[MS-OXCRPC]:
Wire Format Protocol Specification

Revision Summary

Date	Revision History	Revision Class	Comments
04/04/2008	0.1		Initial Availability.
04/25/2008	0.2		Revised and updated property names and other technical content.
06/27/2008	1.0		Initial Release.
08/06/2008	1.01		Revised and edited technical content.
09/03/2008	1.02		Revised and edited technical content.
10/01/2008	1.03		Revised and edited technical content.
12/03/2008	1.04		Revised and edited technical content.
03/04/2009	1.05		Revised and edited technical content.
04/10/2009	2.0		Updated technical content and applicable product releases.
07/15/2009	3.0	Major	Revised and edited for technical content.
11/04/2009	4.0.0	Major	Updated and revised the technical content.
02/10/2010	5.0.0	Major	Updated and revised the technical content.
05/05/2010	6.0.0	Major	Updated and revised the technical content.
08/04/2010	7.0	Major	Significantly changed the technical content.
11/03/2010	7.1	Minor	Clarified the meaning of the technical content.
03/18/2011	7.1	No change	No changes to the meaning, language, or formatting of the technical content.
08/05/2011	8.0	Major	Significantly changed the technical content.
10/07/2011	9.0	Major	Significantly changed the technical content.

Table of Contents

1 Introduction

The Wire Format protocol is specific to the **EMSMDB** and **AsyncEMSMDB** protocol interfaces between a client and server. This protocol extends DCE 1.1: Remote Procedure Call [C706].

1.1 Glossary

The following terms are defined in [MS-GLOS]:

code page
distinguished name (DN)
GUID
handle
Hypertext Transfer Protocol (HTTP)
Interface Definition Language (IDL)
little-endian
name service provider interface (NSPI)
Network Data Representation (NDR)
NT LAN Manager (NTLM) Authentication Protocol
opnum
remote procedure call (RPC)
RPC dynamic endpoint
RPC protocol sequence
Unicode
universally unique identifier (UUID)
well-known endpoint

The following terms are defined in [MS-OXGLOS]:

asynchronous context handle
endpoint
Incremental Change Synchronization (ICS)
locale
mailbox
permission
public folder
recipient
remote operation (ROP)
replica
ROP request
ROP request buffer
ROP response
ROP response buffer
Server object
session context handle
store
stream

The following terms are specific to this document:

Client Access License (CAL): A license that gives a user the right to access the services of a server. To legally access the server software, a CAL can be required. A CAL is not a software product.

Session Context: A server-side partitioning for client isolation. All client actions against a server are scoped to a specific Session Context. All messaging objects and data that is opened by a client are isolated to a Session Context.

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. 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.

[C706] The Open Group, "DCE 1.1: Remote Procedure Call", C706, August 1997, http://www.opengroup.org/public/pubs/catalog/c706.htm

[MS-OXABREF] Microsoft Corporation, "Address Book Name Service Provider Interface (NSPI) Referral Protocol Specification".

[MS-OXCFOLD] Microsoft Corporation, "Folder Object Protocol Specification".

[MS-OXCFXICS] Microsoft Corporation, "Bulk Data Transfer Protocol Specification".

[MS-OXCNOTIF] Microsoft Corporation, "Core Notifications Protocol Specification".

[MS-OXCPRPT] Microsoft Corporation, "Property and Stream Object Protocol Specification".

[MS-OXCROPS] Microsoft Corporation, "Remote Operations (ROP) List and Encoding Protocol Specification".

[MS-OXCSTOR] Microsoft Corporation, "Store Object Protocol Specification".

[MS-OXCTABL] Microsoft Corporation, "Table Object Protocol Specification".

[MS-OXNSPI] Microsoft Corporation, "Exchange Server Name Service Provider Interface (NSPI) Protocol Specification".

[MS-RPCE] Microsoft Corporation, "Remote Procedure Call 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

1.2.2 Informative References

[MSDN-RpcBindingSetAuthInfoEx] Microsoft Corporation, "RpcBindingSetAuthInfoEx Function", http://msdn.microsoft.com/en-us/library/aa375608(v=VS.85).aspx

[MSDN-SOCKADDR] Microsoft Corporation, "sockaddr", http://msdn.microsoft.com/en-us/library/ms740496.aspx

[MSFT-ConfigStaticUDPPort] Microsoft Corporation, "Configuring a Static UDP Port for Push Notifications in an Exchange 2010 Environment",

http://social.technet.microsoft.com/wiki/contents/articles/configuring-a-static-udp-port-for-push-notifications-in-an-exchange-2010-environment.aspx

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

[MS-OXGLOS] Microsoft Corporation, "Exchange Server Protocols Master Glossary".

1.3 Overview

This specification describes the **remote procedure call (RPC)** interfaces that are used by a client to communicate with a server to access personal messaging data over the Wire Format Protocol. This protocol is comprised of the **EMSMDB** and **AsyncEMSMDB**RPC interfaces.

1.3.1 Initiating Communication with the Server

Before a client can retrieve private **mailbox** or **public folder** data from a server on the **EMSMDB** interface, it first makes a call to **EcDoConnectEx** and establishes a **session context handle**. The session context handle is a RPC context **handle**. The client stores this session context handle and uses it on subsequent RPC calls on the **EMSMDB** interface. The server uses the session context handle to identify the client and user who is issuing requests and under which context to perform operations against messaging data.

The **EMSMDB** interface function **EcDoConnectEx** is used to create a session context handle with the server. The server verifies that the authentication context used to make the RPC function call **EcDoConnectEx** has access rights to perform operations as, or on behalf of, the user whose **distinguished name (DN)** is provided on the RPC call. This is done to validate that the client has permission to perform operations as the user specified in the RPC call. If this access check fails, the server fails the RPC call with an access denied return code.

If the security check passes, the server creates a **Session Context**. A session context handle that refers to the Session Context is returned to the client in the response to **EcDoConnectEx**. The returned session context handle is used in subsequent calls to the server.

1.3.2 Issuing Remote Operations for Mailbox Data

The client retrieves private mailbox or public folder data through the interface function **EcDoRpcExt2**. There are no separate interface functions to perform different operations against mailbox data. A single interface function is used to submit a group of **remote operation (ROP)** commands to the server. See [MS-OXCROPS] for more details about ROP commands. The ROP request operations are tokenized into a request buffer and sent to the server as a byte array. The server parses the **ROP request buffer** and performs actions. The response to these actions is then serialized into a **ROP response buffer** and returned to the client as a byte array. At the **EMSMDB** interface level, the format of these ROP request and response buffers is not understood. See [MS-OXCROPS] for more details about how to interpret the ROP buffers. The **EMSMDB** interface function **EcDoRpcExt2** is just the mechanism in which to pass the ROP request buffer to the server.

In the call to **EcDoRpcExt2**, the client passes the session context handle which was created in a successful call to the interface function **EcDoConnectEx**. The server uses the session context handle to identify who is issuing the remote operation ROP commands and under which Session Context to perform them.

1.3.3 Terminating Communication with the Server

When a client wants to terminate communication with a server, it calls **EcDoDisconnect**. In the call to **EcDoDisconnect**, the client passes the session context handle, which was created in a successful

call to the interface function **EcDoConnectEx**. It is suggested that the server clean up any Session Context data associated with this session context handle.

1.3.4 Client/Server Communication Lifetime

Figure 1 shows a typical example of the client and server communication lifetime. This is a simplified overview of how the client connects, issues ROP commands, and disconnects from the server.

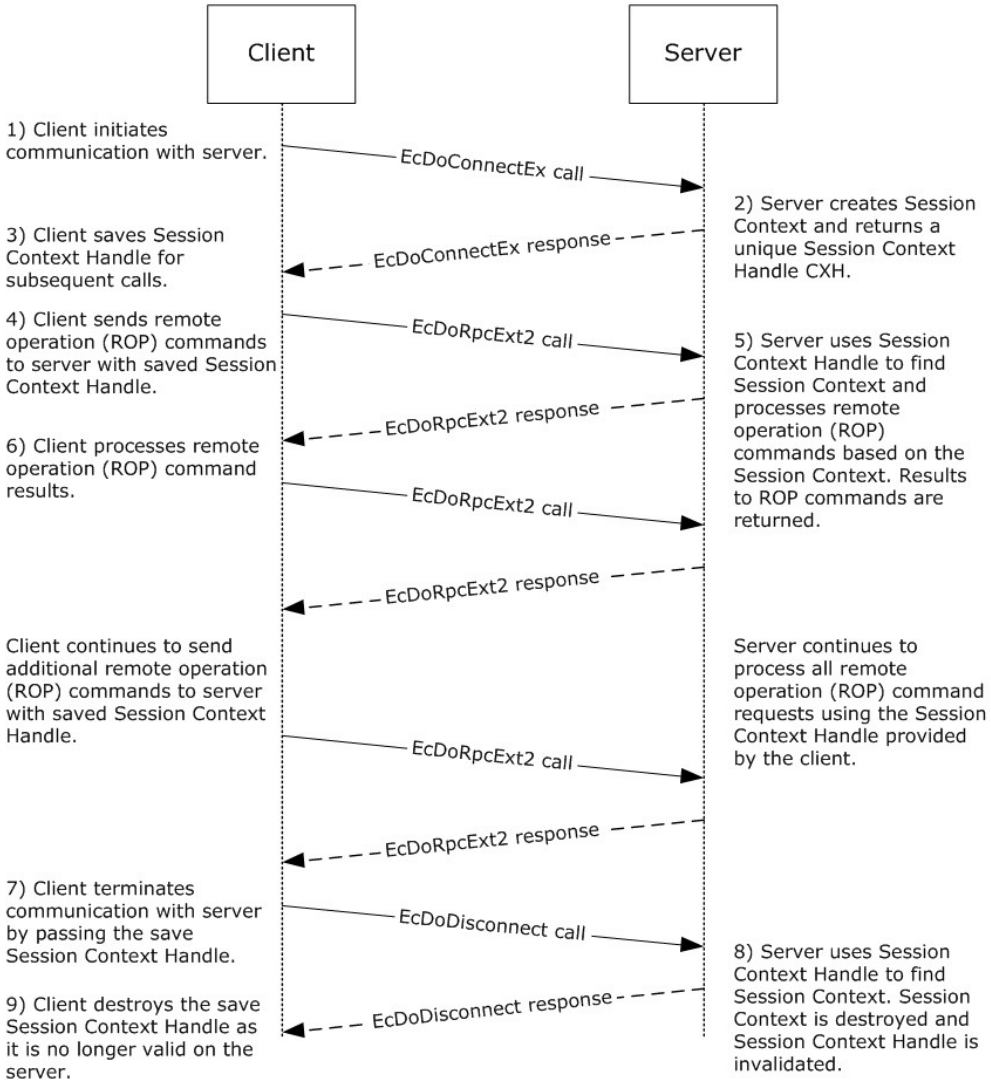


Figure 1: Client/server communications

1.4 Relationship to Other Protocols

This protocol is dependent upon RPC, as described in [C706] and [MS-RPCE], and various network protocol sequences for its transport, as specified in section 2.1.

1.5 Prerequisites/Preconditions

The Wire Format Protocol is comprised of the **EMSMDB** and **AsyncEMSMDB** RPC interfaces and has the same prerequisites as described in [MS-RPCE].

It is assumed that a messaging client has obtained the name of a messaging server that supports this protocol before these interfaces are invoked. How a client accomplishes this task is outside the scope of this specification.

1.6 Applicability Statement

The protocol specified in this document is applicable to environments that require access to private mailbox and/or public folder messaging end-user data.

1.7 Versioning and Capability Negotiation

This specification covers versioning issues in the following areas:

- **Supported Transports:** This protocol uses multiple **RPC protocol sequences** as specified in section 2.1 .
- **Protocol Versions:** The protocol RPC interface **EMSMDB** has a single version number of 0.81 and has been extended by adding methods as specified in section 3.1. The protocol RPC interface **AsyncEMSMDB** has a single version number of 0.01.
- **Security and Authentication Methods:** This protocol supports the following authentication methods: **NTLM**, Kerberos, and Negotiate. These authentication methods are specified in sections 3.1.3 and 3.3.3.
- **Capability Negotiation:** The Ethernet protocol does not support negotiation of the interface version to use. Instead, an implementation must be configured with the interface version to use, as described below in this specification.

1.8 Vendor-Extensible Fields

None.

1.9 Standards Assignments

Parameter	Value	Reference
EMSMDB RPC Interface **universally unique identifier (UUID)**	A4F1DB00-CA47-1067-B31F-00DD010662DA	3.1
AsyncEMSMDB RPC Interface UUID	5261574A-4572-206E-B268-6B199213B4E4	3.3
RPC/**Hypertext Transfer Protocol (HTTP)** protocol sequence **endpoint**	6001	2.1

Parameter	Value	Reference
LRPC protocol sequence endpoint	MSExchangeIS_LPC<1>	2.1

2 Messages

Unless otherwise specified, buffers and fields in this section are depicted in **little-endian** byte order.

2.1 Transport

This protocol works over the following protocol sequences: <2>

Protocol Sequence
ncalrpc
ncacn_ip_tcp
ncacn_http

This protocol uses **well-known endpoints** for network protocol sequences "ncalrpc" and "ncacn_http". The following well-known endpoints are used:

Protocol Sequence	Endpoint
ncalrpc	MSExchangeIS_LPC<3>
ncacn_http	6001

For ncacn_ip_tcp, the protocol uses **RPC dynamic endpoints**.

This protocol MUST use the UUID specified in section 1.9.

This protocol allows any user to establish an authenticated connection to the RPC server using an authentication method as specified in [MS-RPCE] section 1.7. The protocol uses the underlying RPC protocol to retrieve the identity of the caller that made the method call as specified in [MS-RPCE]. The server uses this identity to perform method-specific access checks.

2.2 Common Data Types

In addition to the RPC base types and definitions specified in [C706] and [MS-RPCE], additional data types are defined below.

The following table summarizes the types that are defined in this specification. Any structure that is not defined in this specification is reserved and MUST be ignored by the client.

Type	Name
Simple Data Type	**CXH** (section 2.2.1.1)
Simple Data Type	**ACXH** (section 2.2.1.2)
Simple Data Type	**BIG_RANGE_ULONG** (section 2.2.1.3)
Simple Data Type	**SMALL_RANGE_ULONG** (section 2.2.1.4)
Structure	**RPC_HEADER_EXT** (section 2.2.2.1)

Type	Name
Structure	**AUX_HEADER** (section 2.2.2.2)
Structure	**AUX_PERF_REQUESTID** (section 2.2.2.3)
Structure	**AUX_PERF_SESSIONINFO** (section 2.2.2.4)
Structure	**AUX_PERF_SESSIONINFO_V2** (section 2.2.2.5)
Structure	**AUX_PERF_CLIENTINFO** (section 2.2.2.6)
Structure	**AUX_PERF_SERVERINFO** (section 2.2.2.7)
Structure	**AUX_PERF_PROCESSINFO** (section 2.2.2.8)
Structure	**AUX_PERF_DEFMDB_SUCCESS** (section 2.2.2.9)
Structure	**AUX_PERF_DEFGC_SUCCESS** (section 2.2.2.10)
Structure	**AUX_PERF_MDB_SUCCESS** (section 2.2.2.11)
Structure	**AUX_PERF_MDB_SUCCESS_V2** (section 2.2.2.12)
Structure	**AUX_PERF_GC_SUCCESS** (section 2.2.2.13)
Structure	**AUX_PERF_GC_SUCCESS_V2** (section 2.2.2.14)
Structure	**AUX_PERF_FAILURE** (section 2.2.2.15)
Structure	**AUX_PERF_FAILURE_V2** (section 2.2.2.16)
Structure	**AUX_CLIENT_CONTROL** (section 2.2.2.17)
Structure	**AUX_OSVERSIONINFO** (section 2.2.2.18)
Structure	**AUX_EXORGINFO** (section 2.2.2.19)
Structure	**AUX_PERF_ACCOUNTINFO** (section 2.2.2.20)

2.2.1 Simple Data Types

The Simple Data Types as identified in the **Interface Definition Language (IDL)**. See section 6.

2.2.1.1 CXH

A session context handle to be used with an **EMSMDB** interface.

```
typedef [context_handle] void * CXH;
```

2.2.1.2 ACXH

A **asynchronous context handle** to be used with an **AsyncEMSMDB** interface.

```
typedef [context_handle] void * ACXH;
```

2.2.1.3 BIG_RANGE_ULONG

An unsigned long that MUST be between 0x0 and 0x40000.

```
typedef [range(0x0, 0x40000)] unsigned long BIG_RANGE_ULONG;
```

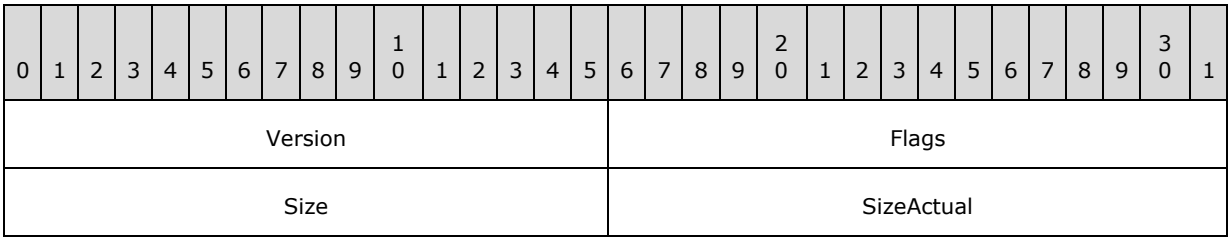
2.2.1.4 SMALL_RANGE_ULONG

An unsigned long that MUST be between 0x0 and 0x1008.

```
typedef [range(0x0, 0x1008)] unsigned long SMALL_RANGE_ULONG;
```

2.2.2 Structures

2.2.2.1 RPC_HEADER_EXT



Version (2 bytes): Defines the version of the header. This value MUST be set to 0x0000.

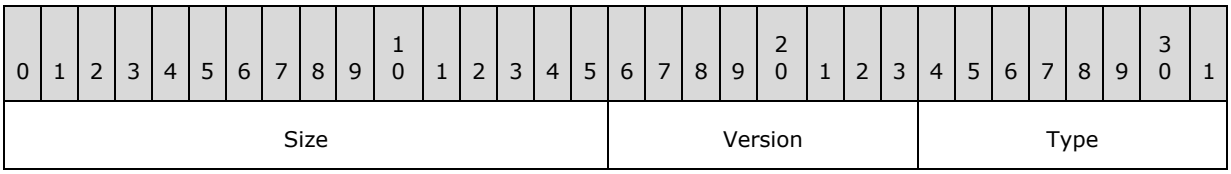
Flags (2 bytes): Flags that specify how data that follows this header MUST be interpreted. The following flags are valid:

Flag	Meaning
Compressed0x0001	The data that follows the **RPC_HEADER_EXT** is compressed. The size of the data when uncompressed is in field **SizeActual**. If this flag is not set, the **Size** and **SizeActual** fields MUST be the same.
XorMagic0x0002	The data following the **RPC_HEADER_EXT** has been obfuscated. See section 3.1.7.3 for more information about the obfuscation algorithm.
Last0x0004	Indicates that no other **RPC_HEADER_EXT** follows the data of the current **RPC_HEADER_EXT**. This flag is used to indicate that there are multiple buffers, each with its own **RPC_HEADER_EXT**, one after the other.

Size (2 bytes): The total length of the payload data that follows the **RPC_HEADER_EXT** structure. This length does not include the length of the **RPC_HEADER_EXT** structure.

SizeActual (2 bytes): The length of the payload data after it has been uncompressed. This field is only useful if the Compressed flag is set in the **flags** field. If the Compressed flag is not set, this value MUST be equal to **Size**.

2.2.2.2 AUX_HEADER



Size (2 bytes): Size of the **AUX_HEADER** structure plus any additional payload data that follows.

Version (1 byte): Version information of the payload data that follows the **AUX_HEADER**. This value in conjunction with the **Type** field determines which structure to use to interpret the data that follows the header.

Version	Value
AUX_VERSION_1	0x01
AUX_VERSION_2	0x02

Type (1 byte): Type of payload data that follows the **AUX_HEADER**. This value in conjunction with the **Version** field determines which structure to use to interpret the data that follows the header. Several of the types distinguish among the client's foreground request (FG), the client's background request (BG), and the client's global catalog request (GC).

The following is a list of block types and the corresponding structure that follows the **AUX_HEADER** when the **Version** field is **AUX_VERSION_1**.

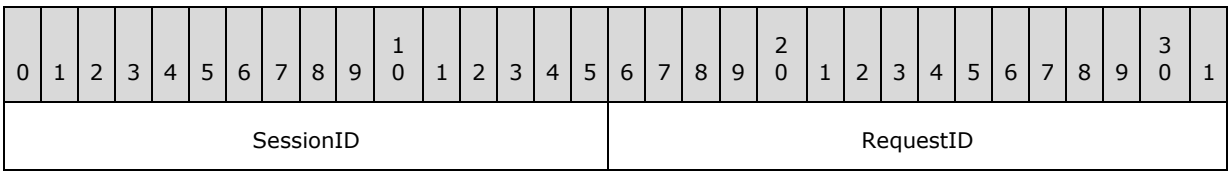
Type	Structure
AUX_TYPE_PERF_REQUESTID0x01	**AUX_PERF_REQUESTID** (section 2.2.2.3)
AUX_TYPE_PERF_CLIENTINFO0x02	**AUX_PERF_CLIENTINFO** (section 2.2.2.6)
AUX_TYPE_PERF_SERVERINFO0x03	**AUX_PERF_SERVERINFO** (section 2.2.2.7)
AUX_TYPE_PERF_SESSIONINFO0x04	**AUX_PERF_SESSIONINFO** (section 2.2.2.4)
AUX_TYPE_PERF_DEFMDB_SUCCESS0x05	**AUX_PERF_DEFMDB_SUCCESS** (section 2.2.2.9)
AUX_TYPE_PERF_DEFGC_SUCCESS0x06	**AUX_PERF_DEFGC_SUCCESS** (section 2.2.2.10)
AUX_TYPE_PERF_MDB_SUCCESS0x07	**AUX_PERF_MDB_SUCCESS** (section 2.2.2.11)
AUX_TYPE_PERF_GC_SUCCESS0x08	**AUX_PERF_GC_SUCCESS** (section 2.2.2.13)
AUX_TYPE_PERF_FAILURE0x09	**AUX_PERF_FAILURE**

Type	Structure
	(section 2.2.2.15)
AUX_TYPE_CLIENT_CONTROL0x0A	**AUX_CLIENT_CONTROL** (section 2.2.2.17)
AUX_TYPE_PERF_PROCESSINFO0x0B	**AUX_PERF_PROCESSINFO** (section 2.2.2.8)
AUX_TYPE_PERF_BG_DEFMDB_SUCCESS0x0C	**AUX_PERF_DEFMDB_SUCCESS** (section 2.2.2.9)
AUX_TYPE_PERF_BG_DEFGC_SUCCESS0x0D	**AUX_PERF_DEFGC_SUCCESS** (section 2.2.2.10)
AUX_TYPE_PERF_BG_MDB_SUCCESS0x0E	**AUX_PERF_MDB_SUCCESS** (section 2.2.2.11)
AUX_TYPE_PERF_BG_GC_SUCCESS0x0F	**AUX_PERF_GC_SUCCES**S (section 2.2.2.13)
AUX_TYPE_PERF_BG_FAILURE0x10	**AUX_PERF_FAILURE** (section 2.2.2.15)
AUX_TYPE_PERF_FG_DEFMDB_SUCCESS0x11	**AUX_PERF_DEFMDB_SUCCESS** (section 2.2.2.9)
AUX_TYPE_PERF_FG_DEFGC_SUCCESS0x12	**AUX_PERF_DEFGC_SUCCESS** (section 2.2.2.10)
AUX_TYPE_PERF_FG_MDB_SUCCESS0x13	**AUX_PERF_MDB_SUCCESS** (section 2.2.2.11)
AUX_TYPE_PERF_FG_GC_SUCCESS0x14	**AUX_PERF_GC_SUCCESS** (section 2.2.2.13)
AUX_TYPE_PERF_FG_FAILURE0x15	**AUX_PERF_FAILURE** (section 2.2.2.15)
AUX_TYPE_OSVERSIONINFO0x16	**AUX_OSVERSIONINFO** (section 2.2.2.18)
AUX_TYPE_EXORGINO0x17	**AUX_EXORGINFO** (section 2.2.2.19)
AUX_TYPE_PERF_ACCOUNTINFO0x18	**AUX_PERF_ACCOUNTINFO** (section 2.2.2.20)
AUX_TYPE_ENDPOINT_CAPABILITIES0x48	**AUX_ENDPOINT_CAPABILITIES** (section 2.2.2.21)<4>

The following is a list of block types and the corresponding structure that follows the **AUX_HEADER** when the **Version** field is **AUX_VERSION_2**.

Type	Structure
AUX_TYPE_PERF_SESSIONINFO0x04	**AUX_PERF_SESSIONINFO_V2** (section 2.2.2.5)
AUX_TYPE_PERF_MDB_SUCCESS0x07	**AUX_PERF_MDB_SUCCESS_V2** (section 2.2.2.12)
AUX_TYPE_PERF_GC_SUCCESS0x08	**AUX_PERF_GC_SUCCESS_V2** (section 2.2.2.14)
AUX_TYPE_PERF_FAILURE0x09	**AUX_PERF_FAILURE_V2** (section 2.2.2.16)
AUX_TYPE_PERF_PROCESSINFO0x0B	**AUX_PERF_PROCESSINFO** (section 2.2.2.8)
AUX_TYPE_PERF_BG_MDB_SUCCESS0x0E	**AUX_PERF_MDB_SUCCESS_V2** (section 2.2.2.12)
AUX_TYPE_PERF_BG_GC_SUCCESS0x0F	**AUX_PERF_GC_SUCCESS_V2** (section 2.2.2.14)
AUX_TYPE_PERF_BG_FAILURE0x10	**AUX_PERF_FAILURE_V2** (section 2.2.2.16)
AUX_TYPE_PERF_FG_MDB_SUCCESS0x13	**AUX_PERF_MDB_SUCCESS_V2** (section 2.2.2.12)
AUX_TYPE_PERF_FG_GC_SUCCESS0x14	**AUX_PERF_GC_SUCCESS_V2** (section 2.2.2.14)
AUX_TYPE_PERF_FG_FAILURE0x15	**AUX_PERF_FAILURE_V2** (section 2.2.2.16)

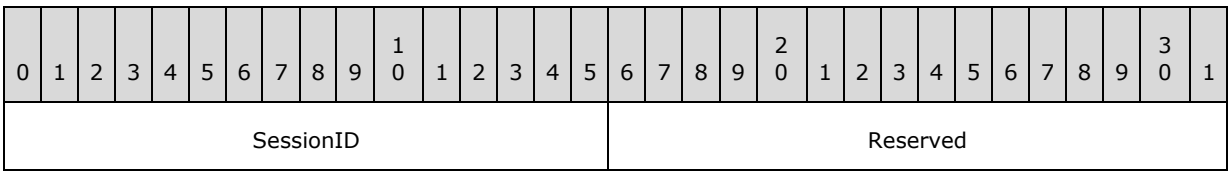
2.2.2.3 AUX_PERF_REQUESTID



SessionID (2 bytes): Session identification number.

RequestID (2 bytes): Request identification.

2.2.2.4 AUX_PERF_SESSIONINFO



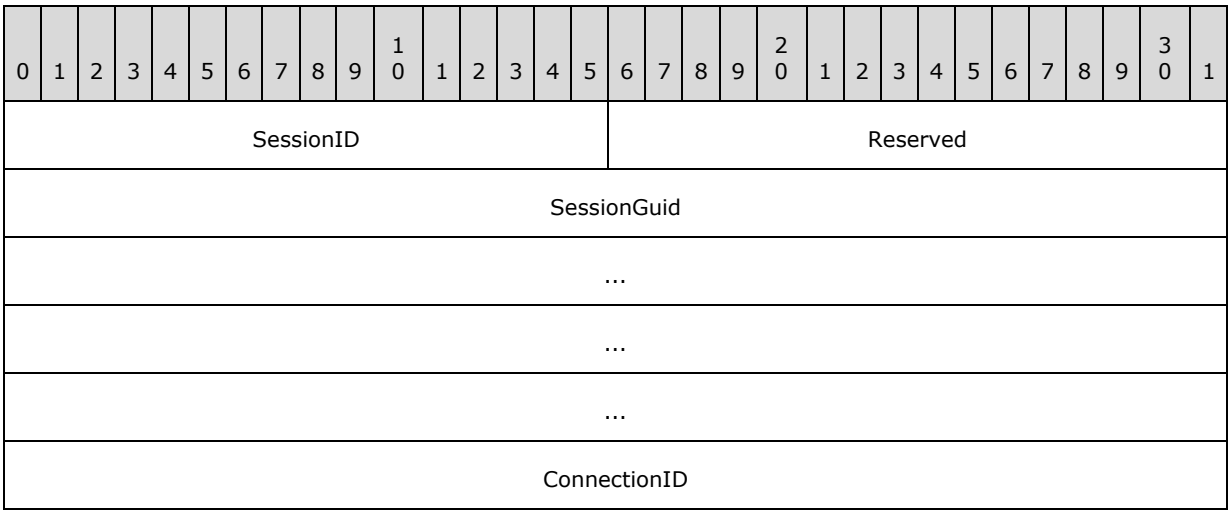
SessionGuid
...
...
...

SessionID (2 bytes): Session identification number.

Reserved (2 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the **stream**. The server MUST ignore the value of this field when reading the stream.

SessionGuid (16 bytes): **GUID** representing the client session to associate with the session identification number in field **SessionID**.

2.2.2.5 AUX_PERF_SESSIONINFO_V2



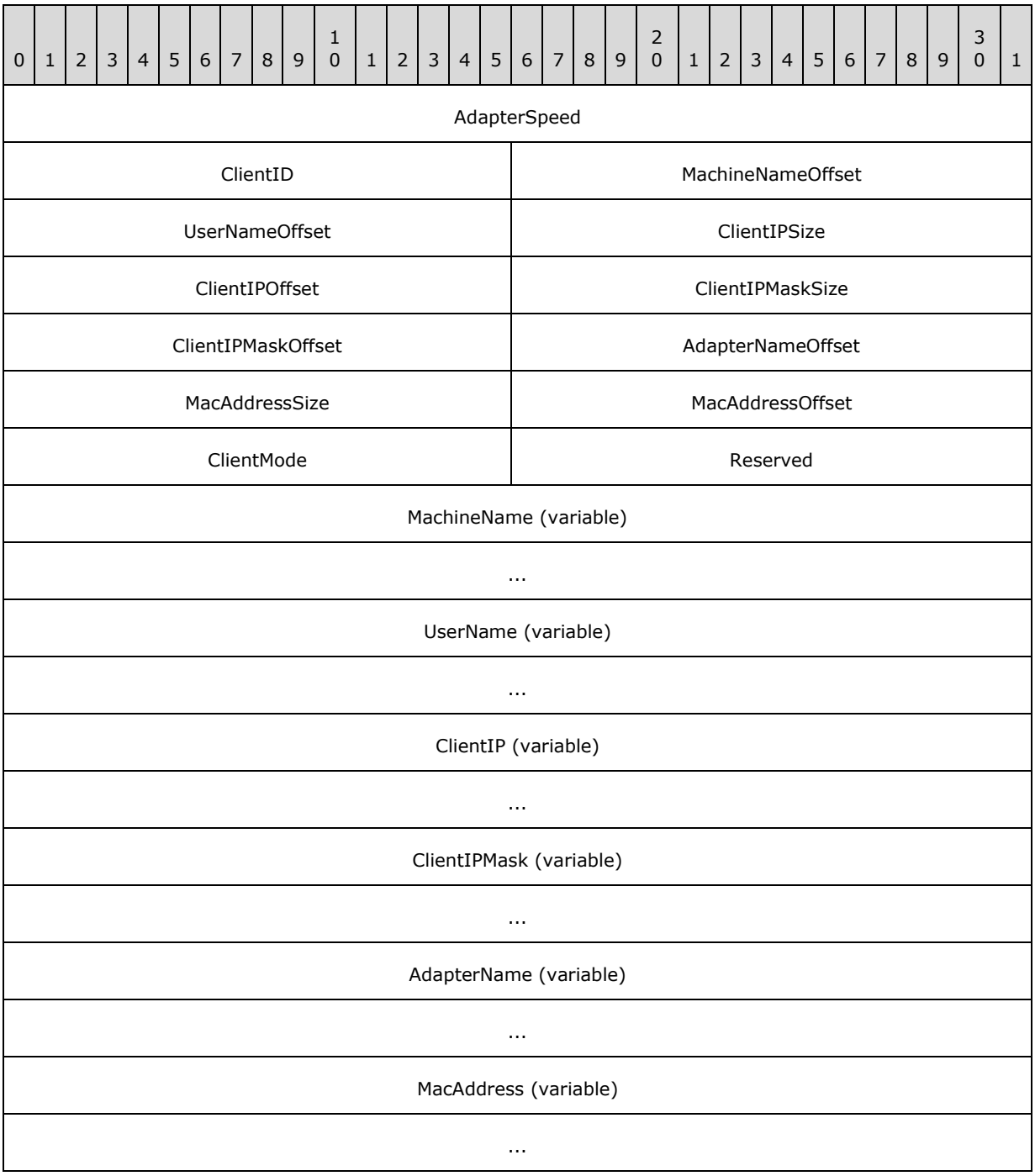
SessionID (2 bytes): Session identification number.

Reserved (2 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

SessionGuid (16 bytes): GUID representing the client session to associate with the session identification number in field **SessionID**.

ConnectionID (4 bytes): Connection identification number.

2.2.2.6 AUX_PERF_CLIENTINFO



AdapterSpeed (4 bytes): Speed of client computer's network adapter (kbits/s).

ClientID (2 bytes): Client-assigned identification number.

MachineNameOffset (2 bytes): The offset from the beginning of the **AUX_HEADER** structure to the **MachineName** field. A value of zero indicates that the **MachineName** field is null or empty.

UserNameOffset (2 bytes): The offset from the beginning of the **AUX_HEADER** structure to the **UserName** field. A value of zero indicates that the **UserName** field is null or empty.

ClientIPSize (2 bytes): Size of the client IP address referenced by the **ClientIPOffset** field. The client IP address is located in the **ClientIP** field.

ClientIPOffset (2 bytes): The offset from the beginning of the **AUX_HEADER** structure to the **ClientIP** field. A value of zero indicates that the **ClientIP** field is null or empty.

ClientIPMaskSize (2 bytes): Size of the client IP subnet mask referenced by the **ClientIPMaskOffset** field. The client IP mask is located in the **ClientIPMask** field.

ClientIPMaskOffset (2 bytes): The offset from the beginning of the **AUX_HEADER** structure to the **ClientIPMask** field. The size of the IP subnet mask is found in the **ClientIPMaskSize** field. A value of zero indicates that the **ClientIPMask** field is null or empty.

AdapterNameOffset (2 bytes): The offset from the beginning of the **AUX_HEADER** structure to the **AdapterName** field. A value of zero indicates that the **AdapterName** field is null or empty.

MacAddressSize (2 bytes): Size of the network adapter MAC address referenced by the **MacAddressOffset** field. The network adapter MAC address is located in the **MacAddress** field.

MacAddressOffset (2 bytes): The offset from the beginning of the **AUX_HEADER** structure to the **MacAddress** field. A value of zero indicates that the **MacAddress** field is null or empty.

ClientMode (2 bytes): Determines the mode in which the client is running. The following table specifies valid values.

Mode	Meaning
CLIENTMODE_UNKNOWN0x00	Client is not designating a mode of operation.
CLIENTMODE_CLASSIC0x01	Client is running in classic online mode.
CLIENTMODE_CACHED0x02	Client is running in cached mode.

Reserved (2 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

MachineName (variable): A null-terminated **Unicode** string that contains the client computer name. This variable field is offset from the beginning of the **AUX_HEADER** structure by the **MachineNameOffset** value.

UserName (variable): A null-terminated Unicode string that contains the user's account name. This variable field is offset from the beginning of the **AUX_HEADER** structure by the **UserNameOffset** value.

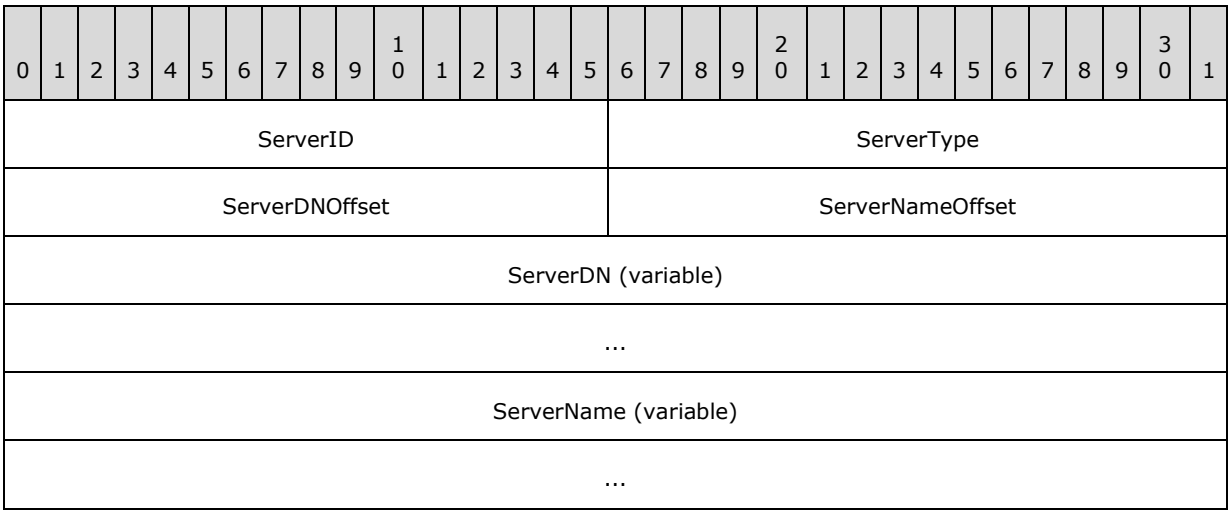
ClientIP (variable): The client's IP address. This variable field is offset from the beginning of the **AUX_HEADER** structure by the **ClientIPOffset** value. The size of the client IP address data is found in the **ClientIPSize** field.

ClientIPMask (variable): The client's IP subnet mask. This variable field is offset from the beginning of the **AUX_HEADER** structure by the **ClientIPMaskOffset** value. The size of the client IP mask data is found in the **ClientIPMaskSize** field.

AdapterName (variable): A null-terminated Unicode string that contains the client network adapter name. This variable field is offset from the beginning of the **AUX_HEADER** structure by the **AdapterNameOffset** value.

MacAddress (variable): The client's network adapter MAC address. This variable field is offset from the beginning of the **AUX_HEADER** structure by the **MacAddressOffset** value. The size of the network adapter **MAC** address data is found in the **MacAddressSize** field.

2.2.2.7 AUX_PERF_SERVERINFO



ServerID (2 bytes): Client assigned server identification number.

ServerType (2 bytes): Server type assigned by client. The following table specifies valid values.

Type	Meaning
SERVERTYPE_UNKNOWN0x00	Unknown server type.
SERVERTYPE_PRIVATE0x01	Client server connection servicing private mailbox data.
SERVERTYPE_PUBLIC0x02	Client server connection servicing public folder data.
SERVERTYPE_DIRECTORY0x03	Client server connection servicing directory data.
SERVERTYPE_REFERRAL0x04	Client server connection servicing referrals.

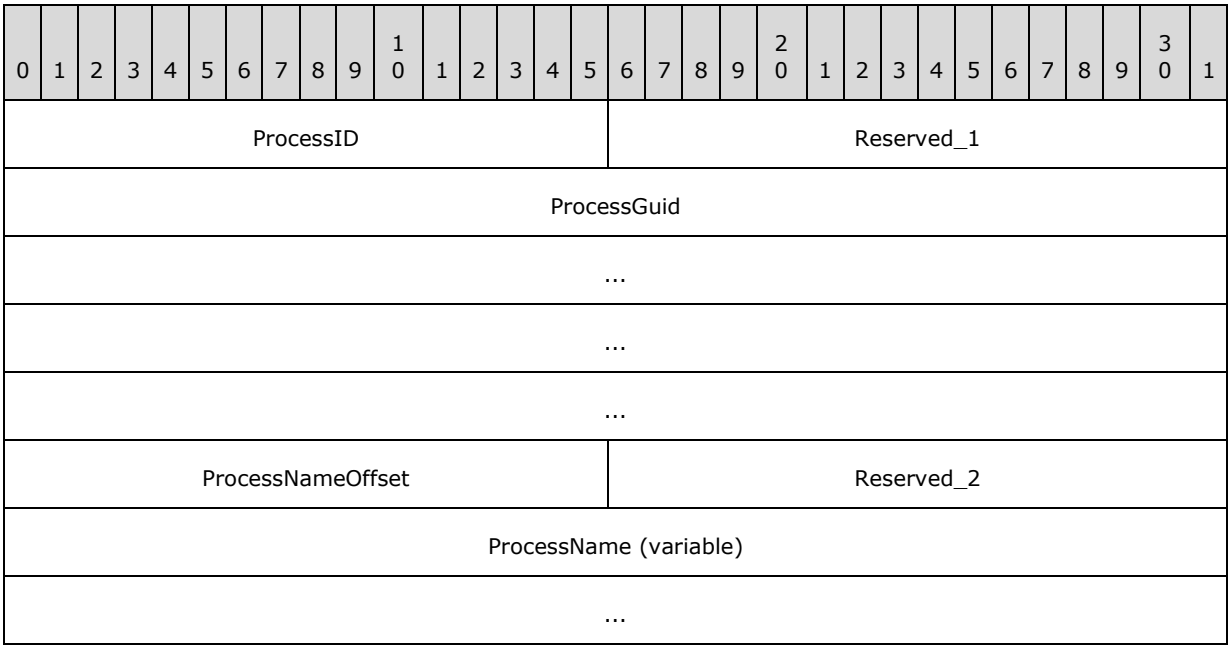
ServerDNOffset (2 bytes): The offset from the beginning of the **AUX_HEADER** structure to the **ServerDN** field. A value of zero indicates that the **ServerDN** field is null or empty.

ServerNameOffset (2 bytes): The offset from the beginning of the **AUX_HEADER** structure to the **ServerName** field. A value of zero indicates that the **ServerName** field is null or empty.

ServerDN (variable): A null-terminated Unicode string that contains the distinguished name (DN) of the server. This variable field is offset from the beginning of the **AUX_HEADER** structure by the **ServerDNOffset** value.

ServerName (variable): A null-terminated Unicode string that contains the server name. This variable field is offset from the beginning of the **AUX_HEADER** structure by the **ServerNameOffset** value.

2.2.2.8 AUX_PERF_PROCESSINFO



ProcessID (2 bytes): Client-assigned process identification number.

Reserved_1 (2 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

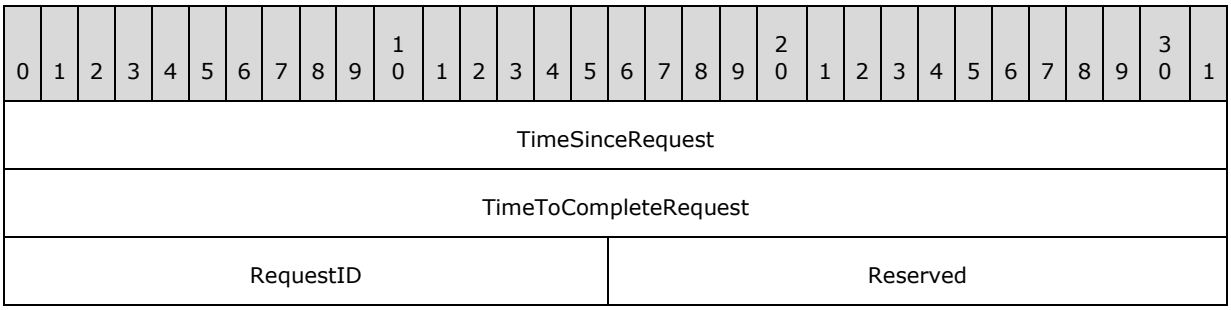
ProcessGuid (16 bytes): GUID representing the client process to associate with the process identification number in field **ProcessID**.

ProcessNameOffset (2 bytes): The offset from the beginning of the **AUX_HEADER** structure to the **ProcessName** field. A value of zero indicates that the **ProcessName** field is null or empty.

Reserved_2 (2 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

ProcessName (variable): A null-terminated Unicode string that contains the client process name. This variable field is offset from the beginning of the **AUX_HEADER** structure by the **ProcessNameOffset** value.

2.2.2.9 AUX_PERF_DEFMDB_SUCCESS



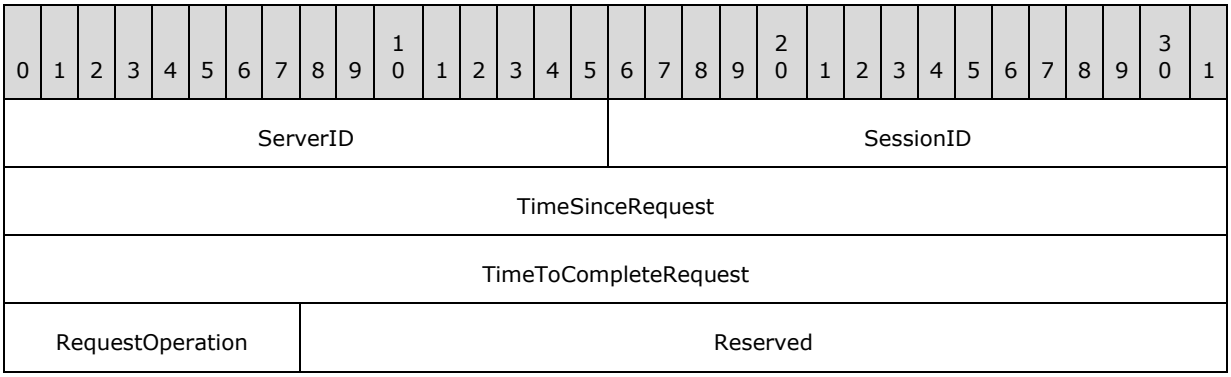
TimeSinceRequest (4 bytes): Number of milliseconds since successful request occurred.

TimeToCompleteRequest (4 bytes): Number of milliseconds the successful request took to complete.

RequestID (2 bytes): Request identification number.

Reserved (2 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

2.2.2.10 AUX_PERF_DEFGC_SUCCESS



ServerID (2 bytes): Server identification number.

SessionID (2 bytes): Session identification number.

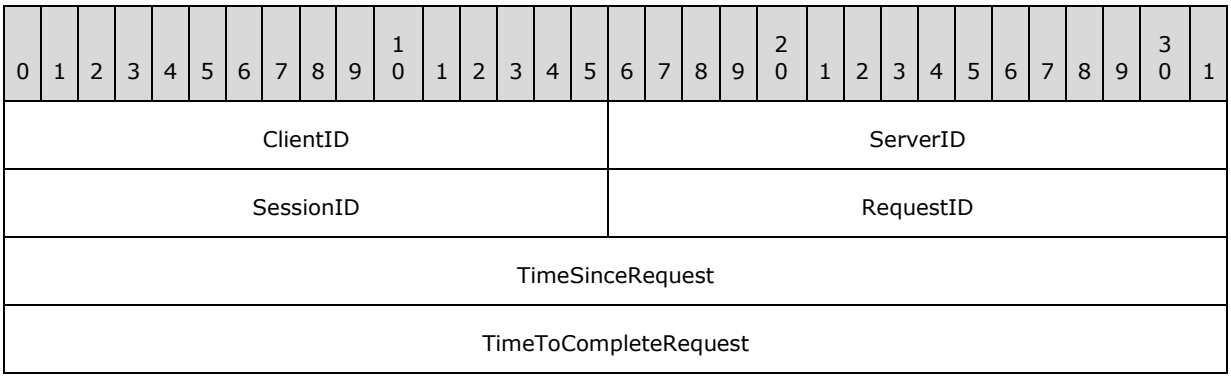
TimeSinceRequest (4 bytes): Number of milliseconds since successful request occurred.

TimeToCompleteRequest (4 bytes): Number of milliseconds the successful request took to complete.

RequestOperation (1 byte): Client-defined operation that was successful.

Reserved (3 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

2.2.2.11 AUX_PERF_MDB_SUCCESS



ClientID (2 bytes): Client identification number.

ServerID (2 bytes): Server identification number.

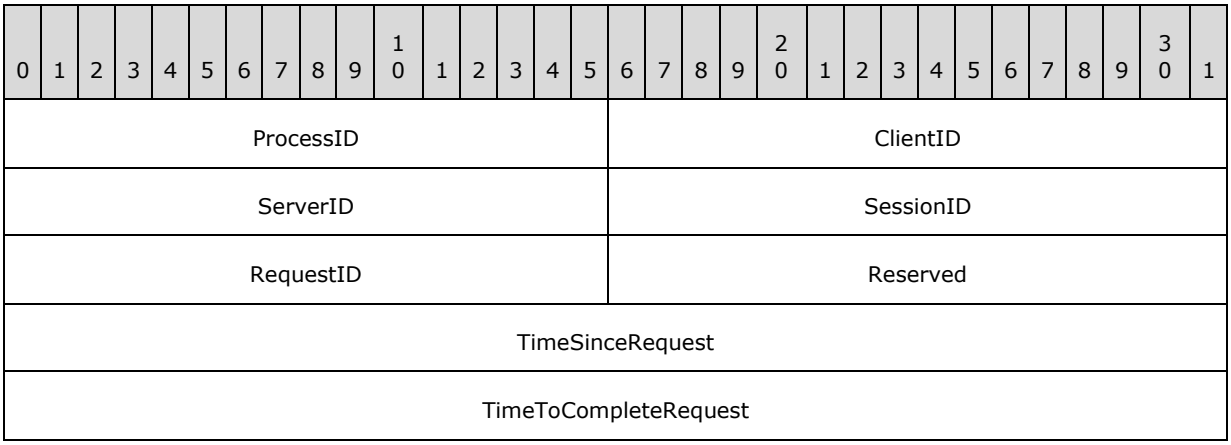
SessionID (2 bytes): Session identification number.

RequestID (2 bytes): Request identification number.

TimeSinceRequest (4 bytes): Number of milliseconds since successful request occurred.

TimeToCompleteRequest (4 bytes): Number of milliseconds the successful request took to complete.

2.2.2.12 AUX_PERF_MDB_SUCCESS_V2



ProcessID (2 bytes): Process identification number.

ClientID (2 bytes): Client identification number.

ServerID (2 bytes): Server identification number.

SessionID (2 bytes): Session identification number.

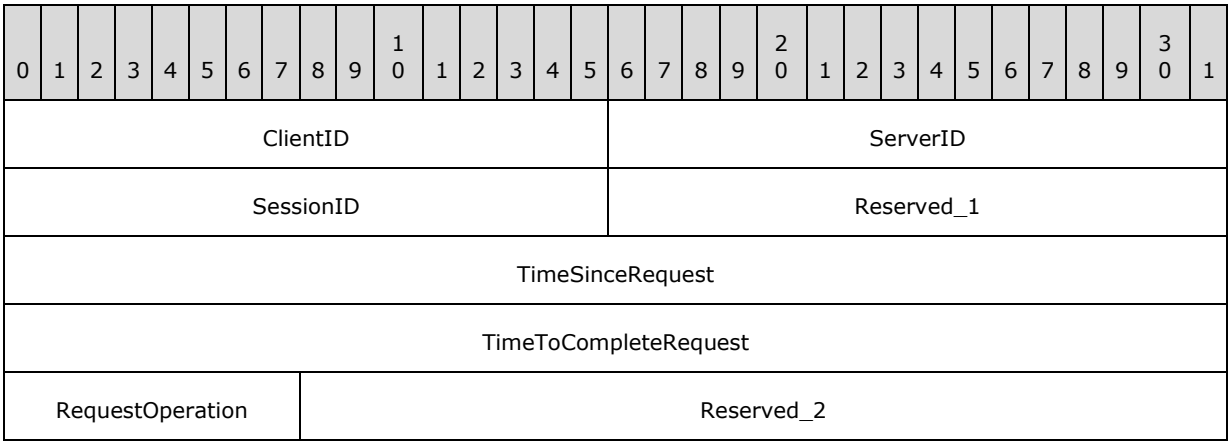
RequestID (2 bytes): Request identification number.

Reserved (2 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

TimeSinceRequest (4 bytes): Number of milliseconds since successful request occurred.

TimeToCompleteRequest (4 bytes): Number of milliseconds the successful request took to complete.

2.2.2.13 AUX_PERF_GC_SUCCESS



ClientID (2 bytes): Client identification number.

ServerID (2 bytes): Server identification number.

SessionID (2 bytes): Session identification number.

Reserved_1 (2 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

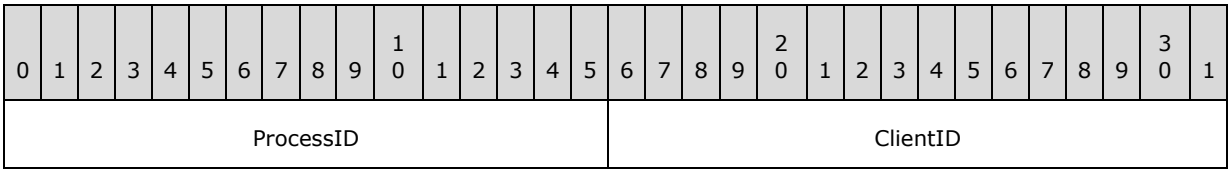
TimeSinceRequest (4 bytes): Number of milliseconds since successful request occurred.

TimeToCompleteRequest (4 bytes): Number of milliseconds the successful request took to complete.

RequestOperation (1 byte): Client-defined operation that was successful.

Reserved_2 (3 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

2.2.2.14 AUX_PERF_GC_SUCCESS_V2



ServerID	SessionID
TimeSinceRequest	
TimeToCompleteRequest	
RequestOperation	Reserved

ProcessID (2 bytes): Process identification number.

ClientID (2 bytes): Client identification number.

ServerID (2 bytes): Server identification number.

SessionID (2 bytes): Session identification number.

TimeSinceRequest (4 bytes): Number of milliseconds since successful request occurred.

TimeToCompleteRequest (4 bytes): Number of milliseconds the successful request took to complete.

RequestOperation (1 byte): Client-defined operation that was successful.

Reserved (3 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

2.2.2.15 AUX_PERF_FAILURE

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
ClientID																ServerID															
SessionID																RequestID															
TimeSinceRequest																															
TimeToFailRequest																															
ResultCode																															
RequestOperation																Reserved															

ClientID (2 bytes): Client identification number.

ServerID (2 bytes): Server identification number.

SessionID (2 bytes): Session identification number.

RequestID (2 bytes): Request identification number.

TimeSinceRequest (4 bytes): Number of milliseconds since failure request occurred.

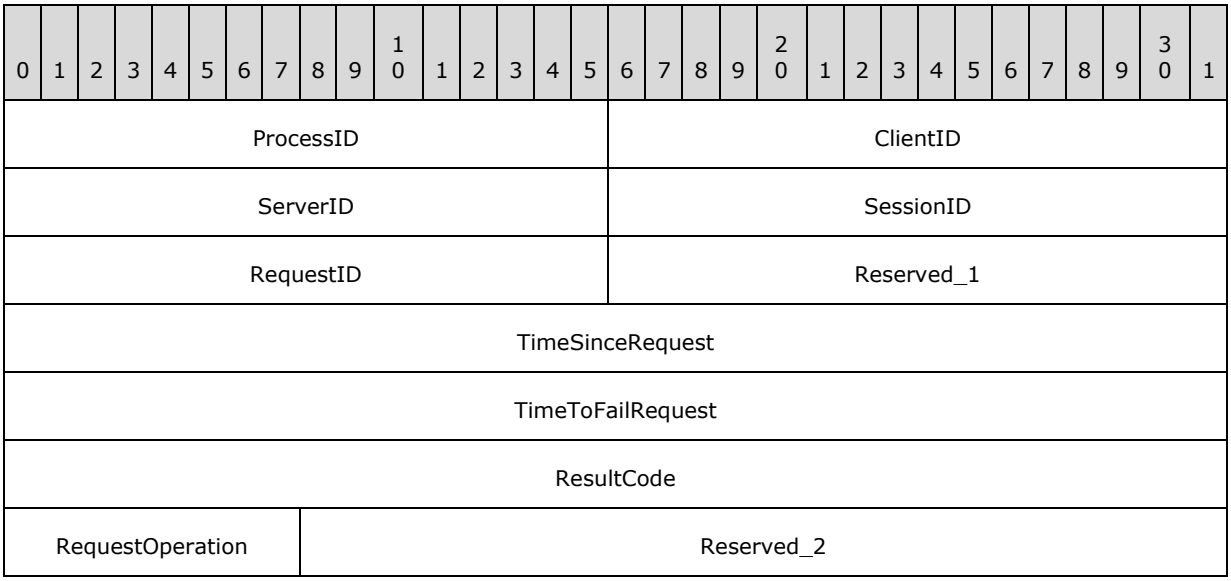
TimeToFailRequest (4 bytes): Number of milliseconds the failure request took to complete.

ResultCode (4 bytes): Error code return of failed request. Returned error codes are implementation specific.

RequestOperation (1 byte): Client-defined operation that failed.

Reserved (3 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

2.2.2.16 AUX_PERF_FAILURE_V2



ProcessID (2 bytes): Process identification number.

ClientID (2 bytes): Client identification number.

ServerID (2 bytes): Server identification number.

SessionID (2 bytes): Session identification number.

RequestID (2 bytes): Request identification number.

Reserved_1 (2 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

TimeSinceRequest (4 bytes): Number of milliseconds since failure request occurred.

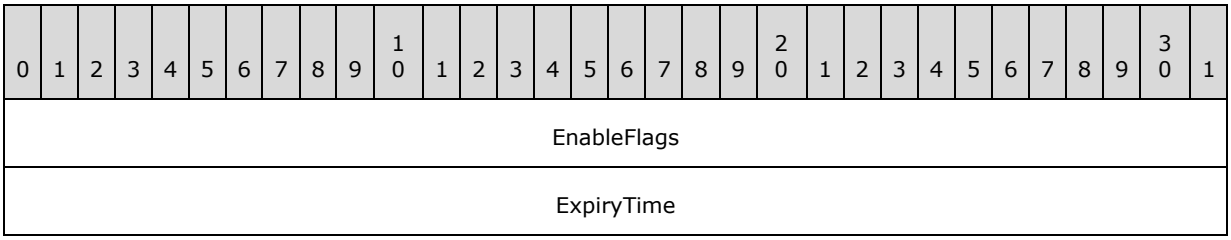
TimeToFailRequest (4 bytes): Number of milliseconds the failure request took to complete.

ResultCode (4 bytes): Error code return of failed request. Returned error codes are implementation specific.

RequestOperation (1 byte): Client-defined operation that failed.

Reserved_2 (3 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

2.2.2.17 AUX_CLIENT_CONTROL

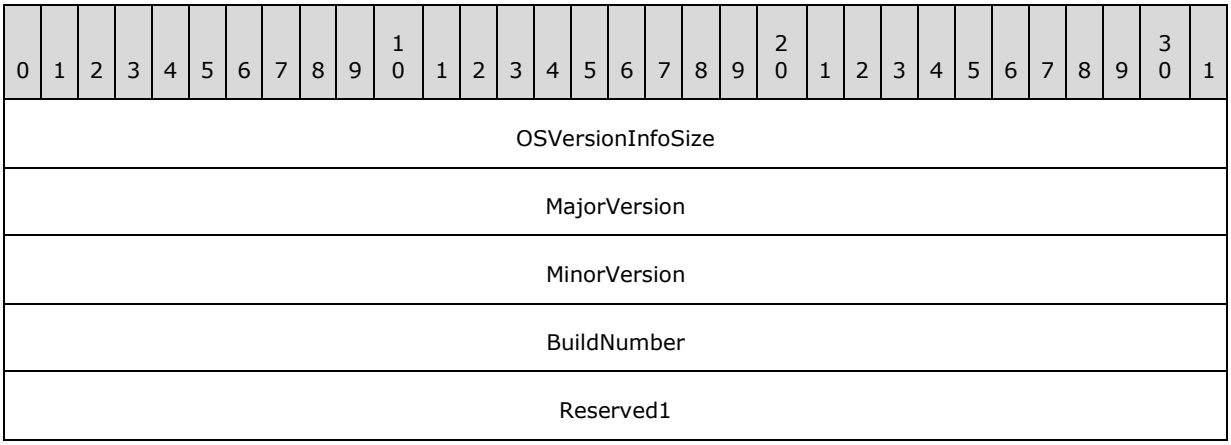


EnableFlags (4 bytes): The following table describes the flags that instruct the client to either enable or disable behavior. To disable a client behavior, the server does not set the flag to the specified value.

Flag	Meaning
ENABLE_PERF_SENDTOSERVER0x00000001	Client MUST start sending performance information to server.
ENABLE_PERF_SENDTOMAILBOX0x00000002	Client MUST start sending performance information as logs to a special location in the user's mailbox.
ENABLE_COMPRESSION0x00000004	Client MUST compress information up to the server. Compression MUST ordinarily be the default behavior, but this allows the server to 'disable' compression.
ENABLE_HTTP_TUNNELING0x00000008	Client MUST utilize RPC/HTTP if configured.
ENABLE_PERF_SENDGCDATA0x00000010	Client MUST include performance data of the client that is communicating with the directory service.

ExpiryTime (4 bytes): The number of milliseconds the client SHOULD keep unsent performance data before the data is expired. Expired data is not transmitted to the server. This prevents the server from receiving stale performance information that is stored on the client.

2.2.2.18 AUX_OSVERSIONINFO



...
...
...
...
...
...
...
(Reserved1 cont'd for 25 rows)
ServicePackMajor	ServicePackMinor
Reserved2

OSVersionInfoSize (4 bytes): Size of the **AUX_OSVERSIONINFO** structure.

MajorVersion (4 bytes): Major version number of the operating system of the server.

MinorVersion (4 bytes): Minor version number of the operating system of the server.

BuildNumber (4 bytes): Build number of the operating system of the server.

Reserved1 (132 bytes): Reserved. Content MUST be ignored by client.

ServicePackMajor (2 bytes): Major version number of the latest operating system service pack that is installed on server.

ServicePackMinor (2 bytes): Minor version number of the latest operating system service pack that is installed on server.

Reserved2 (4 bytes): Reserved. Content MUST be ignored by client.

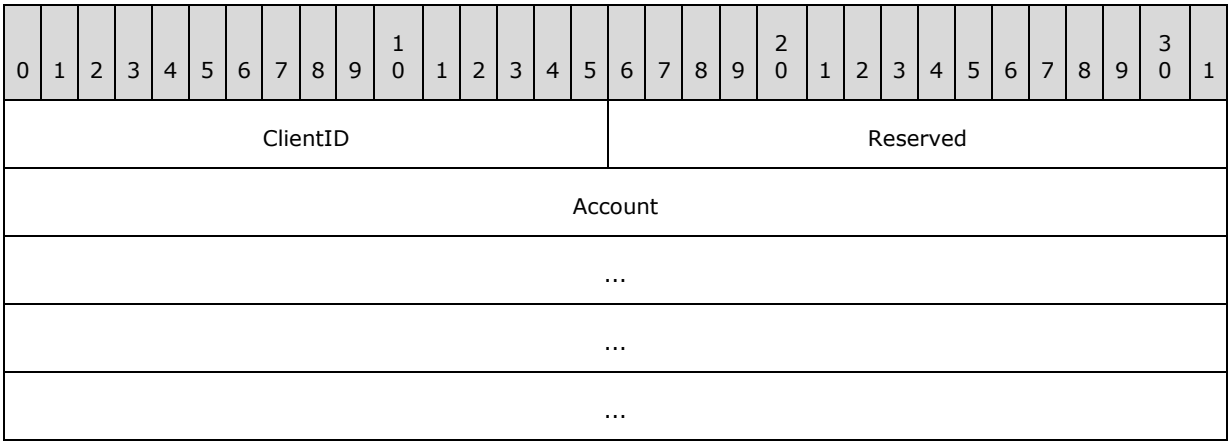
2.2.2.19 AUX_EXORGINFO

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
OrgFlags																															

OrgFlags (4 bytes): Flags indicating the server organizational information. The following table specifies the valid values.

Flag	Meaning
PUBLIC_FOLDERS_ENABLED0x00000001	Organization has public folders.

2.2.2.20 AUX_PERF_ACCOUNTINFO

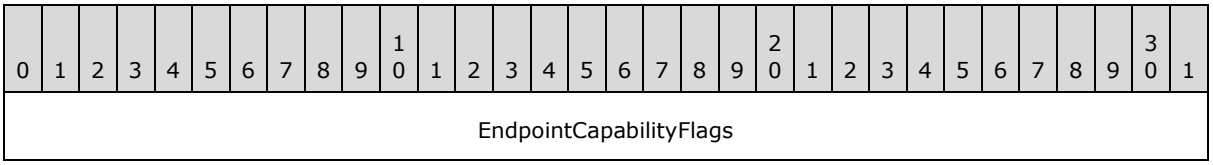


ClientID (2 bytes): Client assigned identification number. Maps to the **ClientID** of the **AUX_PERF_CLIENTINFO** structure (section 2.2.2.6).

Reserved (2 bytes): Padding to enforce alignment of the data on a 4-byte field. The client can fill this field with any value when writing the stream. The server MUST ignore the value of this field when reading the stream.

Account (16 bytes): A GUID representing the client account information that relates to the client identification number in the **ClientID** field.

2.2.2.21 AUX_ENDPOINT_CAPABILITIES



EndpointCapabilityFlag (4 bytes): The following table specifies valid **EndpointCapabilityFlags** flag values.

Flag name	Description
ENDPOINT_CAPABILITIES_SINGLE_ENDPOINT0x00000001	The server supports combined Directory Service Referral interface (RFRI), **name service provider interface (NSPI)**, and EMSMDB interface on a single HTTP endpoint. For more information about RFRI, see [MS-OXABREF]. For more information about NSPI, see [MS-OXNSPI].

Flag name	Description
	The server MAY<5> process requests for different interfaces independently even when requests are transmitted on the same connection. A call to one interface is not to be blocked by a previous call to a different interface on the same connection.

3 Protocol Details

The Wire Format Protocol is comprised of two RPC interfaces: **EMSMDB** and **AsyncEMSMDB**. This section describes the details of each interface.

For some functionality through the **EMSMDB** interface, the client is required to call interface method **EcDoConnectEx** first to establish a session context handle. The session context handle is an RPC context handle. To establish a session context handle, a call to **EcDoConnectEx** MUST be successful. The following table lists all method calls that require a valid session context handle.

Session Context Handle Based Methods	Interface
EcDoDisconnect	EMSMDB
EcRRegisterPushNotification	EMSMDB
EcDoRpcExt2	EMSMDB
EcDoAsyncConnectEx	EMSMDB

For some functionality through the **AsyncEMSMDB** interface, the client is required to call specific interface methods first to establish an asynchronous context handle. The asynchronous context handle is an RPC context handle. To establish an asynchronous context handle, a call to **EcDoAsyncConnectEx** on the **EMSMDB** interface MUST be successful. The following table lists all method calls that require a valid asynchronous context handle context handle.

Asynchronous Context Handle Based Methods	Interface
EcDoAsyncWaitEx	AsyncEMSMDB

3.1 EMSMDB Server Details

The server responds to messages it receives from the client.

3.1.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains 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 document.

Some methods on this interface require session context handle information to be stored on the server and used across multiple interface calls for a long duration of time. For these method calls, this protocol is stateful. The server stores this Session Context information and provides a session context handle to the client to make subsequent interface calls by using this same Session Context information.

The server keeps a list of all active sessions and their associated Session Context information. Each Session Context is identified by a session context handle. After a Session Context has been established, a client can access messaging resources through this Session Context. The server keeps track of all open resources or any state information specific to the session on the Session Context. This can include but is not limited to resources, such as folders, messages, tables, attachments, streams, associated asynchronous context handles, and notification callbacks.

The server isolates all resources associated with one Session Context from all other Session Contexts on the server. Access to resources on one Session Context is not allowed using a session context handle of another Session Context.

When the session context handle is destroyed or the client connection is lost, the Session Context and all Session Context information is destroyed, all open resources are closed, and all **Server objects** that are associated with the Session Context are released.

3.1.2 Timers

None.

3.1.3 Initialization

The server MUST do the following:

1. Register the different protocol sequences that will allow the server to communicate with the client. The supported protocol sequences are specified in section 2.1. Note some protocol sequences use named endpoints, which are also specified in section 2.1.
2. Register the following authentication methods that are allowed on the EMSMDB interface. A client authenticates using one of these authentication methods.
3. RPC_C_AUTHN_WINNT
4. RPC_C_AUTHN_GSS_KERBEROS
5. RPC_C_AUTHN_GSS_NEGOTIATE
6. Start listening for RPC calls.
7. Register the EMSMDB interface.
8. Register the EMSMDB interface to all the registered binding handles created previously.

3.1.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict **Network Data Representation (NDR)** data consistency check at target level 5.0, as specified in [MS-RPCE] section 3.1.1.5.3.2.

The following table lists the methods that this interface includes.<6> The phrase "Reserved for local use" means that the client MUST NOT send the **opnum**, and the server behavior is undefined since it does not affect interoperability. All methods MUST NOT throw exceptions.

Method	Description
Opnum0NotUsedOnWire	Reserved for local use. opnum: 0
EcDoDisconnect	Closes a Session Context with the server. The Session Context is destroyed and all associated server state, objects, and resources that are associated with the Session Context are released. The method requires an active session context handle to be returned from **EcDoConnectEx**.
Opnum2NotUsedOnWire	Reserved for local use. opnum: 2

Method	Description
Opnum3NotUsedOnWire	Reserved for local use. opnum: 3
EcRRegisterPushNotification	Registers a callback address with the server for a Session Context. The callback address is used to notify the client of a pending event on the server. The method requires an active session context handle to be returned from **EcDoConnectEx**.
Opnum5NotUsedOnWire	Reserved for local use. opnum: 5
EcDummyRpc	This call returns a SUCCESS. A client can use it to determine whether it can communicate with the server.
Opnum7NotUsedOnWire	Reserved for local use. opnum: 7
Opnum8NotUsedOnWire	Reserved for local use. opnum: 8
Opnum9NotUsedOnWire	Reserved for local use. opnum: 9
EcDoConnectEx	Creates a session context handle on the server to be used in subsequent calls to **EcDoDisconnect**, **EcDoRpcExt2**, and **EcDoAsyncConnectEx**.
EcDoRpcExt2	Passes generic remote operation (ROP) commands to the server for processing within a Session Context. The method requires an active session context handle to be returned from **EcDoConnectEx**.
Opnum12NotUsedOnWire	Reserved for local use. opnum: 12
Opnum13NotUsedOnWire	Reserved for local use. opnum: 13
EcDoAsyncConnectEx	Binds a session context handle that is returned in **EcDoConnectEx** to a new asynchronous context handle which can be used in calls to **EcDoAsyncWaitEx** in interface **AsyncEMSMDB**. The method requires an active session context handle to be returned from **EcDoConnectEx**.

3.1.4.1 Opnum0NotUsedOnWire

The **Opnum0NotUsedOnWire** method is reserved for local use. The client MUST NOT send this method.

3.1.4.2 EcDoDisconnect (opnum 1)

The method **EcDoDisconnect** closes a Session Context with the server. The Session Context is destroyed and all associated server state, objects, and resources that are associated with the Session Context are released. This call requires that an active session context handle be returned from the method **EcDoConnectEx**.

```
long __stdcall EcDoDisconnect(
    [in, out, ref] CXH * pcxh
);
```

pcxh: On input, contains the session context handle of the Session Context that the client wants to disconnect. On output, the server MUST clear the session context handle to a zero value. Setting the value to zero instructs the RPC layer of the server to destroy the RPC context handle.

Error Codes: If the method succeeds, the return value is 0. If the method fails, the return value is an implementation-specific error code.

Exceptions Thrown: No exceptions are thrown beyond those thrown by the underlying RPC protocol [MS-RPCE].

3.1.4.3 Opnum2NotUsedOnWire

The **Opnum2NotUsedOnWire** method is reserved for local use. The client MUST NOT send this method.

3.1.4.4 Opnum3NotUsedOnWire

The **Opnum3NotUsedOnWire** method is reserved for local use. The client MUST NOT send this method.

3.1.4.5 EcRRegisterPushNotification (opnum 4)

The method **EcRRegisterPushNotification** SHOULD<7> register a callback address with the server for a Session Context. The callback address is used to notify the client of pending events on the server. This call requires that an active session context handle be returned from the method **EcDoConnectEx**.

The server MUST store the callback address and the opaque context data in the Session Context. Whenever the server wants to notify the client of pending events, it sends a packet containing just the opaque context data to the callback address. The callback address specifies which network transport is to be used to send the data packet.

For more information about notification handling, see [MS-OXCNOTIF].

```
long __stdcall EcRRegisterPushNotification(
    [in, out, ref] CXH * pcxh,
     [in] unsigned long iRpc,
     [in, size_is(cbContext)]unsigned char rgbContext[],
     [in] unsigned short cbContext,
     [in] unsigned long grbitAdviseBits,
     [in, size_is(cbCallbackAddress)] unsigned char     rgbCallbackAddress[],
     [in] unsigned short cbCallbackAddress,
     [out] unsigned long *hNotification
);
```

pcxh: On input, the client MUST pass a valid session context handle that was created by calling **EcDoConnectEx**. The server uses the session context handle to identify the Session Context to use for this call. On output, the server MUST return the same session context handle on success.

The server can destroy the session context handle by returning a zero session context handle. Reasons for destroying the session context handle are implementation-dependent; following are examples of why the server might destroy the session context handle:

- The session context handle that was passed in is invalid.
- An attempt was made to access a mailbox that is in the process of being moved.

iRpc: The server MUST completely ignore this value. The client MUST pass a value of 0x00000000.

rgbContext: This parameter contains opaque client-generated context data that is sent back to the client at the callback address, passed in parameter *rgbCallbackAddress*, when the server wants to notify the client of pending event information. The server MUST save this data within the Session Context and use it when sending a notification to the client.

cbContext: This parameter contains the size of the opaque client context data that is passed in parameter *rgbContext*. The server MUST fail this call with error code ecTooBig if this parameter is larger than 0x00000010.

grbitAdviseBits: This parameter MUST be 0xFFFFFFFF.

rgbCallbackAddress: This parameter contains the callback address for the server to use to notify the client of a pending event. The size of this data is in the parameter *cbCallbackAddress*.

The data contained in this parameter follows the format of a **sockaddr** structure. For information about the **sockaddr** structure, see [MSDN-SOCKADDR].

The server supports the address families AF_INET and AF_INET6 for a callback address that corresponds to the protocol sequence types that are specified in section 2.1.

If an address family is requested that is not supported, the server MUST return error code ecInvalidParam. If the address family is supported, but the communications stack of the server does not support the address type, the server MUST return error code ecNotSupported.

cbCallbackAddress: This parameter contains the length of the callback address in parameter *rgbCallbackAddress*. The size of this parameter depends on the address family being used. If this size does not correspond to the **sockaddr** size based on address family, the server MUST return error code ecInvalidParam.

hNotification: If the call completes successfully, this output parameter will contain a handle to the notification callback on the server.

Error Codes: If the method succeeds, the return value is 0. If the method fails, the return value is an implementation-specific error code or one of the protocol-defined error codes listed in the following table.

Name	Value	Meaning
ecInvalidParam	0x80070057	A parameter passed was not valid for the call.
ecNotSupported	0x80040102	The callback address is not supported on the server.
ecTooBig	0x80040305	Opaque context data is too large.

Exceptions Thrown: No exceptions are thrown beyond those thrown by the underlying RPC protocol [MS-RPCE].

3.1.4.6 Opnum5NotUsedOnWire

The **Opnum5NotUsedOnWire** method is reserved for local use. The client MUST NOT send this method.

3.1.4.7 EcDummyRpc (opnum 6)

The method **EcDummyRpc** returns a SUCCESS. A client can use it to determine if it can communicate with the server.

```
long __stdcall EcDummyRpc(
    [in] handle_t hBinding
);
```

hBinding: A valid RPC binding handle.

Error Codes: The function MUST always succeed and return 0.

Exceptions Thrown: No exceptions are thrown beyond those thrown by the underlying RPC protocol [MS-RPCE].

3.1.4.8 Opnum7NotUsedOnWire

The **Opnum7NotUsedOnWire** method is reserved for local use. The client MUST NOT send this method.

3.1.4.9 Opnum8NotUsedOnWire

The **Opnum8NotUsedOnWire** method is reserved for local use. The client MUST NOT send this method

3.1.4.10 Opnum9NotUsedOnWire

The **Opnum9NotUsedOnWire** method is reserved for local use. The client MUST NOT send this method.

3.1.4.11 EcDoConnectEx (opnum 10)

The **EcDoConnectEx** method establishes a new Session Context with the server. The Session Context is persisted on the server until the client disconnects by using **EcDoDisconnect** (section 3.1.4.2). This method returns a session context handle to be used by a client in subsequent calls.

```
long __stdcall EcDoConnectEx(
    [in] handle_t hBinding,
     [out, ref] CXH * pcxh,
     [in, string] unsigned char * szUserDN,
     [in] unsigned long ulFlags,
     [in] unsigned long ulConMod,
     [in] unsigned long cbLimit,
     [in] unsigned long ulCpid,
     [in] unsigned long ulLcidString,
     [in] unsigned long ulLcidSort,
     [in] unsigned long ulIcxrLink,
     [in] unsigned short usFCanConvertCodePages,
     [out] unsigned long * pcmsPollsMax,
     [out] unsigned long * pcRetry,
     [out] unsigned long * pcmsRetryDelay,
     [out] unsigned short * picxr,
     [out, string] unsigned char **szDNPrefix,
     [out, string] unsigned char **szDisplayName,
     [in] unsigned short rgwClientVersion[3],
     [out] unsigned short rgwServerVersion[3],
     [out] unsigned short rgwBestVersion[3],
     [in, out] unsigned long * pulTimeStamp,
     [in, size_is(cbAuxIn)] unsigned char rgbAuxIn[],
     [in] unsigned long cbAuxIn,
```

```
      [out, length_is(*pcbAuxOut), size_is(*pcbAuxOut)] unsigned char rgbAuxOut[],
      [in, out] SMALL_RANGE_ULONG *pcbAuxOut
);
```

hBinding: A valid RPC binding handle.

pcxh: On success, the server MUST return a unique value to be used as a session context handle. This unique value serves as the session context handle for the client.

On failure, the server MUST return a zero value as the session context handle.

szUserDN: User's distinguished name (DN). String containing the DN of the user who is making the **EcDoConnectEx** call in a directory service. Value: "/o=First Organization/ou=First Administrative Group/cn=recipients/cn=janedow".

ulFlags: For ordinary client calls this value MUST be 0x00000000. For Administrative privilege calls this value MUST be 0x00000001.

Value	Meaning
0x00000000	Ordinary client connection.
0x00000001	Administrator privilege requested for connection.
0x00008000	If this flag is not passed and the client version (*rgwClientVersion*) is less than 12.00.0000.000 and no public folders are configured within the messaging system, the server MUST fail the connection attempt with error code ecClientVerDisallowed. If this flag is passed and the client version (*rgwClientVersion*) is less than 12.00.0000.000, the server MUST NOT fail the connection attempt due to public folders not being configured within the messaging system. If the client version (*rgwClientVersion*) is greater than or equal to 12.00.0000.000, the server MUST NOT fail the connection attempt due to public folders not being configured within the messaging system (regardless of whether or not this flag is passed).

ulConMod: The connection modulus is a client-derived 32-bit hash value of the DN passed in field **szUserDN** and can be used by the server to decide which public folder **replica** to use when accessing public folder information when more than one replica of a folder exists. The hash can be used to distribute client access across replicas in a deterministic way for load balancing.

cbLimit: This field is reserved. A client MUST pass a value of 0x00000000.

ulCpid: The **code page** in which text data is sent if Unicode format is not requested by the client on subsequent calls using this Session Context.

ulLcidString: The local ID for everything other than sorting.

ulLcidSort: The local ID for sorting.

ulIcxrLink: This value is used to link the Session Context created by this call with an existing Session Context on the server. If the client wants Session Context linking, it MUST pass the value of 0xFFFFFFFF. To link to an existing Session Context, this value is the session index value returned in field **piCxr** from a previous **EcDoConnectEx** call. In addition to passing the session index in **ulIcxrLink**, the client sets **pulTimeStamp** to the value that was returned in the **pulTimeStamp** field from the previous **EcDoConnectEx** call. These two values MUST be used by the server to identify an active session with the same session index and session creation time stamp. If a session is found, the server MUST link the Session Context created by this call with the one found.<8>

A server allows Session Context linking for the following reasons:

1.To consume a single **Client Access License (CAL)** for all the connections made from a single client computer. This gives a client the ability to open multiple independent connections using more than one Session Context on the server, but be seen to the server as only consuming a single CAL.<9>

2.To get pending notification information for other sessions on the same client computer. For details, see [MS-OXCNOTIF] section 3.1.5.1.1.

Note that the *ulIcxrLink* parameter is defined as a 32-bit value. Other than passing 0xFFFFFFFF for no Session Context linking, the server only uses the low-order 16 bits as the session index. This value is the value returned in **piCxr** from a previous **EcDoConnectEx** call, which is the session index and defined as a 16-bit value.

usFCanConvertCodePages: This field is reserved. The client MUST pass a value of 0x0001.

pcmsPollsMax: The server returns the number of milliseconds that a client waits between polling the server for event information. If the client or server does not support making asynchronous RPC calls for notifications (see the **EcDoAsyncWaitEx** method, section 3.3.4.1), or the client is unable to receive notifications via UDP datagrams (see the **EcRRegisterPushNotifications** method), the client can poll the server to determine whether any events are pending for the client. For more details about notifications and the **EcRRegisterPushNotifications** method, see [MS-OXCNOTIF] section 3.2.5.1.3 and [MS-OXCNOTIF] section 3.2.3.2.1.

pcRetry: The server returns the number of times a client retries future RPC calls using the session context handle returned in this call. This is for client RPC calls that fail with RPC status code RPC_S_SERVER_TOO_BUSY (0x000006BB). This is a suggested retry count for the client and is not to be enforced by the server. For more information about how the client handles the RPC status code RPC_S_SERVER_TOO_BUSY, see section 3.2.4.3.

pcmsRetryDelay: The server returns the number of milliseconds a client waits before retrying a failed RPC call. If any future RPC call to the server using the session context handle returned in this call fails with RPC status code RPC_S_SERVER_TOO_BUSY (0x000006BB), the client waits the number of milliseconds specified in this output parameter before retrying the call. The number of times a client retries is returned in parameter *pcRetry*. This is a suggested delay for the client and is not to be enforced by the server. For more information about how the client handles the RPC status code RPC_S_SERVER_TOO_BUSY, see section 3.2.4.3.

piCxr: The server returns a session index value that is associated with the session context handle returned from this call. This value in conjunction with the session creation time stamp value returned in **pulTimeStamp** will be passed to a subsequent **EcDoConnectEx** call, if the client wants to link two Session Contexts.<10> The server MUST NOT assign two active Session Contexts the same session index value. The server is free to return any 16-bit value for the session index.

The server MUST also use the session index when returning a **RopPending** response command on calls to **EcDoRpcExt2** (section 3.1.5.1.3) to tell the client which Session Context has pending notifications. If Session Contexts are linked, a **RopPending** can be returned for any linked Session Context. For details about **RopPending**, see [MS-OXCROPS] section 3.1.5.1.3 and [MS-OXCNOTIF] section 3.1.5.1.1.

szDNPrefix: The server returns a distinguished name (DN) prefix that is used to build message **recipients**. An empty value indicates that there is nothing to prepend to recipient entries on messages.

szDisplayName: The server returns the display name of the user associated with the *szUserDN* parameter.

rgwClientVersion: The client passes the client protocol version the server uses to determine what protocol functionality the client supports. For more information about how version numbers are interpreted from the wire data, see section 3.1.9.

rgwServerVersion: The server returns the server protocol version the client uses to determine what protocol functionality the server supports. For details about how version numbers are interpreted from the wire data, see section 3.1.9.

rgwBestVersion: The server returns the minimum client protocol version the server supports. This information is useful if the **EcDoConnectEx** call fails with return code ecVersionMismatch. On success, the server returns the value passed in **rgwClientVersion** by the client. The server cannot perform any client protocol version negotiation. The server can either return the minimum client protocol version required to access the server and fail the call with **ecVersionMismatch**, or the server can allow the client and return the value passed by the client in **rgwClientVersion**. It is up to the server implementation to set the minimum client protocol version that is supported by the server. For details about how version numbers are interpreted from the wire data, see section 3.1.9.

pulTimeStamp: On input, this parameter and parameter *ulIcxrLink* are used for linking the Session Context created by this call with an existing Session Context. If the *ulIcxrLink* parameter is not 0xFFFFFFFF, the client MUST pass in the **pulTimeStamp** value returned from the server on a previous call to **EcDoConnectEx** (see the *ulIcxrLink* and *piCxr* parameters for more details). If the server supports Session Context linking, the server verifies that there is a Session Context state with the unique identifier **ulIcxrLink** and it has a creation time stamp equal to the value passed in this parameter. If so, the server MUST link the Session Context created by this call with the one found. If no such Session Context state is found, the server does not fail the **EcDoConnectEx** call, but simply does not do linking.<11>

On output, the server has to return a time stamp in which the new Session Context was created. The server saves the Session Context creation time stamp within the Session Context state for later use if a client attempts to do Session Context linking.

rgbAuxIn: This parameter contains an auxiliary payload buffer. The auxiliary payload buffer is prefixed by an **RPC_HEADER_EXT** structure. Information stored in this header determines how to interpret the data following the header. The length of the auxiliary payload buffer that includes the **RPC_HEADER_EXT** header is contained in parameter cbAuxIn.

See section 3.1.7 for details about how to access the embedded auxiliary payload buffer. See section 3.1.8 for details about how to interpret the auxiliary payload data.

cbAuxIn: On input, this parameter contains the length of the auxiliary payload buffer passed in the *rgbAuxIn* parameter. The server MUST fail with the RPC status code RPC_X_BAD_STUB_DATA (0x000006F7), if this value on input is larger than 0x00001008 bytes in size. The server SHOULD<12> fail with ecRpcFailed (0x80040115) if this value is greater than 0x00000000 and less than 0x00000008. For more information on returning RPC Status Codes, see [C706].

rgbAuxOut: On output, the server can return auxiliary payload data to the client. The server MUST include an **RPC_HEADER_EXT** header before the auxiliary payload data.

See section 3.1.7 for details about how to access the embedded auxiliary payload buffer. See section 3.1.8 for details about how to interpret the auxiliary payload data.

pcbAuxOut: On input, this parameter contains the maximum length of the rgbAuxOut buffer. The server MUST fail with the RPC status code RPC_X_BAD_STUB_DATA (0x000006F7) if this value on input is larger than 0x00001008. For more information on returning RPC Status Codes, see [C706].

On output, this parameter contains the size of the data to be returned in the rgbAuxOut buffer.

Error Codes: If the method succeeds, the return value is 0. If the method fails, the return value is an implementation-specific error code or one of the protocol-defined error codes listed in the following table.

Name	Value	Meaning
ecAccessDenied<13>	0x80070005	The authentication context associated with the binding handle does not have enough privilege or the *szUserDN* parameter is empty.
ecNotEncrypted	0x00000970	The server is configured to require encryption and the binding handle, hBinding, authentication is not set with RPC_C_AUTHN_LEVEL_PKT_PRIVACY. For more information about setting the authentication and authorization, see [MSDN-RpcBindingSetAuthInfoEx]. The client attempts the call again with new binding handle that is encrypted.
ecClientVerDisallowed	0x000004DF	1. The server requires encryption, but the client is not encrypted and the client does not support receiving error code ecNotEncrypted being returned by the server. See section 3.1.9 for details about which client versions do not support receiving error code ecNotEncrypted. 2. The client version has been blocked by the administrator.
ecLoginFailure	0x80040111	Server is unable to log in user to the mailbox or public folder database.
ecUnknownUser	0x000003EB	The server does not recognize the *szUserDN* as a valid enabled mailbox. For more details, see [MS-OXCSTOR] section 3.1.4.1.
ecLoginPerm	0x000003F2	The connection is requested for administrative access, but the authentication context associated with the binding handle does not have enough privilege.
ecVersionMismatch	0x80040110	The client and server versions are not compatible. The client protocol version is older than that required by the server.
ecCachedModeRequired	0x000004E1	The server requires the client to be running in cache mode. See section 3.1.9 for details about which client versions understand this error code.
ecRpcHttpDisallowed	0x000004E0	The server requires the client to not be connected via RPC/HTTP. See section 3.1.9 for details about which client versions understand this error code.
ecProtocolDisabled	0x000007D8	The server disallows the user to access the server via this protocol interface. This could be done if the user is only capable of accessing their mailbox information through a different means (for example, Webmail, POP, IMAP, and so on). See section 3.1.9 for details about which client versions understand this error code.

Exceptions Thrown: No exceptions are thrown beyond those thrown by the underlying RPC protocol [MS-RPCE].

3.1.4.12 EcDoRpcExt2 (opnum 11)

The method **EcDoRpcExt2** passes generic remote operation (ROP) commands to the server for processing within a Session Context. Each call can contain multiple ROP commands. The server

returns the results of each ROP command to the client. This call requires an active session context handle returned from method **EcDoConnectEx**.

```
long __stdcall EcDoRpcExt2(
     [in, out, ref] CXH * pcxh,
     [in, out] unsigned long *pulFlags,
     [in, size_is(cbIn)] unsigned char rgbIn[],
     [in] unsigned long cbIn,
     [out, length_is(*pcbOut), size_is(*pcbOut)] unsigned char rgbOut[],
     [in, out] BIG_RANGE_ULONG *pcbOut,
     [in, size_is(cbAuxIn)] unsigned char rgbAuxIn[],
     [in] unsigned long cbAuxIn,
     [out, length_is(*pcbAuxOut), size_is(*pcbAuxOut)] unsigned char rgbAuxOut[],
     [in, out] SMALL_RANGE_ULONG *pcbAuxOut,
     [out] unsigned long *pulTransTime
);
```

pcxh: On input, the client MUST pass a valid session context handle that was created by calling **EcDoConnectEx**. The server uses the session context handle to identify the Session Context to use for this call. On output, the server MUST return the same session context handle on success.

The server can destroy the session context handle by returning a zero session context handle. Reasons for destroying the session context handle are implementation-dependent; following are examples of why the server might destroy the Session session context handle:

- The server determines that the ROP request payload in the rgbIn buffer is malformed or length parameters are invalid.
- The session context handle that was passed in is invalid.
- An attempt was made to access a mailbox that is in the process of being moved.
- An administrator has blocked a client that has an active connection.

pulFlags: On input, this parameter contains flags that tell the server how to build the *rgbOut* parameter.

Name	Value	Meaning
NoCompression	0x00000001	The server MUST NOT compress ROP response payload (*rgbOut*) or auxiliary payload (*rgbAuxOut*). For details about server behavior when this flag is absent, see section 3.1.7.1.2.
NoXorMagic	0x00000002	The server MUST NOT obfuscate the ROP response payload (*rgbOut*) or auxiliary payload (*rgbAuxOut*). For details about server behavior when this flag is absent, see section 3.1.7.1.2.
Chain	0x00000004	The client allows chaining of ROP response payloads.

See section 3.1.7.1.2 for details about how to use these flags.

On output, the server MUST set this parameter to 0x00000000. The meaning of the output flags are reserved for future use.

rgbIn: This buffer contains the ROP request payload. The ROP request payload is prefixed with an **RPC_HEADER_EXT** header. Information stored in this header determines how to interpret the data following the header. See section 3.1.7 for details about how to access the embedded ROP request

payload. The length of the ROP request payload including the **RPC_HEADER_EXT** header is contained in parameter *cbIn*.

For more information about ROP buffers, see [MS-OXCROPS].

cbIn: On input, this parameter contains the length of the ROP request payload passed in the *rgbIn* parameter. The ROP request payload includes the size of the ROPs plus the size of **RPC_HEADER_EXT**. For more details, see [MS-OXCROPS]. The server SHOULD<14> fail with the RPC status code of RPC_X_BAD_STUB_DATA (0x000006F7) if the request buffer is larger than 0x00008007 bytes in size. For more information on returning RPC status codes, see [C706]. The server SHOULD<15> fail with error code ecRpcFormat if the request buffer is smaller than the size of **RPC_HEADER_EXT** (0x00000008 bytes).

rgbOut: This buffer contains the ROP response payload. The size of the payload is specified in **pcbOut**. Like the ROP request payload, the ROP response payload is also prefixed by a **RPC_HEADER_EXT** header. For details about how to format the ROP response payload, see section 3.1.7. The size of the ROP response payload plus the **RPC_HEADER_EXT** header is returned in *pcbOut*.

For more information about ROP buffers, see [MS-OXCROPS].

pcbOut: On input, this parameter contains the maximum size of the *rgbOut* buffer. The server MUST fail with error code ecRpcFormat if the value in *pcbOut* on input is less than 0x00008007.<16> The server MUST fail with the RPC status code of RPC_X_BAD_STUB_DATA (0x000006F7) if the value in *pcbOut* on input is larger than 0x00040000. For more information on returning RPC Status Codes, see [C706].

On output, this parameter contains the size of the ROP response payload, including the size of the **RPC_HEADER_EXT** header in the *rgbOut* parameter. The server returns 0x00000000 on failure as there is no ROP response payload. The client ignores any data returned on failure.

rgbAuxIn: This parameter contains an auxiliary payload buffer. The auxiliary payload buffer is prefixed by an **RPC_HEADER_EXT** structure. Information stored in this header determines how to interpret the data following the header. The length of the auxiliary payload buffer including the **RPC_HEADER_EXT** header is contained in parameter *cbAuxIn*.

See section 3.1.7 for details about how to access the embedded auxiliary payload buffer. See section 3.1.8 for details about how to interpret the auxiliary payload data.

cbAuxIn: On input, this parameter contains the length of the auxiliary payload buffer passed in the *rgbAuxIn* parameter. The server MUST fail with the RPC status code RPC_X_BAD_STUB_DATA (0x000006F7) if the request buffer is larger than 0x00001008 bytes in size. For more information on returning RPC status codes, see [C706].<17>

rgbAuxOut: On output, the server MAY<18> return auxiliary payload data to the client. The server MUST include a **RPC_HEADER_EXT** header before the auxiliary payload data.

See section 3.1.7 for details about how to access the embedded auxiliary payload buffer. See section 3.1.8 for details about how to interpret the auxiliary payload data.

pcbAuxOut: On input, this parameter contains the maximum length of the rgbAuxOut buffer. The server MUST fail with the RPC status code RPC_X_BAD_STUB_DATA (0x000006F7) if this value on input is larger than 0x00001008. For more information on returning RPC status codes, see [C706].

On output, this parameter contains the size of the data to be returned in the *rgbAuxOut* buffer.

pulTransTime: On output, the server stores the number of milliseconds the call took to execute. This is the total elapsed time from when the call is dispatched on the server to the point in which the server returns the call. This is diagnostic information the client can use to determine the cause of a slow response time from the server. The client can monitor the total elapsed time across the RPC function call and, using this output parameter, can determine whether time was spent transmitting the request/response on the network on processing time on the server.

Error Codes: If the method succeeds, the return value is 0. If the method fails, the return value is an implementation-specific error code or the protocol-defined error code listed in the following table.

Name	Value	Meaning
ecRpcFormat	0x000004B6	The format of the request was found to be invalid. This is a generic error that means the length was found to be invalid or the content was found to be invalid.

Exceptions Thrown: No exceptions are thrown beyond those thrown by the underlying RPC protocol [MS-RPCE].

3.1.4.13 Opnum12NotUsedOnWire

The **Opnum12NotUsedOnWire** method is reserved for local use. The client MUST NOT send this method.

3.1.4.14 Opnum13NotUsedOnWire

The **Opnum13NotUsedOnWire** method is reserved for local use. The client MUST NOT send this method.

3.1.4.15 EcDoAsyncConnectEx (opnum 14)

The method **EcDoAsyncConnectEx** binds a session context handle returned from method **EcDoConnectEx** to a new asynchronous context handle that can be used in calls to **EcDoAsyncWaitEx** in interface **AsyncEMSMDB**. This call requires that an active session context handle be returned from the method **EcDoConnectEx**.

This method is part of Notification handling. For more information about notifications, see [MS-OXCNOTIF].

```
long __stdcall EcDoAsyncConnectEx(
     [in] CXH cxh,
     [out, ref] ACXH * pacxh
);
```

CXH: Client MUST pass a valid session context handle that was created by calling **EcDoConnectEx**. The server uses the session context handle to identify the Session Context to use for this call.

pacxh: On success, the server returns an asynchronous context handle that is associated with the Session Context passed in parameter **CXH**. On a failure the returned value is a Null. This asynchronous context handle can be used to make a call to **EcDoAsyncWaitEx** on interface **AsyncEMSMDB**.

Error Codes: If the method succeeds, the return value is 0. If the method fails, the return value is an implementation-specific error code or the protocol-defined error code listed in the following table.

Name	Value	Meaning
ecRejected	0x000007EE	Server has asynchronous RPC notifications disabled. Client either polls for notifications or calls **EcRRegisterPushNotifications**.

Exceptions Thrown: No exceptions are thrown beyond those thrown by the underlying RPC protocol [MS-RPCE].

3.1.5 Timer Events

None.

3.1.6 Other Local Events

None.

3.1.7 Extended Buffer Handling

Interface methods **EcDoConnectEx** and **EcDoRpcExt2** contain request and response buffers that use an extended buffer mechanism where the payload is preceded by a header. The header contains flags that determine whether or not the payload has been compressed, obfuscated, or another extended buffer and payload exists after the current payload. A single payload MUST NOT exceed 32 KB in size.

An extended buffer is used in fields *rgbAuxIn* and *rgbAuxOut* on the **EcDoConnectEx** method and in the fields *rgbIn*, *rgbOut*, *rgbAuxIn*, and *rgbAuxOut* on the **EcDoRpcExt2** method.

The following sections detail the extended buffer format, compression algorithm, obfuscation algorithm, and extended buffer packing.

3.1.7.1 Extended Buffer Format

See section 2.2.2.1 for details about the structure and individual fields.

The client or server can choose not to compress the payload if the payload is small enough that compression would not yield much benefit. The client or server can choose to not obfuscate the payload if the payload has already been compressed. The client or server can choose to not obfuscate the payload if the client is connected using RPC layer encryption.

The extended buffer is used in both the **EcDoConnectEx** and **EcDoRpcExt2** for a variety of different fields. The information in the following sections describes how the extended buffer is used for the different fields on each method.

3.1.7.1.1 EcDoConnectEx

3.1.7.1.1.1 rgbAuxIn

The input buffer *rgbAuxIn* has the following format:

RPC_HEADER_EXT	Payload

The header MUST contain the Last flag in the flags field.

If the Compressed flag is present in the flags field, the content of the payload MUST be compressed by the client and MUST be uncompressed by the server before it can be interpreted. See section 3.1.7.2 for details about the compression algorithm.

If the XorMagic flag is present in the flags field, the content of the payload MUST be obfuscated by the client and MUST be reverted by the server before it can be interpreted. See section 3.1.7.3 for details about the obfuscation algorithm.

The payload is auxiliary information that can be passed from the client to the server. See section 3.1.8 for details about how to interpret this data.

3.1.7.1.1.2 rgbAuxOut

The output buffer *rgbAuxOut* has the following format:

RPC_HEADER_EXT	Payload

The header MUST contain the Last flag in the flags field.

If the Compressed flag is present in the flags field, the content of the payload MUST be compressed by the server and MUST be uncompressed by the client before it can be interpreted. See section 3.1.7.2 details about the compression algorithm.

If the XorMagic flag is present in the flags field, the content of the payload MUST be obfuscated by the server and MUST be reverted by the client before it can be interpreted. See section 3.1.7.3 for details about the obfuscation algorithm.

The payload is auxiliary information that can be passed from the server to the client. See section 3.1.8 for details about how to interpret this data.

3.1.7.1.2 EcDoRpcExt2

The flags passed to the server in field **pulFlags** by the client request that the server compress or obfuscate the response data returned in field **rgbOut** and **rgbAuxOut**. If the client requests no compression or no obfuscation through the flags NoCompression or NoXorMagic, the server MUST honor the client request. If the client requests compression or obfuscation (through the absence of the flags NoCompression or NoXorMagic), the server can choose not to honor the client request. For example, the server might choose not to compress the payload if the payload is small enough that compression would not yield much benefit, or the server might choose not to obfuscate the payload if the payload has already been compressed, or the server might choose not to compress or obfuscate the payload if the server does not support that functionality. The client MUST NOT assume a response will be compressed or obfuscated if requested and MUST have the ability to handle data which is not compressed or not obfuscated.

3.1.7.1.2.1 rgbIn

The input buffer *rgbIn* has the following format:

RPC_HEADER_EXT	Payload

The header MUST contain the Last flag in the flags field.

If the Compressed flag is present in the flags field, the content of the payload MUST be compressed by the client and MUST be uncompressed by the server before it can be interpreted. See section 3.1.7.2 for details about the compression algorithm.

If the XorMagic flag is present in the flags field, the content of the payload MUST be obfuscated by the client and MUST be reverted by the server before it can be interpreted. See section 3.1.7.3 for details about the obfuscation algorithm.

The payload is remote operation (ROP) request information that can be passed from the client to the server. See [MS-OXCROPS] for details about how to interpret this data.

3.1.7.1.2.2 rgbOut

The output buffer *rgbOut* has the following format:

RPC_HEADER_EXT	Payload	RPC_HEADER_EXT	Payload	...	RPC_HEADER_EXT	Payload

There might be multiple extended buffers contained in the single output buffer. They will each have an RPC_HEADER_EXT header followed by a payload.

All headers except for the last MUST NOT contain the Last flag in the flags field. The last header MUST contain the Last flag in the flags field.

If the Compressed flag is present in the flags field, the content of the payload following the header MUST be compressed by the server and MUST be uncompressed by the client before it can be interpreted. See section 3.1.7.2 for details the compression algorithm.

If the XorMagic flag is present in the flags field, the content of the payload following the header MUST be obfuscated by the server and MUST be reverted by the client before it can be interpreted. See section 3.1.7.3 for details about the obfuscation algorithm.

Compression or obfuscation can be done differently for each header and payload section. The client MUST be able to treat each header and payload independently and interpret the contents solely on the flags specified in the header.

Each payload contains remote operation (ROP) response information that is returned from the server to the client. See [MS-OXCROPS] for details about how to interpret this data.

3.1.7.1.2.3 rgbAuxIn

The input buffer *rgbAuxIn* has the following format:

RPC_HEADER_EXT	Payload

The header MUST contain the Last flag in the flags field.

If the Compressed flag is present in the flags field, the content of the payload MUST be compressed by the client and MUST be uncompressed by the server before it can be interpreted. See section 3.1.7.2 for details about the compression algorithm.

If the XorMagic flag is present in the flags field, the content of the payload MUST be obfuscated by the client and MUST be reverted by the server before it can be interpreted. See section 3.1.7.3 for details about the obfuscation algorithm.

The payload is auxiliary information that can be passed from the client to the server. See section 3.1.8 for details about how to interpret this data.

3.1.7.1.2.4 rgbAuxOut

The output buffer *rgbAuxOut*<19> has the following format:

RPC_HEADER_EXT	Payload

The header MUST contain the Last flag in the flags field.

If the Compressed flag is present in the flags field, the content of the payload MUST be compressed by the server and MUST be uncompressed by the client before it can be interpreted. See section 3.1.7.2 for more details about the compression algorithm.

If the XorMagic flag is present in the flags field, the content of the payload MUST be obfuscated by the server and MUST be reverted by the client before it can be interpreted. See section 3.1.7.3 for more details about the obfuscation algorithm.

The payload is auxiliary information that can be passed from the server to the client. See section 3.1.8 for more details about how to interpret this data.

3.1.7.2 Compression Algorithm

Based on flags that are passed in **RPC_HEADER_EXT** header of the extended buffer, the payload is compressed or decompressed by the server and client by using the LZ77 compression algorithm and the DIRECT2 encoding algorithm.

This section describes the compression algorithm LZ77 and the basic encoding algorithm DIRECT2 that are used by the Wire Format protocol.

3.1.7.2.1 LZ77 Compression Algorithm

The compression algorithm is used to analyze input data and determine how to reduce the size of that input data by replacing redundant information with metadata. Sections of the data that are identical to sections of the data that have been encoded are replaced by small metadata that indicates how to expand those sections again. The encoding algorithm is used to take that combination of data and metadata and serialize it into a stream of bytes that can later be decoded and decompressed.

3.1.7.2.1.1 Compression Algorithm Terminology

The following terms are associated with the compression algorithm.

input stream: The sequence of bytes to be compressed.

byte: The basic data element in the input stream.

coding position: The position of the byte in the input stream that is currently being coded (the beginning of the **lookahead buffer**).

lookahead buffer: The byte sequence from the coding position to the end of the **input stream**.

window: A buffer that indicates the number of bytes from the **coding position** backward. A **window** of size W contains the last W processed bytes.

pointer: Information about the beginning of the **match** in the window (referred to as "B" in the example later in this section) and also specifies its length (referred to as "L" in the example later in this section).

match: The string that is used to find a match of the byte sequence between the **lookahead buffer** and the **window**.

3.1.7.2.1.2 Using the Compression Algorithm

To use the LZ77 compression algorithm:

1.Set the **coding position** to the beginning of the **input stream**.

2.Find the longest **match** in the **window** for the **lookahead buffer**.

3.Output the P,C pair, where P is the **pointer** to the **match** in the **window**, and C is the first byte in the **lookahead buffer** that does not match.

4.If the **lookahead buffer** is not empty, move the **coding position** (and the **window**) L+1 bytes forward.

5.Return to step 2.

3.1.7.2.1.3 Compression Process

The compression algorithm searches the window for the longest **match** with the beginning of the **lookahead buffer** and then outputs a **pointer** to that match. Because even a 1-**byte** match might not be found, the output cannot contain only pointers. The compression algorithm solves this problem by outputting after the pointer the first byte in the lookahead buffer after the match. If no match is found, the algorithm outputs a null-pointer and the byte at the **coding position**.

3.1.7.2.1.4 Compression Process Example

The following table shows the **input stream** that is used for this compression example. The bytes in the input, "AABCBBABC," occupy the first nine positions of the stream.

Input stream

Pos	1	2	3	4	5	6	7	8	9
Byte	A	A	B	C	B	B	A	B	C

The following table shows the output from the compression process. The table includes the following columns:

Step: Indicates the number of the encoding step. A step in the table finishes every time that the encoding algorithm makes an output. With the compression algorithm, this process happens in each pass through step 3.

Pos: Indicates the **coding position**. The first byte in the **input stream** has the coding position 1.

Match: Shows the longest **match** found in the **window**.

Byte: Shows the first **byte** in the **lookahead buffer** after the match.

Output: Presents the output in the format (B,L)C, where (B,L) is the pointer (P) to the match. This gives the following instructions to the decoder: Go back B bytes in the window and copy L bytes to the output. C is the explicit byte.

Note One or more pointers might be included before the explicit byte that is shown in the Byte column.

Compression process output

Step	Pos	Match	Byte	Output
1.	1	--	A	(0,0)A
2.	2	A	B	(1,1)B
3.	4	--	C	(0,0)C
4.	5	B	B	(2,1)B
5.	7	A B	C	(5,2)C

The result of compression, conceptually, is the output column – that is, a series of bytes and optional metadata that indicates whether that byte is preceded by some sequence of bytes that is already in the output.

Because representing the metadata itself requires bytes in the output stream, it is inefficient to represent a single byte that has previously been encoded by two bytes of metadata (offset and length). The overhead of the metadata bytes equals or exceeds the cost of outputting the bytes directly. Therefore, the server protocol only considers sequences of bytes to be a match if the sequences have three or more bytes in common.

3.1.7.2.2 DIRECT2 Encoding Algorithm

The basic notion of the DIRECT2 encoding algorithm is that data appears unchanged in the compressed representation (it is not recommended to try to further compress the data by, for example, applying Huffman compression to that payload), and metadata is encoded in the same output stream, and in line with, the data.

The key to decoding the compressed data is recognizing what **bytes** are metadata and what bytes are data. The decoder MUST be able to identify the presence of metadata in the compressed and encoded data stream. Bitmasks are inserted periodically in the byte stream to provide this information to the decoder.

This section describes the bitmasks that enable the decoder to distinguish data from metadata. It also describes the process of encoding the metadata.

3.1.7.2.2.1 Bitmask

To distinguish data from metadata in the compressed byte stream, the data stream begins with a 4-**byte** bitmask that indicates to the decoder whether the next byte to be processed is data ("0" value in the bit), or if the next byte (or series of bytes) is metadata ("1" value in the bit). If a "0" bit is encountered, the next byte in the **input stream** is the next byte in the output stream. If a "1" bit is encountered, the next byte or series of bytes is metadata that MUST be interpreted further.

For example, a bitmask of 0x01000000 indicates that the first seven bytes are actual data, followed by encoded metadata that starts at the eighth byte. The metadata is followed by 24 additional bytes of data.

When the bitmask has been consumed, the next four bytes in the input stream are another bitmask.

3.1.7.2.2.2 Encoding Metadata

In the output stream, actual data **bytes** are stored unchanged. Bitmasks are stored periodically to indicate whether the next byte or bytes are data or metadata. If the next bit in the bitmask is "1", the next set of bytes in the input data stream is metadata. This metadata contains an offset back to the start of the data to be copied to the output stream, and the length of the data to be copied.

To represent the metadata as efficiently as possible, the encoding of that metadata is not fixed in length. The encoding algorithm supports the largest possible floating compression window to increase the probability of finding a large match; the larger the window, the greater the number of bytes that are needed for the offset. The encoding algorithm also supports the longest possible **match**; the longer the match length, the greater the number of bytes that are needed to encode the length.

3.1.7.2.2.3 Metadata Offset

This protocol assumes the metadata is two **bytes** in length, where the high-order 13 bits are a first complement of the offset, and the low-order three bits are the length. The offset is only encoded with those 13 bits; this value cannot be extended and defines the maximum size of the compression floating window. For example, the metadata 0x0018 is converted into the offset b'000000000011', and the length b'000'. In integers, the offset is '-4', computed by inverting the offset bits, treating the result as a 2s complement, and converting to integer.

3.1.7.2.2.4 Match Length

Unlike the metadata offset, the **match** length is extensible. If the length is less than 10 **bytes**, it is encoded in the three low-order bits of the 2-byte metadata. Although three bits seems to allow for a maximum length of six (the value b'111' is reserved), because the minimum match is three bytes, these three bits actually allow for the expression of lengths from three to nine. The match length goes from L = b'000' + 3 bytes, to L = b'110' + 3 bytes. Because smaller lengths are much more common than the larger lengths, the algorithm tries to optimize for smaller lengths. To encode a length between three and nine, we use the three bits that are "in-line" in the 2-byte metadata.

If the length of the match is greater than nine bytes, an initial bit pattern of b'111' is put in the three bits. This does not signify a length of 10 bytes, but instead a length that is greater than or equal to 10, which is included in the low-order nibble of the following byte.

Every other time that the length is greater than nine, an additional byte follows the initial 2-byte metadata. The first time that the additional byte is included, the low-order nibble is used as the additive length. The next nibble is "reserved" for the next metadata instance when the length is greater than nine. Therefore, the first time that the decoder encounters a length that is greater than nine, it reads the next byte from the data stream and the low-order nibble is extracted and used to compute length for this metadata instance. The high-order nibble is remembered and used the next time that the decoder encounters a metadata length that is greater than nine. The third time that a length that is greater than nine is encountered, another extra byte is added after the 2-byte metadata, with the low-order nibble used for this length and the high-order nibble reserved for the fourth length that is greater than nine, and so on.

If the nibble from this "shared" byte is all 1s (for example, b'1111'), another byte is added after the shared byte to hold more length. In this manner, a length of 24 is encoded as follows:

b'111' (in the three bits in the original two bytes of metadata), plus

b'1110' (in the nibble of the 'shared' byte of extended length)

b'111' means 10 bytes plus b'1110', which is 14, which results in a total of 24.

If the length is more than 24, the next byte is also used in the length calculation. In this manner, a length of 25 is encoded as follows:

b'111' (in the three bits in the original two bytes of metadata), plus

b'1111' (in the nibble of the 'shared' byte of extended length), plus

b'00000000' (in the next byte)

This scheme is good for lengths of up to 278 (a length of 10 in the three bits in the original two bytes of metadata, plus a length of 15 in the nibble of the 'shared' byte of extended length, plus a length of up to 254 in the extra byte).

A "full" (all b'1') bit pattern (b'111', b'1111', and b'11111111') means that there is more length in the following two bytes.

The final two bytes of length differ from the length information that comes earlier in the metadata. For lengths that are equal to 280 or greater, the length is calculated only from these last two bytes, and is not added to the previous length bits. The value in the last two bytes, a 16-bit integer, is three less than the metadata length. These last two bytes allow for a match length of up to 32,768 bytes + 3 bytes (the minimum match length).

The following table summarizes the length representation in metadata.

Note Length is computed from the bits that are included in the metadata plus the minimum match length of three.

Length representation in metadata

Match Length	Length Bits in the Metadata
24	b'111' (three bits in the original two bytes of metadata) + b'1110' (in the high or lower-order nibble, as appropriate, of the shared byte)
25	b'111' (three bits in the original two bytes of metadata) + b'1111' (in the high or lower-order nibble, as appropriate, of the shared byte) + b'00000000' (in the next byte)
26	b'111' (three bits in the original two bytes of metadata) + b'1111' (in the high or lower-order nibble, as appropriate, of the shared byte) + b'00000001' (in the next byte)
279	b'111' (three bits in the original two bytes of metadata) + b'1111' (in the high or lower-order nibble, as appropriate, of the shared byte) + b'11111110' (in the next byte)
280	b'111' (three bits in the original two bytes of metadata)

Match Length	Length Bits in the Metadata
	b'1111' (in the high or lower-order nibble, as appropriate, of the shared byte) b'11111111' (in the next byte) 0x0115 (in the next two bytes). These two bytes represent a length of 277 + 3 (minimum match length). **Note** All the length is included in the final two bytes and is not additive, as were the previous length calculations for lengths that are smaller than 280 bytes.
281	b'111' (three bits in the original two bytes of metadata) b'1111' (in the high or lower-order nibble, as appropriate, of the shared byte) b'11111111' (in the next byte) 0x0116 (in the next two bytes). This is 278 + 3 (minimum match length). **Note** All the length is included in the final two bytes and is not additive, as were the previous length calculations for lengths that are smaller than 280 bytes.

A "full" bit pattern in that last half word does not mean that more metadata is coming after the last bytes.

The LZ77 compression algorithm produces a well-compressed encoding for small valued lengths, but as the length increases, the encoding becomes less well compressed. A match length of greater than 278 bytes requires a relatively large number of bits: 3+4+8+16. This includes three bits in the original two bytes of metadata, four bits in the nibble in the 'shared' byte, eight bits in the next byte, and 16 bits in the final two bytes of metadata.

3.1.7.3 Obfuscation Algorithm

Obfuscation is used to obscure any easily readable messaging data being transmitted between the client and server across the network. This is not intended as a security feature. If a client requests to have secure communications with the server, it MUST use RPC-level packet encryption.

The algorithm used to obscure data is straightforward and simple. Every **byte** of the data to be obfuscated has XOR applied with the value 0xA5.

3.1.7.4 Extended Buffer Packing

As mentioned in section 3.1.7.1.2.2, the *rgbOut* field of method **EcDoRpcExt2** can contain more than one extended buffer, each with an **RPC_HEADER_EXT** header. This concept is called "packing". The server has the ability to "pack" additional response data into the *rgbOut* field based on whether the client has requested this functionality through passing flag Chain in the *pulFlags* field and whether the remote operation (ROP) in the *rgbIn* request buffer on the **EcDoRpcExt2** method support "packing". The ROP commands that support "packing" are **RopQueryRows** ([MS-OXCTABL] section 2.2.2.5), **RopReadStream** ([MS-OXCPRPT] section 2.2.15), and **RopFastTransferSourceGetBuffer** ([MS-OXCFXICS] section 2.2.3.1.1.5).

When processing ROP requests, the server MUST NOT produce more than 32 KB worth of response data for all ROP requests. However, when the server finishes processing a **RopQueryRows** ([MS-OXCROPS] section 2.2.5.4), **RopReadStream** ([MS-OXCROPS] section 2.2.9.2), and **RopFastTransferSourceGetBuffer** ([MS-OXCROPS] section 2.2.12.3) from the *rgbIn* request buffer and it was the last ROP command in the request buffer and the client has requested "packing" through the Chain flag and there is residual room in the *rgbOut* response buffer, the server can add additional data to the *rgbOut* response buffer with its own **RPC_HEADER_EXT** header.

For the server to produce additional response data, it MUST build a response "as if" the client sent another request with only a **RopQueryRows**, **RopReadStream**, or **RopFastTransferSourceGetBuffer**. The additional response data is also limited to 32 KB in size. The additional ROP response is placed into the *rgbOut* buffer following the previous header and payload with its own **RPC_HEADER_EXT** header. The server can then compress and/or obfuscate this payload if the client requests and set the appropriate flags in the header indicating how the payload has been altered. If there is still more residual room in the *rgbOut* buffer, the server can continue to produce more response data until there is not enough room in the *rgbOut* buffer to hold another response.

The server MUST stop adding additional "packed" buffers to the *rgbOut* response buffer if the residual size of the *rgbOut* response buffer is less than 8 KB for **RopReadStream** and **RopFastTransferSourceGetBuffer** and 32 KB for **RopQueryRows**. The server MUST NOT place more than 96 individual payloads into a single *rgbOut* response buffer.

When it adds additional response data, the server MUST alter the request to reflect what has already been done. For example, if the client requests to read 1,000 rows in **RopQueryRows** and the first payload contains 100 rows, the additional response data MUST be processed "as if" the client only request 900 rows. The server MUST NOT return more data to the client than the client originally requested.

For **RopQueryRows**, the server MUST adjust the row count when adding additional response data. For **RopReadStream**, the server MUST adjust the number of bytes to read when adding additional response data. There is no specific limit for **RopFastTransferSourceGetBuffer**, but the server MUST stop packing additional extended buffers that contain **RopFastTransferSourceGetBuffer** when there is no more data for the fast transfer stream. For **RopFastTransferSourceGetBuffer**, the client requests that the server return all the server data. See [MS-OXCROPS] section 2.2.12.3 for details about how to properly format **RopFastTransferSourceGetBuffer** in this way.

3.1.8 Auxiliary Buffer

Methods **EcDoConnectEx** and **EcDoRpcExt2** allow for additional data to travel between the client and server. This additional data is transferred in the auxiliary buffers of both methods. The *rgbAuxIn* is for auxiliary data being sent from the client to the server and *rgbAuxOut* is for auxiliary data being sent from the server to the client.

Unlike the ROP request and response payloads *rgbIn* and *rgbOut*, there is no request and response nature to the auxiliary buffers. The data sent to the server from the client in the auxiliary input buffer is purely informational and the server is not required to respond in the auxiliary output buffer. The data sent from the server to the client is also informational data that the client might use to alter its behavior against the server.

The data being transferred in the auxiliary buffers is divided into two different categories. The first is client-side performance information, which is statistical information the client can keep regarding its communication with the messaging server or the directory service. Part of this information is for when the client fails to communicate with the messaging server or the directory service. The client can then report this information to the server the next time it communicates. The server is free to analyze this information and provide feedback to help diagnose any potential networking or communications issues with the client/server messaging network infrastructure.

The second category of auxiliary information is server-to-client oriented and enables the server to tell the client about topology characteristics of the messaging system. The client can use this information to change how it interacts with the server.

All information in the auxiliary buffer MUST be added with an **AUX_HEADER** preceding the actual auxiliary information. See section 2.2.2.2 for details about the **AUX_HEADER** and how it is

formatted. Within the **AUX_HEADER** header the fields **Version** and **Type** combined determine which auxiliary block follows the header. Section 2.2.2.2 provides details about how to format the **AUX_HEADER** header to indicate which auxiliary block follows.

If the client or server receives an auxiliary **AUX_HEADER** block with a version and type it does not recognize (that is, does not support), it MUST skip over the entire block without throwing an error. The **AUX_HEADER** contains the length of the **AUX_HEADER** plus the following auxiliary block in the field **Size**, and so skipping the information can be done. This will allow for future expansion to the auxiliary blocks without affecting legacy clients or servers.

3.1.8.1 Client Performance Monitoring

The following are sent from the client to the server in the *rgbAuxIn* auxiliary buffer on method **EcDoConnectEx**. Each of these auxiliary blocks MUST be preceded by a properly formatted **AUX_HEADER** header.

Sent by client to server in EcDoConnectEx

Block	Description
AUX_PERF_CLIENTINFO (see section 2.2.2.6)	Sent to the server as diagnostic information about the client for more robust reporting of networking issues.<20> The client MUST assign a unique **ClientID** parameter for each **AUX_PERF_CLIENTINFO** block sent to the server. The **ClientID** is also used in other performance blocks to identify which client to associate the performance data with.
AUX_PERF_PROCESSINFO (see section 2.2.2.8)	Sent to the server as diagnostic information about the client process for more robust reporting of networking issues. The client MUST assign a unique **ProcessID** for each **AUX_PERF_PROCESSINFO** block sent to the server. The **ProcessID** is also used in other performance blocks to identify which client process to associate the performance data with.
AUX_PERF_SESSIONINFO (see section 2.2.2.4)	Sent to the server as diagnostic information about the client session for more robust reporting of networking issues. The client MUST assign a unique **SessionID** for each **AUX_PERF_SESSIONINFO**/**AUX_PERF_SESSIONINFO_V2** block sent to the server. The **SessionID** is also used in other performance blocks to identify which client session to associate the performance data with. If writing a client, it is recommended that **AUX_PERF_SESSIONINFO_V2** be used instead. A server still supports this older session information auxiliary block. This block can also be passed in the **EcDoRpcExt2** auxiliary input buffer.
AUX_PERF_SESSIONINFO_V2 (see section 2.2.2.5)	Sent to the server as diagnostic information about the client session for more robust reporting of networking issues. The client MUST assign a unique **SessionID** for each **AUX_PERF_SESSIONINFO_V2**/**AUX_PERF_SESSIONINFO** block sent to the server. The **SessionID** is also used in other performance blocks to identify which client session to associate the performance data with. This block can also be passed in the **EcDoRpcExt2** auxiliary input buffer.

The following are sent from the client to the server in the *rgbAuxIn* auxiliary buffer on method **EcDoRpcExt2**. Each of these auxiliary blocks MUST be preceded by a properly formatted **AUX_HEADER** header (see section 2.2.2.2).

Sent by client to server in EcDoRpcExt2

Block	Description
AUX_PERF_SESSIONINFO (see section 2.2.2.4)	Sent to the server as diagnostic information about the client session for more robust reporting of networking issues. The client MUST assign a unique **SessionID** for each **AUX_PERF_SESSIONINFO**/**AUX_PERF_SESSIONINFO_V2** block sent to the server. The **SessionID** is also used in other performance blocks to identify which client session to associate the performance data with. If writing a client, it is recommended that **AUX_PERF_SESSIONINFO_V2** be used instead. A server still supports this older session information auxiliary block. This block can also be passed in the **EcDoConnectEx** auxiliary input buffer.
AUX_PERF_SESSIONINFO_V2 (see section 2.2.2.5)	Sent to the server as diagnostic information about the client session for more robust reporting of networking issues. The client MUST assign a unique **SessionID** for each **AUX_PERF_SESSIONINFO_V2**/**AUX_PERF_SESSIONINFO** block sent to the server. The **SessionID** is also used in other performance blocks to identify which client session to associate the performance data with. This block can also be passed in the **EcDoConnectEx** auxiliary input buffer.
AUX_PERF_SERVERINFO (see section 2.2.2.7)	Sent to the server as diagnostic information about the server that the client is communicating with for more robust reporting of networking issues. The client MUST assign a unique **ServerID** for each **AUX_PERF_SERVERINFO** block sent to the server. The **ServerID** is also used in other performance blocks to identify which server a client is communicating with to associate the performance data.
AUX_PERF_REQUESTID (see section 2.2.2.3)	Sent to the server as diagnostic information about a particular request for more robust reporting of networking issues. The client MUST assign a unique **RequestID** for each **AUX_PERF_REQUESTID** block sent to the server. The **RequestID** is also used in other performance blocks to identify which request to associate the performance data with. The client SHOULD have previously sent **AUX_PERF_SESSIONINFO** or **AUX_PERF_SESSIONINFO_V2** to the server for the **SessionID** field within this block.
AUX_PERF_DEFMDB_SUCCESS (see section 2.2.2.9)	Sent to the server as diagnostic information to report a previously successful RPC call to the messaging server. The client SHOULD have previously sent **AUX_PERF_REQUESTID** to the server for the **RequestID** field within this block.
AUX_PERF_DEFGC_SUCCESS (see section 2.2.2.10)	Sent to the server as diagnostic information to report a previously successful call to the Active Directory directory service. The client SHOULD have previously sent **AUX_PERF_SERVERINFO** and **AUX_PERF_SESSIONINFO**/**AUX_PERF_SESSIONINFO_V2** to the server for the **ServerID** and **SessionID** fields within this block.

Block	Description
AUX_PERF_MDB_SUCCESS (see section 2.2.2.11)	Sent to the server as diagnostic information to report a previously successful RPC call to the messaging server. The client SHOULD have previously sent **AUX_PERF_REQUESTID**, **AUX_PERF_CLIENTINFO**, **AUX_PERF_SERVERINFO**, and **AUX_PERF_SESSIONINFO**/**AUX_PERF_SESSIONINFO_V2** to the server for the **RequestID**, **ClientID**, **ServerID**, and **SessionID** fields within this block. If writing a client, it is recommended that **AUX_PERF_MDB_SUCCESS_V2** be used instead. A server still supports this older session information auxiliary block.
AUX_PERF_MDB_SUCCESS_V2 (see section 2.2.2.12)	Sent to the server as diagnostic information to report a previously successful RPC call to the messaging server. The client SHOULD have previously sent **AUX_PERF_REQUESTID**, **AUX_PERF_PROCESSINFO**, **AUX_PERF_CLIENTINFO**, **AUX_PERF_SERVERINFO**, and **AUX_PERF_SESSIONINFO**/**AUX_PERF_SESSIONINFO_V2** to the server for the **RequestID**, **ProcessID**, **ClientID**, **ServerID**, and **SessionID** fields within this block.
AUX_PERF_GC_SUCCESS (see section 2.2.2.13)	Sent to the server as diagnostic information to report a previously successful call to the directory service. The client SHOULD have previously sent **AUX_PERF_CLIENTINFO**, **AUX_PERF_SERVERINFO**, and **AUX_PERF_SESSIONINFO**/**AUX_PERF_SESSIONINFO_V2** to the server for the **ClientID**, **ServerID**, and **SessionID** fields within this block. If writing a client, it is recommended that **AUX_PERF_GC_SUCCESS_V2** be used instead. A server still supports this older session information auxiliary block.
AUX_PERF_GC_SUCCESS_V2 (see section 2.2.2.14)	Sent to the server as diagnostic information to report a previously successful call to the directory service. The client SHOULD have previously sent **AUX_PERF_PROCESSINFO**, **AUX_PERF_CLIENTINFO**, **AUX_PERF_SERVERINFO**, and **AUX_PERF_SESSIONINFO**/**AUX_PERF_SESSIONINFO_V2** to the server for the **ProcessID**, **ClientID**, **ServerID**, and **SessionID** fields within this block.
AUX_PERF_FAILURE (see section 2.2.2.15)	Sent to the server as diagnostic information to report a previously FAILED call to the messaging server or the directory service. The client SHOULD have previously sent **AUX_PERF_REQUESTID**, **AUX_PERF_CLIENTINFO**, **AUX_PERF_SERVERINFO**, and **AUX_PERF_SESSIONINFO**/**AUX_PERF_SESSIONINFO_V2** to the server for the **RequestID**, **ClientID**, **ServerID**, and **SessionID** fields within this block. If writing a client, it is recommended that **AUX_PERF_FAILURE_V2** be used instead. A server still supports this older session information auxiliary block.
AUX_PERF_FAILURE_V2 (see section 2.2.2.16)	Sent to the server as diagnostic information to report a previously FAILED call to the messaging server or the directory service. The client SHOULD have previously sent **AUX_PERF_REQUESTID**, **AUX_PERF_PROCESSINFO**, **AUX_PERF_CLIENTINFO**, **AUX_PERF_SERVERINFO**, and

Block	Description
	AUX_PERF_SESSIONINFO/**AUX_PERF_SESSIONINFO_V2** to the server for the **RequestID**, **ProcessID**, **ClientID**, **ServerID**, and **SessionID** fields within this block.

3.1.8.2 Server Topology Information

The following are sent from the server to the client in the *rgbAuxOut* auxiliary buffer on method **EcDoConnectEx**. Each of these auxiliary blocks MUST be preceded by a properly formatted **AUX_HEADER** header (see section 2.2.2.2).

Sent by server to client in EcDoConnectEx

Block	Description
AUX_CLIENT_CONTROL (see section 2.2.2.17)	Sent to the client to request a change in client behavior. This is a means for the server to dynamically change client behavior. See section 2.2.2.17 for details about what client behavior the server can adjust. The client alters its behavior based on this request.
AUX_OSVERSIONINFO (see section 2.2.2.18)	Sent to the client as informational data to help the client decide whether it needs to alter its behavior against the server. The data provided to the client is the server's operating system version and operating system service pack information.<21>
AUX_EXORGINFO (see section 2.2.2.19)	Sent to the client as informational data to help the client decide whether it needs to alter its behavior against the server. The data provided informs the client of the presence of public folders within the organization. A client MUST NOT try to open a public **store** if the server informs the client that it is not present or disabled. If this block is not returned to the client, the client assumes that public folders are available within the organization.

The following MAY<22> be sent from the server to the client in the rgbAuxOut auxiliary buffer on method **EcDoRpcExt2**. Each of these auxiliary blocks MUST be preceded by a properly formatted **AUX_HEADER** header (see section 2.2.2.2).

Sent by server to client in EcDoRpcExt2

Block	Description
AUX_CLIENT_CONTROL (see section 2.2.2.17)	Sent to the client to request a change in client behavior. This is a means for the server to dynamically change client behavior. See section 2.2.2.17 for details about what client behavior the server can adjust. The client alters its behavior based on this request.

3.1.9 Version Checking

In the method **EcDoConnectEx**, the client passes the client version to the server. In response, the server returns its version to the client. The server version information indicates to the client what functionality is supported on the server. The client version information indicates to the server what functionality the client supports.

Sometimes the functionality represents a change in the protocol wire format. This section describes the following:

- How version numbers are compared.
- Specific server versions and their associated functionality.
- Specific client versions and their associated functionality.

3.1.9.1 Version Number Comparison

On the wire, client and server versions numbers are passed as three WORD values. See section 3.1.4.11 for details about the **EcDoConnectEx** method. In this method, the fields **rgwClientVersion**, **rgwServerVersion**, and **rgwBestVersion** are all passed as three WORD values. However, manipulation MUST be performed before the numbers can be compared.

Because versions that are passed on the wire were historically represented as only three numbers, the version number was expressed as "XX.XXXX.XXX." The first number represented the product major version. The second number was the build major number. The third number was the build minor number. However, this representation prevented the inclusion of a required fourth number, the product minor number, which is used when shipping service packs.

Version numbers are now expressed in the format "XX.XX.XXXX.XXX". For example, "08.01.0215.000" represents a specific server build. The first number is the product major version. The second number is the product minor version. The third number is the build major number. The fourth number is the build minor number.

However, the version size on the wire did not change: it is still represented as three WORD values. A scheme was devised that converts from the three WORD on-the-wire-format of the version into a four-number version. This is referred to as version number normalization.

All versions are converted into four-number versions before any version checks are performed. The following pseudo-code example describes a function that converts the three WORD value wire version format into a four-number format that can then be used for version comparisons.

```
// This routine converts a three WORD version value into a normalized
// four WORD version value.
//
// Version[] is an array of 3 WORD values on the wire.
// NormalizedVersion[] is an array of 4 WORD values for comparison.
//

IF high-bit of Version[1]is set THEN
    SET NormalizedVersion[0] to high-byte of Version[0]
    SET NormalizedVersion[1] to low-byte of Version[0]
    SET NormalizedVersion[2] to Version[1] with high-bit cleared
    SET NormalizedVersion[3] to Version[2]

ELSE
    SET NormalizedVersion[0] to Version[0]
    SET NormalizedVersion[1] to 0
    SET NormalizedVersion[2] to Version[1]
    SET NormalizedVersion[3] to Version[2]
ENDIF
```

The first WORD is divided into two BYTE values, one being the product major version and the other being the product minor version. On the wire, the client and server need to know whether the version that is being passed is in the old scheme or the new scheme. If the highest bit of the second

WORD value on the wire is set, the version on the wire is in the new scheme. Otherwise, it is interpreted as the old scheme where the product minor version is not sent.

3.1.9.2 Server Versions

The following table shows server version values that are returned to the client on the **EcDoConnectEx** method call. The client can assume that the described functionality exists if the version number that is passed in the RPC buffer is equal to or greater than the server version number in which the functionality was added, as shown in the table.

Server version	Description
6.0.6755.0	The server supports passing the sentinel value 0xBABE in the **BufferSize** field of a **RopFastTransferSourceGetBuffer** request ([MS-OXCFXICS] section 2.2.3.1.1.5).
8.0.295.0	The server supports passing the sentinel value 0xBABE in the **ByteCount** field of a **RopReadStream** request ([MS-OXCPRPT] section 2.2.15).
8.0.324.0	The server supports the flag CLI_WITH_PER_MDB_FIX in the **OpenFlags** field of a **RopLogon** request ([MS-OXCSTOR] section 2.2.1.1 and [MS-OXCSTOR] section 3.2.5.1).
8.0.358.0	The server supports the **EcDoAsyncConnectEx** and **EcDoAsyncWaitEx** RPC function calls.
14.0.324.0	The server supports passing the flag ConversationMembers (0x80) in the **TableFlags** field of a **RopGetContentsTable** request ([MS-OXCFOLD] section 2.2.1.14).
14.0.616.0	The server supports passing the flag HardDelete (0x02) in the **ImportDeleteFlags** field of a **RopSynchronizationImportDeletes** request ([MS-OXCFXICS] section 2.2.3.2.4.5).
14.1.67.0	The server supports passing the flag FailOnConflict (0x40) in the **ImportFlag** field of a **RopSynchronizationImportMessageChange** request ([MS-OXCFXICS] section 2.2.3.2.4.2).<23>

A server implementation needs to determine which level of support it will offer clients. Based on this level of support, it MUST return a server version that corresponds to that support. A server cannot mix and match functionality. To support functionality at one server version level, the server MUST support all functionality from previous server version levels.

3.1.9.3 Client Versions

The following table shows client versions that are passed to the server on the **EcDoConnectEx** method call, where the client can expect the server behavior to change if the version that is transferred on the wire is equal to or greater than client version numbers as listed in the table.

Client version	Description
11.0.0.0	The client supports receiving Unicode strings for all string properties on Recipient row data that is returned from the server on **RopReadRecipients** ([MS-OXCROPS] section 2.2.6.6), **RopOpenMessage** ([MS-OXCROPS] section 2.2.6.1), and **RopOpenEmbeddedMessage** ([MS-OXCROPS] section 2.2.6.16).
11.00.0000.4920	The client supports receiving ecServerBusy in the **ReturnValue** field of the **RopFastTransferSourceGetBuffer** ([MS-OXCROPS] section 2.2.12.3) response. The **BackoffTime** field is present when the ReturnValue is ecServerBusy. If **ReturnValue** is not ecServerBusy, the **BackoffTime** field is not present. For details, see [MS-

Client version	Description
	OXCFXICS] section 2.2.3.1.1.5.
12.00.0000.000	The client supports receiving the errors ecCachedModeRequired, ecRpcHttpDisallowed, and ecProtocolDisabled on the **EcDoConnectEx** call; otherwise, the client will get back ecClientVerDisallowed instead. The client supports topologies that do not have public folders available. For client versions prior to 12.00.0000.000, the server MUST fail the **EcDoConnectEx** call with ecClientVerDisallowed unless **EcDoConnectEx** parameter flag 0x00008000 is passed in the *ulFlags* parameter.
12.00.3118.000	The client supports receiving an **AUX_EXORGINFO** block in the *rgbAuxOut* buffer on the **EcDoConnectEx** call. The server SHOULD return the **AUX_EXORGINFO** block in the *rgbAuxOut* buffer on the **EcDoConnectEx** call.
12.00.3619.000	The client supports receiving the errors ecNotEncrypted on the **EcDoConnectEx** call; otherwise, the client will get back ecClientVerDisallowed. This error is returned when the server is configured to only allow encrypted connections and the client is trying to connect on a nonencrypted connection.
12.00.3730.000	The client supports send optimization for **Incremental Change Synchronization (ICS)** using **PidTagTargetEntryId**. See [MS-OXCFXICS] for more details.
12.00.4207.000	The client supports "packing" of **RopReadStream** in the ROP response buffer of the **EcDoRpcExt2** RPC call. The **RopReadStream** MUST be the last ROP in the request buffer on the **EcDoRpcExt2** call. See section 3.1.7.4 for details about extended buffer "packing".
12.00.4228.0000	The client supports receiving **RopBackoff** in the ROP response buffer of the **EcDoRpcExt2** call. For details, see [MS-OXCROPS] section 3.1.5.1.1.

A client implementation needs to determine which level of support it will offer servers. Based on this level of support, it MUST pass a client version that corresponds to that support. A client cannot mix and match functionality. To support functionality at one client version level, it MUST support all functionality from previous client version levels.

3.2 EMSMDB Client Details

3.2.1 Abstract Data Model

For some functionality on the **EMSMDB** interface, it is required that the client store a session context handle and use it on subsequent interface calls that require a session context handle.

3.2.2 Timers

No protocol timers are required beyond the internal timers that are used in RPC to implement resiliency to network outages. For details, see [MS-RPCE].

3.2.3 Initialization

The client creates an RPC connection to the remote server using the details described in section 2.1.

Establishing a connection with the server requires authentication. The RPC binding handle MUST have an authentication method defined.

3.2.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR data consistency check at target level 5.0, as specified in section 3 of [MS-RPCE].

Upon the completion of the RPC method, the client returns the result unmodified to the higher layer. Some method calls require an RPC context handle, which is created in another method call. For details about method dependencies, see section 3.

A client SHOULD<24> use different RPC methods based on the product version being run on the server that it is accessing.

3.2.4.1 Sending EcDoConnectEx

When issuing the interface call **EcDoConnectEx**, some parameters need additional client-side consideration beyond what is stated in section 3.1.4.11. The following is a list of parameters for which the client has specific handling:

hBinding: A valid RPC binding handle that MUST have a server name, protocol sequence, and authentication method defined. Some protocol sequences have named endpoints that MUST be used. See section 2.1 for details about how to create a binding handle.

pcxh: On success, this field will contain the session context handle. On failure, this value is NULL. The session context handle MUST be stored on the client and used in subsequent calls on the **EMSMDB** interface that require a valid session context handle.

ulConMod: The connection modulus hash is determined by the client for a connection. How the client determines the hash value is not important. The client ensures that for a particular distinguished name passed in field **szUserDN**, the hash value is always the same. It is acceptable to have the same hash value for different distinguished names. The client is free to send any 32-bit value.

cbLimit: A client MUST pass a value of 0x00000000.

ulIcxrLink: This value is used to link the Session Context that is created by this call with an existing Session Context on the server that was created by a previous call to **EcDoConnectEx**.<25>

A client can link two Session Contexts for the following reasons:

1.To consume a single Client Access License (CAL) for all the connections made from a single client computer. This gives a client the ability to open multiple independent connections using more than one Session Context on the server, but be seen to the server as only consuming a single CAL.<26>

2.To get pending notification information for other sessions on the same client computer. See **RopPending** in [MS-OXCNOTIF] section 3.1.5.1.1 for details.

If a client does not want to link two Session Contexts or if this is the first call to **EcDoConnectEx**, the client MUST pass a value of 0xFFFFFFFF.

Note that the *ulIcxrLink* parameter is defined as a 32-bit value. Other than passing 0xFFFFFFFF for no Session Context link, the client passes a value with the high-order 16-bits set to zero and the low-order 16-bits MUST be the value returned in field *piCxr* from a previous **EcDoConnectEx** call.

usFCanConvertCodePages: The client MUST pass a value of 0x0001.

pcmsPollsMax: On success, this value is the number of milliseconds the client waits before polling the server for notification information. On failure, the value of this field is undefined and SHOULD be ignored. Other more dynamic options are available to the client for receiving notifications from the server. See [MS-OXCNOTIF] for details about working with Notifications. The client saves this value and associates it with the session context handle.

pcRetry: On success, this value is the number of times the client retries a subsequent **EMSMDB** method call that uses the session context handle that is returned in field *pcxh*. On failure, the value of this field is undefined and SHOULD be ignored. See section 3.2.4.3 for details about retrying RPC calls. The client saves this value and associates it with the session context handle.

pcmsRetryDelay: On success, this value is the number of milliseconds a client waits before retrying a subsequent **EMSMDB** method call that uses the session context handle that is returned in field *pcxh*. On failure, the value of this field is undefined and SHOULD be ignored. See section 3.2.4.3 for details about retrying RPC calls. The client saves this value and associates it with the session context handle.

piCxr: On success, this value is a 16-bit session index that can be used in conjunction with the value returned in pulTimeStamp to link two Session Contexts on the server. On failure, the value of this field is undefined and SHOULD be ignored. See field *ulIcxrLink* for details about how to link Session Contexts and the reason why a client might want to do so.<27>

The client saves this value and associates it with the session context handle. It is the session index returned in a **RopPending** response command on calls to **EcDoRpcExt2**. The **RopPending** response command tells the client that a Session Context on the server has pending notifications. If a client links Session Contexts, a **RopPending** can be returned for any linked Session Context. See [MS-OXCROPS] section 3.1.5.1.3 and [MS-OXCNOTIF] section 3.1.5.1.1 for details about **RopPending**.

rgwClientVersion: The client MUST pass the version number of the highest client protocol version it supports. This value will provide information to the server about the protocol functionality that the client supports. For details about how version numbers are interpreted from the wire data and the expected client behavior, see section 3.1.9.

rgwServerVersion: On success, this value is the server protocol version that the client uses to determine what protocol functionality the server supports. On failure, the value of this field is undefined and SHOULD be ignored. For details about how version numbers are interpreted from the wire data and the expected server behavior, see section 3.1.9. The client saves this value and associates it with the session context handle.

pulTimeStamp: If a client requests to link the Session Context that is created by this call to a previously created Session Context, the client MUST pass on input the session creation time stamp returned in *pulTimeStamp* on a previous **EcDoConnectEx** call. If the client does not want to link Session Contexts, the client passes value 0x00000000.<28>

On success, this value is the Session Context creation time stamp. On failure, the value of this field is undefined and SHOULD be ignored. The server saves the Session Context creation time stamp and associate it with the session context handle.

3.2.4.2 Sending EcDoRpcExt2

When issuing the interface call **EcDoRpcExt2** some parameters require additional client-side consideration beyond what is stated in section 3.1.4.12. The following is a parameter for which the client has specific handling:

pcxh: The client MUST pass a valid session context handle that was created by calling **EcDoConnectEx**. On output, the server might have prematurely closed the client's session by clearing the session context handle to zero. If the value on output is zero, the Session Context on the server has been destroyed.

3.2.4.3 Handling Server Too Busy

All method calls that require a valid session context handle are to be retried if the call fails with RPC status RPC_S_SERVER_TOO_BUSY (0x000006BB). The number of times the client retries and the amount of time the client waits before retrying is based on fields *pcRetry* and *pcmsRetryDelay* returned on **EcDoConnectEx**. **EcDoConnectEx** is the only method that creates a session context handle, so it is a prerequisite for any method that requires a session context handle.

3.2.4.4 Handling Connection Failures

If the client's connection to the server fails or if the server prematurely disconnects a client by clearing the session context handle in the response to an **EMSMDB** method call, the client cleans up any saved session state information and close the session context handle if it is not already set to zero. The binding handle of the session is to be closed.

A client might choose to reconnect to the server automatically by creating a new binding handle and calling **EcDoConnectEx**. This will create a new Session Context on the server. Note that all Server objects previously opened on the server will no longer exist and the client MUST issue ROP commands if the client wants to recreate or reopen the Server objects.

3.2.4.5 Handling Endpoint Consolidation

During the first connection to the server, the client does not know whether the server supports port consolidation. If the client receives the **AUX_ENDPOINT_CAPABILITIES** auxiliary buffer (section 2.2.2.21) in the server's response to the **EcDoConnectEx** method initiated by the client, then the client SHOULD<29> save the information so that on subsequent connections to that server the client can consolidate the RFRI, NSPI, and EMSMDB interfaces to a single port, such as port 6001. There is no requirement that the client consolidate the interfaces since this behavior is completely optional.

There is always a one reconnection lag until the client connects in the most optimal way.

3.2.5 Timer Events

None.

3.2.6 Other Local Events

None.

3.3 AsyncEMSMDB Server Details

The server responds to messages it receives from the client.

3.3.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains 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 document.

The abstract data model for this interface is the same as that for the **EMSMDB** interface. See section 3.1.1 for details about Session Context and session context handles.

Some methods on this interface require Session Context information to be stored on the server and used across multiple interface calls for a long duration of time. For these method calls, this protocol is stateful. The server stores this Session Context information and provides a session context handle to the client to make subsequent interface calls using this same Session Context information.

The **AsyncEMSMDB** uses asynchronous context handle, which are RPC context handles. Every asynchronous context handle maps to the Session Context that is associated with a session context handle. There is only one asynchronous context handle for a Session Context.

All methods on the **AsyncEMSMDB** interface that use an asynchronous context handle are performed against the Session Context that is associated with the asynchronous context handle.

The server keeps a mapping between the asynchronous context handle and an active Session Context on the server. Session Context can be created and destroyed through the **EMSMDB** interface.

When the Session Context is destroyed or the client connection is lost, the asynchronous context handle becomes invalid and will be rejected if used.

3.3.2 Timers

None.

3.3.3 Initialization

The server MUST do the following:

1.Register the different protocol sequences that will allow clients to communicate with the server. The supported protocol sequences are specified in section 2.1. Note that some protocol sequences use named endpoints, which are also specified in section 2.1.

2.Register the different authentication methods that are allowed on the **AsyncEMSMDB** interface:

- RPC_C_AUTHN_WINNT
- RPC_C_AUTHN_GSS_KERBEROS
- RPC_C_AUTHN_GSS_NEGOTIATE

A client authenticates using one of these authentication methods.

3.Start listening for RPC calls.

4.Register the **AsyncEMSMDB** interface.

5.Register the **AsyncEMSMDB** interface to all the registered binding handles created previously.

3.3.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR data consistency check at target level 5.0, as specified in [MS-RPCE] section 3.1.1.5.3.2.

This interface includes the following method:<30>

Method	opnum	Description
EcDoAsyncWaitEx	0	Asynchronous call that the server will not complete until there are pending events on the Session Context. The method requires an active asynchronous context handle returned from **EcDoAsyncConnectEx** on interface **EMSMDB**.

3.3.4.1 EcDoAsyncWaitEx (opnum 0)

The method **EcDoAsyncWaitEx** is an asynchronous call that the server will not complete until there are pending events on the Session Context up to a five minute duration. If no events are available within five minutes of the time that the client last accessed the server through a call to **EcDoRpcExt2**, the server will return the call and will not set the NotificationPending flag in the *pulFlagsOut* field. If an event is pending, the server will complete the call immediately and return the NotificationPending flag in the *pulFlagsOut* field. This call requires an active asynchronous context handle returned from **EcDoAsyncConnectEx** on interface **EMSMDB**. The asynchronous context handle is associated with the Session Context.

This method is part of Notification handling. For more information about notifications, see [MS-OXCNOTIF].

```
long __stdcall EcDoAsyncWaitEx(
     [in] ACXH acxh,
     [in] unsigned long ulFlagsIn,
     [out] unsigned long *pulFlagsOut
);
```

acxh: On input, the client MUST pass a valid asynchronous context handle that was created by calling **EcDoAsyncConnectEx** on interface **EMSMDB**. The server uses the asynchronous context handle to identify the Session Context to use for this call.

ulFlagsIn: Unused. Reserved for future use. Client MUST pass a value of 0x00000000.

pulFlagsOut: Output flags for the client.

Flag	Value	Description
NotificationPending	0x00000001	Signals that events are pending for the client on the Session Context on the server. The client MUST call **EcDoRpcExt2** (with additional data in the ROP request buffer if there is additional data to send to the server, or with an empty ROP request buffer if there is no additional data to send to the server). The server will return the event details in the ROP response buffer.

Error Codes: If the method succeeds, the return value is 0. If the method fails, the return value is an implementation-specific error code or one of the protocol-defined error codes listed in the following table.

Name	Value	Meaning
Rejected	0x000007EE	There is already an **EcDoAsyncWaitEx** call outstanding on this asynchronous context handle.

Name	Value	Meaning
Exiting	0x000003ED	The server is shutting down.

Exceptions Thrown: No exceptions are thrown beyond those thrown by the underlying RPC protocol [MS-RPCE].

3.3.5 Timer Events

None.

3.3.6 Other Local Events

None.

3.4 AsyncEMSMDB Client Details

3.4.1 Abstract Data Model

For some functionality on the **AsyncEMSMDB** interface, it is required that the client store an asynchronous context handle and use it on subsequent interface calls that require an asynchronous context handle.

3.4.2 Timers

No protocol timers are required beyond those internal timers used in RPC to implement resiliency to network outages. For details, see [MS-RPCE].

3.4.3 Initialization

This interface can only be used after first obtaining an asynchronous context handle from the method **EcDoAsyncConnectEx** from interface **EMSMDB**.

3.4.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR data consistency check at target level 5.0, as specified in [MS-RPCE] section 3.1.1.5.3.2.

Upon the completion of the RPC method, the client returns the result unmodified to the higher layer. Some method calls require an RPC context handle, which is created in another method call. For details about method dependencies, see section 3.

A client SHOULD<31> use different RPC methods based on the product version being run on the server that it is accessing.

3.4.5 Timer Events

None.

3.4.6 Other Local Events

None.

4 Protocol Examples

The following are examples of how a client and server use this protocol connection, submit ROP commands, and disconnect.

4.1 Client Connecting to Server

1.Client creates an RPC binding handle to the server with the "ncacn_ip_tcp" protocol sequence and the RPC_C_AUTHN_WINNT authentication method.

2.Client makes **EMSMDB** interface method call **EcDoConnectEx** (section 3.1.4.11) with the following parameters to establish a Session Context with the server:

hBinding: binding handle created in step 1.

pcxh: Pointer to session context handle to hold output value. In this example the client initializes session context handle to zero.

szUserDN: User's distinguished name. String that contains the distinguished name of the user who is making the **EcDoConnectEx** call in a directory service. Value: "/o=First Organization/ou=First Administrative Group/CN=recipients/CN=janedow".

ulFlags: Value 0x00000000. Regular user access.

ulConMod: Value 0x00340567. Client computed hash on szUserDN value.

cbLimit: Value 0x00000000.

ulCpid: Value 0x000004E4. code page 1252.

ulLcidString: Value 0x00000409. **locale** 1033 "en-us".

ulLcidSort: Value 0x00000409. locale 1033 "en-us".

ulIcxrLink: Value 0xFFFFFFFF. No session link.

usFCanConvertCodePages: Value 0x0001.

rgwClientVersion: Pointer to unsigned short array containing values: 0x000C, 0x183E, and 0x03E8. Client supports protocol client version 12.6206.1000.

pulTimeStamp: Pointer to unsigned long value 0x00000000.

rgbAuxIn: Null pointer value.

cbAuxIn: Value 0x00000000.

rgbAuxOut: Pointer to buffer of size 0x1008.

pcbAuxOut: Pointer to unsigned long value 0x00001008.

3.Server processes **EcDoConnectEx** request. Verifies that authentication context associated with *hBinding* handle has ownership privileges to a directory service object that contains a distinguished name in field *szUserDN*. Server creates Session Context and assigns a session context handle (using 0x00001234 for this example). Server returns the following output values:

pcxh: Value at CXH pointer is 0x00001234. Note that the actual RPC context handle returned to the client in this field might not be what the server returned. The RPC layer on the server and client

might map the context handle. The context handle returned to the client is guaranteed to be unique and will map back to the server assigned context handle if used on subsequent calls to the server.

pcmsPollsMax: Value at unsigned long pointer is 0x0000EA60. In this example the client is instructed to poll for events every 60 seconds.

pcRetry: Value at unsigned long pointer is 0x00000006. In this example the client is instructed to retry six times before failing.

pcmsRetryDelay: Value at unsigned long pointer is 0x00001770. In this example the client is instructed to wait 10 seconds between each retry.

picxr: Value at unsigned short pointer is a server assigned session index with value 0x0304.

szDNPrefix: Value at unsigned char pointer is a pointer to a null-terminated ANSI string with value "/o=First Group/ou=First Administrative Group/CN=Configuration/CN=Servers/CN=MBX-SRV-02".

szDisplayName: Value at unsigned char pointer is a pointer to a null-terminated ANSI string with value "MBX-SRV-02".

rgwServerVersion: Value at unsigned short array contains values: 0x0008, 0x82B4, and 0x0003. Server supports protocol server version 8.0.692.3.

rgwBestVersion: Value at unsigned short array contains values: 0x000C, 0x183E, and 0x03E8.

pulTimeStamp: Value at unsigned long pointer is a 32-bit value that represents the internal server time when the Session Context was created.

rgbAuxOut: Server returns the following extended buffer and payload containing auxiliary information.

RPC_HEADER_EXT				**Payload**			
				AUX_HEADER			AUX_EXORGINFO
Version	flags	Size	SizeActual	Size	Version	Type	OrgFlags
0x0000	0x0004	0x0008	0x0008	0x0008	0x01	0x17	0x00000001

Payload is not compressed and not obfuscated.

pcbAuxOut: Value at unsigned long pointer is 0x00000010. Field *rgbAuxOut* is 16 bytes in length.

Return Value: Value is 0x00000000.

4.2 Client Issuing ROP Commands to Server

1.Client has already established a Session Context with the server and has a valid session context handle. For more information, see steps 1 through 3 of section 4.1.

2.Client sends ROP commands to server by calling **EcDoRpcExt2** (section 3.1.4.12) using the session context handle returned from the **EcDoConnectEx** (section 3.1.4.11) call.

pcxh: Pointer to CXH value which is 0x00001234.

pulFlags: Pointer to unsigned long containing value 0x00000003. Client requests server to not compress or XOR payload of *rgbOut* and *rgbAuxOut*.

rgbIn: Client passes extended buffer and payload containing ROP commands to be processed by server. See [MS-OXCROPS] for details about ROP commands.

RPC_HEADER_EXT				**Payload**		
				ROP Request Commands		
Version	flags	Size	SizeActual	RopSize	ROPs	ServerObjectHandleTable
0x0000	0x0004	0x0152	0x0152	0x0142	320 bytes	16 bytes

Payload is not compressed and not obfuscated.

cbIn: Value of 0x0000015A.

rgbAuxIn: Null pointer value.

cbAuxIn: Value of 0x00000000.

rgbOut: Pointer to buffer of size 0x00018008.

pcbOut: Pointer to unsigned long value 0x00018008.

rgbAuxOut: Pointer to buffer of size 0x1008.

pcbAuxOut: Pointer to unsigned long value 0x00001008.

3.Server processes **EcDoRpcExt2** request. Server verifies that the session context handle is for a valid Session Context for this user. Server processes **ROP request** commands and returns **ROP response** results to client. Server returns the following output values:

pcxh: Value at CXH pointer is 0x00001234.

pulFlags: Value at unsigned long is 0x00000000.

rgbOut: Server returns the following extended buffer and payload containing ROP response commands:

RPC_HEADER_EXT				**Payload**		
				ROP Response Commands		
Version	flags	Size	SizeActual	RopSize	ROPs	ServerObjectHandleTable
0x0000	0x0004	0x0052	0x0052	0x0042	64 bytes	16 bytes

Payload is not compressed and not obfuscated.

pcbOut: Value is 0x0000005A.

rgbAuxOut: Server returns nothing in the auxiliary output buffer.

pcbAuxOut: Value is 0x00000000.

pulTransTime: Value at unsigned long pointer is 0x00000010. Contains the number of milliseconds it took the server to process the **EcDoRpcExt2** call.

Return Value: Value is 0x00000000.

4.3 Client Receiving "Packed" ROP Response from Server

1.Client has already established a Session Context with the server and has a valid session context handle. For more information, see steps 1 through 3 of section 4.1.

2.Client sends ROP commands to server by calling **EcDoRpcExt2** (section 2.2.9.2) using the session context handle that is returned from the **EcDoConnectEx** (section 2.2.9.2) call. The last ROP request contains **RopReadStream** ([MS-OXCROPS] section 2.2.9.2), and so client requests response chaining (for example, "packing").

pcxh: Pointer to CXH value, which is 0x00001234.

pulFlags: Pointer to unsigned long containing value 0x00000007. Client requests server to not compress or XOR payload of *rgbOut* and *rgbAuxOut*. Client requests response chaining.

rgbIn: Client passes extended buffer and payload containing ROP commands to be processed by server. See [MS-OXCROPS] for details about ROP commands.

RPC_HEADER_EXT				**Payload**		
				ROP request Commands		
Version	flags	Size	SizeActual	RopSize	ROPs	SOHT
0x0000	0x0004	0x0152	0x0152	0x0142	320 bytes (last ROP command is **RopReadStream**)	16 bytes

Payload is not compressed and not obfuscated.

cbIn: Value of 0x0000015A.

rgbAuxIn: Null pointer value.

cbAuxIn: Value of 0x00000000.

rgbOut: Pointer to buffer of size 0x00018008.

pcbOut: Pointer to unsigned long value 0x00018008.

rgbAuxOut: Pointer to buffer of size 0x1008.

pcbAuxOut: Pointer to unsigned long value 0x00001008.

3.Server processes **EcDoRpcExt2** request. Server verifies that the session context handle is for a valid Session Context for this user. Server processes ROP request commands and returns ROP response results to client. The last ROP was **RopReadStream**, and the client has requested chaining; there is more data to return in the stream being read, there is more room in the *rgbOut* output buffer and the server adds another extended buffer and payload. The server returns the following output values:

pcxh: Value at CXH pointer is 0x00001234.

pulFlags: Value at unsigned long is 0x00000000.

rgbOut: Server returns two extended buffer header and payload pairs containing ROP response commands. The last payload contains only the **RopReadStream** command.

RPC_HEADER_EXTflags : 0x0000Size: 0x7FFE	Payload			RPC_HEADER_EXTflags : 0x0004Size: 0x2008	Payload		
	ROP response Commands				ROP response Command		
	RopSize 0x7FEE	ROPs	SOHT 16 bytes		RopSize 0x1FF8	ROP	SOHT 16 bytes

Payloads are not compressed and not obfuscated.

pcbOut: Value is 0x0000A016.

rgbAuxOut: Server returns nothing in the auxiliary output buffer.

pcbAuxOut: Value is 0x00000000.

pulTransTime: Value at unsigned long pointer is 0x00000010. Contains the number of milliseconds it took the server to process the **EcDoRpcExt2** call.

Return Value: Value is 0x00000000.

4.4 Client Disconnecting from Server

1.Client has already established a Session Context with the server and has a valid session context handle. For more information, see steps 1 through 3 of section 4.1.

2.Client is exiting and requests to destroy the Session Context on the server. Client issues **EcDoDisconnect** using the session context handle that was returned from the **EcDoConnectEx** (section 3.1.4.11) call.

pcxh: Pointer to CXH value, which is 0x00001234.

3.Server processes **EcDoDisconnect** (section 3.1.4.2) request. Server verifies that the session context handle is for a valid Session Context for this user. Server destroys Session Context and invalidates the session context handle. Server returns the following output values:

pcxh: Value at CXH pointer is 0x00000000.

Return Value: Value is 0x00000000.

5 Security

5.1 Security Considerations for Implementers

To reduce exploits of server code, it is recommended that anonymous access to the server not be granted. To make method calls on the **EMSMDB** and **AsyncEMSMDB** interfaces, only properly authenticated RPC binding handles are allowed.

Most of the **EMSMDB** and **AsyncEMSMDB** interface methods require a session context handle, which can only be created from a successful call to **EcDoConnectEx**. The server verifies that the authentication context on the RPC binding handle has sufficient **permissions** to access the server and create a Session Context. These method calls are used by the client to create a Session Context with the server. They are also used to declare to the server who is attempting to access messaging data on the server through the distinguished name passed in the *szUserDN* field. It is recommended that the server verify that the authentication context on the RPC binding handle has ownership permissions to the directory service object that is associated with the distinguished name. If the authentication context does not have adequate permissions, then the server fails the call and does not create a Session Context.

Although the protocol allows for data compression and data obfuscation on method call **EcDoRpcExt2**, it is recommended that data compression and data obfuscation not be used in place of proper encryption. It is recommended that RPC-level encryption be used by the client when establishing a connection with the server. This will properly encrypt all fields of all method calls on the **EMSMDB** and **AsyncEMSMDB** interfaces.

5.2 Index of Security Parameters

None.

6 Appendix A: Full IDL

For ease of implementation, the full IDL is provided below, where "ms-rpce.IDL" refers to the IDL found in [MS-RPCE] section 6. The syntax uses the IDL syntax extensions as specified in [MS-RPCE] section 2.2.4. For example, as specified in [MS-RPCE] section 2.2.4.9, a pointer_default declaration is not required and pointer_default(unique) is assumed.

```
import "ms-rpce.idl";

typedef [context_handle] void * CXH;
typedef [context_handle] void * ACXH;
// Special restricted types to prevent allocation of big buffers.
typedef [range(0x0, 0x40000)] unsigned long BIG_RANGE_ULONG;
typedef [range(0x0, 0x1008)] unsigned long SMALL_RANGE_ULONG;

 [ uuid (A4F1DB00-CA47-1067-B31F-00DD010662DA),
  version(0.81),
  pointer_default(unique)]
interface emsmdb
{
long __stdcall Opnum0Reserved(
);

long __stdcall EcDoDisconnect(
[in, out, ref] CXH * pcxh
);

long __stdcall Opnum2Reserved(
);

long __stdcall Opnum3Reserved(
);

long __stdcall EcRRegisterPushNotification(
[in, out, ref] CXH * pcxh,
[in] unsigned long iRpc,
[in, size_is(cbContext)]unsigned char rgbContext[],
[in] unsigned short cbContext,
[in] unsigned long grbitAdviseBits,
[in, size_is(cbCallbackAddress)] unsigned char rgbCallbackAddress[],
[in] unsigned short cbCallbackAddress,
[out] unsigned long *hNotification
);

long __stdcall Opnum5Reserved(
);

long __stdcall EcDummyRpc(
[in] handle_t hBinding
);

long __stdcall Opnum7Reserved(
);

long __stdcall Opnum8Reserved(
);

long __stdcall Opnum9Reserved(
```

```
);

long __stdcall EcDoConnectEx(
[in] handle_t hBinding,
[out, ref] CXH * pcxh,
[in, string] unsigned char * szUserDN,
[in] unsigned long ulFlags,
[in] unsigned long ulConMod,
[in] unsigned long cbLimit,
[in] unsigned long ulCpid,
[in] unsigned long ulLcidString,
[in] unsigned long ulLcidSort,
[in] unsigned long ulIcxrLink,
[in] unsigned short usFCanConvertCodePages,
[out] unsigned long * pcmsPollsMax,
[out] unsigned long * pcRetry,
[out] unsigned long * pcmsRetryDelay,
[out] unsigned short * picxr,
[out, string] unsigned char **szDNPrefix,
[out, string] unsigned char **szDisplayName,
[in] unsigned short rgwClientVersion[3],
[out] unsigned short rgwServerVersion[3],
[out] unsigned short rgwBestVersion[3],
[in, out] unsigned long * pulTimeStamp,
[in, size_is(cbAuxIn)] unsigned char rgbAuxIn[],
[in] unsigned long cbAuxIn,
[out, length_is(*pcbAuxOut), size_is(*pcbAuxOut)] unsigned char rgbAuxOut[],
[in, out] SMALL_RANGE_ULONG *pcbAuxOut
);

long __stdcall EcDoRpcExt2(
[in, out, ref] CXH * pcxh,
[in, out] unsigned long *pulFlags,
[in, size_is(cbIn)] unsigned char rgbIn[],
[in] unsigned long cbIn,
[out, length_is(*pcbOut), size_is(*pcbOut)] unsigned char rgbOut[],
[in, out] BIG_RANGE_ULONG *pcbOut,
[in, size_is(cbAuxIn)] unsigned char rgbAuxIn[],
[in] unsigned long cbAuxIn,
[out, length_is(*pcbAuxOut), size_is(*pcbAuxOut)] unsigned char rgbAuxOut[],
[in, out] SMALL_RANGE_ULONG *pcbAuxOut,
[out] unsigned long *pulTransTime
);

long __stdcall Opnum12Reserved(
);

long __stdcall Opnum13Reserved(
);

long __stdcall EcDoAsyncConnectEx(
[in] CXH cxh,
[out, ref] ACXH * pacxh
);

}

[ uuid (5261574A-4572-206E-B268-6B199213B4E4),
  version(0.01),
```

```
  pointer_default(unique)]
interface asyncemsmdb
{
long __stdcall EcDoAsyncWaitEx(
[in] ACXH acxh,
[in] unsigned long ulFlagsIn,
[out] unsigned long *pulFlagsOut
);

}
```

7 Appendix B: 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® Exchange Server 2003
- Microsoft® Exchange Server 2007
- Microsoft® Exchange Server 2010
- Microsoft® Office Outlook® 2003
- Microsoft® Office Outlook® 2007
- Microsoft® Outlook® 2010

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 1.9: Exchange 2010 does not support MSExchangeIS_LPC.

<2> Section 2.1: Exchange 2003 and Exchange 2007 allow all RPC protocol sequences listed in section 2.1. Exchange 2010 allows only the following RPC protocol sequences: ncacn_ip_tcp and ncacn_http. Office Outlook 2003, Office Outlook 2007, and Outlook 2010 use only the following RPC protocol sequences: ncacn_ip_tcp and ncacn_http.

<3> Section 2.1: Exchange 2010 does not support MSExchangeIS_LPC.

<4> Section 2.2.2.2: Exchange 2003, Exchange 2007, and Exchange 2010 do not support the **AUX_ENDPOINT_CAPABILITIES** auxiliary buffer. Office Outlook 2003, the initial release version of Office Outlook 2007, Office Outlook 2007 SP1, Office Outlook 2007 SP2, and Outlook 2010 do not support the **AUX_ENDPOINT_CAPABILITIES** auxiliary buffer. Office Outlook 2007 SP3 supports the **AUX_ENDPOINT_CAPABILITIES** auxiliary buffer.

<5> Section 2.2.2.21: Exchange 2003, Exchange 2007 and Exchange 2010 do not support combined RFRI, NSPI, and EMSMDB interfaces on the same connection.

<6> Section 3.1.4: The following table indicates which **EMSMDB** methods are supported in which product versions.

Method	Exchange 2003	Exchange 2007	Exchange 2010
EcDoDisconnect	X	X	X
EcRRegisterPushNotification	X	X	See section 3.1.4.5.
EcDummyRpc	X	X	X

Method	Exchange 2003	Exchange 2007	Exchange 2010
EcDoConnectEx	X	X	X
EcDoRpcExt2	X	X	X
EcDoAsyncConnectEx		X	X

<7> Section 3.1.4.5: Exchange 2003 and Exchange 2007 support the **EcRRegisterPushNotification** RPC. The initial release version of Exchange 2010 does not support **EcRRegisterPushNotification**, and the returned value will always be ecNotSupported. Exchange 2010 SP2 supports the **EcRRegisterPushNotification** RPC when a registry key is created to support push notifications, as described in [MSFT-ConfigStaticUDPPort].

<8> Section 3.1.4.11: Exchange 2010 does not support Session Context linking. If ulIcxrLink is not 0xFFFFFFFF, then the server will not attempt to search for a session with the same Session Context and link to them. It will then return the same value in the **pulTimeStamp** that was passed in.

<9> Section 3.1.4.11: In Exchange 2003 and the initial release version of Exchange 2007, the server counts individual connections for Client Access License accounting, so Session Context linking is useful in method call **EcDoConnectEx** on the **EMSMDB** interface.

<10> Section 3.1.4.11: Exchange 2010 does not support Session Context linking.

<11> Section 3.1.4.11: Exchange 2010 does not support Session Context linking. If ulIcxrLink is not 0xFFFFFFFF, the server will not attempt to search for a session with the same Session Context and link to it. Rather, it will then return the same value in the **pulTimeStamp** that was passed in.

<12> Section 3.1.4.11: The initial release of Exchange 2010 will fail with ecInvalidParam (0x80070057) if *cbAuxIn* is greater than 0x00000000 and less than 0x00000008.

<13> Section 3.1.4.11: Exchange 2003 and Exchange 2007 return ecRpcAuthentication (0x000004B6) if the authentication context associated with the binding handle does not have enough privilege or the *szUserDN* parameter is empty.

<14> Section 3.1.4.12: Exchange 2003 and Exchange 2007 will fail with error code ecRpcFormat if the request buffer is larger than 0x00008007 bytes in size. The initial release version of Exchange 2010 will fail with error code ecRpcFailed (0x80040115) if the request buffer is larger than 0x00008007 bytes in size.

<15> Section 3.1.4.12: The initial release version of Exchange 2010 will not allow a *cbIn* value smaller than 0x00000008. Exchange 2010 SP1 will fail with error code ecRpcFailed (0x80040115) when *cbIn* is less than 0x00000008.

<16> Section 3.1.4.12: Exchange 2010 does not require that the server fail if the output buffer is less than 0x00008007 bytes. It will fail with ecRpcFailed (0x80040115) if the output buffer is not more than 0x00000008 bytes in size.

<17> Section 3.1.4.12: Exchange 2010 will fail with ecRpcFailed (0x80040115) if the *cbAuxIn* parameter is greater than 0x00000000 and less than 0x00000008.

<18> Section 3.1.4.12: Exchange 2003 and Exchange 2007 support returning data in rgbAuxOut.

<19> Section 3.1.7.1.2.4: Exchange 2003 and Exchange 2007 support returning data in rgbAuxOut.

<20> Section 3.1.8.1: Outlook 2010 by default does not populate **MachineName**, **UserName**, **ClientIP**, and **MacAddress** within **AUX_PERF_CLIENTINFO**.

<21> Section 3.1.8.2: Exchange 2010 does not support sending the AUX_OSVERSIONINFO block.

<22> Section 3.1.8.2: Exchange 2003 and Exchange 2007 support returning data in rgbAuxOut.

<23> Section 3.1.9.2: The initial release version of Exchange 2010 does not support the flag FailOnConflict.

<24> Section 3.2.4: The following table indicates which **EMSMDB** interface methods are used by a client when accessing a computer that is running Exchange 2003.

Method	Office Outlook 2003	Office Outlook 2007	Outlook 2010
EcDoDisconnect	X	X	X
EcRRegisterPushNotification	X	X	X
EcDummyRpc			
EcDoConnectEx	X	X	X
EcDoRpcExt2	X	X	X
EcDoAsyncConnectEx			

The following table indicates which **EMSMDB** interface methods are used by a client when it is accessing a computer that is running Exchange 2007.

Method	Office Outlook 2003	Office Outlook 2007	Outlook 2010
EcDoDisconnect	X	X	X
EcRRegisterPushNotification	X	X	X
EcDummyRpc			
EcDoConnectEx	X	X	X
EcDoRpcExt2	X	X	X
EcDoAsyncConnectEx		X	X

The following table indicates which **EMSMDB** interface methods are used by a client when it is accessing a computer that is running Exchange 2010.

Method	Office Outlook 2003	Office Outlook 2007	Outlook 2010
EcDoDisconnect	X	X	X
EcRRegisterPushNotification	See section 3.1.4.5.		
EcDummyRpc			
EcDoConnectEx	X	X	X
EcDoRpcExt2	X	X	X
EcDoAsyncConnectEx		X	X

<25> Section 3.2.4.1: Exchange 2010 does not support Session Context linking.

<26> Section 3.2.4.1: In Exchange 2003 and the initial release version of Exchange 2007, the server counts individual connections for Client Access License accounting, so Session Context linking is useful in method call **EcDoConnectEx** on the **EMSMDB** interface.

<27> Section 3.2.4.1: Exchange 2010 does not support Session Context linking.

<28> Section 3.2.4.1: Exchange 2010 does not support Session Context linking.

<29> Section 3.2.4.5: Office Outlook 2003, the initial release version of Office Outlook 2007, Office Outlook 2007 SP1, Office Outlook 2007 SP2, and Outlook 2010 do not support port consolidation. Office Outlook 2007 SP3 supports port consolidation. Clients that do not support port consolidation ignore the **AUX_ENDPOINT_CAPABILITIES** buffer.

<30> Section 3.3.4: The following table indicates which **AsyncEMSMDB** methods are supported in which product versions.

Method	Exchange 2003	Exchange 2007	Exchange 2010
EcDoAsyncWaitEx		X	X

<31> Section 3.4.4: The following table indicates which **AsyncEMSMDB** interface methods are used by a client when accessing a computer that is running Exchange 2003.

Method	Office Outlook 2003	Office Outlook 2007	Outlook 2010
EcDoAsyncWaitEx			

The following table indicates which **AsyncEMSMDB** interface methods are used by a client when accessing a computer that is running Exchange 2007.

Method	Office Outlook 2003	Office Outlook 2007	Outlook 2010
EcDoAsyncWaitEx		X	X

The following table indicates which **AsyncEMSMDB** interface methods are used by a client when accessing a computer that is running Exchange 2010.

Method	Office Outlook 2003	Office Outlook 2007	Outlook 2010
EcDoAsyncWaitEx		X	X

8 Change Tracking

This section identifies changes that were made to the [MS-OXCRPC] protocol document between the August 2011 and October 2011 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
3.1.4 Message Processing Events and Sequencing Rules	Updated the product behavior note to include a clarifying reference related to EcRRegisterPushNotification in the EMSMDB method support table.	Y	Content updated.
3.1.4.5 EcRRegisterPushNotification (opnum 4)	Updated product behavior note to indicate that Exchange 2010 SP2 supports the EcRRegisterPushNotification RPC when a registry key is created to support push notification.	Y	Content updated.
3.2.4 Message Processing Events and Sequencing Rules	Updated the product behavior note to include a clarifying reference related to EcRRegisterPushNotification in the EMSMDB method support table.	N	Content updated.

9 Index