

[MS-MCIS-Diff]:

Content Indexing Services Protocol

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1 Introduction

This document is a specification of the Content Indexing Services Protocol. This protocol allows a client to communicate with a server hosting an indexing service to issue queries. The protocol is primarily geared toward full text queries. It also allows an administrator to remotely manage the indexing service.

Sections 1.5, 1.8, 1.9, 2, and 3 of this specification are normative. All other sections and examples in this specification are informative.

1.1 Glossary

This document uses the following terms:

binding: A request to include a particular column in a returned rowset. The binding specifies a property to be included in the search results.

bookmark: A marker that uniquely identifies a row within a set of rows.

catalog: The highest-level unit of organization in the indexing service. It represents a set of indexed documents against which queries can be executed by using the [MS-MCIS].

chapter: A range of rows within a set of rows.

column: The container for a single type of information in a row. Columns map to property names and specify what properties are used for the search query's command tree elements.

command tree: A combination of restrictions and sort orders that are specified for a search query.

cursor: (1) An entity that is used as a mechanism to work with one row or a small block of rows (at one time) in a set of data returned in a result set. A cursor is positioned on a single row within the result set. After the cursor is positioned on a row, operations can be performed on that row or on a block of rows starting at that position.

(2) The current position within a result set.

globally unique identifier (GUID): A term used interchangeably with universally unique identifier (UUID) in Microsoft protocol technical documents (TDs). Interchanging the usage of these terms does not imply or require a specific algorithm or mechanism to generate the value. Specifically, the use of this term does not imply or require that the algorithms described in [RFC4122] or [C706] must be used for generating the GUID. See also universally unique identifier (UUID).

handle: A token that can be used to identify and access cursors, chapters, and bookmarks.

HRESULT: An integer value that indicates the result or status of an operation. A particular HRESULT can have different meanings depending on the protocol using it. See [MS-ERREF] section 2.1 and specific protocol documents for further details.

indexing: The process of extracting text or properties from files and storing the extracted values in an index or property cache.

indexing service: A service that creates indexed catalogs for the contents and properties of file systems. Applications can search the catalogs for information from the files on the indexed file system.

inverted index: A persistent structure that contains the text content pulled out of files during indexing. The text in an inverted index maps from a word in a property to a list of the documents and locations within a document that contain that word.

locale: An identifier, as specified in [MS-LCID], that specifies preferences related to language. These preferences indicate how dates and times are to be formatted, how items are to be sorted alphabetically, how strings are to be compared, and so on.

named pipe: A named, one-way, or duplex pipe for communication between a pipe server and one or more pipe clients.

natural language query: A query constructed using human language instead of query syntax. The generic search service (GSS) is free to interpret the query in order to determine the best results. The interpretation is explicitly not specified in order to allow improvements over time.

noise word: A word that is ignored by the Windows Search service (WSS) when present in the restrictions specified for the search query, because it has little discriminatory value. English examples include "a," "and," and "the." Implementers of a generic search service (GSS) MAY choose to follow this guideline.

path: When referring to a file path on a file system, a hierarchical sequence of folders. When referring to a connection to a storage device, a connection through which a machine can communicate with the storage device.

property cache: A cache of file or object properties extracted during indexing.

restriction: A set of conditions that a file must meet to be included in the search results returned by the indexing service in response to a search query. A restriction narrows the focus of a search query, limiting the files that the indexing service includes in the search results only to those files matching the conditions.

row: The collection of columns that contains the property values that describe a single file from the set of files that matched the restriction specified in the search query submitted to the indexing service

rowset: A set of rows returned in the search results.

sort order: A set of rules in a search query that defines the ordering of rows in the search result. Each rule consists of a managed property, such as modified date or size, and a direction for order, such as ascending or descending. Multiple rules are applied sequentially.

virtual root: An alternative path to a folder. A physical folder can have zero or more virtual roots. Paths that begin with a virtual root are called virtual paths. For example, /server/vanityroot might be a virtual root of C:\IIS\web\folder1. Then the file C:\IIS\web\folder1\default.htm would have a virtual path of /server/vanityroot/default.htm.

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

1.2 References

Links to a document in the Microsoft Open Specifications library point to the correct section in the most recently published version of the referenced document. However, because individual documents in the library are not updated at the same time, the section numbers in the documents may not match. You can confirm the correct section numbering by checking the Errata.

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 dohelp@microsoft.com. We will assist you in finding the relevant information.

[IEEE754] IEEE, "IEEE Standard for Binary Floating-Point Arithmetic", IEEE 754-1985, October 1985, <http://ieeexplore.ieee.org/servlet/opac?punumber=2355>

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

[MS-ERREF] Microsoft Corporation, "Windows Error Codes".

[MS-LCID] Microsoft Corporation, "Windows Language Code Identifier (LCID) Reference".

[MS-SMB] Microsoft Corporation, "Server Message Block (SMB) Protocol".

[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>

[SALTON] Salton, G., "Automatic Text Processing: The Transformation Analysis and Retrieval of Information by Computer", 1988, ISBN: 0201122278.

[UNICODE] The Unicode Consortium, "The Unicode Consortium Home Page", 2006, <http://www.unicode.org/>

1.2.2 Informative References

[MSDN-FULLPROPSPEC] Microsoft Corporation, "FULLPROPSPEC structure", <http://msdn.microsoft.com/en-us/library/ms690996.aspx>

[MSDN-ISQL] Microsoft Corporation, "Indexing Service Query Language", <http://msdn.microsoft.com/en-us/library/ms690538.aspx>

[MSDN-OLEDBP] Microsoft Corporation, "OLE DB Provider for Indexing Service", <http://msdn.microsoft.com/en-us/library/ms690319.aspx>

[MSDN-PROPSET] Microsoft Corporation, "Property Sets", <http://msdn.microsoft.com/en-us/library/ms691041.aspx>

[MSDN-QUERYERR] Microsoft Corporation, "Query-Execution Values", <http://msdn.microsoft.com/en-us/library/ms690617.aspx>

1.3 Overview

A content indexing service helps efficiently organize the extracted features of a collection of documents. The Content Indexing Services Protocol allows a client to communicate with a server hosting an indexing service to issue queries and to allow an administrator to manage the indexing server.

When processing files, an indexing service analyzes a set of documents, extracts useful information, and then organizes the extracted information in such a way that properties of those documents can be efficiently returned in response to queries. A collection of documents that can be queried constitutes a catalog. A catalog might contain an inverted index (for quick word matching) and a property cache (for quick retrieval of property values).

Conceptually, a catalog consists of a logical table of properties with the text or value and corresponding locale stored in columns of the table. Each row of the table corresponds to a separate document in the scope of the catalog, and each column of the table corresponds to a property.

The specific tasks performed by the Content Indexing Services Protocol are grouped into two functional areas:

- Remote administration of indexing service catalogs

- Remote querying of indexing service catalogs

1.3.1 Remote Administration Tasks

The Content Indexing Services Protocol enables the following indexing service catalog management tasks from a client:

- Query the current state of an indexing service catalog on the server.
- Update the state of an indexing service catalog.
- Launch the indexing process for a particular set of files.
- Initiate optimization of an index to improve query performance.

All remote administration tasks follow a simple request/response model. No state is maintained on the client for any administration call, and administrative calls can be made in any order.

1.3.2 Remote Querying

The Content Indexing Services Protocol enables clients to perform search queries against a remote server hosting an indexing service. See [MSDN-ISQL] for more information about the Indexing Service Query Language.

The client initiates a search query using the following steps:

1. The client requests a connection to a server hosting an indexing service.
2. The client sends the following parameters for the search query:
 - Rowset properties like the catalog name and configuration information
 - The restriction to specify what documents are to be included and/or excluded from the search results
 - The order in which the search results are to be returned
 - The columns to be returned in the result set
 - The maximum number of rows that are to be returned for the query
 - The maximum time for query execution

After the server has acknowledged the client's request to initiate the query, the client can request status information on the query, but this is not a required step.

3. The client requests a result set from the server, and the server responds by sending the client the property values for files that were included in the results for the client's search query. If the value of a property is too large to fit in a single response buffer, the server will not send the property; instead, it will set the property status to deferred.
4. After the client is finished with the search query, or no longer requires additional results, the client contacts the server to release the query.
5. After the server has released the query, the client might send a request to disconnect from the server. The connection is then closed. Alternatively, the client might issue another query and repeat the sequence from step 2.

1.4 Relationship to Other Protocols

The Content Indexing Services Protocol relies on the SMB protocol, as specified in [MS-SMB], for message transport. No other protocol depends directly on the Content Indexing Services Protocol.<1>

1.5 Prerequisites/Preconditions

It is assumed that the client has obtained the name of the server and a catalog name before this protocol is invoked. How a client does this is not addressed in this specification.

It is also assumed that the client and server have a security association that is usable with named pipes, as specified in [MS-SMB].

1.6 Applicability Statement

The Content Indexing Services Protocol is designed for querying and managing catalogs on a remote server from a client.<2>

1.7 Versioning and Capability Negotiation

This protocol has no versioning or capability negotiation mechanisms.

1.8 Vendor-Extensible Fields

This protocol uses HRESULTs that are vendor extensible. Vendors are free to choose their own values for this field as long as the C bit (0x20000000) is set as specified in [MS-ERREF] section 2.1, indicating that the value is a customer code.

This protocol also uses NTSTATUS values taken from the NTSTATUS number space specified in [MS-ERREF]. Vendors SHOULD<3> reuse those values with their indicated meaning. Choosing any other value runs the risk of a collision in the future.

1.8.1 Property IDs

Properties are represented by IDs known as property IDs. Each property MUST have a globally unique identifier (GUID), as defined in [MS-DTYP] section 2.3.4.3. This identifier consists of a GUID, representing a collection of properties called a property set plus either a string or a 32-bit integer to identify the property within the set. If the integer form of ID is used, the values 0x00000000, 0xFFFFFFFF, and 0xFFFFFFF0 are considered invalid.

Vendors can guarantee that their properties are uniquely defined by placing them in a property set defined by their own GUIDs.<4>

1.9 Standards Assignments

This protocol has no standards assignments, only private assignments made by Microsoft using allocation procedures specified in other protocols.

Microsoft has allocated this protocol a named pipe, as specified in [MS-SMB]. The pipe name is \pipe\CISKADS. See [MS-SMB].

2 Messages

The following sections specify how Content Indexing Services Protocol messages are transported and specify common Content Indexing Services Protocol data types. This protocol references commonly used data types as defined in [MS-DTYP].

Note All 2-byte, 4-byte, and 8-byte signed and unsigned integers in the following structures and messages MUST be transferred in little-endian byte order.

2.1 Transport

All messages MUST be transported using a named pipe, as specified in [MS-SMB]. The following pipe name is used:

- \pipe\CI_SKADS

This protocol uses the underlying SMB named pipe protocol to retrieve the identity of the caller that made the connection, as specified in [MS-SMB] section 2.2.4.9.1. The client MUST set SECURITY_IDENTIFICATION as the ImpersonationLevel in the request to open the named pipe.

2.2 Message Syntax

Several structures and messages in the following sections refer to chapter or bookmark handles (see 2.2.5.1). A handle is a 32-bit long opaque structure that uniquely identifies a chapter or bookmark (1).

Typically, client applications receive handle values by way of method calls; however, there is one value that does not need to be obtained from a server. DB_NULL_HCHAPTER (0x00000000) is a A chapter handle to the unchaptered rowset that contains all query results.

2.2.1 Structures

This section details data structures that are defined and used by the Content Indexing Services Protocol.

The following table summarizes the data structures defined in this section.

Structure	Description
CBaseStorageVariant	Contains the value on which to perform a match operation for a property that is specified in a CPropertyRestriction structure.
SAFEARRAY, SAFEARRAY2	Contains a multidimensional array.
SAFEARRAYBOUND	Represents the bounds for a dimension of an array specified in a SAFEARRAY structure.
CFullPropSpec	Contains a property specification.
CContentRestriction	Contains a string to match for a property value in the property cache.
CNatLanguageRestriction	Contains a natural language query match for a property.
CNodeRestriction	Contains an array of command tree nodes specifying the restrictions for a query.
CPropertyRestriction	Contains a property value to match with an operation.
CScopeRestriction	Contains arestriction on the files to be searched.

Structure	Description
CSort	Identifies a column to sort.
CVectorRestriction	Contains an array of command tree nodes specifying the restrictions for a vector space array query, as specified in [SALTON].
CRestriction	A restriction node in a query command tree.
CColumnSet	Describes the columns to return.
CCategorizationSet	A set of CCategorizationSpecs where each CCategorizationSpec describes the grouping property for one level in a hierarchical result set.
CCategorizationSpec	Specifies the categorization property used to categorize results at one level in a hierarchical result set.
CDbColId	Contains a column identifier.
CDbProp	Contains a rowset property.
CDbPropSet	Contains a set of rowset properties.
CPidMapper	Maps from message internal property IDs (PIDs) to full prop specs.
CRowSeekAt	Contains the offset at which to retrieve rows in a CPMGetRowsIn message.
CRowSeekAtRatio	Identifies the approximate point expressed as a ratio at which to begin retrieval for a CPMGetRowsIn message.
CRowSeekByBookmark	Identifies the bookmarks from which to retrieve rows for a CPMGetRowsIn message.
CRowSeekNext	Contains the number of rows to skip in a CPMGetRowsIn message.
CRowsetProperties	Contains the configuration information for a query and is specified as OLE-DB rowset properties.
CRowVariant	Contains the fixed-size portion of a variable-length data type stored in the CPMGetRowsOut message.
CSortSet	Contains the sort orders for a query.
CTableColumn	Contains a column for the CPMSetsBindingsIn message.
SERIALIZEDPROPERTYVALUE	Contains a serialized value.

2.2.1.1 CBaseStorageVariant

The CBaseStorageVariant structure contains the value on which to perform a match operation for a property specified in the CPropertyRestriction structure.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
vType											vData1											vData2									
vValue (variable)																															

...

vType (2 bytes): A type indicator that indicates the type of **vValue**. It MUST be one of the values specified in the following table.

Value	Meaning
VT_EMPTY 0x0000	vValue is not present. VT_NULL (0x0001) also has the same meaning.
VT_I1 0x0010	A 1-byte signed integer.
VT_UI1 0x0011	A 1-byte unsigned integer.
VT_I2 0x0002	A 2-byte signed integer.
VT_UI2 0x0012	A 2-byte unsigned integer.
VT_BOOL 0x000B	A Boolean value; a 2-byte integer. Note Contains 0x0000 (FALSE) or 0xFFFF (TRUE).
VT_I4 0x0003	A 4-byte signed integer.
VT_UI4 0x0013	A 4-byte unsigned integer.
VT_R4 0x0004	An IEEE 32-bit floating point number, as specified in [IEEE754].
VT_INT 0x0016	A 4-byte signed integer.
VT_UINT 0x0017	A 4-byte unsigned integer. Note that this is identical to VT_UI4 except that VT_UINT cannot be used with VT_VECTOR (defined in the following table); the value chosen is a choice made by the higher layer that provides it to the Content Indexing Services Protocol, but the Content Indexing Services Protocol treats VT_UINT and VT_UI4 as identical, with the exception noted earlier in this paragraph.
VT_ERROR 0x000A	A 4-byte unsigned integer containing an HRESULT value, as specified in [MS-ERREF] section 2.1.
VT_I8 0x0014	An 8-byte signed integer.
VT_UI8 0x0015	An 8-byte unsigned integer.
VT_R8 0x0005	An IEEE 64-bit floating point number, as specified in [IEEE754].
VT_CY 0x0006	An 8-byte two's complement integer (scaled by 10,000).

Value	Meaning
VT_DATE 0x0007	A 64-bit floating point number, as specified in [IEEE754], representing the number of days since 00:00:00 on December 31, 1899 (Coordinated Universal Time).
VT_FILETIME 0x0040	A 64-bit integer representing the number of 100-nanosecond intervals since 00:00:00 on January 1, 1601 (Coordinated Universal Time).
VT_DECIMAL 0x000E	A DECIMAL structure, as specified in section 2.2.1.1.1.1.
VT_CLSID 0x0048	A 16-byte binary value containing a GUID.
VT_BLOB 0x0041	A 4-byte unsigned integer count of bytes in the binary large object (BLOB) followed by that many bytes of data.
VT_BLOB_OBJECT 0x0046	A 4-byte unsigned integer count of bytes in the binary large object (BLOB) followed by that many bytes of data.
VT_BSTR 0x0008	A 4-byte unsigned integer count of bytes in the string followed by a string, as specified in the vValue definition in this section.
VT_LPSTR 0x001E	A null-terminated ANSI string.
VT_LPWSTR 0x001F	A null-terminated Unicode (as specified in [UNICODE]) string.
VT_VARIANT 0x000C	<ol style="list-style-type: none"> When used in a CTableColumn description, a CRowVariant structure. When not used in a CTableColumn description, a CBaseStorageVariant structure. MUST be combined with a type modifier of VT_ARRAY or VT_VECTOR.

The following table specifies the type modifiers for **vType**. Type modifiers can be combined with **vType** by using the bitwise OR operation to change the meaning of **vValue** to indicate that it is one of two possible array types.

Value	Meaning
VT_VECTOR 0x1000	If the type indicator is combined with VT_VECTOR by using an OR operator, vValue is a counted array of values of the indicated type. See section 2.2.1.1.1.2. This type modifier MUST NOT be combined with the following types: VT_INT, VT_UINT, VT_DECIMAL, VT_BLOB, and VT_BLOB_OBJECT.
VT_ARRAY 0x2000	If the type indicator is combined with VT_ARRAY by an OR operator, the value is a SAFEARRAY, containing values of the indicated type. This type modifier MUST NOT be combined with the following types: VT_I8, VT_UI8, VT_FILETIME, VT_CLSID, VT_BLOB, VT_BLOB_OBJECT, VT_LPSTR, and VT_LPWSTR.

When the VT_VARIANT **vType** is used in a CBaseStorageVariant structure, it MUST be combined with a type modifier of VT_ARRAY or VT_VECTOR. There is no such limitation when the VT_VARIANT **vType** is used in a CTableColumn structure, which specifies individual binding.

vData1 (1 byte): When **vType** is VT_DECIMAL, the value of this field is specified as the **Scale** field in section 2.2.1.1.1.1. For all other **vType** fields, the value MUST be set to 0x00.

vData2 (1 byte): When **vType** is VT_DECIMAL, the value of this field is specified as the **Sign** field in section 2.2.1.1.1.1. For all other vType fields, the value MUST be set to 0x00.

vValue (variable): The value for the match operation. The syntax MUST be as indicated in the **vType** field.

The following table summarizes sizes for the **vValue** field, dependent on the **vType** field for fixed-length data types. The size is in bytes.

vType	Size
VT_I1, VT_UI1	1
VT_I2, VT_UI2, VT_BOOL	2
VT_I4, VT_UI4, VT_R4, VT_INT, VT_UINT, VT_ERROR	4
VT_I8, VT_UI8, VT_R8, VT_CY, VT_DATE, VT_FILETIME	8
VT_DECIMAL, VT_CLSID	16

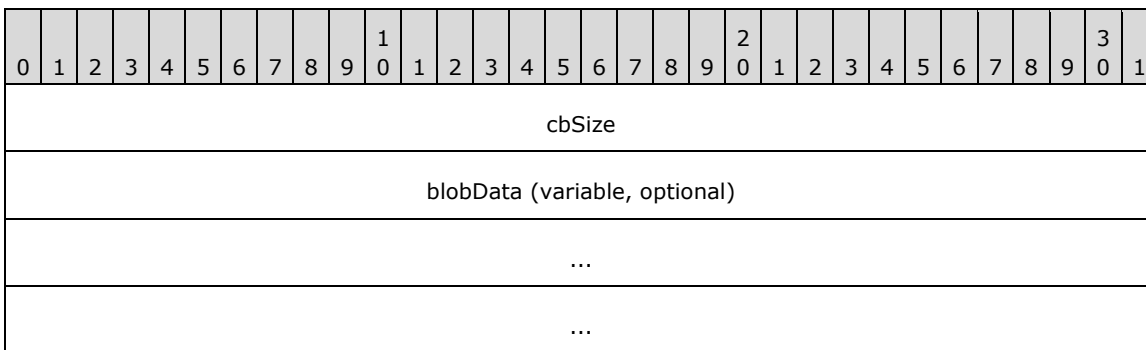
If **vType** is set to VT_BLOB or VT_BSTR, the structure of **vValue** is specified in the following diagram.

For **vType** set to VT_BLOB, this field is opaque binary BLOB data.

For **vType** set to VT_BSTR, this field is a set of characters in an OEM selected character set. The client and server MUST be configured to have interoperable character sets (which is not addressed in this protocol). There is no requirement that it be null-terminated.

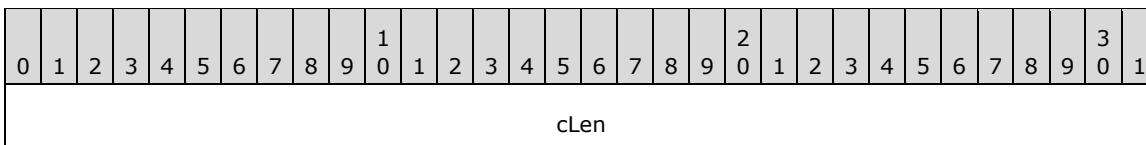
For a **vType** set to either VT_LPSTR or VT_LPWSTR, the structure of **vValue** is shown in the following diagram with the following caveats:

1. If **vType** is set to VT_LPSTR, **cLen** indicates the size of the string in system code page characters, and **string** is a null-terminated string.
2. If **vType** is set to VT_LPWSTR, **cLen** indicates the size of the string in Unicode characters, and **string** is a null-terminated Unicode string.



cbSize: A 32-bit unsigned integer. Indicates the size of the **blobData** field in bytes. If **vType** is set to VT_BSTR, **cbSize** MUST be set to 0x00000000 when the string represented is an empty string.

blobData: MUST be of length **cbSize**, in bytes.



string (variable, optional)
...
...

cLen: A 32-bit unsigned integer, indicating the size of the string field including the terminating null. A value of 0x00000000 indicates that no such string is present.

string: Null-terminated string. This field **MUST** be absent if **cLen** equals 0x00000000.

2.2.1.1.1 CBaseStorageVariant Structures

The following structures are used in the CBaseStorageVariant structure.

2.2.1.1.1.1 DECIMAL

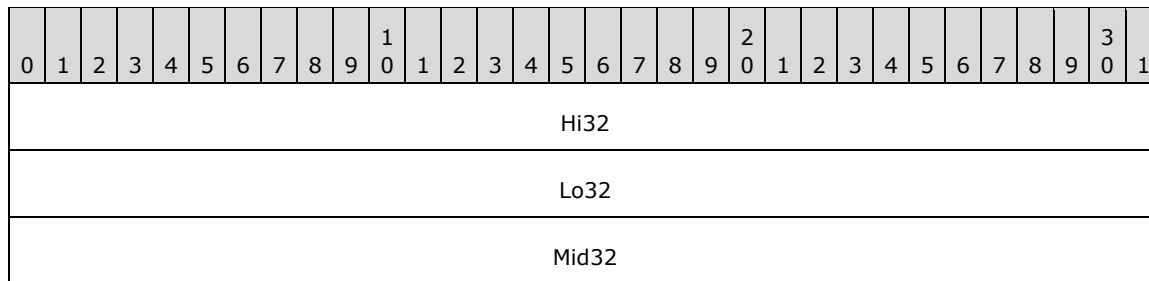
The DECIMAL structure is used to represent an exact numeric value with a fixed precision and fixed scale.

When **vType** is set to VT_DECIMAL (0x0000E), the **vData1** and **vData2** fields of CBaseStorageVariant **MUST** be interpreted as follows.

vData1: The number of digits to the right of the decimal point. **MUST** be in the range 0 to 28.

vData2: The sign of the numeric value. Set to 0x00, if the sign is positive; set to 0x80, if the sign is negative.

When **vType** is set to VT_DECIMAL, the format of the **vValue** field is specified in the following diagram.



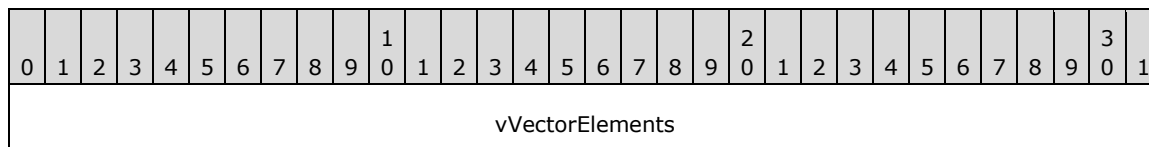
Hi32 (4 bytes): The highest 32 bits of the 96-bit integer.

Lo32 (4 bytes): The lowest 32 bits of the 96-bit integer.

Mid32 (4 bytes): The middle 32 bits of the 96-bit integer.

2.2.1.1.1.2 VT_VECTOR

The VT_VECTOR structure is used to pass one-dimensional arrays.



vVectorData (variable)
...

vVectorElements (4 bytes): Unsigned 32-bit integer, indicating the number of elements in the **vVectorData** field.

vVectorData (variable): An array of items that have a type indicated by **vType** with the 0x1000 bit cleared. The size of an individual fixed-length item can be obtained from the fixed-length data type table, as specified in section 2.2.1.1. The length of this field in bytes can be calculated by multiplying **vVectorElements** by the size of an individual item.

For variable-length data types, **vVectorData** contains a sequence of consecutively marshaled simple types in which the type is indicated by **vType** with the 0x1000 bit cleared. This includes a special case indicated by **vType** VT_ARRAY | VT_VARIANT (that is, 0x100C).

The elements in the **vVectorData** field MUST be separated by 0 to 3 padding bytes such that each element begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this array. If padding bytes are present, the value that they contain is arbitrary. The contents of the padding bytes MUST be ignored by the receiver.

For a **vType** set to VT_ARRAY | VT_VARIANT, the type for items in this sequence is CBaseStorageVariant.

2.2.1.1.1.3 SAFEARRAY

The SAFEARRAY structure is used to pass multidimensional arrays. The structure contains array size information as well as the data in the array.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
cDims																fFeatures															
cbElements																															
Rgsabound (variable)																															
...																															
vData (variable)																															
...																															

cDims (2 bytes): Unsigned 16-bit integer, indicating the number of dimensions of the multidimensional array.

fFeatures (2 bytes): A 16-bit bitfield. The values represent features defined by upper-layer applications and MUST be ignored.

cbElements (4 bytes): A 32-bit value that MUST be ignored by the server.

Rgsabound (variable): An array that contains one SAFEARRAYBOUND structure per dimension in the SAFEARRAY structure. This array has the leftmost dimension first and the rightmost dimension last.

vData (variable): A vector of marshaled items of a particular type indicated by the **vType** field of the containing CBaseStorageVariant with the bit 0x2000 cleared.

vData is marshaled similarly to VT_VECTOR, as specified in section 2.2.1.1.1.2, with the difference that the number of items is not stored in front of the vector. Instead, the number of items is calculated by multiplying the **cElements** value with all safe array bounds given in the **Rgsabound** field. Elements are stored in a vector in order of dimensions, iterating beginning with the rightmost dimension.

The following diagram visually represents a sample two-dimensional array. The first dimension has **cElements** equal to 4 (represented horizontally) and **lLbound** equal to 0, and the second dimension has **cElements** equal to 2 (represented vertically) and **lLbound** equal to 0.

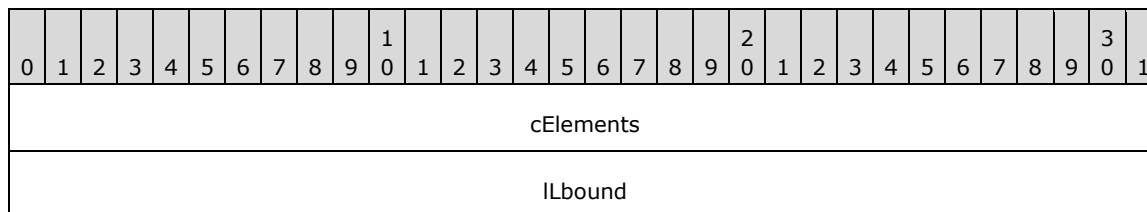
	cElements 0	cElements 1	cElements 2	cElements 3
cElements 0	0x00000001	0x00000002	0x00000003	0x00000005
cElements 1	0x00000007	0x00000011	0x00000013	0x00000017

Figure 1: Two-dimensional array

Using the previous diagram, **vData** will contain the following sequence: 0x00000001, 0x00000007, 0x00000002, 0x00000011, 0x00000003, 0x00000013, 0x00000005, 0x00000017 (iterating through the rightmost dimension first, and then incrementing the next dimension). The preceding **Rgsabound** (which records **cElements** and **lLbound**) would be the following: 0x00000004, 0x00000000, 0x00000002, and 0x00000000.

2.2.1.1.1.4 SAFEFARRAYBOUND

The SAFEFARRAYBOUND structure represents the bounds of one dimension of a SAFEFARRAY or SAFEFARRAY2 structure. Its format is as follows.

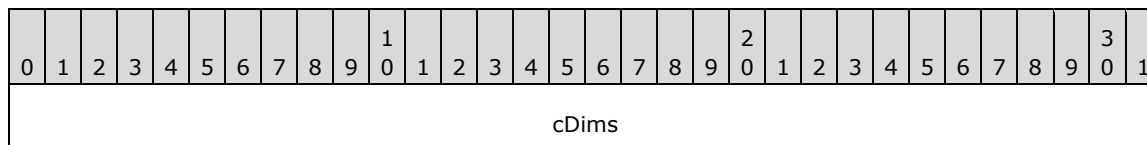


cElements (4 bytes): A 32-bit unsigned integer, specifying the number of elements in the dimension.

lLbound (4 bytes): A 32-bit unsigned integer, specifying the lower bound of the dimension.

2.2.1.1.1.5 SAFEFARRAY2

The SAFEFARRAY2 structure is used to pass multidimensional arrays in SERIALIZEDPROPERTYVALUE. The structure contains boundary information and the data above.



Rgsabound (variable)
...
vData (variable)
...

cDims (4 bytes): Unsigned 32-bit integer, indicating the number of dimensions of the SAFEARRAY2.

Rgsabound (variable): An array that contains one SAFEARRAYBOUND structure per dimension in the SAFEARRAY2. This array has the leftmost dimension first and the rightmost dimension last.

vData (variable): A vector of marshaled items of a particular type indicated by the dwType of the containing SERIALIZEDPROPERTYVALUE with bit 0x2000 cleared. The format of **vData** is the same as that specified for the **vData** field of SAFEARRAY.

2.2.1.2 CFullPropSpec

The CFullPropSpec structure contains a property set GUID and a property identifier to uniquely identify a property. A CFullPropSpec instance has a property set GUID and either an integer property ID or a string property name. For properties to match, the CFullPropSpec structure must match the column identifier in the index. There is no conversion between property IDs and property names. Property names are case insensitive.

For more information, see the Indexing Service definition of FULLPROPSPEC in [MSDN-FULLPROPSPEC].

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
paddingPropSet (variable)																															
...																															
_guidPropSet (16 bytes)																															
...																															
...																															
ulKind																															
PrSpec																															
Property name (variable)																															
...																															

paddingPropSet (variable): This field MUST be 0 to 7 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 8 bytes from the beginning of the message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver.

_guidPropSet (16 bytes): The GUID of the property set to which the property belongs.

ulKind (4 bytes): A 32-bit unsigned integer. MUST be one of the following values that indicates the content of **PrSpec**.

Value	Meaning
PRSPEC_LPWSTR 0x00000000	The PrSpec field specifies the number of non-NULL Unicode characters in the Property name field.
PRSPEC_PROPID 0x00000001	The PrSpec field specifies the property ID (PROPID).

PrSpec (4 bytes): A 32-bit unsigned integer with a meaning as indicated by the **ulKind** field.

Property name (variable): If **ulKind** is set to PRSPEC_PROPID, this field MUST NOT be present. If **ulKind** is set to PRSPEC_LPWSTR, this field MUST contain a case-insensitive array of **PrSpec** non-null Unicode characters that contains the name of the property.

2.2.1.3 CContentRestriction

The CContentRestriction structure contains a word or phrase to match in the inverted index for a specific property.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
_Property (variable)																															
...																															
Padding1 (variable)																															
...																															
Cc																															
_pwcsPhrase (variable)																															
...																															
Padding2 (variable)																															
...																															
Lcid																															
_ulGenerateMethod																															

_Property (variable): A CFullPropSpec structure. This field indicates the property on which to perform a match operation.

Padding1 (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the

message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver.

Cc (4 bytes): A 32-bit unsigned integer, specifying the number of characters in the **_pwcsPhrase** field.

_pwcsPhrase (variable): A non-null-terminated Unicode string representing the word or phrase to match for the property. This field MUST NOT be empty. The **Cc** field contains the length of the string.

Padding2 (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver.

Lcid (4 bytes): A 32-bit unsigned integer, indicating the locale of **_pwcsPhrase**, as specified in [MS-LCID].

_ulGenerateMethod (4 bytes): A 32-bit unsigned integer, specifying the method to use when generating alternative word forms.

Value	Meaning
GENERATE_METHOD_EXACT 0x00000000	Exact match. Each word in the phrase must match exactly in the inverted index.
GENERATE_METHOD_PREFIX 0x00000001	Prefix match. Each word in the phrase is considered a match if the word is a prefix of an indexed string. For example, if the word "barking" is indexed, then "bar" would match when performing a prefix match.
GENERATE_METHOD_INFLECT 0x00000002	Matches inflections of a word. An inflection of a word is a variant of the root word in the same part of speech that has been modified, according to linguistic rules of a given language. For example, inflections of the verb swim in English include swim, swims, swimming, and swam.

2.2.1.4 CNatLanguageRestriction

The CNatLanguageRestriction structure contains a natural language query match for a property. Natural language means that the string has no formal meaning. The indexing service is free to match on the string in any way that it can. It can drop words, add alternative forms or make no changes.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_Property (variable)																															
...																															
_padding_cc (variable)																															
...																															
Cc																															
_pwcsPhrase (variable)																															

...
_padding_lcid (variable)
...
Lcid

_Property (variable): A CFullPropSpec structure. This field indicates the property on which to perform the match operation.

_padding_cc (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver.

Cc (4 bytes): A 32-bit unsigned integer, specifying the number of characters in the **_pwcsPhrase** field.

_pwcsPhrase (variable): A non-null-terminated Unicode string with the text to be searched for within the specific property. This string MUST NOT be empty. The **Cc** field contains the length of the string.

_padding_lcid (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver.

Lcid (4 bytes): A 32-bit unsigned integer indicating the locale of **_pwcsPhrase**, as specified in [MS-LCID].

2.2.1.5 CNodeRestriction

The CNodeRestriction structure contains an array of command tree restriction nodes for constraining the results of a query.

0	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	
_cNode																																			
_paNode (variable)																																			
...																																			

_cNode (4 bytes): A 32-bit unsigned integer specifying the number of CRestriction structures contained in the **_paNode** field.

_paNode (variable): An array of CRestriction structures. Structures in the array MUST be separated by 0 to 3 padding bytes such that each structure begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this array. If padding bytes are present, the value that they contain is arbitrary. The content of the padding bytes MUST be ignored by the receiver.

2.2.1.6 CPropertyRestriction

The CPropertyRestriction structure contains a property to get from each row, a comparison operator, and a constant. For each row, the value returned by the specific property in the row is compared against the constant to determine if it has the relationship specified by the **_relop** field. For the comparison to be true, the data types of the values must match.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_relop																															
_Property (variable)																															
...																															
_prval (variable)																															
...																															

_relop (4 bytes): A 32-bit unsigned integer specifying the relation to perform on the property. **_relop** MUST be one of the values in the following tables.

Value	Meaning
PRLT 0x00000000	A less-than comparison.
PRLE 0x00000001	A less-than-or-equal-to comparison.
PRGT 0x00000002	A greater-than comparison.
PRGE 0x00000003	A greater-than-or-equal-to comparison.
PREQ 0x00000004	An equality comparison.
PRNE 0x00000005	A not-equal comparison.
PRRE 0x00000006	A regular expression comparison.

For PRRE relations, regular expressions are expressed with a string that contains special symbols. Any character except an asterisk (*), period (.), question mark (?), or vertical bar (|) matches itself. A regular expression can be enclosed in a pair of quotation marks ("..."), and MUST be enclosed in quotation marks if the expression contains a space or a closing parenthesis.

The asterisk matches any number of characters. The period matches the end of a string. The question mark matches any one character. The vertical bar (|) is an escape character, which indicates special behavior for the characters shown in the following table. The following table explains the meanings of special characters in regular expressions.

Character	Meaning
(An opening parenthesis opens a group. It MUST be followed by a matching closing parenthesis.
)	A closing parenthesis closes a group. It MUST be preceded by a matching opening parenthesis.
[An opening bracket preceded (escaped) by a vertical bar opens a character class. It MUST be followed by a matching (nonescaped) closing square bracket.
{	An opening brace opens a counted match. It MUST be followed by a matching closing brace.
}	A closing brace closes a counted match. It MUST be preceded by a matching opening brace.
,	A comma separates OR clauses.
*	An asterisk matches zero or more occurrences of the preceding expression.
?	A question mark matches zero or one occurrence of the preceding expression.
+	A plus sign matches one or more occurrences of the preceding expression.
Other	All other characters match themselves.

The following table describes characters which, when located between brackets ([]), have special meanings.

Character	Meaning
^	A caret matches everything but following classes. (It MUST be the first character in the string.)
]	A closing bracket matches another closing bracket. It MAY be preceded only by a caret (^); otherwise, it closes the class.
-	A hyphen is a range operator. It is preceded and followed by normal characters.
Other	All other characters match themselves (or begin or end a range).

The following table describes the syntax used between braces ({ }).

Character	Meaning
{m}	Matches exactly m occurrences of the preceding expression (0 < m < 256).
{m,}	Matches at least m occurrences of the preceding expression (1 < m < 256).
{m, n}	Matches between m and n occurrences of the preceding expression, inclusive (0 < m < 256, 0 < n < 256).

To match the asterisk and question mark, enclose them in brackets. For example, [*]sample matches "*sample".

Value	Meaning
PRAIIBits 0x00000007	A bitwise AND that returns the value equal to _prval .
PRSomeBits 0x00000008	A bitwise AND that returns a nonzero value.

For vector properties, the behavior of the relational operators depends on the result of a logical **OR** using a mask and the relational operator.

If there is no mask, then the restriction is true if the relational operator holds between each element of a property value and the corresponding element in the **__prval** field. If, in addition, the two vectors have different lengths, then the vector lengths are compared using the relational operator.

If there is a mask, the possible values are as follows.

Value	Meaning
PRAII 0x00000100	The restriction is true if every element in a property value has the relationship with some element in the __prval field.
PRAAny 0x00000200	The restriction is true if any element in the property value has the relationship with some element in the __prval field.

__Property (variable): A CFullPropSpec structure indicating the property on which to perform a match operation.

__prval (variable): A CBaseStorageVariant structure containing the value to relate to the property.

2.2.1.7 CScopeRestriction

The CScopeRestriction structure restricts the files to be returned to those that have a path that matches the restriction.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
CcLowerPath																															
__lowerPath (variable)																															
...																															
__padding (variable)																															
...																															
__length																															
__fRecursive																															
__fVirtual																															

CcLowerPath (4 bytes): A 32-bit unsigned integer containing the number of Unicode characters in the **__lowerPath** field.

__lowerPath (variable): A non-null-terminated Unicode string representing the path to which the query is restricted. The **CcLowerPath** field contains the length of the string.

__padding (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the

message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver.

_length (4 bytes): A 32-bit unsigned integer containing the length of **_lowerPath** in Unicode characters. This MUST be the same value as **CcLowerPath**.

_fRecursive (4 bytes): A 32-bit unsigned integer. MUST be set to one of the following values.

Value	Meaning
0x00000000	The server is not to examine any subdirectories.
0x00000001	The server is to recursively examine all subdirectories of the path contained in the _lowerPath field.

_fVirtual (4 bytes): A 32-bit unsigned integer. MUST be set to one of the following values.

Value	Meaning
0x00000000	_lowerPath is a file system path.
0x00000001	_lowerPath is a virtual path (the URL associated with a physical directory on the file system) for a website.

2.2.1.8 CSort

The CSort structure identifies a column, direction, and locale to sort by.

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

pidColumn (4 bytes): A 32-bit unsigned integer. This is the index in CPidMapper for the property to sort by.

dwOrder (4 bytes): A 32-bit unsigned integer. MUST be one of the following values, specifying how to sort based on the column.

Value	Meaning
QUERY_SORTASCEND 0x00000000	The rows are to be sorted in ascending order based on the values in the column specified.
QUERY_SORTDESCEND 0x00000001	The rows are to be sorted in descending order based on the values in the column specified.

locale (4 bytes): A 32-bit unsigned integer indicating the locale (as specified in [MS-LCID]) of the column. The locale determines the sorting rules to use when sorting textual values. An indexing service SHOULD use the appropriate operating system facilities to do this.

2.2.1.9 CVectorRestriction

The CVectorRestriction structure contains a weighted OR operation over restriction nodes. Vector restrictions represent queries using the full-text vector space model of ranking (as specified in [SALTON]). In addition to the OR operation they also compute a rank depending on the ranking algorithm.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_pres (variable)																															
...																															
_padding (variable)																															
...																															
_ulRankMethod																															

_pres (variable): A CNodeRestriction command tree on which a ranked OR operation is to be performed.

_padding (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver.

_ulRankMethod (4 bytes): A 32-bit unsigned integer specifying a ranking algorithm that MUST be set to one of the following values.

Value	Meaning
VECTOR_RANK_MIN 0x00000000	Use the minimum algorithm as specified in [SALTON].
VECTOR_RANK_MAX 0x00000001	Use the maximum algorithm as specified in [SALTON].
VECTOR_RANK_INNER 0x00000002	Use the inner product algorithm as specified in [SALTON].
VECTOR_RANK_DICE 0x00000003	Use the Dice coefficient algorithm as specified in [SALTON].
VECTOR_RANK_JACCARD 0x00000004	Use the Jaccard coefficient algorithm as specified in [SALTON].

2.2.1.10 CRestriction

The CRestriction structure contains a restriction node in a query command tree.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_ulType																															
Weight																															
Restriction (variable)																															
...																															

_ulType (4 bytes): A 32-bit unsigned integer indicating the restriction type used for the command tree node. The type determines what is found in the **Restriction** field of the structure as described in the following table. MUST be set to one of the following values.

Value	Meaning
RTNone 0x00000000	The node represents a noise word in a vector query.
RTAnd 0x00000001	The node contains a CNodeRestriction structure on which a logical AND operation is to be performed.
RTOr 0x00000002	The node contains a CNodeRestriction structure on which a logical OR operation is to be performed.
RTNot 0x00000003	The node contains a CRestriction structure on which a NOT operation is to be performed.
RTContent 0x00000004	The node contains a CContentRestriction structure.
RTProperty 0x00000005	The node contains a CPropertyRestriction structure.
RTProximity 0x00000006	The node contains a CNodeRestriction structure with an array of CContentRestriction structures. Any other kind of restriction is undefined. The restriction requires the words or phrases found in the CContentRestriction structures to be within an indexing service defined range in order to be a match. The indexing service can also compute a rank based on how far apart the words or phrases are.
RTVector 0x00000007	The node contains a CVectorRestriction structure.
RTNatLanguage 0x00000008	The node contains a CNatLanguageRestriction structure.
RTScope 0x00000009	The node contains a CScopeRestriction structure.
RTPhrase 0xFFFFFFFF	The node contains a CNodeRestriction structure on which a phrase match is to be performed.

Weight (4 bytes): A 32-bit unsigned integer representing the weight of the node. Weight indicates the node's importance relative to other nodes in the query command tree. Higher weight values are more important.

Restriction (variable): The restriction type for the command tree node. The syntax MUST be as indicated by the **_ulType** field.

2.2.1.11 CColumnSet

The CColumnSet structure specifies the column numbers to be returned. This structure is always used in reference to a specific CPidMapper structure.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
count																															
indexes (variable)																															
...																															

count (4 bytes): A 32-bit unsigned integer specifying the number of elements in the **indexes** array.

indexes (variable): An array of 4-byte unsigned integers representing zero-based indexes into the **aPropSpec** array in the corresponding CPidMapper structure. The corresponding property values are returned as columns in the result set.

2.2.1.12 CCategorySet

The CCategorySet structure contains information on the grouping is done at each level in a hierarchical result set.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
count																															
categories (variable)																															
...																															

count (4 bytes): A 32-bit unsigned integer containing the number of elements in the categories array.

categories (variable): Array of CCategoryizationSpec structures specifying the grouping for each level in a hierarchical query. The first structure specifies the top level.

2.2.1.13 CCategoryizationSpec

The CCategoryizationSpec structure specifies how grouping is done at one level in a hierarchical query.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_csColumns (variable)																															
...																															

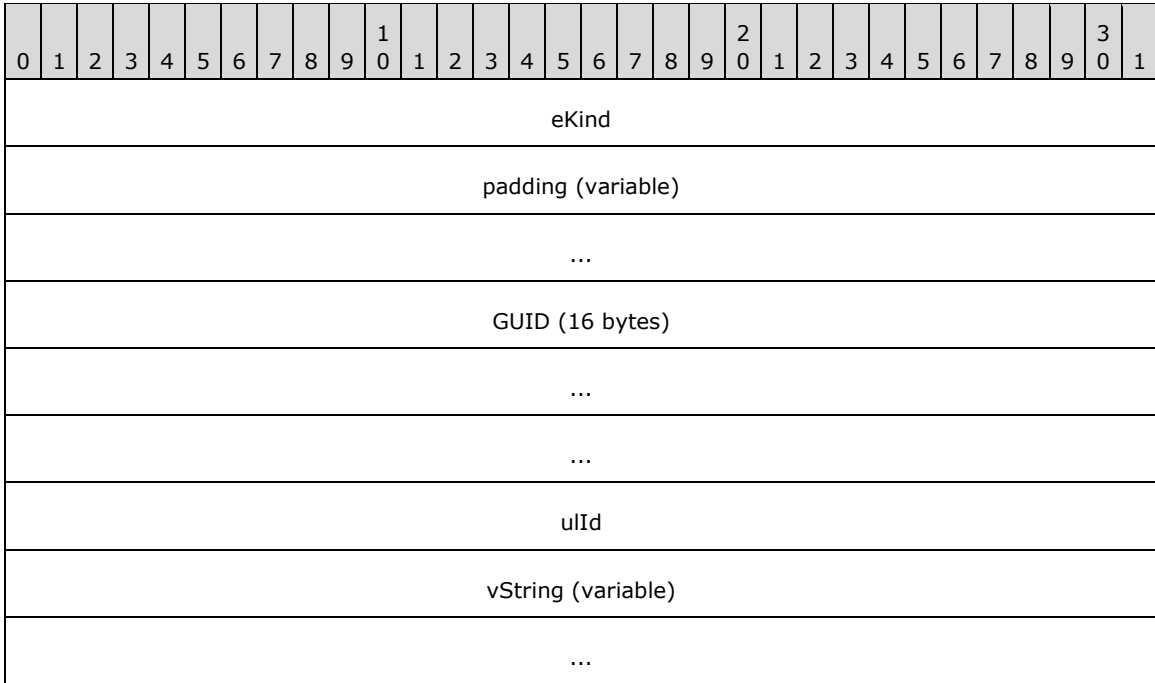
_ulCategType

_csColumns (variable): A CColumnSet structure indicating the columns to return at that level in a hierarchical result set.

_ulCategType (4 bytes): A 32-bit unsigned integer that MUST be set to 0x00000000.

2.2.1.14 CDbColId

The CDbColId structure contains an OLE-DB Column ID.



eKind (4 bytes): MUST be set to one of the following values that indicates the contents of the **GUID**, **ulId**, and **vString** fields.

Value	Meaning
DBKIND_GUID_NAME 0x00000000	vString contains a property name.
DBKIND_GUID_PROPID 0x00000001	ulId contains a 4-byte integer indicating the property ID.
DBKIND_PGUID_NAME 0x00000003	vString contains a property name. This value MUST be treated the same as DBKIND_GUID_NAME.
DBKIND_PGUID_PROPID 0x00000004	ulId contains a 4-byte integer indicating the property ID. This value MUST be treated the same as DBKIND_GUID_PROPID.

padding (variable): This field MUST be 0 to 7 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 8 bytes from the beginning of the message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver.

GUID (16 bytes): GUID which uniquely identifies the property set for the property.

ulId (4 bytes): If **eKind** is DBKIND_GUID_PROPID, this field contains an unsigned integer specifying the property ID. If **eKind** is DBKIND_GUID_NAME, this field contains an unsigned integer specifying the number of Unicode characters contained in the **vString** field.

vString (variable): A non-null-terminated Unicode string representing the property name. It MUST be omitted unless the **eKind** field is set to DBKIND_GUID_NAME.

2.2.1.15 CDbProp

The CDbProp structure contains an OLE-DB DBPROP database property. These properties control how queries are interpreted by the indexing service.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
DBPROPID																															
DBPROPOPTIONS																															
DBPROPSTATUS																															
colid (variable)																															
...																															
_padding (variable)																															
...																															
vValue (variable)																															
...																															

DBPROPID (4 bytes): A 32-bit unsigned integer indicating the property ID. This field uniquely identifies each property in a particular query, but has no other interpretation. In particular, it is not a PROPID as found in the CDbColId structure.

DBPROPOPTIONS (4 bytes): Property options. This field MUST be set to 0x00000001 if the property is optional and to 0x00000000 otherwise.

DBPROPSTATUS (4 bytes): Property status. This field MUST be set to 0x00000000.

colid (variable): A CDbColId structure that defines the database property being passed.

_padding (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver.

vValue (variable): A CBaseStorageVariant structure containing the property value.

2.2.1.15.1 Database Properties

This section details the properties that are used by the Content Indexing Services Protocol to control the behavior of the indexing service. These properties are grouped into three property sets identified in the **guidPropertySet** field of the CDbPropSet structure.

The following table lists the properties that are part of the DBPROPSET_FSCIFRMWRK_EXT property set.

Value	Meaning
DBPROP_CI_CATALOG_NAME 0x00000002	Specifies the name of the catalog or catalogs to query. Value MUST be a VT_LPWSTR or a VT_VECTOR VT_LPWSTR.
DBPROP_CI_INCLUDE_SCOPES 0x00000003	Specifies one or more paths to be included in the query. Value MUST be a VT_LPWSTR or a VT_VECTOR VT_LPWSTR.
DBPROP_CI_SCOPE_FLAGS 0x00000004	Specifies how the paths specified by the DBPROP_CI_INCLUDE_SCOPES property are to be treated. Value MUST be a VT_I4 or a VT_VECTOR VT_I4.
DBPROP_CI_QUERY_TYPE 0x00000007	Specifies the type of query using a CDbColId structure. The structure MUST be set such that the eKind field contains 0x00000001 and the GUID and uID fields are filled with zeros.

The following table lists the flags for the DBPROP_CI_SCOPE_FLAGS property.

Value	Meaning
QUERY_DEEP 0x01	If set, indicates that files in the scope directory and all subdirectories are included in the results. If clear, only files in the scope directory are included in the results. MUST NOT be combined with QUERY_DEEP.
QUERY_VIRTUAL_PATH 0x02	If set, indicates that the scope is a virtual path. If clear, indicates that the scope is a physical directory.

The following table lists the query types for the DBPROP_CI_QUERY_TYPE property.

Value	Meaning
CiNormal 0x00000000	A regular query.
CiVirtualRoots 0x00000001	The query is requesting a list of the virtual roots of the catalog. This value requires administrative privileges.
CiProperties 0x00000003	The query is requesting a list of all of the properties supported by the indexing service.
CiAdminOp 0x00000004	The query is an administrative operation. This value requires administrative privileges.

The following table lists the properties that are part of the DBPROPSET_QUERYEXT property set.

Value	Meaning
DBPROP_USECONTENTINDEX 0x00000002	Use the inverted index to optimize the speed of evaluating content restrictions at the cost of the index possibly being out of date. Value MUST be a VT_BOOL. If TRUE, the server is allowed to fail these queries.
DBPROP_DEFERONINDEXEDTRIMMING	Some operations, such as filtering by scope or security, can be

Value	Meaning
0x00000003	expensive. This flag indicates that it is acceptable to defer this filtering until the results are actually requested. Value MUST be a VT_BOOL.
DBPROP_USEEXTENDEDDBTYPES 0x00000004	Indicates whether the client supports VT_VECTOR data types. If TRUE, the client supports VT_VECTOR; if FALSE, the server is to convert VT_VECTOR data types to VT_ARRAY data types. The value MUST be a VT_BOOL.
DBPROP_FIRSTROWS 0x00000007	If TRUE, the indexing service returns the first rows that match. If FALSE, then rows by default are returned in order of descending rank. Value MUST be a VT_BOOL.

The following table lists the properties that are part of the DBPROPSET_CIFRMWRKCORE_EXT property set.

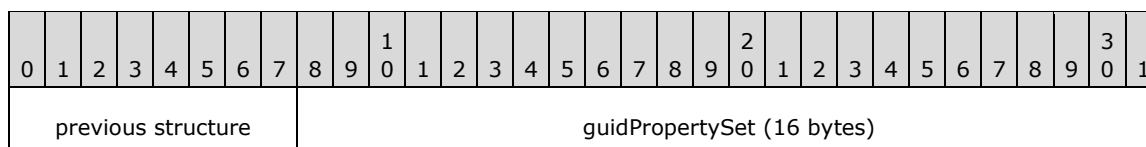
Value	Meaning
DBPROP_MACHINE 0x00000002	Specifies the names of the computers on which a query is to be processed. The value MUST be either VT_BSTR or VT_ARRAY VT_BSTR.
DBPROP_CLIENT_CLSID 0x00000003	Specifies a connection constant for the indexing service. The value can be a VT_CLSID containing 0x2A4880706FD911D0A80800A0C906241A or VT_ARRAY of STRINGS with value {2A488070-6FD9-11D0-A808-00A0C906241A}.

The following table lists properties that are part of the DBPROPSET_MSIDX_ROWSETEXT property set.

Value	Meaning
MSIDXSPROP_ROWSETQUERYSTATUS 0x00000002	Specifies that the client is interested in rowset status. Value MUST be set to 0.
MSIDXSPROP_COMMAND_LOCALE_STRING 0x00000003	Specifies locale ID string for the query.
MSIDXSPROP_QUERY_RESTRICTION 0x00000004	Ignored by the server. MUST be set to an empty BSTR.

2.2.1.16 CDbPropSet

The CDbPropSet structure contains a set of properties. The first field (**guidPropertySet**) is not padded and will start where the previous structure in the message ended (as indicated by the "previous structure" entry in the following diagram). The 1-byte length of "previous structure" is arbitrary, and is not meant to suggest that **guidPropertySet** will begin on any particular boundary. However, the **cProperties** field MUST be aligned to begin at a multiple of 4 bytes from the beginning of the message, and hence, the format is depicted as follows.



...	
...	
...	_padding (variable)
...	
cProperties	
aProps (variable)	
...	

guidPropertySet (16 bytes): A GUID identifying the property set. MUST be set to the binary form corresponding to one of the following values (shown in string representation form), identifying the property set of the properties contained in the **aProps** field.

Value/GUID	Meaning
DBPROPSET_CIFRMWRKCORE_EXT AFAFACA5-B5D1-11D0-8C62-00C04FC2DB8D	Content Index Framework Core Property Set.
DBPROPSET_FSCIFRMWRK_EXT A9BD1526-6A80-11D0-8C9D-0020AF1D740E	File System Content Index Framework Property Set.
DBPROPSET_MSIDX_ROWSETEXT AA6EE6B0-E828-11D0-B23E-00AA0047FC01	Content Index Rowset Property Set.
DBPROPSET_QUERYEXT A7AC77ED-F8D7-11CE-A798-0020F8008025	Query Extension Property Set.

_padding (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver.

cProperties (4 bytes): A 32-bit unsigned integer containing the number of elements in the **aProps** array.

aProps (variable): An array of CDbProp structures containing properties. Structures in the array MUST be separated by 0 to 3 padding bytes such that each structure begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this array. If padding bytes are present, the value that they contain is arbitrary. The content of the padding bytes MUST be ignored by the receiver.

2.2.1.17 CPidMapper

The CPidMapper structure contains an array of property specifications and serves to map from a property offset to a full property specification. The more compact property offsets are used to name properties in other parts of the protocol. Because offsets are more compact, they allow shorter property references in other parts of the protocol.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
count																															
paddingPropSpec (variable)																															
...																															
aPropSpec (variable)																															
...																															

count (4 bytes): A 32-bit unsigned integer containing the number of elements in the **aPropSpec** array.

paddingPropSpec (variable): This field MUST be 0 to 4 bytes in length. The length of this field MUST be such that the byte offset from the beginning of the message to the first structure contained in the **aPropSpec** field is a multiple of 8. The value of the bytes can be any arbitrary value and MUST be ignored by the receiver.

aPropSpec (variable): An array of CFullPropSpec structures.

2.2.1.18 CRowSeekAt

The CRowSeekAt structure contains the offset at which to retrieve rows for a CPMGetRowsIn message.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_chapt																															
_bmkOffset																															
_cskip																															
_hRegion																															

_chapt (4 bytes): A 32-bit value representing the handle of the rowset chapter.

_bmkOffset (4 bytes): A 32-bit value representing the handle of the bookmark, indicating the starting position from which to skip the number of rows specified in **_cskip**, before beginning retrieval.

_cskip (4 bytes): A 32-bit unsigned integer containing the number of rows to skip in the rowset.

_hRegion (4 bytes): A 32-bit unsigned integer. This field MUST be set to 0x00000000 and MUST be ignored.

2.2.1.19 CRowSeekAtRatio

The CRowSeekAtRatio structure identifies the point at which to begin retrieval for a CPMGetRowsIn message.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_chapt																															
_ulNumerator																															
_ulDenominator																															
_hRegion																															

_chapt (4 bytes): A 32-bit value representing the handle of the rowset chapter.

_ulNumerator (4 bytes): A 32-bit unsigned integer representing the numerator of the ratio of rows in the chapter at which to begin retrieval.

_ulDenominator (4 bytes): A 32-bit unsigned integer representing the denominator of the ratio of rows in the chapter at which to begin retrieval. This field **MUST** be greater than zero.

_hRegion (4 bytes): A 32-bit unsigned integer. This field **MUST** be set to 0x00000000 and **MUST** be ignored.

2.2.1.20 CRowSeekByBookmark

The CRowSeekByBookmark structure identifies the bookmarks from which to begin retrieving rows for a CPMGetRowsIn message.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_chapt																															
_cBookmarks																															
_aBookmarks (variable)																															
...																															
_maxRet																															
_ascRet (variable)																															
...																															

_chapt (4 bytes): A 32-bit value representing the handle of the rowset chapter.

_cBookmarks (4 bytes): A 32-bit unsigned integer representing the number of elements in _aBookmarks array.

_aBookmarks (variable): An array of bookmark handles (each represented by 4 bytes) as obtained from a CPMGetRowsOut message.

_maxRet (4 bytes): A 32-bit unsigned integer representing the number of elements in the **_ascRet** array.

_ascRet (variable): An array of HRESULT values. When the CRowSeekByBookmark structure is sent as part of the CPMGetRowsIn request, the number of entries in the array MUST be equal to **_maxRet**. When sent by the client, the values MUST be set to zero when sent and MUST be ignored on receipt. When sent by the server (as part of the CPMGetRowsOut message), the values in the array indicate the result status for each row retrieval.

2.2.1.21 CRowSeekNext

The CRowSeekNext structure contains the number of rows to skip for a CPMGetRowsIn message.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_chapt																															
_cskip																															

_chapt (4 bytes): A 32-bit value representing the handle of the rowset chapter.

_cskip (4 bytes): A 32-bit unsigned integer representing the number of rows to skip in the rowset.

2.2.1.22 CRowsetProperties

The CRowsetProperties structure contains configuration information for a query.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_uBooleanOptions																															
_ulMaxOpenRows																															
_ulMemoryUsage																															
_cMaxResults																															
_cCmdTimeout																															

_uBooleanOptions (4 bytes): The least significant 3 bits of this field MUST contain one of the following three values.

Value	Meaning
eSequential 0x00000001	The cursor (1) can be moved only forward.
eLocatable 0x00000003	The cursor can be moved to any position.
eScrollable 0x00000007	The cursor can be moved to any position and fetch in any direction.

The remaining bits MAY either be clear or set to any combination of the following values by using the bitwise OR operation.

Value	Meaning
eAsynchronous 0x00000008	The client will not wait for execution completion.
eFirstRows 0x00000080	Return the first rows encountered, not the best matches.
eHoldRows 0x00000200	The server MUST NOT discard rows until the client is done with a query.
eChaptered 0x00000800	The rowset supports chapters.
eUseCI 0x00001000	Use the inverted index to evaluate content restrictions even though it can be out of date. If not set, the indexing service can opt to execute the query by going directly against the file system.
eDeferTrimming 0x00002000	Nonindexed trimming operations, like scoping or security checking, can be expensive. This option gives the indexing service the option of deferring these operations until rows are actually requested.

_ulMaxOpenRows (4 bytes): A 32-bit unsigned integer. MUST be set to 0x00000000. It is not used and MUST be ignored.

_ulMemoryUsage (4 bytes): A 32-bit unsigned integer. MUST be set to 0x00000000. It is not used and MUST be ignored.

_cMaxResults (4 bytes): A 32-bit unsigned integer, specifying the maximum number of rows that are to be returned for the query. If **_cMaxResults** is set to 0x00000000, then the server assumes all results are requested and behaves as if 0xFFFFFFFF was specified in **_cMaxResults**.

_cCmdTimeout (4 bytes): A 32-bit unsigned integer, specifying the number of seconds at which a query is to time out and automatically terminate, counting from the time the query starts executing on the server. A value of 0x00000000 means that the query is not to time out.

2.2.1.23 CRowVariant

The CRowVariant structure contains the fixed-size portion of a variable-length data type stored in the CPMGetRowsOut message.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
vType																reserved1															
reserved2																															
Offset (variable)																															
...																															

vType (2 bytes): A type indicator, indicating the type of **vValue**. It MUST be one of the values under the **vType** field, as specified in section 2.2.1.1.

reserved1 (2 bytes): Not used. Can be set to any arbitrary value and MUST be ignored on receipt.

reserved2 (4 bytes): Not used. Can be set to any arbitrary value and MUST be ignored on receipt.

Offset (variable): An offset to variable-length data (for example, a string). This MUST be a 32-bit value (4 bytes long) if 32-bit offsets are being used (per the rules in section 2.2.3.16) or a 64-bit value (8 bytes long) if 64-bit offsets are being used.

2.2.1.24 CSortSet

The CSortSet structure contains the sort order of the query.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
count																															
sortArray (variable)																															
...																															

count (4 bytes): A 32-bit unsigned integer specifying the number of elements in **sortArray**.

sortArray (variable): An array of CSort structures describing the order in which to sort the results of the query. Structures in the array MUST be separated by 0 to 3 padding bytes such that each structure has a 4-byte alignment from the beginning of a message. Such padding bytes can be set to any arbitrary value and MUST be ignored on receipt.

2.2.1.25 CTableColumn

The CTableColumn structure contains a column of a CPMSetsBindingsIn message.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
PropSpec (variable)																															
...																															
vType																															
ValueUsed								_padding1 (optional)								ValueOffset (optional)															
ValueSize (optional)																StatusUsed								_padding2 (optional)							
StatusOffset (optional)																LengthUsed								_padding3 (optional)							
LengthOffset (optional)																															

PropSpec (variable): A CFullPropSpec structure.

vType (4 bytes): Specifies the type of data value contained in the column. For the list of values for this field, see the **vType** field in section 2.2.1.1.

Note The vType values specified in section 2.2.1.1 are 16-bit values. Those values are padded with zeros to 32-bit values for use in this field.

ValueUsed (1 byte): A 1-byte field that MUST be set to one of the following values.

Value	Meaning
0x00	The value of the column is not transferred in the row.
0x01	The value of the column is transferred within the row.

_padding1 (1 byte): A 1-byte field.

Note This field MUST be inserted before **ValueOffset** if, without it, **ValueOffset** would not begin at an even offset from the beginning of the message. The value of this byte is arbitrary and MUST be ignored. If **ValueUsed** is set to 0x00, this field MUST NOT be present.

ValueOffset (2 bytes): An unsigned 2-byte integer specifying the offset of the column value in the row. If **ValueUsed** is set to 0x00, this field MUST NOT be present.

ValueSize (2 bytes): An unsigned 2-byte integer specifying the size of the column value in bytes. If **ValueUsed** is set to 0x00, this field MUST NOT be present.

StatusUsed (1 byte): A 1-byte field that MUST be set to one of the following values.

Value	Meaning
0x00	The status of the column is not transferred within the row.
0x01	The status of the column is transferred within the row.

_padding2 (1 byte): A 1-byte field.

Note This field MUST be inserted before **StatusOffset** if, without it, the **StatusOffset** field would not begin at an even offset from the beginning of the message. The value of this byte is arbitrary and MUST be ignored. If **StatusUsed** is set to 0x00, this field MUST NOT be present.

StatusOffset (2 bytes): An unsigned 2-byte integer. Specifies the offset of the column status in the row. That is, the **StatusOffset** is relative to the beginning of each row.

If **StatusUsed** is set to 0x00, this field MUST NOT be present.

If **StatusUsed** is set to 0x01 in the request, **Status** is represented as one byte in the response by the offset specified in the **StatusOffset** request field. The status byte MUST be equal to one of the following values.

Value	Meaning
0x00	StatusOK
0x01	StatusDeferred
0x02	StatusNull

If the property value is absent for this row, the server MUST set the status byte to StatusNull. If the value is too big to be transferred in the CPMGetRowsOut message (greater than 2048 bytes), the server MUST set the status byte to StatusDeferred. Otherwise, the server MUST set the status byte to StatusOK.

LengthUsed (1 byte): A 1-byte field that MUST be set to one of the following values.

Value	Meaning
0x00	The length of the column MUST NOT be transferred within the row.
0x01	The length of the column is transferred within the row.

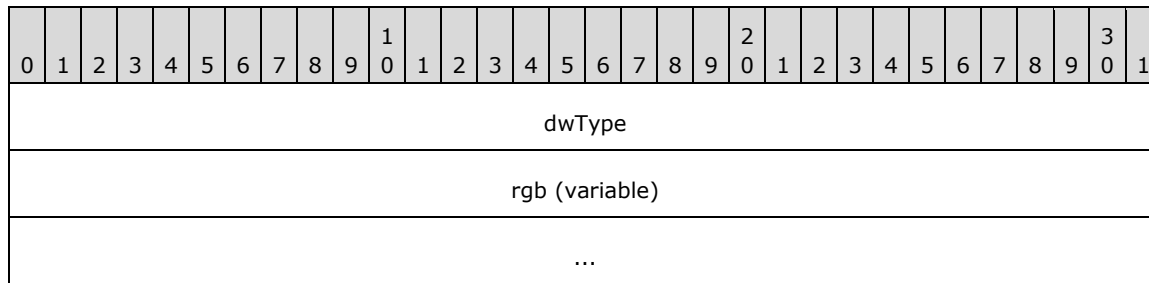
_padding3 (1 byte): A 1-byte field.

Note This field MUST be inserted before **LengthOffset** if, without it, **LengthOffset** would not begin at an even offset from the beginning of a message. The value of this byte is arbitrary, and MUST be ignored. If **LengthUsed** is set to 0x00, this field MUST NOT be present.

LengthOffset (2 bytes): An unsigned 2-byte integer specifying the offset of the column length in the row. In CPMGetRowsOut, length is represented by a 32-bit unsigned integer by the offset specified in **LengthOffset**. If **LengthUsed** is set to 0x00, this field MUST NOT be present.

2.2.1.26 SERIALIZEDPROPERTYVALUE

The SERIALIZEDPROPERTYVALUE structure contains a serialized value.



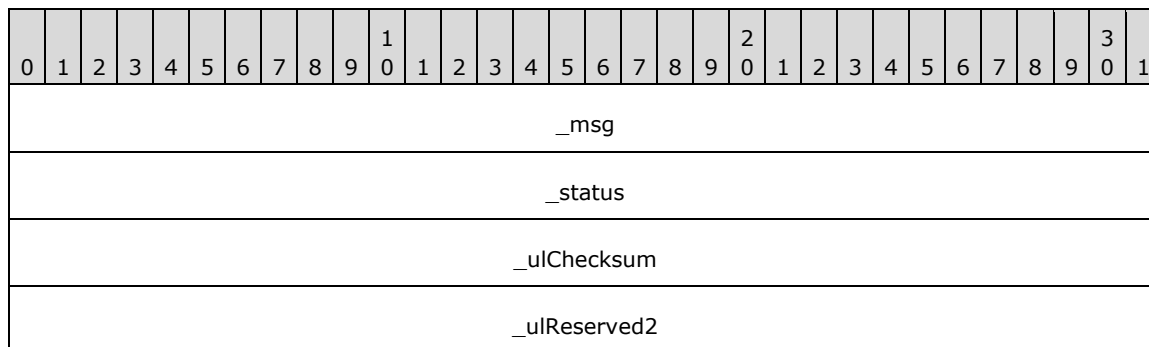
dwType (4 bytes): One of the variant types, as specified in section 2.2.1.1, that can be combined with variant type modifiers. For all variant types, except those combined with VT_ARRAY, SERIALIZEDPROPERTYVALUE has the same layout as CBaseStorageVariant. If the variant type is combined with the VT_ARRAY type modifier, SAFEARRAY2 is used instead of SAFEARRAY in the **vValue** field of CBaseStorageVariant.

rgb (variable): Serialized value. See serialization for **vValue** in section 2.2.1.1.

2.2.2 Message Headers

All Content Indexing Services Protocol messages have a 16-byte header.

The following diagram shows the Content Indexing Services Protocol message header format.



_msg (4 bytes): A 32-bit integer that identifies the type of message following the header. The following table lists the Content Indexing Services Protocol messages and the integer values specified for each message. As shown in the table, some values identify two messages in the table. In those instances, the message following the header can be identified by the direction of the message flow. If the direction is client to server, the message with "In" appended to the message name is indicated. If the direction is server to client, the message with "Out" appended to the message name is indicated.

Value	Meaning
0x000000C8	CPMConnectIn or CPMConnectOut
0x000000C9	CPMDisconnect
0x000000CA	CPMCreateQueryIn or CPMCreateQueryOut
0x000000CB	CPMFreeCursorIn or CPMFreeCursorOut
0x000000CC	CPMGetRowsIn or CPMGetRowsOut
0x000000CD	CPMRatioFinishedIn or CPMRatioFinishedOut
0x000000CE	CPMCompareBmkIn or CPMCompareBmkOut
0x000000CF	CPMGetApproximatePositionIn or CPMGetApproximatePositionOut
0x000000D0	CPMSetBindingsIn
0x000000D1	CPMGetNotify
0x000000D2	CPMSendNotifyOut
0x000000D7	CPMGetQueryStatusIn or CPMGetQueryStatusOut
0x000000D9	CPMCiStateInOut
0x000000E1	CPMForceMergeIn
0x000000E4	CPMFetchValueIn or CPMFetchValueOut
0x000000E6	CPMUpdateDocumentsIn
0x000000E7	CPMGetQueryStatusExIn or CPMGetQueryStatusExOut
0x000000E8	CPMRestartPositionIn
0x000000E9	CPMStopAsynchIn
0x000000EC	CPMSetCatStateIn or CPMSetCatStateOut

_status (4 bytes): An HRESULT value, indicating the status of the requested operation. When sent by the client, can be set to any arbitrary value and MUST be ignored on receipt.<5>

_ulChecksum (4 bytes): The **_ulChecksum** MUST be calculated as specified in section 3.2.4 for the following messages:

- CPMConnectIn
- CPMCreateQueryIn
- CPMSetBindingsIn
- CPMGetRowsIn

- CPMFetchValueIn

Note For all other messages from the client, **_ulChecksum** MUST be set to 0x00000000. A client MUST ignore the **_ulChecksum** field.

_ulReserved2 (4 bytes): If 32-bit offsets are being used, MUST be set to 0x00000000 and MUST be ignored by the receiver. **_ulReserved2** can be used in 64-bit scenarios, as specified in section 2.2.3.16.

2.2.3 Messages

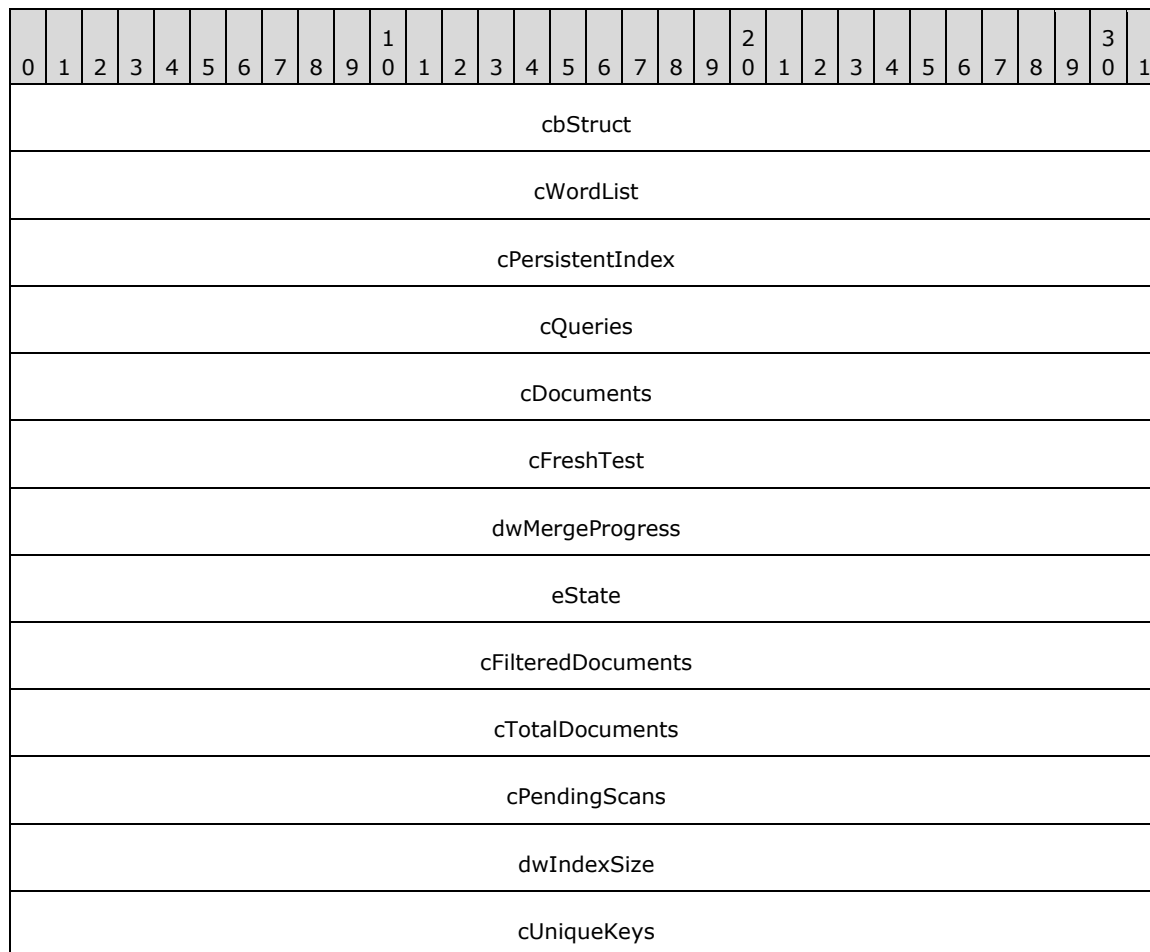
The following sections specify Content Indexing Services Protocol messages.

2.2.3.1 CPMCiStateInOut

The CPMCiStateInOut message contains information on the state of the indexing service. All fields are required whether this message is sent by the client or the server.

Note When the CPMCiStateInOut message is sent by the client, all fields except **cbStruct** MAY contain any value, and the server MUST ignore all fields except **cbStruct**.

The format of the CPMCiStateInOut message that follows the header is shown in the following diagram.



cSecQDocuments
dwPropCacheSize

cbStruct (4 bytes): A 32-bit unsigned integer indicating the size, in bytes, of this message (excluding the common header). MUST be set to 0x0000003C.

cWordList (4 bytes): A 32-bit unsigned integer indicating the number of in-memory indexes created for recently indexed documents.

cPersistentIndex (4 bytes): A 32-bit unsigned integer indicating the number of persisted indexes.

cQueries (4 bytes): A 32-bit unsigned integer indicating a number of actively running queries.

cDocuments (4 bytes): A 32-bit unsigned integer indicating the total number of documents waiting to be indexed.

cFreshTest (4 bytes): A 32-bit unsigned integer indicating the number of unique documents with information in indexes that are not fully optimized for performance.

dwMergeProgress (4 bytes): A 32-bit unsigned integer specifying the completion percentage of current, full optimization of indexes while optimization is in progress. MUST be less than or equal to 100.

eState (4 bytes): A 32-bit unsigned integer indicating the state of content indexing. MUST be zero or one or more of the CI_STATE_* constants defined in the following table.

Value	Meaning
0x00000000	None of the following states apply.
CI_STATE_SHADOW_MERGE 0x00000001	The indexing service is in the process of optimizing some of the indexes to reduce memory usage and improve query performance.
CI_STATE_MASTER_MERGE 0x00000002	The indexing service is in the process of full optimization for all indexes.
CI_STATE_CONTENT_SCAN_REQUIRED 0x00000004	Some documents in the inverted index have changed and the indexing service needs to determine what has been added, changed, or deleted.
CI_STATE_ANNEALING_MERGE 0x00000008	The indexing service is in the process of optimizing indexes to reduce memory usage and improve query performance. This process is more comprehensive than the one identified by the CI_STATE_SHADOW_MERGE value, but it is not as comprehensive as specified by the CI_STATE_MASTER_MERGE value. Such optimizations are implementation-specific because they depend on the way that data is stored internally; the optimizations do not affect the protocol in any way other than response time.
CI_STATE_SCANNING 0x00000010	The indexing service is examining a directory or a set of directories to see if any files have been added, deleted, or updated since the last time the directory was indexed.
CI_STATE_RECOVERING 0x00000020	The indexing service is starting from the last saved state and is in the process of recovering.
CI_STATE_INDEX_MIGRATION_MERGE 0x00000040	The indexing service is backing up inverted indexes.

Value	Meaning
CI_STATE_LOW_MEMORY 0x00000080	Most of the virtual memory of the server is in use.
CI_STATE_HIGH_IO 0x00000100	The level of input/output (I/O) activity on the server is relatively high.
CI_STATE_MASTER_MERGE_PAUSED 0x00000200	The process of full optimization (for all indexes) in progress has been paused. This is given for informational purposes only and does not affect the Content Indexing Services Protocol.
CI_STATE_READ_ONLY 0x00000400	The portion of the indexing service that picks up new documents to index has been paused. This is given for informative purposes only and does not affect the Content Indexing Services Protocol.
CI_STATE_BATTERY_POWER 0x00000800	The portion of the indexing service that picks up new documents to index has been paused to conserve battery lifetime but still replies to the queries. This is given for informative purposes only and does not affect the Content Indexing Services Protocol.
CI_STATE_USER_ACTIVE 0x00001000	The portion of the indexing service that picks up new documents to index has been paused due to high activity by the user (keyboard or mouse) but still replies to the queries. This is given for informative purposes only and does not affect the Content Indexing Services Protocol.
CI_STATE_STARTING 0x00002000	The service is starting. Queries can be run, but scanning and notification have not been enabled yet. This is given for informative purposes only and does not affect the Content Indexing Services Protocol.
CI_STATE_READING_USNS 0x00004000	The service has not read the log kept by the file system to keep track of changes to files or directories in a volume, so the inverted index might not be up to date.

cFilteredDocuments (4 bytes): A 32-bit unsigned integer indicating the number of documents indexed since content indexing has been started.

cTotalDocuments (4 bytes): A 32-bit unsigned integer indicating the total number of documents in the system.

cPendingScans (4 bytes): A 32-bit unsigned integer indicating the number of pending high-level indexing operations. The meaning of this value is provider-specific, but larger numbers are expected to indicate that more indexing remains.<6>

dwIndexSize (4 bytes): A 32-bit unsigned integer indicating the size, in megabytes, of the index (excluding the property cache).

cUniqueKeys (4 bytes): A 32-bit unsigned integer indicating the approximate number of unique keys in the catalog.

cSecQDocuments (4 bytes): A 32-bit unsigned integer indicating the number of documents that the indexing service will attempt to index again because of a failure during the initial indexing attempt.

dwPropCacheSize (4 bytes): A 32-bit unsigned integer indicating the size, in megabytes, of the property cache.

2.2.3.2 CPMSetCatStateIn

The CPMSetCatStateIn message sets the state of a catalog. The format of the CPMSetCatStateIn message that follows the header is as follows.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_partID																															
_dwNewState																															
_CatName (variable)																															
...																															

_partID (4 bytes): MUST be set to 0x00000001.

_dwNewState (4 bytes): MUST be set to exactly one of the following values (that is, they cannot be combined with an OR operator), indicating the new state of the catalog.

Value	Meaning
CICAT_STOPPED 0x00000001	The catalog is stopped. This state means that no new files are to be indexed, and no search queries are to be processed.
CICAT_READONLY 0x00000002	The catalog is read-only. No new files are to be indexed.
CICAT_WRITABLE 0x00000004	The catalog is writable. New files can be indexed, and search queries are to be processed.
CICAT_NO_QUERY 0x00000008	The catalog is not available for querying.
CICAT_GET_STATE 0x00000010	The state of the catalog is not to be changed, only retrieved.
CICAT_ALL_OPENED 0x00000020	A check to see if all of the catalogs have been started. If so, the _dwOldState field sent in the CPMSetCatStateOut reply to this message will be reported as nonzero.

_CatName (variable): The name of the catalog that is to have its state modified. The name MUST be a null-terminated Unicode string. This field MUST be omitted if _dwNewState is set to CICAT_ALL_OPENED.

2.2.3.3 CPMSetCatStateOut

The CPMSetCatStateOut message is a reply to a CPMSetCatStateIn message with the old state of the catalog. The format of the CPMSetCatStateOut message that follows the header is as follows.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_dwOldState																															

_dwOldState (4 bytes): A 32-bit unsigned integer that MUST be one or more of the following flags, indicating the old state of the catalog.

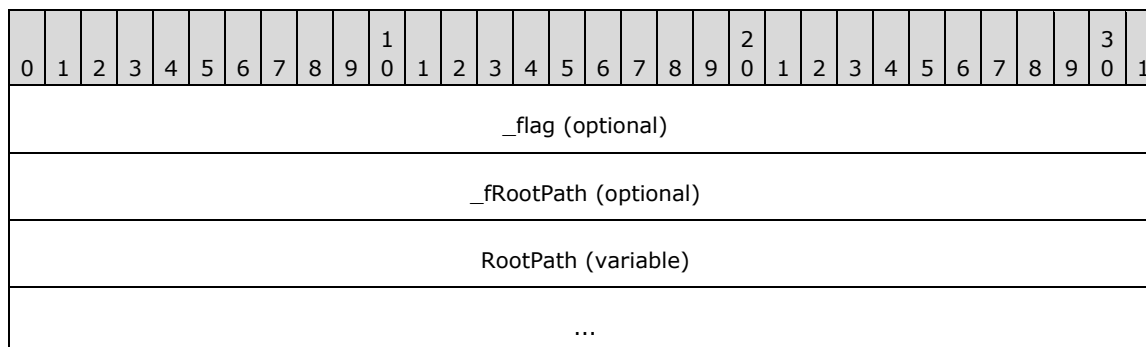
Value	Meaning
CI_NOT_ALL_STARTED 0x00000000	Not all catalogs are started; at least one catalog is stopped.
CICAT_STOPPED 0x00000001	The catalog is stopped. This value MUST NOT be combined with any other value.
CICAT_READONLY 0x00000002	The catalog is read-only. This value MUST NOT be combined with CICAT_WRITABLE or CICAT_STOPPED.
CICAT_WRITABLE 0x00000004	The catalog is writable. This value MUST NOT be combined with CICAT_READONLY or CICAT_STOPPED.
CICAT_NO_QUERY 0x00000008	The catalog is not available for querying. This value MUST NOT be combined with CICAT_STOPPED.

2.2.3.4 CPMUpdateDocumentsIn

The CPMUpdateDocumentsIn message directs the server to index the specified path.

The server will reply with the message header of the CPMUpdateDocumentsIn message with the results of the request contained in the **_status** field of the message header.

The format of the CPMUpdateDocumentsIn message that follows the header is shown in the following diagram.



_flag (4 bytes): A 32-bit unsigned integer indicating the type of update to be performed. This field MUST be present when the message is sent by the client and MUST be absent when the message is sent by the server. This field SHOULD be set to one of the following values.

Value	Meaning
UPD_INCREM 0x00000000	An incremental update is to be performed.
UPD_FULL 0x00000001	A full update is to be performed.
UPD_INIT	A new initialization is to be performed.

Value	Meaning
0x00000002	

_fRootPath (4 bytes): A Boolean value indicating whether the **RootPath** field specifies a path on which to perform the update.

Note This field **MUST** be present when the message is sent by the client and **MUST** be absent when the message is sent by the server. This field **MUST** be set to 0x00000001 or 0x00000000. If set to 0x00000001, a path on which to perform the update is included in **RootPath**. If set to 0x00000000, the update is to be performed on all indexed paths.

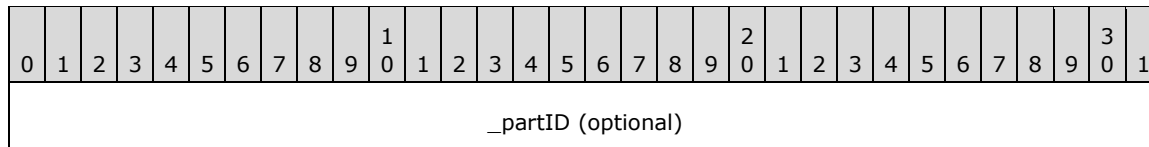
RootPath (variable): The name of the path to be updated.

Note This field **MUST** be present when the message is sent by the client and **_fRootPath** is not set to 0x00000000. This field **MUST** be absent when the message is sent by the server. When present, the name **MUST** be a null-terminated Unicode string.

2.2.3.5 CPMForceMergeIn

The CPMForceMergeIn message requests a server to perform any maintenance necessary to improve query performance. The server will reply with the message header of the CPMForceMergeIn message with the results of the request contained in the **_status** field.

The format of the CPMForceMergeIn message that follows the header is shown in the following diagram.



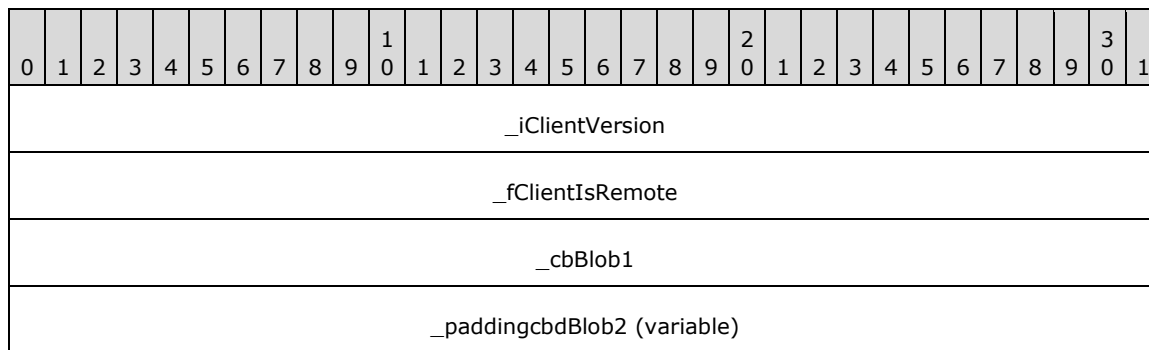
_partID (4 bytes): A 32-bit unsigned integer.

Note This field **MUST** be present when the message is sent by the client and **MUST** be absent when the message is sent by the server. When this field is present, it **MUST** be set to 0x00000001.

2.2.3.6 CPMConnectIn

The CPMConnectIn message begins a session between the client and server.

The format of the CPMConnectIn message that follows the header is shown in the following diagram.



...
_cbBlob2
_padding
...
...
MachineName (variable)
...
UserName (variable)
...
_paddingcPropSets (variable)
...
cPropSets
PropertySet1 (variable)
...
PropertySet2 (variable)
...
_paddingExtPropset (variable)
...
cExtPropSet
aPropertySets (variable)
...

_iClientVersion (4 bytes): A 32-bit integer indicating whether the server is to validate the checksum value specified in the **_ulChecksum** field of the message headers for messages sent by the client.

Note If the **_iClientVersion** field is set to 0x00000008 or greater, the server **MUST** validate the **_ulChecksum** field value for the following messages:

- CPMConnectIn

- CPMCreateQueryIn
- CPMFetchValueIn
- CPMGetRowsIn
- CPMSetBindingsIn

For how the server validates the value specified by the client in the **_ulChecksum** field for the messages previously listed, see section 3.2.4.

If the value is greater than 0x00000008, the client is assumed capable of handling 64-bit offsets in CPMGetRowsOut messages. <8>

_fClientIsRemote (4 bytes): A Boolean value indicating whether the client is running on a different machine from the server.

Note MUST be set to 0x00000001.

_cbBlob1 (4 bytes): A 32-bit unsigned integer indicating the size, in bytes, of the **cPropSet**, **PropertySet1**, and **PropertySet2** fields, combined.

_paddingcbdBlob2 (variable): This field MUST be 0 to 4 bytes in length. The length of this field MUST be such that the byte offset from the beginning of the message to the first structure contained in the **_cbBlob2** field is a multiple of 8. The value of the bytes can be any arbitrary value, and MUST be ignored by the receiver.

_cbBlob2 (4 bytes): A 32-bit unsigned integer indicating the size, in bytes, of the **cExPropSet** and **aPropertySet** fields combined.

_padding (12 bytes): Twelve bytes of padding that MAY contain arbitrary values, and MUST be ignored.

MachineName (variable): The machine name of the client. The name string MUST be a null-terminated array of fewer than 512 Unicode characters, including the NULL terminator.

UserName (variable): A string that represents the user name of the person who is running the application that invoked this protocol. The name string MUST be a null-terminated array of fewer than 512 Unicode characters when concatenated with **MachineName**.

_paddingcPropSets (variable): This field MUST be 0 to 7 bytes in length. The number of bytes MUST be the number required to make the byte offset of the **cPropSets** field a multiple of 8 from the beginning of the message that contains this structure. The value of the bytes can be any arbitrary value and MUST be ignored by the receiver.

cPropSets (4 bytes): A 32-bit unsigned integer indicating the number of CDbPropSet structures following this field.

Note This value MUST be set to 0x00000000, 0x00000001, or 0x00000002.

PropertySet1 (variable): A CDbPropSet structure with **guidPropertySet** containing DBPROPSET_FSCIFRMWRK_EXT (see section 2.2.1.16). This field is not present when **cPropSets** is 0x00000000.

PropertySet2 (variable): A CDbPropSet structure with **guidPropertySet** containing DBPROPSET_CIFRMWRKCORE_EXT (see section 2.2.1.16). This field is not present when **cPropSets** is 0x00000000 or 0x00000001.

_paddingExtPropset (variable): This field MUST be 0 to 7 bytes in length. The number of bytes MUST be the number required to make the byte offset of the **cExtPropSets** field from the

beginning of the message that contains this structure equal a multiple of 8. The value of the bytes can be any arbitrary value, and MUST be ignored by the receiver.

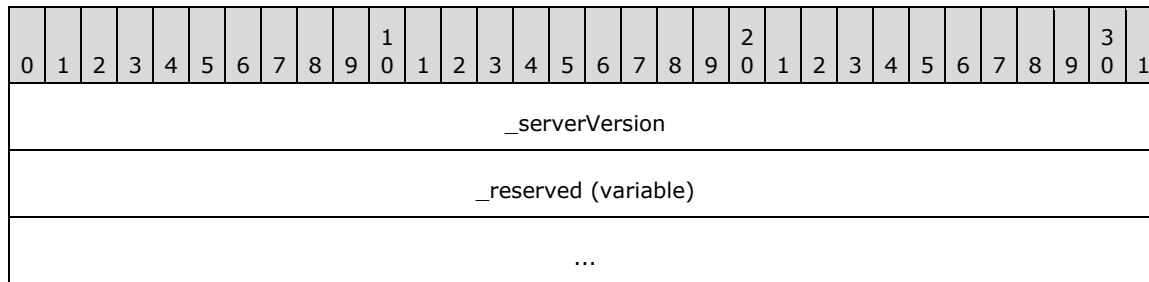
cExtPropSet (4 bytes): A 32-bit unsigned integer indicating the number of CDbPropSet structures following this field.

aPropertySets (variable): An array of CDbPropSet structures specifying other properties. The number of elements in this array MUST be equal to **cExtPropSet**. An example would be DONOTCOMPUTEEXPENSIVEPROPERTIES(A7AC77ED-F8D7-11CE-A798-0020F8008025) which prevents the computation of expensive properties.<9>

2.2.3.7 CPMConnectOut

The CPMConnectOut message contains a response to a CPMConnectIn message.

The format of the CPMConnectOut message that follows the header is shown in the following diagram.



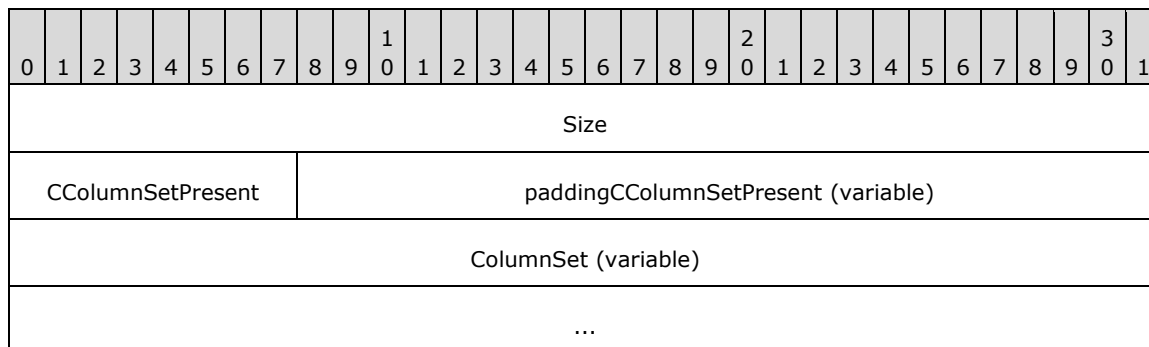
_serverVersion (4 bytes): A 32-bit integer, indicating whether the server can support 64-bit offsets, as specified in section 2.2.3.16.

Value	Meaning
0x00000007	The server can send only 32-bit offsets.
0x00010007	The server can send 32-bit or 64-bit offsets.

_reserved (variable): Reserved. The server can send an arbitrary number of arbitrary values, and the client MUST ignore these values, if they are present.

2.2.3.8 CPMCreateQueryIn

The CPMCreateQueryIn message creates a new query. The format of the CPMCreateQueryIn message that follows the header is shown in the following diagram.



CRestrictionPresent	paddingCRestrictionPresent (variable)
Restriction (variable)	
...	
CSortSetPresent	paddingCSortSetPresent (variable)
SortSet (variable)	
...	
CCategorizationSetPresent	paddingCCategorizationSetPresent (variable)
CCategorizationSet (variable)	
...	
RowSetProperties (20 bytes)	
...	
...	
PidMapper (variable)	
...	

Size (4 bytes): A 32-bit unsigned integer indicating the number of bytes from the beginning of this field to the end of the message.

CColumnSetPresent (1 byte): A byte field indicating if the **ColumnSet** field is present. This field MUST be set to one of the following values.

Value	Meaning
0x00	The ColumnSet field MUST be absent.
0x01	The ColumnSet field MUST be present.

paddingCColumnSetPresent (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver. This field MUST be absent in CColumnSetPresent is set to 0x00.

ColumnSet (variable): A CColumnSet structure containing the property offsets for properties in CPidMapper that are returned as a column.

CRestrictionPresent (1 byte): A byte field indicating if the **Restriction** field is present.

Note If set to any nonzero value, the **Restriction** field MUST be present. If set to 0x00, **Restriction** MUST be absent.

paddingCRestrictionPresent (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, its length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver. This field MUST be absent in CRestrictionPresent is set to 0x00.

Restriction (variable): A CRestriction structure containing the command tree of the query.

CSortSetPresent (1 byte): A byte field indicating if the **SortSet** field is present.

Note If set to any nonzero value, the **SortSet** field MUST be present. If set to 0x00, **SortSet** MUST be absent.

paddingCSortSetPresent (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, the length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver. This field MUST be absent if CSortSetPresent is set to 0x00.

SortSet (variable): A CSortSet structure indicating the sort order of the query.

CCategorizationSetPresent (1 byte): A byte field indicating if the **CCategorizationSet** field is present.

Note If set to any nonzero value, the **CCategorizationSet** field MUST be present. If set to 0x00, **CCategorizationSet** MUST be absent.

paddingCCategorizationSetPresent (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, the length is nonzero), the value that it contains is arbitrary. The content of this field MUST be ignored by the receiver. This field MUST be absent if CCategorizationSetPresent is set to 0x00.

CCategorizationSet (variable): A CCategorizationSet structure that contains the groups for the query.

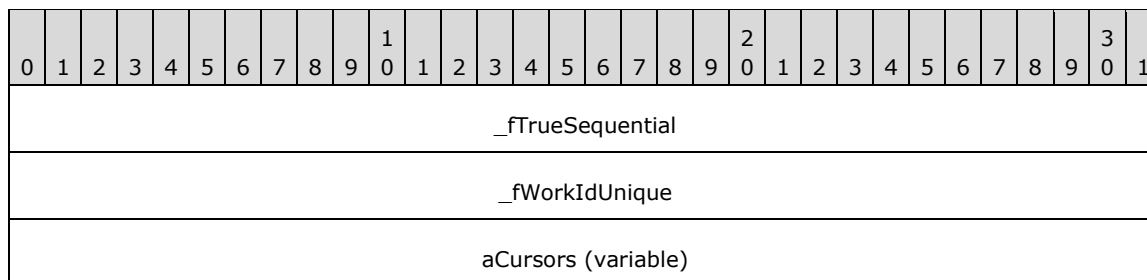
RowSetProperties (20 bytes): A CRowsetProperties structure providing configuration information for the query.

PidMapper (variable): A CPidMapper structure that maps from property offsets to full property descriptions.

2.2.3.9 CPMCreateQueryOut

The CPMCreateQueryOut message contains a response to a CPMCreateQueryIn message.

The format of the CPMCreateQueryOut message that follows the header is shown in the following diagram.



...

_fTrueSequential (4 bytes): A 32-bit unsigned integer. MUST be set to one of the following values.

Note An informative value indicating if the query can be expected to provide results faster.

Value	Meaning
0x00000000	For the query provided in CPMCreateQueryIn, there would be a bigger latency in delivering query results.
0x00000001	For the query provided in CPMCreateQueryIn, the server can use the inverted index in such a way that query results will likely be delivered faster.

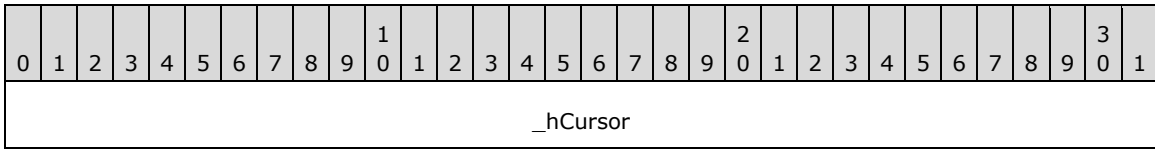
_fWorkIdUnique (4 bytes): A Boolean value indicating if the document identifiers pointed to by the cursors (2) are unique throughout query results. MUST be set to one of the following values.

Value	Meaning
0x00000000	The document identifiers are unique only throughout the rowset.
0x00000001	The document identifiers are unique across multiple query results.

aCursors (variable): An array of 32-bit unsigned integers representing the handles to cursors with the number of elements equal to the number of categories in the **CategorizationSet** field of the CPMCreateQueryIn message, plus one element, which represents an uncategorized cursor.

2.2.3.10 CPMGetQueryStatusIn

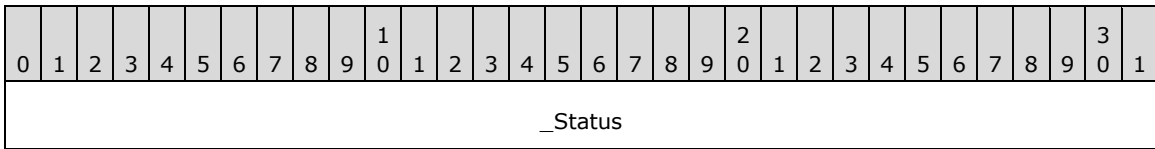
The CPMGetQueryStatusIn message requests the status of a query. The format of the CPMGetQueryStatusIn message that follows the header is shown in the following diagram.



_hCursor (4 bytes): A 32-bit unsigned integer representing the handle from the CPMCreateQueryOut message identifying the query for which to retrieve status information.

2.2.3.11 CPMGetQueryStatusOut

The CPMGetQueryStatusOut message replies to a CPMGetQueryStatusIn message with the status of the query. The format of the CPMGetQueryStatusOut message that follows the header is shown in the following diagram.



_Status (4 bytes): A 32-bit unsigned integer. A bitmask of values defined in the following tables that describe the query.

The following table lists STAT_* values obtained by performing a bitwise AND operation on **_Status** with 0x00000007. The result MUST be one of the following.

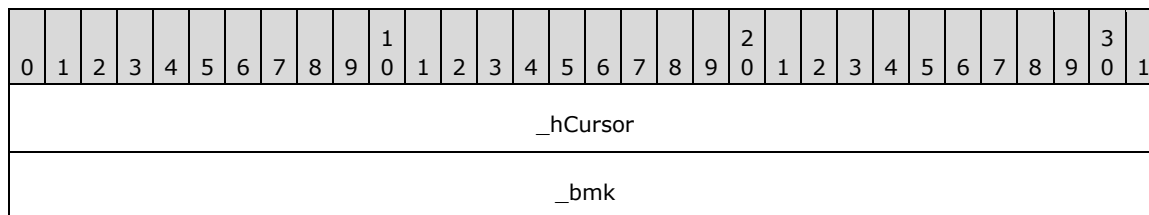
Constant	Meaning
STAT_BUSY 0x00000000	The asynchronous query is still running.
STAT_ERROR 0x00000001	The query is in an error state.
STAT_DONE 0x00000002	The query is complete.
STAT_REFRESH 0x00000003	The query is complete, but updates are resulting in additional query computation.

The following table lists additional STAT_* bits that can be set independently.

Constant	Meaning
STAT_NOISE_WORDS 0x00000010	Noise words were replaced by wildcard characters in the content query.
STAT_CONTENT_OUT_OF_DATE 0x00000020	The results of the query might be incorrect because the query involved modified but unindexed files.
STAT_REFRESH_INCOMPLETE 0x00000040	The results of the query might be incorrect because the query involved modified and indexed files whose content was not included.
STAT_CONTENT_QUERY_INCOMPLETE 0x00000080	The content query was too complex to complete or required enumeration instead of use of the content index.
STAT_TIME_LIMIT_EXCEEDED 0x00000100	The results of the query might be incorrect because the query execution reached the maximum allowable time.

2.2.3.12 CPMGetQueryStatusExIn

A client MAY use the CPMGetQueryStatusExIn message to request the status of a query and additional information such as the number of documents that have been indexed and the number of documents remaining to be indexed. The format of the CPMGetQueryStatusExIn message that follows the header is shown in the following diagram. <10>

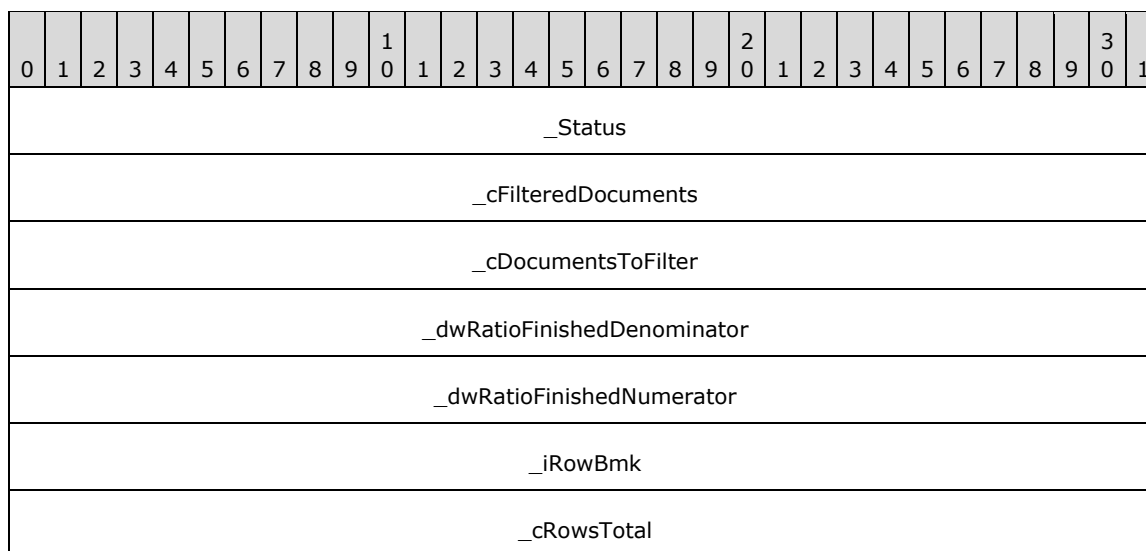


_hCursor (4 bytes): A 32-bit value representing the handle from the CPMCreateQueryOut message identifying the query for which to retrieve status information.

_bmk (4 bytes): A 32-bit value indicating the handle of a bookmark whose position is retrieved.

2.2.3.13 CPMGetQueryStatusExOut

When a CPMGetQueryStatusExIn message is received, the server SHOULD reply with a CPMGetQueryStatusExOut with both the query status and other status information, as outlined in the following format. The format of the CPMGetQueryStatusExOut message that follows the header is shown in the following diagram.



Status (4 bytes): One of the STAT* values specified in section 2.2.3.11.

_cFilteredDocuments (4 bytes): A 32-bit unsigned integer indicating the number of documents that have been indexed.

_cDocumentsToFilter (4 bytes): A 32-bit unsigned integer indicating the number of documents that still remain to be indexed.

_dwRatioFinishedDenominator (4 bytes): A 32-bit unsigned integer indicating the denominator of the ratio of documents that the query has finished processing. MUST be greater than zero.

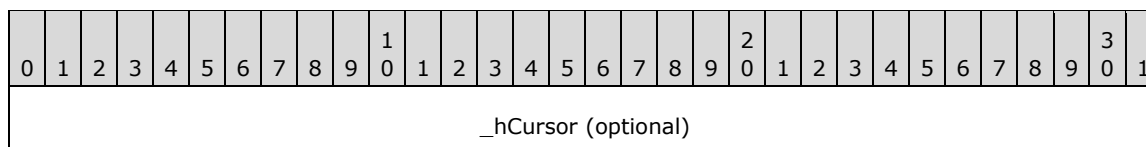
_dwRatioFinishedNumerator (4 bytes): A 32-bit unsigned integer indicating the numerator of the ratio of documents that the query has finished processing.

_iRowBmk (4 bytes): A 32-bit unsigned integer indicating the approximate position of the bookmark in the rowset in terms of rows.

_cRowsTotal (4 bytes): A 32-bit unsigned integer specifying the total number of rows in the rowset.

2.2.3.14 CPMSetsBindingsIn

The CPMSetsBindingsIn message requests the binding of columns to a rowset. The server will reply to the CPMSetsBindingsIn request message using the header section of the CPMSetsBindingsIn message with the results of the request contained in the **_status** field. The format of the CPMSetsBindingsIn message that follows the header is shown in the following diagram.



_cbRow (optional)
_cbBindingDesc (optional)
_dummy (optional)
cColumns (optional)
aColumns (variable)
...

_hCursor (4 bytes): A 32-bit value representing the handle from the CPMCreateQueryOut message that identifies the query for which to set bindings. This field **MUST** be present when the message is sent by the client and **MUST** be absent when the message is sent by the server.

_cbRow (4 bytes): A 32-bit unsigned integer indicating the size, in bytes, of a row. This field **MUST** be present when the message is sent by the client and **MUST** be absent when the message is sent by the server.

_cbBindingDesc (4 bytes): A 32-bit unsigned integer indicating the length, in bytes, of the fields following the **_dummy** field. This field **MUST** be present when the message is sent by the client and **MUST** be absent when the message is sent by the server.

_dummy (4 bytes): This field is unused and **MUST** be ignored. It can be set to any arbitrary value. This field **MUST** be present when the message is sent by the client and **MUST** be absent when the message is sent by the server.

cColumns (4 bytes): A 32-bit unsigned integer indicating the number of elements in the **aColumns** array. This field **MUST** be present when the message is sent by the client and **MUST** be absent when the message is sent by the server.

aColumns (variable): An array of the CTableColumn structures describing the columns of a row in the rowset. This field **MUST** be present when the message is sent by the client and **MUST** be absent when the message is sent by the server. Structures in the array **MUST** be separated by 0 to 3 padding bytes such that each structure has a 4-byte alignment from the beginning of a message. Such padding bytes can be set to any arbitrary value when sent and **MUST** be ignored on receipt.

2.2.3.15 CPMGetRowsIn

The CPMGetRowsIn message requests rows from a query. The format of the CPMGetRowsIn message that follows the header is shown in the following diagram.

0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
_hCursor																															
_cRowsToTransfer																															
_cbRowWidth																															
_cbSeek																															

_cbReserved
_cbReadBuffer
_ulClientBase
_fBwdFetch
eType
SeekDescription (variable)
...

_hCursor (4 bytes): A 32-bit value representing the handle from the CPMCreateQueryOut message identifying the query for which to retrieve rows.

_cRowsToTransfer (4 bytes): A 32-bit unsigned integer indicating the maximum number of rows that the client requests to receive in response to this message.

_cbRowWidth (4 bytes): A 32-bit unsigned integer indicating the length of a row in bytes.

_cbSeek (4 bytes): A 32-bit unsigned integer indicating the size of the message, beginning with eType.

_cbReserved (4 bytes): A 32-bit unsigned integer indicating the offset, in bytes, of the **Rows** field in the CPMGetRowsOut response message. This offset begins from the first byte of the message header and **MUST** be set such that the **Rows** field follows the **SeekDescription** field.

_cbReadBuffer (4 bytes): A 32-bit unsigned integer.

Note This field **MUST** be set to the maximum of the value of **_cbRowWidth**, or 1,000 times the value of **_cRowsToTransfer** rounded up to the nearest 512-byte multiple. The value **MUST NOT** exceed 0x00004000.

_ulClientBase (4 bytes): A 32-bit unsigned integer indicating the base value to use for pointer calculations in the row buffer. If 64-bit offsets are being used, the **_ulReserved2** field of the message header is used as the upper 32 bits, and **_ulClientBase** is used as the lower 32 bits of a 64-bit value. See section 2.2.3.16.

_fBwdFetch (4 bytes): A 32-bit unsigned integer indicating the order in which to fetch the rows.

Note Rows can be fetched in an order different from that in which they are stored.

MUST be set to one of the following values.

Value	Meaning
0x00000000	The rows are to be fetched in forward order from the bookmark.
0x00000001	The rows are to be fetched in reverse order from the bookmark.

eType (4 bytes): A 32-bit unsigned integer. **MUST** contain one of the following values indicating the type of operation to perform.

Value	Meaning
eRowSeekNext 0x00000001	SeekDescription contains a CRowSeekNext structure.
eRowSeekAt 0x00000002	SeekDescription contains a CRowSeekAt structure.
eRowSeekAtRatio 0x00000003	SeekDescription contains a CRowSeekAtRatio structure.
eRowSeekByBookmark 0x00000004	SeekDescription contains a CRowSeekByBookmark structure.

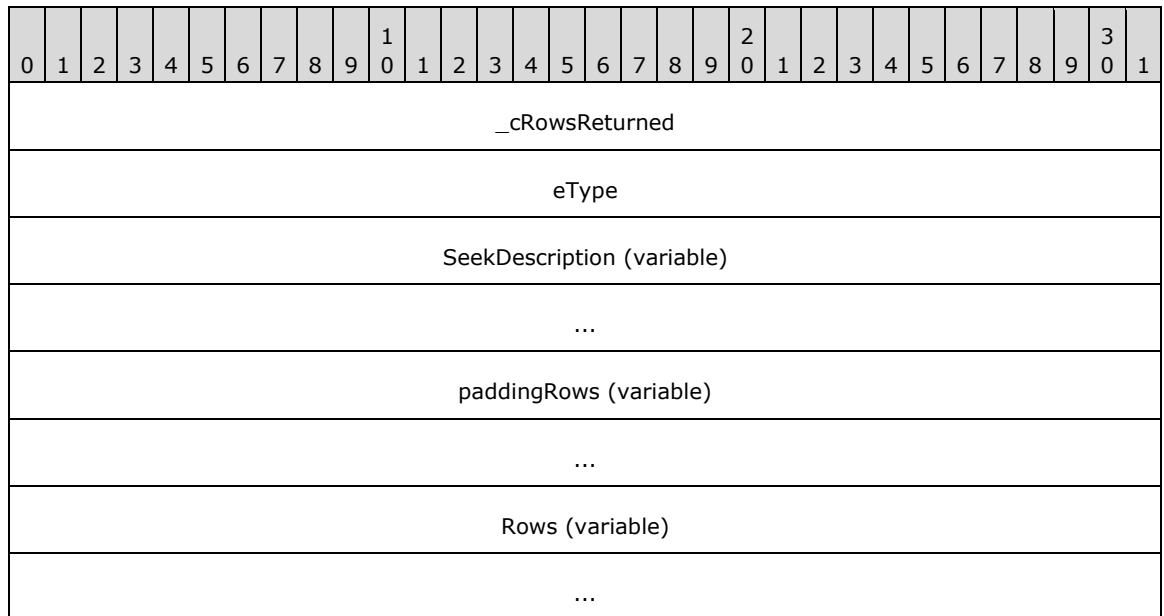
SeekDescription (variable): This field MUST contain a structure of the type indicated by the **eType** value.

2.2.3.16 CPMGetRowsOut

The CPMGetRowsOut message replies to a CPMGetRowsIn message with the rows of a query. Servers MUST format offsets to variable-length data types in the **Row** field as follows.

- The client indicated that it was a 32-bit system (0x00000008 or less in the **_iClientVersion** field of CPMConnectIn): Offsets are 32-bit integers.
- The client indicated that it was a 64-bit system (**_iClientVersion** > 0x00000008 in CPMConnectIn), and the server indicated that it was a 32-bit system (**_serverVersion** set to 0x00000007 in CPMConnectOut): Offsets are 32-bit integers.
- The client indicated that it was a 64-bit system (**_iClientVersion** > 0x00000008 in CPMConnectIn), and the server indicated that it was a 64-bit system (**_serverVersion** set to 0x00010007 in CPMConnectOut): Offsets are 64-bit integers.

The format of the CPMGetRowsOut message that follows the header is depicted in the diagram.



_cRowsReturned (4 bytes): A 32-bit unsigned integer indicating the number of rows returned in the **Rows** field.

eType (4 bytes): A 32-bit unsigned integer. MUST contain one of the following values indicating the type of rowseek operation to perform.

Value	Meaning
eRowsSeekNone 0x00000000	The SeekDescription field is omitted from the message.
eRowSeekNext 0x00000001	SeekDescription contains a CRowSeekNext structure.
eRowSeekAt 0x00000002	SeekDescription contains a CRowSeekAt structure.
eRowSeekAtRatio 0x00000003	SeekDescription contains a CRowSeekAtRatio structure.
eRowSeekByBookmark 0x00000004	SeekDescription contains a CRowSeekByBookmark structure.

SeekDescription (variable): This field MUST contain a structure of the type indicated by the **eType** field.

paddingRows (variable): This field MUST be of sufficient length (0 to **_cbReserved**-1 bytes) to pad the **Rows** field to **_cbReserved** offset from the beginning of a message where **_cbReserved** is the value in the CPMGetRowsIn message. Padding bytes used in this field can be any arbitrary value. This field MUST be ignored by the receiver.

Rows (variable): Row data is formatted as prescribed by column information in the most recent CPMSetsBindingsIn message. Row order is defined by the query and MUST be stored in forward order (for example, row 1 before row 2).

Fixed-sized columns MUST be stored at the offsets specified by the most recent CPMSetsBindingsIn message.

Variable-sized columns (for example, strings) MUST be stored as follows.

- The variable data is returned in reverse row/column order beginning at the end of the buffer. For example, the collection of all variable data for row 1 is at the end, and row 2 is next closest.
- The beginning of the row buffer MUST contain a CRowVariant for each column, stored at the offset specified in the most recent CPMSetsBindingsIn message. **vType** MUST contain the data type (for example: VT_LPWSTR). If, as determined by the rules at the beginning of this section, 32-bit offsets are being used, the **Offset** field in CRowVariant MUST contain a 32-bit value that is the offset of the variable data from the beginning of the CPMGetRowsOut message plus the value of **_ulClientBase** specified in the most recent CPMGetRowsIn message. If 64-bit offsets are being used, the **Offset** field in CRowVariant MUST contain a 64-bit value that is the offset from the beginning of the CPMGetRowsOut message added to a 64-bit value composed by using **_ulClientBase** as the low 32-bit value and **_ulReserved2** as the high 32-bit value.

Note The beginning of the row buffer here refers to the actual offset of the beginning of the row data. That in turn depends on the structure of the data specified by the most recent call to CPMSetsBindingsIn. CPMSetsBindingsIn specifies the structure of the returned data with

CTableRow structures. The calculation of the offsets is thus dependent on the structure specified for the returned rows.

The buffer is filled in from both ends. CRowVariant structures, one for each row, are stored at the beginning of the buffer. Each of these structures points to the row data which is stored starting at the end of the buffer.

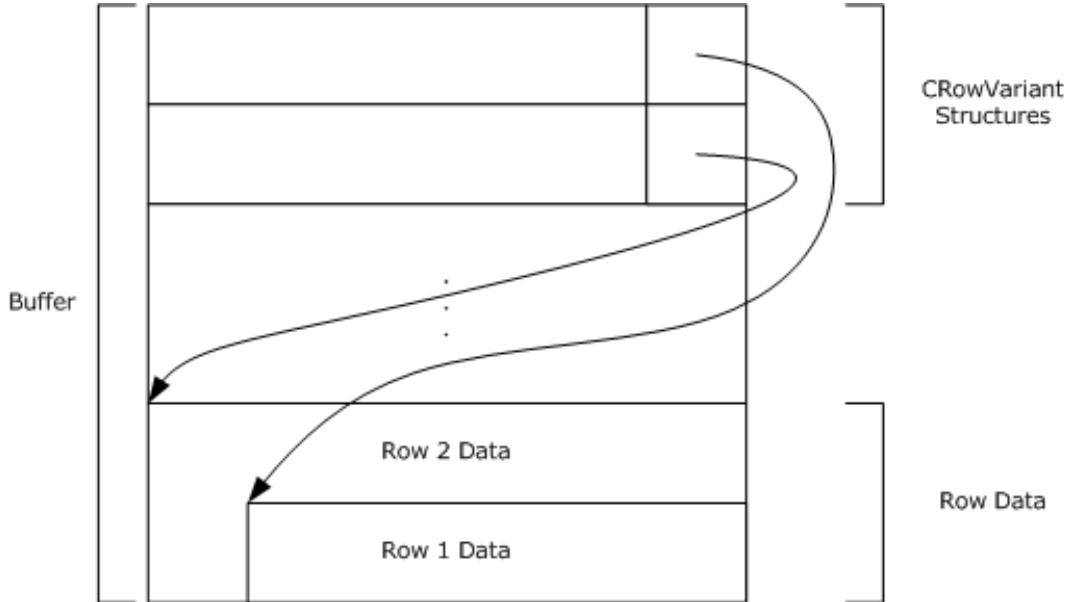


Figure 2: Structure of the row buffer

The following example presents a sample message beginning with the row buffer and formatted using 32-bit offsets. If the CPMSetBindingsIn message specified two columns (Size (VT_I4) and Title (VT_LPWSTR)), and **_ulClientBase** from CPMGetRowsIn was 0x10000, row data for two rows would appear as follows.

Bytes																
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0x10000	Row 1 document id				0x1f		Reserved					0x10040				
0x10010	Row 2 document id				0x1f		Reserved					0x10026				
0x10020	0	0	0	0	0	0	S		E		C		O		N	
0x10030	D		S		T		R		I		N		G		0x00	
0x10040	S		T		R		I		N		G		1		0x00	

Figure 3: Example of row data format using 32-bit offsets

At the beginning of the offset, 0x10000, there are two CRowVariants, one for each column of variable data stored for each of the two rows returned. Each CRowVariant consists of the following:

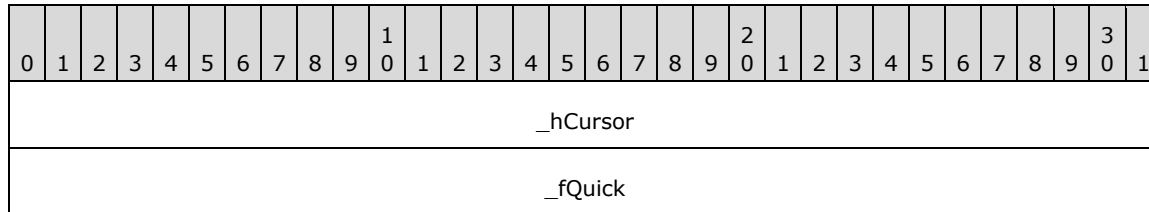
- A 4 byte row identifier in which the column belongs.
- 8 unused bytes that can be set to an arbitrary value.

- A 4 byte offset into the row data where the column data can be located.

The six bytes between the last CRowVariant and the beginning of the column data stored at 0x10026 are padding.

2.2.3.17 CPMRatioFinishedIn

The CPMRatioFinishedIn message requests the completion percentage of a query. The format of the CPMRatioFinishedIn message that follows the header is shown in the following diagram.



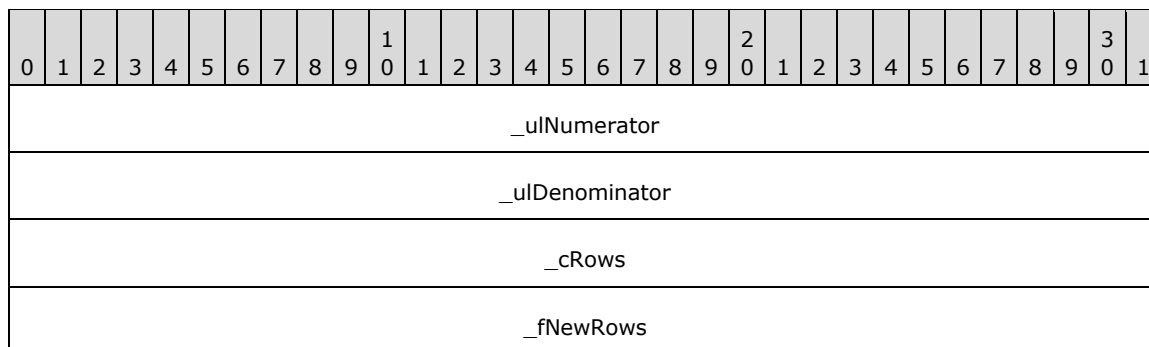
_hCursor (4 bytes): The handle from the CPMCreateQueryOut message identifying the query for which to request completion information.

_fQuick (4 bytes): This is unused and MUST be ignored by the server.

Note This field MUST be set to 0x00000001.

2.2.3.18 CPMRatioFinishedOut

The CPMRatioFinishedOut message replies to a CPMRatioFinishedIn message with the completion ratio of a query. The format of the CPMRatioFinishedOut message that follows the header is shown in the following diagram.



_ulNumerator (4 bytes): A 32-bit unsigned integer indicating the numerator of the completion ratio in terms of rows.

_ulDenominator (4 bytes): A 32-bit unsigned integer indicating the denominator of the completion ratio in terms of row. This field MUST be greater than zero.

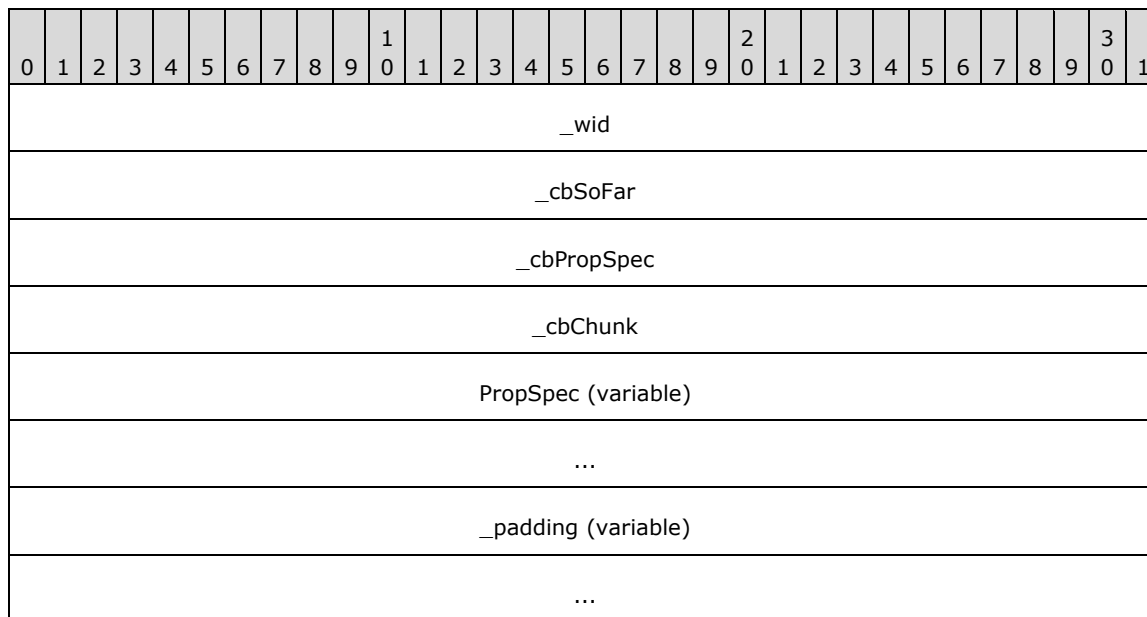
_cRows (4 bytes): A 32-bit unsigned integer indicating the total number of rows for the query.

_fNewRows (4 bytes): A Boolean value indicating if there are new rows available. A value of 0x00000001 indicates that new rows are available in the rowset. A value of 0x00000000 indicates that the rowset does not contain any new rows. This field MUST NOT be set to any other values.

2.2.3.19 CPMFetchValueIn

The CPMFetchValueIn message requests a property value. As specified in section 3.2.4.2.5, this message is sent repeatedly to retrieve all bytes of the property, updating **_cbSoFar** for each, until the **_fMoreExists** field of the CPMFetchValueOut message is set to FALSE.

The format of the CPMFetchValueIn message that follows the header is shown in the following diagram.



_wid (4 bytes): A 32-bit unsigned integer representing the document ID identifying the document for which a property is fetched.

_cbSoFar (4 bytes): A 32-bit unsigned integer containing the number of bytes previously transferred for this property.

Note This field MUST be set to 0x00000000 in the first message.

_cbPropSpec (4 bytes): A 32-bit unsigned integer containing the size of the **PropSpec** field in bytes.

_cbChunk (4 bytes): A 32-bit unsigned integer containing the maximum number of bytes that the sender can accept in a CPMFetchValueOut message. <11>

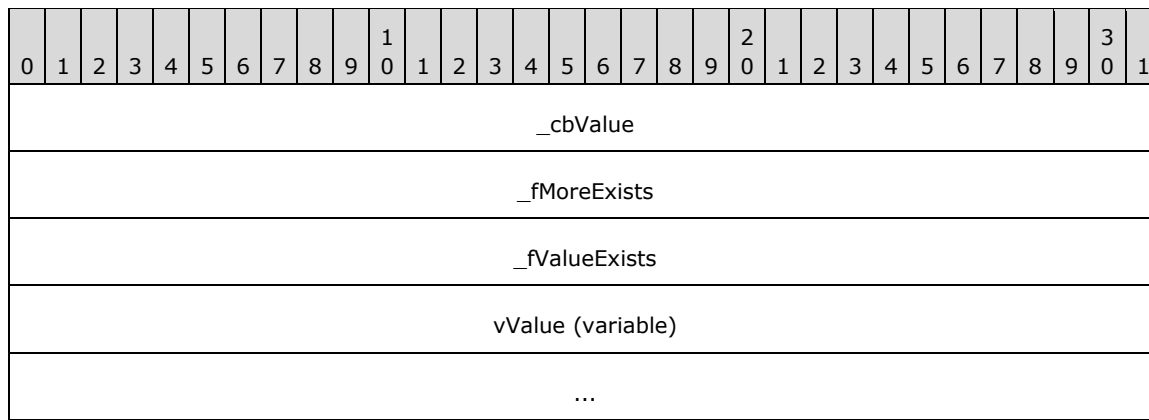
PropSpec (variable): A CFullPropSpec structure specifying the property to retrieve.

_padding (variable): This field MUST be of the length necessary (0 to 3 bytes) to pad the message out to a multiple of 4 bytes in length. The value of the padding bytes can be any arbitrary value. This field MUST be ignored by the receiver.

2.2.3.20 CPMFetchValueOut

The CPMFetchValueOut message replies to a CPMFetchValueIn message with a property value from a previous query. As specified in section 3.1.5.2.8, this message is sent after each CPMFetchValueIn message until all bytes of the property are transferred.

The format of the CPMFetchValueOut message that follows the header is shown in the following diagram.



_cbValue (4 bytes): A 32-bit unsigned integer containing the total size, in bytes, in **vValue**.

_fMoreExists (4 bytes): A Boolean value indicating whether there are additional CPMFetchValueOut messages available.

Value	Meaning
0x00000000	There are no additional data available.
0x00000001	There are additional data available.

_fValueExists (4 bytes): A Boolean value indicating whether there is a value for the property.

Value	Meaning
0x00000000	A value for the property does not exist.
0x00000001	A value for the property exists.

vValue (variable): A portion of a byte array containing a **SERIALIZEDPROPERTYVALUE** where the offset of the beginning of the portion is the value of **_cbSoFar** in **CPMFetchValueIn**. The length of the portion, indicated by the **_cbValue** field, **MUST** be less than or equal to the value of **_cbChunk** in **CPMFetchValueIn**.

2.2.3.21 CPMGetNotify

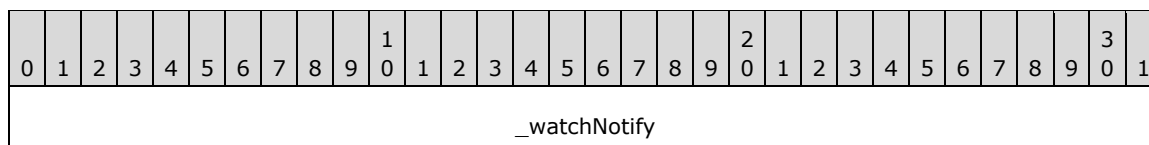
The **CPMGetNotify** message **MAY** request that the client be notified of rowset changes.

The message **MUST NOT** include a body; only the message header (as specified in section 2.2.2) is to be sent.

2.2.3.22 CPMSendNotifyOut

The **CPMSendNotifyOut** message **SHOULD** notify the client of a change to the results of a query.

This message is sent only when a change occurs and a **CPMGetNotify** message has been received. The format of the **CPMSendNotifyOut** message that follows the header is shown in the following diagram.

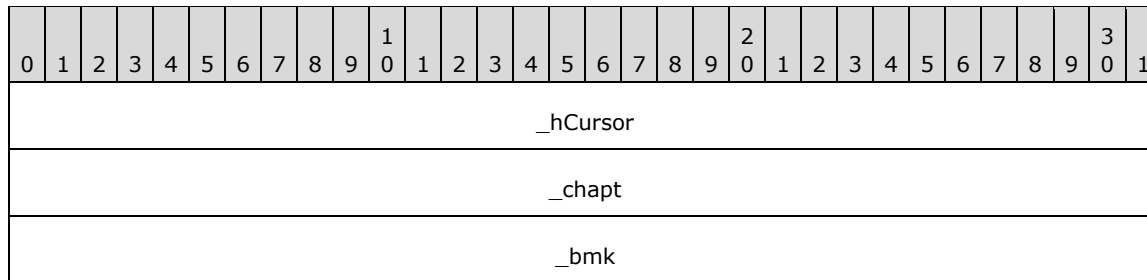


_watchNotify (4 bytes): A 32-bit unsigned integer representing the change to the query. It MUST be one of the following values.

Value	Meaning
DBWATCHNOTIFY_ROWSCHANGED 0x00000001	The number of rows in the query rowset has changed.
DBWATCHNOTIFY_QUERYDONE 0x00000002	The query has completed.
DBWATCHNOTIFY_QUERYREEXECUTED 0x00000003	The query has been executed again.

2.2.3.23 CPMGetApproximatePositionIn

The CPMGetApproximatePositionIn message requests the approximate position of a bookmark in a chapter. The format of the CPMGetApproximatePositionIn message that follows the header is shown in the following diagram.



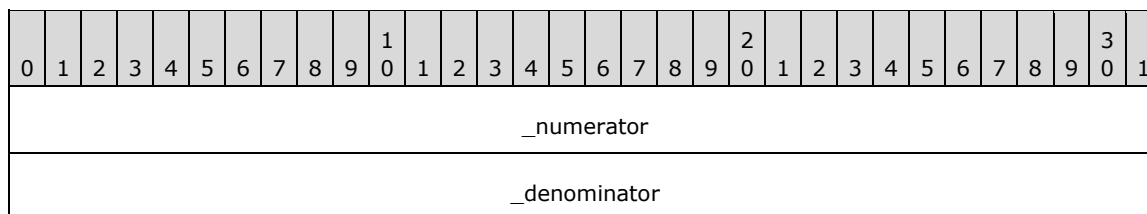
_hCursor (4 bytes): A 32-bit value representing the query cursor (1) obtained from CPMCreateQueryOut for the rowset containing the bookmark.

_chapt (4 bytes): A 32-bit value representing the handle to the chapter containing the bookmark.

_bmk (4 bytes): A 32-bit value representing the handle to the bookmark for which to retrieve the approximate position.

2.2.3.24 CPMGetApproximatePositionOut

The CPMGetApproximatePositionOut message replies to a CPMGetApproximatePositionIn message describing the approximate position of the bookmark in the chapter. The format of the CPMGetApproximatePositionOut message that follows the header is shown in the following diagram.



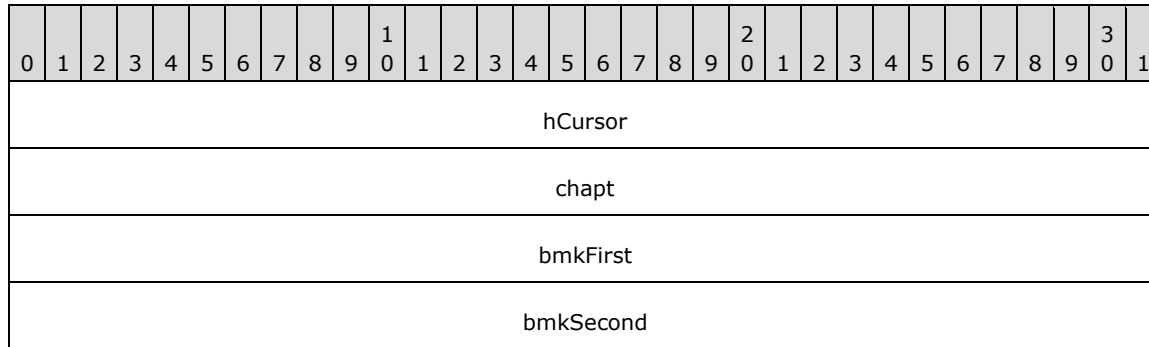
_numerator (4 bytes): A 32-bit unsigned integer containing the row number of the bookmark in the rowset.

_denominator (4 bytes): A 32-bit unsigned integer containing the number of rows in the rowset.

2.2.3.25 CPMCompareBmkIn

The CPMCompareBmkIn message requests a comparison of two bookmarks in a chapter.

The format of the CPMCompareBmkIn message that follows the header is shown in the following diagram.



hCursor (4 bytes): A 32-bit unsigned integer representing the handle from the CPMCreateQueryOut message for the rowset containing the bookmarks.

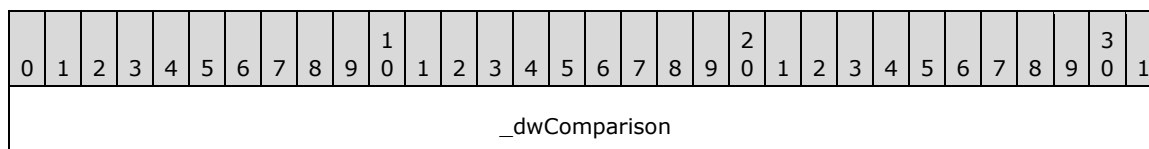
chapt (4 bytes): A 32-bit unsigned integer representing the handle of the chapter containing the bookmarks to compare.

bmkFirst (4 bytes): A 32-bit unsigned integer representing the handle to the first bookmark to compare.

bmkSecond (4 bytes): A 32-bit unsigned integer representing the handle to the second bookmark to compare.

2.2.3.26 CPMCompareBmkOut

The CPMCompareBmkOut message replies to a CPMCompareBmkIn message with the comparison of the two bookmarks in the chapter. The format of the CPMCompareBmkOut message that follows the header is shown in the following diagram.



_dwComparison (4 bytes): A 32-bit unsigned integer. MUST be one of the following values, indicating the relative positions of the two bookmarks in the chapter.

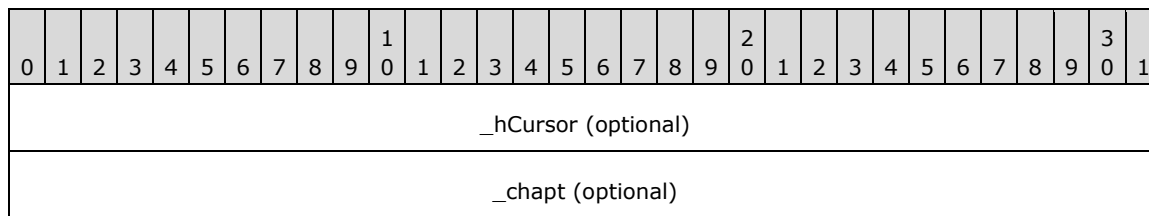
Value	Meaning
DBCOMPARE_LT 0x00000000	The first bookmark is positioned before the second.
DBCOMPARE_EQ 0x00000001	The first bookmark has the same position as the second.
DBCOMPARE_GT	The first bookmark is positioned after the second.

Value	Meaning
0x00000002	
DBCOMPARE_NE 0x00000003	The first bookmark does not have the same position as the second.
DBCOMPARE_NOTCOMPARABLE 0x00000004	The first bookmark is not comparable to the second.

2.2.3.27 CPMRestartPositionIn

The CPMRestartPositionIn message moves the fetch position for a cursor (1) to the beginning of the chapter. As specified in section 3.1.5.2.12, the server will reply using the same message with the results of the request contained in the **_status** field of the Content Indexing Services Protocol header.

The format of the CPMRestartPositionIn message that follows the header is shown in the following diagram.



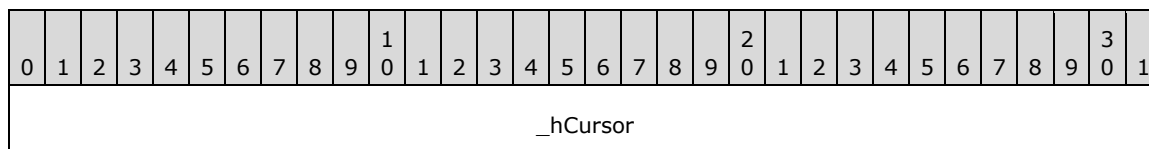
_hCursor (4 bytes): A 32-bit value representing the handle, obtained from a CPMCreateQueryOut message, that identifies the query for which to restart the position. This field **MUST** be present when the message is sent by the client and **MUST** be absent when the message is sent by the server.

_chapt (4 bytes): A 32-bit value representing the handle of a chapter from which to retrieve rows. This field **MUST** be present when the message is sent by the client and **MUST** be absent when the message is sent by the server.

2.2.3.28 CPMStopAsynchIn

The CPMStopAsynchIn message contains a cursor handle for which an asynchronous query **SHOULD** be stopped.

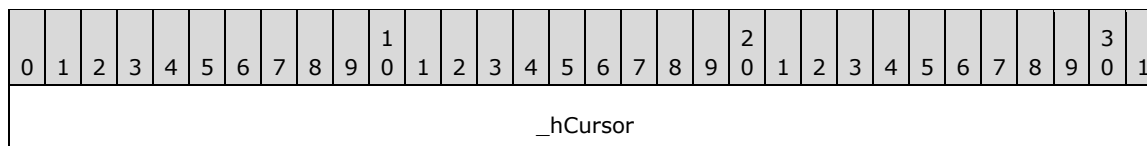
The format of the CPMStopAsynchIn message that follows the header is shown in the following diagram.



_hCursor (4 bytes): The handle from the CPMCreateQueryOut message identifying the query for which to stop asynchronous processing.

2.2.3.29 CPMFreeCursorIn

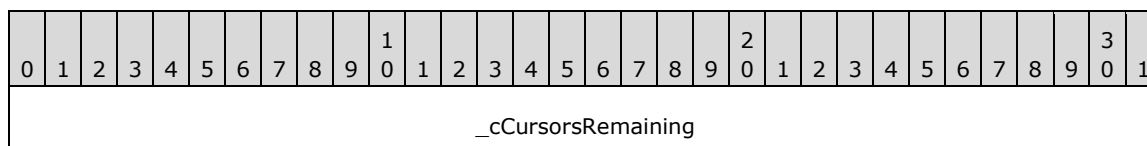
The CPMFreeCursorIn message requests the release of a cursor. The format of the CPMFreeCursorIn message that follows the header is shown in the following diagram.



_hCursor (4 bytes): A 32-bit value representing the handle of the cursor from the CPMCreateQueryOut message to release.

2.2.3.30 CPMFreeCursorOut

The CPMFreeCursorOut message replies to a CPMFreeCursorIn message with the results of freeing a cursor. The format of the CPMFreeCursorOut message that follows the header is shown in the following diagram.



_cCursorsRemaining (4 bytes): A 32-bit unsigned integer indicating the number of cursors still in use for the query.

2.2.3.31 CPMDisconnect

The CPMDisconnect message SHOULD end the connection with the server.

The message MUST NOT include a body; only the message header (as specified in section 2.2.2) is to be sent.

2.2.4 Errors

All Content Indexing Services Protocol messages MUST return 0x00000000 on success; otherwise, they return a 32-bit nonzero error code that can be either an HRESULT value or an NTSTATUS value (see section 1.8). If a buffer is too small to fit a result, a status code of STATUS_INSUFFICIENT_RESOURCES (0xC0000009A) MUST be returned, after which the failing operation is retried with a larger buffer.

All other error values MUST be treated the same; the error MUST be considered fatal and reported to the higher-level caller. Future messages MAY be sent over the same pipe as if no error had occurred.<12>

Note Currently, the HRESULT and NTSTATUS numbering spaces do not overlap except with values of identical meaning; but, even if there were conflicts in the future, they would not cause any protocol issues as long as the value for STATUS_INSUFFICIENT_RESOURCES remains unique because all other error values are treated the same.

2.2.5 Standard Properties

Properties in the indexing service are represented by the combination of a property set GUID and either a string property name or an integer property ID. See CFullPropSpec for more details.

There are three classes of properties: database properties, query properties, and open properties. Database properties help control the indexing service behavior and are as specified in section 2.2.1.15.1. Query properties can be used in a restriction and in some cases returned with every result. They are special because they are built into the indexing service. Open properties are defined by individual applications. There are a typical set of common properties in use, but there is no requirement to use them.

2.2.5.1 Query Properties

Query Property Set

```
#define QueryGuid
{0x49691c90,0x7e17,0x101a,0xa9,0x1c,0x08,0x00,0x2b,0x2e,0xcd,0xa9}
```

Friendly name/PropId	Data type	Description
RankVector 0x00000002	VT_UI4 VT_VECTOR	The 0-1000 rank computed for each element when performing vector ranking.
Rank 0x00000003	VT_I4	The rank 0-1000 computed for this item. How rank is computed is defined by the indexing service. Typically, content and proximity restrictions influence the rank, while other comparison operators do not.
HitCount 0x00000004	VT_I4	The number of words from the query found.
WorkId 0x00000005	VT_I4	A unique identifier for each result found. Use value as a bookmark handle.
All 0x00000006	VT_LPWSTR	Allows a content restriction over all textual properties. Cannot be retrieved.
VPath 0x00000009	VT_LPWSTR	Full virtual path to file, including file name. If there is more than one possible path, then the best match for the specific query is chosen.

Storage Property Set

```
#define StorageGuid
{0xb725f130,0x47ef,0x101a,0xa5,0xf1,0x02,0x60,0x8c,0x9e,0xeb,0xac}
```

The friendly name is Contents, the PropId is 0x00000013, the data type is VT_LPWSTR, and it represents the main contents of a file; usually, this property cannot be retrieved.

2.2.5.2 Common Open Properties

An indexing service can allow querying and retrieval over any property. The following tables outline some properties typically used.

Storage Property Set

```
#define StorageGuid
{0xb725f130,0x47ef,0x101a,0xa5,0xf1,0x02,0x60,0x8c,0x9e,0xeb,0xac}
```

Friendly name/PropId	Data type	Description
Directory 0x00000002	VT_LPWSTR	Physical path to file, not including file name.
ClassId 0x00000003	VT_CLSID	Class ID of object, for example, WordPerfect and Word.
FileIndex 0x00000008	VT_UI8	Unique ID of file.
USN 0x00000009	VT_I8	Update Sequence Number. NTFS drives only.
Filename 0x0000000A	VT_LPWSTR	Name of file.
Path 0x0000000B	VT_LPWSTR	Full physical path to file, including file name.
Size 0x0000000C	VT_I8	Size of file, in bytes.
Attrib 0x0000000D	VT_UI4	File attributes. Documented in Win32 SDK.
Write 0x0000000E	VT_FILETIME	Last time that file was written.
Create 0x0000000F	VT_FILETIME	Time that file was created.
Access 0x00000010	VT_FILETIME	Last time that file was accessed.
AllocSize 0x00000012	VT_I8	Size of disk allocation for file.
ShortFilename 0x00000014	VT_LPWSTR	Short (8.3) file name.

The following table lists the attribute flag values for the Attrib property.

Attribute/value	Description
FILE_ATTRIBUTE_READONLY 0x00000001	The file or directory is read-only. Applications can read the file but cannot write to it or delete it. For a directory, applications cannot delete it.
FILE_ATTRIBUTE_HIDDEN 0x00000002	The file or directory is hidden. It is not included in an ordinary directory listing.
FILE_ATTRIBUTE_SYSTEM 0x00000004	The file or directory is part of the operating system or is used exclusively by the operating system.
FILE_ATTRIBUTE_DIRECTORY 0x00000010	The handle identifies a directory.

Attribute/value	Description
FILE_ATTRIBUTE_ARCHIVE 0x00000020	The file or directory is an archive file. Applications use this attribute to mark files for backup or removal.
FILE_ATTRIBUTE_NORMAL 0x00000080	The file or directory does not have another attributes set. This attribute is valid only if used alone.
FILE_ATTRIBUTE_TEMPORARY 0x00000100	The file is being used for temporary storage. File systems avoid writing data back to mass storage if sufficient cache memory is available, because often the application deletes the temporary file shortly after the handle is closed. In that case, the system can entirely avoid writing the data. Otherwise, the data is written after the handle is closed.
FILE_ATTRIBUTE_SPARSE_FILE 0x00000200	The file is a sparse file.
FILE_ATTRIBUTE_REPARSE_POINT 0x00000400	The file or directory has an associated reparse point.
FILE_ATTRIBUTE_COMPRESSED 0x00000800	The file or directory is compressed. For a file, this means that all of the data in the file is compressed. For a directory, this means that compression is the default for newly created files and subdirectories.
FILE_ATTRIBUTE_OFFLINE 0x00001000	The data of the file is not immediately available. This attribute indicates that the file data has been physically moved to offline storage. This attribute is used by Remote Storage, the hierarchical storage management software. Applications are not to arbitrarily change this attribute.
FILE_ATTRIBUTE_ENCRYPTED 0x00004000	The file or directory is encrypted. For a file, this means that all data in the file is encrypted. For a directory, this means that encryption is the default for newly created files and subdirectories.
FILE_ATTRIBUTE_VIRTUAL 0x00010000	A file is a virtual file.

Property Sets for Documents

```
#define DocPropSetGuid
{0xf29f85e0,0x4ff9,0x1068,0xab,0x91,0x08,0x00,0x2b,0x27,0xb3,0xd9}
```

Friendly name/PropId	Data type	Description
DocTitle 0x00000002	VT_LPWSTR	Title of document.
DocSubject 0x00000003	VT_LPWSTR	Subject of document.
DocAuthor 0x00000004	VT_LPWSTR	Author of document.

Friendly name/PropId	Data type	Description
DocKeywords 0x00000005	VT_LPWSTR	Document keywords.
DocComments 0x00000006	VT_LPWSTR	Comments about document.
DocTemplate 0x00000007	VT_LPWSTR	Name of template for document.
DocLastAuthor 0x00000008	VT_LPWSTR	Most recent user who edited document.
DocRevNumber 0x00000009	VT_LPWSTR	Current version number of document.
DocEditTime 0x0000000A	VT_FILETIME	Total time spent editing document.
DocLastPrinted 0x0000000B	VT_FILETIME	Time that document was last printed.
DocCreatedTm 0x0000000C	VT_FILETIME	Time that document was created.
DocLastSavedTm 0x0000000D	VT_FILETIME	Time that document was last saved.
DocPageCount 0x0000000E	VT_I4	Number of pages in document.
DocWordCount 0x0000000F	VT_I4	Number of words in document.
DocCharCount 0x00000010	VT_I4	Number of characters in document.
DocThumbnail 0x00000011	VT_CF	Thumbnail of document in clipboard format.
DocAppName 0x00000012	VT_LPWSTR	Name of application that created the file.

Property Sets for Documents

```
#define DocPropSetGuid2
{0xd5cdd502,0x2e9c,0x101b,0x93,0x97,0x08,0x00,0x2b,0x2c,0xf9,0xae}
```

Friendly name/PropId	Data type	Description
DocCategory 0x00000002	VT_LPSTR	Type of document, such as a memo, schedule, or white paper.
DocPresentationTarget 0x00000003	VT_LPSTR	Target format (35mm, printer, video, and so on) for a presentation in PowerPoint.

Friendly name/PropId	Data type	Description
DocByteCount 0x00000004	VT_I4	Number of bytes in a document.
DocLineCount 0x00000005	VT_I4	Number of lines contained in a document.
DocParaCount 0x00000006	VT_I4	Number of paragraphs in a document.
DocSlideCount 0x00000007	VT_I4	Number of slides in a Microsoft PowerPoint presentation.
DocNoteCount 0x00000008	VT_I4	Number of pages with notes in a PowerPoint presentation.
DocHiddenCount 0x00000009	VT_I4	Number of hidden slides in a PowerPoint presentation.
DocPartTitles 0x0000000D	VT_LPWSTR VT_VECTOR	Names of document parts. For example, in Excel, part titles are the names of spread-sheets; in PowerPoint, part titles are the names of slides; and in Word for Windows, part titles are the names of the documents in the master document.
DocManager 0x0000000E	VT_LPSTR	Name of the manager of the document's author.
DocCompany 0x0000000F	VT_LPSTR	Name of the company for which the document was written.

Document characterization

```
#define DocCharacterGuid
{0x560c36c0,0x503a,0x11cf,0xba,0xa1,0x00,0x00,0x4c,0x75,0x2a,0x9a}
```

The friendly name is Characterization, the PropId is 0x00000002, its data type is VT_LPWSTR, and it is the characterization, or abstract, of a document; computed by the indexing service.

Music Property Set

```
#define PSGUID_MUSIC
{56A3372E-CE9C-11d2-9F0E-006097C686F6}
```

Friendly name/PropId	Data type	Description
MusicArtist 0x00000002	VT_LPWSTR	Artist who recorded the song.
MusicAlbum 0x00000004	VT_LPWSTR	Album that the song was released on.
MusicYear 0x00000005	VT_LPWSTR	Year that the song was published.

Friendly name/PropId	Data type	Description
MusicTrack 0x00000007	VT_UI4	Track number of the song.
MusicGenre 0x0000000B	VT_LPWSTR	Genre of the song.

Digital Rights Management

```
#define PSGUID_DRM
{AEAC19E4-89AE-4508-B9B7-BB867ABEE2ED}
```

This property set contains properties that describe the digital rights associated with some media.

Friendly name/PropId	Data type	Description
DrmLicense 0x00000002	VT_BOOL	TRUE if there is a license.
DrmDescription 0x00000003	VT_LPWSTR	Description of the license.
DrmPlayCount 0x00000004	VT_UI4	Number of times that the item can be played.
DrmPlayStarts 0x00000005	VT_FILETIME	Date play rights start.
DrmPlayExpires 0x00000006	VT_FILETIME	Date rights expire.

Image Property Set

```
#define PSGUID_IMAGESUMMARYINFORMATION
{0x6444048f,0x4c8b,0x11d1,0x8b,0x70,0x8,0x00,0x36,0xb1,0x1a,0x03}
```

Friendly name/PropId	Data type	Description
ImageFileType 0x00000002	VT_LPWSTR	Type of image file.
ImageCx 0x00000003	VT_UI4	Horizontal size in pixels.
ImageCy 0x00000004	VT_UI4	Vertical size in pixels.
ImageResolutionX 0x00000005	VT_UI4	Horizontal resolution in pixels per inch.
ImageResolutionY 0x00000006	VT_UI4	Vertical resolution in pixels per inch.
ImageBitDepth	VT_UI4	Number of bits per pixel.

Friendly name/PropId	Data type	Description
0x00000007		
ImageColorSpace 0x00000008	VT_LPWSTR	Description of image color space.
ImageCompression 0x00000009	VT_LPWSTR	Description of image compression.
ImageTransparency 0x0000000A	VT_UI4	Degree of transparency from 0-100.
ImageGammaValue 0x0000000B	VT_UI4	Gamma correction value.
ImageFrameCount 0x0000000C	VT_UI4	Frame count for image.
ImageDimensions 0x0000000D	VT_LPWSTR	Description of the image dimensions.

Audio Property Set

```
#define PSGUID_AUDIO
{64440490-4C8B-11D1-8B70-080036B11A03}
```

Audio-Related Properties

Friendly name/PropId	Datatype	Description
AudioFormat 0x00000002	VT_LPWSTR	Format of audio.
AudioTimeLength 0x00000003	VT_UI8	Duration in 100-nanosecond units.
AudioAvgDataRate 0x00000004	VT_UI4	Average encoding rate in bits per second.
AudioSampleRate 0x00000005	VT_UI4	Sample rate in samples per second.
AudioSampleSize 0x00000006	VT_UI4	Sample size in bits per sample.
AudioChannelCount 0x00000007	VT_UI4	Number of channels of audio.

Video Property Set

```
#define PSGUID_VIDEO
{64440491-4C8B-11D1-8B70-080036B11A03}
```

Friendly Name/PropId	Datatype	Description
VideoStreamName 0x00000002	VT_LPWSTR	Name of the stream.
VideoFrameWidth 0x00000003	VT_UI4	Width of a frame in pixels.
VideoFrameHeight 0x00000004	VT_UI4	Height of a frame in pixels.
VideoTimeLength 0x00000005	VT_UI4	Duration in 100-nanosecond units.
VideoFrameCount 0x00000006	VT_UI4	Number of frames in video.
VideoFrameRate 0x00000007	VT_UI4	Frames per second.
VideoDataRate 0x00000008	VT_UI4	Bits per second.
VideoSampleSize 0x00000009	VT_UI4	Bits per sample.
VideoCompression 0x0000000A	VT_LPWSTR	Description of video compression.

Mime Properties

```
#define #define NNTPGuid
{0xAA568EEC, 0xE0E5, 0x11CF, 0x8F, 0xDA, 0x00, 0xAA, 0x00, 0xA1, 0x4F, 0x93}
```

Friendly name/PropId	Data type	Description
MsgNewsgroup 0x00000002	VT_LPWSTR	Newsgroup for the message.
MsgSubject 0x00000005	VT_LPWSTR	Subject of the message.
MsgFrom 0x00000006	VT_LPWSTR	Who sent the message.
MsgMessageID 0x00000007	VT_LPWSTR	Unique ID for email message.
MsgDate 0x0000000C	VT_FILETIME	When the message was sent.
MsgReceivedDate 0x00000035	VT_FILETIME	When the message was received.
MsgArticleID 0x0000003C	VT_UI4	Unique identifier for the newsgroup article.

3 Protocol Details

Content Indexing Services Protocol message requests require only minimal sequencing. A CPMSetCatStateIn message MAY be called at any time. All other messages MUST be preceded by an initial CPMConnectIn message (for example, at least one CPMConnectIn message for each named pipe connection). Beyond the initial connection, there is no other sequencing required by the protocol. However, it is advised that the higher layer adhere to a meaningful message sequence. Some messages include data returned by previous messages. Even though it is legal to send messages in any order, the server will return an error if the data in a particular message is invalid. Message dependencies define only a partial order of message sequence - other messages can be interspersed.

The following figure shows how messages depend on the data from previous messages.

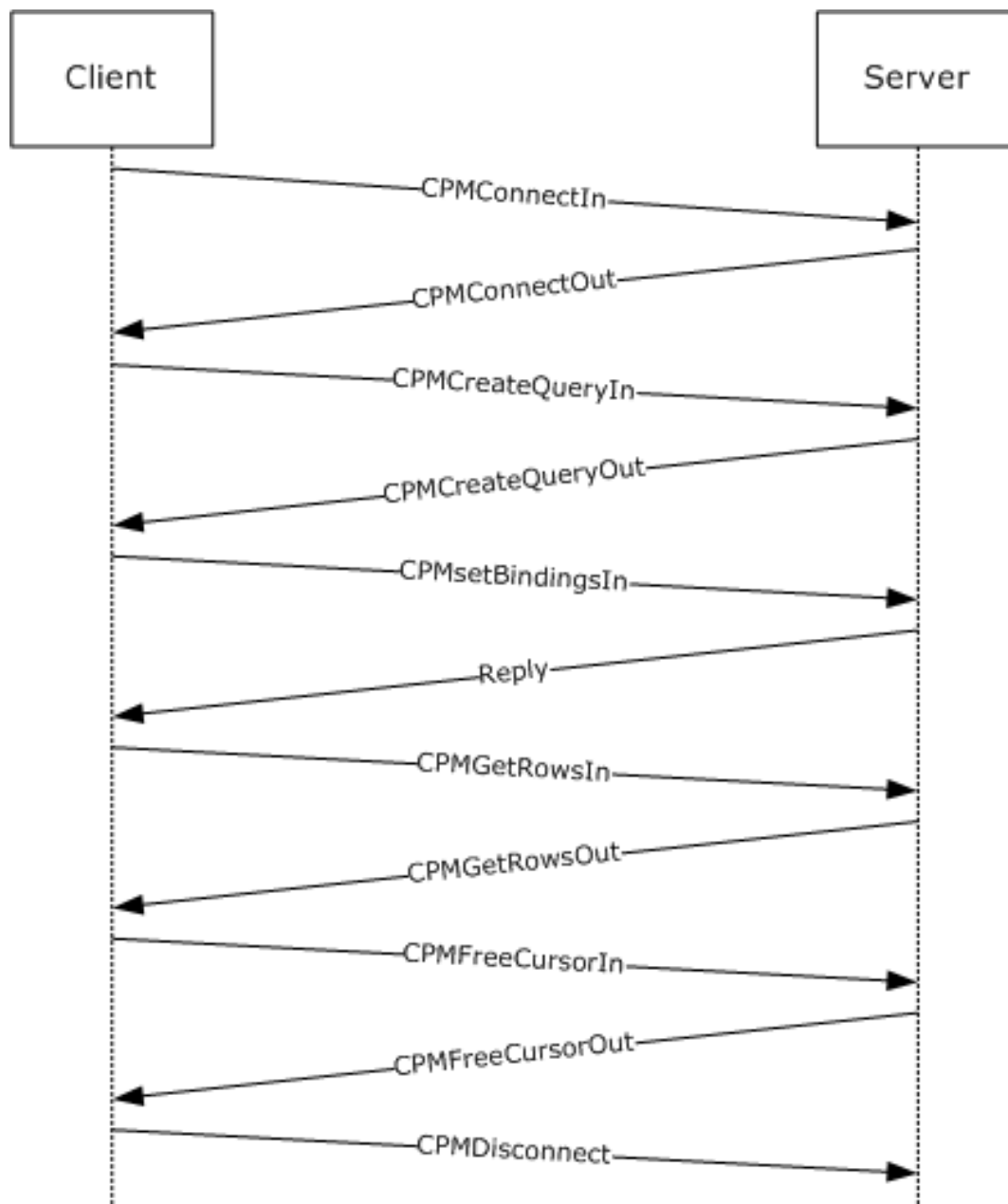


Figure 4: Typical message sequence for a simple query from client to remote computer

The messages represented in the preceding diagram represent a subset of all of the Content Indexing Services Protocol messages used for querying a remote indexing service catalog.

3.1 Server Details

3.1.1 Abstract Data Model

The following section specifies data and state maintained by the Content Indexing Services Protocol server. The data provided in this document explains how the protocol behaves. This section does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this document.

An indexing service implementing the Content Indexing Services Protocol MUST maintain the following abstract data elements:

- The list of clients connected to the server.
- Information about each client, which includes:
 - Client's version (as indicated in the CPMConnectIn message specified in section 2.2.3.6).
 - Catalog associated with the client (by a CPMConnectIn message).
 - Additional client properties as specified in the Properties section.
 - Client's search query.
 - List of cursor (1) handles for the query, and position in result set for each handle.
 - Current set of bindings.
 - Current status of the query, which includes (for each cursor):
 - Number of rows in query result.
 - Numerator and denominator of query completion.
 - Last number of rows, reported by most recent CPMRatioFinishedOut message for this cursor.
 - Whether the query is monitored by the server for changes in query results, and if it is monitored, what changed in the query results since they were last reported to the client by CPMSendNotifyOut.
 - List of chapter handles, served by this query to a client.
 - List of bookmark handles for each cursor, served by this query to a client.
- The current state of the indexing service, which can be "not initialized", "running", or "shutting down". These states are logical only, and can only affect possible error messages received from the service. Note that most of the time the server is in "running" state. The following is the state machine diagram for the server.



Figure 5: State machine diagram for the server

- Per-catalog information: collection of indexed locations, number of documents indexed, size of inverted index, number of unique keys, and so on (see section 2.2.3.1 for complete list), state which corresponds to the values of **dwOldState** in section 2.2.3.3.<13>
- For each language supported, a database of word variations as discussed in GENERATE_METHOD_INFLECT in section 2.2.1.3.

3.1.2 Timers

None.

3.1.3 Initialization

Upon initialization, the server MUST set its state to "not initialized" and start listening for messages on the named pipe specified in section 1.9. After doing any other internal initialization, the server MUST transition to the "running" state.

3.1.4 Higher-Layer Triggered Events

None.

3.1.5 Message Processing and Sequencing Rules

Whenever an error occurs during the processing of a message sent by a client, the server MUST report an error back to the client as follows:

- Stop processing the message sent by the client.
- Respond with the message header (only) of the message sent by the client, keeping **_msg** field intact.
- Set the **_status** field to the error code value.

When a message arrives, the server MUST check the field value to determine whether it is a known type (see section 2.2.2). If the type is not known, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.

The server MUST then validate the **_ulChecksum** field value if the message type is one of the following:

- CPMConnectIn (0x000000C8)
- CPMCreateQueryIn (0x000000CA)
- CPMSetBindingsIn (0x000000D0)
- CPMGetRowsIn (0x000000CC)
- CPMFetchValueIn (0x000000E4)

To validate the **_ulChecksum** field value, the server MUST check the value that the client specified in the **_iClientVersion** field in the CPMConnectIn message.

If the **_iClientVersion** field is less than 0x00000008 and the **_ulChecksum** field is not set to 0x00000000, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error. The server MUST NOT validate the **_ulChecksum** field for clients that set the **_iClientVersion** field to a value less than 0x00000008.

If the **_iClientVersion** field value is 0x00000008 or greater, the server MUST validate that the **_ulChecksum** field was calculated as specified in section 3.2.4. If the **_ulChecksum** value is invalid, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.

Next, the server checks which state it is in. If its state is "not initialized", the server MUST report a CI_E_NOT_INITIALIZED (0x8004180B) error. If its state is "shutting down", the server MUST report a CI_E_SHUTDOWN (0x80041812) error.

After a header has been determined to be valid and after the server has been determined to be in "running" state, further message-specific processing MUST be done as specified in the following subsections.

Some messages are valid only after a previous message has been sent. Typically, an ID or handle from the earlier message is required as input to the later message. These requirements are detailed in the following sections. The following table summarizes the relationship between messages.

Message	Prerequisite Message																	
	CPM CiStateInOut	CPM SetCatStateIn	CPM UpdateDocumentsIn	CPM ForceMergeIn	CPM ConnectOut	CPM CreateQueryOut	CPM GetQueryStatusOut	CPM GetQueryStatusExOut	CPM SetBindingsOut	CPM GetRowsOut	CPM RatioFinishedOut	CPM FetchValueOut	CPM GetNotifyOut	CPM SendNotifyOut	CPM GetApproximatePositionOut	CPM CompareBmkOut	CPM RestartPositionOut	CPM FreeCursorOut
CPM CiStateInOut					X													
CPM SetCatStateIn																		
CPM UpdateDocumentsIn					X													
CPM ForceMergeIn					X													
CPM ConnectIn																		
CPM CreateQueryIn					X													
CPM GetQueryStatusIn					X	X												
CPM GetQueryStatusExIn					X	X												
CPM SetBindingsIn					X	X												
CPM GetRowsIn					X	X		X										
CPM RatioFinishedIn					X	X												
CPM FetchValueIn					X	X		X	X									
CPM GetNotifyIn					X	X												
CPM SendNotifyIn					X	X							X					
CPM GetApproximatePositionIn					X	X												
CPM CompareBmkIn					X	X												
CPM RestartPositionIn					X	X												
CPM FreeCursorIn					X	X												

Figure 6: Relationship between messages

3.1.5.1 Remote Indexing Service Catalog Management

3.1.5.1.1 Receiving a CPM CiStateInOut Request

When the server receives a CPM CiStateInOut message request from the client, the server MUST first check whether the client is in a list of connected clients. If the client is not in the list, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error. Otherwise, the server MUST respond to the client with a CPM CiStateInOut message, filling the message in with information about the client's associated catalog, as specified in section 2.2.3.1.

3.1.5.1.2 Receiving a CPMSetCatStateIn Request

When the server receives a CPMSetCatStateIn message request from the client, the server MUST do the following:

1. Check whether the client has administrative access. If the client does not have administrative access, the server MUST report a STATUS_ACCESS_DENIED (0xC0000022) error.
2. If **_dwNewState** is not equal to CICAT_ALL_OPENED, locate a catalog with the name specified in the **_CatName** field. If the server does not locate such a catalog or the value of **_dwNewState** is not one of the values listed in section 2.2.3.2, the server MUST return a STATUS_INVALID_PARAMETER (0xC000000D) error.
3. If **_dwNewState** is not CICAT_GET_STATE or CICAT_ALL_OPENED, change the state of the catalog to the value specified in one of the figures below, where the following abbreviations are used: STP (CICAT_STOPPED), RO (CICAT_READONLY), RW (CICAT_WRITABLE), and NQ (CICAT_NOQUERY).

If the catalog exists on a read/write media, the following values are used.

_dwNewState				
_dwOldState	STP	RO	RW	NQ
STP	STP	RO	RW	RW NQ
RW	STP	RO	RW	RW NQ
RO	STP	RO	RW	RW NQ
RW NQ	STP	RO	RW NQ	RW NQ

Figure 7: Read/write catalog states

Note The state RO|NQ MUST NOT be used in this case.

If the catalog exists on read-only media such as a CD-ROM, the figure is the following values are used.

_dwNewState				
_dwOldState	STP	RO	RW	NQ
STP	STP	RO	RO	NO
RW	STP	RO	RO	RO NQ
RO	STP	RO	RO	RO NQ
RO NQ	STP	RO NQ	RO	RO NQ

Figure 8: Read-only catalog states

Note The states RW and RW|NQ MUST NOT be used in this case.

4. Respond to the client with a CPMSetCatStateOut message, where **_dwOldState** MUST be set to the previous state of the catalog if **_dwNewState** is CICAT_STOPPED, CICAT_READONLY, CICAT_WRITABLE, CICAT_NO_QUERY or CICAT_GET_STATE. If **_dwNewState** is equal to CICAT_ALL_OPENED, the server MUST check the status of all catalogs. If any catalog was started

since service start up, the server MUST set **_dwOldState** to 0x00000001. If no catalogs were started, the server MUST set **_dwOldState** to 0x00000000.

Note It is very unusual to receive 0x00000000 in response to CICAT_ALL_OPENED.

3.1.5.1.3 Receiving a CPMUpdateDocumentsIn Request

When the server receives a CPMUpdateDocumentsIn message request, the server MUST do the following:

1. Check whether the client is in a list of connected clients (which have an associated catalog). If the client is not in the list, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the client has administrative access. If the client does not have administrative access to the server, the server MUST report a STATUS_ACCESS_DENIED (0xC0000022) error.
3. Begin the process of indexing the path specified by the client by doing a full or incremental scan, depending on the value of the **_flag** field in the CPMUpdateDocumentsIn message. If the path was not previously indexed, it MUST be added to the collection of indexed locations and a full scan MUST be performed. This operation MUST be performed in the catalog associated with the client.
4. Respond to the client with the message header for the CPMUpdateDocumentsIn message, and set the **_status** field to the results of the request.

3.1.5.1.4 Receiving a CPMForceMergeIn Request

When the server receives a CPMForceMergeIn message request, the server MUST do the following:

1. Check whether the client is in a list of connected clients (which have a catalog associated). If the client is not in the list, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the client has administrative access. If the client does not have administrative access, the server MUST report a STATUS_ACCESS_DENIED (0xC0000022) error.
3. Begin any process of maintenance that is necessary to improve query performance on a catalog associated with the client.
4. Respond to the client with a message header for the CPMForceMergeIn message, and set the **_status** field to the results of the request.

Note The process of maintenance is asynchronous and can continue after the client receives the response message. This process does not directly affect the protocol in any way (other than response time).

3.1.5.2 Remote Indexing Service Querying

3.1.5.2.1 Receiving a CPMConnectIn Request

When the server receives a CPMConnectIn request from a client, the server MUST do the following:

1. Check whether the client is already on the list of connected clients. If this is the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the specified catalog exists and is not in the stopped state. If this is not the case, the server MUST report a CI_E_NO_CATALOG (0x8004181D) error.
3. Add the client to the list of connected clients.

4. Associate the catalog with the client.
5. Store the information passed in the CPMConnectIn message (such as catalog name or client version) in the client state.
6. Respond to the client with a CPMConnectOut message.

3.1.5.2.2 Receiving a CPMCreateQueryIn Request

When the server receives a CPMCreateQueryIn message request from a client, the server MUST do the following:

1. Check whether the client is in the list of connected clients. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the client already has a query associated with it. If this is the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
3. Check whether the catalog associated with the client is in a state that allows a query to be processed (CICAT_READONLY or CICAT_WRITABLE). If this is not the case, the server MUST report a QUERY_S_NO_QUERY (0x8004160C) error.
4. Parse the restriction set, sort orders, and groupings that are specified in the query. If the server encounters an error, it MUST report an appropriate error. If this step fails for any other reason, the server MUST report the error encountered. For information about indexing service query errors, see [MSDN-QUERYERR].
5. Save the search query in the state for the client.
6. Make any preparations needed to serve rows to a client and associate the query with appropriate cursor (1) handles (depending on information passed in the CPMCreateQueryIn message).
7. Add those handles to the client's list of cursor handles, and create lists of chapter handles and bookmarks.
8. Initialize the list of chapter handles for every cursor in this query to DB_NULL_HCHAPTER.
9. Mark the query as not monitored for changes.
10. Initialize the number of rows to the currently calculated number of rows (which can be 0 if a query did not start to execute or some number if the query is in a process of execution), and initialize the numerator and denominator of query completion.
11. Respond to the client with a CPMCreateQueryOut message.

3.1.5.2.3 Receiving a CPMGetQueryStatusIn Request

When the server receives a CPMGetQueryStatusIn message request from a client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the cursor handle is in a list of the client's cursor handles. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.
3. Prepare a CPMGetQueryStatusOut message. The server MUST retrieve the current query status and set it in the **_Status** field (see 2.2.3.11 for possible values). If this step fails for any reason, the server MUST report an error.
4. Respond to the client with the CPMGetQueryStatusOut message.

3.1.5.2.4 Receiving a CPMGetQueryStatusExIn Request

If the server receives a CPMGetQueryStatusExIn message request from a client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the cursor (1) handle passed is in a list of the client's cursor handles. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.
3. Prepare a CPMGetQueryStatusExOut message. The server MUST retrieve the current query status and query progress and set **_Status** (see CPMGetQueryStatusOut for possible values), **_dwRatioFinishedDenominator**, and **_dwRatioFinishedNumerator** respectively. The server MUST then set the number of rows in the query results to **_cRowsTotal**. If this step fails for any reason, the server MUST report that an error was encountered.
4. Retrieve information about the client's catalog and fill in **_cFilteredDocuments** and **_cDocumentsToFilter**. If this step fails for any reason, the server MUST report that an error was encountered.
5. Retrieve the position of the bookmark indicated by the handle in the **_bmk** field, and fill the remaining **_iRowBmk** field in the CPMGetQueryStatusExOut message. If this step fails for any reason, the server MUST report that an error was encountered.
6. Respond to the client with the CPMGetQueryStatusExOut message.

3.1.5.2.5 Receiving a CPMRatioFinishedIn Request

When the server receives a CPMRatioFinishedIn message request from a client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the cursor handle passed is in the list of the client's cursor handles. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.
3. Prepare a CPMRatioFinishedOut message. The server MUST retrieve the client's query status and fill in the **_ulNumerator**, **_ulDenominator**, and **_cRows** fields. If this step fails for any reason, the server MUST report that an error was encountered.
4. If **_cRows** is equal to the last reported number of rows for this query, set **_fNewRows** to 0x00000000; otherwise, set it to 0x00000001.
5. Update the last reported number of rows for this query to the value of **_cRows**.
6. Respond to the client with the CPMRatioFinishedOut message.

3.1.5.2.6 Receiving a CPMSetBindingsIn Request

When the server receives a CPMSetBindingsIn message request from a client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the cursor handle passed is in the list of the client's cursor handles. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.

3. Verify that binding information is valid (that is, the column at least specifies value, length, or status to be returned; no overlap in bindings for value, length, or status; and value, length, and status fit in the specified row size) and if not, report a DB_E_BADBINDINFO (0x80040E08) error.
4. Save the binding information associated with the columns specified in the **aColumns** field. If this step fails for any reason, the server MUST report that an error was encountered.
5. Respond to the client with a message header (only) with **_msg** set to CPMSetBindingsIn, and **_status** set to the results of the specified binding.

3.1.5.2.7 Receiving a CPMGetRowsIn Request

When the server receives a CPMGetRowsIn message request from a client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the cursor handle passed is in the list of the client's cursor handles. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.
3. Check whether the client has a current set of bindings. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.
4. Prepare a CPMGetRowsOut message. The server MUST position the cursor in query results as indicated by the seek description. If this step fails for any reason, the server MUST report that an error was encountered.
5. Fetch as many rows as will fit in a buffer, the size of which is indicated by **_cbReadBuffer**, but not more than indicated by **_cRowsToTransfer**. When fetching rows, the server MUST compare each selected column's property value type to the type that is specified in the client's current set of bindings (see section 3.1.1). If the type in the binding is not VT_VARIANT, the server MUST attempt to convert the column's property value to that type. Otherwise, if the DBPROP_USEEXTENDEDDBTYPES flag is set in the client's DBPROPSET_QUERYEXT property set, or if the column's property value is not a VT_VECTOR type, the property value MUST be returned in its normal type. If none of these are the case (that is, the server has a VT_VECTOR type, and the client does not support VT_VECTOR), the server MUST attempt to convert it to a VT_ARRAY type as follows:
 - VT_I8, VT_UI8, VT_FILETIME, and VT_CLSID array elements cannot be converted and instead fail.
 - VT_LPSTR and VT_LPWSTR array elements MUST be converted to VT_BSTR.
 - Array elements of all other types MUST remain unchanged.

Finally, if row columns contain chapter handles or bookmark handles, the server MUST update the corresponding lists. If this step fails for any reason, the server MUST report that an error was encountered.

6. Store the actual number of rows fetched in **_cRowsReturned**.
7. Store fetched rows in the **Rows** field (see note on the following status byte and section 2.2.3.16 on the structure of the **Rows** field).
8. Respond to the client with the CPMGetRowsOut message.

Note Regarding status byte field: If StatusUsed is set to 0x01 in the CTableColumn structure of the CPMSetBindingsIn message for the column, the server MUST set the status byte according the description specified in section 2.2.1.25.

If the property value is absent for this row, the server MUST set the status byte to StatusNull. If the value is too big to be transferred in the CPMGetRowsOut message (greater than 2048 bytes), the server MUST set the status byte to StatusDeferred. Otherwise, the server MUST set the status byte to StatusOK.

3.1.5.2.8 Receiving a CPMFetchValueIn Request

When the server receives a CPMFetchValueIn message request from a client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Prepare a CPMFetchValueOut message. If this step fails for any reason, the server MUST report an error.
3. Find the document indicated by the **_wid** field and check if this document is available for this client and that this document has the property indicated by property ID in the CFullPropSpec structure. In the case both conditions are true, the server MUST set **_fValueExists** to 0x00000000, and otherwise set **_fValueExists** to 0x00000001. The value which is indicated by property ID in the CFullPropSpec structure for that document is referred to later as the "property value". If this step fails for any reason, the server MUST report an error.
4. If **_fValueExists** is equal to 0x00000001, the server MUST do the following:
 1. Serialize the property value to a SERIALIZEDPROPERTYVALUE structure and copy, starting from the **_cbSoFar** offset, at most **_cbChunk** bytes (but not past the end of the serialized property) to **vValue** field. If this step fails for any reason, the server MUST report an error.
 2. Set **_cbValue** to the number of bytes copied in the previous step.
 3. If the length of serialized property is greater than **_cbSoFar** added to **_cbValue**, set **_fMoreExists** to 0x00000001; otherwise, set it to 0x00000000.
5. Respond to the client with the CPMFetchValueOut message.

3.1.5.2.9 Receiving a CPMGetNotify Request

If the server SHOULD receive a CPMGetNotify message from a client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. If there were no changes in the query result set since the last CPMSendNotifyOut message for this client, or if the query is not currently monitored for changes in the results set, the server MUST respond with a CPMGetNotify message and start to monitor the query for changes in the results set. If at a later time there is a change in the query results set, the server MUST send exactly one CPMSendNotifyOut message to the client and MUST specify the change in the **_watchNotify** field.
3. If there were changes to the query result set since the last CPMSendNotifyOut message, the server MUST reply with CPMSendNotifyOut and MUST specify the change in the **_watchNotify** field. Note, that in the case of many changes to the query results, DBWATCHNOTIFY_ROWSCHANGED takes priority (that is, if the query was done and re-executed, and then if the number of rows changed and the query was done again, then the event reported would be DBWATCHNOTIFY_ROWSCHANGED).

3.1.5.2.10 Receiving a CPMGetApproximatePositionIn Request

When the server receives a CPMGetApproximatePositionIn message request from the client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the cursor handle, chapter handle, and bookmark handle passed are in corresponding lists. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.
3. Find a row that is associated with the bookmark handle in the query results and approximate the position of the row in the rowset, referred to by the chapter handle, and determine the numerator and denominator for the position. Note that when the chapter handle is DB_NULL_HCHAPTER, the corresponding chapter is the main rowset of the query. If this step fails for any reason, the server MUST report an error.
4. Respond to the client with a CPMGetApproximatePositionOut message.

3.1.5.2.11 Receiving a CPMCompareBmkIn Request

When the server receives a CPMCompareBmkIn message request from the client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the cursor handle, chapter handle, and bookmark handle passed are in corresponding lists. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.
3. Prepare a CPMCompareBmkOut message.
4. If bookmark handles are equal, **_dwComparison** MUST be set to DBCOMPARE_EQ.
5. Otherwise, the server MUST do the following:
 1. Find rows that are referred to by each bookmark handle in the query results. If the server cannot find one of the rows, DB_E_BADBOOKMARK (0x80040E0E) is returned.
 2. If any one of the rows is not in the chapter indicated by the chapter handle in CPMCompareBmkIn, then **_dwComparison** MUST be set to DBCOMPARE_NOTCOMPARABLE.
 3. Otherwise, when both rows are in the same chapter, the server MUST approximate a position of those rows in the rowset referred to by this chapter's handle. The server MUST then compare position values and set **_dwComparison** to DBCOMPARE_LT if the position of the first row is smaller than the position of the second row; otherwise, **_dwComparison** MUST be set to DBCOMPARE_GT.
6. Respond to the client with filled CPMCompareBmkOut message.

3.1.5.2.12 Receiving a CPMRestartPositionIn Request

When the server receives the CPMRestartPositionIn message request from the client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the cursor handle and chapter handle passed are in corresponding lists. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.

3. Move the cursor to the beginning of the chapter, identified by the chapter handle. Note that when the chapter handle is DB_NULL_HCHAPTER, the corresponding chapter is the main rowset of the query. If this step fails for any reason, the server MUST report an error.
4. Respond to the client with a CPMRestartPositionIn message.

3.1.5.2.13 Receiving a CPMStopAsynchIn Request

If the server SHOULD receive a CPMStopAsynchIn message request from the client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the cursor handle passed is in the list of the client's cursor handles and the cursor was created with the eAsynchronous flag (0x00000008) set. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.
3. Stop asynchronous query processing.
4. Respond to the client with the message header for the CPMStopAsynchIn message request, and set the **_status** field to the result of step 3.

3.1.5.2.14 Receiving a CPMFreeCursorIn Request

When the server receives a CPMFreeCursorIn message request from the client, the server MUST do the following:

1. Check whether the client has a query associated with it. If this is not the case, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error.
2. Check whether the cursor handle passed is in the list of the client's cursor handles. If this is not the case, the server MUST report an E_FAIL (0x80004005) error.
3. Release the cursor and associated resources (see section 3.1.1 for a complete list) for this cursor handle.
4. Remove the cursor from the list of cursors for that client.
5. Respond with a CPMFreeCursorOut message, setting the **_cCursorsRemaining** field with the number of cursors remaining in this client's list.
6. If there are no more cursors for this client, the server MUST release the query and associated resources (see section 3.1.1).

3.1.5.2.15 Receiving a CPMDisconnect Request

If the server SHOULD receive a CPMDisconnect message request from the client, the server MUST remove the client from the list of connected clients and release all resources associated with the client.

3.1.6 Timer Events

None.

3.1.7 Other Local Events

When the server is stopped, it MUST first transition to the "shutting down" state. It MUST then stop listening to the pipe, perform any other implementation-specific shutdown tasks, and then transition into the "stopped" state.

3.2 Client Details

3.2.1 Abstract Data Model

The following section specifies data and state maintained by the Content Indexing Services Protocol client. The data is provided to help explain how the protocol behaves. This section does not mandate that implementations adhere to this model as long as their external behavior is consistent with what is described in this document.

A client has the following abstract state:

Last Message Sent: A copy of the last message sent to the server.

Current Property Value: A partial value of a deferred property, which is in the process of being retrieved.

Current Bytes Received: The number of bytes received for Current Property Value so far.

Named Pipe Connection State: A connection to the server.

3.2.2 Timers

None.

3.2.3 Initialization

No actions are taken until a higher-layer request is received.

3.2.4 Higher-Layer Triggered Events

When a request is received from a higher layer, the client MUST create a named pipe connection to the server, using the details specified in section 2.1. If the client is unable to do so, the higher-layer request MUST be failed. That is, in case of a failure to connect, it is the responsibility of the higher layer to retry if wanted.

A header MUST be pre-pended with fields set as specified in section 2.2.2.

For messages that are specified as requiring a nonzero checksum, the **_ulChecksum** value MUST be calculated as follows:

1. The content of the message after the **_ulReserved2** field in the message header MUST be interpreted as a sequence of 32-bit integers. The client MUST calculate the sum of the numeric values given by these integers.
2. Calculate the bitwise XOR of this value with 0x59533959.
3. Subtract the value given by **_msg** from the value that results from the bitwise XOR.

3.2.4.1 Remote Indexing Service Catalog Management

Each message is triggered by a request from the higher layer. There is no message sequence enforced by the client for Content Indexing Services Protocol message requests for remotely managing catalogs, but (with the exception of a CPMSetCatStateIn message) the server will reply with success only if the client previously connected by means of a CPMConnectIn message.

3.2.4.1.1 Sending a CPMCiStateInOut Request

Typically, the higher layer asks the protocol client to send a CPMCiStateInOut message when it requires information on indexing services on the server.

When requested to send this message, the client MUST do the following:

1. Send a CPMCiStateInOut message, as specified in section 2.2.3.1, to the server.
2. Wait to receive a CPMCiStateInOut message from the server, silently discarding all other messages.
3. Report back the value of the **__status** field of the response (and, if it was successful, the informational structure) to the higher layer.

3.2.4.1.2 Sending a CPMSetCatStateIn Request

Typically, the higher layer asks the protocol client to send a CPMSetCatStateIn message when it requires information on a catalog or all catalogs. For this message, the higher layer needs to provide the protocol client with a value for **__dwNewState** and, if required, the name of the catalog.

When requested to send this message, the client MUST do the following:

1. Send a CPMSetCatStateIn message, as specified in section 2.2.3.2, to the server.
2. Wait to receive a CPMSetCatStateOut message from the server, silently discarding all other messages.
3. Report back the value of the **__status** field of the response (and, if it was successful, the **__dwOldState**) to the higher layer.

3.2.4.1.3 Sending a CPMUpdateDocumentsIn Request

Typically, the higher layer asks to send this message when it needs to either update documents in an existing path or add a new file path to the inverted index. Thus the higher layer is to provide the path and type of a scan, as specified in section 2.2.3.4, where an incremental or full update is meant for existing paths and new initialization is meant for new paths.

To serve the higher-layer request, the client MUST do the following:

1. Send a CPMUpdateDocumentsIn message to the server.
2. Wait to receive a CPMUpdateDocumentsIn message back from the server, silently discarding all other messages.
3. Report back the value of the **__status** field of the response to the higher layer.

3.2.4.1.4 Sending a CPMForceMergeIn Request

Typically, the higher layer requests to send this message when there is a need to improve query performance or when it is part of scheduled indexing service maintenance.

To serve the higher layer, the client MUST do the following:

1. Send a CPMForceMergeIn message to the server.
2. Wait to receive a CPMForceMergeIn message header back from the server, silently discarding all other messages.
3. Report back the value of the **__status** field of the response to the higher layer.

3.2.4.2 Remote Indexing Service Catalog Query Messages

With the exception of CPMGetRowsIn/CPMGetRowsOut and CPMFetchValueIn/CPMFetchValueOut, there is a one-to-one relationship between Content Indexing Services Protocol messages and higher-layer requests. For the two exceptions previously mentioned, there can be multiple messages generated by the client to either satisfy size requirements or retrieve a complete property. The higher layer typically keeps track of all query-specific information (such as cursor handles opened, legal values for bookmark and chapter handles, and **_wid** values for deferred property values) and also tracks if the client is in a connected state, but this is not enforced in any way by the client.

The client portion of the diagram in section 3 illustrates this sequence for a simple indexing service query.

3.2.4.2.1 Sending a CPMConnectIn Request

This message is typically the very first request from the higher layer (as if the client is not connected, the server will fail most of the messages with the exception of CPMSetCatStateIn). The higher level provides the protocol client with the information necessary to connect.

To serve the higher layer, the client **MUST** do the following:

1. Fill in the message, using information that the higher layer client provided (see section 2.2.3.6) in **_iClientVersion**, **MachineName**, **UserName**, **PropertySet1**, **PropertySet2**, and **aPropertySet**.
2. Set **_fClientIsRemote**, **_cbBlob**, **_cbBlob2**, **cPropSet**, and **cExtPropSet**, as specified in section 2.2.3.6.
3. Set the checksum in the **_ulChecksum** field.
4. Send the CPMConnectIn message to the server.
5. Wait to receive a CPMConnectOut message back from the server, silently discarding all other messages.
6. Report back the value of the **_status** field of the response (and, if it was successful, the **_serverVersion**) to the higher layer.

For informative purposes, it is expected that higher layers will typically do the following actions on successful connection, but these are not enforced by the Content Indexing Services Protocol client:

- Use remote indexing service catalog management messages for administrative tasks.
- Use a CPMCreateQueryIn request to create a search query with the purpose of retrieving results from the catalog.

3.2.4.2.2 Sending a CPMCreateQueryIn Request

The higher layer will typically provide information for the query creation after the protocol client is connected. The higher layer provides the client with a restrictions set, columns set, sort order rules and categorization set (each of them can be omitted), rowset properties, and property ID mapper structure.

When this request is received from a higher layer, the client **MUST** do the following:

1. Prepare a CPMCreateQueryIn request as follows.
 1. If a columns set is present, set **CColumnSetPresent** to 0x01, and fill the **ColumnsSet** field.
 2. If restrictions are present, set **CRestrictionPresent** to 0x01, and fill the **Restriction** field.

3. If a sort set is present, set **CSortSetPresent** to 0x01, and fill the **SortSet** field.
 4. If a categorization set is present, set **CCategorizationSetPresent** to 0x01, and fill the **CategorizationSet** field.
 5. Set the rest of the fields as specified in section 2.2.3.8.
2. Calculate the **_ulChecksum** field in the header.
 3. Send the CPMCreateQueryIn message to the server.
 4. Wait to receive the CPMCreateQueryOut message (see section 3.2.5.1), silently discarding all other messages.
 5. Report back the value of the **_status** field of the response (and, if it was successful, the array of cursor handles and informative Boolean values, as specified in section 2.2.3.9) to the higher layer.

3.2.4.2.3 Sending a CPMSetBindingsIn Request

The higher layer will typically set bindings for each column to be returned in the rows when it already has a valid cursor handle (after successfully receiving CPMCreateQueryOut, see section 3.2.5.1). The higher layer is expected to provide an array of CTableColumn structures for the **aColumns** field and a valid cursor handle.

When this request is received from the higher layer, the client MUST do the following:

1. Calculate the number of CTableColumn structures in the **aColumns** array and set the **cColumns** field to this value.
2. Calculate the total size in bytes of the **cColumns** and **aColumns** fields and set the **_cbBindingDesc** field to this value.
3. Set specified fields in the CPMSetBindingsIn message to the values provided by the higher application layer. Set the **ulChecksum** field to the value calculated as specified in section 3.2.5.
4. Send the completed CPMSetBindingsIn message to the server.
5. Wait to receive a CPMSetBindingsIn message from the server, discarding other messages.
6. Indicate the status from the **_status** field of the response to the higher layer.

For informative purposes, it is expected that higher layers will typically request a client to send a CPMGetRowsIn message, but this is not enforced by the Content Indexing Services Protocol.

3.2.4.2.4 Sending a CPMGetRowsIn Request

When the higher layer is about to receive rows data, it will provide the protocol client with a valid cursor and chapter handle and give an appropriate seek description. Typically, a higher layer is expected to do so when it has a valid cursor and/or chapter handle, and the bindings had been set with a CPMSetBindingsIn message. To access the rowset in a chapter, the higher layer is to use the chapter handle received from the server in a previous CPMGetRowsOut message.

When this request is received from the higher layer, the client MUST do the following:

1. Determine what unsigned integer value to specify for the **_cbReadBuffer** field. To determine this value, the client MUST take the maximum value from the following:
 - One thousand times the value of the **_cRowsToTransfer** field.
 - Value of **_cbRowWidth**, rounded up to the nearest 512-byte multiple.

- Take the higher of these two values, up to the 16-kilobyte limit.
 - In cases where a single row is larger than 16 kilobytes, the server cannot return results to this query.
2. Specify a client base for variable-sized row data in the client address space in the **_ulClientBase** field.<14>
 3. Calculate the size of seek description, and set it in the **_cbSeek** field.
 4. Set the value of **_cbReserved** (which would act as an offset for Rows start) to the value of **_cbSeek** plus 0x14.
 5. Send a CPMGetRowsIn message to the server.

3.2.4.2.5 Sending a CPMFetchValueIn Request

If the client receives a CPMGetRowsOut response from the server with the column's Status field set to StatusDeferred (0x01), it means that the property value was not included in the **Rows** field of the CPMGetRowsOut message. In this case, the higher layer typically asks the protocol client to retrieve the value by means of a CPMFetchValueIn message and provides the **PropSpec** and **_wid** values for a deferred property, which the protocol client **MUST** use in the first CPMFetchValueIn message.

If this is the first CPMFetchValueIn message that the client has sent to request the specified property, the client **MUST** do the following:

1. Set all the fields in a message, as specified in section 2.2.3.19.
2. Set **_cbSoFar** to 0x00000000.
3. Set Current Bytes Received to 0.
4. Send the CPMFetchValueIn message to the server.

3.2.4.2.6 Sending a CPMFreeCursorIn Request

After the higher level is no longer using the search query, it can release the resources on the server by asking the client to send a CPMFreeCursorIn message.

When this request is received, the client **MUST** send a CPMFreeCursorIn message to the server, containing the handle specified by the upper layer.

The client **MUST** do the following:

1. Send the completed CPMFreeCursorIn message to the server.
2. Wait to receive a CPMFreeCursorOut message from server, discarding other messages.

3.2.4.2.7 Sending a CPMDisconnect Message

If the higher layer has no more queries for the indexing service, the application can request that the client send a CPMDisconnect message to the server in order to make more server resources available. When the application makes the request, the client **MUST** send the message as requested. There is no response to this message from the server.

3.2.5 Message Processing and Sequencing Rules

When the client receives a message response from the server, the client **MUST** use the Last Message Sent state to determine whether the message received from the server is the one expected by the

client. All messages with the **_msg** field different from the one in Last Message Sent MUST be ignored.

3.2.5.1 Receiving a CPMCreateQueryOut Response

When the client receives a CPMCreateQueryOut message response from the server, the client MUST return back **_status** (and, if the status is successful, cursor handle values) to the higher layer. Any further actions are determined by the higher layer.

Because the higher layer is aware of query structure, it will always expect the correct number of cursor handles to be returned in the CPMCreateQueryOut message. The cursor handles are returned in the following order: The first handle is returned to the unchaptered rowset, and the second is returned to the first chaptered rowset (which is the grouping of results based on the first category specified in the **CategorizationSet** field of the CPMCreateQueryIn message).

For informative purposes, it is expected that higher layers can do the following actions, but these are not enforced by the Content Indexing Services Protocol client:

- Use CPMSetBindingsIn to set bindings for individual columns and to do any subsequent actions on the querypath.
- Use CPMGetQueryStatusIn to check on the execution progress of a query.
- Use CPMRatioFinishedIn to request the completion percentage of the query.

3.2.5.2 Receiving a CPMGetRowsOut Response

When the client receives a CPMGetRowsOut message response from the server, the client MUST do the following:

1. Check if the **_status** field in the header indicates success or failure.
2. If the **_status** value is STATUS_BUFFER_TOO_SMALL (0xC0000023), the client MUST check the Last Message Sent state. If it does not contain a CPMGetRowsIn message, the received message MUST be silently ignored. Otherwise, the client MUST send to the server a new CPMGetRowsIn message with all fields identical to the stored one except that the **_cbReadBuffer** MUST be increased by 512 (but not greater than 0x4000). If **_status** is STATUS_BUFFER_TOO_SMALL (0xC0000023) and Last Message Sent already has **_cbReadBuffer** equal to 0x4000, the client MUST report the error to the higher level.
3. If the **_status** value is any other error value, the client MUST indicate the failure to the higher layer.
4. If the **_status** value indicates success, the results MUST be indicated to the higher layer requesting the information, and further actions are determined by the higher layer.

For informative purposes, it is expected that higher layers will typically do the following actions, but these are not enforced by the Content Indexing Services Protocol client:

- If the values in rows represent the document IDs, chapter, or bookmark handles, the higher layer will typically store them for use in subsequent operations that involve valid document IDs, chapter, or bookmark handles.
- The higher layer will typically store, display, or otherwise use the data from row values.
- For the values that were marked as deferred, the higher layer will fetch the value using CPMFetchValueIn messages.

- The seek description is returned back to the higher layer as well and can be reused or examined by the higher layer.

For informative purposes, if the higher layer requested handles to chapters and bookmarks that were received in the rows, it can do the following:

- Use `CPMGetQueryStatusExIn` to check on the execution progress of a query as well as additional status information such as the number of filtered documents, documents remaining to be filtered, the ratio of documents processed by the query, the total number of rows in the query, and the position of the bookmark in the rowset.
- Use `CPMGetNotify` to request that the server notify the client of rowset changes.
- Use `CPMGetApproximatePositionIn` to request the approximate position of a bookmark in a chapter.
- Use `CPMCompareBmkIn` to request a comparison of two bookmarks in a chapter.
- Use `CPMRestartPositionIn` to request the server to change the location of the cursor to the start of the rowset.

3.2.5.3 Receiving a `CPMFetchValueOut` Response

When the client receives a `CPMFetchValueOut` message response from the server, the client **MUST** do the following:

1. Check if the **`_status`** field in the header indicates success or failure. In case of failure, notify the higher layer. Otherwise, continue to the next step.
2. Check **`_fValueExist`**, and, if set to `0x00000000`, notify the higher layer that the value was not found.
3. Otherwise, append **`_cbValue`** bytes from **`vValue`** to Current Property Value.
4. If **`_fMoreExists`** is set to `0x00000001`, increment Current Bytes Received by **`_cbValue`** and send a `CPMFetchValueIn` message to the server, setting **`_cbSoFar`** to the value of Current Bytes Received, **`_cbPropSpec`** to zero, and **`_cbChunk`** to the buffer size required by the higher layer.
5. If **`_fMoreExists`** is set to `0x00000000`, indicate the property value from Current Property Value to the higher layer.

3.2.5.4 Receiving a `CPMFreeCursorOut` Response

When the client receives a successful `CPMFreeCursorOut` message response from the server, the client **MUST** return the **`_cCursorsRemaining`** value to the higher layer.

The following information is given for informative purposes only and is not enforced by the Content Indexing Services Protocol client. The higher layer is expected to keep track of cursor handles and to not use ones that have already been freed. When the number of **`_cCursorsRemaining`** is equal to `0x00000000`, the higher layer can use the connection to specify another query (using a `CPMCreateQueryIn` message).

3.2.6 Timer Events

None.

3.2.7 Other Local Events

None.

4 Protocol Examples

4.1 Example 1

In the following example, consider a scenario in which the user JOHN on machine A wants to obtain the sizes of files that contain the word "Microsoft" from the set of documents stored on server X in catalog SYSTEM. Assume that machine A is running a 32-bit Windows XP operating system and machine X is running a 32-bit Windows Server 2003 operating system.

1. The user launches a search application and enters the search query. The application, in turn, passes the search query to the protocol client.
2. The protocol client establishes a connection with indexing server X. The protocol client uses the named pipe `\pipe\CI_SKADS` to connect to the server X over SMB.
3. The protocol client then prepares a CPMConnectIn message with the following values.

The header of the message is populated as follows:

- `_msg` is set to `0x000000C8`, indicating that this is a CPMConnectIn message.
- `_status` is set to `0x00000000`.
- `_ulChecksum` contains the checksum, computed as specified in section 3.2.4.
- `_ulReserved2` is set to `0x00000000`.

The body of the message is populated as follows:

- `_iClientVersion` is set to `0x00000008`, indicating that the server is to validate the checksum field.
- `_fClientIsRemote` is set to `0x00000001`, indicating that the server is a remote server.
- `_cbBlob1` is set to the size in bytes of the `cPropSet`, `PropertySet1`, and `PropertySet2` fields combined.
- `_cbBlob2` is set to `0x00000004` (meaning no extra property sets).
- `MachineName` is set to A.
- `UserName` is set to JOHN.
- `cPropSets` is set to `0x00000002`.

The `PropertySet1` field is of type `CDbPropSet`. The `CDbPropSet` structure constituting the `PropertySet1` field is populated as follows:

- The `GuidPropSet` field is set to `A9BD1526-6A80-11D0-8C9D-0020AF1D740E` (`DBPROPSET_FSCIFRMWRK_EXT`).
- The `cProperties` field is set to `0x00000004`.
- The `aProps` field is an array of `CDbProp` structures. For the `aProps[0]` element:
 - `PropId` is set to `0x00000002` (`DBPROP_CI_CATALOG_NAME`).
 - `DBPROPOPTIONS` is set to `0x00000000`.
 - `DBPROPSTATUS` is set to `0x00000000`.

- For the ColId element:
 - eKind is set to 0x00000001 (DBKIND_GUID_PROPID).
 - GUID is null (all zeros), meaning that the value applies to the query, not just a single column.
 - ulID is set to 0x00000000.
- For the vValue element:
 - vType is set to 0x001F (VT_LPWSTR).
 - vValue is set to "SYSTEM", the name of the wanted catalog.
- For the aProps[1] element:
 - PropId is set to 0x00000007 (DBPROP_CI_QUERY_TYPE).
 - DBPROPOPTIONS is set to 0x00000000.
 - DBPROPSTATUS is set to 0x00000000.
- For the ColId element:
 - eKind is set to 0x00000001 (DBKIND_GUID_PROPID).
 - GUID is null (all zeros), meaning that the value applies to the query, not just a single column.
 - ulID is set to 0x00000000.
- For the vValue element:
 - vType is set to 0x0003 (VT_I4).
 - vValue is set to 0x00000000 (CiNormal), meaning that it is a regular query.
- For the aProps[2] element:
 - PropId is set to 0x00000004 (DBPROP_CI_SCOPE_FLAGS).
 - DBPROPOPTIONS is set to 0x00000000.
 - DBPROPSTATUS is set to 0x00000000.
- For the ColId element:
 - eKind is set to 0x00000001 (DBKIND_GUID_PROPID).
 - GUID is null (all zeros), meaning that the value applies to the query, not just a single column.
 - ulID is set to 0x00000000.
- For the vValue element:
 - vType is set to 0x1003 (VT_VECTOR | VT_I4).
 - vValue is set to 0x00000001 / 0x00000001 (one element with value 1), meaning search subfolders.
- For the aProps[3] element:

- PropId is set to 0x00000003 (DBPROP_CI_INCLUDE_SCOPES).
- DBPROPOPTIONS is set to 0x00000000.
- DBPROPSTATUS is set to 0x00000000.
- For the ColId element:
 - eKind is set to 0x00000001 (DBKIND_GUID_PROPID).
 - GUID is null (all zeros), meaning the value applies to the query, not just a single column.
 - ulID is set to 0x00000000.
- For the vValue element:
 - vType is set to 0x101F (VT_VECTOR | VT_LPWSTR).
 - vValue is set to 0x00000001 / 0x00000002 / "\". (one element with a two-character null-terminated string), meaning the root scope.

The PropertySet2 field is of type CDbPropSet. The CDbPropSet structure comprising the PropertySet1 field is populated as follows:

- GuidPropSet is set to AFAFACA5-B5D1-11D0-8C62-00C04FC2DB8D (DBPROPSET_CIFRMWRKCORE_EXT).
- The cProperties field is set to 0x00000001.
- The aProps field is an array of CDbProp structures.
 - For the aProps[0] element:
 - PropId is set to 0x00000002 (DBPROP_MACHINE).
 - DBPROPOPTIONS is set to 0x00000000.
 - DBPROPSTATUS is set to 0x00000000.
 - For the ColId element:
 - eKind is set to 0x00000001 (DBKIND_GUID_PROPID).
 - GUID is null (all zeros), meaning that the value applies to the query, not just a single column.
 - ulID is set to 0x00000000.
 - For the vValue element:
 - vType is set to 0x0008 (VT_BSTR).
 - vValue is set to 0x04 / "X" (4 bytes / null-terminated Unicode string), meaning "X" – name of a server.
- The cExtPropSet field is set to 0x00000000.
- The aPropertySets array does not exist.

Various padding fields are filled in as needed. The message is sent to the server.

4. The server verifies that the `_ulChecksum` is correct, verifies that the user is authorized to make this request, and responds with a `CPMConnectOut` message.

The header of the message is populated as follows:

- `_msg` is set to `0x000000C8`, indicating that this is a `CPMConnectOut` message.
- `_status` is set to `0x00000000` indicating `SUCCESS`.
- `_ulChecksum` is set to `0`.
- `_ulReserved2` is set to `0x00000000`.

The body of the message is populated as follows:

- The `_serverVersion` field is set to `0x00000007` (32-bit Windows XP or 32-bit Windows Server 2003).
- The `_reserved` fields are filled with arbitrary data.

5. The client prepares a `CPMCreateQueryIn` message.

The header of the message is populated as follows:

- `_msg` is set to `0x000000CA`, indicating that this is a `CPMCreateQueryIn` message.
- `_status` is set to `0x00000000`.
- `_ulChecksum` contains the checksum, computed according to section 3.2.4.
- `_ulReserved2` is set to `0x00000000`.

The body of the message is populated as follows:

- The `Size` field is set to the size of the rest of the message.
- The `CColumnSetPresent` field is set to `0x01`.

The `ColumnSet` field is of type `CColumnSet`. The `CColumnSet` structure comprising this field is set as follows:

- The `_count` field is set to `0x00000001`, indicating that one column is returned.
- The `indexes` array is `0x00000000`, indicating the first entry in `_aPropSpec`.
- The `CRestrictionPresent` field is set to `0x01`, indicating that the `Restriction` field is present.
- The `Restriction` field is of type `CRestriction` and is set as follows:
 - `_ulType` is set to `0x00000004` (`RTContent`).
 - `_weight` is set to `0x00000000`.
- The rest of the field contains a `CContentRestriction` structure:
 - `_Property` is set to GUID `b725f130-47ef-101a-a5f1-02608c9eebac` / `0x00000001` (for `PRSPEC_PROPID`) / `0x13`, which represents the document body.
 - `_Cc` is set to `0x00000009`.
 - `_pwcsphrase` is set to the string "Microsoft".
 - `_lcid` is set to `0x409` (for English).

- `_ulGenerateMethod` is set to `0x00000000` (exact match).
- `CSortPresent` is set to `0x00`.
- `CCategorizationSetPresent` is set to `0x00`.

`RowSetProperties` is set as follows:

- `_uBooleanOptions` is set to `0x00000001` (sequential).
- `_ulMaxOpenRows` is set to `0x00000000`.
- `_ulMemoryUsage` is set to `0x00000000`.
- `_cMaxResults` is set to `0x00000100` (return at most 256 rows).
- `_cCmdTimeOut` is set to `0x00000000` (never time out).

`PidMapper` is set as follows:

- `_count` is set to `0x00000001`.
- `_aPropSpec` is set to `GUID b725f130-47ef-101a-a5-f1-02608c9eebac / 0x00000001` (for `PRSPEC_PROPID`)/`0x0000000c`, which represents the Windows file size property.

6. The server processes it and responds with a `CPMCreateQueryOut` message.

The header of the message is populated as follows:

- `_msg` is set to `0x000000CA`, indicating that this is a `CPMCreateQueryOut` message.
- `_status` is set to `SUCCESS`.
- `_ulChecksum` is set to `0x00000000` (or any other arbitrary value).
- `_ulReserved2` is set to `0x00000000` (or any other arbitrary value).

The body of the message is populated as follows:

- `_fTrueSequential` is set to `0x00000000`, indicating that the query can use an inverted index.
- `_fWorkIdUnique` is set to `0x00000001`.
- The `aCursors` array contains only one element, representing a cursor handle to this query. The value depends on the state of the server, assuming that the returned value is `0xAAAAAAAA`.

7. The client issues a `CPMSetBindingsIn` request message to define the format of a row.

The header of the message is populated as follows:

- `_msg` is set to `0x000000D0`, indicating that this is a `CPMSetBindingsIn` message.
- `_status` is set to `SUCCESS`.
- `_ulChecksum` contains the checksum, computed according to section 3.2.4.
- `_ulReserved2` is set to `0x00000000` (or any other arbitrary value).

The body of the message is populated as follows:

- `_hCursor` is set to `0xAAAAAAAA`.
- `_cbRow` is set to `0x10` (big enough to fit columns).

- `_cbBindingDesc` is set to the size of the `_cColumns` and `_aColumns` fields combined.
- `_dummy` is omitted.
- `_cColumns` is set to `0x00000001`.
- The `_aColumns` array is set to contain one `CTableColumn` structure containing the following:
 - `_PropSpec` is set to GUID `b725f130-47ef-101a-a5-f1-02608c9eebac / 0x00000001` (for `PRSPEC_PROPID`) / `0x0000000c`, which represents the Windows file size property.
 - `_vType` is set to `0x0015` (`VT_UI8`).
 - `_ValueUsed` is set to `0x01` (column transferred in row).
 - `_ValueOffset` is set to `0x0002` (at beginning of row).
 - `_ValueSize` is set to `0x08` (size of a `VT_UI8`).
 - `_StatusUsed` is set to `0x01`.
 - `_StatusOffset` is set to `0x0A`.
 - `_LengthUsed` is set to `0x00`.

8. The server processes it and responds with a `CPMSetBindingsIn` message.

The header of the message is populated as follows:

- `_msg` is set to `0x000000D0`.
- `_status` is set to `SUCCESS`.
- `_ulChecksum` is set to `0x00000000` (or any other arbitrary value).
- `_ulReserved2` is set to `0x00000000` (or any other arbitrary value).

9. The client issues a `CPMGetRowsIn` request message, assuming that the client is prepared to accept 100 rows at this point and wants them in ascending order.

The header of the message is populated as follows:

- `_msg` is set to `0x000000CC`, indicating that this is a `CPMGetRowsIn` message.
- `_status` is set to `0x00000000`.
- `_ulChecksum` contains the checksum, computed as specified in section 3.2.4.
- `_ulReserved2` is set to `0x00000000`.

The body of the message is populated as follows:

- `_hCursor` is set to `0xAAAAAAAA`.
- `_cRowsToTransfer` is set to `0x00000064`.
- `_cRowWidth` is set to `0x00000010` (from bindings).
- `_cbSeek` is set to `0x0C`, which is the size of the `eType` and `CRowSeekNext` fields combined.
- `_cbReserved` is set to `0x20` (`0x14` plus `_cbSeek`).
- `_cbReadBuffer` is set to `0x800` (`0x64*0x10` rounded up to the next multiple of `0x200`).

- `_ulClientBase` is set to `0x00000000`.
- `_fBwdfetch` is set to `0x00000000`, indicating that the rows are to be fetched in forward order.
- `eType` is set to `0x00000001`, indicating that the client wants the next rows.
- `SeekDescription` is set to `CRowSeekNext`. The `CRowSeekNext` structure contains the following values:
 - `_cSkip` is set to `0x00000000`, indicating that the client does not want to skip rows.

10. The server processes it and responds with a `CPMGetRowsOut` message, assuming the server found 100 documents that contain the word "Microsoft".

The header of the message is populated as follows:

- `_msg` is set to `0x000000CC`, indicating that this is a `CPMGetRowsOut` message.
- `_status` is set to `SUCCESS`.
- `_ulChecksum` is set to `0x00000000`.
- `_ulReserved2` is set to `0x00000000`.

The body of the message is populated as follows:

- `_CRowsReturned` is set to `0x00000064`.
- `eType` is set to `0x00000001`.

`SeekDescription` contains a `CRowSeekNext` structure, populated as follows:

- `_cSkip` is set to `0x00000000`, indicating that the client does not want to skip rows.

`Rows` contains the size of the 100 documents that contain the word "Microsoft". Because this is fixed-size data, it is structured as a list of 100, 8-byte unsigned integers.

11. The client sends a `CPMDisconnect` message to end the connection.

The header of the message is populated as follows:

- `_msg` is set to `0x000000C9`, indicating that this is a `CPMDisconnect` message.
- `_status` is set to `0x00000000`.
- `_ulChecksum` is set to `0x00000000`.

12. The server processes the message and removes all client states.

4.2 Example 2

In the previous example, the query was quite simple. Now consider a slightly more complex query, assuming that the user wants to retrieve the size of the documents that contain the following words: "Microsoft" and "Office". This is specified in the following steps.

Change the `Restriction` field contained in the `CPMCreateQueryIn` message sent in step 5 (example 1) as follows:

- The `Restriction` field is of type `CRestriction` and is set as follows:
 - `_ulType` is set to `0x00000001` (`RTAnd`).

_weight is set to 0x00000000.

The rest of the field contains a CNodeRestriction structure:

- _cNode is set to 0x00000002, indicating that there are two nodes in the paNode array.
- The _paNode field is an array of two CRestriction structures.
 - _paNode[0] contains the following:
 - _ulType is set to 0x00000004 (RTContent).
 - _weight is set to 0x00000000.
 - The rest of the field contains a CContentRestriction structure:
 - __Property is set to GUID b725f130-47ef-101a-a5f1-02608c9eebac / 0x00000001 (for PRSPEC_PROPID) / 0x13.
 - __Cc is set to 0x00000009.
 - __pwcsphrase is set to the string "Microsoft".
 - __lcid is set to 0x409 (for English).
 - __ulGenerateMethod is set to 0x00000000 (exact match).
 - _paNode[1] I contains the following:
 - _ulType is set to 0x00000004 (RTContent).
 - _weight is set to 0x00000000.
 - The rest of the field contains a CContentRestriction structure:
 - __Property is set to GUID b725f130-47ef-101a-a5f1-02608c9eebac / 0x00000001 (for PRSPEC_PROPID) / 0x13.
 - __Cc is set to 0x00000006.
 - __pwcsphrase is set to the string "Windows".
 - __lcid is set to 0x409 (for English).
 - __ulGenerateMethod is set to 0x00000000 (exact match).

5 Security

5.1 Security Considerations for Implementers

For Indexing implementations that index secure content, consider using the user context provided by the server message block (SMB) protocol (as specified in [MS-SMB]) to trim search results and return only those accessible to the caller.

5.2 Index of Security Parameters

The only security parameter is the impersonations level (see section 2.1).

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.

- Windows 2000 operating system
- Windows XP operating system
- Windows Server 2003 operating system
- Windows Vista operating system
- Windows Server 2008 operating system
- Windows 7 operating system
- Windows Server 2008 R2 operating system

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

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

<1> Section 1.4: Applications typically interact with an OLE DB interface wrapper, such as a protocol client, and not directly with the protocol. For more information, see [MSDN-OLEDBP].

<2> Section 1.6: This protocol is implemented on Windows 2000 Server operating system, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, and Windows Server 2008 R2. However, the Content Indexing Services Protocol is deprecated on Windows Vista, Windows Server 2008, Windows 7, and Windows Server 2008 R2. That is, the Windows implementation of the Content Indexing Services Protocol is still available on Windows Vista, Windows Server 2008, Windows 7, and Windows Server 2008 R2, but is not installed by default and will not be available in future releases after Windows 7 and Windows Server 2008 R2.

<3> Section 1.8: Windows uses only the values specified in [MS-ERREF].

<4> Section 1.8.1: See [MSDN-PROPSET] for a list of supported property sets.

<5> Section 2.2.2: The client always sets the **_status** field to 0x00000000.

<6> Section 2.2.3.1: This value is usually zero except immediately after indexing has been started or after a notification queue overflows.

<7> Section 2.2.3.4: If a value other than UPD_INCREM (0x00000000), UPD_FULL (0x00000001) or UPD_INIT (0x00000002) is set for the **_flag** field, the server acts as if the **_flag** field was set to UPD_INIT (0x00000002) and perform a full scan.

<8> Section 2.2.3.6: On Windows clients, the **_iClientVersion** is set as follows.

Value	Meaning
0x00000005	Client OS is Windows 2000 Server.
0x00000008	Client OS is 32-bit Windows XP, 32-bit Windows Server 2003, 32-bit Windows Vista, 32-bit

Value	Meaning
	Windows Server 2008, or 32-bit Windows 7.
0x00010008	Client OS is Windows XP 64-Bit Edition operating system, 64-bit Windows Server 2003, 64-bit Windows Vista, 64-bit Windows Server 2008, 64-bit Windows 7, or 64-bit Windows Server 2008 R2.

<9> Section 2.2.3.6: OLE-DB properties are frequently used.

<10> Section 2.2.3.12: Windows does not use this message.

<11> Section 2.2.3.19: Windows sets this field to 0x00004000.

<12> Section 2.2.4: The same pipe connection is used for the following messages except when the error is returned in a CPMConnectOut message. In the latter case, the pipe connection is terminated.

<13> Section 3.1.1: The catalog state begins in the CICAT_WRITABLE state. But when the catalog is stored on a read-only media such as a CD-ROM, the catalog state begins in the CICAT_READONLY state.

<14> Section 3.2.4.2.4: For a 32-bit client talking to a 32-bit server or a 64-bit client talking to a 64-bit server, this value is set to a memory address of the receiving buffer in the application process. This allows for pointers received in the **Rows** field of CPMGetRowsOut to be correct memory pointers in a client application process. Otherwise, the value is set to 0x00000000.

7 Change Tracking

No table of changes is available. The document is either new or has had no changes since its last release.

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