[MS-OXCNOTIF]:
Core Notifications Protocol Specification

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Revision Summary

Date	Revision History	Revision Class	Comments
04/04/2008	0.1		Initial Availability.
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.
12/03/2008	1.03		Minor editorial fixes.
03/04/2009	1.04		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	3.1.0	Minor	Updated the technical content.
02/10/2010	4.0.0	Major	Updated and revised the technical content.

Table of Contents

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)
remote operation (ROP)
remote procedure call (RPC)
ROP request buffer
ROP response buffer
Session Context Handle (CXH)
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.

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-OXCMSG] Microsoft Corporation, "Message and Attachment Object Protocol Specification", June 2008.

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

[MS-OXCRPC] Microsoft Corporation, "Wire Format Protocol Specification", June 2008.

[MS-OXCSTOR] Microsoft Corporation, "Store Object Protocol Specification", June 2008.

[MS-OXCTABL] Microsoft Corporation, "Table Object Protocol Specification", June 2008.

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

[MSDN-ENM] Microsoft Corporation, "Event Notification in MAPI", http://go.microsoft.com/fwlink/?LinkId=113730.

[MSDN-WS2] Microsoft Corporation, "Windows Sockets 2", http://go.microsoft.com/fwlink/?LinkID=113731.

1.3 Protocol 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 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. 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.
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, 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 responses. The server SHOULD generate the most useful response that it is capable of generating.

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	See [MS-OXCROPS] for more details.
LogonId	Byte	1	See [MS-OXCROPS] for more details.
InputHandleIndex	Byte	1	See [MS-OXCROPS] for more details.
OutputHandleIndex	Byte	1	See [MS-OXCROPS] for more details.
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	The field is reserved. The field value MUST be zero. The behavior is undefined if the value is not zero.
WantWholeStore	Byte	1	Set to **TRUE** (non-zero) if the scope for notifications is the entire

Name	Type	Size	Description
			database. Set to **FALSE** (zero) otherwise.
FolderID	ID	8	ID of the folder to limit the scope of notifications. This field is available only if **WantWholeStore** is zero.
MessageID	ID	8	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 notification subscription response.

Name	Type	Size	Description
OutputHandleIndex	Handle	4	Handle of the Notification Subscription object created by this ROP. See [MS-OXCROPS] for more details.

2.2.1.2.1.1 NotificationTypes

The following table lists the notification types that are available.

Value	Meaning
0x01	The server MUST send notifications to the client when *CriticalError* events occur within the scope of interest.
0x02	The server MUST send notifications to the client when *NewMail* events occur within the scope of interest.
0x04	The server MUST send notifications to the client when *ObjectCreated* events occur within the scope of interest.
0x08	The server MUST send notifications to the client when *ObjectDeleted* events occur within the scope of interest.
0x10	The server MUST send notifications to the client when *ObjectModified* events occur within the scope of interest.
0x20	The server MUST send notifications to the client when *ObjectMoved* events occur within the scope of interest.
0x40	The server MUST send notifications to the client when *ObjectCopied* events occur within the scope of interest.
0x80	The server MUST send 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<3> 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
InputHandle	handle	4	Handle of the **Logon object**. See [MS-OXCROPS] for more details.

The following table shows the ICS Advisor response.

Name	Type	Size	Description
OutputHandle	handle	4	Handle of the ICS Advisor object created by this ROP. See [MS-OXCROPS] for more details. <4>

2.2.1.2.3 RopRegisterSynchronizationNotifications

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

Name	Type	Size	Description
InputHandle	Handle	4	Handle of the ICS Advisor object.
NumberOfFolderIDs	Short	2	Number of folder IDs that limit the scope of the **notification subscription**.
FolderIDs	ID[]	*NumberOfFolderIDs*	List of folder IDs that limit the scope of the notification subscription.
ChangeNumbers	ULong[]	*NumberOfFolderIDs*	List of folder **change numbers (CNs)**.

For details about the response, see [MS-OXCROPS].

2.2.1.2.4 RopSetSynchronizationNotificationGuid

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

Name	Type	Size	Description
InputHandle	Handle	4	Handle of the ICS Advisor object. See [MS-OXCROPS] for more details.
NotificationGuid	GUID	16	A notification GUID to assign to the ICS Advisor object.

For details about the response, see [MS-OXCROPS].

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] 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] 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] 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] 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**.

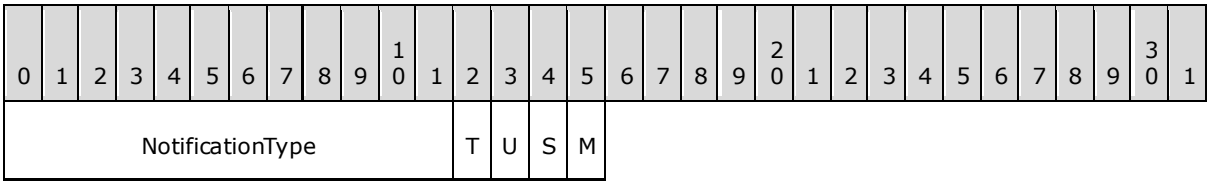
Name	Type	Size	Description
NotificationHandle	Handle	4	Handle of the target object for the notification. The target object can be a notification subscription, an ICS Advisor, or a table.
NotificationFlags	Short	2	Set of bits describing the type of the notification and availability of the notification data fields. See section 2.2.1.4.1.1.
TableEventType	Byte	1	Subtype of the notification for a *TableModified* 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 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.
TableRowPreviousInstance	ULong	4	An identifier of the instance of the previous row in the table. See [MS-OXCTABL] for more details. This field is only available if bit 0x8000 is set in **NotificationFlags** and **TableEventType** is available and is equal

Name	Type	Size	Description
			to 0x03, 0x04, or 0x05.
TableRowOldFolderID	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.
TableRowOldMessageID	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.
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	*TableRowDataSize*	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** (non-zero) 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 []	*FolderIDNumber*	Folder IDs. This field is available only if the **NotificationType** value in **NotificationFlags** is 0x0200.
ICSChangeNumbers	ULong[]	*FolderIDNumber*	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.
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 in **NotificationFlags** is 0x0004, 0x0008, 0x0020, or 0x0040 and bit 0x4000 and bit 0x8000 are set or bit 0x4000 and bit

Name	Type	Size	Description
			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.
Tags	ULong[]	*TagCount*	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 **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** (non-zero) if **MessageClass** is in **Unicode**. Set to **FALSE** (zero) otherwise. This field is available only if the **NotificationType** value in **NotificationFlags** is 0x0002. <5>
MessageClass	String	*Variable*	Null-terminated string containing the message class of the new mail. The string is in Unicode if **UnicodeFlag** is **TRUE** (non-zero). 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.



Value	Meaning
0x0001	The notification is for *CriticalError* event.
0x0002	The notification is for *NewMail* events.
0x0004	The notification is for *ObjectCreated* event.
0x0008	The notification is for *ObjectDeleted* event.
0x0010	The notification is for *ObjectModified* event.
0x0020	The notification is for *ObjectMoved* event.
0x0040	The notification is for *ObjectCopied* event.
0x0080	The notification is for *SearchCompleted* event.
0x0100	The notification is for *TableModified* events.
0x0200	The notification is for *StatusObjectModified* event.
0x0400	The value is reserved and MUST NOT be used.

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

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

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

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

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

The meaning of other flags is provided in the following table.

Value	Meaning
0x1000	**T** bit. The notification contains information about a change in total number of messages

Value	Meaning
	in a folder triggering the event. If this bit is set, then **NotificationType** MUST be 0x0010.
0x2000	**U** bit. The notification contains information about a change in number of unread messages in a folder triggering the event. If this bit is set, then **NotificationType** MUST be 0x0010.
0x4000	**S** bit. The notification is caused by an event in a search folder. If this bit is set, then bit 0x8000 MUST be set.
0x8000	**M** bit. The notification is caused by an event on a Message.

2.2.1.4.1.2 TableEventType

Value	Meaning
0x01	The notification is for *TableChanged* events.
0x02	The notification is for *TableError* events.
0x03	The notification is for *TableRowAdded* event.
0x04	The notification is for *TableRowDeleted* events.
0x05	The notification is for *TableRowModified* event.
0x06	The notification is for *TableSortDone* event.
0x07	The notification is for *TableRestrictionChanged* event.
0x08	The notification is for *TableColumnsChanged* event.

2.2.1.4.1.3 MessageFlags

See [MS-OXCMSG] for details.

2.2.1.4.1.4 MessageClass

See [MS-OXCMSG] 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

None.

3.1.3 Initialization

3.1.3.1 Subscribing for Notifications

3.1.3.1.1 Receiving RopRegisterNotification

When a RopRegisterNotification 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 various fields of the RopRegisterNotification 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 *StatusObjectModified* 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 special actions to register for notifications on table events. The server SHOULD create a subscription to table notifications 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 EcRRegisterPushNotification

When a call to **EcRRegisterPushNotification** 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 immediately 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 Message Processing Events and Sequencing Rules

3.1.4.1 Notifying Client about Pending Notifications

3.1.4.1.1 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.

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

3.1.4.1.3 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 ACXHthat 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 immediately 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.

3.1.4.2 Sending Notification Details

3.1.4.2.1 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.

3.1.5 Timer Events

None.

3.1.6 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 an ICS Advisor object with a special GUID via RopSetSynchronizationNotificationGuid. If the client has assigned a GUID to the ICS Advisor object, 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 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** by using the TCP/IP protocol, it SHOULD register 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. See section 1.7 to determine 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 Message Processing Events and Sequencing Rules

3.2.4.1 Receiving Notification About Pending Notifications

3.2.4.1.1 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**.

3.2.4.1.2 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.

3.2.4.1.3 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.

3.2.4.2 Receiving Notification Details

3.2.4.2.1 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.

3.2.5 Timer Events

None.

3.2.6 Other Local Events

None.

4 Protocol Examples

None.

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 product versions. References to product versions include released service packs.

- 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.

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 2.2.1.2.2: Exchange 2010 does not support the creation of this object.

<4> Section 2.2.1.2.2: Exchange 2010 parses these ROPs, but the return value is "Not Supported".

<5> 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 made to [MS-OXCNOTIF] protocol documentation between November 2009 and February 2010 releases. Changes are classed as major, minor, or editorial.

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.
- A protocol is deprecated.
- The removal of a document from the documentation set.
- Changes made for template compliance.

Minor changes do not affect protocol interoperability or implementation. Examples are updates to fix technical accuracy or ambiguity at the sentence, paragraph, or table level.

Editorial changes apply to grammatical, formatting, and style issues.

No changes means that the document is identical to its last release.

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

- New content added.
- Content update.
- 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 always have the revision type "Editorially updated."

Some important terms used in revision 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.

Changes are listed in the following table. If you need further information, please contact protocol@microsoft.com.

Section	Tracking number (if applicable) and description	Major change (Y or N)	Revision Type
1.3.1.2 Polling	50292 Updated the content to reflect that EcDoConnect calls also return the interval at which the client polls the server for notifications. Clarified the fact that the polling method is not recommended when the clinet needs to be very responsive to events.	N	Content update.
1.3.1.3 Push Notification	50292 Added a behavior note that indicates that Outlook 2007 and Outlook 2010 use either the basic polling method or the Asynchronous RPC Notification method.	N	New product behavior note added.
2.2.1.2.2 RopSynchronizationOpenAdvisor	50292 Added a behavior note that states that Exchange 2010 does not support this object.	Y	New product behavior note added.
3.1.3.1.4 Receiving RopSetSynchronizationNotificationGuid	53929 Removed the glossary term link for the term ICS.	N	Content update.
3.1.4.1.2 Sending Push Notification Datagram	53929 Removed the glossary term link for the term actions.	N	Content update.

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