[MS-CSVP]:
Failover Cluster:
Setup and Validation Protocol (ClusPrep) Specification

Intellectual Property Rights Notice for Open Specifications Documentation

- **Technical Documentation.** Microsoft publishes Open Specifications documentation for protocols, file formats, languages, standards as well as overviews of the interaction among each of these technologies.
- **Copyrights.** This documentation is covered by Microsoft copyrights. Regardless of any other terms that are contained in the terms of use for the Microsoft website that hosts this documentation, you may make copies of it in order to develop implementations of the technologies described in the Open Specifications and may distribute portions of it in your implementations using these technologies or your documentation as necessary to properly document the implementation. You may also distribute in your implementation, with or without modification, any schema, IDL's, or code samples that are included in the documentation. This permission also applies to any documents that are referenced in the Open Specifications.
- **No Trade Secrets.** Microsoft does not claim any trade secret rights in this documentation.
- **Patents.** Microsoft has patents that may cover your implementations of the technologies described in the Open Specifications. Neither this notice nor Microsoft's delivery of the documentation grants any licenses under those or any other Microsoft patents. However, a given Open Specification may be covered by Microsoft Open Specification Promise or the Community Promise. If you would prefer a written license, or if the technologies described in the Open Specifications are not covered by the Open Specifications Promise or Community Promise, as applicable, patent licenses are available by contacting iplg@microsoft.com.
- **Trademarks.** The names of companies and products contained in this documentation may be covered by trademarks or similar intellectual property rights. This notice does not grant any licenses under those rights.
- **Fictitious Names.** The example companies, organizations, products, domain names, e-mail addresses, logos, people, places, and events depicted in this documentation are fictitious. No association with any real company, organization, product, domain name, email address, logo, person, place, or event is intended or should be inferred.

Reservation of Rights. All other rights are reserved, and this notice does not grant any rights other than specifically described above, whether by implication, estoppel, or otherwise.

Tools. The Open Specifications do not require the use of Microsoft programming tools or programming environments in order for you to develop an implementation. If you have access to Microsoft programming tools and environments you are free to take advantage of them. Certain Open Specifications are intended for use in conjunction with publicly available standard specifications and network programming art, and assumes that the reader either is familiar with the aforementioned material or has immediate access to it.

Revision Summary

Date	Revision History	Revision Class	Comments
01/25/2008	0.1	Major	MCPP Milestone RSAT Initial Availability
03/14/2008	0.1.1	Editorial	Revised and edited the technical content.
05/16/2008	0.1.2	Editorial	Revised and edited the technical content.
06/20/2008	1.0	Major	Updated and revised the technical content.
07/25/2008	1.0.1	Editorial	Revised and edited the technical content.
08/29/2008	1.0.2	Editorial	Revised and edited the technical content.
10/24/2008	1.1	Minor	Updated the technical content.
12/05/2008	2.0	Major	Updated and revised the technical content.
01/16/2009	2.0.1	Editorial	Revised and edited the technical content.
02/27/2009	3.0	Major	Updated and revised the technical content.
04/10/2009	4.0	Major	Updated and revised the technical content.
05/22/2009	5.0	Major	Updated and revised the technical content.
07/02/2009	6.0	Major	Updated and revised the technical content.
08/14/2009	6.0.1	Editorial	Revised and edited the technical content.
09/25/2009	6.1	Minor	Updated the technical content.
11/06/2009	7.0	Major	Updated and revised the technical content.
12/18/2009	8.0	Major	Updated and revised the technical content.
01/29/2010	9.0	Major	Updated and revised the technical content.
03/12/2010	10.0	Major	Updated and revised the technical content.
04/23/2010	10.0.1	Editorial	Revised and edited the technical content.
06/04/2010	11.0	Major	Updated and revised the technical content.
07/16/2010	11.0	No change	No changes to the meaning, language, or formatting of the technical content.
08/27/2010	11.0	No change	No changes to the meaning, language, or formatting of the technical content.
10/08/2010	11.0	No change	No changes to the meaning, language, or formatting of the technical content.
11/19/2010	11.0	No change	No changes to the meaning, language, or formatting of

Date	Revision History	Revision Class	Comments
			the technical content.
01/07/2011	11.0	No change	No changes to the meaning, language, or formatting of the technical content.
02/11/2011	12.0	Major	Significantly changed the technical content.
03/25/2011	13.0	Major	Significantly changed the technical content.
05/06/2011	13.0	No change	No changes to the meaning, language, or formatting of the technical content.
06/17/2011	13.1	Minor	Clarified the meaning of the technical content.

Contents

1 Introduction

The Failover Cluster: Setup and Validation Protocol (ClusPrep) consists of **DCOM** interfaces, as specified in [MS-DCOM], that are used for remotely configuring cluster nodes, cleaning up cluster nodes, and validating that hardware and software settings are compatible with **failover clustering**.

1.1 Glossary

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

active node
authentication level
Authentication Service (AS)
basic volume
cluster
cluster name
cluster state
device
disk
disk signature
domain naming service name
dynamic endpoint
Dynamic Host Configuration Protocol (DHCP)
dynamic volume
endpoint
failover cluster
firewall rule
fully qualified domain name (FQDN)
globally unique identifier (GUID)
GUID partitioning table (GPT)
interface
Interface Definition Language (IDL)
master boot record (MBR)
Microsoft Interface Definition Language (MIDL)
Network Data Representation (NDR)
node
offline
online
opnum
partition
registry
remote procedure call (RPC)
RPC protocol sequence
RPC transfer syntax
RPC transport
SCSI
SCSI logical unit number (LUN)
SCSI protocol
sector
security provider
share
strict NDR/NDR64 data consistency check

time source
universally unique identifier (UUID)
volume
well-known endpoint

The following terms are specific to this document:

cluster secret: A value unique to an instance of a **cluster** and known to all **nodes** configured in the **cluster**. The **cluster secret** is used in implementation-specific server-to-server protocols that enable a **node** to actively participate in a **cluster**.

Device-Specific Module (DSM): A hardware-specific driver that has passed the Microsoft Multipath I/O (MPIO) test and submission process. For further information, see [MSFT-MPIO] in the Frequently Asked Questions, partner questions on the test, and submission process.

IPv4: IP version 4 as specified in [RFC794].

IPv6: IP version 6 as specified in [RFC2460].

QFE number: The unique number associated with a **QFE** that is used to easily identify a **QFE**.

quick fix engineering (QFE): Quick fixes by engineering, also called **QFEs**, are uniquely numbered to enable each fix to be identified easily by its associated **QFE number**.

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

1.2 References

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

1.2.1 Normative References

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

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

[IANAifType] Internet Assigned Numbers Authority, "IANAifType-MIB Definitions", January 2007, http://www.iana.org/assignments/ianaiftype-mib

[MS-CMRP] Microsoft Corporation, "Failover Cluster: Management API (ClusAPI) Protocol Specification".

[MS-DCOM] Microsoft Corporation, "Distributed Component Object Model (DCOM) Remote Protocol Specification".

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

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

[MS-FASP] Microsoft Corporation, "Firewall and Advanced Security Protocol Specification".

[MS-OAUT] Microsoft Corporation, "OLE Automation Protocol Specification".

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

[MS-SMB2] Microsoft Corporation, "Server Message Block (SMB) Version 2 Protocol Specification".

[RFC1924] Elz, R., "A Compact Representation of IPv6 Addresses", RFC 1924, April 1996, http://tools.ietf.org/html/rfc1924.txt

[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

[RFC2553] Gilligan, R., Thomson, S., Bound, J., and Stevens, W., "Basic Socket Interface Extensions for IPv6", RFC 2553, March 1999, http://www.ietf.org/rfc/rfc2553.txt

[RFC2863] McCloghrie, K., and Kastenholz, F., "The Interfaces Group MIB", RFC 2863, June 2000, http://www.ietf.org/rfc/rfc2863.txt?number=2863.txt

[SPC-3] International Committee on Information Technology Standards, "SCSI Primary Commands - 3 (SPC-3)", Project T10/1416-D, May 2005, http://www.t10.org/cgi-bin/ac.pl?t=f&f=/spc3r23.pdf

1.2.2 Informative References

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

[MSFT-MPIO] Microsoft Corporation "Multipath I/O", http://www.microsoft.com/WindowsServer2003/technologies/storage/mpio/default.mspx

[RFC794] Cerf, V., "PRE-EMPTION", RFC 794, September 1981, http://www.ietf.org/rfc/rfc794.txt

[RFC2460] Deering, S., and Hinden, R., "Internet Protocol, Version 6 (IPv6) Specification", RFC 2460, December 1998, http://www.ietf.org/rfc/rfc2460.txt

1.3 Overview

The ClusPrep Protocol provides DCOM interfaces that enable a client to:

- Validate the server configuration so as to make it eligible to become a node in a failover cluster.
- Configure a server to no longer be a node in a failover cluster.
- Retrieve log information from a node in a failover cluster.
- Determine whether the hardware/software settings of a server meet the requirements to be part of a failover cluster.

1.4 Relationship to Other Protocols

The Failover Cluster: Setup and Validation Protocol (ClusPrep) relies on the Distributed Component Object Model (DCOM) Remote Protocol, which uses **remote procedure call (RPC)** as a transport, as specified in [MS-DCOM].

The Failover Cluster: Setup and Validation Protocol (ClusPrep) creates a file containing diagnostic data, as specified in section 3.10.4. The server makes this file available to clients via a file **share**.

Protocol clients can access this file using the Server Message Block (SMB) Version 2 Protocol, as specified in [MS-SMB2].

The Failover Cluster: Cluster Management Remote Protocol (ClusAPI) ([MS-CMRP]) clients can use the ClusPrep Protocol in conjunction with the ClusAPI Protocol when removing a **node** from a **cluster**, as specified in section 3.6.4.1.

1.5 Prerequisites/Preconditions

This protocol is implemented over DCOM and RPC and, as a result, has the prerequisites identified in [MS-DCOM] and [MS-RPCE] as being common to DCOM and RPC interfaces.

1.6 Applicability Statement

The ClusPrep Protocol is specific to a Windows Server® 2008 operating system or Windows Server® 2008 R2 operating system failover cluster. As such, the protocol is applicable to a server that will be, is, or was a node in a failover cluster.

1.7 Versioning and Capability Negotiation

This document covers versioning issues in the following areas:

- **Supported Transports:** This protocol uses the DCOM Remote Protocol and multiple RPC protocol sequences as specified in section 2.1.
- **Protocol Versions:** This protocol has multiple interfaces, as defined in section 2.1.
- **Security and Authentication Methods:** Authentication and security are provided as specified in [MS-DCOM] and [MS-RPCE].
- **Capability Negotiation:** This protocol does not support negotiation of the interface version to use. Instead, this protocol uses only the interface version number specified in the Interface Definition Language (IDL) for versioning and capability negotiation.

1.8 Vendor-Extensible Fields

This protocol does not define any vendor-extensible fields.

This protocol uses HRESULT values as defined in [MS-ERREF] section 2.1. Vendors can define their own HRESULT values provided that they set the C bit (0x20000000) for each vendor-defined value to indicate that the value is a customer code.

1.9 Standards Assignments

Parameter	Value	Reference
RPC Interface UUID for IClusterStorage2	12108A88-6858-4467-B92F-E6CF4568DFB6	None
RPC Interface UUID for IClusterNetwork2	2931C32C-F731-4c56-9FEB-3D5F1C5E72BF	None
RPC Interface UUID for IClusterCleanup	D6105110-8917-41A5-AA32-8E0AA2933DC9	None
RPC Interface UUID for IClusterSetup	491260B5-05C9-40D9-B7F2-1F7BDAE0927F	None
RPC Interface UUID for IClusterLog	85923CA7-1B6B-4E83-A2E4-F5BA3BFBB8A3	None

Parameter	Value	Reference
RPC Interface UUID for IClusterFirewall	F1D6C29C-8FBE-4691-8724-F6D8DEAEAFC8	None
CLSID for ClusterStorage2	C72B09DB-4D53-4f41-8DCC-2D752AB56F7C	None
CLSID for ClusterNetwork2	E1568352-586D-43e4-933F-8E6DC4DE317A	None
CLSID for ClusterCleanup	A6D3E32B-9814-4409-8DE3-CFA673E6D3DE	None
CLSID for ClusterSetup	04D55210-B6AC-4248-9E69-2A569D1D2AB6	None
CLSID for ClusterLog	88E7AC6D-C561-4F03-9A60-39DD768F867D	None
CLSID for ClusterFirewall	3CFEE98C-FB4B-44C6-BD98-A1DB14ABCA3F	None

2 Messages

This protocol references commonly used data types as defined in [MS-DTYP].

2.1 Transport

This protocol MUST use the DCOM Remote Protocol, as specified in [MS-DCOM], as its transport. On its behalf, the DCOM Remote Protocol uses the following RPC protocol sequence: RPC over TCP, as specified in [MS-RPCE]. This protocol uses RPC Dynamic Endpoints, as specified in [C706] section 4. The server MUST require an RPC authentication level that is not less than RPC_C_AUTHN_LEVEL_PKT_PRIVACY.

This protocol MUST use the following **universally unique identifiers (UUIDs)**:

- **IClusterStorage2**: 12108A88-6858-4467-B92F-E6CF4568DFB6
- **IClusterNetwork2**: 2931C32C-F731-4c56-9FEB-3D5F1C5E72BF
- **IClusterCleanup**: D6105110-8917-41A5-AA32-8E0AA2933DC9
- **IClusterSetup**: 491260B5-05C9-40D9-B7F2-1F7BDAE0927F
- **IClusterLog**: 85923CA7-1B6B-4E83-A2E4-F5BA3BFBB8A3
- **IClusterFirewall**: F1D6C29C-8FBE-4691-8724-F6D8DEAEAFC8

The protocol MUST use the following **class identifiers (CLSIDs)**:

- C72B09DB-4D53-4f41-8DCC-2D752AB56F7C for the class that implements IClusterStorage2
- E1568352-586D-43e4-933F-8E6DC4DE317A for the class that implements IClusterNetwork2
- A6D3E32B-9814-4409-8DE3-CFA673E6D3DE for the class that implements IClusterCleanup
- 04D55210-B6AC-4248-9E69-2A569D1D2AB6 for the class that implements IClusterSetup
- 88E7AC6D-C561-4F03-9A60-39DD768F867D for the class that implements IClusterLog
- 3CFEE98C-FB4B-44C6-BD98-A1DB14ABCA3F for the class that implements IClusterFirewall

2.2 Common Data Types

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

The following list summarizes the types that are defined in this specification:

- **CPREP_DISKID_ENUM**
- **CPREP_DISKID**
- **DiskStackType**
- **CPREP_SCSI_ADDRESS**
- **DISK_PROPS**

- REGISTERED_DSM
- REGISTERED_DSMS
- STORAGE_DEVICE_ID_DESCRIPTOR
- STORAGE_IDENTIFIER
- ADAPTERLIST
- SERIALIZEDGUID
- ADAPTER
- IPPREFIX
- **CLUSTER_NETWORK_PROFILE**

2.2.1 CPREP_DISKID_ENUM

The **CPREP_DISKID_ENUM** enumeration defines possible kinds of **disk** identifiers.

```
typedef  enum _CPREP_DISKID_ENUM
{
  CprepIdSignature = 0x00000000,
  CprepIdGuid = 0x00000001,
  CprepIdNumber = 0x00000fa0,
  CprepIdUnknown = 0x00001388
} CPREP_DISKID_ENUM,
 *PCPREP_DISKID_ENUM;
```

CprepIdSignature: A small computer system interface (SCSI) signature that is 4 bytes in length. Used to identify **master boot record (MBR)** disks.

CprepIdGuid: A signature of a **GUID partitioning table (GPT)** disk, which is a **GUID**. A GUID, also known as a UUID, is a 16-byte structure, intended to serve as a unique identifier for an object.

CprepIdNumber: The number by which the disk is identified.

CprepIdUnknown: A signature used for disks that are not identified via one of the previously described ways.

2.2.2 CPREP_DISKID

The **CPREP_DISKID** structure holds information needed to identify a **SCSI logical unit number (LUN)** in the system.

```
typedef struct _CPREP_DISKID {
  CPREP_DISKID_ENUM DiskIdType;
  [switch_is(DiskIdType)] union {
    [case(CprepIdSignature)]
      unsigned long DiskSignature;
    [case(CprepIdGuid)]
      GUID DiskGuid;
    [case(CprepIdNumber)]
      unsigned long DeviceNumber;
```

```
    [case(CprepIdUnknown)]
      unsigned long Junk;
  };
} CPREP_DISKID,
 *PCPREP_DISKID;
```

DiskIdType: This MUST be one of the valid **CPREP_DISKID_ENUM** values.

DiskSignature: This field is valid only if **DiskIdType** is **CprepIdSignature**. It MUST contain the 4-byte signature of the disk. How the **disk signature** is assigned is implementation-specific.

DiskGuid: This field is valid only if **DiskIdType** is **CprepIdGuid**. It MUST contain the **GUID** that identifies the disk. How the disk **GUID** is assigned is implementation-specific.

DeviceNumber: This field is valid only if **DiskIdType** is **CprepIdNumber**. It MUST contain the number that identifies the disk. The **device** number ranges from zero to the number of disks accessible by the server minus one. How the device number is assigned is implementation-specific.

Junk: This field is valid only if **DiskIdType** is **CprepIdUnknown**. The value of this field is not used.

2.2.3 DiskStackType

The **DiskStackType** enumeration defines valid driver types that a disk driver is implemented as.

```
typedef  enum _DiskStackType
{
  DiskStackScsiPort = 0x00000000,
  DiskStackStorPort = 0x00000001,
  DiskStackFullPort = 0x00000002
} DiskStackType;
```

DiskStackScsiPort: The driver is a SCSIPort driver.

DiskStackStorPort: The driver is a StorPort driver.

DiskStackFullPort: The driver is a monolithic driver and does not conform to any storage driver submodel.

2.2.4 CPREP_SCSI_ADDRESS

The **CPREP_SCSI_ADDRESS** structure holds information to identify a disk via the **SCSI protocol**. The structure is included in this document because it is referenced by the **DISK_PROPS** structure; however, the values in this structure are never read by the client.

```
typedef struct _CPREP_SCSI_ADDRESS {
  unsigned long Length;
  unsigned char PortNumber;
  unsigned char PathId;
  unsigned char TargetId;
  unsigned char Lun;
} CPREP_SCSI_ADDRESS,
```

```
*PCPREP_SCSI_ADDRESS;
```

Length: Not used.

PortNumber: Not used.

PathId: Not used.

TargetId: Not used.

Lun: Not used.

2.2.5 DISK_PROPS

The **DISK_PROPS** structure holds information about a single disk.

```
typedef struct _DISK_PROPS {
  unsigned long DiskNumber;
  CPREP_DISKID DiskId;
  unsigned long DiskBusType;
  DiskStackType StackType;
  CPREP_SCSI_ADDRESS ScsiAddress;
  long DiskIsClusterable;
  wchar_t AdapterDesc[260];
  unsigned long NumPaths;
  unsigned long Flags;
} DISK_PROPS,
 *PDISK_PROPS;
```

DiskNumber: The zero-based device number assigned to the disk by the operating system.

DiskId: A valid **CPREP_DISKID** structure with the correct identifier for the disk.

DiskBusType: The type of bus to which the disk is attached. It MUST be one of the following values.

Value	Meaning
BUS_UNKNOWN 0x00000000	The bus type is not one of those that follows.
BUS_SCSI 0x00000001	The bus type is SCSI.
BUS_ATAPI 0x00000002	The bus type is AT attachment packet interface (ATAPI).
BUS_ATA 0x00000003	The bus type is advanced technology attachment (ATA).
BUS_1394 0x00000004	The bus type is IEEE 1394.
BUS_SSA	The bus type is serial storage architecture (SSA).

Value	Meaning
0x00000005	
BUS_FIBRE 0x00000006	The bus type is Fibre Channel.
BUS_USB 0x00000007	The bus type is universal serial bus (USB).
BUS_RAID 0x00000008	The bus type is redundant array of independent disks (RAID).
BUS_ISCSI 0x00000009	The bus type is Internet small computer system interface (iSCSI).
BUS_SAS 0x0000000A	The bus type is Serial Attached SCSI (SAS).
BUS_SATA 0x0000000B	The bus type is Serial ATA (SATA).

StackType: The driver subtype of the device driver. It MUST be one of the valid values for **DiskStackType**.

ScsiAddress: The SCSI address of the disk. It MUST be a valid **CPREP_SCSI_ADDRESS**.

DiskIsClusterable: A Boolean flag that indicates whether the disk can be clustered. A value of TRUE or 1 indicates that the disk can be clustered. A value of FALSE or 0 indicates that the disk cannot be clustered. The value of the **DiskIsClusterable** member can be determined in an implementation-specific way.

AdapterDesc: A user-friendly description of the adapter to which the disk is connected.

NumPaths: The number of IO paths to the disk. A Multipath I/O (MPIO) disk has a number greater than 1.

Flags: Information about the disk. It MUST be one or more of the following values bitwise OR'd together.

Value	Meaning
DISK_NOTHING 0x00000000	A placeholder value used to initialize variables.
DISK_BOOT 0x00000001	The disk is the boot device.
DISK_SYSTEM 0x00000002	The disk contains the operating system.
DISK_PAGEFILE 0x00000004	The disk contains an operating system pagefile.
DISK_HIBERNATE 0x00000008	The disk will be used to store system hibernation data.
DISK_CRASHDUMP	The disk will be used to store system crash dump data.

Value	Meaning
0x00000010	
DISK_REMOVABLE 0x00000020	The disk is on removable media.
DISK_CLUSTERNOSUPP 0x00000040	The disk is not supported by the cluster implementation. The criteria for support are implementation-specific.
DISK_BUSNOSUPP 0x00000100	The disk is on a bus not supported by the cluster implementation. The criteria for support are implementation-specific.
DISK_SYSTEMBUS 0x00000200	The disk is on the same bus as the disk containing the operating system.
DISK_ALREADY_CLUSTERED 0x00000400	The disk is already controlled by the cluster.
DISK_SYTLE_MBR 0x00001000	The disk is MBR.
DISK_STYLE_GPT 0x00002000	The disk is GPT.
DISK_STYLE_RAW 0x00004000	The disk is neither MBR nor GPT.
DISK_PART_BASIC 0x00008000	The disk is configured with **basic volumes**.
DISK_PART_DYNAMIC 0x00010000	The disk is configured with **dynamic volumes**.
DISK_CLUSTERED_ONLINE 0x00020000	The disk is controlled by the cluster and is **online**.
DISK_UNREADABLE 0x00040000	The disk cannot be read.
DISK_MPIO 0x00080000	The disk is controlled by MPIO.
DISK_CLUSTERED_OTHER 0x00100000	The disk is controlled by cluster software other than the **failover cluster** implementation.
DISK_MISSING 0x00200000	The disk could not be found.
DISK_REDUNDANT 0x00400000	The disk was reached via a redundant IO path.
DISK_SNAPSHOT 0x00800000	The disk is a snapshot disk.

2.2.6 REGISTERED_DSM

The REGISTERED_DSM packet contains information about a single **Device-Specific Module (DSM)**.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
DsmName																															
...																															
...																															
...																															
...																															
...																															
...																															
...																															
(DsmName cont'd for 24 rows)																															
MajorVersion																															
MinorVersion																															
ProductBuild																															
QfeNumber																															

DsmName (128 bytes): The name of the DSM.

MajorVersion (4 bytes): The major version of the driver.

MinorVersion (4 bytes): The minor version of the driver.

ProductBuild (4 bytes): The build number of the driver.

QfeNumber (4 bytes): The **QFE number** of the driver.

2.2.7 REGISTERED_DSMS

The REGISTERED_DSMS packet contains a list of REGISTERED_DSM structures and their count.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
NumDsms																															
Dms (variable)																															

...

NumDsms (4 bytes): The number of REGISTERED_DSM structures that directly follow this field.

Dms (variable): An array of valid REGISTERED_DSM structures.

2.2.8 STORAGE_DEVICE_ID_DESCRIPTOR

The STORAGE_DEVICE_ID_DESCRIPTOR structure contains identifiers for a given storage device.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
Version																															
Size																															
NumberOfIdentifiers																															
Identifiers (variable)																															
...																															

Version (4 bytes): A number that is the version of the structure. The value is not important, but an implementation MUST return the same value for all servers running that implementation.

Size (4 bytes): The size, in bytes, of the structure.

NumberOfIdentifiers (4 bytes): The number of identifiers in the **Identifiers** area of the structure.

Identifiers (variable): A set of STORAGE_IDENTIFIER structures. The first structure starts at the start of this field.

2.2.9 STORAGE_IDENTIFIER

The STORAGE_IDENTIFIER structure contains an identifier for a storage device.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
CodeSet																															
Type																															
IdentifierSize																				NextOffset											
Association																															

Identifier (variable)
...

CodeSet (4 bytes): This field has the same meaning and possible values as the **CODE SET** field described in [SPC-3] section 7.6.3.1.

Type (4 bytes): This field has the same meaning and possible values as the **IDENTIFIER TYPE** field described in [SPC-3] section 7.6.3.1.

IdentifierSize (2 bytes): The length, in bytes, of the **Identifier** field.

NextOffset (2 bytes): The offset, in bytes, from the start of this structure to the next STORAGE_IDENTIFIER structure.

Association (4 bytes): This field has the same meaning and possible values as the **ASSOCIATION** field described in [SPC-3] section 7.6.3.1.

Identifier (variable): This field has the same meaning as the **IDENTIFIER** field described in [SPC-3] section 7.6.3.1.

2.2.10 ADAPTERLIST

An ADAPTERLIST contains a list of information about the network adapters on a given system.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
AdapterListNameLength																AdapterListName															
...																															
...																															
...																															
...																															
...																															
...																															
...																															
(AdapterListName cont'd for 4 rows)																															
ServerNameLength																ServerName (variable)															
...																															

NumberOfAdapters	Adapter (variable)
...	
NumberOfGuids	Guid (variable)
...	

AdapterListNameLength (2 bytes): An unsigned short that MUST contain the value 0x002E.

AdapterListName (46 bytes): MUST be the UNICODE string "class mscs::AdapterList" without a terminating null character.

ServerNameLength (2 bytes): An unsigned short that MUST contain the size in bytes of the **ServerName** field.

ServerName (variable): MUST be the fully qualified domain name (FQDN) of the server as a Unicode string without a terminating null character.

NumberOfAdapters (2 bytes): An unsigned short that MUST contain the number of **Adapter** items that follow it.

Adapter (variable): MUST be a valid ADAPTER structure.

NumberOfGuids (2 bytes): An unsigned short that MUST contain the number of **Guid** items that follow it.

Guid (variable): MUST be a valid SERIALIZEDGUID structure. The number of **Guids** MUST be greater than or equal to 2 multiplied by the value of **NumberOfAdapters**.

2.2.11 SERIALIZEDGUID

The SERIALIZEDGUID contains a GUID in string format.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
GuidLength																Guid															
...																															
...																															
...																															
...																															
...																															
...																															

...
(Guid cont'd for 10 rows)
...

GuidLength (2 bytes): An unsigned short that MUST be 0x0048.

Guid (72 bytes): MUST be the Unicode string UUID as defined in [C706].

2.2.12 ADAPTER

The ADAPTER structure contains information about a single network adapter on the system.

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
AdapterNameLength																AdapterName															
...																															
...																															
...																															
...																															
...																															
...																															
...																															
(AdapterName cont'd for 2 rows)																															
DescriptionLength																Description (variable)															
...																															
FriendlyNameLength																FriendlyName (variable)															
...																															
NameLength																Name (variable)															
...																															

NumberOfPrefixes	Prefix (variable)
...	
PhysicalAddressLength	PhysicalAddress (variable)
...	
NumberOfAddresses	Address
...	
...	
...	
...	
...	
...	
...	
(Address cont'd for 24 rows)	
...	NumberOfGatewayAddresses
GatewayAddress	
...	
...	
...	
...	
...	
...	
...	
(GatewayAddress cont'd for 24 rows)	

AdapterType
TunnelType
OperStatus
DhcpEnabled
InternalNetwork
ClusterAdapter

AdapterNameLength (2 bytes): An unsigned short that MUST be the value 0x0026.

AdapterName (38 bytes): MUST be the Unicode string "class mscs::Adapter" without a terminating null character.

DescriptionLength (2 bytes): An unsigned short that MUST contain the size, in bytes, of the **Description** field.

Description (variable): A user-friendly description of the adapter, the value of which is implementation-specific. The string SHOULD be unique for ADAPTERs in an ADAPTERLIST. MUST be a Unicode string without a terminating null character.

FriendlyNameLength (2 bytes): An unsigned short that MUST contain the size, in bytes, of the **FriendlyName** field.

FriendlyName (variable): A user-friendly name to identify the adapter, the value of which is implementation-specific. The string MUST be unique for ADAPTERs in an ADAPTERLIST. MUST be a Unicode string without a terminating null character.

NameLength (2 bytes): An unsigned short that MUST contain the size, in bytes, of the **Name** field.

Name (variable): The name that the adapter identifies itself as, the value of which is implementation-specific. The string MUST be unique for ADAPTERs in an ADAPTERLIST. MUST be a Unicode string without a terminating null character.

NumberOfPrefixes (2 bytes): An unsigned short that MUST be the number of following **Prefix** elements.

Prefix (variable): MUST be a valid IPPREFIX structure. Contains the associated prefix lengths for the addresses of the adapter listed in the **Address** field.

PhysicalAddressLength (2 bytes): An unsigned short that MUST contain the size, in bytes, of the **PhysicalAddress** field.

PhysicalAddress (variable): MUST be a Unicode string without a terminating null character. The value of the string is the string representation in hexadecimal of the Media Access Control (MAC) address of the adapter. If the **AdapterType** field is IF_TYPE_ETHERNET_CSMACD (0x00000006), this string MUST be in the form "AA-BB-CC-DD-EE-FF", where AA is the 2-byte hexadecimal representation of the first byte of the MAC address, BB is the 2-byte representation of the second byte of the MAC address, etc., to FF, the 2-byte representation of the sixth byte of the MAC address. Alphabetic characters (A–F) in the hexadecimal

representations MUST be capitalized. If the **AdapterType** field is some value other than IF_TYPE_ETHERNET_CSMACD, then the same form is used. If the MAC address has fewer than 8 bytes, the server SHOULD set characters beyond the length of the MAC address to 0x00.

NumberOfAddresses (2 bytes): An unsigned short that MUST be the number of following **Address** elements.

Address (128 bytes): The addresses of the adapter. MUST be laid out as a sockaddr_in or sockaddr_in6 structure as specified in [RFC2553]. The remaining bytes SHOULD be set to 0x00.

NumberOfGatewayAddresses (2 bytes): An unsigned short that MUST be the number of following **GatewayAddress** structures.

GatewayAddress (128 bytes): The addresses of the network gateway. MUST be laid out as a sockaddr_in or sockaddr_in6 structure as specified in [RFC2553]. The remaining bytes SHOULD be set to 0x00.

AdapterType (4 bytes): A constant that describes the adapter type. MUST be one of the values specified by the Internet Assigned Numbers Authority (IANA) [IANAifType].

TunnelType (4 bytes): A constant that describes the type of tunnel protocol that the adapter supports. MUST be one of the values defined by the IANA [IANAifType] or 0.

Value	Meaning
1 — 15	A tunnel type defined by the IANA [IANAifType].
TUNNEL_TYPE_NONE 0	A tunnel type was not specified.

OperStatus (4 bytes): A number representing the status of the adapter. MUST be one of the values defined in [RFC2863].

DhcpEnabled (4 bytes): MUST be set to 0x01 if the adapter is enabled for **Dynamic Host Configuration Protocol (DHCP)**; otherwise, the value MUST be 0x00.

Value	Meaning
0x01	The adapter is enabled for DHCP.
0x00	The adapter is not enabled for DHCP.

InternalNetwork (4 bytes): MUST be set to 0x01 if the adapter is recommended by the implementation to be suitable as a private network; otherwise, the value MUST be set to 0x00. A private network is specified in [MS-CMRP] section 3.1.1.7. The algorithm to determine private network suitability is implementation-specific.

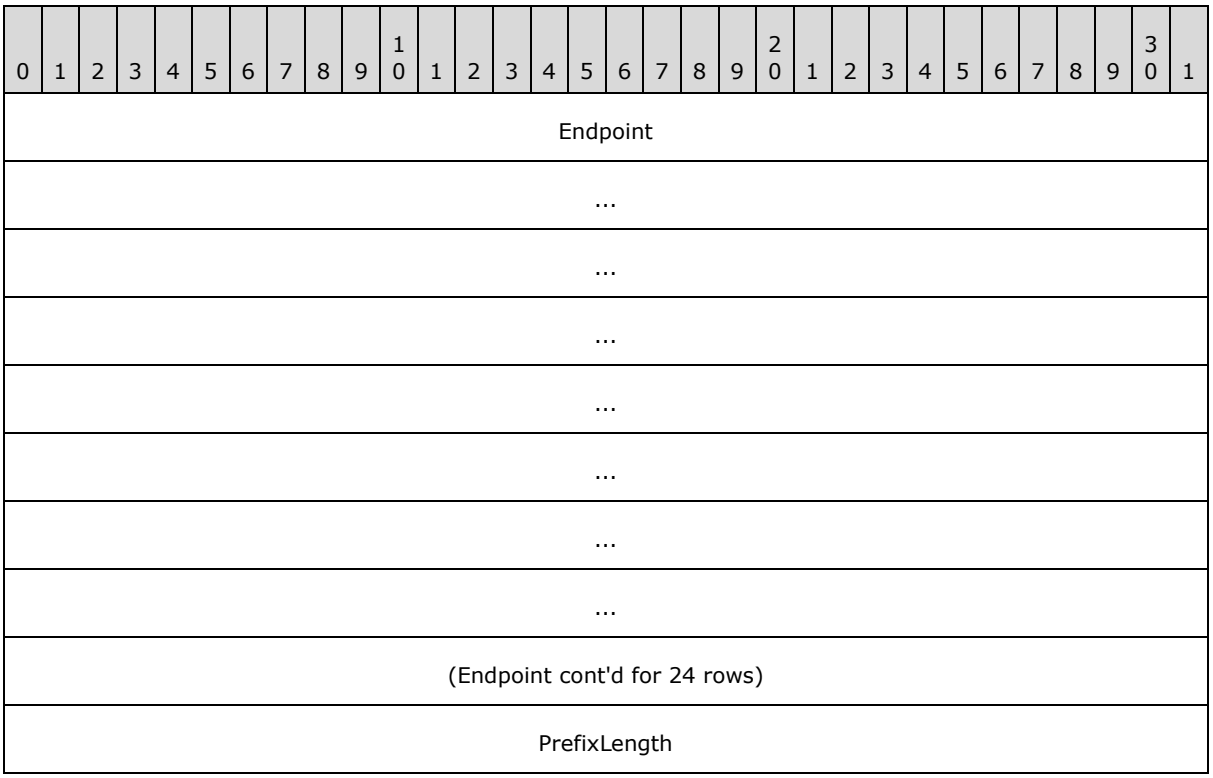
Value	Meaning
0x01	The adapter is recommended by the implementation to be suitable as a private network.
0x00	The adapter is not recommended by the implementation to be suitable as a private network.

ClusterAdapter (4 bytes): MUST be set to 0x01 if the adapter is determined to be a cluster adapter; otherwise, the value MUST be set to 0x00. A cluster adapter is a virtual adapter managed by the cluster software, but is not a cluster network interface as specified in [MS-CMRP]. In a given AdapterList there SHOULD be exactly one adapter with **ClusterAdapter** set to 1.

Value	Meaning
0x01	The adapter is a cluster adapter.
0x00	The adapter is not a cluster adapter.

2.2.13 IPPREFIX

The IPPREFIX structure contains an IP address and the prefix length of its associated network.



Endpoint (128 bytes): MUST be laid out as a sockaddr_in or sockaddr_in6 structure as specified in [RFC2553]. The remaining bytes SHOULD be set to 0x00.

PrefixLength (4 bytes): The prefix length of the associated network of the IP address in **Endpoint**.

2.2.14 CLUSTER_NETWORK_PROFILE

The **CLUSTER_NETWORK_PROFILE** enumeration defines the valid values for network adapter firewall profiles. When the server firewall enforces policies specified in [MS-FASP], the server

SHOULD determine the network adapter firewall profile by querying the server firewall for the network adapter profile and mapping that value as specified below.

```
typedef  enum _CLUSTER_NETWORK_PROFILE
{
  ClusterNetworkProfilePublic = 0x00,
  ClusterNetworkProfilePrivate = 0x01,
  ClusterNetworkProfileDomainAuthenticated = 0x02
} CLUSTER_NETWORK_PROFILE,
 *PCLUSTER_NETWORK_PROFILE;
```

ClusterNetworkProfilePublic: See **FW_PROFILE_TYPE_PUBLIC** in [MS-FASP] section 2.2.2.

ClusterNetworkProfilePrivate: See **FW_PROFILE_TYPE_PRIVATE** in [MS-FASP] section 2.2.2.

ClusterNetworkProfileDomainAuthenticated: See **FW_PROFILE_TYPE_DOMAIN** in [MS-FASP] section 2.2.2.

3 Protocol Details

The client side of this protocol is simply a pass-through. That is, no additional timer or other state is required on the client side of this protocol. Calls made by the higher-layer protocol or application are passed directly to the transport, and the results returned by the transport are passed directly back to the higher-layer protocol or application.

3.1 Common Client Details

The client side of the Failover Cluster: Setup and Validation Protocol (ClusPrep) is implemented by all client interfaces on a per configuration basis.<1>

3.1.1 Abstract Data Model

None.

3.1.2 Timers

None.

3.1.3 Initialization

None.

3.1.4 Message Processing Events and Sequencing Rules

None.

3.1.5 Timer Events

None.

3.1.6 Other Local Events

None.

3.2 IClusterStorage2 Server Details

3.2.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This document does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this document.

The server MUST implement the following elements:

ClusPrepDisk: A **ClusPrepDisk** is an object that is associated with a disk that is accessible to the server and implements the target role in the SCSI-3 protocol [SPC-3] with the server fulfilling the role of initiator. A disk associated with a **ClusPrepDisk** is typically a storage device.

ClusPrepDisk.CPrep_DiskId: A **ClusPrepDisk** has identification properties as specified in the **CPREP_DISKID (section 2.2.2)** structure.

ClusPrepDisk.DiskProps: A **ClusPrepDisk** has configuration properties as specified in the **DISK_PROPS (section 2.2.5)** structure.

ClusPrepDisk.AttachedState: A **ClusPrepDisk** has an attach state that is either Attached or Not Attached as specified in **CprepDiskAttach (section 3.2.4.14)**.

ClusPrepDisk.OwnedState: A **ClusPrepDisk** has an owned state that is NotOwned, OwnedButNotByThisServer, or OwnedByThisServer. **ClusPrepDisk.OwnedState** transitions between NotOwned and OwnedByThisServer as specified in **CprepDiskPRArbitrate (section 3.2.4.15)** and **CprepDiskStopDefense (section 3.2.4.6)**.

ClusPrepDisk.OnlineState: A **ClusPrepDisk** has an online state that is either Online or Not Online as specified in **CprepDiskOnline (section 3.2.4.7)** and **CprepDiskSetOnline (section 3.2.4.26)**.

The disk associated with a **ClusPrepDisk** can have one or more **partitions**. Partitions are numbered from zero to the number of partitions on that disk minus one.

Partitions are associated with **volumes** that can have a file system. Partitions and volumes are accessible when **ClusPrepDisk.OnlineState** is equal to Online. How partitions and volumes are manipulated and associated with each other with respect to a disk is implementation-specific.

ClusPrepDiskList: A **ClusPrepDiskList** is an unordered list of **ClusPrepDisks**.

See **CprepPrepareNodePhase2 (section 3.2.4.4)** for more information on how the **ClusPrepDiskList** is constructed.

Prepare State: A server maintains its prepare state, which indicates whether it is capable of handling all of the methods in the interface. Possible values can be Initial, Preparing, or Online.

Latency Time Source: A server maintains a **time source** that can be used to measure the latency of an operation in millisecond granularity. For example, a server typically has a local time source that reports the time of day or that reports the elapsed time since the server computer booted.

3.2.2 Timers

No protocol timers are required beyond those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.2.3 Initialization

The Failover Cluster: Setup and Validation IClusterStorage2 Remote Protocol server MUST be initialized by registering the RPC interface and listening on the RPC **well-known endpoint**, as specified in section 2.1. The server MUST then wait for Failover Cluster: Setup and Validation IClusterStorage2 Remote Protocol clients to establish connections.

The **Prepare State** is initialized to Initial.

The **ClusPrepDiskList** is initialized to an empty list.

3.2.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict **Network Data Representation (NDR)** data consistency check at target level 6.0, as specified in section 3 of [MS-RPCE].

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with nonzero conformant value, as specified in section 3 of [MS-RPCE].

The server MUST fail a method with error 0x80070548 (ERROR_INVALID_SERVER_STATE) if the server's **Prepare State** (3.2.1) is not correct for that method. The required **Prepare State** is as follows:

- **CprepPrepareNode (section 3.2.4.3)** requires **Prepare State** Initial.
- **CprepPrepareNodePhase2 (section 3.2.4.4)** requires **Prepare State** Preparing.
- All other methods require **Prepare State** Online.

Once the server's **Prepare State** is Online, it remains Online until the DCOM object exporter removes the application-specific state associated with the IClusterStorage2 interface, as defined in [MS-DCOM] section 1.3.6.

A **ClusPrepDisk** object has three state variables, as specified in section 3.2.1: **ClusPrepDisk.AttachedState**, **ClusPrepDisk.OwnedState**, and **ClusPrepDisk.OnlineState**. These states are related as follows:

- **ClusPrepDisk.AttachedState** MUST be Attached in order for **ClusPrepDisk.OwnedState** to be OwnedByThisServer.
- **ClusPrepDisk.OwnedState** MUST be OwnedByThisServer in order for **ClusPrepDisk.OnlineState** to be Online.

Methods in the protocol that take a **CPREP_DISKID (section 2.2.2)** as an input parameter have requirements on the values of **ClusPrepDisk.AttachedState**, **ClusPrepDisk.OwnedState**, and **ClusPrepDisk.OnlineState**. The server MUST accept the following methods regardless of the values of **ClusPrepDisk.AttachedState**, **ClusPrepDisk.OwnedState**, and **ClusPrepDisk.OnlineState**:

- **CprepDiskGetProps (section 3.2.4.5)**
- **CprepDiskGetUniqueIds (section 3.2.4.13)**
- **CprepDiskAttach (section 3.2.4.14)**

For the following methods, the server MUST require that the value of **ClusPrepDisk.AttachedState** is equal to Attached:

- **CprepDiskRawRead (section 3.2.4.1)**
- **CprepDiskRawWrite (section 3.2.4.2)**
- **CprepDiskVerifyUnique (section 3.2.4.8)**
- **CprepDiskPRArbitrate (section 3.2.4.15)**
- **CprepDiskPRRegister (section 3.2.4.16)**

- **CprepDiskPRUnRegister (section 3.2.4.17)**
- **CprepDiskPRReserve (section 3.2.4.18)**
- **CprepDiskPRRelease (section 3.2.4.19)**
- **CprepDiskGetArbSectors (section 3.2.4.21)**
- **CprepDiskIsPRPresent (section 3.2.4.22)**
- **CprepDiskPRPreempt (section 3.2.4.23)**
- **CprepDiskPRClear (section 3.2.4.24)**
- **CprepDiskIsOnline (section 3.2.4.25)**
- **CprepDiskIsReadable (section 3.2.4.28)**

For the following methods, the server MUST additionally require that the value of **ClusPrepDisk.OwnedState** is equal to OwnedByThisServer:

- **CprepDiskStopDefense (section 3.2.4.6)**
- **CprepDiskOnline (section 3.2.4.7)**
- **CprepDiskSetOnline (section 3.2.4.26)**

For the following methods, the server MUST additionally require that the value of **ClusPrepDisk.OnlineState** is equal to Online:

- **CprepDiskWriteFileData (section 3.2.4.9)**
- **CprepDiskVerifyFileData (section 3.2.4.10)**
- **CprepDiskDeleteFile (section 3.2.4.11)**
- **CprepDiskOffline (section 3.2.4.12)**
- **CprepDiskDiskPartitionIsNtfs (section 3.2.4.20)**
- **CprepDiskGetFSName (section 3.2.4.27)**

For methods that take a **CPREP_DISKID** (section 2.2.2) as an input parameter, the server MUST look in the **ClusPrepDiskList** for a **ClusPrepDisk** object that matches the **CPREP_DISKID** input parameter. If no such object is found, the server SHOULD<2> return 0x80070002 (ERROR_FILE_NOT_FOUND). If the **CPREP_DISKID** provided by the client matches more than one **ClusPrepDisk** in the server's **ClusPrepDiskList**, then the server SHOULD execute the method for one of the matching **ClusPrepDisk** objects. The matching **ClusPrepDisk** that the server chooses is arbitrary and implementation-specific.

For those methods listed previously that take a CPREP_DISKID as an input parameter and require that **ClusPrepDisk.AttachedState** is equal to Attached (or that **ClusPrepDisk.OwnedState** is equal to OwnedByThisServer or that **ClusPrepDisk.OnlineState** is equal to Online), the server SHOULD<3> fail the method with 0x80070002 (ERROR_FILE_NOT_FOUND) if the matching **ClusPrepDisk.AttachedState** is not equal to Attached.

For those methods listed previously that take a CPREP_DISKID as an input parameter and require that **ClusPrepDisk.OwnedState** is equal to OwnedByThisServer (or that

ClusPrepDisk.OnlineState is equal to Online), the server MUST fail with error 0x8007139F (ERROR_INVALID_STATE) if the matching **ClusPrepDisk.OwnedState** is not equal to OwnedByThisServer.

For those methods listed previously that take a CPREP_DISKID as an input parameter and require that **ClusPrepDisk.OnlineState** is equal to Online, the server MUST fail with error 0x8007139F (ERROR_INVALID_STATE) if the matching **ClusPrepDisk.OnlineState** is not equal to Online.

For those methods that take a *ulPartition* as the partition number, the server MUST use an implementation-specific mechanism to map the partition identified by *ulPartition* to a volume. If *ulPartition* cannot be mapped to a volume, then the server MUST return ERROR_FILE_NOT_FOUND.

For those methods that access a volume through a file system, the server MUST use an implementation-specific mechanism to verify that the volume contains a file system. If the volume does not contain a file system, then the server MUST return ERROR_UNRECOGNIZED_VOLUME.

All methods MUST NOT throw exceptions.

This DCOM interface inherits the IUnknown interface. Method opnum field values start with 3; opnum values 0 through 2 represent the **IUnknown::QueryInterface**, **IUnknown::AddRef**, and **IUnknown::Release** methods, respectively, as specified in [MS-DCOM] section 3.1.1.5.8.

Methods in RPC Opnum Order

Method	Description
CprepDiskRawRead	Reads a given **sector** on a disk. Opnum: 3
CprepDiskRawWrite	Writes to a given sector on a disk. Opnum: 4
CprepPrepareNode	A setup method called before other methods. Opnum: 5
CprepPrepareNodePhase2	Determines the number of disks that are accessible to the server and implement the target role in the SCSI-3 protocol [SPC-3] on the system. Opnum: 6
CprepDiskGetProps	Gets the properties about a given **ClusPrepDisk**. Opnum: 7
Opnum8NotUsedOnWire	This method is not called. Opnum: 8
Opnum9NotUsedOnWire	This method is not called. Opnum: 9
Opnum10NotUsedOnWire	This method is not called. Opnum: 10
Opnum11NotUsedOnWire	This method is not called. Opnum: 11

Method	Description
CprepDiskStopDefense	Stops any ownership defense started by **CprepDiskPRArbitrate** for a disk. Opnum: 12
CprepDiskOnline	Performs the process of transitioning **ClusPrepDisk.OnlineState** to Online. This method waits for the process of transitioning to be completed and the file systems to be mounted. Opnum: 13
CprepDiskVerifyUnique	Determines whether multiple **ClusPrepDisks** have the same signature. Opnum: 14
Opnum15NotUsedOnWire	This method is not called. Opnum: 15
Opnum16NotUsedOnWire	This method is not called. Opnum: 16
CprepDiskWriteFileData	Writes to a given file on a given partition on a given disk. Opnum: 17
CprepDiskVerifyFileData	Verifies the contents of a given file on a given partition on a given disk. Opnum: 18
CprepDiskDeleteFile	Deletes a given file on a given partition on a given disk. Opnum: 19
CprepDiskOffline	Performs the process of transitioning a **ClusPrepDisk.OnlineState** to a value of Not Online. Opnum: 20
Opnum21NotUsedOnWire	This method is not called. Opnum: 21
CprepDiskGetUniqueIds	Retrieves SCSI page 83h data for a given disk. Opnum: 22
CprepDiskAttach	Performs specific setup for the **ClusPrepDisk** before executing other methods. If setup is successful, the **ClusPrepDisk.AttachedState** transitions to Attached. Opnum: 23
CprepDiskPRArbitrate	Attempts to take ownership of a disk and starts the process to maintain ownership. Opnum: 24
CprepDiskPRRegister	Adds a SCSI-3 persistent reservation registration to a disk. Opnum: 25
CprepDiskPRUnRegister	Removes a SCSI-3 persistent reservation registration from a disk. Opnum: 26

Method	Description
CprepDiskPRReserve	Performs a SCSI-3 persistent reservation reserve to disk. Opnum: 27
CprepDiskPRRelease	Performs a SCSI-3 persistent reservation release to disk. Opnum: 28
CprepDiskDiskPartitionIsNtfs	Determines whether a given partition on a given disk has the NT file system (NTFS) file system. Opnum: 29
CprepDiskGetArbSectors	Gets two free sectors on a given disk for read/write access. Opnum: 30
CprepDiskIsPRPresent	Determines whether a SCSI-3 persistent reservation is present on a disk. Opnum: 31
CprepDiskPRPreempt	Performs a SCSI-3 persistent reservation preempt to a disk. Opnum: 32
CprepDiskPRClear	Performs a SCSI-3 persistent reservation clear on a disk. Opnum: 33
CprepDiskIsOnline	Determines whether a **ClusPrepDisk.OnlineState** is equal to Online. Opnum: 34
CprepDiskSetOnline	Begins the process of transitioning **ClusPrepDisk.OnlineState** to Online. This method does not wait for the process of transitioning to be completed and for the file systems to be mounted. Opnum: 35
CprepDiskGetFSName	Returns the name of the file system on a given partition on a given disk. Opnum: 36
CprepDiskIsReadable	Determines whether the disk can be read. Opnum: 37
CprepDiskGetDsms	Gets MPIO device driver information. Opnum: 38

3.2.4.1 CprepDiskRawRead (Opnum 3)

The **CprepDiskRawRead** method reads information directly from a single 512 byte sector on a given disk.

```
HRESULT CprepDiskRawRead(
  [in] CPREP_DISKID DiskId,
  [in] unsigned long ulSector,
  [in] unsigned long cbData,
  [out, size_is(cbData), length_is(*pcbDataRead)]
    byte* pbData,
```

```
    [out] unsigned long* pcbDataRead,
    [out] unsigned long* ulLatency
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk that holds the sector from which to read.

ulSector: The sector number to read from.

cbData: The size, in bytes, of the buffer *pbData*.

pbData: The data to read from the disk.

pcbDataRead: On successful completion, the server MUST set this to *cbData*. Otherwise the client MUST ignore this value.

ulLatency: The time, in milliseconds, that the read took to be performed.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.
0x8007001E ERROR_READ_FAULT	An attempt to read a buffer size larger than 512 was performed.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The **opnum** field value for this method is 3.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- If *cbData* is larger than 512, then return ERROR_READ_FAULT.
- Read a 512 byte sector from the disk at the correct sector and place the first *cbData* bytes from this data into the *pbData* buffer.

  Note While performing the read operation, use the **Latency Time Source** ADM element in an implementation-specific manner to determine the elapsed time. For example, prior to initiating the read operation, observe the current time of day in millisecond granularity. Upon completion

of the read, again observe the current time of day. The elapsed time can be calculated by subtracting the first observed value from the second.

- Set *pcbDataRead* to *cbData*.
- Set *ulLatency* to the time, in milliseconds, that the read operation took to complete.

The server returns the following information to the client:

- The data read
- How long the read took to complete

3.2.4.2 CprepDiskRawWrite (Opnum 4)

The **CprepDiskRawWrite** method writes information directly to a single 512 byte sector on a given disk.

```
HRESULT CprepDiskRawWrite(
  [in] CPREP_DISKID DiskId,
  [in] unsigned long ulSector,
  [in] unsigned long cbData,
  [in, size_is(cbData)] byte* pbData,
  [out] unsigned long* pcbDataWritten,
  [out] unsigned long* ulLatency
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk that holds the sector to which to write.

ulSector: The sector number to write to.

cbData: The size, in bytes of the buffer *pbData*.

pbData: The data to write to the disk.

pcbDataWritten: If the **CprepDiskRawWrite** method is successful, the server MUST set this value to 512. If an error occurs, the server MUST set **pcbDataWritten** to zero.

ulLatency: The time, in milliseconds, that the write took to be performed.

Return Values: A signed, 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.
0x8007001D	The size of the passed buffer was larger than 512 bytes.

Return value/code	Description
ERROR_WRITE_FAULT	

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 4.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- If the passed *cbData* is greater than 512, then return ERROR_WRITE_FAULT.
- Write a single sector of 512 bytes from *pbData* to the disk at the correct sector. If the size of *cbData* is less than 512 bytes, then *pbData* is padded to 512 bytes with arbitrary data.

  Note While performing the write operation, use the **Latency Time Source** ADM element in an implementation-specific manner to determine the elapsed time. For example, prior to initiating the write operation, observe the current time of day in millisecond granularity. Upon completion of the write, again observe the current time of day. The elapsed time can be calculated by subtracting the first observed value from the second.
- Set *pcbDataWritten* to 512.
- Set *ulLatency* to the time, in milliseconds, that the write operation took to complete.

The server returns the following information to the client:

- The amount of data written (512 bytes).
- How long the write took.

3.2.4.3 CprepPrepareNode (Opnum 5)

The **CprepPrepareNode** method prepares the server in an implementation-specific way to execute the other methods in the interface. It also informs the client about version information.

This method is called before any other.

```
HRESULT CprepPrepareNode(
  [out] unsigned long* pulMajorVersion,
  [out] unsigned long* pulMinorVersion,
  [out] unsigned long* pdwCPrepVersion
);
```

pulMajorVersion: The server MUST set this to the operating system major version.

pulMinorVersion: The server MUST set this to the operating system minor version.

pdwCPrepVersion: Unused.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 5.

When processing this call the server MUST do the following:

- Set *pulMajorVersion* as discussed earlier in this section.
- Set *pulMinorVersion* as discussed earlier in this section.
- Set the server **Prepare State** to Preparing.

The server returns the following information to the client:

- The output parameters set to the appropriate values described earlier

3.2.4.4 CprepPrepareNodePhase2 (Opnum 6)

The **CprepPrepareNodePhase2** method determines the number of disks accessible to the system.

```
HRESULT CprepPrepareNodePhase2(
  [in] unsigned long AttachDisksOnSystemBus,
  [out] unsigned long* pulNumDisks
);
```

AttachDisksOnSystemBus: The client MUST pass in the value 0x00000001.

pulNumDisks: The number of disks accessible to the system.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 6.

When processing this call, the server MUST do the following:

- Determine the number of disks accessible to the system in an implementation-specific way.
- For each disk:
  - Create a **ClusPrepDisk** object.
  - Initialize **ClusPrepDisk.AttachedState** to Not Attached.
  - Initialize **ClusPrepDisk.OnlineState** to Not Online.
  - Initialize **ClusPrepDisk.OwnedState** to Not Owned.
  - Add the disk to **ClusPrepDiskList**.
- Set *pulNumDisks* to that number.
- Set the server **Prepare State** to Online.

The server returns the following information to the client:

- The number of disks attached to the system

3.2.4.5 CprepDiskGetProps (Opnum 7)

The **CprepDiskGetProps** method retrieves information about the configuration and status of a given disk.

```
HRESULT CprepDiskGetProps(
  [in] CPREP_DISKID DiskId,
  [out] DISK_PROPS* DiskProps
);
```

DiskId: The identifier of the **ClusPropDisk** for which to get the disk properties.

DiskProps: The properties of the selected **ClusPropDisk**.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000	The call was successful.

Return value/code	Description
S_OK	
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 7.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Gather the information about the given disk.
- Populate a valid **DISK_PROPS** structure with the information.

The server returns the following information to the client:

- The properties of the selected disk.

3.2.4.6 CprepDiskStopDefense (Opnum 12)

The **CprepDiskStopDefense** method stops any implementation-specific method of maintaining ownership of a disk.

In order to perform a "stop defense", the following conditions MUST be met:

- The Ownership value of the designated disk MUST be OwnedByThisServer, as a result of a previous successful **CprepDiskPRArbitrate (section 3.2.4.15)** call.
- The affected **ClusPrepDisk.OnlineState** has to be equal to Not Online.
- Both the **CprepDiskPRArbitrate** and **CprepDiskOffline (section 3.2.4.12)** methods MUST be called before **CprepDiskStopDefense**.

```
HRESULT CprepDiskStopDefense(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.
0x8007139F ERROR_INVALID_STATE	The value of **ClusPrepDisk.OwnedState** is not equal to OwnedByThisServer.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 12.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Relinquish ownership of the disk associated with the **ClusPrepDisk** object, as specified in section 3.2.6.2.
- Set the **ClusPrepDisk.OwnedState** value to NotOwned.

3.2.4.7 CprepDiskOnline (Opnum 13)

The **CprepDiskOnline** method begins the transition of a **ClusPrepDisk.OnlineState** to Online and then waits for the transition to complete.

```
HRESULT CprepDiskOnline(
  [in] CPREP_DISKID DiskId,
  [out] unsigned long* MaxPartitionNumber
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk whose associated volumes will become online.

MaxPartitionNumber: The number of partitions on the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

Return value/code	Description
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.
0x8007139F ERROR_INVALID_STATE	The value of **ClusPrepDisk.OwnedState** is not equal to OwnedByThisServer.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 13.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Start the online process in the same way that **CprepDiskSetOnline** does.
- Wait for the implementation-specific process where volumes on the disk become online, to complete.
- If the online process is successful, then count the number of partitions on the disk.
- Set **ClusPrepDisk.OnlineState** to Online.

The server returns the following information to the client:

- The number of partitions on the disk

If the **ClusPrepDisk.OnlineState** was already Online, then the online process is not performed and the method returns S_OK.

3.2.4.8 CprepDiskVerifyUnique (Opnum 14)

The **CprepDiskVerifyUnique** method determines whether the same disk identifier is assigned to more than one **ClusPrepDisk** in the attached state.

```
HRESULT CprepDiskVerifyUnique(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful and only one **ClusPrepDisk** has the ID.
0x800707DE ERROR_DUPLICATE_TAG	There is more than one **ClusPrepDisk** with the given ID.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 14.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Determine whether any other **ClusPrepDisk** objects in **ClusPrepDiskList** also match the *DiskId* parameter and have the **ClusPrepDisk.AttachedState** value set equal to Attached.

3.2.4.9 CprepDiskWriteFileData (Opnum 17)

The **CprepDiskWriteFileData** method writes information to a file on a given partition on a given disk.

```
HRESULT CprepDiskWriteFileData(
  [in] CPREP_DISKID DiskId,
  [in] unsigned long ulPartition,
  [in, string] wchar_t* FileName,
  [in] unsigned long cbDataIn,
  [in, size_is(cbDataIn)] byte* DataIn
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk that holds the file to write to.

ulPartition: The partition number of the partition associated with the volume on the disk that holds the file to write to.

FileName: The path and name of the file to write to.

cbDataIn: The size, in bytes, of the buffer *DataIn*.

DataIn: The data to write to the file.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x8007139F ERROR_INVALID_STATE	The **ClusPrepDisk.OnlineState** is not equal to Online.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found or *ulPartition* cannot be mapped to a volume.
0x800703ED ERROR_UNRECOGNIZED_VOLUME	The volume does not contain a file system.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 17.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Verify that the **ClusPrepDisk.OnlineState** is Online as described in section 3.2.4.
- Map *ulPartition* to the corresponding volume as described in section 3.2.4.
- Verify that the volume contains a file system as described in section 3.2.4.
- Create the file if it does not exist.
- Write the contents of buffer *DataIn* to the file, starting at offset 0.
- Truncate the file length to *cbDataIn* bytes if its current length is greater than *cbDataIn* bytes.

3.2.4.10 CprepDiskVerifyFileData (Opnum 18)

The **CprepDiskVerifyFileData** method verifies that the data in the file matches the data passed to the method.

```
HRESULT CprepDiskVerifyFileData(
  [in] CPREP_DISKID DiskId,
  [in] unsigned long ulPartition,
  [in, string] wchar_t* FileName,
  [in] unsigned long cbDataIn,
  [in, size_is(cbDataIn)] byte* DataIn
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk that holds the file to verify.

ulPartition: The partition number of the partition associated with the volume on the disk that holds the file to verify from.

FileName: The path and name of the file to verify from.

cbDataIn: The size, in bytes, of the buffer *DataIn*.

DataIn: The data to verify against the file.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x8007139F ERROR_INVALID_STATE	The **ClusPrepDisk.OnlineState** is not equal to Online.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found or *ulPartition* cannot be mapped to a volume. The file does not exist.
0x800703ED ERROR_UNRECOGNIZED_VOLUME	The volume does not contain a file system.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 18.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in Section 3.2.4.
- Verify that the **ClusPrepDisk.OnlineState** is Online as described in section 3.2.4.
- Map *ulPartition* to the corresponding volume as described in section 3.2.4.
- Verify that the volume contains a file system as described in section 3.2.4.
- If the file does not exist, return ERROR_FILE_NOT_FOUND.
- Starting at offset 0, verify that the contents of the file match the number of *cbDataIn* bytes and the contents of *DataIn*. Verification is performed by a byte for byte comparison of the two sets of data.

3.2.4.11 CprepDiskDeleteFile (Opnum 19)

The **CprepDiskDeleteFile** method deletes a file on a given partition on a given disk.

```
HRESULT CprepDiskDeleteFile(
```

```
    [in] CPREP_DISKID DiskId,
    [in] unsigned long ulPartition,
    [in, string] wchar_t* FileName
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk that holds the file to be deleted.

ulPartition: The partition number of the partition associated with the volume on the disk that holds the file to be deleted.

FileName: The path and name of the file to delete.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x8007139F ERROR_INVALID_STATE	The **ClusPrepDisk.OnlineState** is not equal to Online.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found or *ulPartition* cannot be mapped to a volume.
0x800703ED ERROR_UNRECOGNIZED_VOLUME	The volume does not contain a file system.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 19.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Verify that the **ClusPrepDisk.OnlineState** is Online as described in section 3.2.4.
- Map *ulPartition* to the corresponding volume as described in section 3.2.4.
- Verify that the volume contains a file system as described in section 3.2.4.
- Delete the file specified in an implementation-specific manner.

3.2.4.12 CprepDiskOffline (Opnum 20)

The **CprepDiskOffline** method begins the transition of a **ClusPrepDisk.OnlineState** to Not Online and then waits for the transition to complete.

```
HRESULT CprepDiskOffline(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk whose associated volumes will become **offline**.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.
0x8007139F ERROR_INVALID_STATE	The value of **ClusPrepDisk.OnlineState** is not equal to Online.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 20.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Flush all unwritten data to the disk.
- Invalidate all handles to files on the disk.
- Dismount all file systems on the disk.
- Block read/write access to the disk.
- Perform implementation-specific processing to make the volumes associated with the disk offline.
- Set **ClusPrepDisk.OnlineState** to Not Online.

3.2.4.13 CprepDiskGetUniqueIds (Opnum 22)

The **CprepDiskGetUniqueIds** method returns device ID data about the **ClusPrepDisk**.

```
HRESULT CprepDiskGetUniqueIds(
  [in] CPREP_DISKID DiskId,
  [in] unsigned long cbData,
  [out, size_is(cbData), length_is(*pcbDataOut)]
    byte* pbData,
  [out] unsigned long* pcbDataOut,
  [out] unsigned long* pcbNeeded
);
```

DiskId: The identifier representing the **ClusPrepDisk** for which to retrieve the device ID data.

cbData: The size, in bytes, of the *pbData* buffer passed to the server.

pbData: The output buffer for the device ID data.

pcbDataOut: The size, in bytes, of the amount of data written to *pbData* on a successful return.

pcbNeeded: If ERROR_INSUFFICIENT_BUFFER is returned, then this parameter contains the size, in bytes, of the buffer required for a successful call.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x8007007A ERROR_INSUFFICIENT_BUFFER	*pbData* is not large enough.
0x80070032 ERROR_NOT_SUPPORTED	The disk does not support device ID data.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 22.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Retrieve the page 83h SCSI data described in [SPC-3] section 7.6.3.1 in an implementation-specific way for the given disk.

- If the retrieved 83h SCSI data does not contain at least one identifier of the types **SCSI name string**, **EUI-64 based** or **NAA** as described in [SPC-3] section 7.6.3.1, then return ERROR_NOT_SUPPORTED.
- If the data buffer *pbData* with size *cbData* is not large enough to store the SCSI page 83 data formatted as a STORAGE_DEVICE_ID_DESCRIPTOR structure, then return ERROR_INSUFFICIENT_BUFFER.
- Pack the data *pbData* formatted as a STORAGE_DEVICE_ID_DESCRIPTOR structure.

The server returns the following data to the client:

- A STORAGE_DEVICE_ID_DESCRIPTOR with SCSI page 83h data for the disk

3.2.4.14 CprepDiskAttach (Opnum 23)

The **CprepDiskAttach** method offers implementations an opportunity to do disk-specific setup before processing is done on a disk.

```
HRESULT CprepDiskAttach(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070490 ERROR_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 23.

When processing this call, the server MUST:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Perform any implementation-specific processing needed to support the successful operation of the other methods that require a **ClusPrepDisk.AttachedState** to be Attached.
- Set the attach state of the designated **ClusPrepDisk.AttachedState** to Attached.

If the **ClusPrepDisk.AttachedState** was already equal to Attached, then the attach process is not performed and the method returns S_OK.

3.2.4.15 CprepDiskPRArbitrate (Opnum 24)

The **CprepDiskPRArbitrate** method establishes ownership of a **ClusPrepDisk**.

```
HRESULT CprepDiskPRArbitrate(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 24.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Establish ownership of the disk associated with the **ClusPrepDisk** object, as specified in section 3.2.6.1.
- If the result of establishing ownership indicates that the disk is owned by a different server, set **ClusPrepDisk.OwnedState** to OwnedButNotByThisServer and return a nonzero error code.
- Otherwise, set the **ClusPrepDisk.OwnedState** value to OwnedByThisServer.

3.2.4.16 CprepDiskPRRegister (Opnum 25)

The **CprepDiskPRRegister** method performs a SCSI PERSISTENT RESERVE OUT command with a REGISTER AND IGNORE EXISTING KEY action.

```
HRESULT CprepDiskPRRegister(
  [in] CPREP_DISKID DiskId
```

```
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 25.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Generate an arbitrary non-zero key using an implementation-specific method suitable for the PERSISTENT RESERVE OUT command with a REGISTER AND IGNORE EXISTING KEY action as specified in [SPC-3] section 6.12.
- Issue a PERSISTENT RESERVE OUT command with a REGISTER AND IGNORE EXISTING KEY action as specified in [SPC-3] section 6.12, using the key generated in the previous step.

3.2.4.17 CprepDiskPRUnRegister (Opnum 26)

The **CprepDiskPRUnRegister** method performs a SCSI PERSISTENT RESERVE OUT command with a REGISTER AND IGNORE EXISTING KEY action with a key of 0.

```
HRESULT CprepDiskPRUnRegister(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 26.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Issue a PERSISTENT RESERVE OUT command with a REGISTER AND IGNORE EXISTING KEY action as specified in [SPC-3] section 6.12. The key value MUST be zero.

3.2.4.18 CprepDiskPRReserve (Opnum 27)

The **CprepDiskPRReserve** method performs a SCSI PERSISTENT RESERVE OUT command with a RESERVE action.

```
HRESULT CprepDiskPRReserve(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 27.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Issue a PERSISTENT RESERVE OUT command with a RESERVE action as specified in [SPC-3] section 6.12.

3.2.4.19 CprepDiskPRRelease (Opnum 28)

The **CprepDiskPRRelease** method performs a SCSI PERSISTENT RESERVE OUT command with a RELEASE action.

```
HRESULT CprepDiskPRRelease(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 28.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Issue a PERSISTENT RESERVE OUT command with a RELEASE action as specified in [SPC-3] section 6.12.

3.2.4.20 CprepDiskDiskPartitionIsNtfs (Opnum 29)

The **CprepDiskDiskPartitionIsNtfs** method determines whether the file system on a given partition on a given disk is NTFS.

```
HRESULT CprepDiskDiskPartitionIsNtfs(
  [in] CPREP_DISKID DiskId,
  [in] unsigned long ulPartition
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

ulPartition: The partition number of the partition associated with the volume to query for file system information.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070022 ERROR_WRONG_DISK	The partition on the disk has a file system other than NTFS.
0x8007139F ERROR_INVALID_STATE	The **ClusPrepDisk.OnlineState** value is not equal to Online.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found or *ulPartition* cannot be mapped to a volume.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 29.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Verify that the **ClusPrepDisk.OnlineState** is Online as described in section 3.2.4;
- Map *ulPartition* to the corresponding volume as described in section 3.2.4.
- Return ERROR_WRONG_DISK if **CprepDiskGetFSName** would return any file system name other than "NTFS".
- Return S_OK if **CprepDiskGetFSName** would return "NTFS".

3.2.4.21 CprepDiskGetArbSectors (Opnum 30)

The **CprepDiskGetArbSectors** method returns two sectors on the disk that can be used as a "scratch pad" for raw reads/writes.

```
HRESULT CprepDiskGetArbSectors(
  [in] CPREP_DISKID DiskId,
  [out] unsigned long* SectorX,
  [out] unsigned long* SectorY
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

SectorX: The first sector number that is available.

SectorY: The second sector number that is available.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 30.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- In an implementation-specific way, find two sectors on the disk that are available for raw read/write without disturbing any data that resides on the disk.

The server returns the following information to the client:

- The numbers of the two available sectors

3.2.4.22 CprepDiskIsPRPresent (Opnum 31)

The **CprepDiskIsPRPresent** method determines whether there are any PERSISTENT RESERVE reservations on the disk.

```
HRESULT CprepDiskIsPRPresent(
  [in] CPREP_DISKID DiskId,
  [out] unsigned long* Present
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Present: MUST be 0x00000000 if no reserves are present. MUST be 0x00000001 if reserves are present.

Value	Meaning
0x00000000	No reserves are present.
0x00000001	Reserves are present.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 31.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Issue a PERSISTENT RESERVE IN command with a READ RESERVATION action, as specified in [SPC-3] section 6.11.
- Set the *Present* parameter correctly, depending on the results.

Upon successful completion, the server returns the following data to the client:

- A value indicating whether persistent reserves are present on the disk

3.2.4.23 CprepDiskPRPreempt (Opnum 32)

The **CprepDiskPRPreempt** method performs a SCSI PERSISTENT RESERVE OUT command with a PREEMPT action.

```
HRESULT CprepDiskPRPreempt(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 32.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Issue a PERSISTENT RESERVE OUT command with a PREEMPT action as specified in [SPC-3] section 6.12.

3.2.4.24 CprepDiskPRClear (Opnum 33)

The **CprepDiskPRClear** method performs a SCSI PERSISTENT RESERVE OUT command with a CLEAR action.

```
HRESULT CprepDiskPRClear(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002	The disk was not found.

Return value/code	Description
ERROR_FILE_NOT_FOUND	

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 33.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Issue a PERSISTENT RESERVE OUT command with a CLEAR action as specified in [SPC-3] section 6.12.

3.2.4.25 CprepDiskIsOnline (Opnum 34)

The **CprepDiskIsOnline** method reports whether the **ClusPrepDisk**, identified by the *DiskId* parameter, has **ClusPrepDisk.OnlineState** equal to Online.

```
HRESULT CprepDiskIsOnline(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier representing the **ClusPrepDisk**.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful and **ClusPrepDisk.OnlineState** is equal to Online.
0x80070015 ERROR_NOT_READY	**ClusPrepDisk.OnlineState** is not equal to Online.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 34.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Return S_OK if the **ClusPrepDisk.OnlineState** is Online or ERROR_NOT_READY if the **ClusPrepDisk.OnlineState** is Not Online state.

3.2.4.26 CprepDiskSetOnline (Opnum 35)

The **CprepDiskSetOnline** method starts the process of transitioning **ClusPrepDisk.OnlineState** to Online.

```
HRESULT CprepDiskSetOnline(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier representing the **ClusPrepDisk**.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x8007139F ERROR_INVALID_STATE	The value of **ClusPrepDisk.OwnedState** is not equal to OwnedByThisServer.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 35.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Start the process for transitioning the **ClusPrepDisk.OnlineState** to Online. This process is done via an implementation-specific mechanism that causes the volumes on the disk to become online.

If the **ClusPrepDisk.OnlineState** is already in the Online state, then the online process is repeated.

3.2.4.27 CprepDiskGetFSName (Opnum 36)

The **CprepDiskGetFSName** method returns the name of the file system on a given partition on a given disk.

```
HRESULT CprepDiskGetFSName(
  [in] CPREP_DISKID DiskId,
  [in] unsigned long Partition,
  [out] wchar_t FsName[100]
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Partition: The partition number of the partition associated with the volume to query for file system information.

FsName: A null-terminated output string that contains the name of the file system. The value MUST be "NTFS" if the partition has the NTFS file system. The value MUST be "FAT" for the file allocation table (FAT) file system. No file system and unrecognized file systems MUST be "RAW". Other values can be used for file systems not specified here.

Value	Meaning
"NTFS"	The partition file system is NTFS.
"FAT"	The partition file system is FAT.
"RAW"	There is no partition file system, or it is unrecognized.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found or *ulPartition* cannot be mapped to a volume.
0x8007139F ERROR_INVALID_STATE	The **ClusPrepDisk.OnlineState** is not equal to Online.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 36.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Verify that the **ClusPrepDisk.OnlineState** is Online as described in section 3.2.4;

- Map *ulPartition* to the corresponding volume as described in section 3.2.4.
- Determine the file system on the given partition on the given disk.
- Place the name of the file system in the *FsName* buffer.

The server returns the following information to the client:

- The name of the file system.

3.2.4.28 CprepDiskIsReadable (Opnum 37)

The **CprepDiskIsReadable** method determines whether the disk data on the disk can be successfully read.

```
HRESULT CprepDiskIsReadable(
  [in] CPREP_DISKID DiskId
);
```

DiskId: The identifier of the **ClusPrepDisk** representing the disk.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 37.

When processing this call, the server MUST do the following:

- Obtain the **ClusPrepDisk** identified by the *DiskId* parameter as described in section 3.2.4.
- Via an implementation-specific means, attempt to read from the disk and if successful, then conclude that the disk supports being read from. If unsuccessful, then conclude that the disk does not support being read from.

3.2.4.29 CprepDiskGetDsms (Opnum 38)

The **CprepDiskGetDsms** method returns the DSMs installed on the system.

```
HRESULT CprepDiskGetDsms(
  [in] unsigned long Size,
  [out] unsigned long* pReserved,
  [out, size_is(Size), length_is(*pReserved)]
    byte* RegisteredDsms
);
```

Size: The size, in bytes, of the *RegisteredDsms* parameter.

pReserved: After completion of the method, the client MUST ignore this value.

RegisteredDsms: The buffer that holds the DSM data. The format of the buffer is a REGISTERED_DSMS structure.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x800700EA ERROR_MORE_DATA	*RegisteredDsms* was not large enough to hold all the data.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 38.

When processing this call, the server MUST do the following:

- Using an implementation-specific process, determine the set of DSMs on the system.
- Populate the *RegisteredDsms* parameter with DSM data in the format of a REGISTERED_DSMS structure.

The server returns the following information to the client:

- If the number of bytes required to return all DSMs in the *RegisteredDsms* parameter is larger than the size of *RegisteredDsms*, then return ERROR_MORE_DATA.
- The DSMs used by the system.

3.2.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.2.6 Other Local Events

Except as specified in the following subsections, no additional local events are used on the server beyond the events maintained in the underlying RPC protocol.

3.2.6.1 Establish Ownership of a Disk

The server has a mechanism to establish ownership of the disk associated with a **ClusPrepDisk** object. This event is invoked within the IClusterStorage2 server and is not exposed externally.

The caller provides the following:

- CPREP_DISKID: Identifies the disk of which ownership should be established

The server SHOULD first determine whether the designated disk is owned by a different server. If so, the server SHOULD return a result to the caller indicating that the disk is owned by a different server.

If the disk is not owned by a different server, the server SHOULD establish itself as the owner of the disk. The server SHOULD maintain ownership of the disk until a subsequent call to relinquish ownership of the disk, as specified in 3.2.6.2. The server SHOULD return a result to the caller indicating that ownership of the disk was established successfully.

How the server determines whether the designated disk is owned by a different server, how the server establishes itself as owner of the disk, and how the server maintains ownership of the disk are all implementation-specific.

3.2.6.2 Relinquish Ownership of a Disk

The server has a mechanism to relinquish ownership of the disk associated with a **ClusPrepDisk** object. This event is invoked within the IClusterStorage2 server and is not exposed externally.

The caller provides the following:

- CPREP_DISKID: Identifies the disk of which ownership should be relinquished.

The server SHOULD stop maintaining ownership of the disk and remove itself as the owner of the disk, such that the disk has no owner.

No information is returned to the caller from this event.

How the server stops maintaining ownership of the disk and how the server removes itself as owner of the disk are implementation-specific.

3.3 IClusterStorage2 Client Details

3.3.1 Abstract Data Model

None.

3.3.2 Timers

No protocol timers are required beyond those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.3.3 Initialization

The client application initiates the conversation with the server by performing DCOM activation ([MS-DCOM] section 3.2.4.1.1) of the CLSID ([MS-DCOM] section 2.2.7) specified in section 1.9. After delivering the interface pointer to the DCOM object as a result of the activation, the client application works with the object by making calls on the DCOM interface that it supports. After the conversation with the server completes, the client application performs a release on the interface pointer.

3.3.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a **strict NDR/NDR64 data consistency check** at target level 6.0, as specified in section 3 of [MS-RPCE].

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with nonzero conformant value, as specified in section 3 of [MS-RPCE].

Clients MAY invoke protocol methods in any order, unless otherwise noted in the following subsections, and except where ordering is determined by server **Prepare State** requirements, server **ClusPrepDisk.AttachedState** requirements, or server **ClusPrepDisk.OnlineState** requirements (as specified in section 3.2).

3.3.4.1 Preparing a Server

Because the server's initial **Prepare State** (3.2.1) restricts the methods that can be called, the client MUST call **CprepPrepareNode** before any other methods in the interface. Then, before calling any further methods in the interface, the client MUST call **CprepPrepareNodePhase2**.

3.3.4.2 Attaching CPrepDisks

Because the **ClusPrepDisk.AttachedState** (section 3.2.1) restricts the methods that can be called for a **ClusPrepDisk**, the client MUST call **CprepDiskAttach** before calling any other method with a **CPREP_DISKID** input parameter, except for **CprepDiskGetProps** and **CprepDiskGetUniqueIds**.

3.3.4.3 Querying Disk Sectors

Prior to calling any method that designates a sector for reading or writing (**CprepDiskRawRead** and **CprepDiskRawWrite**), a client SHOULD call **CprepDiskGetArbSectors** to determine the sector numbers to use.

3.3.4.4 Querying Disk Partitions

Prior to any method that references a partition (**CprepDiskWriteFileData**, **CprepDiskVerifyFileData**, **CprepDiskDeleteFile**, **CprepDiskDiskPartitionIsNtfs**, and **CprepDiskGetFSName**), a client MUST call **CprepDiskOnline** to transition the **ClusPrepDisk.OnlineState** to Online. In subsequent methods that reference a partition, the client SHOULD NOT designate a partition number outside of the integer range of 0 to the number of partitions returned by **CprepDiskOnline** minus 1.

3.3.4.5 Accessing a Partition File System

A client SHOULD NOT call methods that access a disk file system (**CprepDiskWriteFileData**, **CprepDiskVerifyFileData**, and **CprepDiskDeleteFile**) unless the client first identifies the partition as an NTFS partition, either by calling **CprepDiskDiskPartitionIsNtfs** or **CprepDiskGetFSName**.

3.3.4.6 SCSI-3 Persistent Reservations

Certain methods in the interface require the server and a disk to fulfill the SCSI-3 protocol [SPC-3], particularly with respect to persistent reservations. As such, for a successful outcome to these methods, it is necessary that method ordering requirements of the SCSI-3 protocol [SPC-3] be followed.

For a particular disk, assuming that the server behaves correctly as an initiator and the disk behaves correctly as a target, a client SHOULD adhere to the following sequencing for successful execution of methods:

- **CprepDiskPRRegister** SHOULD be called before **CprepDiskPRUnRegister**.
- **CprepDiskPRRegister** SHOULD be called before **CprepDiskPRReserve**.
- **CprepDiskPRReserve** SHOULD be called before **CprepDiskPRPreempt**.
- **CprepDiskPRArbitrate** and **CprepDiskOffline** MUST be called before **CprepDiskStopDefense**.
- **CprepDiskPRClear** SHOULD be called before **CprepDiskPRRegister**, when used as part of a persistent reservation sequence as follows:
  - **CprepDiskPRClear**
  - **CprepDiskPRRegister**
  - **CprepDiskPRReserve**
- **CprepDiskPRReserve** SHOULD be called before **CprepDiskPRRelease**.

3.3.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.3.6 Other Local Events

A client's invocation of each method is typically the result of local application activity. The local application on the client computer specifies values for all input parameters. No other higher-layer triggered events are processed. The values specified for input parameters are described in section 2.

No additional local events are used on the client beyond the events maintained in the underlying RPC protocol.

3.4 IClusterNetwork2 Server Details

3.4.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This document does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this document.

Firewall State: The set of **firewall rules** currently configured and enabled on the server. A firewall rule can be associated with a group of firewall rules that is identifiable by name. There can be multiple groups of firewall rules configured in the Firewall State of a server. A firewall rule is also associated with a network adapter such that for each network adapter on the server, it can be determined which firewall rules and/or groups of firewall rules are associated with that adapter. The data type of a firewall rule and the initialization of a firewall rule are implementation-specific. A server typically defines and initializes a firewall rule as specified for **FW_RULE** in [MS-FASP].

Network Adapter Configuration: Information about the set of network adapters on the server and their associated settings and configuration. In this protocol, the **Network Adapter Configuration** is defined as the data type ADAPTERLIST (section 2.2.10). The initialization and manipulation of **Network Adapter Configuration** is implementation-specific.

Initialization State: Indicates whether the server has been initialized and can fulfill methods in the interface. The value can be set to either True or False and is initially set to False.

3.4.2 Timers

No protocol timers are required except those listed in the following subsections and those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.4.2.1 Round-Trip Message Timer

This timer controls the amount of time the server waits for completion of round-trip communication, as specified in section 3.4.4.2.

3.4.3 Initialization

The Failover Cluster Setup and Validation IClusterNetwork2 Remote Protocol server MUST be initialized by registering the RPC interface and listening on the RPC well-known endpoint, as specified in section 2.1. The server MUST then wait for Failover Cluster Setup and Validation IClusterNetwork2 Remote Protocol clients to establish connections.

3.4.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR/NDR64 data consistency check at target level 6.0, as specified in [MS-RPCE] section 3.

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with nonzero conformant value, as specified in [MS-RPCE] section 3.

The **InitializeNode (Opnum 4)** method SHOULD be called before other methods described in section 3.4.4.

All methods MUST NOT throw exceptions.

This DCOM **interface** inherits the **IUnknown** interface. Method opnum field values start with 3; opnum values 0 through 2 represent the **IUnknown::QueryInterface**, **IUnknown::AddRef**, and **IUnknown::Release** methods, respectively, as specified in [MS-DCOM] section 3.1.1.5.8.

Methods in RPC Opnum Order

Method	Description
SendRTMessage	Sends a message from the server to another server, to which the other server responds. Opnum: 3
InitializeNode	Performs server setup required to successfully implement the other methods. Opnum: 4
GetIpConfigSerialized	Returns information about the network interfaces attached to the system. Opnum: 5
CleanupNode	Restores the server to its pre-InitializeNode state. Opnum: 6
QueryFirewallConfiguration	Determines whether the server's firewall configuration is set appropriately for cluster operation. Opnum: 7

3.4.4.1 InitializeNode (Opnum 4)

The **InitializeNode** method prepares the server in an implementation-specific way to execute the other methods in the interface. It also informs the client about what port will be used and version information.

```
HRESULT InitializeNode(
  [in] unsigned short RequestUDPPort,
  [out] unsigned short* BoundUDPPort,
  [out] unsigned long* NodeMajorVersion,
  [out] unsigned long* NodeMinorVersion,
  [out] unsigned long* ClusprepVersion
);
```

RequestUDPPort: A value that the client provides that affects the value of *BoundUDPPort*.

BoundUDPPort: This parameter is currently not used by the protocol.

NodeMajorVersion: The server MUST set this to an implementation-specific value.<4>

NodeMinorVersion: The server MUST set this to an implementation-specific value.<5>

ClusprepVersion: The server MUST set this to an implementation-specific value.<6>

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000	The call was successful.

Return value/code	Description
S_OK	

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 4.

When processing this call the server MUST do the following:

- Set the server **Initialization State** to True. The initialized state remains True until either the **CleanupNode (section 3.4.4.4)** method is called or the DCOM object exporter removes the application-specific state associated with the IClusterNetwork2 interface, as defined in [MS-DCOM] section 1.3.6.
- Set *NodeMajorVersion* to an implementation-specific value.<7>
- Set *NodeMinorVersion* to an implementation-specific value.<8>
- Set *ClusprepVersion* to an implementation-specific value.<9>
- If *RequestUDPPort* is nonzero, set *BoundUDPPort* to *RequestUDPPort*; else set *BoundUDPPort* to 3343.

The server returns the following information to the client:

- The output parameters set to the values specified previously

3.4.4.2 SendRTMessage (Opnum 3)

The **SendRTMessage** method determines whether roundtrip communication works between two network addresses.

The server SHOULD fail this method if the server **Initialization State** is False.

```
HRESULT SendRTMessage(
  [in] BSTR SourceIPAddress,
  [in] BSTR DestIPAddress,
  [in] unsigned short DestPort,
  [in] unsigned short AddressFamily,
  [in] unsigned long MessageSize,
  [in] unsigned long Timeout,
  [out] unsigned long* RTElapsedTime
);
```

SourceIPAddress: The address from which to send the network request. **IPv4** addresses MUST be represented in dotted decimal notation. **IPv6** addresses MUST be represented in the form specified by [RFC1924].<10>

DestIPAddress: The address to which to send the network request. The address is in the same representation as *SourceIPAddress*.

DestPort: This address is unused.

AddressFamily: The address type of the *SourceIPAddress* and *DestIPAddress* parameters.

Value	Meaning
AF_INET 0x0002	The addresses are in IPv4 format.
AF_INET6 0x0017	The addresses are in IPv6 format.

MessageSize: Unused.

Timeout: This is an implementation-specific value.<11> For the **SendRTMessage** method, the maximum value for the **Timeout** member is 1,000 milliseconds.

RTElapsedTime: The elapsed time (in milliseconds) between when the server sends the message from the *SourceIPAddress* to *DestIPAddress* and when it receives a reply from the destination address.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 3.

When processing this call, the server MUST do the following:

- Initialize the Round-Trip Message Timer to 1000 milliseconds.
- Use an implementation-specific mechanism to send a network message from *SourceIPAddress* to *DestIPAddress*, such that a reply message is sent back from *DestIPAddress* to the *SourceIPAddress*.

  Note While performing the round-trip message operation, use an implementation-specific mechanism to determine the elapsed time. For example, prior to sending the message, observe the current time of day in millisecond granularity. Upon receipt of the reply, again observe the current time of day. The elapsed time can be calculated by subtracting the first observed value from the second.

- If the Round-Trip Message Timer (section 3.4.2.1) expires before receiving the reply, the server MUST return an error code.

Return the following information to the client:

- The elapsed time (in milliseconds) between when the server sends the message from the *SourceIPAddress* to *DestIPAddress* and when it receives a reply from the destination address.

3.4.4.3 GetIpConfigSerialized (Opnum 5)

The **GetIpConfigSerialized** method queries the network adapter configuration and returns select information about the adapters.

The server SHOULD support this method even if the server **Initialization State** is False.

```
HRESULT GetIpConfigSerialized(
  [in] small ApplyClusterFilter,
  [out] SAFEARRAY( byte )* Data,
  [out] int* pcbOut
);
```

ApplyClusterFilter: A flag that indicates which adapters to return. If FALSE, then all adapters MUST be returned. If TRUE, then all nonfiltered adapters MUST be returned. Adapters that MUST be filtered are cluster adapters (as specified in the **ClusterAdapter** field of the ADAPTER structure), loopback adapters, and tunnel adapters.

Value	Meaning
TRUE -128 — -1	Return all nonfiltered adapters.
FALSE 0	Return all adapters.
TRUE 1 — 128	Return all nonfiltered adapters.

Data: A buffer that, on success, MUST contain a valid ADAPTERLIST structure. The client MUST ignore all **Guid** items in the ADAPTERLIST structure except for those **Guid** items ranging from the first item through the count of 2 multiplied by the value of **NumberOfAdapters**.

pcbOut: MUST be the size of the *Data* buffer, in bytes.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 5.

When processing this call, the server MUST do the following:

- Query the network adapter configuration using an implementation-specific method.
- Filter out adapters as required by the *ApplyClusterFilter* parameter.
- Format the data as an ADAPTERLIST structure.

Return the following information to the client:

- Return the adapter data via the *Data* parameter.
- Return the size, in bytes, of *Data* via the *pcbOut* parameter.

3.4.4.4 CleanupNode (Opnum 6)

The **CleanupNode** method cleans up any state initialized by **InitializeNode**.

The server SHOULD fail this method if the server **Initialization State** is False.

```
HRESULT CleanupNode();
```

This method has no parameters.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 6.

When processing this call, the server MUST do the following:

- Perform implementation-specific cleanup to reverse any state setup by **InitializeNode**.

- Set the server **Initialization State** ADM element to False.

3.4.4.5 QueryFirewallConfiguration (Opnum 7)

The **QueryFirewallConfiguration** method determines whether the firewall state of the server is compatible with failover clustering. The firewall settings that constitute compatibility with failover clustering are implementation-specific. When the server firewall enforces policies specified in [MS-FASP], the server SHOULD determine the firewall state according to how the group of rules is enabled, as specified later in this section.

The server SHOULD support this method even if the server **Initialization State** is False.

```
HRESULT QueryFirewallConfiguration(
  [out] small* serverRulesEnabled,
  [out] small* mgmtRulesEnabled
);
```

serverRulesEnabled: An output parameter that MUST be set on a successful return. The value MUST be TRUE if firewall settings are compatible with server-to-server failover clustering communication. When the server firewall enforces policies specified in [MS-FASP], the server SHOULD set this value to TRUE if the group of rules with the localized name "Failover Clusters" is enabled.

Value	Meaning
TRUE -128 — -1	Firewall settings allow the traffic specified previously.
FALSE 0	Firewall settings do not allow the traffic specified previously.
TRUE 1 — 128	Firewall settings allow the traffic specified previously.

mgmtRulesEnabled: An output parameter that MUST be set on a successful return. The value MUST be TRUE if firewall settings are compatible with failover cluster management components. When the server firewall enforces policies specified in [MS-FASP], the server SHOULD set this value to TRUE if the group of rules with the localized name "Failover Cluster Manager"<12> is enabled.

Value	Meaning
TRUE -128 — -1	Firewall settings allow the traffic specified previously.
FALSE 0	Firewall settings do not allow the traffic specified previously.
TRUE 1 — 128	Firewall settings allow the traffic specified previously.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation.

For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 7.

When processing this call the server MUST do the following:

- Query the firewall state for the server to determine whether the Firewall Rules that meet the *serverRulesEnabled* category are present and enabled.
- Query the firewall state for the server to determine whether the Firewall Rules that meet the *mgmtRulesEnabled* category are present and enabled.

Return the following information to the client:

- *serverRulesEnabled* and *mgmtRulesEnabled* set as described previously.

3.4.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.4.6 Other Local Events

No additional local events are used on the client beyond the events maintained in the underlying RPC protocol.

3.5 IClusterNetwork2 Client Details

3.5.1 Abstract Data Model

None.

3.5.2 Timers

No protocol timers are required beyond those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.5.3 Initialization

The client application initiates the conversation with the server by performing DCOM activation (as specified in [MS-DCOM] section 3.2.4.1.1) of the **CLSID**, as specified in section 1.9. After getting the interface pointer to the DCOM object as a result of the activation, the client application works

with the object by making calls on the DCOM interface that it supports. After the conversation with the server completes, the client application performs a release on the interface pointer.

3.5.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR/NDR64 data consistency check at target level 6.0, as specified in section 3 of [MS-RPCE].

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with nonzero-conformant value, as specified in section 3 of [MS-RPCE].

The client MUST successfully call **InitializeNode (section 3.4.4.1)** before calling any other method in the interface.

The client SHOULD call **CleanupNode (section 3.4.4.4)** after it is finished calling all other methods in the interface.

3.5.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.5.6 Other Local Events

A client's invocation of each method is typically the result of local application activity. The local application on the client computer specifies values for all input parameters. No other higher-layer triggered events are processed. The values for input parameters are specified in section 2.

No additional local events are used on the client beyond the events maintained in the underlying RPC protocol.

3.6 IClusterCleanup Server Details

The ClusPrep server provides a method to allow a client to restore a server which was formerly a node in a cluster but was evicted from that cluster to its precluster installation state. Evicting a node from a cluster is specified in [MS-CMRP] section 3.1.1.6.

3.6.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This document does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this document.

A server that implements this protocol was potentially configured as a node in a failover cluster. As such, the configuration operation may have left various executable and data files on the server as well as other persisted data, such as data that can be stored in a **registry**.

Configuration of a server as a node of a cluster is done by using implementation-specific methods between servers.

3.6.2 Timers

No protocol timers are required except those listed in the following subsections and those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.6.2.1 Delay Cleanup Timer

This timer controls the amount of time the server waits before initiating cleanup, as specified in section 3.6.4.1.

3.6.2.2 Cleanup Timer

This timer controls the amount of time the server waits for cleanup to complete, as specified in section 3.6.4.1.

3.6.3 Initialization

The Failover Cluster Setup and Validation IClusterCleanup Remote Protocol server MUST be initialized by registering the RPC interface and listening on the RPC well-known endpoint, as specified in section 2.1. The server MUST then wait for Failover Cluster Setup and Validation IClusterCleanup Remote Protocol clients to establish connections.

3.6.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR/NDR64 data consistency check at target level 6.0, as specified in section 3 of [MS-RPCE].

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with nonzero conformant value, as specified in section 3 of [MS-RPCE].

The IClusterCleanup interface methods do not have any dependencies, including:

- **CleanUpEvictedNode (Opnum 3)**
- **ClearPR (Opnum 4)**

All methods MUST NOT throw exceptions.

This DCOM interface inherits the **IUnknown** interface. Method opnum field values start with 3; opnum values 0 through 2 represent the **IUnknown::QueryInterface**, **IUnknown::AddRef**, and **IUnknown::Release** methods, respectively, as specified in [MS-DCOM] section 3.1.1.5.8.

Methods in RPC Opnum Order

Method	Description
CleanUpEvictedNode	Restores the server to its precluster installation state. Opnum: 3
ClearPR	Removes SCSI-3 persistent reservations on the disk. Opnum: 4

3.6.4.1 CleanUpEvictedNode (Opnum 3)

The **CleanUpEvictedNode** method removes all persistent artifacts that exist on the server after it is evicted from a cluster.

This method is idempotent. After it is invoked, the target server can no longer be a server for the Failover Cluster: Cluster Management Remote Protocol (ClusAPI) ([MS-CMRP]) until the server is reconfigured as a member of a cluster by using implementation-specific methods between servers.

```
HRESULT CleanUpEvictedNode(
  [in] unsigned long DelayBeforeCleanup,
  [in] unsigned long TimeOut,
  [in] unsigned long Flags
);
```

DelayBeforeCleanup: The number of milliseconds that the server MUST delay before cleanup is started on the target server. If this value is zero, the server is cleaned up immediately.

TimeOut: The number of milliseconds that the server MUST wait for cleanup to complete. This time-out is independent of the preceding delay; therefore, if *DelayBeforeCleanup* is greater than *TimeOut*, this method will time out. However, after cleanup is initiated, cleanup will run to completion regardless of the method waiting.

Flags: A set of bit flags specifying the requested actions to be taken during cleanup. This parameter MUST be set to at least one of the following values.

Value	Meaning
CLUSTERCLEANUP_STOP_CLUSTER_SERVICE 0x00000000	Issue a stop command to the cluster service and wait for it to stop.
CLUSTERCLEANUP_DONT_STOP_CLUSTER_SERVICE 0x00000001	Do not issue a stop command to the cluster service.
CLUSTERCLEANUP_DONT_WAIT_CLUSTER_SERVICE_STOP 0x00000002	Do not wait for the cluster service to stop.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070102 WAIT_TIMEOUT	The Cleanup Timer (section 3.6.2.2) expired before cleanup was completed.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 3.

When processing this call the server MUST do the following:

- Initialize the Cleanup Timer to the value specified in the *Timeout* parameter.
- Initialize the Delay Cleanup Timer (section 3.6.2.1) to the value specified in the *DelayBeforeCleanup* parameter.
- Wait for the Delay Cleanup Timer to expire.
- Remove all artifacts on the server that make it part of a cluster.
- At any time during execution of the previous steps, if the Cleanup Timer expires, the server MUST complete the method, even though cleanup operations continue.

3.6.4.2 ClearPR (Opnum 4)

The **ClearPR** method performs a SCSI PERSISTENT RESERVE OUT command with a REGISTER AND IGNORE EXISTING KEY action, followed by a CLEAR action.

```
HRESULT ClearPR(
  [in] unsigned long DeviceNumber
);
```

DeviceNumber: The number of the disk to act on.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The disk was not found.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 4.

When processing this call, the server MUST do the following:

- Determine the list of disks accessible to the system and for each disk, create an entry in a list that stores the device number in an implementation-specific way. Device numbers are assigned incrementally starting from zero to the number of disks minus one. The mapping between device number and actual device is implementation-specific and is established prior to the method call.
- Find the disk corresponding to the value passed in the *DeviceNumber* parameter. If the disk is not found, return ERROR_FILE_NOT_FOUND.
- Issue a PERSISTENT RESERVE OUT command REGISTER AND IGNORE EXISTING KEY action as specified in [SPC-3] section 6.12.
- Issue a PERSISTENT RESERVE OUT command CLEAR action as specified in [SPC-3] section 6.12.
- Destroy the list of disks accessible to the system created as part of this method.

3.6.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.6.6 Other Local Events

No additional local events are used on the client beyond the events maintained in the underlying RPC protocol.

3.7 IClusterCleanup Client Details

3.7.1 Abstract Data Model

None.

3.7.2 Timers

No protocol timers are required beyond those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.7.3 Initialization

The client application initiates the conversation with the server by performing DCOM activation (as specified in [MS-DCOM] section 3.2.4.1.1) of the **CLSID** specified in section 1.9. After getting the interface pointer to the DCOM object as a result of the activation, the client application works with the object by making calls on the DCOM interface that it supports. After the conversation with the server completes, the client application performs a release on the interface pointer.

3.7.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR/NDR64 data consistency check at target level 6.0, as specified in section 3 of [MS-RPCE].

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with nonzero conformant value, as specified in section 3 of [MS-RPCE].

3.7.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.7.6 Other Local Events

A client's invocation of each method is typically the result of local application activity. The local application on the client computer specifies values for all input parameters. No other higher-layer triggered events are processed. The values for input parameters are specified in section 2.

No additional local events are used on the client beyond the events maintained in the underlying RPC protocol.

3.8 IClusterSetup Server Details

3.8.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the explanation of how the protocol behaves. This document does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this document.

The following information MUST be maintained by the server for use in responding to client queries and commands:

cluster secret: Of type **BSTR (section 2.2.5)**, as specified in [MS-DTYP] section 2.2.5. The size of the **cluster secret** is not bounded by this protocol.

Fully qualified domain name (FQDN): Corresponds to the **fully qualified domain name (FQDN)** of the server.

3.8.2 Timers

No protocol timers are required beyond those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.8.3 Initialization

The Failover Cluster Setup and Validation **IClusterSetup** Remote Protocol server MUST be initialized by registering the RPC interface and listening on the RPC well-known endpoint, as specified in section 2.1. The server MUST then wait for Failover Cluster Setup and Validation **IClusterSetup** Remote Protocol clients to establish connections.

The server initializes the **cluster secret** ADM element to the last value that was set by a client using the **ConfigSvcSecret (section 3.8.4.1)** method in a previous activation of the **IClusterSetup** interface. If **ConfigSvcSecret** has not successfully executed on this server in a previous activation of the **IClusterSetup** interface, the server initializes the **cluster secret** to an empty string.

The server initializes the **fully qualified domain name (FQDN)** ADM element with the fully qualified domain name (FQDN) of the server.

3.8.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR/NDR64 data consistency check at target level 6.0, as specified in section 3 of [MS-RPCE].

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with a nonzero conformant value, as specified in section 3 of [MS-RPCE].

The order in which IClusterSetup interface methods are invoked becomes a precondition for subsequent methods. Preconditions include the following:

- The **ConfigSvcSecret (Opnum 3)** method MUST be called before the **RetrieveSvcSecret (Opnum 4)** method is called; however, the **ConfigSvcSecret** call MAY be from a previous activation of the IClusterSetup interface.
- The **RetrieveHostLabel (Opnum 5)** method has no dependencies.

All methods MUST NOT throw exceptions.

This DCOM interface inherits the IUnknown interface. Method opnum field values start with 3; opnum values 0 through 2 represent the **IUnknown::QueryInterface**, **IUnknown::AddRef**, and **IUnknown::Release** methods, respectively, as specified in [MS-DCOM] section 3.1.1.5.8.

Methods in RPC Opnum Order

Method	Description
ConfigSvcSecret	Instructs the server to store the cluster secret locally. Opnum: 3
RetrieveSvcSecret	Retrieves the cluster secret from the server. Opnum: 4
RetrieveHostLabel	Retrieves the fully qualified domain name (FQDN) of the server. Opnum: 5

3.8.4.1 ConfigSvcSecret (Opnum 3)

The **ConfigSvcSecret** method stores the cluster secret in an implementation-specific manner on the server.

```
HRESULT ConfigSvcSecret(
  [in] BSTR SecretBLOB
);
```

SecretBLOB: The cluster secret for the cluster in which this server is or will be a node.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 3.

When processing this call the server MUST store the cluster secret such that it persists across reboots and does not change except as part of processing a subsequent **ConfigSvcSecret** method call. The server MUST overwrite any previous value of the cluster secret. The server SHOULD store the cluster secret in a secure way.

3.8.4.2 RetrieveSvcSecret (Opnum 4)

The **RetrieveSvcSecret** method returns the cluster secret stored on this server.

```
HRESULT RetrieveSvcSecret(
  [out] BSTR* SecretBLOB
);
```

SecretBLOB: The value of the cluster secret as stored on this server.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070002 ERROR_FILE_NOT_FOUND	The cluster secret has not yet been configured by a previous call to **ConfigSvcSecret**.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 4.

When processing this call the server MUST do the following:

- Retrieve the cluster secret from its storage in an implementation-specific manner.

- If the cluster secret was not previously set by a call to **ConfigSvcSecret**, the server MUST return 0x80070002 (ERROR_FILE_NOT_FOUND) error code.

The server returns the following information to the client:

- The cluster secret.

3.8.4.3 RetrieveHostLabel (Opnum 5)

The **RetrieveHostLabel** method returns the fully qualified domain name (FQDN) of the server.

```
HRESULT RetrieveHostLabel(
  [out] BSTR* HostLabel
);
```

HostLabel: The host name of the server. This is the first part of the FQDN.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 5.

When processing this call, the server MUST do the following:

- Retrieve the server hostname via an implementation-specific method.

Return the following information to the client:

- The server hostname

3.8.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.8.6 Other Local Events

No additional local events are used on the client beyond the events maintained in the underlying RPC protocol.

3.9 IClusterSetup Client Details

3.9.1 Abstract Data Model

None.

3.9.2 Timers

No protocol timers are required beyond those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.9.3 Initialization

The client application initiates the conversation with the server by performing DCOM activation (as specified in [MS-DCOM] section 3.2.4.1.1) of the **CLSID** specified in section 1.9. After getting the interface pointer to the DCOM object as a result of the activation, the client application works with the object by making calls on the DCOM interface that it supports. After the conversation with the server completes, the client application performs a release on the interface pointer.

3.9.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR/NDR64 data consistency check at target level 6.0, as specified in section 3 of [MS-RPCE].

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with a nonzero conformant value, as specified in section 3 of [MS-RPCE].

The client MUST have previously called **ConfigSvcSecret** before calling **RetrieveSvcSecret**; however, the **ConfigSvcSecret** call MAY be from a previous activation of the IClusterSetup interface.

3.9.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.9.6 Other Local Events

A client's invocation of each method is typically the result of local application activity. The local application on the client computer specifies values for all input parameters. No other higher-layer triggered events are processed. The values for input parameters are specified in section 2.

No additional local events are used on the client beyond the events maintained in the underlying RPC protocol.

3.10 IClusterLog Server Details

3.10.1 Abstract Data Model

None.

3.10.2 Timers

No protocol timers are required beyond those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.10.3 Initialization

The Failover Cluster Setup and Validation **IClusterLog** Remote Protocol server MUST be initialized by registering the RPC interface and listening on the RPC well-known endpoint, as specified in section 2.1. The server MUST then wait for Failover Cluster Setup and Validation **IClusterLog** Remote Protocol clients to establish connections.

3.10.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR/NDR64 data consistency check at target level 6.0, as specified in section 3 of [MS-RPCE].

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with nonzero conformant value, as specified in section 3 of [MS-RPCE].

The IClusterLog interface methods do not have any dependencies, including:

- **GenerateClusterLog (Opnum 3)**
- **GenerateTimeSpanLog (Opnum 4)**

All methods MUST NOT throw exceptions.

This DCOM interface inherits the IUnknown interface. Method opnum field values start with 3; opnum values 0 through 2 represent the **IUnknown::QueryInterface**, **IUnknown::AddRef**, and **IUnknown::Release** methods, respectively, as specified in [MS-DCOM] section 3.1.1.5.8.

Methods in RPC Opnum Order

Method	Description
GenerateClusterLog	Creates a file with log entries. Opnum: 3
GenerateTimeSpanLog	Creates a file with log entries that date back only for the specified number of minutes. Opnum: 4

3.10.4.1 GenerateClusterLog (Opnum 3)

The **GenerateClusterLog** method writes a file that contains diagnostic information about failover clusters for the server on which it executes. The content and format of the file are implementation-specific, but SHOULD contain diagnostic information.

```
HRESULT GenerateClusterLog(
  [out] BSTR* LogFilePath
);
```

LogFilePath: Upon successful completion of this method, the server MUST set this parameter to the location where the server has exposed a file containing the diagnostic log data. The path is relative to the machine and starts with a share name. The format is "<share>\<filename>" where <share> is a share name, and <filename> is the name of the file or device. The *LogFilePath* parameter MUST form a valid **UncPath** if "\\<servername>\" is prepended to its contents.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 3.

When processing this call, the server MUST do the following:

- Place a file in a shared location on the machine.
- Generate the server-relative path to the file.

The server returns the following information to the client:

- The server-relative path to the file

3.10.4.2 GenerateTimeSpanLog (Opnum 4)

The **GenerateTimeSpanLog** method writes a file that contains diagnostic information about failover clusters for the server on which it executes. The content and format of the file is implementation-specific, but SHOULD contain diagnostic information.

```
HRESULT GenerateTimeSpanLog(
  [in] unsigned long SpanMinutes,
  [out] BSTR* LogFilePath
);
```

SpanMinutes: A value, in minutes, that indicates those values that SHOULD be in the log. Events that occurred in the range of Now to (Now - *SpanMinutes*) MUST be in the log and no others. Now is the GMT on the server.

LogFilePath: Has the same meaning as parameter *LogFilePath* for the **GenerateClusterLog** method specified in section 3.10.4.1.

Return Values: Return values are the same as the return values for the **GenerateClusterLog** method specified in section 3.10.4.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

For any other condition, this method MUST return a value that is not one of the values listed in the preceding table. The client MUST behave in one consistent, identical manner for all values that are not listed in the preceding table.

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

The opnum field value for this method is 4.

When processing this call the server MUST do the following:

- Generate the file with the correct data, honoring the *SpanMinutes* parameter.
- Place the file in a valid *LogFilePath* on the machine, as described in section 3.10.4.1.
- Generate the server-relative path to the file.

Return the following information to the client:

- The server-relative path to the file

3.10.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.10.6 Other Local Events

No additional local events are used on the client beyond the events maintained in the underlying RPC protocol.

3.11 IClusterLog Client Details

3.11.1 Abstract Data Model

The client should use the abstract data model defined by the server; see section 3.10.1.

3.11.2 Timers

No protocol timers are required beyond those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.11.3 Initialization

The client application initiates the conversation with the server by performing DCOM activation ([MS-DCOM] section 3.2.4.1.1) of the **CLSID** specified in section 1.9. After getting the interface pointer to the DCOM object as a result of the activation, the client application works with the object by making calls on the DCOM interface that it supports. After the conversation with the server completes, the client application performs a release on the interface pointer.

3.11.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR/NDR64 data consistency check at target level 6.0, as specified in section 3 of [MS-RPCE].

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with a nonzero conformant value, as specified in section 3 of [MS-RPCE].

3.11.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.11.6 Other Local Events

A client's invocation of each method is typically the result of local application activity. The local application on the client computer specifies values for all input parameters. No other higher-layer triggered events are processed. The values for input parameters are specified in section 2.

No additional local events are used on the client beyond the events maintained in the underlying RPC protocol.

3.12 IClusterFirewall Server Details

The server SHOULD<13> support the IClusterFirewall DCOM interface.

3.12.1 Abstract Data Model

The abstract data model for IClusterFirewall is the same as the abstract data model for IClusterNetwork2 in section 3.4.1.

3.12.2 Timers

No protocol timers are required beyond those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.12.3 Initialization

The Failover Cluster Setup and Validation IClusterFirewall Remote Protocol server MUST be initialized by registering the RPC interface and listening on the RPC well-known endpoint, as specified in section 2.1. The server MUST then wait for Failover Cluster Setup and Validation IClusterFirewall Remote Protocol clients to establish connections.

3.12.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR/NDR64 data consistency check at target level 6.0, as specified in [MS-RPCE] section 3.

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with nonzero conformant value, as specified in [MS-RPCE] section 3.

The order in which IClusterFirewall interface methods are invoked becomes a precondition for subsequent methods. Preconditions include the following:

- The **InitializeAdapterConfiguration (Opnum 3)** method MUST be called before other methods described in section 3.12.

All methods MUST NOT throw exceptions.

This DCOM interface inherits the **IUnknown** interface. Method opnum field values start with 3; opnum values 0 through 2 represent the **IUnknown::QueryInterface**, **IUnknown::AddRef**, and **IUnknown::Release** methods, respectively, as specified in [MS-DCOM] section 3.1.1.5.8.

Methods in RPC Opnum Order

Method	Description
InitializeAdapterConfiguration	Performs server setup required to successfully implement the other methods. Opnum: 3
GetNextAdapterFirewallConfiguration	Returns information about a network interface attached to the system. Opnum: 4

3.12.4.1 InitializeAdapterConfiguration (Opnum 3)

The **InitializeAdapterConfiguration** method initializes the server **Firewall State** to process subsequent calls of **GetNextAdapterFirewallConfiguration**.

This method is called at least once before **GetNextAdapterFirewallConfiguration**.

```
HRESULT InitializeAdapterConfiguration(
  [out] ULONG* cRetAdapters
);
```

cRetAdapters: A pointer to an unsigned 32-bit integer indicating the number of adapters in the network adapter index of the **Firewall State**. Upon successful completion of this method, the server MUST set this value. If the method fails, the client MUST ignore this value.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.

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

The opnum field value for this method is 3.

When processing this call, the server MUST initialize the **Firewall State**. The server MUST retain the **Firewall State** until either the protocol session terminates or this method is called again (in which case the server MUST reinitialize the **Firewall State**).

The server returns the following information to the client:

- The output parameters set to the values specified previously.

3.12.4.2 GetNextAdapterFirewallConfiguration (Opnum 4)

The **GetNextAdapterFirewallConfiguration** method returns information about a specific network adapter attached to the system.

```
HRESULT GetNextAdapterFirewallConfiguration(
  [in] ULONG idx,
  [out] GUID* adapterId,
  [out] CLUSTER_NETWORK_PROFILE* adapterProfile,
  [out] BOOLEAN* serverRulesEnabled,
  [out] BOOLEAN* managementRulesEnabled,
  [out] BOOLEAN* commonRulesEnabled
);
```

idx: A 32-bit unsigned integer that indicates the index of the adapter information to retrieve. The server MUST fail this method with error 0x80070057 **(E_INVALIDARG)** if *idx* is greater than or equal to the *cRetAdapters* value returned by the previous call to **InitializeAdapterConfiguration (Opnum 3)**.

adapterId: A GUID that uniquely identifies the network adapter on the system. Upon successful completion of this method, the server MUST set this value. If the method fails, the client MUST ignore this value.

adapterProfile: The firewall profile assigned to the network adapter. Upon successful completion of this method, the server MUST set this value to one of the specified values of **CLUSTER_NETWORK_PROFILE**. If the method fails, the client MUST ignore this value.

serverRulesEnabled: An output parameter that indicates whether the server is suitable for server-to-server failover clustering communication. Upon successful completion of this method, the server MUST set this value to TRUE if the server is suitable or to FALSE if the server is not suitable. When the server firewall enforces policies specified in [MS-FASP], the server SHOULD set this value to TRUE if the group of rules with the localized name "Failover Clusters" is enabled. If the method fails, the client MUST ignore this value.

Value	Meaning
TRUE -128 — -1	Firewall settings allow the traffic specified previously.
FALSE 0	Firewall settings do not allow the traffic specified previously.
TRUE 1 — 128	Firewall settings allow the traffic specified previously.

managementRulesEnabled: An output parameter that indicates whether the server is compatible with the failover cluster management components. Upon successful completion of this method, the server MUST set this value to TRUE if the server is compatible or to FALSE if the server is not compatible. When the server firewall enforces policies specified in [MS-FASP], the server SHOULD set this value to TRUE if the group of rules with the localized name "Failover Cluster Manager" is enabled. If the method fails, the client MUST ignore this value.

Value	Meaning
TRUE	Firewall settings allow the traffic specified previously.

Value	Meaning
-128 — -1	
FALSE 0	Firewall settings do not allow the traffic specified previously.
TRUE 1 — 128	Firewall settings allow the traffic specified previously.

commonRulesEnabled: An output parameter that indicates whether the server is compatible with the failover cluster components common to failover cluster management and server-to-server failover clustering communications. Upon successful completion of this method, the server MUST set this value to TRUE if the server is compatible or to FALSE if the server is not compatible. When the server firewall enforces policies specified in [MS-FASP], the server SHOULD set this value to TRUE if the group of rules with the localized name "Failover Cluster Common" is enabled. If the method fails, the client MUST ignore this value.

Value	Meaning
TRUE -128 — -1	Firewall settings allow the traffic specified previously.
FALSE 0	Firewall settings do not allow the traffic specified previously.
TRUE 1 — 128	Firewall settings allow the traffic specified previously.

Return Values: A signed 32-bit value that indicates return status. If the method returns a negative value, it has failed. Zero or positive values indicate success, with the lower 16 bits in positive nonzero values containing warnings or flags defined in the method implementation. For more information about Win32 error codes and **HRESULT** values, see [MS-ERREF] sections 2.2 and 2.1.

Return value/code	Description
0x00000000 S_OK	The call was successful.
0x80070057 E_INVALIDARG	The value the client specified in *idx* is greater than or equal to the *cRetAdapters* value returned by the previous call to **InitializeAdapterConfiguration**.
0x8000FFFF E_UNEXPECTED	**InitializeAdapterConfiguration** has not yet been called.

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

The opnum field value for this method is 4.

The server returns the following information to the client:

- The output parameters set to the values specified previously.

3.12.5 Timer Events

None.

3.12.6 Other Local Events

None.

3.13 IClusterFirewall Client Details

The client SHOULD<14> support the IClusterFirewall DCOM interface.

3.13.1 Abstract Data Model

The client should use the abstract data model defined by the server; see section 3.12.1.

3.13.2 Timers

No protocol timers are required beyond those used internally by RPC to implement resiliency to network outages, as specified in [MS-RPCE] section 3.2.3.2.1.

3.13.3 Initialization

The client application initiates the conversation with the server by performing DCOM activation (as specified in [MS-DCOM] section 3.2.4.1.1) of the **CLSID** as specified in section 1.9. After getting the interface pointer to the DCOM object as a result of the activation, the client application works with the object by making calls on the DCOM interface that it supports. After the conversation with the server completes, the client application performs a release on the interface pointer.

3.13.4 Message Processing Events and Sequencing Rules

This protocol MUST indicate to the RPC runtime that it is to perform a strict NDR/NDR64 data consistency check at target level 6.0, as specified in [MS-RPCE] section 3.

This protocol MUST indicate to the RPC runtime that it is to reject a NULL unique or full pointer with nonzero conformant value, as specified in [MS-RPCE] section 3.

3.13.5 Timer Events

No protocol timer events are required on the client beyond the timers required in the underlying RPC protocol.

3.13.6 Other Local Events

A client's invocation of each method typically is the result of local application activity. The local application on the client computer specifies values for all input parameters. No other higher-layer triggered events are processed. The values for input parameters are specified in section 2.

No additional local events are used on the client beyond the events maintained in the underlying RPC protocol.

4 Protocol Examples

4.1 A Shared Disk Online

The following example illustrates how a protocol client brings a disk that is shared by multiple servers online. Assume that only one disk will be brought online and that the disk is currently not owned by any server.

The following diagram is a depiction of the message flow.

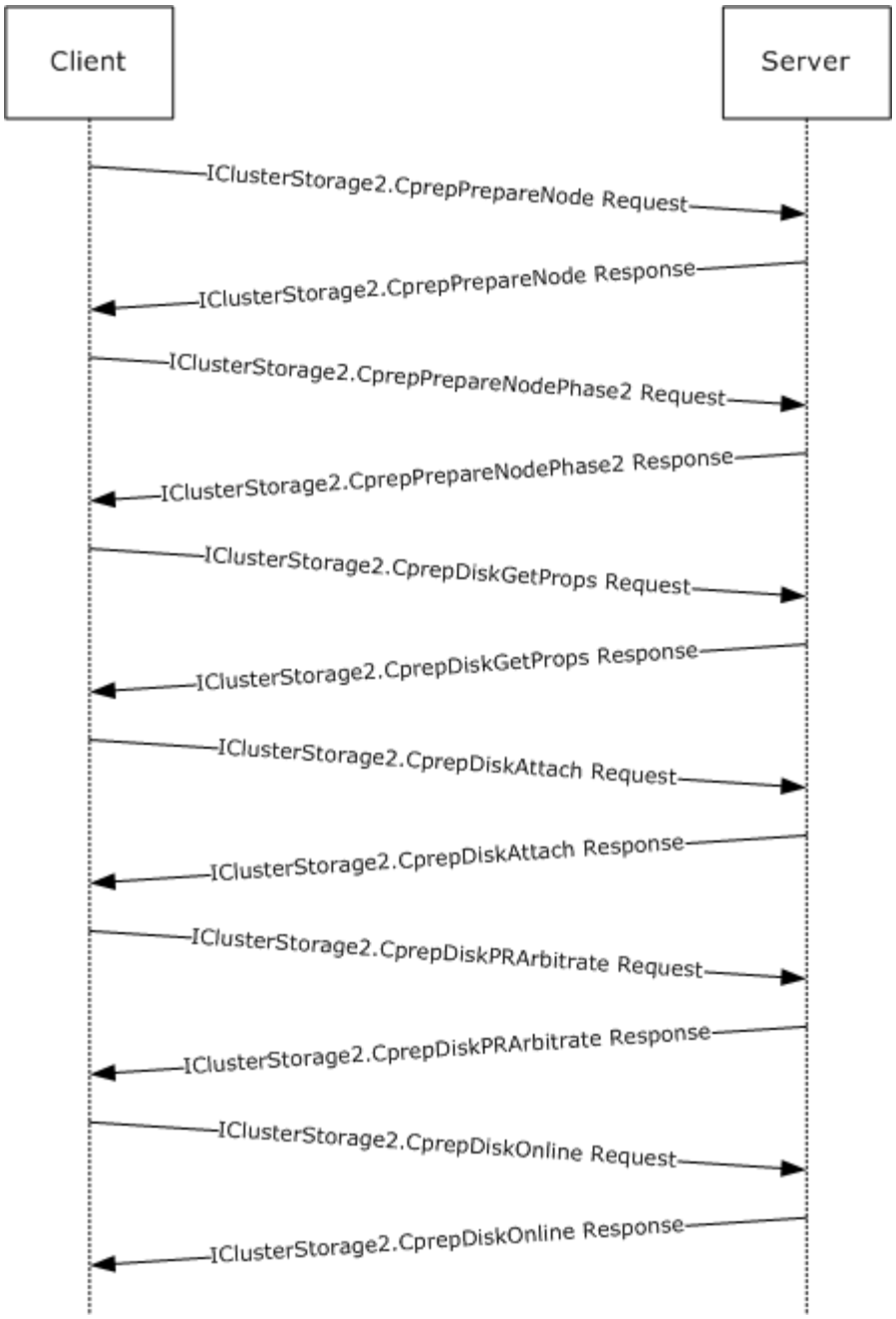


Figure 1: Message flow: Bringing a shared Disk online

1. The client initializes an RPC connection for the correct interface as specified in section 3.3.3. The client knows the names of the server.

2. The client issues a **CprepPrepareNode** request.

3. The client issues a **CprepPrepareNodePhase2** request. This returns the number of disks attached to the system.

4. The client picks a disk number for a shared disk and issues a **CprepDiskGetProps** request. This returns, among other things, the **CPREP_DISKID** structure to use to represent the **ClusPrepDisk**.

5. The client uses the **CPREP_DISKID** from the previous call and issues a **CprepDiskAttach** call. This allows the server-side implementation to do any preprocessing needed to support further operations on the disk.

6. The client issues a **CprepDiskPRArbitrate** request, again using the **CPREP_DISKID** for the disk. This establishes ownership of the disk, which is required to bring the disk online.

7. The client uses the **CPREP_DISKID** for the **ClusPrepDisk** and calls **CprepDiskOnline**, which brings the **ClusPrepDisk** to an online state.

4.2 Validate Network Configuration

The following example illustrates how a protocol client validates network communication to and from the protocol server.

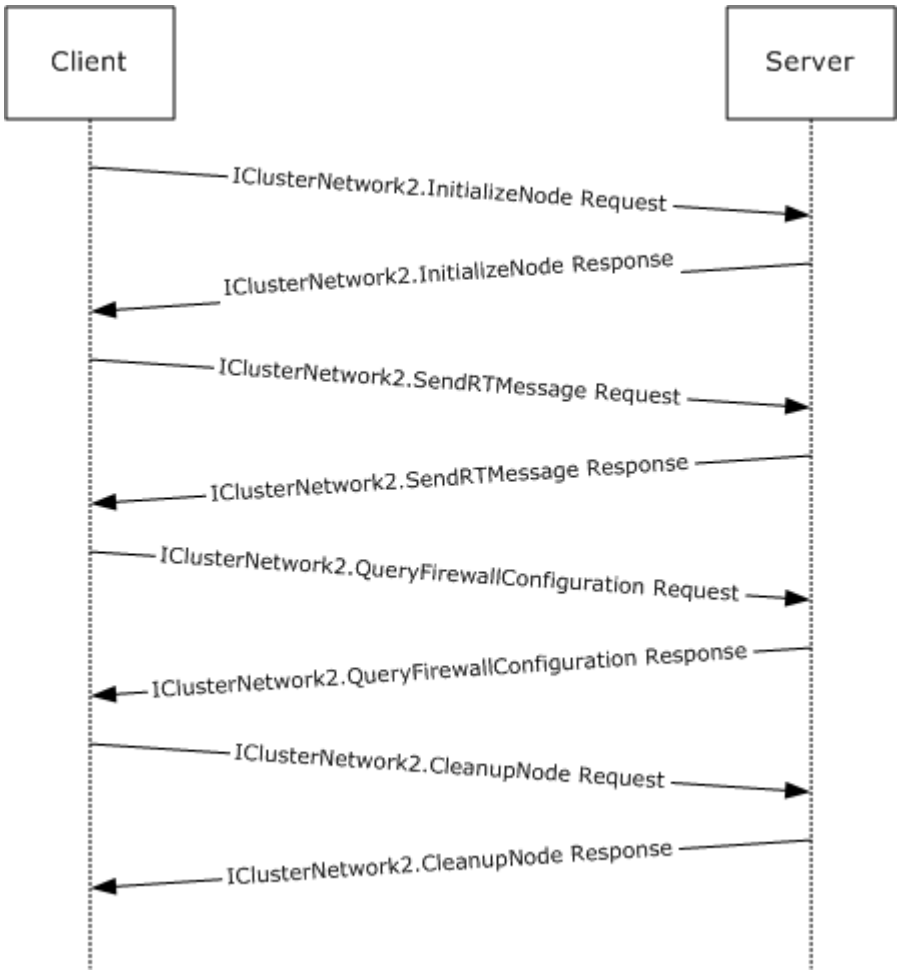


Figure 2: Message flow: Validating the network configuration

1. The client initializes an RPC connection for the correct interface as specified in section 3.4.3. The client recognizes the names of the server.
2. The client issues an **InitializeNode** method request. This prepares the server for further communication with the client.
3. The client issues a **SendRTMessage** method request. This verifies that the networking communication channel is functional.
4. The client uses the **QueryFirewallConfiguration** method to determine whether the firewall state of the server is compatible with failover clustering.
5. The client uses the **CleanupNode** method to remove any state initialized by **InitializeNode**.

4.3 Cluster Setup

The following example illustrates how a protocol client sets up a cluster to and from the protocol server.

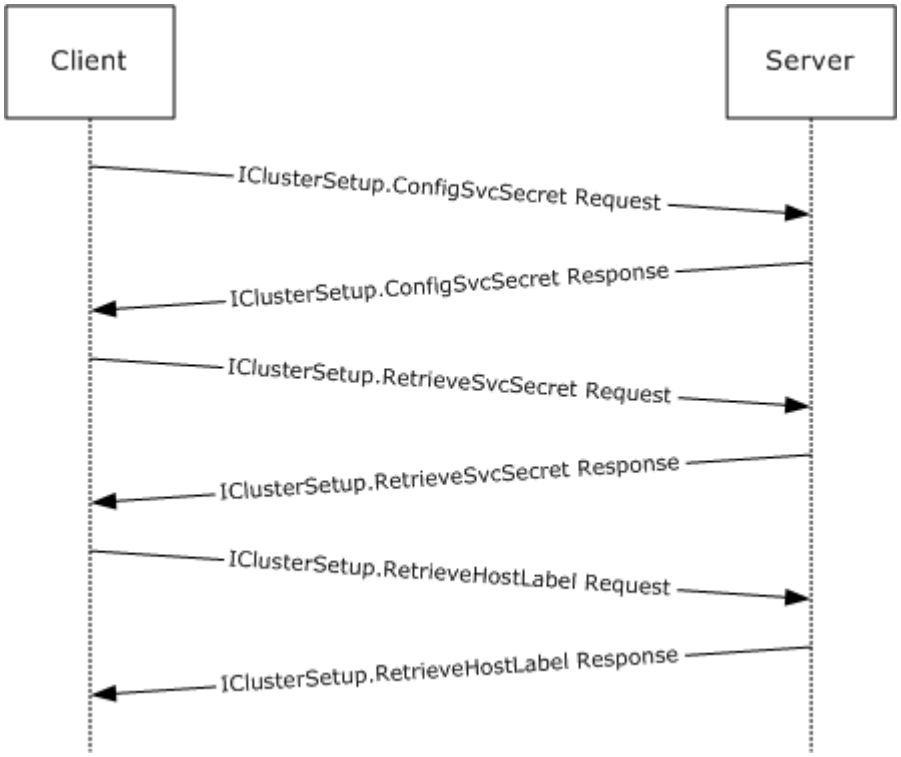


Figure 3: Message flow: Setting up a cluster

1. The client initializes an RPC connection for the correct interface as specified in section 3.8.3. The client recognizes the names of the server.
2. The client uses the **ConfigSvcSecret** method to store the cluster secret in an implementation-specific manner on the server.
3. The client uses the **RetrieveSvcSecret** method to retrieve the cluster secret stored on this server.

4. The client uses the **RetrieveHostLabel** method to obtain the fully qualified domain name (FQDN) of the server.

5 Security

5.1 Security Considerations for Implementers

None.

5.2 Index of Security Parameters

None.

6 Appendix A: Full IDL

For ease of implementation, the full IDL is provided below, where "ms-oaut.idl" refers to the IDL found in [MS-OAUT] Appendix A. The syntax uses the IDL syntax extensions defined in [MS-RPCE] sections 2.2.4 and 3.1.1.5.1. For example, as noted in [MS-RPCE] section 2.2.4.9, a pointer_default declaration is not required and pointer_default(unique) is assumed.

```
import "ms-oaut.idl";
#define SAFEARRAY(type) SAFEARRAY

typedef enum _CPREP_DISKID_ENUM {
    CprepIdSignature = 0x00000000,
    CprepIdGuid      = 0x00000001,
    CprepIdNumber    = 0x00000fa0,
    CprepIdUnknown   = 0x00001388
} CPREP_DISKID_ENUM, *PCPREP_DISKID_ENUM;

typedef struct _CPREP_DISKID {
    CPREP_DISKID_ENUM       DiskIdType;
    [switch_is(DiskIdType)] union {
        [case(CprepIdSignature)]    unsigned long DiskSignature;
        [case(CprepIdGuid)]         GUID          DiskGuid;
        [case(CprepIdNumber)]       unsigned long DeviceNumber;
        [case(CprepIdUnknown)]      unsigned long Junk;
    };
} CPREP_DISKID, *PCPREP_DISKID;

typedef enum _DiskStackType {
    DiskStackScsiPort = 0x00000000,
    DiskStackStorPort = 0x00000001,
    DiskStackFullPort = 0x00000002
} DiskStackType;

typedef struct _CPREP_SCSI_ADDRESS {
    unsigned long  Length;
    unsigned char  PortNumber;
    unsigned char  PathId;
    unsigned char  TargetId;
    unsigned char  Lun;
} CPREP_SCSI_ADDRESS, *PCPREP_SCSI_ADDRESS;

typedef struct _DISK_PROPS {
    unsigned long       DiskNumber;
    CPREP_DISKID        DiskId;
    unsigned long       DiskBusType;
    DiskStackType       StackType;
    CPREP_SCSI_ADDRESS  ScsiAddress;
    long                DiskIsClusterable;
    wchar_t             AdapterDesc[260];
    unsigned long       NumPaths;
    unsigned long       Flags;
} DISK_PROPS, * PDISK_PROPS;

typedef  enum _CLUSTER_NETWORK_PROFILE {
  ClusterNetworkProfilePublic = 0x00,
  ClusterNetworkProfilePrivate = 0x01,
  ClusterNetworkProfileDomainAuthenticated = 0x02
} CLUSTER_NETWORK_PROFILE, *PCLUSTER_NETWORK_PROFILE;
```

```
[
    object,
    uuid(12108A88-6858-4467-B92F-E6CF4568DFB6),
    pointer_default(unique)
]
interface IClusterStorage2 : IUnknown
{
    HRESULT CprepDiskRawRead(
        [in] CPREP_DISKID DiskId,
        [in] unsigned long ulSector,
        [in] unsigned long cbData,
        [out, size_is(cbData), length_is(*pcbDataRead)] byte *pbData,
        [out] unsigned long *pcbDataRead,
        [out] unsigned long *ulLatency
    );

    HRESULT CprepDiskRawWrite(
        [in] CPREP_DISKID DiskId,
        [in] unsigned long ulSector,
        [in] unsigned long cbData,
        [in, size_is(cbData)] byte* pbData,
        [out] unsigned long* pcbDataWritten,
        [out] unsigned long *ulLatency
    );

    HRESULT CprepPrepareNode(
        [out] unsigned long* pulMajorVersion,
        [out] unsigned long* pulMinorVersion,
        [out] unsigned long* pdwCPrepVersion
    );

    HRESULT CprepPrepareNodePhase2(
        [in] unsigned long AttachDisksOnSystemBus,
        [out] unsigned long* pulNumDisks
    );

    HRESULT CprepDiskGetProps(
        [in] CPREP_DISKID DiskId,
        [out] DISK_PROPS * DiskProps
    );

    HRESULT Opnum8NotUsedOnWire();
    HRESULT Opnum9NotUsedOnWire();
    HRESULT Opnum10NotUsedOnWire();
    HRESULT Opnum11NotUsedOnWire();

    HRESULT CprepDiskStopDefense(
        [in] CPREP_DISKID DiskId
    );

    HRESULT CprepDiskOnline(
        [in] CPREP_DISKID DiskId,
        [out] unsigned long* MaxPartitionNumber
    );

    HRESULT CprepDiskVerifyUnique(
        [in] CPREP_DISKID DiskId
    );
```

```
HRESULT Opnum15NotUsedOnWire();
HRESULT Opnum16NotUsedOnWire();

HRESULT CprepDiskWriteFileData(
    [in] CPREP_DISKID DiskId,
    [in] unsigned long ulPartition,
    [in, string] wchar_t* FileName,
    [in] unsigned long cbDataIn,
    [in, size_is(cbDataIn)] byte* DataIn
);

HRESULT CprepDiskVerifyFileData(
    [in] CPREP_DISKID DiskId,
    [in] unsigned long ulPartition,
    [in, string] wchar_t* FileName,
    [in] unsigned long cbDataIn,
    [in, size_is(cbDataIn)] byte* DataIn
);

HRESULT CprepDiskDeleteFile(
    [in] CPREP_DISKID DiskId,
    [in] unsigned long ulPartition,
    [in, string] wchar_t* FileName
);

HRESULT CprepDiskOffline(
    [in] CPREP_DISKID DiskId
);

HRESULT Opnum21NotUsedOnWire();

HRESULT CprepDiskGetUniqueIds(
    [in] CPREP_DISKID DiskId,
    [in] unsigned long cbData,
    [out, size_is(cbData), length_is(*pcbDataOut)] byte* pbData,
    [out] unsigned long *pcbDataOut,
    [out] unsigned long *pcbNeeded
);

HRESULT CprepDiskAttach(
    [in] CPREP_DISKID DiskId
);

HRESULT CprepDiskPRArbitrate(
    [in] CPREP_DISKID DiskId
);

HRESULT CprepDiskPRRegister(
    [in] CPREP_DISKID DiskId
);

HRESULT CprepDiskPRUnRegister(
    [in] CPREP_DISKID DiskId
);

HRESULT CprepDiskPRReserve(
    [in] CPREP_DISKID DiskId
);
```

```
    HRESULT CprepDiskPRRelease(
        [in] CPREP_DISKID DiskId
    );

    HRESULT CprepDiskDiskPartitionIsNtfs(
        [in] CPREP_DISKID DiskId,
        [in] unsigned long ulPartition
    );

    HRESULT CprepDiskGetArbSectors(
        [in] CPREP_DISKID DiskId,
        [out] unsigned long *SectorX,
        [out] unsigned long *SectorY
    );

    HRESULT CprepDiskIsPRPresent(
        [in] CPREP_DISKID DiskId,
        [out] unsigned long *Present
    );

    HRESULT CprepDiskPRPreempt(
        [in] CPREP_DISKID DiskId
    );

    HRESULT CprepDiskPRClear(
        [in] CPREP_DISKID DiskId
    );

    HRESULT CprepDiskIsOnline(
        [in] CPREP_DISKID DiskId
    );

    HRESULT CprepDiskSetOnline(
        [in] CPREP_DISKID DiskId
    );

    HRESULT CprepDiskGetFSName(
        [in] CPREP_DISKID DiskId,
        [in] unsigned long Partition,
        [out] wchar_t FsName[100]
    );

    HRESULT CprepDiskIsReadable(
        [in] CPREP_DISKID DiskId
    );

    HRESULT CprepDiskGetDsms(
        [in] unsigned long Size,
        [out] unsigned long *pReserved,
        [out, size_is(Size), length_is(*pReserved)] byte *RegisteredDsms
    );
};

[
    object,
    uuid(2931C32C-F731-4c56-9FEB-3D5F1C5E72BF),
    pointer_default(unique)
]
```

```
interface IClusterNetwork2 : IUnknown
{
    HRESULT SendRTMessage(
        [in] BSTR SourceIPAddress,
        [in] BSTR DestIPAddress,
        [in] unsigned short DestPort,
        [in] unsigned short AddressFamily,
        [in] unsigned long MessageSize,
        [in] unsigned long Timeout,
        [out] unsigned long* RTElapsedTime
    );

    HRESULT InitializeNode(
        [in] unsigned short RequestUDPPort,
        [out] unsigned short *BoundUDPPort,
        [out] unsigned long* NodeMajorVersion,
        [out] unsigned long* NodeMinorVersion,
        [out] unsigned long* ClusprepVersion
    );

    HRESULT GetIpConfigSerialized(
        [in]  small ApplyClusterFilter,
        [out] SAFEARRAY(byte) * Data,
        [out] int* pcbOut
    );

    HRESULT CleanupNode ();

    HRESULT QueryFirewallConfiguration(
        [out] small* serverRulesEnabled,
        [out] small* mgmtRulesEnabled
    );
};

[
    object,
    uuid(D6105110-8917-41A5-AA32-8E0AA2933DC9),
    pointer_default(unique)
]

interface IClusterCleanup : IUnknown
{
    HRESULT CleanUpEvictedNode(
        [in] unsigned long DelayBeforeCleanup,
        [in] unsigned long TimeOut,
        [in] unsigned long Flags
    );

    HRESULT ClearPR(
        [in] unsigned long DeviceNumber
    );
};

[
    object,
    uuid(491260B5-05C9-40D9-B7F2-1F7BDAE0927F),
    pointer_default(unique)
]
interface IClusterSetup : IUnknown
```

```
{
    HRESULT ConfigSvcSecret(
        [in] BSTR SecretBLOB
    );

    HRESULT RetrieveSvcSecret(
        [out] BSTR* SecretBLOB
    );

    HRESULT RetrieveHostLabel(
        [out] BSTR* HostLabel
    );
};

[
    object,
    uuid(85923CA7-1B6B-4E83-A2E4-F5BA3BFBB8A3),
    pointer_default(unique)
]
interface IClusterLog : IUnknown
{
    HRESULT GenerateClusterLog(
        [out] BSTR* LogFilePath
    );

    HRESULT GenerateTimeSpanLog(
        [in] unsigned long SpanMinutes,
        [out] BSTR* LogFilePath
    );
};

[
    object,
    uuid(F1D6C29C-8FBE-4691-8724-F6D8DEAEAFC8),
    pointer_default(unique)
]
interface IClusterFirewall : IUnknown{
    HRESULT InitializeAdapterConfiguration (
        [out] unsigned long* cRetAdapters
        );
    HRESULT GetNextAdapterFirewallConfiguration (
        [in] unsigned long idx,
        [out] GUID * adapterId,
        [out] CLUSTER_NETWORK_PROFILE * adapterProfile,
        [out] small* serverRulesEnabled,
        [out] small* managementRulesEnabled,
        [out] small* commonRulesEnabled
        );
};

    [
        uuid(C72B09DB-4D53-4f41-8DCC-2D752AB56F7C),
    ]
    coclass ClusterStorage2
    {
        [default] interface IClusterStorage2;
    };

    [
```

```
    uuid(E1568352-586D-43e4-933F-8E6DC4DE317A),
]
coclass ClusterNetwork2
{
    [default] interface IClusterNetwork2;
};

[
    uuid(A6D3E32B-9814-4409-8DE3-CFA673E6D3DE),
]
coclass ClusterCleanup
{
    [default] interface IClusterCleanup;
};

[
    uuid(04D55210-B6AC-4248-9E69-2A569D1D2AB6),
]
coclass ClusterSetup
{
    [default] interface IClusterSetup;
};

[
    uuid(88E7AC6D-C561-4F03-9A60-39DD768F867D),
]
coclass ClusterLog
{
    [default] interface IClusterLog;
};

[
    uuid(3CFEE98C-FB4B-44C6-BD98-A1DB14ABCA3F),
]
coclass ClusterFirewall
{
    [default] interface IClusterFirewall;
};
```

7 Appendix B: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include released service packs:

- Windows Vista® operating system with Service Pack 1 (SP1)
- 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 3.1: Windows Vista SP1, Windows Vista SP2, and Windows 7 implement the client side of the Failover Cluster: Setup and Validation Protocol (ClusPrep).

<2> Section 3.2.4: For **CprepDiskAttach**, ERROR_NOT_FOUND is returned.

<3> Section 3.2.4: **CprepDiskIsOnline (section 3.2.4.25)** and **CprepDiskSetOnline (section 3.2.4.26)** return 0x80070490 (ERROR_NOT_FOUND) if the **ClusPrepDisk** designated by the **CPREP_DISKID** parameter is not in the Attached state.

<4> Section 3.4.4.1: In Windows Server 2008 R2, the value has to be the server's operating system major version. In Windows Server 2008, the value has to be 100.

<5> Section 3.4.4.1: In Windows Server 2008 R2, the value has to be the server's operating system minor version. In Windows Server 2008, the value has to be 200.

<6> Section 3.4.4.1: In Windows Server 2008 R2, the value has to be 3. In Windows Server 2008, the value has to be 1.

<7> Section 3.4.4.1: In Windows Server 2008 R2, the value has to be the server's operating system major version. In Windows Server 2008, the value has to be 100.

<8> Section 3.4.4.1: In Windows Server 2008 R2, the value has to be the server's operating system minor version. In Windows Server 2008, the value has to be 200.

<9> Section 3.4.4.1: In Windows Server 2008 R2, the value has to be 3. In Windows Server 2008, the value has to be 1.

<10> Section 3.4.4.2: The *SourceIPAddress* parameter currently serves only as a placeholder that is used to enable future modifications to the method of network verification.

<11> Section 3.4.4.2: In Windows Server 2008 R2, this is the maximum amount of time to wait for a response from the destination address. In Windows Server 2008, the value is unused.

<12> Section 3.4.4.5: Windows Server 2008 sets this value to TRUE if the group of rules with the localized name "Failover Cluster Management" is enabled.

<13> Section 3.12: Windows Server 2008 does not support the IClusterFirewall DCOM interface.

<14> Section 3.13: Neither Windows Server 2008 nor Windows Vista SP1 supports the IClusterFirewall DCOM interface.

8 Change Tracking

This section identifies changes that were made to the [MS-CSVP] protocol document between the May 2011 and June 2011 releases. Changes are classified as New, Major, Minor, Editorial, or No change.

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

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

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

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

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

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

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

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

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

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

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

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

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

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
1.2 References	Added explanatory statement regarding the removal of the publishing year from Microsoft Open Specification document references.	N	Content updated.

9 Index

I

T

V