[MS-UPSDBDAP]:
User Profile Synchronization (UPS):
Database Data Access Protocol Specification

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Revision Summary

Date	Revision History	Revision Class	Comments
08/14/2009	0.1	Major	First Release.
09/25/2009	0.2	Minor	Updated the technical content.
11/06/2009	0.2.1	Editorial	Revised and edited the technical content.
12/18/2009	0.2.2	Editorial	Revised and edited the technical content.
01/29/2010	0.2.3	Editorial	Revised and edited the technical content.
03/12/2010	1.0	Major	Updated and revised the technical content.
04/23/2010	2.0	Major	Updated and revised the technical content.
06/04/2010	2.1	Minor	Updated the technical content.
07/16/2010	3.0	Major	Significantly changed the technical content.
08/27/2010	3.1	Minor	Clarified the meaning of the technical content.
10/08/2010	3.1	No change	No changes to the meaning, language, or formatting of the technical content.
11/19/2010	3.1	No change	No changes to the meaning, language, or formatting of the technical content.
01/07/2011	3.1	No change	No changes to the meaning, language, or formatting of the technical content.
02/11/2011	3.1	No change	No changes to the meaning, language, or formatting of the technical content.
03/25/2011	3.1	No change	No changes to the meaning, language, or formatting of the technical content.
05/06/2011	3.1	No change	No changes to the meaning, language, or formatting of the technical content.
06/17/2011	3.2	Minor	Clarified the meaning of the technical content.

Date	Revision History	Revision Class	Comments
09/23/2011	3.2	No change	No changes to the meaning, language, or formatting of the technical content.
12/16/2011	3.3	Minor	Clarified the meaning of the technical content.
03/30/2012	3.3	No change	No changes to the meaning, language, or formatting of the technical content.
07/12/2012	3.4	Minor	Clarified the meaning of the technical content.

Contents

1 Introduction

This document specifies the User Profile Synchronization (UPS) Database Data Access Protocol, which describes the communication between a UPS service, acting as a client, and a UPS database, acting as a server. This document specifies the communication sequences used by a **synchronization engine** to perform data query and update commands on **back-end database server (BEDS)** as part of file, user, and group synchronization operations.

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

1.1 Glossary

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

base64
distinguished name (DN)
domain
domain name (1)
domain controller (DC)
globally unique identifier (GUID)
HRESULT
Lightweight Directory Access Protocol (LDAP)
outbound
schema
security identifier (SID)
Unicode
Unicode character
Unicode string
UTC (Coordinated Universal Time)
Windows Management Instrumentation (WMI)
XML
XML namespace

The following terms are specific to this document:

anchor: An attribute value or series of attribute values of an object used to uniquely identity an object.

back-end database server (BEDS): A server that hosts data, configuration settings, and stored procedures that are associated with one or more applications.

connector filter: A synchronization rule that prevents an object changing from a **disconnector object** to a **connector object**.

connector object: A **staging object** that is linked to a **metaverse object**.

connector space: A staging area that contains representations of the objects from a connected **data source** and their attributes.

connector space object: See **connector object**.

data source: A database, Web service, disk, file, or other collection of information from which data is queried or submitted. Supported **data sources** can vary based on application and the data provider that is specified.

delete-add: A **pending import** type that occurs when the **synchronization engine** finds a **staging object** in the **connector space** with the same **distinguished name (DN)** but a different object types.

delta import: An import from a connected directory where only the changes that have occurred since the last import are imported.

delta synchronization: A **synchronization process** which process only those objects which have **pending imports**.

deprovisioning: Deletion of a **connector space object**.

disconnector object: A **staging object** that is not linked to a **metaverse object**.

drop file: A file created by a **management agent (MA)** during either an import or an export operation. The file contains an **XML** representation of all of the data being processed by the **MA** during that operation.

explicit connector object: A **connector object** which cannot transition to a **disconnector object**.

explicit disconnector object: A **disconnector object** which cannot transition to a **connector object**.

export attribute flow: An action which transfers attributes values from a **metaverse object** to a **connector space object**.

export attribute rules: A set of rules which govern **export attribute flow**.

export batch number: A counter which is incremented each time an export run-step is executed for a **management agent**.

export sequence number: This is counter that starts at zero and increments for each successful exported change during a run profile.

full import: An import from a connected directory where all objects and attributes are imported.

full synchronization: A **synchronization process** which process all **staging objects**.

hologram: A set of object attributes that have been imported and synchronized to the **metaverse**.

Identity Lifecycle Manager (ILM): A Microsoft product that supports managing identities, authentication and authorization credentials, and identity-based access policies across heterogeneous environments.

image: A set of object attributes used to track a given set of attribute changes, such as the changes that are **pending export** or **pending import**.

import attribute flow: An action which transfers attribute values from an import object to a **metaverse object**.

import attribute rules: A set of rules which govern **import attribute flow**.

indexable: A database field that can be indexed.

join: An action which establishes a link between import objects and an existing **metaverse object**.

LDIF: A standard plain-text data interchange format for representing **Lightweight Directory Access Protocol (LDAP)** directory content and update requests.

management agent (MA): An object that translates the operation of the **synchronization engine** into the format that a connected **data source** understands.

metaverse: A storage area that contains the aggregated information from multiple connected **data sources**.

metaverse object: Any of the combined objects in the **metaverse**. A **metaverse object** contains the aggregated view that the **synchronization engine** has of all the **staging objects** in all the **connector spaces**.

multi-valued attribute: An attribute that can contain multiple values of the same type.

non-indexable: A database field that cannot be indexed.

normal connector objects: Alternate term for a **connector object**, used to distinguish a **connector object** from an **explicit connector object**.

normal disconnector objects: Alternate term for a **disconnector object**, used to distinguish a **disconnector object** from an **explicit disconnector object**.

obsoletion: The process of the **synchronization engine** marking objects in the **connector space** that were not imported with a delete **pending import** type.

pending export: A status used to mark a **staging object** with information that has not yet been exported to the connected **data source**.

pending import: A status used to mark a **staging object** with information that has not yet been synchronized with the **metaverse**.

placeholder: A **staging object** which represents a component of another **staging object's** hierarchical name that has not yet been imported.

primary object class: The most-derived object class in a list of object classes or types.

projection: An action that creates a **metaverse object** and establishes a link between import objects and an existing **metaverse object**.

provision: An action that creates a **connector space object** and establishes a link with an existing **metaverse object**.

provisioning: Creation of a **connector space object**.

single-valued attribute: An attribute that can have only one value.

staging file: A file containing either data from a connected **data source** before it is imported by the **synchronization engine**, or data exported from the **synchronization engine** before it has been processed by the connected **data source**.

staging object: A representation of an instance of a connected **data source** object.

staging process: A process in which the **synchronization engine** compares the information received from the connected **data source** with the information about a **staging object** and determines whether the **staging object** requires updates.

synchronization engine: An object that performs synchronization.

synchronization process: The process of matching the data contained in the **metaverse** and the connected **data sources**.

transient state: A state of a **staging object** that occurs when a **staging object** has the same **DN** but a different **anchor** attribute value than an imported object.

watermark: A value that denotes the state of all objects in the **data source** at a particular point in time.

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

1.2 References

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

1.2.1 Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dochelp@microsoft.com. We will assist you in finding the relevant information. Please check the archive site, http://msdn2.microsoft.com/en-us/library/E4BD6494-06AD-4aed-9823-445E921C9624, as an additional source.

[DSML2] OASIS Standard, "Directory Services Markup Language v2.0", December 2001, http://xml.coverpages.org/DSMLv2-draft14.pdf

[FIPS197] National Institute of Standards and Technology, "Federal Information Processing Standards Publication 197: Advanced Encryption Standard (AES)", November 2001, http://csrc.nist.gov/publications/fips/fips197/fips-197.pdf

[MC-SMP] Microsoft Corporation, "Session Multiplex Protocol Specification".

[MS-ADA1] Microsoft Corporation, "Active Directory Schema Attributes A-L".

[MS-ADA2] Microsoft Corporation, "Active Directory Schema Attributes M".

[MS-ADA3] Microsoft Corporation, "Active Directory Schema Attributes N-Z".

[MS-DTYP] Microsoft Corporation, "Windows Data Types".

[MS-TDS] Microsoft Corporation, "Tabular Data Stream Protocol Specification".

[MS-UPSCDS] Microsoft Corporation, "User Profile Synchronization (UPS): Configuration Data Structure".

[MSTSQL] Microsoft Corporation, "T-SQL Language Reference", (Volume 5 of Microsoft SQL Server 2000 Reference Library, Microsoft Press, 2001, ISBN: 0-7356-1280-3)

[RFC793] Postel, J., "Transmission Control Protocol", STD 7, RFC 793, September 1981, http://www.ietf.org/rfc/rfc0793.txt

[RFC1122] Braden, R., Ed., "Requirements for Internet Hosts -- Communication Layers", STD 3, RFC 1122, October 1989, http://www.ietf.org/rfc/rfc1122.txt

[RFC2246] Dierks, T., and Allen, C., "The TLS Protocol Version 1.0", RFC 2246, January 1999, http://www.ietf.org/rfc/rfc2246.txt

[RFC4122] Leach, P., Mealling, M., and Salz, R., "A Universally Unique Identifier (UUID) URN Namespace", RFC 4122, July 2005, http://www.ietf.org/rfc/rfc4122.txt

[RFC4648] Josefsson, S., "The Base16, Base32, and Base64 Data Encodings", RFC 4648, October 2006, http://www.ietf.org/rfc/rfc4648.txt

[SSL3] Netscape, "SSL 3.0 Specification", http://tools.ietf.org/html/draft-ietf-tls-ssl-version3-00

If you have any trouble finding [SSL3], please check here.

[XMLNS-2ED] World Wide Web Consortium, "Namespaces in XML 1.0 (Second Edition)", August 2006, http://www.w3.org/TR/2006/REC-xml-names-20060816/

[XMLSCHEMA1] Thompson, H.S., Ed., Beech, D., Ed., Maloney, M., Ed., and Mendelsohn, N., Ed., "XML Schema Part 1: Structures", W3C Recommendation, May 2001, http://www.w3.org/TR/2001/REC-xmlschema-1-20010502/

[XMLSCHEMA2] Biron, P.V., Ed., and Malhotra, A., Ed., "XML Schema Part 2: Datatypes", W3C Recommendation, May 2001, http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/

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

1.2.2 Informative References

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

[MS-WMI] Microsoft Corporation, "Windows Management Instrumentation Remote Protocol Specification".

1.3 Overview

The User Profile Synchronization (UPS) Database Data Access Protocol specifies the communication between the synchronization engine and the back-end database server (BEDS) used to synchronize users, groups, and other objects between **data sources**. This client-to-server protocol uses the Tabular Data Stream Protocol [MS-TDS] as its transport between the synchronization engine, acting as a client, and the BEDS, acting as a server.

The concepts and processing steps of the synchronization engine are described in [MS-UPSCDS] section 1.3.

The logical flow of the system is illustrated in the following figure.

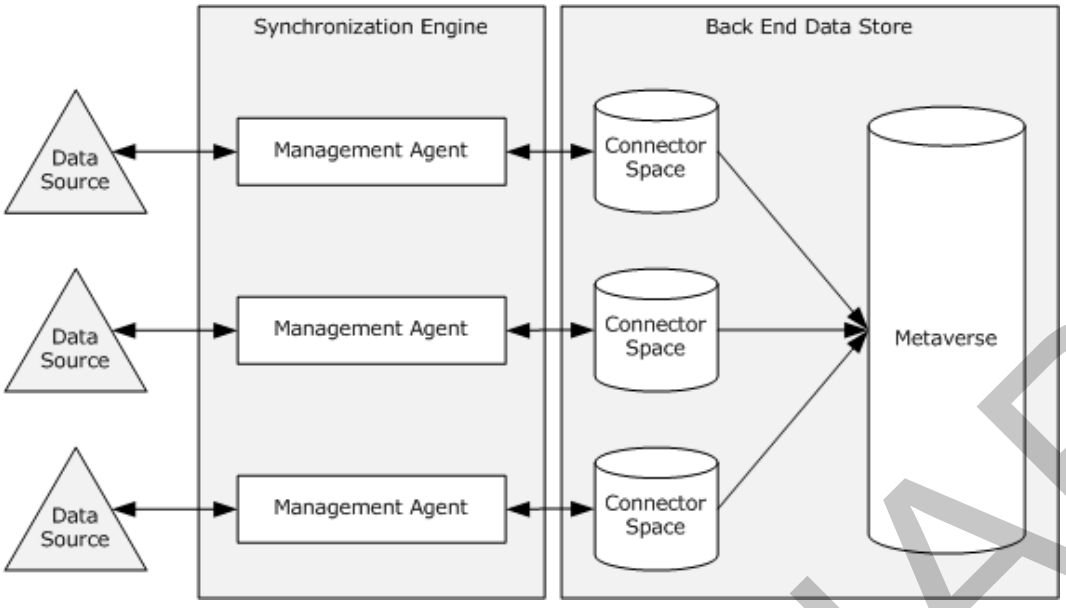


Figure 1: Logical Flow Diagram

In addition to storing the objects being synchronized, the synchronization engine stores the configuration for the **synchronization process** in the BEDS.

The synchronization engine encapsulates interaction with a data source using a **management agent**. The management agent translates a synchronization engine import or export operation into the format that the data source understands.

A management agent can be configured to create a **drop file** during an import or export operation. Drop files contain **XML** representations of all of the objects that were being imported or exported. The management agents can be configured to flow the data to the drop file and stop, or to create the drop file and continue to import or export the data from the **connector space**. The management agents can be configured to resume the flow of data from the drop file to the connector space or from the drop file to the data source.

1.4 Relationship to Other Protocols

This protocol relies on the Tabular Data Stream Protocol [MS-TDS] as its transport protocol to invoke Stored Procedures and T-SQL statements to inspect and manipulate object data via Result Sets and Return Codes.

TDS depends on Transport Layer Security/Secure Sockets Layer (TLS/SSL) [RFC2246] [SSL3] for network channel encryption. Although the TDS protocol depends on TLS/SSL to encrypt data transmission, the negotiation of the encryption setting between the client and server and the initial TLS/SSL handshake are handled in the TDS layer.

If the Multiple Active Result Set (MARS) feature is enabled, then the Session Multiplexing protocol (SMUX) [MC-SMP] is required. This relationship is illustrated in the following figure.

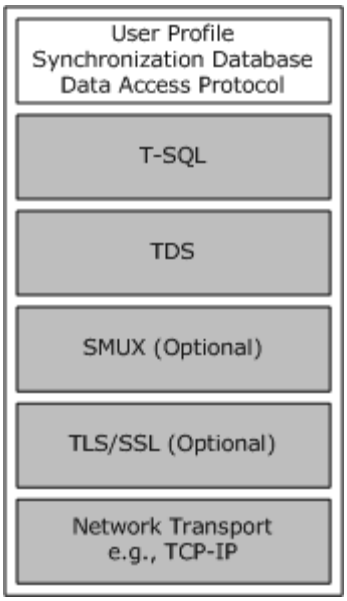


Figure 2: Relationship to other protocols

The synchronization engine relies on this protocol to retrieve and manipulate object information persistently stored on the BEDS, and to synchronize that data to the data sources.

Specifications for TCP-IP network transport are found in [RFC793] and [RFC1122].

1.5 Prerequisites/Preconditions

The operations described by this protocol operate between a protocol client and a protocol server. The client is expected to have the location and connection information for the required databases on the protocol server.

This protocol requires the protocol client to have appropriate permissions to call the stored procedures in the required databases on the protocol server.

1.6 Applicability Statement

This protocol is only applicable to the User Profile Synchronization Engine when communicating with the BEDS for configuration, synchronization, and administration operations.

1.7 Versioning and Capability Negotiation

This document covers versioning issues in the following areas:

- **Protocol Versions:** The protocol supports a single version of the database **schema**, stored procedures, and data structures. The version is defined in section 2.2.5.15.
- **Security and Authentication Methods:** This protocol supports the SSPI and SQL Authentication with the BEDS. These authentication methods are defined in [MS-TDS].

1.8 Vendor-Extensible Fields

None.

1.9 Standards Assignments

None.

2 Messages

2.1 Transport

The Tabular Data Stream Protocol [MS-TDS] is the transport protocol used to call the stored procedures, query SQL Views or SQL Tables, and return result codes and result sets.

2.2 Common Data Types

This section defines the data types that are used in this protocol. In these data types, **GUID** values are specified using the following formats:

- Binary Structures (section 2.2.3): GUID packet representation ([MS-DTYP] section 2.3.2.2).
- Result Sets (section 2.2.4) and Tables and Views (section 2.2.5): The **uniqueidentifier** data type [MSTSQL], which uses the string form of **universally unique identifier (UUID)** ([RFC4122] section 3).
- XML Structures (section 2.2.6): The **guidType** simple type, which uses the string form of UUID.

2.2.1 Simple Data Types and Enumerations

The following simple data types and enumerations are defined for use with this protocol. Only the values defined in the following data type definitions SHOULD be used. All other values are reserved for future use and SHOULD NOT be used.

2.2.1.1 Execution Result Strings

The following execution result **Unicode strings** are used by the synchronization engine to report and display the execution status of a run profile.

Value	Description
"in-progress"	The run profile execution is still in progress.
"success"	The run profile completed successfully.
"no-start-credentials"	The credentials for the management agent are invalid.
"no-start-connection"	The management agent was unable to establish a connection to the data source.
"no-start-file-not-found"	The input file could not be found for an import staging profile.
"no-start-file-access-denied"	The management agent does not have permissions to read or write the **staging file** or **drop file**.
"no-start-file-sharing-	The file system reported a sharing violation when the management agent tried to access the **staging file** or **drop file**.

Value	Description
violation"	
"no-start-file-open"	A generic file create/write error. During the creation of a staging file, this will be reported for any file access error other than: ▪ no-start-file-access-denied ▪ no-start-file-sharing-violation ▪ stopped-disk-full Specific details of the failure will be written to the application event log.
"no-start-database-permission"	The management agent does not have the permissions needed to access the data source database.
"no-start-database-table"	The management agent could not read or write the database table.
"no-start-database-schema-mismatch"	The database schema does not match the schema defined for the management agent.
"no-start-ma-working-directory"	The management agent working directory could not be accessed.
"no-start-full-import-required"	The management agent does not have a valid **watermark** for the data source server it is accessing. A **full import** MUST be performed in order to get all changes and bring the watermark current.
"no-start-file-contains-incorrect-step-type"	The step-type of drop file does not match the step-type of run profile step.
"no-start-bad-ma-configuration"	The management agent has incorrect configuration in the XML definition.
"no-start-partition-not-configured"	The management agent does not have a valid partition configured.
"missing-partition-for-run-step"	The partition defined for this run step does not exist.
"no-start-no-domain-controller"	The management agent could not locate a **domain controller**.
"no-start-partition-rename"	The management agent detected a partition rename in the data source.

Value	Description
"no-start-partition-delete"	The data source partition has been deleted.
"no-start-change-log-not-enabled"	The data source change log has not been enabled.
"stopped-change-log-out-of-order"	The data source change log is out of order.
"no-start-delta-step-type-not-configured"	The delta step type is not configured.
"no-start-file-code-page"	The code page configured for the management agent does not match the code page detected in the import file.
"stopped-parsing-errors"	The run step stopped because there were parsing errors while reading the data.
"no-start-server"	The management agent failed to start because of an unspecified server error.
"no-start-ma"	The management agent failed to start because of an unspecified management agent error.
"no-start-no-steps-in-profile"	There are not steps defined in the run profile. Define at least one run step.
"no-start-notes-api-not-availible"	Reserved.
"no-start-notes-client-init-failure"	Reserved.
"no-start-header-row-mismatch"	The header row in the input file and the header row configured in the file management agent do not match.
"stopped-connectivity"	The run step stopped because of connectivity errors.
"stopped-user-termination-from-wmi-or-ui"	The user stopped the run.
	The extension terminated the run.

Value	Description
"stopped-user-termination-from-extension"	
"stopped-service-shutdown"	The run stopped because the service is shutting down.
"stopped-object-limit"	The run step stopped when it reached the maximum number of objects per run.
"stopped-deletion-limit"	The run step stopped because the number of deletions exceeded the defined limit.
"stopped-error-limit"	The run step stopped when it exceeded the specified maximum number of errors.
"stopped-import-read"	The run step stopped when it encountered an error reading from the import file
"stopped-export-write"	The run step stopped when it encountered an error writing to the export file.
"stopped-bad-ma-configuration"	The run stopped because the management agent configuration is invalid.
"stopped-file-embedded-nulls"	The run step stopped because the import file contains embedded nulls.
"stopped-deadlocked"	The run step failed because of a database deadlock.
"stopped-code-page-conversion"	The run step stopped because the management agent was unable to convert data to or from the specified codepage.
"stopped-server"	The run step stopped because the server encountered an unexpected error.
"stopped-ma"	The run step stopped because the management agent encountered unexpected errors.
"stopped-extension-dll-not-configured-for-mv"	The run step stopped because the **metaverse** extension has not been configured.
"stopped-extension-dll-not-configured-for-ma"	The run step stopped because the management agent rules extension has not been configured.
"stopped-extension-dll-	The run step stopped because the extension DLL could not be found in the extensions folder.

Value	Description
file-not-found"	
"stopped-extension-dll-invalid-assembly"	The run step stopped because the specified rules extension DLL is not a valid extension assembly.
"stopped-extension-dll-load"	The run step stopped because the specified rules extension could not be loaded.
"stopped-extension-dll-no-implementation"	The run step stopped because the extension DLL did not implement the necessary interface.
"stopped-extension-dll-ambiguous"	The run step stopped because there are duplicate extension object implementations in the specified extension DLL.
"stopped-extension-dll-instantiation"	The run step stopped because the extension object in the extension DLL could not be instantiated.
"stopped-database-connection-lost"	The run step stopped because the connection to the database was lost.
"stopped-extension-dll-missing-dependency"	The run step stopped because the extension DLL is missing a dependency.
"stopped-extension-dll-exception"	The run step stopped because the extension DLL threw an exception.
"stopped-extension-dll-updated-version"	The run step stopped because a newer version of the extension DLL was placed in the extensions folder.
"stopped-extension-dll-access"	The run step stopped because the extension DLL could not be accessed due to a permission error.
"stopped-file-error"	The run step stopped because of a file error.
"stopped-disk-full"	The run step stopped because the disk is full.
"stopped-database-disk-full"	The run step stopped because the database disk is full.
"stopped-out-of-memory"	The run step stopped because the server is out of memory.

Value	Description
"stopped-entry-point-not-implemented"	The run step stopped because the extensible management agent does not implement the entry point.
"completed-discovery-errors"	The run step completed, but there were one or more discovery errors.
"completed-sync-errors"	The run step completed, but there were one or more synchronization errors.
"completed-export-errors"	The run step completed, but there were on or more export errors.
"completed-warnings"	The run step completed, but there were one or more warnings.
"completed-transient-objects"	The run step completed, but there were one or more objects left in a **transient state**.
"completed-no-objects"	The run step completed, but there were no objects processed.
"stopped-export-disabled"	The run step stopped because the management agent is configured for import operations only.
"stopped-server-down"	The run step stopped because the data source server is down.
"stopped-bad-server-credentials"	The run step stopped because the extensible management agent reported that the credentials are invalid.
"stopped-unexpected-data"	The run step stopped because the extensible management agent encountered unexpected data.
"stopped-extensible-extension-error"	The run step stopped because the extensible management agent returned an ExtensibleExtensionException exception.
"stopped-failed-to-delete-file"	The run step stopped because the extensible management agent failed to delete the import or export file.
"stopped-entry-export-error"	The run step stopped because the script host received a FatalEntryExportException exception.
	The run step stopped because the extensible management agent returned an EndConnectionException exception while calling the end connection entry

Value	Description
"stopped-error-in-end-connection"	point.
"stopped-ma-extension-error-in-end-connection"	The run step stopped because the extensible management agent returned an unexpected exception while calling the end connection entry point.
"stopped-ma-extension-timeout"	The run step stopped because the extensible management agent timed out while performing an operation.
"stopped-password-extension-timeout"	The run step stopped because the password extension timed out while processing a password.
"stopped-password-extension-not-configured"	The run step stopped because the password extension was not configured.

2.2.1.2 Management Agent Export Type

The management agent export type indicates the type of export supported by a management agent.

Value	Description
1	The management agent supports updating a single attribute value.
2	The management agent only supports updating an entire attribute. Attribute-value level exports are not supported.
3	The management agent only supports updating an entire object. Attribute and attribute-value level exports are not supported.

2.2.1.3 Management Agent Types

The management agent type values are used by the sync engine to distinguish the type of a management agent instance.

Value	Description
"AD"	Active Directory Domain Services
"iPlanet"	Sun One Directory Server
"eDirectory"	Novell Directory Services
	IBM Directory Server

Value	Description
"IBM DS"	
"FIM"	FIM Management Agent
"Extensible"	Extensible Management Agent

2.2.2 Bit Fields and Flag Structures

The following bit field and flag structures are defined for use with this protocol. Only the values defined in the following data type definitions SHOULD be used. All other values are reserved for future use and SHOULD NOT be used.

2.2.2.1 ABITS Flags

A 2-bit value used in attribute definitions as stored in a binary **image**.

Value	Description
0x0	None
0x1	The attribute is for export only.
0x2	The attribute is encrypted.

2.2.2.2 AMODT Flags

A 3-bit flag indicating the type of attribute modification in a binary image.

Value	Description
0x0	Not configured
0x1	Add
0x2	Replace
0x3	Update
0x4	Delete

2.2.2.3 ATYPE Enumeration

A 1-byte unsigned integer enumeration that specifies the attribute type as stored in a binary image.

Value	Description
0x01	A reference attribute.
0x02	An octet attribute.
0x03	A string attribute.
0x04	A number attribute.
0x05	A Boolean attribute.
0x81	A **multi-valued reference attribute**.
0x82	A **multi-valued octet attribute**.
0x83	A **multi-valued string attribute**.
0x84	A **multi-valued number attribute**.

2.2.2.4 Connector State Flags

A 4-byte integer that specifies the state of the connector space connection. The only valid values of the connector state flags are as follows:

Value	Description
0x00000000	The state of the connector is normal.
0x00000001	The state of the connector is explicit.
0x00000002	The state of the connector is filtered.

2.2.2.5 Critical Error Codes

This table documents the critical error codes used by the synchronization engine.

Value/DisplayString	Description
0x8007000E stopped-out-of-memory	Ran out of memory
0x8023043A stopped-database-disk-full	The database operation failed because there was not enough disk space. This could be because there is no space on the disk or because the database or database log file size could not be increased.
0x80230501 rules-error	Rules Engine generic error encountered.
0x80230621 database-connection-lost	A connection to SQL Server could not be established
0x80230700 extension-dll-not-configured-for-ma	An extension is not configured for the specified management agent.
0x80230701 extension-dll-not-configured-for-mv	The metaverse extension is not configured.
0x80230704 extension-dll-load	The extension could not be loaded.
0x80230705 extension-dll-no-implementation	The extension does not contain an implementation of the class and method that was called.
0x80230706 extension-dll-ambiguous	The extension contains multiple objects named "ScriptObject" in different namespaces.
0x80230707 extension-dll-instantiation	The extension could not be instantiated.
0x8023070D extension-dll-invalid-filename	The extension name contains invalid characters.
0x80230713 extension-dll-invalid-assembly	The specified extension is not a valid assembly.
0x80230714 extension-dll-file-not-found	The specified extension could not be found.
0x80230715 extension-dll-access	The synchronization service account does not have permission to load the specified extension.
0x80230716 extension-dll-exception	The operation failed because there was an error in the Initialize method of the extension.
0x80230717 extension-dll-updated-during-execution	The operation failed because an extension was modified while a management agent was executing.
0x80230718 extension-dll-missing-	The operation failed because the extension's process terminated unexpectedly.

Value/DisplayString	Description
dependency	
0x8023071A stopped-user-termination-from-extension	The extension requested that the run be terminated.
0x80230727 extension-dll-file-not-found	The specified management agent extension could not be found.
0x80230728 extension-dll-invalid-assembly	The specified management agent extension is not a valid assembly.
0x80230729 extension-dll-load	The management agent extension could not be loaded.
0x8023072A extension-dll-no-implementation	The management agent extension does not contain a class that implements the extension interface(s).
0x8023072B extension-dll-ambiguous	The management agent extension contains multiple objects that implement the extension interface(s).
0x8023072C extension-dll-instantiation	The management agent extension could not be instantiated.
0x8023072D extension-dll-missing-dependency	The operation failed because a dependency could not be found for the management agent extension.
0x8023072F extension-dll-access	The synchronization service account does not have permission to load the specified management agent extension.
0x80230731 stopped-user-termination-from-extension	The management agent extension requested that the run be terminated.
0x80230800 object-limit-error	The management agent run was terminated as the object count threshold was exceeded.
0x80230801 stopped-server	The management agent run was terminated as there were unspecified server errors on import.
0x80230817 stopped-error-limit	The management agent run was terminated as the error limit was exceeded.
0x8023081A stopped-disk-full	The management agent run was terminated as the disk was full.
0x8023081E stopped-file-embedded-nulls	Parsing failed as the file contained embedded terminating null characters.
0x80230824 stopped-bad-ma-configuration	The management agent run was terminated as the management agent was configured improperly.
0x80230825	The management agent run was terminated by the user.

Value/DisplayString	Description
unexpected-error	
0x80230826 unexpected-error	The management agent run was terminated as the server is shutting down.
0x80230835 deletion-limit-error	The management agent run was terminated as the deletion count threshold was exceeded.

2.2.2.6 Delete State Flags

Connector space object delete state flags that are returned from the stored procedure mms_ProcessCsObjectDeletion.

Value	Description
0x00000000	Unknown link state.
0x00000001	The connector space object is still referenced by import, **hologram**, or export links. It MAY have children.
0x00000002	The connector space object is still referenced by export links. It MAY have children.
0x00000003	The connector space object still has children.
0x00000004	The connector space object has truly been deleted.

2.2.2.7 Header Value Type Flags

A 4-byte unsigned integer bitmask that specifies the characteristics of this image, and the special attribute values that are present in the binary image structure. All bits not specified here MUST be zero.

Value	Description
0x00000008	An image value. If this bit is not set, then this is a delta image.
0x00000010	The object includes lineage data.
0x00000020	The object has a current **distinguished name (DN)**.
0x00000040	The object has a new DN.
0x00000080	The object has a **primary object class**.

Value	Description
0x00000100	The object has an **anchor** value.
0x00000200	The object has a parent anchor value.

2.2.2.8 Import/Export Operation Flags

A 4-byte unsigned integer that specifies the type of the import or export operation. The only valid values of the import/export operation flags are as follows:

Value	Description
0x00000001	An ADD operation.
0x00000002	A MODIFY operation.
0x00000003	A **DELETE-ADD** operation.
0x00000004	A DELETE operation.

2.2.2.9 Lineage Rule Type

A 4-byte integer flag indicating the rule type that was responsible for the lineage change.

Value	Description
0x00000000	Unknown
0x00000001	Disconnect Filter
0x00000002	**Projection**
0x00000003	**Join**
0x00000004	**Provisioning**
0x00000005	Metaverse Deletion
0x00000006	**Import Attribute Flow**

Value	Description
0x00000007	**Export Attribute Flow**
0x00000008	Connector Space Deprovisioning
0x00000009	Account Joiner

2.2.2.10 Link State Flags

A 4-byte integer flag indicating the association of the link data to the correct part of the connector space image.

Value	Description
0x00000000	The link data is for a reference in the hologram.
0x00000001	The link data is for a reference in the **pending import** image.
0x00000002	The link data is for a reference in the export image.

2.2.2.11 Management Agent Capabilities

The management agent capabilities flag is a 32-bit value indicating the capabilities of a management agent.

Value	Description
0x00000001	Provides immediate export confirmation
0x00000002	DN is the anchor attribute for this management agent
0x00000004	Provides an immutable anchor
0x00000008	Object renamed that fall out of scope will not be submitted as deletes by this management agent.
0x00000010	Supports native DNs
0x00000020	Supports hierarchical DNs
	Supports LDAP-style DNs

Value	Description
0x00000040	
0x00000080	Supports renaming of containers
0x00000100	Supports providing parent anchor for each object during import
0x00000200	Supports renaming of leaf nodes
0x00000400	Does not support exporting of reference values on first export pass (that is, supports referential integrity)
0x00000800	Supports full import
0x00001000	Supports **delta import**
0x00002000	Supports export
0x00004000	The management agent will function without first running a full import run profile
0x00008000	Supports concurrent operations
0x00010000	Requires full replace of object to be deleted
0x00020000	Requires attribute update list on export
0x00040000	Supports retrieving of schema
0x00080000	Requires normalization to uppercase
0x00100000	Requires normalization to remove accent characters
0x00400000	Support storing sync configuration. MUST be 0 for all management agents instance except those with **ma_type** with the literal "FIM"

2.2.2.12 Management Agent Statistics Enumeration

The management agent statistics enumeration indicates which statistic type was updated.

Value	Description
0x00000000	No statistics.
0x00000001	Staging unchanged.
0x00000002	Staging add.
0x00000003	Staging update.
0x00000004	Staging rename.
0x00000005	Staging delete.
0x00000006	Staging delete-add.
0x00000007	Staging failure.
0x00000008	Disconnector filtered.
0x00000009	Disconnector joined, no flow.
0x0000000A	Disconnector joined with flow.
0x0000000B	Disconnector joined, remove **metaverse object**.
0x0000000C	Disconnector projected, no flow.
0x0000000D	Disconnector projected with flow.
0x0000000E	Disconnector remains a disconnector.
0x0000000F	**Connector filtered**, remove metaverse object.
0x00000010	Connector filtered, leave metaverse object.
	Connector with flow.

Value	Description
0x00000011	
0x00000012	Connector with flow, remove metaverse object.
0x00000013	Connector, no flow.
0x00000014	Connector delete, remove metaverse object.
0x00000015	Connector delete, leave metaverse object.
0x00000016	Connector delete-add processed.
0x00000017	Flow failure.
0x00000018	Export add.
0x00000019	Export update.
0x0000001A	Export rename.
0x0000001B	Export delete.
0x0000001C	Export delete-add.
0x0000001D	Export failure.
0x0000001F	Provisioned flow.
0x00000020	Provisioned, no flow.
0x00000021	Provisioned add, no flow.
0x00000022	Provisioned add with flow.
0x00000023	Provisioned rename, no flow.

Value	Description
0x00000024	Provisioned rename with flow.
0x00000025	Provisioned delete.
0x00000026	Provisioned delete-add, no flow.
0x00000027	Provisioned delete-add with flow.
0x00000028	Provisioned flow reset.

2.2.2.13 Management Agent Statistics Flags

The management agent statistics flags are a bitmask which indicate which statistics are available.

Value	Description
0x0000000000000000	No statistics.
0x0000000000000001	Staging unchanged.
0x0000000000000002	Staging add.
0x0000000000000004	Staging update.
0x0000000000000008	Staging rename.
0x0000000000000010	Staging delete.
0x0000000000000020	Staging delete-add.
0x0000000000000040	Staging failure.
0x0000000000000080	Disconnector filtered.
0x0000000000000100	Disconnector joined, no flow.
	Disconnector joined with flow.

Value	Description
0x000000000000200	
0x000000000000400	Disconnector joined, remove metaverse object.
0x000000000000800	Disconnector projected, no flow.
0x000000000001000	Disconnector projected with flow.
0x000000000002000	Disconnector remains a disconnector.
0x000000000004000	Connector filtered, remove metaverse object.
0x000000000008000	Connector filtered, leave metaverse object.
0x000000000010000	Connector with flow.
0x000000000020000	Connector with flow, remove metaverse object.
0x000000000040000	Connector, no flow.
0x000000000080000	Connector delete, remove metaverse object.
0x000000000100000	Connector delete, leave metaverse object.
0x000000000200000	Connector delete-add processed.
0x000000000400000	Flow failure.
0x000000000800000	Export add.
0x000000001000000	Export update.
0x000000002000000	Export rename.
0x000000004000000	Export delete.

Value	Description
0x0000000080000000	Export delete-add.
0x0000000010000000	Export failure.
0x0000000020000000	Provisioned flow.
0x0000000040000000	Provisioned, no flow.
0x0000000080000000	Provisioned add, no flow.
0x0000000100000000	Provisioned add with flow.
0x0000000200000000	Provisioned rename, no flow.
0x0000000400000000	Provisioned rename with flow.
0x0000000800000000	Provisioned delete.
0x0000001000000000	Provisioned delete-add, no flow.
0x0000002000000000	Provisioned delete-add with flow.
0x0000008000000000	Provisioned flow reset.

2.2.2.14 Move Operations

Connector space objects can have move operations triggered during various operations by the synchronization engine. The following table defines the states that indicate what synchronization operation triggered the move operation.

Value	Description
0x00000000	None
0x00000001	Import
0x00000002	Export

Value	Description
0x00000003	Provisioning

2.2.2.15 OMODT Flags

A 3-bit flag indicating the object modification type of a binary image.

Value	Description
0x0	Not configured
0x1	None
0x2	Add
0x3	Replace
0x4	Update
0x5	Delete
0x6	Delete/Add The existing object will be deleted, and a new object will be added in its place.
0x7	Obsolete

2.2.2.16 Partition Allowed Operations

The partition allowed operations flag is a 32-bit value indicating the run profile operations allowed on a partition.

Value	Description
0x00000001	Delta import is allowed.
0x00000002	Delta import not allowed; management agent configuration has changed.
0x00000004	Delta import not allowed; metaverse configuration has changed.
0x00000008	Delta import not allowed; metaverse rules extension has changed.

Value	Description
0x00000010	Delta import not allowed; management agent rules extension has changed.
0x20000000	Suppress warnings for all partitions in the management agent.
0x40000000	No operations are allowed; MUST be set while management agent is being created.

2.2.2.17 Per-Object Error Codes

This table documents the per-object error codes used by the synchronization engine.

Value/Display String	Description
0x8023021C connector-filter-rule-violation	Connector filter rules violation.
0x8023021F unsupported-container-rename	Container rename is not supported.
0x80230220 exported-change-not-reimported	Unconfirmed export is not reimported.
0x80230226 unsupported-container-delete	Container deletion is not supported.
0x8023022E extension-provisioning-call-limit-reached	Excessive number of nested **deprovisioning** calls during provisioning.
0x80230318 encryption-key-lost	Failed to decrypt encrypted attributes for connector space or metaverse object due to missing encryption key.
0x80230401 locking-error-needs-retry	An attempt was made to acquire a lock to an object that has already been locked
0x80230414 write-locking-error-needs-retry	The store cannot get the write lock for the management agent.
0x80230424 locking-error-needs-retry	A deadlock has occurred in SQL Server.
0x80230429 unexported-container-rename	Unexported container rename fails because it has imported children.
0x8023042A mv-constraint-violation	Constraint violation for value in the metaverse.
0x8023042B unique-index-violation	Unique index violation.

Value/Display String	Description
0x8023044E locking-error-needs-retry	A deadlock occurred in SQL Server while trying to acquire an application lock.
0x80230452 locking-error-needs-retry	The SQL server timed out while attempting an I/O operation.
0x80230510 cs-attribute-type-mismatch	An attribute on a connector space object did not conform to the connector space schema.
0x80230513 flow-multi-values-to-single-value	An attribute from a source metaverse object could not be exported to the connector space because it did not conform to schema.
0x80230514 ambiguous-export-flow-to-single-valued-attribute	An attempt to export multiple values to a **single-valued attribute**.
0x8023051B dn-index-out-of-bounds	The DN-component mapping index is too large for the distinguished name.
0x8023051E extension-join-resolution-invalid-object-type	The join resolution rule changed the object type to one that does not exist in the metaverse schema.
0x8023051F extension-projection-invalid-object-type	The projection rule specified an object type that does not exist in the metaverse schema.
0x80230521 ambiguous-import-flow-from-multiple-connectors	Import flow was rejected because the destination metaverse object had multiple connectors from the source management agent.
0x80230523 flow-multi-values-to-single-value	An attempt was made to flow multiple values to a single-valued attribute during import attribute flow.
0x80230524 cannot-parse-dn-component	A distinguished name component could not be parsed by a DN-component mapping; it was not in the correct format for the destination attribute type.
0x80230525 flow-multi-values-to-single-value	An attempt was made to map multiple values to a single-valued attribute.
0x80230528 cannot-parse-object-id	The metaverse object-id was not specified in the correct format.
0x80230529 extension-join-resolution-index-out-of-bounds	The join resolution rule returned an invalid index.
0x8023052B join-object-id-must-be-single-valued	The join resolution requires that the metaverse object-id be a single-valued attribute.
0x8023052C locking-error-needs-retry	A thread in the rules extension was rolled back to avert possible deadlock.

Value/Display String	Description
0x8023052D extension-deprovisioning-invalid-result	The deprovision rule returned an invalid value.
0x80230554 sync-rule-invalid-xml-attribute-flow	The synchronization rule XML defines an invalid/incomplete attribute flow.
0x80230555 sync-rule-invalid-expression	The synchronization rule XML defines an invalid/incomplete expression.
0x80230556 sync-rule-required-attr-not-found	The synchronization rule requires an attribute that was not found
0x80230557 sync-rule-scoping-filter-invalid-xml	The XML format of the scoping rules is invalid.
0x80230558 sync-rule-scoping-filter-invalid-operator	The specified scope operator cannot be applied.
0x8023055A sync-rule-validation-parsing-error	Encountered an error while parsing/validating a synchronization rule.
0x8023055B sync-rule-inbound-flow-rules-invalid	The synchronization rule's inbound flow rule is invalid.
0x8023055C sync-rule-outbound-flow-rules-invalid	The synchronization rule's **outbound** flow rule is invalid.
0x8023055D sync-rule-flow-provisioning-failed	Synchronization rule based provisioning failed.
0x8023055E invalid-boolean-constant-flow	The synchronization rule's Boolean constant flow MUST only use true or false.
0x8023055F invalid-reference-constant-flow	The synchronization rule cannot define a string to reference flow for a destination attribute that does not allow it.
0x80230560 sync-rule-invalid-function-xml	The synchronization rule's flow defines a function call that does not adhere to the standard format for one or more functions.
0x80230561 sync-rule-invalid-export-scoping-xml	The synchronization rule's flow defines an export scoping element that does not adhere to the standard format for that scoping element.
0x80230562 sync-rule-invalid-relationship-criteria-xml	The synchronization rule's relationship criteria do not adhere to the standard format for relationship criteria.

Value/Display String	Description
0x80230563 sync-rule-relationship-criteria-attribute-not-found	The synchronization rule's relationship criteria reference an attribute that is not defined within the schema.
0x80230564 sync-rule-flow-attribute-not-found	The synchronization rule's flow mapping does not have the referenced attribute defined within the schema.
0x80230703 extension-dll-exception	The extension threw an exception.
0x80230708 extension-dll-timeout	The extension did not complete an operation within the configured time limit.
0x8023070B extension-projection-object-type-not-set	The extension method returned true but did not return a metaverse object type.
0x8023070C extension-projection-object-type-not-set	The extension method returned true but returned a 0-length metaverse object type name.
0x8023070E extension-join-resolution-index-out-of-bounds	The extension returned a metaverse object index that is out of range.
0x8023070F extension-unexpected-attribute-value	The extension encountered unexpected data in an object.
0x80230710 extension-entry-point-not-implemented	The extension does not implement the entry point.
0x80230719 extension-dll-crash	The operation failed because the extension's process terminated unexpectedly.
0x80230730 extension-entry-point-not-implemented	The password extension does not implement the entry point.
0x80230732 extension-entry-point-not-implemented	The extensible extension does not implement the entry point.
0x80231315 datetime-string-format-incorrect	Strings representing date times MUST be **UTC (Coordinated Universal Time)** and formatted as follows: yyyy-MM-dd HH:mm:ss.fff.
0x80231316 failed-impersonation	The management agent failed to impersonate with the given credentials.
0x80231317 failed-app-store-access	The management agent failed to validate against the application store with the specified credentials.
0x80231318 failed-schema-access	The management agent failed to create the schema manager needed for import.

Value/Display String	Description
0x80231319 app-store-import-exception	Encountered exception when querying objects from the application store.
0x80231320 unsupported-attribute-type	While importing an object, an unsupported attribute type was found.
0x80231321 sync-config-operation-not-supported	The requested sync config operation is not supported.
0x80231322 failed-creation-via-web-services	The object creation via web services failed.
0x80231323 failed-modification-via-web-services	The object modification via web services failed.
0x80231324 ambigous-reference-value-for-export-flow	The reference value to export flowed is connected to multiple cs objects.
0x80231326 failed-deletion-via-web-services	The object delete via Web services failed.
0x80231327 dre-missing-required-attribute	DetectedRuleEntry object does not have all the REQUIRED attributes.

2.2.2.18 Synchronization Statistics Enumeration

The synchronization statistics enumeration indicates which synchronization statistic type was updated.

Value	Description
0x00000000	Flow failure.
0x00000001	Disconnector filtered.
0x00000002	Disconnector joined, no flow.
0x00000003	Disconnector joined with flow.
0x00000004	Disconnector joined, remove metaverse object.
0x00000005	Disconnector projected, no flow.

Value	Description
0x00000006	Disconnector projected with flow.
0x00000007	Disconnector remains a disconnector.
0x00000008	Connector filtered, remove metaverse object.
0x00000009	Connector filtered, leave metaverse object.
0x0000000A	Connector with flow.
0x0000000B	Connector with flow, remove metaverse object.
0x0000000C	Connector, no flow.
0x0000000D	Connector delete, remove metaverse object.
0x0000000E	Connector delete, leave metaverse object.
0x0000000F	Connector delete-add processed.
0x00000010	Provisioned add, no flow.
0x00000011	Provisioned add with flow.
0x00000012	Provisioned rename, no flow.
0x00000013	Provisioned rename with flow.
0x00000014	Provisioned flow.
0x00000015	Provisioned, no flow.
0x00000016	Provisioned delete.
	Provisioned delete-add, no flow.

Value	Description
0x00000017	
0x00000018	Provisioned delete-add with flow.
0x00000019	Canceled out, management agent statistics not set.
0x00000063	Unexpected. Not necessarily an error as this can be caused by account jointer intervention.

2.2.2.19 VMODT Flags

A 1-byte flag indicating the type of value modification in a binary image.

Value	Description
0x0	Not configured
0x1	Add
0x2	Delete

2.2.3 Binary Structures

The synchronization engine uses a binary image format for storing object data of varying schema and configuration. The hologram and delta images of an object are stored in this binary image format. These binary images are then compressed so that they take up less space. It is this compressed binary data that is stored in the back-end database server (BEDS).

The following binary structures are defined for use with this protocol. Only the values defined in the following data type definitions SHOULD be used. All other values are reserved for future use and SHOULD NOT be used.

2.2.3.1 Binary Image Compression

The synchronization engine compresses the binary image data using the following encoding. The binary data consists of lots of **Unicode** text that happens to be mainly ASCII characters.

- **Unicode characters** in the range of 0x0000 to 0x007F are stored in 1 byte. The high bit MUST be zero.
- Unicode characters in the range of 0x0080 to 0x3FFF are stored in 2 bytes. The high bit MUST be 1 and the next highest bit MUST be zero.
- Unicode characters in the range of 0x4000 to 0xFFFF are stored in 3 bytes. The lowest 6 bits MUST be zero. The two high bits MUST be 1.

Once encoded, the data can be decoded by checking the high bit of the first byte. If it is zero, the character is in the low 7 bits of that byte. If it is not zero, then check the high two bits of the second

byte. If the high bit is 1 and the next highest bit is 0, the character is in the low 14 bits of those bytes. If the high bit is not 1 and the next highest bit is not zero, then the two highest bits of the third byte MUST be 1. The character is in bits 6 through 29 where the lowest bit is designated bit zero.

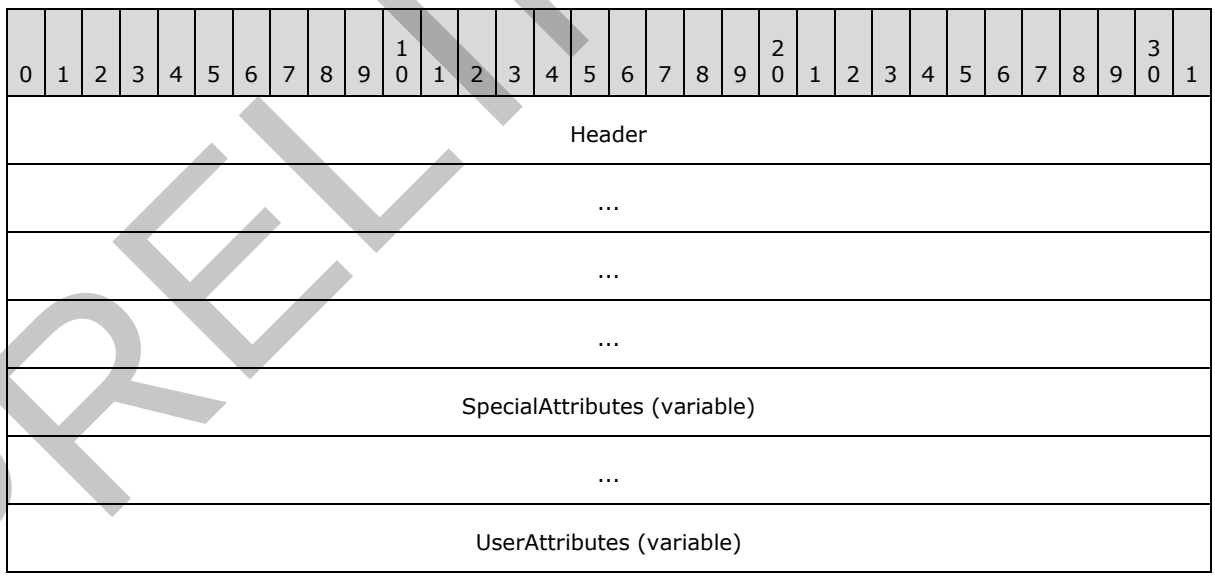
This table shows the encoding used:

Character Range	Encoded Format																							Encoding Size
	0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	
0x0000 - 0x007F	x	x	x	x	x	x	x	0																	1-byte
0x0080 - 0x3FFF	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0	1									2-bytes
0x4000 - 0xFFFF	0	0	0	0	0	0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1	1	3-bytes

All binary images MUST be encoded before they are written to the back end database server.

2.2.3.2 Binary Image Structure

A structure that specifies the format of the uncompressed binary image data.



...

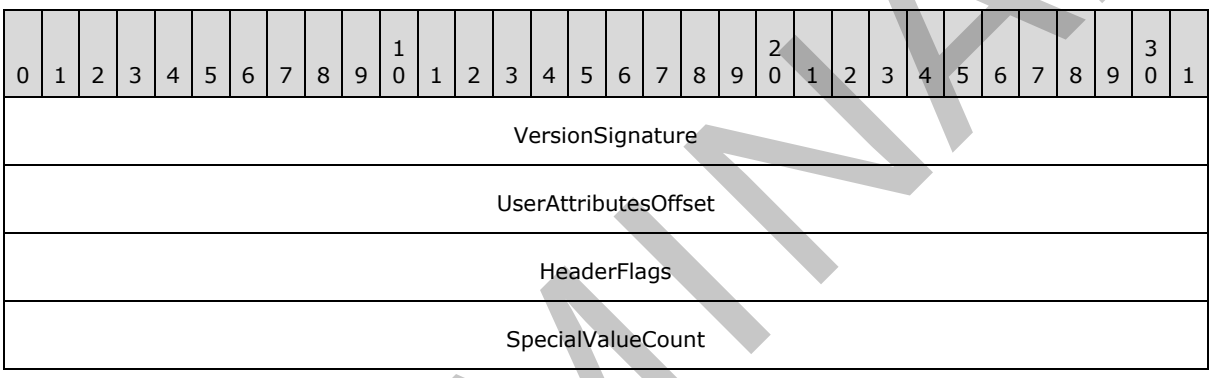
Header (16 bytes): A HOBL_HEADER_V1 structure (section 2.2.3.3) that gives the version for the structure, the offset to the user attributes, the header flags indicating which special attributes are present, and the count of special attributes.

SpecialAttributes (variable): A variable-length structure containing zero or more attributes that are used frequently by the synchronization engine, as defined in section 2.2.3.4. This data is aligned on 4-byte boundaries.

UserAttributes (variable): A variable-length structure containing zero or more user attributes as defined in section 2.2.3.5. The offset to the start of this structure is defined in the **HOBL_HEADER_V1** structure.

2.2.3.3 HOBL_HEADER_V1 Structure

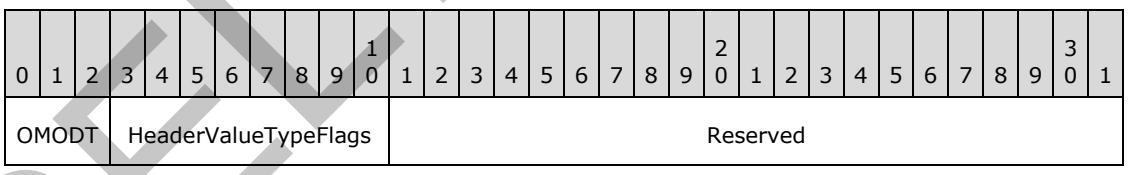
A 16-byte structure that specifies the header of a Binary Image Structure (section 2.2.3.2).



VersionSignature (4 bytes): The version signature of the Binary Image Structure. This MUST be 0xFFFFFFFE.

UserAttributesOffset (4 bytes): The offset, in bytes, from the end of the HOBL_HEADER_V1 structure to the start of the User Attributes (section 2.2.3.5).

HeaderFlags (4 bytes): A 4-byte value that is encoded with the following two types of data.



OMODT (3 bits): The object modification type. This MUST be one of the values in section 2.2.2.15.

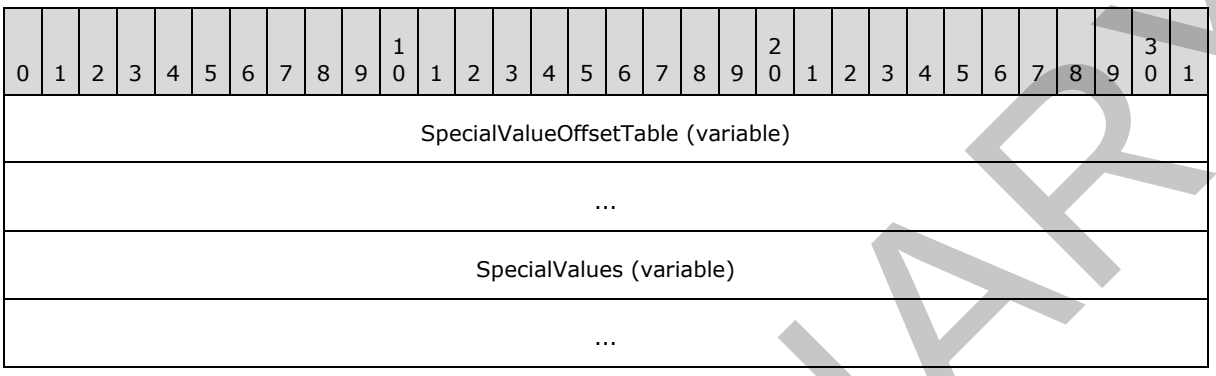
HeaderValueTypeFlags (1 byte): Bit flags that indicate which special attribute values are present in this Binary Image Structure. This MUST be zero, or a combination of the bit values from section 2.2.2.7.

Reserved (21 bits): Reserved for future use and MUST be zero.

SpecialValueCount (4 bytes): A count of the number of Special Values (section 2.2.3.4.1) in this structure.

2.2.3.4 SpecialAttributes

SpecialAttributes are those attributes that are needed frequently by the synchronization engine in order to accomplish the most basic operations. SpecialAttributes follow the **SpecialValueCount** in the header (see section 2.2.3.3).



SpecialValueOffsetTable (variable): An array of 4-byte offset values. The offsets are absolute values from the beginning of the Binary Image Structure (section 2.2.3.2) to the location of a SpecialValues (section 2.2.3.4.1) structure.

The number of entries in this table is determined by the **SpecialValueCount**, and which header value type flags are specified in the HOBL_HEADER_V1 structure. The order of the **SpecialValueOffsetTable** is always:

- Current DN
- New DN
- Primary Object Class
- Lineage
- Anchor
- Parent Anchor
- Object Class Data (secondary)

Example:

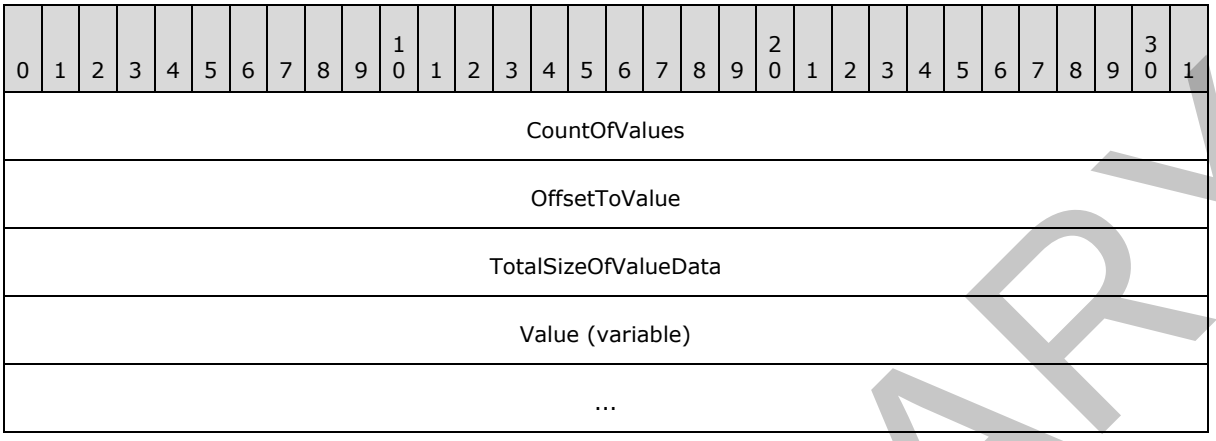
If the header value type flags for current DN (0x00000020) and primary object class (0x00000080) are defined, then the **SpecialValueCount** will be 2, and the size of the **SpecialValueOffsetTable** will be 8 bytes.

The values are always stored in the order specified above. In this example, the first offset in the **SpecialValueOffsetTable** will be for the current DN, and the second value will be for the primary object class.

SpecialValues (variable): An array of SpecialValues, as described in section 2.2.3.4.1.

2.2.3.4.1 SpecialValues

Each SpecialValues referred to from the **SpecialValueOffsetTable** will have the following structure:



CountOfValues (4 bytes): The count of values for this attribute. If this value is zero, the rest of this structure will not exist for this attribute, and the next part of the Binary Image Structure (section 2.2.3.2) will immediately follow this field.

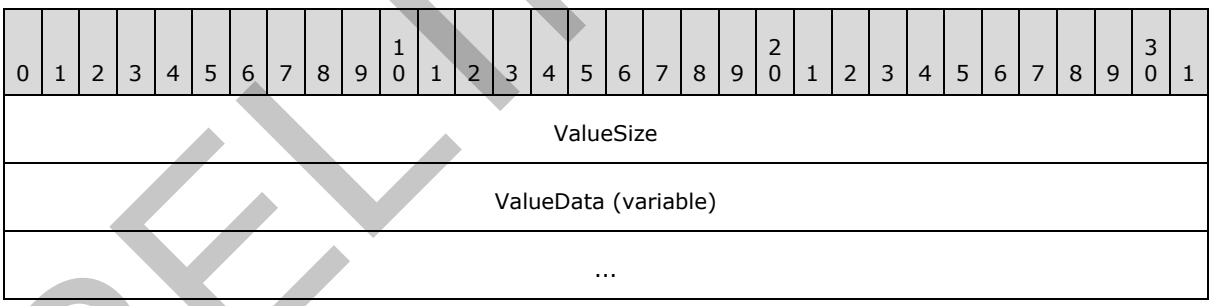
OffsetToValue (4 bytes): The offset, in bytes, from the end of the previous attribute or value to the total value size data.

TotalSizeOfValueData (4 bytes): The size, in bytes, of all ValueData (section 2.2.3.4.2) for this attribute. This includes the count of bytes for each individual value and the actual values.

Value (variable): An array of ValueData, as described in section 2.2.3.4.2.

2.2.3.4.2 ValueData

Each **Value** field within a SpecialValues (section 2.2.3.4.1) structure contains a ValueData structure, which is a size followed by data.



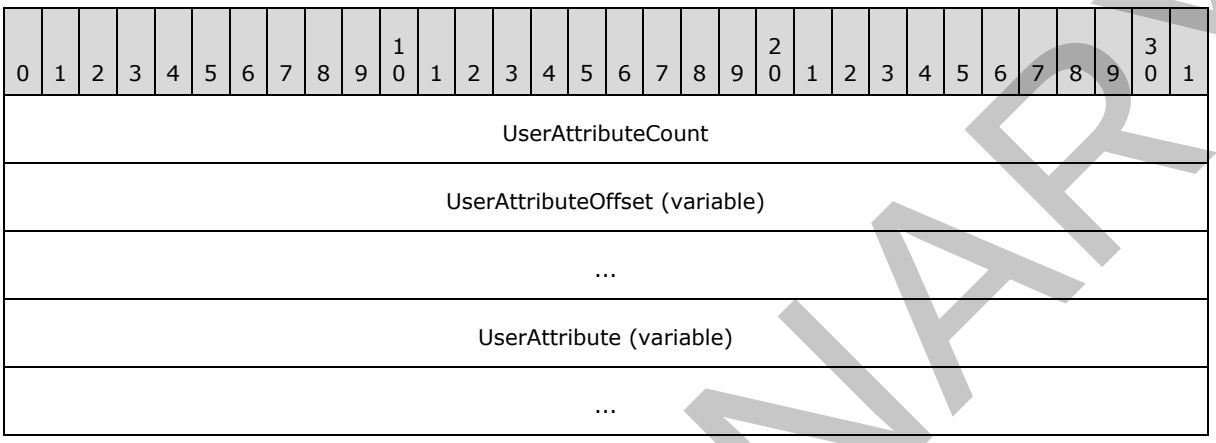
ValueSize (4 bytes): The size, in bytes, of the data in the **ValueData** field plus the 4-byte size of this field. This value does not include padding bytes to make the **ValueData** field end on a 4-byte boundary.

ValueData (variable): The data. This field MUST start immediately after **ValueSize**, which is on a 4-byte boundary, and it MUST end on a 4-byte boundary. For example, if the data is 10 bytes, there will be 2-bytes of padding to fill out the data to the next 4-byte boundary. The actual size of the data can be determined by subtracting 4 from the value of **ValueSize**.

2.2.3.5 UserAttributes

UserAttributes are dynamically configurable attributes that can have any number of attributes and each attribute can have zero or more values. UserAttributes immediately follow the SpecialAttributes section. Each attribute is stored in sorted order, according to the binary representation of the attribute name. The sort does not take into account any locale.

This is a structure that specifies the format for the UserAttributes section of a Binary Image Structure (section 2.2.3.2).



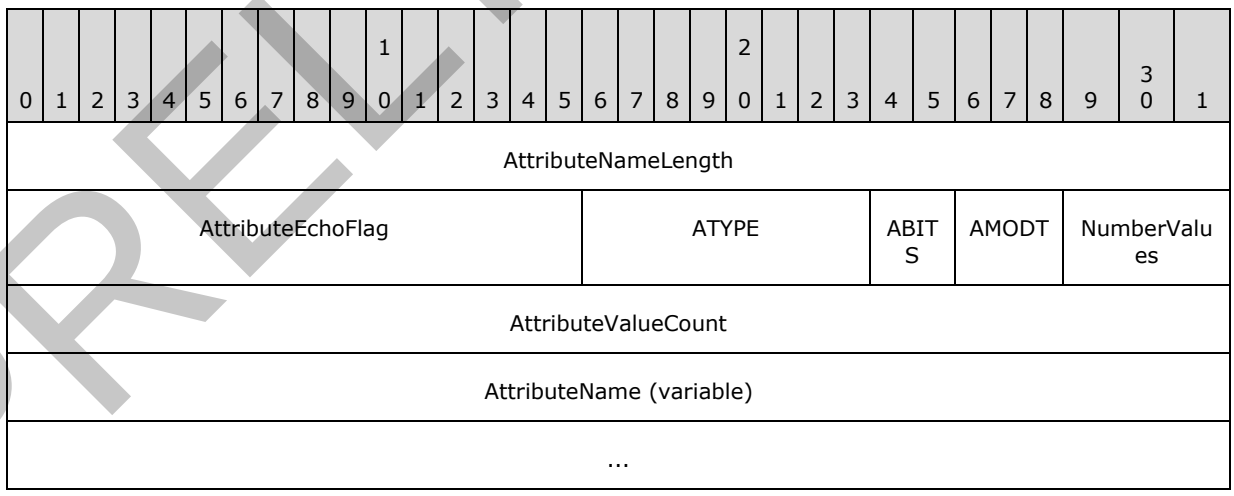
UserAttributeCount (4 bytes): A count of the number of UserAttributes.

UserAttributeOffset (variable): An array of offsets. The offset, in bytes, from the beginning of the UserAttributes section, to the individual **UserAttribute**. There will be one offset value per **UserAttribute** as defined in the **UserAttributeCount** field.

UserAttribute (variable): An array of UserAttributes, as described in section 2.2.3.5.1. The number of UserAttributes is defined by the **UserAttributeCount** found at the beginning of this structure.

2.2.3.5.1 UserAttribute

Individual UserAttributes have the following structure.



AttributeValues (variable)
...

AttributeNameLength (4 bytes): The length of the null-terminated attribute name in bytes, including the null terminator and null padding used to align the data to the next 4-byte boundary.

AttributeEchoFlag (2 bytes): This field is set to 0x80 if this value is being echoed back to the synchronization engine by the data source.

ATYPE (1 byte): An attribute type value as defined in section 2.2.2.3.

ABITS (2 bits): Attribute flags as defined in section 2.2.2.1.

AMODT (3 bits): The attribute modification type, as defined in 2.2.2.2.

NumberValues (3 bits): This MUST be set to one of the following values:

0x0 - The attribute has more than 2 values

0x1 - The attribute has 2 values

0x2 - The attribute has 1 value

0x4 - The attribute has no values

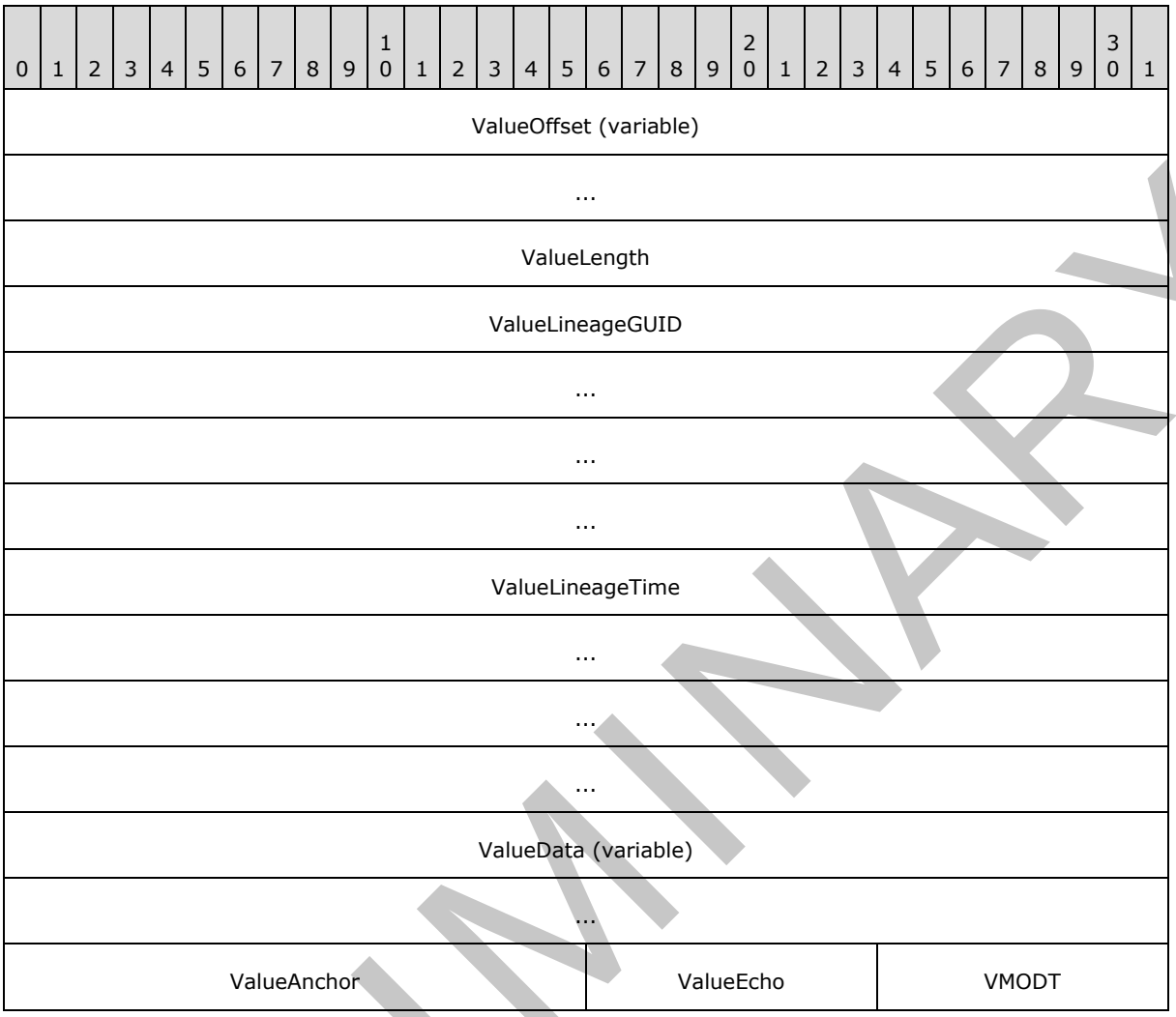
AttributeValueCount (4 bytes): The number of attribute values. If the **NumberValues** bits are all cleared, then there are more than two attribute values, and this field MUST be present. If any of the **NumberValues** bits are set, then this field MUST NOT be present, and the **AttributeName** field MUST begin at this location in the structure.

AttributeName (variable): A null-terminated Unicode string that contains the attribute name. The length of the attribute name is specified by the **AttributeNameLength** field. If the **AttributeValueCount** field is present, the **AttributeName** field MUST start immediately after the **AttributeValueCount** field. If the **AttributeValueCount** field is not present, the **AttributeName** field MUST start immediately after the **NumberValues** field. The **AttributeName** field MUST start on a 4-byte boundary, and it MUST end on a 4-byte boundary. For example, if the attribute name including the null terminator is 10 bytes, there will be 2 bytes of padding to fill out the data to the next 4-byte boundary.

AttributeValues (variable): The attribute values, as specified in section 2.2.3.5.2. If **NumberValues** bit 31 is set, then there are no attribute values, and this field MUST NOT be present.

2.2.3.5.2 AttributeValues

AttributeValues have the following structure.



ValueOffset (variable): There are *n*-1 value offset fields of 4 bytes each. If there are 10 values, there will be 9 **ValueOffset** fields, each containing the offset, in bytes, from the start of the **ValueData** to that specific value. If there is 1 value, there will be no **ValueOffset**, and the **ValueLength** will appear at this location.

ValueLength (4 bytes): The length of the first value. If this attribute is a reference attribute as defined by the **ATYPE Enumeration (section 2.2.2.3)**, then this field MUST be present. Otherwise, it MUST be absent.

Lineage data identifies where a value came from and why it was placed in the attribute. If the **VMODT** is not Delete and **HeaderValueTypeFlags** have the lineage bit set, then the following two values will be present. Otherwise, they will not exist in the structure.

ValueLineageGUID (16 bytes): The lineage **GUID** identifying the source of this value. This GUID MUST be a lineage_id value from the mms_lineage_cross_reference (section 2.2.5.5) table.

ValueLineageTime (16 bytes): A UTC (Coordinated Universal Time) **SYSTEMTIME** value ([MS-DTYP] section 2.3.11) that indicates when the value was written.

ValueData (variable): The **ValueData** will be variable length. The length is specified by the **ValueLength** above. If the **ValueLength** does not exist (because this is not a reference attribute), the length is determined by subtracting this **ValueOffset** from the next **ValueOffset**. If this is the last value, the length can be determined by subtracting this **ValueOffset** from the next **UserAttributeOffset**. If this is the last value of the last attribute, the length is determined by subtracting this **ValueOffset** from the total size of data in this structure.

ValueAnchor (2 bytes): If this attribute is a reference value as defined by the **ATYPE Enumeration**, then each value will have an anchor immediately following the main value. This anchor is a binary data stream that is not encoded. It will be the length computed by the following expression:

```
anchor length = overall value length - VMOTD length - Echo length - value data
length
```

If this attribute is not a reference attribute, then this value will not have an anchor value. A value will not have both lineage and an anchor value.

ValueEcho (1 byte): Reserved. This MUST be zero.

VMODT (1 byte): The value modification type. This MUST be a value specified in section 2.2.2.19.

2.2.4 Result Sets

The following result sets are defined for use with this protocol. Only the values defined in the following data type definitions SHOULD be used. All other values are reserved for future use and SHOULD NOT be used. Result sets MAY contain no rows.

2.2.4.1 mms_connectorspace.ResultSet

This result set contains all attributes from the mms_connectorspace table.

```
object_id uniqueidentifier,
ma_id uniqueidentifier,
pobject_id uniqueidentifier,
rdn nvarchar(438),
ancestors varbinary(944),
depth int,
anchor varbinary(800),
partition_id uniqueidentifier,
creation_date datetime,
is_provisioned bit,
disconnection_id uniqueidentifier,
disconnection_modification_date datetime,
last_import_modification_date datetime,
last_export_modification_date datetime,
count_import_modications int,
count_export_modications int,
is_connector bit,
connector_state int,
pending bit,
is_rename_retry bit,
is_reference_retry bit,
is_rebuild_in_progress bit,
```

```
  is_seen_by_import bit,
  is_phantom_parent bit,
  is_phantom_link bit,
  is_phantom_delete bit,
  is_full_sync bit,
  is_obsoletion bit,
  is_pending_reference_delete bit,
  import_operation int,
  export_operation int,
  is_import_error bit,
  count_import_error_retries int,
  initial_import_error_date datetime,
  last_import_error_date datetime,
  import_error_code int,
  is_export_error bit,
  count_export_error_retries int,
  initial_export_error_date datetime,
  last_export_error_date datetime,
  export_error_code int,
  current_export_batch_number int,
  current_export_sequence_number int,
  unapplied_export_batch_number int,
  unapplied_export_sequencer_number int,
  original_export_batch_number int,
  original_export_sequencer_number int,
  key_id int,
  hologram image,
  deltas image,
  import_error_detail ntext,
  export_error_detail ntext,
  transient_dn ntext,
  transient_details ntext,
  password_change_history ntext,
  is_pending_reference_rename bit,
  pending_moveop int,
  password_incoming_timestamp datetime,
  password_outgoing_timestamp datetime,
```

object_id: A GUID uniquely identifying this connector space object.

ma_id: A GUID uniquely identifying the management agent instance for this connector space object.

pobject_id: A GUID uniquely identifying the parent connector space object. Root objects MUST have a value of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a value of 00000000-0000-0000-0000-000000000001.

rdn: A string containing the relative distinguished name of this connector space object.

ancestors: A binary value containing the object_id values of all direct ancestor records from the root node down to the immediate parent of this object. This value MUST NOT be encoded. Root objects MUST have a value of 0x0.

depth: A numeric value representing the depth of this connector space object in the hierarchy. Root objects MUST have a depth of 1.

anchor: A binary value containing the anchor value for this connector space object. This value MUST NOT be encoded.

partition_id: A GUID value uniquely identifying partition for this connector space object. This value MUST be NULL for **placeholder** objects. All other objects MUST reference the partition that contains them.

creation_date: The UTC time that this connector space object was created by the synchronization engine. This MUST be blank for objects that are being imported from a data source into the connector space. This MUST be specified for objects that are being created by the synchronization engine.

is_provisioned: A bit where a value of 1 indicates that the synchronization engine created this object.

disconnection_id: A GUID identifying the rule that resulted in this object transitioning from a connector to a disconnector. This MUST be NULL if the object was never connected, or if the object was not disconnected because of a join rule.

disconnection_modification_date: The UTC time that this object was disconnected from the metaverse. This MUST contain a valid time value if the disconnection_id is not NULL.

last_import_modification_date: The UTC time that this object was last modified by importing data from the data source. This MUST be NULL for newly created objects that have not been exported.

last_export_modification_date: The UTC time that the **pending export** delta value for this connector space object was last updated. This MUST be NULL if there is no pending export delta.

count_import_modications: A count of the number of times that a new pending import delta has been written to the object. This synchronization engine MUST reset this to zero once the pending import image has been synchronized.

count_export_modications: A count of the number of times that a new pending export delta has been written to the object. This synchronization engine MUST reset this to zero once the pending export image has been exported.

is_connector: A bit where a value of 1 indicates the object is a connector.

connector_state: A number that specifies the connector state of this object. This MUST be set to one of the values specified in section 2.2.2.4.

pending: A bit where a value of 1 indicates this object has pending import data that needs to be synchronized.

is_rename_retry: A bit where a value of 1 indicates the object needs to be reprocessed for a pending rename operation.

is_reference_retry: A bit where a value of 1 indicates the object reference attributes need to be re-evaluated.

is_rebuild_in_progress: A bit where a value of 1 indicates the object has been created and exported, but it has not been confirmed with an import operation.

is_seen_by_import: A bit where a value of 1 indicates the object has been seen by the import process.

is_phantom_parent: A bit where a value of 1 indicates the connector space object is a hierarchy placeholder for a descendent of this object that has been staged or **provisioned**.

is_phantom_link: A bit where a value of 1 indicates the connector space object has not been staged, but it is referenced by another object and therefore has been created as a placeholder to maintain the reference link.

is_phantom_delete: A bit where a value of 1 indicates the connector space object has been deleted, but MUST remain as a hierarchy placeholder because of references to objects below it in the hierarchy.

is_full_sync: A bit where a value of 1 indicates the object requires a **full synchronization**.

is_obsoletion: A bit where a value of 1 indicates the object is obsolete, and needs to be removed later in the processing cycle after all regular objects have been processed.

is_pending_reference_delete: A bit where a value of 1 indicates the object needs to have pending reference deletes processed and finalized.

import_operation: A numeric value specifying the type of import operation that is pending. This MUST be NULL for placeholder objects and newly provisioned objects that have not yet been exported. This MUST contain one of the values specified in section 2.2.2.8 for objects with a pending import operation.

export_operation: A numeric value specifying the type of export operation that is pending. This MUST be NULL for placeholder objects and objects with no pending export data. This MUST contain one of the values specified in section 2.2.2.8 for objects with a pending export operation.

is_import_error: A bit where a value of 1 indicates that this object had an error during the last inbound synchronization operation.

count_import_error_retries: A count of the number of consecutive inbound synchronization errors that have occurred on this object. The synchronization engine MUST set this to zero when the object is successfully staged.

initial_import_error_date: The UTC time of the first inbound synchronization error, or NULL if there were no errors.

last_import_error_date: The UTC time of the most recent inbound synchronization error, or NULL if there were no errors.

import_error_code: An **HRESULT** error code for the last import operation. This MUST be zero, NULL, or a value from section 2.2.2.17 or from section 2.2.2.5.

is_export_error: A bit where a value of 1 indicates that this object had an export error during the last export operation.

count_export_error_retries: A count of the number of export error retries that have been performed on this object. The synchronization engine MUST set this to zero when the object is successfully exported to the data source.

initial_export_error_date: The UTC time of the first export error, or NULL if there were no export errors.

last_export_error_date: The UTC time of the last export error, or NULL if there were no export errors.

export_error_code: An HRESULT error code for the last export operation. This MUST be zero, NULL, or a value from section 2.2.2.17 or section 2.2.2.5.

current_export_batch_number: The current **export batch number** for this object.

current_export_sequence_number: The current **export sequence number** for this object.

unapplied_export_batch_number: The export batch number for the changes in the pending export image.

unapplied_export_sequencer_number: The export sequence number for the changes in the pending export image.

original_export_batch_number: The export batch number the first time this object was exported.

original_export_sequencer_number: The export sequence number the first time this object was exported.

key_id: A numeric encryption key ID that identifies the encryption key set used to encrypt data for this object. If no data has been encrypted, this will be NULL.

hologram: A compressed binary image structure containing the object and attribute data. The format of this data is specified in section 2.2.3.

deltas: A compressed binary image structure containing the delta object and attribute data. The format of this data is specified in section 2.2.3.

import_error_detail: An XML fragment containing the inbound synchronization error details. The format of this fragment is defined in section 2.2.6.4.11.

export_error_detail: An XML fragment containing the export error details. The format of this fragment is defined in section 2.2.6.4.7.

transient_dn: A string containing the distinguished name of the object before it was moved to a transient state. This value MUST be NULL if the object is not a transient object.

transient_details: Reserved. This field MUST be NULL.

password_change_history: An XML fragment containing the password change history operations that have been performed through **WMI** [MS-WMI]. This MUST be NULL or a valid XML fragment, as defined in section 2.2.6.4.17.

is_pending_reference_rename: A bit where a value of 1 indicates this object has pending reference rename operations that still need to be performed.

pending_moveop: The pending move operation, if any. This MUST be NULL, or one of the values from the section 2.2.2.14.

password_incoming_timestamp: The UTC time of the most recent inbound password received for this object. This is used for filtering out stale password synchronization events. This MUST be NULL or a valid datetime value.

password_outgoing_timestamp: The UTC time of the most recent outbound password received for this object. This is used for filtering out stale password synchronization events. This MUST be NULL or a valid datetime value.

2.2.4.2 mms_connectorspace_ids.ResultSet

This result set contains a list of connector space objects identifiers.

```
object_id uniqueidentifier,
```

object_id: A GUID uniquely identifying the connector space object.

2.2.4.3 mms_getcsguidfrommvguid.ResultSet

This result set contains a list of connector space objects that are joined to a specified metaverse object.

```
cs_object_id uniqueidentifier,
```

cs_object_id: A GUID uniquely identifying the connector space object.

2.2.4.4 mms_GetCSLinkIDsForObject.ResultSet

This result set contains a list of all connector space objects that are referenced by a specified connector space object.

```
reference_id uniqueidentifier,
```

reference_id: A GUID uniquely identifying the referenced connector space object.

2.2.4.5 mms_getcsmvlinkforcs.ResultSet

This result set contains the linked metaverse object for a specified connector space object. The back-end database server (BEDS) holds a lock on this row until the transaction is completed.

```
mv_object_id uniqueidentifier,
cs_object_id uniqueidentifier,
lineage_id uniqueidentifier,
lineage_date datetime,
```

mv_object_id: A GUID uniquely identifying the metaverse object.

cs_object_id: A GUID uniquely identifying the connector space object.

lineage_id: A GUID uniquely identifying the lineage of this connector space to metaverse link.

lineage_date: A time in UTC that this link was established.

2.2.4.6 mms_getcsmvlinksformv.ResultSet

This result set contains the list of connector space objects connected to the specified metaverse object.

```
cs_object_id uniqueidentifier,
lineage_id uniqueidentifier,
lineage_date datetime,
ma_id uniqueidentifier,
rdn nvarchar(438),
pobject_id uniqueidentifier,
```

cs_object_id: A GUID uniquely identifying the connector space object.

lineage_id: A GUID uniquely identifying the lineage of this connector space to metaverse link.

lineage_date: A time in UTC that this link was established.

ma_id: A GUID uniquely identifying the management agent for this connector space object.

rdn: The relative distinguished name of this object.

pobject_id: A GUID uniquely identifying the parent connector space object. Root objects MUST have a value of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a value of 00000000-0000-0000-0000-000000000001.

2.2.4.7 mms_getcsobjectwithanchorfast.ResultSet

This result set contains the connector space object matching the specified anchor value and management agent identifier.

```
pobject_id uniqueidentifier,
rdn nvarchar(438),
```

pobject_id: A GUID uniquely identifying the parent connector space object. Root objects MUST have a value of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a value of 00000000-0000-0000-0000-000000000001.

rdn: The relative distinguished name of this connector space object.

2.2.4.8 mms_getmvmulti.ResultSet

This result set contains all **multi-valued attributes** for a specified metaverse object identifier. There is one row per value. The results are ordered by attribute name. All values with the same attribute_name MUST have the same value type. Exactly one value type (numeric_value, string_value_indexable, binary_value_indexable, string_value_not_indexable, or binary_value_not_indexable) MUST be filled in per value. All other value types in the row MUST be NULL.

```
attribute_name nvarchar(128),
lineage_id uniqueidentifier,
lineage_date datetime,
numeric_value bigint,
string_value_indexable nvarchar(448),
binary_value_indexable varbinary(900),
string_value_not_indexable ntext,
binary_value_not_indexable image,
```

attribute_name: The attribute name.

lineage_id: A lineage GUID from the mms_lineage_cross_reference table.

lineage_date: The UTC time that this attribute was last updated.

numeric_value: The numeric attribute value. This MUST be NULL if this is not a numeric attribute.

string_value_indexable: The string attribute value if this is an **indexable** string. This MUST be NULL if this is not an indexable string.

binary_value_indexable: The binary attribute value if this is an indexable binary value. This MUST be NULL if this is not an indexable binary value.

string_value_not_indexable: The string attribute value if this is a **non-indexable** string. This MUST be NULL if this is not a non-indexable string.

binary_value_not_indexable: The binary attribute value if this is a non-indexable binary value. This MUST be NULL if this is not a non-indexable binary value.

2.2.4.9 mms_getmvrefasobjid.ResultSet

This result set contains the reference attributes for a specified metaverse object. The results are ordered first by attribute_name and then by reference_id.

```
attribute_name nvarchar(128),
lineage_id uniqueidentifier,
lineage_date datetime,
reference_id uniqueidentifier,
```

attribute_name: The attribute name.

lineage_id: A lineage GUID from the mms_lineage_cross_reference table.

lineage_date: The UTC time that this attribute was last updated.

reference_id: A GUID uniquely identifying the referenced metaverse object.

2.2.4.10 mms_getmvrefattributes.ResultSet

This result set contains the reference attributes for a specified metaverse object. The results are ordered by reference_id.

```
object_id uniqueidentifier,
attribute_name nvarchar(128),
lineage_id uniqueidentifier,
lineage_date datetime,
reference_id uniqueidentifier,
```

object_id: A GUID uniquely identifying the metaverse object.

attribute_name: The attribute name.

lineage_id: A lineage GUID from the mms_lineage_cross_reference table.

lineage_date: The UTC time that this attribute was last updated.

reference_id: A GUID uniquely identifying the referenced metaverse object.

2.2.4.11 mms_getmvsvbfandmaguids.ResultSet

This result set contains the provisioning retry and reference retry information for a specified metaverse object.

```
is_provisioning_retry bit,
is_ref_retry bit,
ma_guids_for_reference_retry image,
```

is_provisioning_retry: A bit where a value of 1 indicates that this metaverse object is required to retry the provisioning operation. This MUST be NULL or 1.

is_ref_retry: A bit where a value of 1 indicates that this metaverse object is required to have the reference attributes re-evaluated by the synchronization engine. If there is a list of management agent GUIDs in the ma_guids_for_reference_retry field, the sync engine MUST reprocess all references from this metaverse object to each management agent specified. If ma_guids_for_reference_retry is NULL, the synchronization engine MUST process all references from this metaverse object to all of its connected management agents.

ma_guids_for_reference_retry: A list of management agent GUIDs needing reference retry processing. If this is not NULL, the is_ref_retry bit MUST be set to 1 and this binary stream of GUIDs MUST be from the ma_id field of the mms_management_agent table. Optional.

2.2.4.12 mms_getolddnwithrdnpobjid.ResultSet

This result set contains the transient distinguished name (DN) for a connector space object.

```
transient_dn ntext,
```

transient_dn: The transient distinguished name for the connector space object. This MUST be NULL if the connector space is not a transient object.

2.2.4.13 mms_GetPendingCsRefDeletes.ResultSet

This result set contains all referenced objects, for a specified connector space object, that are flagged for pending deletion.

```
rdn nvarchar(438),
pobject_id uniqueidentifier,
state int,
```

rdn: The relative distinguished name of the referenced connector space object. This MUST not be NULL.

pobject_id: A GUID uniquely identifying the parent connector space object. Root objects MUST have a value of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a value of 00000000-0000-0000-0000-000000000001.

state: The link state flag. This MUST be a valid value as defined in section 2.2.2.10.

2.2.4.14 mms_GetPendingCsRefRenames.ResultSet

This result set contains all referenced objects, for a specified connector space object, that are flagged for a rename operation.

```
rdn nvarchar(438),
pobject_id uniqueidentifier,
old_dn ntext,
```

rdn: The relative distinguished name of the referenced connector space object. This MUST not be NULL.

pobject_id: A GUID uniquely identifying the parent connector space object. Root objects MUST have a value of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a value of 00000000-0000-0000-0000-000000000001.

old_dn: The old distinguished name value. This MUST not be NULL.

2.2.4.15 mms_getpobjidrdnancwithobjid.ResultSet

This result set contains ancestor and transient information for a specified connector space object.

```
pobject_id uniqueidentifier,
rdn nvarchar(438),
ancestors varbinary(944),
transient_dn ntext,
```

pobject_id: A GUID uniquely identifying the parent connector space object. Root objects MUST have a value of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a value of 00000000-0000-0000-0000-000000000001.

rdn: The relative distinguished name of the connector space object. This MUST not be NULL.

ancestors: A binary value containing the object_id values of all direct ancestor records from the root node down to the immediate parent of this object. This value MUST NOT be encoded. Root objects MUST have a value of 0x0.

transient_dn: A string containing the distinguished name of the object before it was moved to a transient state, or NULL if the object is not a transient object.

2.2.4.16 mms_getprojected_csrefguids.ResultSet

This result set contains all referenced connector space objects in a specified management agent for a specified metaverse object and attribute. The results MUST be ordered by the reference_id.

```
cs_object_id uniqueidentifier,
anchor varbinary(800),
pobject_id uniqueidentifier,
rdn nvarchar(438),
reference_id uniqueidentifier,
```

cs_object_id: A GUID uniquely identifying the referenced connector space object.

anchor: A binary value containing the anchor value for the referenced connector space object. This value MUST NOT be encoded.

pobject_id: A GUID uniquely identifying the parent connector space object. Root objects MUST have a value of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a value of 00000000-0000-0000-0000-000000000001.

rdn: A string containing the relative distinguished name of the referenced connector space object.

reference_id: A GUID uniquely identifying the referenced metaverse object.

2.2.4.17 mms_getprojected_mvrefguids.ResultSet

This result set contains a distinct list of the metaverse GUID strings of all projected references for a given connector space object and attribute.

```
mv_object_id nvarchar(36),
```

mv_object_id: A GUID Unicode string that uniquely identifies the metaverse object. The string MUST conform to the following format:

```
[0-9a-fA-F]{8}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{12}
```

2.2.4.18 mms_getrowwithrdnpobjidfast.ResultSet

This result set contains a subset of the connector space object attributes that are needed for determining synchronization behavior.

```
is_connector bit,
connector_state int,
is_rebuild_in_progress bit,
is_seen_by_import bit,
is_phantom_link bit,
is_phantom_parent bit,
is_phantom_delete bit,
is_reference_retry bit,
pending bit,
is_rename_retry bit,
pobject_id uniqueidentifier,
rdn nvarchar(438),
```

is_connector: A bit where a value of 1 indicates the object is a connector.

connector_state: A number that specifies the connector state of this object. This MUST be set to one of the values specified in section 2.2.2.4.

is_rebuild_in_progress: A bit where a value of 1 indicates the object has been created and exported, but it has not been confirmed with an import operation.

is_seen_by_import: A bit where a value of 1 indicates the object has been imported from the data source during the full import run profile.

is_phantom_link: A bit where a value of 1 indicates the connector space object has not been staged, but it is referenced by another object and therefore has been created as a placeholder to maintain the reference link.

is_phantom_parent: A bit where a value of 1 indicates the connector space object is a hierarchy placeholder for a descendent of this object that has been staged or provisioned.

is_phantom_delete: A bit where a value of 1 indicates the connector space object has been deleted, but remains as a hierarchy placeholder because of references to objects below it in the hierarchy.

is_reference_retry: A bit where a value of 1 indicates the object reference attributes need to be re-evaluated.

pending: A bit where a value of 1 indicates this object has pending import data that needs to be synchronized.

is_rename_retry: A bit where a value of 1 indicates the object needs to be reprocessed for a pending rename operation.

pobject_id: A GUID uniquely identifying the parent connector space object. Root objects MUST have a value of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a value of 00000000-0000-0000-0000-000000000001.

rdn: A string containing the relative distinguished name of this connector space object.

2.2.4.19 mms_metaverse_ids.ResultSet

This result set contains the identifiers of all metaverse objects that are marked for reference retry processing.

```
object_id uniqueidentifier,
```

object_id: A GUID identifying the metaverse object.

2.2.4.20 mms_metaverse_single_value.ResultSet

This result set contains all single-valued attributes of a specified metaverse object without the associated lineage data. This result set MUST contain one row if there was a matching metaverse object. This result set MUST contain zero rows if there was not a matching metaverse object.

The following REQUIRED attributes are used by the synchronization engine for tracking and managing the metaverse object.

- object_id
- object_type
- object_type_lineage_id
- object_type_lineage_date
- last_modification_date
- is_ref_retry

- is_provisioning_retry
- ma_guids_for_reference

The remainder of the attributes in the metaverse contain object data, and they are optional. These optional attributes will only contain data if the schema for the metaverse object type specifies that attribute as being associated with the object type, and there are import attribute flow rules defined to populate the attribute with data, and the source object contained data for that attribute. Not all of the connected systems use the same terminology, so in a number of cases there may be more than one field in the schema that can be used to hold a particular value. The import attribute flow rules for each management agent will determine which metaverse fields are populated with data.

```
object_id uniqueidentifier,
object_type nvarchar(64),
object_type_lineage_id uniqueidentifier,
object_type_lineage_date datetime,
last_modification_date datetime,
is_ref_retry bit,
is_provisioning_retry bit,
uid nvarchar(448),
accountName nvarchar(448),
ad_UserCannotChangePassword bit,
address nvarchar(448),
type nvarchar(448),
c nvarchar(448),
city nvarchar(448),
cn nvarchar(448),
co nvarchar(448),
comment nvarchar(448),
company nvarchar(448),
title nvarchar(448),
temporal bit,
telephoneNumber nvarchar(448),
street nvarchar(448),
costCenter nvarchar(448),
costCenterName nvarchar(448),
country nvarchar(448),
createConnectedSystemObject bit,
createILMObject bit,
csObjectID nvarchar(448),
dc nvarchar(448),
deleteTime nvarchar(448),
department nvarchar(448),
description nvarchar(448),
disconnectConnectedSystemObject bit,
displayName nvarchar(448),
division nvarchar(448),
domain nvarchar(448),
email nvarchar(448),
employeeEndDate nvarchar(448),
employeeID nvarchar(448),
employeeStartDate nvarchar(448),
employeeStatus nvarchar(448),
employeeType nvarchar(448),
status nvarchar(448),
expirationTime nvarchar(448),
facsimileTelephoneNumber nvarchar(448),
firstName nvarchar(448),
```

```
    flowType bigint,
    freezeCount bigint,
    freezeLevel nvarchar(448),
    st nvarchar(448),
    sn nvarchar(448),
    generationQualifier nvarchar(448),
    givenName nvarchar(448),
    homePhone nvarchar(448),
    scope nvarchar(448),
    info nvarchar(448),
    initials nvarchar(448),
    jobTitle nvarchar(448),
    l nvarchar(448),
    lastName nvarchar(448),
    lastResetAttemptTime nvarchar(448),
    location nvarchar(448),
    loginName nvarchar(448),
    mail nvarchar(448),
    mailNickname nvarchar(448),
    resetPassword nvarchar(448),
    membershipAddWorkflow nvarchar(448),
    membershipLocked bit,
    middleName nvarchar(448),
    mobile nvarchar(448),
    mobilePhone nvarchar(448),
    registrationRequired bit,
    o nvarchar(448),
    register bit,
    objectSid varbinary(900),
    objectType nvarchar(448),
    officeFax nvarchar(448),
    officeLocation nvarchar(448),
    officePhone nvarchar(448),
    ou nvarchar(448),
    pager nvarchar(448),
    personalTitle nvarchar(448),
    precedence bigint,
    physicalDeliveryOfficeName nvarchar(448),
    postOfficeBox nvarchar(448),
    postalAddress nvarchar(448),
    postalCode nvarchar(448),
    photo image,
    objectID ntext,
    namespace ntext,
    relationshipCriteria ntext,
    memberFilter ntext,
    returnType ntext,
    ilmObjectType ntext,
    functionParameters ntext,
    functionName ntext,
    expectedRuleEntryAction ntext,
    statusError ntext,
    connector ntext,
    connectedSystemScope ntext,
    connectedSystem ntext,
    connectedObjectType ntext,
    assembly ntext,
    ma_guids_for_reference_retry image,
```

object_id: A GUID uniquely identifying the metaverse object. This MUST be present.

object_type: A string containing the metaverse object type. This MUST be present.

object_type_lineage_id: A GUID uniquely identifying the lineage record in the mms_lineage_cross_reference table. This MUST be present.

object_type_lineage_date: The UTC time that the object_type was last updated. This MUST be present.

last_modification_date: The UTC time that the metaverse object was last updated. This MUST be present.

is_ref_retry: A bit where a value of 1 indicates if this metaverse object needs to have the reference attributes re-evaluated by the synchronization engine. If there is a binary stream of management agent GUIDs in the ma_guids_for_reference_retry field, the sync engine MUST reprocess all references from this metaverse object to each management agent specified. If ma_guids_for_reference_retry is NULL, the synchronization engine MUST process all references from this metaverse object to all of its connectors.

is_provisioning_retry: A bit where a value of 1 indicates if this metaverse object needs to have the provisioning operation retried. This MUST be NULL or 1.

uid: A user identifier as described in [MS-ADA3] section 2.329. Optional.

accountName: An account name. Optional.

ad_UserCannotChangePassword: A bit where a value of 1 indicates that the user cannot change their password in Active Directory. Optional.

address: A street address. Optional.

type: A group type value typically used to differentiate a security group from a distribution list. Optional.

c: A country or region as described in [MS-ADA1] section 2.94. Optional.

city: A city. Optional.

cn: A common name for the object as described in [MS-ADA1] section 2.110. Optional.

co: A country name as described in [MS-ADA1] section 2.111. Optional.

comment: A comment as described in [MS-ADA1] section 2.116. Optional.

company: A company name as described in [MS-ADA1] section 2.118. Optional.

title: A person's job title as described in [MS-ADA3] section 2.310. Optional.

temporal: A bit where a value of 1 indicates that this object has temporal events that need to be processed. Optional.

telephoneNumber: A telephone number as described in [MS-ADA3] section 2.299. Optional.

street: A street as described in [MS-ADA3] section 2.278. Optional.

costCenter: A cost center code, typically an accounting code. Optional.

costCenterName: A cost center name. Optional.

country: A country name. Optional.

createConnectedSystemObject: A bit where a value of 1 indicates that a synchronization rule SHOULD create a connector space object. Optional.

createILMObject: A bit where a value of 1 indicates whether to create an **ILM** object. This is used by a synchronization rule object type. Optional.

csObjectID: A connector space object ID. Optional.

dc: A domain controller as described in [MS-ADA1] section 2.142. Optional.

deleteTime: A delete time. Optional.

department: A department name as described in [MS-ADA1] section 2.151. Optional.

description: A description as described in [MS-ADA1] section 2.153. Optional.

disconnectConnectedSystemObject: A bit where a value of 1 indicates that a synchronization rule MUST disconnect the metaverse object from a connector space object.

displayName: A display name as described in [MS-ADA1] section 2.175. Optional.

division: A division as described in [MS-ADA1] section 2.179. Optional.

domain: A **domain name**. Optional.

email: An email address. Optional.

employeeEndDate: An employee termination date. Optional.

employeeID: An employee identifier as described in [MS-ADA1] section 2.217. Optional.

employeeStartDate: An employee start date. Optional.

employeeStatus: An employee status value. Optional.

employeeType: An employee type as described in [MS-ADA1] section 2.219. Optional.

status: A status value. Optional.

expirationTime: An expiration time. Optional.

facsimileTelephoneNumber: A facsimile telephone number as described in [MS-ADA1] section 2.229. Optional.

firstName: A person's first name. Typically the givenName attribute will be used instead. Optional.

flowType: A attribute flow type used by a synchronization rule object to specify whether the attribute flow is import or export. Optional.

freezeCount: A password freeze count. Optional.

freezeLevel: A password freeze level. Optional.

st: A state or province name as described in [MS-ADA3] section 2.277. Optional.

sn: A person's surname (last name or family name) as described in [MS-ADA3] section 2.275. Optional.

generationQualifier: A person's generation as described in [MS-ADA1] section 2.271. For example junior (Jr.), or II. Optional.

givenName: A person's given name (first name) as described in [MS-ADA1] section 2.273. Optional.

homePhone: A home telephone as described in [MS-ADA1] section 2.297. Optional.

scope: A group scope value. Optional.

info: An information value as described in [MS-ADA1] section 2.304. Optional.

initials: A person's initials for parts of the person's full name as described in [MS-ADA1] section 2.307. Optional.

jobTitle: A person's job title. Optional.

l: A locality name, such as country, city, or other geographical area as described in [MS-ADA1] section 2.345. Optional.

lastName: A person's last name. Typically the sn attribute will be used instead. Optional.

lastResetAttemptTime: A time of the person's last password reset attempt. Optional.

location: A person's location, such as their office number, as described in [MS-ADA1] section 2.369. Optional.

loginName: A person's login name. Optional.

mail: A mail string containing the list of email addresses belonging to a contact object as described in [MS-ADA2] section 2.6. Optional.

mailNickname: A mail nickname or alias. Optional.

resetPassword: A reset password value. Optional.

membershipAddWorkflow: A string indicating the workflow type for group membership. Optional.

membershipLocked: A bit where a value of 1 indicates that the group membership is locked. Optional.

middleName: A person's middle name as described in [MS-ADA2] section 2.48. Optional.

mobile: A person's mobile telephone number as described in [MS-ADA2] section 2.52. Optional.

mobilePhone: A mobile telephone number. Optional.

registrationRequired: A bit where a value of 1 indicates that password reset registration is REQUIRED. Optional.

o: An organization name as described in [MS-ADA3] section 2.38. Optional.

register: A bit where a value of 1 indicates this account is registered for password reset. Optional.

objectSid: An object **security identifier (SID)** as described in [MS-ADA3] section 2.45. Optional.

objectType: An object type. Optional.

officeFax: A person's office facsimile telephone number. Optional.

officeLocation: A person's office location. Optional.

officePhone: A person's office telephone number. Optional.

ou: An organizational unit as described in [MS-ADA3] section 2.73. Optional.

pager: A pager telephone number as described in [MS-ADA3] section 2.79. Optional.

personalTitle: A personal title as described in [MS-ADA3] section 2.91. Optional.

precedence: A precedence value used to order objects. Optional.

physicalDeliveryOfficeName: A physical delivery office name as described in [MS-ADA3] section 2.93. Optional.

postOfficeBox: A post office box number as described in [MS-ADA3] section 2.112. Optional.

postalAddress: A postal address as described in [MS-ADA3] section 2.110. Optional.

postalCode: A postal code as described in [MS-ADA3] section 2.111. Optional.

photo: A photograph as described in [MS-ADA3] section 2.92. Optional.

objectID: An object identifier. Optional.

namespace: An object namespace. Optional.

relationshipCriteria: A relationship criteria used to describe the relationship of a metaverse object to a connector space object. This is used by synchronization rule processing. Optional.

memberFilter: A group member filter specified by the synchronization rule. Optional.

returnType: A return type. Optional.

ilmObjectType: The type of ILM object specified by the synchronization rule. Optional.

functionParameters: Function parameters for synchronization rule processing. Optional.

functionName: A function name for synchronization rule processing. Optional.

expectedRuleEntryAction: An expected rules entry action for an expected rules entry object. Optional.

statusError: An error result. Optional.

connector: A connector string. Optional.

connectedSystemScope: The scope at which a synchronization rule object applies to a connector space. Optional.

connectedSystem: The management agent GUID of the management agent associated with the synchronization rule object. Optional.

connectedObjectType: The connector space object type of objects connected or created as a result of this synchronization rule object. Optional.

assembly: An assembly name for scripted flow rules defined by this synchronization rule object. Optional.

ma_guids_for_reference_retry: A list of management agent GUIDs requiring reference retry processing. The GUIDs are concatenated and stored as a binary value in this field. The GUIDs MUST exist in the ma_id attribute of the mms_management_agent table. The is_ref_retry attribute MUST be 1 if this is not NULL. Optional.

2.2.4.21 mms_metaverse_with_lineage.ResultSet

This result set contains all single valued attributes of a specified metaverse object. This result set MUST contain one row if there was a matching metaverse object. This result set MUST contain zero rows if there was not a matching metaverse object.

This result set is a join of the mms_metaverse table, the mms_metaverse_lineageguid table, and the mms_metaverse_lineagedate table. The two lineage tables contain most of the same column names as the primary mms_metaverse table, but they contain lineage data that the sync engine uses for flow control and managing attribute precedence. Joining the tables in the result set means that most of the attributes returned will have duplicate names. For example, the displayName attribute will appear three times. Accessing the attributes requires that they are fully qualified with the table name and the attribute name.

The mms_metaverse table contains the data values. The following REQUIRED attributes are used by the synchronization engine for tracking and managing the metaverse object.

- object_id
- object_type
- object_type_lineage_id
- object_type_lineage_date
- last_modification_date
- is_ref_retry
- is_provisioning_retry
- ma_guids_for_reference

The remainder of the attributes in the metaverse contain object data, and they are optional. These optional attributes will only contain data if the schema for the metaverse object type specifies that attribute as being associated with the object type, and there are import attribute flow rules defined to populate the attribute with data, and the source object contained data for that attribute. Not all of the connected systems use the same terminology, so in a number of cases there may be more than one field in the schema that can be used to hold a particular value. The import attribute flow rules for each management agent will determine which metaverse fields are populated with data.

For each attribute, the mms_metaverse_lineageguid data contains the identifier of the lineage cross-reference data in the mms_lineage_cross_reference table. This provides details on where the attribute data came from, and why it was placed in the metaverse. To compliment this, the mms_metaverse_lineagedate data contains the UTC time that each attribute value was last updated.

* Attributes marked with a single asterisk come from the mms_metaverse_lineageguid table (section 2.2.5.9).

** Attributes marked with a double asterisk come from the mms_metaverse_lineagedate table (section 2.2.5.8).

```
  object_id uniqueidentifier,
  object_type nvarchar(64),
  object_type_lineage_id uniqueidentifier,
  object_type_lineage_date datetime,
  last_modification_date datetime,
  is_ref_retry bit,
  is_provisioning_retry bit,
  uid nvarchar(448),
  accountName nvarchar(448),
  ad_UserCannotChangePassword bit,
  address nvarchar(448),
  type nvarchar(448),
  c nvarchar(448),
  city nvarchar(448),
  cn nvarchar(448),
  co nvarchar(448),
  comment nvarchar(448),
  company nvarchar(448),
  title nvarchar(448),
  temporal bit,
  telephoneNumber nvarchar(448),
  street nvarchar(448),
  costCenter nvarchar(448),
  costCenterName nvarchar(448),
  country nvarchar(448),
  createConnectedSystemObject bit,
  createILMObject bit,
  csObjectID nvarchar(448),
  dc nvarchar(448),
  deleteTime nvarchar(448),
  department nvarchar(448),
  description nvarchar(448),
  disconnectConnectedSystemObject bit,
  displayName nvarchar(448),
  division nvarchar(448),
  domain nvarchar(448),
  email nvarchar(448),
  employeeEndDate nvarchar(448),
  employeeID nvarchar(448),
  employeeStartDate nvarchar(448),
  employeeStatus nvarchar(448),
  employeeType nvarchar(448),
  status nvarchar(448),
  expirationTime nvarchar(448),
  facsimileTelephoneNumber nvarchar(448),
  firstName nvarchar(448),
  flowType bigint,
  freezeCount bigint,
  freezeLevel nvarchar(448),
  st nvarchar(448),
  sn nvarchar(448),
  generationQualifier nvarchar(448),
  givenName nvarchar(448),
  homePhone nvarchar(448),
  scope nvarchar(448),
  info nvarchar(448),
  initials nvarchar(448),
  jobTitle nvarchar(448),
  l nvarchar(448),
```

```
  lastName nvarchar(448),
  lastResetAttemptTime nvarchar(448),
  location nvarchar(448),
  loginName nvarchar(448),
  mail nvarchar(448),
  mailNickname nvarchar(448),
  resetPassword nvarchar(448),
  membershipAddWorkflow nvarchar(448),
  membershipLocked bit,
  middleName nvarchar(448),
  mobile nvarchar(448),
  mobilePhone nvarchar(448),
  registrationRequired bit,
  o nvarchar(448),
  register bit,
  objectSid varbinary(900),
  objectType nvarchar(448),
  officeFax nvarchar(448),
  officeLocation nvarchar(448),
  officePhone nvarchar(448),
  ou nvarchar(448),
  pager nvarchar(448),
  personalTitle nvarchar(448),
  precedence bigint,
  physicalDeliveryOfficeName nvarchar(448),
  postOfficeBox nvarchar(448),
  postalAddress nvarchar(448),
  postalCode nvarchar(448),
  photo image,
  objectID ntext,
  namespace ntext,
  relationshipCriteria ntext,
  memberFilter ntext,
  returnType ntext,
  ilmObjectType ntext,
  functionParameters ntext,
  functionName ntext,
  expectedRuleEntryAction ntext,
  statusError ntext,
  connector ntext,
  connectedSystemScope ntext,
  connectedSystem ntext,
  connectedObjectType ntext,
  assembly ntext,
  ma_guids_for_reference_retry image,
  object_id uniqueidentifier,
  accountName uniqueidentifier,
  ad_UserCannotChangePassword uniqueidentifier,
  address uniqueidentifier,
  assembly uniqueidentifier,
  c uniqueidentifier,
  city uniqueidentifier,
  cn uniqueidentifier,
  co uniqueidentifier,
  comment uniqueidentifier,
  company uniqueidentifier,
  connectedObjectType uniqueidentifier,
  connectedSystem uniqueidentifier,
  connectedSystemScope uniqueidentifier,
```

```
  connector uniqueidentifier,
  costCenter uniqueidentifier,
  costCenterName uniqueidentifier,
  country uniqueidentifier,
  createConnectedSystemObject uniqueidentifier,
  createILMObject uniqueidentifier,
  csObjectID uniqueidentifier,
  dc uniqueidentifier,
  deleteTime uniqueidentifier,
  department uniqueidentifier,
  description uniqueidentifier,
  disconnectConnectedSystemObject uniqueidentifier,
  displayName uniqueidentifier,
  division uniqueidentifier,
  domain uniqueidentifier,
  email uniqueidentifier,
  employeeEndDate uniqueidentifier,
  employeeID uniqueidentifier,
  employeeStartDate uniqueidentifier,
  employeeStatus uniqueidentifier,
  employeeType uniqueidentifier,
  expectedRuleEntryAction uniqueidentifier,
  expirationTime uniqueidentifier,
  facsimileTelephoneNumber uniqueidentifier,
  firstName uniqueidentifier,
  flowType uniqueidentifier,
  freezeCount uniqueidentifier,
  freezeLevel uniqueidentifier,
  functionName uniqueidentifier,
  functionParameters uniqueidentifier,
  generationQualifier uniqueidentifier,
  givenName uniqueidentifier,
  homePhone uniqueidentifier,
  ilmObjectType uniqueidentifier,
  info uniqueidentifier,
  initials uniqueidentifier,
  jobTitle uniqueidentifier,
  l uniqueidentifier,
  lastName uniqueidentifier,
  lastResetAttemptTime uniqueidentifier,
  location uniqueidentifier,
  loginName uniqueidentifier,
  mail uniqueidentifier,
  mailNickname uniqueidentifier,
  memberFilter uniqueidentifier,
  membershipAddWorkflow uniqueidentifier,
  membershipLocked uniqueidentifier,
  middleName uniqueidentifier,
  mobile uniqueidentifier,
  mobilePhone uniqueidentifier,
  namespace uniqueidentifier,
  o uniqueidentifier,
  objectID uniqueidentifier,
  objectSid uniqueidentifier,
  objectType uniqueidentifier,
  officeFax uniqueidentifier,
  officeLocation uniqueidentifier,
  officePhone uniqueidentifier,
  ou uniqueidentifier,
```

```
  pager uniqueidentifier,
  personalTitle uniqueidentifier,
  photo uniqueidentifier,
  physicalDeliveryOfficeName uniqueidentifier,
  postOfficeBox uniqueidentifier,
  postalAddress uniqueidentifier,
  postalCode uniqueidentifier,
  precedence uniqueidentifier,
  register uniqueidentifier,
  registrationRequired uniqueidentifier,
  relationshipCriteria uniqueidentifier,
  resetPassword uniqueidentifier,
  returnType uniqueidentifier,
  scope uniqueidentifier,
  sn uniqueidentifier,
  st uniqueidentifier,
  status uniqueidentifier,
  statusError uniqueidentifier,
  street uniqueidentifier,
  telephoneNumber uniqueidentifier,
  temporal uniqueidentifier,
  title uniqueidentifier,
  type uniqueidentifier,
  uid uniqueidentifier,
  object_id uniqueidentifier,
  accountName datetime,
  ad_UserCannotChangePassword datetime,
  address datetime,
  assembly datetime,
  c datetime,
  city datetime,
  cn datetime,
  co datetime,
  comment datetime,
  company datetime,
  connectedObjectType datetime,
  connectedSystem datetime,
  connectedSystemScope datetime,
  connector datetime,
  costCenter datetime,
  costCenterName datetime,
  country datetime,
  createConnectedSystemObject datetime,
  createILMObject datetime,
  csObjectID datetime,
  dc datetime,
  deleteTime datetime,
  department datetime,
  description datetime,
  disconnectConnectedSystemObject datetime,
  displayName datetime,
  division datetime,
  domain datetime,
  email datetime,
  employeeEndDate datetime,
  employeeID datetime,
  employeeStartDate datetime,
  employeeStatus datetime,
  employeeType datetime,
```

```
  expectedRuleEntryAction datetime,
  expirationTime datetime,
  facsimileTelephoneNumber datetime,
  firstName datetime,
  flowType datetime,
  freezeCount datetime,
  freezeLevel datetime,
  functionName datetime,
  functionParameters datetime,
  generationQualifier datetime,
  givenName datetime,
  homePhone datetime,
  ilmObjectType datetime,
  info datetime,
  initials datetime,
  jobTitle datetime,
  l datetime,
  lastName datetime,
  lastResetAttemptTime datetime,
  location datetime,
  loginName datetime,
  mail datetime,
  mailNickname datetime,
  memberFilter datetime,
  membershipAddWorkflow datetime,
  membershipLocked datetime,
  middleName datetime,
  mobile datetime,
  mobilePhone datetime,
  namespace datetime,
  o datetime,
  objectID datetime,
  objectSid datetime,
  objectType datetime,
  officeFax datetime,
  officeLocation datetime,
  officePhone datetime,
  ou datetime,
  pager datetime,
  personalTitle datetime,
  photo datetime,
  physicalDeliveryOfficeName datetime,
  postOfficeBox datetime,
  postalAddress datetime,
  postalCode datetime,
  precedence datetime,
  register datetime,
  registrationRequired datetime,
  relationshipCriteria datetime,
  resetPassword datetime,
  returnType datetime,
  scope datetime,
  sn datetime,
  st datetime,
  status datetime,
  statusError datetime,
  street datetime,
  telephoneNumber datetime,
  temporal datetime,
```

```
title datetime,
type datetime,
uid datetime,
```

object_id: A GUID uniquely identifying the metaverse object. This MUST be present.

object_type: A string containing the metaverse object type. This MUST be present.

object_type_lineage_id: A GUID uniquely identifying the lineage record in the mms_lineage_cross_reference table. This MUST be present.

object_type_lineage_date: The UTC time that the object_type was last updated. This MUST be present.

last_modification_date: The UTC time that the metaverse object was last updated. This MUST be present.

is_ref_retry: A bit where a value of 1 indicates if this metaverse object needs to have the reference attributes re-evaluated by the synchronization engine. If there is a binary stream of management agent GUIDs in the ma_guids_for_reference_retry field, the sync engine MUST reprocess all references from this metaverse object to each management agent specified. If ma_guids_for_reference_retry is NULL, the synchronization engine MUST process all references from this metaverse object to all of its connectors.

is_provisioning_retry: A bit where a value of 1 indicates if this metaverse object needs to have the provisioning operation retried.

uid: A user identifier as described in [MS-ADA3] section 2.329. Optional.

accountName: An account name. Optional.

ad_UserCannotChangePassword: A bit where a value of 1 indicates that the user cannot change their password in Active Directory. Optional.

address: A street address. Optional.

type: A group type value typically used to differentiate a security group from a distribution list. Optional.

c: A country or region as described in [MS-ADA1] section 2.94. Optional.

city: A city. Optional.

cn: A common name for the object as described in [MS-ADA1] section 2.110. Optional.

co: A country name as described in [MS-ADA1] section 2.111. Optional.

comment: A comment as described in [MS-ADA1] section 2.116. Optional.

company: A company name as described in [MS-ADA1] section 2.118. Optional.

title: A person's job title as described in [MS-ADA3] section 2.310. Optional.

temporal: A bit where a value of 1 indicates that this object has temporal events that need to be processed. Optional.

telephoneNumber: A telephone number as described in [MS-ADA3] section 2.299. Optional.

street: A street as described in [MS-ADA3] section 2.278. Optional.

costCenter: A cost center code, typically an accounting code. Optional.

costCenterName: A cost center name. Optional.

country: A country name. Optional.

createConnectedSystemObject: A bit where a value of 1 indicates that a synchronization rule SHOULD create a connector space object. Optional.

createILMObject: A bit where a value of 1 indicates whether to create an ILM object. This is used by a synchronization rule object type. Optional.

csObjectID: A connector space object ID. Optional.

dc: A domain controller as described in [MS-ADA1] section 2.142. Optional.

deleteTime: A delete time. Optional.

department: A department name as described in [MS-ADA1] section 2.151. Optional.

description: A description as described in [MS-ADA1] section 2.153. Optional.

disconnectConnectedSystemObject: A bit where a value of 1 indicates that a synchronization rule MUST disconnect the metaverse object from a connector space object.

displayName: A display name as described in [MS-ADA1] section 2.175. Optional.

division: A division as described in [MS-ADA1] section 2.179. Optional.

domain: A domain name. Optional.

email: An email address. Optional.

employeeEndDate: An employee termination date. Optional.

employeeID: An employee identifier as described in [MS-ADA1] section 2.217. Optional.

employeeStartDate: An employee start date. Optional.

employeeStatus: An employee status value. Optional.

employeeType: An employee type as described in [MS-ADA1] section 2.219. Optional.

status: A status value. Optional.

expirationTime: An expiration time. Optional.

facsimileTelephoneNumber: A facsimile telephone number as described in [MS-ADA1] section 2.229. Optional.

firstName: A person's first name. Typically the givenName attribute will be used instead. Optional.

flowType: A attribute flow type used by a synchronization rule object to specify whether the attribute flow is import or export. Optional.

freezeCount: A password freeze count. Optional.

freezeLevel: A password freeze level. Optional.

st: A state or province name as described in [MS-ADA3] section 2.277. Optional.

sn: A person's surname (last name or family name) as described in [MS-ADA3] section 2.275. Optional.

generationQualifier: A person's generation as described in [MS-ADA1] section 2.271. For example junior (Jr.), or II. Optional.

givenName: A person's given name (first name) as described in [MS-ADA1] section 2.273. Optional.

homePhone: A home telephone as described in [MS-ADA1] section 2.297. Optional.

scope: A group scope value. Optional.

info: An information value as described in [MS-ADA1] section 2.304. Optional.

initials: A person's initials for parts of the person's full name as described in [MS-ADA1] section 2.307. Optional.

jobTitle: A person's job title. Optional.

l: A locality name, such as country, city, or other geographical area as described in [MS-ADA1] section 2.345. Optional.

lastName: A person's last name. Typically the sn attribute will be used instead. Optional.

lastResetAttemptTime: A time of the person's last password reset attempt. Optional.

location: A person's location, such as their office number, as described in [MS-ADA1] section 2.369. Optional.

loginName: A person's login name. Optional.

mail: A mail string containing the list of email addresses belonging to a contact object as described in [MS-ADA2] section 2.6. Optional.

mailNickname: A mail nickname or alias. Optional.

resetPassword: A reset password value. Optional.

membershipAddWorkflow: A string indicating the workflow type for group membership. Optional.

membershipLocked: A bit where a value of 1 indicates that the group membership is locked. Optional.

middleName: A person's middle name as described in [MS-ADA2] section 2.48. Optional.

mobile: A person's mobile telephone number as described in [MS-ADA2] section 2.52. Optional.

mobilePhone: A mobile telephone number. Optional.

registrationRequired: A bit where a value of 1 indicates that password reset registration is REQUIRED. Optional.

o: An organization name as described in [MS-ADA3] section 2.38. Optional.

register: A bit where a value of 1 indicates this account is registered for password reset. Optional.

objectSid: An object security identifier (SID) as described in [MS-ADA3] section 2.45. Optional.

objectType: An object type. Optional.

officeFax: A person's office facsimile telephone number. Optional.

officeLocation: A person's office location. Optional.

officePhone: A person's office telephone number. Optional.

ou: An organizational unit as described in [MS-ADA3] section 2.73. Optional.

pager: A pager telephone number as described in [MS-ADA3] section 2.79. Optional.

personalTitle: A personal title as described in [MS-ADA3] section 2.91. Optional.

precedence: A precedence value used to order objects. Optional.

physicalDeliveryOfficeName: A physical delivery office name as described in [MS-ADA3] section 2.93. Optional.

postOfficeBox: A post office box number as described in [MS-ADA3] section 2.112. Optional.

postalAddress: A postal address as described in [MS-ADA3] section 2.110. Optional.

postalCode: A postal code as described in [MS-ADA3] section 2.111. Optional.

photo: A photograph as described in [MS-ADA3] section 2.92. Optional.

objectID: An object identifier. Optional.

namespace: An object namespace. Optional.

relationshipCriteria: A relationship criteria used to describe the relationship of a metaverse object to a connector space object. This is used by synchronization rule processing. Optional.

memberFilter: A group member filter specified by the synchronization rule. Optional.

returnType: A return type. Optional.

ilmObjectType: The type of ILM object specified by the synchronization rule. Optional.

functionParameters: Function parameters for synchronization rule processing. Optional.

functionName: A function name for synchronization rule processing. Optional.

expectedRuleEntryAction: An expected rules entry action for an expected rules entry object. Optional.

statusError: An error result. Optional.

connector: A connector string. Optional.

connectedSystemScope: The scope at which a synchronization rule object applies to a connector space. Optional.

connectedSystem: The management agent GUID of the management agent associated with the synchronization rule object. Optional.

connectedObjectType: The connector space object type of objects connected or created as a result of this synchronization rule object. Optional.

assembly: An assembly name for scripted flow rules defined by this synchronization rule object. Optional.

ma_guids_for_reference_retry: A list of management agent GUIDs needing reference retry processing. The GUIDs MUST exist in the ma_id attribute of the mms_management_agent table. The is_ref_retry attribute MUST be 1 if this is not NULL. Optional.

object_id: A GUID uniquely identifying the metaverse object. This MUST be present. *

accountName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

ad_UserCannotChangePassword: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

address: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

assembly: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

c: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

city: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

cn: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

co: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

comment: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

company: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

connectedObjectType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

connectedSystem: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

connectedSystemScope: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

connector: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

costCenter: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

costCenterName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

country: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

createConnectedSystemObject: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

createILMObject: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

csObjectID: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

dc: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

deleteTime: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

department: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

description: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

disconnectConnectedSystemObject: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

displayName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

division: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

domain: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

email: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

employeeEndDate: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

employeeID: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

employeeStartDate: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

employeeStatus: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

employeeType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

expectedRuleEntryAction: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

expirationTime: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

facsimileTelephoneNumber: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

firstName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

flowType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

freezeCount: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

freezeLevel: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

functionName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

functionParameters: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

generationQualifier: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

givenName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

homePhone: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

ilmObjectType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

info: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

initials: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

jobTitle: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

l: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

lastName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

lastResetAttemptTime: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

location: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

loginName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

mail: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

mailNickname: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

memberFilter: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

membershipAddWorkflow: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

membershipLocked: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

middleName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

mobile: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

mobilePhone: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

namespace: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

o: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

objectID: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

objectSid: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

objectType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

officeFax: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

officeLocation: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

officePhone: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

ou: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

pager: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

personalTitle: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

photo: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

physicalDeliveryOfficeName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

postOfficeBox: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

postalAddress: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

postalCode: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

precedence: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

register: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

registrationRequired: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

relationshipCriteria: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

resetPassword: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

returnType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

scope: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

sn: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

st: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

status: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

statusError: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

street: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

telephoneNumber: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

temporal: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

title: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

type: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

uid: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. *

object_id: A GUID uniquely identifying the metaverse object. This MUST be present. **

accountName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

ad_UserCannotChangePassword: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

address: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

assembly: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

c: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

city: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

cn: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

co: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

comment: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

company: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

connectedObjectType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

connectedSystem: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

connectedSystemScope: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

connector: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

costCenter: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

costCenterName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

country: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

createConnectedSystemObject: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

createILMObject: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

csObjectID: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

dc: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

deleteTime: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

department: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

description: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

disconnectConnectedSystemObject: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

displayName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

division: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

domain: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

email: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

employeeEndDate: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

employeeID: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

employeeStartDate: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

employeeStatus: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

employeeType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

expectedRuleEntryAction: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

expirationTime: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

facsimileTelephoneNumber: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

firstName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

flowType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

freezeCount: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

freezeLevel: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

functionName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

functionParameters: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

generationQualifier: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

givenName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

homePhone: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

ilmObjectType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

info: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

initials: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

jobTitle: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

l: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

lastName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

lastResetAttemptTime: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

location: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

loginName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

mail: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

mailNickname: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

memberFilter: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

membershipAddWorkflow: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

membershipLocked: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

middleName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

mobile: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

mobilePhone: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

namespace: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

o: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

objectID: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

objectSid: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

objectType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

officeFax: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

officeLocation: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

officePhone: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

ou: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

pager: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

personalTitle: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

photo: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

physicalDeliveryOfficeName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

postOfficeBox: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

postalAddress: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

postalCode: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

precedence: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

register: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

registrationRequired: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

relationshipCriteria: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

resetPassword: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

returnType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

scope: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

sn: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

st: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

status: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

statusError: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

street: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

telephoneNumber: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

temporal: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

title: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

type: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

uid: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL. **

2.2.4.22 mms_partition_successfulbatch.ResultSet

This result set contains the last successful export batch number for all partitions in a specified management agent.

```
partition_id uniqueidentifier,
last_successful_export_batch_number int,
```

partition_id: A GUID uniquely identifying the partition.

last_successful_export_batch_number: The last successful export batch number for this partition. This starts at zero and increments for each successful export to the partition.

2.2.4.23 mms_supportsparentcontainers.ResultSet

This result set contains a single row that indicates the specified management agent supports hierarchical containers. If no row is returned, then the management agent does not support hierarchy.

```
depth int,
```

depth: A numeric value representing the depth of a connector space object in the hierarchy. Root objects MUST have a depth of 1. This result set MUST always return a number greater than 1 else it will be an empty result set.

2.2.5 Tables and Views

The following tables are defined for use with this protocol. Only the values defined in the following data type definitions SHOULD be used. All other values are reserved for future use and SHOULD NOT be used.

2.2.5.1 mms_connectorspace

The mms_connectorspace table contains information about connector space object from all connector spaces. The mms_connectorspace table is logically divided into management agents by the ma_id, and further into logical partitions by the partition_id.

```
object_id uniqueidentifier NOT NULL,
ma_id uniqueidentifier NULL,
pobject_id uniqueidentifier NOT NULL,
rdn nvarchar(876) NOT NULL,
ancestors varbinary(944) NOT NULL,
depth int NOT NULL,
anchor varbinary(800) NULL,
partition_id uniqueidentifier NULL,
creation_date datetime NULL,
is_provisioned bit NULL,
disconnection_id uniqueidentifier NULL,
disconnection_modification_date datetime NULL,
last_import_modification_date datetime NULL,
last_export_modification_date datetime NULL,
count_import_modications int NULL,
count_export_modications int NULL,
is_connector bit NULL,
connector_state int NULL,
pending bit NULL,
is_rename_retry bit NULL,
is_reference_retry bit NULL,
is_rebuild_in_progress bit NULL,
is_seen_by_import bit NULL,
is_phantom_parent bit NULL,
is_phantom_link bit NULL,
is_phantom_delete bit NULL,
is_full_sync bit NULL,
is_obsoletion bit NULL,
is_pending_reference_delete bit NULL,
import_operation int NULL,
export_operation int NULL,
is_import_error bit NULL,
count_import_error_retries int NULL,
initial_import_error_date datetime NULL,
last_import_error_date datetime NULL,
import_error_code int NULL,
is_export_error bit NULL,
count_export_error_retries int NULL,
initial_export_error_date datetime NULL,
last_export_error_date datetime NULL,
export_error_code int NULL,
current_export_batch_number int NULL,
current_export_sequence_number int NULL,
unapplied_export_batch_number int NULL,
unapplied_export_sequencer_number int NULL,
original_export_batch_number int NULL,
```

```
original_export_sequencer_number int NULL,
key_id int NULL,
hologram varbinary(max) NULL,
deltas varbinary(max) NULL,
import_error_detail nvarchar(max) NULL,
export_error_detail nvarchar(max) NULL,
transient_dn nvarchar(max) NULL,
transient_details nvarchar(max) NULL,
password_change_history nvarchar(max) NULL,
is_pending_reference_rename bit NULL,
pending_moveop int NULL,
password_incoming_timestamp datetime NULL,
password_outgoing_timestamp datetime NULL,
```

object_id: A GUID uniquely identifying the connector space object.

ma_id: A GUID uniquely identifying the management agent instance for the connector space object. This MUST match a management agent record in the mms_management_agent table.

pobject_id: A GUID uniquely identifying the parent connector space object. Root objects MUST have a value of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a value of 00000000-0000-0000-0000-000000000001.

rdn: A string containing the relative distinguished name of this connector space object.

ancestors: A binary value containing the concatenated object_id values of all direct ancestor records, in order, from the root node down to the immediate parent of this object. This value MUST NOT be encoded. If the object has no ancestor, the value MUST be 0x0.

depth: A numeric value representing the depth of this connector space object in the hierarchy. Root objects MUST have a depth of 1.

anchor: A binary value containing the anchor value for this connector space object. This value MUST NOT be encoded.

partition_id: A GUID value uniquely identifying partition for this connector space object. This value MUST be NULL for placeholder objects. All other objects MUST reference the partition that contains them in the mms_partition table.

creation_date: The UTC time that this connector space object was created by the synchronization engine. This MUST be blank for objects that are being imported from a data source into the connector space. This MUST be specified for objects that are being created by the synchronization engine.

is_provisioned: A bit where a value of 1 indicates that the synchronization engine created this object.

disconnection_id: A GUID identifying the rule that resulted in this object transitioning from a connector to a disconnector. This MUST be NULL if the object was never connected, or if the object was not disconnected because of a join rule.

disconnection_modification_date: The UTC time that this object was disconnected from the metaverse. This MUST contain a valid time value if the disconnection_id is not NULL.

last_import_modification_date: The UTC time that this object was last modified by importing data from the data source. This MUST be NULL for newly created objects that have not been exported.

last_export_modification_date: The UTC time that the pending export delta value for this connector space object was last updated. This MUST be NULL if there is no pending export delta.

count_import_modications: A count of the number of times that a new pending import delta has been written to the object. This synchronization engine MUST reset this to zero once the pending import image has been synchronized.

count_export_modications: A count of the number of times that a new pending export delta has been written to the object. This synchronization engine MUST reset this to zero once the pending export image has been exported.

is_connector: A bit where a value of 1 indicates the object is a connector.

connector_state: A number that specifies the connector state of this object. This MUST be set to one of the values specified in section 2.2.2.4.

pending: A bit where a value of 1 indicates this object has pending import data that needs to be synchronized.

is_rename_retry: A bit where a value of 1 indicates the object needs to be reprocessed for a pending rename operation.

is_reference_retry: A bit where a value of 1 indicates the object reference attributes need to be re-evaluated.

is_rebuild_in_progress: A bit where a value of 1 indicates the object has been created and exported, but it has not been confirmed with an import operation.

is_seen_by_import: A bit where a value of 1 indicates the object has been imported from the data source during the full import run profile.

is_phantom_parent: A bit where a value of 1 indicates the connector space object is a hierarchy placeholder for a descendent of this object that has been staged or provisioned.

is_phantom_link: A bit where a value of 1 indicates the connector space object has not been staged, but it is referenced by another object and therefore has been created as a placeholder to maintain the reference link.

is_phantom_delete: A bit where a value of 1 indicates the connector space object has been deleted, but MUST remain as a hierarchy placeholder because of references to objects below it in the hierarchy.

is_full_sync: A bit where a value of 1 indicates the object requires a full synchronization.

is_obsoletion: A bit where a value of 1 indicates the object is obsolete, and MUST be removed later in the processing cycle after all regular objects have been processed.

is_pending_reference_delete: A bit where a value of 1 indicates the object needs to have pending reference deletes processed and finalized.

import_operation: A numeric value specifying the type of import operation that is pending. This MUST be NULL for placeholder objects and newly provisioned objects that have not yet been exported. This MUST contain one of the values specified in section 2.2.2.8 for objects with a pending import operation.

export_operation: A numeric value specifying the type of export operation that is pending. This MUST be NULL for placeholder objects and objects with no pending export data. This MUST contain one of the values specified in section 2.2.2.8 for objects with a pending export operation.

is_import_error: A bit where a value of 1 indicates that this object had an error during the last inbound synchronization operation.

count_import_error_retries: A count of the number of consecutive inbound synchronization errors that have occurred on this object. The synchronization engine MUST set this to zero when the object is successfully staged.

initial_import_error_date: The UTC time of the first inbound synchronization error, or NULL if there were no errors.

last_import_error_date: The UTC time of the most recent inbound synchronization error, or NULL if there were no errors.

import_error_code: An HRESULT error code for the last import operation. This MUST be zero, NULL, or a value from section 2.2.2.17 or from section 2.2.2.5.

is_export_error: A bit where a value of 1 indicates that this object had an export error during the last export operation.

count_export_error_retries: A count of the number of export error retries that have been performed on this object. The synchronization engine MUST set this to zero when the object is successfully exported to the data source.

initial_export_error_date: The UTC time of the first export error, or NULL if there were no export errors.

last_export_error_date: The UTC time of the last export error, or NULL if there were no export errors.

export_error_code: An HRESULT error code for the last export operation. This MUST be zero, NULL, or a value from section 2.2.2.17 or from section 2.2.2.5.

current_export_batch_number: The current export batch number for this object.

current_export_sequence_number: The current export sequence number for this object.

unapplied_export_batch_number: The export batch number for the changes in the pending export image.

unapplied_export_sequencer_number: The export sequence number for the changes in the pending export image.

original_export_batch_number: The export batch number the first time this object was exported.

original_export_sequencer_number: The export sequence number the first time this object was exported.

key_id: A numeric encryption key ID that identifies the encryption key set used to encrypt data for this object. If no data has been encrypted, this will be NULL.

hologram: A compressed binary image structure containing the object and attribute data. The format of this data is specified in section 2.2.3.

deltas: A compressed binary image structure containing the delta object and attribute data. The format of this data is specified in section 2.2.3.

import_error_detail: An XML fragment containing the inbound synchronization error details. The format of this fragment is defined in section 2.2.6.4.11.

export_error_detail: An XML fragment containing the export error details. The format of this fragment is defined in section 2.2.6.4.7.

transient_dn: A string containing the distinguished name of the object before it was moved to a transient state, or NULL if the object is not a transient object.

transient_details: Reserved. This field MUST be NULL.

password_change_history: An XML fragment containing the password change history operations that have been performed through WMI [MS-WMI]. This MUST be NULL or a valid XML fragment as defined in section 2.2.6.4.17.

is_pending_reference_rename: A bit where a value of 1 indicates this object has pending reference rename operations that still are required to be performed.

pending_moveop: The pending move operation, if any. This MUST be NULL, or one of the values from the section 2.2.2.14.

password_incoming_timestamp: The UTC time of the most recent inbound password received for this object. This MUST be NULL or a valid datetime value.

password_outgoing_timestamp: The UTC time of the most recent outbound password received for this object. This MUST be NULL or a valid datetime value.

2.2.5.2 mms_cs_link

The mms_cs_link table contains information about references from one connector space object to another.

```
object_id uniqueidentifier NOT NULL,
attribute_name nvarchar(256) NOT NULL,
state int NULL,
reference_id uniqueidentifier NOT NULL,
is_deleted bit NULL,
is_renamed bit NULL,
old_dn nvarchar(max) NULL,
```

object_id: A GUID uniquely identifying this connector space object. This GUID MUST exist in the mms_connectorspace table.

attribute_name: The attribute name.

state: The link state flag. This MUST be a valid value as defined in section 2.2.2.10.

reference_id: A GUID uniquely identifying the referenced connector space object. This GUID MUST exist in the object_id column of the mms_connectorspace table.

is_deleted: A bit where a value of 1 indicates the reference is flagged for deletion.

is_renamed: A bit where a value of 1 indicates the referenced connector space object has a pending rename operation.

old_dn: The distinguished name of the referenced connector space object before it was renamed. This MUST be NULL if the is_renamed bit is not 1.

2.2.5.3 mms_csmv_link

The mms_csmv_link table contains information linking a connector space object to a metaverse object.

```
mv_object_id uniqueidentifier NOT NULL,
cs_object_id uniqueidentifier NOT NULL,
lineage_id uniqueidentifier NOT NULL,
lineage_date datetime NOT NULL,
```

mv_object_id: A GUID uniquely identifying the metaverse object. This value MUST match a metaverse object record in the mms_metaverse table.

cs_object_id: A GUID uniquely identifying the connector space object. This value MUST match a connector space object record in the mms_connectorspace table.

lineage_id: A GUID uniquely identifying the lineage data in the mms_lineage_cross_reference table.

lineage_date: The UTC time that this record was last update

2.2.5.4 mms_extensions

The mms_extensions table contains copies of the binary extensions and the extension configuration files used by the synchronization engine.

```
file_name nvarchar(520) NOT NULL,
file_size bigint NOT NULL,
file_time datetime NOT NULL,
file_content varbinary(max) NOT NULL,
```

file_name: The file name and extension of the file. This MUST not include the file path.

file_size: The size of the file in bytes.

file_time: The timestamp of the file.

file_content: The binary content of the file.

2.2.5.5 mms_lineage_cross_reference

The mms_lineage_cross_reference table identifies the lineage for attributes and objects that are flowed into the metaverse.

```
lineage_id uniqueidentifier NOT NULL,
ma_id uniqueidentifier NOT NULL,
rule_type int NOT NULL,
creation_date datetime NOT NULL,
```

lineage_id: A GUID uniquely identifying the lineage record.

ma_id: A GUID uniquely identifying the source management agent. This value MUST match a management agent record in the mms_management_agent table.

rule_type: The type of rule that was applied to create this lineage. This MUST be a value as specified in section 2.2.2.9.

creation_date: The UTC time that this lineage record was created.

2.2.5.6 mms_management_agent

This mms_management_agent table contains the configuration for all the management agents. There is one row for each management agent configuration.

```
ma_id uniqueidentifier NOT NULL,
ma_name nvarchar(256) NOT NULL,
ma_type nvarchar(200) NULL,
subtype nvarchar(510) NULL,
ma_listname nvarchar(510) NULL,
company_name nvarchar(510) NULL,
version_number int NULL,
internal_version_number int NULL,
creation_date datetime NULL,
modification_date datetime NULL,
capabilities_mask int NULL,
ma_export_type int NULL,
current_run_number int NULL,
key_id int NULL,
ma_description nvarchar(max) NULL,
ui_settings_xml nvarchar(max) NULL,
ma_extension_xml nvarchar(max) NULL,
ma_schema_xml nvarchar(max) NULL,
attribute_inclusion_xml nvarchar(max) NULL,
stay_disconnector_xml nvarchar(max) NULL,
join_rule_xml nvarchar(max) NULL,
projection_rule_xml nvarchar(max) NULL,
export_attribute_flow_xml nvarchar(max) NULL,
provisioning_cleanup_xml nvarchar(max) NULL,
controller_configuration_xml nvarchar(max) NULL,
controller_configuration_password nvarchar(max) NULL,
private_configuration_xml nvarchar(max) NULL,
encrypted_configuration nvarchar(max) NULL,
dn_construction_xml nvarchar(max) NULL,
is_password_sync_allowed bit NULL,
passwordsync_xml nvarchar(max) NULL,
component_mappings_xml nvarchar(max) NULL,
```

ma_id: A GUID uniquely identifying the management agent instance.

ma_name: A name describing the management agent instance.

ma_type: A string indicating the management agent type. Valid values are specified in section 2.2.1.3.

subtype: A type description string for this management agent instance. This value MUST NOT be specified unless the **ma_type** is the literal "Extensible".

ma_listname: A string indicating the management agent type name. This value MUST NOT be specified unless the **ma_type** is the literal "Extensible".

company_name: A string indicating a company name of an extensible management agent. This value MUST NOT be specified unless the **ma_type** is the literal "Extensible".

version_number: The integer version number of the management agent instance. The synchronization engine sets this to 1 for new management agents and increments it every time a change is made to the management agent definition.

internal_version_number: A version number indicating the version of an extensible management agent. This value MUST NOT be specified unless the **ma_type** is the literal "Extensible".

creation_date: The UTC time which this management agent instance was created.

modification_date: The UTC time which this management agent instance was last updated.

capabilities_mask: The capabilities of this management agent instance. Valid values are specified in section 2.2.2.11.

ma_export_type: The capabilities of this management agent instance. Valid values are specified in section 2.2.1.2.

current_run_number: A number identifying this last run profile execution. This MUST match a run history record in the mms_run_history table.

key_id: A numeric encryption key ID that identifies the encryption key set used to encrypt data for this management agent instance.

ma_description: A string describing the management agent instance.

ui_settings_xml: A list of connector space and metaverse query definitions for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.24; however, the root element MUST be **ma-ui-settings** instead of **SyncConfig-ma-ui-settings**.

ma_extension_xml: The script-based rule extension assembly for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.20; however, the root element MUST be **extension** instead of **SyncConfig-extension**.

ma_schema_xml: The schema for the data source associated with the management agent instance in DSML format as specified in [DSML2]. The value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.11; however, the root element MUST begin with the first child element, **dsml**.

attribute_inclusion_xml: A list of the selected attributes from the data sources associated with the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.13; however, the root element MUST be **attribute-inclusion** instead of **SyncConfig-attribute-inclusion**.

stay_disconnector_xml: A list of connector filter rules for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.14; however, the root element MUST be **stay-disconnector** instead of **SyncConfig-stay-disconnector**.

join_rule_xml: A list of join rules for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.15; however, the root element MUST be **join** instead of **SyncConfig-join**.

projection_rule_xml: A list of projection rules for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.16; however, the root element MUST be **projection** instead of **SyncConfig-projection**.

export_attribute_flow_xml: A list of export attribute flow rules for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.17; however, the root element MUST be **export-attribute-flow** instead of **SyncConfig-export-attribute-flow**.

provisioning_cleanup_xml: The deprovisioning rule for the management agent instance. This value MUST conform to the schema defined in section 2.2.6.4.20.

controller_configuration_xml: A configuration for running script-based rules for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.21; however, the root element MUST be **controller-configuration** instead of **SyncConfig-controller-configuration**.

controller_configuration_password: The password associated with the account defined in **controller_configuration_xml**. This value MAY <1> be encrypted.

private_configuration_xml: The configuration for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.25; however, the root element MUST be **private-configuration** instead of **SyncConfig-private-configuration**.

encrypted_configuration: The encrypted attributes for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.30; however, the root element MUST be **encrypted-attributes** instead of **SyncConfig-encrypted-attributes**. This value MAY <2> be encrypted.

dn_construction_xml: The DN construction rule for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.28; however, the root element MUST be **dn-construction** instead of **SyncConfig-dn-construction**. This value MUST be NULL if **ma_type** is any of the following values:

- "AD"
- "iPlanet"
- "eDirectory"
- "IBM DS"
- "Extensible", if and only if **private_configuration_xml** contains an **ldif_format** element.

is_password_sync_allowed: A value indicating whether password synchronization is supported on the management agent instance. The value MUST be 1 if password synchronization is supported; otherwise, the value MUST be 0.

passwordsync_xml: The password synchronization configuration for the management agent instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.23; however, the root element MUST be **password-sync** instead of **SyncConfig-password-sync**.

component_mappings_xml: The value MUST conform to the schema defined in section 2.2.6.4.1.

2.2.5.7 mms_metaverse

The mms_metaverse table contains information about the metaverse objects.

The following REQUIRED attributes are used by the synchronization engine for tracking and managing the metaverse object.

- object_id
- object_type
- object_type_lineage_id
- object_type_lineage_date
- last_modification_date
- is_ref_retry
- is_provisioning_retry
- ma_guids_for_reference

The remainder of the attributes in the metaverse contain object data, and they are optional. These optional attributes will only contain data if the schema for the metaverse object type specifies that attribute as being associated with the object type, and there are import attribute flow rules defined to populate the attribute with data, and the source object contained data for that attribute. Not all of the connected systems use the same terminology, so in a number of cases there may be more than one field in the schema that can be used to hold a particular value. The import attribute flow rules for each management agent will determine which metaverse fields are populated with data.

Some attributes are shared across multiple object types. For example, displayName is used on most object types, and most rows in the metaverse have the opportunity to include a displayName value, provided it is present on the authoritative connector space object. Other attributes are specific to a particular object type, and MAY be present rarely in the metaverse.

In addition to attributes being scoped by type, many attribute are simply not imported or flowed. Also, attributes MAY be repurposed for holding data other than the documented purpose. Therefore, the stated purpose of a field is only a guideline.

```
object_id uniqueidentifier NOT NULL,
object_type nvarchar(128) NOT NULL,
object_type_lineage_id uniqueidentifier NULL,
object_type_lineage_date datetime NULL,
last_modification_date datetime NOT NULL,
is_ref_retry bit NULL,
is_provisioning_retry bit NULL,
uid nvarchar(896) NULL,
accountName nvarchar(896) NULL,
ad_UserCannotChangePassword bit NULL,
address nvarchar(896) NULL,
type nvarchar(896) NULL,
c nvarchar(896) NULL,
city nvarchar(896) NULL,
cn nvarchar(896) NULL,
co nvarchar(896) NULL,
comment nvarchar(896) NULL,
company nvarchar(896) NULL,
```

```
    title nvarchar(896) NULL,
    temporal bit NULL,
    telephoneNumber nvarchar(896) NULL,
    street nvarchar(896) NULL,
    costCenter nvarchar(896) NULL,
    costCenterName nvarchar(896) NULL,
    country nvarchar(896) NULL,
    createConnectedSystemObject bit NULL,
    createILMObject bit NULL,
    csObjectID nvarchar(896) NULL,
    dc nvarchar(896) NULL,
    deleteTime nvarchar(896) NULL,
    department nvarchar(896) NULL,
    description nvarchar(896) NULL,
    disconnectConnectedSystemObject bit NULL,
    displayName nvarchar(896) NULL,
    division nvarchar(896) NULL,
    domain nvarchar(896) NULL,
    email nvarchar(896) NULL,
    employeeEndDate nvarchar(896) NULL,
    employeeID nvarchar(896) NULL,
    employeeStartDate nvarchar(896) NULL,
    employeeStatus nvarchar(896) NULL,
    employeeType nvarchar(896) NULL,
    status nvarchar(896) NULL,
    expirationTime nvarchar(896) NULL,
    facsimileTelephoneNumber nvarchar(896) NULL,
    firstName nvarchar(896) NULL,
    flowType bigint NULL,
    freezeCount bigint NULL,
    freezeLevel nvarchar(896) NULL,
    st nvarchar(896) NULL,
    sn nvarchar(896) NULL,
    generationQualifier nvarchar(896) NULL,
    givenName nvarchar(896) NULL,
    homePhone nvarchar(896) NULL,
    scope nvarchar(896) NULL,
    info nvarchar(896) NULL,
    initials nvarchar(896) NULL,
    jobTitle nvarchar(896) NULL,
    l nvarchar(896) NULL,
    lastName nvarchar(896) NULL,
    lastResetAttemptTime nvarchar(896) NULL,
    location nvarchar(896) NULL,
    loginName nvarchar(896) NULL,
    mail nvarchar(896) NULL,
    mailNickname nvarchar(896) NULL,
    resetPassword nvarchar(896) NULL,
    membershipAddWorkflow nvarchar(896) NULL,
    membershipLocked bit NULL,
    middleName nvarchar(896) NULL,
    mobile nvarchar(896) NULL,
    mobilePhone nvarchar(896) NULL,
    registrationRequired bit NULL,
    o nvarchar(896) NULL,
    register bit NULL,
    objectSid varbinary(900) NULL,
    objectType nvarchar(896) NULL,
    officeFax nvarchar(896) NULL,
```

```
officeLocation nvarchar(896) NULL,
officePhone nvarchar(896) NULL,
ou nvarchar(896) NULL,
pager nvarchar(896) NULL,
personalTitle nvarchar(896) NULL,
precedence bigint NULL,
physicalDeliveryOfficeName nvarchar(896) NULL,
postOfficeBox nvarchar(896) NULL,
postalAddress nvarchar(896) NULL,
postalCode nvarchar(896) NULL,
photo varbinary(max) NULL,
objectID nvarchar(max) NULL,
namespace nvarchar(max) NULL,
relationshipCriteria nvarchar(max) NULL,
memberFilter nvarchar(max) NULL,
returnType nvarchar(max) NULL,
ilmObjectType nvarchar(max) NULL,
functionParameters nvarchar(max) NULL,
functionName nvarchar(max) NULL,
expectedRuleEntryAction nvarchar(max) NULL,
statusError nvarchar(max) NULL,
connector nvarchar(max) NULL,
connectedSystemScope nvarchar(max) NULL,
connectedSystem nvarchar(max) NULL,
connectedObjectType nvarchar(max) NULL,
assembly nvarchar(max) NULL,
ma_guids_for_reference_retry varbinary(max) NULL,
```

object_id: A GUID uniquely identifying the metaverse object. This MUST be present and it MUST be unique within the metaverse.

object_type: A string containing the metaverse object type. This MUST be present and MUST match the object types defined in the metaverse schema.

object_type_lineage_id: A GUID uniquely identifying the lineage record in the mms_lineage_cross_reference table. This lineage information provides details of which connectorspace object caused this metaverse object to be created. This MUST be present.

object_type_lineage_date: The UTC time that the object_type was last updated. This MUST be present.

last_modification_date: The UTC time that the metaverse object was last updated. This MUST be present.

is_ref_retry: A bit where a value of 1 indicates if this metaverse object needs to have the reference attributes re-evaluated by the synchronization engine. If there is a binary stream of management agent GUIDs in the ma_guids_for_reference_retry field, the sync engine MUST reprocess all references from this metaverse object to each management agent specified. If ma_guids_for_reference_retry is NULL, the synchronization engine MUST process all references from this metaverse object to all of its connectors.

is_provisioning_retry: A bit where a value of 1 indicates if this metaverse object needs to have the provisioning operation retried. This MUST be NULL or 1.

uid: A user identifier as described in [MS-ADA3] section 2.329. Optional.

accountName: An account name. Optional.

ad_UserCannotChangePassword: A bit where a value of 1 indicates that the user cannot change their password in Active Directory. Optional.

address: A street address. Optional.

type: A group type value typically used to differentiate a security group from a distribution list. Optional.

c: A country or region as described in [MS-ADA1] section 2.94. Optional.

city: A city. Optional.

cn: A common name for the object as described in [MS-ADA1] section 2.110. Optional.

co: A country name as described in [MS-ADA1] section 2.111. Optional.

comment: A comment as described in [MS-ADA1] section 2.116. Optional.

company: A company name as described in [MS-ADA1] section 2.118. Optional.

title: A person's job title as described in [MS-ADA3] section 2.310. Optional.

temporal: A bit where a value of 1 indicates that this object has temporal events that need to be processed. Optional.

telephoneNumber: A telephone number as described in [MS-ADA3] section 2.299. Optional.

street: A street as described in [MS-ADA3] section 2.278. Optional.

costCenter: A cost center code, typically an accounting code. Optional.

costCenterName: A cost center name. Optional.

country: A country name. Optional.

createConnectedSystemObject: A bit where a value of 1 indicates that a synchronization rule SHOULD create a connector space object. Optional.

createILMObject: A bit where a value of 1 indicates whether to create an ILM object. This is used by a synchronization rule object type. Optional.

csObjectID: A connector space object ID. Optional.

dc: A domain controller as described in [MS-ADA1] section 2.142. Optional.

deleteTime: A delete time. Optional.

department: A department name as described in [MS-ADA1] section 2.151. Optional.

description: A description as described in [MS-ADA1] section 2.153. Optional.

disconnectConnectedSystemObject: A bit where a value of 1 indicates that a synchronization rule MUST disconnect the metaverse object from a connector space object.

displayName: A display name as described in [MS-ADA1] section 2.175. Optional.

division: A division as described in [MS-ADA1] section 2.179. Optional.

domain: A domain name. Optional.

email: An email address. Optional.

employeeEndDate: An employee termination date. Optional.

employeeID: An employee identifier as described in [MS-ADA1] section 2.217. Optional.

employeeStartDate: An employee start date. Optional.

employeeStatus: An employee status value. Optional.

employeeType: An employee type as described in [MS-ADA1] section 2.219. Optional.

status: A status value. Optional.

expirationTime: An expiration time. Optional.

facsimileTelephoneNumber: A facsimile telephone number as described in [MS-ADA1] section 2.229. Optional.

firstName: A person's first name. Typically, the givenName attribute will be used instead. Optional.

flowType: An attribute flow type used by a synchronization rule object to specify whether the attribute flow is import or export. Optional.

freezeCount: A password freeze count. Optional.

freezeLevel: A password freeze level. Optional.

st: A state or province name as described in [MS-ADA3] section 2.277. Optional.

sn: A person's surname (last name or family name) as described in [MS-ADA3] section 2.275. Optional.

generationQualifier: A person's generation as described in [MS-ADA1] section 2.271. For example junior (Jr.), or II. Optional.

givenName: A person's given name (first name) as described in [MS-ADA1] section 2.273. Optional.

homePhone: A home telephone as described in [MS-ADA1] section 2.297. Optional.

scope: A group scope value. Optional.

info: An information value as described in [MS-ADA1] section 2.304. Optional.

initials: A person's initials for parts of the person's full name as described in [MS-ADA1] section 2.307. Optional.

jobTitle: A person's job title. Optional.

l: A locality name, such as country, city, or other geographical area as described in [MS-ADA1] section 2.345. Optional.

lastName: A person's last name. Typically the sn attribute will be used instead. Optional.

lastResetAttemptTime: A time of the person's last password reset attempt. Optional.

location: A person's location, such as their office number, as described in [MS-ADA1] section 2.369. Optional.

loginName: A person's login name. Optional.

mail: A mail string containing the list of email addresses belonging to a contact object as described in [MS-ADA2] section 2.6. Optional.

mailNickname: A mail nickname or alias. Optional.

resetPassword: A reset password value. Optional.

membershipAddWorkflow: A string indicating the workflow type for group membership. Optional.

membershipLocked: A bit where a value of 1 indicates that the group membership is locked. Optional.

middleName: A person's middle name as described in [MS-ADA2] section 2.48. Optional.

mobile: A person's mobile telephone number as described in [MS-ADA2] section 2.52. Optional.

mobilePhone: A mobile telephone number. Optional.

registrationRequired: A bit where a value of 1 indicates that password reset registration is REQUIRED. Optional.

o: An organization name as described in [MS-ADA3] section 2.38. Optional.

register: A bit where a value of 1 indicates this account is registered for password reset. Optional.

objectSid: An object security identifier (SID) as described in [MS-ADA3] section 2.45. Optional.

objectType: An object type. Optional.

officeFax: A person's office facsimile telephone number. Optional.

officeLocation: A person's office location. Optional.

officePhone: A person's office telephone number. Optional.

ou: An organizational unit as described in [MS-ADA3] section 2.73. Optional.

pager: A pager telephone number as described in [MS-ADA3] section 2.79. Optional.

personalTitle: A personal title as described in [MS-ADA3] section 2.91. Optional.

precedence: A precedence value used to order objects. Optional.

physicalDeliveryOfficeName: A physical delivery office name as described in [MS-ADA3] section 2.93. Optional.

postOfficeBox: A post office box number as described in [MS-ADA3] section 2.112. Optional.

postalAddress: A postal address as described in [MS-ADA3] section 2.110. Optional.

postalCode: A postal code as described in [MS-ADA3] section 2.111. Optional.

photo: A photograph as described in [MS-ADA3] section 2.92. Optional.

objectID: An object identifier. Optional.

namespace: An object namespace. Optional.

relationshipCriteria: A relationship criteria used to describe the relationship of a metaverse object to a connector space object. This is used by synchronization rule processing. Optional.

memberFilter: A group member filter specified by the synchronization rule. Optional.

returnType: A return type. Optional.

ilmObjectType: The type of ILM object specified by the synchronization rule. Optional.

functionParameters: Function parameters for synchronization rule processing. Optional.

functionName: A function name for synchronization rule processing. Optional.

expectedRuleEntryAction: An expected rules entry action for an expected rules entry object. Optional.

statusError: An error result. Optional.

connector: A connector string. Optional.

connectedSystemScope: The scope at which a synchronization rule object applies to a connector space. Optional.

connectedSystem: The management agent GUID of the management agent associated with the synchronization rule object. Optional.

connectedObjectType: The connector space object type of objects connected or created as a result of this synchronization rule object. Optional.

assembly: An assembly name for scripted flow rules defined by this synchronization rule object. Optional.

ma_guids_for_reference_retry: A list of management agent GUIDs requiring reference retry processing. The GUIDs MUST exist in the ma_id attribute of the mms_management_agent table. The is_ref_retry attribute MUST be 1 if this is not NULL. Optional.

2.2.5.8 mms_metaverse_lineagedate

The mms_metaverse_lineagedate table contains the last UTC time that each metaverse attribute was updated. The only mandatory attribute in this table is the object_id. The remainder of the fields are OPTIONAL. More, fewer, or different fields MAY exist, depending upon the currently defined metaverse schema.

```
object_id uniqueidentifier NOT NULL,
accountName datetime NULL,
ad_UserCannotChangePassword datetime NULL,
address datetime NULL,
assembly datetime NULL,
c datetime NULL,
city datetime NULL,
cn datetime NULL,
co datetime NULL,
comment datetime NULL,
company datetime NULL,
connectedObjectType datetime NULL,
connectedSystem datetime NULL,
connectedSystemScope datetime NULL,
connector datetime NULL,
```

```
  costCenter datetime NULL,
  costCenterName datetime NULL,
  country datetime NULL,
  createConnectedSystemObject datetime NULL,
  createILMObject datetime NULL,
  csObjectID datetime NULL,
  dc datetime NULL,
  deleteTime datetime NULL,
  department datetime NULL,
  description datetime NULL,
  disconnectConnectedSystemObject datetime NULL,
  displayName datetime NULL,
  division datetime NULL,
  domain datetime NULL,
  email datetime NULL,
  employeeEndDate datetime NULL,
  employeeID datetime NULL,
  employeeStartDate datetime NULL,
  employeeStatus datetime NULL,
  employeeType datetime NULL,
  expectedRuleEntryAction datetime NULL,
  expirationTime datetime NULL,
  facsimileTelephoneNumber datetime NULL,
  firstName datetime NULL,
  flowType datetime NULL,
  freezeCount datetime NULL,
  freezeLevel datetime NULL,
  functionName datetime NULL,
  functionParameters datetime NULL,
  generationQualifier datetime NULL,
  givenName datetime NULL,
  homePhone datetime NULL,
  ilmObjectType datetime NULL,
  info datetime NULL,
  initials datetime NULL,
  jobTitle datetime NULL,
  l datetime NULL,
  lastName datetime NULL,
  lastResetAttemptTime datetime NULL,
  location datetime NULL,
  loginName datetime NULL,
  mail datetime NULL,
  mailNickname datetime NULL,
  memberFilter datetime NULL,
  membershipAddWorkflow datetime NULL,
  membershipLocked datetime NULL,
  middleName datetime NULL,
  mobile datetime NULL,
  mobilePhone datetime NULL,
  namespace datetime NULL,
  o datetime NULL,
  objectID datetime NULL,
  objectSid datetime NULL,
  objectType datetime NULL,
  officeFax datetime NULL,
  officeLocation datetime NULL,
  officePhone datetime NULL,
  ou datetime NULL,
  pager datetime NULL,
```

```
personalTitle datetime NULL,
photo datetime NULL,
physicalDeliveryOfficeName datetime NULL,
postOfficeBox datetime NULL,
postalAddress datetime NULL,
postalCode datetime NULL,
precedence datetime NULL,
register datetime NULL,
registrationRequired datetime NULL,
relationshipCriteria datetime NULL,
resetPassword datetime NULL,
returnType datetime NULL,
scope datetime NULL,
sn datetime NULL,
st datetime NULL,
status datetime NULL,
statusError datetime NULL,
street datetime NULL,
telephoneNumber datetime NULL,
temporal datetime NULL,
title datetime NULL,
type datetime NULL,
uid datetime NULL,
```

object_id: A GUID uniquely identifying the metaverse object.

accountName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

ad_UserCannotChangePassword: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

address: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

assembly: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

c: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

city: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

cn: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

co: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

comment: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

company: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

connectedObjectType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

connectedSystem: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

connectedSystemScope: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

connector: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

costCenter: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

costCenterName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

country: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

createConnectedSystemObject: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

createILMObject: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

csObjectID: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

dc: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

deleteTime: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

department: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

description: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

disconnectConnectedSystemObject: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

displayName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

division: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

domain: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

email: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

employeeEndDate: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

employeeID: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

employeeStartDate: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

employeeStatus: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

employeeType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

expectedRuleEntryAction: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

expirationTime: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

facsimileTelephoneNumber: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

firstName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

flowType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

freezeCount: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

freezeLevel: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

functionName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

functionParameters: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

generationQualifier: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

givenName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

homePhone: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

ilmObjectType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

info: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

initials: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

jobTitle: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

l: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

lastName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

lastResetAttemptTime: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

location: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

loginName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

mail: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

mailNickname: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

memberFilter: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

membershipAddWorkflow: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

membershipLocked: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

middleName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

mobile: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

mobilePhone: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

namespace: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

o: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

objectID: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

objectSid: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

objectType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

officeFax: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

officeLocation: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

officePhone: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

ou: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

pager: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

personalTitle: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

photo: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

physicalDeliveryOfficeName: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

postOfficeBox: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

postalAddress: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

postalCode: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

precedence: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

register: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

registrationRequired: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

relationshipCriteria: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

resetPassword: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

returnType: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

scope: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

sn: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

st: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

status: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

statusError: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

street: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

telephoneNumber: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

temporal: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

title: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

type: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

uid: The UTC time that this attribute was last updated. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

2.2.5.9 mms_metaverse_lineageguid

The mms_metaverse_lineageguid table contains the identifier of the lineage cross-reference data in the mms_lineage_cross_reference table. This provides details on where the attribute data came from, and why it was placed in the metaverse. The only mandatory attribute in this table is the object_id. The remainder of the fields are OPTIONAL. More, fewer, or different fields MAY exist, depending upon the currently defined metaverse schema. There MUST be a lineage GUID for each attribute in the metaverse that has a value.

```
object_id uniqueidentifier NOT NULL,
accountName uniqueidentifier NULL,
ad_UserCannotChangePassword uniqueidentifier NULL,
address uniqueidentifier NULL,
assembly uniqueidentifier NULL,
c uniqueidentifier NULL,
city uniqueidentifier NULL,
cn uniqueidentifier NULL,
co uniqueidentifier NULL,
comment uniqueidentifier NULL,
company uniqueidentifier NULL,
connectedObjectType uniqueidentifier NULL,
connectedSystem uniqueidentifier NULL,
connectedSystemScope uniqueidentifier NULL,
connector uniqueidentifier NULL,
costCenter uniqueidentifier NULL,
costCenterName uniqueidentifier NULL,
country uniqueidentifier NULL,
```

```
createConnectedSystemObject uniqueidentifier NULL,
createILMObject uniqueidentifier NULL,
csObjectID uniqueidentifier NULL,
dc uniqueidentifier NULL,
deleteTime uniqueidentifier NULL,
department uniqueidentifier NULL,
description uniqueidentifier NULL,
disconnectConnectedSystemObject uniqueidentifier NULL,
displayName uniqueidentifier NULL,
division uniqueidentifier NULL,
domain uniqueidentifier NULL,
email uniqueidentifier NULL,
employeeEndDate uniqueidentifier NULL,
employeeID uniqueidentifier NULL,
employeeStartDate uniqueidentifier NULL,
employeeStatus uniqueidentifier NULL,
employeeType uniqueidentifier NULL,
expectedRuleEntryAction uniqueidentifier NULL,
expirationTime uniqueidentifier NULL,
facsimileTelephoneNumber uniqueidentifier NULL,
firstName uniqueidentifier NULL,
flowType uniqueidentifier NULL,
freezeCount uniqueidentifier NULL,
freezeLevel uniqueidentifier NULL,
functionName uniqueidentifier NULL,
functionParameters uniqueidentifier NULL,
generationQualifier uniqueidentifier NULL,
givenName uniqueidentifier NULL,
homePhone uniqueidentifier NULL,
ilmObjectType uniqueidentifier NULL,
info uniqueidentifier NULL,
initials uniqueidentifier NULL,
jobTitle uniqueidentifier NULL,
l uniqueidentifier NULL,
lastName uniqueidentifier NULL,
lastResetAttemptTime uniqueidentifier NULL,
location uniqueidentifier NULL,
loginName uniqueidentifier NULL,
mail uniqueidentifier NULL,
mailNickname uniqueidentifier NULL,
memberFilter uniqueidentifier NULL,
membershipAddWorkflow uniqueidentifier NULL,
membershipLocked uniqueidentifier NULL,
middleName uniqueidentifier NULL,
mobile uniqueidentifier NULL,
mobilePhone uniqueidentifier NULL,
namespace uniqueidentifier NULL,
o uniqueidentifier NULL,
objectID uniqueidentifier NULL,
objectSid uniqueidentifier NULL,
objectType uniqueidentifier NULL,
officeFax uniqueidentifier NULL,
officeLocation uniqueidentifier NULL,
officePhone uniqueidentifier NULL,
ou uniqueidentifier NULL,
pager uniqueidentifier NULL,
personalTitle uniqueidentifier NULL,
photo uniqueidentifier NULL,
physicalDeliveryOfficeName uniqueidentifier NULL,
```

```
  postOfficeBox uniqueidentifier NULL,
  postalAddress uniqueidentifier NULL,
  postalCode uniqueidentifier NULL,
  precedence uniqueidentifier NULL,
  register uniqueidentifier NULL,
  registrationRequired uniqueidentifier NULL,
  relationshipCriteria uniqueidentifier NULL,
  resetPassword uniqueidentifier NULL,
  returnType uniqueidentifier NULL,
  scope uniqueidentifier NULL,
  sn uniqueidentifier NULL,
  st uniqueidentifier NULL,
  status uniqueidentifier NULL,
  statusError uniqueidentifier NULL,
  street uniqueidentifier NULL,
  telephoneNumber uniqueidentifier NULL,
  temporal uniqueidentifier NULL,
  title uniqueidentifier NULL,
  type uniqueidentifier NULL,
  uid uniqueidentifier NULL,
```

object_id: A GUID uniquely identifying the metaverse object. This value MUST match a metaverse object record in the mms_metaverse table.

accountName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

ad_UserCannotChangePassword: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

address: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

assembly: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

c: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

city: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

cn: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

co: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

comment: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

company: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

connectedObjectType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

connectedSystem: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

connectedSystemScope: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

connector: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

costCenter: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

costCenterName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

country: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

createConnectedSystemObject: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

createILMObject: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

csObjectID: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

dc: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

deleteTime: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

department: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

description: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

disconnectConnectedSystemObject: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

displayName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

division: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

domain: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

email: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

employeeEndDate: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

employeeID: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

employeeStartDate: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

employeeStatus: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

employeeType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

expectedRuleEntryAction: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

expirationTime: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

facsimileTelephoneNumber: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

firstName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

flowType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

freezeCount: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

freezeLevel: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

functionName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

functionParameters: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

generationQualifier: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

givenName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

homePhone: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

ilmObjectType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

info: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

initials: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

jobTitle: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

l: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

lastName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

lastResetAttemptTime: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

location:A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

loginName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

mail: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

mailNickname: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

memberFilter: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

membershipAddWorkflow: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

membershipLocked: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

middleName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

mobile: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

mobilePhone: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

namespace: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

o: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

objectID: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

objectSid: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

objectType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

officeFax: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

officeLocation: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

officePhone: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

ou: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

pager: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

personalTitle: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

photo: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

physicalDeliveryOfficeName: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

postOfficeBox: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

postalAddress: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

postalCode: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

precedence: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

register: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

registrationRequired: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

relationshipCriteria: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

resetPassword: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

returnType: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

scope: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

sn: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

st: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

status: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

statusError: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

street: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

telephoneNumber: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

temporal: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

title: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

type: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

uid: A lineage GUID from the mms_lineage_cross_reference table. This MUST be present if the attribute from the mms_metaverse table has a value, otherwise it MUST be NULL.

2.2.5.10 mms_metaverse_multivalue

This mms_metaverse_multivalue table contains all multi-valued attributes for a specified metaverse object identifier. There is one row per value. All values with the same attribute_name MUST have the same value type. Exactly one value type (numeric_value, string_value_indexable, binary_value_indexable, string_value_not_indexable, or binary_value_not_indexable) MUST be filled in per value. All other value types in the row MUST be NULL.

```
object_id uniqueidentifier NOT NULL,
attribute_name nvarchar(256) NOT NULL,
lineage_id uniqueidentifier NULL,
lineage_date datetime NOT NULL,
string_value_indexable nvarchar(896) NULL,
binary_value_indexable varbinary(900) NULL,
numeric_value bigint NULL,
string_value_not_indexable nvarchar(max) NULL,
binary_value_not_indexable varbinary(max) NULL,
```

object_id: A GUID uniquely identifying the metaverse object. This value MUST match a metaverse object record in the mms_metaverse table.

attribute_name: The metaverse attribute name

lineage_id: A lineage GUID from the mms_lineage_cross_reference table.

lineage_date: The UTC time that this attribute was last updated.

string_value_indexable: The string attribute value if this is an indexable string. This MUST be NULL if this is not an indexable string.

binary_value_indexable: The binary attribute value if this is an indexable binary value. This MUST be NULL if this is not an indexable binary value.

numeric_value: The numeric attribute value. This MUST be NULL if this is not a numeric attribute.

string_value_not_indexable: The string attribute value if this is a non-indexable string. This MUST be NULL if this is not a non-indexable string.

binary_value_not_indexable: The binary attribute value if this is a non-indexable binary value. This MUST be NULL if this is not a non-indexable binary value.

2.2.5.11 mms_mv_link

The mms_mv_link table contains information about references from one metaverse object to another.

```
object_id uniqueidentifier NOT NULL,
attribute_name nvarchar(256) NOT NULL,
lineage_id uniqueidentifier NOT NULL,
lineage_date datetime NOT NULL,
reference_id uniqueidentifier NOT NULL,
```

object_id: A GUID uniquely identifying the metaverse object.

attribute_name: The attribute name of the reference attribute.

lineage_id: A GUID uniquely identifying the lineage record in the mms_lineage_cross_reference table.

lineage_date: The UTC time that the reference was last updated.

reference_id: A GUID uniquely identifying the referenced metaverse object. This value MUST exist in the object_id column of the mms_metaverse table.

2.2.5.12 mms_partition

The mms_partition table contains the partition definitions for the management agents. Each management agent MUST have at least one partition defined.

```
partition_id uniqueidentifier NOT NULL,
ma_id uniqueidentifier NOT NULL,
version_number int NULL,
creation_date datetime NULL,
modification_date datetime NULL,
partition_name nvarchar(800) NOT NULL,
current_export_batch_number int NULL,
current_export_sequence_number int NULL,
last_successful_export_batch_number int NULL,
allowed_operations_flag int NULL,
is_selected bit NULL,
partition_display_name nvarchar(256) NULL,
filter_xml nvarchar(max) NULL,
filter_hints_xml nvarchar(max) NULL,
ma_custom_data_xml nvarchar(max) NULL,
passwordsync_xml nvarchar(max) NULL,
```

partition_id: A GUID uniquely identifying the partition.

ma_id: A GUID uniquely identifying the management agent associated with this partition.

version_number: A version number for this partition definition. The synchronization engine sets this to 1 for new partitions and increments it every time a change is made to the partition definition.

creation_date: The UTC time that this partition was created.

modification_date: The UTC time that this partition was last updated.

partition_name: The name of this partition.

current_export_batch_number: The current export batch number for this partition.

current_export_sequence_number: The current export sequence number for this partition.

last_successful_export_batch_number: The last successful export batch number for this partition.

allowed_operations_flag: A 32-bit value indicating the run profile operations allowed on a partition. Valid values are specified in section 2.2.2.16.

is_selected: A value indicating whether the partition has been selected for inclusion in the management agent. The value MUST be 1 (selected) or 0 (unselected).

partition_display_name: The user-defined display name for this partition.

filter_xml: A value used to determine which objects to import from a data source. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.31.7.

filter_hints_xml: A value used to provides hints to the management agent for which object types to import from a data source. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.31.12.

ma_custom_data_xml: A value used to specify management agent specific information about the partition. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.2.31.8.

passwordsync_xml: This value contains information specifying the password synchronization settings for a management agent partition. This value MUST be NULL if **ma_type** in the **mms_management_agent** (section 2.2.5.6) for the management agent instance associated with this partition is NOT the following value:

- "AD"

This value MUST conform to the schema defined in section 2.2.6.4.18.1 if **ma_type** in the **mms_management_agent** (section 2.2.5.6) for the management agent instance associated with this partition is the following value:

- "AD"

2.2.5.13 mms_run_history

The mms_run_history table contains information about the overall operations of management agents. Each collection of operations is defined as a run profile, and the results of the run are stored in this table, and in the mms_step_history and mms_step_object_details tables.

```
run_history_id uniqueidentifier NOT NULL,
ma_id uniqueidentifier NOT NULL,
run_profile_id uniqueidentifier NOT NULL,
run_number int NOT NULL,
username nvarchar(512) NOT NULL,
is_run_complete bit NOT NULL,
run_result nvarchar(200) NULL,
current_step_number int NOT NULL,
total_steps int NOT NULL,
start_date datetime NOT NULL,
end_date datetime NULL,
run_profile_name nvarchar(512) NOT NULL,
mms_timestamp bigint NULL,
operation_bitmask bigint NOT NULL,
```

run_history_id: A GUID uniquely identifying this run instance.

ma_id: A GUID uniquely identifying the management agent instance for this run instance. This MUST match a management agent record in the mms_management_agent table at the time the run started.

run_profile_id: A GUID uniquely identifying the run profile. This value MUST match a run profile record in the mms_run_profile table.

run_number: A number uniquely identifying this instance of the run profile execution.

username: The **domain** and user name that triggered the execution of the run profile. This MUST be in the form DOMAIN\UserName.

is_run_complete: A bit where a value of 1 indicates that the run is complete.

run_result: A string indicating the run result. Valid values are specified in section 2.2.1.1.

current_step_number: The current run step that is being executed starting with step 1. When the run completes, this MUST be set to the total step number.

total_steps: The total count of run steps in this run profile.

start_date: The UTC time that this run execution started.

end_date: The UTC time that this run execution completed. This MUST be NULL if the run is still in progress.

run_profile_name: The name of the run profile at the time the run was created. This is used for displaying history even if the run profile is subsequently deleted from the system.

mms_timestamp: A sequential integer identifier derived from the mms_timestamp field in the mms_server_configuration table.

operation_bitmask: Flags that indicate what operation(s) were performed during the run, and what statistics have been collected in the run history. The possible flags are defined in section 2.2.2.13.

2.2.5.14 mms_run_profile

The mms_run_profile table contains the definitions for all management agent run profiles. There is one row for each run profile.

```
run_profile_id uniqueidentifier NOT NULL,
ma_id uniqueidentifier NOT NULL,
version_number int NOT NULL,
creation_date datetime NULL,
modification_date datetime NULL,
run_profile_name nvarchar(256) NOT NULL,
configuration_xml nvarchar(max) NOT NULL,
```

run_profile_id: A GUID uniquely identifying the run profile.

ma_id: A GUID uniquely identifying the management agent associated with this run profile. This value MUST match a management agent record in the mms_management_agent table.

version_number: The version of the last change made to this run profile. This MUST start at 1. The synchronization engine will increment the version, allowing conflict detection for simultaneous edits.

creation_date: The UTC time that this run profile was created.

modification_date: The UTC time that this run profile was last modified.

run_profile_name: The name of this run profile.

configuration_xml: An XML fragment containing the run profile configuration. This MUST be formatted as specified in section 2.2.6.4.2.

2.2.5.15 mms_server_configuration

```
instance_id uniqueidentifier NOT NULL,
fixed_schema_version_number int NULL,
server_configuration_version_number int NULL,
keyset_id int NULL,
mms_timestamp bigint NULL,
operation_bitmask bigint NULL,
administrators_sid varbinary(85) NULL,
operators_sid varbinary(85) NULL,
account_joiners_sid varbinary(85) NULL,
browse_sid varbinary(85) NULL,
passwordset_sid varbinary(85) NULL,
password_change_history_size int NULL,
computer_id nvarchar(max) NULL,
mv_schema_xml nvarchar(max) NULL,
import_attribute_flow_xml nvarchar(max) NULL,
provisioning_configuration_xml nvarchar(max) NULL,
mv_deletion_rule_xml nvarchar(max) NULL,
mv_extension_dll_xml nvarchar(max) NULL,
passwordsync_xml nvarchar(max) NULL,
mms_timestamp_current smallint(8) NULL,
```

instance_id: A GUID uniquely identifying the server configuration instance.

fixed_schema_version_number: A numeric value which MUST be 301.

server_configuration_version_number: The numeric value which represents the version number of the server configuration instance. The synchronization engine sets this to 1 for a new server configuration and increments it every time a change is made to the server configuration definition.

keyset_id: A numeric encryption key ID that identifies the encryption key set used to encrypt data for this server configuration instance.

mms_timestamp: A sequential integer identifier that MUST be incremented for every INSET, UPDATE or DELETE to the mms_run_history table.

operation_bitmask: A numeric value which MUST be 9223372036854743037.

administrators_sid: A binary security identifier (SID) that uniquely identifies the security group with administrator privileges on the synchronization engine. The format for the SID is specified in [MS-DTYP] section 2.4.2.

operators_sid: A binary SID that uniquely identifies the security group with operator privileges on the synchronization engine.

account_joiners_sid: A binary SID that uniquely identifies the security group with account joiner privileges on the synchronization engine.

browse_sid: A binary SID that uniquely identifies the security group with browse privileges on the synchronization engine.

passwordset_sid: A binary SID that uniquely identifies the security group with password set privileges on the synchronization engine.

password_change_history_size: A numeric value specifying the maximum number of log entries to maintain, per connector space object, for password set or change operations performed through the WMI provider. This MUST be 24.

computer_id: The name of the machine on which the synchronization engine is running.

mv_schema_xml: The schema for the data source associated with the management agent instance in DSML format as specified in [DSML2]. The value MUST conform to the schema defined in [MS-UPSCDS] section 2.3.4; however, the root element MUST be with the first child element, **dsml**.

import_attribute_flow_xml: The import attribute flow rules for the server configuration instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.3.5; however, the root element MUST be **import-attribute-flow** instead of **SyncConfig-import-attribute-flow**.

provisioning_configuration_xml: The provisioning rules for the server configuration instance. This value MUST conform to the schema defined in section 2.2.6.4.22.

mv_deletion_rule_xml: The metaverse deletion rule for the server configuration instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.3.6; however, the root element MUST be **mv-deletion** instead of **SyncConfig-mv-deletion**.

mv_extension_dll_xml: The script-based rule extension assembly for the server configuration instance. This value MUST conform to the schema defined in [MS-UPSCDS] section 2.3.3; however, the root element MUST be **extension** instead of **SyncConfig-extension**.

passwordsync_xml: The password synchronization configuration for the server configuration instance. This value MUST conform to the schema defined in section 2.2.6.4.18.2.

mms_timestamp_current: A UTC (Coordinated Universal Time) **SYSTEMTIME** value ([MS-DTYP] section 2.3.11) that the synchronization engine MAY <3> update periodically.

2.2.5.16 mms_step_history

The mms_step_history table contains statistics and run step detail status information. Each collection of operations is defined as a run profile, and the results of the run are stored in this table, and in the mms_run_history and mms_step_object_details tables.

```
step_history_id uniqueidentifier NOT NULL,
run_history_id uniqueidentifier NOT NULL,
step_number int NOT NULL,
step_result nvarchar(200) NOT NULL,
start_date datetime NOT NULL,
end_date datetime NOT NULL,
stage_no_change int NULL,
stage_add int NULL,
stage_update int NULL,
stage_rename int NULL,
stage_delete int NULL,
stage_deleteadd int NULL,
stage_failure int NULL,
disconnector_filtered int NULL,
disconnector_joined_no_flow int NULL,
disconnector_joined_flow int NULL,
disconnector_joined_remove_mv int NULL,
disconnector_projected_no_flow int NULL,
disconnector_projected_flow int NULL,
disconnector_projected_remove_mv int NULL,
disconnector_remains int NULL,
connector_filtered_remove_mv int NULL,
connector_filtered_leave_mv int NULL,
connector_flow int NULL,
connector_flow_remove_mv int NULL,
connector_no_flow int NULL,
connector_delete_remove_mv int NULL,
connector_delete_leave_mv int NULL,
connector_delete_add_processed int NULL,
flow_failure int NULL,
export_add int NULL,
export_update int NULL,
export_rename int NULL,
export_delete int NULL,
export_deleteadd int NULL,
export_failure int NULL,
current_export_batch_number int NULL,
last_successful_export_batch_number int NULL,
step_file_name nvarchar(max) NULL,
ma_connection_information_xml nvarchar(max) NULL,
ma_discovery_errors_xml nvarchar(max) NULL,
ma_counters_xml nvarchar(max) NULL,
sync_errors_xml nvarchar(max) NULL,
step_xml nvarchar(max) NOT NULL,
mv_retry_errors_xml nvarchar(max) NULL,
flow_counters_xml nvarchar(max) NULL,
```

step_history_id: A GUID uniquely identifying this run step history object.

run_history_id: A GUID uniquely identifying the run history object associated with this run step. This value MUST match a run history record in the mms_run_history table.

step_number: An integer identifying what step this was in the overall run profile definition.

step_result: A Unicode string identifying the overall result of the run step. This MUST be a value specified in section 2.2.1.1.

start_date: The UTC time that this run step started.

end_date: The UTC time that this run step stopped.

stage_no_change: A count of the number of **staging objects** processed resulting in no change in the connector space.

stage_add: A count of the number of staging objects processed resulting in the addition of a connector space object.

stage_update: A count of the number of staging objects processed resulting in the update of a connector space object.

stage_rename: A count of the number of staging objects processed resulting in the rename of a connector space object.

stage_delete: A count of the number of staging objects processed resulting in the deletion of a connector space object.

stage_deleteadd: A count of the number of staging objects processed resulting in the delete-add of a connector space object.

stage_failure: A count of the number of staging objects processed resulting in a failure.

disconnector_filtered: A count of the number of connector space objects that were filtered from the synchronization process by a filter rule.

disconnector_joined_no_flow: A count of the number of connector space objects that were joined to an existing metaverse object, but had no attribute flow.

disconnector_joined_flow: A count of the number of connector space objects that were joined to an existing metaverse object and had attribute flow.

disconnector_joined_remove_mv: A count of the number of connector space objects that were joined to a metaverse object, and subsequently resulted in the metaverse object being removed.

disconnector_projected_no_flow: A count of the number of connector space objects that were projected into the metaverse, but had no attribute flow.

disconnector_projected_flow: A count of the number of connector space objects that were projected into the metaverse and had attribute flow.

disconnector_projected_remove_mv: A count of the number of connector space objects that were projected into the metaverse and subsequently resulted in the metaverse object being removed.

disconnector_remains: A count of the number of connector space objects that remained disconnected from the metaverse.

connector_filtered_remove_mv: A count of the number of connector space objects with an existing connection to a metaverse object that were filtered, becoming disconnected from the metaverse, resulting in the removal of the metaverse object.

connector_filtered_leave_mv: A count of the number of connector space objects with an existing connection to a metaverse object that were filtered, becoming disconnected from the metaverse, but leaving the metaverse object in place.

connector_flow: A count of the number of connector space objects with an existing connection to a metaverse object that had attribute flow to the metaverse.

connector_flow_remove_mv: A count of the number of connector space objects with an existing connection to a metaverse object that had attribute flow to the metaverse which resulted in the removal of the metaverse object.

connector_no_flow: A count of the number of connector space objects with an existing connection to a metaverse object that had no attribute flow to the metaverse.

connector_delete_remove_mv: A count of the number of connector space objects with an existing connection to a metaverse object that were deleted, resulting in the removal of the metaverse object.

connector_delete_leave_mv: A count of the number of connector space objects with an existing connection to a metaverse object that were deleted, but left the metaverse object in place.

connector_delete_add_processed: A count of the number of connector space objects with an existing connection to a metaverse object that had a delete-add operation processed.

flow_failure: A count of the number of connector space objects with general flow failure.

export_add: A count of the number of object additions exported to the data source.

export_update: A count of the number of objects updated in the data source.

export_rename: A count of the number of objects renamed in the data source.

export_delete: A count of the number of objects deleted in the data source.

export_deleteadd: A count of the number of objects deleted and replaced by a newly added object in the data source.

export_failure: A count of the number of objects that failed to export successfully to the data source.

current_export_batch_number: The current export batch number at the time this export step began.

last_successful_export_batch_number: The last successful export batch number at the time this export step began.

step_file_name: The file name of the defined drop file for this step.

ma_connection_information_xml: An XML fragment containing the connection result information for this run step. This MUST be formatted as specified in section 2.2.6.4.3.

ma_discovery_errors_xml: An XML fragment containing management agent discovery errors for this run step. This MUST be formatted as specified in section 2.2.6.4.13.

ma_counters_xml: An XML fragment containing management agent counters for this run step. This MUST be formatted as specified in sections 2.2.6.4.8 and 2.2.6.4.9.

sync_errors_xml: An XML fragment containing the synchronization errors for this run step. This MUST be formatted as specified in section 2.2.6.4.23.

step_xml: An XML fragment describing the run step configuration at the time this step was performed. This MUST be formatted as specified in section 2.2.6.4.4.

mv_retry_errors_xml: An XML fragment describing the metaverse retry errors that occurred during synchronization. This MUST be NULL if no errors occurred. This MUST be formatted as specified in section 2.2.6.4.14 if errors occurred.

flow_counters_xml: This contains XML fragments specifying the inbound and outbound flow counters. If there are inbound-flow-counters, they MUST be formatted as specified in section 2.2.6.4.12. If there are outbound-flow-counters, they MUST be formatted as specified in section 2.2.6.4.15.

2.2.5.17 mms_step_object_details

The mms_step_object_details table contains information about the individual connector space objects that were processed as part of the run profile step. There is one row per connector space object.

```
step_object_id uniqueidentifier NOT NULL,
step_history_id uniqueidentifier NOT NULL,
statistics_type int NOT NULL,
ma_statistics_type int NOT NULL,
update_count int NOT NULL,
ma_id uniqueidentifier NULL,
cs_object_id uniqueidentifier NOT NULL,
cs_dn nvarchar(max) NOT NULL,
```

step_object_id: A GUID uniquely identifying this record in the table.

step_history_id: A GUID uniquely identifying the associated run step in the mms_step_history table.

statistics_type: A number indicating which synchronization statistic values incremented while processing this object. Valid values are in section 2.2.2.18.

ma_statistics_type: A number indicating which management agent statistic values were incremented while processing this object. Valid values are in section 2.2.2.12.

update_count: The number of times the statistics were updated after they were initially set during the run.

ma_id: A GUID uniquely identifying the management agent associated with this step object details record. This value MUST match an ma_id value in the mms_management_agent table.

cs_object_id: A GUID uniquely identifying the connector space object associated with this step object details record. This value MUST match an object_id value in the mms_connectorspace table.

cs_dn: The distinguished name of the connector space object at the time of the step object details event.

2.2.6 XML Structures

The following XML structures are defined for use with this protocol. Only the values defined in the following data type definitions SHOULD be used. All other values are reserved for future use and SHOULD NOT be used.

The syntax of the definitions in this section uses XML schema as defined in [XMLSCHEMA1] and [XMLSCHEMA2].

2.2.6.1 Namespaces

This specification defines and references various **XML namespaces** using the mechanisms specified in [XMLNS-2ED]. Although this specification associates a specific XML namespace prefix for each XML namespace that is used, the choice of any particular prefix is implementation-specific and not significant for interoperability.

The following table defines the XML namespace prefix that is used in the element and type specifications in this section.

Prefix	Namespace URI	Reference
xs	http://www.w3.org/2001/XMLSchema	[XMLSCHEMA1] [XMLSCHEMA2]

2.2.6.2 Simple Types

The following table summarizes the set of common XML schema simple type definitions defined by this specification. XML schema simple type definitions that are specific to a particular operation are described with the operation.

Simple type	Description
algorithmStepType	This type enumerates the synchronization engine operations that can be performed.
applyRulesSubtype	This type enumerates SubType values used in a synchronization run step.
changeType	This type enumerates the types of password operations that can be performed.
connectionResult	This type enumerates the possible results of a management agent connection attempt.
DateTimeValue	This type specifies a date and time value in the format yyyy-mm-dd hh:mm:ss.fff.
discoveryErrorType	This type enumerates discovery error types.
dnType	This type specifies the format of distinguished name value.
exportErrorType	This type enumerates export error types.
exportSubType	This type enumerates SubType values used in an export run step.
extensionCallsite	This type enumerates the interface and method that was called by the synchronization engine.
guidType	This type specifies the format of a GUID value.

Simple type	Description
importAndMVRetryErrorType	This type enumerates per-object errors types that occur during import or synchronization of an object.
importSubType	This type enumerates SubType values used in an import run step.
stepType	This type enumerates the possible run step types.
transientType	This type enumerates the type of operation that can result in an object becoming a transient object.

2.2.6.2.1 algorithnmStepType Simple Type

This type enumerates the synchronization engine operations that can be performed.

```
<xs:simpleType name="algorithnmStepType">
  <xs:restriction
    base="xs:string"
  >
    <xs:enumeration
      value="connector-filter"
     />
    <xs:enumeration
      value="deprovisioning"
     />
    <xs:enumeration
      value="export-flow"
     />
    <xs:enumeration
      value="import-flow"
     />
    <xs:enumeration
      value="join"
     />
    <xs:enumeration
      value="mv-deletion"
     />
    <xs:enumeration
      value="mv-object-type-change"
     />
    <xs:enumeration
      value="projection"
     />
    <xs:enumeration
      value="provisioning"
     />
    <xs:enumeration
      value="recall"
     />
    <xs:enumeration
      value="staging"
     />
    <xs:enumeration
      value="validate-connector-filter"
     />
  </xs:restriction>
</xs:simpleType>
```

Enumeration

The following values are defined by the **algorithnmStepType** simple type:

Value	Description
connector-filter	The connector space object was being processed to see if it met the conditions of the connector filter.
deprovisioning	The connector space object was being processed for deletion.
export-flow	The pending exports for the connector space object were being processed.
import-flow	The pending imports for the connector space object were being processed.
join	The connector space object was being processed to see if it met the conditions of the join rule.
mv-deletion	The metaverse object associated with this connector space object was being deleted.
mv-object-type-change	The object type of the metaverse object associated with this connector space object changed.
projection	The connector space object was being processed to see if it met the conditions of the projection rule.
provisioning	A new connector space object was being created from a metaverse object.
recall	An attribute value associated with this connector space object was being removed from the linked metaverse object.
staging	The connector space object was imported into the connector space.
validate-connector-filter	The synchronization engine was validating the connector filter.

2.2.6.2.2 applyRulesSubtype Simple Type

This type enumerates SubType values used in a synchronization run step.

```
<xs:simpleType name="applyRulesSubtype">
  <xs:restriction
    base="xs:string"
  >
    <xs:enumeration
      value="apply-pending"
     />
    <xs:enumeration
      value="reevaluate-flow-connectors"
     />
    <xs:enumeration
      value="reevaluate-join-flow-all"
     />
  </xs:restriction>
```

```
</xs:simpleType>
```

Enumeration

The following values are defined by the **applyRulesSubtype** simple type:

Value	Description
apply-pending	Attempts to synchronize all connectors with staged pending imports and also attempts to join/project (and flow attributes) on all normal disconnectors even if they have failed to join during previous apply-pending runs.
reevaluate-flow-connectors	Reevaluates attribute flow for all connectors in the connector space under this management agent.
reevaluate-join-flow-all	Reevaluates join and attribute flow for all entries in the connector space (connectors and disconnectors). Explicit connectors/disconnectors will not be re-evaluated.

2.2.6.2.3 changeType Simple Type

This type enumerates the types of password operations that can be performed.

```
<xs:simpleType name="changeType">
  <xs:restriction
    base="xs:string"
  >
    <xs:enumeration
      value="SET"
     />
    <xs:enumeration
      value="CHANGE"
     />
  </xs:restriction>
</xs:simpleType>
```

Enumeration

The following values are defined by the **changeType** simple type:

Value	Description
SET	The password operation performed was an administrative password set.
CHANGE	The password operation performed was a password change.

2.2.6.2.4 connectionResult Simple Type

This type enumerates the strings used to indicate the results of connection attempts between a management agent and a data source.

```
<xs:simpleType name="connectionResult">
  <xs:restriction
```

```
    base="xs:string"
  >
    <xs:enumeration
      value="success"
     />
    <xs:enumeration
      value="warning-no-watermark"
     />
    <xs:enumeration
      value="failed-connection"
     />
    <xs:enumeration
      value="failed-authentication"
     />
    <xs:enumeration
      value="failed-search"
     />
    <xs:enumeration
      value="dropped-connection"
     />
  </xs:restriction>
</xs:simpleType>
```

Enumeration

The following values are defined by the **connectionResult** simple type:

Value	Description
success	Successful connection to the data source.
warning-no-watermark	The management agent cannot read the watermark when doing a full import for a data source.
failed-connection	The management agent failed to connect to the specified data source.
failed-authentication	The management agent connected to the specified data source but failed to authenticate.
failed-search	A search request failed in the data source.
dropped-connection	The data source was unexpectedly disconnected.

2.2.6.2.5 DateTimeValue Simple Type

This type specifies a date and time value in the format yyyy-mm-dd hh:mm:ss.fff.

```
<xs:simpleType name="DateTimeValue">
  <xs:restriction
    base="xs:string"
  >
    <xs:pattern
      value="([0-9]){4}-([0-9]){2}-([0-9]){2} ([0-9]){2}:([0-9]){2}:([0-9]){2}.([0-9]){3}"
     />
  </xs:restriction>
```

```
</xs:simpleType>
```

Patterns

The following pattern is defined by the **DateTimeValue** simple type:

```
([0-9]){4}-([0-9]){2}-([0-9]){2} ([0-9]){2}:([0-9]){2}:([0-9]){2}.([0-9]){3}
```

2.2.6.2.6 discoveryErrorType Simple Type

This type enumerates discovery error types.

```
<xs:simpleType name="discoveryErrorType">
  <xs:restriction
    base="xs:string"
  >
    <xs:enumeration
      value="missing-change-type"
     />
    <xs:enumeration
      value="invalid-change-type"
     />
    <xs:enumeration
      value="multi-valued-change-type"
     />
    <xs:enumeration
      value="need-full-object"
     />
    <xs:enumeration
      value="missing-dn"
     />
    <xs:enumeration
      value="dn-not-ldap-conformant"
     />
    <xs:enumeration
      value="invalid-dn"
     />
    <xs:enumeration
      value="missing-anchor-component"
     />
    <xs:enumeration
      value="multi-valued-anchor-component"
     />
    <xs:enumeration
      value="anchor-too-long"
     />
    <xs:enumeration
      value="duplicate-object"
     />
    <xs:enumeration
      value="missing-object-class"
     />
    <xs:enumeration
      value="missing-object-type"
     />
```

```
      <xs:enumeration
        value="unmappable-object-type"
       />
      <xs:enumeration
        value="parse-error"
       />
      <xs:enumeration
        value="read-error"
       />
      <xs:enumeration
        value="staging-error"
       />
      <xs:enumeration
        value="invalid-modification-type"
       />
      <xs:enumeration
        value="conflicting-modification-types"
       />
      <xs:enumeration
        value="multi-single-mismatch"
       />
      <xs:enumeration
        value="invalid-attribute-value"
       />
      <xs:enumeration
        value="invalid-base64-value"
       />
      <xs:enumeration
        value="invalid-numeric-value"
       />
      <xs:enumeration
        value="invalid-boolean-value"
       />
      <xs:enumeration
        value="reference-value-not-ldap-conformant"
       />
      <xs:enumeration
        value="invalid-reference-value"
       />
      <xs:enumeration
        value="unsupported-value-type"
       />
    </xs:restriction>
  </xs:simpleType>
```

Enumeration

The following values are defined by the **discoveryErrorType** simple type:

Value	Description
missing-change-type	Returned during a delta import run when the change type value is not present.
invalid-change-type	Returned during an import when the change type column value does not match the list of valid changes types.

Value	Description
multi-valued-change-type	Returned during a delta import run when more than one value for the change type is present.
need-full-object	Returned during a delta import run when management agent has submitted a modification on an object which cannot be located in the connector space.
missing-dn	Returned during import when there is no distinguished name (DN) value.
dn-not-ldap-conformant	Returned when a management agent reports a distinguished name (DN) value that does not conform to the LDAP specification.
invalid-dn	Returned when a management agent reports that a DN does not meet the minimum requirements for a DN.
missing-anchor-component	Returned by a management agent when the anchor could not be constructed because one or more anchor construction rule attributes did not have values.
multi-valued-anchor-component	Returned by the management agent for Sun ONE Directory Server indicating the management agent could not construct the anchor because an anchor construction rule attribute had more than one value.
anchor-too-long	Returned by a management agent indicating the management agent anchor construction produced an anchor which exceeded the maximum size limit.
duplicate-object	Returned during an import when an object with the same anchor has already been reported to the synchronization engine during this execution of a run profile.
missing-object-class	Returned during an import when the management agent could not read a value for the object class attribute.
missing-object-type	Returned during an import when the management agent could not read a value for the object type attribute.
unmappable-object-type	Returned by a file management agent when it reads an object which has a set of object class values that cannot be matched to any of the prefix mappings.
parse-error	Returned by the management agent when it cannot parse an object entry.
read-error	Returned by a management agent when there is a generic error reading a particular object.
staging-error	Returned by a management agent indicating the synchronization engine could not stage the delta in the connector space.
invalid-modification-type	Returned during a delta import of management agent when either: ▪ value modification type is not one of the standard **LDIF** modification types; ▪ a non-replace LDIF delta on **objectclass**, such as **add: objectclass** or **delete: objectclass**.
conflicting-modification-types	Returned during a delta import of an management agent when reading an LDIF file when either: ▪ there are different attribute level modification types in the same record

Value	Description
	▪ multiple replace LDIF objectclass deltas are seen in the same file, such as: ▪ replace: objectclass ▪ objectclass: group.- replace: objectclassobjectclass: user
multi-single-mismatch	Returned by a management agent when more than one value add or more than one value delete for an attribute that is defined in the management agent properties as a single-valued attribute.
invalid-attribute-value	Returned by a management agent when an attribute value is read that does not conform to the attribute type declared in schema.
invalid-base64-value	Returned by the management agent when a failure to parse a value encoded using **base64** encoding occurs.
invalid-numeric-value	Returned by a management agent when a failure to parse a numeric value occurs.
invalid-boolean-value	Returned by a management agent when a failure to parse a Boolean value occurs.
reference-value-not-ldap-conformant	Returned by a management agent indicating a DN value does not conform to the LDAP specification.
invalid-reference-value	Returned by a management agent when a reference value is not in a valid format.
unsupported-value-type	Returned by a management agent when a file reference is specified for an attribute which is not of the string attribute type or when a URI reference is specified for an attribute which is not of the string attribute type.

2.2.6.2.7 dnType Simple Type

This type specifies the format of the distinguished name (DN) value.

```
<xs:simpleType name="dnType">
  <xs:restriction
    base="xs:string"
  >
    <xs:pattern
      value="(.*=.*,){0,}.*=.*"
     />
  </xs:restriction>
</xs:simpleType>
```

Patterns

The following pattern is defined by the **dnType** simple type:

```
(.*=.*,){0,}.*=.*
```

2.2.6.2.8 exportErrorType Simple Type

This type enumerates export error types.

```
<xs:simpleType name="exportErrorType">
  <xs:restriction
    base="xs:string"
  >
    <xs:enumeration
      value="ambiguous-update"
     />
    <xs:enumeration
      value="anchor-too-long"
     />
    <xs:enumeration
      value="cd-connectivity-error"
     />
    <xs:enumeration
      value="cd-error"
     />
    <xs:enumeration
      value="cd-existing-attribute-or-value"
     />
    <xs:enumeration
      value="cd-existing-object"
     />
    <xs:enumeration
      value="cd-missing-object"
     />
    <xs:enumeration
      value="certifier-ou-not-configured"
     />
    <xs:enumeration
      value="code-page-conversion"
     />
    <xs:enumeration
      value="constraint-violation"
     />
    <xs:enumeration
      value="dn-attributes-failure"
     />
    <xs:enumeration
      value="duplicate-anchor"
     />
    <xs:enumeration
      value="encrypted-attributes"
     />
    <xs:enumeration
      value="error-code"
     />
    <xs:enumeration
      value="error-literal"
     />
    <xs:enumeration
      value="insufficient-columns"
     />
    <xs:enumeration
      value="insufficient-field-width"
     />
```

```
<xs:enumeration
  value="invalid-attribute-value"
 />
<xs:enumeration
  value="invalid-dn"
 />
<xs:enumeration
  value="invalid-provisioning-attribute-value"
 />
<xs:enumeration
  value="kerberos-no-logon-server"
 />
<xs:enumeration
  value="kerberos-time-skew"
 />
<xs:enumeration
  value="locking-error-needs-retry"
 />
<xs:enumeration
  value="missing-anchor-component"
 />
<xs:enumeration
  value="missing-provisioning-attribute"
 />
<xs:enumeration
  value="modify-naming-attribute"
 />
<xs:enumeration
  value="no-export-to-this-object-type"
 />
<xs:enumeration
  value="non-existent-parent"
 />
<xs:enumeration
  value="partial-success"
 />
<xs:enumeration
  value="password-policy-violation"
 />
<xs:enumeration
  value="password-set-disallowed"
 />
<xs:enumeration
  value="permission-issue"
 />
<xs:enumeration
  value="provision-to-secondary-nab"
 />
<xs:enumeration
  value="readonly-attribute"
 />
<xs:enumeration
  value="rename-to-existing-dn"
 />
<xs:enumeration
  value="syntax-violation"
 />
<xs:enumeration
  value="temporary-certifier-file-creation-failure"
```

```
      />
     <xs:enumeration
       value="type-mismatch"
      />
     <xs:enumeration
       value="unexpected-error"
      />
     <xs:enumeration
       value="unexpected-provisioning-attribute"
      />
   </xs:restriction>
 </xs:simpleType>
```

Enumeration

The following values are defined by the **exportErrorType** simple type:

Value	Description
ambiguous-update	The management agent cannot fulfill an update or delete request because the anchor is not unique.
anchor-too-long	An attempt is made to construct an anchor that exceeded the maximum size limit.
cd-connectivity-error	An error is encountered while attempting to connect with a data source, but there is no specialized error type for this error.
cd-error	An error is encountered while attempting to communicate with a data source, but there is no specialized error type for this error.
cd-existing-attribute-or-value	A request to add an attribute or value is exported to the data source, but the attribute or value is already present in the data source.
cd-existing-object	A request to add an object is exported to the data source, but the object is already present in the data source.
cd-missing-object	A request to modify an object is exported to the data source, but the object cannot be found in the data source.
certifier-ou-not-configured	A certifier organizational unit could not be located in the data source.
code-page-conversion	An attempt is made to export an attribute value, which is stored in Unicode to the code page of the export file, but fails because of conversion errors.
constraint-violation	An attempt is made to export an add, modify, or delete request that violates the constraints of a data source.
dn-attributes-failure	An attempt is made to export an add or modify request that sets a reference value for which there is no corresponding data source object.
duplicate-anchor	The anchor on a newly provisioned object is not unique.
encrypted-attributes	One or more attributes in the data source are encrypted and cannot be written as clear text.

Value	Description
error-code	The data source returned an error that could not be translated into a specific error.
error-literal	The data source returned a literal error string.
insufficient-columns	The number of columns in the data source schema did not match the management agent schema.
insufficient-field-width	The width of a field in the data source was not sufficient to accept the data from the management agent.
invalid-attribute-value	An attempt is made to flow out an attribute value that contains characters which are not valid for the data source.
invalid-dn	An attempt is made to export a newly provisioned object or rename an existing object, and the distinguished name is incompatible with the data source naming requirements.
invalid-provisioning-attribute-value	An attempt is made to export a newly provisioned object, but certain attributes for provisioning set by the script-based synchronization rules are not valid.
kerberos-no-logon-server	An attempt is made to set or change a password attribute, and the management agent cannot resolve a server for the domain part of the logon credentials.
kerberos-time-skew	The password attribute is being set or changed, and the time on the synchronization engine server differs from the time on the domain controller by more than the amount defined in the Kerberos policy.
locking-error-needs-retry	Returned by a management agent when another management agent is trying to synchronize the same connector space object.
missing-anchor-component	An attempt is made to export a newly provisioned object, but an anchor cannot be generated because a value required for constructing the anchor is not available.
missing-provisioning-attribute	An attempt is made to export a newly provisioned object, but a required attribute is missing.
modify-naming-attribute	An attempt is made to export a request where a naming attribute.
no-export-to-this-object-type	An attempt is made to create or modify an object in a data source but the data source does not permit additions or modifications to objects of that type.
non-existent-parent	An attempt is made to export an add or a rename request but the parent object does not exist in the data source.
partial-success	The export operations succeeded but some reference attributes will be required to be retried later after the referenced objects are exported to the data source.
password-policy-violation	The password attribute is set or changed to a value which does not meet the administrator defined password policy of the data source.
password-set-disallowed	The management agent connection security is not configured in a secure mode to allow password operations.
permission-issue	An attempt is made to export an add, modify, or delete request and the management

Value	Description
	agent has insufficient permissions to perform the operation against the data source.
provision-to-secondary-nab	An attempt is made to export a new object to a secondary address book in a data source that requires additions to be made in the primary address book.
readonly-attribute	An attempt is made to modify an attribute that is read-only in the data source.
rename-to-existing-dn	An attempt is made to change the distinguished name of the object at the time of export but there is already an object in the data source with the new distinguished name. The distinguished name of an object can be changed on export when the data source applies certain normalization rules that cause the distinguished name to change.
syntax-violation	An attempt is made to export a request where the value for an attribute violates certain value constraints.
temporary-certifier-file-creation-failure	A management agent was unable to write the certifier information to a temporary file. This step is required before the certifier can be sent to the data source.
type-mismatch	An attempt is made to export an attribute to a data source where the attribute type in the connector space does not match the attribute type in the data source.
unexpected-error	An attempt is made to export a change and an unexpected error is encountered.
unexpected-provisioning-attribute	An attempt is made to export a new object to a data source and the object contains an attribute that is unexpected at the time object creation.

2.2.6.2.9 exportSubType Simple Type

This type enumerates SubType values used in an export run step.

```
<xs:simpleType name="exportSubType">
  <xs:restriction
    base="xs:string"
  >
    <xs:enumeration
      value="resume-from-file"
     />
    <xs:enumeration
      value="to-file"
     />
    <xs:enumeration
      value="to-file, resume-from-file"
     />
  </xs:restriction>
</xs:simpleType>
```

Enumeration

The following values are defined by the **exportSubType** simple type:

Value	Description
resume-from-file	This will resume an export run from a drop file. With this subtype, export batch number will not be updated.
to-file	This will drop a file during export and stop. With this subtype, export batch number will not be updated.
to-file, resume-from-file	This will export to a drop file and then continue to export to the data source.

2.2.6.2.10 extensionCallsite Simple Type

This type enumerates the interface and method that was called by the synchronization engine.

```
<xs:simpleType name="extensionCallsite">
  <xs:restriction
    base="xs:string"
  >
    <xs:enumeration
      value="initialize"
     />
    <xs:enumeration
      value="provisioning"
     />
    <xs:enumeration
      value="mv-deletion"
     />
    <xs:enumeration
      value="projection"
     />
    <xs:enumeration
      value="import-flow"
     />
    <xs:enumeration
      value="export-flow"
     />
    <xs:enumeration
      value="cs-deprovisioning"
     />
    <xs:enumeration
      value="join-mapping"
     />
    <xs:enumeration
      value="join-resolution"
     />
    <xs:enumeration
      value="disconnector-filter"
     />
  </xs:restriction>
</xs:simpleType>
```

Enumeration

The following values are defined by the **extensionCallsite** simple type:

Value	Description
initialize	The initialize method of the script-based synchronization rule interface is being called.
provisioning	The connector space object creation method of the script-based synchronization rule is being called.
mv-deletion	The metaverse object deletion method of the script-based synchronization rule is being called.
projection	The projection method of the script-based synchronization rule is being called.
import-flow	The import flow method of the script-based synchronization rule is being called.
export-flow	The export flow method of the script-based synchronization rule is being called.
cs-deprovisioning	The connector space object deletion method of the script-based synchronization rule is being called.
join-mapping	The join method of the script-based synchronization rule is being called.
join-resolution	The join resolution method of the script-based synchronization rule is being called.
disconnector-filter	The connector filter method of the script-based synchronization rule is being called.

2.2.6.2.11 guidType Simple Type

This specifies the format of a globally unique identifier (GUID) string.

```
<xs:simpleType name="guidType">
  <xs:restriction
    base="xs:string"
  >
    <xs:pattern
      value="(\{([0-9a-fA-F]){8}-([0-9a-fA-F]){4}-([0-9a-fA-F]){4}-([0-9a-fA-F]){4}-([0-9a-
fA-F]){12}\})"
     />
  </xs:restriction>
</xs:simpleType>
```

Patterns

The following pattern is defined by the **guidType** simple type:

```
(\{([0-9a-fA-F]){8}-([0-9a-fA-F]){4}-([0-9a-fA-F]){4}-([0-9a-fA-F]){4}-([0-9a-fA-F]){12}\})
```

2.2.6.2.12 importAndMVRetryErrorType Simple Type

This type enumerates per-object error types that occur during import or synchronization of an object.

```
<xs:simpleType name="importAndMVRetryErrorType">
  <xs:restriction
```

```
      base="xs:string"
    >
      <xs:enumeration
        value="ambiguous-export-flow-to-single-valued-attribute"
       />
      <xs:enumeration
        value="ambiguous-import-flow-from-multiple-connectors"
       />
      <xs:enumeration
        value="ambigous-reference-value-for-export-flow"
       />
      <xs:enumeration
        value="app-store-import-exception"
       />
      <xs:enumeration
        value="cannot-parse-dn-component"
       />
      <xs:enumeration
        value="cannot-parse-object-id"
       />
      <xs:enumeration
        value="connector-filter-rule-violation"
       />
      <xs:enumeration
        value="cs-attribute-type-mismatch"
       />
      <xs:enumeration
        value="datetime-string-format-incorrect"
       />
      <xs:enumeration
        value="dn-index-out-of-bounds"
       />
      <xs:enumeration
        value="dre-missing-required-attribute"
       />
      <xs:enumeration
        value="encryption-key-lost"
       />
      <xs:enumeration
        value="exported-change-not-reimported"
       />
      <xs:enumeration
        value="extension-deprovisioning-invalid-result"
       />
      <xs:enumeration
        value="extension-dll-crash"
       />
      <xs:enumeration
        value="extension-dll-exception"
       />
      <xs:enumeration
        value="extension-dll-timeout"
       />
      <xs:enumeration
        value="extension-entry-point-not-implemented"
       />
      <xs:enumeration
        value="extension-join-resolution-invalid-object-type"
       />
```

```
<xs:enumeration
  value="extension-join-resolution-index-out-of-bounds"
 />
<xs:enumeration
  value="extension-projection-invalid-object-type"
 />
<xs:enumeration
  value="extension-projection-object-type-not-set"
 />
<xs:enumeration
  value="extension-provisioning-call-limit-reached"
 />
<xs:enumeration
  value="extension-unexpected-attribute-value"
 />
<xs:enumeration
  value="failed-app-store-access"
 />
<xs:enumeration
  value="failed-creation-via-web-services"
 />
<xs:enumeration
  value="failed-deletion-via-web-services"
 />
<xs:enumeration
  value="failed-impersonation"
 />
<xs:enumeration
  value="failed-modification-via-web-services"
 />
<xs:enumeration
  value="failed-schema-access"
 />
<xs:enumeration
  value="flow-multi-values-to-single-value"
 />
<xs:enumeration
  value="invalid-boolean-constant-flow"
 />
<xs:enumeration
  value="invalid-reference-constant-flow"
 />
<xs:enumeration
  value="join-object-id-must-be-single-valued"
 />
<xs:enumeration
  value="locking-error-needs-retry"
 />
<xs:enumeration
  value="mv-constraint-violation"
 />
<xs:enumeration
  value="sync-config-operation-not-supported"
 />
<xs:enumeration
  value="sync-rule-flow-attribute-not-found"
 />
<xs:enumeration
  value="sync-rule-flow-provisioning-failed"
```

```
      />
      <xs:enumeration
        value="sync-rule-inbound-flow-rules-invalid"
      />
      <xs:enumeration
        value="sync-rule-invalid-export-scoping-xml"
      />
      <xs:enumeration
        value="sync-rule-invalid-expression"
      />
      <xs:enumeration
        value="sync-rule-invalid-function-xml"
      />
      <xs:enumeration
        value="sync-rule-invalid-relationship-criteria-xml"
      />
      <xs:enumeration
        value="sync-rule-invalid-xml-attribute-flow"
      />
      <xs:enumeration
        value="sync-rule-outbound-flow-rules-invalid"
      />
      <xs:enumeration
        value="sync-rule-relationship-criteria-attribute-not-found"
      />
      <xs:enumeration
        value="sync-rule-required-attr-not-found"
      />
      <xs:enumeration
        value="sync-rule-scoping-filter-invalid-operator"
      />
      <xs:enumeration
        value="sync-rule-scoping-filter-invalid-xml"
      />
      <xs:enumeration
        value="sync-rule-validation-parsing-error"
      />
      <xs:enumeration
        value="unexpected-error"
      />
      <xs:enumeration
        value="unexported-container-rename"
      />
      <xs:enumeration
        value="unique-index-violation"
      />
      <xs:enumeration
        value="unsupported-attribute-type"
      />
      <xs:enumeration
        value="unsupported-container-delete"
      />
      <xs:enumeration
        value="unsupported-container-rename"
      />
      <xs:enumeration
        value="write-locking-error-needs-retry"
      />
    </xs:restriction>
```

```
</xs:simpleType>
```

Enumeration

The following values are defined by the **importAndMVRetryErrorType** simple type:

Value	Description
ambiguous-export-flow-to-single-valued-attribute	The export flow rule for a management agent attempted to flow values from a multi-valued attribute of a metaverse object to a single-valued attribute in the connector space.
ambiguous-import-flow-from-multiple-connectors	An import attribute flow rule for a management agent with multiple **connector objects** joined to a metaverse object.
ambigous-reference-value-for-export-flow	An export attribute flow rule for a management agent attempted to flow reference values from a multi-valued attribute of a metaverse object to a single-valued attribute in the connector space.
app-store-import-exception	An exception occurred while performing an import staging operation from the application store.
cannot-parse-dn-component	The dn-part mapping rule cannot flow an improperly formatted distinguished name component to the metaverse object.
cannot-parse-object-id	The string value used to search for a metaverse object in a join rule is not in the correct globally unique identifier (GUID) format.
connector-filter-rule-violation	A connector object became a filtered **disconnector object** as a result of a connector-filter configuration during provisioning or export attribute flow.
cs-attribute-type-mismatch	The type of the imported attribute does not match the attribute type specified in the management agent schema.
datetime-string-format-incorrect	The format of a datetime value received during inbound staging from the application store is incorrect.
dn-index-out-of-bounds	The distinguished name component index value used in an import attribute flow is larger than the number of components in the distinguished name (DN) of the source object.
dre-missing-required-attribute	The DetectedRuleEntry object does not have all of the required attributes.
encryption-key-lost	The synchronization server encountered encrypted for which it no longer has access to the encryption keys.
exported-change-not-reimported	Changes exported to a management agent were not reconfirmed during this import management agent run.
extension-deprovisioning-invalid-result	The implementation of the script-based synchronization deprovision rule returns an invalid result.
extension-dll-crash	The process executing the script-based synchronization rule unexpectedly terminated.
extension-dll-exception	The script-based synchronization rule caused an exception.

Value	Description
extension-dll-timeout	The script-based synchronization rule contains an extension timeout value and the call to the extension exceeds this timeout value.
extension-entry-point-not-implemented	The script-based rules extension did not implement a required interface and method.
extension-join-resolution-invalid-object-type	The implementation of the script-based synchronization join rule in the rules extension sets the value of the outbound metaverse object type to a value that is not listed in the metaverse schema.
extension-join-resolution-index-out-of-bounds	The implementation of the script-based synchronization join rule in the rules extension set an index value that is less than zero or greater than the number of metaverse entry objects.
extension-projection-invalid-object-type	The implementation of the script-based synchronization projection rule in the rules extension sets the value of the outbound metaverse object type to a value that is not listed in the metaverse schema.
extension-projection-object-type-not-set	The implementation of the script-based synchronization projection rule in the rules extension does not specify the metaverse object type.
extension-provisioning-call-limit-reached	The script-based synchronization provision method is called more than 10 times during the synchronization of a single object.
extension-unexpected-attribute-value	The script-based synchronization rule rules extension specifies that is encountered an unexpected attribute value.
failed-app-store-access	The synchronization engine had a failure while trying to access the application store.
failed-creation-via-web-services	The synchronization engine failed to create an object using the web service interface to the application store.
failed-deletion-via-web-services	The synchronization engine failed to delete an object using the web service interface to the application store.
failed-impersonation	The synchronization engine failed to impersonate using the specified account of a management agent.
failed-modification-via-web-services	The synchronization engine failed to modify an object using the web service interface to the application store.
failed-schema-access	The synchronization engine had a failure while trying to access the schema in the application store.
flow-multi-values-to-single-value	The synchronization engine attempted to import or export an attribute a multi-valued attribute to single-valued attribute.
invalid-boolean-constant-flow	A synchronization rule for a Boolean attribute contains an invalid constant value.
invalid-reference-constant-flow	A synchronization rule for a reference attribute contains an invalid constant value.
join-object-id-must-be-single-valued	The data source attribute value used to join a metaverse object through a join rule contains more than one value. The data source attribute value used in the join rule can only contain a single-value.

Value	Description
locking-error-needs-retry	Returned by a management agent when another management agent is trying to synchronize the same connector space object resulting in a SQL deadlock.
mv-constraint-violation	The attribute value from the connector space exceeds the length restrictions of the metaverse attribute.
sync-config-operation-not-supported	The requested synchronization configuration operation is not supported.
sync-rule-flow-attribute-not-found	An attribute specified in the synchronization rule flow definition was not found in the schema, or is not a member of the object class or any of its auxiliary classes.
sync-rule-flow-provisioning-failed	An exception is returned while a synchronization rule is provisioning and performing initial attribute flow to a new connector space object.
sync-rule-inbound-flow-rules-invalid	The inbound flow rules of a synchronization rule definition are invalid.
sync-rule-invalid-export-scoping-xml	The synchronization rule's flow defines an export scoping element that does not adhere to the standard format for <scoping>.
sync-rule-invalid-expression	The synchronization rule defines an invalid or incomplete expression.
sync-rule-invalid-function-xml	The synchronization rule's flow defines a function call that does not adhere to the standard format for <fn>.
sync-rule-invalid-relationship-criteria-xml	The synchronization rule's relationship criteria does not adhere to the standard format for <conditions>.
sync-rule-invalid-xml-attribute-flow	The synchronization rule defines an invalid or incomplete attribute flow.
sync-rule-outbound-flow-rules-invalid	The synchronization rule's outbound flow rule is invalid.
sync-rule-relationship-criteria-attribute-not-found	The synchronization rule's relationship criteria references an attribute that is not defined within the schema.
sync-rule-required-attr-not-found	The synchronization rule requires an attribute that was not found.
sync-rule-scoping-filter-invalid-operator	The synchronization rule specified a scope operator cannot be applied.
sync-rule-scoping-filter-invalid-xml	The synchronization rule specified invalid XML format for the scoping rule.
sync-rule-validation-parsing-error	An error was encountered while parsing or validating a synchronization rule.
unexpected-error	An unexpected error occurred.
unexported-container-rename	The implementation of the script-based synchronization provisioning or deprovisioning rule attempted to rename a container object with one or more

Value	Description
	unexported child objects.
unique-index-violation	The synchronization engine detected an invalid index for an attribute in the metaverse.
unsupported-attribute-type	An unsupported attribute type was found while importing objects from the application store.
unsupported-container-delete	The management agent is attempting to delete a container object during deprovisioning.
unsupported-container-rename	The management agent is attempting to rename a container object during deprovisioning.
write-locking-error-needs-retry	Returned by a management agent when another management agent is trying to synchronize the same connector space object.

2.2.6.2.13 importSubType Simple Type

This type enumerates SubType values used in an import run step.

```
<xs:simpleType name="importSubType">
  <xs:restriction
    base="xs:string"
  >
    <xs:enumeration
      value="resume-from-file"
     />
    <xs:enumeration
      value="resume-from-file, to-cs"
     />
    <xs:enumeration
      value="to-cs"
     />
    <xs:enumeration
      value="to-file"
     />
    <xs:enumeration
      value="to-file, resume-from-file"
     />
    <xs:enumeration
      value="to-file, resume-from-file, to-cs"
     />
  </xs:restriction>
</xs:simpleType>
```

Enumeration

The following values are defined by the **importSubType** simple type:

Value	Description
resume-from-file	This subtype resumes an import run from a drop file. With this subtype, the

Value	Description
	watermark will not be updated for delta import.
resume-from-file, to-cs	This subtype resumes an import run from a drop file, stages the import data in the connector space and stops the import run. With this subtype, the watermark will not be updated for delta import.
to-cs	This subtype stages the import data in the connector space and stops the import run.
to-file	This subtype creates a drop file during import and stops without staging the import data in the connector space. With this subtype, the watermark will not be updated for a delta import.
to-file, resume-from-file	This subtype creates a drop file, continues the import run, and synchronizes the imported changes to the metaverse without stopping.
to-file, resume-from-file, to-cs	This creates a drop file during import, stages import data in the connector space, and stops the import run.

2.2.6.2.14 stepType Simple Type

This type enumerates the possible run step types.

```
<xs:simpleType name="stepType">
  <xs:restriction
    base="xs:string"
  >
    <xs:enumeration
      value="apply-rules"
     />
    <xs:enumeration
      value="delta-import"
     />
    <xs:enumeration
      value="export"
     />
    <xs:enumeration
      value="full-import"
     />
    <xs:enumeration
      value="full-import-reevaluate-rules"
     />
  </xs:restriction>
</xs:simpleType>
```

Enumeration

The following values are defined by the **stepType** simple type:

Value	Description
apply-rules	Specifies a synchronization operation. The **applyRulesSubtype** determines the scope of the operation.

Value	Description
delta-import	Specifies a delta import operation. The **importSubType** determines the scope of the operation.
export	Specifies an export operation. The **exportSubType** determines the scope of the operation.
full-import	Specifies a full import operation. The **importSubType** determines the scope of the operation.
full-import-reevaluate-rules	Specifies a full import of all data from the data source and a full synchronization of all objects in the connector space.

2.2.6.2.15 transientType Simple Type

This type enumerates the type of operations that can result in an object becoming a transient object.

```
<xs:simpleType name="transientType">
  <xs:restriction
    base="xs:string"
  >
    <xs:enumeration
      value="add"
     />
    <xs:enumeration
      value="add-parent"
     />
    <xs:enumeration
      value="move"
     />
    <xs:enumeration
      value="move-parent"
     />
    <xs:enumeration
      value="link"
     />
  </xs:restriction>
</xs:simpleType>
```

Enumeration

The following values are defined by the **transientType** simple type:

Value	Description
add	The transient was created because a different object with the same distinguished name is being added.
add-parent	The transient was created because a parent object with the same distinguished name is being added.
move	The transient was created because a different object is being moved and the move will result in it having the same distinguished name.

Value	Description
move-parent	The transient was created because a parent object is being moved and the move will result in it having the same distinguished name.
link	The transient object was created to resolve a conflicting reference link.

2.2.6.3 Complex Types

The following table lists the common complex types defined by the **XML schema** for this protocol. Complex types that are specific to a particular operation are defined with that operation.

Complex Type	Description
attributeDeltaType (section 2.2.6.3.1)	Defines the format of a delta attribute.
attributeType (section 2.2.6.3.2)	Defines the format of an attribute.
binaryAnchorType (section 2.2.6.3.3)	Defines the format and encoding of a binary anchor value.
constantMappingType (section 2.2.6.3.4)	Defines the constant value in a constant mapping.
counterDetailFalseType (section 2.2.6.3.5)	Defines support for an attribute value of "false".
counterDetailTrueType (section 2.2.6.3.6)	Defines support for an attribute value of "true".
directMappingType (section 2.2.6.3.7)	Defines the source attribute in a direct mapping.
dn-valueDeltaType (section 2.2.6.3.8)	Defines the type for a distinguished name (DN) delta value and the operation being performed.
dn-valueType (section 2.2.6.3.9)	Defines the type for a DN and the associated anchor value.
dnAttributeDeltaType (section 2.2.6.3.10)	Defines the type for a named DN attribute delta value and the operation being performed.
dnAttributeType (section 2.2.6.3.11)	Defines the type for a named DN attribute and whether it supports multiple values.
dnPartMappingType (section 2.2.6.3.12)	Defines a DN part mapping.
extensionErrorInfoType (section 2.2.6.3.13)	Defines the error information returned from a call to a rules extension.
rulesErrorInfoType (section 2.2.6.3.14)	Defines the error information that identifies the rule that caused an error.
scriptedMappingType (section 2.2.6.3.15)	Defines one or more source attributes in a scripted mapping, as well as the script context.
step-dataType (section	Defines a template for management agent specific data for the run

Complex Type	Description
2.2.6.3.16)	profile step in the <custom-data> element (section 2.2.6.4.4).
valueDeltaType (section 2.2.6.3.17)	Defines the type for a delta value.
valueType (section 2.2.6.3.18)	Defines the type for a value.

2.2.6.3.1 attributeDeltaType Complex Type

The **attributeDeltaType** complex type defines the format of a delta attribute.

```
<xs:complexType name="attributeDeltaType">
  <xs:sequence>
    <xs:element name="value"
      type="valueDeltaType"
      minOccurs="1"
      maxOccurs="unbounded"
     />
  </xs:sequence>
  <xs:attribute name="name"
    type="xs:string"
    use="required"
   />
  <xs:attribute name="type"
    use="required"
  >
    <xs:simpleType>
      <xs:restriction
        base="xs:string"
      >
        <xs:enumeration
          value="binary"
         />
        <xs:enumeration
          value="string"
         />
        <xs:enumeration
          value="integer"
         />
        <xs:enumeration
          value="boolean"
         />
      </xs:restriction>
    </xs:simpleType>
  </xs:attribute>
  <xs:attribute name="multivalued"
    type="xs:boolean"
    use="required"
   />
  <xs:attribute name="operation"
    use="required"
  >
    <xs:simpleType>
      <xs:restriction
        base="xs:string"
      >
```

```
          <xs:enumeration
            value="add"
           />
          <xs:enumeration
            value="replace"
           />
          <xs:enumeration
            value="update"
           />
          <xs:enumeration
            value="delete"
           />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:complexType>
```

Child Elements

Element	Type	Description
value	**valueDeltaType**	The value for this delta operation. There MUST be at least one <value> element. There can be more than one <value> element if the **multivalued** attribute is "true".

Attributes

Name	Type	Description
name	xs:string	The name of this attribute.
type	enumeration	The type of the attribute value. The type MUST be one of the values specified in the following table. **Value** / **Description** binary — The attribute has a binary value. string — The attribute has a string value. integer — The attribute has an integer value. boolean — The attribute has a Boolean value.
multivalued	xs:boolean	A Boolean value that indicates whether this attribute supports multiple values.
operation	enumeration	The delta operation being performed on this attribute. This operation MUST be one of the values specified in the following table. **Value** / **Description** add — The attribute is being added. replace — The attribute is being replaced.

Name	Type	Description
		update: The attribute is being updated. delete: The attribute is being deleted.

2.2.6.3.2 attributeType Complex Type

The **attributeType** complex type defines the format of an attribute.

```
<xs:complexType name="attributeType">
  <xs:sequence>
    <xs:element name="value"
      type="valueType"
      minOccurs="1"
      maxOccurs="unbounded"
     />
  </xs:sequence>
  <xs:attribute name="name"
    type="xs:string"
    use="required"
   />
  <xs:attribute name="type"
    use="required"
  >
    <xs:simpleType>
      <xs:restriction
        base="xs:string"
      >
        <xs:enumeration
          value="binary"
         />
        <xs:enumeration
          value="string"
         />
        <xs:enumeration
          value="integer"
         />
        <xs:enumeration
          value="boolean"
         />
      </xs:restriction>
    </xs:simpleType>
  </xs:attribute>
  <xs:attribute name="multivalued"
    type="xs:boolean"
    use="required"
   />
 </xs:complexType>
```

Child Elements

Element	Type	Description
value	valueType	The value of this attribute. There MUST be at least one <value> element. There can be more than one <value> element if the **multivalued** attribute is "true".

Attributes

Name	Type	Description
name	xs:string	The name of this attribute.
type	enumeration	The type of the attribute value. The type MUST be one of the values specified in the following table. **Value** / **Description** binary — The attribute has a binary value. string — The attribute has a string value. integer — The attribute has an integer value. boolean — The attribute has a Boolean value.
multivalued	xs:boolean	A Boolean value that indicates whether this attribute supports multiple values.

2.2.6.3.3 binaryAnchorType Complex Type

The **binaryAnchorType** complex type defines the format and encoding of a binary anchor value.

```
<xs:complexType name="binaryAnchorType">
  <xs:simpleContent>
    <xs:extension
      base="xs:string"
    >
      <xs:attribute name="encoding"
        type="xs:string"
        use="optional"
        fixed="base64"
       />
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
```

Attributes

Name	Type	Description
encoding	xs:string	This attribute MUST be present if the anchor is base64 encoded.

2.2.6.3.4 constantMappingType Complex Type

The **constantMappingType** complex type defines the constant value in a constant mapping.

```
<xs:complexType name="constantMappingType">
  <xs:sequence>
    <xs:element name="constant-value"
      type="xs:string"
      minOccurs="1"
      maxOccurs="1"
     />
  </xs:sequence>
</xs:complexType>
```

Child Elements

Element	Type	Description
constant-value	xs:string	The constant value to be applied to a rule.

2.2.6.3.5 counterDetailFalseType Complex Type

The **counterDetailFalseType** complex type allows the **detail** attribute of a counter to be set to "false".

```
<xs:complexType name="counterDetailFalseType">
  <xs:simpleContent>
    <xs:extension
      base="xs:unsignedInt"
    >
      <xs:attribute name="detail"
        type="xs:string"
        fixed="false"
        use="required"
       />
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
```

Attributes

Name	Type	Description
detail	xs:string	This attribute allows a counter to be set to "false" instead of 0.

2.2.6.3.6 counterDetailTrueType Complex Type

The **counterDetailTrueType** complex type allows the **detail** attribute of a counter to be set to "true".

```
<xs:complexType name="counterDetailTrueType">
  <xs:simpleContent>
```

```
    <xs:extension
      base="xs:unsignedInt"
    >
      <xs:attribute name="detail"
        type="xs:string"
        fixed="true"
        use="required"
       />
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
```

Attributes

Name	Type	Description
detail	xs:string	This attribute allows a counter to be set to "true" instead of 1.

2.2.6.3.7 directMappingType Complex Type

The **directMappingType** complex type defines the source attribute in a direct mapping.

```
<xs:complexType name="directMappingType">
  <xs:sequence>
    <xs:element name="src-attribute"
      maxOccurs="1"
      minOccurs="1"
    >
      <xs:complexType>
        <xs:simpleContent>
          <xs:extension
            base="xs:string"
          >
            <xs:attribute name="intrinsic"
              type="xs:boolean"
              use="optional"
             />
          </xs:extension>
        </xs:simpleContent>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>
```

Child Elements

Element	Type	Description
src-attribute	N/A	The name of the source attribute.

Attributes

Name	Type	Description
intrinsic	xs:boolean	A Boolean value that specifies whether the attribute is intrinsic.

2.2.6.3.8 dn-valueDeltaType Complex Type

The **dn-valueDeltaType** complex type defines the type for a distinguished name (DN) delta value and the operation being performed.

```
<xs:complexType name="dn-valueDeltaType">
  <xs:complexContent>
    <xs:extension
      base="dn-valueType"
    >
      <xs:attribute name="operation"
        use="required"
      >
        <xs:simpleType>
          <xs:restriction
            base="xs:string"
          >
            <xs:enumeration
              value="add"
             />
            <xs:enumeration
              value="delete"
             />
          </xs:restriction>
        </xs:simpleType>
      </xs:attribute>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
```

Attributes

Name	Type	Description
operation	enumeration	The delta operation being performed on the DN. This operation MUST be one of the values in the following table. **Value** / **Description** add / The DN is being added. delete / The DN is being deleted.

2.2.6.3.9 dn-valueType Complex Type

The **dn-valueType** complex type defines the type for a distinguished name (DN) and the associated anchor value.

```
<xs:complexType name="dn-valueType">
```

```
  <xs:sequence>
    <xs:element name="dn"
      type="dnType"
      maxOccurs="1"
      minOccurs="1"
     />
    <xs:element name="anchor"
      type="binaryAnchorType"
      maxOccurs="1"
      minOccurs="1"
     />
  </xs:sequence>
</xs:complexType>
```

Child Elements

Element	Type	Description
dn	**dnType**	The DN value.
anchor	**binaryAnchorType**	The anchor value that is associated with the DN value.

2.2.6.3.10 dnAttributeDeltaType Complex Type

The **dnAttributeDeltaType** complex type defines the type for a named distinguished name (DN) attribute delta value and the operation being performed.

```
<xs:complexType name="dnAttributeDeltaType">
  <xs:sequence>
    <xs:element name="value"
      type="dn-valueDeltaType"
      minOccurs="1"
      maxOccurs="unbounded"
     />
  </xs:sequence>
  <xs:attribute name="operation"
    use="required"
  >
    <xs:simpleType>
      <xs:restriction
        base="xs:string"
      >
        <xs:enumeration
          value="add"
        />
        <xs:enumeration
          value="replace"
        />
        <xs:enumeration
          value="update"
        />
        <xs:enumeration
          value="delete"
        />
      </xs:restriction>
```

```
    </xs:simpleType>
  </xs:attribute>
  <xs:attribute name="name"
    type="xs:string"
    use="required"
   />
  <xs:attribute name="multivalued"
    type="xs:boolean"
    use="required"
   />
</xs:complexType>
```

Child Elements

Element	Type	Description
value	dn-valueDeltaType	The DN delta value. There MUST be at least one <value> element. There can be more than one <value> element if the **multivalued** attribute is "true".

Attributes

Name	Type	Description
operation	enumeration	The delta operation being performed on this attribute. The operation MUST be one of the values specified in the following table. **Value** / **Description** add – The attribute is being added. replace – The attribute is being replaced. update – The attribute is being updated. delete – The attribute is being deleted.
name	xs:string	The name of this attribute.
multivalued	xs:boolean	A Boolean value that indicates whether this attribute supports multiple values.

2.2.6.3.11 dnAttributeType Complex Type

The **dnAttributeType** complex type defines the type for a named distinguished name (DN) attribute and whether it supports multiple values.

```
<xs:complexType name="dnAttributeType">
  <xs:sequence>
    <xs:element name="value"
     type="dn-valueType"
     minOccurs="1"
     maxOccurs="unbounded"
    />
```

```
    </xs:sequence>
    <xs:attribute name="name"
      type="xs:string"
      use="required"
     />
    <xs:attribute name="multivalued"
      type="xs:boolean"
      use="required"
     />
  </xs:complexType>
```

Child Elements

Element	Type	Description
value	dn-valueType	The DN value. There MUST be at least one <value> element. There can be more than one <value> element if the **multivalued** attribute is "true".

Attributes

Name	Type	Description
name	xs:string	The name of this attribute.
multivalued	xs:boolean	A Boolean value that indicates whether this attribute supports multiple values.

2.2.6.3.12 dnPartMappingType Complex Type

The **dnPartMappingType** complex type defines a distinguished name (DN) part mapping.

```
<xs:complexType name="dnPartMappingType">
  <xs:sequence>
    <xs:element name="dn-part"
      type="xs:unsignedByte"
      minOccurs="1"
      maxOccurs="1"
     />
  </xs:sequence>
</xs:complexType>
```

Child Elements

Element	Type	Description
dn-part	xs:unsignedByte	The starting offset into a DN to use for this mapping.

2.2.6.3.13 extensionErrorInfoType Complex Type

The **extensionErrorInfoType** complex type defines the error information returned from a call to a rules extension.

```
<xs:complexType name="extensionErrorInfoType">
  <xs:sequence>
    <xs:element name="extension-name"
      type="xs:string"
      minOccurs="1"
      maxOccurs="1"
     />
    <xs:element name="extension-callsite"
      type="extensionCallsite"
      minOccurs="1"
      maxOccurs="1"
     />
    <xs:element name="extension-context"
      type="xs:string"
      minOccurs="1"
      maxOccurs="1"
     />
    <xs:element name="call-stack"
      type="xs:string"
      minOccurs="1"
      maxOccurs="1"
     />
  </xs:sequence>
</xs:complexType>
```

Child Elements

Element	Type	Description
extension-name	xs:string	The file name of the extension. This value MUST NOT contain the path to the file.
extension-callsite	**extensionCallsite**	The call site within the extension that was called at the time of the error. This MUST be a value specified in the **extensionCallsite** simple type (section 2.2.6.2.10).
extension-context	xs:string	The context string defined by a scripted rule and passed to a scripted rules extension.
call-stack	xs:string	The call-stack of the failure for the rules extension.

2.2.6.3.14 rulesErrorInfoType Complex Type

The **rulesErrorInfoType** complex type defines the error information that identifies the rule that caused an error.

```
<xs:complexType name="rulesErrorInfoType">
  <xs:sequence>
    <xs:element name="context"
      maxOccurs="1"
      minOccurs="1"
    >
      <xs:complexType>
        <xs:sequence>
          <xs:element name="attribute-mapping"
```

```
            maxOccurs="1"
            minOccurs="1"
          >
            <xs:complexType>
              <xs:sequence>
                <xs:choice>
                  <xs:element name="direct-mapping"
                    type="directMappingType"
                    maxOccurs="1"
                    minOccurs="1"
                   />
                  <xs:element name="scripted-mapping"
                    type="scriptedMappingType"
                    maxOccurs="1"
                    minOccurs="1"
                   />
                  <xs:element name="constant-mapping"
                    type="constantMappingType"
                    maxOccurs="1"
                    minOccurs="1"
                   />
                  <xs:element name="dn-part-mapping"
                    type="dnPartMappingType"
                    maxOccurs="1"
                    minOccurs="1"
                   />
                </xs:choice>
              </xs:sequence>
              <xs:attribute name="dest-attr"
                type="xs:string"
                use="required"
               />
              <xs:attribute name="context-id"
                type="guidType"
                use="required"
               />
            </xs:complexType>
          </xs:element>
        </xs:sequence>
        <xs:attribute name="ma-id"
          type="guidType"
          use="required"
         />
        <xs:attribute name="ma-name"
          type="xs:string"
          use="required"
         />
        <xs:attribute name="cs-object-id"
          type="guidType"
          use="required"
         />
        <xs:attribute name="dn"
          type="dnType"
          use="required"
         />
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:complexType>
```

Child Elements

Element	Type	Description
context	N/A	The context for this rule, as defined by the remaining attributes.
attribute-mapping	N/A	Information about the mapping type and source attributes.
direct-mapping	**directMappingType**	The attribute mapping values in a direct mapping.
scripted-mapping	**scriptedMappingType**	The attribute mapping values in a scripted mapping.
constant-mapping	**constantMappingType**	The attribute mapping values in a constant mapping.
dn-part-mapping	**dnPartMappingType**	The attribute mapping values in a distinguished name (DN) part mapping.

Attributes

Name	Type	Description
dest-attr	xs:string	The name of the destination attribute.
context-id	**guidType**	A GUID identifying the destination attribute.
ma-id	**guidType**	A GUID uniquely identifying the management agent instance.
ma-name	xs:string	The management agent instance name.
cs-object-id	**guidType**	A GUID uniquely identifying the connector space object.
dn	**dnType**	The DN of the connector space object.

2.2.6.3.15 scriptedMappingType Complex Type

The **scriptedMappingType** complex type defines one or more source attributes in a scripted mapping, as well as the script context.

```
<xs:complexType name="scriptedMappingType">
  <xs:sequence>
    <xs:element name="src-attribute"
      maxOccurs="unbounded"
      minOccurs="1"
    >
      <xs:complexType>
        <xs:simpleContent>
          <xs:extension
            base="xs:string"
          >
            <xs:attribute name="intrinsic"
```

```
            type="xs:boolean"
            use="optional"
           />
         </xs:extension>
       </xs:simpleContent>
     </xs:complexType>
   </xs:element>
   <xs:element name="script-context"
     type="xs:string"
     maxOccurs="1"
     minOccurs="1"
    />
  </xs:sequence>
</xs:complexType>
```

Child Elements

Element	Type	Description
src-attribute	N/A	The name of the source attribute.
script-context	xs:string	The context of the mapping to the rules extension code.

Attributes

Name	Type	Description
intrinsic	xs:boolean	A Boolean value that specifies whether the attribute is intrinsic.

2.2.6.3.16 step-dataType Complex Type

The **step-dataType** complex type defines a template for management agent specific data for the run profile step in the <custom-data> element (section 2.2.6.4.4).

```
<xs:complexType name="step-dataType">
  <xs:sequence>
    <xs:element name="batch-size"
      type="xs:unsignedInt"
     />
    <xs:element name="page-size"
      type="xs:unsignedInt"
     />
    <xs:element name="time-limit"
      type="xs:unsignedInt"
     />
  </xs:sequence>
</xs:complexType>
```

Child Elements

Element	Type	Description
batch-size	xs:unsignedInt	The number of objects that the management agent will write to the connector space at one time.
page-size	xs:unsignedInt	The number of objects the management agent will read from the data source at one time, where a value of 0 means there is no limit.
time-limit	xs:unsignedInt	The number of seconds that the management agent will wait for a response from the data source.

2.2.6.3.17 valueDeltaType Complex Type

The **valueDeltaType** complex type defines the type for a delta value.

```
<xs:complexType name="valueDeltaType">
  <xs:complexContent>
    <xs:extension
      base="valueType"
    >
      <xs:attribute name="operation"
        use="required"
      >
        <xs:simpleType>
          <xs:restriction
            base="xs:string"
          >
            <xs:enumeration
              value="add"
             />
            <xs:enumeration
              value="delete"
             />
          </xs:restriction>
        </xs:simpleType>
      </xs:attribute>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
```

Attributes

Name	Type	Description
operation	enumeration	The delta operation being performed on the value. This operation MUST be one of the values in the following table. **Value** / **Description** add — The value is being added. delete — The value is being deleted.

2.2.6.3.18 valueType Complex Type

The **valueType** complex type defines the type for a value.

```
<xs:complexType name="valueType">
  <xs:simpleContent>
    <xs:extension
      base="xs:string"
    >
      <xs:attribute name="encoding"
        type="xs:string"
        use="optional"
        fixed="base64"
       />
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
```

Attributes

Name	Type	Description
encoding	xs:string	This attribute MUST be present if the value is base64 encoded.

2.2.6.4 Elements

The following table lists the common elements defined by the XML schema for this protocol. Elements that are specific to a particular operation are defined with that operation.

Element	Description
component-mappings (section 2.2.6.4.1)	The <component-mappings> element is not used.
configuration (section 2.2.6.4.2)	The <configuration> element contains one or more run step definitions for a run profile.
connection-log	The <connection-log> element contains information about the results of connection attempts between a management agent and a data source.
custom-data (section 2.2.6.4.4)	The <custom-data> element contains management agent specific data for the run profile step.
dropfile-name (section 2.2.6.4.5)	The <dropfile-name> element contains the file name of the drop file.
export-counters (section 2.2.6.4.6)	The <export-counters> element contains counters for export operations to a data source.
export-error (section 2.2.6.4.7)	The <export-error> element contains information about the last export error that occurred when writing a connector space object to a data source.
filtered-deletions (section 2.2.6.4.8)	The <filtered-deletions> element contains the count of deletions in which the target connector space object could not be found.
filtered-objects (section	The <filtered-objects> element contains the count of the objects that were

Element	Description
2.2.6.4.9)	filtered from processing during the import because they are obsolete.
import-error (section 2.2.6.4.10)	The <import-error> element contains details of an instance of an import error. This is used in a synchronization-errors element.
import-status (section 2.2.6.4.11)	The <import-status> element contains information about the last synchronization error that occurred on a connector space object.
inbound-flow-counters (section 2.2.6.4.12)	The <inbound-flow-counters> element contains counters for inbound flow operations to the metaverse.
ma-discovery-errors (section 2.2.6.4.13)	The <ma-discovery-errors> element contains information about specific object errors that occurred while the management agent was reading data from the data source.
mv-retry-errors (section 2.2.6.4.14)	The <mv-retry-errors> element contains information about objects that could not be synchronized.
outbound-flow-counters (section 2.2.6.4.15)	The <outbound-flow-counters> element contains counters for outbound flow operations from the metaverse to the connector space.
partition (section 2.2.6.4.16)	The <partition> element contains the name of the management agent partition for the run profile step.
password-change-history (section 2.2.6.4.17)	The <password-change-history> element contains information about the password operations that were performed through the WMI interface of the synchronization engine on a connector space object.
password-sync (section 2.2.6.4.18.1)	This form of <password-sync> element is used as part of the management agent configuration, and it contains information specifying the password synchronization settings for a management agent partition.
password-sync (section 2.2.6.4.18.2)	This form of <password-sync> element is used as part of the overall synchronization engine configuration, and it specifies whether password synchronization is enabled in the synchronization engine.
provisioning (section 2.2.6.4.20)	The <provisioning> element contains information specifying when a connector space object is created.
provisioning-cleanup (section 2.2.6.4.19)	The <provisioning-cleanup> element contains information specifying when a connector space object is deleted.
staging-counters (section 2.2.6.4.21)	The <staging-counters> element contains counters for inbound staging operations.
step (section 2.2.6.4.22)	The <step> element contains information about a run profile step.
synchronization-errors (section 2.2.6.4.23)	The <synchronization-errors> element contains one or more synchronization errors as defined by the import-error and export-error elements.
threshold (section 2.2.6.4.24)	The <threshold> element specifies the thresholds for the run profile step.
transient-details (section 2.2.6.4.25)	The <transient-details> element contains information specifying why a connector space object was converted to a transient object.

2.2.6.4.1 component-mappings Element

The component-mappings element is not used. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="component-mappings">
  <xs:simpleType>
    <xs:restriction
      base="xs:string"
    >
      <xs:length
        value="0"
       />
    </xs:restriction>
  </xs:simpleType>
</xs:element>
```

2.2.6.4.2 configuration Element

This configuration element contains the steps for run profile definitions. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="configuration">
  <xs:complexType>
    <xs:sequence>
      <xs:element
        minOccurs="1"
        maxOccurs="unbounded"
        ref="step"
       />
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
step	**step**	The definition for an individual run step, as defined in section 2.2.6.4.22. There MUST be at least 1 step element.

2.2.6.4.3 connection-log Element

The connection-log element contains information about the results of connection attempts between a management agent and a data source. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="connection-log">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="connection-result"
        type="connectionResult"
```

```
        />
      <xs:element name="server"
        type="xs:string"
       />
      <xs:element name="incident"
        minOccurs="0"
        maxOccurs="unbounded"
      >
        <xs:complexType>
          <xs:sequence>
            <xs:element name="connection-result"
              type="connectionResult"
             />
            <xs:element name="date"
              type="DateTimeValue"
             />
            <xs:element name="server"
              type="xs:string"
             />
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
connection-result	**connectionResult**	A string containing the last connection result for this run step. This MUST be a value specified in section 2.2.6.2.4.
server	xs:string	The server connection information of the last connection attempt for this run step.
incident	N/A	An element that contains the results of an individual connection incident.
connection-result	**connectionResult**	A string containing the connection result for this incident.
date	**DateTimeValue**	The UTC time of the connection incident.
server	xs:string	The server connection information for this incident.

The following is an example of the <connection-log> element.

```
<connection-log>
  <connection-result>success</connection-result>
  <server>DC1.fabrikam.com:389</server>
  <incident>
    <connection-result>success</connection-result>
    <date>2009-05-15 17:34:56.507</date>
    <server>DC1.fabrikam.com:389</server>
```

```
  </incident>
</connection-log>
```

2.2.6.4.4 custom-data Element

The **custom-data** element defines management agent specific data for the run profile step.

```
<xs:element name="custom-data">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="adma-step-data"
        type="step-dataType"
        minOccurs="0"
       />
      <xs:element name="dsma-step-data"
        type="step-dataType"
        minOccurs="0"
       />
      <xs:element name="edma-step-data"
        type="step-dataType"
        minOccurs="0"
       />
      <xs:element name="ipma-step-data"
        type="step-dataType"
        minOccurs="0"
       />
      <xs:element name="run-config">
        <xs:complexType>
          <xs:sequence>
            <xs:choice>
              <xs:element name="input-file"
                type="xs:string"
               />
              <xs:element name="output-file"
                type="xs:string"
               />
            </xs:choice>
            <xs:element name="delete-file-after-use"
              type="xs:unsignedInt"
              minOccurs="0"
             />
            <xs:element name="timeout"
              type="xs:unsignedInt"
             />
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
adma-step-data	**step-dataType**	Step data specific to management agents of type "AD", "ADAM", and "AD GAL".
dsma-step-data	**step-dataType**	Step data specific to management agents of type "IBM DS".
edma-step-data	**step-dataType**	Step data specific to management agents of type "eDirectory".
ipma-step-data	**step-dataType**	Step data specific to management agents of type "iPlanet".
run-config	N/A	Step data specific to management agents of type "Extensible".
input-file	xs:string	The input file name. This element MUST be present if the step-type is "delta-import", "full-import", or "full-import-reevaluate-rules" (section 2.2.6.2.14); otherwise, this element MUST NOT be present. The input file name string value MUST NOT include the file path.
output-file	xs:string	The output file name for file-based export management agents. This element MUST be present if the step-type is "export" (section 2.2.6.2.14) and the export is file-based; otherwise, this element MUST NOT be present. The output file name string value MUST NOT include the file path.
delete-file-after-use	xs:unsignedInt	Whether the file is deleted after import or export, where a value of 0 specifies do not delete the file and 1 specifies delete.
timeout	xs:unsignedInt	The number of seconds that the management agent is expected to wait for a response from the data source.

The **custom-data** element MUST contain a child element that defines step data according to the management agent type, as specified by the **ma_type** column of the **mms_management_agent** table (section 2.2.5.6). Examples of custom data child elements are provided as follows:

- For management agents of type "AD", "ADAM", or "AD GAL": adma-step-data Custom Data (section 2.2.6.4.4.1))
- For management agents of type "IBM DS": dsma-step-data Custom Data (section 2.2.6.4.4.2))
- For management agents of type "eDirectory": edma-step-data Custom Data (section 2.2.6.4.4.3))
- For management agents of type "iPlanet": ipma-step-data Custom Data (section 2.2.6.4.4.4))
- For management agents of type "Extensible": run-config Custom Data (section 2.2.6.4.4.5))

2.2.6.4.4.1 adma-step-data Custom Data

The <adma-step-data> element (section 2.2.6.4.4) contains settings specific to management agents of type "AD", "ADAM", and "AD GAL". This element MUST be present for this management agent type, as specified by the **ma_type** column of the **mms_management_agent** table (section 2.2.5.6).

The following is an example of the <adma-step-data> element:

```
<adma-step-data>
  <batch-size>100</batch-size>
  <page-size>500</page-size>
  <time-limit>120</time-limit>
</adma-step-data>
```

2.2.6.4.4.2 dsma-step-data Custom Data

The <dsma-step-data> element (section 2.2.6.4.4) contains settings specific to management agents of type "IBM DS". This element MUST be present for this management agent type, as specified by the **ma_type** column of the **mms_management_agent** table (section 2.2.5.6).

The following is an example of the <dsma-step-data> element:

```
<dsma-step-data>
  <batch-size>100</batch-size>
  <size-limit>500</page-size>
  <time-limit>120</time-limit>
</dsma-step-data>
```

2.2.6.4.4.3 edma-step-data Custom Data

The <edma-step-data> element (section 2.2.6.4.4) contains settings specific to management agents of type "eDirectory". This element MUST be present for this management agent type, as specified by the **ma_type** column of the **mms_management_agent** table (section 2.2.5.6).

The following is an example of the <edma-step-data> element:

```
<edma-step-data>
  <batch-size>100</batch-size>
  <page-size>500</page-size>
  <time-limit>120</time-limit>
</edma-step-data>
```

2.2.6.4.4.4 ipma-step-data Custom Data

The <ipma-step-data> element (section 2.2.6.4.4) contains settings specific to management agents of type "iPlanet". This element MUST be present for this management agent type, as specified by the **ma_type** column of the **mms_management_agent** table (section 2.2.6.4.4).

The following is an example of the <ipma-step-data> element:

```
<ipma-step-data>
  <time-limit>120</time-limit>
  <size-limit>0</size-limit>
  <batch-size>1</batch-size>
</ipma-step-data>
```

2.2.6.4.4.5 run-config Custom Data

The <run config> element (section 2.2.6.4.4) contains settings specific to management agents of type "Extensible". This element MUST be present for this management agent type, as specified by the **ma_type** column of the mms_management_agent table (section 2.2.5.6).

The following is an example of an import operation in the <run-config> element:

```
<run-config>
  <input-file>myFile.txt</input-file>
  <delete-file-after-use>1</delete-file-after-use>
  <timeout>0</timeout>
</run-config>
```

The following is an example of an export operation in the <run-config> element:

```
<run-config>
  <output-file>myFile.txt</output-file>
  <delete-file-after-use>1</delete-file-after-use>
  <timeout>0</timeout>
</run-config>
```

2.2.6.4.5 dropfile-name Element

The **dropfile-name** element specifies the file name of a drop file.

```
<xs:element name="dropfile-name"
  type="xs:string"
 />
```

This element MUST be present with a <step> element (section 2.2.6.4.22), if the step-type and sub-type values in that element indicate that a drop file will be used.

2.2.6.4.6 export-counters Element

The **export-counters** element contains statistical counters for an export operation. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="export-counters">
  <xs:complexType name="export-counters">
    <xs:sequence>
      <xs:element name="export-add"
       type="counterDetailTrueType"
       maxOccurs="1"
       minOccurs="1"
       />
      <xs:element name="export-update"
       type="counterDetailTrueType"
       maxOccurs="1"
       minOccurs="1"
       />
      <xs:element name="export-rename"
       type="counterDetailTrueType"
```

```
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="export-delete"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="export-delete-add"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="export-failure"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
export-add	**counterDetailTrueType**	Information about the number of new object creations that the management agent has processed successfully. **@detail**: This MUST be true.
export-update	**counterDetailTrueType**	Information about the number of object updates which the management agent has processed successfully. **@detail**: This MUST be true.
export-rename	**counterDetailTrueType**	Information about the number of object renames which the management agent has processed successfully. **@detail**: This MUST be true.
export-delete	**counterDetailTrueType**	Information about the number of object updates not involving renaming the object that the management agent has processed successfully. **@detail**: This MUST be true.
export-delete-add	**counterDetailTrueType**	Information about the number of modifications involving deleting the existing object and adding a new object with the same distinguished name that the management agent has processed successfully. **@detail**: This MUST be true.
export-failure	**counterDetailTrueType**	Information about the number of operation failures. **@detail**: This MUST be true.

2.2.6.4.7 export-error Element

The export-error element contains information about the last export error that occurred when writing a connector space object to a data source. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="export-error">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="date-occurred"
        type="DateTypeValue"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="first-occurred"
        type="DateTypeValue"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="retry-count"
        type="xs:unsignedInt"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="error-type"
        type="exportErrorType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="cd-error"
        maxOccurs="1"
        minOccurs="1"
      >
        <xs:complexType>
          <xs:sequence>
            <xs:element name="error-code"
              type="xs:string"
              maxOccurs="1"
              minOccurs="1"
             />
            <xs:element name="error-literal"
              type="xs:string"
              maxOccurs="1"
              minOccurs="1"
             />
            <xs:element name="server-error-detail"
              type="xs:string"
              maxOccurs="1"
              minOccurs="0"
             />
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
date-occurred	DateTypeValue	The UTC time that the export error last occurred.
first-occurred	DateTypeValue	The UTC time that the export error first occurred.
retry-count	xs:unsignedInt	The number of times the export was retried that resulted in the error.
error-type	exportErrorType	The type of error that occurred. This MUST be a value specified in section 2.2.6.2.8.
cd-error	N/A	This element contains management agent information about the data source error and MUST be present if the error-type element is "cd-error".
error-code	xs:string	A management agent specific error code.
error-literal	xs:string	A management agent specific error literal.
server-error-detail	xs:string	A management agent specific error text.

The following is an example of the export-error element.

```
<export-error>
  <date-occurred>2009-02-27 1:23:45.678</date-occurred>
  <first-occurred>2009-02-26 23:23:12.435</first-occurred>
  <retry-count>2</retry-count>
  <error-type>non-existent-parent</error-type>
  <cd-error>
    <error-code>0x80040005</error-code>
    <error-literal>E_FAIL</error-literal>
  </cd-error>
</export-error>
```

2.2.6.4.8 filtered-deletions Element

The filtered-deletions element contains the count of deletions in which the target connector space object could not be found. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="filtered-deletions"
  type="xs:unsignedInt"
 />
```

The following is an example of the filtered-deletions element.

```
<filtered-deletions>26</filtered-deletions>
```

2.2.6.4.9 filtered-objects Element

The filtered-objects element contains the count of the objects that were filtered from processing during the import because they are obsolete. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="filtered-objects"
  type="xs:unsignedInt"
 />
```

The following is an example of the filtered-objects element.

```
<filtered-objects>720</filtered-objects>
```

2.2.6.4.10 import-error Element

The import-error element contains details of an instance of an import error, which is an error importing a connector space delta into the metaverse. This element is used in a <synchronization-errors> element (section 2.2.6.4.23), and an instance MUST be present for each object that encountered an error during import. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="import-error">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="first-occurred"
        type="DateTimeValue"
        maxOccurs="1"
        minOccurs="0"
       />
      <xs:element name="retry-count"
        type="xs:unsignedByte"
        maxOccurs="1"
        minOccurs="0"
       />
      <xs:element name="date-occurred"
        type="DateTimeValue"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="error-type"
        type="importAndMVRetryErrorType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="algorithm-step"
        type="algorithmStepType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="change-not-reimported"
        maxOccurs="1"
        minOccurs="0"
      >
```

```
<xs:complexType>
  <xs:sequence>
    <xs:element name="delta"
      maxOccurs="1"
      minOccurs="1"
    >
      <xs:complexType>
        <xs:sequence>
          <xs:element name="anchor"
            type="binaryAnchorType"
            minOccurs="0"
            maxOccurs="1"
           />
          <xs:element name="dn-attr"
            type="dnType"
            minOccurs="0"
            maxOccurs="unbounded"
           />
          <xs:element name="attr"
            type="attributeDeltaType"
            minOccurs="0"
            maxOccurs="unbounded"
           />
        </xs:sequence>
        <xs:attribute name="operation"
          use="required"
        >
          <xs:simpleType>
            <xs:restriction
              base="xs:string"
            >
              <xs:enumeration
                value="add"
               />
              <xs:enumeration
                value="replace"
               />
              <xs:enumeration
                value="update"
               />
              <xs:enumeration
                value="delete"
              />
              <xs:enumeration
                value="obsolete"
               />
              <xs:enumeration
                value="delete-add"
               />
            </xs:restriction>
          </xs:simpleType>
        </xs:attribute>
        <xs:attribute name="dn"
          type="dnType"
          use="required"
         />
      </xs:complexType>
    </xs:element>
    <xs:element name="entry"
```

```
      maxOccurs="1"
      minOccurs="1"
    >
      <xs:complexType>
        <xs:sequence>
          <xs:element name="anchor"
            type="binaryAnchorType"
            maxOccurs="1"
            minOccurs="1"
           />
          <xs:element name="parent-anchor"
            type="binaryAnchorType"
            maxOccurs="1"
            minOccurs="1"
           />
          <xs:element name="primary-objectclass"
            type="xs:string"
            maxOccurs="1"
            minOccurs="1"
           />
          <xs:element name="objectclass">
            <xs:complexType>
              <xs:sequence>
                <xs:element name="oc-value"
                  type="xs:string"
                  minOccurs="1"
                  maxOccurs="unbounded"
                 />
              </xs:sequence>
            </xs:complexType>
          </xs:element>
          <xs:element name="dn-attr"
            type="dnAttributeType"
            minOccurs="0"
            maxOccurs="unbounded"
           />
          <xs:element name="attr"
            type="attributeType"
            maxOccurs="unbounded"
            minOccurs="0"
            />
        </xs:sequence>
        <xs:attribute name="dn"
          type="dnType"
          use="required"
         />
      </xs:complexType>
    </xs:element>
  </xs:sequence>
 </xs:complexType>
</xs:element>
<xs:element name="extension-error-info"
  type="extensionErrorInfoType"
  maxOccurs="1"
  minOccurs="0"
 />
<xs:element name="rules-error-info"
  type="rulesErrorInfoType"
  maxOccurs="1"
```

```
        minOccurs="0"
       />
    </xs:sequence>
    <xs:attribute name="cs-guid"
      type="xs:string"
      use="required"
     />
    <xs:attribute name="dn"
      type="xs:string"
      use="required"
     />
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
first-occurred	**DateTimeValue**	The date, in UTC, when this error first occurred. This date differs from date-occurred if the same error has been encountered on a previous run. If the same error had not been encountered on a previous run, this date is the same as date-occurred.
retry-count	xs:unsignedByte	The run number of previously executed run profile for which the same error has been encountered. If the same error was not encountered on a previous run, this value is zero.
date-occurred	**DateTimeValue**	The date, in Coordinated Universal Time (UTC), when this instance of the error occurred.
error-type	**importAndMVRetryErrorType**	This value indicates the type of error that occurred. This MUST be a value specified in section 2.2.6.2.12.
algorithm-step	**algorithmStepType**	The stage of synchronization when the error occurred. This MUST be a value specified in section 2.2.6.2.1.
change-not-reimported	N/A	This element contains information about an exported change that was not confirmed on import and MUST be present if any change previously export by the synchronization engine was not re-imported during this run profile step.
delta	N/A	The delta that was exported to the data source on the last export run.
anchor	**binaryAnchorType**	The anchor of the object. The value of this element MUST be encoded using base64 encoding, as defined in [RFC4648] section 4. This element MUST be present if the anchor is available for this object. **@encoding**: The encoding of the anchor, which MUST be "base64".
dn-attr	**dnType**	The attribute which has a value that was not confirmed. This element MUST be present if the DN is available for this object.

<table>
<tr><th>Element</th><th>Type</th><th>Description</th></tr>
<tr><td></td><td></td><td>@name: The attribute name.
@operation: The operation being performed. This MUST be one of the following:
▪ "add"
▪ "update"
▪ "replace"
▪ "delete"
@multi-valued: Indicates whether the attribute is multi-valued.</td></tr>
<tr><td>attr</td><td>attributeDeltaType</td><td>The attribute that has a value that was not confirmed. An instance of this element MUST be present for every attribute that contains values that were previously exported by the synchronization engine and was not imported in this run profile step.
@name: The attribute name.
@operation: The operation being performed and MUST be one of the following:
▪ "add"
▪ "update"
▪ "replace"
▪ "delete"
@type: The attribute type. This MUST be one of the following:
▪ "binary"
▪ "string"
▪ "integer"
▪ "Boolean"</td></tr>
<tr><td>entry</td><td>N/A</td><td>The import object received from the data source during the last import.
The following elements have syntax that is identical to previously described elements, with the exception that they apply to the pending import received from the data source during the last import instead of the delta that was exported to the data source on the last export run:<table><tr><th>Element</th><th>Same syntax as:</th></tr><tr><td>import-error/change-not-reimported/entry
All child elements not specified in the following</td><td>import-error/change-not-reimported/delta</td></tr></table></td></tr>
</table>

Element	Type	Description
		sections.
anchor	**binaryAnchorType**	The anchor value of the object. The value of this element MUST be encoded using base64 encoding, as defined in [RFC4648] section 4. **@encoding**: The encoding of the anchor, which MUST be "base64".
parent-anchor	**binaryAnchorType**	The parent's anchor of the object. The value of this element MUST be encoded using base64 encoding, as defined in [RFC4648] section 4. **@encoding**: The encoding of the anchor, which MUST be "base64".
primary-objectclass	xs:string	The primary object class for the object.
objectclass	N/A	The object class for the object.
oc-value	xs:string	The object class values for the object. This element MUST be present if the object class is available in the object.
dn-attr	**dnAttributeType**	The DN attribute value received from the connected data source. This element MUST be present if the DN is available for this object. **@name**: The attribute name. **@operation**: The operation being performed. This MUST be one of the following: ▪ "add" ▪ "update" ▪ "replace" ▪ "delete" **@multi-valued**: Indicates whether the attribute is multi-valued.
attr	**attributeType**	The attribute value received from the connected data source. **@name**: The attribute name. **@operation**: The operation being performed. This MUST be one of the following: ▪ "add" ▪ "update" ▪ "replace" ▪ "delete"

Element	Type	Description
		@typei: The attribute type. This MUST be one of the following: ▪ "binary" ▪ "string" ▪ "integer" ▪ "Boolean"
extension-error-info	**extensionErrorInfoType**	The contextual information about an exception and in some cases the call stack of an exception. This element MUST be present if an error occurred during the processing of a script-based synchronization rule.
rules-error-info	**rulesErrorInfoType**	This identifies the rule that caused the import error. This element MUST be present if an error occurs in a synchronization rule during import.

Attributes

Name	Type	Description
operation	enumeration	The operation that was attempted and MUST be one of the following: **Value** / **Description** add — An add operation replace — A replace operation update — An update operation delete — A delete operation obsolete — An operation that marks the object as obsolete. delete-add — A delete operation followed by an add operation.
dn	**dnType**	The distinguished name (DN) of the connector spec object for this delete entry and MUST NOT be present if the import-error/change-not-reimported/delta element has an **operation** value of "obsolete".
dn	**dnType**	
cs-guid	xs:string	The GUID for the connector space object which encountered the import error.
dn	xs:string	The DN identifying the connector space object which encountered the import error.

Note Descriptions provided but not defined in structure:

import-error/change-not-reimported/delta/dn-value: The value which was not confirmed.

import-error/change-not-reimported/delta/dn-value/@operation: The operation for the attribute. This MUST be one of the following:

- "add"
- "delete"

import-error/change-not-reimported/delta/dn-value/dn: The DN value.

import-error/change-not-reimported/delta/dn-value/anchor: The anchor of the object. The value of the element MUST be encoded using base64 encoding, as defined in [RFC4648] section 4.

import-error/change-not-reimported/delta/dn-value/anchor/@encoding: The encoding of the anchor, which MUST be "base64".

import-error/change-not-reimported/delta/attr/value: The value that was not confirmed. This value MUST be encoded using base64 encoding, as defined in [RFC4648] section 4, if the **import-error/change-not-reimported/delta/attr/@type** attribute is "binary".

import-error/change-not-reimported/delta/attr/value/@operation: The operation being performed. This MUST be one of the following:

- "add"
- "update"

import-error/change-not-reimported/delta/attr/value/@encoding: The encoding of the attribute value. This MUST be present if **import-error/change-not-reimported/delta/attr/@type** is "binary".

import-error/change-not-reimported/delta/attr/value/@encoding MUST be "base64".

import-error/extension-error-info/extension-name: The name of the script-based synchronization rule implementation file.

import-error/extension-error-info/extension-callsite: The extension interface and method that was being called at the time of the error. This MUST be a value specified in section 2.2.6.2.10.

import-error/extension-error-info/extension-context: The context string passed to the extension script-based synchronization rule.

import-error/extension-error-info/call-stack: The call stack of the rules extension at the time of the import error.

import-error/rule-error-info/context: This contains information used to identify the rule that failed during the import.

import-error/rule-error-info/context/@ma-id: The GUID for the management agent.

import-error/rule-error-info/context/@ma-name: The name of the management agent.

import-error/rule-error-info/context/@cs-object-id: The GUID for the object in the connector space where the error occurred.

import-error/rule-error-info/context/@dn: The distinguished name for the object in the connector space where the error occurred.

import-error/rule-error-info/context/attribute-mapping: Information about the mapping type and source attributes.

import-error/rule-error-info/context/attribute-mapping/@dest-attr: The name of the destination attribute.

import-error/rule-error-info/context/attribute-mapping/@context-id: The GUID of the attribute.

import-error/rule-error-info/context/attribute-mapping/direct-mapping: The mapping for a direct mapping.

import-error/rule-error-info/context/attribute-mapping/direct-mapping/src-attribute: The name of the source attribute.

import-error/rule-error-info/context/attribute-mapping/direct-mapping/src-attribute/@instrinsic: This MUST be true if the **import-error/rule-error-info/context/attribute-mapping/direct-mapping/src**-attribute is "dn".

import-error/rule-error-info/context/attribute-mapping/scripted-mapping: The mapping for a scripted mapping.

import-error/rule-error-info/context/attribute-mapping/scripted-mapping/src-attribute: The name of the source attribute.

import-error/rule-error-info/context/attribute-mapping/ scripted-mapping/src-attribute/@intrinsic: This MUST be true if the **import-error/rule-error-info/context/attribute-mapping/scripted-mapping/src**-attribute is "dn".

import-error/rule-error-info/context/attribute-mapping/constant-mapping: The mapping for a constant mapping.

import-error/rule-error-info/context/attribute-mapping/constant-mapping/constant-value: The constant value to flow.

import-error/rule-error-info/context/attribute-mapping/dn-part-mapping: The mapping for a DN parts mapping.

import-error/rule-error-info/context/attribute-mapping/dn-part-mapping/dn-part: The DN element index, where 1 is the right-most element of the DN, from the DN to flow.

2.2.6.4.11 import-status Element

The import-status element contains information about the last synchronization error that occurred on a connector space object. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="import-status">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="algorithm-step"
        type="algorithmStepType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="rules-error-info"
        maxOccurs="1"
```

```
    minOccurs="1"
  >
    <xs:complexType>
      <xs:sequence>
        <xs:element name="context"
          maxOccurs="1"
          minOccurs="1"
        >
          <xs:complexType>
            <xs:sequence>
              <xs:element name="attribute-mapping"
                maxOccurs="1"
                minOccurs="1"
              >
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="direct-mapping"
                      maxOccurs="1"
                      minOccurs="0"
                    >
                      <xs:complexType>
                        <xs:sequence>
                          <xs:element name="scr-attribute"
                            type="xs:string"
                            maxOccurs="1"
                            minOccurs="1"
                          />
                        </xs:sequence>
                      </xs:complexType>
                    </xs:element>
                    <xs:element name="constant-mapping"
                      maxOccurs="1"
                      minOccurs="0"
                    >
                      <xs:complexType>
                        <xs:sequence>
                          <xs:element name="constant-value"
                            type="xs:string"
                            maxOccurs="1"
                            minOccurs="1"
                          />
                        </xs:sequence>
                      </xs:complexType>
                    </xs:element>
                    <xs:element name="scripted-mapping"
                      maxOccurs="1"
                      minOccurs="0"
                    >
                      <xs:complexType>
                        <xs:sequence>
                          <xs:element name="scr-attribute"
                            type="xs:string"
                          />
                          <xs:element name="script-context"
                            type="xs:string"
                          />
                        </xs:sequence>
                      </xs:complexType>
                    </xs:element>
```

```
                    </xs:sequence>
                    <xs:attribute name="dest-attr"
                      type="xs:string"
                      use="required"
                     />
                    <xs:attribute name="context-id"
                      type="guidType"
                      use="required"
                     />
                  </xs:complexType>
                </xs:element>
              </xs:sequence>
              <xs:attribute name="ma-id"
                type="guidType"
                use="required"
               />
              <xs:attribute name="ma-name"
                type="xs:string"
                use="required"
               />
              <xs:attribute name="cs-object-id"
                type="guidType"
                use="required"
               />
              <xs:attribute name="dn"
                type="dnType"
                use="required"
               />
            </xs:complexType>
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:element name="extension-error-info"
      maxOccurs="1"
      minOccurs="1"
    >
      <xs:complexType>
        <xs:sequence>
          <xs:element name="extension-name"
            type="xs:string"
           />
          <xs:element name="extenstion-callsite"
            type="extensionCallsite"
           />
          <xs:element name="extension-context"
            type="xs:string"
           />
          <xs:element name="call-stack"
            type="xs:string"
           />
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
 </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
algorithm-step	**algorithmStepType**	The step that was being performed at the time of the error. This MUST be a value specified in section 2.2.6.2.1.
rules-error-info	N/A	The rule that caused the import error. This element MUST be present if and only if an error occurs in a synchronization rule during import.
context	N/A	The context in which the error occurred.
attribute-mapping	N/A	The mapping between the source attribute(s) and the destination attribute.
direct-mapping	N/A	The mapping type is a direct flow between a source attribute and a destination attribute.
scr-attribute	xs:string	The source attribute that is mapped to the destination attribute.
constant-mapping	N/A	The mapping type is a constant value to be applied to the destination attribute.
constant-value	xs:string	The constant value that is mapped to the destination attribute.
scripted-mapping	N/A	The mapping type that is to be evaluated by a rules extension.
scr-attribute	xs:string	The source attributes that are available to the rules extension.
script-context	xs:string	A context string that is passed into the extension to allow it to select the correct mapping instructions to execute.
extension-error-info	N/A	Details of the extension code that triggered the error.
extension-name	xs:string	The name of the extension file without the file system path.
extenstion-callsite	**extensionCallsite**	The synchronization operation that was being performed at the time of the call into the extension. This MUST be a value specified in section 2.2.6.2.10.
extension-context	xs:string	A context string that is passed into the extension to allow it to select the correct mapping instructions to execute.
call-stack	xs:string	The call stack of the rules extension at the time of the error.

Attributes

Name	Type
dest-attr	xs:string
context-id	**guidType**
ma-id	**guidType**

Name	Type
ma-name	xs:string
cs-object-id	**guidType**
dn	**dnType**

The following is an example of an import status structure.

```
<import-status>
  <algorithm-step>import-flow</algorithm-step>
  <rules-error-info>
    <context ma-id="{2C627010-95B4-4236-9116-EBD934714307}"
             ma-name="test-dom"
             cs-object-id="{B9CA1E82-FDCB-4024-930B-F4E206CFFB6D}"
             dn="CN=Administrator,CN=Users,DC=test-dom,DC=com">
      <attribute-mapping dest-attr="cn"
                         context-id="{08F314C0-AC10-46CB-858C-2A84B69663C0}">
        <scripted-mapping>
          <src-attribute>cn</src-attribute>
          <script-context>cd.user:cn-&gt;mv.person:cn</script-context>
        </scripted-mapping>
      </attribute-mapping>
    </context>
  </rules-error-info>
  <extension-error-info>
    <extension-name>test-domExtension.dll</extension-name>
    <extension-callsite>import-flow</extension-callsite>
    <extension-context>cd.user:cn-&gt;mv.person:cn</extension-context>
    <call-stack>Microsoft.MetadirectoryServices.EntryPointNotImplementedException: Error in
the application.     at
Mms_ManagementAgent_test_domExtension.MAExtensionObject.Microsoft.MetadirectoryServices.IMASy
nchronization.MapAttributesForImport(String FlowRuleName, CSEntry csentry, MVEntry mventry)
in C:\Users\Administrator\Documents\test-domExtension\test-domExtension.cs:line 89  </call-
stack>
  </extension-error-info>
</import-status>
```

2.2.6.4.12 inbound-flow-counters Element

The inbound-flow-counters element contains statistical counters gathered during an import synchronization operation. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="inbound-flow-counters">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="disconnector-filtered"
       type="counterDetailTrueType"
       maxOccurs="1"
       minOccurs="1"
       />
      <xs:element name="disconnector-joined-no-flow"
       type="counterDetailTrueType"
       maxOccurs="1"
       minOccurs="1"
```

```
 />
<xs:element name="disconnector-joined-flow"
  type="counterDetailTrueType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="disconnector-joined-remove-mv"
  type="counterDetailTrueType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="disconnector-projected-no-flow"
  type="counterDetailTrueType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="disconnector-projected-flow"
  type="counterDetailTrueType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="disconnector-projected-remove-mv"
  type="counterDetailTrueType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="disconnector-remains"
  type="counterDetailFalseType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="connector-filtered-remove-mv"
  type="counterDetailTrueType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="connector-filtered-leave-mv"
  type="counterDetailTrueType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="connector-flow"
  type="counterDetailTrueType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="connector-flow-remove-mv"
  type="counterDetailTrueType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="connector-no-flow"
  type="counterDetailTrueType"
  maxOccurs="1"
  minOccurs="1"
 />
<xs:element name="connector-delete-remove-mv"
  type="counterDetailTrueType"
  maxOccurs="1"
```

```
        minOccurs="1"
       />
      <xs:element name="connector-delete-leave-mv"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="connector-delete-add-processed"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="flow-failure"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
disconnector-filtered	counterDetailTrueType	This element contains information about the number of disconnectors that were run through the connector filter and marked as filtered disconnectors. **@detail**: This MUST be true.
disconnector-joined-no-flow	counterDetailTrueType	This element contains information about the number of disconnectors that were successfully joined by the synchronization engine for which there was no attribute changes flowed to the metaverse. **@detail**: This MUST be true.
disconnector-joined-flow	counterDetailTrueType	This element contains information about the number of disconnectors that were successfully joined by the synchronization engine for which attribute changes flowed to the metaverse. **@detail**: This MUST be true.
disconnector-joined-remove-mv	counterDetailTrueType	This element contains the number of disconnectors that the synchronization engine joined to metaverse objects in the first part of the synchronization process, but removed during deprovisioning. **@detail**: This MUST be true.
disconnector-projected-no-flow	counterDetailTrueType	This element contains information about the number of disconnectors that were projected by the synchronization engine for which there was no import attribute flow to the metaverse. **@detail**: This MUST be true.
disconnector-	counterDetailTrueType	This element contains information about the number of disconnectors that were projected by the synchronization

Element	Type	Description
projected-flow		engine for which attribute changes flowed to the metaverse. **@detail**: This MUST be true.
disconnector-projected-remove-mv	counterDetailTrueType	This element contains the number of disconnectors that the synchronization engine tried to project to the metaverse, but in the process of provisioning, an object was disconnected that resulted in the deletion of the metaverse object. **@detail**: This MUST be true.
disconnector-remains	counterDetailFalseType	This element contains information about the number of disconnectors that successfully passed the connector filter test, but which remain as normal disconnectors in the connector space because there were no rules calling for them to project or join. **@detail**: This MUST be false.
connector-filtered-remove-mv	counterDetailTrueType	This element contains information about the number of connectors that were disconnected by the connector filter on this pass where the metaverse object was removed. **@detail**: This MUST be true.
connector-filtered-leave-mv	counterDetailTrueType	This element contains information about the number of connectors that were disconnected by the connector filter on this pass but the metaverse object was left in place. **@detail**: This MUST be true.
connector-flow	counterDetailTrueType	This element contains information about the number of connectors that passed the connector filter test and remained connectors, and contained new or changed values which flowed to the metaverse. **@detail**: This MUST be true.
connector-flow-remove-mv	counterDetailTrueType	This element contains the number of existing connectors that meet the following conditions: ▪ Passed the connector filter test. ▪ Import attribute flow rules applied to these connectors. ▪ Their metaverse object was removed because the provisioning extension disconnected the connectors joined to that metaverse object. **@detail**: This MUST be true.
connector-no-flow	counterDetailTrueType	This element contains information about the number of connectors that passed the connector filter test and remained connectors. When import attribute flow was applied to these connectors, no attributes flowed to the metaverse. **@detail**: This MUST be true.
connector-delete-remove-	counterDetailTrueType	This element contains information about the number of connectors that were deleted on this pass where the

Element	Type	Description
mv		metaverse object was removed. **@detail**: This MUST be true.
connector-delete-leave-mv	counterDetailTrueType	This element contains information about the number of connectors that were deleted on this pass where the metaverse object was left in place. **@detail**: This MUST be true.
connector-delete-add-processed	counterDetailTrueType	This element contains information about the number of connectors for which delete-add processing was performed. **@detail**: This MUST be true.
flow-failure	counterDetailTrueType	This element contains information about the number of synchronization failures. **@detail**: This MUST be true.

2.2.6.4.13 ma-discovery-errors Element

The ma-discovery-errors element contains information about specific object errors that occurred while the management agent was reading data from the data source. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="ma-discovery-errors">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ma-object-error"
        minOccurs="1"
        maxOccurs="unbounded"
      >
        <xs:complexType>
          <xs:sequence>
            <xs:element name="error-type"
              type="discoveryErrorType"
             />
            <xs:element name="entry-number"
              type="xs:unsignedInt"
              maxOccurs="1"
              minOccurs="0"
             />
            <xs:element name="line-number"
              type="xs:unsignedInt"
              maxOccurs="1"
              minOccurs="0"
             />
            <xs:element name="column-number"
              type="xs:unsignedInt"
              maxOccurs="1"
              minOccurs="0"
             />
            <xs:element name="dn"
              type="xs:string"
              maxOccurs="1"
              minOccurs="0"
             />
            <xs:element name="anchor"
```

```
            type="xs:string"
            maxOccurs="1"
            minOccurs="0"
           />
          <xs:element name="attribute-name"
            type="xs:string"
            maxOccurs="1"
            minOccurs="0"
           />
          <xs:element name="cd-error"
            maxOccurs="1"
            minOccurs="0"
          >
            <xs:complexType>
              <xs:sequence>
                <xs:element name="error-literal"
                  type="xs:string"
                 />
              </xs:sequence>
            </xs:complexType>
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
 </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
ma-object-error	N/A	Details about the object error that occurred.
error-type	**discoveryErrorType**	The type of discovery error. This MUST be a value specified in section 2.2.6.2.6.
entry-number	xs:unsignedInt	A count of the number of entries in the object. This MUST be present if the ma-discovery-errors/ma-object-error/error-type element has the value "parse-error".
line-number	xs:unsignedInt	The line number of the input file at or near where the problem occurred. This MUST be present if the management agent is reading import data from a file and the ma-discovery-errors/ma-object-error/error-type element has the value "parse-error".
column-number	xs:unsignedInt	The column number of the input file at or near where the problem occurred. This element MUST be present if the management agent is reading import data from a file and the ma-discovery-errors/ma-object-error/error-type element has the value "parse-error".
dn	xs:string	The distinguished name of the object, if available.
anchor	xs:string	The anchor value of the object. This MUST be base64-encoded if any of the following are true, otherwise it MUST be stored as a

Element	Type	Description
		string. ▪ The length of the anchor value is less than two bytes. ▪ The length of the anchor value is two bytes and the value is 0x0000. ▪ The anchor value is not terminated with 0x0000. ▪ Any character value in the anchor is less than 0x0020. ▪ Any character value in the anchor is greater than 0x007E.
attribute-name	xs:string	The name of the attribute that resulted in the discovery error.
cd-error	N/A	The error reported by the connected directory.
error-literal	xs:string	The literal error string returned from the data source for the error.

The following is an example of the ma-discovery-errors element:

```
<ma-discovery-errors>
  <ma-object-error>
    <error-type>missing-change-type</error-type>
    <entry-number>35</entry-number>
    <dn>CN=User1,DN=fabrikam,DN=com</dn>
    <anchor>d1465d5d-9a46-4e48-b653-ec2cf7dd7023</anchor>
  </ma-object-error>
</ma-discovery-errors>
```

2.2.6.4.14 mv-retry-errors Element

The mv-retry-errors element contains information about objects that could not be synchronized. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="mv-retry-errors">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="retry-error"
        minOccurs="0"
        maxOccurs="unbounded"
      >
        <xs:complexType>
          <xs:sequence>
            <xs:element name="date-occurred"
              type="DateTimeValue"
              maxOccurs="1"
              minOccurs="1"
             />
            <xs:element name="error-type"
              type="importAndMVRetryErrorType"
              maxOccurs="1"
              minOccurs="1"
```

```
            />
           <xs:element name="algorithm-step"
             type="algorithmStepType"
             maxOccurs="1"
             minOccurs="1"
            />
           <xs:element name="extension-error-info"
             type="extensionErrorInfoType"
             maxOccurs="1"
             minOccurs="0"
            />
           <xs:element name="rules-error-info"
             type="rulesErrorInfoType"
             maxOccurs="1"
             minOccurs="0"
            />
         </xs:sequence>
         <xs:attribute name="mvGuid"
           type="xs:string"
           use="required"
          />
         <xs:attribute name="displayName"
           type="xs:string"
           use="required"
          />
       </xs:complexType>
     </xs:element>
   </xs:sequence>
 </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
retry-error	N/A	This element contains information about a specific error instance. **@displayName**: The displayName of the metaverse object which requires retry.
date-occurred	DateTimeValue	The UTC time that the error occurred.
error-type	importAndMVRetryErrorType	This value indicates the type of error that occurred. This MUST be a value specified in section 2.2.6.2.12.
algorithm-step	algorithmStepType	The stage of synchronization where the error occurred. This MUST be a value specified in section 2.2.6.2.1. **@ma**: This is the management agent name. **@dn**: This is the distinguished name (DN) of the connector space object.
extension-error-info	extensionErrorInfoType	This element contains detailed context information for an error generated from a rules extension.
rules-error-info	rulesErrorInfoType	This element contains detailed context information for the rule that was executing when the error was

Element	Type	Description
		generated.

Attributes

Name	Type	Description
mvGuid	xs:string	The GUID of the metaverse object that requires retry.
displayName	xs:string	The displayName of the metaverse object that requires retry.

2.2.6.4.15 outbound-flow-counters Element

The outbound-flow-counters element contains statistical counters for outbound synchronization operations. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="outbound-flow-counters">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="provisioned-add-no-flow"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="0"
       />
      <xs:element name="provisioned-add-flow"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="0"
       />
      <xs:element name="provisioned-rename-no-flow"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="0"
       />
      <xs:element name="provisioned-rename-flow"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="0"
       />
      <xs:element name="provisioned-disconnect"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="0"
       />
      <xs:element name="connector-flow"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="0"
       />
      <xs:element name="connector-no-flow"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="0"
       />
      <xs:element name="provisioned-delete-add-no-flow"
        type="counterDetailTrueType"
```

```
        maxOccurs="1"
        minOccurs="0"
       />
      <xs:element name="provisioned-delete-add-flow"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="0"
       />
    </xs:sequence>
    <xs:attribute name="ma"
      type="xs:string"
      use="required"
     />
    <xs:attribute name="ma-id"
      type="guidType"
      use="required"
     />
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
provisioned-add-no-flow	counterDetailTrueType	This element contains information about the number of newly provisioned connectors that were added to the connector space of this management agent. These connectors might not have export attribute flow from metaverse to connector space; the provisioning process might have set some initial values at the time of provisioning. This element MUST be present if the number of newly provisioned connectors without attribute flow is greater than 0. **@detail**: This MUST be true.
provisioned-add-flow	counterDetailTrueType	This element contains information about the number of newly provisioned connectors that were added to the connector space of this management agent. These connectors might contain some actual export attribute flow from metaverse to connector space, in addition to initial values the provisioning process might have set at the time of provisioning. This element MUST be present if the number of newly provisioned connectors with attribute flow is greater than 0. **@detail**: This MUST be true.
provisioned-rename-no-flow	counterDetailTrueType	This element contains information about the number of provisioned renames during this management agent run where there was no actual export attribute flow from metaverse to connector space. This element MUST be present if the number of provisioned renames without attribute flow is greater than 0. **@detail**: This MUST be true.
provisioned-rename-flow	counterDetailTrueType	This element contains information about the number of provisioned renames during this run management agent where export attributes flowed from the metaverse to the connector space. This element MUST be present if the number of

Element	Type	Description
		provisioned renames with attribute flow is greater than 0. **@detail**: This MUST be true.
provisioned-disconnect	counterDetailTrueType	This element contains information about the number of provisioned disconnects during this run. This element MUST be present if the number of provisioned disconnects is greater than 0. **@detail**: This MUST be true.
connector-flow	counterDetailTrueType	This element contains information about the number of connectors where export attribute flowed attributes from the metaverse to this object. This element MUST be present if the number of connectors with export attribute flow is greater than 0. **@detail**: This MUST be true.
connector-no-flow	counterDetailTrueType	This element contains information about the number of connectors where export attribute flow was attempted but there was no attribute flow. This element MUST be present if the number of connectors without export attribute flow is greater than 0. **@detail**: This MUST be true.
provisioned-delete-add-no-flow	counterDetailTrueType	This element contains information about the number of provisioned delete-adds where export attribute flow was attempted but there was no attribute flow. This element MUST be present if the number of provisioned delete-adds without export attribute flow is greater than 0. **@detail**: This MUST be true.
provisioned-delete-add-flow	counterDetailTrueType	This element contains information about the number of provisioned delete-adds where export attribute flowed attributes from the metaverse to this object. This element MUST be present if the number of provisioned delete-adds with export attribute flow is greater than 0. **@detail**: This MUST be true.

Attributes

Name	Type	Description
ma	xs:string	The display name of the management agent.
ma-id	guidType	The GUID of the management agent.

2.2.6.4.16 partition Element

The **partition** element specifies the name of the management agent partition for the run profile step.

```
<xs:element name="partition"
  type="xs:string"
 />
```

This element MUST be present with a <step> element (section 2.2.6.4.22).

2.2.6.4.17 password-change-history Element

The password-change-history element contains information about the password operations that were performed through the WMI interface of the synchronization engine on a connector space object. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="password-change-history">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="event"
        maxOccurs="unbounded"
      >
        <xs:complexType>
          <xs:sequence>
            <xs:element name="change-type"
              type="changeType"
              maxOccurs="1"
              minOccurs="1"
             />
            <xs:element name="time"
              type="DateTimeValue"
              maxOccurs="1"
              minOccurs="1"
             />
            <xs:element name="performed-by"
              type="xs:string"
              maxOccurs="1"
              minOccurs="1"
             />
            <xs:element name="error-code"
              type="xs:string"
              maxOccurs="1"
              minOccurs="1"
             />
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
event	N/A	The event record for an individual password operation event. The maximum number of operations that the server will maintain is stored in the mms_server_configuration table, but this structure itself is unbounded.

Element	Type	Description
change-type	changeType	The type of password operation that was performed. This MUST be a value specified in section 2.2.6.2.3.
time	DateTimeValue	The UTC time of the password operation.
performed-by	xs:string	The person that performed the operation in the format domain\username.
error-code	xs:string	See following table.

Error Codes

Value	Description
success	Success
access-denied	The account that is calling this method is not a member of the FIMSyncPasswordSet group.
bad-password	The specified OldPassword parameter does not match the password for the account.
ma-access-denied	The management agent account does not have the right to set the password.
ma-credentials-failure	The management agent was unable to log on to the connected directory using the stored credentials.
ma-encryption-not-enabled	The management agent did not set the password because 128-bit encryption has not been configured on the connection used by the management agent to communicate with the connected directory.
ma-feature-not-supported	The management agent does not support password changes.
ma-object-type-not-supported	The management agent does not support password changes on this object type.
new-password-ill-formed	The specified new password cannot be used as a password because the parameter contains characters that cannot be entered from a keyboard.
new-password-violate-policy	The specified new password does not comply with the password policy set by the administrator.
object-newly-provisioned	The object has been provisioned as a new object but the object has not been created in the connected directory.
object-not-found	The object has been deleted from the server.
partition-not-configured	The specified object is in a partition that has not yet been configured.
password-sync-disabled	The password synchronization setting for the specified management agent is not enabled.
server-down	The server could not connect to the connected directory.
time-difference-at-dc	The new password cannot be set because the time on the server is more than five minutes from the time on the Active Directory server.

The following is an example of a password-change-history structure with two operations.

```
<password-change-history>
  <event>
    <change-type>SET</change-type>
    <time>2002-12-27 01:23:45.678</time>
    <performed-by>jsmith</performed-by>
    <error-code>success</error-code>
  </event>
  <event>
    <change-type>CHANGE</change-type>
    <time>2002-12-28 05:13:35.008</time>
    <performed-by>jsmith</performed-by>
    <error-code>bad-password</error-code>
  </event>
</password-change-history>
```

2.2.6.4.18 password-sync Elements

There are two possible schemas for the <password-sync> element, depending on the context:

- A <password-sync> element (section 2.2.6.4.18.1) that contains information specifying the password synchronization settings for a management agent partition. This element is used in the **mms_partition** table (section 2.2.5.12).
- A <password-sync> element (section 2.2.6.4.18.2) that specifies whether password synchronization is enabled in the synchronization engine. This element is used in the **mms_server_configuration** table (section 2.2.5.15).

2.2.6.4.18.1 password-sync Element

The password-sync element contains information specifying the password synchronization settings for a management agent partition. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="password-sync">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="password-sync-source-enabled"
        type="xs:int"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="password-sync-target-mas"
        maxOccurs="1"
        minOccurs="1"
      >
       <xs:complexType>
        <xs:sequence>
          <xs:element name="password-sync-target-ma"
            type="xs:string"
            maxOccurs="unbounded"
            minOccurs="0"
           />
        </xs:sequence>
       </xs:complexType>
```

```
      </xs:element>
      <xs:element name="max-changes-allowed-enabled"
        type="xs:int"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="max-changes-allowed"
        type="xs:int"
        maxOccurs="1"
        minOccurs="1"
       />
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
password-sync-source-enabled	xs:int	A value indicating whether the management agent associated with this partition will process a password change originating from the data source for this partition.
password-sync-target-mas	N/A	A list of management agents that will receive password changes resulting from password changes received from this partition.
password-sync-target-ma	xs:string	The GUID of a management agent that will receive password changes resulting from password changes received from this partition. This GUID MUST exist in the mms_management_agents table.
max-changes-allowed-enabled	xs:int	A value indicating whether the synchronization engine will enforce the number of changes processed within a 24-hour period. This value MUST be 1 (enabled) or 0 (disabled).
max-changes-allowed	xs:int	A value indicating the maximum number of password changed the synchronization engine will allow within a 24-hour period. This value MUST be between 1 and 9999.

2.2.6.4.18.2 password-sync Element

The password-sync element contains information specifying whether password synchronization is enabled in the synchronization engine. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="password-sync">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="password-sync-enabled"
        type="xs:int"
       />
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
password-sync-enabled	xs:int	A value where 1 indicates if password synchronization is enabled in the synchronization engine.

2.2.6.4.19 provisioning-cleanup Element

The provisioning-cleanup element contains information specifying when a connector space object is deleted. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="provisioning-cleanup">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="action"
        maxOccurs="1"
        minOccurs="0"
      >
        <xs:simpleType>
          <xs:restriction
            base="xs:string"
          >
            <xs:enumeration
              value="delete-object"
             />
            <xs:enumeration
              value="make-normal-disconnector"
             />
            <xs:enumeration
              value="make-explicit-disconnector"
             />
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
    </xs:sequence>
    <xs:attribute name="type"
      use="required"
    >
      <xs:simpleType>
        <xs:restriction
          base="xs:string"
        >
          <xs:enumeration
            value="declared"
           />
          <xs:enumeration
            value="scripted"
           />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
action	N/A	**delete-object:** The synchronization engine will stage a delete operation for the data source whenever a connector space object is deleted. **make-normal-disconnector:** The synchronization engine will keep the connector space object as a normal disconnector. **make-explicit-disconnector:** The synchronization engine will keep the connector space object as an explicit disconnector.

Attributes

Name	Type	Description
type	enumeration	The type attribute MUST be one of the following values: **Value** / **Description** declared — Deletion of connector space objects is determined by the action element. scripted — Deletion of connector space objects is determined by the script-based rule extension specified in ma_extension_xml in the mms_management_agent table, and the action element MUST NOT be present.

2.2.6.4.20 provisioning Element

The provisioning element contains information specifying when a connector space object is created. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="provisioning">
  <xs:complexType>
    <xs:attribute name="type"
      use="required"
    >
      <xs:simpleType>
        <xs:restriction
          base="xs:string"
        >
          <xs:enumeration
            value="both"
          />
          <xs:enumeration
            value="none"
          />
          <xs:enumeration
            value="scripted"
          />
          <xs:enumeration
            value="sync-rule"
          />
        </xs:restriction>
      </xs:simpleType>
    </xs:attribute>
  </xs:complexType>
```

```
</xs:element>
```

Attributes

Name	Type	Description
type	enumeration	The type attribute MUST be one of the following: **Value** / **Description** both — The synchronization engine will first process synchronization rule provisioning, and the process scripted provisioning. none — The synchronization engine will not provision new connector space objects. scripted — The extension specified in mv_extension_dll_xml of mms_server_configuration will determine when to create connector space objects in response to metaverse object changes. sync-rule — The synchronization rules defined in the metaverse will determine when to create connector space objects in response to metaverse object changes.

2.2.6.4.21 staging-counters Element

The staging-counters element contains statistical counters of the staging operations performed. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="staging-counters">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="stage-no-change"
        type="counterDetailFalseType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="stage-add"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="stage-update"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="stage-rename"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="stage-delete"
```

```
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="stage-delete-add"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
      <xs:element name="stage-failure"
        type="counterDetailTrueType"
        maxOccurs="1"
        minOccurs="1"
       />
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
stage-no-change	counterDetailFalseType	This element contains information about the number of imported entries that were not changed. **@detail**: This MUST be false.
stage-add	counterDetailTrueType	This element contains information about the number of imported entries that were added to the connector space. **@detail**: This MUST be true.
stage-update	counterDetailTrueType	This element contains information about the number of imported entries that were updated that were updated in the connector space. **@detail**: This MUST be true.
stage-rename	counterDetailTrueType	This element contains information about the number of imported entries that were renamed in the connector space. **@detail**: This MUST be true.
stage-delete	counterDetailTrueType	This element contains information about the number of imported entries that were deleted from the connector space **@detail**: This MUST be true.
stage-delete-add	counterDetailTrueType	This element contains information about the number of imported entries that were deleted then added in the connector space. **@detail**: This MUST be true.
stage-failure	counterDetailTrueType	This element contains information about the number of import entry failures. **@detail**: This MUST be true.

2.2.6.4.22 step Element

The **step element** contains information about a run profile step. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="step">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="step-type">
        <xs:complexType
          mixed="true"
        >
          <xs:sequence
            minOccurs="0"
          >
            <xs:element name="apply-rules-subtype"
              type="applyRulesSubtype"
              minOccurs="0"
             />
            <xs:element name="export-subtype"
              type="exportSubType"
              minOccurs="0"
             />
            <xs:element name="import-subtype"
              type="importSubType"
              minOccurs="0"
             />
          </xs:sequence>
          <xs:attribute name="type"
            type="stepType"
            use="required"
           />
        </xs:complexType>
      </xs:element>
      <xs:element
        ref="threshold"
       />
      <xs:element
        ref="partition"
       />
      <xs:element
        ref="dropfile-name"
       />
      <xs:element
        ref="custom-data"
       />
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
step-type	N/A	The type of run profile step, including subtypes used in synchronization, export, and import run steps.

Element	Type	Description
apply-rules-subtype	**applyRulesSubtype**	The scope when the synchronization engine is performing a synchronization operation. This element MUST be present if the **step-type/@type** attribute is "apply-rules"; otherwise, it MUST NOT be present. If present, this MUST be a value specified in section 2.2.6.2.2.
export-subtype	**exportSubType**	The scope of an export operation. If this element is not present, the export will go directly to the data source. If this element is present, it MUST be a value specified in section 2.2.6.2.9.
import-subtype	**importSubType**	The scope of an import operation. If this element is not present, the import will go from the data source all the way to the metaverse. If this element is present, it MUST be a value specified in section 2.2.6.2.13.
threshold	**threshold**	The maximum number of objects to process.
partition	**partition**	The name of the management agent partition.
dropfile-name	**dropfile-name**	The file name of the drop file.
custom-data	**custom-data**	The management agent specific data.

Attributes

Name	Type	Description
type	**stepType**	The type of run profile step. This MUST be a value specified in section 2.2.6.2.14.

2.2.6.4.23 synchronization-errors Element

The synchronization-errors element contains import-error elements and/or export-error elements. It MUST have at least one import-error or export-error. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="synchronization-errors">
  <xs:complexType>
    <xs:sequence>
      <xs:element
        maxOccurs="unbounded"
        minOccurs="0"
        ref="import-error"
       />
      <xs:element
       maxOccurs="unbounded"
       minOccurs="0"
       ref="export-error"
      />
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
import-error	**import-error**	This MUST be an import-error element as specified in section 2.2.6.4.10.
export-error	**export-error**	This MUST be an export-error element as specified in section 2.2.6.4.7.

2.2.6.4.24 threshold Element

The **threshold** element specifies the threshold for the run profile step, which is the maximum number of objects to process. A value of 0 is used to specify all objects. If this element is not present, then the threshold defaults to all objects.

```
<xs:element name="threshold"
  type="xs:unsignedInt"
 />
```

This element can be present with a <step> element (section 2.2.6.4.22).

2.2.6.4.25 transient-details Element

The **transient-details** element contains information specifying why a connector space object was converted to a transient object. This element is specified via the following XML schema [XMLSCHEMA1] definition:

```
<xs:element name="transient-details">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="date"
        type="DateTimeValue"
       />
      <xs:element name="type"
        type="transientType"
       />
      <xs:element name="existing-anchor"
        type="xs:string"
       />
      <xs:element name="source-dn"
        type="xs:string"
       />
      <xs:element name="source-anchor"
        type="xs:string"
       />
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Child Elements

Element	Type	Description
date	DateTimeValue	The UTC time that the connector space object was converted to a transient object.
type	**transientType**	The type of operation that resulted in the connector space object becoming a transient object. This MUST be a value specified in section 2.2.6.2.15.
existing-anchor	xs:string	The anchor value of the connector space object. This MUST be encoded using base64 encoding, as defined in [RFC4648] section 4, if any of the following are true, otherwise it MUST be stored as a string. ▪ The length of the anchor value is less than two bytes. ▪ The length of the anchor value is two bytes and the value is 0x0000. ▪ The anchor value is not terminated with 0x0000. ▪ Any character value in the anchor is less than 0x0020. ▪ Any character value in the anchor is greater than 0x007E.
source-dn	xs:string	The distinguished name of the connector space object that caused this object to become a transient object.
source-anchor	xs:string	The anchor value of the connector space object that caused this object to become a transient object. This MUST be encoded using base64 encoding as defined in [RFC4648] section 4 if any of the following are true, otherwise it MUST be stored as a string. ▪ The length of the anchor value is less than two bytes. ▪ The length of the anchor value is two bytes and the value is 0x0000. ▪ The anchor value is not terminated with 0x0000. ▪ Any character value in the anchor is less than 0x0020. ▪ Any character value in the anchor is greater than 0x007E.

The following is an example of the <transient-details> element.

```
<transient-details>
  <date>2009-05-29 09:15:43.568</date>
  <type>add</type>
  <existing-anchor>SVZwJp18NEGNHH3NpWTX/w==</existing-anchor>
  <source-dn>CN=User1,OU=Users,DN=Fabrikam,DN=com</source-dn>
  <source-anchor>SRI0fDRBRnylZNf/obYLMg==</source-anchor>
</transient-details>
```

2.2.6.5 Attributes

This specification does not define any common XML schema attribute definitions.

2.2.6.6 Groups

This specification does not define any common XML schema group definitions.

2.2.6.7 Attribute Groups

This specification does not define any common XML schema attribute group definitions.

3 Protocol Details

3.1 Server Details

The back-end database server responds to stored procedure calls and T-SQL statements from the client. The server returns result sets and return codes to the client. The server never initiates communication with other endpoints of the protocol.

3.1.1 Abstract Data Model

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

The synchronization engine is the client in this protocol, and the back-end database server (BEDS) is the server. In addition to using the stored procedures documented in section 3.1, the synchronization engine can construct dynamic T-SQL statements to create, read, update, or delete data in the BEDS. The dynamic queries MUST conform to the table definitions as specified in section 2.2.5.

The BEDS stores configuration data for the server that defines

- management agents
- run profiles
- server configuration (global server settings)
- scripted rules extensions

The BEDS stores connector space objects and maintains the state of those objects for import, synchronization, and export operations. A connector space object cannot reference another connector space object unless the referenced object exists in the connector space table, or a placeholder connector space object has been created to hold the reference. The connector space can be logically partitioned to segment the processing of operations against the connector space.

The BEDS stored metaverse objects. Metaverse objects MUST NOT exist unless they are referenced by at least one connector space object. A metaverse object cannot reference another metaverse object unless the referenced object exists in the metaverse table. The metaverse does not support placeholder objects. The metaverse maintains lineage data that tells which management agent created a metaverse object and when it was created. The metaverse maintains which management agent contributed a given attribute, and when it was most recently updated.

The BEDS stores run profile definitions that are a collection of sequences operations that SHOULD be performed by the synchronization engine every time it executes the run profile definition. The detailed results of the run profile execution are stored in the run history.

3.1.2 Timers

None.

3.1.3 Initialization

A connection that uses the underlying protocol layers MUST be established before using this protocol, as specified in [MS-TDS].

3.1.4 Higher-Layer Triggered Events

None.

3.1.5 Message Processing Events and Sequencing Rules

Unless specified otherwise, GUID parameters in the stored procedures defined in this section are the **uniqueidentifier** data type [MSTSQL], which uses the string form of universally unique identifier (UUID) ([RFC4122] section 3).

3.1.5.1 mms_addcslink

This stored procedure adds a reference link from one connector space object to another connector space object. The objects MUST be in the same connector space (that is, they MUST have the same ma_id).

```
PROCEDURE mms_addcslink (
@objid uniqueidentifier,
@csref_id uniqueidentifier,
@attr nvarchar(128),
@rstate int,
);
```

@objid: A GUID uniquely identifying the source connector space object. This object MUST exist in the connector space table.

@csref_id: A GUID uniquely identifying the referenced connector space object. This object MUST exist in the connector space table and have the same ma_id as the source connector space object.

@attr: The name of the reference attribute. This MUST be a reference attribute as defined in the management agent schema.

@rstate: The link state flag. This MUST be a valid value as defined in section 2.2.2.10.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.2 mms_addcsobj

This stored procedure adds a placeholder connector space object.

```
PROCEDURE mms_addcsobj (
@guidMA uniqueidentifier,
@pobjid uniqueidentifier,
@ancestor varbinary(944),
@rdn nvarchar(438),
@depth int,
@objid uniqueidentifier OUTPUT,
);
```

@guidMA: A GUID uniquely identifying the management agent. This MUST be a valid ma_id value from the mms_management_agent table.

@pobjid: A GUID uniquely identifying the parent connector space object. The parent object MUST exist in the connector space. The parent object MUST have the same ma_id as the connector space object being added. If this is a root object, there will be no parent, in which case this MUST be 00000000-0000-0000-0000-000000000000.

@ancestor: A binary value containing the object_id values of all direct ancestor records from the root node down to the immediate parent of this object. For objects without a parent, this MUST be 0x0.

@rdn: A string containing the relative distinguished name of this connector space object. This MUST include the distinguished name qualifier, such as CN=.

@depth: The depth of this object in the hierarchy. Root objects are at a depth of 1.

@objid: This will receive the newly created connector space object_id value.

Value	Description
newid	A newly created GUID that is returned in the @objid parameter.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.3 mms_addcsobjwithpartition

This stored procedure adds a placeholder connector space object and associates it with a specific partition.

```
PROCEDURE mms_addcsobjwithpartition (
@guidMA uniqueidentifier,
@pobjid uniqueidentifier,
@guidPartition uniqueidentifier,
@ancestor varbinary(944),
@rdn nvarchar(438),
@depth int,
@objid uniqueidentifier OUTPUT,
);
```

@guidMA: A GUID uniquely identifying the management agent. This MUST be a valid ma_id value from the mms_management_agent table.

@pobjid: A GUID uniquely identifying the parent connector space object. The parent object MUST exist in the connector space. The parent object MUST have the same ma_id as the connector space object being added. If this is a root object, there will be no parent, in which case this MUST be 00000000-0000-0000-0000-000000000000.

@guidPartition: A GUID uniquely identifying the partition. This MUST be a valid parition_id value from the mms_partition table. The partition MUST have the same ma_id as the connector space object.

@ancestor: A binary value containing the object_id values of all direct ancestor records from the root node down to the immediate parent of this object. For objects without a parent, this MUST be 0x0.

@rdn: A string containing the relative distinguished name of this connector space object. This MUST include the distinguished name qualifier, such as CN=.

@depth: The depth of this object in the hierarchy. Root objects are at a depth of 1.

@objid: This will receive the newly created connector space object_id value.

Value	Description
newid	A newly created GUID that is returned in the @objid parameter.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.4 mms_addextensions

This stored procedure adds an extension DLL to the mms_extensions table.

```
PROCEDURE mms_addextensions (
@name nvarchar(260),
@size bigint,
@time datetime,
@content image,
);
```

@name: The name of the extension. This MUST NOT include the path.

@size: This MUST be the size of the extension in bytes.

@time: This MUST be the file time of the extension.

@content: The binary contents of the extension DLL.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.5 mms_addmvlink

This stored procedure adds a reference from one metaverse object to another metaverse object.

```
PROCEDURE mms_addmvlink (
@mvobj_id uniqueidentifier,
@mvref_id uniqueidentifier,
@attr nvarchar(128),
@lineage_id uniqueidentifier,
@date datetime,
);
```

@mvobj_id: A GUID uniquely identifying the source metaverse object. This MUST be an object_id from the mms_metaverse table.

@mvref_id: A GUID uniquely identifying the referenced metaverse object. This MUST be an object_id from the mms_metaverse table.

@attr: The name of the attribute. This MUST be an attribute defined in the metaverse schema as a reference attribute.

@lineage_id: A GUID uniquely identifying the lineage record in the mms_lineage_cross_reference table. This MUST be a lineage_id from the mms_lineage_cross_reference table.

@date: This MUST be the current UTC time.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.6 mms_addstepobjectdetails

This stored procedure adds a detail record to a specified step of a run.

```
PROCEDURE mms_addstepobjectdetails (
@stepid uniqueidentifier,
@statstype int,
@mastatstype int,
@guidCs uniqueidentifier,
@csdn ntext,
);
```

@stepid: A GUID uniquely identifying the run step associated with this detail record. This MUST be from an existing record in the mms_step_history table.

@statstype: A number indicating which synchronization statistic values incremented while processing this object. This MUST be a value specified in section 2.2.2.18.

@mastatstype: A number indicating which management agent statistic values were incremented while processing this object. This MUST be a value specified in section 2.2.2.12.

@guidCs: A GUID uniquely identifying the connector space object associated with this step object details record. This MUST be the GUID of a connector space object in the same management agent and partition as specified by the parent record in the mms_step_history table.

@csdn: The distinguished name of the connector space object. This MUST be present.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.7 mms_addstepobjectdetails_guidma

This stored procedure adds a detail record to a specified step of a run.

```
PROCEDURE mms_addstepobjectdetails_guidma (
@stepid uniqueidentifier,
@statstype int,
```

```
@mastatstype int,
@guidCs uniqueidentifier,
@csdn ntext,
@guidMa uniqueidentifier,
);
```

@stepid: A GUID uniquely identifying the run step associated with this detail record. This MUST be from an existing record in the mms_step_history table.

@statstype: A number indicating which synchronization statistic values incremented while processing this object. This MUST be a value specified in section 2.2.2.18.

@mastatstype: A number indicating which management agent statistic values were incremented while processing this object. This MUST be a value specified in section 2.2.2.12.

@guidCs: A GUID uniquely identifying the connector space object associated with this step object details record. This MUST be the GUID of a connector space object in the same management agent and partition as specified by the parent record in the mms_step_history table.

@csdn: The distinguished name of the connector space object. This MUST be present.

@guidMa: A GUID uniquely identifying the management agent associated with this connector space object. This MUST be a ma_id from the mms_management_agent table and it MUST be the same ma_id that is assigned to the connector space object identified by @guidCs.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.8 mms_CleanupPendingRefDeletesOnCsLinks

This stored procedure cleans up connector space references that have been marked as deleted. If the @cleanupImport bit is specified, then all links for the pending import image, as specified in section 2.2.2.10, will be deleted. If this @cleanupHologram bit is specified, then all remaining links will have the is_deleted flag cleared.

If there are no records with a matching @objid, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_CleanupPendingRefDeletesOnCsLinks (
@objid uniqueidentifier,
@cleanupHologram bit,
@cleanupImport bit,
);
```

@objid: A GUID uniquely identifying the connector space object.

@cleanupHologram: A bit where a value of 1 indicates that the server is performing hologram processing, so all links that are flagged for deletion SHOULD be cleared.

@cleanupImport: A bit where a value of 1 indicates that the server is performing import processing, so all pending import links with the is_deleted set SHOULD be deleted.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.9 mms_CleanupPendingRefRenamesOnCsLinks

This stored procedure clears the is_renamed flag on all connector space references for a specified connector space object.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_CleanupPendingRefRenamesOnCsLinks (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.10 mms_clearmvretryflags

This stored procedure clears the retry flags on a specified metaverse object.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_clearmvretryflags (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.11 mms_clearstaleexportfailuresxml

This stored procedure clears the export error detail information from the connector space objects in a specified partition where the current_export_batch_number is less than or equal to the specified successful batch number.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_clearstaleexportfailuresxml (
@guidPartition uniqueidentifier,
@successfulbatch numeric(10,0),
);
```

@guidPartition: A GUID uniquely identifying the partition whose connector spaces object export error detail will be cleared.

@successfulbatch: The last successfully exported batch number for the partition.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.12 mms_deleteallhologramcslink

This stored procedure deletes all hologram connector space references for the specified connector space object.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deleteallhologramcslink (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.13 mms_deletecslinks

This stored procedure deletes all connector space references for the specified connector space object.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deletecslinks (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.14 mms_deleteexportcslinks

This stored procedure deletes all export connector space references for the specified connector space object.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deleteexportcslinks (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.15 mms_deleteexportcslinksattribute

This stored procedure deletes all export connector space references for the specified attribute name and connector space object.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deleteexportcslinksattribute (
@objid uniqueidentifier,
@attrCS nvarchar(128),
);
```

@objid: A GUID uniquely identifying the connector space object.

@attrCS: The attribute name.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.16 mms_deleteholegramcslink

This stored procedure deletes a specific hologram connector space reference for a specific attribute from a connector space object.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deleteholegramcslink (
@objid uniqueidentifier,
@csref_id uniqueidentifier,
@attr nvarchar(128),
);
```

@objid: A GUID uniquely identifying the connector space object.

@csref_id: A GUID uniquely identifying the referenced connector space object.

@attr: The attribute name.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.17 mms_deleteimportcslinks

This stored procedure deletes all import connector space references for the specified connector space object.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deleteimportcslinks (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.18 mms_deleteimportcslinksattribute

This stored procedure deletes all hologram and import connector space references for the specified attribute name and connector space object.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deleteimportcslinksattribute (
@objid uniqueidentifier,
@attrCS nvarchar(128),
);
```

@objid: A GUID uniquely identifying the connector space object.

@attrCS: The attribute name.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.19 mms_deletemvlink

This stored procedure deletes a single reference link from a metaverse object.

If there are no records with a matching parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deletemvlink (
@mvobj_id uniqueidentifier,
@mvref_id uniqueidentifier,
@attr nvarchar(128),
);
```

@mvobj_id: A GUID uniquely identifying the metaverse object.

@mvref_id: A GUID uniquely identifying the referenced metaverse object.

@attr: The attribute name.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.20 mms_deletependingimportcslinks

This stored procedure deletes all import connector space references for the connector space object.

If there are no records matching the parameters, the BEDS MUST leave the database in an unchanged state.

```
PROCEDURE mms_deletependingimportcslinks (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.21 mms_deletephantoms

This stored procedure deletes all phantom connector space objects for the specified management agent where the phantom objects are no longer referenced by other connector space objects and are not parents to any other connector space objects.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deletephantoms (
@ma_id uniqueidentifier,
);
```

@ma_id: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.22 mms_deleterunhistory

This stored procedure deletes all run history records for the specified management agent.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deleterunhistory (
@guidMa uniqueidentifier,
);
```

@guidMa: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.23 mms_deletestephistory

This stored procedure deletes all run history step records for the specified management agent. This MUST be called before calling mms_deleterunhistory.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deletestephistory (
@guidMa uniqueidentifier,
);
```

@guidMa: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.24 mms_deletestepobjectdetails

This stored procedure deletes all run history step object detail records for the specified management agent. This MUST be called before calling mms_deletestephistory.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_deletestepobjectdetails (
@guidMa uniqueidentifier,
);
```

@guidMa: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.25 mms_fixbatchnumbersfortransients

This stored procedure updates the export batch number equal to the specified current batch number for all transient objects in a partition where the current export batch number is greater than the specified successful batch number.

If there are no records matching the parameters, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_fixbatchnumbersfortransients (
@partitionid uniqueidentifier,
@currentbatch numeric(10,0),
@successfulbatch numeric(10,0),
);
```

@partitionid: A GUID uniquely identifying the partition.

@currentbatch: The current batch number to be applied to the export batch number.

@successfulbatch: The successful batch number.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.26 mms_fixpobjidforimmediatechildren

This stored procedure moves all immediate children of a parent connector space object to another parent connector space object.

If there are no records matching the @guidFrom parameter, the back-end database server (BEDS) MUST leave the database in an unchanged state.

```
PROCEDURE mms_fixpobjidforimmediatechildren (
@guidFrom uniqueidentifier,
@guidTo uniqueidentifier,
);
```

@guidFrom: A GUID uniquely identifying the original parent connector space object.

@guidTo: A GUID uniquely identifying the new parent connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.27 mms_flowreftomvall

This stored procedure rebuilds all metaverse links for a specified metaverse object and attribute from a specified connector space object and attribute. The procedure first deletes the existing metaverse links. The procedure then translates all hologram links to the specified connector space object into matching metaverse link records.

If a valid metaverse object and attribute are specified, the existing metaverse links MUST be removed, irrespective of whether the connector space object and attribute are valid.

```
PROCEDURE mms_flowreftomvall (
@csobj_id uniqueidentifier,
@mvobj_id uniqueidentifier,
@attr_cs nvarchar(128),
@attr_mv nvarchar(128),
@lineage_id uniqueidentifier,
@date datetime,
);
```

@csobj_id: A GUID uniquely identifying the connector space object.

@mvobj_id: A GUID uniquely identifying the metaverse object.

@attr_cs: The connector space attribute name.

@attr_mv: The metaverse attribute name.

@lineage_id: A GUID uniquely identifying the lineage record in the mms_lineage_cross_reference table.

@date: The UTC time that this operation was performed.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.28 mms_getchildcountforcsobj

This stored procedure retrieves the count of all connector space objects having the specified parent object identifier.

```
PROCEDURE mms_getchildcountforcsobj (
@guid uniqueidentifier,
@count int OUTPUT,
);
```

@guid: A GUID uniquely identifying the parent connector space object. To count root objects, specify 00000000-0000-0000-0000-000000000000. To count transient objects, specify 00000000-0000-0000-0000-000000000001.

@count: An integer parameter that receives the count.

Value	Description
mms_connectorspace.count	The count of child connector space objects.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.29 mms_getcsexportdeletecount

This stored procedure returns a count of all connector space objects in the specified partition that have a pending export delete or export delete-add operation, and are not transient objects.

```
PROCEDURE mms_getcsexportdeletecount (
@partitionid uniqueidentifier,
@successfulbatch numeric(10,0),
@currentbatch numeric(10,0),
@count int OUTPUT,
);
```

@partitionid: A GUID uniquely identifying the partition.

@successfulbatch: The last successful batch number exported from this management agent.

@currentbatch: The current batch number for this management agent.

@count: An integer parameter that receives the count.

Value	Description
mms_connectorspace.count	The count of connector space objects with pending export delete or export delete-add operations.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.30 mms_getcsexportsearchaddmodify

This stored procedure returns a result set containing the connector space identifiers with pending export add or export modify operations. The result set MUST not include transient objects. The result set MUST be ordered by the objects with the fewest references and the shallowest depth first.

```
PROCEDURE mms_getcsexportsearchaddmodify (
@partitionid uniqueidentifier,
@successfulbatch numeric(10,0),
@currentbatch numeric(10,0),
);
```

@partitionid: A GUID uniquely identifying the partition.

@successfulbatch: The last successful batch number exported from this management agent.

@currentbatch: The current batch number for this management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace_ids.ResultSet.

3.1.5.31 mms_getcsexportsearchdelete

This stored procedure returns a result set containing the connector space identifiers with pending export delete or export delete-add operations. The result set MUST not include transient objects. The result set MUST be ordered by the objects with the greatest depth first.

```
PROCEDURE mms_getcsexportsearchdelete (
@partitionid uniqueidentifier,
@successfulbatch numeric(10,0),
@currentbatch numeric(10,0),
);
```

@partitionid: A GUID uniquely identifying the partition.

@successfulbatch: The last successful batch number exported from this management agent.

@currentbatch: The current batch number for this management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace_ids.ResultSet.

3.1.5.32 mms_GetCsFixupCount

This stored procedure retrieves the count of connector space objects within the specified management agent that have references flagged for deletion.

```
PROCEDURE mms_GetCsFixupCount (
@guidMA uniqueidentifier,
@count int OUTPUT,
);
```

@guidMA: A GUID uniquely identifying the management agent.

@count: An integer parameter that receives the count.

Value	Description
mms_cs_link.count	The count of connector space objects with references flagged for deletion.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.33 mms_getcsguidfromanchor

This stored procedure retrieves all connector space object identifiers across all management agents that have the specified anchor value.

```
PROCEDURE mms_getcsguidfromanchor (
@anchor varbinary(800),
);
```

@anchor: A binary anchor value.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace_ids.ResultSet.

3.1.5.34 mms_getcsguidfrommvguid

This stored procedure retrieves the connector space object identifiers for all connector space objects linked to the specified metaverse object.

```
PROCEDURE mms_getcsguidfrommvguid (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getcsguidfrommvguid.ResultSet.

3.1.5.35 mms_GetCSLinkCountForObject

This stored procedure retrieves the count of referenced connector space objects for a specified connector space object. The count includes hologram, import, and export references.

```
PROCEDURE mms_GetCSLinkCountForObject (
@objid uniqueidentifier,
@count int OUTPUT,
);
```

@objid: A GUID uniquely identifying the connector space object.

@count: An integer parameter that receives the count.

Value	Description
mms_cs_link.count	The count of references for the specified connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.36 mms_GetCSLinkIDsForObject

This stored procedure retrieves a list of referenced connector space object identifiers for the specified connector space object.

```
PROCEDURE mms_GetCSLinkIDsForObject (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_GetCSLinkIDsForObject.ResultSet.

3.1.5.37 mms_getcsmvlinkforcs

This stored procedure retrieves the metaverse links for the specified connector space object. The back-end database server (BEDS) MUST maintain a shared read lock on the data until the transaction is committed or rolled back.

```
PROCEDURE mms_getcsmvlinkforcs (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getcsmvlinkforcs.ResultSet.

3.1.5.38 mms_getcsmvlinkforcs_nolock

This stored procedure retrieves the metaverse links for the specified connector space object.

```
PROCEDURE mms_getcsmvlinkforcs_nolock (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getcsmvlinkforcs.ResultSet.

3.1.5.39 mms_getcsmvlinksformv

This stored procedure retrieves the connector space identifier and lineage information for all connector space objects connected to the specified metaverse object. The results are ordered by the management agent identifier. The back-end database server (BEDS) MUST maintain a shared read lock on the data until the transaction is committed or rolled back.

```
PROCEDURE mms_getcsmvlinksformv (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return an mms_getcsmvlinksformv.ResultSet.

3.1.5.40 mms_getcsmvlinksformv_nolock

This stored procedure retrieves the connector space identifier and lineage information for all connector space objects connected to the specified metaverse object. The results are ordered by the management agent identifier.

```
PROCEDURE mms_getcsmvlinksformv_nolock (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getcsmvlinksformv.ResultSet.

3.1.5.41 mms_getcsobjectwithanchorfast

This stored procedure retrieves the parent connector space object identifier and relative distinguished name of a connector space object with the specified anchor value in the specified management agent.

```
PROCEDURE mms_getcsobjectwithanchorfast (
@anchor varbinary(800),
@guidMA uniqueidentifier,
);
```

@anchor: A binary anchor value.

@guidMA: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getcsobjectwithanchorfast.ResultSet.

3.1.5.42 mms_getcsobjectwithguid

This stored procedure returns a connector space object matching the specified connector space object identifier.

```
PROCEDURE mms_getcsobjectwithguid (
@guid uniqueidentifier,
);
```

@guid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.43 mms_getcsobjectwithguid_holdlock

This stored procedure returns a connector space object matching the specified connector space object identifier. The back-end database server (BEDS) MUST maintain a shared read lock on the data until the transaction is committed or rolled back.

```
PROCEDURE mms_getcsobjectwithguid_holdlock (
@guid uniqueidentifier,
);
```

@guid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.44 mms_getcsobjectwithguid_nolock

This stored procedure returns a connector space object matching the specified connector space object identifier. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_getcsobjectwithguid_nolock (
@guid uniqueidentifier,
);
```

@guid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.45 mms_getcsobjectwithguid_xlock

This stored procedure returns a connector space object matching the specified connector space object identifier. The back-end database server (BEDS) MUST maintain an exclusive write lock on the data until the transaction is committed or rolled back.

```
PROCEDURE mms_getcsobjectwithguid_xlock (
@guid uniqueidentifier,
);
```

@guid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.46 mms_getcsobjidphantomlinkwithanchor

This stored procedure retrieves the object identifier, parent object identifier, relative distinguished name, and phantom link flag for the connector space object matching the specified anchor value within the specified management agent.

```
PROCEDURE mms_getcsobjidphantomlinkwithanchor (
@anchor varbinary(800),
@guidMA uniqueidentifier,
@objid uniqueidentifier OUTPUT,
@pobjid uniqueidentifier OUTPUT,
@rdnout nvarchar(438) OUTPUT,
```

```
@phantomlink int OUTPUT,
);
```

@anchor: A binary anchor value.

@guidMA: A GUID uniquely identifying the management agent.

@objid: A GUID receiving the connector space object identifier.

Value	Description
mms_connectorspace.object_id	A GUID uniquely identifying the connector space identifier. If there was a match, this MUST be a value from column object_id of table 2.2.5.1; otherwise, this MUST be NULL.

@pobjid: A GUID receiving the parent connector space object identifier.

Value	Description
mms_connectorspace.pobject_id	A GUID identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001. If there was a match, this MUST be a value from column pobject_id of table 2.2.5.1; otherwise, this MUST be NULL.

@rdnout: The relative distinguished name of the object.

Value	Description
mms_connectorspace.rdn	The relative distinguished name of the object. If there was a match, this MUST be a value from column rdn of table 2.2.5.1; otherwise, this MUST be NULL.

@phantomlink: A bit flag indicating whether this connector space object is a phantom link object.

Value	Description
mms_connectorspace.is_phantom_link	A bit indicating whether this connector space object is a phantom link object. If there was a match, this MUST be a value from column is_phantom_link of table 2.2.5.1; otherwise, this MUST be NULL.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.47 mms_getcsobjidwithanchor

This stored procedure retrieves the object identifier, parent object identifier, and relative distinguished name for the connector space object matching the specified anchor value within the specified management agent.

```
PROCEDURE mms_getcsobjidwithanchor (
```

```
@anchor varbinary(800),
@guidMA uniqueidentifier,
@objid uniqueidentifier OUTPUT,
@pobjid uniqueidentifier OUTPUT,
@rdnout nvarchar(438) OUTPUT,
);
```

@anchor: A binary anchor value.

@guidMA: A GUID uniquely identifying the management agent.

@objid: A GUID receiving the connector space object identifier.

Value	Description
mms_connectorspace.object_id	A GUID uniquely identifying the connector space identifier. If there was a match, this MUST be a value from column object_id of table 2.2.5.1; otherwise, this MUST be NULL.

@pobjid: A GUID receiving the parent connector space object identifier.

Value	Description
mms_connectorspace.pobject_id	A GUID identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001. If there was a match, this MUST be a value from column pobject_id of table 2.2.5.1; otherwise, this MUST be NULL.

@rdnout: The relative distinguished name of the object.

Value	Description
mms_connectorspace.rdn	The relative distinguished name of the object. If there was a match, this MUST be a value from column rdn of table 2.2.5.1; otherwise, this MUST be NULL.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.48 mms_getcsobjidwithrdnpobjid

This stored procedure retrieves the connector space object identifier for the connector space object with the specified parent object identifier and relative distinguished name.

```
PROCEDURE mms_getcsobjidwithrdnpobjid (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
@objid uniqueidentifier OUTPUT,
);
```

@rdn: The relative distinguished name of the object.

@pobjid: A GUID uniquely identifying the parent connector space object.

@objid: A GUID to receive the connector space object identifier.

Value	Description
mms_connectorspace.object_id	A GUID uniquely identifying the connector space object. If there was a match, this MUST be a value from column object_id of table 2.2.5.1; otherwise, this MUST be NULL.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.49 mms_getcsobjidwithrdnpobjidmaid

This stored procedure retrieves the connector space object identifier for the connector space object with the specified management agent identifier, parent object identifier and relative distinguished name.

```
PROCEDURE mms_getcsobjidwithrdnpobjidmaid (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
@guidMA uniqueidentifier,
@objid uniqueidentifier OUTPUT,
);
```

@rdn: The relative distinguished name of the object.

@pobjid: A GUID uniquely identifying the parent connector space object.

@guidMA: A GUID uniquely identifying the management agent.

@objid: A GUID to receive the connector space object identifier.

Value	Description
mms_connectorspace.object_id	A GUID uniquely identifying the connector space object. If there was a match, this MUST be a value from column object_id of table 2.2.5.1; otherwise, this MUST be NULL.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.50 mms_getcsretrycount

This stored procedure retrieves the count of connector space objects for a given management agent that have the is_reference_retry, is_rename_retry, or is_import_error flag set.

```
PROCEDURE mms_getcsretrycount (
@guidMA uniqueidentifier,
@count int OUTPUT,
);
```

@guidMA: A GUID uniquely identifying the management agent.

@count: An integer parameter that receives the count.

Value	Description
mms_connectorspace.count	The count of connector space objects.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.51 mms_getdoublelink

This stored procedure retrieves the connector space object identifiers of objects that have references to both of the specified connector space object identifiers.

```
PROCEDURE mms_getdoublelink (
@guid1 uniqueidentifier,
@guid2 uniqueidentifier,
);
```

@guid1: A GUID uniquely identifying the first connector space object.

@guid2: A GUID uniquely identifying the second connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace_ids.ResultSet.

3.1.5.52 mms_getfirstlevelchildren

This stored procedure retrieves all child connector space objects of a specified parent connector space object. All objects in the result set MUST have the same pobject_id.

```
PROCEDURE mms_getfirstlevelchildren (
@guid uniqueidentifier,
);
```

@guid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.53 mms_getmareadlock

This stored procedure takes an application read lock on the back-end database server (BEDS).

The synchronization engine passes the management agent identifier as a string, and the BEDS takes an application read lock on the specified string. This stored procedure MUST be called inside of a transaction. The lock MUST be released when the transaction is committed or rolled back.

```
PROCEDURE mms_getmareadlock (
@lockname varchar(40),
);
```

@lockname: The management agent GUID as a string.

Error code values:

Value	Description
transaction (process id d) failed to get the requisite application lock "s" and has been chosen as a deadlock victim. rerun the transaction.	The BEDS failed to acquire the lock. The transaction has been rolled back.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.54 mms_getmawritelock

This stored procedure takes an application write lock on the back-end database server (BEDS).

The synchronization engine passes the management agent identifier as a string, and the BEDS takes an application write lock on the specified string. This stored procedure MUST be called inside of a transaction. The lock MUST be released when the transaction is committed or rolled back.

```
PROCEDURE mms_getmawritelock (
@lockname varchar(40),
);
```

@lockname: The management agent GUID as a string.

Error code values:

Value	Description
transaction (process id d) failed to get the requisite application lock "s" and has been chosen as a deadlock victim. rerun the transaction.	The BEDS failed to acquire the lock. The transaction has been rolled back.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.55 mms_GetMvAttributesNeedToBeConverted

This stored procedure retrieves a comma separated list of metaverse attribute names that are currently defined as nvarchar(450), and which contain 449 or 450 characters of data in one or more metaverse rows.

```
PROCEDURE mms_GetMvAttributesNeedToBeConverted (
@returnAttributeNames varchar(max),
);
```

@returnAttributeNames: A string parameter that receives the comma separated list of attribute names. If there were no metaverse string attributes that contain 449 or 450 characters, then this value MUST be NULL.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.56 mms_getmvmulti

This stored procedure retrieves all multi-valued attributes for a specified metaverse object identifier. There is one row per value. The results MUST be ordered by attribute name. All values with the same attribute_name MUST have the same value type.

```
PROCEDURE mms_getmvmulti (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getmvmulti.ResultSet.

3.1.5.57 mms_getmvmulti_nolock

This stored procedure retrieves all multi-valued attributes for a specified metaverse object identifier. There is one row per value. The results MUST be ordered by attribute name. All values with the same attribute_name MUST have the same value type. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_getmvmulti_nolock (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getmvmulti.ResultSet.

3.1.5.58 mms_getmvobjwithrefretry

This stored procedure retrieves the identifiers of all metaverse objects that are marked for reference retry processing. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_getmvobjwithrefretry ();
```

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_metaverse_ids.ResultSet.

3.1.5.59 mms_getmvobjwithrefretryordeltaorprovision

This stored procedure retrieves the identifiers of all metaverse objects that are marked for either reference retry processing or provisioning retry processing.

```
PROCEDURE mms_getmvobjwithrefretryordeltaorprovision ();
```

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_metaverse_ids.ResultSet.

3.1.5.60 mms_getmvrefasobjid

This stored procedure retrieves the reference attributes for a specified metaverse object. The results are ordered by attribute_name and reference_id.

```
PROCEDURE mms_getmvrefasobjid (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getmvrefasobjid.ResultSet.

3.1.5.61 mms_getmvrefasobjid_nolock

This stored procedure retrieves the reference attributes for a specified metaverse object. The results are ordered by attribute_name and reference_id. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_getmvrefasobjid_nolock (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getmvrefasobjid.ResultSet.

3.1.5.62 mms_getmvrefattributes

This stored procedure retrieves the reference attributes for a specified metaverse object. The results are ordered by reference_id. The back-end database server (BEDS) MUST hold a shared lock on the rows in this result set until the transaction is committed or rolled back.

```
PROCEDURE mms_getmvrefattributes (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getmvrefattributes.ResultSet.

3.1.5.63 mms_getmvretrycount

This stored procedure retrieves the count of all metaverse objects that are flagged for reference retry or provisioning retry operations. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_getmvretrycount (
@count int OUTPUT,
);
```

@count: An integer parameter that receives the count.

Value	Description
mms_metaverse.count	The count of metaverse objects flagged for retry operations.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.64 mms_getmvscriptlock

This stored procedure takes an exclusive application lock on the back-end database server (BEDS) for script objects.

This stored procedure MUST be called inside of a transaction. The lock MUST be released when the transaction is committed or rolled back.

```
PROCEDURE mms_getmvscriptlock ();
```

Error code values:

Value	Description
transaction (process id d) failed to get the requisite application lock "s" and has been chosen as a deadlock victim. rerun the transaction.	The BEDS failed to acquire the lock. The transaction has been rolled back.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.65 mms_getmvsvall_holdlock

This stored procedure retrieves all single-valued attributes of a specified metaverse object. The back-end database server (BEDS) MUST hold a shared read lock on the rows from the three tables making up this result until the transaction is committed or rolled back.

```
PROCEDURE mms_getmvsvall_holdlock (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_metaverse_with_lineage.ResultSet.

3.1.5.66 mms_getmvsvall_nolock

This stored procedure retrieves all single-valued attributes and the associated attribute lineage data of a specified metaverse object. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions do not block the current transaction from reading the locked data.

```
PROCEDURE mms_getmvsvall_nolock (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_metaverse_with_lineage.ResultSet.

3.1.5.67 mms_getmvsvall_xlock

This stored procedure retrieves all single-valued attributes and the associated attribute lineage data of a specified metaverse object. The back-end database server (BEDS) MUST hold an exclusive write lock on the rows from the three tables making up the result set until the transaction is committed or rolled back.

```
PROCEDURE mms_getmvsvall_xlock (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_metaverse_with_lineage.ResultSet.

3.1.5.68 mms_getmvsvbfandmaguids_holdlock

This stored procedure retrieves the provisioning retry and reference retry information for a specified metaverse object. The back-end database server (BEDS) MUST hold a shared lock on the rows in this result set until the transaction is committed or rolled back.

```
PROCEDURE mms_getmvsvbfandmaguids_holdlock (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getmvsvbfandmaguids.ResultSet.

3.1.5.69 mms_getmvsvbfandmaguids_xlock

This stored procedure retrieves the provisioning retry and reference retry information for a specified metaverse object. The back-end database server (BEDS) MUST hold an exclusive write lock on the rows in this result set until the transaction is committed or rolled back.

```
PROCEDURE mms_getmvsvbfandmaguids_xlock (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getmvsvbfandmaguids.ResultSet.

3.1.5.70 mms_getmvsvdata_holdlock

This stored procedure retrieves all single-valued attributes of a specified metaverse object without the associated lineage data. The back-end database server (BEDS) MUST hold a shared lock on the rows until the transaction is committed or rolled back.

```
PROCEDURE mms_getmvsvdata_holdlock (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_metaverse_single_value.ResultSet.

3.1.5.71 mms_getmvsvdata_xlock

This stored procedure retrieves all single-valued attributes of a specified metaverse object without the associated lineage data. The back-end database server (BEDS) MUST hold an exclusive write lock on the rows until the transaction is committed or rolled back.

```
PROCEDURE mms_getmvsvdata_xlock (
@mvobjid uniqueidentifier,
);
```

@mvobjid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_metaverse_single_value.ResultSet.

3.1.5.72 mms_getobjidancwithanchor

This stored procedure retrieves the object identifier and ancestors of a connector space object matching the specified anchor and ma_id values.

```
PROCEDURE mms_getobjidancwithanchor (
@anchor varbinary(800),
@guidMA uniqueidentifier,
@objid uniqueidentifier OUTPUT,
@ancestor varbinary(944) OUTPUT,
);
```

@anchor: A binary anchor value.

@guidMA: A GUID uniquely identifying the management agent.

@objid: A GUID that receives the connector space identifier.

Value	Description
mms_connectorspace.object_id	A GUID uniquely identifying the connector space object. If there was a match, this MUST be a value from column object_id of table 2.2.5.1; otherwise, this MUST be NULL.

@ancestor: A binary value containing the object_id values of all direct ancestor records from the root node down to the immediate parent of this object. For objects without a parent, this MUST be 0x0.

Value	Description
mms_connectorspace.ancestors	A binary value containing the object_id values of all direct ancestor records from the root node down to the immediate parent of this object. If there was a match, this MUST be a value from column ancestors of table 2.2.5.1; otherwise, this MUST be NULL.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.73 mms_getobjidancwithrdnpobjid

This stored procedure retrieves the object identifier, ancestors, and relative distinguished name of a connector space object matching the specified relative distinguished name and parent identifier values.

```
PROCEDURE mms_getobjidancwithrdnpobjid (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
@objid uniqueidentifier OUTPUT,
@ancestor varbinary(944) OUTPUT,
@rdnout nvarchar(438) OUTPUT,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

@objid: A GUID that receives the connector space identifier.

Value	Description
mms_connectorspace.object_id	A GUID uniquely identifying the connector space object. If there was a match, this MUST be a value from column object_id of table 2.2.5.1; otherwise, this MUST be NULL.

@ancestor: A binary value containing the object_id values of all direct ancestor records from the root node down to the immediate parent of this object. For objects without a parent, this MUST be 0x0.

Value	Description
mms_connectorspace.ancestors	A binary value containing the object_id values of all direct ancestor records from the root node down to the immediate parent of this object. If there was a match, this MUST be a value from column ancestors of table 2.2.5.1; otherwise, this MUST be NULL.

@rdnout: The relative distinguished name of the connector space object.

Value	Description
mms_connectorspace.rdn	The relative distinguished name of the connector space object. If there was a match, this MUST be a value from column rdn of table 2.2.5.1; otherwise, this MUST be NULL.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.74 mms_getobjidancwithrdnpobjidmaid

This stored procedure retrieves the object identifier, ancestors, and relative distinguished name of a connector space object matching the specified relative distinguished name parent identifier, and management agent identifier values.

```
PROCEDURE mms_getobjidancwithrdnpobjidmaid (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
@guidMA uniqueidentifier,
@objid uniqueidentifier OUTPUT,
@ancestor varbinary(944) OUTPUT,
@rdnout nvarchar(438) OUTPUT,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

@guidMA: A GUID uniquely identifying the management agent.

@objid: A GUID that receives the connector space identifier.

Value	Description
mms_connectorspace.object_id	A GUID uniquely identifying the connector space object. If there was a match, this MUST be a value from column object_id of table 2.2.5.1; otherwise, this MUST be NULL.

@ancestor: A binary value containing the object_id values of all direct ancestor records from the root node down to the immediate parent of this object. For objects without a parent, this MUST be 0x0.

Value	Description
mms_connectorspace.ancestors	A binary value containing the object_id values of all direct ancestor records from the root node down to the immediate parent of this object. If there was a match, this MUST be a value from column ancestors of table 2.2.5.1; otherwise, this MUST be NULL.

@rdnout: The relative distinguished name of the connector space object.

Value	Description
mms_connectorspace.rdn	The relative distinguished name of the connector space object. If there was a match, this MUST be a value from column rdn of table 2.2.5.1; otherwise, this MUST be NULL.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.75 mms_getolddnwithrdnpobjid

This stored procedure retrieves the distinguished name of a connector space object before it was moved to a transient state, as specified by the relative distinguished name and the parent object identifier.

```
PROCEDURE mms_getolddnwithrdnpobjid (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getolddnwithrdnpobjid.ResultSet.

3.1.5.76 mms_getpartitionsuccessfulbatchforma

This stored procedure retrieves the last successful export batch number for all partitions in a specified management agent. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_getpartitionsuccessfulbatchforma (
@guidMa uniqueidentifier,
);
```

@guidMa: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_partition_successfulbatch.ResultSet.

3.1.5.77 mms_getpartitionsuccessfulbatchforpartition

This stored procedure retrieves the last successful export batch number for a specified partition in the synchronization engine. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_getpartitionsuccessfulbatchforpartition (
@guidPartition uniqueidentifier,
);
```

@guidPartition: A GUID uniquely identifying the partition.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_partition_successfulbatch.ResultSet.

3.1.5.78 mms_GetPendingCsRefDeletes

This stored procedure retrieves all connector space objects for which a reference link with the specified connector space object exists, that are flagged for pending deletion.

```
PROCEDURE mms_GetPendingCsRefDeletes (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_GetPendingCsRefDeletes.ResultSet.

3.1.5.79 mms_GetPendingCsRefDeletesNoLock

This stored procedure retrieves all connector space objects for which a reference link with the specified connector space object exists, that are flagged for pending deletion. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying

data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_GetPendingCsRefDeletesNoLock (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_GetPendingCsRefDeletes.ResultSet.

3.1.5.80 mms_GetPendingCsRefRenames

This stored procedure returns all connector space objects for which a reference link with the specified connector space object exists, that are flagged for a rename operation.

```
PROCEDURE mms_GetPendingCsRefRenames (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_GetPendingCsRefRenames.ResultSet.

3.1.5.81 mms_GetPendingCsRefRenamesNoLock

This stored procedure returns all connector space objects for which a reference link with the specified connector space object exists, that are flagged for a rename operation. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_GetPendingCsRefRenamesNoLock (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_GetPendingCsRefRenames.ResultSet.

3.1.5.82 mms_getpobjidrdnancwithguid

This stored procedure retrieves the parent object identifier, relative distinguished name, anchor value, export operation flag, current batch number, and partition identifier for the specified connector space object.

```
PROCEDURE mms_getpobjidrdnancwithguid (
@guid uniqueidentifier,
@pobjid uniqueidentifier OUTPUT,
@rdn nvarchar(438) OUTPUT,
@anchor varbinary(256) OUTPUT,
@expop int OUTPUT,
@currentbatch int OUTPUT,
@guidPartition uniqueidentifier OUTPUT,
);
```

@guid: A GUID uniquely identifying the connector space object.

@pobjid: A GUID to receive the parent object identifier.

Value	Description
mms_connectorspace.pobject_id	A GUID uniquely identifying the parent connector space object. If there was a match, this MUST be a value from column pobject_id of the mms_connectorspace table (section 2.2.5.1); otherwise, this MUST be NULL.

@rdn: The relative distinguished name of the connector space object.

Value	Description
mms_connectorspace.rdn	The relative distinguished name of the connector space object. If there was a match, this MUST be a value from column rdn of table 2.2.5.1; otherwise, this MUST be NULL.

@anchor: A binary anchor value.

Value	Description
mms_connectorspace.anchor	A binary anchor value. If there was a match, this MUST be a value from column anchor of table 2.2.5.1; otherwise, this MUST be NULL.

@expop: An export operation flag value.

Value	Description
mms_connectorspace.export_operation	An export operation flag value. If there was a match, this MUST be a value from column export_operation of table 2.2.5.1; otherwise, this MUST be NULL.

@currentbatch: The current export batch number for the connector space object.

Value	Description
mms_connectorspace.current_export_batch_number	The current export batch number for the connector space object. If there was a match, this MUST be a value from column current_export_batch_number of table 2.2.5.1; otherwise, this MUST be NULL.

@guidPartition: A GUID to receive the partition identifier.

Value	Description
mms_connectorspace.partition_id	A GUID uniquely identifying the partition. If there was a match, this MUST be a value from column partition_id of table 2.2.5.1; otherwise, this MUST be NULL.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.83 mms_getpobjidrdnancwithobjid

This stored procedure retrieves ancestor and transient information for a specified connector space object.

```
PROCEDURE mms_getpobjidrdnancwithobjid (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getpobjidrdnancwithobjid.ResultSet.

3.1.5.84 mms_getprojected_csrefguids

This stored procedure retrieves all referenced connector space objects in a specified management agent for a specified metaverse object and attribute. The results MUST be ordered by the reference_id.

```
PROCEDURE mms_getprojected_csrefguids (
@mvobj_id uniqueidentifier,
@attr_mv nvarchar(128),
@ma_id uniqueidentifier,
);
```

@mvobj_id: A GUID uniquely identifying the metaverse object.

@attr_mv: An attribute name.

@ma_id: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getprojected_csrefguids.ResultSet.

3.1.5.85 mms_getprojected_csrefguids_noorder

This stored procedure retrieves all referenced connector space objects in a specified management agent for a specified metaverse object and attribute. The results are not ordered.

```
PROCEDURE mms_getprojected_csrefguids_noorder (
@mvobj_id uniqueidentifier,
@attr_mv nvarchar(128),
@ma_id uniqueidentifier,
);
```

@mvobj_id: A GUID uniquely identifying the metaverse object.

@attr_mv: An attribute name.

@ma_id: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getprojected_csrefguids.ResultSet.

3.1.5.86 mms_getprojected_mvrefguids

This stored procedure retrieves a distinct list of the metaverse GUID strings of all projected references for a given connector space object and attribute.

```
PROCEDURE mms_getprojected_mvrefguids (
@csobj_id uniqueidentifier,
@attr_cs nvarchar(128),
);
```

@csobj_id: A GUID uniquely identifying the connector space object.

@attr_cs: The attribute name of the reference attribute.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getprojected_mvrefguids.ResultSet.

3.1.5.87 mms_getrowcountforcslinks

This stored procedure counts the total number of connector space references to a specified connector space object.

```
PROCEDURE mms_getrowcountforcslinks (
```

```
@guidRef uniqueidentifier,
@count int OUTPUT,
);
```

@guidRef: A GUID uniquely identifying the referenced connector space object.

@count: An integer parameter that receives the count.

Value	Description
mms_cs_link.count	The count of references to the specified connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.88 mms_getrowcountofpartition

This stored procedure retrieves the count of partitions matching the specified partition identifier.

```
PROCEDURE mms_getrowcountofpartition (
@guidPartition uniqueidentifier,
@count int OUTPUT,
);
```

@guidPartition: A GUID uniquely identifying the partition.

@count: An integer parameter that receives the count.

Value	Description
mms_partition.count	Partition identifiers MUST be unique, therefore, the count MUST be 1 if the partition existed, or 0 if it did not exist.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.89 mms_getrowcountofprofilename

This stored procedure retrieves the count of run profiles matching the specified management agent identifier and run profile name.

```
PROCEDURE mms_getrowcountofprofilename (
@profilename nvarchar(128),
@guidMa uniqueidentifier,
@count int OUTPUT,
);
```

@profilename: The run profile name.

@guidMa: A GUID uniquely identifying the management agent.

@count: An integer parameter that receives the count.

Value	Description
mms_run_profile.count	The count of run profiles matching the specified management agent identifier and run profile name. This MUST be 0 if there were no records matching the @profilename and @guidMa. This MUST be 1 if there was a record matching the @profilename and @guidMA. This MUST NOT be greater than 1.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.90 mms_getrowcountoftransient

This stored procedure retrieves the count of transient objects in a specified partition. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_getrowcountoftransient (
@guidPartition uniqueidentifier,
@count int OUTPUT,
);
```

@guidPartition: A GUID uniquely identifying the partition.

@count: An integer parameter that receives the count.

Value	Description
mms_connectorspace.count	The count of transient objects in the partition.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.91 mms_getrowcountwithanchor

This stored procedure retrieves the count of connector space objects in the specified management agent with the specified anchor.

```
PROCEDURE mms_getrowcountwithanchor (
@anchor varbinary(800),
@guidMA uniqueidentifier,
@count bigint OUTPUT,
);
```

@anchor: A binary anchor value.

@guidMA: A GUID uniquely identifying the management agent.

@count: An integer parameter that receives the count.

Value	Description
mms_connectorspace.count	The count of connector space objects in the connector space with a matching anchor value and management agent identifier.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.92 mms_getrowwithanchor

This stored procedure retrieves the connector space object matching the specified management agent identifier and anchor value.

```
PROCEDURE mms_getrowwithanchor (
@anchor varbinary(800),
@guidMA uniqueidentifier,
);
```

@anchor: A binary anchor value.

@guidMA: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.93 mms_getrowwithanchor_xlock

This stored procedure retrieves the connector space object matching the specified management agent identifier and anchor value. The back-end database server (BEDS) MUST hold an exclusive write lock on this data until the current transaction is committed or rolled back.

```
PROCEDURE mms_getrowwithanchor_xlock (
@anchor varbinary(800),
@guidMA uniqueidentifier,
);
```

@anchor: A binary anchor value.

@guidMA: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.94 mms_getrowwithanchor_holdlock

This stored procedure retrieves the connector space object matching the specified management agent identifier and anchor value. The back-end database server (BEDS) MUST hold a shared lock on this data until the current transaction is committed or rolled back.

```
PROCEDURE mms_getrowwithanchor_holdlock (
@anchor varbinary(800),
@guidMA uniqueidentifier,
);
```

@anchor: A binary anchor value.

@guidMA: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.95 mms_getrowwithrdnpobjid

This stored procedure retrieves the connector space object matching the specified relative distinguished name and parent object identifier.

```
PROCEDURE mms_getrowwithrdnpobjid (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.96 mms_getrowwithrdnpobjid_holdlock

This stored procedure retrieves the connector space object matching the specified relative distinguished name and parent object identifier. The back-end database server (BEDS) MUST hold a shared lock on this data until the current transaction is committed or rolled back.

```
PROCEDURE mms_getrowwithrdnpobjid_holdlock (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.97 mms_getrowwithrdnpobjid_xlock

This stored procedure retrieves the connector space object matching the specified relative distinguished name and parent object identifier. The back-end database server (BEDS) MUST hold an exclusive write lock on this data until the current transaction is committed or rolled back.

```
PROCEDURE mms_getrowwithrdnpobjid_xlock (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.98 mms_getrowwithrdnpobjidfast

This stored procedure retrieves a sub-set of the connector space object attributes that are needed for determining synchronization behavior, using the relative distinguished name and parent connector space object identifier.

```
PROCEDURE mms_getrowwithrdnpobjidfast (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getrowwithrdnpobjidfast.ResultSet.

3.1.5.99 mms_getrowwithrdnpobjidmaid

This stored procedure retrieves the connector space object matching the specified relative distinguished name, parent object identifier, and management agent identifier.

```
PROCEDURE mms_getrowwithrdnpobjidmaid (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
@guidMA uniqueidentifier,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

@guidMA: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.100 mms_getrowwithrdnpobjidmaid_holdlock

This stored procedure retrieves the connector space object matching the specified relative distinguished name, parent object identifier, and management agent identifier. The back-end database server (BEDS) MUST hold a shared lock on this data until the current transaction is committed or rolled back.

```
PROCEDURE mms_getrowwithrdnpobjidmaid_holdlock (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
@guidMA uniqueidentifier,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

@guidMA: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.101 mms_getrowwithrdnpobjidmaid_xlock

This stored procedure retrieves the connector space object matching the specified relative distinguished name, parent object identifier, and management agent identifier. The back-end database server (BEDS) MUST hold an exclusive write lock on this data until the current transaction is committed or rolled back.

```
PROCEDURE mms_getrowwithrdnpobjidmaid_xlock (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
@guidMA uniqueidentifier,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

@guidMA: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_connectorspace.ResultSet.

3.1.5.102 mms_getrowwithrdnpobjidmaidfast

This stored procedure returns a sub-set of the connector space object attributes that are needed for determining synchronization behavior, using the relative distinguished name, parent object identifier, and management agent identifier to specify connector space object.

```
PROCEDURE mms_getrowwithrdnpobjidmaidfast (
@rdn nvarchar(438),
@pobjid uniqueidentifier,
@guidMA uniqueidentifier,
);
```

@rdn: The relative distinguished name of the connector space object.

@pobjid: A GUID uniquely identifying the parent connector space object. Root objects MUST have a GUID of 00000000-0000-0000-0000-000000000000. Transient objects MUST have a GUID of 00000000-0000-0000-0000-000000000001.

@guidMA: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_getrowwithrdnpobjidfast.ResultSet.

3.1.5.103 mms_getstepobjectdetails_stats

This stored procedure retrieves the statistics type and count for a specified run step, connector space identifier, and management agent statistics type.

```
PROCEDURE mms_getstepobjectdetails_stats (
@stepid uniqueidentifier,
@guidCs uniqueidentifier,
@mastatstype int,
@statstype int OUTPUT,
@updatecount int OUTPUT,
);
```

@stepid: A GUID uniquely identifying the run step detail record.

@guidCs: A GUID uniquely identifying the connector space object.

@mastatstype: A number indicating which management agent statistic values were incremented while processing this object. This MUST be a value specified in section 2.2.2.12.

@statstype: A number indicating which synchronization statistic values incremented while processing this object. This MUST be a value specified in section 2.2.2.18.

@updatecount: The count of the number of times the specified operation was performed on the specified connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.104 mms_getunappliedids_nolock

This stored procedure retrieves the list of connector space object identifiers that are ready for export. The back-end database server (BEDS) MUST NOT issue shared locks to prevent other transactions from modifying data read by the current transaction, and exclusive locks set by other transactions MUST NOT block the current transaction from reading the locked data.

```
PROCEDURE mms_getunappliedids_nolock (
@guidPartition uniqueidentifier,
@dwSuccessfulMa int,
@dwCurrentMa int,
);
```

@guidPartition: A GUID uniquely identifying the management agent partition.

@dwSuccessfulMa: The last successful export batch number for the management agent.

@dwCurrentMa: The current export batch number for the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return an mms_connectorspace_ids.ResultSet.

3.1.5.105 mms_maketransient

This stored procedure converts the specified connector space object to a transient connector space object by setting the relative distinguished name, transient distinguished name, parent object identifier, ancestors, and transient details to the values specified.

```
PROCEDURE mms_maketransient (
@objid uniqueidentifier,
@rdn nvarchar(438),
@olddn ntext,
@details ntext,
);
```

@objid: A GUID uniquely identifying the connector space object.

@rdn: A new relative distinguished name for the transient object.

@olddn: The current distinguished name of the connector space object.

@details: A transient-details XML element as specified in section 2.2.6.4.25.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.106 mms_markcsrefretry

This stored procedure flags connector space objects that reference the specified connector space object, were seen by the last import, are not phantom objects, and are connected to a metaverse object, for reference retry processing.

```
PROCEDURE mms_markcsrefretry (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the referenced connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.107 mms_MarkFullMvRefRetryAndDeleteLinks

This stored procedure first sets the reference retry flag on all metaverse objects that reference a specified metaverse object. It then deletes all references from or to the specified metaverse object.

```
PROCEDURE mms_MarkFullMvRefRetryAndDeleteLinks (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the referenced metaverse object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.108 mms_markmvprovisioningretry

This stored procedure sets the provisioning retry flag on the specified metaverse object.

```
PROCEDURE mms_markmvprovisioningretry (
@objid uniqueidentifier,
);
```

@objid: A GUID uniquely identifying the metaverse object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.109 mms_MarkRenamedDescendents

This stored procedures sets the pending move operation flag and rename retry flag on all connector space objects in the specified management agent that fall between the low ancestor value and the high ancestor value. The connector space objects MUST have both a hologram and delta image. The rename retry flag will be set if the object already has the rename retry flag set, or if the object is a connector.

This stored procedure will overwrite any pending move operations with the new move operation.

```
PROCEDURE mms_MarkRenamedDescendents (
@ma_id uniqueidentifier,
@ancestors_lo varbinary(944),
@ancestors_hi varbinary(944),
@moveop int,
);
```

@ma_id: A GUID uniquely identifying the management agent.

@ancestors_lo: The ancestors value of the connector space object that is being renamed and MUST have the descendents renamed.

@ancestors_hi: The ancestors value of the connector space object that is being renamed and MUST have the descendents renamed plus 1.

@moveop: A move operation as specified in section 2.2.2.14.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.110 mms_MarkRenamedDescendentsNoCeiling

This stored procedures sets the pending move operation flag and rename retry flag on all connector space objects in the specified management agent that have an ancestor value greater than or equal to the specified ancestor value. The connector space objects MUST have both a hologram and delta image. The rename retry flag will be set if the object already has the rename retry flag set, or if the object is a connector.

This stored procedure will overwrite any pending move operations with the new move operation.

```
PROCEDURE mms_MarkRenamedDescendentsNoCeiling (
@ma_id uniqueidentifier,
@ancestors_lo varbinary(944),
@moveop int,
);
```

@ma_id: A GUID uniquely identifying the management agent.

@ancestors_lo: The ancestors value of the connector space object that is being renamed and MUST have the descendents renamed.

@moveop: A move operation as specified in section 2.2.2.14.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.111 mms_MarkRenamedLinks

This stored procedure sets the pending reference rename flag on all connector space objects that reference the specified connector space object. It then updates the reference links that are not currently being renamed to indicate that they are now being renamed and stores the specified old distinguished name on the link.

```
PROCEDURE mms_MarkRenamedLinks (
@objid uniqueidentifier,
@olddn ntext,
);
```

@objid: A GUID uniquely identifying the referenced connector space object.

@olddn: The distinguished name of the connector space object before the rename operation.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.112 mms_MarkRenamedLinksWithRefRetry

This stored procedure sets the pending reference rename flag on all connector space objects that reference the specified connector space object. It sets the reference retry flag on the object if the reference retry flag is already set or if the object was seen by the last import and is a connector; otherwise it clears the reference retry flag. It then updates the reference links that are not currently being renamed to indicate that they are now being renamed and stores the specified old distinguished name on the link.

```
PROCEDURE mms_MarkRenamedLinksWithRefRetry (
@objid uniqueidentifier,
@olddn ntext,
);
```

@objid: A GUID uniquely identifying the referenced connector space object.

@olddn: The distinguished name of the connector space object before the rename operation.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.113 mms_ProcessCsObjectDeletion

This stored procedure processes the deletion of a connector space object. It will mark deletion and reference retry data on the referencing connector space objects, delete all links with this object as a source, and determine the final delete state of the object.

```
PROCEDURE mms_ProcessCsObjectDeletion (
@objid uniqueidentifier,
@deleterefs bit,
@delstate int OUTPUT,
);
```

@objid: A GUID uniquely identifying the referenced connector space object.

@deleterefs: A bit where a value of 1 indicates that the stored procedure MUST mark the deleted flag on reference links, and set the pending reference delete flag and reference retry flag on referencing objects.

@delstate: An integer indicating the result of processing the deletion on the specified object. This MUST be a value specified in section 2.2.2.6.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.114 mms_movecslinks

This stored procedure moves all connector space links that reference one object to reference a different object.

```
PROCEDURE mms_movecslinks (
@guidFrom uniqueidentifier,
@guidTo uniqueidentifier,
);
```

@guidFrom: A GUID uniquely identifying the referenced connector space object.

@guidTo: A GUID uniquely identifying the new referenced connector space object. This MUST be a valid connector space object in the mms_connector space table.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.115 mms_releasemawritelock

This stored procedure releases an exclusive application write lock take on the back-end database server (BEDS) for the specified management agent and replaces it with a shared lock.

```
PROCEDURE mms_releasemawritelock (
@lockname varchar(40),
);
```

@lockname: The management agent GUID as a string in the curly-brace representation ([MS-DTYP] section 2.3.2.3).

Error code values:

Value	Description
transaction (process id d) failed to get the requisite application lock "s" and has been chosen as a deadlock victim. rerun the transaction.	The BEDS failed to acquire the lock. The transaction has been rolled back.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.116 mms_releasemvscriptlock

This stored procedure releases an exclusive application lock on the back-end database server (BEDS) for script objects.

```
PROCEDURE mms_releasemvscriptlock ();
```

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.117 mms_setimporterror

This stored procedure updates the specified connector space object with import error information. The count of import error retries is set to zero.

```
PROCEDURE mms_setimporterror (
@objid uniqueidentifier,
@importerr ntext,
@errorcode int,
@errortime datetime,
);
```

@objid: A GUID uniquely identifying the connector space object.

@importerr: An XML fragment containing the inbound synchronization error details. The format of this fragment is defined in section 2.2.6.4.11.

@errorcode: An HRESULT error code for the last import operation. This MUST be zero, NULL, or a value from section 2.2.2.17 or from section 2.2.2.5.

@errortime: The UTC time of the import error or NULL if the error is being cleared. Both the import error date and last import error date are updated with this value.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.118 mms_setmvprovisioningretryusingcsguid

This stored procedure sets the provisioning retry flag on the metaverse object connected to the specified connector space object.

```
PROCEDURE mms_setmvprovisioningretryusingcsguid (
@csobjid uniqueidentifier,
);
```

@csobjid: A GUID uniquely identifying the connector space object.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.119 mms_supportsparentcontainers

This stored procedure selects the top one depth field from the specified management agent with a depth greater than one. This is used to determine if the management agent support hierarchical containers.

```
PROCEDURE mms_supportsparentcontainers (
@ma_id uniqueidentifier,
);
```

@ma_id: A GUID uniquely identifying the management agent.

Return Values: An integer which MUST be 0.

Result Sets:

This stored procedure MUST return a mms_supportsparentcontainers.ResultSet.

3.1.5.120 mms_updateimporterror

This stored procedure updates the import error information for the specified connector space object, and increments the count of import error retries.

```
PROCEDURE mms_updateimporterror (
@objid uniqueidentifier,
@importerr ntext,
@errorcode int,
@errortime datetime,
);
```

@objid: A GUID uniquely identifying the connector space object.

@importerr: An XML fragment containing the inbound synchronization error details. The format of this fragment is defined in section 2.2.6.4.11.

@errorcode: An HRESULT error code for the last import operation. This MUST be zero, NULL, or a value from section 2.2.2.17 or from section 2.2.2.5.

@errortime: The UTC time of the import error. The last import error date is updated with this value.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.5.121 mms_updatestepobjectdetails_stats

This stored procedure updates the statistics type and update count for the specified run step, connector space identifier, and management agent statistics type.

```
PROCEDURE mms_updatestepobjectdetails_stats (
@stepid uniqueidentifier,
@guidCs uniqueidentifier,
@mastatstype int,
@statstype int,
@updatecount int,
);
```

@stepid: A GUID uniquely identifying the run step history object.

@guidCs: A GUID uniquely identifying the connector space object.

@mastatstype: A number indicating which management agent statistic values were incremented while processing this object. This MUST be a value specified in section 2.2.2.12.

@statstype: A number indicating which synchronization statistic values incremented while processing this object. This MUST be a value specified in section 2.2.2.18.

@updatecount: The update count of this statistic.

Return Values: An integer which MUST be 0.

Result Sets: MUST NOT return any result sets.

3.1.6 Timer Events

None.

3.1.7 Other Local Events

None.

3.2 Client Details

The client interacts with the server by issuing stored procedure calls and dynamic T-SQL statements to the server, and processes the results returned. The client is responsible for initiating the communications in this protocol.

3.2.1 Abstract Data Model

The synchronization engine is the client in this protocol. In addition to using the stored procedures specified in section 3.1, the synchronization engine can construct dynamic T-SQL statements to

create, read, update, or delete data in the back-end database server (BEDS). The dynamic queries MUST conform to the table definitions, as specified in section 2.2.5.

3.2.2 Timers

None.

3.2.3 Initialization

None.

3.2.4 Higher-Layer Triggered Events

None.

3.2.5 Message Processing Events and Sequencing Rules

The client handles each stored procedure with the same basic processing method of calling the stored procedure and waiting for the result code and any result sets that will be returned.

3.2.6 Timer Events

None.

3.2.7 Other Local Events

None.

4 Protocol Examples

None.

5 Security

5.1 Security Considerations for Implementers

Security for this protocol is controlled by the access rights to the databases on the back-end database server (BEDS), which is negotiated as part of the Tabular Data Stream (TDS) Protocol [MS-TDS].

The service account used by the synchronization engine can access the appropriate database on the BEDS. If the account does not have sufficient access rights, access will be denied when attempting to set up the TDS connection to the database or when calling the stored procedures.

Interactions with SQL are susceptible to tampering and other types of security risks. Implementers are advised to sanitize the input parameters for a stored procedure before invoking the stored procedure.

Interactions with SQL are susceptible to spoofing. Implementers are advised to use transport layer security for communications with SQL, as specified in [MS-TDS] section 3.2.

5.2 Index of Security Parameters

None.

6 Appendix A: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include released service packs:

- Microsoft® SharePoint® Server 2010
- Microsoft® SharePoint® Server 2013 Preview

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

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

<1> Section 2.2.5.6: This value is encoded using AES256, as defined in [FIPS197], using a key set pointed to by **key_id** and encrypted using base64 encoding, as defined in [RFC4648] section 4.

<2> Section 2.2.5.6: This value is encoded using AES256, as defined in [FIPS197], using a key set pointed to by **key_id** and encrypted using base64 encoding, as defined in [RFC4648] section 4.

<3> Section 2.2.5.15: mms_timestamp_current is updated by the synchronization engine every 10 to 30 seconds while the synchronization engine is running.

7 Change Tracking

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
1.4 Relationship to Other Protocols	Added statement about TCP-IP network transport and cited [RFC793] and [RFC1122].	N	Content updated.

8 Index

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