

[MS-OXCNOTIF]: Core Notifications Protocol Specification

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Revision Summary

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08/04/2010	5.0	Major	Significantly changed the technical content.

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1 Introduction

This document specifies a protocol for transmitting notifications to a client about certain events on a server. This protocol is commonly used to inform the client about changes that occurred in folders and messages on the server.

1.1 Glossary

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

ASCII
Asynchronous Context Handle (ACXH)
binary large object (BLOB)
change number (CN)
folder ID (FID)
GUID
handle
Logon object
message ID (MID)
property (1)
remote operation (ROP)
remote procedure call (RPC)
ROP request buffer
ROP response buffer
Server object
Server object handle table
Session Context Handle (CXH)
Table object
Unicode

The following terms are specific to this document:

callback address: An object that encapsulates an Internet address registered by a client that a server can use for push **notifications**.

ICS Advisor object: A handle to an object that is created on the server and that receives event notifications.

Internet datagram: The unit of data exchanged between a pair of Internet modules (includes the Internet header).

notification: A message the client receives when a specific event occurs on the server.

notification subscription: A request to receive **notifications** from the server.

outstanding RPC call: An asynchronous **remote procedure call (RPC)** that has not yet been completed by the server.

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.

[MS-OXCFOLD] Microsoft Corporation, "[Folder Object Protocol Specification](#)", April 2008.

[MS-OXCMSG] Microsoft Corporation, "[Message and Attachment Object Protocol Specification](#)", April 2008.

[MS-OXCROPS] Microsoft Corporation, "[Remote Operations \(ROP\) List and Encoding Protocol Specification](#)", April 2008.

[MS-OXCRPC] Microsoft Corporation, "[Wire Format Protocol Specification](#)", April 2008.

[MS-OXCSTOR] Microsoft Corporation, "[Store Object Protocol Specification](#)", April 2008.

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

1.2.2 Informative References

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

[MSDN-ENM] Microsoft Corporation, "Event Notification in MAPI", [http://msdn.microsoft.com/en-us/library/ms528269\(EXCHG.10\).aspx](http://msdn.microsoft.com/en-us/library/ms528269(EXCHG.10).aspx)

[MSDN-WS2] Microsoft Corporation, "Windows Sockets 2", [http://msdn.microsoft.com/en-us/library/ms740673\(VS.85\).aspx](http://msdn.microsoft.com/en-us/library/ms740673(VS.85).aspx)

1.3 Overview

The messaging client can register to receive **notifications** about certain events that can happen on the messaging server. When an event occurs on the server, and a client has registered to receive the notification, the server sends the notification details to the client in the **ROP response buffer** on the **EcDoRpcExt2** calls, as specified in [MS-OXCRPC], in the format described by [RopNotify](#), as specified in [MS-OXCROPS].

The Core Notifications protocol is logically divided into two parts: one that notifies a client about pending notifications, and one that transmits the notifications. The following subsections describe the two parts of the protocol.

1.3.1 Pending Notifications

Because the receipt of notification details is only done through the ROP response buffer that is returned from **EcDoRpcExt2** calls, the server needs a mechanism to inform the client of any pending notifications on the session context on the server when the client is idle and not actively calling **EcDoRpcExt2**. The server provides four different methods that a client can use to be notified of pending notifications.

The following subsections describe the four methods that the server provides.

1.3.1.1 RopPending

If there are pending notifications for the session, the server sends [RopPending](#), as specified in [\[MS-OXCROPS\]](#), in the ROP response buffer on **EcDoRpcExt2** call.

1.3.1.2 Polling

If a client is idle and is not making **EcDoRpcExt2** calls, it cannot receive [RopNotify](#). The simplest way for a client to retrieve notification details is to make **EcDoRpcExt2** calls on regular intervals. The server allows the client to call **EcDoRpcExt2** with no **remote operation (ROP)** request operations. This provides the client a means to retrieve any pending notifications.

The interval at which the client polls the server for notifications is returned on the **EcDoConnect** and **EcDoConnectEx** calls as specified in [\[MS-OXCRPC\]](#) section [3.1.4.11](#). The output parameter *pcmsPollsMax* in both of these calls contains the number of milliseconds the client waits before polling the server for event information. It is not recommended that the client poll the server more frequently than what is returned by the server. If the client needs to be very responsive to events on the server, the polling method is not recommended.

1.3.1.3 Push Notification

Instead of polling the server at regular intervals to get notification details, the client can register a **callback address** with the server. The server will send an **Internet datagram** to the callback address to inform the client that notifications are pending on the server for the session.

Clients connecting via RPC/HTTP protocol may use the Push Notification method of being signaled of pending notifications. [<1>](#)

1.3.1.4 Asynchronous RPC Notification

Asynchronous **RPC Notification** method allows the client to make an asynchronous **RPC** call to the server where the server does not complete the RPC call until there is a notification for the session. This method works through RPC/HTTP protocol connections with the server where the **Push Notification** method will not. The client determines if the server supports this notification method by examining the server version information that is returned from the **EcDoConnectEx** call. See section [1.7](#) to determine which minimum server version is required to use the Asynchronous **RPC Notification** method.

1.3.2 Notification Details

After the client is notified of pending notifications by any of the methods described in sections [1.3.1.1](#), [1.3.1.2](#), [1.3.1.3](#), and [1.3.1.4](#), the client calls **EcDoRpcExt2** to retrieve the notification details. The server adds any notification details in the ROP response buffer of the **EcDoRpcExt2** by using the [RopNotify](#) response command. The server returns as many notification details through multiple [RopNotify](#) response commands as the ROP response buffer allows. If the server was not able to fit all pending notifications in the response buffer, the server also returns the [RopPending](#) response command to indicate that some notifications are still pending.

1.4 Relationship to Other Protocols

The Core Notifications protocol specification provides a low-level explanation of notifying a client about events on the server. For information about the application of this protocol in a MAPI provider, see [\[MSDN-ENM\]](#).

This specification relies on an understanding of [\[MS-OXCRPC\]](#) and [\[MS-OXCROPS\]](#).

1.5 Prerequisites/Preconditions

This specification assumes that the client has previously logged on to the server and created a session context.

1.6 Applicability Statement

The Core Notifications protocol was designed to be used for the following:

- Notifying clients about certain events on the server.
- Notifying clients about notifications pending for the client on the server.

This protocol provides basic information, high efficiency, and complete preservation of data fidelity for these uses. It might not be appropriate for use in scenarios that do the following:

- Require replication of mailbox content between clients and servers.
- Require client-driven copying of data between different mailboxes on different servers.
- Require exporting or importing of data from or to a mailbox.

1.7 Versioning and Capability Negotiation

This specification covers versioning issues in the following areas:

- **Supported Transports:** This protocol uses the Wire Format protocol [\[MS-OXCRPC\]](#), the Remote Operations (ROP) List and Encoding protocol [\[MS-OXCROPS\]](#), and Internet protocols as specified in section [2.1](#).
- **Protocol Versions:** This protocol has only one interface version.
- **Capability Negotiation:** The protocol does not require Asynchronous RPC Notifications to be implemented. The client examines the server version to determine if Asynchronous RPC Notifications are supported. See [\[MS-OXCRPC\]](#) for more details about how to determine server version. [<2>](#)
- **Localization:** This protocol passes text strings in notification details. Localization considerations for such strings are specified in section [2.2.1.4.1.4](#).

1.8 Vendor-Extensible Fields

None.

1.9 Standards Assignments

None.

2 Messages

2.1 Transport

The commands specified by this protocol are sent to and received from the server respectively by using the underlying **ROP request buffers** and ROP response buffers, as specified in [\[MS-OXCROPS\]](#).

Asynchronous calls are made on the server by using remote procedure call (RPC) transport, as specified in [\[MS-OXCRPC\]](#).

Datagrams are sent from server to client by using underlying networking protocols. For more information, see [\[MSDN-WS2\]](#).

2.2 Message Syntax

2.2.1 Notifications

2.2.1.1 Server Event Types

The following table describes the events that happen on the server. Clients can register to receive notifications about these events.

Name	Description
CriticalError	A critical error has occurred on the server. <3>
NewMail	A new e-mail message has been received by the server.
ObjectCreated	A new item has been created on the server.
ObjectDeleted	An existing item has been deleted from the server.
ObjectModified	An existing item has been modified on the server.
ObjectMoved	An existing item has been moved to another location on the server.
ObjectCopied	An existing item has been copied on the server.
SearchComplete	A search operation has been completed on the server.

2.2.1.1.1 TableModified Event Types

The following table describes the table modification event types.

Name	Description
TableChanged	A table has been changed.
TableError	An error occurred.
TableRowAdded	A new row has been added to the table.
TableRowDeleted	An existing row has been deleted from the table.

Name	Description
TableRowModified	An existing row has been modified in the table.
TableSortDone	A table sort has been completed.
TableRestrictionChanged	A table restriction has been changed.
TableColumnsChanged	Table columns have been changed.

When a client subscribes to notifications on table changes, the server does one of the following three things, listed in order from the most useful to the least useful to the client:

1. Generates an informative notification such as TableRowAdded.
2. Generates a basic notification for TableChanged.
3. Does not generate a notification at all.

The notification that is generated depends on several factors, including the following:

- The type of table that has been changed.
- The resources that are available to the server.
- The number of recent changes that affect the table.
- Other implementation-dependent conditions.

A client **MUST** be able to handle any of the three response types in the previous numbered list. The server **SHOULD** generate the most useful response that it is capable of generating, as specified in the previous numbered list.

2.2.1.2 Subscription Management

2.2.1.2.1 RopRegisterNotification

RopRegisterNotification creates a subscription for specified notifications on the server and returns a **handle** of the subscription to the client. The following table describes the notification subscription request.

Name	Type	Size	Description
RopId	Byte	1	Unsigned 8-bit integer. This value specifies the type of ROP. For this operation, this field is set to 0x29.
LogonId	Byte	1	Unsigned 8-bit integer. This value specifies the logon associated with this operation.
InputHandleIndex	Byte	1	Unsigned 8-bit integer. This index specifies the location in the Server object handle table where the handle for the input Server object is stored.
OutputHandleIndex	Byte	1	Unsigned 8-bit integer. This index specifies the location in the Server object handle table where the handle for the output Server object will be stored.

Name	Type	Size	Description
NotificationTypes	Byte	1	A set of bits describing notifications that the client is interested in receiving. See section 2.2.1.2.1.1 .
Reserved	Byte	1	This field is reserved. The field value MUST be zero. The server behavior is undefined if the value is not zero.
WantWholeStore	Byte	1	Set to TRUE (nonzero) if the scope for notifications is the entire database. Set to FALSE (zero) otherwise.
FolderID	ID	8	The ID of the folder to limit the scope of notifications. This field is available only if WantWholeStore is zero.
MessageID	ID	8	The ID of the message inside the folder referenced by FolderID to limit the scope for notifications. This field is available only if WantWholeStore is zero.

The following table describes the notifications subscription response.

Name	Type	Size	Description
OutputHandleIndex	Byte	1	Handle of the Notification Subscription object created by this ROP. This index MUST be set to the OutputHandleIndex specified in the request.

2.2.1.2.1.1 NotificationTypes

The following table lists the notification types that are available.

Value	Meaning
0x01	The server sends notifications to the client when CriticalError events occur within the scope of interest. <4>
0x02	The server sends notifications to the client when NewMail events occur within the scope of interest.
0x04	The server sends notifications to the client when ObjectCreated events occur within the scope of interest.
0x08	The server sends notifications to the client when ObjectDeleted events occur within the scope of interest.
0x10	The server sends notifications to the client when ObjectModified events occur within the scope of interest.
0x20	The server sends notifications to the client when ObjectMoved events occur within the scope of interest.
0x40	The server sends notifications to the client when ObjectCopied events occur within the scope of interest.
0x80	The server sends notifications to the client when SearchCompleted events occur within the scope of interest.

See section [2.2.1.1](#) for details about server events.

2.2.1.2.2 RopSynchronizationOpenAdvisor

RopSynchronizationOpenAdvisor creates an **ICS Advisor object** [<5>](#) on the server and returns a handle of the object to the client. The following table shows the ICS Advisor request.

Name	Type	Size	Description
InputHandleIndex	Handle	1	Handle of the Logon object . See [MS-OXCROPS] section 2.2.14.2 for more details.

The following table shows the ICS Advisor response.

Name	Type	Size	Description
OutputHandleIndex	Handle	1	Handle of the ICS Advisor object created by this ROP. See [MS-OXCROPS] section 2.2.14.2 for more details. <6>

2.2.1.2.3 RopRegisterSynchronizationNotifications

RopRegisterSynchronizationNotifications creates a subscription for *StatusObjectModified* notifications on the server.

Name	Type	Size	Description
InputHandleIndex	Byte	1	Handle of the ICS Advisor object.
FolderCount	Short	2	Number of folder IDs that limit the scope of the notification subscription .
FolderIDs	ID[]	<i>NumberOfFolderIDs</i>	List of folder IDs that limit the scope of the notification subscription.
FolderChangeNumbers	ULong[]	<i>NumberOfFolderIDs</i>	List of folder change numbers (CNs) .

For details about the response, see [\[MS-OXCROPS\]](#) section 2.2.14.3.

2.2.1.2.4 RopSetSynchronizationNotificationGuid

RopSetSynchronizationNotificationGuid assigns a notification **GUID** to an ICS Advisor object on the server.

Name	Type	Size	Description
InputHandleIndex	Byte	1	Handle of the ICS Advisor object. See [MS-OXCROPS] section 2.2.14.4 for more details.
NotificationGuid	GUID	16	A notification GUID to assign to the ICS Advisor object.

For details about the response, see [\[MS-OXCROPS\]](#) section 2.2.14.4.

2.2.1.3 Pending Notifications

2.2.1.3.1 RopPending

[RopPending](#) notifies the client that there are pending notifications on the server for the client. This ROP MUST appear only in response buffers of **EcDoRpcExt2**. See [\[MS-OXCROPS\]](#) section 2.2.14.6 for more details.

2.2.1.3.2 EcRRegisterPushNotification

EcRRegisterPushNotification is an RPC method that is used to register a callback address of a client on the server. See [\[MS-OXCRPC\]](#) section 3.1.4.5 for more details.

2.2.1.3.3 EcDoAsyncConnectEx

EcDoAsyncConnectEx is an RPC method that is used to acquire an **Asynchronous Context Handle (ACXH)** on the server to use in subsequent **EcDoAsyncWaitEx** calls. See [\[MS-OXCRPC\]](#) section 3.1.4.15 for more details.

2.2.1.3.4 EcDoAsyncWaitEx

EcDoAsyncWaitEx is an asynchronous RPC method that is used to inform a client about pending notifications on the server. See [\[MS-OXCRPC\]](#) section 3.3.4.1 for more details.

2.2.1.4 Notification Details

2.2.1.4.1 RopNotify

RopNotify provides the client with the details of notifications that are sent by server. This ROP MUST appear only in response buffers of **EcDoRpcExt2**.

Name	Type	Size	Description
NotificationHandle	Handle	4	Handle of the target object for the notification. The target object can be a notification subscription, an ICS Advisor, or a table.
NotificationFlags	Short	2	Set of bits describing the type of the notification and availability of the notification data fields. See section 2.2.1.4.1.1 .
TableEventType	Byte	2	Subtype of the notification for a <i>TableModified</i> event. This field is available only if the NotificationType value in NotificationFlags is 0x0100. See section 2.2.1.4.1.2 .
TableRowFolderID	ID	8	Folder ID of the item that is triggering this notification. This field is only available if the TableEventType field is available and is equal to 0x03, 0x04, or 0x05.
TableRowMessageID	ID	8	Message ID of the item triggering this

Name	Type	Size	Description
			notification. This field is only available if bit 0x8000 is set in NotificationFlags and TableEventType is available and is equal to 0x03, 0x04, or 0x05.
TableRowInstance	ULong	4	An identifier of the instance of the previous row in the table. This field is only available if bit 0x8000 is set in NotificationFlags and TableEventType is available and is equal to 0x03, 0x04, or 0x05.
InsertAfterTableRowFolderID	ID	8	Old folder ID of the item triggering this notification. This field is only available if the TableEventType field is available and is equal to 0x03 or 0x05.
InsertAfterTableRowID	ID	8	Old message ID of the item triggering this notification. This field is only available if bit 0x8000 is set in NotificationFlags and TableEventType is available and is equal to 0x03 or 0x05.
InsertAfterTableRowInstance	ULong	4	An identifier of the instance of the row where the modified row is inserted.
TableRowDataSize	Short	2	Length of table row data. This field is only available if the TableEventType field is available and is equal to 0x03 or 0x05.
TableRowData	String	<i>TableRowDataSize</i>	Table row data. This field is only available if the TableEventType field is available and is equal to 0x03 or 0x05.
HierarchyChanged	Byte	1	Set to TRUE (nonzero) if folder hierarchy has changed. Set to FALSE (zero) otherwise. This field is available only if the NotificationType value in NotificationFlags is 0x0200.
FolderIDNumber	ULong	4	Number of folder IDs. This field is available only if the NotificationType value in NotificationFlags is 0x0200.
FolderIDs	GID []	<i>FolderIDNumber</i>	Folder IDs. This field is available only if the NotificationType value in NotificationFlags is 0x0200.
ICSChangeNumbers	ULong[]	<i>FolderIDNumber</i>	Folder CNs. This field is available only if the NotificationType value in NotificationFlags is 0x0200.
FolderId	ID	8	Folder ID of the item triggering the event. This field is available only if the NotificationType value in NotificationFlags is not 0x0100, 0x0200, or 0x0400.

Name	Type	Size	Description
MessageId	ID	8	Message ID of the item triggering the event. This field is available only if the NotificationType value in NotificationFlags is not 0x0100, 0x0200, or 0x0400, and bit 0x8000 is set in NotificationFlags .
ParentFolderId	ID	8	Folder ID of the parent folder of the item triggering the event. This field is available only if the NotificationType value is 0x0004, 0x0008, 0x0020, or 0x0040, and it is sent for either a message in a search folder (both bit 0x4000 and bit 0x8000 are set in NotificationFlags) or a folder (both bit 0x4000 and bit 0x8000 are not set in NotificationFlags).
OldFolderId	ID	8	Old folder ID of the item triggering the event. This field is available only if the NotificationType value in NotificationFlags is 0x0020 or 0x0040.
OldMessageId	ID	8	Old message ID of the item triggering the event. This field is available only if the NotificationType value in NotificationFlags is 0x0020 or 0x0040 and bit 0x8000 is set in NotificationFlags .
OldParentFolderId	ID	8	Old parent folder ID of the item triggering the event. This field is available only if the NotificationType value in NotificationFlags is 0x0020 or 0x0040 and bit 0x8000 is not set in NotificationFlags .
TagCount	Short	2	Number of property tags. This field is available only if the NotificationType value in NotificationFlags is 0x0004 or 0x0010. A value of 0xFFFF is returned if there were too many tags to fit into the response and the list of property tags was omitted.
Tags	ULong[]	<i>TagCount</i>	List of IDs of properties that have changed. This field is available only if TagCount is available and TagCount is not equal to 0xFFFF.
TotalMessageCount	ULong	4	Total number of items in a folder triggering this event. This field is available only if bit 0x1000 is set in NotificationFlags .
UnreadMessageCount	ULong	4	Number of unread items in a folder triggering this event. This field is available only if bit 0x2000 is set in

Name	Type	Size	Description
			NotificationFlags.
MessageFlags	ULong	4	Message flags of new mail that has been received. This field is available only if the NotificationType value in NotificationFlags is 0x0002.
UnicodeFlag	Byte	1	Set to TRUE (nonzero) if MessageClass is in Unicode . Set to FALSE (zero) otherwise. This field is available only if the NotificationType value in NotificationFlags is 0x0002.<7>
MessageClass	String	Variable	Null-terminated string containing the message class of the new mail. The string is in Unicode if UnicodeFlag is TRUE (nonzero). The string is in ASCII if UnicodeFlag is FALSE (zero). This field is available only if the NotificationType value in NotificationFlags is 0x0002.

2.2.1.4.1.1 NotificationFlags

NotificationFlags is a 16-bit combination of an enumeration and flags. The layout is shown in the following table.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
NotificationType												T	U	S	M																

NotificationType (12 bits): **NotificationType** is a 12 bit enumeration defining the type of the notification. The possible values are listed in the following table.

Value	Meaning
0x0001	The notification is for a CriticalError event.
0x0002	The notification is for a NewMail event.
0x0004	The notification is for an ObjectCreated event.
0x0008	The notification is for an ObjectDeleted event.
0x0010	The notification is for an ObjectModified event.
0x0020	The notification is for an ObjectMoved event.
0x0040	The notification is for an ObjectCopied event.
0x0080	The notification is for a SearchCompleted event.
0x0100	The notification is for a TableModified events.

Value	Meaning
0x0200	The notification is for a StatusObjectModified event.
0x0400	This value is reserved.

T (1 bit): Value = 0x1000. The notification contains information about a change in total number of messages in a folder triggering the event. If this bit is set, **NotificationType** MUST be 0x0010.

U (1 bit): Value = 0x2000. The notification contains information about a change in number of unread messages in a folder triggering the event. If this bit is set, **NotificationType** MUST be 0x0010.

S (1 bit): Value = 0x4000. The notification is caused by an event in a search folder. If this bit is set, bit 0x8000 MUST be set.

M (1 bit): Value = 0x8000. The notification is caused by an event on a message.

2.2.1.4.1.2 TableEventType

The following table lists the table event types that are available.

Value	Meaning
0x0001	The notification is for TableChanged events.
0x0002	The notification is for TableError events.
0x0003	The notification is for TableRowAdded events.
0x0004	The notification is for TableRowDeleted events.
0x0005	The notification is for TableRowModified events.
0x0006	The notification is for TableSortDone events.
0x0007	The notification is for TableRestrictionChanged events.
0x0008	The notification is for TableColumnsChanged events.

2.2.1.4.1.3 MessageFlags

See [\[MS-OXCMSG\]](#) section 2.2.1.6 for details.

2.2.1.4.1.4 MessageClass

See [\[MS-OXCMSG\]](#) section 2.2.1.3 for details.

3 Protocol Details

3.1 Notifications Server Details

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 specification does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described.

3.1.2 Timers

The server SHOULD allow for a certain time interval between datagrams until the client has retrieved all event information for the session. The server MUST provide server administrators a means to configure the time interval between the datagrams.

3.1.3 Initialization

3.1.3.1 Subscribing for Notifications

3.1.3.1.1 Receiving RopRegisterNotification

When a [RopRegisterNotification](#) (section 2.2.1.2.1) message is received by the server, the server SHOULD create a new Notification Subscription object and associate it with the session context. The server SHOULD save the information provided in the [RopRegisterNotification](#) fields for future use.

The server SHOULD allow multiple notification subscriptions to be created and associated with the same session context.

3.1.3.1.2 Receiving RopSynchronizationOpenAdvisor

When [RopSynchronizationOpenAdvisor](#) message is received by the server, the server SHOULD create a new ICS Advisor object and associate it with the session context.

The server SHOULD allow multiple ICS Advisors to be created and associated with the same session context.

3.1.3.1.3 Receiving RopRegisterSynchronizationNotifications

When a [RopRegisterSynchronizationNotifications](#) message is received by the server, *InputHandle* MUST be a valid handle of the ICS Advisor object.

The server SHOULD allow multiple [RopRegisterSynchronizationNotifications](#) messages to be received for the same ICS Advisor object.

The server SHOULD adjust the scope of the notification subscription with the details provided by the last [RopRegisterSynchronizationNotifications](#) message that was successfully processed.

3.1.3.1.4 Receiving RopSetSynchronizationNotificationGuid

When a [RopSetSynchronizationNotificationGuid](#) message is received by the server, the *InputHandle* MUST be a valid handle of the ICS Advisor object.

The server SHOULD allow multiple [RopSetSynchronizationNotificationGuid](#) messages to be received for the same ICS Advisor object.

The server SHOULD assign the ICS Advisor a notification GUID provided by the last [RopSetSynchronizationNotificationGuid](#) message that was successfully processed.

The server MUST NOT send any *nStatusObjectModified* notifications to the client, if these notifications were triggered by a client logon that has a [PidTagChangeNotificationGuid](#) property value that matches the GUID assigned to the ICS Advisor object by [RopSetSynchronizationNotificationGuid](#). See [\[MS-OXCSTOR\]](#) for more details.

3.1.3.1.5 Subscribing for Table Notifications

The server SHOULD NOT require any additional actions to register for notifications on table events. If a table is created on the server, the server SHOULD create a subscription to table notifications automatically for every table created on the server. The server MUST NOT create a subscription to table notifications for the tables that were created with a **NoNotifications** flag. See [\[MS-OXCFOLD\]](#) for more details.

3.1.3.2 Initializing Pending Notifications

3.1.3.2.1 Receiving EcRRRegisterPushNotification

When a call to **EcRRRegisterPushNotification** is received by the server, a valid callback address in the **rgbCallbackAddress** field and buffer with opaque client data in the **rgbContext** field MUST be present. The server MUST fail the call and MUST NOT take any actions if the callback address is not a valid **SOCKADDR** structure. See [\[MSDN-WS2\]](#) for more information.

The server SHOULD support a variety of different callback address types. The server SHOULD support at minimum the AF_INET address type for IP support and AF_INET6 address type for IPv6 support.

The server MUST save the callback address and opaque context data on the session context for future use.

After the callback address has been successfully registered with the server, the server SHOULD send a datagram containing the client's opaque data.

3.1.3.2.2 Receiving EcDoAsyncConnectEx

When a call to **EcDoAsyncConnectEx** is received by the server, the server MUST create an ACXH and MUST bind it to the **Session Context Handle (CXH)** used to make the call.

3.1.4 Higher-Layer Triggered Events

None.

3.1.5 Message Processing Events and Sequencing Rules

3.1.5.1 Notifying Client about Pending Notifications

3.1.5.1.1 Sending RopPending

The server SHOULD send a [RopPending](#) response command to the client whenever there are pending notifications on the session context associated with the client and any linked session contexts.

3.1.5.1.2 Sending Push Notification Datagram

The server MUST NOT take any actions if the client has not previously registered a callback address using **EcRRegisterPushNotification**.

The server MUST send a datagram to the callback address when a notification is available for the client. The datagram sent by the server MUST contain the opaque data that was provided by the client when the callback address was registered.

The server MUST continue sending a datagram to the callback address at periodic intervals if event details are still queued for the client. The server SHOULD only stop sending datagrams when all the notifications have been retrieved from the server through **EcDoRpcExt2** calls.

3.1.5.1.3 Receiving and Completing Asynchronous RPC call

Whenever an asynchronous call to **EcDoAsyncWaitEx** on interface **AsyncEMSMDB** is received by the server, the server MUST validate that the ACXH provided is a valid ACXH that was returned from **EcDoAsyncConnectEx**. The server SHOULD NOT complete the call until there is a notification for the client session, or the call has been outstanding on the server for a certain time. If the server already has a call outstanding for the same CXH, the server SHOULD complete the new call.

If the server completes the **outstanding RPC call** when there is a notification for the client session, the server MUST return the value **NotificationPending** in the output field *pulFlagsOut*. The server MUST return zero in *pulFlagsOut* if the call was completed for any other reasons.

3.1.5.2 Sending Notification Details

3.1.5.2.1 Sending RopNotify

The server SHOULD send a [RopNotify](#) response command to the client whenever there are pending notifications on the session context that is associated with the client. The server SHOULD send as many notification details through multiple [RopNotify](#) response commands as the ROP response buffer allows. If the server was not able to fit the details for all pending notifications into the ROP response buffer, it SHOULD also send a [RopPending](#) response command if the response buffer allows.

3.1.6 Timer Events

None.

3.1.7 Other Local Events

None.

3.2 Notifications Client Details

3.2.1 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 specification does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described.

3.2.2 Timers

None.

3.2.3 Initialization

3.2.3.1 Subscribing for Notifications

3.2.3.1.1 Sending RopRegisterNotification

If the client needs to receive notifications from the server, the client SHOULD send a [RopRegisterNotification](#) to the server. The client MUST provide specific details about notifications it needs to receive and the scope of the notification as specified in section [2.2.1.2.1](#). Upon receiving the response from the server, the client MUST save the returned handle to the Notification Subscription object. When the client no longer needs to receive notifications, the handle of the Notification Subscription object MUST be released by using [RopRelease](#).

The client MAY send [RopRegisterNotification](#) multiple times to the server.

3.2.3.1.2 Sending RopSynchronizationOpenAdvisor

If the client needs to receive *StatusObjectModified* notifications, it MUST first create an ICS Advisor object by sending [RopSynchronizationOpenAdvisor](#). The client MUST save the returned handle to the ICS Advisor object. When the client no longer needs to receive *StatusObjectModified* notifications, the handle of the ICS Advisor object MUST be released by using [RopRelease](#).

The client can send [RopSynchronizationOpenAdvisor](#) multiple times to the server.

3.2.3.1.3 Sending RopRegisterSynchronizationNotifications

After the ICS Advisor object has been created by using [RopSynchronizationOpenAdvisor](#), the client SHOULD define the scope of notifications by using [RopRegisterSynchronizationNotifications](#). The client can send [RopRegisterSynchronizationNotifications](#) multiple times to the server.

3.2.3.1.4 Sending RopSetSynchronizationNotificationGuid

If the client needs to suppress *StatusObjectModified* notifications on certain operations, it SHOULD assign a *StatusObjectModified* with a special GUID via [RopSetSynchronizationNotificationGuid](#). If the client has assigned a GUID to the *StatusObjectModified*, the client MUST set the value of the [PidTagChangeNotificationGuid](#) property to the Logon object to suppress *StatusObjectModified* notifications for the operations made by using that logon.

3.2.3.1.5 Subscribing for Table Notifications

The client MUST NOT take any actions to subscribe to table notifications. The subscription is created automatically when the client creates a **Table object** on the server.

3.2.3.2 Initializing Push Notifications

3.2.3.2.1 Sending EcRRegisterPushNotifications

The client calls **EcRRegisterPushNotification** to register a callback address for the session context. In addition to the callback address, the client MUST provide a buffer of opaque data to the server.

The client can register a variety of different callback address types if the server supports the address type. It is not required, but recommended that a client register a callback address by using an address type that corresponds to the protocol being used to communicate with the server. For example, if the client makes an RPC call to **EcDoConnectEx**, as specified in [MS-OXCRPC] section [3.1.4.11](#), by using the TCP/IP protocol, it registers an AF_INET callback address in call **EcRRegisterPushNotification**.

Clients connecting via RPC/HTTP protocol SHOULD NOT use the Push Notification method of being signaled of pending event information. The client SHOULD either use the basic Polling method or the Asynchronous RPC Notification method described in sections [1.3.1.2](#) and [1.3.1.4](#).

Because of network conditions such as firewalls or the use of RPC/HTTP connections by the client, it is not always possible for the datagram that is sent from the server to the client's callback address to be successful. To overcome this problem, the client SHOULD poll the server by using the polling method, even after registering a callback address with the server through **EcRRegisterPushNotification**, up until it receives a datagram from the server. When the client receives a datagram from the server at the callback address, it SHOULD stop polling the server and rely on datagrams pushed from the server to know when to call **EcDoRpcExt2** to retrieve event information.

3.2.3.2.2 Sending EcDoAsyncConnectEx

The client SHOULD determine whether the server supports **EcDoAsyncConnectEx** by examining the server version information that is returned from the **EcDoConnectEx** call, as specified in [MS-OXCRPC] section [3.1.4.11](#). See section [1.7](#) for details about which minimum server version is required to utilize the **Asynchronous RPC Notification** method.

The client can call **EcDoAsyncConnectEx** after a successful **EcDoConnectEx** call. The client MUST save the returned ACXH after the **EcDoAsyncConnectEx** call completes. The client MUST use the ACXH in the subsequent **EcDoAsyncWaitEx** calls to the server.

3.2.4 Higher-Layer Triggered Events

None.

3.2.5 Message Processing Events and Sequencing Rules

3.2.5.1 Receiving Notification About Pending Notifications

3.2.5.1.1 Receiving RopPending

Upon receiving [RopPending](#) in the response buffer of **EcDoRpcExt2**, the client MUST determine whether the session index provided in the [RopPending](#) matches any of the sessions created by the client. If the session index matches, the client SHOULD make **EcDoRpcExt2** calls to receive notification details from the server by using the CXH that is associated with the session specified by the session index. If the session index in [RopPending](#) does not match the index of any session created by the client, the client MUST NOT take any actions.

3.2.5.1.2 Receiving Push Notification Datagram

Upon receiving a datagram on the callback address that was previously registered by the client via **EcRRegisterPushNotification**, the client MUST verify that the content of the datagram is valid by matching it with the content of the opaque data **binary large object (BLOB)** that was provided to the server via **EcRRegisterPushNotification**. If the content of the datagram is valid, the client SHOULD make **EcDoRpcExt2** calls to receive notification details from the server. Otherwise, the client MUST NOT take any actions on the datagram.

3.2.5.1.3 Sending and Receiving EcDoAsyncWaitEx

If the server supports Asynchronous RPC Notifications, and the client successfully created ACXH by calling **EcDoAsyncConnectEx**, the client SHOULD call **EcDoAsyncWaitEx** to determine whether notifications are pending on the server.

When a call to **EcDoAsyncWaitEx** completes, the client MUST examine its return value and the value of the *pulFlagsOut* output parameter. If the return value is 0x00000000 and bit 0x00000001 is set in the *pulFlagsOut* output parameter, the client SHOULD make **EcDoRpcExt2** calls to receive notification details from the server.

After the results of **EcDoAsyncWaitEx** are processed, the client SHOULD call **EcDoAsyncWaitEx** again to continue to listen for more notifications.

3.2.5.2 Receiving Notification Details

3.2.5.2.1 Receiving RopNotify

Upon receiving [RopNotify](#), the client MUST verify that *NotificationHandle* is a valid handle to a notification subscription, an ICS Advisor, or a Table object that was previously created by the client. If the *NotificationHandle* is valid, the client can update its internal state by using the details provided in the [RopNotify](#). Otherwise, the client MUST ignore the [RopNotify](#).

3.2.6 Timer Events

None.

3.2.7 Other Local Events

None.

4 Protocol Examples

The examples in this section are XML fragments that contain various notifications. The type of notification is identified by the **name** attribute of the <Data> element.

[XML]

```
<Data name="NewMailNotification">
  <Buffer>
    02                // NewMail
    80                // Message
    010000000078291F // Message FID
    0100000000783484 // Message MID

    22000000         // MessageFlags
    00                // ASCII
    49504D2E4E6F746500 // Message class
  </Buffer>
</Data>

<Data name="ObjectCreatedNotification">
  <Buffer>
    04                // ObjectCreated
    00                // No flags
    0100000000782781 // Object FID
    0100000000782780 // Parent FID
    0000              // Number of PTAGs
  </Buffer>
</Data>

<Data name="ObjectCreatedNotification">
  <Buffer>
    04                // ObjectCreated
    80                // Message
    0100000000782780 // Message FID
    0100000000784172 // Message MID

    1F00              // Number of PTAGs
    0B001B0E          // PTAGs...
    0300790E
    02010B30
    0300A166
    0300F13F
    40000730
    40000830
    0201F93F
    1E00F83F
    03005940
    0201FB3F
    1E00FA3F
    03005A40
    0201BD67
    0201BE67
    40000967
    1F003510
    1F000010
    02010910
```



```

02011310
1E00040E
1E00030E
1F003700
1F003D00
1F001D0E
0B001F0E
0300FD3F
40003900
4000060E
0300080E
0300230E
</Buffer>
</Data>

<Data name="ObjectDeletedNotification">
  <Buffer>
    08                // ObjectDeleted
    00                // No flags
    0100000000782780 // Folder FID
    010000000078277F // Parent FID
  </Buffer>
</Data>

<Data name="ObjectModifiedNotification">
  <Buffer>
    10                // ObjectModified
    00                // No flags
    0100000000782780 // Object FID

    0200                // Number of PTAGs
    03003866            // Ptags...
    0B000A36
  </Buffer>
</Data>

<Data name="ObjectModifiedNotification">
  <Buffer>
    10                // ObjectModified
    20                // UnreadItemsChanged
    010000000078291F // Object FID
    0100                // Number of PTAGs
    03000336            // Ptag
    00000000            // Value of unread items changes
  </Buffer>
</Data>

<Data name="ObjectModifiedNotification">
  <Buffer>
    10                // ObjectModified
    10                // TotalItemsChanged
    0100000000782780 // Object FID

    0400                // Number of PTAGs
    03000236            // Ptags...
    0300080E
    0300AF66
    0300B366
  </Buffer>
</Data>

```

```

        01000000          // Value of total items changes
    </Buffer>
</Data>

<Data name="ObjectModifiedNotification">
    <Buffer>
        10                // ObjectModified
        30                // UnreadItemsChanged
        010000000078291F  // Object FID

        0500              // Number of PTAGs
        03000236           // Ptags...
        03000336
        0300080E
        0300AF66
        0300B366

        04000000          // Value of total items changes
        03000000          // Value of unread items changes
    </Buffer>
</Data>

<Data name="ObjectMovedNotification">
    <Buffer>
        20                // ObjectMoved
        80                // Message
        0100000000782781  // Message FID
        0100000000784378  // Message MID
        0100000000782780  // Old message FID
        0100000000784172  // Old message MID
    </Buffer>
</Data>

<Data name="ObjectCopiedNotification">
    <Buffer>
        40                // ObjectCopied
        80                // Message
        0100000000782780  // Message FID
        0100000000784173  // Message MID
        0100000000782780  // Old message FID
        0100000000784172  // Old message MID
    </Buffer>
</Data>

<Data name="TableModifiedNotification">
    <Buffer>
        00 01            // NotificationType = Hierarchy
        01 00            // TableModifiedNotificationType = TableChanged
    </Buffer>
</Data>

<Data name="TableModifiedNotification">
    <Buffer>
        00 01            // NotificationType = Hierarchy
        07 00            // TableModifiedNotificationType = TableRestrictDone
    </Buffer>
</Data>

<Data name="TableRowAddModifiedNotification">

```

```

<Buffer>
  00 01          // NotificationType (Hierarchy)
  03 00          // TableModifiedNotificationType (Added)
  01 00 00 02 81 6C EA 9D // FID
  01 00 00 02 81 6C EA 9E // InsertAfterFID

  A3 00 // Size of the property row

  // Values for the columns of the new row
  00          // no errors
  42 00 69 00 6c 00 6c 00
  79 00 20 00 44 00 2e 00
  53 00 2e 00 20 00 50 00
  72 00 6f 00 78 00 79 00 00

  00 7e
  00 00 00 00 00 dc
  a7 40 c8 c0 42 10 1a b4 b9 08 00 2b 2f e1 82 01
  00 00 00 00 00 00 00 2f 4f 3d 46 49 52 53 54 20
  4f 52 47 41 4e 49 5a 41 54 49 4f 4e 2f 4f 55 3d
  45 58 43 48 41 4e 47 45 20 41 44 4d 49 4e 49 53
  54 52 41 54 49 56 45 20 47 52 4f 55 50 20 28 46
  59 44 49 42 4f 48 46 32 33 53 50 44 4c 54 29 2f
  43 4e 3d 52 45 43 49 50 49 45 4e 54 53 2f 43 4e
  3d 44 53 50 52 4f 58 59 00
</Buffer>
</Data>

<Data name="TableRowAddModifiedNotification">
  <Buffer>
    00 C1          // NotificationType = Contents (TableModified | SearchFolder |
Message)
    03 00          // TableModifiedNotificationType (Added)
    01 00 00 00 00 78 60 45 // FID
    01 00 00 02 81 6C FC 84 // MID
    01 00 00 00 // Instance
    01 00 00 00 00 78 60 45 // InsertAfterFID
    01 00 00 02 81 6C FC 82 // InsertAfterMID
    01 00 00 00 // InsertAfterInstance

    A3 00 // Size of the property row

    // Values for the columns of the new row
    00          // no errors
    42 00 69 00 6c 00 6c 00
    79 00 20 00 44 00 2e 00
    53 00 2e 00 20 00 50 00
    72 00 6f 00 78 00 79 00 00

    00 7e
    00 00 00 00 00 dc
    a7 40 c8 c0 42 10 1a b4 b9 08 00 2b 2f e1 82 01
    00 00 00 00 00 00 00 2f 4f 3d 46 49 52 53 54 20
    4f 52 47 41 4e 49 5a 41 54 49 4f 4e 2f 4f 55 3d
    45 58 43 48 41 4e 47 45 20 41 44 4d 49 4e 49 53
    54 52 41 54 49 56 45 20 47 52 4f 55 50 20 28 46
    59 44 49 42 4f 48 46 32 33 53 50 44 4c 54 29 2f
    43 4e 3d 52 45 43 49 50 49 45 4e 54 53 2f 43 4e
    3d 44 53 50 52 4f 58 59 00
  </Buffer>
</Data>

```

```

    </Buffer>
</Data>

<Data name="TableRowAddModifiedNotification">
  <Buffer>
    00 01          // NotificationType (Hierarchy)
    05 00          // TableModifiedNotificationType (Modified)
    01 00 00 00 00 78 60 45 // FID
    01 00 00 00 00 78 60 50 // InsertAfterFID

    A3 00 // Size of the property row

    // Values for the columns of the new row
    00          // no errors
    42 00 69 00 6c 00 6c 00
    79 00 20 00 44 00 2e 00
    53 00 2e 00 20 00 50 00
    72 00 6f 00 78 00 79 00 00

    00 7e
    00 00 00 00 00 dc
    a7 40 c8 c0 42 10 1a b4 b9 08 00 2b 2f e1 82 01
    00 00 00 00 00 00 00 00 2f 4f 3d 46 49 52 53 54 20
    4f 52 47 41 4e 49 5a 41 54 49 4f 4e 2f 4f 55 3d
    45 58 43 48 41 4e 47 45 20 41 44 4d 49 4e 49 53
    54 52 41 54 49 56 45 20 47 52 4f 55 50 20 28 46
    59 44 49 42 4f 48 46 32 33 53 50 44 4c 54 29 2f
    43 4e 3d 52 45 43 49 50 49 45 4e 54 53 2f 43 4e
    3d 44 53 50 52 4f 58 59 00
  </Buffer>
</Data>

<Data name="TableRowAddModifiedNotification">
  <Buffer>
    00 C1          // NotificationType (Contents)
    05 00          // TableModifiedNotificationType (Modified)
    01 00 00 00 00 78 60 45 // FID
    01 00 00 02 81 6C FC 83 // MID
    01 00 00 00 // Instance
    01 00 00 00 00 78 60 46 // InsertAfterFID
    01 00 00 02 81 6C FC 84 // InsertAfterMID
    01 00 00 00 // Insert after instance

    A3 00 // Size of the property row

    // Values for the columns of the new row
    00          // no errors
    42 00 69 00 6c 00 6c 00
    79 00 20 00 44 00 2e 00
    53 00 2e 00 20 00 50 00
    72 00 6f 00 78 00 79 00 00

    00 7e
    00 00 00 00 00 dc
    a7 40 c8 c0 42 10 1a b4 b9 08 00 2b 2f e1 82 01
    00 00 00 00 00 00 00 00 2f 4f 3d 46 49 52 53 54 20
    4f 52 47 41 4e 49 5a 41 54 49 4f 4e 2f 4f 55 3d
    45 58 43 48 41 4e 47 45 20 41 44 4d 49 4e 49 53
    54 52 41 54 49 56 45 20 47 52 4f 55 50 20 28 46

```

```

59 44 49 42 4f 48 46 32 33 53 50 44 4c 54 29 2f
43 4e 3d 52 45 43 49 50 49 45 4e 54 53 2f 43 4e
3d 44 53 50 52 4f 58 59 00
</Buffer>
</Data>

<Data name="TableRowDeletedModifiedNotification">
  <Buffer>
    00 01      // NotificationType = Hierarchy (TableModified)
    04 00      // TableModifiedNotificationType = Deleted
    01 00 00 00 00 78 60 45 // FID
  </Buffer>
</Data>

<Data name="TableRowDeletedModifiedNotification">
  <Buffer>
    00 C1      // NotificationType = Contents (TableModified | SearchFolder |
Message)
    04 00      // TableModifiedNotificationType = Deleted
    01 00 00 02 81 6C EA 96 // FID
    01 00 00 02 81 6D 09 01 // MID
    01 00 00 00 // Instance
  </Buffer>
</Data>

```

5 Security

5.1 Security Considerations for Implementers

There are no special security considerations specific to this protocol. General security considerations pertaining to the underlying ROP transport protocol specified in [\[MS-OXCROPS\]](#) do apply.

6 Appendix A: Product Behavior

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

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

Exceptions, if any, are noted below. If a service pack number appears with the product version, behavior changed in that service pack. The new behavior also applies to subsequent service packs of the product unless otherwise specified. If a product edition appears with the product version, behavior is different in that product edition.

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

[<1> Section 1.3.1.3:](#) Outlook 2007 and Outlook 2010 use either the basic polling method or the Asynchronous RPC Notification method described in section [1.3.1.4](#).

[<2> Section 1.7:](#) Outlook 2007, Outlook 2010, Exchange 2007, and Exchange 2010 support Asynchronous RPC Notifications.

[<3> Section 2.2.1.1:](#) Exchange 2003, Exchange 2007, and Exchange 2010 cannot trigger this event.

[<4> Section 2.2.1.2.1.1:](#) Exchange 2010 returns NotImplemented for a **RopRegisterNotification** request with a **CriticalError** notification type.

[<5> Section 2.2.1.2.2:](#) Exchange 2010 does not support the creation of this object.

[<6> Section 2.2.1.2.2:](#) Exchange 2010 parses these ROPs, but the return value is "Not Supported".

[<7> Section 2.2.1.4.1:](#) The server returns ANSI values for Outlook 2003 and Outlook 2007 clients if the client is running in "cached mode".

7 Change Tracking

This section identifies changes that were made to the [MS-OXCNOTIF] protocol document between the May 2010 and August 2010 releases. Changes are classified as New, Major, Minor, Editorial, or No change.

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

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

- A document revision that incorporates changes to interoperability requirements or functionality.
- An extensive rewrite, addition, or deletion of major portions of content.
- The removal of a document from the documentation set.
- Changes made for template compliance.

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

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

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

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

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

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

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

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

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

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

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
1.1 Glossary	56275 Added "property" to the list of terms that are defined in [MS-OXGLOS].	N	Content update.
1.1 Glossary	Added "Server object" and "Server object handle table" to the list of terms that are defined in [MS-OXGLOS].	N	Content update.
1.1 Glossary	56541 Added "Table object" to the list of terms that are defined in [MS-OXGLOS].	N	Content update.
1.1 Glossary	56257 Updated definition of ICS Advisor object.	N	Content update.
1.2.1 Normative References	55751 Moved [MS-OXGLOS] from the Normative References section to the Informative References section.	N	Content update.
1.2.1 Normative References	55332 Removed the reference for [MS-OXCTABL].	N	Content update.

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
1.2.1 Normative References	Added the reference [MS-OXCFOOLD].	N	Content update.
1.3.1.2 Polling	55991 Added section reference to MS-OXCRPC.	N	Content update.
2.2.1.1 Server Event Types	56614 Added a product behavior note for the CriticalError event type.	N	Content update.
2.2.1.1.1 TableModified Event Types	55927 Updated the description of the possible server behaviors to clarify the order of usefulness.	N	Content update.
2.2.1.1.1 TableModified Event Types	56149 Clarified which response types a client has to be able to handle.	N	Content update.
2.2.1.2.1 RopRegisterNotification	56255 Clarified that the description for Reserved applies to server behavior.	N	Content update.
2.2.1.2.1 RopRegisterNotification	Updated the descriptions for the parts listed in the table.	N	Content update.
2.2.1.2.1 RopRegisterNotification	55996 Updated the type and size for the OutputHandleIndex.	N	Content update.
2.2.1.2.1.1 NotificationTypes	55928 Removed the normative language from the descriptions in the table.	N	Content update.
2.2.1.2.1.1 NotificationTypes	56614 Added a product behavior note for the CriticalError notification type.	N	Content update.
2.2.1.2.2 RopSynchronizationOpenAdvisor	55332 Added a section number for the [MS-OXCROPS] references.	N	Content update.
2.2.1.2.2 RopSynchronizationOpenAdvisor	55996 Changed the size from 4 bytes to 1 byte, changed InputHandle to InputHandleIndex, and changed OutputHandle to OutputHandleIndex.	N	Content update.
2.2.1.2.3 RopRegisterSynchronizationNotifications	55332 Added a section number for the [MS-OXCROPS] reference.	N	Content update.

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
2.2.1.2.3 RopRegisterSynchronizationNotifications	55993 Changed InputHandle to InputHandleIndex, NumberOfFolderIDs to FolderCount, and ChangeNumbers to FolderChangeNumbers.	N	Content update.
2.2.1.2.4 RopSetSynchronizationNotificationGuid	55332 Added a section number for the [MS-OXCROPS] reference.	N	Content update.
2.2.1.2.4 RopSetSynchronizationNotificationGuid	55996 Updated the type and size for InputHandleIndex.	N	Content update.
2.2.1.3.1 RopPending	55332 Added a section number for the [MS-OXCROPS] reference.	N	Content update.
2.2.1.3.2 EcRRegisterPushNotification	55332 Added a section number for the [MS-OXCRPC] reference.	N	Content update.
2.2.1.3.3 EcDoAsyncConnectEx	55332 Added a section number for the [MS-OXCRPC] reference.	N	Content update.
2.2.1.3.4 EcDoAsyncWaitEx	55332 Added a section number for the [MS-OXCRPC] reference.	N	Content update.
2.2.1.4.1 RopNotify	56282 Updated the values in the description for ParentFolderId.	N	Content update.
2.2.1.4.1 RopNotify	55400 Changed the size for TableEventType from 1 to 2 bytes.	N	Content update.
2.2.1.4.1 RopNotify	55706 Updated the description for TagCount to include the definition of the return value 0xFFFF.	N	Content update.
2.2.1.4.1 RopNotify	55332 Removed the reference to [MS-OXCTABL].	N	Content update.
2.2.1.4.1 RopNotify	55894 Updated field names, and added the InsertAfterTableRowInstance field.	N	Content update.
2.2.1.4.1.1 NotificationFlags	55428 Moved the NotificationType	N	Content update.

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
	description above the table of values.		
2.2.1.4.1.1 NotificationFlags	55466 Restructured the section to removed duplicate bit value information.	N	Content update.
2.2.1.4.1.1 NotificationFlags	56256 Updated the description for value 0x0400.	N	Content update.
2.2.1.4.1.2 TableEventType	55400 Updated the syntax for the values.	N	Content update.
2.2.1.4.1.3 MessageFlags	56148 Added a section number for the reference.	N	Content update.
2.2.1.4.1.4 MessageClass	56148 Added the section number for the reference.	N	Content update.
3.1.3.1.1 Receiving RopRegisterNotification	56254 Updated the description to clarify field usage.	N	Content update.
3.1.3.1.5 Subscribing for Table Notifications	56253 Updated the description to clarify when the client and server register for table notifications.	N	Content update.
3.1.3.2.1 Receiving EcRRegisterPushNotification	48239 Updated the description of the server behavior after the callback address has been registered.	N	Content removed.
3.1.4 Higher-Layer Triggered Events	56220 Added new section.	N	New content added for template compliance.
3.1.5.1.3 Receiving and Completing Asynchronous RPC call	48239 Updated the description of the behavior of the server when it completes a new call.	Y	Content removed.
3.2.3.2.1 Sending EcRRegisterPushNotifications	56277 Removed normative language from the example statement.	N	Content update.
3.2.3.2.1 Sending EcRRegisterPushNotifications	55991 Added section reference to MS-OXCRPC.	N	Content update.

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
3.2.3.2.2 Sending EcDoAsyncConnectEx	55991 Added a cross-reference to the specification that defines EcDoConnectEx.	N	Content update.
3.2.4 Higher-Layer Triggered Events	56220 Added new section.	N	New content added for template compliance.
4 Protocol Examples	48235 Added notification examples.	Y	New content added.

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