Windows Protocols Errata

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Errata are content issues in published versions of protocols documents that could impact an **implementation**. Examples of errata are errors or missing information in the normative sections of the Technical Specifications or in the use cases (examples) in the Technical Specifications and Overview Documents.

Content issues that don't impact an implementation, for example, editorial updates due to typos, formatting updates, and rewrites for readability and clarity, are **not** included in Errata.

The sections below list the Windows Protocols documents that contain active Errata (i.e., Errata not yet released with the documents on Docs.Microsoft.Com [DMC]) and provide links to archived Errata (i.e., Errata already released with the documents on DMC).

Protocols Documents with Active Errata

[MC-NMF]: .NET Message Framing Protocol

[MS-ADDM]: Active Directory Web Services: Data Model and Common Elements

[MS-ADFSPIP]: Active Directory Federation Services and Proxy Integration Protocol

[MS-ADSC]: Active Directory Schema Classes

[MS-ADTS]: Active Directory Technical Specification

[MS-CIFS]: Common Internet File System (CIFS) Protocol

[MS-CMRP]: Failover Cluster: Management API (ClusAPI) Protocol

[MS-CSRA]: Certificate Services Remote Administration Protocol

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

[MS-DFSC]: Distributed File System (DFS) Referral Protocol

[MS-DNSP]: Domain Name Service (DNS) Server Management Protocol

[MS-ECS]: Enterprise Client Synchronization Protocol

[MS-EMFPLUS]: Enhanced Metafile Format Plus Extensions

[MS-ERREF]: Windows Error Codes

[MS-EVEN]: EventLog Remoting Protocol

[MS-FRS2]: Distributed File System Replication Protocol

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[MS-FSA]: File System Algorithms

[MS-FSCC]: File System Control Codes

[MS-GPOL]: Group Policy: Core Protocol

[MS-NCNBI]: Network Controller Northbound Interface Specification

[MS-NLMP]: NT LAN Manager (NTLM) Authentication Protocol

[MS-NNS]: .NET NegotiateStream Protocol

[MS-NRPC]: Netlogon Remote Protocol

[MS-PAC]: Privilege Attribute Certificate Data Structure

[MS-PAR]: Print System Asynchronous Remote Protocol

[MS-RAI]: Remote Assistance Initiation Protocol

[MS-RDPBCGR]: Remote Desktop Protocol: Basic Connectivity and Graphics Remoting

[MS-RDPECAM]: Remote Desktop Protocol: Video Capture Virtual Channel Extension

[MS-RDPEDISP]: Remote Desktop Protocol: Display Update Virtual Channel Extension

[MS-RDPEGFX]: Remote Desktop Protocol: Graphics Pipeline Extension

[MS-RDPELE]: Remote Desktop Protocol: Licensing Extension

[MS-RDPEMT]: Remote Desktop Protocol: Multitransport Extension

[MS-RDPEPC]: Remote Desktop Protocol: Print Virtual Channel Extension

[MS-RDPERP]: Remote Desktop Protocol: Remote Programs Virtual Channel Extension

[MS-RDPEUDP]: Remote Desktop Protocol: UDP Transport Extension

[MS-RDPEUDP2]: Remote Desktop Protocol: UDP Transport Extension

[MS-RDPRFX]: Remote Desktop Protocol: RemoteFX Codec Extension

[MS-RPRN]: Print System Remote Protocol

[MS-RRP]: Windows Remote Registry Protocol

[MS-SAMR]: Security Account Manager (SAM) Remote Protocol (Client-to-Server)

[MS-SCMR]: Service Control Manager Remote Protocol

[MS-SFU]: Kerberos Protocol Extensions Service for User and Constrained Delegation Protocol

[MS-SMB2]: Server Message Block (SMB) Protocol Versions 2 and 3

[MS-SWN]: Service Witness Protocol

[MS-TDS]: Tabular Data Stream Protocol

[MS-TSTS]: Terminal Services Terminal Server Runtime Interface Protocol

[MS-WKST]: Workstation Service Remote Protocol

[MS-WMIO]: Windows Management Instrumentation Encoding Version 1.0 Protocol

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[MS-WUSP]: Windows Update Services: Client-Server Protocol

[MS-XCA]: Xpress Compression Algorithm

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[MC-DTCXA]: MSDTC Connection Manager OleTx XA Protocol

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[MC-NMF]: .NET Message Framing Protocol

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Errata below are for Protocol Document Version V9.0 – 2018/03/16.

Errata Published*	Description
2018/07/02	In Section 2.2.6, Preamble Message, the field descriptions have been modified as follows and have been moved to follow the packet diagram. Changed from: The VersionRecord MUST be formatted as specified in section 2.2.3.1. The ModeRecord MUST be formatted as specified in section 2.2.3.2. The ViaRecord MUST be formatted as specified in section 2.2.3.3. The EnvelopeEncodingRecord MUST be formatted as specified in section 2.2.3.4 Changed to: VersionRecord (3 bytes): This field MUST be formatted as specified in section 2.2.3.1. ModeRecord (2 bytes): This field MUST be formatted as specified in section 2.2.3.2. ViaRecord (variable): This field MUST be formatted as specified in section 2.2.3.3. EnvelopeEncodingRecord (variable): This field MUST be formatted as specified in section 2.2.3.4

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[MC-PRCR]: Peer Channel Custom Resolver Protocol

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[MS-ABTP]: Automatic Bluetooth Pairing Protocol

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[MS-ADA2]: Active Directory Schema Attributes M

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[MS-ADA3]: Active Directory Schema Attributes N-Z

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[MS-ADDM]: Active Directory Web Services: Data Model and Common Elements

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Errata below are for Protocol Document Version V15.0 – 2018/09/12.

Errata Published*	Description
2018/12/17	In Section 1.2.1, Normative References, the following reference has been deleted: [RFC4346] Dierks, T., and Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.1", RFC 4346, April 2006, http://www.ietf.org/rfc/rfc4346.txt In Section 2.1, Endpoints, changed from: The ADWS protocol set uses two types of authentication. Each endpoint (except for the "mex" endpoint) supports one or the other. The forms of authentication are: • Windows Integrated: These endpoints use Transport Layer Security (TLS) [RFC4346] to protect the TCP transport. Integrated Windows authentication using the .Net Negotiate Stream protocol [MS-NNS] is used to authenticate the client to the server at the transport layer and to negotiate the session key used for TLS. Changed to: The ADWS protocol set uses two types of authentication. Each endpoint (except for the "mex" endpoint) supports one or the other. The forms of authentication are: • Windows Integrated: These endpoints use integrated Windows authentication with the .Net Negotiate Stream protocol [MS-NNS] to authenticate the client and provide message security at the transport layer.

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[MS-ADFSOAL]: Active Directory Federation Services OAuth Authorization Code Lookup Protocol

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[MS-ADFSPIP]: Active Directory Federation Services and Proxy Integration Protocol

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Errata below are for Protocol Document Version V7.0 – 2018/09/12.

Errata Published*	Description
2019/05/27	In the sections listed below, the enum Certificate Type values have been changed from string to integer: Section 2.2.2.12, Port Type Section 2.2.2.14, TLS Query Behavior Section 2.2.2.15, Certificate Validation Section 2.2.2.16, Certificate Type Section 2.2.2.17, Error Type Section 3.10.5.1.1.3, Processing Details Section 3.10.5.1.1.3, Processing Details Section 3.11.5, Message Processing Events and Sequencing Rules Section 3.11.5.1, End-user X509 Certificate Success Processing Section 3.11.5.2, End-user X509 Certificate Common Processing Section 6, Appendix A: Full JSON Schema For details on the above changes, see the PDF doc here.
2019/05/27	In Section 3.10.5.1.1.2, Response Body, changed from: No response body is returned. Changed to: The response from the server MUST be returned to the client.

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[MS-ADFSWAP]: Active Directory Federation Service (AD FS) Web Agent Protocol

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[MS-ADLS]: Active Directory Lightweight Directory Services Schema

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[MS-ADSC]: Active Directory Schema Classes

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Errata below are for Protocol Document Version V23.0 – 2018/03/16.

Errata Published*	Description

2019/09/16	In Section 2.243, Class samDomain, changed from:
	
	`(OA;CIOI;RPWP;3f78c3e5-f79a-46bd-a0b8-9d18116ddc79;;PS)`
	`S:(AU;SA;WDWOWP;;;WD)(AU;SA;CR;;;BA)(AU;SA;CR;;;DU)`
	
	Changed to:
	
	`(OA;CIOI;RPWP;3f78c3e5-f79a-46bd-a0b8-9d18116ddc79;;PS)`
	`(OA;CIIO;SW;9b026da6-0d3c-465c-8bee-5199d7165cba;bf967a86-0de6-11d0-a285-00aa003049e2;PS)`
	`(OA;CIIO;SW;9b026da6-0d3c-465c-8bee-5199d7165cba;bf967a86-0de6-11d0-a285-00aa003049e2;CO)`
	`S:(AU;SA;WDWOWP;;;WD)(AU;SA;CR;;;BA)(AU;SA;CR;;;DU)`

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[MS-ADTS]: Active Directory Technical Specification

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Errata below are for Protocol Document Version V9.0 – 2019/03/13.

Errata Published*	Description
2019/09/16	In Section 2.2.20.5.2, KEY_USAGE_FIDO, changed from: authData: A base64-encoded public key. Changed to: authData: A base64-encoded Authenticator Data structure, as described in section 6.1 of [W3C-WebAuthPKC1].
2019/04/29	In Section 3.1.1.2.5, Schema Modifications, information about the error 'unwillingToPerform / ERROR_DS_CANT_CREATE_UNDER_SCHEMA', which occurs when attempting to add any object other than a schema object in the schema NC, has been added. Changed from: A Delete of an attributeSchema or classSchema object (5) fails, with error unwillingToPerform / ERROR_DS_CANT_DELETE. There is no constraint on the amount of time between when an object (5) in the schema NC is successfully added or modified and when the DC enforces the updated schema (1). …

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Errata Published*	Description
	Changed to: A Delete of an attributeSchema or classSchema object (5) fails, with error unwillingToPerform / ERROR_DS_CANT_DELETE. An attempt to add any object other than a schema object in the schema NC fails with the error unwillingToPerform / ERROR_DS_CANT_CREATE_UNDER_SCHEMA. There is no constraint on the amount of time between when an object (5) in the schema NC is successfully added or modified and when the DC enforces the updated schema (1). …

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[MS-AIPS]: Authenticated Internet Protocol

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[MS-APDS]: Authentication Protocol Domain Support

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[MS-AZOD]: Authorization Protocols Overview

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[MS-BKRP]: BackupKey Remote Protocol

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[MS-CAPR]: Central Access Policy Identifier (ID) Retrieval Protocol

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[MS-CDP]: Connected Devices Platform Protocol Version 3

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[MS-CHAP]: Extensible Authentication Protocol Method for Microsoft Challenge Handshake Authentication Protocol (CHAP)

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[MS-CFB]: Compound File Binary File Format

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[MS-CIFS]: Common Internet File System (CIFS) Protocol

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Errata below are for Protocol Document Version V28.0 – 2018/09/12.

Errata Published*	Description
2019/09/02	In Section 2.2.4.13.2, Response, the following error code has been added to the NT status code table: STATUS_LOCK_NOT_GRANTED (0xC0000055) In Section 3.3.1.7, Per Unique Open, the following ADM element has been added: Server.Open.LastFailedLockOffset: A 32-bit signed integer indicating the lock offset specified in SMB_COM_LOCK_BYTE_RANGE request, which the server failed. In Section 3.3.5.15, Receiving an SMB_COM_LOCK_BYTE_RANGE Request, the following has been changed from: In the event of an error, including failure to grant the lock on the byte range, the server MUST send an error response message. If the server cannot immediately grant the lock, the server SHOULD<265> reattempt the lock request for a brief interval, returning an error response with a Status of STATUS_FILE_LOCK_CONFLICT (ERRDOS/ERRlock) to the client if the lock cannot be granted. If the lock is successful, the server MUST construct an SMB_COM_LOCK_BYTE_RANGE Response (section 2.2.4.13.2) message. The response MUST be sent to the client as specified in section 3.3.4.1. An entry for the newly-granted byte-range lock MUST be added to Server.Open.Locks. The type of the lock MUST be exclusive, and the entry MUST be formatted with a 32-bit offset (LOCKING_ANDX_RANGE32). <264> Section 3.3.5.15: Windows-based servers request a byte-range lock from the underlying object store as described in [MS-FSA] section 2.1.5.7, with the following mapping of input elements:

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	• Open is the Open indicated by the SMB_Parameters.Words.FID field of the request. • FileOffset is the SMB_Parameters.Words.LockOffsetInBytes field of the request. • Length is the SMB_Parameters.Words.CountOfBytesToLock field of the request. • ExclusiveLock – TRUE • FailImmediately – TRUE • LockKey is set to ((Open.FID << 16) | Open.PID.PIDLow). The returned Status is copied into the SMB_Header.Status field of the response. Changed to: If the server cannot immediately grant the lock, the server SHOULD<265> reattempt the lock request for a brief interval. In the event of an error, including failure to grant the lock on the byte range, the server MUST send an error response message. If the underlying object store returns STATUS_CANCELLED, the server MUST set SMB_Header.Status field of the response to STATUS_FILE_LOCK_CONFLICT (ERRDOS/ERRlock). For any other error, status returned MUST be copied into SMB_Header.Status field of the response. The server MUST set Server.Open.LastFailedLockOffset to LockOffsetInBytes field of the request. If the lock is successful, the server MUST construct an SMB_COM_LOCK_BYTE_RANGE Response (section 2.2.4.13.2) message. The response MUST be sent to the client as specified in section 3.3.4.1. An entry for the newly-granted byte-range lock MUST be added to Server.Open.Locks. The type of the lock MUST be exclusive, and the entry MUST be formatted with a 32-bit offset (LOCKING_ANDX_RANGE32). The server MUST set Server.Open.LastFailedLockOffset to -1. <264> Section 3.3.5.15: Windows-based servers request a byte-range lock from the underlying object store as described in [MS-FSA] section 2.1.5.7, with the following mapping of input elements: • Open is the Open indicated by the SMB_Parameters.Words.FID field of the request. • FileOffset is the SMB_Parameters.Words.LockOffsetInBytes field of the request. • Length is the SMB_Parameters.Words.CountOfBytesToLock field of the request. • ExclusiveLock – TRUE • FailImmediately – FALSE, if Server.Open.LastFailedLockOffset is equal to LockOffsetInBytes field of the request. Otherwise - TRUE LockKey is set to ((Open.FID << 16) | Open.PID.PIDLow).
2018/10/29	In Section 3.2.4.44, Application Requests Querying DFS Referrals, the following has been changed from:

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	An input buffer containing the application-provided REQ_GET_DFS_REFERRAL structure. Changed to: An input buffer containing the application-provided REQ_GET_DFS_REFERRAL structure specifiedin [MS-DFSC] section 2.2.2. In Section 3.4.4.9, A Local Client Application Queries DFS Referrals, the following has been changed from: An input buffer containing the application-provided REQ_GET_DFS_REFERRAL or REQ_GET_DFS_REFERRAL_EX structure. Changed to: An input buffer containing the application-provided structure REQ_GET_DFS_REFERRAL specified in [MS-DFSC] section 2.2.2 or REQ_GET_DFS_REFERRAL_EX specified in [MS-DFSC] section 2.2.3.

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[MS-CMRP]: Failover Cluster: Management API (ClusAPI) Protocol

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Errata below are for Protocol Document Version V36.0 – 2019/03/13.

Errata Published*	Description

2019/08/19	A new section has been added to define the STORAGE_MEDIA_TYPE enumeration.
	Added:
	
	2.2.2.27 STORAGE_MEDIA_TYPE
	
	The STORAGE_MEDIA_TYPE enumeration defines the possible values of media type.
	typedef enum STORAGE_MEDIA_TYPE
	
	`{`
	`  UNKNOWN = 0x00000000,`
	`  DISK = 0x00000003,`
	`  SSD = 0x00000004,`
	`  SCM = 0x00000005`
	`};`
	
	In Section 2.2.3.51, CLUS_PHYSICAL_DISK_INFO, a reference has been added to the new section 2.2.2.27, STORAGE_MEDIA_TYPE, where the STORAGE_MEDIA_TYPE enumeration is defined.
	
	Changed from:
	...
	
	MediaType (4 bytes): A media type enumerated by STORAGE_MEDIA_TYPE.
	
	...
	
	Changed to:

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Errata Published*	Description
	... MediaType (4 bytes): A media type enumerated by STORAGE_MEDIA_TYPE, as specified in section 2.2.2.27. ... In Section 3.1.4.2.141, ApiExecuteReadBatch (Opnum 145), the description of the successful completion of the ApiExecuteReadBatch method has been revised to more clearly indicate that CLUSREG_READ_VALUE is a command type, which is defined previously in the section. Changed from: ... If the read operation is successful, a CLUS_REG_READ_VALUE BATCH_UPDATE_COMMAND is returned with its Data and ValueType fields filled out. ... Changed to: ... If the read operation is successful, a BATCH_UPDATE_COMMAND of command type CLUSREG_READ_VALUE is returned with its Data and ValueType fields filled out. ...
2019/08/19	In Section 2.2.3.37, SR_RESOURCE_TYPE_ELIGIBLE_DISKS_RESULT, the missing underscore in the structure name has been added. Changed from: ... The SR_RESOURCE_TYPE_ELIGIBLE DISKS_RESULT structure SHOULD<33> be used to return a list of disks for storage replication. It is a custom-marshalled structure that contains the following fields. ... - - - -

Errata Published*	Description
	The SR_RESOURCE_TYPE_ELIGIBLE_DISKS_RESULT structure SHOULD<33> be used to return a list of disks for storage replication. It is a custom-marshalled structure that contains the following fields. ... In Section 2.2.3.41, SR_RESOURCE_TYPE_REPLICATED_DISKS_RESULT, the description for ReplicatedDisks was revised to include a descriptor. Changed from: ... ReplicatedDisks (variable): An array of SR_RESOURCE_TYPE_REPLICATED_DISKs, each representing a replicated disk in the cluster state. ... Changed to: ... ReplicatedDisks (variable): An array of SR_RESOURCE_TYPE_REPLICATED_DISK elements, each representing a replicated disk in the cluster state. ... In Section 3.1.1.12, Cluster Version, the missing "_CLEAR" in the name of the second section referenced has been added. Changed from: ... Upgrade: Upgrades the cluster to a higher supported version (Protocol Version 3 only). For more information, see CLUSCTL_CLUSTER_UPGRADE_CLUSTER_VERSION (section 3.1.4.3.7.18), CLUSCTL_CLUSTER_UPGRADE_IN_PROGRESS (section 3.1.4.3.7.19), and CLUSCTL_CLUSTER_IS_READY_FOR_UPGRADE (section 3.1.4.3.7.20). ... Changed to: ... Upgrade: Upgrades the cluster to a higher supported version (Protocol Version 3 only). For more information, see CLUSCTL_CLUSTER_UPGRADE_CLUSTER_VERSION (section 3.1.4.3.7.18), CLUSCTL_CLUSTER_CLEAR_UPGRADE_IN_PROGRESS (section 3.1.4.3.7.19), and CLUSCTL_CLUSTER_IS_READY_FOR_UPGRADE (section 3.1.4.3.7.20). ... In Section 7, Appendix B: Product Behavior, the missing underscore in the name of the structure has been added.

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	Changed from: ... <33> Section 2.2.3.37: The SR_RESOURCE_TYPE_ELIGIBLE_DISKS RESULT structure is not implemented in Windows NT 4.0 SP3, Windows NT 4.0 SP4, Windows 2000, Windows XP, Windows Server 2003, Windows Vista SP1, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, and Windows Server 2012 R2. ... Changed to: ... <33> Section 2.2.3.37: The SR_RESOURCE_TYPE_ELIGIBLE_DISKS_RESULT structure is not implemented in Windows NT 4.0 SP3, Windows NT 4.0 SP4, Windows 2000, Windows XP, Windows Server 2003, Windows Vista SP1, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, and Windows Server 2012 R2. ...

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[MS-COMA]: Component Object Model Plus (COMplus) Remote Administration Protocol

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[MS-CSRA]: Certificate Services Remote Administration Protocol

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Errata below are for Protocol Document Version V38.0 – 2018/09/12.

Errata Published*	Description
2019/03/18	In this document, changed the default value of the CA for Windows Server 2019. In Section 3.1.4.2.14, ICertAdminD2::GetConfigEntry (Opnum 44), changed from: … 8. For each input in the left column of the table below, the CA MUST perform the processing rules in the corresponding cell in the right column. Input Parameters / Processing rule for pVariant … / … pwszNodePath is EMPTY and pwszEntry is "Version" / The CA MUST return the value of the OnNextRestart_Config_Product_Version ADM element as a VARIANT. The vt member of the VARIANT MUST be set to VT_I4 and the lVal member MUST be set to the one of the following values: 0x00010001 – Server is Windows 2000 Server operating system 0x00020002 – Server is Windows Server 2003 operating system 0x00030001 – Server is Windows Server 2008 operating system 0x00040001 – Server is Windows Server 2008 R2 operating system 0x00050001 – Server is Windows Server 2012 operating system 0x00060001 – Server is Windows Server 2012 R2 operating system <72>

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Errata Published*	Description
	<table><tr><td></td><td>0x00070001 – Server is Windows Server 2016 operating system 0x00080001 – Server is Windows Server 2019 operating system</td></tr><tr><td>…</td><td>…</td></tr></table> Changed to: … 8. For each input in the left column of the table below, the CA MUST perform the processing rules in the corresponding cell in the right column. <table><tr><th>Input Parameters</th><th>Processing rule for pVariant</th></tr><tr><td>…</td><td>…</td></tr><tr><td>pwszNodePath is EMPTY and pwszEntry is "Version"</td><td>The CA MUST return the value of the OnNextRestart_Config_Product_Version ADM element as a VARIANT. The vt member of the VARIANT MUST be set to VT_I4 and the lVal member MUST be set to the one of the following values: 0x00010001 – Server is Windows 2000 Server operating system 0x00020002 – Server is Windows Server 2003 operating system 0x00030001 – Server is Windows Server 2008 operating system 0x00040001 – Server is Windows Server 2008 R2 operating system 0x00050001 – Server is Windows Server 2012 operating system 0x00060001 – Server is Windows Server 2012 R2 operating system <72> 0x00070001 – Server is Windows Server 2016 operating system or Windows Server 2019 operating system</td></tr><tr><td>…</td><td>…</td></tr></table> In Section 7, Appendix B: Product Behavior, changed from: <11> Section 3.1.1.10: Microsoft CAs persist only a subset of the configuration data. They store the configuration data in the registry in the following locations: … Version ADM Datum: Config_Product_Version and OnNextRestart_Config_Product_Version Registry Value Type: REG_DWORD

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Errata Published*	Description
	Default Value: By default, the value depends on the Windows version: … 0x00080001: Windows Server 2019 Changed to: <11> Section 3.1.1.10: Microsoft CAs persist only a subset of the configuration data. They store the configuration data in the registry in the following locations: … Version ADM Datum: Config_Product_Version and OnNextRestart_Config_Product_Version Registry Value Type: REG_DWORD Default Value: By default, the value depends on the Windows version: … 0x00070001: Windows Server 2016 or Windows Server 2019

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[MS-CSSP]: Credential Security Support Provider (CredSSP) Protocol

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

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Errata below are for Protocol Document Version V27.0 – 2019/03/13.

Errata Published*	Description

2019/08/05	In Section 3.2.4.4, CprepPrepareNodePhase2 (Opnum 6), more detail has been added to clarify server processing steps for this call.
	
	Changed from:
	...
	
	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
	
	Changed to:
	...
	
	When processing this call, the server MUST do the following:
	• Determine the number of disks accessible to the system in an implementation-specific way.
	• If the Flags field includes ForceOfflineNonClusteredDisks but does not include SkipNonClusteredPools, detach spaces using non-clustered pools before including them in disks eligible for validation.
	• If the Flags field includes SkipNonClusteredPools, skip non-clustered pools for validation.
	• If the Flags field includes neither ForceOfflineNonClusteredDisks nor SkipNonClusteredPools, skip non-clustered pools with attached spaces for validation.

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Errata Published*	Description

	• 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 the number of disks in ClusPrepDiskList.
	• Set the server Prepare State to Online.
	The server returns the following information to the client:
	• pulNumDisks

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[MS-DCOM]: Distributed Component Object Model (DCOM) Remote Protocol

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[MS-DFSC]: Distributed File System (DFS) Referral Protocol

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Errata below are for Protocol Document Version V28.0 – 2018/09/12.

Errata Published*	Description
2018/10/29	In Section 3.1.4.2, Sending a DFS Referral Request to the Server, the following has been changed from: The client MUST query the DFS referral, as specified in [MS-CIFS] section 3.4.4.9, by passing ClientGenericContext, HostName, UserCredentials, MaxOutputSize, the REQ_GET_DFS_REFERRAL_EX or REQ_GET_DFS_REFERRAL structure as the input buffer, and the FSCTL code set to FSCTL_DFS_GET_REFERRALS or FSCTL_DFS_GET_REFERRALS_EX based on the input buffer. Changed to: The client MUST query the DFS referral, as specified in [MS-CIFS] section 3.4.4.9, by passing ClientGenericContext, HostName, UserCredentials, MaxOutputSize, the REQ_GET_DFS_REFERRAL_EX or REQ_GET_DFS_REFERRAL structure as the input buffer, and the FSCTL code set to FSCTL_DFS_GET_REFERRALS, if the input buffer is an REQ_GET_DFS_REFERRAL, or FSCTL_DFS_GET_REFERRALS_EX, if the input buffer is an REQ_GET_DFS_REFERRAL_EX.

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[MS-DHCPM]: Microsoft Dynamic Host Configuration Protocol (DHCP) Server Management Protocol

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[MS-DNSP]: Domain Name Service (DNS) Server Management Protocol

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Errata below are for Protocol Document Version V35.0 – 2019/03/13.

Errata Published*	Description
2019/04/29	In Section 2.2.15.1.1.6, DNS_RPC_CRITERIA_ENUM, a product behavior note has been updated to indicate a change in the product versions that support the DnsPolicyCriteriaEDNSSubnet policy. Changed from: DnsPolicyCriteriaEDNSSubnet: Usage of this enum constant will fail the request with Win32 Error-9974 (DNS_ERROR_POLICY_INVALID_SETTINGS).<90> <90> Section 2.2.15.1.1.6: DnsPolicyCriteriaEDNSSubnet is not implemented in Windows Server v1809 operating system and earlier. Changed to: DnsPolicyCriteriaEDNSSubnet: Usage of this enum constant will fail the request with Win32 Error-9974 (DNS_ERROR_POLICY_INVALID_SETTINGS).<90> <90> Section 2.2.15.1.1.6: DnsPolicyCriteriaEDNSSubnet is implemented in Windows Server v1809 operating system with [MSKB-4497934] and later. Also, in Section 1.2.1, Normative References, the following reference has been added: [MSKB-4497934] Microsoft Corporation, "May 20, 2019 - KB4497934", https://support.microsoft.com/en-us/help/4497934

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[MS-DPWSSN]: Devices Profile for Web Services (DPWS) Size Negotiation Extension

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[MS-DRSR]: Directory Replication Service (DRS) Remote Protocol

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[MS-DTCO]: MSDTC Connection Manager: OleTx Transaction Protocol

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[MS-DSCPM]: Desired State Configuration Pull Model Protocol

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[MS-DTYP]: Windows Data Types

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[MS-DVRD]: Device Registration Discovery Protocol

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[MS-DVRE]: Device Registration Enrollment Protocol

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[MS-DVRJ]: Device Registration Join Protocol

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[MS-ECS]: Enterprise Client Synchronization Protocol

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Errata below are for Protocol Document Version V9.0 – 2018/09/12.

Errata Published*	Description
2019/09/16	In Section 3.4.5.3.1.3, Processing Details, the following was changed from: Otherwise, if FileMetadata.RemoteStreamId is not equal to StreamId, and FileSize is greater than the space available for a user, the server MUST set ProtocolType to 0x00 and MUST set PrepareResult to ERROR_DISK_FULL, as specified in [MS-ERREF] section 2.1.1. Changed to: Otherwise, if FileMetadata.FileStreamId is not equal to FILE_INFO_INPUT_ENTRY.StreamId, and FILE_INFO_INPUT_ENTRY.FileSize is greater than the space available for a user, the server MUST set ProtocolType to 0x00 and MUST set PrepareResult to ERROR_DISK_FULL, as specified in [MS-ERREF] section 2.1.1.

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[MS-EFSR]: Encrypting File System Remote (EFSRPC) Protocol

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[MS-EMF]: Enhanced Metafile Format

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[MS-EMFPLUS]: Enhanced Metafile Format Plus Extensions

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td>2018/12/10</td><td>In this document several sections have been modified to reference [MS-LCID], the Windows Language Code Identifier (LCID) Reference.

In Section 1.6, Versioning and Localization, changed from:

Localization: EMF+ structures contain the following locale-specific data:
• Language identifiers that correspond to natural languages in locales, including countries, geographical regions, and administrative districts. For details, see the LanguageIdentifier enumeration.

Changed to:
Localization: EMF+ structures contain the following locale-specific data:
• Language identifiers that correspond to natural languages in locales, including countries, geographical regions, and administrative districts. For details, see [MS-LCID] section 2.1.

In Section 2.1.1, Enumeration Constant Types, changed from:

<table>
<tr><th>Name</th><th>Section</th><th>Description</th></tr>
<tr><td>LineCapTypeLanguageIdentifier</td><td>2.1.1.17</td><td>Defines identifiers for natural languages in locales, including countries, geographical regions, and administrative districts. Defines types of line caps to use at the ends of lines that are drawn with graphics pens.</td></tr>
</table>

Changed to:</td></tr>
</table>

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><th>Name</th><th>Section</th><th>Description</th></tr>
<tr><td>LineCapType</td><td>2.1.1.17</td><td>Defines types of line caps to use at the ends of lines that are drawn with graphics pens.</td></tr>
</table>

In Section 2.1.1.17, LanguageIdentifier Enumeration, the section title and introduction have been changed.

Changed from:
2.1.1.17 LanguageIdentifier Enumeration
The LanguageIdentifier enumeration defines identifiers for natural languages in locales, including countries, geographical regions, and administrative districts.

Changed to:
2.1.1.17 LineCapType Enumeration
The LineCapType enumeration defines types of line caps to use at the ends of lines that are drawn with graphics pens.

In Section 2.2.2.23, EmfPlusLanguageIdentifier Object, changed from:
…
The encoded language identifier values are defined in the LanguageIdentifier enumeration.
…

Changed to:
…
The encoded LCID values are defined in [MS-LCID] section 2.2.
…

Section 2.1.3.2, Language Identifiers, has been removed.</td></tr>
<tr><td>2018/11/26</td><td>In Section 2.1.1, Enumeration Constant Types, the “WrapMode” enumeration has been added to the list of defined enumerations.

Added:

<table>
<tr><th>Name</th><th>Section</th><th>Description</th></tr>
<tr><td>…</td><td>…</td><td>…</td></tr>
<tr><td>WrapMode</td><td>2.1.1.34</td><td>Defines how the pattern from a texture or gradient brush is tiled across a shape or at shape boundaries.</td></tr>
</table>
</td></tr>
</table>

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>
In Section 2.1.2, Bit Flag Constant Types, the "PathPointType" enumeration has been added to the list of defined flags.

Added:

<table>
<tr><th>Name</th><th>Section</th><th>Description</th></tr>
<tr><td>…</td><td>…</td><td>…</td></tr>
<tr><td>PathPointType</td><td>2.1.2.6</td><td>Specifies the type properties of points on graphics paths.</td></tr>
<tr><td>…</td><td>…</td><td>…</td></tr>
</table>
In Section 2.3.8.1, EmfPlusSetTSClip, the name of the "Rects" field has been changed to "rects" throughout the section. For example, changed from:

rects (variable): An array of NumRects rectangles that define clipping areas. The format of this data is determined by the C bit in the Flags field.
The compression scheme for data in this record uses the following algorithm. Each point of each rectangle is encoded in either a single byte or 2 bytes. If the point is encoded in a single byte, the high bit (0x80) of the byte MUST be set, and the value is a signed number represented by the lower 7 bits. If the high bit is not set, then the value is encoded in 2 bytes, with the high-order byte encoded in the 7 lower bits of the first byte, and the low-order byte value encoded in the second byte.
Each point is encoded as the difference between the point in the current rect and the point in the previous rect. The bottom point of the rect is encoded as the difference between the bottom coordinate and the top coordinate on the current rect.
See section 2.3.8 for the specification of additional terminal server record types.

Changed to:

Rects (variable): An array of NumRects rectangles that define clipping areas. The format of this data is determined by the C bit in the Flags field.
The compression scheme for data in this record uses the following algorithm. Each point of each rectangle is encoded in either a single byte or 2 bytes. If the point is encoded in a single byte, the high bit (0x80) of the byte MUST be set, and the value is a signed number represented by the lower 7 bits. If the high bit is not set, then the value is encoded in 2 bytes, with the high-order byte encoded in the 7 lower bits of the first byte, and the low-order byte value encoded in the second byte.
Each point is encoded as the difference between the point in the current rectangle and the point in the previous rectangle. The bottom point of the rectangle is encoded as the difference between the bottom coordinate and the top coordinate on the current rectangle.
See section 2.3.8 for the specification of additional terminal server record types.
</td></tr>
</table>

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[MS-ERREF]: Windows Error Codes

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Errata below are for Protocol Document Version V19.0 – 2018/09/12.

Errata Published*	Description
2019/08/05	In the Section 1.1, Glossary, the entry for the term message identifier, which is at odds with the definition in Section 2.2, has been removed.

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[MS-EVEN]: EventLog Remoting Protocol

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Errata below are for Protocol Document Version V22.0 – 2018/09/12.

Errata Published*	Description
2019/09/02	In Section 2.2.6, Handles, the section name has been changed to reflect the name of the type it describes. Changed from: 2.2.6 Handles Changed to: 2.2.6 IELF_HANDLE In Section 3.1.4.7, ElfrReadELW (Opnum 10), the name of the EVENTLOG_BACKWARDS_READ flag contained a misspelling in one place. Changed from: … If neither of the two flags are set, the server will treat it as if the EVENTLOG_BACKWORDS_READ flag is set. ... Changed to: … If neither of the two flags are set, the server will treat it as if the EVENTLOG_BACKWARDS_READ flag is set. ...

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[MS-EVEN6]: EventLog Remoting Protocol Version 6.0

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[MS-FASP]: Firewall and Advanced Security Protocol

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[MS-FAX]: Fax Server and Client Remote Protocol

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[MS-FRS2]: Distributed File System Replication Protocol

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Errata below are for Protocol Document Version V28.0 – 2018/09/12.

Errata Published*	Description
2019/02/19	In Section 1.2.1, Normative References, the following reference has been added: [MS-XCA] Microsoft Corporation, "Xpress Compression Algorithm". In Section 2.2.1.4.15, XPRESS Block, the Block Data field has been changed from: If the value of the Block Compressed Size field is less than the value of the Block Uncompressed Size field, then the data has been compressed. For more information about decompressing compressed data, see section 3.1.1.1.3.9. Changed to: If the value of the Block Compressed Size field is less than the value of the Block Uncompressed Size field, then the data has been compressed. For more information about decompressing compressed data, see section 3.1.1.2. In Section 3.1.1.1, Compression, the following was changed from: Many of the FrsTransport methods use compression to reduce the amount of data that is returned to the client. This section describes algorithms and a conceptual model of possible data organization that an implementation maintains in order to decompress compressed data. The described organization is provided to facilitate the explanation of how the algorithm behaves. Error checking and handling has been omitted from all algorithms in the interests of clarity. This document does not mandate that implementations adhere to this model as long as their external behavior is consistent with what is described in this document. Changed to: Many of the FrsTransport methods use the LZ77+Huffman Compression algorithm, specified in [MS-XCA] section 2.1, to compress data. This document does not mandate that implementations adhere to this model as long as their external behavior is consistent with what is described in this document.

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Errata Published*	Description
	The following sections have been removed and replaced with links to MS-XCA: 3.1.1.1.1 Pseudocode Conventions 3.1.1.1.2 Data Structures 3.1.1.1.2.1 PREFIX_CODE_NODE 3.1.1.1.2.2 PREFIX_CODE_SYMBOL 3.1.1.1.2.3 BITSTRING 3.1.1.1.3 Procedures 3.1.1.1.3.1 PrefixCodeTreeRebuild 3.1.1.1.3.2 PrefixCodeTreeAddLeaf 3.1.1.1.3.3 SortSymbols 3.1.1.1.3.4 CompareSymbols 3.1.1.1.3.5 BitstringInit 3.1.1.1.3.6 BitstringLookup 3.1.1.1.3.7 BitstreamSkip 3.1.1.1.3.8 PrefixCodeTreeDecodeSymbol A new section, 3.1.1.2, Decompression, has been added: FrsTransport methods that compress data will always return information specifying the size of the original data. It is the caller's responsibility to determine whether the returned data is compressed. If the size of the compressed data buffer that is returned by the server in bytes is equal to the size in bytes of the original uncompressed data, then the buffer returned by the server contains uncompressed data. In Section 3.2.4.1.7, RequestRecords (Opnum 6), the description of the compressedRecords field has been changed from: compressedRecords: The data records, compressed using the DFS-R compression algorithm specified in section 3.1.1.1. The compressedRecords bytes correspond to an array of FRS_ID_GVSN entries. DFS-R uses custom marshaling in this RPC call to compress the set of transmitted records. The size of the FRS_ID_GVSN array is given by the numRecords parameter. The decompression algorithm specified in section 3.1.1.1.3.9 can be used to decompress the received data into a buffer of sizeof(FRS_ID_GVSN)*numRecords bytes, which can be re-interpreted as an array of FRS_ID_GVSN entries. Changed to: compressedRecords: The data records, compressed using the algorithm specified in section 3.1.1.1. The compressedRecords bytes correspond to an array of FRS_ID_GVSN entries. DFS-R uses custom marshaling in this RPC call to compress the set of transmitted records. The size of the FRS_ID_GVSN array is given by the numRecords parameter. The decompression algorithm specified in section 3.1.1.1 can be used to decompress the received data into a buffer of sizeof(FRS_ID_GVSN)*numRecords bytes, which can be re-interpreted as an array of FRS_ID_GVSN entries. In Section 3.2.4.1.14, InitializeFileTransferAsync (Opnum 13), changed from: 2. An encapsulation of the marshaled file data stream using the compressed data format (as specified in section 3.2.4.1.14.2) generated by the DFS-R compression

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Errata Published*	Description
	algorithm specified in section 3.1.1.1. Even if the marshaled file data stream is not compressed by the server, it is still encapsulated using the compressed data format. Changed to: 2. An encapsulation of the marshaled file data stream using the compressed data format (as specified in section 3.2.4.1.14.2) generated by the compression algorithm specified in section 3.1.1.1. Even if the marshaled file data stream is not compressed by the server, it is still encapsulated using the compressed data format.

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[MS-FSA]: File System Algorithms

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Errata below are for Protocol Document Version V29.0 – 2019/05/30.

Errata Published*	Description
2019/09/02	In Section 2.1.1.1, Per Volume, a new ADM element has been added: • ReservedSpace: A 64-bit unsigned integer specifying the amount of free space of the volume in bytes that is reserved for implementation specific use and not available to callers. This value MUST be a multiple of ClusterSize and MUST be less than or equal to Volume.FreeSpace. In Section 2.1.5.9.11, FSCTL_GET_NTFS_VOLUME_DATA, the following bullet point has been changed from: OutputBuffer.TotalReserved set to an implementation-specific value. Changed to: OutputBuffer.TotalReserved set to Open.File.Volume.ReservedSpace / Open.File.Volume.ClusterSize. In Section 2.1.5.9.12, FSCTL_GET_REFS_VOLUME_DATA, the following bullet point has been changed from: OutputBuffer.TotalReserved set to an implementation-specific value.

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Errata Published*	Description
	Changed to: OutputBuffer.TotalReserved set Open.File.Volume.ReservedSpace / Open.File.Volume.ClusterSize. In Section 2.1.5.12.3, FileFsSizeInformation, the following bullet points have been changed from: OutputBuffer.AvailableAllocationUnits set to Open.File.Volume.FreeSpace / Open.File.Volume.ClusterSize. If RemainingQuota < Open.File.Volume.FreeSpace: Changed to: OutputBuffer.AvailableAllocationUnits set to (Open.File.Volume.FreeSpace - Open.File.Volume.ReservedSpace) / Open.File.Volume.ClusterSize. If RemainingQuota < (Open.File.Volume.FreeSpace - Open.File.Volume.ReservedSpace): In Section 2.1.5.12.7, FileFsFullSizeInformation, the following bullet points have been changed from: OutputBuffer.CallerAvailableAllocationUnits set to Open.File.Volume.FreeSpace / Open.File.Volume.ClusterSize. OutputBuffer.ActualAvailableAllocationUnits set to Open.File.Volume.FreeSpace / Open.File.Volume.ClusterSize. If RemainingQuota < Open.File.Volume.FreeSpace: Changed to: OutputBuffer.CallerAvailableAllocationUnits set to (Open.File.Volume.FreeSpace - Open.File.Volume.ReservedSpace) / Open.File.Volume.ClusterSize. OutputBuffer.ActualAvailableAllocationUnits set to (Open.File.Volume.FreeSpace - Open.File.Volume.ReservedSpace) / Open.File.Volume.ClusterSize. If RemainingQuota < (Open.File.Volume.FreeSpace - Open.File.Volume.ReservedSpace):
2019/07/08	In Section 2.1.5.11.28, FileStandardLinkInformation, the error code was changed from: This operation is not supported and MUST be failed with STATUS_INVALID_INFO_CLASS. Changed to: This operation is not supported and MUST be failed with STATUS_NOT_SUPPORTED.

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[MS-FSCC]: File System Control Codes

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Errata below are for Protocol Document Version V45.0 – 2018/09/12.

Errata Published*	Description
2019/08/05	In Section 2.3.42, FSCTL_QUERY_FILE_REGIONS Reply, the length of the Region field has been changed from 24 bytes to variable.
2019/08/05	In Section 2.3.41, FSCTL_QUERY_FILE_REGIONS Request, a new Reserved field has been added to the end of the data element. Added: Reserved (4 bytes): A 32-bit unsigned integer that is reserved. This field SHOULD be 0x00000000 and MUST be ignored.
2019/08/05	In Section 2.3.41, FSCTL_QUERY_FILE_REGIONS Request, new product behavior notes have been added to FILE_REGION_USAGE_VALID_CACHED_DATA and FILE_REGION_USAGE_VALID_NONCACHED_DATA. Added: <30> Section 2.3.41: This region usage flag can only be specified for volumes using the NTFS file system. <31> Section 2.3.41: This region usage flag can only be specified for volumes using the ReFS file system. In Section 2.3.42.1, FILE_REGION_INFO, the DesiredUsage field has been changed from: DesiredUsage (4 bytes): A 32-bit unsigned integer that indicates the usage for the given region of the file. The valid values are defined in section 2.3.41.

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>Changed to:

DesiredUsage (4 bytes): A 32-bit unsigned integer that indicates the usage for the given region of the file.
<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>0x00000000</td><td>The given range is invalid. It does not match the criteria of the requested DesiredUsage as specified in section 2.3.41.</td></tr><tr><td>FILE _USAGE_VALID_CACHED_DATA 0x00000001</td><td>Defines those regions of the file that exists before VDL as it exists in the cache manager.<32></td></tr><tr><td>FILE _USAGE_VALID_NONCACHED_DATA 0x00000002</td><td>Defines those regions of the files that exist before VDL on the storage device.<33></td></tr></table>
<32> Section 2.3.42.1: The NTFS file system is the only file system that returns this region usage value.
<33> Section 2.3.42.1: The ReFS file system is the only file system that returns this region usage value.</td></tr>
<tr><td>2018/12/10</td><td>In Section 2.1.5, Pathname, the following has been removed:

• Each pathname component MUST be no more than 255 characters in length.

In Section 2.1.5.2, Filename, the following has been added:

• A filename MUST be at least one character but no more than 255 characters in length.

In Section 2.1.5.3, Streamname, the following has been added:

• A streamname MUST be no more than 255 characters in length.</td></tr>
<tr><td>2018/12/10</td><td>In Section 2.3.9.2, SMB2_DUPLICATE_EXTENTS_DATA_EX, a new field called Reserved has been added to the packet diagram and the field descriptions.

Added:

Reserved (4 bytes): This field SHOULD be set to zero and MUST be ignored.</td></tr>
<tr><td>2018/11/12</td><td>In the sections listed below, the description of the EaSize field has been changed.

Section 2.4.8, FileBothDirectoryInformation
Section 2.4.14, FileFullDirectoryInformation
Section 2.4.17, FileIdBothDirectoryInformation
Section 2.4.18, FileIdFullDirectoryInformation</td></tr>
</table>

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>Changed from:

EaSize (4 bytes): A 32 -bit unsigned integer that contains the combined length, in bytes, of the extended attributes (EA) for the file.

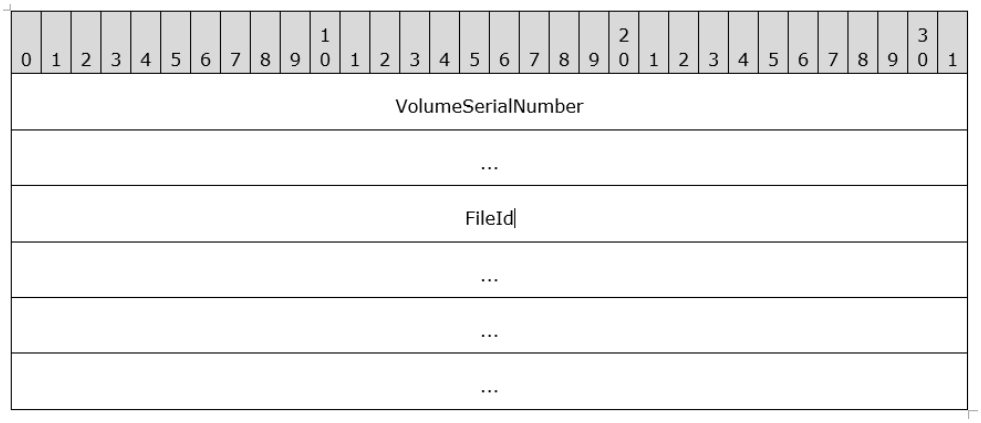
Changed to:

EaSize (4 bytes): If FILE_ATTRIBUTE_REPARSE_POINT is set in the FileAttributes field, this field MUST contain a reparse tag as specified in section 2.1.2.1. Otherwise, this field is a 32 -bit unsigned integer that contains the combined length, in bytes, of the extended attributes (EA) for the file.,</td></tr>
<tr><td>2018/11/12</td><td>In Section 2.4, File Information Classes, the following has been added:

<table>
<tr><th>File information class</th><th>Level</th><th>Uses</th></tr>
<tr><td>…</td><td>…</td><td>…</td></tr>
<tr><td>FileIdInformation</td><td>59</td><td>Query<78></td></tr>
<tr><td>…</td><td>…</td><td>…</td></tr>
</table>
<78> Section 2.4: The FileIdInformation information class is supported in the NTFS and ReFS file systems in Windows 8 and subsequent and Windows Server 2012 and subsequent.

The following new section has been added:

Section 2.4.43 FileIdInformation
This information class is used to query the volume serial number and fileid information for a file.
A FILE_ID_INFORMATION data element, defined as follows, is provided by the server.



VolumeSerialNumber (8 bytes): A 64-bit unsigned integer that contains the serial number of the volume where the file is located.
FileId (16 bytes): An opaque 128-bit signed integer that is an identifier of the file. For file systems that support file identifiers that are less than 128 bits, the unsupported portions of this value MUST be set to zero.<121></td></tr>
</table>

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>This operation returns a status code as specified in section 2.2. Upon success, the status code returned by the function that processes this file information class is STATUS_SUCCESS. The most common error codes are listed in the following table.
<table>
<tr><th>Error Code</th><th>Meaning</th></tr>
<tr><td>STATUS_INFO_LENGTH_MISMATCH
0xC0000004</td><td>The specified information record length does not match the length that is required for the specified information class.</td></tr>
</table>
</td></tr>
</table>

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[MS-FSRVP]: File Server Remote VSS Protocol

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[MS-FSVCA]: File Set Version Comparison Algorithms

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[MS-GPPREF]: Group Policy: Preferences Extension Data Structure

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[MS-GPSB]: Group Policy: Security Protocol Extension

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[MS-GPOL]: Group Policy: Core Protocol

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Errata Published*	Description
2019/05/27	In Section 2.2.4, GPO Search, changed from: The gpt.ini file MUST be encoded in UTF-8 and is described with the following Augmented Backus-Naur Form (ABNF), as specified in [RFC4234]. Changed to: The gpt.ini file MUST be encoded in ANSI and is described with the following Augmented Backus-Naur Form (ABNF), as specified in [RFC4234].

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[MS-GSSA]: Generic Security Service Algorithm for Secret Key Transaction Authentication for DNS (GSS-TSIG) Protocol Extension

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[MS-HGSA]: Host Guardian Service: Attestation Protocol

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[MS-HTTPE]: Hypertext Transfer Protocol (HTTP) Extensions

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[MS-HVRS]: Hyper-V Remote Storage Profile

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[MS-ICPR]: ICertPassage Remote Protocol

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[MS-IKEE]: Internet Key Exchange Protocol Extensions

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[MS-IPAMM2]: IP Address Management (IPAM) Management Protocol Version 2

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[MS-IPHTTPS]: IP over HTTPS (IP-HTTPS) Tunneling Protocol

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[MS-IRP]: Internet Information Services (IIS) Inetinfo Remote Protocol

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[MS-KILE]: Kerberos Protocol Extensions

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[MS-KPP]: Key Provisioning Protocol

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[MS-KPS]: Key Protection Service Protocol

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[MS-LCID]: Windows Language Code Identifier (LCID) Reference

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[MS-LSAD]: Local Security Authority (Domain Policy) Remote Protocol

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[MS-LSAT]: Local Security Authority (Translation Methods) Remote Protocol

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[MS-MDE]: Mobile Device Enrollment Protocol

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[MS-MDE2]: Mobile Device Enrollment Protocol Version 2

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[MS-MDM]: Mobile Device Management Protocol

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[MS-MICE]: Miracast over infrastructure Connection Establishment Protocol

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[MS-MSSOD]: Media Streaming Server Protocols Overview

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[MS-MWBE]: Microsoft Web Browser Federated Sign-On Protocol Extensions

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[MS-MWBF]: Microsoft Web Browser Federated Sign-On Protocol

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[MS-NCNBI]: Network Controller Northbound Interface Specification

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td>2018/12/17</td><td>
In several sections throughout this document, missing element Type designations have been added to existing element or header tables. For example, in Section 2.2.1.2, Request Headers, the text in bold has been added to the existing table as shown below.
<table>
<tr><td>Header</td><td>Section</td><td>Type</td><td>Description</td></tr>
<tr><td>Content-Type</td><td>2.2.1.1</td><td>Required or Optional Required for PUT, must be "application/json; charset=UTF-8". Optional for GET or Delete</td><td>The content type of the payload.</td></tr>
</table>
In the following sections, the added Type designations are shown in bold.

2.2.2, Common JSON Elements
<table>
<tr><td>resourceId</td><td>Optional or Required When optional for ancestor resource, then required for descendant resource. See section 2.2.3.</td></tr>
<tr><td>resourceRef</td><td>Read-only Optional or Required See section 1.3.3.2.</td></tr>
<tr><td>properties.etag</td><td>Read-only</td></tr>
</table>
</td></tr>
</table>

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Errata Published*	Description

properties.provisioningState	**Read-only**

3.1.5.1 accessControlLists

configurationState.id	**Optional Read-only**
virtualNetworkInterfaceErrors	**Optional Read-only**

3.1.5.5.3 frontendIPConfigurations

configurationState.vipEndpointStates	**Read-only**
configurationState.vipEndpointStates.vipEndpoint	**Read-only**
configurationState.vipEndpointStates.dipEndpointStates	**Read-only**
configurationState.vipEndpointStates.dipEndpointStates.dipEndpoint	**Read-only**
configurationState.vipEndpointStates.dipEndpointStates.hostIPAddress	**Read-only**
configurationState.vipEndpointStates.dipEndpointStates.hostId	**Read-only**
configurationState.vipEndpointStates.dipEndpointStates.AdapterId	**Read-only**
configurationState.vipEndpointStates.dipEndpointStates.ProbeRule	**Read-only**

3.1.5.11 networkInterfaces

dnsSettings	**Optional**
dnsSettings.dnsServers	**Optional**
ipConfigurations	**Read-only**
isHostVirtualNetworkInterface	**Optional FALSE is default. Cannot be changed after creation.**
internalDnsNameLabel	**Optional**
isPrimary	**Optional TRUE is default.**
isMultitenantStack	**Optional**
privateMacAddress	**Optional**
privateMacAllocationMethod	**Required**
serviceInsertionElements	**Optional Read-only**

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Errata Published*	Description
	3.1.5.14 publicIPAddresses dnsSettings — **Optional** 3.1.5.15 servers connections — **Required** connections.credential — **Required** connections.credentialType — **Required** connections.managementAddresses — **Required** certificate — **Optional or Required Required only if the certificate used by the server is self-signed.** 3.1.5.18 virtualNetworks configurationState.id — **Optional Read-only** configurationState.hostErrors — **Optional Read-only** 3.1.5.18.3 virtualNetworkPeerings remoteVirtualNetwork — **Required** 3.1.5.21 virtualServers connections.credential — **Optional** connections.credentialType — **Optional** connections.managementAddresses — **Optional** In Section 3.1.5.26, changed from:

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><td>HTTP method</td><td>Description</td></tr>
<tr><td>PUT</td><td>Create a new virtualNetworkManager resource or update an existing VirtualGateways resource.</td></tr>
<tr><td>GET</td><td>Get one virtualNetworkManager resource</td></tr>
</table>

Changed to:
<table>
<tr><td>HTTP method</td><td>Description</td></tr>
<tr><td>PUT</td><td>Update the virtualNetworkManager singleton resource.</td></tr>
<tr><td>GET</td><td>Get the virtualNetworkManager resource.</td></tr>
</table>
</td></tr>
</table>

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[MS-NCT]: Network Cost Transfer Protocol

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[MS-NFPB]: Near Field Proximity Bidirectional Services Protocol

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[MS-NFPS]: Near Field Proximity Sharing Protocol

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[MS-NKPU]: Network Key Protector Unlock Protocol

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[MS-NLMP]: NT LAN Manager (NTLM) Authentication Protocol

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Errata below are for Protocol Document Version V30.0 – 2018/09/12.

Errata Published*	Description
2019/09/16	In Section 2.2.2.1, AV_PAIR, changed "MsvChannelBindings: to" MsvAvChannelBindings". In Section 3.1.5.2.1, Client Receives a CHALLENGE_MESSAGE, changed "LmChallenResponseMaxLen" to "LmChallengeResponseMaxLen". In Section 3.2.1.1, Variables Internal to the Protocol, changed "NTLM_NEGOTIATE" to "NEGOTIATE_MESSAGE".
2019/09/02	In Section 2.2.2.5, NEGOTIATE, the description of M bit has been changed from: M (1 bit): If set, requests the presence of a signature block on all messages.NTLMSSP_NEGOTIATE_ALWAYS_SIGN MUST be set in the NEGOTIATE_MESSAGE to the server and the CHALLENGE_MESSAGE to the client. NTLMSSP_NEGOTIATE_ALWAYS_SIGN is overridden by NTLMSSP_NEGOTIATE_SIGN and NTLMSSP_NEGOTIATE_SEAL, if they are supported. An alternate name for this field is NTLMSSP_NEGOTIATE_ALWAYS_SIGN. Changed to: M (1 bit): If set, a session key is generated regardless of the states of NTLMSSP_NEGOTIATE_SIGN and NTLMSSP_NEGOTIATE_SEAL. A session key MUST always exist to generate the MIC (section 3.1.5.1.2) in the authenticate message. NTLMSSP_NEGOTIATE_ALWAYS_SIGN MUST be set in the NEGOTIATE_MESSAGE to the server and the CHALLENGE_MESSAGE to the client. NTLMSSP_NEGOTIATE_ALWAYS_SIGN is overridden by NTLMSSP_NEGOTIATE_SIGN and NTLMSSP_NEGOTIATE_SEAL, if they are supported. An alternate name for this field is NTLMSSP_NEGOTIATE_ALWAYS_SIGN.
2018/12/17	In Sections 4.2.2, NTLM v1 Authentication, 4.2.3, NTLM v1 with Client Challenge, and 4.2.4, NTLMv2 Authentication, the name of a flag has been changed from: NTML NTLMSSP_NEGOTIATE_NTLM

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Errata Published*	Description
	Changed to: NTLMSSP_NEGOTIATE_NTLM

* Date format: YYYY/MM/DD

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[MS-NMFMB]: .NET Message Framing MSMQ Binding Protocol

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[MS-NNS]: .NET NegotiateStream Protocol

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Errata below are for Protocol Document Version V7.0 – 2017/12/01.

Errata Published*	Description
2019/02/19	In Section 2.2.2, Data Message, the maximum size of the PayloadSize field has been changed from '0x0000FC00' to '0x0000FC30', to accommodate for both the application data size and the size increase that occurs when this protocol signs or encrypts the data to be transferred. Changed from: PayloadSize (4 bytes): The unsigned size, in bytes, of the Payload field. The maximum value for this field is 0x0000FC00 (that is, 63K, or 64,512). Changed to: PayloadSize (4 bytes): The unsigned size, in bytes, of the Payload field. The maximum value for this field is 0x0000FC30 (64,560).

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[MS-NRPC]: Netlogon Remote Protocol

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Errata below are for Protocol Document Version V35.0 – 2018/09/12.

Errata Published *	Description
2019/09/02	In Sections 2, 3, and 7 of this document, the following has been changed: 1. "NETLOGON_LOGOFF_UAS_INFORMATION" changed to "NETLOGON_LOGOFF_UAS_INFO" .(2 places) 2. "DOMAIN_NAME buffer" changed to "DOMAIN_NAME_BUFFER". 3. "ERROR_ACCESS DENIED" changed to "ERROR_ACCESS_DENIED" (3 places) 4. "ServerSession" changed to "ServerSessionInfo". 5. "DsrGetDCName" changed to "DsrGetDcName" (2 places) 6. "STATUS_NOT SUPPORTED" changed to "STATUS_NOT_SUPPORTED". 7. "NETLOGON_WORKSTATION_INFOFORMATION" in reference to WkstaBuffer changed to "NETLOGON_WORKSTATION_INFO". 8. "TrustedDomainInformation" changed to "TrustedDomainInformationEx". 9. "AllowableControlBits" changed to "AllowableAccountControlBits".
2019/04/01	In Section 2.2.1.4.5, NETLOGON_NETWORK_INFO, the definition of the Identity field has been changed from: Identity: NETLOGON_LOGON_IDENTITY_INFO structure, as specified in section 2.2.1.4.15, that contains information about the logon identity.

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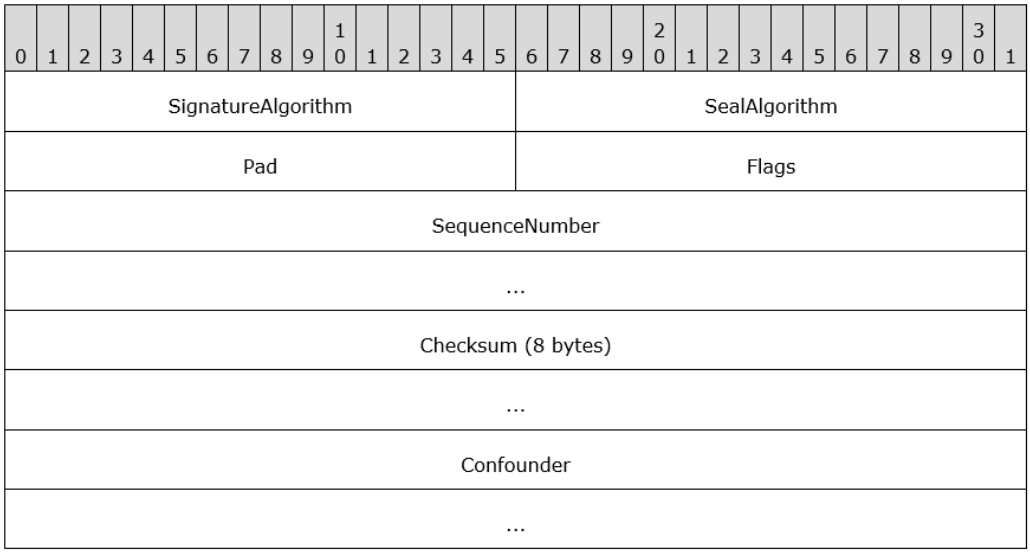
Errata Published *	Description
	Changed to: Identity: NETLOGON_LOGON_IDENTITY_INFO structure, as specified in section 2.2.1.4.15, that contains information about the logon identity. The Identity.LogonDomainName field MUST match the DomainName field of the authenticate message received by the client. The authenticate message is defined in [MS-NLMP] section 2.2.1.3. In Section 2.2.1.4.15, NETLOGON_LOGON_IDENTITY_INFO, the definition of the LogonDomainName field has been changed from: LogonDomainName: Contains the NetBIOS name of the domain of the account. Changed to: LogonDomainName: Contains the NetBIOS name of the domain of the account. The case of the domain name MUST be preserved across all messages.
2018/10/15	In Section 2.2.1.3.3, NL_AUTH_SHA2_SIGNATURE, a 24-byte Reserved field has been added after the Confounder field. Changed from:  … Confounder (8 bytes): A buffer that is employed when the structure is used for encryption, in addition to signing. The bytes are filled with random data that is used by the encryption algorithm. If the structure is used only for signing, the Confounder is not included. For details about the Confounder and encrypting the data, see section 3.3.4.2.1. Changed to:

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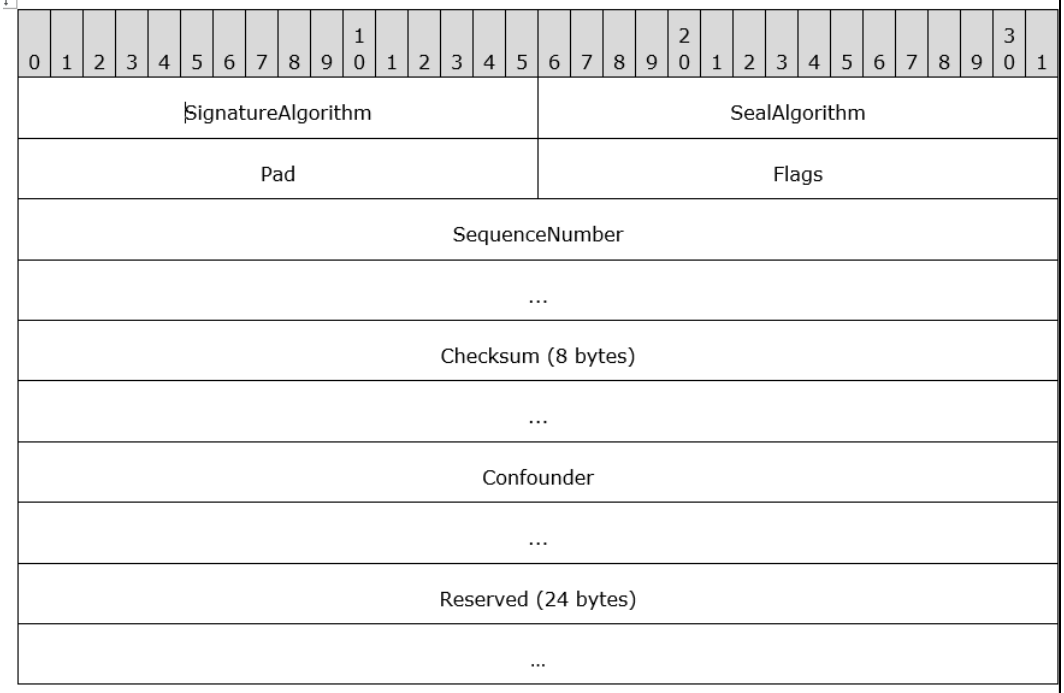
Errata Published *	Description



…

Confounder (8 bytes): A buffer that is employed when the structure is used for encryption, in addition to signing. The bytes are filled with random data that is used by the encryption algorithm. If the structure is used only for signing, the Confounder is not included. For details about the Confounder and encrypting the data, see section 3.3.4.2.1.

Reserved (24 bytes): The sender SHOULD<19> set these bytes to zero, and the receiver MUST ignore them.

In Section 3.3.4.2.1, Generating a Client Netlogon Signature Token, step 7 has been updated to specify that after the signature is computed, only the first 8 bytes are copied into the Checksum field of either NL_AUTH_SHA2_SIGNATURE (if AES is negotiated) or NL_AUTH_SIGNATURE.

Changed from:

…

7. If AES is negotiated, then a signature MUST be computed using the following algorithm:

CALL SHA256Reset(&HashContext, Sk, sizeof(Sk));

…

Note: In the second call to MD5Update, only the first 8-bytes of the NL_AUTH_SIGNATURE structure are used.

After the signature is computed, the signature MUST be truncated, with only the first 8 bytes being copied into the Checksum field of NL_AUTH_SIGNATURE.

Changed to:

…

7. If AES is negotiated, then a signature MUST be computed using the following algorithm:

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Errata Published *	Description
	CALL SHA256Reset(&HashContext, Sk, sizeof(Sk)); … Note: In the second call to MD5Update, only the first 8-bytes of the NL_AUTH_SIGNATURE structure are used. After the signature is computed, the signature MUST be truncated, with only the first 8 bytes being copied into the Checksum field of NL_AUTH_SHA2_SIGNATURE (section 2.2.1.3.3) if AES is negotiated, otherwise, into the Checksum field of NL_AUTH_SIGNATURE (section 2.2.1.3.2).

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[MS-NSPI]: Name Service Provider Interface (NSPI) Protocol

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[MS-OAPX]: OAuth 2.0 Protocol Extensions

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[MS-OAPXBC]: OAuth 2.0 Protocol Extensions for Broker Clients

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[MS-OIDCE]: OpenID Connect 1.0 Protocol Extensions

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[MS-OLEDS]: Object Linking and Embedding (OLE) Data Structures

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[MS-OTPCE]: One-Time Password Certificate Enrollment Protocol

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[MS-PAC]: Privilege Attribute Certificate Data Structure

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Errata below are for Protocol Document Version V19.0 – 2018/09/12.

Errata Published*	Description
2019/09/02	In Section 3.1, Logon Authorization Information, the string format for two SIDs has been changed from: S-1-5-397955417-626881126-188441444 Changed to: S-1-5-21-397955417-626881126-188441444 Changed from: S-1-5-397955417-626881126-188441444-3392609 Changed to: S-1-5-21-397955417-626881126-188441444-3392609

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[MS-PAR]: Print System Asynchronous Remote Protocol

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Errata Published*	Description
2018/12/10	In Section 3.1.4.2.7, RpcAsyncInstallPrinterDriverFromPackage (Opnum 62), changed from: The print server SHOULD<10> perform the following additional validation steps: … • Validate that, if the printer driver specified by the client is a derived printer driver, either the class printer driver on which the derived printer driver depends is already installed on the print server, or a driver package containing the class printer driver is installed in the print server's driver store, or the print server can locate a driver package containing the class printer driver through some other implementation-specific mechanism;<11> otherwise, the server returns ERROR_UNKNOWN_PRINTER_DRIVER. Changed to: The print server SHOULD<10> perform the following additional validation steps: … • Validate that, if the printer driver specified by the client is a derived printer driver, either the class printer driver on which the derived printer driver depends is already installed on the print server, or a driver package containing the class printer driver is installed in the print server's driver store, or the print server can locate a driver package containing the class printer driver through some other implementation-specific mechanism;<11> otherwise, the server returns ERROR_UNKNOWN_PRINTER_DRIVER. This HRESULT error code is constructed by using the HRESULT From WIN32 Error Code Macro ([MS-ERREF] section 2.1.2) on the 16-bit Win32 value for this error ([MS-ERREF] section 2.2).

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[MS-PEAP]: Protected Extensible Authentication Protocol (PEAP)

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[MS-PKAP]: Public Key Authentication Protocol

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[MS-PSRDP]: PowerShell Remote Debugging Protocol

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[MS-PSRP]: PowerShell Remoting Protocol

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[MS-RA]: Remote Assistance Protocol

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[MS-RAI]: Remote Assistance Initiation Protocol

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Errata below are for Protocol Document Version V9.0 – 2018/09/12.

<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td>2019/06/24</td><td>In Section 2.2.2, Remote Assistance Connection String 2, details for the URI attribute have been added for the Listener node.

Changed from:

...

3. The Transport Node has Listener child Nodes that give information about the Server IP and port. This Listener node <L> has the following attributes.

<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>P</td><td>Port: The dynamic port on which the Remote Assistance connection could happen.</td></tr>
<tr><td>N</td><td>Server Name: The name/IP address of the server, that is, the novice computer.</td></tr>
</table>
...

Changed to:

...

3. The Transport Node has Listener child Nodes that give information about the Server IP and port. This Listener node <L> has the following attributes.</td></tr>
</table>

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Errata Published*	Description
	<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>P</td><td>Port: The dynamic port on which the Remote Assistance connection could happen.</td></tr><tr><td>N</td><td>Server Name: The name/IP address of the server, that is, the novice computer.</td></tr><tr><td>U</td><td>URI: The full URI if websocket listener is enabled. The U (URI) is used instead of the P (port) attribute. N (server name) attribute is still included.</td></tr></table> ...

*Date format: YYYY/MM/DD

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[MS-RDPADRV]: Remote Desktop Protocol Audio Level and Drive Letter Persistence Virtual Channel Extension

This topic lists the Errata found in [MS-RDPADRV] since it was last published. Since this topic is updated frequently, we recommend that you subscribe to these RSS or Atom feeds to receive update notifications.

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[MS-RDPBCGR]: Remote Desktop Protocol: Basic Connectivity and Graphics Remoting

This topic lists the Errata found in [MS-RDPBCGR] since it was last published. Since this topic is updated frequently, we recommend that you subscribe to these RSS or Atom feeds to receive update notifications.

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Errata below are for Protocol Document Version V50.0 – 2019/03/13.

Errata Published*	Description
2019/08/19	In Section 2.2.8.1.1.3, Client Input Event PDU (TS_INPUT_PDU), removed the reference to slow-path. Changed from: The slow-path Input Event PDU is used to transmit input events from client to server.<32><33> ... Changed to: The Input Event PDU is used to transmit input events from client to server.<32><33> ... In Section 2.2.8.1.1.3.1, Client Input Event PDU Data (TS_INPUT_PDU_DATA), specified Slow-Path Input Events in the introductory sentence and in the numEvents field description. Changed from: The TS_INPUT_PDU_DATA structure contains a collection of slow-path input events generated by the client and intended to be processed by the server.

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Errata Published*	Description
	... numEvents (2 bytes): A 16-bit, unsigned integer. The number of slow-path input events packed together in the slowPathInputEvents field. ... slowPathInputEvents (variable): A collection of Slow-Path Input Events (section 2.2.8.1.1.3.1.1) to be processed by the server. The number of events present in this array is given by the numEvents field. Changed to: The TS_INPUT_PDU_DATA structure contains a collection of Slow-Path Input Events (section 2.2.8.1.1.3.1.1) generated by the client and intended to be processed by the server. ... numEvents (2 bytes): A 16-bit, unsigned integer. The number of Slow-Path Input Events packed together in the slowPathInputEvents field. ... slowPathInputEvents (variable): A collection of Slow-Path Input Events to be processed by the server. The number of events present in this array is given by the numEvents field. In Section 2.2.8.1.1.3.1.1, Slow-Path Input Event (TS_INPUT_EVENT), removed the reference to slow-path and clarified how the contents of the input event are specified in the slowPathInputData field description. Changed from: ... slowPathInputData (variable): TS_KEYBOARD_EVENT, TS_UNICODE_KEYBOARD_EVENT, TS_POINTER_EVENT, TS_POINTERX_EVENT, or TS_SYNC_EVENT. The actual contents of the slow-path input event (sections 2.2.8.1.1.3.1.1.1 through 2.2.8.1.1.3.1.1.5). Changed to: ... slowPathInputData (variable): TS_KEYBOARD_EVENT, TS_UNICODE_KEYBOARD_EVENT, TS_POINTER_EVENT, TS_POINTERX_EVENT, or TS_SYNC_EVENT. The actual contents of the input event specified by the messageType field (sections 2.2.8.1.1.3.1.1.1 through 2.2.8.1.1.3.1.1.6). In Section 3.2.5.8.1.1, Sending Input Event PDU, changed the section title from Sending Slow-Path Input Event PDU to Sending Input Event PDU and specified Input Event PDU and slowPathInputEvents field sections. Changed from: 3.2.5.8.1.1 Sending Slow-Path Input Event PDU The structure and fields of the Slow-Path Input Event PDU are specified in 2.2.8.1.1.3.1.1, and the techniques specified in section 3.2.5.1 demonstrate how to initialize the contents of the PDU. The slowPathInputEvents field encapsulates a collection of input events and is populated with the following input event data:

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	... Changed to: 3.2.5.8.1.1 Sending Input Event PDU The structure and fields of the Input Event PDU are specified in sections 2.2.8.1.1.3 and 2.2.8.1.1.3.1, and the techniques specified in section 3.2.5.1 demonstrate how to initialize the contents of the PDU. The slowPathInputEvents field (section 2.2.8.1.1.3.1) encapsulates a collection of input events and is populated with the following input event data: ... In Section 3.3.5.8.1.1, Processing Input Event PDU, changed the section title from Processing Slow-Path Input Event PDU to Processing Input Event PDU and specified Input Event PDU and slowPathInputEvents field sections. Changed from: 3.3.5.8.1.1 Processing Slow-Path Input Event PDU The structure and fields of the Slow-Path Input Event PDU are described in section 2.2.8.1.1.3, and the techniques described in section 3.3.5.2 demonstrate how to process the contents of the PDU. The slowPathInputEvents field encapsulates a collection of input events and is populated with the following input event data: ... If a slow-path input event structure is received that does not match one of the known types, the server SHOULD drop the connection. ... Changed to: 3.3.5.8.1.1 Processing Input Event PDU The structure and fields of the Input Event PDU are described in sections 2.2.8.1.1.3 and 2.2.8.1.1.3.1, and the techniques described in section 3.3.5.2 demonstrate how to process the contents of the PDU. The slowPathInputEvents field (section 2.2.8.1.1.3.1) encapsulates a collection of input events and is populated with the following input event data: ... If an input event is received that does not match one of the known types, the server SHOULD drop the connection. ...
2019/08/19	In Section 2.2.9.1.2.1.11, Fast-Path Large Pointer Update (TS_FP_LARGEPOINTERATTRIBUTE), changed the FASTPATH_UPDATETYPE_LARGE_POINTER value in the updateHeader field description.

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Errata Published*	Description
	Changed from: ... updateHeader (1 byte): An 8-bit, unsigned integer. The format of this field is the same as the updateHeader byte field specified in the Fast-Path Update (section 2.2.9.1.2.1) structure. The updateCode bitfield (4 bits in size) MUST be set to FASTPATH_UPDATETYPE_LARGE_POINTER (15). ... Changed to: ... updateHeader (1 byte): An 8-bit, unsigned integer. The format of this field is the same as the updateHeader byte field specified in the Fast-Path Update (section 2.2.9.1.2.1) structure. The updateCode bitfield (4 bits in size) MUST be set to FASTPATH_UPDATETYPE_LARGE_POINTER (12). ...
2019/07/08	In Section 5.5, Automatic Reconnection, clarified in the fourth step that the derived security verifier has the same value for a given auto-reconnect random when auto-reconnecting with Enhanced RDP Security. Changed from: ... 4. The client derives a 16-byte security verifier from the random number contained in the auto-reconnect cookie received in Step 2. This security verifier is wrapped in a Client Auto-Reconnect Packet (section 2.2.4.3) and sent to the server as part of the extended information (section 2.2.1.11.1.1.1) of the Client Info PDU (section 2.2.1.11). The auto-reconnect random is used to key the HMAC function ([RFC2104]), which uses MD5 as the iterative hash function. The security verifier is derived by applying the HMAC to the client random received in Step 3. SecurityVerifier = HMAC(AutoReconnectRandom, ClientRandom) When Enhanced RDP Security is in effect the client random value is not generated (section 5.3.2). In this case, for the purpose of generating the security verifier, the client random is assumed to be an array of 32 zero bytes. This effectively means that the derived security verifier will always have the same value when carrying out auto-reconnect under the Enhanced RDP Security. Hence, care is taken to authenticate the identity of the server to which the client is reconnecting, ensuring that the identity has not changed in the period between connections. ... Changed to: ... 4. The client derives a 16-byte security verifier from the random number contained in the auto-reconnect cookie received in Step 2. This security verifier is wrapped in a Client Auto-Reconnect Packet (section 2.2.4.3) and sent to the server as part of the extended information (section 2.2.1.11.1.1.1) of the Client Info PDU (section 2.2.1.11).

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	The auto-reconnect random is used to key the HMAC function ([RFC2104]), which uses MD5 as the iterative hash function. The security verifier is derived by applying the HMAC to the client random received in Step 3. SecurityVerifier = HMAC(AutoReconnectRandom, ClientRandom) When Enhanced RDP Security is in effect the client random value is not generated (section 5.3.2). In this case, for the purpose of generating the security verifier, the client random is assumed to be an array of 32 zero bytes. This implies that the derived security verifier will always have the same value for a given auto-reconnect random when auto-reconnecting with Enhanced RDP Security. ...

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[MS-RDPEA]: Remote Desktop Protocol: Audio Output Virtual Channel Extension

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[MS-RDPEAR]: Remote Desktop Protocol Authentication Redirection Virtual Channel

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[MS-RDPECLIP]: Remote Desktop Protocol: Clipboard Virtual Channel Extension

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[MS-RDPECAM]: Remote Desktop Protocol: Video Capture Virtual Channel Extension

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Errata below are for Protocol Document Version V1.0 – 2018/09/12.

Errata Published*	Description

2019/02/19	In Section 4.6.2, Property List Response, an annotated dump of a Property List Response (section 2.2.3.17) has been added.
	
	Added:
	The following is an annotated dump of a Property List Response (section 2.2.3.17).
	
	`00000000  02 15 01 02 03 00 00 00 00 fa 00 00 00 05 00 00  ................`
	`00000010  00 00 00 00 00 02 02 01 00 00 00 00 ff 00 00 00  ................`
	`00000020  01 00 00 00 80 00 00 00                          ........`
	`02->SHARED_MSG_HEADER::Version = 2`
	`15->SHARED_MSG_HEADER::MessageId = PropertyListResponse(21)`
	`01->PropertyDescription[0]::PropertySet = CameraControl(1)`
	`02->PropertyDescription[0]::PropertyId = Focus(2)`
	`03->PropertyDescription[0]::Capabilities = Manual and Auto(1 + 2)`
	`00 00 00 00->PropertyDescription[0]::MinValue = 0`
	`fa 00 00 00->PropertyDescription[0]::MaxValue = 250`
	`05 00 00 00->PropertyDescription[0]::Step = 5`
	`00 00 00 00->PropertyDescription[0]::DefaultValue = 0`
	`02->PropertyDescription[1]::PropertySet = VideoProcAmp(2)`
	`02->PropertyDescription[1]::PropertyId = Brightness(2)`
	`01->PropertyDescription[1]::Capabilities = Manual(1)`
	`00 00 00 00->PropertyDescription[1]::MinValue = 0`
	`ff 00 00 00->PropertyDescription[1]::MaxValue = 255`
	`01 00 00 00->PropertyDescription[1]::Step = 1`
	`80 00 00 00->PropertyDescription[1]::DefaultValue = 128`

2019/02/19	In Section 2.2.1, Shared Message Header (SHARED_MSG_HEADER), updated values to hexadecimal format for consistency in the MessageId field table. Changed from: ... MessageId (1 byte): An 8-bit unsigned integer that specifies the type of the message. Value / Meaning SuccessResponse 1 / A Success Response (section 2.2.3.1) message.

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Errata Published*	Description	
	ErrorResponse 2	An Error Response (section 2.2.3.2) message.
	SelectVersionRequest 3	A Select Version Request (section 2.2.2.1) message.
	SelectVersionResponse 4	A Select Version Response (section 2.2.2.2) message.
	DeviceAddedNotification 5	A Device Added Notification (section 2.2.2.3) message.
	DeviceRemovedNotification 6	A Device Removed Notification (section 2.2.2.4) message.
	ActivateDeviceRequest 7	An Activate Device Request (section 2.2.3.3) message.
	DeactivateDeviceRequest 8	A Deactivate Device Request (section 2.2.3.4) message.
	StreamListRequest 9	A Stream List Request (section 2.2.3.5) message.
	StreamListResponse 10	A Stream List Response (section 2.2.3.6) message.
	MediaTypeListRequest 11	A Media Type List Request (section 2.2.3.7) message.
	MediaTypeListResponse 12	A Media Type List Response (section 2.2.3.8) message.
	CurrentMediaTypeRequest 13	A Current Media Type Request (section 2.2.3.9) message.
	CurrentMediaTypeResponse 14	A Current Media Type Response (section 2.2.3.10) message.
	StartStreamsRequest 15	A Start Streams Request (section 2.2.3.11) message.
	StopStreamsRequest 16	A Stop Streams Request (section 2.2.3.12) message.
	SampleRequest 17	A Sample Request (section 2.2.3.13) message.
	SampleResponse 18	A Sample Response (section 2.2.3.14) message.
	SampleErrorResponse 19	A Sample Error Response (section 2.2.3.15) message.
	PropertyListRequest 20	A Property List Request (section 2.2.3.16) message. This message is supported only by version 2 of the protocol.
	PropertyListResponse 21	A Property List Response (section 2.2.3.17) message. This message is

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Errata Published*	Description

	supported only by version 2 of the protocol.
PropertyValueRequest 22	A Property Value Request (section 2.2.3.18) message. This message is supported only by version 2 of the protocol.
PropertyValueResponse 23	A Property Value Response (section 2.2.3.19) message. This message is supported only by version 2 of the protocol.
SetPropertyValueRequest 24	A Set Property Value Request (section 2.2.3.20) message. This message is supported only by version 2 of the protocol.

Changed to:

...

MessageId (1 byte): An 8-bit unsigned integer that specifies the type of the message.

Value	Meaning
SuccessResponse 0x01	A Success Response (section 2.2.3.1) message.
ErrorResponse 0x02	An Error Response (section 2.2.3.2) message.
SelectVersionRequest 0x03	A Select Version Request (section 2.2.2.1) message.
SelectVersionResponse 0x04	A Select Version Response (section 2.2.2.2) message.
DeviceAddedNotification 0x05	A Device Added Notification (section 2.2.2.3) message.
DeviceRemovedNotification 0x06	A Device Removed Notification (section 2.2.2.4) message.
ActivateDeviceRequest 0x07	An Activate Device Request (section 2.2.3.3) message.
DeactivateDeviceRequest 0x08	A Deactivate Device Request (section 2.2.3.4) message.
StreamListRequest 0x09	A Stream List Request (section 2.2.3.5) message.
StreamListResponse 0x0A	A Stream List Response (section 2.2.3.6) message.
MediaTypeListRequest 0x0B	A Media Type List Request (section 2.2.3.7) message.
MediaTypeListResponse 0x0C	A Media Type List Response (section 2.2.3.8) message.

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Errata Published*	Description

CurrentMediaTypeRequest 0x0D	A Current Media Type Request (section 2.2.3.9) message.
CurrentMediaTypeResponse 0x0E	A Current Media Type Response (section 2.2.3.10) message.
StartStreamsRequest 0x0F	A Start Streams Request (section 2.2.3.11) message.
StopStreamsRequest 0x10	A Stop Streams Request (section 2.2.3.12) message.
SampleRequest 0x11	A Sample Request (section 2.2.3.13) message.
SampleResponse 0x12	A Sample Response (section 2.2.3.14) message.
SampleErrorResponse 0x13	A Sample Error Response (section 2.2.3.15) message.
PropertyListRequest 0x14	A Property List Request (section 2.2.3.16) message. This message is supported only by version 2 of the protocol.
PropertyListResponse 0x15	A Property List Response (section 2.2.3.17) message. This message is supported only by version 2 of the protocol.
PropertyValueRequest 0x16	A Property Value Request (section 2.2.3.18) message. This message is supported only by version 2 of the protocol.
PropertyValueResponse 0x17	A Property Value Response (section 2.2.3.19) message. This message is supported only by version 2 of the protocol.
SetPropertyValueRequest 0x18	A Set Property Value Request (section 2.2.3.20) message. This message is supported only by version 2 of the protocol.

In Section 2.2.3.2, Error Response, updated values to hexadecimal format for consistency in the ErrorCode field table.

Changed from:

...

ErrorCode (4 bytes): A 32-bit unsigned integer containing an error code.

Value	Meaning
UnexpectedError 1	An unexpected error occurred.

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Errata Published*	Description

InvalidMessage 2	An invalid message was received. Either the message is malformed, or the protocol version or message type is unexpected.
NotInitialized 3	The object MUST be initialized before the requested operation can be carried out. This error could be returned, for example, when attempting to communicate with a deactivated camera device.
InvalidRequest 4	The request is invalid in the current state.
InvalidStreamNumber 5	The provided stream number was invalid.
InvalidMediaType 6	The data specified for the stream format is invalid, inconsistent, or not supported.
OutOfMemory 7	The client ran out of memory.
ItemNotFound 8	The device does not support the requested property. This error code is generated only by version 2 of the protocol.
SetNotFound 9	The device does not support the requested property set. This error code is generated only by version 2 of the protocol.
OperationNotSupported 10	The requested operation is not supported. This error code is generated only by version 2 of the protocol.

Changed to:

...

ErrorCode (4 bytes): A 32-bit unsigned integer containing an error code.

Value	Meaning
UnexpectedError 0x00000001	An unexpected error occurred.
InvalidMessage 0x00000002	An invalid message was received. Either the message is malformed, or the protocol version or message type is unexpected.
NotInitialized 0x00000003	The object MUST be initialized before the requested operation can be carried out. This error could be returned, for example, when attempting to communicate with a deactivated camera device.

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Errata Published*	Description

InvalidRequest 0x00000004	The request is invalid in the current state.
InvalidStreamNumber 0x00000005	The provided stream number was invalid.
InvalidMediaType 0x00000006	The data specified for the stream format is invalid, inconsistent, or not supported.
OutOfMemory 0x00000007	The client ran out of memory.
ItemNotFound 0x00000008	The device does not support the requested property. This error code is generated only by version 2 of the protocol.
SetNotFound 0x00000009	The device does not support the requested property set. This error code is generated only by version 2 of the protocol.
OperationNotSupported 0x0000000A	The requested operation is not supported. This error code is generated only by version 2 of the protocol.

In Section 2.2.3.6.1, STREAM_DESCRIPTION, updated the value to hexadecimal format for consistency in the StreamCategory field table.

Changed from:

...

StreamCategory (1 byte): An 8-bit unsigned integer that specifies the category of the stream.

Value	Meaning
Capture 1	Capture category streams provide a stream of compressed or uncompressed digital video.

Changed to:

...

StreamCategory (1 byte): An 8-bit unsigned integer that specifies the category of the stream.

Value	Meaning
Capture 0x01	Capture category streams provide a stream of compressed or uncompressed digital video.

In Section 2.2.3.8.1, MEDIA_TYPE_DESCRIPTION, updated values to hexadecimal format for consistency in the Format field table.

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>
Changed from:
...
Format (1 byte): An 8-bit unsigned integer that specifies the stream codec.
<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>H264 1</td><td>H.264 video as described in [ITU-H.264-201704]. Media samples contain H.264 bitstream data with start codes and interleaved sequence parameter set/picture parameter set (SPS/PPS) packets. Each sample contains one complete picture, either one field or one frame.</td></tr>
<tr><td>MJPG 2</td><td>Motion JPEG. Motion JPEG is a video compression format in which each video frame of a digital video sequence is independently compressed as a JPEG image.</td></tr>
<tr><td>YUY2 3</td><td>YUY2 video as specified in [MSDN-YUVFormats].</td></tr>
<tr><td>NV12 4</td><td>NV12 video as described in [MSDN-YUVFormats].</td></tr>
<tr><td>I420 5</td><td>I420 video. Identical to YV12 as described in [MSDN-YUVFormats] except that the order of the U and V planes is reversed.</td></tr>
<tr><td>RGB24 6</td><td>RGB, 24 bits per pixel.</td></tr>
<tr><td>RGB32 7</td><td>RGB, 32 bits per pixel.</td></tr>
</table>
...

Changed to:
...
Format (1 byte): An 8-bit unsigned integer that specifies the stream codec.
<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>H264 0x01</td><td>H.264 video as described in [ITU-H.264-201704]. Media samples contain H.264 bitstream data with start codes and interleaved sequence parameter set/picture parameter set (SPS/PPS) packets. Each sample contains one complete picture, either one field or one frame.</td></tr>
<tr><td>MJPG 0x02</td><td>Motion JPEG. Motion JPEG is a video compression format in which each video frame of a digital video sequence is independently compressed as a JPEG image.</td></tr>
</table>
</td></tr>
</table>

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Errata Published*	Description

YUY2 0x03	YUY2 video as specified in [MSDN-YUVFormats].
NV12 0x04	NV12 video as described in [MSDN-YUVFormats].
I420 0x05	I420 video. Identical to YV12 as described in [MSDN-YUVFormats] except that the order of the U and V planes is reversed.
RGB24 0x06	RGB, 24 bits per pixel.
RGB32 0x07	RGB, 32 bits per pixel.

...

In Section 2.2.3.17.1, PROPERTY_DESCRIPTION, updated values to hexadecimal format for consistency in the PropertySet and PropertyId field tables.

Changed from:

...

PropertySet (1 byte): An 8-bit unsigned integer that specifies the property set.

Value	Meaning
CameraControl 1	This property set category controls camera device settings.
VideoProcAmp 2	This property set controls devices that can adjust the image color attributes of analog or digital signals.

PropertyId (1 byte): An 8-bit unsigned integer that contains the identifier of the property within the property set specified by the PropertySet field.

CameraControl properties:

Value	Meaning
Exposure 1	This property controls the exposure time of the device.
Focus 2	This property controls the focus setting of the device.
Pan 3	This property controls the pan setting of the device.
Roll 4	This property controls the roll setting of the device.
Tilt 5	This property controls the tilt setting of the device.
Zoom 6	This property controls the zoom setting of the device.

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>
VideoProcAmp properties:
<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>BacklightCompensation 1</td><td>This property controls the backlight compensation setting of the device. This value MUST be either 0 or 1. The value 0 indicates that backlight compensation is disabled. The value 1 indicates that backlight compensation is enabled.</td></tr>
<tr><td>Brightness 2</td><td>This property controls the brightness setting of the device.</td></tr>
<tr><td>Contrast 3</td><td>This property controls the contrast setting of the device.</td></tr>
<tr><td>Hue 4</td><td>This property controls the hue setting of the device.</td></tr>
<tr><td>WhiteBalance 5</td><td>This property controls the white balance setting of the device.</td></tr>
</table>
...

Changed to:
...
PropertySet (1 byte): An 8-bit unsigned integer that specifies the property set.
<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>CameraControl 0x01</td><td>This property set category controls camera device settings.</td></tr>
<tr><td>VideoProcAmp 0x02</td><td>This property set controls devices that can adjust the image color attributes of analog or digital signals.</td></tr>
</table>
PropertyId (1 byte): An 8-bit unsigned integer that contains the identifier of the property within the property set specified by the PropertySet field.
CameraControl properties:
<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>Exposure 0x01</td><td>This property controls the exposure time of the device.</td></tr>
<tr><td>Focus 0x02</td><td>This property controls the focus setting of the device.</td></tr>
<tr><td>Pan 0x03</td><td>This property controls the pan setting of the device.</td></tr>
<tr><td>Roll 0x04</td><td>This property controls the roll setting of the device.</td></tr>
<tr><td>Tilt 0x05</td><td>This property controls the tilt setting of the device.</td></tr>
</table>
</td></tr>
</table>

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Errata Published*	Description

Zoom 0x06	This property controls the zoom setting of the device.

VideoProcAmp properties:

Value	Meaning
BacklightCompensation 0x01	This property controls the backlight compensation setting of the device. This value MUST be either 0 or 1. The value 0 indicates that backlight compensation is disabled. The value 1 indicates that backlight compensation is enabled.
Brightness 0x02	This property controls the brightness setting of the device.
Contrast 0x03	This property controls the contrast setting of the device.
Hue 0x04	This property controls the hue setting of the device.
WhiteBalance 0x05	This property controls the white balance setting of the device.

...

In Section 2.2.3.19.1, PROPERTY_VALUE, updated values to hexadecimal format for consistency in the Mode field table.

Changed from:

...

Mode (1 byte): An 8-bit unsigned integer that specifies how the property was set.

Value	Meaning
Manual 1	The value was set manually.
Auto 2	The value was set automatically.

...

Changed to:

...

Mode (1 byte): An 8-bit unsigned integer that specifies how the property was set.

Value	Meaning
Manual 0x01	The value was set manually.
Auto 0x02	The value was set automatically.

...

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[MS-RDPEDISP]: Remote Desktop Protocol: Display Update Virtual Channel Extension

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Errata below are for Protocol Document Version V7.0 – 2018/09/12.

Errata Published*	Description
2019/08/19	In Section 1, Introduction, changed the source of the display configuration changes from server to client. Changed from: This document specifies the Remote Desktop Protocol: Display Control Channel Extension to the Remote Desktop Protocol: Basic Connectivity and Graphics Remoting, as specified in [MS-RDPBCGR] sections 1 to 5. This control protocol is used by the server to request display configuration changes in a remote session. Display configuration changes include the addition, removal and repositioning of monitors, resolution updates, and orientation updates. Changed to: This document specifies the Remote Desktop Protocol: Display Control Channel Extension to the Remote Desktop Protocol: Basic Connectivity and Graphics Remoting, as specified in [MS-RDPBCGR] sections 1 to 5. This control protocol is used by the client to request display configuration changes in a remote session. Display configuration changes include the addition, removal and repositioning of monitors, resolution updates, and orientation updates.

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[MS-RDPEDYC]: Remote Desktop Protocol: Dynamic Channel Virtual Channel Extension

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[MS-RDPEFS]: Remote Desktop Protocol: File System Virtual Channel Extension

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[MS-RDPEGDI]: Remote Desktop Protocol: Graphics Device Interface (GDI) Acceleration Extensions

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[MS-RDPEGFX]: Remote Desktop Protocol: Graphics Pipeline Extension

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Errata below are for Protocol Document Version V14.0 – 2018/09/12.

Errata Published*	Description
2019/02/19	In Section 2.2.4.5, RFX_AVC444_BITMAP_STREAM, "YUV420 frame" in the cbAvc420EncodedBitstream1 field description has been replaced with "luma frame". Changed from: ... cbAvc420EncodedBitstream1 (30 bits): A 30-bit unsigned integer that specifies the size, in bytes, of the luma frame present in the avc420EncodedBitstream1 field. If no YUV420 frame is present, then this field MUST be set to zero. ... Changed to: ... cbAvc420EncodedBitstream1 (30 bits): A 30-bit unsigned integer that specifies the size, in bytes, of the YUV420 frame present in the avc420EncodedBitstream1 field. If no YUV420 frame is present, then this field MUST be set to zero. ... In Section 2.2.4.6, RFX_AVC444V2_BITMAP_STREAM, "YUV420 frame" in the cbAvc420EncodedBitstream1 field description has been replaced with "luma frame". Changed from: ... cbAvc420EncodedBitstream1 (30 bits): A 30-bit unsigned integer that specifies the size, in bytes, of the luma frame present in the avc420EncodedBitstream1 field. If no YUV420 frame is present, then this field MUST be set to zero. ...

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>Changed to:
...
cbAvc420EncodedBitstream1 (30 bits): A 30-bit unsigned integer that specifies the size, in bytes, of the YUV420 frame present in the avc420EncodedBitstream1 field. If no YUV420 frame is present, then this field MUST be set to zero.
...</td></tr>
<tr><td>2018/12/10</td><td>In Section 2.2.1.6, RDPGFX_CAPSET, the RDPGFX_CAPVERSION_106 value has been changed from 0x000A0601 to 0x000A0600 in the version field description.

Changed from:
...
version (4 bytes): A 32-bit unsigned integer that specifies the version of the capability set.

<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>...</td><td>…</td></tr><tr><td>RDPGFX_CAPVERSION_106
0x000A0601</td><td>RDPGFX_CAPSET_VERSION106
(section 2.2.3.9)</td></tr></table>
Changed to:
...
version (4 bytes): A 32-bit unsigned integer that specifies the version of the capability set.

<table><tr><th>Value</th><th>Meaning</th></tr><tr><td>...</td><td>…</td></tr><tr><td>RDPGFX_CAPVERSION_106
0x000A0600</td><td>RDPGFX_CAPSET_VERSION106
(section 2.2.3.9)</td></tr></table>

In Section 2.2.3.9, RDPGFX_CAPSET_VERSION106, the RDPGFX_CAPVERSION_106 value has been changed from 0x000A0601 to 0x000A0600 in the version field description.

Changed from:
...
version (4 bytes): A 32-bit unsigned integer that specifies the version of the capability set. This field MUST be set to RDPGFX_CAPVERSION_106 (0x000A0601).
...

Changed to:
...
version (4 bytes): A 32-bit unsigned integer that specifies the version of the capability set. This field MUST be set to RDPGFX_CAPVERSION_106 (0x000A0600).
...</td></tr>
</table>

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[MS-RDPEGT]: Remote Desktop Protocol Geometry Tracking Virtual Channel Protocol Extension

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[MS-RDPEI]: Remote Desktop Protocol: Input Virtual Channel Extension

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[MS-RDPELE]: Remote Desktop Protocol: Licensing Extension

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Errata below are for Protocol Document Version V14.0 – 2018/09/12.

Errata Published*	Description
2018/12/10	In Section 4, Protocol Examples, text has been added to clarify that the sample protocol packets are only examples and should not be considered to have been generated as part of the same protocol run. Changed from: For a complete listing of RDP headers, see [MS-RDPBCGR] section 4. Changed to: For a complete listing of RDP headers, see [MS-RDPBCGR] section 4. The sample protocol packets listed in sections 4.1 through to 4.7 are provided as examples and should not be considered to have been generated as part of the same protocol run.
2018/12/10	In Section 2.2.2.5, Client Platform Challenge Response (CLIENT_PLATFORM_CHALLENGE_RESPONSE), text has been added to clarify that decrypted Client Hardware Identification should follow the Platform Challenge Response Data in the MACData field description. Changed from: MACData (16 bytes): An array of 16 bytes containing an MD5 digest (MAC) generated over the decrypted Client Hardware Identification and Platform Challenge Response Data. ... Changed to: MACData (16 bytes): An array of 16 bytes containing an MD5 digest (MAC) generated over the Platform Challenge Response Data and decrypted Client Hardware Identification. ...

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[MS-RDPEMC]: Remote Desktop Protocol: Multiparty Virtual Channel Extension

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[MS-RDPEMT]: Remote Desktop Protocol: Multitransport Extension

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March 2, 2016 - Download

Errata below are for Protocol Document Version V10.0 – 2018/09/12.

Errata Published*	Description
2019/03/18	In Section 1.3, Overview, clarified that a port number is not specified in an Initiate Multitransport Request PDU. Changed from: The Initiate Multitransport Request PDU contains information that uniquely identifies the multitransport connection; it contains a request ID and a cookie, a protocol identifier that identifies the type of multitransport connection that the client attempts to establish, and a port number that identifies the port on which the server is listening. When the client receives the Initiate Multitransport Request PDU, it attempts to establish a secure multitransport connection with the server. Changed to: The Initiate Multitransport Request PDU contains information that uniquely identifies the multitransport connection; it contains a request ID, a cookie, and a protocol identifier that identifies the type of multitransport connection that the client attempts to establish. When the client receives the Initiate Multitransport Request PDU, it attempts to establish a secure multitransport connection with the server.

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[MS-RDPEPC]: Remote Desktop Protocol: Print Virtual Channel Extension

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td>2019/07/08</td><td>In Section 2.2.2.1, Client Device List Announce Request (DR_PRN_DEVICE_ANNOUNCE), added the section number that describes XPS mode to the RDPDR_PRINTER_ANNOUNCE_FLAG_XPSFORMAT value meaning in the Flags field table.

Changed from:
...
Flags (4 bytes): A 32-bit unsigned integer that indicates the properties of the client printer queue. This bit field MUST be a valid combination of any of the following values.
<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>...</td><td>,,,</td></tr>
<tr><td>RDPDR_PRINTER_ANNOUNCE_FLAG_XPSFORMAT
0x00000010</td><td>This client/printer supports XML Paper Specification (XPS) format.</td></tr>
<tr><td>...</td><td>,,,</td></tr>
</table>

Changed to:
...
Flags (4 bytes): A 32-bit unsigned integer that indicates the properties of the client printer queue. This bit field MUST be a valid combination of any of the following values.
<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>...</td><td>…</td></tr>
<tr><td>RDPDR_PRINTER_ANNOUNCE_FLAG_XPSFORMAT
0x00000010</td><td>This client/printer supports XML Paper Specification (XPS) format (section 3.1.1.2).</td></tr>
</table>
</td></tr>
</table>

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Errata Published*	Description
	… …

In Section 2.2.2.2, Server Printer Set XPS Mode (DR_PRN_USING_XPS), added that the DR_PRN_USING_XPS message indicates to the client that future printer write request messages will use the XPS format.

Changed from:

This message is sent from server to client to set the device in XPS mode (see section 3.1.1.2).

...

Changed to:

This message is sent from server to client to set the device in XPS mode (see section 3.1.1.2) and indicate to the client that future Printer Write Request (section 2.2.2.9) messages will use the XPS format.

...

In Section 3.1.1.2, XPS Mode, added the section number that describes the server behavior if it chooses to use the XPS format.

Changed from:

...

The server MUST notify the client with the message DR_PRN_USING_XPS (section 2.2.2.2) if it chooses to use the XPS format.

...

Changed to:

...

The server MUST notify the client with the DR_PRN_USING_XPS (section 2.2.2.2) message as described in section 3.3.5.1.2 if it chooses to use the XPS format.

...

In Section 3.3.5.1.2, Sending a Printer Set XPS Mode Message, clarified the server Printer Write Request message section number.

Changed from:

...

If the server chooses to send print data in XPS format, the server MUST send this message to the client prior to sending any data in the write request messages (section 2.2.2.1).

Changed to:

...

If the server chooses to send print data in XPS format, the server MUST send this message to the client prior to sending any data in the Printer Write Request (section 2.2.2.9) message.

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[MS-RDPEPNP]: Remote Desktop Protocol: Plug and Play Devices Virtual Channel Extension

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[MS-RDPERP]: Remote Desktop Protocol: Remote Programs Virtual Channel Extension

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Errata below are for Protocol Document Version V27.0 – 2018/09/12.

Errata Published*	Description
2019/09/02	In this document, multiple sections have been updated to clarify resize margins. For details on these changes, see the PDF doc here.
2019/07/08	In Section 2.2.2.2.2, Client Information PDU (TS_RAIL_ORDER_CLIENTSTATUS), clarified that one or more flags must be set and addressed the scenario when zero flags would be set in the Flags field description. Changed from: ... Flags (4 bytes): An unsigned 32-bit integer. RAIL features that are supported by the client; MUST be set to one of the following. ... Changed to: ... Flags (4 bytes): An unsigned 32-bit integer. RAIL features that are supported by the client; MUST be set to one or more of the following feature flags, or zero if none of the features are supported. ...
2019/06/24	In this document, information about window resize margins has been added for clarification.

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Errata Published*	Description
	In Section 1.3.4, Window Resize Margins, clarified how the resize margins should be processed relative to the window boundaries. Changed from: Window resize margins are supported by RDP 10.2. The dimensions of these margins are defined by the server and are to be used by the client to create a transparent hit-testable region around the RemoteApp window graphics. Any mouse, pen, or touch input within these margins is to be sent to the server. ... Changed to: Window resize margins are supported by RDP 10.2. The dimensions of these margins are defined by the server and are to be used by the client to create a transparent hit-testable region around the RemoteApp window graphics. Any mouse, pen, or touch input within these margins is to be sent to the server. Window resize margins must be used to extend the window geometry and are not included in the boundaries of the window sent in the Window Information Order (section 2.2.1.3.1.2.1). ... In Section 2.2.1.3.1.2.1, New or Existing Window, clarified how the resize margins should be processed relative to the window boundaries in the WindowLeftResizeMargin, WindowRightResizeMargin, WindowTopResizeMargin, and WindowBottomResizeMargin field descriptions. Changed from: WindowLeftResizeMargin (4 bytes): An unsigned 32-bit integer specifying the width of the transparent hit-testable margin along the left edge of the window. Any mouse, pen, or touch input within this margin SHOULD be sent to the server. This field is present only if the WINDOW_ORDER_FIELD_RESIZE_MARGIN_X flag is set in the FieldsPresentFlags field of TS_WINDOW_ORDER_HEADER. WindowRightResizeMargin (4 bytes): An unsigned 32-bit integer specifying the width of the transparent hit-testable margin along the right edge of the window. Any mouse, pen or touch input within this margin SHOULD be sent to the server. This field is present only if the WINDOW_ORDER_FIELD_ RESIZE_MARGIN_X flag is set in the FieldsPresentFlags field of TS_WINDOW_ORDER_HEADER. WindowTopResizeMargin (4 bytes): An unsigned 32-bit integer specifying the height of the transparent hit-testable margin along the top edge of the window. Any mouse, pen or touch input within this margin SHOULD be sent to the server. This field is present only if the WINDOW_ORDER_FIELD_ RESIZE_MARGIN_Y flag is set in the FieldsPresentFlags field of TS_WINDOW_ORDER_HEADER. WindowBottomResizeMargin (4 bytes): An unsigned 32-bit integer specifying the height of the transparent hit-testable margin along the bottom edge of the window. Any mouse, pen or touch input within this margin SHOULD be sent to the server.

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	This field is present only if the WINDOW_ORDER_FIELD_ RESIZE_MARGIN_Y flag is set in the FieldsPresentFlags field of TS_WINDOW_ORDER_HEADER. ... Changed to: ... WindowLeftResizeMargin (4 bytes): An unsigned 32-bit integer specifying the width of the transparent hit-testable margin along the left edge of the window. Any mouse, pen, or touch input within this margin SHOULD be sent to the server. This field is present only if the WINDOW_ORDER_FIELD_RESIZE_MARGIN_X flag is set in the FieldsPresentFlags field of TS_WINDOW_ORDER_HEADER. Resize margins SHOULD be used to extend the window geometry (defined by the WindowOffsetX, WindowOffsetY, WindowWidth and WindowHeight fields) and are not included in the window boundaries. WindowRightResizeMargin (4 bytes): An unsigned 32-bit integer specifying the width of the transparent hit-testable margin along the right edge of the window. Any mouse, pen or touch input within this margin SHOULD be sent to the server. This field is present only if the WINDOW_ORDER_FIELD_ RESIZE_MARGIN_X flag is set in the FieldsPresentFlags field of TS_WINDOW_ORDER_HEADER. Resize margins SHOULD be used to extend the window geometry (defined by the WindowOffsetX, WindowOffsetY, WindowWidth and WindowHeight fields) and are not included in the window boundaries. WindowTopResizeMargin (4 bytes): An unsigned 32-bit integer specifying the height of the transparent hit-testable margin along the top edge of the window. Any mouse, pen or touch input within this margin SHOULD be sent to the server. This field is present only if the WINDOW_ORDER_FIELD_ RESIZE_MARGIN_Y flag is set in the FieldsPresentFlags field of TS_WINDOW_ORDER_HEADER. Resize margins SHOULD be used to extend the window geometry (defined by the WindowOffsetX, WindowOffsetY, WindowWidth and WindowHeight fields) and are not included in the window boundaries. WindowBottomResizeMargin (4 bytes): An unsigned 32-bit integer specifying the height of the transparent hit-testable margin along the bottom edge of the window. Any mouse, pen or touch input within this margin SHOULD be sent to the server. This field is present only if the WINDOW_ORDER_FIELD_ RESIZE_MARGIN_Y flag is set in the FieldsPresentFlags field of TS_WINDOW_ORDER_HEADER. Resize margins SHOULD be used to extend the window geometry (defined by the WindowOffsetX, WindowOffsetY, WindowWidth and WindowHeight fields) and are not included in the window boundaries. ...

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Errata Published*	Description
	In Section 2.2.2.2.2, Client Information PDU (TS_RAIL_ORDER_CLIENTSTATUS), added the TS_RAIL_CLIENTSTATUS_HIGH_DPI_ICONS_SUPPORTED value and its meaning to the Flags field description table. Changed from: ... Flags (4 bytes): An unsigned 32-bit integer. RAIL features that are supported by the client; MUST be set to one of the following. Value Meaning ... TS_RAIL_CLIENTSTATUS_WINDOW_RESIZE_MARGIN_SUPPORTED 0x00000010 Indicates that the client supports resize margins using the Window Information PDU (section 2.2.1.3.1). TS_RAIL_CLIENTSTATUS_APPBAR_REMOTING_SUPPORTED 0x00000040 Indicates that the client supports application desktop toolbar remoting using the Window Information PDU (section 2.2.1.3.1). ... Changed to: Flags (4 bytes): An unsigned 32-bit integer. RAIL features that are supported by the client; MUST be set to one of the following. Value Meaning ... TS_RAIL_CLIENTSTATUS_WINDOW_RESIZE_MARGIN_SUPPORTED 0x00000010 Indicates that the client supports resize margins using the Window Information PDU (section 2.2.1.3.1). TS_RAIL_CLIENTSTATUS_HIGH_DPI_ICONS_SUPPORTED 0x00000020 Indicates that the client supports icons up to 96×96 pixels in size in the Window Icon PDU (section 2.2.1.3.1.2.2). If this flag is not present, icon dimensions are limited to 32×32 pixels. TS_RAIL_CLIENTSTATUS_APPBAR_REMOTING_SUPPORTED 0x00000040 Indicates that the client supports application desktop toolbar remoting using the Window Information PDU (section 2.2.1.3.1). ... In Section 3.2.5.1.6, Processing Window Information Orders, described what the boundaries of the window defined by the WindowOffsetX, WindowOffsetY, WindowWidth and WindowHeight fields include and do not include. Changed from: ... Upon receipt of a Window Information Order for the deregistration of an application desktop toolbar window, the client SHOULD locate the local RAIL window that corresponds to the WindowId reported in the Hdr field and deregister the application desktop toolbar window. If no such window can be found, the client SHOULD ignore the order. Upon receipt of a Window Information Order for the edge of an application desktop toolbar window, the client SHOULD locate the local RAIL window that corresponds to the WindowId

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Errata Published*	Description
	reported in the Hdr field and update the edge to which the window is anchored. If no such window can be found, the client SHOULD ignore the order. Changed to: ... Upon receipt of a Window Information Order for the deregistration of an application desktop toolbar window, the client SHOULD locate the local RAIL window that corresponds to the WindowId reported in the Hdr field and deregister the application desktop toolbar window. If no such window can be found, the client SHOULD ignore the order. The boundaries of the window (defined by the WindowOffsetX, WindowOffsetY, WindowWidth and WindowHeight fields) only include the visible area of the window, and do not include window resize margins (if present). However, the Client Window Move PDU (section 2.2.2.7.4) and Client Window Snap PDU (section 2.2.2.7.5) do include resize margins in the window boundaries. For this reason, clients SHOULD NOT expect the window boundaries reported in the Window Information Order (section 2.2.1.3.1.2.1) to match boundaries previously sent in a Window Move/Snap PDU. Upon receipt of a Window Information Order for the edge of an application desktop toolbar window, the client SHOULD locate the local RAIL window that corresponds to the WindowId reported in the Hdr field and update the edge to which the window is anchored. If no such window can be found, the client SHOULD ignore the order.
2019/02/19	In Section 2.2.1.3.1.2.1, New or Existing Window, added that the string is not guaranteed to be null-terminated in the TitleInfo field description. Changed from: ... TitleInfo (variable): UNICODE_STRING. Variable length. Contains the window's title string. The maximum value for the CbString field of UNICODE_STRING is 520 bytes. This structure is present only if the WINDOW_ORDER_FIELD_TITLE flag is set in the FieldsPresentFlags field of TS_WINDOW_ORDER_HEADER. ... Changed to: ... TitleInfo (variable): UNICODE_STRING. Variable length. Contains the window's title string. This string is not guaranteed to be null-terminated. The maximum value for the CbString field of UNICODE_STRING is 520 bytes. This structure is present only if the WINDOW_ORDER_FIELD_TITLE flag is set in the FieldsPresentFlags field of TS_WINDOW_ORDER_HEADER. ... In Section 2.2.2.7.1, Server Min Max Info PDU (TS_RAIL_ORDER_MINMAXINFO), changed unsigned 16-bit integer to signed 16-bit integer in the MaxWidth, MaxHeight, MaxPosX, MaxPosY, MinTrackWidth, MinTrackHeight, MaxTrackWidth, and MaxTrackHeight field descriptions. Changed from: ... MaxWidth (2 bytes): An unsigned 16-bit integer. The width of the maximized window.

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	MaxHeight (2 bytes): An unsigned 16-bit integer. The height of the maximized window. MaxPosX (2 bytes): An unsigned 16-bit integer. The x-coordinate of the top-left corner of the maximized window. MaxPosY (2 bytes): An unsigned 16-bit integer. The y-coordinate of the top-left corner of the maximized window. MinTrackWidth (2 bytes): An unsigned 16-bit integer. The minimum width to which the window can be resized. MinTrackHeight (2 bytes): An unsigned 16-bit integer. The minimum height to which the window can be resized. MaxTrackWidth (2 bytes): An unsigned 16-bit integer. The maximum width to which the window can be resized. MaxTrackHeight (2 bytes): An unsigned 16-bit integer. The maximum height to which the window can be resized. Changed to: ... MaxWidth (2 bytes): A signed 16-bit integer. The width of the maximized window. MaxHeight (2 bytes): A signed 16-bit integer. The height of the maximized window. MaxPosX (2 bytes): A signed 16-bit integer. The x-coordinate of the top-left corner of the maximized window. MaxPosY (2 bytes): A signed 16-bit integer. The y-coordinate of the top-left corner of the maximized window. MinTrackWidth (2 bytes): A signed 16-bit integer. The minimum width to which the window can be resized. MinTrackHeight (2 bytes): A signed 16-bit integer. The minimum height to which the window can be resized. MaxTrackWidth (2 bytes): A signed 16-bit integer. The maximum width to which the window can be resized. MaxTrackHeight (2 bytes): A signed 16-bit integer. The maximum height to which the window can be resized. In Section 2.2.2.7.2, Server Move/Size Start PDU (TS_RAIL_ORDER_LOCALMOVESIZE), changed unsigned 16-bit integer to signed 16-bit integer in the PosX and PosY field descriptions. Changed from:

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	... PosX (2 bytes): An unsigned 16-bit integer. The meaning of this field depends upon the value of the MoveSizeType field. ... PosY (2 bytes): An unsigned 16-bit integer. The meaning of this field depends on the value of the MoveSizeType field. ... Changed to: ... PosX (2 bytes): A signed 16-bit integer. The meaning of this field depends upon the value of the MoveSizeType field. ... PosY (2 bytes): A signed 16-bit integer. The meaning of this field depends on the value of the MoveSizeType field. ... In Section 2.2.2.7.3, Server Move/Size End PDU (TS_RAIL_ORDER_LOCALMOVESIZE), changed unsigned 16-bit integer to signed 16-bit integer in the TopLeftX and TopLeftY field descriptions. Changed from: ... TopLeftX (2 bytes): An unsigned 16-bit integer. The x-coordinate of the moved or resized window's top-left corner. TopLeftY (2 bytes): An unsigned 16-bit integer. The y-coordinate of the moved or resized window's top-left corner. Changed to: ... TopLeftX (2 bytes): A signed 16-bit integer. The x-coordinate of the moved or resized window's top-left corner. TopLeftY (2 bytes): A signed 16-bit integer. The y-coordinate of the moved or resized window's top-left corner. In Section 2.2.2.7.4, Client Window Move PDU (TS_RAIL_ORDER_WINDOWMOVE), changed unsigned 16-bit integer to signed 16-bit integer in the Left, Top, Right, and Bottom field descriptions. Changed from: ... Left (2 bytes): An unsigned 16-bit integer. The x-coordinate of the top-left corner of the window's new position. Top (2 bytes): An unsigned 16-bit integer. The y-coordinate of the top-left corner of the window's new position.

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	Right (2 bytes): An unsigned 16-bit integer. The x-coordinate of the bottom-right corner of the window's new position. Bottom (2 bytes): An unsigned 16-bit integer. The y-coordinate of the bottom-right corner of the window's new position. Changed to: ... Left (2 bytes): A signed 16-bit integer. The x-coordinate of the top-left corner of the window's new position. Top (2 bytes): A signed 16-bit integer. The y-coordinate of the top-left corner of the window's new position. Right (2 bytes): A signed 16-bit integer. The x-coordinate of the bottom-right corner of the window's new position. Bottom (2 bytes): A signed 16-bit integer. The y-coordinate of the bottom-right corner of the window's new position. In Section 2.2.2.7.5, Client Window Snap PDU (TS_RAIL_ORDER_SNAP_ARRANGE), changed unsigned 16-bit integer to signed 16-bit integer in the Left, Top, Right, and Bottom field descriptions. Changed from: ... Left (2 bytes): An unsigned 16-bit integer. The x-coordinate of the top-left corner of the window's new position. Top (2 bytes): An unsigned 16-bit integer. The y-coordinate of the top-left corner of the window's new position. Right (2 bytes): An unsigned 16-bit integer. The x-coordinate of the bottom-right corner of the window's new position. Bottom (2 bytes): An unsigned 16-bit integer. The y-coordinate of the bottom-right corner of the window's new position. Changed to: ... Left (2 bytes): A signed 16-bit integer. The x-coordinate of the top-left corner of the window's new position. Top (2 bytes): A signed 16-bit integer. The y-coordinate of the top-left corner of the window's new position. Right (2 bytes): A signed 16-bit integer. The x-coordinate of the bottom-right corner of the window's new position.

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	Bottom (2 bytes): A signed 16-bit integer. The y-coordinate of the bottom-right corner of the window's new position. In Section 2.2.2.8.1, Server Get Application ID Response PDU (TS_RAIL_ORDER_GET_APPID_RESP), changed the ApplicationId field size from 512 bytes to 520 bytes. Changed from: ... <Bit table> Hdr WindowId ApplicationId (512 bytes) ... ... ApplicationId (512 bytes): A null-terminated string of Unicode characters specifying the Application ID that the Client SHOULD associate with its window, if it supports using the Application ID for identifying and grouping windows. Changed to: ... <Bit table> Hdr WindowId ApplicationId (520 bytes) ... ... ApplicationId (520 bytes): A null-terminated string of Unicode characters specifying the Application ID that the Client SHOULD associate with its window, if it supports using the Application ID for identifying and grouping windows. In Section 2.2.2.8.2, Server Get Application ID Extended Response PDU (TS_RAIL_ORDER_GET_APPID_RESP_EX), changed the ApplicationId field size from 512 bytes to 520 bytes. Changed from: ... <Bit table> Hdr WindowId ApplicationId (512 bytes) ... ... ApplicationId (512 bytes): A null-terminated string of Unicode characters specifying the Application ID that the Client SHOULD associate with its window, if it supports using the Application ID for identifying and grouping windows. ...

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	Changed to: ... <Bit table> Hdr WindowId ApplicationId (520 bytes) ... ... ApplicationId (520 bytes): A null-terminated string of Unicode characters specifying the Application ID that the Client SHOULD associate with its window, if it supports using the Application ID for identifying and grouping windows. ...
2019/02/19	In Section 4.2.1, TS_RAIL_ORDER_HANDSHAKE, Filter Updated PDUs has been changed to Handshake PDU. Changed from: The following are network captures of the Filter Updated PDUs (TS_RAIL_ORDER_HANDSHAKE, as specified in 2.2.2.2.1). ... Changed to: The following are network captures of the Handshake PDU (TS_RAIL_ORDER_HANDSHAKE, as specified in 2.2.2.2.1). ...
2019/02/19	In Section 1.3.2.1, RAIL Session Connection, text that describes EnhancedRemoteApp in a RAIL-specific connection establishment sequence bulleted item and clarifies when the server should send a HandshakeEx PDU instead of a Handshake PDU after the RDP connection is established has been added. Changed from: ... ● The Alternate Shell field of the Client Info PDU, as specified in [MS-RDPBCGR] section 2.2.1.11, is NOT used to communicate the initial application started in the session. Instead, the initial application information is communicated to the server via the Client Execute PDU. ● If the server supports RAIL, the Demand Active PDU has to contain the Remote Programs Capability Set and Window List Capability Set to indicate that it supports RAIL. .. After the RDP connection is established, a RAIL client and server exchange Handshake PDUs over the RAIL Virtual Channel to indicate that each is ready for data on the virtual channel. .. Changed to: ... ● The Alternate Shell field of the Client Info PDU, as specified in [MS-RDPBCGR] section 2.2.1.11, is NOT used to communicate the initial application started in the session. Instead, the initial application information is communicated to the server via the Client Execute PDU.

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	• The client can set the INFO_HIDEF_RAIL_SUPPORTED flag of the Client Info PDU (as specified in [MS-RDPBCGR] section 2.2.1.11.1.1) to request an Enhanced RemoteApp session. If the server does not support Enhanced RemoteApp, it should fall back to a standard RemoteApp session. • If the server supports RAIL, the Demand Active PDU has to contain the Remote Programs Capability Set and Window List Capability Set to indicate that it supports RAIL. ... After the RDP connection is established, a RAIL client and server exchange Handshake PDUs over the RAIL Virtual Channel to indicate that each is ready for data on the virtual channel. The server should send a HandshakeEx PDU instead of a Handshake PDU if the client and server both indicate support for it in the Remote Programs Capability Set, or if Enhanced RemoteApp is in use. The client must respond with a Handshake PDU. ... In Section 3.1.5.1, Constructing Handshake PDU, references have been added to the HandshakeEx PDU section. Changed from: The Handshake PDU is constructed during initialization of the remote applications integrated locally (RAIL) virtual channel. The buildNumber field SHOULD be initialized to the build or version of the sending party. This PDU MUST be sent before any other PDU on the virtual channel. Changed to: The Handshake PDU is constructed during initialization of the remote applications integrated locally (RAIL) virtual channel. The buildNumber field SHOULD be initialized to the build or version of the sending party. This PDU (or alternatively the HandshakeEx PDU (section 2.2.2.2.3) if the sending party is the server) MUST be sent before any other PDU on the virtual channel. In Section 3.1.5.2 Processing Handshake PDU, references have been added to the HandshakeEx PDU section. Changed from: ... The receiving party MUST NOT process any other virtual channel PDUs unless the Handshake PDU has been received. Changed to: ... The receiving party MUST NOT process any other virtual channel PDUs unless either the Handshake PDU or (if the receiving party is the client) the HandshakeEx PDU (section 2.2.2.2.3) has been received. In Section 3.2.5.1.3, Constructing Client Info PDU, text describing Enhanced RemoteApp and the INFO_HIDEF_RAIL_SUPPORTED flag has been added. Changed from: ...

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	For remote applications integrated locally (RAIL) clients, the flags field of the Info Packet (as specified in [MS-RDPBCGR] section 2.2.1.11.1.1) MUST have the INFO_RAIL (0x00008000) flag set. This informs the server that the client wants to create a RAIL session. Changed to: ... For remote applications integrated locally (RAIL) clients, the flags field of the Info Packet (as specified in [MS-RDPBCGR] section 2.2.1.11.1.1) MUST have the INFO_RAIL (0x00008000) flag set. This informs the server that the client wants to create a RAIL session. If the client supports Enhanced RemoteApp, the flags field SHOULD also have the INFO_HIDEF_RAIL_SUPPORTED (0x02000000) flag set. This flag requests that the server create a RAIL session in Enhanced RemoteApp mode. Setting this flag does not guarantee that Enhanced RemoteApp will be enabled since the server may not support this mode. A new section, Section 3.2.5.2.1.2, Processing HandshakeEx PDU, has been added: The client SHOULD check the buildNumber field to verify compatibility of the receiver with the sender.<25> If the TS_RAIL_ORDER_HANDSHAKEEX_FLAGS_HIDEF (0x00000001) flag in the railHandshakeFlags field is set, the remote session is running in Enhanced RemoteApp mode, and the client SHOULD handle the RDPGFX_MAP_SURFACE_TO_WINDOW_PDU ([MS-RDPEGFX] section 2.2.2.20) message. If this flag is not set, the session is not running in Enhanced RemoteApp mode, even if the client requested it in the Client Info PDU (as specified in section 3.2.5.1.3). In this scenario, the client SHOULD NOT expect to receive Enhanced RemoteApp messages. The client MUST NOT process any other virtual channel PDUs unless either the HandshakeEx PDU (section 2.2.2.2.3) or the Handshake PDU (section 2.2.2.2.1) has been received. In Section 3.3.5.1.3, Processing Client Info PDU, text that describes when the client has requested that the RAIL session be created in EnhancedRemoteApp mode and what happens if the server supports Enhanced RemoteApp mode has been added. Changed from: ... If the flags field of the Info Packet (as specified in [MS-RDPBCGR] section 2.2.1.11.1.1) has the INFO_RAIL (0x00008000) flag set, it indicates that the client wants to start a remote applications integrated locally (RAIL) connection. If the server supports RAIL, it SHOULD indicate this by using the Demand Active PDU (see section 3.3.5.1.4). Changed to: ... If the flags field of the Info Packet (as specified in [MS-RDPBCGR] section 2.2.1.11.1.1) has the INFO_RAIL (0x00008000) flag set, it indicates that the client wants to start a remote applications integrated locally (RAIL) connection. If the server supports RAIL, it SHOULD indicate this by using the Demand Active PDU (see section 3.3.5.1.4).

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	If the flags field of the Info Packet has the INFO_HIDEF_RAIL_SUPPORTED (0x02000000) flag set, it indicates that the client has requested that the RAIL session be created in Enhanced RemoteApp mode. If the server supports Enhanced RemoteApp mode this mode SHOULD be enabled, and upon initialization of the RAIL virtual channel the HandshakeEx PDU (section 2.2.2.2.3) MUST be sent with the TS_RAIL_ORDER_HANDSHAKEEX_FLAGS_HIDEF (0x00000001) flag set (section 3.3.5.2.1.2). If the INFO_HIDEF_RAIL_SUPPORTED flag is not set, the server MUST NOT enable Enhanced RemoteApp. A new section, Section 3.3.5.2.1.2, Sending HandshakeEx PDU, has been added: The HandshakeEx PDU MUST be constructed as specified in section 2.2.2.2.3. If Enhanced RemoteApp has been enabled for the current RAIL session (section 3.3.5.1.3), the server MUST set the TS_RAIL_ORDER_HANDSHAKEEX_FLAGS_HIDEF (0x00000001) flag. If it has not been enabled, the server MUST NOT set this flag. If Enhanced RemoteApp is not enabled, and support for the HandshakeEx PDU was not indicated in the Remote Programs Capability Set (section 2.2.1.1.1), the server MUST send the Handshake PDU (section 3.1.5.1) instead of the HandshakeEx PDU. In Section 6: Appendix A, Product Behavior, a new product behavior note has been added: <25> Section 3.2.5.2.1.2: Windows implementations ignore any incompatibility resulting from checking the buildNumber field between the sender and the receiver.

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[MS-RDPESC]: Remote Desktop Protocol: Smart Card Virtual Channel Extension

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[MS-RDPESP]: Remote Desktop Protocol: Serial and Parallel Port Virtual Channel Extension

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[MS-RDPEUDP]: Remote Desktop Protocol: UDP Transport Extension

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Errata below are for Protocol Document Version V40.0 – 2018/09/12.

Errata Published*	Description
2019/05/27 (replaces Errata originally published on 2019/03/18)	In Section 3.1.5.1.1, SYN Datagrams, clarified that it is the client that sets the RDPUDP_FLAG_SYNLOSSY flag when the RDPUDP_CORRELATION_ID_PAYLOAD structure is included in a SYN datagram. Changed from: • The RDPUDP_FLAG_SYNLOSSY flag MUST be set only when neither endpoint requires retransmission of lost datagrams. Changed to: • The RDPUDP_FLAG_SYNLOSSY flag MUST be set by the client only when neither endpoint requires retransmission of lost datagrams.
2019/02/19	In Section 3.1.5.1.1, SYN Datagrams, clarified that when a SYN datagram is created, it has to be zero-padded to increase the size to either the uUpStreamMtu field or the uDownStreamMtu field, whichever is smaller. Changed from: ... 5. This datagram MUST be zero-padded to increase the size of this datagram to 1232 bytes. Changed to: ... 5. This datagram MUST be zero-padded to increase the size of this datagram to uUpStreamMtu or uDownStreamMtu, whichever is smaller.
2019/02/19	In Section 3.1.5, Message Processing Events and Sequencing Rules, changed Listen/ to Listen, Close/- to Close, and ACK/ to ACK in the terminal server state and Close/- to Close and SYN+ACK/ACK to SYN+ACK/ACK(+DATA) in the terminal client state illustrated in the State diagram for the terminal server and terminal client states figure.

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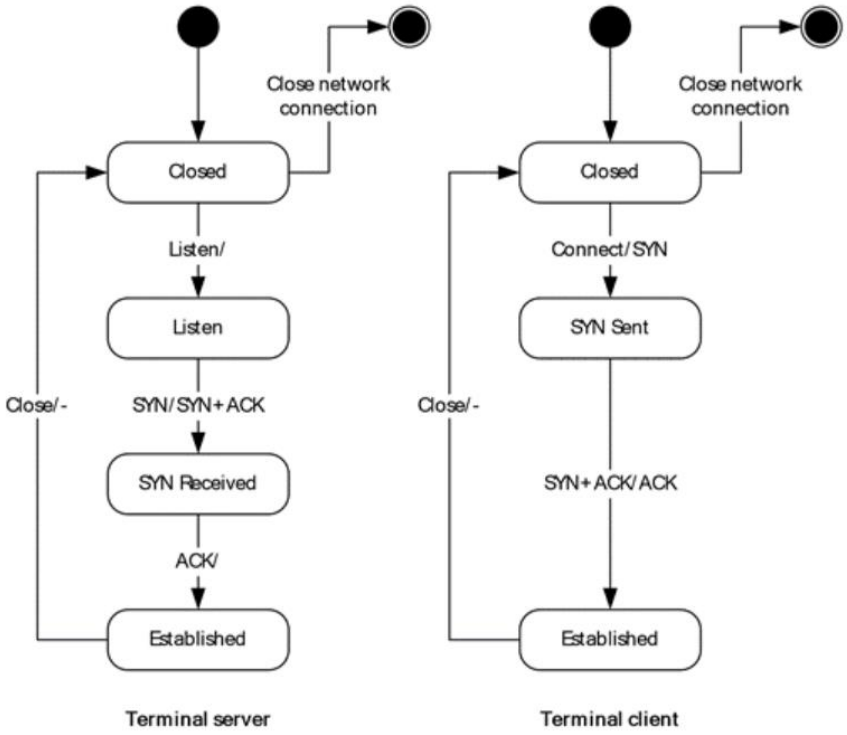
	Changed from:  Figure 13: State diagram for the terminal server and terminal client states Changed to:

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	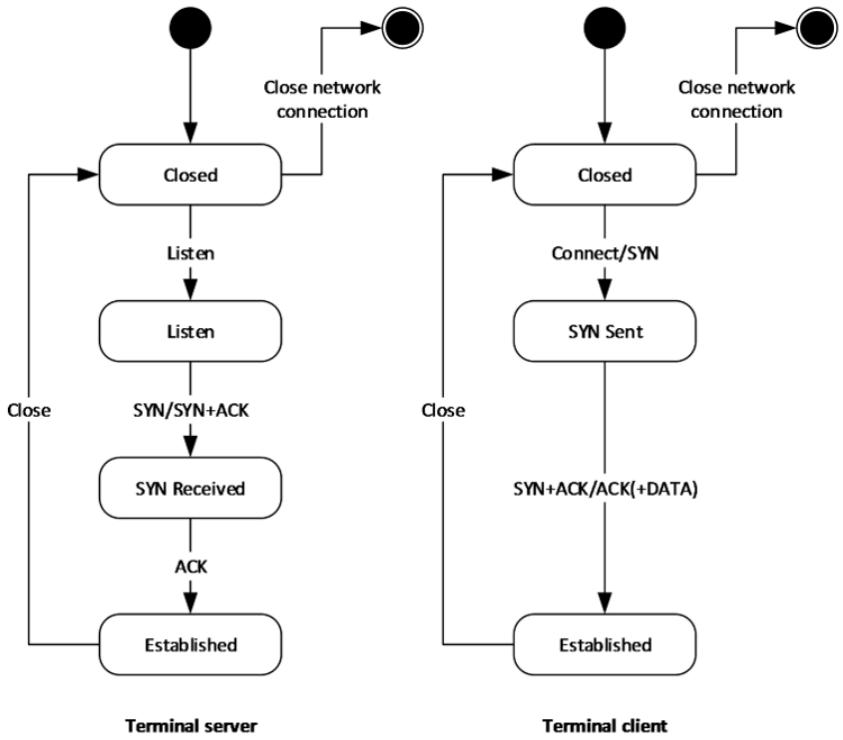 **Figure 13: State diagram for the terminal server and terminal client states** In Section 3.1.5.2, Connection Sequence, changed the following: Listen/- : to Listen: in the first connection sequence; Connect/SYN-: to Connect/SYN: in the second connection sequence; and ACK/-: to ACK: in the fifth connection sequence. Changed from: ... 1. Listen/- : The terminal server enters the Listen state: ... 2. Connect/SYN-: ... 5. ACK/-: ... Changed to: ... 1. Listen: The terminal server enters the Listen state: ... 2. Connect/SYN: ... 5. ACK: ...

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[MS-RDPEUDP2]: Remote Desktop Protocol: UDP Transport Extension Version 2

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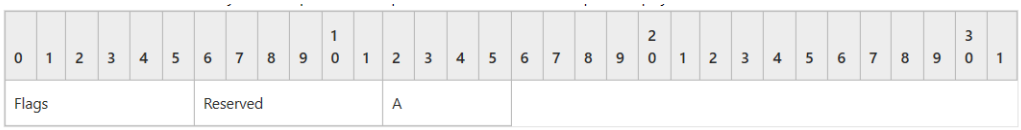
Errata below are for Protocol Document Version V2.0 – 2019/03/13.

Errata Published *	Description
2019/08/19	In Section 2.2.1.1, RDP-UDP2 Packet Header, changed the Flags field to 12 bits and updated the field values. Changed from: The Header field is mandatory, and it specifies the presence of the various optional payloads that follow.  Flags (6 bits): A 6-bit unsigned integer that specifies a bitmap of flags indicating the presence of optional payloads that follow the header. In a packet, one or more of the flags MUST be specified in the Header field. Flags / Meaning ACK 0x01 — ACK payload (section 2.2.1.2.1) is present. This flag MUST NOT be set if the ACKVEC flag is set. DATA 0x02 — DataHeader payload (section 2.2.1.2.5) and DataBody payload (section 2.2.1.2.7) are present. ACKVEC 0x04 — ACK Vector payload (section 2.2.1.2.6) is present. This flag MUST NOT be set if the ACK flag is set. AOA 0x08 — AckOfAcks payload (section 2.2.1.2.4) is present. OVERHEADSIZE 0x10 — OverheadSize payload (section 2.2.1.2.2) is present.

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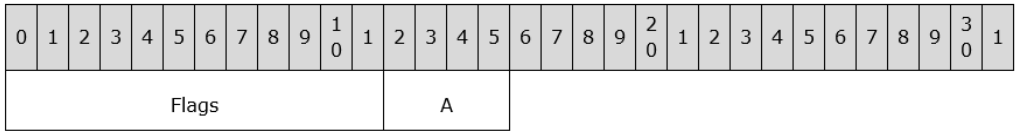
DELAYACKINFO 0x20	DelayAckInfo payload (section 2.2.1.2.3) is present.

Reserved (6 bits): A 6-bit reserved field that MUST be set to 0.

...

Changed to:

The Header field is mandatory, and it specifies the presence of the various optional payloads that follow.



Flags (12 bits): A 12-bit unsigned integer that specifies a bitmap of flags indicating the presence of optional payloads that follow the header. In a packet, one or more of the flags MUST be specified in the Header field.

Flags	Meaning
ACK 0x001	ACK payload (section 2.2.1.2.1) is present. This flag MUST NOT be set if the ACKVEC flag is set.
DATA 0x004	DataHeader payload (section 2.2.1.2.5) and DataBody payload (section 2.2.1.2.7) are present.
ACKVEC 0x008	ACK Vector payload (section 2.2.1.2.6) is present. This flag MUST NOT be set if the ACK flag is set.
AOA 0x010	AckOfAcks payload (section 2.2.1.2.4) is present.
OVERHEADSIZE 0x040	OverheadSize payload (section 2.2.1.2.2) is present.
DELAYACKINFO 0x100	DelayAckInfo payload (section 2.2.1.2.3) is present.

...

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[MS-RDPEV]: Remote Desktop Protocol: Video Redirection Virtual Channel Extension

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[MS-RDPEVOR]: Remote Desktop Protocol: Video Optimized Remoting Virtual Channel Extension

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[MS-RDPEXPS]: Remote Desktop Protocol: XML Paper Specification (XPS) Print Virtual Channel Extension

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[MS-RDPRFX]: Remote Desktop Protocol: RemoteFX Codec Extension

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Errata below are for Protocol Document Version V20.0 – 2018/09/12.

Errata Published*	Description
2019/02/19	In Section 4.2.4.1, Input TS_RFX_TILESET Message, updated the first line of an annotated dump of a TS_RFX_TILESET message containing a single encoded 64x64 tile from "00000000 c7 cc 3e 0b 00 00 01 01 c2 ca 00 00 51 50 01 40" to "00000000 c7 cc 3e 0b 00 00 01 00 c2 ca 00 00 51 50 01 40". Changed from: The following is an annotated dump of a TS_RFX_TILESET (section 2.2.2.3.4) message containing a single encoded 64x64 tile. 00000000 c7 cc 3e 0b 00 00 01 01 c2 ca 00 00 51 50 01 40 ... Changed to: The following is an annotated dump of a TS_RFX_TILESET (section 2.2.2.3.4) message containing a single encoded 64x64 tile. 00000000 c7 cc 3e 0b 00 00 01 00 c2 ca 00 00 51 50 01 40 ...
2019/02/19	In Section 3.1.8.1.6, Linearization, updated the converted value of -10 to 10 after coefficients from LL3 undergo differential encoding. Changed from: ... The coefficients from LL3 also undergo differential encoding. Except for the first coefficient, every raster-scanned LL3 coefficient is subtracted from its previous neighbor. For example, if the raster-scanned LL3 coefficients are [64, 32, 42, 54, 50, 60, 40, 70] Then, after differential encoding, they would get converted to

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Errata Published*	Description
	[64, -32, 10, 12, -4, -10, -20, 30] Changed to: ... The coefficients from LL3 also undergo differential encoding. Except for the first coefficient, every raster-scanned LL3 coefficient is subtracted from its previous neighbor. For example, if the raster-scanned LL3 coefficients are [64, 32, 42, 54, 50, 60, 40, 70] Then, after differential encoding, they would get converted to [64, -32, 10, 12, -4, 10, -20, 30]

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[MS-RMPR]: Rights Management Services (RMS): Client-to-Server Protocol

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[MS-RMSOD]: Rights Management Services Protocols Overview

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[MS-RPCE]: Remote Procedure Call Protocol Extensions

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[MS-RPCH]: Remote Procedure Call over HTTP Protocol

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[MS-RPRN]: Print System Remote Protocol

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Errata below are for Protocol Document Version V32.0 – 2018/09/12.

<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td>2018/12/10</td><td>In Section 1.7, Versioning and Capability Negotiation, changed from:

• Capability Negotiation: Functional negotiation … by comparing the value returned by the server in the dwBuildNumber member of OSVERSIONINFO (section 2.2.3.10.1) with well-known version-specific dwBuildNumber values.<2>
<2> Section 1.7: The values of the dwBuildNumber member in the OSVERSIONINFO structure (section 2.2.3.10.1) for specific versions of Windows are shown in the table that follows.
<table><tr><th>Version</th><th>dwBuildNumber value</th></tr><tr><td>Windows 10 and Windows Server 2016</td><td>>= 10586</td></tr><tr><td>…</td><td>…</td></tr></table>
Changed to:
• Capability Negotiation: Functional negotiation … by comparing the value returned by the server in the dwBuildNumber member of OSVERSIONINFO (section 2.2.3.10.1) with well-known version-specific dwBuildNumber values.<2>
<2> Section 1.7: The values of the dwBuildNumber member in the OSVERSIONINFO structure (section 2.2.3.10.1) for specific versions of Windows are shown in the table that follows.
<table><tr><th>Version</th><th>dwBuildNumber value</th></tr><tr><td>Windows Server operating system</td><td>>= 16299</td></tr><tr><td>Windows 10 and Windows Server 2016</td><td>>= 10586</td></tr><tr><td>…</td><td>…</td></tr></table></td></tr>
</table>

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Errata Published*	Description
	In Section 2.2.3.10.1, OSVERSIONINFO, changed from: dwBuildNumber (4 bytes): The build number of the OS. This is a version-specific value.<168> <168> Section 2.2.3.10.1: The values of the dwBuildNumber member in the OSVERSIONINFO structure (section 2.2.3.10.1) for specific versions of Windows is shown in the table that follows. On Windows Vista and later, an error is returned if the value is less than that shown in the table. Changed to: dwBuildNumber (4 bytes): The build number of the OS. This is a version-specific value.<168> <168> Section 2.2.3.10.1: The values of the dwBuildNumber member in the OSVERSIONINFO structure (section 2.2.3.10.1) for specific versions of Windows are listed in the product behavior note for dwBuildNumber in Versioning and Capability Negotiation (section 1.7). In Section 3.1.4.1.8.8, SPLCLIENT_CONTAINER Parameters, changed from: pClientInfo: This parameter is a pointer to an SPLCLIENT_CONTAINER (section 2.2.1.2.14) structure that specifies client information. The Level member of the SPLCLIENT_CONTAINER structure MUST be 0x00000001.<245> The value of the dwBuildNum member is used to verify that the client OS version is valid. It is a version-specific number.<246> <246> Section 3.1.4.1.8.8: The values of the dwBuildNumber member in the OSVERSIONINFO structure (section 2.2.3.10.1) for specific versions of Windows are listed in the product behavior note for dwBuildNumber in Versioning and Capability Negotiation (section 1.7). Changed to: pClientInfo: This parameter is a pointer to an SPLCLIENT_CONTAINER (section 2.2.1.2.14) structure that specifies client information. The Level member of the SPLCLIENT_CONTAINER structure MUST be 0x00000001.<245> The value of the dwBuildNum member is used to verify that the client OS version is valid. It is a version-specific number.<246> <246> Section 3.1.4.1.8.8: The values of the dwBuildNumber member in the OSVERSIONINFO structure (section 2.2.3.10.1) for specific versions of Windows are listed in the product behavior note for dwBuildNumber in Versioning and Capability Negotiation (section 1.7). On Windows Vista and later, an error is returned if the value is less than that shown for the corresponding Windows version in the table.
2018/10/29	In Section 2.2.3.10.1, OSVERSIONINFO, the description of dwBuildNumber has been changed from: dwBuildNumber (4 bytes): The build number of the OS.<168>. Changed to:

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Errata Published*	Description
	dwBuildNumber (4 bytes): The build number of the OS. This SHOULD<168> be a version-specific value. In Section 3.1.4.1.8.8, SPLCLIENT_CONTAINER Parameters, the following has been changed from: pClientInfo: This parameter is a pointer to an SPLCLIENT_CONTAINER (section 2.2.1.2.14) structure that specifies client information. The Level member of the SPLCLIENT_CONTAINER structure MUST be 0x00000001.<245> Changed to: pClientInfo: This parameter is a pointer to an SPLCLIENT_CONTAINER (section 2.2.1.2.14) structure that specifies client information. The Level member of the SPLCLIENT_CONTAINER structure MUST be 0x00000001.<245> The dwBuildNum member is used to verify that the client OS version is valid. It SHOULD<246> be a version-specific number. In Section 7, Appendix B: Product Behavior, the following behavior notes have been changed. Changed from: <168> Section 2.2.3.10.1: The dwBuildNumber value for OSVERSIONINFO and OSVERSIONINFOEX for specific versions of Windows is shown in the table that follows. Changed to: <168> Section 2.2.3.10.1: The dwBuildNumber value for OSVERSIONINFO and OSVERSIONINFOEX for specific versions of Windows is shown in the table that follows. On Windows Vista and later, an error is returned if the value is less than that shown in the table. Changed from: <245> Section 3.1.4.1.8.8: Windows does not use the following members: pUserName, dwBuildNum, dwMajorVersion, dwMinorVersion, and wProcessorArchitecture. pMachineName is used only if the server cannot determine the client machine name using remote procedure call (RPC) functions. The pMachineName member can be NULL. Changed to: <245> Section 3.1.4.1.8.8: Windows does not use the following members: pUserName, dwMajorVersion, dwMinorVersion, and wProcessorArchitecture. pMachineName is used only if the server cannot determine the client machine name using remote procedure call (RPC) functions. The pMachineName member can be NULL. In that section a new behavior note 246 has been added:

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	<246> Section 3.1.4.1.8.8: Windows version-specific values are listed in the product behavior note for dwBuildNumber in OSVERSIONINFO structure (section 2.2.3.10.1).

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[MS-RRASM]: Routing and Remote Access Server (RRAS) Management Protocol

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[MS-RRP]: Windows Remote Registry Protocol

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Errata below are for Protocol Document Version V34.0 – 2019/03/13.

Errata Published*	Description
2019/08/05	In Sections 3.1.5.4, 3.1.5.28, and 3.1.5.29: Changed all instances of BaseRegEnumValues to BaseRegEnumValue In Section 3.1.5.7: Changed PRRP_UNICODE_STRING to RRP_UNICODE_STRING Changed instances of KEY_CREATE_SUBKEY to KEY_CREATE_SUB_KEY In Section 3.1.5.15: Changed phKeyResult to phKResult In Section 3.1.5.19: Changed RegRestoreKey to BaseRegRestoreKey In Section 3.1.5.20: Removed an extra space in ERROR_INVALID_HANDLE In Sections 3.1.5.26 and 3.1.5.30: Changed lpValueBuf to lpvalueBuf

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[MS-RSMC]: Remote Session Monitoring and Control Protocol

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[MS-RSVD]: Remote Shared Virtual Disk Protocol

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[MS-SAMR]: Security Account Manager (SAM) Remote Protocol (Client-to-Server)

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Errata below are for Protocol Document Version V9.0 – 2018/03/16.

Errata Published*	Description
2019/05/27	In Section 2.1, Transport, changed from: The server SHOULD use this identity to perform method-specific access checks, as specified in the message processing section of each method.<11> The server SHOULD<12> reject calls that do not use an authentication level of either RPC_C_AUTHN_LEVEL_NONE or RPC_C_AUTHN_LEVEL_PKT_PRIVACY (see [MS-RPCE] section 2.2.1.1.8). Changed to: The server SHOULD use this identity to perform method-specific access checks, as specified in the message processing section of each method.<11> RPC clients for this protocol MUST use authentication level RPC_C_AUTHN_LEVEL_NONE when invoking RPC over SMB methods. The server SHOULD<12> reject calls that do not use an authentication level of either RPC_C_AUTHN_LEVEL_NONE or RPC_C_AUTHN_LEVEL_PKT_PRIVACY (see [MS-RPCE] section 2.2.1.1.8).

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[MS-SAMS]: Security Account Manager (SAM) Remote Protocol (Server-to-Server)

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[MS-SCMR]: Service Control Manager Remote Protocol

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Errata below are for Protocol Document Version V29.0 – 2019/03/13.

Errata Published*	Description
2019/08/05	In Section 2.2.23, SC_RPC_NOTIFY_PARAMS, the structure name mentioned in the description for pStatusChangeParams has been changed from PSERVICE_NOTIFY_STATUS_CHANGE_PARAMS_2 to SERVICE_NOTIFY_STATUS_CHANGE_PARAMS_2. Changed from: pStatusChangeParams: A PSERVICE_NOTIFY_STATUS_CHANGE_PARAMS_2 (section 2.2.44) structure that contains the service status notification information. Changed to: pStatusChangeParams: A SERVICE_NOTIFY_STATUS_CHANGE_PARAMS_2 (section 2.2.44) structure that contains the service status notification information. In Section 3.1.4.33, REnumServiceGroupW (Opnum 35), a parameter name has been changed from dwServiceParameter to dwCurrentState. Changed from: … In response to this request from the client, for a successful operation the server MUST determine the list of service records in the SCM database identified by the hSCManager parameter with a ServiceGroup value matching the pszGroupName parameter, determine that their ServiceStatus.dwCurrentState is equal to the state specified by dwServiceParameter, and determine that their Type value is equal to the dwServiceType parameter of the client request. The server MUST return this list by setting the service name and state of each service in this list in the array of ENUM_SERVICE_STATUSW (section 2.2.11) structures pointed to by the lpBuffer parameter and MUST set number of services returned in the lpServicesReturned parameter. ... Changed to: ...

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>
In response to this request from the client, for a successful operation the server MUST determine the list of service records in the SCM database identified by the hSCManager parameter with a ServiceGroup value matching the pszGroupName parameter, determine that their ServiceStatus.dwCurrentState is equal to the state specified by dwCurrentState, and determine that their Type value is equal to the dwServiceType parameter of the client request. The server MUST return this list by setting the service name and state of each service in this list in the array of ENUM_SERVICE_STATUSW (section 2.2.11) structures pointed to by the lpBuffer parameter and MUST set number of services returned in the lpServicesReturned parameter.

...

In Section 3.1.4.37, RQueryServiceConfig2W (Opnum 39), in the description for hService, a change was made to the name of the parameter mentioned in the description for the SERVICE_CONFIG_PREFERRED_NODE value.

Changed from:
…
<table>
<tr><td>SERVICE_CONFIG_PREFERRED_NODE
0x00000009<70></td><td>The lpInfo parameter is a pointer to a SERVICE_PREFERRED_NODE_INFO structure.<71></td></tr>
</table>
...

Changed to:
...
<table>
<tr><td>SERVICE_CONFIG_PREFERRED_NODE
0x00000009<70></td><td>The lpBuffer parameter is a pointer to a SERVICE_PREFERRED_NODE_INFO structure.<71></td></tr>
</table>
...
</td></tr>
<tr><td>2019/08/05</td><td>
In Section 6, Appendix A: Full IDL:
Several definitions to the IDL that were not previously included, but are necessary for implementation of the protocol, have been added.
The namespace for the type attribute in the XML definition has been changed from "s1" to "tns".

Changed from:
...

<pre>
typedef struct _SERVICE_TRIGGER_INFO {
    [range(0, 64)] DWORD   cTriggers;
    [size_is(cTriggers)]
    PSERVICE_TRIGGER   pTriggers;
    PBYTE   pReserved;
} SERVICE_TRIGGER_INFO, *PSERVICE_TRIGGER_INFO;
</pre>
</td></tr>
</table>

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Errata Published*	Description

	typedef ULONG SECURITY_INFORMATION, *PSECURITY_INFORMATION;
	
	DWORD
	RCloseServiceHandle(
	[in,out] LPSC_RPC_HANDLE hSCObject
	);
	...
	
	DWORD
	RCreateWowService(
	[in] SC_RPC_HANDLE hSCManager,
	[in,string,range(0, SC_MAX_NAME_LENGTH)]
	wchar_t * lpServiceName,
	[in,string,unique,range(0, SC_MAX_NAME_LENGTH)]
	wchar_t * lpDisplayName,
	[in] DWORD dwDesiredAccess,
	[in] DWORD dwServiceType,
	[in] DWORD dwStartType,
	[in] DWORD dwErrorControl,
	[in,string,range(0, SC_MAX_PATH_LENGTH)]
	wchar_t * lpBinaryPathName,
	[in,string,unique,range(0, SC_MAX_NAME_LENGTH)]
	wchar_t * lpLoadOrderGroup,
	[in,out,unique]
	LPDWORD lpdwTagId,
	[in,unique,size_is(dwDependSize)]
	LPBYTE lpDependencies,
	[in, range (0, SC_MAX_DEPEND_SIZE)]
	DWORD dwDependSize,
	[in,string,unique,range(0, SC_MAX_ACCOUNT_NAME_LENGTH)]
	wchar_t * lpServiceStartName,
	[in,unique,size_is(dwPwSize)]
	LPBYTE lpPassword,
	[in, range(0, SC_MAX_PWD_SIZE)]
	DWORD dwPwSize,
	[in] USHORT dwServiceWowType,
	[out] LPSC_RPC_HANDLE lpServiceHandle
	);
	
	…
	
	Changed to:
	...
	
	typedef struct _SERVICE_TRIGGER_INFO {
	[range(0, 64)] DWORD cTriggers;
	[size_is(cTriggers)]
	PSERVICE_TRIGGER pTriggers;
	PBYTE pReserved;
	} SERVICE_TRIGGER_INFO, *PSERVICE_TRIGGER_INFO;
	typedef ULONG SECURITY_INFORMATION, *PSECURITY_INFORMATION;
	
	typedef struct _ENUM_SERVICE_STATUSA {
	LPSTR lpServiceName;
	LPSTR lpDisplayName;
	SERVICE_STATUS ServiceStatus;
	} ENUM_SERVICE_STATUSA, *LPENUM_SERVICE_STATUSA;
	
	typedef struct _ENUM_SERVICE_STATUSW {
	LPWSTR lpServiceName;
	LPWSTR lpDisplayName;
	SERVICE_STATUS ServiceStatus;
	} ENUM_SERVICE_STATUSW, *LPENUM_SERVICE_STATUSW;

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Errata Published*	Description

```
        typedef struct _ENUM_SERVICE_STATUS_PROCESSA {
            LPSTR                   lpServiceName;
            LPSTR                   lpDisplayName;
            SERVICE_STATUS_PROCESS    ServiceStatusProcess;
        } ENUM_SERVICE_STATUS_PROCESSA,
    *LPENUM_SERVICE_STATUS_PROCESSA;

        typedef struct _ENUM_SERVICE_STATUS_PROCESSW {
            LPWSTR                  lpServiceName;
            LPWSTR                  lpDisplayName;
            SERVICE_STATUS_PROCESS    ServiceStatusProcess;
    } ENUM_SERVICE_STATUS_PROCESSW, *LPENUM_SERVICE_STATUS_PROCESSW;
        typedef struct _SERVICE_DESCRIPTION_WOW64
        {
            DWORD    dwDescriptionOffset;
        } SERVICE_DESCRIPTION_WOW64, *LPSERVICE_DESCRIPTION_WOW64;

        typedef struct _SERVICE_FAILURE_ACTIONS_WOW64
        {
            DWORD    dwResetPeriod;
            DWORD    dwRebootMsgOffset;
            DWORD    dwCommandOffset;
            DWORD    cActions;
            DWORD    dwsaActionsOffset;
        } SERVICE_FAILURE_ACTIONS_WOW64,
    *LPSERVICE_FAILURE_ACTIONS_WOW64;

        typedef struct _SERVICE_REQUIRED_PRIVILEGES_INFO_WOW64
        {
            DWORD    dwRequiredPrivilegesOffset;
        } SERVICE_REQUIRED_PRIVILEGES_INFO_WOW64,
    *LPSERVICE_REQUIRED_PRIVILEGES_INFO_WOW64;

    DWORD
    RCloseServiceHandle(
        [in,out] LPSC_RPC_HANDLE  hSCObject
        );

    ...

    DWORD
    RCreateWowService(
        [in]        SC_RPC_HANDLE       hSCManager,
        [in,string,range(0, SC_MAX_NAME_LENGTH)]
                    wchar_t *           lpServiceName,
        [in,string,unique,range(0, SC_MAX_NAME_LENGTH)]
                    wchar_t *           lpDisplayName,
        [in]        DWORD               dwDesiredAccess,
        [in]        DWORD               dwServiceType,
        [in]        DWORD               dwStartType,
        [in]        DWORD               dwErrorControl,
        [in,string,range(0, SC_MAX_PATH_LENGTH)]
                    wchar_t *           lpBinaryPathName,
        [in,string,unique,range(0, SC_MAX_NAME_LENGTH)]
                    wchar_t *           lpLoadOrderGroup,
        [in,out,unique]
                    LPDWORD             lpdwTagId,
        [in,unique,size_is(dwDependSize)]
                    LPBYTE              lpDependencies,
        [in, range (0, SC_MAX_DEPEND_SIZE)]
                    DWORD               dwDependSize,
        [in,string,unique,range(0, SC_MAX_ACCOUNT_NAME_LENGTH)]
                    wchar_t *           lpServiceStartName,
        [in,unique,size_is(dwPwSize)]
                    LPBYTE              lpPassword,
        [in, range(0, SC_MAX_PWD_SIZE)]
```


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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>
<pre>
                    DWORD   dwPwSize,
        [in]   USHORT   dwServiceWowType,
        [out]   LPSC_RPC_HANDLE   lpServiceHandle
        );

    DWORD
    ROpenSCManager2(
         [in] handle_t BindingHandle,
         [in,string,unique,range(0, SC_MAX_NAME_LENGTH)]
             wchar_t *DatabaseName,
         [in] DWORD DesiredAccess,
         [out] LPSC_RPC_HANDLE ScmHandle
        );
</pre>
</td></tr>
<tr><td>2019/08/05</td><td>
In Section 2.2.1, SECURITY_INFORMATION, a definition has been added to the table for LABEL_SECURITY_INFORMATION.

Changed from:

<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>DACL_SECURITY_INFORMATION
0x00000004</td><td>If set, the security descriptor MUST include the object's discretionary access control list (DACL). DACL information is specified in [MS-AZOD] section 1.1.1.3.</td></tr>
<tr><td>GROUP_SECURITY_INFORMATION
0x00000002</td><td>If set, specifies the security identifier (SID), as defined in [MS-DTYP] section 2.4.2, (LSAPR_SID) of the object's primary group. Primary group information is specified in [MS-DTYP].</td></tr>
<tr><td>OWNER_SECURITY_INFORMATION
0x00000001</td><td>If set, specifies the security identifier (SID) (LSAPR_SID) of the object's owner.</td></tr>
<tr><td>SACL_SECURITY_INFORMATION
0x00000008</td><td>If set, the security descriptor MUST include the object's system access control list (SACL). SACL information is specified in [MS-AZOD] section 1.1.1.3.</td></tr>
</table>

Changed to:

<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>DACL_SECURITY_INFORMATION
0x00000004</td><td>If set, the security descriptor MUST include the object's discretionary access control list (DACL). DACL information is specified in [MS-AZOD] section 1.1.1.3.</td></tr>
<tr><td>GROUP_SECURITY_INFORMATION
0x00000002</td><td>If set, specifies the security identifier (SID), as defined in [MS-DTYP] section 2.4.2, (LSAPR_SID) of the object's primary group. Primary group information is specified in [MS-DTYP].</td></tr>
</table>
</td></tr>
</table>

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Errata Published*	Description	
	OWNER_SECURITY_INFORMATION 0x00000001	If set, specifies the security identifier (SID) (LSAPR_SID) of the object's owner.
	SACL_SECURITY_INFORMATION 0x00000008	If set, the security descriptor MUST include the object's system access control list (SACL). SACL information is specified in [MS-AZOD] section 1.1.1.3.
	LABEL_SECURITY_INFORMATION 0x00000010	If set, specifies the mandatory integrity label. The mandatory integrity label is an ACE in the SACL of the object.

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[MS-SHLLINK]: Shell Link (.LNK) Binary File Format

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[MS-SFMWA]: Server and File Management Web APIs

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[MS-SFU]: Kerberos Protocol Extensions Service for User and Constrained Delegation Protocol

This topic lists the Errata found in the MS-SFU document since it was last published. Since this topic is updated frequently, we recommend that you subscribe to these RSS or Atom feeds to receive update notifications.

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Errata below are for Protocol Document Version V17.0 – 2018/09/12.

Errata Published*	Description
2019/09/02	In Section 3.2.5.2, KDC Receives S4U2proxy KRB_TGS_REQ, has been changed from: --Set and the USER_NOT_DELEGATED bit is set in the UserAccountControl field in the KERB_VALIDATION_INFO structure ([MS-PAC] section 2.5), then the KDC MUST return KRB-ERR-BADOPTION with STATUS_NOT_FOUND. Changed to: --Set and the USER_NOT_DELEGATED bit is set in the UserAccountControl field in the KERB_VALIDATION_INFO structure ([MS-PAC] section 2.5), then the KDC MUST return KRB-ERR-BADOPTION with STATUS_ACCOUNT_RESTRICTION ([MS-ERREF] section 2.3.1).

2019/07/22	In Section 2.2.1, PA-FOR-USER, corrected that PA-FOR-USER is not encrypted.
	
	Changed from:
	The following code defines the ASN.1 structure of the PA-FOR-USER padata type.
	
	`padata-type ::= PA-FOR-USER`
	`-- value 129`
	`padata-value ::= EncryptedData`
	`-- PA-FOR-USER-ENC`
	
	`PA-FOR-USER-ENC ::= SEQUENCE {`
	`userName [0] PrincipalName,`
	`userRealm [1] Realm,`
	`cksum [2] Checksum,`
	`auth-package [3] KerberosString`
	`}`
	
	Changed to:
	The following code defines the ASN.1 structure of the PA-FOR-USER padata type.
	
	`PA-FOR-USER ::= SEQUENCE {`
	`-- PA TYPE 129`
	`userName [0] PrincipalName,`
	`userRealm [1] Realm,`
	`cksum [2] Checksum,`
	`auth-package [3] KerberosString`
	`}`

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2019/04/29	In this document, changes have been made to clarify the behavior of S4u2Self with x509 certificate regarding use of PA_FOR_USER following a cross-realm referral. In Section 3.1.5.1.1, Service Sends S4U2self KRB_TGS_REQ, has been changed from: The user identification for these cases is carried in a PA-FOR-USER padata type or a PA-S4U-X509-USER padata type, respectively. Changed to: The PA-FOR-USER padata type can be used only in the former case, while a PA-S4U-X509-USER padata type can carry the user identity in both cases." A new section, Section 3.1.5.1.1.1, When to Use Each padata Type, has been added: What padata type Service 1 sends is determined by two factors. First, determine whether the TGT session key is of a newer type, defined here as ciphers that are not DES or RC4 based. Second, determine whether the client username was provided explicitly or was extracted from a certificate. Service 1 SHOULD populate and send a PA-FOR-USER structure when one of the following is true: --No certificate was presented for the user. --No user name was explicitly provided, and instead a certificate was provided that contained the user name in the Subject Alternate Name (SAN) field. Service 1 SHOULD populate and send a PA-S4U-X509-USER structure when one of the following is true: --No PA-FOR-USER is being sent. --The session key of the TGT being used is not a DES or RC4 key type. In Section 3.1.5.1.1.2, the title has been changed from "Using the User's Realm and User Name" to "Identify the User". In Section 3.1.5.1.1.13.1.5.1.1.2, Sending the S4USelf KRB_TGT_REQ, has been changed from: The S4U2self information in the KRB_TGS_REQ consists of: padata-type = PA-FOR-USER (ID129), which consists of four fields: userName, userRealm, cksum, and auth-package. Changed to: If Service 1 sends a PA-FOR-USER (ID129) structure, it consists of four fields: userName, userRealm, cksum, and auth-package. In that same section, the following paragraph has been added: If sending a PA-S4U-X509-USER (ID 130) structure, the cname and crealm should contain the same values as used for userName and userRealm in a PA-FOR-USER. If a client certificate was provided, the subject-certificate field MUST contain the client's X509 certificate encoded in ASN.1, as specified in [RFC3280]."

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	Section 3.1.5.1.1.2, Using the User's Certificate to Identify the User, has been removed. In Section 3.1.5.1.2, Service Receives S4U2self KRB_TGS_REP, the following paragraph has been added: In service tickets from KDCs that support S4U, the cname contains the name of the user. Services can further detect if the KDC supports PA_S4U_X509_USER by checking the reply padata for a PA-S4U-X509-USER preauth data. Furthermore, the KDC uses this reply padata to return a normalized form of the user name. Service 1 MUST take the cname from the reply PA-S4U-X509-USER and use it to replace both the cname from PA-S4U-X509-USER and the userName from PA-FOR-USER in any subsequent KRB_TGS_REQ requests used to chase referrals back to Service 1's realm. Additionally, the certificate is removed from the PA-S4U-X509-USER padata. For details on the above changes, see the PDF doc here.

*Date format: YYYY/MM/DD

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[MS-SMB]: Server Message Block (SMB) Protocol

This topic lists the Errata found in [MS-SMB] since it was last published. Since this topic is updated frequently, we recommend that you subscribe to these RSS or Atom feeds to receive update notifications.

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[MS-SMB2]: Server Message Block (SMB) Protocol Versions 2 and 3

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Errata below are for Protocol Document Version V58.0 – 2019/04/30.

Errata Published*	Description
2019/09/02	In Section 2.2.3.1.4, SMB2_NETNAME_NEGOTIATE_CONTEXT_ID, the following has been changed from: The SMB2_NETNAME_NEGOTIATE_CONTEXT_ID context is specified in an SMB2 NEGOTIATE request to indicate the server name the client connects to. The server MUST ignore this context. The format of the data in the Data field of this SMB2_NEGOTIATE_CONTEXT is as follows. Changed to: The SMB2_NETNAME_NEGOTIATE_CONTEXT_ID context is specified in an SMB2 NEGOTIATE request to indicate the server name the client connects to. The format of the data in the Data field of this SMB2_NEGOTIATE_CONTEXT is as follows. In Section 3.2.5.2, Receiving an SMB2 NEGOTIATE Response, the following has been changed from:

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	● If the NegotiateContextList contains more than one SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context, the client MUST return an error to the calling application. Changed to: ● If the NegotiateContextList does not contain exactly one SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context, the client MUST return an error to the calling application. The following was added: ● For each context in the received NegotiateContextList, if the context is any negotiate context other than SMB2_PREAUTH_INTEGRITY_CAPABILITIES, SMB2_COMPRESSION_CAPABILITIES, and SMB2_ENCRYPTION_CAPABILITIES negotiate context, the client MUST ignore the negotiate context. In Section 3.3.5.4, Receiving an SMB2 NEGOTIATE Request, the following has been changed from: ● If the NegotiateContextList contains more than one SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context, the server MUST fail the negotiate request with STATUS_INVALID_PARAMETER. Changed to: ● If the NegotiateContextList does not contain exactly one SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context, the server MUST fail the negotiate request with STATUS_INVALID_PARAMETER. The following was added: ● For each context in the received NegotiateContextList , if the context is SMB2_NETNAME_NEGOTIATE_CONTEXT_ID or any negotiate context other than SMB2_PREAUTH_INTEGRITY_CAPABILITIES, SMB2_COMPRESSION_CAPABILITIES, and SMB2_ENCRYPTION_CAPABILITIES negotiate context, the server MUST ignore the negotiate context.
2019/08/19	In Section 2.2.3.1.4, SMB2_NETNAME_NEGOTIATE_CONTEXT_ID, the NetName field has been changed from: NetName (variable): A null-terminated Unicode string containing the server name and specified by the client application. Changed to: NetName (variable): A Unicode string containing the server name and specified by the client application. In Section 3.2.1.2, Per SMB2 Transport Connection, the description of Connection.ServerName has been changed from:

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	Connection.ServerName: A null-terminated Unicode UTF-16 fully qualified domain name, a NetBIOS name, or an IP address of the server machine. Changed to: Connection.ServerName: A Unicode UTF-16 fully qualified domain name, a NetBIOS name, or an IP address of the server machine. In Section 3.2.1.9, Per Server, the description of ServerName has been changed from: ServerName: A fully qualified domain name, a NetBIOS name, or an IP address of the server machine. Changed to: ServerName: A Unicode UTF-16 fully qualified domain name, a NetBIOS name, or an IP address of the server machine. In Section 3.2.4.2.2.2, SMB2-Only Negotiate, the last bullet point has been changed from: ● NetName MUST be set to the application-provided ServerName formatted as null-terminated Unicode string. Changed to: ● NetName MUST be set to the application-provided ServerName.
2019/08/05	In Section 2.2.2.1, SMB2 ERROR Context Response, the description of ErrorId has been changed from: ErrorId (4 bytes): An identifier for the error context. This field MUST be set to the following value. Changed to: ErrorId (4 bytes): An identifier for the error context. This field MUST be set to one of the following values.
2019/08/05	In Section 3.1.4.4, Compressing the Message, the following has been changed from: The sender MUST perform the following: Set Offset to the length, in bytes, if any, of the uncompressed part of the message. Otherwise, set Offset to zero. Set OriginalCompressedSegmentSize to the uncompressed length, in bytes, of the portion of the message that is compressed. Assemble the outgoing message as a concatenation of the SMB2 COMPRESSION_TRANSFORM_HEADER followed by the uncompressed portion of the message followed by the compressed payload. The sender MUST compress the data using the CompressionAlgorithm as specified in [MS-XCA] section 2.

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	If the size of the resulting SMB2 message is less than OriginalCompressedSegmentSize, the sender MUST replace the SMB2 message with the concatenated SMB2 COMPRESSION_TRANSFORM_HEADER and compressed SMB2 message. Changed to: The sender MUST perform the following: If the entire SMB2 message is being compressed, then set Offset to zero; otherwise, set Offset to the length, in bytes, of the uncompressed part of the message. Set OriginalCompressedSegmentSize to the uncompressed length, in bytes, of the portion of the message that is being compressed. The sender MUST compress the data using the CompressionAlgorithm as specified in [MS-XCA] section 2. If the size of the compressed data is less than OriginalCompressedSegmentSize, the sender MUST perform the following: If Offset is zero, the sender MUST replace the SMB2 message with the SMB2 COMPRESSION_TRANSFORM_HEADER followed by the compressed SMB2 message. Otherwise, the sender MUST replace the portion of the SMB2 message selected for compression with the compressed part and prepend the SMB2 message with the SMB2 COMPRESSION_TRANSFORM_HEADER.
2019/08/05	In this document, multiple sections have been updated to handle multichannel scenarios. For details on these changes, see the PDF doc here.
2019/06/24	In Section 3.3.5.4, Receiving an SMB2 NEGOTIATE Request, information about how the compression algorithms are handled has been added. Changed from: The server SHOULD <234> set Connection.CompressionIds to all the algorithms in the CompressionAlgorithms field, in the order they are received. If the server does not support any of the algorithms provided by the client, Connection.CompressionIds MUST be set to an empty list. Changed to: The server SHOULD <234> set Connection.CompressionIds to all the supported compression algorithms common to both client and server in the CompressionAlgorithms field, in the order they are received. If the server does not support any of the algorithms provided by the client, Connection.CompressionIds MUST be set to an empty list. In this same section, the following step has been removed from the processing rules: ● If CompressionAlgorithm received in the request is “NONE”.
2019/06/10	In Section 3.3.5.15, Receiving an SMB2 IOCTL Request, we added some clarifying information. Changed from:

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	If InputCount is not equal to zero, the server MUST fail the request with STATUS_INVALID_PARAMETER in the following cases: ▪ If InputOffset is greater than zero but less than (size of SMB2 header + size of the SMB2 IOCTL request not including Buffer) or if InputOffset is greater than (size of SMB2 header + size of the SMB2 IOCTL request). ▪ If OutputOffset is greater than zero but less than (size of SMB2 header + size of the SMB2 IOCTL request not including Buffer) or if OutputOffset is greater than (size of SMB2 header + size of the SMB2 IOCTL request). ▪ If (InputOffset + InputCount) is greater than (size of SMB2 header + size of the SMB2 IOCTL request). ▪ If (OutputOffset + OutputCount) is greater than (size of SMB2 header + size of the SMB2 IOCTL request). ▪ If OutputCount is greater than zero and OutputOffset is less than (InputOffset + InputCount). Changed to: If InputCount is not equal to zero, the server MUST fail the request with STATUS_INVALID_PARAMETER in the following cases: ▪ If InputOffset is greater than zero but less than (size of SMB2 header + size of the SMB2 IOCTL request not including Buffer). ▪ If InputOffset is not a multiple of 8 bytes. ▪ If InputOffset is greater than size of SMB2 Message. ▪ If (InputOffset + InputCount) is greater than size of SMB2 Message. If InputCount is equal to zero and InputOffset is greater than size of SMB2 Message, the server MAY<320> fail the request with STATUS_INVALID_PARAMETER. The server SHOULD<321> ignore OutputOffset and OutputCount fields. <320> Section 3.3.5.15: Windows 8 and later and Windows Server 2012 and later do not fail the request. <321> Section 3.3.5.15: Windows Vista, Windows Server 2008, Windows 7, and Windows Server 2008 R2 fail the request with STATUS_INVALID_PARAMETER in the following cases: ▪ If OutputCount is not equal to zero and OutputOffset is greater than zero but less than (size of SMB2 header + size of the SMB2 IOCTL request not including Buffer). ▪ If OutputCount is not equal to zero and OutputOffset is greater than size of SMB2 Message. ▪ If OutputCount is not equal to zero and OutputOffset is not rounded up to a multiple of 8 bytes. ▪ If (OutputOffset + OutputCount) is greater than size of SMB2 Message. ▪ If OutputCount is greater than zero and OutputOffset is less than (InputOffset + InputCount). Windows 7 and Windows Server 2008 R2 fail the request with STATUS_INVALID_PARAMETER if OutputOffset or OutputCount is greater than size of SMB2 Message.
2019/04/29	In Section 2.2.3.1, SMB2 NEGOTIATE_CONTEXT Request Values, the value of SMB2_COMPRESSION_CAPABILITIES has been changed from: 0x0004

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	Changed to: 0x0003 In Section 6, Appendix A: Product Behavior, the following behavior notes have been changed from: <13> Section 2.2.3.1: Windows 10 v1809 operating system and prior, Windows Server v1809 operating system and prior, and Windows Server 2019 and prior do not support compression. <14> Section 2.2.3.1: Windows 10 v1809 and prior, Windows Server v1809 and prior, and Windows Server 2019 and prior do not support SMB2 _NETNAME_NEGOTIATE_CONTEXT_ID. <53> Section 2.2.19: Windows 10 v1809 and prior and Windows Server v1809 and prior do not support SMB2_READFLAG_REQUEST_COMPRESSED flag. <72> Section 2.2.42: Windows 10 v1809 and prior and Windows Server v1809 and prior do not support compression and SMB2 COMPRESSION_TRANSFORM_HEADER. Changed to: <13> Section 2.2.3.1: Windows 10 v1809 operating system and prior, Windows Server v1809 operating system and prior, and Windows Server 2019 and prior do not send or process SMB2_COMPRESSION_CAPABILITIES. <14> Section 2.2.3.1: Windows 10 v1809 and prior, Windows Server v1809 and prior, and Windows Server 2019 and prior do not send or process SMB2 _NETNAME_NEGOTIATE_CONTEXT_ID. <53> Section 2.2.19: Windows 10 v1809 and prior and Windows Server v1809 and prior do not send or process SMB2_READFLAG_REQUEST_COMPRESSED flag. <72> Section 2.2.42: Windows 10 v1809 and prior and Windows Server v1809 and prior do not send or process SMB2 COMPRESSION_TRANSFORM_HEADER.
2019/04/29	This document has been updated to add the DataLength validation step for the processing of SMB2_ENCRYPTION_CAPABILITIES negotiate context. In Section 3.3.5.2, Receiving Any Message, the following has been changed from: If the Connection.Dialect is "3.1.1", then the server MUST process the negotiate context list that is specified by the request's NegotiateContextOffset and NegotiateContextCount fields as follows: Processing the SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context: If the negotiate context list does not contain exactly one SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context, then the server MUST fail the negotiate request with STATUS_INVALID_PARAMETER. If the SMB2_PREAUTH_INTEGRITY_CAPABILITIES HashAlgorithms array does not contain any hash algorithms that the server supports, then the server MUST fail the negotiate request with STATUS_SMB_NO_PREAUTH_INTEGRITY_HASH_OVERLAP (0xC05D0000). Changed to: If the Connection.Dialect is "3.1.1", then the server MUST process the NegotiateContextList that is specified by the request's NegotiateContextOffset and NegotiateContextCount fields as follows:

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	If the NegotiateContextList contains more than one SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context, the server MUST fail the negotiate request with STATUS_INVALID_PARAMETER. If the NegotiateContextList contains more than one SMB2_ENCRYPTION_CAPABILITIES negotiate context, the server MUST fail the negotiate request with STATUS_INVALID_PARAMETER. If the NegotiateContextList contains more than one SMB2_COMPRESSION_CAPABILITIES negotiate context, the server MUST fail the negotiate request with STATUS_INVALID_PARAMETER. Processing the SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context: If the DataLength of the negotiate context is less than the size of SMB2_PREAUTH_INTEGRITY_CAPABILITIES structure, the server MUST fail the negotiate request with STATUS_INVALID_PARAMETER. If the SMB2_PREAUTH_INTEGRITY_CAPABILITIES HashAlgorithms array does not contain any hash algorithms that the server supports, the server MUST fail the negotiate request with STATUS_SMB_NO_PREAUTH_INTEGRITY_HASH_OVERLAP (0xC05D0000). ... Changed from: If the negotiate context list contains more than one SMB2_ENCRYPTION_CAPABILITIES negotiate context, then the server MUST fail the negotiate request with STATUS_INVALID_PARAMETER. The server MUST set Connection.CipherId to one of the ciphers in the client's SMB2_ENCRYPTION_CAPABILITIES Ciphers array in an implementation-specific manner. If the client and server have no common cipher, then the server MUST sets Connection.CipherId to 0. Changed to: If the DataLength of the negotiate context is less than the size of the SMB2_ENCRYPTION_CAPABILITIES structure, the server MUST fail the negotiate request with STATUS_INVALID_PARAMETER. The server MUST set Connection.CipherId to one of the ciphers in the client's SMB2_ENCRYPTION_CAPABILITIES Ciphers array in an implementation-specific manner. If the client and server have no common cipher, the server MUST set Connection.CipherId to 0. In Section, 3.3.5.4, Receiving an SMB2 NEGOTIATE Request, the following has been changed from: If Connection.Dialect is "3.1.1", then the server MUST build a negotiate context list for its negotiate response as follows: Building an SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context: The server MUST add an SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context to the response's negotiate context list. HashAlgorithmCount MUST be set to 1. SaltLength MUST be set to an implementation-specific<239> number of Salt bytes. HashAlgorithms[0] MUST be set to Connection.PreauthIntegrityHashId. The Salt buffer MUST be filled with SaltLength unique bytes that are generated for this response by a cryptographic secure pseudo-random number generator. Building an SMB2_ENCRYPTION_CAPABILITIES negotiate response context:

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	If the server received an SMB2_ENCRYPTION_CAPABILITIES negotiate context in the client's negotiate request, then the server MUST add an SMB2_ENCRYPTION_CAPABILITIES negotiate context to the response's negotiate context list. Note that the server MUST send an SMB2_ENCRYPTION_CAPABILITIES context even if the client and server have no common cipher. This is done so that the client can differentiate between a server that does not support encryption (no SMB2_ENCRYPTION_CAPABILITIES context in the response's negotiate context list) and a server that supports encryption but does not share a cipher with the client (an SMB2_ENCRYPTION_CAPABILITIES context in the response's negotiate context list that indicates a cipher of 0). Changed to: If Connection.Dialect is "3.1.1", then the server MUST build a NegotiateContextList for its negotiate response as follows: Building an SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context: The server MUST add an SMB2_PREAUTH_INTEGRITY_CAPABILITIES negotiate context to the response's NegotiateContextList. HashAlgorithmCount MUST be set to 1. SaltLength MUST be set to an implementation-specific<239> number of Salt bytes. HashAlgorithms[0] MUST be set to Connection.PreauthIntegrityHashId. The Salt buffer MUST be filled with SaltLength unique bytes that are generated for this response by a cryptographic secure pseudo-random number generator. Building an SMB2_ENCRYPTION_CAPABILITIES negotiate response context: If the server received an SMB2_ENCRYPTION_CAPABILITIES negotiate context in the client's negotiate request, the server MUST add an SMB2_ENCRYPTION_CAPABILITIES negotiate context to the response's NegotiateContextList. Note that the server MUST send an SMB2_ENCRYPTION_CAPABILITIES context even if the client and server have no common cipher. This is done so that the client can differentiate between a server that does not support encryption (no SMB2_ENCRYPTION_CAPABILITIES context in the response's NegotiateContextList) and a server that supports encryption but does not share a cipher with the client (an SMB2_ENCRYPTION_CAPABILITIES context in the response's NegotiateContextList that indicates a cipher of 0).
2019/04/29	This document has been updated to handle the case when an invalid ProtocolId is received in the header of the message. In Section 2.2.1.1, SMB2 Packet Header – ASYNC, the following has been changed from: ProtocolId (4 bytes): The protocol identifier. The value MUST be (in network order) 0xFE, 'S', 'M', and 'B'. Changed to: ProtocolId (4 bytes): The protocol identifier. The value MUST be set to 0x424D53FE, also represented as (in network order) 0xFE, 'S', 'M', and 'B'. In Section 2.2.1.2, SMB2 Packet Header – SYNC, the following has been changed from: ProtocolId (4 bytes): The protocol identifier. The value MUST be (in network order) 0xFE, 'S', 'M', and 'B'. Changed to:

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	ProtocolId (4 bytes): The protocol identifier. The value MUST be set to 0x424D53FE, also represented as (in network order) 0xFE, 'S', 'M', and 'B'. In Section 2.2.41, SMB2 TRANSFORM_HEADER, the following has been changed from: ProtocolId (4 bytes): The protocol identifier. The value MUST be (in network order) 0xFD, 'S', 'M', and 'B'. Changed to: ProtocolId (4 bytes): The protocol identifier. The value MUST be set to 0x424D53FD, also represented as (in network order) 0xFD, 'S', 'M', and 'B'. In Section 2.2.42, SMB2 COMPRESSION_TRANSFORM_HEADER, the following has been changed from: ProtocolId (4 bytes): The protocol identifier. The value MUST be (in network order) 0xFC, 'S', 'M', and 'B'. Changed to: ProtocolId (4 bytes): The protocol identifier. The value MUST be set to 0x424D53FC, also represented as (in network order) 0xFC, 'S', 'M', and 'B'. In Section 3.2.5.1, Receiving Any Message, the following has been changed from: If the server implements the SMB 3.x dialect family and ProtocolId in the header of the received message is 0x424d53FD, the client MUST decrypt the request as specified in section 3.2.5.1.1 before performing the following steps. If the server implements the SMB 3.1.1 dialect and ProtocolId in the header of the received message is 0x424d53FC, the client MUST decompress the request as specified in section 3.2.5.1.10 before performing the following steps. Unless specifically noted in a subsequent section, the following logic MUST be applied to any response message that is received from the server by the client. If the status code in the SMB2 header is not equal to STATUS_SUCCESS, the client SHOULD<143> retry the operation, in an implementation-specific manner, on the same or different channel. The client MUST ignore the CreditCharge field in the SMB2 header. If the message size received exceeds Connection.MaxTransactSize, the client MUST disconnect the connection. Changed to: If the client implements the SMB 3.x dialect family and ProtocolId in the header of the received message is 0x424D53FD, the client MUST decrypt the request as specified in section 3.2.5.1.1 before performing the following steps. If the client implements the SMB 3.1.1 dialect and ProtocolId in the header of the received message is 0x424D53FC, the client MUST decompress the request as specified in section 3.2.5.1.10 before performing the following steps. If ProtocolId in the header of the received message is 0x424D53FE, the client MUST perform the following: Unless specifically noted in a subsequent section, the following logic MUST be applied to any response message that is received from the server by the client. If the status code in the

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	SMB2 header is not equal to STATUS_SUCCESS, the client SHOULD<143> retry the operation, in an implementation-specific manner, on the same or different channel. The client MUST ignore the CreditCharge field in the SMB2 header. If the message size received exceeds Connection.MaxTransactSize, the client MUST disconnect the connection. Otherwise the client MUST disconnect the connection. In Sections 3.2.5.1.1, Decrypting the Message, and 3.2.5.1.10, Decompressing the Message, all instances of "0x424d53FE" have been changed to "0x424D53FE" In Section 3.3.5.2, Receiving Any Message, the following has been changed from: If the server implements the SMB 3.x dialect family, and the ProtocolId in the header of the received message is 0x424d53FD, the server MUST decrypt the message as specified in section 3.3.5.2.1 before performing the following steps. If the server supports compression and the ProtocolId in the header of the received message is 0x424d53FC, the server MUST decompress the message as specified in section 3.3.5.2.13 before performing the following steps. Changed to: If ProtocolId in the header of the received message is 0x424D53FF and the command received is SMB_COM_NEGOTIATE, the client MUST process the request as specified in section 3.3.5.3. If the server implements the SMB 3.x dialect family, and the ProtocolId in the header of the received message is 0x424D53FD, the server MUST decrypt the message as specified in section 3.3.5.2.1 before performing the following steps. If the server supports compression and the ProtocolId in the header of the received message is 0x424D53FC, the server MUST decompress the message as specified in section 3.3.5.2.13 before performing the following steps. If ProtocolId in the header of the received message is 0x424D53FE, the server MUST perform the following: ... Otherwise, the server MUST disconnect the connection. In Section 3.3.5.2.1, Decrypting the Message, "0x424d53FC" has been changed to "0x424D53FC" and "0x424d53FE" has been changed to "0x424D53FE" In Section 3.3.5.2.6, Handling Incorrectly Formatted Requests, the following has been removed: The ProtocolId field in the SMB2 header is not equal to 0xFE, 'S', 'M', and 'B' (in network order). In Section 3.3.5.2.13, Decompressing the message, "0x424d53FE" has been changed to "0x424D53FE" In Section 3.3.5.3, Receiving an SMB_COM_NEGOTIATE, the following has been changed from:

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	If the request does not have a valid SMB2 header following the syntax specified in section 2.2.1, the server MUST check to see if it has received an SMB_COM_NEGOTIATE as described in section 1.7. This request is defined in [MS-SMB] section 2.2.4.5.1, with the SMB header defined in section 2.2.3.1. If the request matches the format described there, and Connection.NegotiateDialect is 0xFFFF, processing MUST continue as specified in 3.3.5.3.1. Otherwise, the server MUST disconnect the connection, as specified in section 3.3.7.1, without sending a response. Changed to: If Connection.NegotiateDialect is 0xFFFF, processing MUST continue as specified in 3.3.5.3.1. Otherwise, the server MUST disconnect the connection, as specified in section 3.3.7.1, without sending a response. For details on the above changes, see the PDF doc here.
2019/04/15	In two sections, the logic for checking against Dialect and Channel has been modified. In Section 3.3.5.12, Receiving an SMB2 READ Request, the following has been changed from: Connection.Dialect is "3.0.2" or "3.1.1" and Channel is not equal to SMB2_CHANNEL_RDMA_V1 or SMB2_CHANNEL_NONE. Connection.Dialect is "3.0" and Channel is not equal to SMB2_CHANNEL_RDMA_V1_INVALIDATE. Changed to: Connection.Dialect is "3.0.2" or "3.1.1" and Channel is not equal to SMB2_CHANNEL_RDMA_V1_INVALIDATE or SMB2_CHANNEL_RDMA_V1 or SMB2_CHANNEL_NONE. Connection.Dialect is "3.0" and Channel is not equal to SMB2_CHANNEL_RDMA_V1 or SMB2_CHANNEL_NONE. In Section 3.3.5.13, Receiving an SMB2 WRITE Request, the following has been changed from: Connection.Dialect is "3.0.2" or "3.1.1" and Channel is not equal to SMB2_CHANNEL_RDMA_V1 or SMB2_CHANNEL_NONE. Connection.Dialect is "3.0" and Channel is not equal to SMB2_CHANNEL_RDMA_V1_INVALIDATE. Changed to: Connection.Dialect is "3.0.2" or "3.1.1" and Channel is not equal to SMB2_CHANNEL_RDMA_V1_INVALIDATE or SMB2_CHANNEL_RDMA_V1 or SMB2_CHANNEL_NONE. Connection.Dialect is "3.0" and Channel is not equal to SMB2_CHANNEL_RDMA_V1 or SMB2_CHANNEL_NONE.
2019/04/15	In Section 2.2.31.1, SRV_COPYCHUNK_COPY, the first paragraph has been changed from:

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	The SRV_COPYCHUNK_COPY packet is sent in an SMB2 IOCTL Request by the client to initiate a server-side copy of data. It is set as the contents of the input data buffer. This packet consists of the following: … Changed to: The SRV_COPYCHUNK_COPY packet is sent to the server in an SMB2 IOCTL Request using FSCTL_SRV_COPYCHUNK or FSCTL_SRV_COPYCHUNK_WRITE by the client to initiate a server-side copy of data. It is set as the contents of the input data buffer. This packet consists of the following: … In Section 2.2.32.1, SRV_COPYCHUNK_RESPONSE, the first paragraph has been changed from: The SRV_COPYCHUNK_RESPONSE packet is sent in an SMB2 IOCTL Response by the server to return the results of a server-side copy operation . It is placed in the Buffer field of the SMB2 IOCTL Response packet. This packet consists of the following: … Changed to: The SRV_COPYCHUNK_RESPONSE packet is sent to the client by the server in an SMB2 IOCTL Response for FSCTL_SRV_COPYCHUNK or FSCTL_SRV_COPYCHUNK_WRITE requests to return the results of a server-side copy operation . It is placed in the Buffer field of the SMB2 IOCTL Response packet. This packet consists of the following: …
2019/04/15	Several sections have been updated to modify information about an input buffer. In Section 2.2.31, SMB2 IOCTL Request, the InputOffset field has been changed from: InputOffset (4 bytes): The offset, in bytes, from the beginning of the SMB2 header to the input data buffer. If no input data is required for the FSCTL/IOCTL command being issued, the client SHOULD set this value to 0.<57> <57> Section 2.2.31: If no input data is required for the FSCTL/IOCTL command being issued, Windows-based clients set this field to any value. Changed to: InputOffset (4 bytes): The offset, in bytes, from the beginning of the SMB2 header to the input data buffer. If no input data is required for the FSCTL/IOCTL command being issued, this field can be set to any value by the client and MUST be ignored by the server. In Section 3.2.4.20.1, Application Requests Enumeration of Previous Versions, the following has been changed from: The SMB2 IOCTL Request MUST be initialized as follows: ● The CtlCode field is set to FSCTL_SRV_ENUMERATE_SNAPSHOTS. ● The FileId field is set to Open.FileId. ● The InputOffset field SHOULD<131> be set to 0. ● The InputCount field is set to 0.

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	• The OutputOffset field SHOULD<132> be set to zero. • The OutputCount field is set to 0. • The MaxInputResponse field is set to 0. … Changed to: The SMB2 IOCTL Request MUST be initialized as specified in section 2.2.31, with the exception of the following values: • The CtlCode field is set to FSCTL_SRV_ENUMERATE_SNAPSHOTS. • The FileId field is set to Open.FileId. • The InputCount field is set to 0. • The MaxInputResponse field is set to 0. … In Section 3.2.4.20.2.1, Application Requests a Source File Key, the following has been changed from: The SMB2 IOCTL Request MUST be initialized as follows: • The CtlCode field is set to the FSCTL_SRV_REQUEST_RESUME_KEY. • The FileId field is set to Open.FileId. • The InputOffset field SHOULD<133> be set to 0. • The InputCount field is set to 0. • The OutputOffset field SHOULD<134> be set to 0. • The OutputCount field is set to 0. … Changed to: The SMB2 IOCTL Request MUST be initialized as specified in section 2.2.31, with the exception of the following values: • The CtlCode field is set to the FSCTL_SRV_REQUEST_RESUME_KEY. • The FileId field is set to Open.FileId. • The InputCount field is set to 0. • The OutputOffset field SHOULD<134> be set to 0. … In Section 3.2.4.20.5, Application Requests a Peek at Pipe Data, the following has been changed from: The SMB2 IOCTL Request MUST be initialized as follows: • The CtlCode field is set to FSCTL_PIPE_PEEK. • The FileId field is set to Open.FileId. • The InputOffset field SHOULD<139> be set to 0. • The InputCount field is set to 0. • The OutputOffset field SHOULD<140> be set to zero. • The OutputCount field is set to 0.

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	… Changed to: The SMB2 IOCTL Request MUST be initialized as specified in section 2.2.31, with the exception of the following values: ● The CtlCode field is set to FSCTL_PIPE_PEEK. ● The FileId field is set to Open.FileId. ● The InputCount field is set to 0. ● The OutputOffset field SHOULD<140> be set to zero. … In Section 3.2.4.20.10, Application Requests Querying Server's Network Interfaces, has been changed from: The SMB2 IOCTL Request MUST be initialized as specified in section 2.2.31, with the exception of the following values: ● The CtlCode field is set to FSCTL_QUERY_NETWORK_INTERFACE_INFO. ● The FileId field is set to { 0xFFFFFFFFFFFFFFFF, 0xFFFFFFFFFFFFFFFF }. ● The MaxInputResponse field is set to 0. ● The MaxOutputResponse field is set to an implementation-specific<145> value. ● SMB2_0_IOCTL_IS_FSCTL is set to TRUE in the Flags field. ● The InputOffset field is set to the offset to the Buffer, in bytes, from the beginning of the SMB2 header. … Changed to: The SMB2 IOCTL Request MUST be initialized as specified in section 2.2.31, with the exception of the following values: ● The CtlCode field is set to FSCTL_QUERY_NETWORK_INTERFACE_INFO. ● The FileId field is set to { 0xFFFFFFFFFFFFFFFF, 0xFFFFFFFFFFFFFFFF }. ● The InputCount field is set to 0. ● The MaxInputResponse field is set to 0. ● The MaxOutputResponse field is set to an implementation-specific<145> value. ● SMB2_0_IOCTL_IS_FSCTL is set to TRUE in the Flags field. … In Section 3.3.5.15, Receiving an SMB2 IOCTL Request, the following has been changed from: The server MUST fail the request with STATUS_INVALID_PARAMETER in the following cases: … Changed to: If InputCount is not equal to zero, the server MUST fail the request with STATUS_INVALID_PARAMETER in the following cases: …

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[MS-SMBD]: SMB2 Remote Direct Memory Access (RDMA) Transport Protocol

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[MS-SPNG]: Simple and Protected GSS-API Negotiation Mechanism (SPNEGO) Extension

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[MS-SQOS]: Storage Quality of Service Protocol

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[MS-SSTP]: Secure Socket Tunneling Protocol (SSTP)

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[MS-SSTR]: Smooth Streaming Protocol

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[MS-SWN]: Service Witness Protocol

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Errata below are for Protocol Document Version V11.0 – 2018/09/12.

Errata Published*	Description
2019/02/19	In Section 7, Appendix B: Product Behavior Product Behavior, note 2 has been changed from: <2> Section 3.1.3: Windows Server 2012 sets this value to 0x00010001. Windows Server 2012 R2, Windows Server 2016, Windows Server operating system, and Windows Server 2019 set this value to 0xFFFFFFFF. Changed to: <2> Section 3.1.3: Windows Server 2012 sets this value to 0x00010001. Windows Server 2012 R2, Windows Server 2016, Windows Server operating system, and Windows Server 2019 set this value to 0x00020000.

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[MS-TCC]: Tethering Control Channel Protocol

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[MS-TDS]: Tabular Data Stream Protocol

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Errata below are for Protocol Document Version V26.0 – 2019/03/13.

Errata Published*	Description
2019/09/02	In Section 2.2.3.1.3, Length, the minimum, maximum, and default values of a TDS packet size have been clarified. Changed from: Length is the size of the packet including the 8 bytes in the packet header. It is the number of bytes from the start of this header to the start of the next packet header. Length is a 2-byte, unsigned short int and is represented in network byte order (big-endian). Starting with TDS 7.3, the Length MUST be the negotiated packet size when sending a packet from client to server, unless it is the last packet of a request (that is, the EOM bit in Status is ON) or the client has not logged in. Changed to: Length is the size of the packet including the 8 bytes in the packet header. It is the number of bytes from the start of this header to the start of the next packet header. Length is a 2-byte, unsigned short int and is represented in network byte order (big-endian). The Length value MUST be greater than or equal to 512 bytes and smaller than or equal to 32,767 bytes. The default value is 4,096 bytes. Starting with TDS 7.3, the Length MUST be the negotiated packet size when sending a packet from client to server, unless it is the last packet of a request (that is, the EOM bit in Status is ON) or the client has not logged in.
2019/06/24	In Section 2.2.7.8, ENVCHANGE, the syntax of the NEWVALUE value for the Commit Transaction type has been changed from "0x00" to %0x00. Changed from:

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><th>Type</th><th>Old Value</th><th>New Value</th></tr>
<tr><td>. . .</td><td>. . .</td><td>. . .</td></tr>
<tr><td>9: Commit Transaction</td><td>OLDVALUE = B_VARBYTE</td><td>NEWVALUE = "0x00"</td></tr>
<tr><td>. . .</td><td>. . .</td><td>. . .</td></tr>
</table>
Changed to:
<table>
<tr><th>Type</th><th>Old Value</th><th>New Value</th></tr>
<tr><td>. . .</td><td>. . .</td><td>. . .</td></tr>
<tr><td>9: Commit Transaction</td><td>OLDVALUE = B_VARBYTE</td><td>NEWVALUE = %0x00</td></tr>
<tr><td>. . .</td><td>. . .</td><td>. . .</td></tr>
</table>
</td></tr>
<tr><td>2019/05/13</td><td>
In section 2.2.6.4, LOGIN7, changed the description of the ClientTimeZone parameter.
Changed from:
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>. . .</td><td>. . .</td></tr>
<tr><td>ClientTimeZone</td><td>The time zone of the client machine.</td></tr>
<tr><td>. . .</td><td>. . .</td></tr>
</table>
Changed to:
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>. . .</td><td>. . .</td></tr>
<tr><td>ClientTimeZone</td><td>This field is not used and can be set to zero.</td></tr>
<tr><td>. . .</td><td>. . .</td></tr>
</table>
In subsections of section 4, Protocol Examples, changed the value of the ClientTimeZone parameter.
In section 4.2, Login Request, and section 4.3, Login Request with Federated Authentication, changed from:
<pre>
. . .
<ClientTimZone>
  <LONG>E0 01 00 00 </LONG>
</ClientTimZone>
. . .
</pre>
Changed to:
<pre>
. . .
<ClientTimeZone>
  <LONG>00 00 00 00 </LONG>
</ClientTimeZone>
</pre>
</td></tr>
</table>

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	. . . In section 4.16, FeatureExt with SESSIONRECOVERY Feature Data, changed from: . . . <ClientTimZone> <DWORD>E0 01 00 00 </DWORD> </ClientTimZone> . . .> Changed to: . . . <ClientTimeZone> <DWORD>00 00 00 00 </DWORD> </ClientTimeZone> . . .
2019/05/13	In various sections, changed the names of BIGVARBINTYPE and BIGVARCHRTYPE to BIGVARBINARYTYPE and BIGVARCHARTYPE, respectively. In section 2.2.5.4.2, Variable-Length Data Types, changed from: . . . BIGVARBINTYPE = %xA5 ; VarBinary BIGVARCHRTYPE = %xA7 ; VarChar BIGBINARYTYPE = %xAD ; Binary . . . USHORTLEN_TYPE = BIGVARBINTYPE / BIGVARCHRTYPE Changed to: . . . BIGVARBINARYTYPE = %xA5 ; VarBinary BIGVARCHARTYPE = %xA7 ; VarChar BIGBINARYTYPE = %xAD ; Binary . . . USHORTLEN_TYPE = BIGVARBINARYTYPE / BIGVARCHARTYPE In section 2.2.5.4.3, Partially Length-Prefixed Data Types, changed from: PARTLENTYPE = XMLTYPE / BIGVARCHRTYPE / BIGVARBINTYPE / NVARCHARTYPE / UDTTYPE BIGVARCHRTYPE, BIGVARBINTYPE, and NVARCHARTYPE can represent two types each:

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>
Changed to:
PARTLENTYPE = XMLTYPE
/
BIGVARCHARTYPE
/
BIGVARBINARYTYPE
/
NVARCHARTYPE
/
UDTTYPE

BIGVARCHARTYPE, BIGVARBINARYTYPE, and NVARCHARTYPE can represent two types each:
In section 2.2.5.5.4, SQL_VARIANT Values, changed from:

<table>
<tr><th>VARIANT_BASETYPE</th><th>VARIANT_PROPBYTES</th><th>VARIANT_PROPERTIES</th></tr>
<tr><td>. . .</td><td>. . .</td><td>. . .</td></tr>
<tr><td>BIGVARBINTYPE, BIGBINARYTYPE</td><td>2</td><td>2 bytes specifying max length</td></tr>
<tr><td>. . .</td><td>. . .</td><td>. . .</td></tr>
<tr><td>BIGVARCHRTYPE, BIGCHARTYPE, NVARCHARTYPE, NCHARTYPE</td><td>7</td><td>5-byte COLLATION, followed by a 2-byte max length</td></tr>
</table>
Changed to:
<table>
<tr><th>VARIANT_BASETYPE</th><th>VARIANT_PROPBYTES</th><th>VARIANT_PROPERTIES</th></tr>
<tr><td>. . .</td><td>. . .</td><td>. . .</td></tr>
<tr><td>BIGVARBINARYTYPE, BIGBINARYTYPE</td><td>2</td><td>2 bytes specifying max length</td></tr>
<tr><td>. . .</td><td>. . .</td><td>. . .</td></tr>
<tr><td>BIGVARCHARTYPE, BIGCHARTYPE, NVARCHARTYPE, NCHARTYPE</td><td>7</td><td>5-byte COLLATION, followed by a 2-byte max length</td></tr>
</table>

In section 2.2.5.6, Type Info Rule Definition, changed from:
. . .
COLLATION occurs only if the type is BIGCHARTYPE, BIGVARCHRTYPE, TEXTTYPE, NTEXTTYPE, NCHARTYPE, or NVARCHARTYPE.
Changed to:
. . .
COLLATION occurs only if the type is BIGCHARTYPE, BIGVARCHARTYPE, TEXTTYPE, NTEXTTYPE, NCHARTYPE, or NVARCHARTYPE.
</td></tr>
</table>

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[MS-TLSP]: Transport Layer Security (TLS) Profile

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[MS-TPMVSC]: Trusted Platform Module (TPM) Virtual Smart Card Management Protocol

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[MS-TSCH]: Task Scheduler Service Remoting Protocol

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[MS-TSGU]: Terminal Services Gateway Server Protocol

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[MS-TSTS]: Terminal Services Terminal Server Runtime Interface Protocol

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Errata below are for Protocol Document Version V26.0 – 2018/09/12.

Errata Published*	Description
2019/04/15	In Section 3.10.4.1.1, RpcShadow2 (Opnum 0), the format of the pszInvitation field has been clarified. In addition, a reference to a Windows platform-specific API has been removed and substituted with a link to MS-RAI Section 2.2.2. Changed from: pszInvitation: The output data containing the invitation string for the shadow session. The data returned is an invitation string in an XML format that can be used with the Windows Desktop Sharing API IRDPSRAPIViewer::Connect method to connect to the session running in the target session (specified by TargetSessionId). The caller must allocate a buffer to hold this data and specify the size of the buffer in cchInvitation. Changed to: pszInvitation: The output data containing the invitation string for the shadow session. The data returned is a Unicode string in the XML format specified in [MS-RAI] section 2.2.2 that can be used to connect to a session running in the target session (specified by TargetSessionId). The caller must allocate a buffer to hold this data and specify the size of the buffer in cchInvitation.

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[MS-TSWP]: Terminal Services Workspace Provisioning Protocol

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[MS-UAMG]: Update Agent Management Protocol

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[MS-UCODEREF]: Windows Protocols Unicode Reference

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[MS-VAPR]: Virtual Application Publication and Reporting (App-V) Protocol

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[MS-VHDX]: Virtual Hard Disk v2 (VHDX) File Format

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[MS-W32T]: W32Time Remote Protocol

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[MS-WCCE]: Windows Client Certificate Enrollment Protocol

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[MS-WCFESAN]: WCF-Based Encrypted Server Administration and Notification Protocol

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[MS-WDSMT]: Windows Deployment Services Multicast Transport Protocol

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[MS-WDSOSD]: Windows Deployment Services Operation System Deployment Protocol

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[MS-WFDAA]: Wi-Fi Direct (WFD) Application to Application Protocol

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[MS-WFDPE]: Wi-Fi Display Protocol Extension

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[MS-WKST]: Workstation Service Remote Protocol

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Errata below are for Protocol Document Version V28.0 – 2018/09/12.

Errata Published*	Description
2018/11/12	In Section 3.2.4.8, NetrUseGetInfo (Opnum 9), changed from: … The server MUST fill the return structures as follows: • If the Level member is 0, the server MUST return the information about the connection by filling the USE_INFO_0_CONTAINER (section 2.2.5.25) structure in the Buffer field of the InfoStruct parameter as follows. USE_INFO_0_CONTAINER contains an array of USE_INFO_0 structures. • ui0_local set to Connection.local • ui0_remote set to Connection.Remote • If the Level member is 1, the server MUST return the information about the connection by filling the USE_INFO_1_CONTAINER (section 2.2.5.26) structure in the Buffer field of the InfoStruct parameter as follows. USE_INFO_1_CONTAINER contains an array of USE_INFO_1 structures. • ui1_local set to Connection.local • ui1_remote set to Connection.remote • ui1_password set to NULL • ui1_status set to Connection.status • ui1_asg_type set to Connection.asgtype • ui1_refcount set to Connection.refcount • ui1_usecount set to Connection.useCount • If the Level member is 2, the server MUST return the information about the connection by filling the USE_INFO_2_CONTAINER (section 2.2.5.27) structure in the Buffer field of the InfoStruct parameter as follows. USE_INFO_2_CONTAINER contains an array of USE_INFO_2 structures. • ui2_local set to Connection.local • ui2_remote set to Connection.remote • ui2_password set to NULL • ui2_status set to Connection.status • ui2_asg_type set to Connection.asgtype • ui2_refcount set to Connection.refcount • ui2_usecount set to Connection.useCount • ui2_domainname set to Connection.domain • If the Level member is 3, the server MUST return the information about the connection by filling the USE_INFO_3_CONTAINER structure in the Buffer field of the

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Errata Published*	Description
	InfoStruct parameter as follows. USE_INFO_3_CONTAINER contains an array of USE_INFO_3 structures. ● ui2_local set to Connection.local ● ui2_remote set to Connection.remote ● ui2_password set to NULL ● ui2_status set to Connection.status ● ui2_asg_type set to Connection.asgtype ● ui2_refcount set to Connection.refcount ● ui2_usecount set to Connection.useCount ● ui2_domainname set to Connection.domain ● ui2_flag set to 0 The server MUST invoke the event to end the client impersonation ([MS-RPCE] section 3.3.3.4.3.3). Changed to: … The server MUST fill the return structures as follows: ● If the Level member is 0, the server MUST return the information about the connection by filling the USE_INFO_0_CONTAINER (section 2.2.5.25) structure in the Buffer field of the InfoStruct parameter as follows. USE_INFO_0_CONTAINER contains an array of USE_INFO_0 structures. ● ui0_local set to Connection.local ● ui0_remote set to Connection.Remote ● If the Level member is 1, the server MUST return the information about the connection by filling the USE_INFO_1_CONTAINER (section 2.2.5.26) structure in the Buffer field of the InfoStruct parameter as follows. USE_INFO_1_CONTAINER contains an array of USE_INFO_1 structures. ● ui1_local set to Connection.local ● ui1_remote set to Connection.remote ● ui1_password set to NULL ● ui1_status set to Connection.status ● ui1_asg_type set to Connection.asgtype ● ui1_refcount set to Connection.refcount ● ui1_usecount set to Connection.usecount ● If the Level member is 2 or 3, the server MUST return the information about the connection by filling the USE_INFO_2_CONTAINER (section 2.2.5.27) structure in the Buffer field of the InfoStruct parameter as follows. USE_INFO_2_CONTAINER contains an array of USE_INFO_2 structures. ● ui2_local set to Connection.local ● ui2_remote set to Connection.remote ● ui2_password set to NULL ● ui2_status set to Connection.status ● ui2_asg_type set to Connection.asgtype ● ui2_refcount set to Connection.refcount ● ui2_usecount set to Connection.usecount ● ui2_username set to Connection.username ● ui2_domainname set to Connection.domain The server MUST invoke the event to end the client impersonation ([MS-RPCE] section 3.3.3.4.3.3).

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td>2018/11/12</td><td>In Section 3.2.4.13, NetrJoinDomain2 (Opnum 22), changed from:

<table>
<tr><th>Value/code</th><th>Meaning</th></tr>
<tr><td>…</td><td>…</td></tr>
<tr><td>NETSETUP_MACHINE_PWD_PASSED
0x00000080</td><td>Indicates that the Password parameter SHOULD<58> specify the password for the machine joining the domain. This flag is valid only for unsecured joins, which MUST be indicated by setting the NETSETUP_JOIN_UNSECURE flag. If this flag is set, the value of Password determines the value stored for the computer password during the join process.</td></tr>
<tr><td>…</td><td>…</td></tr>
<tr><td>NETSETUP_INSTALL_INVOCATION
0x00040000</td><td>Indicates that the protocol method was invoked during installation</td></tr>
</table>

Changed to:

<table>
<tr><th>Value/code</th><th>Meaning</th></tr>
<tr><td>…</td><td>…</td></tr>
<tr><td>NETSETUP_MACHINE_PWD_PASSED
0x00000080</td><td>Indicates that the Password parameter SHOULD<58> specify the password for the machine joining the domain. This flag is valid only for unsecured joins, which MUST be indicated by setting the NETSETUP_JOIN_UNSECURE flag, or read-only joins, which MUST be indicated by setting the NETSETUP_JOIN_READONLY flag. If this flag is set, the value of Password determines the value stored for the computer password during the join process.</td></tr>
<tr><td>…</td><td>…</td></tr>
<tr><td>NETSETUP_JOIN_READONLY
0x00000800</td><td>Specifies that the join SHOULD <121> be performed in a read-only manner against an existing account object. This option is intended to enable the server to join a domain using a read-only domain controller.</td></tr>
<tr><td>NETSETUP_INSTALL_INVOCATION
0x00040000</td><td>Indicates that the protocol method was invoked during installation</td></tr>
</table>
<121> Section 3.2.4.13: Windows NT, Windows 2000, Windows XP, Windows Server 2003, and Windows Server 2003 R2 do not implement this option.</td></tr>
</table>

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Errata Published*	Description
	In Section 3.2.4.13.3, Domain Join Specific Message Processing, changed from: The following statements define the sequence of message-processing operations: 1. If the NETSETUP_MACHINE_PWD_PASSED bit is set in Options, and the NETSETUP_JOIN_UNSECURE bit is not set in Options, the server MUST return ERROR_INVALID_PARAMETER. Otherwise, message processing continues. 2. If the NETSETUP_MACHINE_PWD_PASSED bit is set in Options, and AccountName is not NULL, the server MUST return ERROR_INVALID_PARAMETER. Otherwise, message processing continues. 3. If the NETSETUP_MACHINE_PWD_PASSED bit is set in Options, and either Password is NULL or the length of the PasswordString is zero, the server MUST return ERROR_PASSWORD_RESTRICTION. Otherwise, message processing continues. 4. If the NETSETUP_MACHINE_PWD_PASSED bit is set in Options, the value of PasswordString MUST be copied to the value of ComputerPasswordString, and PasswordString MUST be set to NULL. 5. If the server processing the message is already joined to a domain, and the NETSETUP_DOMAIN_JOIN_IF_JOINED bit is not set in Options, the server MUST return NERR_SetupAlreadyJoined. Otherwise, message processing continues. … 6. If DomainNameString contains the character "\",… The specified domain controller MUST be validated by invoking the DsrGetDcNameEx2 method ([MS-NRPC] section 3.5.4.3.1) on the DomainControllerString computer, specifying the following parameters: … • Flags = B | J | R … If the call fails, or the returned domain controller name does not match DomainControllerString, the server MUST invoke the DsrGetDcNameEx2 method ([MS-NRPC] section 3.5.4.3.1) on the DomainControllerString computer, specifying the following parameters: … • Flags = B | J | S … 29. The following LDAP attributes… Changed to: The following statements define the sequence of message-processing operations: 1. If the NETSETUP_MACHINE_PWD_PASSED bit is set in Options, and the NETSETUP_JOIN_UNSECURE bit is not set in Options, the server MUST return ERROR_INVALID_PARAMETER. Otherwise, message processing continues. 2. If the NETSETUP_MACHINE_PWD_PASSED bit is set in Options, and AccountName is not NULL, the server MUST return ERROR_INVALID_PARAMETER. Otherwise, message processing continues. 3. If the NETSETUP_MACHINE_PWD_PASSED bit is set in Options, and either Password is NULL or the length of the PasswordString is zero, the server MUST return ERROR_PASSWORD_RESTRICTION. Otherwise, message processing continues. 4. If the NETSETUP_MACHINE_PWD_PASSED bit is set in Options, the value of PasswordString MUST be copied to the value of ComputerPasswordString, and PasswordString MUST be set to NULL.

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	5. If the NETSETUP_JOIN_READONLY bit is set in Options, and NETSETUP_MACHINE_PWD_PASSED bit is not set in Options, the server MUST return ERROR_INVALID_PARAMETER. Otherwise, message processing continues. 6. If the NETSETUP_JOIN_READONLY bit is set in Options, and the NETSETUP_ACCT_CREATE bit is set in Options, the server MUST return ERROR_INVALID_PARAMETER. Otherwise, message processing continues. 7. If the NETSETUP_JOIN_READONLY bit is set in Options, the server MUST perform all subsequent message processing as if NETSETUP_DEFER_SPN_SET and NETSETUP_JOIN_UNSECURE bits are set in Options. 8. If the server processing the message is already joined to a domain, and the NETSETUP_DOMAIN_JOIN_IF_JOINED bit is not set in Options, the server MUST return NERR_SetupAlreadyJoined. Otherwise, message processing continues.… 9. If DomainNameString contains the character "\",… The specified domain controller MUST be validated by invoking the DsrGetDcNameEx2 method ([MS-NRPC] section 3.5.4.3.1) on the DomainControllerString computer, specifying the following parameters: … ● Flags : if NETSETUP_JOIN_READONLY bit is set in Options, set Flags = (B | R); otherwise set Flags to (B | J | R) … If the call fails, or the returned domain controller name does not match DomainControllerString, the server MUST invoke the DsrGetDcNameEx2 method ([MS-NRPC] section 3.5.4.3.1) on the DomainControllerString computer, specifying the following parameters: … ● Flags : if NETSETUP_JOIN_READONLY bit is set in Options, set Flags = (B | S); otherwise set Flags to (B | J | S) … 32. If the NETSETUP_JOIN_READONLY bit is not set in Options, the following LDAP attributes…

*Date format: YYYY/MM/DD

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[MS-WMIO]: Windows Management Instrumentation Encoding Version 1.0 Protocol

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Errata below are for Protocol Document Version V15.0 – 2018/09/12.

Errata Published*	Description
2019/06/10	In Section 3 Structure Examples, we revised the octet value of PropertyInfoRef. Changed from: A0 00 00 00 Changed to: 0A 00 00 00

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[MS-WMF]: Windows Metafile Format

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[MS-WPO]: Windows Protocols Overview

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[MS-WSDS]: WS-Enumeration Directory Services Protocol Extensions

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[MS-WSMV]: Web Services Management Protocol Extensions for Windows Vista

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[MS-WSP]: Windows Search Protocol

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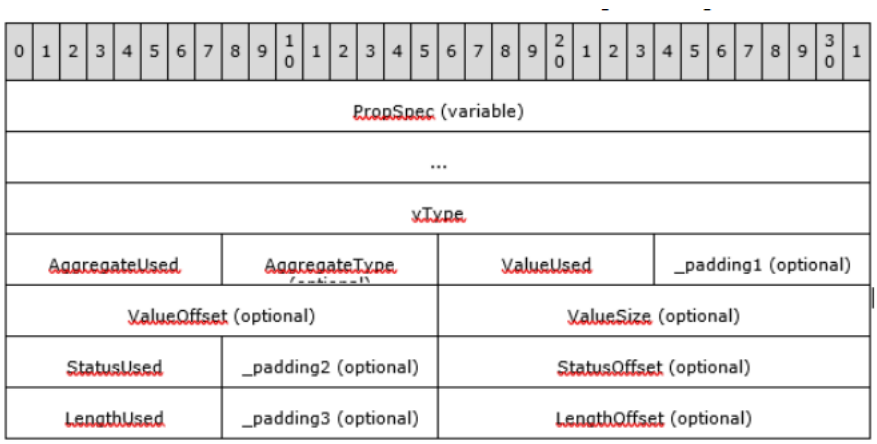
Errata below are for Protocol Document Version V32.0 – 2018/09/12.

Errata Published*	Description
2019/09/16	In Section 2.2.1.44, CTableColumn, "(optional)" was added to the AggregateType field in the packet diagram.
2019/09/16	In Section 2.2.1.44, CTableColumn, added the _padding_vtype field. Changed from: The CTableColumn structure contains a column of a CPMSetBindingsIn message.  PropSpec (variable): A CFullPropSpec structure. vType (4 bytes): A 32-bit unsigned integer that specifies the type of data value contained in the column. See the vType field in section 2.2.1.1 for the list of values for this field. ... Changed to: The CTableColumn structure contains a column of a CPMSetBindingsIn message.

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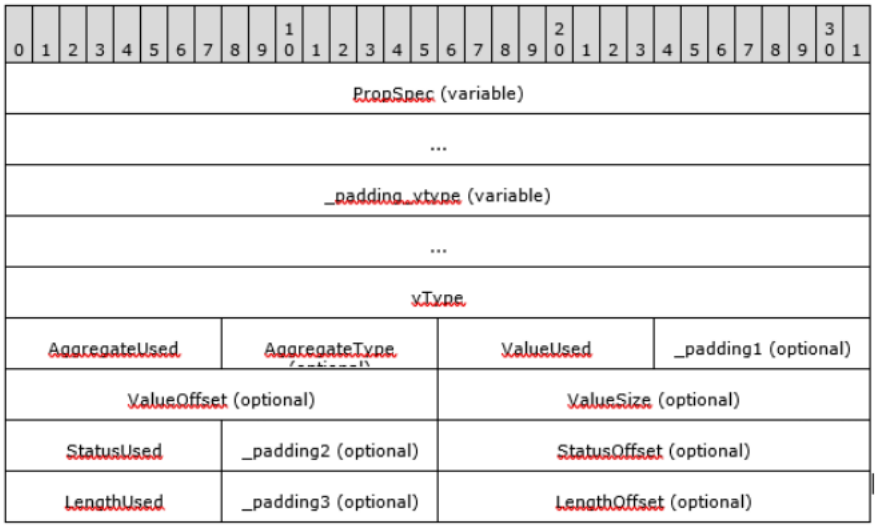
Errata Published*	Description
	 PropSpec (variable): A CFullPropSpec structure. _padding_vtype (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following vType field begins at an offset that is a multiple of 4 bytes from the beginning of the message. If this field is present (that is, length nonzero), the value it contains is arbitrary. The content of this field MUST be ignored by the receiver. vType (4 bytes): A 32-bit unsigned integer that specifies the type of data value contained in the column. See the vType field in section 2.2.1.1 for the list of values for this field. ...
2019/09/16	In Section 2.2.3.3, CPMConnectOut, clarified when the server version number can support 64-bit offsets in the _serverVersion field description. Changed from: ... _serverVersion (4 bytes): A 32-bit integer that indicates whether the server can support 64-bit offsets. Values greater than or equal to 0x00010000 indicate 64-bit support. Values less than 0x00010000 indicate 32-bit support.<7><8> ... Changed to: ... _serverVersion (4 bytes): A 32-bit integer that indicates whether the server can support 64-bit offsets. A bitwise AND operation is performed to determine whether the server version is capable of handling 64-bit offsets. 0x10000 is added to the version ID and is used when identifying whether the operating system is 32-bit or 64-bit.<7><8> ...
2019/09/16	In Section 2.2.4, Errors, added the error code DB_S_ENDOFROWSET. Changed from: Windows Search Protocol (WSP) messages indicate success two ways:

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Errata Published*	Description
	• A zero value (0x00000000). • An HRESULT success value, such as DB_S_ENDOFROWSET, in which the thirty-first bit is not set. ... The following are common error codes: • E_OUTOFMEMORY (0x8007000e) • STATUS_INVALID_PARAMETER (0xc000000d) • STATUS_NO_MEMORY (0xc0000017) • STATUS_INSUFFICIENT_RESOURCES (0xc000009a) • CI_E_NOT_FOUND (0x80041815) • STATUS_INVALID_PARAMETER_MIX (0xc0000030) • ERROR_INVALID_PARAMETER (0x80070057) • CI_E_TIMEOUT (0x8004181F) • E_ACCESSDENIED (0x80070005) • CI_E_BUFFERTOOSMALL (0x8004180c) Note The HRESULT and NTSTATUS numbering spaces do not currently overlap—except with values of identical meaning. However, even if there are conflicts in the future, they would not cause protocol issues as long as the value for STATUS_INSUFFICIENT_RESOURCES remains unique, because all other error values are treated the same. Changed to: Windows Search Protocol (WSP) messages indicate success two ways: • A zero value (0x00000000). • An HRESULT success value, such as DB_S_ENDOFROWSET, in which the thirty-first bit is not set. ... The following are common error codes: • E_OUTOFMEMORY (0x8007000e) • STATUS_INVALID_PARAMETER (0xc000000d) • STATUS_NO_MEMORY (0xc0000017) • STATUS_INSUFFICIENT_RESOURCES (0xc000009a) • CI_E_NOT_FOUND (0x80041815) • STATUS_INVALID_PARAMETER_MIX (0xc0000030) • ERROR_INVALID_PARAMETER (0x80070057) • CI_E_TIMEOUT (0x8004181F) • E_ACCESSDENIED (0x80070005) • CI_E_BUFFERTOOSMALL (0x8004180c) • DB_S_ENDOFROWSET (0x00040EC6) The HRESULT and NTSTATUS numbering spaces do not currently overlap—except with values of identical meaning. However, even if there are conflicts in the future, they would not cause protocol issues as long as the value for STATUS_INSUFFICIENT_RESOURCES remains unique, because all other error values are treated the same.

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Errata Published*	Description
2019/09/16	In Section 3.1.5.2.15, Receiving a CPMFindIndicesIn Request, the first step was changed from: Search the ConnectedClientsIdentifiers list for the HANDLE of the named pipe over which the server has received the CPMFindIndicesIn message. If it is not present, the server MUST report an E_INVALIDARG (0x80070057) error. Changed to: Search the ConnectedClientsIdentifiers list for the HANDLE of the named pipe over which the server has received the CPMFindIndicesIn message. If it is not present, the server MUST report an ERROR_INVALID_PARAMETER (0x80070057) error.
2019/09/16	In Section 3.1.5.2.1,Receiving a CPMConnectIn Request, the following was changed from: DS_E_ INVALIDDATASOURCE: Generated when the catalog was not specified correctly. Changed to: DS_E_ INVALIDDATASOURCE or ERROR_INVALID_PARAMETER: Generated when the catalog was not specified correctly.
2019/09/16	In Section 2.2.1.44, CTableColumn, updated the descriptions of the ValueOffset, StatusOffset, and LengthOffset fields. Changed from: ... _padding1 (1 byte): A padding field. Note This field MUST be inserted before ValueOffset if, without it, ValueOffset would not begin at an even offset from the beginning of the message. The value of this byte is arbitrary and MUST be ignored. If ValueUsed is set to 0x00, this field MUST NOT be present. ValueOffset (2 bytes): An unsigned 2-byte integer specifying the offset of the column value in the row. If ValueUsed is set to 0x00, this field MUST NOT be present. ... _padding2 (1 byte): A padding field. Note This field MUST be inserted before StatusOffset if, without it, the StatusOffset field would not begin at an even offset from the beginning of the message. The value of this byte is arbitrary and MUST be ignored. If StatusUsed is set to 0x00, this field MUST NOT be present. StatusOffset (2 bytes): An unsigned 2-byte integer. Note Specifies the offset of the column status in the row. If StatusUsed is set to 0x00, this field MUST NOT be present. ... _padding3 (1 byte): A padding field. Note This field MUST be inserted before LengthOffset if, without it, LengthOffset would not begin at an even offset from the beginning of a message. The value of this byte is arbitrary and MUST be ignored. If LengthUsed is set to 0x00, this field MUST NOT be present.

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Errata Published*	Description
	LengthOffset (2 bytes): An unsigned 2-byte integer specifying the offset of the column length in the row. In CPMGetRowsOut, length is represented by a 32-bit unsigned integer by the offset specified in LengthOffset. If LengthUsed is set to 0x00, this field MUST NOT be present. Changed to: ... _padding1 (1 byte): A padding field. This field MUST be inserted before ValueOffset if, without it, ValueOffset would not begin at an even offset from the beginning of the message. The value of this byte is arbitrary and MUST be ignored. If ValueUsed is set to 0x00, this field MUST NOT be present. ValueOffset (2 bytes): An unsigned 2-byte integer specifying the offset of the column value in the row. If ValueUsed is set to 0x00, this field MUST NOT be present. The offset value is within row size(CPMSetBindingIn._cbRow), and the offset + ValueSize is within row size too. ... _padding2 (1 byte): A padding field. This field MUST be inserted before StatusOffset if, without it, the StatusOffset field would not begin at an even offset from the beginning of the message. The value of this byte is arbitrary and MUST be ignored. If StatusUsed is set to 0x00, this field MUST NOT be present. StatusOffset (2 bytes): An unsigned 2-byte integer. Specifies the offset of the column status in the row. If StatusUsed is set to 0x00, this field MUST NOT be present. The offset value is within row size(CPMSetBindingIn._cbRow), and the offset + 1 is within row size too. ... _padding3 (1 byte): A padding field. This field MUST be inserted before LengthOffset if, without it, LengthOffset would not begin at an even offset from the beginning of a message. The value of this byte is arbitrary and MUST be ignored. If LengthUsed is set to 0x00, this field MUST NOT be present. LengthOffset (2 bytes): An unsigned 2-byte integer specifying the offset of the column length in the row. In CPMGetRowsOut, length is represented by a 32-bit unsigned integer by the offset specified in LengthOffset. If LengthUsed is set to 0x00, this field MUST NOT be present. The offset value is within row size(CPMSetBindingIn._cbRow), and the offset + 4 is within row size too.
2019/09/16	In Section 3.1.5.2.6, Receiving a CPMGetRowsIn Request, the following was added to the second step: If _hCursor is invalid, then E_INVALIDARG SHOULD<30> be returned. <30> Section 3.1.5.2.6: On 32-bit clients and servers E_INVALIDARG is returned. On 64-bit clients and servers STATUS_INVALID_PARAMETER is returned.
2019/09/16	In Section 2.2.4, Errors, the following was changed from: ERROR_INVALID_PARAMETER (0x57)

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Errata Published*	Description
	Changed to: ERROR_INVALID_PARAMETER (0x80070057)
2019/09/16	In Section 3.1.5.2.1, Receiving a CPMConnectIn Request, step 6 has been changed from: 6. Call the GetServerVersions abstract interface of the GSS. Fill in the _serverVersion field using the _serverVersion output argument obtained from the GetServerVersions abstract interface. If supportsVersioningInfo is true, fill in the dwWinVerMajor, dwWinVerMinor, dwNLSVerMajor, and dwNLSVerMinor fields with the values returned by GetServerVersions. Otherwise, in order to indicate that versioning is not supported (see section 3.2.4.2.1), the server MUST copy four DWORDs at the offset starting after _serverVersion in the CPMConnectIn message to the same location in the CPMConnectOut reply (the offset right after _serverVersion). Changed to: 6. Call the GetServerVersions abstract interface of the GSS. Fill in the _serverVersion field using the _serverVersion output argument obtained from the GetServerVersions abstract interface. If supportsVersioningInfo is true, fill in the dwWinVerMajor, dwWinVerMinor, dwNLSVerMajor, and dwNLSVerMinor fields with the values returned by GetServerVersions. Otherwise, in order to indicate that versioning is not supported (see section 3.2.4.2.1), the server MUST copy four DWORDs at the offset starting after _iClientVersion in the CPMConnectIn message to the same location in the CPMConnectOut reply (the offset right after _serverVersion).
2019/09/16	In Section 1.2.2, Informative References, added the [MSDOCS-NLST] reference. Changed from: [Jones] Sparck Jones, K., Walker, S., and Robertson, S.E., "A Probabilistic Model of Information and Retrieval: Development and Status", September 1998, University of Cambridge Technical Report UCAM-CL-TR-446. [MSDN-FULLPROPSPEC] Microsoft Corporation, "FULLPROPSPEC structure", http://msdn.microsoft.com/en-us/library/ms690996.aspx [MSDN-OLEDBP] Microsoft Corporation, "OLE DB Provider for Indexing Service", http://msdn.microsoft.com/en-us/library/ms690319.aspx [MSDN-PROPLIST] Microsoft Corporation, "Windows Properties", http://msdn.microsoft.com/en-us/library/windows/desktop/dd561977(v=VS.85).aspx Changed to: [Jones] Sparck Jones, K., Walker, S., and Robertson, S.E., "A Probabilistic Model of Information and Retrieval: Development and Status", September 1998, University of Cambridge Technical Report UCAM-CL-TR-446. [MSDN-FULLPROPSPEC] Microsoft Corporation, "FULLPROPSPEC structure", http://msdn.microsoft.com/en-us/library/ms690996.aspx [MSDN-OLEDBP] Microsoft Corporation, "OLE DB Provider for Indexing Service", http://msdn.microsoft.com/en-us/library/ms690319.aspx

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<table>
<tr><th>Errata Published*</th><th>Description</th></tr>
<tr><td></td><td>
[MSDN-PROPLIST] Microsoft Corporation, "Windows Properties", http://msdn.microsoft.com/en-us/library/windows/desktop/dd561977(v=VS.85).aspx

[MSDOCS-NLST] Microsoft Corporation, "National Language Support Terminology", https://docs.microsoft.com/en-us/windows/win32/intl/nls-terminology

In Section 2.2.3.3, CPMConnectOut, added the [MSDOCS-NLST] reference to the dwNLSVerMinor field description.

Changed from:
...
dwNLSVerMinor (4 bytes): 32-bit unsigned integer that contains the defined National Language Support (NLS) version number of the Windows operating system on a server. If server doesn't supports version reporting then this field MUST be omitted. <12>

If present, the dwNLSVerMajor and dwNLSVerMinor fields can contain one of the following values:

<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>NLS_VERSION_40500
0x00040500</td><td>Defined NLS version is 0x00040500.</td></tr>
<tr><td>NLS_VERSION_60000
0x00060000</td><td>Defined NLS version is 0x00060000.</td></tr>
<tr><td>NLS_VERSION_60101
0x00060101</td><td>Defined NLS version is 0x00060101.</td></tr>
</table>

Changed to:
...
dwNLSVerMinor (4 bytes): 32-bit unsigned integer that contains the defined National Language Support (NLS) version number of the Windows operating system on a server. If server doesn't supports version reporting then this field MUST be omitted. <12> For more information on NLS see [MSDOCS-NLST].

If present, the dwNLSVerMajor and dwNLSVerMinor fields can contain one of the following values:

<table>
<tr><th>Value</th><th>Meaning</th></tr>
<tr><td>NLS_VERSION_40500
0x00040500</td><td>Defined NLS version is 0x00040500.</td></tr>
<tr><td>NLS_VERSION_60000
0x00060000</td><td>Defined NLS version is 0x00060000.</td></tr>
</table>
</td></tr>
</table>

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Errata Published*	Description
	<table><tr><td>NLS_VERSION_60101 0x00060101</td><td>Defined NLS version is 0x00060101.</td></tr></table>
2019/09/16	In Section 3.1.5.2.1, Receiving a CPMConnectIn Request, updated the processing rules for _fClientIsRemote in the first numbered step. Changed from: When the server receives a CPMConnectIn request from a client, the server MUST do the following. 1. Search the ConnectedClientIdentifiers list for the handle of the named pipe over which the server has received the CPMConnectIn message. If it is present, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error. ... Changed to: When the server receives a CPMConnectIn request from a client, the server MUST do the following. 1. Search the ConnectedClientIdentifiers list for the handle of the named pipe over which the server has received the CPMConnectIn message. If it is present, the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error. If _fClientIsRemote is not set to 0x00000001 the server MUST report a STATUS_INVALID_PARAMETER (0xC000000D) error. ...
2019/09/16	In Section 2.2.1.4, CInternalPropertyRestriction, a new field called _padding_lcid was added: _padding_lcid (variable): This field MUST be 0 to 3 bytes in length. The length of this field MUST be such that the following _lcid field begins at an offset that is a multiple of 4 bytes from the beginning of the message that contains this structure. If this field is present (that is, length nonzero), the value it contains is arbitrary. The content of this field MUST be ignored by the receiver.
2019/09/16	In Section 2.2.1.1, CBaseStorageVariant, removed the description of what happens if the vType field is set to VT_BSTR in the cbSize field description. Changed from: ... cbSize (4 bytes): A 32-bit unsigned integer. Note Indicates the size of the blobData field in bytes. If vType is set to VT_BSTR, cbSize MUST be set to 0x00000000 when the string represented is an empty string. ... Changed to: ... cbSize (4 bytes): A 32-bit unsigned integer. Note Indicates the size of the blobData field in bytes.

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	...
2019/09/16	In Section 1.7, Versioning and Capability Negotiation, the last row of the table was changed from: 0x00010700 64-bit Windows 7 or Windows Server 2008 R2 operating system. Changed to: 0x00010700 64-bit Windows 7 and later or Windows Server 2008 R2 operating system and later.
2019/09/16	In Section 1.4, Relationship to Other Protocols, the following was changed from: The Windows Search Protocol relies on the SMB Protocol, as specified in [MS-SMB] for message transport. No other protocol depends directly on the Windows Search Protocol. Changed to: The Windows Search Protocol relies on the SMB Protocol, as specified in [MS-SMB], or the SMB2 Protocol, as specified in [MS-SMB2], for message transport. No other protocol depends directly on the Windows Search Protocol. In Section 1.5, Prerequisites/Preconditions, the following was changed from: The client is expected to have obtained the name of the server and a catalog name before this protocol is invoked. It is also assumed that the client and server have a security association usable with named pipes as specified in [MS-SMB]. Changed to: The client is expected to have obtained the name of the server and a catalog name before this protocol is invoked. It is also assumed that the client and server have a security association usable with named pipes as specified in [MS-SMB] or [MS-SMB2]. In Section 1.9, Standards Assignments, the following was changed from: Microsoft has allocated this protocol a named pipe as specified in [MS-SMB]. The pipe name is \pipe\MSFTEWDS. Changed to: Microsoft has allocated this protocol a named pipe as specified in [MS-SMB] or [MS-SMB2]. The pipe name is \pipe\MSFTEWDS. In Section 2.1, Transport, the following has been changed from: This protocol uses the underlying server message block (SMB) named pipe protocol to retrieve the identity of the caller that made the connection as specified in [MS-SMB] section 2.2.4.9.1. The client MUST set SECURITY_IMPERSONATION as the ImpersonationLevel in the request to open the named pipe.<2>

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	Changed to: This protocol uses the underlying server message block (SMB) named pipe protocol to retrieve the identity of the caller that made the connection as specified in [MS-SMB] section 2.2.4.9.1. or [MS-SMB2] section 2.2.13. The client MUST set SECURITY_IMPERSONATION as the ImpersonationLevel in the request to open the named pipe.<2> In Section 5.1, Security Considerations for Implementers, the following was changed from: For indexing implementations that index secure content, consider using the user context provided by [MS-SMB] to trim search results and return only those results accessible to the caller. Changed to: For indexing implementations that index secure content, consider using the user context provided by [MS-SMB] or [MS-SMB2] to trim search results and return only those results accessible to the caller.
2019/09/16	In Section 4.1, Example 1, added step 11 to describe the server response to the initial CPMGetRowsIn request. Changed from: ... 10. The client issues a CPMGetRowsIn request message, assuming that the client is prepared to accept 32 rows at this point, and requests them in ascending order. ● The header of the message is populated as follows: ● _msg is set to 0x000000CC, indicating that this is a CPMGetRowsIn message. ● _status is set to 0x00000000. ● _ulChecksum contains the checksum, computed according to section 3.2.4. ● _ulReserved2 is set to 0x00000000. ● The body of the message is populated as follows: ● _hCursor is set to 0xAAAAAAAA. ● _cRowsToTransfer is set to 0x00000014. ● _cRowWidth is set to 0x00000020 (from bindings). ● _cbSeek is set to 0x0000000C, which is the size of the eType, _chapt, and CRowSeekNext fields combined. ● _cbReserved is set to 0x0x20 (0x14 plus _cbSeek). ● _cbReadBuffer is set to 0x4000 (because 1000 * 0x20 > 0x4000). ● _ulClientBase is set to 0x03C924C8 (execution dependent). ● _fBwdfetch is set to 0x00000000, indicating that the rows are to be fetched in forward order. ● eType is set to 0x0000001, indicating that the client wants next rows. ● _chapt is set to 0 (not a chaptered result). ● eType is set to 0x00000000 (eRowsSeekNone), meaning start with next 0x00000000.

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	• The body of the message is populated as follows: • _CRowsReturned is set to 0x00000002. • eType is set to 0x00000000 (eRowsSeekNone). • _chapt is set to 0x00000000 (not a chaptered result). • Rows contain the size of the two documents that contain the word "flowers". The raw buffer will look similar to the following (-- indicates unused space): -- -- 00 00 (status OK for both columns) 7E 00 00 00 (length = 0x7E - 0x10 (inline) = 0x6E bytes of string) 1F 00 -- -- (VT_LPWSTR) -- -- -- -- 58 64 C9 03 (address of VT_LPWSTR: 0x03C96458 - base 0x03C924C8 = offset 0x3F90 into buffer) -- -- -- -- 96 02 00 00 (WorkId = 0x296) -- -- -- -- -- -- 00 00 (status OK for both columns) 86 00 00 00 (length = 0x86 - 0x10 (inline) = 0x76 bytes of string) 1F 00 -- -- (VT_LPWSTR) -- -- -- -- E0 63 C9 03 (address of VT_LPWSTR: 0x03C963E0 - base 0x03C924C8 = offset 0x3F18 into buffer) -- -- -- -- 97 02 00 00 (WorkId = 0x297) -- -- -- -- • And at offset 0x3F90 into the buffer will be a Unicode string of length 55 (including null) "file://UserA-4/Users/UserA/Pictures/forest flowers.jpg". • And at offset 0x3F18 into the buffer will be a Unicode string of length 59 (including null) "file://UserA-4/Users/UserA/Pictures/frangipani flowers.jpg". 11. The client issues another CPMGetRowsIn request message to look for more rows. • The header of the message is populated as follows: • _msg is set to 0x000000CC, indicating that this is a CPMGetRowsIn message. • _status is set to 0x00000000. • _ulChecksum contains the checksum, computed according to section 3.2.4. • _ulReserved2 is set to 0x00000000. • The body of the message is populated as follows: • _hCursor is set to 0xAAAAAAAA. • _cRowsToTransfer is set to 0x00000014. • _cRowWidth is set to 0x00000020 (from bindings).

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	• _cbSeek is set to 0x0000000C, which is the size of the eType, _chapt, and CRowSeekNext fields combined. • _cbReserved is set to 0x0x20 (0x14 plus _cbSeek). • _cbReadBuffer is set to 0x4000 (because 1000 * 0x20 > 0x4000). • _ulClientBase is set to 0x03C924C8 (execution dependent). • _fBwdfetch is set to 0x00000000, indicating that the rows are to be fetched in forward order. • eType is set to 0x0000001, indicating that the client wants next rows. • _chapt is set to 0 (not a chaptered result). • eType is set to 0x00000000 (eRowsSeekNone), I meaning start with next available row. 12. The server processes it and responds with a CPMGetRowsOut message, assuming the server found no more documents that contain the word "flowers". • The header of the message is populated as follows: • _msg is set to 0x000000CC, indicating that this is a CPMGetRowsOut message. • _status is set to SUCCESS. • _ulChecksum is set to 0x00000000. • _ulReserved2 is set to 0x00000000. • The body of the message is populated as follows: • _CRowsReturned is set to 0x00000000, meaning no more rows are available. ... Changed to: ... 10. The client issues a CPMGetRowsIn request message, assuming that the client is prepared to accept 32 rows at this point, and requests them in ascending order. • The header of the message is populated as follows: • _msg is set to 0x000000CC, indicating that this is a CPMGetRowsIn message. • _status is set to 0x00000000. • _ulChecksum contains the checksum, computed according to section 3.2.4. • _ulReserved2 is set to 0x00000000. • The body of the message is populated as follows: • _hCursor is set to 0xAAAAAAAA. • _cRowsToTransfer is set to 0x00000014. • _cRowWidth is set to 0x00000020 (from bindings). • _cbSeek is set to 0x0000000C, which is the size of the eType, _chapt, and CRowSeekNext fields combined. • _cbReserved is set to 0x0x20 (0x14 plus _cbSeek). • _cbReadBuffer is set to 0x4000 (because 1000 * 0x20 > 0x4000). • _ulClientBase is set to 0x03C924C8 (execution dependent). • _fBwdfetch is set to 0x00000000, indicating that the rows are to be fetched in forward order.

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	• eType is set to 0x0000001, indicating that the client wants next rows. • _chapt is set to 0 (not a chaptered result). • _cskip of CRowSeekNext is set to 0 (receive row from beginning) because eType above indicates SeekDescription is set to CRowSeekNext. 11. The server processes it and responds with a CPMGetRowsOut message, assuming the server found two documents that contain the word "flowers". • The header of the message is populated as follows: • _msg is set to 0x000000CC, indicating that this is a CPMGetRowsOut message. • _status is set to SUCCESS. • _ulChecksum is set to 0x00000000. • _ulReserved2 is set to 0x00000000. • The body of the message is populated as follows: • _CRowsReturned is set to 0x00000002. • eType is set to 0x00000000 (eRowsSeekNone). • _chapt is set to 0x00000000 (not a chaptered result). • Rows contain the size of the two documents that contain the word "flowers". The raw buffer will look similar to the following (-- indicates unused space): -- -- 00 00 (status OK for both columns) 7E 00 00 00 (length = 0x7E - 0x10 (inline) = 0x6E bytes of string) 1F 00 -- -- (VT_LPWSTR) -- -- -- -- 58 64 C9 03 (address of VT_LPWSTR: 0x03C96458 - base 0x03C924C8 = offset 0x3F90 into buffer) -- -- -- -- 96 02 00 00 (WorkId = 0x296) -- -- -- -- -- -- 00 00 (status OK for both columns) 86 00 00 00 (length = 0x86 - 0x10 (inline) = 0x76 bytes of string) 1F 00 -- -- (VT_LPWSTR) -- -- -- -- E0 63 C9 03 (address of VT_LPWSTR: 0x03C963E0 - base 0x03C924C8 = offset 0x3F18 into buffer) -- -- -- -- 97 02 00 00 (WorkId = 0x297) -- -- -- -- • And at offset 0x3F90 into the buffer will be a Unicode string of length 55 (including null) "file://UserA-4/Users/UserA/Pictures/forest flowers.jpg". • And at offset 0x3F18 into the buffer will be a Unicode string of length 59 (including null) "file://UserA-4/Users/UserA/Pictures/frangipani flowers.jpg". 12. The client issues another CPMGetRowsIn request message to look for more rows. • The header of the message is populated as follows:

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Errata Published*	Description
	• _msg is set to 0x000000CC, indicating that this is a CPMGetRowsIn message. • _status is set to 0x00000000. • _ulChecksum contains the checksum, computed according to section 3.2.4. • _ulReserved2 is set to 0x00000000. • The body of the message is populated as follows: • _hCursor is set to 0xAAAAAAAA. • _cRowsToTransfer is set to 0x00000014. • _cRowWidth is set to 0x00000020 (from bindings). • _cbSeek is set to 0x0000000C, which is the size of the eType, _chapt, and CRowSeekNext fields combined. • _cbReserved is set to 0x0x20 (0x14 plus _cbSeek). • _cbReadBuffer is set to 0x4000 (because 1000 * 0x20 > 0x4000). • _ulClientBase is set to 0x03C924C8 (execution dependent). • _fBwdfetch is set to 0x00000000, indicating that the rows are to be fetched in forward order. • eType is set to 0x0000001, indicating that the client wants next rows. • _chapt is set to 0 (not a chaptered result). • _cskip of CRowSeekNext is set to 0 (receive row from beginning) because eType above indicates SeekDescription is set to CRowSeekNext. ...
2019/09/16	In Section 2.2.1.30, CDbColId, the description of the paddingGuidAlign field has been changed from: paddingGuidAlign (variable): This field MUST be 0 to 8 bytes in length. The length of this field MUST be such that the following field begins at an offset that is a multiple of 8 bytes from the beginning of the message that contains this structure. If this field is present (that is, length nonzero), the value it contains is arbitrary. The content of this field MUST be ignored by the receiver. Changed to: paddingGuidAlign (variable): The length of this field MUST be such that the following field begins at the first offset that is a multiple of 8 bytes from the beginning of the message that contains this structure. If this field is present (that is, length nonzero), the value it contains is arbitrary. The content of this field MUST be ignored by the receiver.

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[MS-WSTEP]: WS-Trust X.509v3 Token Enrollment Extensions

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[MS-WSUSAR]: Windows Server Update Services: Administrative API Remoting Protocol

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[MS-WSUSOD]: Windows Server Update Services Protocols Overview

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[MS-WSUSSS]: Windows Update Services: Server-Server Protocol

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[MS-WUSP]: Windows Update Services: Client-Server Protocol

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Errata below are for Protocol Document Version V28.0 – 2018/09/12.

Errata Published*	Description
2019/06/24	In this document, the properties of the LastChangeTime element of the Deployment complex type have been updated to indicate that it is mandatory. In Section 2.2.2.2.4, SyncUpdates, the minOccurs value for the LastChangeTime element of the Deployment complex type has been changed from "0" to "1". Changed from: … `<s:complexType name="Deployment"> <s:sequence> <s:element minOccurs="1" maxOccurs="1" name="ID" type="s:int" /> <s:element minOccurs="1" maxOccurs="1" name="Action" type="s1:DeploymentAction" /> <s:element minOccurs="0" maxOccurs="1" name="Deadline" type="s:string" /> <s:element minOccurs="1" maxOccurs="1" name="IsAssigned" type="s:boolean" /> <s:element minOccurs="0" maxOccurs="1" name="LastChangeTime" type="s:string" /> <s:element minOccurs="0" maxOccurs="1" name="DownloadPriority" type="s:string" /> <s:element minOccurs="0" maxOccurs="1" name="HardwareIds" type="s1:ArrayOfString" /> <s:element minOccurs="0" maxOccurs="1" name="AutoSelect" type="s:string" /> <s:element minOccurs="0" maxOccurs="1" name="AutoDownload" type="s:string" /> <s:element minOccurs="0" maxOccurs="1" name="SupersedenceBehavior" type="s:string" /> <s:element minOccurs="0" maxOccurs="1" name="FlagBitmask" type="s:string" /> </s:sequence>`

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	</s:complexType> ... LastChangeTime: Specifies when the deployment was created, in the syntax specified for s:date (as specified in [XMLSCHEMA2] section 3.2.9). ... Changed to: … <s:complexType name="Deployment"> <s:sequence> <s:element minOccurs="1" maxOccurs="1" name="ID" type="s:int" /> <s:element minOccurs="1" maxOccurs="1" name="Action" type="s1:DeploymentAction" /> <s:element minOccurs="0" maxOccurs="1" name="Deadline" type="s:string" /> <s:element minOccurs="1" maxOccurs="1" name="IsAssigned" type="s:boolean" /> <s:element minOccurs="1" maxOccurs="1" name="LastChangeTime" type="s:string" /> <s:element minOccurs="0" maxOccurs="1" name="DownloadPriority" type="s:string" /> <s:element minOccurs="0" maxOccurs="1" name="HardwareIds" type="s1:ArrayOfString" /> <s:element minOccurs="0" maxOccurs="1" name="AutoSelect" type="s:string" /> <s:element minOccurs="0" maxOccurs="1" name="AutoDownload" type="s:string" /> <s:element minOccurs="0" maxOccurs="1" name="SupersedenceBehavior" type="s:string" /> <s:element minOccurs="0" maxOccurs="1" name="FlagBitmask" type="s:string" /> </s:sequence> </s:complexType> ... LastChangeTime: Specifies when the deployment was created, in the syntax specified for s:date (as specified in [XMLSCHEMA2] section 3.2.9). This element MUST be present.

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	...
	
	In Section 6.2, Client Web Service WSDL, changed from:
	
	…
	
	`<s:element minOccurs="0" maxOccurs="1" name="LastChangeTime" type="s:string" />`
	
	…
	
	Changed to:
	…
	
	`<s:element minOccurs="1" maxOccurs="1" name="LastChangeTime" type="s:string" />`
	
	…

2019/04/29	In Section 3.1.5.7, SyncUpdates, and Section 3.1.5.12, SyncPrinterCatalog, a note has been added to clarify that only one revision can be sent for a given update. In Section 3.1.5.7, SyncUpdates, changed from: … Xml: The revision's associated "core" metadata (FragmentType = "Core"). SyncUpdatesResponse.OutOfScopeRevisionIDs: Populated with the IDs of revision that are in the CachedRevisions list that are not in the NeededRevisions list. … Changed to: ... Xml: The revision's associated "core" metadata (FragmentType = "Core"). Note: The server implementation MUST send no more than one Revision for a given Update. It is recommended that the implementation SHOULD, in the event of multiple matches, select only the latest Revision (the one with the highest revision number). SyncUpdatesResponse.OutOfScopeRevisionIDs: Populated with the IDs of revision that are in the CachedRevisions list that are not in the NeededRevisions list. ... In Section 3.1.5.12, SyncPrinterCatalog, changed from: … Xml: The "core" metadata (FragmentType = "Core") associated with the revision. SyncPrinterCatalogResponse.OutOfScopeRevisionIDs: Populated with the revision's IDs in the CachedRevisions list that are not in the NeededRevisions list. ... Changed to:

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	… Xml: The "core" metadata (FragmentType = "Core") associated with the revision. Note: The server implementation MUST send no more than one Revision for a given Update. It is recommended that the implementation SHOULD, in the event of multiple matches, select only the latest Revision (the one with the highest revision number). SyncPrinterCatalogResponse.OutOfScopeRevisionIDs: Populated with the revision's IDs in the CachedRevisions list that are not in the NeededRevisions list. ...

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[MS-XCA]: Xpress Compression Algorithm

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Errata below are for Protocol Document Version V5.0 – 2018/09/12.

Errata Published*	Description

2019/09/02	In Section 2.4.4, Processing, pseudocode supporting longer matches has been updated
	
	Changed from:
	...
	The match length can be greater than the match offset, and this necessitates the 1-byte-at-a-time copying strategy shown in the following pseudocode.
	
	`BufferedFlags = 0`
	`BufferedFlagCount = 0`
	`InputPosition = 0`
	`OutputPosition = 0`
	`LastLengthHalfByte = 0`
	`Loop until break instruction or error`
	`  If BufferedFlagCount == 0`
	`  BufferedFlags = read 4 bytes at InputPosition`
	`  InputPosition += 4`
	`  BufferedFlagCount = 32`
	`  BufferedFlagCount = BufferedFlagCount – 1`
	`  If (BufferedFlags & (1 << BufferedFlagCount)) == 0`
	`  Copy 1 byte from InputPosition to OutputPosition.  Advance both.`
	`  Else`
	`  If InputPosition == InputBufferSize`
	`  Decompression is complete.  Return with success.`
	`  MatchBytes = read 2 bytes from InputPosition`
	`  InputPosition += 2`
	`  MatchLength = MatchBytes mod 8`
	`  MatchOffset = (MatchBytes / 8) + 1`
	`  If MatchLength == 7`
	`  If LastLengthHalfByte == 0`
	`  MatchLength = read 1 byte from InputPosition`
	`  MatchLength = MatchLength mod 16`
	`  LastLengthHalfByte = InputPosition`
	`  InputPosition += 1`
	`  Else`
	`  MatchLength = read 1 byte from LastLengthHalfByte position`
	`  MatchLength = MatchLength / 16`
	`  LastLengthHalfByte = 0`
	`  If MatchLength == 15`
	`  MatchLength = read 1 byte from InputPosition`
	`  InputPosition += 1`
	`  If MatchLength == 255`
	`  MatchLength = read 2 bytes from InputPosition`
	`  InputPosition += 2`
	`  If MatchLength < 15 + 7`
	`  Return error.`
	`  MatchLength -= (15 + 7)`
	`  MatchLength += 15`

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	MatchLength += 7
	MatchLength += 3
	For i = 0 to MatchLength – 1
	Copy 1 byte from OutputBuffer[OutputPosition – MatchOffset]
	OutputPosition += 1
	
	Changed to:
	...
	The match length can be greater than the match offset, and this necessitates the 1-byte-at-a-time copying strategy shown in the following pseudocode.
	
	BufferedFlags = 0
	BufferedFlagCount = 0
	InputPosition = 0
	OutputPosition = 0
	LastLengthHalfByte = 0
	Loop until break instruction or error
	If BufferedFlagCount == 0
	BufferedFlags = read 4 bytes at InputPosition
	InputPosition += 4
	BufferedFlagCount = 32
	BufferedFlagCount = BufferedFlagCount – 1
	If (BufferedFlags & (1 << BufferedFlagCount)) == 0
	Copy 1 byte from InputPosition to OutputPosition. Advance both.
	Else
	If InputPosition == InputBufferSize
	Decompression is complete. Return with success.
	MatchBytes = read 2 bytes from InputPosition
	InputPosition += 2
	MatchLength = MatchBytes mod 8
	MatchOffset = (MatchBytes / 8) + 1
	If MatchLength == 7
	If LastLengthHalfByte == 0
	MatchLength = read 1 byte from InputPosition
	MatchLength = MatchLength mod 16
	LastLengthHalfByte = InputPosition
	InputPosition += 1
	Else
	MatchLength = read 1 byte from LastLengthHalfByte position
	MatchLength = MatchLength / 16
	LastLengthHalfByte = 0
	If MatchLength == 15
	MatchLength = read 1 byte from InputPosition
	InputPosition += 1
	If MatchLength == 255
	MatchLength = read 2 bytes from InputPosition
	InputPosition += 2
	If MatchLength == 0
	MatchLength = read 4 bytes from InputPosition
	InputPosition += 4 bytes
	If MatchLength < 15 + 7
	Return error.
	MatchLength -= (15 + 7)
	MatchLength += 15
	MatchLength += 7
	MatchLength += 3
	For i = 0 to MatchLength – 1
	Copy 1 byte from OutputBuffer[OutputPosition – MatchOffset]

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	OutputPosition += 1
2019/07/08	In Section 2.1.4.2, Huffman Code Construction Phase, clarified that the sorting algorithm used in the Huffman Code construction phase is stable. Changed from: ... The following flowchart illustrates the length-limited canonical Huffman code construction method. ... Changed to: ... The following flowchart illustrates the length-limited canonical Huffman code construction method. Note that the sorting algorithm used in the Huffman Code construction phase is stable. ...
2019/07/08	In Section 2.1.4.3 Final Encoding Phase, clarified that some implementations of the decompression algorithm expect a terminating Huffman symbol and that it is recommended the encoding algorithm append this symbol. Changed from: Some implementations of the decompression algorithm expect an extra symbol to mark the end of the data. For example, certain implementations fail during decompression if the Huffman symbol 256 is not found after the actual data. For this reason, the encoding algorithm appends this symbol and increments the count of symbol 256 before the Huffman codes are constructed. Changed to: Implementations of the decompression algorithm may expect an extra symbol to mark the end of the data. For example, certain implementations fail during decompression if the Huffman symbol 256 is not found after the actual data. For this reason, the encoding algorithm SHOULD append this symbol and increment the count of symbol 256 before the Huffman codes are constructed.

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[MS-XCEP]: X.509 Certificate Enrollment Policy Protocol

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