "451

4.7.0 Timeout waiting for client input". The server MUST end the session as specified in [\[RFC5321\]](#) section 3.8.

### 3.2.7 Other Local Events

**MaxHopCount event:** Occurs when the maximum hop count is exceeded. The default value for the edge and hub SMTP server maximum hop count MUST be 60. The SMTP response that is sent after this event occurs MUST be "554 5.4.6 Hop count exceeded – possible mail loop". This response MUST be sent when the **Received:** header fields, as specified in [\[RFC5321\]](#) section 6.3, length is more than the configured maximum hop count. This response is sent at the end of a **DATA** or **BDAT** command. The server MUST end the session.

**MaxLocalHopCount event:** Occurs when the maximum local hop count is exceeded. The default value for the edge or hub SMTP server maximum local hop count MUST be 12. The SMTP response that is sent after this event occurs MUST be "554 5.4.6 Hop count exceeded – possible mail loop". This response MUST be sent when the server has received the message more than the configured maximum local hop count. This response is sent at the end of a **DATA** or **BDAT** command. The server MUST end the session.

**TooManyRecipients event:** Occurs when the maximum recipients count is exceeded on a message. The default value for the edge or hub SMTP server maximum recipients count MUST be 200. The SMTP response that is sent after this event occurs MUST be "452 4.5.3 Too many recipients". This response MUST be sent at the end of a **RCPT TO** command. The server MUST end the session.

**MessageRateLimitExceeded event:** Occurs when the message submission rate for a client has exceeded the configured limit. The default value for an edge SMTP server MUST be 600 messages per minute and MUST be based on a unique IP address. The default value for a hub SMTP server MUST be 5 messages per minute and MUST be based on a unique user. The SMTP response sent after this event occurs MUST be "421 4.4.2 Message submission rate for this client has exceeded the configured limit". This response MUST be sent at the end of a **MAIL FROM** command. The server MUST end the session.

**HeaderSizeExceeded event:** Occurs when the message header size exceeds 64 KB. The SMTP response that is sent after this event occurs MUST be "552 5.3.4 Header size exceeds fixed maximum size". This response MUST be sent at the end of a **DATA** or **BDAT** command. The server MUST end the session.

**MessageSizeExceeded event:** Occurs when the message size exceeds 10 MB. The SMTP response that is sent after this event occurs MUST be "552 5.3.4 Message size exceeds fixed maximum message size". This response MUST be sent at the end of a **DATA** or **BDAT** command. The server MUST end the session. A client can use the **SIZE** command, as specified in [\[RFC1870\]](#), to get the maximum message size configured for the server before sending a message.

**ProtocolViolationCount event:** Occurs when the maximum number of logon or protocol errors is exceeded. The value for the maximum logon error count MUST be 3. The value for the maximum protocol error count MUST be 5. The SMTP response that is sent after this event occurs MUST be "421 4.7.0 Too many errors on this connection, closing transmission channel". The server MUST end the session.

**OutOfResources event:** Occurs when a client initiates a TCP connection to the server and the server is low on memory or disk space. The SMTP response sent after this event occurs MUST be "452 4.3.1 Insufficient system resources". The server MUST end the session.

**NewConnectionNotAvailable event:** Occurs when an SMTP server cannot process a new connection. It indicates that the process is in a hanging or crashed condition. The SMTP response

that is sent after this event occurs MUST be "421 4.4.2 Connection dropped". The server MUST end the session.

**BindingNotConfigured event:** Occurs when an SMTP server is not configured to accept connections from a client at a specific IP address or user. The SMTP response that is sent after this event occurs MUST be "421 4.3.2 Service not available". The server MUST end the session.

**ConnectionCountExceeded event:** Occurs when an SMTP server has exceeded 5000 concurrent inbound connections. The SMTP response that is sent after this event occurs MUST be "421 4.3.2 The maximum number of concurrent server connections has exceeded a limit, closing transmission channel". The server MUST end the session.

**ConnectionCountPerSource event:** Occurs when an SMTP server has exceeded 20 inbound connections for an IP address. The SMTP response that is sent after this event occurs MUST be "421 4.3.2 The maximum number of concurrent connections has exceeded a limit, closing transmission channel". The server MUST end the session.

**IPAddressNotAllowed event:** Occurs when a gateway SMTP server binding receives a connection from an IP address that is not allowed. For a static range of blocked IP addresses, the SMTP response that is sent after this event occurs MUST be "550 5.7.1 External client with IP address {0} does not have permissions to submit to this server. Visit <http://support.microsoft.com/kb/928123> for more information". For a dynamic range of blocked IP addresses, the SMTP response MUST be "550 5.7.1 External client with IP address {0} does not have permissions to submit to this server". The {0} input is the IP address that is not allowed. If the client IP address is found on a blocked list of IP addresses, the SMTP server response sent after this event MUST be "550 5.7.1 Recipient not authorized, your IP has been found on a block list". The server MUST end the session.

**AcknowledgementDelay event:** Occurs when the server waits 30 seconds for a mail item to be delivered to the next hop. This event occurs after the end of **DATA** or **BDAT LAST** command, as specified in [\[RFC3030\]](#) section 2. If the **AcknowledgementDelay event** occurs, the server MUST send acknowledgment of receiving the mail item even if transport has not delivered the item to the next hop. The server sends the response as specified in [\[RFC5321\]](#) and processes the next command. The server state does not change.

**Tarпит event:** Occurs when an unauthenticated user connects to the server or at the end of a **MAIL FROM** command when the server sends an error response. The server MUST ignore connect attempts for 5 seconds and then send the response to the client. The server sends the response as specified in [\[RFC5321\]](#) and processes the next command. The server state does not change.

## 4 Protocol Examples

None.

## 5 Security

### 5.1 Security Considerations for Implementers

The specifications listed in section [1.2.1](#) describe security considerations for implementers.

### 5.2 Index of Security Parameters

Security parameters for message submission authentication are described in [\[RFC4409\]](#).



## 6 Appendix A: Product Behavior

The information in this specification is applicable to the following Microsoft products:

- Microsoft® Office Outlook® 2003
- Microsoft® Exchange Server 2003
- Microsoft® Office Outlook® 2007
- Microsoft® Exchange Server 2007
- Microsoft® Outlook® 2010
- Microsoft® Exchange Server 2010

Exceptions, if any, are noted below. If a service pack number appears with the product version, behavior changed in that service pack. 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 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 product does not follow the prescription.

## 7 Change Tracking

This section identifies changes that were made to the [MS-OXSMTP] protocol document between the May 2010 and August 2010 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](mailto:protocol@microsoft.com).

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
<a href="#">1 Introduction</a>	Updated the introduction.	Y	Content update.
<a href="#">1.1 Glossary</a>	Added the term "Transmission Control Protocol (TCP" to the list of terms that are defined in [MS-OXGLOS].	N	Content update.
<a href="#">1.2.1 Normative References</a>	55751 Moved [MS-OXGLOS] from Normative References section to Informative References section.	N	Content update.
<a href="#">1.2.1 Normative References</a>	Added [RFC791], [RFC1652], [RFC1869], [RFC1870], [RFC1891], [RFC2034], [RFC2460], [RFC2920],[RFC3030], [RFC3207], [RFC5321] and [RFC5322] reference information.	Y	Content update.
<a href="#">1.2.2 Informative References</a>	Removed the [RFC2821] and [RFC821] references.	N	Content update.
<a href="#">1.3 Overview</a>	Updated the overview.	Y	Content update.
<a href="#">1.4 Relationship to Other Protocols</a>	Updated the content.	Y	Content update.
<a href="#">1.5 Prerequisites/Preconditions</a>	Added content.	Y	Content update.

<b>Section</b>	<b>Tracking number (if applicable) and description</b>	<b>Major change (Y or N)</b>	<b>Change type</b>
<a href="#">1.6 Applicability Statement</a>	Updated the content.	N	Content update.
<a href="#">1.7 Versioning and Capability Negotiation</a>	Updated the content.	Y	Content update.
<a href="#">1.9 Standards Assignments</a>	Added content.	Y	Content update.
<a href="#">2.1 Transport</a>	Added transport information.	Y	Content update.
<a href="#">2.2 Message Syntax</a>	Added message syntax information.	Y	Content update.
<a href="#">2.2.1 Namespaces</a>	Added new section.	Y	New content added.
<a href="#">3 Protocol Details</a>	Moved information from this section into subsections	Y	Content update.
<a href="#">3.1 Client Details</a>	Updated the content.	Y	Content update.
<a href="#">3.1.1 Abstract Data Model</a>	Added information about the state model.	Y	Content update.
<a href="#">3.1.5 Message Processing Events and Sequencing Rules</a>	Added information about client message processing and sequencing rules.	Y	Content update.
<a href="#">3.2 Server Details</a>	Updated content	Y	Content update.
<a href="#">3.2.1 Abstract Data Model</a>	Added information about the state model.	Y	Content update.
<a href="#">3.2.2 Timers</a>	Added information about the ConnectionTimer and the ConnectionInactivityTimer.	Y	Content update.
<a href="#">3.2.3 Initialization</a>	Added information about initialization of the ConnectionTimer and ConnectionInactivityTimer timers.	Y	Content update.
<a href="#">3.2.5 Message Processing Events and Sequencing Rules</a>	Added information about message processing events and sequencing rules.	Y	Content update.
<a href="#">3.2.6 Timer Events</a>	Added information about the ConnectionTimeOut and the ConnectionInactivityTimeOut timer events.	Y	Content update.
<a href="#">3.2.7</a>	Added information about other local events.	Y	Content

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
<a href="#">Other Local Events</a>			update.
<a href="#">5.1 Security Considerations for Implementers</a>	Added content.	N	Content update.

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