[MS-NRPC]:

Netlogon Remote Protocol

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Revision Summary

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4/3/2007	1.1		Version 1.1 release
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Table of Contents

1 Introduction

The Netlogon Remote Protocol is a **remote procedure call (RPC)** interface that is used for user and machine authentication on domain-based networks.

The Netlogon Remote Protocol RPC interface is also used to replicate the **database** for **backup domain controllers (BDCs)**.

The Netlogon Remote Protocol in Windows is used to maintain domain relationships from the members of a **domain** to the **domain controller (DC)**, among DCs for a domain, and between DCs across domains. This RPC interface is used to discover and manage these relationships.

Sections 1.8, 2, and 3 of this specification are normative and can contain the terms MAY, SHOULD, MUST, MUST NOT, and SHOULD NOT as defined in [RFC2119]. Sections 1.5 and 1.9 are also normative but do not contain those terms. All other sections and examples in this specification are informative.

1.1 Glossary

The following terms are specific to this document:

Active Directory: A general-purpose network **directory service**. **Active Directory** also refers to the Windows implementation of a **directory service**. **Active Directory** stores information about a variety of objects in the network. Importantly, user accounts, computer accounts, groups, and all related credential information used by the Windows implementation of Kerberos are stored in **Active Directory**. **Active Directory** is either deployed as Active Directory Domain Services (AD DS) or Active Directory Lightweight Directory Services (AD LDS). [MS-ADTS] describes both forms. For more information, see [MS-AUTHSOD] section 1.1.1.5.2, Lightweight Directory Access Protocol (LDAP) versions 2 and 3, Kerberos, and **DNS**.

Advanced Encryption Standard (AES): A block cipher that supersedes the Data Encryption Standard (DES). AES can be used to protect electronic data. The AES algorithm can be used to encrypt (encipher) and decrypt (decipher) information. Encryption converts data to an unintelligible form called ciphertext; decrypting the ciphertext converts the data back into its original form, called plaintext. AES is used in symmetric-key cryptography, meaning that the same key is used for the encryption and decryption operations. It is also a block cipher, meaning that it operates on fixed-size blocks of plaintext and ciphertext, and requires the size of the plaintext as well as the ciphertext to be an exact multiple of this block size. AES is also known as the Rijndael symmetric encryption algorithm [FIPS197].

alias: A **group** that is local to a particular machine (as opposed to a **group** that has security permissions and settings for the entire **domain**).

authentication level: A numeric value indicating the level of authentication or message protection that **remote procedure call (RPC)** will apply to a specific message exchange. For more information, see [C706] section 13.1.2.1 and [MS-RPCE].

authenticator: When used in reference to the Netlogon Protocol, the data stored in the NETLOGON_AUTHENTICATOR structure.

authoritative response: An authoritative response is one in which the server has all necessary resources to service the caller's request. If some of the resources are temporarily unavailable, then the server will indicate that its response is not authoritative. When a server does not return an authoritative response, it is reasonable for the caller to retry the request at another server. The reasons why a request is non-authoritative are always implementation-specific and could include any failure of the server to allocate necessary resources.

backup domain controller (BDC): A **domain controller (DC)** that receives a copy of the **domain** directory database from the **primary domain controller (PDC)**. This copy is synchronized periodically and automatically with the **primary domain controller (PDC)**. BDCs also authenticate user logons and can be promoted to function as the **PDC**. There is only one **PDC** or **PDC** emulator in a **domain**, and the rest are **backup domain controllers**.

binary large object (BLOB): A collection of binary data stored as a single entity in a database.

checked build: A special build of a Windows NT operating system–based operating system that contains fewer compiler optimizations and more debugging checks than a production environment build. The purpose of the checked build is to make identifying and diagnosing operating system–level problems easier. For more information, see [MSDN-CHKBLD].

client challenge: A 64-bit **nonce** generated on the client side.

computer name: The **DNS** or NetBIOS name.

computer object: An object of class computer. A **computer object** is a **security principal** object; the principal is the operating system running on the computer. The shared secret allows the operating system running on the computer to authenticate itself independently of any user running on the system. See **security principal**.

credential: Previously established, authentication (2) data that is used by a security principal to establish its own identity. When used in reference to the Netlogon Protocol, it is the data that is stored in the NETLOGON_CREDENTIAL structure.

database: For the purposes of the Netlogon RPC, a database is a collection of user accounts, machine accounts, aliases, groups, and policies, managed by a component. The database, or the component managing the database, must expose a mechanism to enable Netlogon to gather changes from and apply changes to the database. Additionally, it must export a database serial number in order to track changes for efficient replication.

database serial number: A numeric value that is incremented each time a database transaction is applied to the database.

decryption: In cryptography, the process of transforming encrypted information to its original clear text form.

delta: One of a set of possible changes that can be made to a **database**.

direct trust: A type of authentication functionality in which one **domain** accepts another **domain** as an authoritative source to provide object authentication and other **Active Directory** services for that other **domain**. For example, if a **direct trust** is established from **domain**, DOMAIN-A, to **domain**, DOMAIN-B, DOMAIN-A trusts DOMAIN-B. If a **domain**, DOMAIN-A, must authenticate an object, such as a user account, from a **domain**, DOMAIN-B, DOMAIN-A requests that DOMAIN-B authenticate the user account, and DOMAIN-A will treat the response from DOMAIN-B as reliable.

directory service (DS): A service that stores and organizes information about a computer network's users and network shares, and that allows network administrators to manage users' access to the shares. See also **Active Directory**.

domain: A set of users and computers sharing a common namespace and management infrastructure. At least one computer member of the set must act as a **domain controller (DC)** and host a member list that identifies all members of the domain, as well as optionally hosting the **Active Directory** service. The domain controller provides authentication (2) of members, creating a unit of trust for its members. Each domain has an identifier that is shared among its members. For more information, see [MS-AUTHSOD] section 1.1.1.5 and [MS-ADTS].

domain account: A stored set of attributes (2) representing a principal used to authenticate a user or machine to an **Active Directory** domain.

domain controller (DC): The service, running on a server, that implements **Active Directory**, or the server hosting this service. The service hosts the data store for objects and interoperates with other **DCs** to ensure that a local change to an object replicates correctly across all **DCs**. When **Active Directory** is operating as Active Directory Domain Services (AD DS), the **DC** contains full NC replicas of the configuration naming context (config NC), schema naming context (schema NC), and one of the domain NCs in its **forest**. If the AD DS **DC** is a global catalog server (GC server), it contains partial NC replicas of the remaining domain NCs in its **forest**. For more information, see [MS-AUTHSOD] section 1.1.1.5.2 and [MS-ADTS]. When **Active Directory** is operating as Active Directory Lightweight Directory Services (AD LDS), several AD LDS **DCs** can run on one server. When **Active Directory** is operating as AD DS, only one AD DS **DC** can run on one server. However, several AD LDS **DCs** can coexist with one AD DS **DC** on one server. The AD LDS **DC** contains full NC replicas of the config NC and the schema NC in its **forest**.

domain local group: An **Active Directory group** that allows user objects, global groups, and universal groups from any **domain** as members. It may additionally include, and be a member of, other **domain local groups** from within its **domain**. A group object g is a **domain local group** if and only if GROUP_TYPE_RESOURCE_GROUP is present in g!groupType; see [MS-ADTS] section 2.2.12, "Group Type Flags". A security-enabled **domain local group** is valid for inclusion within access control lists (ACLs) from its own **domain**. If a **domain** is in **mixed mode**, then a security-enabled **domain local group** in that **domain** allows only user objects as members.

domain member (member machine): A machine that is joined to a domain by sharing a secret between the machine and the domain.

domain name: A **domain name** or a **NetBIOS name** that identifies a **domain**.

Domain Name System (DNS): A hierarchical, distributed database that contains mappings of **domain names** to various types of data, such as IP addresses. DNS enables the location of computers and services by user-friendly names, and it also enables the discovery of other information stored in the database.

domain tree: A set of **domains** that are arranged hierarchically, typically following an accompanying DNS hierarchy, with trusts between parents and children. An example **domain tree** might be a.example.com, b.example.com, and example.com; domain A and domain B each trust example.com but do not trust each other directly. They will have a transitive trust relationship through example.com.

dynamic endpoint: A network-specific server address that is requested and assigned at run time. For more information, see [C706].

encryption key: One of the input parameters to an encryption algorithm. Generally speaking, an encryption algorithm takes as input a clear-text message and a key, and results in a cipher-text message. The corresponding **decryption** algorithm takes a cipher-text message, and the key, and results in the original clear-text message.

endpoint: A network-specific address of a remote procedure call (RPC) server process for remote procedure calls. The actual name and type of the endpoint depends on the **RPC** protocol sequence that is being used. For example, for RPC over TCP (RPC Protocol Sequence ncacn_ip_tcp), an endpoint might be TCP port 1025. For RPC over Server Message Block (RPC Protocol Sequence ncacn_np), an endpoint might be the name of a named pipe. For more information, see [C706].

enterprise network: The network of computer systems in an organization, such as a corporation. An enterprise can span geographical locations and often includes a variety of computer types, operating systems, protocols, and network architectures.

forest: One or more **domains** that share a common schema and trust each other transitively. An organization can have multiple **forests**. A **forest** establishes the security and administrative boundary for all the objects that reside within the **domains** that belong to the **forest**. In contrast, a **domain** establishes the administrative boundary for managing objects, such as users, groups, and computers. In addition, each **domain** has individual security policies and trust relationships with other **domains**.

forest trust: A type of **trust** where the trusted party is a **forest**, which means that all **domains** in that **forest** are trusted.

forest trust information: Information about namespaces, **domain names**, and **security identifiers (SIDs)** owned by a trusted **forest**.

full database synchronization: A mechanism for synchronizing an entire database record set on a particular replication partner.

fully qualified domain name (FQDN): (1) An unambiguous **domain name** that gives an absolute location in the **Domain Name System's (DNS)** hierarchy tree, as defined in [RFC1035] section 3.1 and [RFC2181] section 11.

(2) In **Active Directory**, a **fully qualified domain name (FQDN) (1)** that identifies a **domain**.

global catalog (GC): A unified partial view of multiple **naming contexts (NCs)** in a distributed partitioned directory. The **Active Directory** directory service **GC** is implemented by GC servers. The definition of **global catalog** is specified in [MS-ADTS] section 3.1.1.1.8.

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

group: A collection of objects that can be treated as a whole.

Hash-based Message Authentication Code (HMAC): A mechanism for message authentication (2) using cryptographic hash functions. HMAC can be used with any iterative cryptographic hash function (for example, MD5 and SHA-1) in combination with a secret shared key. The cryptographic strength of HMAC depends on the properties of the underlying hash function.

interactive logon: A software method in which the account information and credentials input by the user interactively are authenticated by a **server** or **domain controller (DC)**.

Interface Definition Language (IDL): The International Standards Organization (ISO) standard language for specifying the interface for remote procedure calls. For more information, see [C706] section 4.

Key Distribution Center (KDC): The Kerberos service that implements the authentication (2) and ticket granting services specified in the Kerberos protocol. The service runs on computers selected by the administrator of the realm or domain; it is not present on every machine on the network. It must have access to an account database for the realm that it serves. Windows **KDCs** are integrated into the **domain controller** role of a Windows Server operating system acting as a Domain Controller. It is a network service that supplies tickets to clients for use in authenticating to services.

keyed-hash Message Authentication Code: A symmetric keyed hashing algorithm used to verify the integrity of data to help ensure it has not been modified while in storage or transit.

Local Security Authority (LSA): A protected subsystem that authenticates and logs users onto the local system. **LSA** also maintains information about all aspects of local security on a system, collectively known as the local security policy of the system.

Local Security Authority (LSA) database: A Microsoft-specific terminology for the part of the user account database containing account privilege information (such as specific account rights) and domain security policy information.

mailslot: A mechanism for one-way interprocess communications (IPC). For more information, see [MSLOT] and [MS-MAIL].

mixed mode: A state of an **Active Directory domain** that supports **domain controllers (DCs)** running Windows NT Server 4.0 operating system. **Mixed mode** does not allow organizations to take advantage of new **Active Directory** features such as universal groups, nested group membership, and interdomain group membership. See also native mode.

naming context (NC): An **NC** is a set of objects organized as a tree. It is referenced by a DSName. The DN of the DSName is the distinguishedName attribute of the tree root. The **GUID** of the DSName is the objectGUID attribute of the tree root. The **security identifier (SID)** of the DSName, if present, is the objectSid attribute of the tree root; for Active Directory Domain Services (AD DS), the **SID** is present if and only if the **NC** is a domain naming context (domain NC). **Active Directory** supports organizing several **NCs** into a tree structure.

NetBIOS name: A 16-byte address that is used to identify a NetBIOS resource on the network. For more information, see [RFC1001] and [RFC1002].

Netlogon: In a Windows NT-compatible network security environment, the component responsible for synchronization and maintenance functions between a **primary domain controller (PDC)** and backup domain controllers (BDC). **Netlogon** is a precursor to the directory replication server (DRS) protocol.

network logon: A software method in which the account information and credentials previously supplied by the user as part of an interactive logon are used again to log the user onto another network resource.

nonce: A number that is used only once. This is typically implemented as a random number large enough that the probability of number reuse is extremely small. A nonce is used in authentication protocols to prevent replay attacks. For more information, see [RFC2617].

OEM character set: See **original equipment manufacturer (OEM) character set**.

one-way function (OWF): The calculation of a hash of the password using the Rivest-Shamir-Adleman (RSA) MD4 function. **OWF** is used to refer to the resulting value of the hash operation.

opnum: An operation number or numeric identifier that is used to identify a specific **remote procedure call (RPC)** method or a method in an interface. For more information, see [C706] section 12.5.2.12 or [MS-RPCE].

original equipment manufacturer (OEM) character set: A character encoding used where the mappings between characters is dependent upon the code page configured on the machine, typically by the manufacturer.

partial database synchronization: A mechanism for synchronizing a set of database records on a particular replication partner.

primary domain: A **domain** (identified by a **security identifier (SID)**) that the server is joined to. For a **domain controller (DC)**, the **primary domain** is that of the **domain** itself.

primary domain controller (PDC): A **domain controller (DC)** designated to track changes made to the accounts of all computers on a **domain**. It is the only computer to receive these

changes directly, and is specialized so as to ensure consistency and to eliminate the potential for conflicting entries in the **Active Directory** database. A **domain** has only one **PDC**.

principal: An authenticated entity that initiates a message or channel in a distributed system.

privilege: The right of a user to perform system-related operations, such as debugging the system. A user's authorization context specifies what privileges are held by that user.

RC4: A variable key-length symmetric encryption algorithm. For more information, see [SCHNEIER] section 17.1.

read-only domain controller (RODC): A **domain controller (DC)** that does not accept originating updates. Additionally, an **RODC** does not perform outbound replication. An RODC cannot be the primary domain controller (PDC) for its domain.

relative identifier (RID): The last item in the series of SubAuthority values in a SID (as specified in [SIDD]). It distinguishes one account or group from all other accounts and groups in the domain. No two accounts or groups in any domain share the same relative identifier.

remote procedure call (RPC): A context-dependent term commonly overloaded with three meanings. Note that much of the industry literature concerning RPC technologies uses this term interchangeably for any of the three meanings. Following are the three definitions: (*) The runtime environment providing remote procedure call facilities. The preferred usage for this meaning is "RPC runtime". (*) The pattern of request and response message exchange between two parties (typically, a client and a server). The preferred usage for this meaning is "RPC exchange". (*) A single message from an exchange as defined in the previous definition. The preferred usage for this term is "RPC message". For more information about RPC, see [C706].

RPC protocol sequence: A character string that represents a valid combination of a **remote procedure call (RPC)** protocol, a network layer protocol, and a transport layer protocol, as described in [C706] and [MS-RPCE].

RPC transport: The underlying network services used by the remote procedure call (RPC) runtime for communications between network nodes. For more information, see [C706] section 2.

secret key: A symmetric encryption key shared by two entities, such as between a user and the **domain controller (DC)**, with a long lifetime. A password is a common example of a secret key. When used in a context that implies Kerberos only, a principal's secret key.

secure channel: An authenticated **remote procedure call (RPC)** connection between two machines in a **domain** with an established **security context** used for signing and encrypting **RPC** packets.

Security Account Manager (SAM): A centrally managed service, such as Active Directory Domain Services (AD DS), that enables a server to establish a trust relationship with other authorized servers. The SAM also maintains information about domains and **security principals**, and provides client-to-server information by using several available standards for access control lists (ACLs).

security account manager (SAM) built-in database: Microsoft-specific terminology for the part of the user account database that contains account information (such as account names and passwords) for accounts and groups that are pre-created at the database installation.

security context: An abstract data structure that contains authorization information for a particular **security principal** in the form of a Token/Authorization Context (see [MS-DTYP] section 2.5.2). A server uses the authorization information in a **security context** to check access to requested resources. A **security context** also contains a key identifier that associates mutually established cryptographic keys, along with other information needed to perform secure communication with another security principal.

security identifier (SID): An identifier for **security principals** in Windows that is used to identify an account or a group. Conceptually, the **SID** is composed of an account authority portion (typically a **domain**) and a smaller integer representing an identity relative to the account authority, termed the **relative identifier (RID)**. The **SID** format is specified in [MS-DTYP] section 2.4.2; a string representation of **SIDs** is specified in [MS-DTYP] section 2.4.2 and [MS-AZOD] section 1.1.1.2.

security principal: A unique entity that is identifiable through cryptographic means by at least one key. It frequently corresponds to a human user, but also can be a service that offers a resource to other security principals. Also referred to as principal.

security provider: A pluggable security module that is specified by the protocol layer above the **remote procedure call (RPC)** layer, and will cause the **RPC** layer to use this module to secure messages in a communication session with the server. The security provider is sometimes referred to as an authentication service. For more information, see [C706] and [MS-RPCE].

security support provider (SSP): A dynamic-link library (DLL) that implements the **Security Support Provider Interface (SSPI)** by making one or more security packages available to applications. Each security package provides mappings between an application's **SSPI** function calls and an actual security model's functions. Security packages support security protocols such as Kerberos authentication and NTLM.

Security Support Provider Interface (SSPI): A Windows-specific API implementation that provides the means for connected applications to call one of several security providers to establish authenticated connections and to exchange data securely over those connections. This is the Windows equivalent of Generic Security Services (GSS)-API, and the two families of APIs are on-the-wire compatible.

server: A computer on which the **remote procedure call (RPC)** server is executing.

server challenge: A 64-bit nonce generated on the server side.

Server Message Block (SMB): A protocol that is used to request file and print services from server systems over a network. The SMB protocol extends the CIFS protocol with additional security, file, and disk management support. For more information, see [CIFS] and [MS-SMB].

service principal name (SPN): The name a client uses to identify a service for mutual authentication. (For more information, see [RFC1964] section 2.1.1.) An **SPN** consists of either two parts or three parts, each separated by a forward slash ('/'). The first part is the service class, the second part is the instance name, and the third part (if present) is the service name. For example, "ldap/dc-01.fabrikam.com/fabrikam.com" is a three-part **SPN** where "ldap" is the service class name, "dc-01.fabrikam.com" is the instance name, and "fabrikam.com" is the service name. See [SPNNAMES] for more information about **SPN** format and composing a unique **SPN**.

session key: A relatively short-lived symmetric key (a cryptographic key negotiated by the client and the server based on a shared secret). A **session key's** lifespan is bounded by the session to which it is associated. A **session key** should be strong enough to withstand cryptanalysis for the lifespan of the session.

shared secret: A piece of data that is known only to the **security principal** and an authenticating authority; for example, a user and a domain controller. It is used to prove the **principal's** identity. A password is a common example of a shared secret. Also called a "secret key".

Shared Services Provider (SSP): A logical grouping of shared service applications, and their supporting resources, that can be configured and managed from a single server and can be used by multiple server farms.

site: A collection of one or more well-connected (reliable and fast) TCP/IP subnets. By defining **sites** (represented by site objects) an administrator can optimize both **Active Directory** access

and **Active Directory** replication with respect to the physical network. When users log in, **Active Directory** clients find **domain controllers (DCs)** that are in the same **site** as the user, or near the same **site** if there is no **DC** in the **site**. See also Knowledge Consistency Checker (KCC). For more information, see [MS-ADTS].

sub-authentication: Optional and additional authentication functionality, usually provided by extending an authentication algorithm.

sub-authentication package: An optional component that provides additional authentication functionality. If a **sub-authentication package** is installed, the authentication package calls the **sub-authentication package** before returning its authentication result. The request to verify by a **sub-authentication package** is indicated by the ParameterControl field of the LogonInformation parameter (see [MS-APDS] section 3.1.5.2.1, Verifying Responses with Sub-Authentication Packages).

transitive trust: The state of two domains establishing trust through an intermediary domain. For example, if domain A trusts domain B, and domain B trusts domain C, then domain A may be configured to trust domain C through transitive trust.

trust: To accept another authority's statements for the purposes of authentication and authorization, especially in the case of a relationship between two domains. If **domain** A trusts **domain** B, **domain** A accepts **domain** B's authentication and authorization statements for **principals** represented by security principal objects in **domain** B; for example, the list of groups to which a particular user belongs. As a noun, a **trust** is the relationship between two **domains** described in the previous sentence.

trusted domain object (TDO): A collection of properties that define a trust relationship with another domain, such as direction (outbound, inbound, or both), trust attributes, name, and security identifier of the other domain. For more information, see [MS-ADTS].

Unicode: A character encoding standard developed by the Unicode Consortium that represents almost all of the written languages of the world. The **Unicode** standard [UNICODE5.0.0/2007] provides three forms (UTF-8, UTF-16, and UTF-32) and seven schemes (UTF-8, UTF-16, UTF-16 BE, UTF-16 LE, UTF-32, UTF-32 LE, and UTF-32 BE).

universally unique identifier (UUID): A 128-bit value. UUIDs can be used for multiple purposes, from tagging objects with an extremely short lifetime, to reliably identifying very persistent objects in cross-process communication such as client and server interfaces, manager entry-point vectors, and **RPC** objects. UUIDs are highly likely to be unique. UUIDs are also known as **globally unique identifiers (GUIDs)** and these terms are used interchangeably in the Microsoft protocol technical documents (TDs). Interchanging the usage of these terms does not imply or require a specific algorithm or mechanism to generate the UUID. Specifically, the use of this term does not imply or require that the algorithms described in [RFC4122] or [C706] must be used for generating the UUID.

user account database: A database that maintains user account information.

user principal name (UPN): A user account name (sometimes referred to as the user logon name) and a domain name that identifies the domain in which the user account is located. This is the standard usage for logging on to a Windows domain. The format is: someone@example.com (in the form of an email address). In **Active Directory**, the userPrincipalName attribute (2) of the account object, as described in [MS-ADTS].

writable domain controller: A **domain controller** that performs originating updates and outbound replication.

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

1.2 References

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

1.2.1 Normative References

We conduct frequent surveys of the normative references to assure their continued availability. If you have any issue with finding a normative reference, please contact dochelp@microsoft.com. We will assist you in finding the relevant information.

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

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

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

[MS-ADSC] Microsoft Corporation, "Active Directory Schema Classes".

[MS-ADTS] Microsoft Corporation, "Active Directory Technical Specification".

[MS-APDS] Microsoft Corporation, "Authentication Protocol Domain Support".

[MS-CIFS] Microsoft Corporation, "Common Internet File System (CIFS) Protocol".

[MS-DRSR] Microsoft Corporation, "Directory Replication Service (DRS) Remote Protocol".

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

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

[MS-GPSB] Microsoft Corporation, "Group Policy: Security Protocol Extension".

[MS-LSAD] Microsoft Corporation, "Local Security Authority (Domain Policy) Remote Protocol".

[MS-MAIL] Microsoft Corporation, "Remote Mailslot Protocol".

[MS-NBTE] Microsoft Corporation, "NetBIOS over TCP (NBT) Extensions".

[MS-NLMP] Microsoft Corporation, "NT LAN Manager (NTLM) Authentication Protocol".

[MS-PAC] Microsoft Corporation, "Privilege Attribute Certificate Data Structure".

[MS-RCMP] Microsoft Corporation, "Remote Certificate Mapping Protocol".

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

[MS-RPRN] Microsoft Corporation, "Print System Remote Protocol".

[MS-RRP] Microsoft Corporation, "Windows Remote Registry Protocol".

[MS-SAMR] Microsoft Corporation, "Security Account Manager (SAM) Remote Protocol (Client-to-Server)".

[MS-SAMS] Microsoft Corporation, "Security Account Manager (SAM) Remote Protocol (Server-to-Server)".

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

[MS-SNTP] Microsoft Corporation, "Network Time Protocol (NTP) Authentication Extensions".

[MS-WKST] Microsoft Corporation, "Workstation Service Remote Protocol".

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1.2.2 Informative References

[LANMAN] Microsoft Corporation, "LAN Manager Authentication Level", http://msdn.microsoft.com/en-us/library/ms814176.aspx

[LSAPOLICY] Microsoft Corporation, "LSA Policy", http://msdn.microsoft.com/en-us/library/ms721831.aspx

[MS-ADOD] Microsoft Corporation, "Active Directory Protocols Overview".

[MS-GPOD] Microsoft Corporation, "Group Policy Protocols Overview".

[NTLM] Microsoft Corporation, "Microsoft NTLM", http://msdn.microsoft.com/en-us/library/aa378749.aspx

[NTSTATUSERR] Microsoft Corporation, "NTSTATUS Values", http://msdn.microsoft.com/en-us/library/ff557697.aspx

[PIPE] Microsoft Corporation, "Named Pipes", http://msdn.microsoft.com/en-us/library/aa365590.aspx

[SIDATT] Microsoft Corporation, "TOKEN_GROUPS", http://msdn.microsoft.com/en-us/library/aa379624.aspx

[SPNNAMES] Microsoft Corporation, "Name Formats for Unique SPNs", http://msdn.microsoft.com/en-us/library/ms677601.aspx

[SSPI] Microsoft Corporation, "SSPI", http://msdn.microsoft.com/en-us/library/aa380493.aspx

1.3 Overview

The Netlogon Remote Protocol is used for secure communication between machines in a domain (both **domain members** and domain controllers) and domain controllers. The communication is secured by using a shared **session key** computed between the client and the DC that is engaged in the secure communication. The session key is computed by using a preconfigured **shared secret** that is known to the client and the DC.

The Netlogon Remote Protocol client and server can only run on domain-joined systems, and are started during boot. When a system is unjoined from the domain, then the client and server are stopped and will not be started during boot.

The following sections describe the scenarios in which this protocol is used. It provides an overview about the general purpose of this protocol and the flow of its operations.

1.3.1 Pass-Through Authentication

In a scenario where a user does an **interactive logon** to a client machine and connects to a server, the connection must be authenticated. The client and the server engage in an authentication protocol, such as NTLM (as specified in [MS-NLMP]), which validates the user **credentials** and logs the user on to the server upon successful validation. This type of logon is known as **network logon** because it happens over a network connection from the client to the server.

To authenticate the user, the server must pass the user credentials securely to a domain controller in the domain of the user account. (The domain controller is the entity, other than the client machine, that knows the user **secret key**; that is, the user password.) After the logon request is delivered to the DC and the DC successfully validates the credentials, the DC refers back to the server those attributes of the user account that the server can use in authorization decisions (such as granting the user access to a particular file).

It is the responsibility of the Netlogon Remote Protocol to deliver the logon request to the domain controller over a **secure channel** that is established from the server (acting as the secure channel client) to the DC (acting as the secure channel server). The secure channel is achieved by encrypting the communication traffic with a session key computed using a secret key (called a server's machine account password) shared by the server and the domain controller.

Upon successful validation of the user credentials on the DC, this protocol is responsible for delivering the user authorization attributes (referred to as user validation information) back to the server over the secure channel.

This mechanism of delegating the authentication request to a domain controller is called pass-through authentication, a process in which the server passes the logon request through to the domain

controller. The following illustration depicts a process of pass-through authentication in which the authentication request is passed over a secure channel from a server in Domain A to a DC in the domain containing the user account, in this case also Domain A.

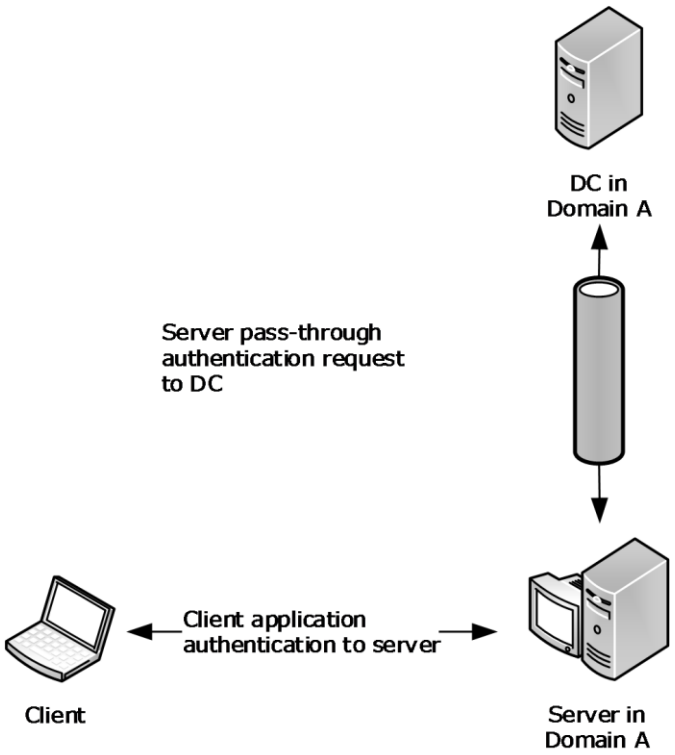


Figure 1: Pass-through authentication

1.3.2 Pass-Through Authentication and Domain Trusts

The user account can be in a domain other than the domain of the server. In that case, the DC receiving the logon request from the server must pass the request on to a DC in the domain of the user account. To make such scenarios work, the domain of the server (called the resource domain) and the domain of the user account (called the account domain) engage in a **trust** relationship, in which authentication decisions made in the account domain are trusted in the resource domain. In such trust relationships, the resource domain is called the trusting domain, while the account domain is called the trusted domain. Trust relationships are established by administrators of the two domains.

The result of a trust establishment is a shared secret (called a trust password) that DCs use in the two domains for computing the session key that is used for protecting the secure channel traffic. By using this secure channel, the DC in the resource domain can pass logon requests securely to the DC in the account domain, in the same way that the server passed the logon request to the former DC. The secure channel between DCs in two domains that are connected via a trust relationship is called a trusted domain secure channel. In contrast, the secure channel between the server and the DC in the resource domain is called a workstation secure channel. The following illustration depicts a process of pass-through authentication in which the authentication request is passed over two secure channels: from a server in Domain A to a DC in the same domain, and then from that DC to a DC in Domain B, which contains the user account.

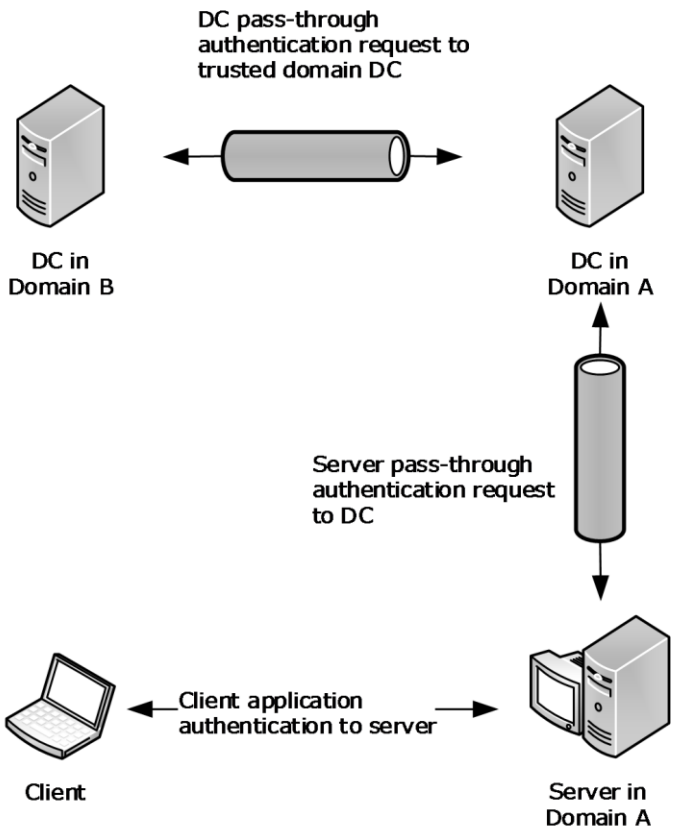


Figure 2: Pass-through authentication and domain trusts

In the above scenario, the two domains are connected by means of a **direct trust** relationship. Consider a scenario in which the two domains are connected by means of an "intermediate trust partner"; the resource domain trusts the intermediate domain, which in turn trusts the account domain. There can be multiple domains connected by means of trust relationships along the chain of direct domain trusts between the resource and the account domains. This type of trust relationship, in which the resource domain trusts the account domain through a chain of trust relationships between intermediate domains, is called **transitive trust**. Each link in the transitive trust chain is backed by a shared secret used by DCs in two domains involved in the link for establishing the secure channel. Thus, the resource domain DC can deliver the logon request to the account domain DC over a chain of secure channels.

1.3.3 Account Database Replication

Account database replication is relevant only for server-to-server communication of the protocol.

So far we have considered scenarios in which there is one DC in a domain. In practice, multiple DCs are placed into a domain for redundancy and load balancing so that multiple DCs can service logon requests from many servers. In such scenarios, the DCs need to share the **user account database**.<1><2>

A BDC was a domain controller that maintained a full copy of the domain account database and could satisfy authentication requests, but would not allow modification of the accounts. Instead, the BDCs of

a domain would replicate the account database from the **PDC** using the Netlogon replication protocol.<3><4>

To request and transfer the replication data securely, Netlogon uses the secure channel that the BDCs establish with the PDC using the BDC's machine account password. This type of secure channel is called the server secure channel.

1.3.4 Secure Channel Maintenance

The security of a channel based on a shared secret depends on the secrecy of that shared value. Good cryptographic hygiene requires that such a shared value not be permanent. This protocol includes the facility to choose a new password and communicate that from the client to the DC. This allows client implementations of this protocol to set new passwords on machine accounts (if the request comes over a workstation secure channel) or on the trust accounts (if the request comes over a trusted domain secure channel).

1.3.5 Domain Trust Services

In some application scenarios, it may be desirable to obtain the list of domain trusts. For example, an application collecting user credentials may need to present the list of trusted domains from which users may choose their domains. The Netlogon Remote Protocol provides services to such applications via methods for retrieving domain trust information.

1.3.6 Message Protection Services

Some applications may need to authenticate their messages sent to and received from a DC. Windows Time Service is an example of such an application running on a machine that authenticates messages carrying time information received from the DC. The Netlogon Remote Protocol provides services to such applications via methods for computing a cryptographic digest of the message by using the machine account or trust password as the cryptographic key. By using these methods, the application running on the DC obtains the message digest and includes it in its response to the client. The application running on the client receives the message, obtains the message digest, and compares the digest with that received from the DC. If the two digests are the same, the client determines that the message was indeed sent by the DC.

1.3.7 Administrative Services

Administrators may need to control or query the behavior related to Netlogon operations. For example, an administrator may want to force a change of the machine account password, or may want to reset the secure channel to a particular DC in the domain. Netlogon provides such administrative services via methods for querying and controlling the server.

1.3.7.1 Netlogon Operational Flow on Domain Members

The first action that a Netlogon client performs on a domain member is finding a DC in its domain with which to set up the secure channel. This process is called the DC discovery. After a DC is discovered, the domain member sets up a secure channel to the DC.

For all subsequent requests from the client to the DC pertaining to authentication, the Netlogon Remote Protocol transmits the request by using the secure channel. The Netlogon Remote Protocol receives the user validation data over the secure channel from the DC and returns the data to the authentication protocol.

Periodically, the operating system can use the Netlogon Remote Protocol to change the machine account password.

1.3.7.2 Netlogon Operational Flow on Domain Controllers

Upon receiving a logon request, Netlogon determines the account domain of the user being authenticated. Netlogon determines the trust link over which to send the request toward the account domain. Netlogon finds a DC in the trusted domain on that link and sets up the secure channel to that DC by using the trust password for the trusted domain. Netlogon passes the logon request through to that DC. Netlogon receives the user validation data from that DC and returns the data to the secure channel client making the logon request.

Netlogon synchronizes BDC account databases with the PDC account database.

Periodically, Netlogon changes the machine account password for the DC. On the PDC, Netlogon periodically changes trust passwords for all directly trusted domains.<5>

Netlogon performs the aforementioned services requested by applications or administrators.

1.3.8 Netlogon Structures and Methods

The Netlogon Remote Protocol structures and methods that are specified in section 2.2.1 and section 3.5.4 are grouped according to the Netlogon scenarios and operational flows as follows:

- DC Location Structures (section 2.2.1.2) and DC Location Methods (section 3.5.4.3). This protocol uses the structures and methods in this **group** to locate a domain controller in the specified domain. Methods in this group are also used for obtaining the **site** information that is related to DC discovery, as well as for maintaining **DNS** registration information for domain controllers.
- Secure Channel Establishment and Maintenance Structures (section 2.2.1.3) and Secure Channel Establishment and Maintenance Methods (section 3.5.4.4). Structures and methods in this group are used for setting up and maintaining the secure channel.
- Pass-Through Authentication Structures (section 2.2.1.4) and Pass-Through Authentication Methods (section 3.5.4.5). These structures and methods are used for performing pass-through authentication and obtaining user validation information.
- Account Database Replication Structures (section 2.2.1.5) and Account Database Replication Methods (section 3.5.4.6). This group of structures and methods is used in the Netlogon replication protocol.
- Domain Trust Structures (section 2.2.1.6) and Domain Trust Methods (section 3.5.4.7). Structures and methods in this group are used for retrieving domain trust information.
- Message Protection Methods (section 3.5.4.8). Methods in this group are used for performing the message protection services.
- Administrative Services Structures (section 2.2.1.7) and Administrative Services Methods (section 3.5.4.9). This group of structures and methods is used for querying and controlling the Netlogon Remote Protocol server.
- Obsolete Structures (section 2.2.1.8) and Obsolete Methods (section 3.5.4.10). The structures and methods in this group are unsupported and obsolete.

1.3.8.1 History of Netlogon

The Netlogon Remote Protocol is an older protocol that predates Windows NT and has been through multiple revisions and expansions. As a result, some of the methods are not used in non–LAN Manager environments, and new structures and methods were introduced to support the new functionality required.

1.3.8.1.1 Microsoft LAN Manager

Microsoft's first major entrance into the network operating system field was LAN Manager, a suite of products that worked on MS-DOS, OS/2, Windows 3.0 operating system, and Windows NT 3.1 operating system. While LAN Manager produced many of the underlying paradigms for how services were accessed over the network, the implementation of those paradigms have changed significantly between LAN Manager and Windows NT. In cases where those interfaces were implemented by using RPC [MS-RPCE] the Windows NT line of products may have had support for older clients to make use of those interfaces or methods within those interfaces. However, Windows NT–based products do not use those methods; therefore, those methods are not documented.

1.3.8.1.2 New Methods Derived from Existing Methods

In many cases, a new method would differ from an existing method by the addition of one or a few new parameters. In such cases, one of two naming conventions was used. One convention was that the new method would typically be named identically to the existing method, except for the addition of a suffix such as Ex (to mean Extended, as in the DsrGetDcNameEx method, which is the extended version of the original DsrGetDcName method). The other convention was to add a numeral value to reflect the method revision number (as in the NetrServerAuthenticate2 method and NetrServerAuthenticate3 method, which are the new versions of the original NetrServerAuthenticate method).

1.3.8.1.3 Using Dummy Fields in Structures

The requirements of this protocol have evolved over time. During the original design phase, typed but unused fields were appended to some structures. In later versions of the protocol, if new data needed to be transmitted between the client and the server, these fields could be used without ill effects, so long as the type of the data was preserved. The servers of a previous version of the Netlogon protocol would receive and ignore the fields.

In many cases, an introduction of a new Ex structure necessitated an introduction of a corresponding Ex RPC method for passing the new structure between the client and the server. As an alternative to the growing number of Ex structures and methods, an approach was introduced to avoid the addition of new structures and methods by using dummy fields. New structures would have a few unused fields, such as **DummyString1**, **DummyString2**, **DummyLong1**, and **DummyLong2**. These dummy fields allow additional information that was not conceived originally to be passed through the interface in a safe fashion. If the structure has not been extended, these fields are set to zero and ignored upon receipt.

For example, a dummy field **DummyString1** of the NETLOGON_ONE_DOMAIN_INFO (section 2.2.1.3.10) structure was used at one point to carry trust extension attributes. As a dummy field got used, it might or might not be renamed. In the case of NETLOGON_ONE_DOMAIN_INFO, **DummyString1** was renamed as **TrustExtension** to reflect the new nature of the field. This scheme of dummy field usage worked well: this protocol running on a new client receiving the NETLOGON_ONE_DOMAIN_INFO structure would use the **TrustExtension** field as appropriate, while the NETLOGON_ONE_DOMAIN_INFO running on an old client would completely ignore the **DummyString1** field.

1.3.8.1.4 Fields and Structures Used by Netlogon Pass-through Methods

During the design of the **NetrLogonSamLogon** method which is used for Netlogon pass-through, three fields were created to pass information opaquely for applications:

- **LogonLevel**
- **LogonInformation**
- **ValidationLevel**

At that time it was thought that there would be four types of logon:

- Interactive
- Network
- Service
- Generic

In Windows, only three were used: Interactive, Network, and Generic. Service type remains an option that can be used by callers, and like all Netlogon pass-through behavior, it must be specified by the receiving protocol.

1.3.8.1.5 Using Negotiated Flags

The client and the server often need to know the capabilities of their partners in their client/server communications. For example, it is sometimes necessary or desirable for a newer version client to avoid calling a method that the older version server does not implement. Similarly, the new server should avoid sending fields that the old client is going to treat as dummies and ignore. To make this possible, the client and the server need to establish a common set of capabilities that both the client and the server support.

For this reason, the NetrServerAuthenticate3 (section 3.5.4.4.2) method, which is called early on during setup of the secure channel between the client and the server, includes the *NegotiateFlags* parameter. The *NegotiateFlags* parameter uses a set of bit flags to carry the client and server capabilities. The client sets its capabilities on input, and the server responds with capabilities that it supports out of those sent by the client. The resulting set of bit flags is the set of capabilities that the client and the server mutually support.

1.4 Relationship to Other Protocols

The Netlogon Remote Protocol depends on RPC and on the **mailslot** datagram delivery service, as specified in [MS-SMB], which are its transports.

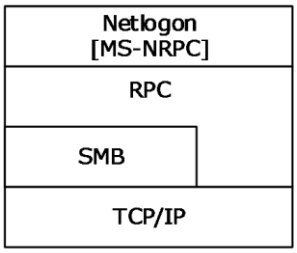


Figure 3: Transport relationships

Other non-RFC standard specifications relevant to the implementation of the Netlogon Remote Protocol are:

- Active Directory Technical Specification [MS-ADTS] defines AD data types, data structures, and their interactions, many of which are relevant to the functioning of the Netlogon Remote Protocol.
- Group Policy: Security Protocol Extension [MS-GPSB] is for managing secure channel signing and encryption settings.
- Local Security Authority (Domain Policy) Remote Protocol Specification [MS-LSAD] is used for accessing certain directory information.

- NT LAN Manager (NTLM) Authentication Protocol Specification [MS-NLMP] uses netlogon for pass-through authentication and specifies how to do one-way functions (OWF) of the computer password.
- Security Account Manager (SAM) Remote Protocol Specification (Client-to-Server) [MS-SAMR] is used for account lookup during session-key negotiation.

Authentication Protocol Domain Support Specification [MS-APDS] is an example of how authentication protocols can use generic pass-through (section 3.2.4.1).

1.5 Prerequisites/Preconditions

This protocol is an RPC interface and, as a result, has the prerequisites that [MS-RPCE] specifies as being common to RPC interfaces.

Netlogon replication uses the mailslot datagram delivery mechanism; therefore, it depends on this mailslot delivery mechanism being operational before Netlogon begins operation. For mailslot operational requirements, see [MS-MAIL] section 1.5. For more information about the mailslot delivery mechanism, see [MS-CIFS] section 2.2.4.33.

To use this protocol or to use Netlogon as an **SSP**, a computer requires a shared secret (section 3.1.1) with the domain controller (DC).

The client of the secure channel is required to discover the DC to which it is establishing a secure channel. Thus, a domain member discovers a DC in its domain.

A BDC discovers the primary domain controller (PDC) in its domain. A DC discovers a DC for each of its trusted domains.

Upon establishing a secure channel, a client can call any of the methods of this protocol that require a secure channel. This requires both the client and the server to have a working RPC implementation, including the security extensions ([MS-RPCE] section 2.2.1.1.7). For a complete list of methods that require a secure channel, see section 3.5.

All methods of this protocol are RPC calls from the client to the server that perform the complete operation in a single call. No shared state between the client and server is assumed other than the **security context** that was previously established. There are no restrictions on the number of times that a method can be called or the order in which methods can be called, unless explicitly noted in sections 3.4 and 3.5.

The Netlogon Remote Protocol client and server can run only on domain-joined systems. This protocol is enabled or disabled during the domain join and unjoin tasks as described in [MS-ADOD] and specified in [MS-WKST] sections 3.2.4.12, 3.2.4.13, and 3.2.4.14.

1.6 Applicability Statement

The Netlogon Remote Protocol is used only when the client or server is a member of a Windows domain.

The Netlogon Remote Protocol contains an implementation of a **security support provider (SSP)**, which provides packet encryption and signing services to secure client and server communication at the RPC packet level. These security services are used for establishing a secure channel for RPC-based client-to-server communication.

The Netlogon Remote Protocol can act as a secure transport for NTLM authentication and for other authentication mechanisms between arbitrary servers and the account authority or domain controller for that server. The Netlogon Remote Protocol also provides methods for maintaining the trust password for all versions of Windows and backup domain controller (BDC) replication for Windows NT

4.0 operating system. Additional information for the methods in this topic is provided in section 3 for cases where the server is not a member of a domain and resolves requests independently.

1.7 Versioning and Capability Negotiation

- Supported Transports: This protocol uses the mailslot datagram delivery service, RPC over named pipes ([PIPE]), and RPC over TCP/IP as its only transports. Also see section 2.1.
- Security and Authentication Methods: As specified in section 3.2 and [MS-RPCE] section 1.7.
- Protocol Version: This protocol's RPC interface has a single version number of 1.0. Microsoft may extend this protocol by adding RPC methods to the interface with **opnums** lying numerically beyond those defined in this document. A client determines whether such methods are supported by attempting to invoke the method. If the version of the interface does not implement the method being invoked, it is required that the RPC server return an opnum out of range error. RPC versioning and capability negotiation for this situation is specified in [C706] and [MS-RPCE] section 2.1.

  For methods with multiple definitions (for example, NetrServerAuthenticate (section 3.5.4.4.4), NetrServerAuthenticate2 (section 3.5.4.4.3), and NetrServerAuthenticate3 (section 3.5.4.4.2)), the Netlogon Remote Protocol first tries the most recent definition of the method for which it has code. If that fails, this protocol tries the next most recent definition, and so on. Using the NetrServerAuthenticate example, this protocol tries NetrServerAuthenticate3 first, NetrServerAuthenticate2 second, and finally NetrServerAuthenticate.
- Capability Negotiation: When a secure channel is established, the *NegotiateFlags* parameter of the NetrServerAuthenticate2 and NetrServerAuthenticate3 methods is used to negotiate a common set of capabilities that each of the participants in the negotiation can support. See section 3.1.4.2.

1.8 Vendor-Extensible Fields

This protocol uses NTSTATUS values as defined in [MS-ERREF] section 2.3. Vendors are free to choose their own values for this field, as long as the C bit (0x20000000) is set, indicating it is a customer code.

1.9 Standards Assignments

Parameter	Value	Reference
RPC interface UUID	12345678-1234-ABCD-EF00-01234567CFFB	Section 2.1
Pipe name	\PIPE\NETLOGON	Section 2.1
Mailslot name	\MAILSLOT\NET\NETLOGON	Section 2.1

2 Messages

2.1 Transport

This protocol uses the following **RPC protocol sequences** as specified in [MS-RPCE] section 2.1:

- RPC over TCP/IP
- RPC over named pipes

This protocol uses RPC **dynamic endpoints** for RPC over TCP/IP, as specified in [C706] section 4.

This protocol uses the following well-known **endpoint**. This endpoint is a named pipe for RPC over **SMB**:

- \PIPE\NETLOGON

This protocol uses the mailslot datagram delivery service ([MS-MAIL] and [MS-SMB]). Mailslot messages (see [MS-MAIL] section 2.2.1) are sent to the following mailslot:

- \MAILSLOT\NET\NETLOGON. This named mailslot is used in the Netlogon replication protocol, as detailed in section 3.6.

This protocol MUST use the **universally unique identifier (UUID)** 12345678-1234-ABCD-EF00-01234567CFFB. The RPC version number is 1.0.

This protocol uses the Netlogon SSP. The server MUST use the RPC security provider extensions ([MS-RPCE] section 2.2.1.1.7). It MUST register the Netlogon security package as specified in section 3.3.

2.2 Common Data Types

In addition to the RPC base types and definitions that are specified in [C706] section 4.2.9 and [MS-RPCE] section 2.2, additional data types are defined in the following sections.

2.2.1 Structures and Enumerated Types

This section specifies structures and enumerated types that are used by the Netlogon RPC methods specified in section 3.5. Section 2.2.1.1 specifies the basic structures that are elementary to this protocol and which are used by many methods. In the sections that follow 2.2.1.1, structures are grouped according to their usage scenarios as described in section 1.3.

2.2.1.1 Basic Structures

Structures in this group are basic structures that do not fall into any particular category of Netlogon usage scenarios. They are used by multiple Netlogon Remote Protocol methods.

2.2.1.1.1 CYPHER_BLOCK

The CYPHER_BLOCK structure defines an encrypted eight-character string. The type of encryption used is application-dependent.

```
typedef struct _CYPHER_BLOCK {
  CHAR data[8];
} CYPHER_BLOCK,
 *PCYPHER_BLOCK;
```

data: An encrypted eight-character string.

2.2.1.1.2 STRING

The STRING structure contains the length, the maximum length, and a pointer to a buffer containing the string.

```
typedef struct _STRING {
  unsigned short Length;
  unsigned short MaximumLength;
  [size_is(MaximumLength), length_is(Length)]
    char* Buffer;
} STRING,
 *PSTRING;
```

Length: The length of the data pointed to by **Buffer**, in bytes.

MaximumLength: The total allocated length of the data pointed to by **Buffer**, in bytes.<6>

Buffer: A pointer to a buffer containing the character string.

2.2.1.1.3 LM_OWF_PASSWORD

The LM_OWF_PASSWORD structure carries a one-way function (OWF) of a LAN Manager password. The LM_OWF_PASSWORD structure MAY be encrypted, as specified by each method that uses this structure. See the NetrServerPasswordSet method in section 3.5.4.4.6 for encryption information.

```
typedef struct  LM OWF PASSWORD {
  CYPHER_BLOCK data[2];
} LM OWF PASSWORD,
 *PLM_OWF_PASSWORD,
 ENCRYPTED_LM_OWF_PASSWORD,
 *PENCRYPTED_LM_OWF_PASSWORD;
```

data: An array of CYPHER_BLOCK (section 2.2.1.1.1) data structures that contains the LMOWFv1 of a password. LMOWFv1 is specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1.

2.2.1.1.4 NT_OWF_PASSWORD

The NT_OWF_PASSWORD structure defines a **one-way function (OWF)** of a Windows NT operating system domain password. The NT_OWF_PASSWORD structure can be encrypted, as specified by each method that uses this structure. When this structure is encrypted, Netlogon methods can use the DES encryption algorithm in ECB mode, as specified in [MS-SAMR] section 2.2.11.1.1 Encrypting an NT Hash or LM Hash Value with a specified key. The session key is the specified 16-byte key used to derive its keys using the 16-byte value process, as specified in [MS-SAMR] section 2.2.11.1.4. For specific encryption information, see the individual methods, such as NetrServerTrustPasswordsGet (section 3.5.4.4.8) and NetrServerGetTrustInfo (section 3.5.4.7.6).

```
typedef struct  NT OWF PASSWORD {
  CYPHER_BLOCK data[2];
} NT_OWF_PASSWORD,
 *PNT_OWF_PASSWORD,
 ENCRYPTED_NT_OWF_PASSWORD,
 *PENCRYPTED_NT_OWF_PASSWORD;
```

data: An array of CYPHER_BLOCK (section 2.2.1.1.1) structures that contains the NTOWFv1 of a password. NTOWFv1 is specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1.

2.2.1.1.5 NETLOGON_AUTHENTICATOR

The NETLOGON_AUTHENTICATOR structure defines an authentication credential.

```
typedef struct _NETLOGON_AUTHENTICATOR {
  NETLOGON_CREDENTIAL Credential;
  DWORD Timestamp;
} NETLOGON_AUTHENTICATOR,
 *PNETLOGON_AUTHENTICATOR;
```

Credential: A NETLOGON_CREDENTIAL (section 2.2.1.3.4) structure that contains the encrypted portion of the **authenticator**.

Timestamp: An integer value that contains the time of day at which the client constructed this authentication credential, represented as the number of elapsed seconds since 00:00:00 of January 1, 1970. The authenticator is constructed just before making a call to a method that requires its usage.

2.2.1.2 DC Location Structures

The structures in this group relate to locating a domain controller as outlined in section 1.3.

2.2.1.2.1 DOMAIN_CONTROLLER_INFOW

The DOMAIN_CONTROLLER_INFOW structure defines information returned by the following methods: DsrGetDcName (section 3.5.4.3.3), DsrGetDcNameEx (section 3.5.4.3.2), and DsrGetDcNameEx2 (section 3.5.4.3.1). This structure is used to describe naming and addressing information about a domain controller (DC).<7>

```
typedef struct  DOMAIN CONTROLLER INFOW {
  [string, unique] wchar_t* DomainControllerName;
  [string, unique] wchar_t* DomainControllerAddress;
  unsigned long DomainControllerAddressType;
  GUID DomainGuid;
  [string, unique] wchar t* DomainName;
  [string, unique] wchar_t* DnsForestName;
  unsigned long Flags;
  [string, unique] wchar_t* DcSiteName;
  [string, unique] wchar_t* ClientSiteName;
} DOMAIN_CONTROLLER_INFOW,
 *PDOMAIN_CONTROLLER_INFOW;
```

DomainControllerName: A pointer to a null-terminated UTF-16 string that contains a NetBIOS or **fully qualified domain name (FQDN) (2)** of the DC, prefixed with "\\".

DomainControllerAddress: A pointer to a null-terminated **Unicode** string that contains the DC address, prefixed with "\\". The string can be either a textual representation of an IPv4/IPv6 address<8> or the **NetBIOS name** of the DC, determined by the **DomainControllerAddressType** field.

DomainControllerAddressType: A 32-bit value indicating the DC address type, which MUST be one, and only one, of the following.

Value	Meaning
0x00000001	The address is a string that contains an IPv4 address in dotted-decimal notation (for example, 192.168.0.1), or an IPv6 address in colon-separated notation.<9>

Value	Meaning
0x00000002	The address is a NetBIOS name.

DomainGuid: A **globally unique identifier (GUID)** structure ([MS-DTYP] section 2.3.4.1) that contains an identifier for the domain. When there is no domain GUID, this field MUST be set to zero.<10> A GUID can be used across all computers and networks wherever a unique identifier is required.

DomainName: A pointer to a Unicode string that contains the NetBIOS or fully qualified domain name (FQDN) (2) of the domain.

DnsForestName: A pointer to a null-terminated Unicode string that contains the fully qualified domain name (FQDN) (2) of the **forest**.

Flags: A set of bit flags in little-endian format that describe the features and roles of the DC. A flag is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table, with the exceptions that bit J cannot be combined with A, B, D, E, or P; bit F cannot be combined with I; and bit K cannot be combined with L.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
O	N	M	0	0	0	0	0	0	0	0	0	0	0	0	S	R	Q	P	L	K	J	I	H	G	F	E	D	C	B	0	A

Where the bits are defined as:

Value	Description
A	The DC is the domain's primary domain controller (PDC).
B	The DC contains the **global catalog (GC)** for the forest **Active Directory**.
C	The DC supports the Lightweight Directory Access Protocol (LDAP).
D	The DC supports a directory service.
E	The DC is a Kerberos **Key Distribution Center (KDC)**.
F	The DC has a network time service available but no clock hardware.
G	The DC is in the closest site to the client.
H	The DC has a writable directory service available.
I	The DC has clock hardware and a network time service available.
J	The DC is an LDAP server servicing an Application **naming context (NC)** ([MS-ADTS] section 3.1.1.1.5).

Value	Description
K	The DC is a **read-only DC**.<11>
L	The server is a **writable domain controller**.<12>
M	The DC's name is a DNS name.
N	The DC's **domain name** is a DNS name.
O	The DC's forest name is a DNS name.
P	The DC has an Active Directory Web Service available.<13>
Q	The DC has a functional level of DS_BEHAVIOR_WIN2012 or later.
R	The DC has a functional level of DS_BEHAVIOR_WIN2012R2 or later.
S	The DC has a functional level of DS_BEHAVIOR_WINTHRESHOLD or later.

All other bits MUST be set to zero and MUST be ignored on receipt.

DcSiteName: Pointer to a null-terminated Unicode string that contains the site name that is associated with the DC. When there is no associated site, this field MUST be NULL.<14>

ClientSiteName: Pointer to a null-terminated Unicode string that contains the client's site name. When there is no client site name, this field MUST be NULL.

2.2.1.2.2 NL_SITE_NAME_ARRAY

The NL_SITE_NAME_ARRAY structure defines an array of site names.

```
typedef struct _NL_SITE_NAME_ARRAY {
  unsigned long EntryCount;
  [size_is(EntryCount)] PRPC_UNICODE_STRING SiteNames;
} NL_SITE_NAME_ARRAY,
 *PNL_SITE_NAME_ARRAY;
```

EntryCount: The number of entries in **SiteNames**.

SiteNames: A pointer to an array of null-terminated RPC_UNICODE_STRING strings that contain site names. For more information about sites, see [MS-ADTS] section 6.1.1.2.2.1.

2.2.1.2.3 NL_SITE_NAME_EX_ARRAY

The NL_SITE_NAME_EX_ARRAY structure defines an array of site and subnet names. This structure extends the NL_SITE_NAME_ARRAY (section 2.2.1.2.2) structure by adding an array of subnets that correspond to the sites.

```
typedef struct _NL_SITE_NAME_EX_ARRAY {
```

```
  unsigned long EntryCount;
  [size_is(EntryCount)] PRPC_UNICODE_STRING SiteNames;
  [size_is(EntryCount)] PRPC_UNICODE_STRING SubnetNames;
} NL_SITE_NAME_EX_ARRAY,
 *PNL_SITE_NAME_EX_ARRAY;
```

EntryCount: The number of entries in **SiteNames** and **SubnetNames**.

SiteNames: A pointer to an array of null-terminated Unicode strings that contain site names. For details about sites, see [MS-ADTS] section 6.1.1.2.2.1.

SubnetNames: A pointer to an array of null-terminated Unicode strings that contain subnet names. For details about subnets, see [MS-ADTS] section 6.1.1.2.2.2.1.

2.2.1.2.4 NL_SOCKET_ADDRESS

The NL_SOCKET_ADDRESS structure contains a socket address.

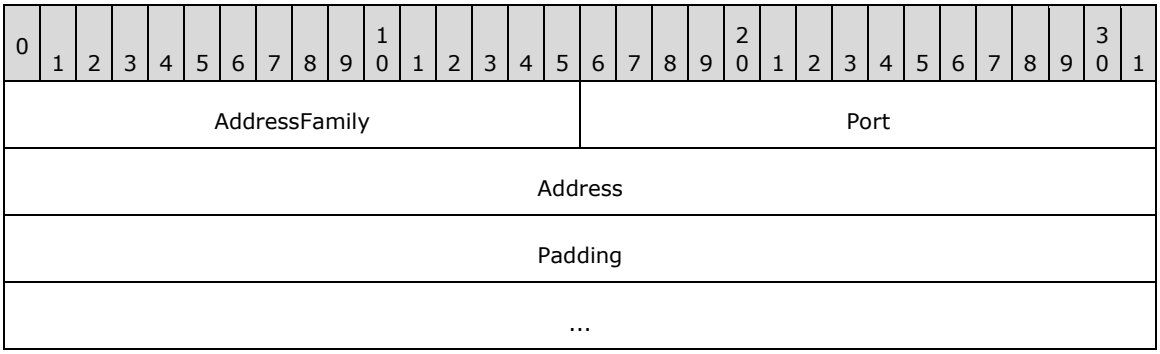
```
typedef struct _NL_SOCKET_ADDRESS {
  [size_is(iSockaddrLength)] unsigned char* lpSockaddr;
  unsigned long iSockaddrLength;
} NL_SOCKET_ADDRESS,
 *PNL_SOCKET_ADDRESS;
```

lpSockaddr: A pointer to an octet string. The format of the **lpSockaddr** member when an IPv4 socket address is used is specified in section 2.2.1.2.4.1. The format of the **lpSockaddr** member when an IPv6 socket address is used is specified in section 2.2.1.2.4.2.

iSockaddrLength: The length of the octet string pointed to by **lpSockaddr**, in bytes.

2.2.1.2.4.1 IPv4 Address Structure

The IPv4_Sockaddr structure specifies the format of an IPv4 socket address. This structure is built as if on a little-endian machine, and is treated as a byte array.



AddressFamily (2 bytes): The address family; MUST be 0x0002.

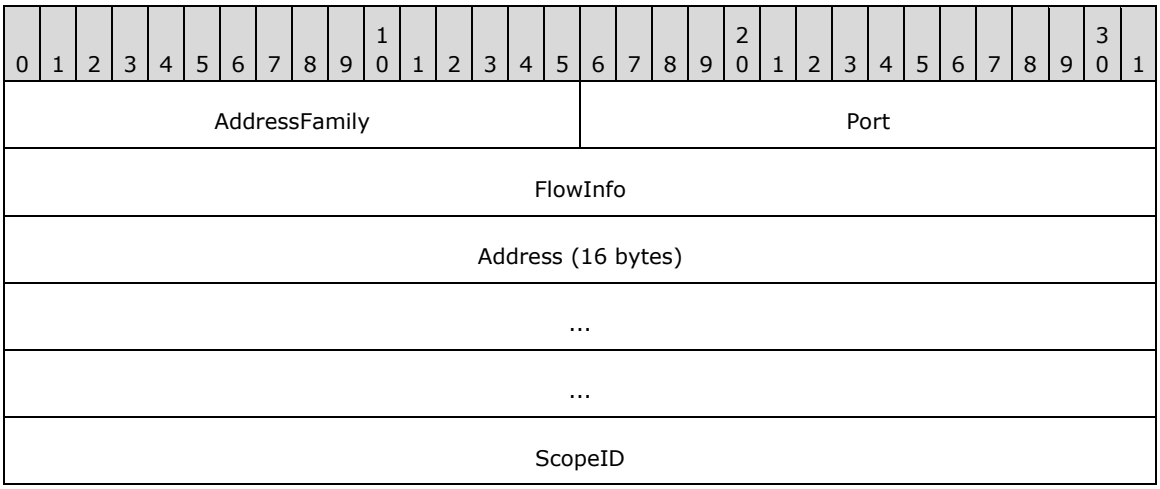
Port (2 bytes): An IP port number.

Address (4 bytes): An IP address, as specified in [RFC791].

Padding (8 bytes): Set to zero. This field is ignored by the server.

2.2.1.2.4.2 IPv6 Address Structure

The IPv6_Sockaddr structure specifies the format of an IPv6 socket address. This structure is built as if on a little-endian machine, and is treated as a byte array.



AddressFamily (2 bytes): Address family; MUST be 0x0017.

Port (2 bytes): An IP port number.

FlowInfo (4 bytes): Flow information. This field is not currently used by the protocol. The field MUST be set to zero and MUST be ignored on receipt.

Address (16 bytes): An IP address, as specified in [RFC3493].

ScopeID (4 bytes): Set of interfaces for a scope, as specified in [RFC3493].

2.2.1.2.5 NL_DNS_NAME_INFO

The NL_DNS_NAME_INFO structure provides the information on a DNS name (record) (as specified in [RFC2782]) to be updated by the DsrUpdateReadOnlyServerDnsRecords (section 3.5.4.3.11) method. The DsrUpdateReadOnlyServerDnsRecords method will update DNS as requested by the **Register** field's value in this structure.

```
typedef struct _NL_DNS_NAME_INFO {
  unsigned long Type;
  [string] wchar_t* DnsDomainInfo;
  unsigned long DnsDomainInfoType;
  unsigned long Priority;
  unsigned long Weight;
  unsigned long Port;
  unsigned char Register;
  unsigned long Status;
} NL_DNS_NAME_INFO,
 *PNL_DNS_NAME_INFO;
```

Type: The type of DNS name, which MUST be one, and only one, of the following:

Value	Meaning
NlDnsLdapAtSite 22	_ldap._tcp.<SiteName>._sites.<DnsDomainName>. Allows a client to find an LDAP server in the domain named by <DnsDomainName>, and is in the site named by <SiteName>.
NlDnsGcAtSite	_ldap._tcp.<SiteName>._sites.gc._msdcs.<DnsForestName>.

Value	Meaning
25	Allows a client to find a DC serving a Global Catalog (GC) in the forest named by <DnsForestName>, and is in the site named by <SiteName>.
NlDnsDsaCname 28	<DsaGuid>._msdcs.<DnsForestName>. Allows a client to find a DC in the forest named by <DnsForestName> based on the DSA GUID. For a definition of DSA GUID, see [MS-ADTS] section 1.1.
NlDnsKdcAtSite 30	_kerberos._tcp.<SiteName>._sites.dc._msdcs.<DnsDomainName>. Allows a client to find a DC running a Kerberos KDC in the domain named by <DnsDomainName>, and is in the site named by <SiteName>.
NlDnsDcAtSite 32	_ldap._tcp.<SiteName>._sites.dc._msdcs.<DnsDomainName>. Allows a client to find a DC in the domain named by <DnsDomainName>, and is in the site named by <SiteName>.
NlDnsRfc1510KdcAtSite 34	_kerberos._tcp.<SiteName>._sites.<DnsDomainName>. Allows a client to find a RFC-1510 compliant Kerberos KDC in the domain named by <DnsDomainName>, and is in the site named by <SiteName>.
NlDnsGenericGcAtSite 36	_gc._tcp.<SiteName>._sites.<DnsForestName>. Allows a client to find a Global Catalog (GC) server in the forest named by <DnsForestName>, and is in the site named by <SiteName>.

DnsDomainInfo: The string that will be based on the **DnsDomainInfoType** defined below.

DnsDomainInfoType: The type of **DnsDomainInfo** member, which MUST be one, and only one, of the following.

Value	Meaning
NlDnsDomainName 1	The **DnsDomainInfo** member is a DNS domain name.
NlDnsDomainNameAlias 2	The **DnsDomainInfo** member is a DNS domain name **alias**.
NlDnsForestName 3	The **DnsDomainInfo** member is a DNS forest name.
NlDnsForestNameAlias 4	The **DnsDomainInfo** member is a DNS forest name alias.
NlDnsNdncDomainName 5	The **DnsDomainInfo** member is a non-domain NC (application NC) name. For a definition of application NC, see [MS-ADTS] section 1.1.
NlDnsRecordName 6	The **DnsDomainInfo** member is a DNS record name that is required to be deregistered. This is valid only for deregistration in which the Register value is set to FALSE. For the types of DNS record name, see [MS-ADTS] section 6.3.2.

Priority: The priority for DNS SRV records.

Weight: The weight for DNS SRV records.

Port: The port for the DNS SRV record.

Register: Zero indicates to deregister the DNS name; other values indicate to register the DNS name.

Status: The update status of the DNS name. Status MUST be set to 0x00000000 on success; otherwise, it contains a nonzero error code.<15>

2.2.1.2.6 NL_DNS_NAME_INFO_ARRAY

The NL_DNS_NAME_INFO_ARRAY structure provides the information on DNS names (records) to be updated by the DsrUpdateReadOnlyServerDnsRecords (section 3.5.4.3.11) method.

```
typedef struct _NL_DNS_NAME_INFO_ARRAY {
  unsigned long EntryCount;
  [size_is(EntryCount)] PNL_DNS_NAME_INFO DnsNamesInfo;
} NL_DNS_NAME_INFO_ARRAY,
 *PNL_DNS_NAME_INFO_ARRAY;
```

EntryCount: The number of entries in the **DnsNamesInfo** field.

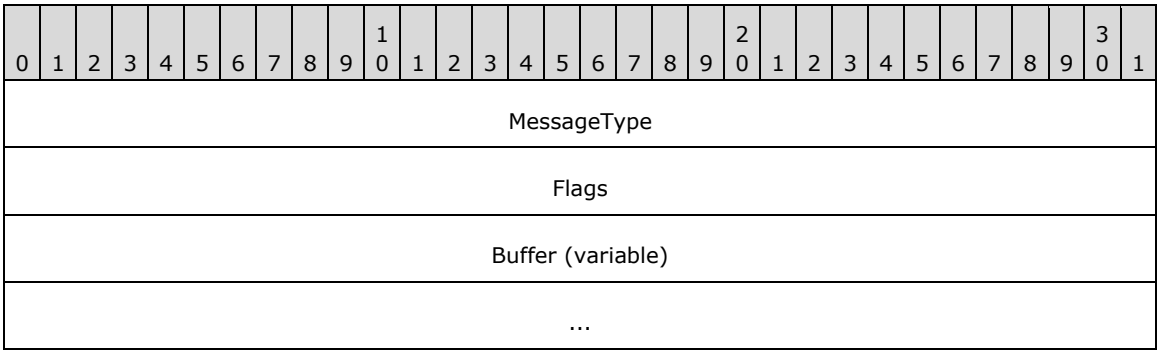
DnsNamesInfo: The pointer to an array of NL_DNS_NAME_INFO (section 2.2.1.2.5) structure, which contains DNS names info.<16>

2.2.1.3 Secure Channel Establishment and Maintenance Structures

Structures and enumerated types in this group are used to establish and maintain the secure channel as outlined in section 1.3.

2.2.1.3.1 NL_AUTH_MESSAGE

The NL_AUTH_MESSAGE structure is a token containing information that is part of the first message in establishing a security context between a client and a server. It is used for establishing the secure session when Netlogon functions as a security support provider (SSP). For details about NL_AUTH_MESSAGE construction, see section 3.3.4.1.



MessageType (4 bytes): A 32-bit unsigned integer. This value is used to indicate whether the message is a negotiate request message sent from a client to a server, or a negotiate response message sent from the server to the client. **MessageType** MUST be one, and only one, of the following.

Value	Meaning
0x00000000	This is a negotiate request message.
0x00000001	This is a negotiate response message.

Flags (4 bytes): A set of bit flags indicating the **principal** names carried in the request. A flag is TRUE (or set) if its value is equal to 1. These flags are set only in negotiate request messages. The value is constructed from one or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	E	D	C	B	A

Where the bits are defined as:

Value	Description
A	Buffer contains a NetBIOS domain name as an OEM_STRING ([MS-CIFS] section 2.2.1.1).
B	Buffer contains a NetBIOS **computer name** as an OEM_STRING ([MS-CIFS] section 2.2.1.1).
C	Buffer contains a DNS domain name as a compressed UTF-8 string, as specified in [RFC1035] section 4.1.4.
D	Buffer contains a DNS host name as a compressed UTF-8 string, as specified in [RFC1035] section 4.1.4.
E	Buffer contains a NetBIOS computer name as a compressed UTF-8 string, as specified in [RFC1035] section 4.1.4.

All other bits MUST be set to zero and MUST be ignored on receipt.

Buffer (variable): Text buffer that contains a concatenation of null-terminated strings for each of the name flags set in the **Flags** field. The order is the same as the order of the **Flags** values (A–E). This buffer is only used in negotiate request messages. For negotiate response messages, the buffer contains a NULL character.

2.2.1.3.2 NL_AUTH_SIGNATURE

The NL_AUTH_SIGNATURE structure is a security token that defines the authentication signature used by Netlogon to execute Netlogon methods over a secure channel. It follows the security trailer that a **security provider** MUST associate with a signed or encrypted message. A security trailer or sec_trailer structure ([MS-RPCE] section 2.2.2.11) has syntax equivalent to the auth_verifier_co_t structure, as specified in "Common Authentication Verifier Encodings" in [C706] section 13.2.6.1. When Netlogon is functioning as its own SSP for the RPC connection, this structure contains the signature, a sequence number, and if encryption is requested, a confounder. See section 3.3.4.2.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
SignatureAlgorithm																SealAlgorithm															
Pad																Flags															
SequenceNumber																															
...																															

Checksum
...
Confounder
...

SignatureAlgorithm (2 bytes): A 16-bit little-endian integer that identifies the algorithm that is used for signature computation. The only supported signature algorithm is HMAC-MD5, as specified in [RFC2104]. The **SignatureAlgorithm** field MUST contain the following value.

Value	Meaning
0x0077	The packet is signed using HMAC-MD5.

SealAlgorithm (2 bytes): A 16-bit little-endian integer that identifies the algorithm used for encryption. The only supported encryption algorithm is RSA-**RC4**. The **SealAlgorithm** field MUST contain one of the following values.

Value	Meaning
0xFFFF	The packet is not encrypted.
0x007A	The packet is encrypted using RC4.

Pad (2 bytes): A 2-byte padding field. Both bytes MUST be set to 0xFF.

Flags (2 bytes): Specifies properties of the structure. No flags are currently defined. Both bytes MUST be set to zero and MUST be ignored on receipt.

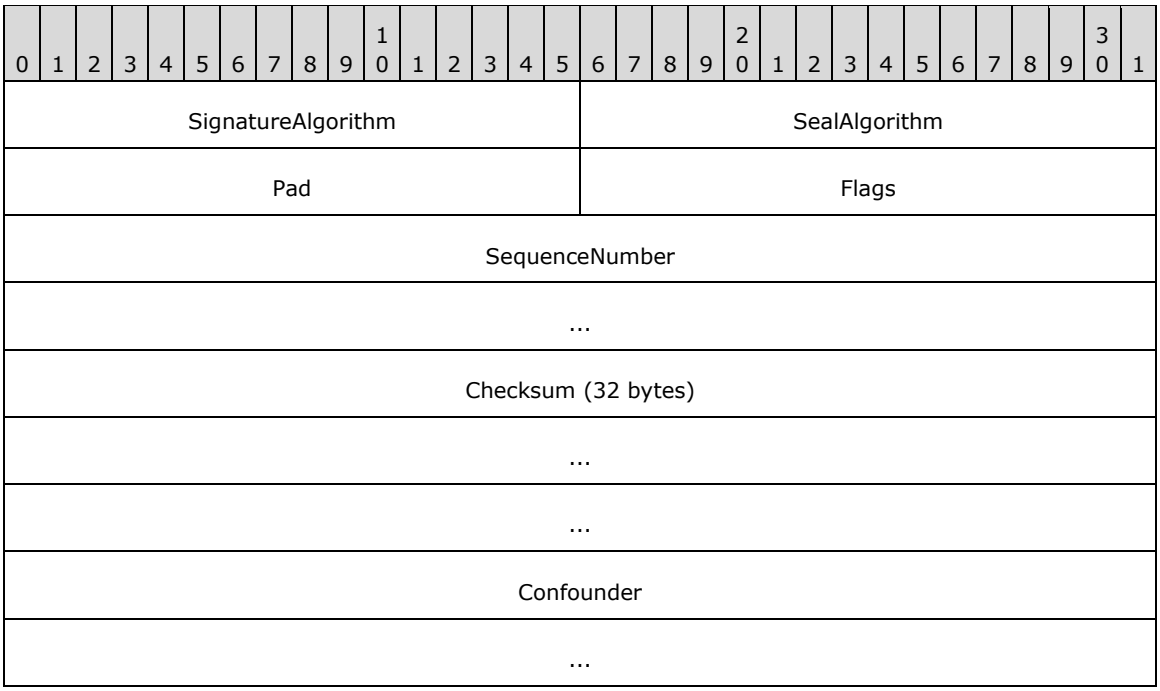
SequenceNumber (8 bytes): A 64-bit little-endian integer containing the sequence number of the RPC message. For more details about how to calculate the **SequenceNumber**, see section 3.3.4.2.1.

Checksum (8 bytes): A 64-bit value containing the final checksum of the signature and the RPC message. For more details about how to calculate the checksum, see section 3.3.4.2.1.

Confounder (8 bytes): A buffer used 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.

2.2.1.3.3 NL_AUTH_SHA2_SIGNATURE

The NL_AUTH_SHA2_SIGNATURE structure is a security token that defines the SHA2 authentication signature used by Netlogon to execute Netlogon methods over a secure channel. <17> It follows the security trailer that a security provider MUST associate with a signed or encrypted message. A security trailer or sec_trailer structure ([MS-RPCE] section 2.2.2.11) has syntax equivalent to the auth_verifier_co_t structure, as specified in [C706] section 13.2.6.1. When Netlogon is functioning as its own SSP for the RPC connection, this structure contains the signature, a sequence number, and (if encryption is requested) a confounder. See section 3.3.4.2.



SignatureAlgorithm (2 bytes): A 16-bit little-endian integer that identifies the algorithm that is used for signature computation. The only supported signature algorithm is HMAC-SHA256 [RFC4634]. The **SignatureAlgorithm** field MUST contain the following value.

Value	Meaning
0x0013	The packet is signed using HMAC-SHA256.

SealAlgorithm (2 bytes): A 16-bit little-endian integer that identifies the algorithm used for encryption. The only supported encryption algorithm is AES-128 [FIPS197]. The **SealAlgorithm** field MUST contain one of the following values.

Value	Meaning
0xFFFF	The packet is not encrypted.
0x001A	The packet is encrypted using AES-128.

Pad (2 bytes): A 2-byte padding field. Both bytes MUST be set to 0xFF.

Flags (2 bytes): Specifies properties of the structure. No **Flags** are currently defined. Both bytes MUST be set to zero and MUST be ignored on receipt.

SequenceNumber (8 bytes): A 64-bit little-endian integer containing the sequence number of the RPC message. For more details about how to calculate the **SequenceNumber**, see section 3.3.4.2.1.

Checksum (32 bytes): A 256-bit value containing the final **Checksum** of the signature and the RPC message. For more details about how to calculate the **Checksum**, see section 3.3.4.2.1.

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.

2.2.1.3.4 NETLOGON_CREDENTIAL

The NETLOGON_CREDENTIAL structure contains 8 bytes of data that have two distinct uses: for session-key negotiation and for building a Netlogon authenticator.

```
typedef struct  NETLOGON CREDENTIAL {
  char data[8];
} NETLOGON_CREDENTIAL,
 *PNETLOGON_CREDENTIAL;
```

data: The meaning of the 8 bytes of data contained in this structure is determined by the following:

- When session-key negotiation is performed, the data field carries an 8-byte challenge. Also see section 3.1.4.1.
- When the NETLOGON_CREDENTIAL is used as part of a NETLOGON_AUTHENTICATOR structure, the data field carries 8 bytes of encrypted data, as specified in sections 3.1.4.4 and 3.1.4.5.

2.2.1.3.5 NETLOGON_LSA_POLICY_INFO

The NETLOGON_LSA_POLICY_INFO structure defines **Local Security Authority (LSA)** policy information as an unsigned character buffer. For details, see [LSAPOLICY] and [MS-LSAD].

```
typedef struct _NETLOGON_LSA_POLICY_INFO {
  unsigned long LsaPolicySize;
  [size is(LsaPolicySize)] unsigned char* LsaPolicy;
} NETLOGON LSA POLICY INFO,
 *PNETLOGON_LSA_POLICY_INFO;
```

LsaPolicySize: This field is not used, and is set to zero.

LsaPolicy: This field is not used, and is initialized to NULL.

2.2.1.3.6 NETLOGON_WORKSTATION_INFO

The NETLOGON_WORKSTATION_INFO structure defines information passed into the NetrLogonGetDomainInfo method, as specified in 3.5.4.4.9. It is used to convey information about a member workstation from the client side to the server side.<18>

```
typedef struct _NETLOGON_WORKSTATION_INFO {
  NETLOGON LSA POLICY INFO LsaPolicy;
  [string] wchar_t* DnsHostName;
  [string] wchar t* SiteName;
  [string] wchar_t* Dummy1;
  [string] wchar_t* Dummy2;
  [string] wchar_t* Dummy3;
  [string] wchar t* Dummy4;
  RPC UNICODE STRING OsVersion;
  RPC UNICODE STRING OsName;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long WorkstationFlags;
  unsigned long KerberosSupportedEncryptionTypes;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_WORKSTATION_INFO,
 *PNETLOGON_WORKSTATION_INFO;
```

LsaPolicy: A NETLOGON_LSA_POLICY_INFO structure, as specified in section 2.2.1.3.5, that contains the LSA policy for this domain.

DnsHostName: A null-terminated Unicode string that contains the DNS host name of the client.

SiteName: A null-terminated Unicode string that contains the name of the site where the workstation resides.

Dummy1: MUST be set to NULL and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

Dummy2: MUST be set to NULL and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

Dummy3: MUST be set to NULL and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

Dummy4: MUST be set to NULL and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

OsVersion: An RPC_UNICODE_STRING structure in which the **Length** and **MaximumLength** fields are set to the size of an OSVERSIONINFOEX structure and the **Buffer** field points to an OSVERSIONINFOEX ([MS-RPRN] section 2.2.3.10.2) structure. *OsVersion* contains the version number of the operating system installed on the client machine.

OsName: A null-terminated Unicode string that contains the name of the operating system installed on the client machine.<19> The DC that receives this data structure updates the **operatingSystem** attribute of the client's machine account object in Active Directory, as specified in [MS-ADA3] section 2.53.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

WorkstationFlags: A set of bit flags specifying workstation behavior. A flag is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B	A

Where the bits are defined as:

Value	Description
A	Client will receive inbound trusts as specified in [MS-LSAD] section 2.2.7.9. The client sets this bit in order to receive the inbound trusts.
B	Client handles the update of the **service principal name (SPN)**.

All other bits MUST be set to zero and MUST be ignored on receipt.

KerberosSupportedEncryptionTypes: The **msDS-SupportedEncryptionTypes** attribute of the client's machine account object in Active Directory, as specified in [MS-ADA2] section 2.458.<20>

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

2.2.1.3.7 NL_TRUST_PASSWORD

The NL_TRUST_PASSWORD structure defines a buffer for carrying a computer account password, or a trust password, to be transmitted over the wire.<21> It is transported as an input parameter to the NetrServerPasswordSet2 method, as specified in section 3.5.4.4.5. Domain members use NetrServerPasswordSet2 to change their computer account password. The primary domain controller uses NetrServerPasswordSet2 to change trust passwords for all directly trusted domains. The NL_TRUST_PASSWORD structure is encrypted using the negotiated encryption algorithm before it is sent over the wire.

```
typedef struct _NL_TRUST_PASSWORD {
  WCHAR Buffer[256];
  unsigned long Length;
} NL_TRUST_PASSWORD,
 *PNL_TRUST_PASSWORD;
```

Buffer: Array of Unicode characters that is treated as a byte buffer containing the password, as follows:

- For a computer account password, the buffer has the following format:

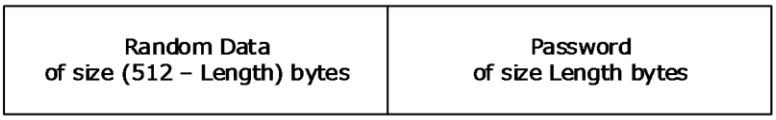


Figure 4: Computer account password buffer format

The first (512 – Length) bytes MUST be randomly generated data that serves as an additional source of entropy during encryption. The last Length bytes of the buffer MUST contain the clear text password.

- For a domain trust password, the buffer has the following format:

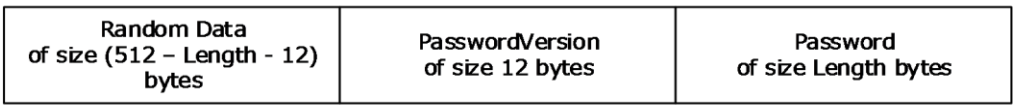


Figure 5: Domain trust password buffer format

The last Length bytes of the buffer contain the clear text password. The 12 bytes preceding the password are filled with the password version information as defined below. The rest of the buffer is filled with randomly generated data.

- The **PasswordVersion** part of the preceding diagram has the following format:

Figure 6: Password version buffer format

Where **ReservedField**, **PasswordVersionNumber**, and **PasswordVersionPresent** are the fields of the NL_PASSWORD_VERSION structure, as specified in section 2.2.1.3.8. The **PasswordVersionPresent** field is used to indicate whether the buffer contains a computer account password or a trust password: If the value of the **PasswordVersionPresent** field is 0x02231968, then the buffer contains a trust password; otherwise the buffer contains a computer account password.

Length: The length of the password, in bytes.

2.2.1.3.8 NL_PASSWORD_VERSION

The NL_PASSWORD_VERSION structure defines a password version number that is used to distinguish between different versions of information passed in the **Buffer** field of the NL_TRUST_PASSWORD structure. The NL_PASSWORD_VERSION structure is prepended to the password in the buffer of NL_TRUST_PASSWORD. This structure is only used for interdomain trust accounts.<22>

```
typedef struct _NL_PASSWORD_VERSION {
  unsigned long ReservedField;
  unsigned long PasswordVersionNumber;
  unsigned long PasswordVersionPresent;
} NL_PASSWORD_VERSION,
 *PNL_PASSWORD_VERSION;
```

ReservedField: MUST be set to zero when sent and MUST be ignored on receipt.

PasswordVersionNumber: Integer value that contains the current password version number. The password version number is incremented by one when a new password is generated; the value for the first password is one.

PasswordVersionPresent: MUST be 0x02231968, which is a constant used to indicate that the password version number is present and is stored in **PasswordVersionNumber**. This member is relevant only for server-to-server communication.

2.2.1.3.9 NETLOGON_WORKSTATION_INFORMATION

The NETLOGON_WORKSTATION_INFORMATION union selects between two parameters of type NETLOGON_WORKSTATION_INFO structure, as specified in section 2.2.1.3.6, based on the value of the *Level* parameter of the NetrLogonGetDomainInfo method, as specified in section 3.5.4.4.9.<23>

```
typedef
[switch_type(DWORD)]
union _NETLOGON_WORKSTATION_INFORMATION {
  [case(1)]
    PNETLOGON_WORKSTATION_INFO WorkstationInfo;
  [case(2)]
    PNETLOGON_WORKSTATION_INFO LsaPolicyInfo;
} NETLOGON_WORKSTATION_INFORMATION,
```

```
*PNETLOGON_WORKSTATION_INFORMATION;
```

WorkstationInfo: Field is selected when the switched DWORD ([MS-DTYP] section 2.2.9) constant is 0x00000001.

LsaPolicyInfo: Field is selected when the switched DWORD constant is 0x00000002.

2.2.1.3.10 NETLOGON_ONE_DOMAIN_INFO

The NETLOGON_ONE_DOMAIN_INFO structure defines information about a single domain. It is in turn contained in the NETLOGON_DOMAIN_INFO structure, as specified in section 2.2.1.3.11. The NETLOGON_DOMAIN_INFO structure describes domain relationships and is generated as output from the NetrLogonGetDomainInfo method, as specified in section 3.5.4.4.9.<24>

```
typedef struct _NETLOGON_ONE_DOMAIN_INFO {
  RPC_UNICODE_STRING DomainName;
  RPC_UNICODE_STRING DnsDomainName;
  RPC_UNICODE_STRING DnsForestName;
  GUID DomainGuid;
  PRPC_SID DomainSid;
  RPC_UNICODE_STRING TrustExtension;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_ONE_DOMAIN_INFO,
 *PNETLOGON_ONE_DOMAIN_INFO;
```

DomainName: A null-terminated Unicode string that contains the NetBIOS name of the domain being described. This field MUST NOT be an empty string.

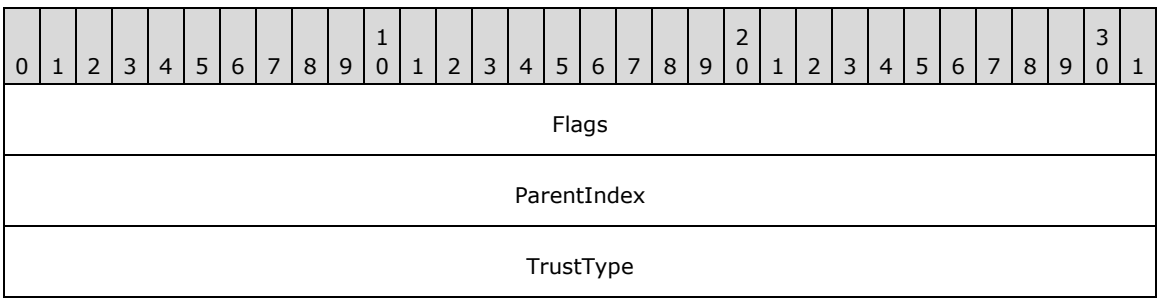
DnsDomainName: A null-terminated Unicode string that contains the DNS domain name for this domain. This field MUST NOT be an empty string.

DnsForestName: A null-terminated Unicode string that contains the DNS forest name for this domain.

DomainGuid: A globally unique 128-bit identifier for this domain.

DomainSid: The **security identifier (SID)**, as specified in [MS-DTYP] section 2.4.2.3 for this domain.

TrustExtension: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, which does not point to a Unicode string, but in fact points to a buffer of size 16, in bytes, in the following format.



TrustAttributes

This structure is supplementary domain trust information that contains the following fields of a DS_DOMAIN_TRUSTSW structure: **Flags**, **ParentIndex**, **TrustType**, and **TrustAttributes**. For more details on usage in NetrLogonGetDomainInfo, see section 3.5.4.4.9. For more details on the DS_DOMAIN_TRUSTSW structure, see section 2.2.1.6.2.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

2.2.1.3.11 NETLOGON_DOMAIN_INFO

The NETLOGON_DOMAIN_INFO structure defines information returned as output from the NetrLogonGetDomainInfo method, as specified in section 3.5.4.4.9. It contains information about a domain, including naming information and a list of trusted domains.<25>

```
typedef struct _NETLOGON_DOMAIN_INFO {
  NETLOGON_ONE_DOMAIN_INFO PrimaryDomain;
  unsigned long TrustedDomainCount;
  [size_is(TrustedDomainCount)] PNETLOGON_ONE_DOMAIN_INFO TrustedDomains;
  NETLOGON_LSA_POLICY_INFO LsaPolicy;
  RPC_UNICODE_STRING DnsHostNameInDs;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long WorkstationFlags;
  unsigned long SupportedEncTypes;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_DOMAIN_INFO,
 *PNETLOGON_DOMAIN_INFO;
```

PrimaryDomain: A NETLOGON_ONE_DOMAIN_INFO structure, as specified in section 2.2.1.3.10, that contains information about the domain of which the server is a member.

TrustedDomainCount: The number of trusted domains listed in TrustedDomains.

TrustedDomains: A pointer to an array of NETLOGON_ONE_DOMAIN_INFO structures, as specified in section 2.2.1.3.10, which contain information about domains with which the current domain has a trust relationship.

LsaPolicy: A NETLOGON_LSA_POLICY_INFO data structure that contains the LSA policy for this domain. This field is not used. The **LsaPolicy.LsaPolicySize** field is set to zero, and the **LsaPolicy.LsaPolicy** field is set to NULL.

DnsHostNameInDs: A null-terminated Unicode string that contains the Active Directory DNS host name for the client.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

WorkstationFlags: A set of bit flags that specify workstation behavior. A flag is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B	A

Where the bits are defined as:

Value	Description
A	Client receives inbound trusts.
B	Client handles the update of the service principal name (SPN). See [SPNNAMES] for details.

All other bits MUST be set to zero and MUST be ignored on receipt.

SupportedEncTypes: A set of bit flags that specify the encryption types supported, as specified in [MS-LSAD] section 2.2.7.18. See [MS-LSAD] for a specification of these bit values and their allowed combinations.<26>

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

2.2.1.3.12 NETLOGON_DOMAIN_INFORMATION

The NETLOGON_DOMAIN_INFORMATION union selects either a NETLOGON_DOMAIN_INFO, as specified in section 2.2.1.3.11, or a NETLOGON_LSA_POLICY_INFO, as specified in section 2.2.1.3.5,

data type based on the value of the *Level* parameter to the NetrLogonGetDomainInfo method, as specified in section 3.5.4.4.9.<27>

```
typedef
[switch_type(DWORD)]
union  NETLOGON_DOMAIN_INFORMATION {
  [case(1)]
    PNETLOGON_DOMAIN_INFO DomainInfo;
  [case(2)]
    PNETLOGON_LSA_POLICY_INFO LsaPolicyInfo;
} NETLOGON_DOMAIN_INFORMATION,
 *PNETLOGON_DOMAIN_INFORMATION;
```

DomainInfo: This field is selected when the switched DWORD ([MS-DTYP] section 2.2.9) value is set to 0x00000001. The union contains a NETLOGON_DOMAIN_INFO structure, as specified in section 2.2.1.3.11.

LsaPolicyInfo: This field is selected when the switched DWORD value is set to 0x00000002. The union contains a NETLOGON_LSA_POLICY_INFO structure, as specified in section 2.2.1.3.5.

2.2.1.3.13 NETLOGON_SECURE_CHANNEL_TYPE

The NETLOGON_SECURE_CHANNEL_TYPE enumeration specifies the type of secure channel to use in a logon transaction.

```
typedef  enum _NETLOGON_SECURE_CHANNEL_TYPE
{
  NullSecureChannel = 0,
  MsvApSecureChannel = 1,
  WorkstationSecureChannel = 2,
  TrustedDnsDomainSecureChannel = 3,
  TrustedDomainSecureChannel = 4,
  UasServerSecureChannel = 5,
  ServerSecureChannel = 6,
  CdcServerSecureChannel = 7
} NETLOGON_SECURE_CHANNEL_TYPE;
```

NullSecureChannel: An unauthenticated channel type. This value MUST NOT be used in the Netlogon RPC calls between a client and a remote server. The error code STATUS_INVALID_PARAMETER SHOULD be returned.

MsvApSecureChannel: A secure channel between the local Windows NT LAN Manager (NTLM) security provider and the Netlogon server. The client and the server are the same machine for this channel type. This value MUST NOT be used in the Netlogon RPC calls between a client and a remote server. The error code STATUS_INVALID_PARAMETER SHOULD be returned.

WorkstationSecureChannel: A secure channel from a domain member to a domain controller (DC).

TrustedDnsDomainSecureChannel: A secure channel between two DCs, connected through a trust relationship created between two Active Directory domains. A **trusted domain object (TDO)** is used in this type of channel.

TrustedDomainSecureChannel: A secure channel between two DCs, connected through a trust relationship created between two domains, one or both of which is a Windows NT 4.0 operating system domain.

UasServerSecureChannel: Secure channel from a LAN Manager server to a domain controller. This value is no longer supported, and it MUST NOT be used in the Netlogon RPC calls between a client and a remote server. The error code STATUS_INVALID_PARAMETER SHOULD be returned.

ServerSecureChannel: A secure channel from a backup domain controller to a primary domain controller.

CdcServerSecureChannel: Secure channel from a read-only domain controller (RODC) <28> to a domain controller.<29>

2.2.1.3.14 NETLOGON_CAPABILITIES

The NETLOGON_CAPABILITIES union carries the supported Netlogon capabilities.<30>

```
typedef
[switch_type(DWORD)]
union _NETLOGON_CAPABILITIES {
  [case(1)]
    ULONG ServerCapabilities;
} NETLOGON_CAPABILITIES,
 *PNETLOGON_CAPABILITIES;
```

ServerCapabilities: A 32-bit set of bit flags that identify the server's capabilities (section 3.5.4.4.10).

2.2.1.3.15 NL_OSVERSIONINFO_V1

The NL_OSVERSIONINFO_V1 structure specifies the values used to update the **operatingSystemVersion** and **operatingSystem** attributes on the client's computer account object in Active Directory on a normal (writable) DC.<31>

```
typedef struct _NL_OSVERSIONINFO_V1 {
  DWORD dwOSVersionInfoSize;
  DWORD dwMajorVersion;
  DWORD dwMinorVersion;
  DWORD dwBuildNumber;
  DWORD dwPlatformId;
  wchar t szCSDVersion[128];
  unsigned short wServicePackMajor;
  unsigned short wServicePackMinor;
  unsigned short wSuiteMask;
  unsigned char wProductType;
  unsigned char wReserved;
} NL_OSVERSIONINFO_V1;
```

dwOSVersionInfoSize: The size, in bytes, of this data structure. Set this member to sizeof(NL_OSVERSIONINFO_V1).

dwMajorVersion: The major version number of the operating system. This member can be one of the following values.

Value	Meaning
4	The operating system is Windows NT 4.0.
5	The operating system is Windows 2000 operating system, Windows XP operating system, Windows Server 2003 operating system, or Windows Server 2003 R2 operating system.
6	The operating system is Windows Vista operating system, Windows Server 2008 operating system, Windows 7 operating system, Windows Server 2008 R2 operating system, Windows 8 operating system, Windows Server 2012 operating system, Windows 8.1 operating system, or Windows Server 2012 R2 operating system.
10	The operating system is Windows 10 operating system or Windows Server 2016 Technical Preview

Value	Meaning
	operating system.

dwMinorVersion: The minor version number of the operating system. This member can be one of the following values.

Value	Meaning
0	The operating system is Windows NT 4.0, Windows 2000, Windows Vista, Windows Server 2008, Windows 10, or Windows Server 2016 Technical Preview.
1	The operating system is Windows XP, Windows 7, or Windows Server 2008 R2.
2	The operating system is Windows XP Professional x64 Edition operating system, Windows Server 2003, Windows Server 2003 R2, Windows 8, or Windows Server 2012.
3	The operating system is Windows 8.1 or Windows Server 2012 R2.

dwBuildNumber: The build number of the operating system.

dwPlatformId: The operating system platform. This member can be 0x00000002.

szCSDVersion: A null-terminated string, such as "Service Pack 3", that indicates the latest service pack installed on the system. If no service pack has been installed, the string is empty.

wServicePackMajor: The major version number of the latest service pack installed on the system. For example, for "Service Pack 3", the major version number is 3. If no service pack has been installed, the value is 0.

wServicePackMinor: The minor version number of the latest service pack installed on the system. For example, for "Service Pack 3", the minor version number is 0.

wSuiteMask: A bit mask that identifies the product suites available on the system. This member can be a combination of the following values.

Value	Meaning
VER_SUITE_BACKOFFICE 0x00000004	Microsoft BackOffice components are installed.
VER_SUITE_BLADE 0x00000400	Windows Server 2003 Web Edition operating system is installed.
VER_SUITE_COMPUTE_SERVER 0x00004000	Windows Server 2003 operating system Compute Cluster Edition is installed.
VER_SUITE_DATACENTER 0x00000080	Windows 2000 Datacenter Server operating system, Windows Server 2003 Datacenter Edition operating system, or Windows Server 2008 Datacenter operating system is installed.
VER_SUITE_ENTERPRISE 0x00000002	Windows NT Server 4.0 operating system, Enterprise Edition, Windows 2000 Advanced Server operating system, Windows Server 2003 Enterprise Edition operating system, or Windows Server 2008 Enterprise operating system is installed.
VER_SUITE_EMBEDDEDNT 0x00000040	Windows XP Embedded is installed.

Value	Meaning
VER_SUITE_PERSONAL 0x00000200	Windows XP Home Edition operating system, Windows Vista Home Basic, or Windows Vista Home Premium is installed.
VER_SUITE_SINGLEUSERTS 0x00000100	Remote Desktop is supported, but only one interactive session is supported. This value is set unless the system is running in application server mode.
VER_SUITE_SMALLBUSINESS 0x00000001	Microsoft Small Business Server was once installed on the system, but may have been upgraded to another version of Windows. For this bit flag, see the Remarks section.
VER_SUITE_SMALLBUSINESS_RESTRICTED 0x00000020	Microsoft Small Business Server is installed with the restrictive client license in force. For this bit flag, see the Remarks section.
VER_SUITE_STORAGE_SERVER 0x00002000	Windows Storage Server 2003 operating system or Windows Storage Server 2003 R2 operating system, Standard Edition is installed.
VER_SUITE_TERMINAL 0x00000010	Terminal Services is installed. This value is always set. If VER_SUITE_TERMINAL is set but VER_SUITE_SINGLEUSERTS is not set, the system is running in application server mode.

wProductType: Any additional information about the system. This member can be one of the following values.

Value	Meaning
VER_NT_DOMAIN_CONTROLLER 0x00000002	The system is a domain controller.
VER_NT_SERVER 0x00000003	The system is a server. Note that a server that is also a domain controller is reported as VER_NT_DOMAIN_CONTROLLER, not VER_NT_SERVER.
VER_NT_WORKSTATION 0x00000001	The operating system is Windows NT Workstation 4.0 operating system, Windows 2000 Professional operating system, Windows XP Home Edition, Windows XP Professional operating system, Windows Vista, Windows 7, Windows 8, Windows 8.1, or Windows 10.

wReserved: Reserved for future use.<32>

2.2.1.3.16 NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES_V1

The NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES_V1 structure specifies the values to update on the client's computer account object in Active Directory on a normal (writable) domain controller.<33>

```
typedef struct _NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES_V1 {
  [unique, string] wchar_t* ClientDnsHostName;
  [unique] NL_OSVERSIONINFO_V1* OsVersionInfo;
  [unique, string] wchar_t* OsName;
} NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES_V1;
```

ClientDnsHostName: A NULL or null-terminated Unicode string that is used to update the attribute **dNSHostName** on the client's computer account object in Active Directory.

OsVersionInfo: If not NULL, the attribute **operatingSystemVersion** on the client's computer account in Active Directory (using the ABNF Syntax as specified in [RFC2234]) is set to:

- If OsVersionInfo.dwBuildNumber is 0:

```
operatingSystemVersion = MajorVersion "." MinorVersion
MajorVersion = OsVersionInfo.dwMajorVersion
MinorVersion = OsVersionInfo.dwMinorVersion
```

- Otherwise:

```
operatingSystemVersion = MajorVersion "." MinorVersion "."
                         BuildNumber
MajorVersion = OsVersionInfo.dwMajorVersion
MinorVersion = OsVersionInfo.dwMinorVersion
BuildNumber = OsVersionInfo.dwBuildNumber
```

OsName: NULL or a null-terminated Unicode string that is used to update the attribute **operatingSystem** on the client's computer account object in Active Directory.<34>

2.2.1.3.17 NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES

The NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES union defines versioning.

```
typedef
[switch_type(DWORD)]
union {
  [case(1)]
    NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES_V1 V1;
} NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES;
```

V1: An NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES_V1 (section 2.2.1.3.16) structure.<35>

2.2.1.3.18 NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1

The NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1 structure specifies the values returned from the normal (writable) DC.<36>

```
typedef struct  NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1 {
  [unique, string] wchar_t* HubName;
  [unique, string] wchar_t** OldDnsHostName;
  [unique] unsigned long* SupportedEncTypes;
} NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1;
```

HubName: The NetBIOS name of the writable domain controller receiving NetrChainSetClientAttributes (section 3.5.4.4.11).<37>

OldDnsHostName: The client's DNS host name, if any, from the attribute **dNSHostName** on the client's computer account object in Active Directory on the writable domain controller. If there was an update to the attribute **dNSHostName** by the writable domain controller as a result of receiving NetrChainSetClientAttributes, this value will hold the previous value of that attribute.

SupportedEncTypes: The supported encryption algorithms received from the NetrLogonGetDomainInfo request, in the **SupportedEncType** field in the NETLOGON_DOMAIN_INFO (section 2.2.1.3.11) structure.<38>

2.2.1.3.19 NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES

The NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES union defines versioning. Currently, only version 1 is supported.

```
typedef
[switch_type(DWORD)]
union {
  [case(1)]
    NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1 V1;
} NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES;
```

V1: An NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1 (section 2.2.1.3.18) structure.<39>

2.2.1.4 Pass-Through Authentication Structures

Structures and enumerated types in this group are used for generic pass-though and for user logon and logoff, as outlined in section 1.3.

2.2.1.4.1 LM_CHALLENGE

The LM_CHALLENGE structure carries a LAN Manager authentication challenge.

```
typedef struct {
  char data[8];
} LM_CHALLENGE;
```

data: A string of eight characters that contains a LAN Manager authentication challenge, which is an unencrypted **nonce**.

For more information, see [LANMAN].

2.2.1.4.2 NETLOGON_GENERIC_INFO

The NETLOGON_GENERIC_INFO structure defines a structure that contains logon information in binary format. Microsoft implementations of authentication protocols make use of this structure for passing generic logon data through the Netlogon secure channel to a DC in the domain that contains the user account to use the domain's database. For an example of using the NETLOGON_GENERIC_INFO structure, see any of the examples documented in [MS-APDS].

```
typedef struct _NETLOGON_GENERIC_INFO {
  NETLOGON_LOGON_IDENTITY_INFO Identity;
  RPC_UNICODE_STRING PackageName;
  unsigned long DataLength;
  [size_is(DataLength)] unsigned char* LogonData;
} NETLOGON_GENERIC_INFO,
 *PNETLOGON_GENERIC_INFO;
```

Identity: The NETLOGON_LOGON_IDENTITY_INFO structure, as specified in section 2.2.1.4.15, contains information about the logon identity. The **LogonDomainName** field of the NETLOGON_LOGON_IDENTITY_INFO structure indicates the target domain that contains the user account.

PackageName: Contains the name of the security provider, such as Kerberos, to which the data will be delivered on the domain controller in the target domain that was specified in the **Identity** field. This name MUST match the name of an existing security provider; otherwise, the **Security Support Provider Interface (SSPI)** ([SSPI]) returns a package not found error.

DataLength: The length, in bytes, of **LogonData**.

LogonData: A pointer to a block of binary data that contains the information to be sent to the security package referenced in **PackageName**. This data is opaque to Netlogon.

2.2.1.4.3 NETLOGON_INTERACTIVE_INFO

The NETLOGON_INTERACTIVE_INFO structure defines information about an interactive logon instance.

```
typedef struct _NETLOGON_INTERACTIVE_INFO {
  NETLOGON_LOGON_IDENTITY_INFO Identity;
  LM_OWF_PASSWORD LmOwfPassword;
  NT_OWF_PASSWORD NtOwfPassword;
} NETLOGON_INTERACTIVE_INFO,
 *PNETLOGON_INTERACTIVE_INFO;
```

Identity: A NETLOGON_LOGON_IDENTITY_INFO structure, as specified in section 2.2.1.4.15, that contains information about the logon identity.

LmOwfPassword: An LM_OWF_PASSWORD structure, as specified in section 2.2.1.1.3, that contains the LMOWFv1 of a password. LMOWFv1 is specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1.

NtOwfPassword: An NT_OWF_PASSWORD structure, as specified in section 2.2.1.1.4, that contains the NTOWFv1 of a password. NTOWFv1 is specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1.

2.2.1.4.4 NETLOGON_SERVICE_INFO

The NETLOGON_SERVICE_INFO structure defines information about a service account logon. Windows services use service accounts as their run-time security identity.

```
typedef struct _NETLOGON_SERVICE_INFO {
  NETLOGON_LOGON_IDENTITY_INFO Identity;
  LM_OWF_PASSWORD LmOwfPassword;
  NT_OWF_PASSWORD NtOwfPassword;
} NETLOGON_SERVICE_INFO,
 *PNETLOGON_SERVICE_INFO;
```

Identity: NETLOGON_LOGON_IDENTITY_INFO structure, as specified in section 2.2.1.4.15, that contains information about the logon identity.

LmOwfPassword: LM_OWF_PASSWORD structure, as specified in section 2.2.1.1.3, that contains the LMOWFv1 of a password. LMOWFv1 is specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1.

NtOwfPassword: NT_OWF_PASSWORD structure, as specified in section 2.2.1.1.4, that contains the NTOWFv1 of a password. NTOWFv1 is specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1.

2.2.1.4.5 NETLOGON_NETWORK_INFO

The NETLOGON_NETWORK_INFO structure defines information that describes a network account logon.

```
typedef struct _NETLOGON_NETWORK_INFO {
  NETLOGON_LOGON_IDENTITY_INFO Identity;
  LM_CHALLENGE LmChallenge;
```

```
  STRING NtChallengeResponse;
  STRING LmChallengeResponse;
} NETLOGON_NETWORK_INFO,
 *PNETLOGON_NETWORK_INFO;
```

Identity: NETLOGON_LOGON_IDENTITY_INFO structure, as specified in section 2.2.1.4.15, that contains information about the logon identity.

LmChallenge: LM_CHALLENGE structure, as specified in section 2.2.1.4.1, that contains the network authentication challenge. For details about challenges, see [MS-NLMP].

NtChallengeResponse: String that contains the NT response (see [MS-NLMP]) to the network authentication challenge.

LmChallengeResponse: String that contains the LAN Manager response (see [MS-NLMP]) to the network authentication challenge.

2.2.1.4.6 NETLOGON_LEVEL

The NETLOGON_LEVEL union defines a union of all types of logon information.

```
typedef
[switch_type(NETLOGON_LOGON_INFO_CLASS)]
union _NETLOGON_LEVEL {
  [case(NetlogonInteractiveInformation)]
    PNETLOGON_INTERACTIVE_INFO LogonInteractive;
  [case(NetlogonInteractiveTransitiveInformation)]
    PNETLOGON_INTERACTIVE_INFO LogonInteractiveTransitive;
  [case(NetlogonServiceInformation)]
    PNETLOGON_SERVICE_INFO LogonService;
  [case(NetlogonServiceTransitiveInformation)]
    PNETLOGON_SERVICE_INFO LogonServiceTransitive;
  [case(NetlogonNetworkInformation)]
    PNETLOGON_NETWORK_INFO LogonNetwork;
  [case(NetlogonNetworkTransitiveInformation)]
    PNETLOGON_NETWORK_INFO LogonNetworkTransitive;
  [case(NetlogonGenericInformation)]
    PNETLOGON_GENERIC_INFO LogonGeneric;
  [default]     ;
} NETLOGON_LEVEL,
 *PNETLOGON_LEVEL;
```

LogonInteractive: This field is selected when the logon information type is **NetlogonInteractiveInformation**. The data type is NETLOGON_INTERACTIVE_INFO, as specified in section 2.2.1.4.3.

LogonInteractiveTransitive: This field is selected when the logon information type is **NetlogonInteractiveTransitiveInformation**. The data type is NETLOGON_INTERACTIVE_INFO, as specified in section 2.2.1.4.3.

LogonService: This field is selected when the logon information type is **NetlogonServiceInformation**. The data type is NETLOGON_SERVICE_INFO, as specified in section 2.2.1.4.4.

LogonServiceTransitive: This field is selected when the logon information type is **NetlogonServiceTransitiveInformation**. The data type is NETLOGON_SERVICE_INFO, as specified in section 2.2.1.4.4.

LogonNetwork: This field is selected when the logon information type is **NetlogonNetworkInformation**. The data type is NETLOGON_NETWORK_INFO, as specified in section 2.2.1.4.5.

LogonNetworkTransitive: This field is selected when the logon information type is **NetlogonNetworkTransitiveInformation**. The data type is NETLOGON_NETWORK_INFO, as specified in section 2.2.1.4.5.

LogonGeneric: This field is selected when the logon information type is **NetlogonGenericInformation**. The data type is NETLOGON_GENERIC_INFO, as specified in section 2.2.1.4.2.

2.2.1.4.7 NETLOGON_SID_AND_ATTRIBUTES

The NETLOGON_SID_AND_ATTRIBUTES structure contains a security identifier (SID) and its attributes.

```
typedef struct _NETLOGON_SID_AND_ATTRIBUTES {
  PRPC_SID Sid;
  unsigned long Attributes;
} NETLOGON_SID_AND_ATTRIBUTES,
 *PNETLOGON_SID_AND_ATTRIBUTES;
```

Sid: A pointer to a security identifier (SID).

Attributes: A set of bit flags that contains the set of security attributes assigned to this SID. A bit is TRUE (or set) if its value is equal to 1. The value is constructed from one or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	B	A

Where the bits are defined as:

Value	Description
A	The SID cannot have the **SE_GROUP_ENABLED** attribute removed. Corresponds to the SID attribute **SE_GROUP_MANDATORY**. This attribute prevents the user from disabling the group. Disabling a group causes the group to be ignored by access validation routines. For more information, see [SIDATT].
B	The SID is enabled by default (as opposed to being enabled by an application). Corresponds to the SID attribute **SE_GROUP_ENABLED_BY_DEFAULT**. For more information, see [SIDATT].
C	The SID is enabled for access checks. Corresponds to the SID attribute **SE_GROUP_ENABLED**. For more information, see [SIDATT].
D	This group is a **domain local group**. Corresponds to **SE_GROUP_RESOURCE**. For more information, see [SIDATT].

All other bits MUST be set to zero and MUST be ignored on receipt.

These values are opaque to the Netlogon protocol. They are not used or processed directly. All fields of this structure have the same meaning as the identically named fields in the **KERB_SID_AND_ATTRIBUTES** structure as specified in [MS-PAC] section 2.2.1.

2.2.1.4.8 NETLOGON_VALIDATION_GENERIC_INFO2

The NETLOGON_VALIDATION_GENERIC_INFO2 structure defines a structure that contains account information in binary format. Microsoft implementations of authentication protocols make use of this structure to return generic account information upon successful logon validation. For an example of using the NETLOGON_VALIDATION_GENERIC_INFO2 structure, see any of the examples in [MS-APDS].

```
typedef struct _NETLOGON_VALIDATION_GENERIC_INFO2 {
  unsigned long DataLength;
  [size_is(DataLength)] unsigned char* ValidationData;
} NETLOGON_VALIDATION_GENERIC_INFO2,
 *PNETLOGON_VALIDATION_GENERIC_INFO2;
```

DataLength: An integer value that contains the length of the data referenced by **ValidationData**, in bytes.

ValidationData: A pointer to a buffer that contains the logon validation information.

2.2.1.4.9 USER_SESSION_KEY

The USER_SESSION_KEY structure defines an encrypted user session key.

```
typedef struct _USER_SESSION_KEY {
  CYPHER_BLOCK data[2];
} USER_SESSION_KEY,
 *PUSER_SESSION_KEY;
```

data: A two-element CYPHER_BLOCK structure, as specified in section 2.2.1.1.1, that contains the 16-byte encrypted user session key.

2.2.1.4.10 GROUP_MEMBERSHIP

The GROUP_MEMBERSHIP structure identifies the group to which an account belongs.

```
typedef struct  GROUP_MEMBERSHIP {
  unsigned long RelativeId;
  unsigned long Attributes;
} GROUP_MEMBERSHIP,
 *PGROUP_MEMBERSHIP;
```

RelativeId: The **relative identifier (RID)** for a particular group.

Attributes: A set of values that describe the group membership attributes set for the RID specified in **RelativeId**. The value is constructed from one or more bit flags from the following table.

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

Where the bits are defined as:

Value	Description
A	The SID cannot have the **SE_GROUP_ENABLED** attribute removed. Corresponds to the SID attribute **SE_GROUP_MANDATORY**. This attribute prevents the user from disabling the group. Disabling a group causes the group to be ignored by access validation routines. For more information, see [SIDATT].
B	The SID is enabled by default (as opposed to being enabled by an application). Corresponds to the SID attribute **SE_GROUP_ENABLED_BY_DEFAULT**. For more information, see [SIDATT].
C	The SID is enabled for access checks. Corresponds to the SID attribute **SE_GROUP_ENABLED**. The **SE_GROUP_ENABLED** attribute enables the group. For more information, see [SIDATT].

All other bits MUST be zero and MUST be ignored on receipt.

These values are opaque to the Netlogon protocol. They are not used or processed directly. All fields of this structure have the same meaning as the identically named fields in the **GROUP_MEMBERSHIP** structure as specified in [MS-PAC] section 2.2.2.

2.2.1.4.11 NETLOGON_VALIDATION_SAM_INFO

The NETLOGON_VALIDATION_SAM_INFO structure defines account information retrieved from a database upon a successful user logon validation.

All fields of this structure, except the fields detailed following the structure definition, have the same meaning as the identically named fields in the KERB_VALIDATION_INFO structure, as specified in [MS-PAC] section2.5. Additionally, fields of this structure that are defined as OLD_LARGE_INTEGER are 64-bit timestamps equivalent to the identically named fields in the KERB_VALIDATION_INFO structure of **FILETIME** type ([MS-DTYP] section 2.3.3).

```
typedef struct _NETLOGON_VALIDATION_SAM_INFO {
  OLD_LARGE_INTEGER LogonTime;
  OLD_LARGE_INTEGER LogoffTime;
  OLD_LARGE_INTEGER KickOffTime;
  OLD_LARGE_INTEGER PasswordLastSet;
  OLD_LARGE_INTEGER PasswordCanChange;
  OLD_LARGE_INTEGER PasswordMustChange;
  RPC_UNICODE_STRING EffectiveName;
  RPC_UNICODE_STRING FullName;
  RPC_UNICODE_STRING LogonScript;
  RPC_UNICODE_STRING ProfilePath;
  RPC_UNICODE_STRING HomeDirectory;
  RPC_UNICODE_STRING HomeDirectoryDrive;
  unsigned short LogonCount;
  unsigned short BadPasswordCount;
  unsigned long UserId;
  unsigned long PrimaryGroupId;
  unsigned long GroupCount;
  [size_is(GroupCount)] PGROUP_MEMBERSHIP GroupIds;
  unsigned long UserFlags;
  USER_SESSION_KEY UserSessionKey;
  RPC_UNICODE_STRING LogonServer;
  RPC_UNICODE_STRING LogonDomainName;
  PRPC_SID LogonDomainId;
  unsigned long ExpansionRoom[10];
} NETLOGON_VALIDATION_SAM_INFO,
 *PNETLOGON_VALIDATION_SAM_INFO;
```

LogonServer: An **RPC_UNICODE_STRING** structure that contains the NetBIOS name of the server that populates this structure.

ExpansionRoom: A ten-element array of unsigned 32-bit integers. This member has a function similar to that of dummy fields, as detailed in section 1.3.8.1.3. Each element of the array MUST be zero when sent, and MUST be ignored on receipt.

2.2.1.4.12 NETLOGON_VALIDATION_SAM_INFO2

The NETLOGON_VALIDATION_SAM_INFO2 structure is an extension to NETLOGON_VALIDATION_SAM_INFO, as specified in section 2.2.1.4.11, with support for storing extra SIDs.

All fields of this structure, except the fields detailed following the structure definition, have the same meaning as the identically named fields in the KERB_VALIDATION_INFO structure as specified in [MS-PAC] section 2.5. Additionally, fields of this structure that are defined as OLD_LARGE_INTEGER are 64-bit timestamps equivalent to the identically named fields in the KERB_VALIDATION_INFO structure of **FILETIME** type ([MS-DTYP] section 2.3.3).

```
typedef struct _NETLOGON_VALIDATION_SAM_INFO2 {
  OLD_LARGE_INTEGER LogonTime;
  OLD_LARGE_INTEGER LogoffTime;
  OLD_LARGE_INTEGER KickOffTime;
  OLD_LARGE_INTEGER PasswordLastSet;
  OLD_LARGE_INTEGER PasswordCanChange;
  OLD_LARGE_INTEGER PasswordMustChange;
  RPC_UNICODE_STRING EffectiveName;
  RPC_UNICODE_STRING FullName;
  RPC_UNICODE_STRING LogonScript;
  RPC_UNICODE_STRING ProfilePath;
  RPC_UNICODE_STRING HomeDirectory;
  RPC_UNICODE_STRING HomeDirectoryDrive;
  unsigned short LogonCount;
  unsigned short BadPasswordCount;
  unsigned long UserId;
  unsigned long PrimaryGroupId;
  unsigned long GroupCount;
  [size_is(GroupCount)] PGROUP_MEMBERSHIP GroupIds;
  unsigned long UserFlags;
  USER_SESSION_KEY UserSessionKey;
  RPC_UNICODE_STRING LogonServer;
  RPC_UNICODE_STRING LogonDomainName;
  PRPC_SID LogonDomainId;
  unsigned long ExpansionRoom[10];
  unsigned long SidCount;
  [size_is(SidCount)] PNETLOGON_SID_AND_ATTRIBUTES ExtraSids;
} NETLOGON_VALIDATION_SAM_INFO2,
 *PNETLOGON_VALIDATION_SAM_INFO2;
```

LogonServer: An **RPC_UNICODE_STRING** structure that contains the NetBIOS name of the server that populates this structure.

ExpansionRoom: A ten-element array of unsigned 32-bit integers. This member has a function similar to that of dummy fields, as detailed in section 1.3.8.1.3. Each element of the array MUST be zero when sent, and MUST be ignored on receipt.

2.2.1.4.13 NETLOGON_VALIDATION_SAM_INFO4

The NETLOGON_VALIDATION_SAM_INFO4 structure extends NETLOGON_VALIDATION_SAM_INFO2, as specified in section 2.2.1.4.12, by storing the fully qualified domain name (FQDN) (2) of the domain of the user account and the user principal.

All fields of this structure, except the fields detailed following the structure definition, have the same meaning as the identically named fields in the KERB_VALIDATION_INFO structure, as specified in [MS-PAC] section 2.5. Additionally, fields of this structure that are defined as OLD_LARGE_INTEGER are

64-bit timestamps equivalent to the identically named fields in the KERB_VALIDATION_INFO structure of **FILETIME** type ([MS-DTYP] section 2.3.3).

```
typedef struct _NETLOGON_VALIDATION_SAM_INFO4 {
  OLD_LARGE_INTEGER LogonTime;
  OLD_LARGE_INTEGER LogoffTime;
  OLD_LARGE_INTEGER KickOffTime;
  OLD_LARGE_INTEGER PasswordLastSet;
  OLD_LARGE_INTEGER PasswordCanChange;
  OLD_LARGE_INTEGER PasswordMustChange;
  RPC_UNICODE_STRING EffectiveName;
  RPC_UNICODE_STRING FullName;
  RPC_UNICODE_STRING LogonScript;
  RPC_UNICODE_STRING ProfilePath;
  RPC_UNICODE_STRING HomeDirectory;
  RPC_UNICODE_STRING HomeDirectoryDrive;
  unsigned short LogonCount;
  unsigned short BadPasswordCount;
  unsigned long UserId;
  unsigned long PrimaryGroupId;
  unsigned long GroupCount;
  [size_is(GroupCount)] PGROUP_MEMBERSHIP GroupIds;
  unsigned long UserFlags;
  USER_SESSION_KEY UserSessionKey;
  RPC_UNICODE_STRING LogonServer;
  RPC_UNICODE_STRING LogonDomainName;
  PRPC_SID LogonDomainId;
  unsigned CHAR LMKey[8];
  ULONG UserAccountControl;
  ULONG SubAuthStatus;
  OLD_LARGE_INTEGER LastSuccessfulILogon;
  OLD_LARGE_INTEGER LastFailedILogon;
  ULONG FailedILogonCount;
  ULONG Reserved4[1];
  unsigned long SidCount;
  [size_is(SidCount)] PNETLOGON_SID_AND_ATTRIBUTES ExtraSids;
  RPC_UNICODE_STRING DnsLogonDomainName;
  RPC_UNICODE_STRING Upn;
  RPC_UNICODE_STRING ExpansionString1;
  RPC_UNICODE_STRING ExpansionString2;
  RPC_UNICODE_STRING ExpansionString3;
  RPC_UNICODE_STRING ExpansionString4;
  RPC_UNICODE_STRING ExpansionString5;
  RPC_UNICODE_STRING ExpansionString6;
  RPC_UNICODE_STRING ExpansionString7;
  RPC_UNICODE_STRING ExpansionString8;
  RPC_UNICODE_STRING ExpansionString9;
  RPC_UNICODE_STRING ExpansionString10;
} NETLOGON_VALIDATION_SAM_INFO4,
 *PNETLOGON_VALIDATION_SAM_INFO4;
```

LogonServer: An **RPC_UNICODE_STRING** structure that contains the NetBIOS name of the server that populates this structure.

LMKey: Contains the first 8 bytes of the LMOWF ([MS-NLMP] section 3.3.1) if NTLMV1 is used, or the first 8 bytes of the KXKEY ([MS-NLMP] section 3.4.5.1) if NTLMV2 is used.

Reserved4: An unsigned 32-bit integer. This member is reserved. MUST be zero when sent, and MUST be ignored on receipt.

DnsLogonDomainName: Contains the fully qualified domain name (FQDN) (2) of the domain of the user account.

Upn: Contains the **user principal name (UPN)**.

ExpansionString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. Expansion strings have a function similar to that of dummy fields, as detailed in section 1.3.8.1.3.

ExpansionString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. Expansion strings have a function similar to that of dummy fields, as detailed in section 1.3.8.1.3.

ExpansionString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. Expansion strings have a function similar to that of dummy fields, as detailed in section 1.3.8.1.3.

ExpansionString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. Expansion strings have a function similar to that of dummy fields, as detailed in section 1.3.8.1.3.

ExpansionString5: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. Expansion strings have a function similar to that of dummy fields, as detailed in section 1.3.8.1.3.

ExpansionString6: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. Expansion strings have a function similar to that of dummy fields, as detailed in section 1.3.8.1.3.

ExpansionString7: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. Expansion strings have a function similar to that of dummy fields, as detailed in section 1.3.8.1.3.

ExpansionString8: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. Expansion strings have a function similar to that of dummy fields, as detailed in section 1.3.8.1.3.

ExpansionString9: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. Expansion strings have a function similar to that of dummy fields, as detailed in section 1.3.8.1.3.

ExpansionString10: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. Expansion strings have a function similar to that of dummy fields, as detailed in section 1.3.8.1.3.

2.2.1.4.14 NETLOGON_VALIDATION

The NETLOGON_VALIDATION union defines a union of all types of user validation information values.

```
typedef
[switch type(enum  NETLOGON VALIDATION INFO CLASS)]
union _NETLOGON_VALIDATION {
  [case(NetlogonValidationSamInfo)]
    PNETLOGON_VALIDATION_SAM_INFO ValidationSam;
  [case(NetlogonValidationSamInfo2)]
    PNETLOGON_VALIDATION_SAM_INFO2 ValidationSam2;
  [case(NetlogonValidationGenericInfo2)]
    PNETLOGON_VALIDATION_GENERIC_INFO2 ValidationGeneric2;
  [case(NetlogonValidationSamInfo4)]
    PNETLOGON_VALIDATION_SAM_INFO4 ValidationSam4;
  [default]     ;
} NETLOGON VALIDATION,
 *PNETLOGON_VALIDATION;
```

ValidationSam: This field is selected when the validation information type is **NetlogonValidationSamInfo**. The selected data type is NETLOGON_VALIDATION_SAM_INFO, as specified in section 2.2.1.4.11.

ValidationSam2: This field is selected when the validation information type is **NetlogonValidationSamInfo2**. The selected data type is NETLOGON_VALIDATION_SAM_INFO2, as specified in section 2.2.1.4.12.

ValidationGeneric2: This field is selected when the validation information type is **NetlogonValidationGenericInfo2**. The selected data type is NETLOGON_VALIDATION_GENERIC_INFO2, as specified in section 2.2.1.4.8.

ValidationSam4: This field is selected when the validation information type is **NetlogonValidationSamInfo4**. The selected data type is NETLOGON_VALIDATION_SAM_INFO4, as specified in section 2.2.1.4.13.

2.2.1.4.15 NETLOGON_LOGON_IDENTITY_INFO

The NETLOGON_LOGON_IDENTITY_INFO structure defines a logon identity within a domain.

```
typedef struct _NETLOGON_LOGON_IDENTITY_INFO {
  RPC_UNICODE_STRING LogonDomainName;
  unsigned long ParameterControl;
  OLD_LARGE_INTEGER Reserved;
  RPC_UNICODE_STRING UserName;
  RPC_UNICODE_STRING Workstation;
} NETLOGON LOGON IDENTITY INFO,
 *PNETLOGON_LOGON_IDENTITY_INFO;
```

LogonDomainName: Contains the NetBIOS name of the domain of the account.

ParameterControl: A set of bit flags that contain information pertaining to the logon validation processing. A flag is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
X	W	V	U	T	S	R	Q	0	0	0	P	0	0	0	O	0	N	M	L	K	J	I	H	G	F	E	D	C	B	A	0

Where the bits are defined as:

Value	Description
A	Clear text passwords can be transmitted for this logon identity.
B	Update the logon statistics for this account upon successful logon.
C	Return the user parameter list for this account upon successful logon.
D	Do not attempt to log this account on as a guest upon logon failure.
E	Allow this account to log on with the domain controller account.

Value	Description
F	Return the password expiration date and time upon successful logon.
G	Send a **client challenge** upon logon request.
H	Attempt logon as a guest for this account only.
I	Return the profile path upon successful logon.
J	Attempt logon to the specified domain only.
K	Allow this account to log on with the computer account.
L	Disable allowing fallback to guest account for this account.
M	Force the logon of this account as a guest if the password is incorrect.
N	This account has supplied a clear text password.
O	Allow NTLMv1 authentication ([MS-NLMP]) when only NTLMv2 ([NTLM]) is allowed.
P	Use **sub-authentication** ([MS-APDS] section 3.1.5.2.1).
Q	Encode the **sub-authentication package** identifier. Bits Q–X are used to encode the integer value of the sub-authentication package identifier (this is in little-endian order).
R	Encode the sub-authentication package identifier. Bits Q–X are used to encode the integer value of the sub-authentication package identifier (this is in little-endian order).
S	Encode the sub-authentication package identifier. Bits Q–X are used to encode the integer value of the sub-authentication package identifier (this is in little-endian order).
T	Encode the sub-authentication package identifier. Bits Q–X are used to encode the integer value of the sub-authentication package identifier (this is in little-endian order).
U	Encode the sub-authentication package identifier. Bits Q–X are used to encode the integer value of the sub-authentication package identifier (this is in little-endian order).
V	Encode the sub-authentication package identifier. Bits Q–X are used to encode the integer value of the sub-authentication package identifier (this is in little-endian order).
W	Encode the sub-authentication package identifier. Bits Q–X are used to encode the integer value of the sub-authentication package identifier (this is in little-endian order).
X	Encode the sub-authentication package identifier. Bits Q–X are used to encode the integer value of the sub-authentication package identifier (this is in little-endian order).

Reserved: MUST be set to zero when sent and MUST be ignored on receipt.

UserName: Contains the name of the user.

Workstation: Contains the NetBIOS name of the workstation from which the user is logging on.

2.2.1.4.16 NETLOGON_LOGON_INFO_CLASS

The NETLOGON_LOGON_INFO_CLASS enumeration identifies a particular type of logon information block.

```
typedef  enum _NETLOGON_LOGON_INFO_CLASS
{
  NetlogonInteractiveInformation = 1,
  NetlogonNetworkInformation = 2,
  NetlogonServiceInformation = 3,
  NetlogonGenericInformation = 4,
  NetlogonInteractiveTransitiveInformation = 5,
  NetlogonNetworkTransitiveInformation = 6,
  NetlogonServiceTransitiveInformation = 7
} NETLOGON_LOGON_INFO_CLASS;
```

NetlogonInteractiveInformation: Logon information provided pertains to an interactive account logon. Interactive account logon requires a user to physically input credentials at the client that are then authenticated by the DC.<40>

NetlogonNetworkInformation: Logon information provided pertains to a network account logon. Network logon is transparent to the user. The user has already input his or her credentials during interactive logon and has been authenticated by the server or DC. These credentials are used again to log the user onto another network resource without prompting the user for his or her credentials.<41>

NetlogonServiceInformation: Logon information provided pertains to a service account logon. A service account acts as a non-privileged user on the local computer and presents anonymous credentials to any remote server.<42>

NetlogonGenericInformation: Logon information provided pertains to a generic account logon. This type of account logon is for generic pass-through authentication, as specified in section 3.2.4.1, that enables servers to forward NTLM and Digest authentication credentials to a DC for authorization.<43>

NetlogonInteractiveTransitiveInformation: Logon information provided pertains to a transitive interactive account logon and can be passed through transitive trust links.<44>

NetlogonNetworkTransitiveInformation: Logon information provided pertains to a transitive network account logon and can be passed through transitive trust links.<45>

NetlogonServiceTransitiveInformation: Logon information provided pertains to a transitive service account logon and can be passed through transitive trust links.<46>

2.2.1.4.17 NETLOGON_VALIDATION_INFO_CLASS

The NETLOGON_VALIDATION_INFO_CLASS enumeration selects the type of logon information block being used.

```
typedef  enum _NETLOGON_VALIDATION_INFO_CLASS
{
  NetlogonValidationUasInfo = 1,
  NetlogonValidationSamInfo = 2,
  NetlogonValidationSamInfo2 = 3,
```

```
  NetlogonValidationGenericInfo = 4,
  NetlogonValidationGenericInfo2 = 5,
  NetlogonValidationSamInfo4 = 6
} NETLOGON_VALIDATION_INFO_CLASS;
```

NetlogonValidationUasInfo: Associated structure is NETLOGON_VALIDATION_UAS_INFO (section 2.2.1.8.1).<47><48>

NetlogonValidationSamInfo: Associated structure is NETLOGON_VALIDATION_SAM_INFO (section 2.2.1.4.11).<49>

NetlogonValidationSamInfo2: Associated structure is NETLOGON_VALIDATION_SAM_INFO2 (section 2.2.1.4.12).<50>

NetlogonValidationGenericInfo: Associated structure is NETLOGON_VALIDATION_GENERIC_INFO2 (section 2.2.1.4.8).<51>

NetlogonValidationGenericInfo2: Associated structure is NETLOGON_VALIDATION_GENERIC_INFO2 (section 2.2.1.4.8).<52>

NetlogonValidationSamInfo4: Associated structure is NETLOGON_VALIDATION_SAM_INFO4 (section 2.2.1.4.13).<53>

2.2.1.4.18 NETLOGON Specific Access Masks

Access Rights: The access rights defined by this protocol are specified by the bit settings in the following table:

Name	Value	Informative Summary
NETLOGON_UAS_LOGON_ACCESS	0x0001	Obsolete (LAN Manager).
NETLOGON_UAS_LOGOFF_ACCESS	0x0002	Obsolete (LAN Manager).
NETLOGON_CONTROL_ACCESS	0x0004	Granted to **security principals** that are system operators, account operators, administrators, or components of the operating system.
NETLOGON_QUERY_ACCESS	0x0008	Granted to all security principals.
NETLOGON_SERVICE_ACCESS	0x0010	Granted to all security principals that are administrators or components of the operating system.
NETLOGON_FTINFO_ACCESS	0x0020	Granted to all security principals that are authenticated users.
NETLOGON_WKSTA_RPC_ACCESS	0x0040	Granted to all security principals that are local users or administrators.

2.2.1.5 Account Database Replication Structures

Structures and enumerated types in this group are used for account database replication as outlined in section 1.3. These structures are relevant only for server-to-server communication, and are obsolete.

2.2.1.5.1 NETLOGON_DB_CHANGE (Announcement) Message

The following is the format of the payload of a mailslot message used in Netlogon replication, as specified in section 3.6. The message is used to indicate that one or more changes have taken place in

the account database, and carries an indication of the changes from the PDC to the BDC. Because it is sent in the open, this is a hint, and the BDC must connect to the PDC over a reliable transport and secure connection to obtain the actual change.

The DBChangeInfo field represents information about a state of one of the databases (**Security Account Manager Built-in**, **Security Account Manager (SAM)**, or **Local Security Authority**). The number of DBChangeInfo fields is specified by the DBCount field. The format of the DBChangeInfo field is described below.

The fields in the above diagram are in little-endian format and have the following meanings:

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
MessageType																LowSerialNumber															
...																DateAndTime															
...																Pulse															
...																Random															
...																PrimaryDCName (variable)															
...																															
DomainName (variable)																															
...																															
UnicodePrimaryDCName (variable)																															
...																															
UnicodeDomainName (variable)																															
...																															
DBCount																															
DBChangeInfo (variable)																															
...																															
DomainSidSize																															
DomainSid (variable)																															
...																															
MessageFormatVersion																															

MessageToken

MessageType (2 bytes): A two-byte field identifying the message. MUST be set to 0x000A.

LowSerialNumber (4 bytes): The low DWORD part of the 64-bit **database serial number** of the SAM database.

DateAndTime (4 bytes): An unsigned 32-bit value representing the time stamp for the SAM database creation time. This MUST be expressed as the number of seconds elapsed since midnight of January 1, 1970.

Pulse (4 bytes): An unsigned 32-bit value that specifies the message interval in seconds between change announcements sent to the BDCs.

Random (4 bytes): An unsigned 32-bit value that indicates the number of seconds the recipient of the message SHOULD <54> wait before contacting the sender.

PrimaryDCName (variable): The null-terminated name of the PDC sending the message. MUST be encoded in the **original equipment manufacturer (OEM) character set**.

DomainName (variable): The null-terminated domain name encoded in the **OEM character set**. The domain name is padded to a multiple of 2 bytes for alignment reasons.

UnicodePrimaryDCName (variable): The null-terminated name of the PDC sending the message. MUST be encoded in the Unicode character set.

UnicodeDomainName (variable): The null-terminated domain name. MUST be encoded in the Unicode character set.

DBCount (4 bytes): An unsigned 32-bit value representing the number of DBChangeInfo fields in the message.

DBChangeInfo (variable): A set of **DBChangeInfo** messages, specified below, that indicate the changes that are pending replication. There are **DBCount** entries in this set.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
DBIndex																															
LargeSerialNumber																															
...																															
DateAndTime																															
...																															

DBIndex (4 bytes): A 32-bit value that identifies the database as follows:

Value	Meaning
0x00000000	Indicates the SAM database.
0x00000001	Indicates the SAM built-in database.
0x00000002	Indicates the LSA database.

LargeSerialNumber (8 bytes): A 64-bit value that contains the database serial number for the database identified by the **DBIndex** field.

DateAndTime (8 bytes): The time in UTC of the database creation expressed as an 8-byte value in the TIME format in a **FILETIME** structure, as specified in [MS-RPCE] Appendix A (section 6).

In what follows, the above message is referred to as the announcement message.

DomainSidSize (4 bytes): An unsigned 32-bit value specifying the size in bytes of the DomainSid field.

DomainSid (variable): The SID of the domain.

MessageFormatVersion (4 bytes): An unsigned 32-bit value containing the version of the message format. MUST be set to 0x00000001.

MessageToken (4 bytes): An unsigned 32-bit field identifying the message. MUST be set to 0xFFFFFFFF.

2.2.1.5.2 NLPR_QUOTA_LIMITS

The NLPR_QUOTA_LIMITS structure defines a set of system resources that are available to a domain user.

```
typedef struct  NLPR_QUOTA_LIMITS {
  unsigned long PagedPoolLimit;
  unsigned long NonPagedPoolLimit;
  unsigned long MinimumWorkingSetSize;
  unsigned long MaximumWorkingSetSize;
  unsigned long PagefileLimit;
  OLD_LARGE_INTEGER Reserved;
} NLPR_QUOTA_LIMITS,
 *PNLPR_QUOTA_LIMITS;
```

PagedPoolLimit: Specifies the number of bytes of paged pool memory assigned to the user. The paged pool is an area of system memory (physical memory used by the operating system) for objects that can be written to disk when they are not being used.

NonPagedPoolLimit: Specifies the number of bytes of nonpaged pool memory assigned to the user. The nonpaged pool is an area of system memory for objects that cannot be written to disk but MUST remain in physical memory as long as they are allocated.

MinimumWorkingSetSize: Specifies the minimum set size assigned to the user. The working set of a process is the set of memory pages currently visible to the process in physical RAM memory. These pages are present in memory when the application is running and available for an application to use without triggering a page fault.

MaximumWorkingSetSize: Specifies the maximum set size assigned to the user.

PagefileLimit: Specifies the maximum size, in bytes, of the paging file, which is a reserved space on disk that backs up committed physical memory on the computer.

Reserved: SHOULD be set to zero and MUST be ignored on receipt.

2.2.1.5.3 NETLOGON_DELTA_ACCOUNTS

The NETLOGON_DELTA_ACCOUNTS structure contains the settings and privileges for a Local Security Authority (LSA) account. This structure is used for replicating the LSA account data from the primary domain controller (PDC) to a backup domain controller (BDC).

```
typedef struct _NETLOGON_DELTA_ACCOUNTS {
  ULONG PrivilegeEntries;
  ULONG PrivilegeControl;
  [size_is(PrivilegeEntries)] ULONG* PrivilegeAttributes;
  [size_is(PrivilegeEntries)] PRPC_UNICODE_STRING PrivilegeNames;
  NLPR_QUOTA_LIMITS QuotaLimits;
  ULONG SystemAccessFlags;
  SECURITY_INFORMATION SecurityInformation;
  ULONG SecuritySize;
  [size_is(SecuritySize)] UCHAR* SecurityDescriptor;
  RPC_UNICODE_STRING DummyString1;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  ULONG DummyLong1;
  ULONG DummyLong2;
  ULONG DummyLong3;
  ULONG DummyLong4;
} NETLOGON_DELTA_ACCOUNTS,
 *PNETLOGON_DELTA_ACCOUNTS;
```

PrivilegeEntries: The number of privileges associated with the LSA account.

PrivilegeControl: A bit flag describing the properties of the account privileges. A flag is TRUE (or set) if its value is equal to 1. PrivilegeControl MAY be the following value.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	A

Where the bits are defined as:

Value	Description
A	All of the specified privileges MUST be held by the process that is requesting access.

All other bits MUST be set to zero and MUST be ignored on receipt.

PrivilegeAttributes: Pointer to an array of unsigned 32-bit values that contain a set of bit flags describing each **privilege's** attributes. An attribute is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B	A

Where the bits are defined as:

Value	Description
A	Privilege is enabled by default.
B	Privilege is enabled.

All other bits MUST be set to zero and MUST be ignored on receipt.

PrivilegeNames: A pointer to an array of privilege names represented as RPC_UNICODE_STRING structures. See [MS-DTYP] section 2.3.10 for a specification of the RPC_UNICODE_STRING structure. The names of the privileges are implementation-specific.

QuotaLimits: An NLPR_QUOTA_LIMITS structure that describes the account's current quota settings. For more details about the NLPR_QUOTA_LIMITS structure, see section 2.2.1.5.2.

SystemAccessFlags: A set of the following bit flags that specify the ways in which the account is permitted to access the system as detailed in POLICY_MODE_INTERACTIVE, POLICY_MODE_NETWORK, POLICY_MODE_BATCH, POLICY_MODE_SERVICE, and POLICY_MODE_PROXY of [MS-LSAD]. See [MS-LSAD] for the specification of these bit values and allowed combinations.

SecurityInformation: A SECURITY_INFORMATION structure, as specified in [MS-DTYP] section 2.4.7, that specifies portions of a security descriptor about the trusted domain.

SecuritySize: The size, in bytes, of the **SecurityDescriptor** field.

SecurityDescriptor: A pointer to a SECURITY_DESCRIPTOR structure, as specified in [MS-DTYP] section 2.4.6, that describes the security settings for the account object.

DummyString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

2.2.1.5.4 NETLOGON_DELTA_ALIAS

The NETLOGON_DELTA_ALIAS structure contains information about a SAM alias. This structure is used to replicate the SAM alias data from the PDC to a BDC.

```
typedef struct _NETLOGON_DELTA_ALIAS {
  RPC_UNICODE_STRING Name;
  unsigned long RelativeId;
  SECURITY INFORMATION SecurityInformation;
  unsigned long SecuritySize;
```

```
  [size_is(SecuritySize)] unsigned char* SecurityDescriptor;
  RPC_UNICODE_STRING Comment;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_DELTA_ALIAS,
 *PNETLOGON_DELTA_ALIAS;
```

Name: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the alias name.

RelativeId: The RID for the alias.

SecurityInformation: A SECURITY_INFORMATION structure, as specified in [MS-DTYP] section 2.4.7, that contains security settings for the alias.

SecuritySize: The size, in bytes, of the **SecurityDescriptor** field.

SecurityDescriptor: A pointer to a SECURITY_DESCRIPTOR structure, as specified in [MS-DTYP] section 2.4.6, that describes the security information for the alias object.

Comment: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the administrative comment string for the alias.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

2.2.1.5.5 NLPR_SID_INFORMATION

The NLPR_SID_INFORMATION structure is used to form a wrapper for a SID; it is used to transmit a SID during certain replication operations. See section 3.6 for details.

```
typedef struct _NLPR_SID_INFORMATION {
  PRPC_SID SidPointer;
} NLPR_SID_INFORMATION,
```

```
 *PNLPR_SID_INFORMATION;
```

SidPointer: A pointer to a SID structure.

2.2.1.5.6 NLPR_SID_ARRAY

The NLPR_SID_ARRAY structure defines an array of pointers to security identifier structures.

```
typedef struct _NLPR_SID_ARRAY {
  unsigned long Count;
  [size_is(Count)] PNLPR_SID_INFORMATION Sids;
} NLPR_SID_ARRAY,
 *PNLPR_SID_ARRAY;
```

Count: The number of pointers in the **Sids** array.

Sids: An array of NLPR_SID_INFORMATION structures, as specified in section 2.2.1.5.5, each of which is a pointer to a SID.

2.2.1.5.7 NETLOGON_DELTA_ALIAS_MEMBER

The NETLOGON_DELTA_ALIAS_MEMBER structure contains all the members of a SAM alias. This structure is used for replicating the SAM alias data from the PDC to a BDC, as detailed in section 3.6.

```
typedef struct _NETLOGON_DELTA_ALIAS_MEMBER {
  NLPR_SID_ARRAY Members;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_DELTA_ALIAS_MEMBER,
 *PNETLOGON_DELTA_ALIAS_MEMBER;
```

Members: An NLPR_SID_ARRAY structure, as specified in section 2.2.1.5.6, that contains an array of SIDs for each member of the alias.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

2.2.1.5.8 NETLOGON_DELTA_DELETE_GROUP

The NETLOGON_DELTA_DELETE_GROUP structure contains information about a group to be deleted in the database. This structure is used for replicating the SAM group data from the PDC to a BDC, as detailed in section 3.6.

```
typedef struct _NETLOGON_DELTA_DELETE_GROUP {
  [string] wchar_t* AccountName;
  RPC_UNICODE_STRING DummyString1;
```

```
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_DELTA_DELETE_GROUP,
 *PNETLOGON_DELTA_DELETE_GROUP;
```

AccountName: A null-terminated Unicode string that contains the name of the group to delete.

DummyString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

2.2.1.5.9 NETLOGON_DELTA_DELETE_USER

The NETLOGON_DELTA_DELETE_USER structure contains information about a user account to be deleted in the database.

```
typedef struct  NETLOGON DELTA DELETE USER {
  [string] wchar_t* AccountName;
  RPC_UNICODE_STRING DummyString1;
  RPC_UNICODE_STRING DummyString2;
  RPC UNICODE STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON DELTA DELETE USER,
 *PNETLOGON_DELTA_DELETE_USER;
```

AccountName: A null-terminated Unicode string that contains the name of the user to delete.

DummyString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

2.2.1.5.10 NETLOGON_DELTA_DOMAIN

The NETLOGON_DELTA_DOMAIN structure contains information about a domain. Most of the fields in this structure are obtained by querying the database. This structure is used to replicate the domain data from the PDC to a BDC, as detailed in section 3.6.

All fields of this structure, except the fields detailed following the structure definition, have the same meaning as the identically named fields in the Domain Fields section ([MS-SAMR] section 2.2.4.1).

```
typedef struct _NETLOGON_DELTA_DOMAIN {
  RPC_UNICODE_STRING DomainName;
  RPC_UNICODE_STRING OemInformation;
  OLD_LARGE_INTEGER ForceLogoff;
  unsigned short MinPasswordLength;
  unsigned short PasswordHistoryLength;
  OLD_LARGE_INTEGER MaxPasswordAge;
  OLD_LARGE_INTEGER MinPasswordAge;
  OLD_LARGE_INTEGER DomainModifiedCount;
  OLD_LARGE_INTEGER DomainCreationTime;
  SECURITY_INFORMATION SecurityInformation;
  unsigned long SecuritySize;
  [size_is(SecuritySize)] unsigned char* SecurityDescriptor;
  RPC_UNICODE_STRING DomainLockoutInformation;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long PasswordProperties;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_DELTA_DOMAIN,
 *PNETLOGON_DELTA_DOMAIN;
```

SecurityInformation: A SECURITY_INFORMATION structure, as specified in [MS-DTYP] section 2.4.7, that specifies portions of a security descriptor about the domain.

SecuritySize: The size, in bytes, of the **SecurityDescriptor** field.

SecurityDescriptor: A pointer to a SECURITY_DESCRIPTOR structure, as specified in [MS-DTYP] section 2.4.6, that contains the security settings for the domain object.

DomainLockoutInformation: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the domain lockout information detailed in [MS-SAMR]. The **Buffer** field points to the SAMPR_DOMAIN_LOCKOUT_INFORMATION structure, as specified in [MS-SAMR] section 2.2.4.15, and the **Length** and **MaximumLength** fields are set to the size in bytes of the SAMPR_DOMAIN_LOCKOUT_INFORMATION structure pointed to by the **Buffer** field.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

2.2.1.5.11 NETLOGON_DELTA_ENUM

The NETLOGON_DELTA_ENUM structure defines a common structure that encapsulates all possible types of database changes. Database changes, in the context of Netlogon, are called **deltas**.

```
typedef struct _NETLOGON_DELTA_ENUM {
  NETLOGON_DELTA_TYPE DeltaType;
  [switch_is(DeltaType)] NETLOGON_DELTA_ID_UNION DeltaID;
  [switch_is(DeltaType)] NETLOGON_DELTA_UNION DeltaUnion;
} NETLOGON_DELTA_ENUM,
 *PNETLOGON_DELTA_ENUM;
```

DeltaType: One of the values from the NETLOGON_DELTA_TYPE enumeration, as specified in section 2.2.1.5.28.

DeltaID: One of the NETLOGON_DELTA_ID_UNION types selected based on the value of the **DeltaType** field.

DeltaUnion: One of the NETLOGON_DELTA_UNION types selected based on the value of the **DeltaType** field.

2.2.1.5.12 NETLOGON_DELTA_ENUM_ARRAY

The NETLOGON_DELTA_ENUM_ARRAY structure defines an array of delta objects.

```
typedef struct _NETLOGON_DELTA_ENUM_ARRAY {
  DWORD CountReturned;
  [size_is(CountReturned)] PNETLOGON_DELTA_ENUM Deltas;
} NETLOGON_DELTA_ENUM_ARRAY,
 *PNETLOGON_DELTA_ENUM_ARRAY;
```

CountReturned: The number of elements in the Deltas field.

Deltas: An array of NETLOGON_DELTA_ENUM structures, as specified in section 2.2.1.5.11.

2.2.1.5.13 NETLOGON_DELTA_GROUP

The NETLOGON_DELTA_GROUP structure contains information about a SAM group account. This structure is used for replicating the group data from the PDC to a BDC, as detailed in section 3.6.

```
typedef struct  NETLOGON DELTA GROUP {
  RPC_UNICODE_STRING Name;
  unsigned long RelativeId;
  unsigned long Attributes;
  RPC UNICODE STRING AdminComment;
  SECURITY_INFORMATION SecurityInformation;
  unsigned long SecuritySize;
  [size_is(SecuritySize)] unsigned char* SecurityDescriptor;
  RPC_UNICODE_STRING DummyString1;
  RPC UNICODE STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC UNICODE STRING DummyString4;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON DELTA GROUP,
 *PNETLOGON_DELTA_GROUP;
```

Name: A RPC_UNICODE_STRING structure that contains the group name.

RelativeId: The RID for the group.

Attributes: A set of bit flags that describe attributes of the SID. An attribute is true (or set) if its value is equal to 1. The value is constructed from one or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	B	A

Where the bits are defined as:

Value	Description
A	The SID cannot have the **SE_GROUP_ENABLED** attribute removed. Corresponds to the SID attribute **SE_GROUP_MANDATORY**. This attribute prevents the user from disabling the group. Disabling a group causes the group to be ignored by access validation routines. For more information, see [SIDATT].
B	The SID is enabled by default (as opposed to being enabled by an application). Corresponds to the SID attribute **SE_GROUP_ENABLED_BY_DEFAULT**. For more information, see [SIDATT].
C	The SID is enabled for access checks. Corresponds to the SID attribute **SE_GROUP_ENABLED**. For

Value	Description
	more information, see [SIDATT].

All other bits MUST be set to zero and MUST be ignored on receipt.

AdminComment: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains an administrative comment for the group.

SecurityInformation: A SECURITY_INFORMATION structure, as specified in [MS-DTYP] section 2.4.7, that specifies portions of a security descriptor about the group.

SecuritySize: The size, in bytes, of the **SecurityDescriptor** field.

SecurityDescriptor: A pointer to a SECURITY_DESCRIPTOR structure, as specified in [MS-DTYP] section 2.4.6, that contains the security settings of the group object.

DummyString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

2.2.1.5.14 NLPR_LOGON_HOURS

The NLPR_LOGON_HOURS structure contains the logon policy information that specifies when a user account is permitted to authenticate.

```
typedef struct _NLPR_LOGON_HOURS {
  unsigned short UnitsPerWeek;
  [size_is(1260), length_is((UnitsPerWeek + 7)/8)]
    unsigned char* LogonHours;
} NLPR LOGON HOURS,
 *PNLPR_LOGON_HOURS;
```

The fields in this structure have the same meanings as identically named fields of the SAMPR_LOGON_HOURS structure, as specified in [MS-SAMR] section 2.2.7.5.

2.2.1.5.15 NLPR_USER_PRIVATE_INFO

The NLPR_USER_PRIVATE_INFO structure defines a data buffer that is optionally encrypted with the session key, as detailed in this section. The structure is used to carry user account passwords as follows.

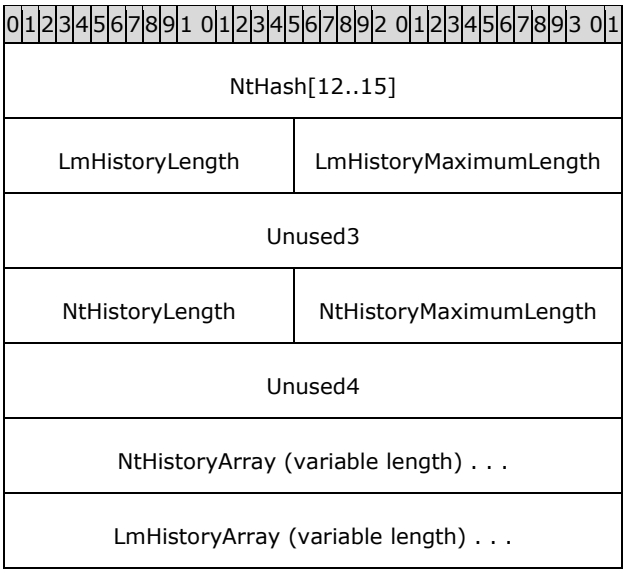
```
typedef struct _NLPR_USER_PRIVATE_INFO {
  unsigned char SensitiveData;
  unsigned long DataLength;
  [size_is(DataLength)] unsigned char* Data;
} NLPR_USER_PRIVATE_INFO,
 *PNLPR_USER_PRIVATE_INFO;
```

SensitiveData: Is either TRUE (0x01) or FALSE (0x00). The **SensitiveData** field indicates whether or not the data is encrypted as follows. If this field is set to 0x00, then the data is not encrypted. If the field is set to 0x01, the data pointed to by the **Data** field is encrypted with the session key used on the secure channel between the client and the server exchanging this data structure to the client. The encryption algorithm is RC4 if the flag C is set in the negotiated flags between the client and the server, as specified in section 3.1.4.2; otherwise the encryption algorithm is DES.

DataLength: The size, in bytes, of the **Data** field.

Data: A pointer to a buffer with a size of **DataLength**. If the **SensitiveData** field is set to TRUE, this data is encrypted as described in the description of the **SensitiveData** field. The buffer content prior to encryption (if any) is shown in the following table.

0 1 2 3 4 5 6 7 8 9 1 0 1 2 3 4 5 6 7 8 9 2 0 1 2 3 4 5 6 7 8 9 3 0 1	
DataType	
LmLength	LmMaximumLength
Unused1	
LmHash[0..3]	
LmHash[4..7]	
LmHash[8..11]	
LmHash[12..15]	
NtLength	NtMaximumLength
Unused2	
NtHash[0..3]	
NtHash[4..7]	
NtHash[8..11]	



DataType: An unsigned integer. This value MUST be 0x00000002.

LmLength: An unsigned (short) integer. This value MUST be either 0x0010 or 0x0000. If 0x0010, the **LmHash** field contains the LM hash of the user password (specified in [MS-NLMP]). If 0x0000, the value of the **LmHash** field is undefined and MUST be ignored upon receipt.

LmMaximumLength: This value MUST be the same value as **LmLength**.

Unused1: This value MUST be zero and ignored on receipt.

LmHash: The encrypted ([MS-SAMR] section 2.2.11.1) LM OWF ([MS-NLMP] section 3.3) of the user password. The 16-byte encryption key is created by concatenating four times the relative ID (from the given user's SID).

NtLength: An unsigned (short) integer. This value MUST be either 0x0010 or 0x0000. If 0x0010, the **NtHash** field contains the NT hash of the user password (specified in [MS-NLMP]). If 0x0000, the value of the **NtHash** field is undefined and MUST be ignored upon receipt.

NtMaximumLength: This value MUST be the same value as **NtLength**.

Unused2: This value SHOULD be zero and ignored on receipt.

NtHash: The encrypted ([MS-SAMR] section 2.2.11.1) NT OWF ([MS-NLMP] section 3.3) of the user password. The 16-byte encryption key is created by concatenating four times the relative ID (from the given user's SID).

LmHistoryLength: An unsigned (short) integer. This value is the length, in bytes, of the **LmHistoryArray** field.

LmHistoryMaximumLength: This value MUST be the same value as **LmHistoryLength**.

Unused3: This value SHOULD be zero and ignored on receipt.

NtHistoryLength: An unsigned (short) integer. This value is the length, in bytes, of the **NtHistoryArray** field.

NtHistoryMaximumLength: This value MUST be the same value as **NtHistoryLength**.

Unused4: This value SHOULD be zero and ignored on receipt.

NtHistoryArray: An array of NT hash values of user passwords for the given user. The array is ordered so that the first element is the hash of the current password and the last element is the hash of the oldest password.

Note The number of elements in the array is the value of the **NtHistoryLength** field divided by 0x0010.

LmHistoryArray: An array of LM hash values of user passwords for the given user. The array is ordered so that the first element is the hash of the current password and the last element is the hash of the oldest password.

Note The number of elements in the array is the value of the **LmHistoryLength** field divided by 0x0010.

2.2.1.5.16 NETLOGON_DELTA_USER

The NETLOGON_DELTA_USER structure contains information about a SAM user account. This structure is used for replicating the user account data from the PDC to a BDC, as detailed in section 3.6.

All fields of this structure, except the fields detailed following the structure definition, have the same meanings as the identically named fields in the Common User Fields, as specified in [MS-SAMR] section 2.2.7.1 and the SAMPR_USER_INTERNAL1_INFORMATION structure fields, as specified in [MS-SAMR] section 2.2.7.23.

```
typedef struct _NETLOGON_DELTA_USER {
  RPC_UNICODE_STRING UserName;
  RPC_UNICODE_STRING FullName;
  unsigned long UserId;
  unsigned long PrimaryGroupId;
  RPC_UNICODE_STRING HomeDirectory;
  RPC_UNICODE_STRING HomeDirectoryDrive;
  RPC_UNICODE_STRING ScriptPath;
  RPC_UNICODE_STRING AdminComment;
  RPC_UNICODE_STRING WorkStations;
  OLD_LARGE_INTEGER LastLogon;
  OLD_LARGE_INTEGER LastLogoff;
  NLPR_LOGON_HOURS LogonHours;
  unsigned short BadPasswordCount;
  unsigned short LogonCount;
  OLD_LARGE_INTEGER PasswordLastSet;
  OLD_LARGE_INTEGER AccountExpires;
  unsigned long UserAccountControl;
  ENCRYPTED_NT_OWF_PASSWORD EncryptedNtOwfPassword;
  ENCRYPTED_LM_OWF_PASSWORD EncryptedLmOwfPassword;
  unsigned char NtPasswordPresent;
  unsigned char LmPasswordPresent;
  unsigned char PasswordExpired;
  RPC_UNICODE_STRING UserComment;
  RPC_UNICODE_STRING Parameters;
  unsigned short CountryCode;
  unsigned short CodePage;
  NLPR_USER_PRIVATE_INFO PrivateData;
  SECURITY_INFORMATION SecurityInformation;
  unsigned long SecuritySize;
  [size_is(SecuritySize)] unsigned char* SecurityDescriptor;
  RPC_UNICODE_STRING ProfilePath;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_DELTA_USER,
```

```
*PNETLOGON_DELTA_USER;
```

PrivateData: An NLPR_USER_PRIVATE_INFO structure, as specified in section 2.2.1.5.15, containing the **PrivateData** field of the SAMPR_USER_INFORMATION structure, as specified in [MS-SAMR] section 2.2.7.6.

SecurityInformation: A SECURITY_INFORMATION structure, as specified in [MS-DTYP] section 2.4.7, that specifies portions of a security descriptor about the user account.

SecuritySize: The size, in bytes, of **SecurityDescriptor**.

SecurityDescriptor: A pointer to a SECURITY_DESCRIPTOR structure, as specified in [MS-DTYP] section 2.4.6, that specifies the security settings for the user account object.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong1: The high part (the first 32 bits) of the **LastBadPasswordTime** field of the SAMPR_USER_INTERNAL3_INFORMATION structure, as specified in [MS-SAMR] section 2.2.7.7.

DummyLong2: The high part (the first 32 bits) of the **LastBadPasswordTime** field of the SAMPR_USER_INTERNAL3_INFORMATION structure, as specified in [MS-SAMR] section 2.2.7.7.

DummyLong3: The high part (the first 32 bits) of the **LastBadPasswordTime** field of the SAMPR_USER_INTERNAL3_INFORMATION structure, as specified in [MS-SAMR] section 2.2.7.7.

DummyLong4: The high part (the first 32 bits) of the **LastBadPasswordTime** field of the SAMPR_USER_INTERNAL3_INFORMATION structure, as specified in [MS-SAMR] section 2.2.7.7.

2.2.1.5.17 NETLOGON_DELTA_GROUP_MEMBER

The NETLOGON_DELTA_GROUP_MEMBER structure contains information about members of a group by providing pointers to a list of group members and their respective attributes. This structure is used to replicate the group membership data from the PDC to a BDC, as detailed in section 3.6.

All fields of this structure, except the fields detailed following the structure definition, have the same meanings as the identically named fields of the SAMPR_GET_MEMBERS_BUFFER structure, as specified in [MS-SAMR] section 2.2.3.14. The last four fields of the structure (DummyLong1, DummyLong2, DummyLong3, and DummyLong4) are not found in [MS-SAMR].

```
typedef struct _NETLOGON_DELTA_GROUP_MEMBER {
  [size_is(MemberCount)] unsigned long* Members;
  [size_is(MemberCount)] unsigned long* Attributes;
  unsigned long MemberCount;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_DELTA_GROUP_MEMBER,
 *PNETLOGON_DELTA_GROUP_MEMBER;
```

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is specified in section 1.3.8.1.3.

2.2.1.5.18 NETLOGON_DELTA_ID_UNION

The NETLOGON_DELTA_ID_UNION union defines an account identifier type that is selected based on the requested database change.

```
typedef
[switch_type(NETLOGON_DELTA_TYPE)]
union _NETLOGON_DELTA_ID_UNION {
  [case(AddOrChangeDomain, AddOrChangeGroup, DeleteGroup, RenameGroup, AddOrChangeUser,
DeleteUser, RenameUser, ChangeGroupMembership, AddOrChangeAlias, DeleteAlias,
RenameAlias, ChangeAliasMembership, DeleteGroupByName, DeleteUserByName)]
    unsigned long Rid;
  [case(AddOrChangeLsaPolicy, AddOrChangeLsaTDomain, DeleteLsaTDomain,
AddOrChangeLsaAccount, DeleteLsaAccount)]
    PRPC_SID Sid;
  [case(AddOrChangeLsaSecret, DeleteLsaSecret)]
    [string] wchar_t* Name;
  [default]     ;
} NETLOGON_DELTA_ID_UNION,
 *PNETLOGON_DELTA_ID_UNION;
```

Rid: A 32-bit RID whose type is selected when the following delta types are switched: AddOrChangeDomain(1), AddOrChangeGroup(2), RenameGroup(4), DeleteGroup(3), AddOrChangeUser(5), DeleteUser(6), RenameUser(7), ChangeGroupMembership(8), AddOrChangeAlias(9), DeleteAlias(10), RenameAlias(11), ChangeAliasMembership(12), DeleteGroupByName(20), and DeleteUserByName(21).

Sid: A pointer to a SID whose type is selected when the following delta types are switched: AddOrChangeLsaPolicy(13), AddOrChangeLsaDomain(14), DeleteLsaTDomain(15), AddOrChangeLsaAccount(16), and DeleteLsaAccount(17).

Name: A null-terminated Unicode string that contains an identifier name. This identifier type is selected when the following delta types are switched: AddOrChangeLsaSecret(18) and DeleteLsaSecret(19).

2.2.1.5.19 NETLOGON_DELTA_POLICY

The NETLOGON_DELTA_POLICY structure contains information about the LSA policy. This structure is used for replicating the LSA policy data from the PDC to a BDC, as detailed in section 3.6.

```
typedef struct _NETLOGON_DELTA_POLICY {
  unsigned long MaximumLogSize;
  OLD_LARGE_INTEGER AuditRetentionPeriod;
  unsigned char AuditingMode;
  unsigned long MaximumAuditEventCount;
  [size_is(MaximumAuditEventCount + 1)]
    unsigned long* EventAuditingOptions;
  RPC_UNICODE_STRING PrimaryDomainName;
  PRPC_SID PrimaryDomainSid;
```

```
    NLPR_QUOTA_LIMITS QuotaLimits;
    OLD_LARGE_INTEGER ModifiedId;
    OLD_LARGE_INTEGER DatabaseCreationTime;
    SECURITY_INFORMATION SecurityInformation;
    unsigned long SecuritySize;
    [size is(SecuritySize)] unsigned char* SecurityDescriptor;
    RPC_UNICODE_STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    unsigned long DummyLong1;
    unsigned long DummyLong2;
    unsigned long DummyLong3;
    unsigned long DummyLong4;
  } NETLOGON_DELTA_POLICY,
   *PNETLOGON_DELTA_POLICY;
```

MaximumLogSize: This field has the same meaning as the identically named field of the POLICY_AUDIT_LOG_INFO structure, as specified in [MS-LSAD] section 2.2.4.3.

AuditRetentionPeriod: This field has the same meaning as the identically named field of the POLICY_AUDIT_LOG_INFO structure, as specified in [MS-LSAD] section 2.2.4.3.

AuditingMode: This field has the same meaning as the identically named field of the LSAPR_POLICY_AUDIT_EVENTS_INFO structure, as specified in [MS-LSAD] section 2.2.4.4.

MaximumAuditEventCount: This field has the same meaning as the identically named field of the LSAPR_POLICY_AUDIT_EVENTS_INFO structure, as specified in [MS-LSAD] section 2.2.4.4.

EventAuditingOptions: This field has the same meaning as the identically named field of the LSAPR_POLICY_AUDIT_EVENTS_INFO structure, as specified in [MS-LSAD] section 2.2.4.4.

PrimaryDomainName: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the NetBIOS name of the primary domain.

PrimaryDomainSid: A pointer to the SID for the primary domain.

QuotaLimits: An NLPR_QUOTA_LIMITS structure, as specified in section 2.2.1.5.2, that contains information about system resource quotas imposed on an account.

ModifiedId: An OLD_LARGE_INTEGER structure, as specified in [MS-SAMR] section 2.2.2.2, that contains the count that is incremented each time the database is modified. This count is the database serial number for the database.

DatabaseCreationTime: A 64-bit time stamp, equivalent to a **FILETIME**, specifying when the database was created.

SecurityInformation: A SECURITY_INFORMATION bit flag that contains security information about the policy. For details about SECURITY_INFORMATION structure, see [MS-DTYP] section 2.4.7.

SecuritySize: The size, in bytes, of the **SecurityDescriptor** field.

SecurityDescriptor: A pointer to a SECURITY_DESCRIPTOR structure, as specified in [MS-DTYP] section 2.4.6, that describes the security settings for the LSA policy object.

DummyString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

2.2.1.5.20 NLPR_CR_CIPHER_VALUE

The NLPR_CR_CIPHER_VALUE structure defines an encrypted string buffer that contains the value of an LSA Secret Object as specified in [MS-LSAD].

```
typedef struct _NLPR_CR_CIPHER_VALUE {
  unsigned long Length;
  unsigned long MaximumLength;
  [size_is(MaximumLength), length_is(Length)]
    unsigned char* Buffer;
} NLPR_CR_CIPHER_VALUE,
 *PNLPR_CR_CIPHER_VALUE;
```

Length: The length, in bytes, of the used portion of the buffer.

MaximumLength: The maximum length, in bytes, of the buffer.

Buffer: A pointer to a buffer that contains the secret data encrypted with the session key used on the secure channel between the client and the server exchanging this data structure. The encryption algorithm is RC4 if the flag C is set in the negotiated flags between the client and the server as detailed in section 3.1.4.2; otherwise the encryption algorithm is DES.

2.2.1.5.21 NETLOGON_DELTA_SECRET

The NETLOGON_DELTA_SECRET structure contains information about the LSA secret object, as specified in [MS-LSAD]. This structure is used to replicate the LSA secret object data from the PDC to a BDC, as detailed in section 3.6.

```
typedef struct _NETLOGON_DELTA_SECRET {
  NLPR_CR_CIPHER_VALUE CurrentValue;
  OLD_LARGE_INTEGER CurrentValueSetTime;
  NLPR_CR_CIPHER_VALUE OldValue;
  OLD_LARGE_INTEGER OldValueSetTime;
  SECURITY_INFORMATION SecurityInformation;
  unsigned long SecuritySize;
  [size_is(SecuritySize)] unsigned char* SecurityDescriptor;
  RPC_UNICODE_STRING DummyString1;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long DummyLong1;
```

```
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_DELTA_SECRET,
 *PNETLOGON_DELTA_SECRET;
```

CurrentValue: An NLPR_CR_CIPHER_VALUE structure, as specified in section 2.2.1.5.20, that contains the encrypted current value of the LSA secret.

CurrentValueSetTime: A 64-bit time stamp, equivalent to a **FILETIME**, at which the current value of the LSA secret object was set.

OldValue: An NLPR_CR_CIPHER_VALUE structure, as specified in section 2.2.1.5.20, that contains the encrypted previous (old) value of the LSA secret.

OldValueSetTime: A 64-bit time stamp, equivalent to a **FILETIME**, at which the previous value of the LSA secret object was set.

SecurityInformation: A SECURITY_INFORMATION structure, as specified in [MS-DTYP] section 2.4.7, that specifies portions of a security descriptor about the secret object.

SecuritySize: The size, in bytes, of the **SecurityDescriptor** member.

SecurityDescriptor: A pointer to a SECURITY_DESCRIPTOR structure, as specified in [MS-DTYP] section 2.4.6 that describes the security settings for the LSA secret object.

DummyString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

2.2.1.5.22 NETLOGON_DELTA_TRUSTED_DOMAINS

The NETLOGON_DELTA_TRUSTED_DOMAINS structure contains information about a trusted domain. This structure is used for replicating the trusted domain data from the PDC to a BDC.

```
typedef struct _NETLOGON_DELTA_TRUSTED_DOMAINS {
  RPC_UNICODE_STRING DomainName;
  unsigned long NumControllerEntries;
  [size_is(NumControllerEntries)]
    PRPC_UNICODE_STRING ControllerNames;
  SECURITY_INFORMATION SecurityInformation;
  unsigned long SecuritySize;
  [size_is(SecuritySize)] unsigned char* SecurityDescriptor;
  RPC_UNICODE_STRING DummyString1;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long TrustedPosixOffset;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_DELTA_TRUSTED_DOMAINS,
 *PNETLOGON_DELTA_TRUSTED_DOMAINS;
```

DomainName: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the NetBIOS name of the trusted domain.

NumControllerEntries: Number of domain controller (DC) names listed in the **ControllerNames** field.<55>

ControllerNames: Pointer to an array of RPC_UNICODE_STRING structures, as specified in [MS-DTYP] section 2.3.10, that contain the NetBIOS names of the DCs in the trusted domain. The only restriction is the maximum value of the 32-bit unsigned integer enforced by RPC.<56>

SecurityInformation: A SECURITY_INFORMATION structure, as specified in [MS-DTYP] section 2.4.7, that specifies portions of a security descriptor about the trusted domain.

SecuritySize: Size, in bytes, of the **SecurityDescriptor** field.

SecurityDescriptor: Pointer to a SECURITY_DESCRIPTOR structure, as specified in [MS-DTYP] section 2.4.6 that describes the security settings for the trusted domain object.

DummyString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

TrustedPosixOffset: The value that contains the POSIX offset for the trusted domain, as specified in [MS-ADTS] section 6.1.6.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

2.2.1.5.23 NETLOGON_RENAME_ALIAS

The NETLOGON_RENAME_ALIAS structure specifies a rename of an alias.

```
typedef struct _NETLOGON_DELTA_RENAME_ALIAS {
  RPC_UNICODE_STRING OldName;
  RPC_UNICODE_STRING NewName;
  RPC_UNICODE_STRING DummyString1;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_RENAME_ALIAS,
 *PNETLOGON_DELTA_RENAME_ALIAS;
```

OldName: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the previous name of the alias.

NewName: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the new name to assign to the alias.

DummyString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

2.2.1.5.24 NETLOGON_RENAME_GROUP

The NETLOGON_RENAME_GROUP structure specifies a rename of a group.

```
typedef struct _NETLOGON_DELTA_RENAME_GROUP {
```

```
  RPC_UNICODE_STRING OldName;
  RPC_UNICODE_STRING NewName;
  RPC_UNICODE_STRING DummyString1;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
  unsigned long DummyLong4;
} NETLOGON_RENAME_GROUP,
 *PNETLOGON_DELTA_RENAME_GROUP;
```

OldName: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the group's previous name.

NewName: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the new name to assign to the group.

DummyString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

2.2.1.5.25 NETLOGON_RENAME_USER

The NETLOGON_RENAME_USER structure specifies a rename of a user account.

```
typedef struct  NETLOGON_DELTA_RENAME_USER {
  RPC_UNICODE_STRING OldName;
  RPC_UNICODE_STRING NewName;
  RPC_UNICODE_STRING DummyString1;
  RPC_UNICODE_STRING DummyString2;
  RPC_UNICODE_STRING DummyString3;
  RPC_UNICODE_STRING DummyString4;
  unsigned long DummyLong1;
  unsigned long DummyLong2;
  unsigned long DummyLong3;
```

```
  unsigned long DummyLong4;
} NETLOGON_RENAME_USER,
 *PNETLOGON_DELTA_RENAME_USER;
```

OldName: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the user account's previous name.

NewName: An RPC_UNICODE_STRING structure, as specified in [MS-DTYP] section 2.3.10, that contains the new name to assign to the user account.

DummyString1: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString2: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString3: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyString4: MUST contain 0 for the **Length** field, 0 for the **MaximumLength** field, and NULL for the **Buffer** field. It is ignored upon receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong1: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong2: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong3: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

DummyLong4: MUST be set to zero and MUST be ignored on receipt. The Netlogon usage of dummy fields is described in section 1.3.8.1.3.

2.2.1.5.26 NLPR_MODIFIED_COUNT

The NLPR_MODIFIED_COUNT structure specifies a count for the number of times an account's database has been modified.

```
typedef struct _NLPR_MODIFIED_COUNT {
  OLD LARGE INTEGER ModifiedCount;
} NLPR MODIFIED COUNT,
 *PNLPR_MODIFIED_COUNT;
```

ModifiedCount: An OLD_LARGE_INTEGER structure, as specified in [MS-SAMR] section 2.2.2.2, that contains the number of modifications made to the database since its creation. This value is the database serial number.

2.2.1.5.27 NETLOGON_DELTA_UNION

The NETLOGON_DELTA_UNION union defines a union of all types of database changes (deltas).

```
typedef
[switch_type(NETLOGON_DELTA_TYPE)]
```

```
union _NETLOGON_DELTA_UNION {
  [case(AddOrChangeDomain)]
    PNETLOGON_DELTA_DOMAIN DeltaDomain;
  [case(AddOrChangeGroup)]
    PNETLOGON_DELTA_GROUP DeltaGroup;
  [case(RenameGroup)]
    PNETLOGON_DELTA_RENAME_GROUP DeltaRenameGroup;
  [case(AddOrChangeUser)]
    PNETLOGON_DELTA_USER DeltaUser;
  [case(RenameUser)]
    PNETLOGON DELTA RENAME USER DeltaRenameUser;
  [case(ChangeGroupMembership)]
    PNETLOGON_DELTA_GROUP_MEMBER DeltaGroupMember;
  [case(AddOrChangeAlias)]
    PNETLOGON_DELTA_ALIAS DeltaAlias;
  [case(RenameAlias)]
    PNETLOGON DELTA RENAME ALIAS DeltaRenameAlias;
  [case(ChangeAliasMembership)]
    PNETLOGON DELTA ALIAS MEMBER DeltaAliasMember;
  [case(AddOrChangeLsaPolicy)]
    PNETLOGON_DELTA_POLICY DeltaPolicy;
  [case(AddOrChangeLsaTDomain)]
    PNETLOGON DELTA TRUSTED DOMAINS DeltaTDomains;
  [case(AddOrChangeLsaAccount)]
    PNETLOGON_DELTA_ACCOUNTS DeltaAccounts;
  [case(AddOrChangeLsaSecret)]
    PNETLOGON_DELTA_SECRET DeltaSecret;
  [case(DeleteGroupByName)]
    PNETLOGON DELTA DELETE GROUP DeltaDeleteGroup;
  [case(DeleteUserByName)]
    PNETLOGON DELTA DELETE USER DeltaDeleteUser;
  [case(SerialNumberSkip)]
    PNLPR_MODIFIED_COUNT DeltaSerialNumberSkip;
  [default]     ;
} NETLOGON DELTA UNION,
 *PNETLOGON_DELTA_UNION;
```

DeltaDomain: A pointer to a NETLOGON_DELTA_DOMAIN structure, as specified in section 2.2.1.5.10, that describes a domain. This structure is selected when the delta type is AddOrChangeDomain.

DeltaGroup: A pointer to a NETLOGON_DELTA_GROUP structure, as specified in section 2.2.1.5.13, that describes a group account. This structure is selected when the delta type is AddOrChangeGroup.

DeltaRenameGroup: A pointer to a NETLOGON_RENAME_GROUP structure, as specified in section 2.2.1.5.24, that describes a rename of a group account. This structure is selected when the delta type is RenameGroup.

DeltaUser: A pointer to a NETLOGON_DELTA_USER structure, as specified in section 2.2.1.5.16, that describes a domain user account. This structure is selected when the delta type is AddOrChangeUser.

DeltaRenameUser: A pointer to a NETLOGON_RENAME_USER structure, as specified in section 2.2.1.5.25, that describes a rename of a user account. This structure is selected when the delta type is RenameUser.

DeltaGroupMember: A pointer to a NETLOGON_DELTA_GROUP_MEMBER structure, as specified in section 2.2.1.5.17, that describes a group membership. This structure is selected when the delta type is ChangeGroupMembership.

DeltaAlias: A pointer to a NETLOGON_DELTA_ALIAS structure, as specified in section 2.2.1.5.4, that describes an alias. This structure is selected when the delta type is AddOrChangeAlias.

DeltaRenameAlias: A pointer to a NETLOGON_RENAME_ALIAS structure, as specified in section 2.2.1.5.23, that describes a rename of an alias. This structure is selected when the delta type is RenameAlias.

DeltaAliasMember: A pointer to a NETLOGON_DELTA_ALIAS_MEMBER structure, as specified in section 2.2.1.5.7, that describes an alias membership. This structure is selected when the delta type is ChangeAliasMembership.

DeltaPolicy: A pointer to a NETLOGON_DELTA_POLICY structure, as specified in section 2.2.1.5.19, that describes an LSA policy. This structure is selected when the delta type is AddOrChangeLsaPolicy.

DeltaTDomains: A pointer to a NETLOGON_DELTA_TRUSTED_DOMAINS structure, as specified in section 2.2.1.5.22, that describes a trusted domain. This structure is selected when the delta type is AddOrChangeLsaTDomain.

DeltaAccounts: A pointer to a NETLOGON_DELTA_ACCOUNTS structure, as specified in section 2.2.1.5.3, that describes an LSA account. This structure is selected when the delta type is AddOrChangeLsaAccount.

DeltaSecret: A pointer to a NETLOGON_DELTA_SECRET structure, as specified in section 2.2.1.5.21, that describes a LSA secret object as detailed in [MS-LSAD]. This structure is selected when the delta type is AddOrChangeLsaSecret.

DeltaDeleteGroup: A pointer to a NETLOGON_DELTA_DELETE_GROUP structure, as specified in section 2.2.1.5.8, that describes a group account deletion. This structure is selected when the delta type is DeleteGroupByName.

DeltaDeleteUser: A pointer to a NETLOGON_DELTA_DELETE_USER structure, as specified in section 2.2.1.5.9, that describes a user account deletion. This structure is selected when the delta type is DeleteUserByName.

DeltaSerialNumberSkip: A pointer to an NLPR_MODIFIED_COUNT structure, as specified in section 2.2.1.5.26, that holds the database serial number. This structure is selected when the delta type is SerialNumberSkip.

2.2.1.5.28 NETLOGON_DELTA_TYPE

The NETLOGON_DELTA_TYPE enumeration defines an enumerated set of possible database changes.

```
typedef  enum _NETLOGON_DELTA_TYPE
{
  AddOrChangeDomain = 1,
  AddOrChangeGroup = 2,
  DeleteGroup = 3,
  RenameGroup = 4,
  AddOrChangeUser = 5,
  DeleteUser = 6,
  RenameUser = 7,
  ChangeGroupMembership = 8,
  AddOrChangeAlias = 9,
  DeleteAlias = 10,
  RenameAlias = 11,
  ChangeAliasMembership = 12,
  AddOrChangeLsaPolicy = 13,
  AddOrChangeLsaTDomain = 14,
  DeleteLsaTDomain = 15,
  AddOrChangeLsaAccount = 16,
  DeleteLsaAccount = 17,
  AddOrChangeLsaSecret = 18,
  DeleteLsaSecret = 19,
  DeleteGroupByName = 20,
  DeleteUserByName = 21,
```

```
  SerialNumberSkip = 22
} NETLOGON_DELTA_TYPE;
```

AddOrChangeDomain: Adds or changes a domain Security Account Manager (SAM) account.

AddOrChangeGroup: Adds or changes a group SAM account.

DeleteGroup: Deletes a group SAM account.

RenameGroup: Renames a group SAM account.

AddOrChangeUser: Adds or changes a user SAM account.

DeleteUser: Deletes a user SAM account.

RenameUser: Renames a user SAM account.

ChangeGroupMembership: Changes a group membership record.

AddOrChangeAlias: Adds or changes an alias.

DeleteAlias: Deletes an alias.

RenameAlias: Renames an alias.

ChangeAliasMembership: Changes the membership record for an alias.

AddOrChangeLsaPolicy: Adds or changes an LSA policy.

AddOrChangeLsaTDomain: Adds or changes a trusted **domain account**.

DeleteLsaTDomain: Deletes a trusted domain account.

AddOrChangeLsaAccount: Adds or changes an LSA user or machine account.

DeleteLsaAccount: Deletes an LSA user or machine account.

AddOrChangeLsaSecret: Adds or changes an LSA encrypted data block.

DeleteLsaSecret: Deletes an LSA encrypted data block.

DeleteGroupByName: Deletes a group account based on a string name.<57>

DeleteUserByName: Deletes a user account based on a string name.<58>

SerialNumberSkip: Updates the database serial number.<59>

2.2.1.5.29 SYNC_STATE

The SYNC_STATE enumeration tracks the progress of synchronization of the database between BDCs and PDCs. Synchronization is initiated by the client calling NetrDatabaseSync2 (section 3.5.4.6.2). All references to *SyncContext* in the following synchronization state descriptions refer to the *SyncContext* parameter in that method.

```
typedef  enum _SYNC_STATE
{
  NormalState = 0,
  DomainState = 1,
  GroupState = 2,
  UasBuiltInGroupState = 3,
  UserState = 4,
```

```
  GroupMemberState = 5,
  AliasState = 6,
  AliasMemberState = 7,
  SamDoneState = 8
} SYNC_STATE,
 *PSYNC_STATE;
```

NormalState: A state that MUST be used unless the current synchronization is the restart of a full synchronization.

DomainState: The *SyncContext* parameter is the domain RID with which to continue.

GroupState: The *SyncContext* parameter is the global group RID with which to continue.

UasBuiltInGroupState: Not used.

UserState: The *SyncContext* parameter is the user RID with which to continue.

GroupMemberState: The *SyncContext* parameter is the global group RID with which to continue.

AliasState: The *SyncContext* parameter MUST have a value of 0, indicating synchronization restarts at the first database alias and that AddOrChangeAlias (see NETLOGON_DELTA_TYPE enumeration, 2.2.1.5.28) was the last account change being performed prior to the restart.

AliasMemberState: The *SyncContext* parameter MUST have a value of 0, indicating synchronization restarts at the first database alias and that ChangeAliasMembership (see NETLOGON_DELTA_TYPE enumeration, 2.2.1.5.28) was the last account change being performed prior to the restart.

SamDoneState: The database has finished synchronization.

2.2.1.6 Domain Trust Structures

Structures in this group are used for retrieving trust information as outlined in section 1.3.

2.2.1.6.1 DOMAIN_NAME_BUFFER

The DOMAIN_NAME_BUFFER structure defines information returned by the NetrEnumerateTrustedDomains method, as specified in section 3.5.4.7.3. The structure is used to describe a set of trusted domain names.

```
typedef struct _DOMAIN_NAME_BUFFER {
  unsigned long DomainNameByteCount;
  [unique, size_is(DomainNameByteCount)]
    unsigned char* DomainNames;
} DOMAIN_NAME_BUFFER,
 *PDOMAIN_NAME_BUFFER;
```

DomainNameByteCount: The size, in bytes, of the buffer pointed to by the **DomainNames** field, including all UTF-16 null characters.

DomainNames: The Unicode string buffer that contains the list of trusted domains. The list format is a UTF-16 string composed of one or more substrings. Each substring is separated from adjacent substrings by the UTF-16 null character, 0x0000. After the final substring, the string is terminated by two UTF-16 null characters.

For example, if there are three trusted domains, DOMAIN1, DOMAIN2, and DOMAIN3, the **DomainNames** string buffer would have the following form:

DOMAIN1<null>DOMAIN2<null>DOMAIN3<null><null>

where <null> is the UTF-16 null character, 0x0000.

2.2.1.6.2 DS_DOMAIN_TRUSTSW

The DS_DOMAIN_TRUSTSW structure defines information about a domain trust. It is part of the NETLOGON_TRUSTED_DOMAIN_ARRAY structure returned by the DsrEnumerateDomainTrusts method, as specified in section 3.5.4.7.1. This structure contains naming information and trust-related information for a specific trusted domain.<60>

```
typedef struct _DS_DOMAIN_TRUSTSW {
  [string] wchar_t* NetbiosDomainName;
  [string] wchar_t* DnsDomainName;
  unsigned long Flags;
  unsigned long ParentIndex;
  unsigned long TrustType;
  unsigned long TrustAttributes;
  PRPC_SID DomainSid;
  GUID DomainGuid;
} DS_DOMAIN_TRUSTSW,
 *PDS_DOMAIN_TRUSTSW;
```

NetbiosDomainName: A pointer to a null-terminated Unicode string that contains the NetBIOS name of the trusted domain.

DnsDomainName: A pointer to a null-terminated Unicode string that contains the fully qualified domain name (FQDN) (2) of the trusted domain.

Flags: A set of bit flags that defines the domain trust attributes. A flag is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	F	E	D	C	B	A

Where the bits are defined as:

Value	Description
A	Domain is a member of a forest.
B	Domain is directly trusted by the current domain.
C	Domain is the root of a forests.
D	Domain is the primary domain of the queried server.
E	Primary domain is running in native mode.
F	Domain directly trusts the current domain.

All other bits MUST be set to zero and MUST be ignored on receipt.

ParentIndex: An integer value that contains the index in the NETLOGON_TRUSTED_DOMAIN_ARRAY array (returned by the DsrEnumerateDomainTrusts method) that corresponds to the parent domain of the domain represented by this structure. This field is only set if all of the following conditions are met:

- The A flag was specified in the *Flags* parameter of the DsrEnumerateDomainTrusts method.
- The **Flags** field of this structure, DS_DOMAIN_TRUSTSW, does not contain the C flag.

Otherwise, it MUST be set to zero and MUST be ignored.

TrustType: An integer value that describes the type of domain with which the trust is associated. **TrustType** MUST be one of the following values.

Value	Meaning
0x00000001	Trust is with a Windows NT Domain.<61>
0x00000002	Trust is with a Windows Active Directory-based Domain.<62>
0x00000003	Trust is with an MIT Kerberos realm.
0x00000004	Trust is with a Distributed Computing Environment (DCE) realm.

All other values MUST be ignored on receipt.

TrustAttributes: A set of bit flags describing trust link attributes. A flag is true (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table, with the exception that bit F cannot be combined with E or D.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	I	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G	F	E	D	C	B	A

Where the bits are defined as:

Value	Description
A	Trust link MUST NOT allow transitivity.
B	Trust link is valid only for Windows 2000, Windows XP, Windows Server 2003, Windows Vista, and Windows Server 2008 domains.
C	Trust link MUST be set for SID filtering of the client domain. For details about SID filtering, see [MS-PAC].
D	Trust link can contain **forest trust information**.
E	Trust link is to either a domain or a forest that is not part of the **enterprise network**.
F	Trust link is internal to the forest.
G	Trust is to be treated as external for trust boundary purposes.

Value	Description
H	Domain is parent domain.
I	Domain is root of another forest.

All other bits MUST be set to zero and MUST be ignored on receipt.

DomainSid: A pointer to an SID structure that identifies the current domain. If the **TrustType** field is set to C or D, the value is 0.

DomainGuid: A GUID that identifies the current domain.

2.2.1.6.3 NETLOGON_TRUSTED_DOMAIN_ARRAY

The NETLOGON_TRUSTED_DOMAIN_ARRAY structure defines information returned by the NetrEnumerateTrustedDomainsEx method, as specified in section 3.5.4.7.2.<63> It contains an array of DS_DOMAIN_TRUSTSW structures, as specified in section 2.2.1.6.2, that describe domains trusted by the server processing the call.

```
typedef struct _NETLOGON_TRUSTED_DOMAIN_ARRAY {
  DWORD DomainCount;
  [size_is(DomainCount)] PDS_DOMAIN_TRUSTSW Domains;
} NETLOGON_TRUSTED_DOMAIN_ARRAY,
 *PNETLOGON_TRUSTED_DOMAIN_ARRAY;
```

DomainCount: The number of entries in the **Domains** field.

Domains: The data structure that contains an array of DS_DOMAIN_TRUSTSW structures, as specified in section 2.2.1.6.2, that represent trusted domains.

2.2.1.6.4 NL_GENERIC_RPC_DATA

The NL_GENERIC_RPC_DATA structure defines a format for marshaling arrays of unsigned long values and Unicode strings, by value, over RPC.<64> The NL_GENERIC_RPC_DATA structure can be used to transmit generic data over RPC from the server to a client.

```
typedef struct _NL_GENERIC_RPC_DATA {
  unsigned long UlongEntryCount;
  [size_is(UlongEntryCount)] unsigned long* UlongData;
  unsigned long UnicodeStringEntryCount;
  [size_is(UnicodeStringEntryCount)]
    PRPC_UNICODE_STRING UnicodeStringData;
} NL_GENERIC_RPC_DATA,
 *PNL_GENERIC_RPC_DATA;
```

UlongEntryCount: The number of entries in **UlongData**.

UlongData: A pointer to an array of unsigned 32-bit integer values.

UnicodeStringEntryCount: The number of entries in **UnicodeStringData**.

UnicodeStringData: A pointer to an array of Unicode string structures.

2.2.1.7 Administrative Services Structures

Structures in this group are used to query and control Netlogon behavior, as outlined in section 1.3.

2.2.1.7.1 NETLOGON_CONTROL_DATA_INFORMATION

The NETLOGON_CONTROL_DATA_INFORMATION union is used as input to the NetrLogonControl2 method, as specified in section 3.5.4.9.2, and the NetrLogonControl2Ex method, as specified in section 3.5.4.9.1. This union selects a data type, based on the FunctionCode parameter passed to the method. For details about FunctionCode values, see NetrLogonControl2Ex, section 3.5.4.9.1.

```
typedef
[switch_type(DWORD)]
union  NETLOGON CONTROL DATA INFORMATION {
  [case(5,6,9,10)]
    [string] wchar_t* TrustedDomainName;
  [case(65534)]
    DWORD DebugFlag;
  [case(8)]
    [string] wchar_t* UserName;
  [default]     ;
} NETLOGON_CONTROL_DATA_INFORMATION,
 *PNETLOGON_CONTROL_DATA_INFORMATION;
```

TrustedDomainName: A pointer to a null-terminated Unicode string that contains a trusted domain name. Switched on the DWORD ([MS-DTYP] section 2.2.9) values 0x00000005, 0x00000006, 0x00000009, and 0x0000000A. The DWORD values are equivalent to FunctionCode values. For a complete list of the Netlogon function codes and their associated meanings, see NetrLogonControl2Ex, section 3.5.4.9.1.

DebugFlag: A DWORD that contains an implementation-specific debug flag. Switched on the value 0x0000FFFE.

UserName: A pointer to null-terminated Unicode string that contains a user name. Switched on the DWORD value 0x00000008.

2.2.1.7.2 NETLOGON_INFO_1

The NETLOGON_INFO_1 structure defines information returned as part of an administrative query, as detailed in the description of the NetrLogonControl2Ex method in section 3.5.4.9.1. This structure is used to convey information about the state and properties of the secure channel to a DC in the primary domain of the queried server. Additionally, for Windows NT 4.0 backup domain controllers, this structure contains information about the state of the database synchronization.

```
typedef struct _NETLOGON_INFO_1 {
  DWORD netlog1_flags;
  NET_API_STATUS netlog1_pdc_connection_status;
} NETLOGON_INFO_1,
 *PNETLOGON_INFO_1;
```

netlog1_flags: A set of bit flags that have the following meanings. A flag is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G	F	E	D	C	B	A

The flags are defined in the following table.<65>

Value	Description
A	One of the databases is out-of-date, and replication is needed.<66>
B	At least one of the databases is currently being replicated.<67>
C	At least one of the databases requires a full synchronization update.<68>
D	At least one database record requires an update.<69>
E	The DC used on the secure channel is reachable over TCP/IP. If this flag is not set, then the DC does not have a known IP address.<70>
F	The DC used on the secure channel runs the Windows Time Service.<71>
G	The last update of one of the DNS records on the DC failed.<72>

All other bits MUST be set to zero and MUST be ignored on receipt.

To a client, bit D will appear arbitrarily set to 0 or 1 and the client is not expected to perform any action based on this value. For more information, see the server to server database synchronization topic in section 3.6.

netlog1_pdc_connection_status: The integer value that indicates the connection status (section 3.4.5.3.1) of the secure channel to a DC in the primary domain of the queried server. See section 3.4.5.3.1 for more information.

2.2.1.7.3 NETLOGON_INFO_2

The NETLOGON_INFO_2 structure defines information returned as part of an administrative query of the status of the Netlogon server, as detailed in the description of the NetrLogonControl2Ex method in section 3.5.4.9.1. This structure is used to convey information about the status and properties of the secure channel to a DC in the primary or directly trusted domain specified by the caller of the NetrLogonControl2Ex method.

```
typedef struct _NETLOGON_INFO_2 {
  DWORD netlog2_flags;
  NET API STATUS netlog2 pdc connection status;
  [string] wchar_t* netlog2_trusted_dc_name;
  NET_API_STATUS netlog2_tc_connection_status;
} NETLOGON_INFO_2,
 *PNETLOGON_INFO_2;
```

netlog2_flags: A set of bit flags describing the following control query responses from the DC. A flag is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	0	B	A	0	0	0	0

Where the flags are as defined as shown in the following table.<73>

Value	Description
A	The DC used on the secure channel has an IP address (either IPv4 or IPv6).<74>
B	The DC used on the secure channel runs the Windows Time Service.<75>
C	Signifies that the trust verification status was returned in the netlog2_pdc_connection_status field.<76>

All other bits MUST be set to zero and MUST be ignored on receipt.

netlog2_pdc_connection_status: Unless the C bit is set in **netlog2_flags** field, this field indicates the connection status (section 3.4.5.3.1) of the secure channel to a DC in the primary domain of the queried server. If the C bit is set in **netlog2_flags** field, this field indicates the connection status of verifying the secure channel to the DC in the specified domain (specified by the caller of the NetrLogonControl2Ex method; see section 3.5.4.9.1 for more information).

netlog2_trusted_dc_name: A pointer to a null-terminated Unicode string that contains the DNS or NetBIOS name of the DC used on the secure channel for the specified domain. The name is the fully qualified domain name (FQDN) (2) if the DC was discovered using the discovery mechanism based on the DNS query and LDAP ping ([MS-ADTS] section 6.3.3). The name is the NetBIOS name if the DC was discovered using the mailslot-based mechanism ([MS-ADTS] section 6.3.5).

netlog2_tc_connection_status: An integer value that indicates the connection status (section 3.4.5.3.1) of the secure channel to the DC in the specified domain.

2.2.1.7.4 NETLOGON_INFO_3

The NETLOGON_INFO_3 structure defines information returned as part of an administrative query of the status of the Netlogon server, as detailed in the description of the NetrLogonControl2Ex method in section 3.5.4.9.1. This structure is used to return the number of NTLM logons attempted on the queried server since the last restart.

```
typedef struct _NETLOGON_INFO_3 {
  DWORD netlog3_flags;
  DWORD netlog3_logon_attempts;
  DWORD netlog3_reserved1;
  DWORD netlog3_reserved2;
  DWORD netlog3_reserved3;
  DWORD netlog3_reserved4;
  DWORD netlog3_reserved5;
} NETLOGON_INFO_3,
 *PNETLOGON_INFO_3;
```

netlog3_flags: MUST be set to zero and MUST be ignored on receipt.

netlog3_logon_attempts: The number of NTLM logon attempts made on the server since the last restart.

netlog3_reserved1: MUST be set to zero and MUST be ignored on receipt.

netlog3_reserved2: MUST be set to zero and MUST be ignored on receipt.

netlog3_reserved3: MUST be set to zero and MUST be ignored on receipt.

netlog3_reserved4: MUST be set to zero and MUST be ignored on receipt.

netlog3_reserved5: MUST be set to zero and MUST be ignored on receipt.

2.2.1.7.5 NETLOGON_INFO_4

The NETLOGON_INFO_4 structure defines information that is returned as part of an administrative query of the status of the Netlogon server, as detailed in the description of the NetrLogonControl2Ex method in section 3.5.4.9.1. This structure is used to convey information about the status and properties of the secure channel to a DC in the primary or directly trusted domain containing the user account specified by the caller of the NetrLogonControl2Ex method.

```
typedef struct _NETLOGON_INFO_4 {
  [string] wchar_t* netlog4_trusted_dc_name;
  [string] wchar_t* netlog4_trusted_domain_name;
} NETLOGON_INFO_4,
 *PNETLOGON_INFO_4;
```

netlog4_trusted_dc_name: A pointer to a null-terminated Unicode string that contains the DNS or NetBIOS name of a DC that is used on the secure channel for the primary or directly trusted domain containing the specified user account. The name is the fully qualified domain name (FQDN) (2) if the DC was discovered using the discovery mechanism based on the DNS query and LDAP ping ([MS-ADTS] section 6.3.3). The name is the NetBIOS name if the DC was discovered using the mailslot-based mechanism ([MS-ADTS] section 6.3.5).

netlog4_trusted_domain_name: A pointer to a null-terminated Unicode string that contains the NetBIOS name of the primary or directly trusted domain containing the specified user account.

2.2.1.7.6 NETLOGON_CONTROL_QUERY_INFORMATION

The NETLOGON_CONTROL_QUERY_INFORMATION union selects an appropriate **NETLOGON_INFO** data type, based on the value of the *QueryLevel* parameter to the NetrLogonControl2Ex method described in section 3.5.4.9.1.

```
typedef
[switch_type(DWORD)]
union  NETLOGON_CONTROL_QUERY_INFORMATION {
  [case(1)]
    PNETLOGON_INFO_1 NetlogonInfo1;
  [case(2)]
    PNETLOGON_INFO_2 NetlogonInfo2;
  [case(3)]
    PNETLOGON_INFO_3 NetlogonInfo3;
  [case(4)]
    PNETLOGON_INFO_4 NetlogonInfo4;
  [default]     ;
} NETLOGON_CONTROL_QUERY_INFORMATION,
 *PNETLOGON_CONTROL_QUERY_INFORMATION;
```

NetlogonInfo1: This field is selected when the switched DWORD ([MS-DTYP] section 2.2.9) value is 1. For more details about NETLOGON_INFO_1, see section 2.2.1.7.2.

NetlogonInfo2: This field is selected when the switched DWORD value is 2. For more details about NETLOGON_INFO_2, see section 2.2.1.7.3.

NetlogonInfo3: This field is selected when the switched DWORD value is 3. For more details about NETLOGON_INFO_3, see section 2.2.1.7.4.

NetlogonInfo4: This field is selected when the switched DWORD value is 4. For more details about NETLOGON_INFO_4, see section 2.2.1.7.5.

2.2.1.8 Obsolete Structures

The structures in this group are unsupported and are out of the scope of this document, but they are types associated with parameters in methods that are also obsolete (see section 3.4.5.8 for details), and are thus provided here. The structures were used in versions of Windows not covered by this document.

2.2.1.8.1 NETLOGON_VALIDATION_UAS_INFO

The NETLOGON_VALIDATION_UAS_INFO structure was for the support of LAN Manager products and is beyond the scope of this document.

```
typedef struct _NETLOGON_VALIDATION_UAS_INFO {
  [string] wchar t* usrlog1 eff name;
  DWORD usrlog1_priv;
  DWORD usrlog1_auth_flags;
  DWORD usrlog1_num_logons;
  DWORD usrlog1_bad_pw_count;
  DWORD usrlog1_last_logon;
  DWORD usrlog1 last logoff;
  DWORD usrlog1_logoff_time;
  DWORD usrlog1_kickoff_time;
  DWORD usrlog1_password_age;
  DWORD usrlog1_pw_can_change;
  DWORD usrlog1_pw_must_change;
  [string] wchar t* usrlog1 computer;
  [string] wchar_t* usrlog1_domain;
  [string] wchar_t* usrlog1_script_path;
  DWORD usrlog1_reserved1;
} NETLOGON_VALIDATION_UAS_INFO,
 *PNETLOGON_VALIDATION_UAS_INFO;
```

2.2.1.8.2 NETLOGON_LOGOFF_UAS_INFO

The NETLOGON_LOGOFF_UAS_INFO structure was for the support of LAN Manager products and is beyond the scope of this document.

```
typedef struct _NETLOGON_LOGOFF_UAS_INFO {
  DWORD Duration;
  unsigned short LogonCount;
} NETLOGON_LOGOFF_UAS_INFORMATION,
 *PNETLOGON_LOGOFF_UAS_INFO;
```

2.2.1.8.3 UAS_INFO_0

The UAS_INFO_0 structure was for the support of LAN Manager products and is beyond the scope of this document.

```
typedef struct _UAS_INFO_0 {
  char ComputerName[16];
```

```
  unsigned long TimeCreated;
  unsigned long SerialNumber;
} UAS_INFO_0,
 *PUAS_INFO_0;
```

2.2.1.8.4 NETLOGON_DUMMY1

The NETLOGON_DUMMY1 union serves as a placeholder.<77>

```
typedef
[switch_type(DWORD)]
union {
  [case(1)]
    unsigned long Dummy;
} NETLOGON_DUMMY1,
 *PNETLOGON_DUMMY1;
```

Dummy: The field is selected when the switched DWORD ([MS-DTYP] section 2.2.9) value is 1.

2.3 Directory Service Schema Elements Used by the Netlogon Remote Protocol

The Netlogon Remote Protocol accesses the **directory service** schema classes and attributes listed in the following table.

For the syntactic specifications of the following <Class> or <Class><Attribute> pairs, refer to Active Directory Domain Services (AD DS) ([MS-ADA1], [MS-ADA3], and [MS-ADSC]).

Class	Attribute
nTDSDSA	objectGUID
trustedDomain	trustAuthIncoming trustAuthOutgoing
computer	lmPwdHistory operatingSystem securityIdentifier operatingSystemVersion servicePrincipalName unicodePwd dnsHostName

3 Protocol Details

The Netlogon Remote Protocol remote procedure call (RPC) interface is used primarily by Windows to maintain the relationship between a machine and its domain, and relationships among domain controllers (DCs) and domains. As such, there are several distinct responsibilities that the RPC interface fulfills while acting in this maintenance capacity. These responsibilities are as follows:

- The Netlogon Remote Protocol RPC interface is used to establish and maintain the secure channel that is used by members of a domain to communicate with the domain controller (DC).
- The Netlogon Remote Protocol RPC interface is used to transport authentication requests from domain members to the DC, and among DCs. This functionality is most commonly implemented by authentications using the NTLM Authentication Protocol ([MS-NLMP]), but it is also used by other protocols such as Kerberos and Digest ([MS-APDS] section 1.4).
- The Netlogon Remote Protocol RPC interface is used to transmit certain account changes, such as password changes or account lockout information. Details about the types of account changes that can be transmitted are as specified in Netlogon NT Replication Details (section 3.6).
- The Netlogon Remote Protocol serves as its own security provider for its RPC connection; that is, the authentication protocol is used both within the RPC exchanges for specific methods, and also as a general authentication protocol for the entire Netlogon Remote Protocol RPC interface.
- For Windows NT 4.0 operating system, the Netlogon Remote Protocol RPC interface was used to replicate account information from the primary domain controllers (PDCs) to the backup domain controllers (BDCs). PDCs also use mailslots to broadcast messages to the BDCs; these messages (as specified in section 2.2.1.5.1) are not transmitted via RPC.

This section presents the details of the Netlogon Protocol:

- Section 3.1 specifies the authentication aspects that are common to all Netlogon Remote Protocol roles, including establishing the secure channel. Before any method that utilizes the secure channel can be invoked, the authentication process that is described in this section MUST be completed.
- Section 3.2 specifies the use of the Netlogon Remote Protocol for pass-through authentication.
- Section 3.3 specifies the use of the Netlogon Remote Protocol authentication method as a generic security authentication mechanism.
- Sections 3.4 and 3.5 detail client and server operations, respectively.
- Finally, section 3.6 specifies the behavior of the Netlogon Remote Protocol in the account replication role in environments with Windows NT 4.0 BDCs.

All the Netlogon Remote Protocol methods return 0x00000000 (NERR_Success) to indicate success; otherwise, they return a 32-bit nonzero error code. There are two types of error codes returned, NET_API_STATUS ([MS-ERREF] section 2.2) and NTSTATUS ([MS-ERREF] section 2.3). For more information about NTSTATUS values, see [NTSTATUSERR].

Common Error Processing Rules

Several Netlogon Remote Protocol methods apply the processing rules listed in the following section to determine which error codes are returned. The applicable processing rules from those mentioned in this section are referred to in each of the method descriptions. Error codes prepended with the prefix STATUS are of type NTSTATUS; the remaining error codes are of type NET_API_STATUS.

Common Error Processing Rule	Description
A	If a server does not support a specific Netlogon RPC method, it MUST return ERROR_NOT_SUPPORTED or STATUS_NOT SUPPORTED, based on the return type. This includes the case when the server is not a domain controller.
B	If the input parameter to a Netlogon RPC request is a computer name or server name, the server SHOULD look up this name in the domain the server hosts. If the name is not found, the server MUST return ERROR_INVALID_COMPUTERNAME or STATUS_INVALID_COMPUTER_NAME. <78>
C	If a server needs to locate a domain controller (DC) to service a Netlogon RPC request, it follows the method specified in [MS-ADTS] section 6.3.6. If the DC cannot be located by following this method, the server MUST return ERROR_NO_LOGON_SERVERS or STATUS_NO_LOGON_SERVERS, depending on the return type.
D	If the Directory Service is paused and the Netlogon RPC method cannot be processed further, the server SHOULD return STATUS_DS_BUSY.
E	The server MUST return ERROR_NO_SUCH_DOMAIN if the DC could not be located for the specified domain, or if the specified domain is not primary or directly trusted.

The default pointer type for the Netlogon Remote Protocol RPC interface is pointer_default(unique). Method calls are received at a dynamically assigned endpoint ([MS-RPCE] section 3.3.3.3.1.4). The endpoints for the Netlogon Remote Protocol service are negotiated by the RPC endpoint mapper ([MS-RPCE] section 3.3.3.3.1.4).

Out of Memory Errors

Netlogon Remote Protocol methods require allocation of memory in order to execute their processing rules. If a client or server is unable to allocate the memory required, it MUST return STATUS_NO_MEMORY.

3.1 Netlogon Common Authentication Details

The Netlogon RPC interface is used to establish and maintain the secure channel. The client MUST attempt to establish this secure channel with a domain controller within the client's domain. (Common Error Processing Rule C MUST be applied whenever a secure connection to a DC is required by a method.) Establishing the secure channel is accomplished by first negotiating a session key (as specified in section 3.1.4.1) over nonprotected RPC (nonprotected RPC is an RPC connection without any underlying security support), resulting in both the client and server mutually verifying each other's credentials. Verifying Netlogon credentials on both the client and server establishes that both ends shared the same password information for the requesting client. Therefore, both Netlogon credentials are valid. The client and server both store a copy of the Netlogon credential computed by using the client challenge. This stored client Netlogon credential serves as a seed for authenticating further client-to-server operations.

Upon successful mutual verification, both client and server have the information necessary to compute a session key. The session key is used to secure further RPC communication between the two machines.

The following sections specify the common steps in the authentication portion of the Netlogon RPC interface, including Netlogon credential computation and the derivation and use of the session key.

3.1.1 Abstract Data Model

This section describes a conceptual model of possible data organization that an implementation maintains to participate in this protocol. The described organization is provided to facilitate the

explanation of how the protocol behaves. This document does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this document.

The Netlogon interface is used to create a secure connection between a client and a server, where the server is a domain controller (DC). The client of the Netlogon interface can be a member of the domain, another DC in the same domain, or a DC in a different but trusting domain. This secure connection is often referred to as the secure channel.

The connection is secured by the use of cryptographic algorithms. The key used for these algorithms, the session key, is computed on both the client and the server and is based on a shared secret that has been previously shared between the client and the server. After the session key is computed on both sides, it is used to encrypt the communication between the two parties. There are two methods of deriving the key. The method used is version-dependent, as specified in section 3.1.4.3.

Abstract variables of the session key operations are as follows:

ClientStoredCredential: A NETLOGON_CREDENTIAL (section 2.2.1.3.4) structure containing the credential that is created by the client and received by the server and that is used during computation and verification of the Netlogon authenticator (section 3.1.4.5).

ClientChallenge: A pointer to a NETLOGON_CREDENTIAL structure that contains the client challenge.

NegotiateFlags: A 32-bit set of bit flags that identify the negotiated capabilities between the client and the server.

ServerStoredCredential: A NETLOGON_CREDENTIAL structure containing the credential that is created by the server and received by the client and that is used during computation and verification of the Netlogon authenticator.

ServerChallenge: A pointer to a NETLOGON_CREDENTIAL structure that contains the **server challenge** response.

SharedSecret: An even-numbered sequence of bytes, with no embedded zero values, that is a plain-text secret (password) shared between the client and the server. Implementers can choose to store the **unicodePwd** ([MS-ADA3] section 2.332) instead of a clear text version of the shared secret.<79><80><81> For more information, refer to the ADM element **Password** in [MS-WKST] section 3.2.1.6; initialization of this shared ADM element is covered in the domain join and unjoin sections of [MS-WKST] (sections 3.2.4.13 and 3.2.4.14).

TrustPasswordVersion: An unsigned 32-bit integer which indicates the number of times that a trust password has changed.<82>

SealSecureChannel: A Boolean setting that indicates whether the RPC message has to be encrypted or just integrity-protected ([C706] section 13.2.5). When TRUE, the message will be encrypted; otherwise, it will be integrity-protected.

StrongKeySupport: A Boolean setting that indicates whether a strong method of creating the session key will be used. A strong method, in the context of Netlogon, is one that uses the MD5 message-digest algorithm [RFC1321]. The behavior of this setting is specified in section 3.1.4.3.

The Netlogon client and server variables are as follows:

LocatedDCsCache: A cache SHOULD be implemented containing a set of previously located DCs. The fields of the cache are implementation-specific but are required to contain enough information to be able to respond correctly to a DC locator request. Any cache implementation MUST be able to return the set of cache results given a domain name. The results SHOULD be equivalent to the DOMAIN_CONTROLLER_INFOW structure. Also, each entry SHOULD maintain, and return with any cache lookup, two timestamps. The first timestamp indicates when the entry was created so that age checks can be performed in order to invalidate stale cache entries. The second timestamp

indicates the last communication with the indicated machine in order to facilitate periodic liveliness tests with the cached DC (see section 3.5.4.3.1 for more information).

SealSecureChannel: A Boolean setting that indicates whether the RPC message has to be encrypted or just integrity-protected ([C706] section 13.2.5). When TRUE, the message will be encrypted; otherwise, it will be integrity-protected.

Implementations that use the Windows registry [MS-GPSB] section 2.2.5 to persistently store and retrieve the SealSecureChannel variable SHOULD use the following:

- RegistryValueName: HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters
- RegistryValueType: 4
- RegistryValue: SealSecureChannel

The implementation SHOULD also expose the key and value at the specified registry path using the Windows Remote Registry Protocol [MS-RRP]. For each abstract data model element that is loaded from the registry, there is one instance that is shared between [MS-RRP] and the protocol(s) that uses the abstract data model element. Any changes made to the registry keys will be reflected in the abstract data model elements when a PolicyChange event is received ([MS-GPOD] section 2.8.2).

3.1.2 Timers

None.

3.1.3 Initialization

See section 3.4.3 for client initialization, and see section 3.5.3 for server initialization.

3.1.4 Message Processing Events and Sequencing Rules

Netlogon communication between a client and a server occurs through RPC calls. A subset of the methods defined by Netlogon's RPC interface requires a session key to be established between the client and the server before these methods are called. Section 3.1.4.6 lists all Netlogon methods that require a session key. This section also specifies the sequence of steps that a client MUST follow when calling any method in the list. Section 3.1.4.7 specifies the required sequence of steps that a client MUST follow when calling methods that do not require a session key. Section 3.1.4.3 specifies how the session key is computed. Section 3.1.4.10 specifies how a client attempts to locate a domain controller in a domain.

3.1.4.1 Session-Key Negotiation

Session-key negotiation between a client and a server is performed over an unprotected RPC channel.

The following diagram illustrates the negotiation flow.

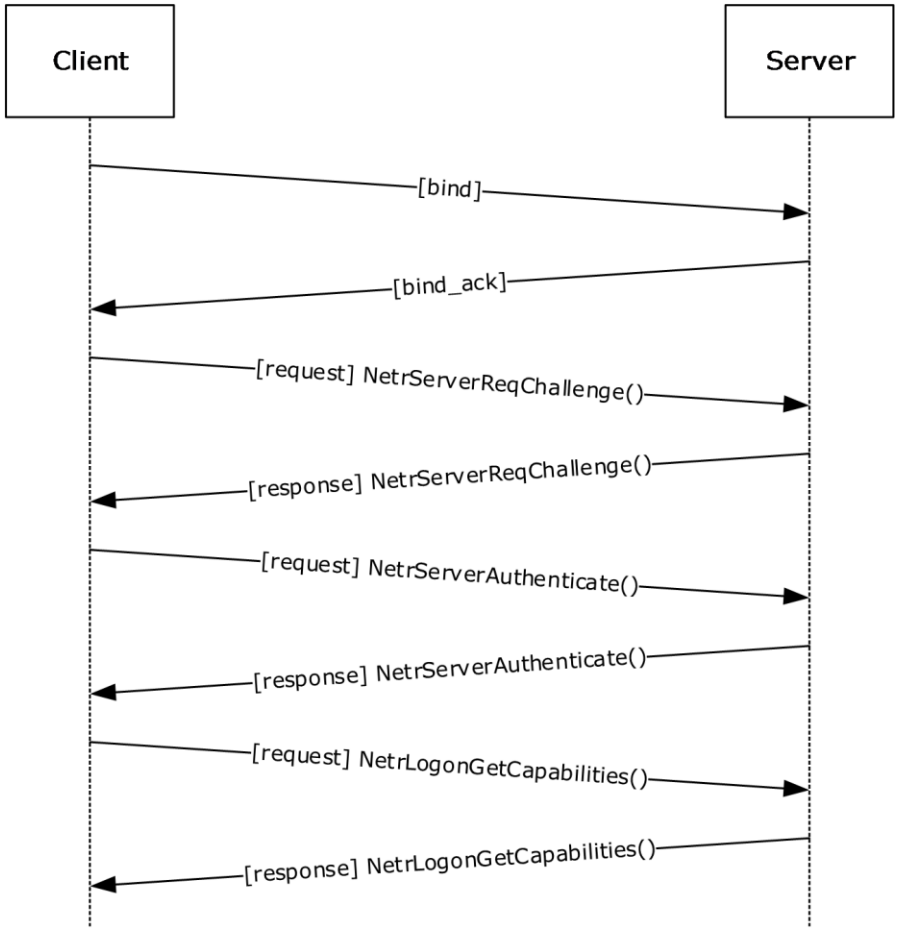


Figure 7: Session-key negotiation

Session-key negotiation works as follows.

1. The client binds to the remote Netlogon RPC endpoint on the server. The client then generates a nonce, called the client challenge, and sends the client challenge to the server as an input argument to the NetrServerReqChallenge method call.

2. The server receives the client's NetrServerReqChallenge call. The server generates its own nonce, called the server challenge (SC). In its response to the client's NetrServerReqChallenge method call, the server sends the SC back to the client as an output argument to NetrServerReqChallenge. After the client has received the server's response, both computers have one another's challenge nonce (client challenge and server challenge, respectively).

3. The client computes a session key, as specified in section 3.1.4.3, Session-Key Computation. The client specifies an initial set of capabilities by providing an initial set of values in the NegotiateFlags.

4. The client computes its client Netlogon credential by using client challenge as input to the credential computation algorithm, as specified in section 3.1.4.4.

5. The client exchanges its client Netlogon credential with the server by passing it in the NetrServerAuthenticate, NetrServerAuthenticate2, or NetrServerAuthenticate3 call as the

ClientCredential input argument. The selection of the particular method called by the client is specified in section 3.4.5.2.2.

6. The server receives the NetrServerAuthenticate, NetrServerAuthenticate2, or NetrServerAuthenticate3 call and verifies the client Netlogon credential. It does this by computing a session key, as specified in section 3.1.4.3, duplicating the client Netlogon credential computation, using its stored copy of client challenge, and comparing the result of this recomputation with the client Netlogon credential that was just received from the client. If the comparison fails, the server MUST fail session-key negotiation without further processing of the following steps.

7. The server computes its server Netlogon credential by using the server challenge as input to the credential computation algorithm, as specified in section 3.1.4.4. The server returns the server Netlogon credential as the ServerCredential output parameter of the NetrServerAuthenticate, NetrServerAuthenticate2, or NetrServerAuthenticate3 call.

8. The client verifies the server Netlogon credential. It does this by recomputing the server Netlogon credential, using its stored copy of server challenge, and comparing the result of this recomputation with the server Netlogon credential passed back from the server. If the comparison fails, the client MUST fail session-key negotiation.

9. Upon mutual verification, the client and server agree to use the computed session key for encrypting and/or signing further communications.

10. The client calls the NetrLogonGetCapabilities method.<83>

11. The server returns the negotiated flags for the current exchange.<84>

12. The client compares the received ServerCapabilities (section 3.5.4.4.10) with the negotiated NegotiateFlags (section 3.5.4.4.2), and if there is a difference, the session key negotiation is aborted.<85>

13. The client sets the ServerSessionInfo.LastAuthenticationTry (indexed by server name) to the current time. This prevents authentication retries from occurring for 45 seconds, unless a new transport notification is received.

In the first phase of session-key negotiation (NetrServerReqChallenge), the client and server exchange nonces. This allows both the client and the server to compute a session key by using the algorithm described in section 3.1.4.3. To provide mutual authentication, both the client and the server calculate a Netlogon credential based on their own nonce, using the computed session key, and exchange them in the second phase of session-key negotiation (NetrServerAuthenticate or NetrServerAuthenticate2 or NetrServerAuthenticate3). Because nonces are exchanged in the first phase, this allows each side to calculate the other party's Netlogon credential locally, and then compare it with the received one. If the locally computed credential matches the one supplied by the other party, this proves to the client and to the server that the respective party has access to the shared secret.

For more information about the methods involved in session-key negotiation, see client and server details in sections 3.4 and 3.5.

3.1.4.2 Netlogon Negotiable Options

As part of the session-key negotiation, the client and server use the *NegotiateFlags* parameter of NetrServerAuthenticate2 or NetrServerAuthenticate3 to negotiate support for the following options. The client offers an initial set of capabilities through the *NegotiateFlags* parameter to the server as input. The server then selects the capabilities acceptable to it. The capabilities that are supported by the server are combined with the capabilities supported by the client by performing a bit-wise AND; the result of the operation is returned to the client as output, as detailed in sections 3.5.4.4.2 and 3.5.4.4.3. The client MUST inspect the returned negotiation capabilities to determine whether server-

selected capabilities are supported by the client, and that all of the capabilities required by the client are returned by the server. For example, a client could be configured outside the protocol to require strong-key support; if the server did not offer strong-key support, the client SHOULD reject the server.

If **NT4Emulator** is set to TRUE and bit U has not been set in *NegotiateFlags* as input, then the server MUST return 0 for bits J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, and Y in the output of the *NegotiateFlags* parameter.

The following options are negotiable between the client and the server as part of the session-key negotiation. An option is TRUE (or set) if its value is equal to 1.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	Y	X	0	0	0	0	W	0	0	V	U	T	S	R	Q	P	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A

Where the negotiable options are defined as the following:

Option	Meaning
A	Not used. MUST be ignored on receipt.
B	Windows NT 3.5 operating system BDCs persistently try to update their database to the PDC's version once they get a notification indicating that their database is out-of-date. Presence of this flag indicates support for this behavior. Server-to-server only.
C	Supports RC4 encryption.
D	Not used. MUST be ignored on receipt.
E	Supports BDCs handling CHANGELOGs. Server-to-server only.
F	Supports restarting of full synchronization between DCs. Server-to-server only.
G	Does not require ValidationLevel 2 for nongeneric passthrough.
H	Supports the NetrDatabaseRedo (Opnum 17) functionality (section 3.5.4.6.4).
I	Supports refusal of password changes.
J	Supports the NetrLogonSendToSam (Opnum 32) functionality.<86>
K	Supports generic pass-through authentication.<87>
L	Supports concurrent RPC calls.<88>
M	Supports avoiding of user account database replication.<89> Server-to-server only.
N	Supports avoiding of Security Authority database replication.<90> Server-to-server only.
O	Supports strong keys.<91>
P	Supports transitive trusts.<92>
Q	Not used. MUST be ignored on receipt.
R	Supports the NetrServerPasswordSet2 functionality.<93>
S	Supports the NetrLogonGetDomainInfo functionality.<94>
T	Supports cross-**forest trusts**.<95>

Option	Meaning
U	Supports neutralizing Windows NT 4.0 emulation. Note that when this flag is negotiated between a client and a server, it indicates that the server SHOULD ignore the **NT4Emulator** ADM element.<96>
V	Supports RODC pass-through to different domains.<97>
W	Supports **Advanced Encryption Standard (AES)** encryption (128 bit in 8-bit CFB mode) and SHA2 hashing as specified in sections 2.2.1.3.3, 3.1.4.3, 3.1.4.4, and 3.3.<98>
X	Not used. MUST be ignored on receipt.
Y	Supports Secure RPC.<99>

All other bits MUST be set as specified in the *NegotiateFlags* description and MUST be ignored on receipt.

3.1.4.3 Session-Key Computation

Although ClientChallenge and ServerChallenge are treated normally as byte arrays, ClientChallenge and ServerChallenge are treated as 64-bit integers in little-endian format to set the sum in the following pseudocode. The carry of the most-significant bit is ignored in the sum of the ClientChallenge and ServerChallenge.

3.1.4.3.1 AES Session-Key

If AES support is negotiated between the client and the server, the strong-key support flag is ignored and the session key is computed with the HMAC-SHA256 algorithm [RFC4634], as specified in the steps of pseudocode that follow. SHA256Reset, SHA256Input, SHA256FinalBits, and SHA256Result are predicates or functions specified in [RFC4634]. MD4 is specified in [RFC1320].

```
ComputeSessionKey(SharedSecret, ClientChallenge,
                  ServerChallenge)
     M4SS := MD4(UNICODE(SharedSecret))

     CALL SHA256Reset(HashContext, M4SS, sizeof(M4SS));
     CALL SHA256Input(HashContext, ClientChallenge, sizeof(ClientChallenge));
     CALL SHA256FinalBits (HashContext, ServerChallenge, sizeof(ServerChallenge));
     CALL SHA256Result(HashContext, SessionKey);
     SET SessionKey to lower 16 bytes of the SessionKey;
```

The key produced with AES support negotiated is 128 bits (16 bytes).

3.1.4.3.2 Strong-key Session-Key

If AES is not negotiated and strong-key support is one of the flags in the NegotiateFlags between the client and the server, the session key is computed with the MD5 message-digest algorithm [RFC1321], as specified in the steps of pseudocode that follow. MD5Init, MD5Update, and MD5Final are predicates or functions specified in [RFC1321]. HMAC_MD5 is a function specified in [RFC2104]. The md5Context variable is of type MD5_CTX, as specified in [RFC1321].

```
SET zeroes to 4 bytes of 0

ComputeSessionKey(SharedSecret, ClientChallenge,
                  ServerChallenge)

     M4SS := MD4(UNICODE(SharedSecret))

     CALL MD5Init(md5context)
```

```
CALL MD5Update(md5context, zeroes, [4 bytes])
CALL MD5Update(md5context, ClientChallenge, [8 bytes])
CALL MD5Update(md5context, ServerChallenge, [8 bytes])
CALL MD5Final(md5context)
CALL HMAC_MD5(md5context.digest, md5context.digest length,
              M4SS, length of M4SS, output)
SET Session-Key to output
```

The key produced with strong-key support negotiated is 128 bits (16 bytes).

3.1.4.3.3 DES Session-Key

If neither AES nor strong-key support is negotiated between the client and the server, the session key is computed by using the DES encryption algorithm in ECB mode, as specified in [FIPS81], as follows.

```
ComputeSessionKey(SharedSecret, ClientChallenge,
                  ServerChallenge)

     M4SS := MD4(UNICODE(SharedSecret))

     SET sum to ClientChallenge + ServerChallenge
     SET k1 to lower 7 bytes of the M4SS
     SET k2 to upper 7 bytes of the M4SS
     CALL DES_ECB(sum, k1, &output1)
     CALL DES_ECB(output1, k2, &output2)
     SET Session-Key to output2
```

The key produced without AES and strong-key support negotiated is 64 bits and is padded to 128 bits with zeros in the most-significant bits.

3.1.4.4 Netlogon Credential Computation

When establishing a secure channel, the input is the client challenge when the Netlogon credential for the client is being computed, and the server challenge when the Netlogon credential for the server is being computed. For subsequent calls using authenticators, the input is the previously computed credential.

Output contains the computed 64-bit Netlogon credential.

3.1.4.4.1 AES Credential

If AES support is negotiated between the client and the server, the Netlogon credentials are computed using the AES-128 encryption algorithm in 8-bit CFB mode with a zero initialization vector.

```
ComputeNetlogonCredential(Input, Sk,
             Output)

      SET IV = 0
      CALL AesEncrypt(Input, Sk, IV, Output)
```

AesEncrypt is the AES-128 encryption algorithm in 8-bit CFB mode with a zero initialization vector [FIPS197].

3.1.4.4.2 DES Credential

The session key is computed as follows.

```
InitLMKey(KeyIn, KeyOut)
      KeyOut[0] = KeyIn[0] >> 0x01;
      KeyOut[1] = ((KeyIn[0]&0x01)<<6) | (KeyIn[1]>>2);
      KeyOut[2] = ((KeyIn[1]&0x03)<<5) | (KeyIn[2]>>3);
      KeyOut[3] = ((KeyIn[2]&0x07)<<4) | (KeyIn[3]>>4);
      KeyOut[4] = ((KeyIn[3]&0x0F)<<3) | (KeyIn[4]>>5);
      KeyOut[5] = ((KeyIn[4]&0x1F)<<2) | (KeyIn[5]>>6);
      KeyOut[6] = ((KeyIn[5]&0x3F)<<1) | (KeyIn[6]>>7);
      KeyOut[7] = KeyIn[6] & 0x7F;

for( int i=0; i<8; i++ ){
      KeyOut[i] = (KeyOut[i] << 1) & 0xfe;
   }
```

Assume bytes(s, e, l) returns bytes from s to e of the byte array l. After a session key is computed, a Netlogon credential is computed. If AES support is not negotiated between the client and the server, the Netlogon credentials are computed using DES:

```
ComputeNetlogonCredential(Input, Sk,
             Output)

      SET k1 to bytes(0, 6, Sk)
      CALL InitLMKey(k1, k3)
      SET k2 to bytes(7, 13, Sk)
      CALL InitLMKey(k2, k4)
      CALL DES_ECB(Input, k3, &output1)
      CALL DES_ECB(output1, k4, &output2)
      SET Output to output2
```

DES_ECB is the DES encryption algorithm in ECB mode ([FIPS81] and [FIPS46-2]).

3.1.4.5 Netlogon Authenticator Computation and Verification

All methods that require a secure channel, except NetrLogonSamLogonEx, will use Netlogon authenticators. If the Netlogon RPC call is using Netlogon authenticators, the following steps are used to calculate the authenticator:

1. Each time a client sends a new request, it records the current time stamp (expressed as the number of seconds since 00:00:00 on January 1, 1970 (UTC)) in the **TimeStamp** field of the NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5. The client also adds the value of this time stamp to the stored Netlogon client credential and encrypts the result with the session key, using the Netlogon credential computation algorithm described in section 3.1.4.4. The result of this computation is stored in the **Credential** field of the NETLOGON_AUTHENTICATOR structure and is then sent to the server.

```
SET TimeNow = current time;
SET ClientAuthenticator.Timestamp = TimeNow;
SET ClientStoredCredential = ClientStoredCredential + TimeNow;
CALL ComputeNetlogonCredential(ClientStoredCredential,
              Session-Key, ClientAuthenticator.Credential);
```

2. When the server receives a request, the server confirms the validity of the Netlogon authenticator that it received with the request. Validation is achieved by adding the time stamp transmitted in the received Netlogon authenticator to the server's stored copy of the Netlogon credential, and by encrypting the result with the session key, using the algorithm specified in section 3.1.4.4. The server then compares the Netlogon credential that it just calculated with the Netlogon credential

transmitted in the received Netlogon authenticator. If the Netlogon credentials do not match, the operation fails, and an error indicating that access is denied is returned to the client.

If the Netlogon credentials match, the server increments the Netlogon credential in the Netlogon authenticator by one, performs the computation described in section 3.1.4.4, Netlogon Credential Computation, and stores the new Netlogon credential. The server returns a Netlogon authenticator that contains the new Netlogon credential to the client.

```
SET ServerStoredCredential = ServerStoredCredential +
              ClientAuthenticator.Timestamp;
CALL ComputeNetlogonCredential(ServerStoredCredential,
              Session-Key, TempCredential);
IF TempCredential != ClientAuthenticator.Credential
   THEN return access denied error

SET ServerStoredCredential = ServerStoredCredential + 1;
CALL ComputeNetlogonCredential(ServerStoredCredential,
              Session-Key, ServerAuthenticator.Credential);
```

3. The client validates the returned Netlogon authenticator by incrementing its stored Netlogon credential by one, encrypting the result with the session key using the algorithm described in section 3.1.4.4, and comparing the results. If this is successful, the client stores the Netlogon credential part of the Netlogon authenticator as the new Netlogon credential. If the validation failed, the client SHOULD re-establish its secure channel with the domain controller.

```
SET ClientStoredCredential = ClientStoredCredential + 1;
CALL ComputeNetlogonCredential(ClientStoredCredential,
              Session-Key, TempCredential);
IF TempCredential != ServerAuthenticator.Credential
   THEN return abort
```

In each of the addition operations previously performed, the least-significant 4 bytes of the credential are added with the 4-byte time stamp value (or the constant 1), and overflow is ignored. This leaves the most-significant 4 bytes of the credential unmodified.

3.1.4.6 Calling Methods Requiring Session-Key Establishment

To call the methods in the following set, the client and the server MUST have performed session-key negotiation. If negotiation has not been completed prior to the time of a call, negotiation MUST be initiated and completed before making the call. Each method that requires a secure channel is described in section 3.5, with the errors specified. For descriptions of the following methods, see section 3.5.

- NetrGetForestTrustInformation
- NetrLogonGetCapabilities
- NetrLogonSamLogon
- NetrLogonSamLogonEx
- NetrLogonSamLogonWithFlags
- NetrLogonSamLogoff
- NetrLogonSendToSam

- NetrServerPasswordGet
- NetrServerPasswordSet
- NetrServerPasswordSet2
- NetrServerGetTrustInfo
- NetrServerTrustPasswordsGet
- NetrLogonGetDomainInfo
- NetrDatabaseDeltas
- NetrDatabaseSync2
- NetrDatabaseSync
- NetrDatabaseRedo
- NetrAccountDeltas
- NetrAccountSync
- NetrLogonDummyRoutine1

The client follows this sequence of steps.

1. The client binds to the RPC server.<100>

   The client and server SHOULD utilize a secure bind.<101>If a secure bind is used, the client instructs the RPC runtime to use the Netlogon SSP ([MS-RPCE] section 2.2.1.1.7) for privacy/integrity of the RPC messages. If the SealSecureChannel setting is TRUE, the client requests the Privacy **authentication level** from the RPC runtime. If the SealSecureChannel setting is FALSE, then the authentication level requested is Integrity.

2. If the call to be made uses Netlogon authenticators, the client MUST compute the Netlogon authenticator to be passed as a parameter to the RPC method, as specified in section 3.1.4.5.

3. The client calls the method on the server. If the RPC server denies access, the client SHOULD attempt to re-establish the session key with the target server if the difference between the current time and value of ServerSessionInfo.LastAuthenticationTry (indexed by the name of the target server) is greater than 45 seconds.

4. The server MUST verify the authenticator, if used, and compute the return authenticator, as specified in section 3.1.4.5.

5. The client MUST validate the returned authenticator, if used.

6. The client MAY unbind from the server, or it MAY<102> reuse the binding for multiple RPC calls.

3.1.4.7 Calling Methods Not Requiring Session-Key Establishment

The client follows this sequence of steps:

1. The client SHOULD bind to the RPC server using the named pipe "\PIPE\NETLOGON", or MAY bind to the RPC server over TCP/IP.

   Note The TCP/IP channel cannot support impersonation for access control, and is therefore unusable. The server will ignore any calls made via this channel.

2. The client MUST call the method on the server.

3. The client SHOULD unbind from the server, or it MAY reuse the binding for multiple RPC calls.

3.1.4.8 Determining If the Implementation Is Running on a Domain Controller

The implementation determines whether it is running on a domain controller by querying the current server configuration by calling the abstract interface **ServerGetInfo** specified in [MS-DTYP] section 2.6, specifying a level of 101. The resulting bufptr contains a **SERVER_INFO_101** structure, as specified in [MS-DTYP] section 2.3.12. The determination is TRUE if **sv101_version_type** contains SV_TYPE_DOMAIN_CTRL or SV_TYPE_DOMAIN BAKCTRL. If **sv101_version_type** does not contain either of these values, the determination is FALSE.

3.1.4.9 Determining if a Request is for the Current Domain

If the server is running on a domain controller (DC), then the server determines if a request is for its domain or not by comparing the domain the request was intended for and the domain-name ADM element.

3.1.4.10 Client Domain Controller Location

The client MUST attempt to locate a domain controller (DC) of a given domain. A client locally invokes processing rules specified in DsrGetDCName (section 3.5.4.3.3) with the method parameters set as follows:

- Set the *ComputerName* parameter to NULL.
- Set the *DomainName* parameter to the domain name.
- Set the *DomainGuid* parameter to NULL.
- Set the *SiteGuid* parameter to NULL.
- Set the *Flags* parameter to a bitwise OR of the bits L and R that are specified in DsrGetDcNameEx2 (section 3.5.4.3.1).

If DsrGetDCName returns with no errors, the **DomainControllerName** field of the returned **DomainControllerInfo** structure will contain the DC name.

3.1.5 Timer Events

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

3.1.6 Other Local Events

No additional local events are used on the client beyond the events maintained in the underlying RPC transport and GP notification.

The Netlogon client and server register a local change notification callback with the Group Policy: Security Protocol Extension Client [MS-GPSB]. The client SHOULD send Netlogon a PolicyChange event when the policy is changed.

When Netlogon receives a PolicyChange event, those NRPC implementations that use the Windows registry to persistently store and retrieve the SealSecureChannel variable SHOULD load the new value from the HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Netlogon\Parameters registry path and SealSecureChannel key.

3.2 Pass-Through Authentication Details

Netlogon has various roles, one of which is to securely transport data for authentication packages between the client and the server.

3.2.1 Abstract Data Model

None.

3.2.2 Timers

None.

3.2.3 Initialization

Using Netlogon for pass-through authentication requires a session key to have already been negotiated, as specified in section 3.1.4.1.

3.2.4 Message Processing Events and Sequencing Rules

Netlogon is used to securely transport data for authentication packages between the client and the server. This is accomplished by packages calling the NetrLogonSamLogon or NetrLogonSamLogonEx methods. Netlogon takes the data specified in the input parameters by the authentication package on the client and sends it unexamined over the secure channel to the server. The server delivers the data to the target authentication package.

3.2.4.1 Generic Pass-Through

When using the NetrLogonSamLogon method, as specified in section 3.5.4.5.3, or the NetrLogonSamLogonEx method, as specified in section 3.5.4.5.1, for generic pass-through, the following requirements MUST be met:

- The *LogonLevel* parameter is 4 (NetlogonGenericInformation).
- The *ValidationLevel* parameter is 5 (NetlogonValidationGenericInfo2).
- The *LogonInformation* parameter is NETLOGON_GENERIC_INFO.
- NETLOGON_GENERIC_INFO.**PackageName** is "Kerberos" ([MS-APDS] section 3.2.5.1) or "WDigest" ([MS-APDS] section 3.3.5.1).

Protocols that use Netlogon for generic pass-through will also include opaque **Binary Large Objects (BLOBs)** that comprise their respective message data. These BLOBs are passed in the **LogonData** field of the NETLOGON_GENERIC_INFO structure, with the size of the data specified in the **DataLength** field. The BLOB is passed from one system's Netlogon component to the other system's component over the wire. Netlogon will then pass the opaque BLOB to the security package specified in the **PackageName** field.

The NETLOGON_LOGON_IDENTITY_INFO structure (as specified in section 2.2.1.4.15) inside the NETLOGON_GENERIC_INFO structure (as specified in section 2.2.1.4.2) MUST:

- Contain the LogonDomainName.
- Ensure that the rest of the NETLOGON_LOGON_IDENTITY_INFO fields are zeroed out.

The response is sent by the domain controller via the *ValidationInformation* parameter, which points to a pointer to the NETLOGON_VALIDATION_GENERIC_INFO2 structure.

See [MS-APDS] for a specification of how NTLM, Kerberos, and Digest authentication packages use the Netlogon secure channel.

3.2.5 Timer Events

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

3.2.6 Other Local Events

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

3.3 Netlogon as a Security Support Provider

In addition to other functionality, Netlogon also serves as a limited private SSP <103> for use by Netlogon and RPC ([MS-RPCE] section 2.2.1.1.7) when encrypting and signing data during communication.<104> Central to this capability is the use of the session key, as specified in section 3.1. This section specifies the behavior of the security provider role for both client and server.

Netlogon implements a service that allows the RPC runtime to perform a security context negotiation between the client and the server and to use per-message calls to protect the data being passed over the network. For Netlogon to be able to perform this functionality, a session key

MUST have been established between the client and the server as described in section 3.1. Netlogon registers with the RPC runtime as a security provider with the auth_type value (as specified in [MS-RPCE] section 2.2.2.11) of 0x44.

When serving as its own generic SSP, Netlogon always provides the following service features:

- Integrity: Signed messages are constructed so that they cannot be tampered with while in transit. The generation and receipt of the Netlogon Signature token will always provide integrity protection for the messages.
- Sequence Detect: Signed messages are constructed such that out-of-order sequences can be detected. The generation and receipt of the Netlogon Signature token will always detect out-of-sequence messages.

3.3.1 Abstract Data Model

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

Netlogon serves as a security provider for its own RPC connections. As such, it provides the following service: Confidentiality.

For protocol features, once a session key has been established through the session-key negotiation, Netlogon relies upon the RPC runtime to invoke the per-message functions. The following define the services provided by the Netlogon security support provider (SSP).

Note The following defined variables are logical, abstract parameters that an implementation is required to maintain and expose to provide the proper level of service. How these variables are maintained and exposed is determined by the implementation.

Confidentiality: A Boolean setting that indicates that the caller is requiring encryption of messages so that they cannot be read while in transit. Requesting this service results in Netlogon encrypting the message. For more information, see sections 3.1.4.2 and 3.1.4.3.

As per [MS-RPCE] section 2.2.2.11, the **auth_level** field of the **sec_trailer** structure determines the authentication level used. Netlogon only supports RPC_C_AUTHN_LEVEL_PKT_INTEGRITY and RPC_C_AUTHN_LEVEL_PKT_PRIVACY. A value of RPC_C_AUTHN_LEVEL_PKT_INTEGRITY implies that Integrity is provided by the Netlogon SSP, and a value of RPC_C_AUTHN_LEVEL_PKT_PRIVACY implies that Confidentiality is provided by the Netlogon SSP. Sequence detection is always provided.

The Netlogon SSP maintains the following set of data for each session:

ClientSequenceNumber: A 64-bit integer value used for detecting out-of-order messages on the client side.

ServerSequenceNumber: A 64-bit integer value used for detecting out-of-order messages on the server side.

Session-Key: See section 3.1.4.3 for **Session-Key** computation details.

NegotiateFlags: See section 3.1.1 for **NegotiateFlags** details.

MessageBlockSize: An integer that indicates the minimum size of messages for encryption. This value MUST be 1.

3.3.2 Timers

None.

3.3.3 Initialization

Establishing a Netlogon security context requires a session key to have already been negotiated, as described in section 3.1.4.1.

3.3.4 Message Processing Events and Sequencing Rules

Netlogon uses two types of tokens when functioning as an SSP: NL_AUTH_MESSAGE and NL_AUTH_SIGNATURE.

3.3.4.1 The NL_AUTH_MESSAGE Token

The NL_AUTH_MESSAGE token contains information that is part of the first message in an authenticated transaction between a client and a server. It contains a message type, flags, and naming information. For the exact format, see section 2.2.1.3.1.

The NL_AUTH_MESSAGE token is part of the RPC PDU AUTH trailer structure as specified in [MS-RPCE] section 2.2.2.11.

The client generates an initial token and sends it to the server. The server receives the token, processes it, and passes back a return token to the client.

The exchange of this message requires a session key to have been negotiated as described in section 3.1. Upon successful exchange of tokens, the application can start using per-message calls to protect the data being passed over the network.

3.3.4.1.1 Generating an Initial NL_AUTH_MESSAGE Token

The client generates a NL_AUTH_MESSAGE token to initiate authentication to a server. The **MessageType** field of this token MUST be set to zero to indicate that this is a Negotiate message type.

The client MUST provide at least one domain name and one computer name in the token by providing the **Flags** bit and the corresponding text buffer. The **Flags** field is a bitwise OR of the values described under the **Flags** field of the NL_AUTH_MESSAGE token in section 2.2.1.3.1. This value represents the names available in the token. The **Buffer** field is then composed by concatenating the strings of the names indicated by the **Flags** value. The compressed UTF-8 strings are generated, as specified in [RFC1035] section 4.1.4.

The following is an example token on the wire.

```
00 00 00 00 17 00 00 00 4E 54 44 45 56 00 4E 41     ........NTDEV.NA
53 4B 4F 00 05 6E 74 64 65 76 04 63 6F 72 70 09     SKO..ntdev.corp.
6D 69 63 72 6F 73 6F 66 74 03 63 6F 6D 00 05 4E     microsoft.com..N
41 53 4B 4F 00                                      ASKO.
```

3.3.4.1.2 Receiving an Initial NL_AUTH_MESSAGE Token

When the server receives the initial NL_AUTH_MESSAGE token, the server will check the token type and extract the client names using the Flags values and corresponding text buffer passed. The server MUST return SEC_E_INVALID_TOKEN (0x80090308), indicating that an invalid token has been received, when any of the following are true:

- The MessageType is not set to 0x00000000.
- A flag for a particular name type is present and the corresponding text buffer cannot be extracted from the Buffer.
- The token does not contain at least one domain name and one computer name.

The server initializes **ServerSequenceNumber** to 0. This sequence number is used to detect out-of-order messages.

3.3.4.1.3 Generating a Return NL_AUTH_MESSAGE Token

Upon successful verification and extraction of data from the initial token, the server verifies that a successful session-key negotiation has occurred by the presence of the **Session-Key** data item for the client. If no negotiation has occurred, the server MUST return SEC_E_INVALID_TOKEN (0x80090308) indicating that an invalid token has been received.

The server generates a return NL_AUTH_MESSAGE (section 2.2.1.3.1) token. The **MessageType** MUST be set to 1 to indicate that this is a Negotiate response message type, the **Flags** field SHOULD be set to zero, the **Buffer** field SHOULD contain a NULL character, and the NL_AUTH_MESSAGE token MUST be padded to 12 bytes in length.

The return NL_AUTH_MESSAGE token is then sent back to the client along with any additional application-specific data.

3.3.4.1.4 Receiving a Return NL_AUTH_MESSAGE Token

When the client receives the return token, it verifies that:

- the NL_AUTH_MESSAGE token is at least 12 bytes in length, and
- the MessageType is set to 1.

If either of these conditions are not true, the client MUST return SEC_E_INVALID_TOKEN (0x80090308) indicating that an invalid token has been received.

Otherwise, the client initializes ClientSequenceNumber to 0, which is used to detect out-of-order messages.

3.3.4.2 The Netlogon Signature Token

The Netlogon Signature token contains information that MUST be part of each protected message. It contains a signature algorithm identifier, encryption algorithm identifier, confounder, flags, sequence number, and checksum (see section 2.2.1.3.2 for the exact format). When data is protected/signed, a Netlogon Signature token is generated that describes the algorithms used and contains the checksum of the data to be sent. When data is received and is unprotected/verified, the Netlogon Signature token is used.

3.3.4.2.1 Generating a Client Netlogon Signature Token

If AES is negotiated, a client generates an NL_AUTH_SHA2_SIGNATURE token that contains an **HMAC**-SHA256 checksum [RFC4634], a sequence number, and a **Confounder** (if confidentiality has been requested) to send data protected on the wire. The data is encrypted using the AES algorithm. If AES is not negotiated, a client generates a Netlogon Signature token that contains an HMAC-MD5 checksum ([RFC2104]), a sequence number, and a **Confounder** (if confidentiality has been requested) to send data protected on the wire. The data is encrypted using the negotiated encryption algorithm. Note that in the algorithm that follows, the term Confidentiality is used as defined in section 3.3.1. The following steps are performed to generate the client Netlogon Signature tokens and to encrypt the data if requested.

1. If AES is negotiated:
   - The **SignatureAlgorithm** first byte MUST be set to 0x13, and the second byte MUST be set to 0x00.
   - If the Confidentiality option (section 3.3.1) is requested from the application, then the **SealAlgorithm** first byte MUST be set to 0x1A, the second byte MUST be set to 0x00, and the **Confounder** MUST be filled with cryptographically random data.
   - If the Confidentiality option (section 3.3.1) is not requested, then the **SealAlgorithm** MUST be filled with two bytes of 0xff and the **Confounder** is not included in the token.
2. If AES is not negotiated:
   - The **SignatureAlgorithm** first byte MUST be set to 0x77, and the second byte MUST be set to 0x00.
   - If the Confidentiality option (section 3.3.1) is requested from the application, then the **SealAlgorithm** first byte MUST be set to 0x7A, the second byte MUST be set to 0x00, and the **Confounder** MUST be filled with cryptographically random data.
   - If the Confidentiality option is not requested, then the **SealAlgorithm** MUST be filled with two bytes of value 0xff and the **Confounder** is not included in the token.
3. The **Pad** MUST be filled with 0xff bytes.
4. The **Flags** MUST be filled with 0x00 bytes.
5. The **SequenceNumber** MUST be computed using the following algorithm.

```
Assume byte(n, l) returns byte n of the 32-bit number l.
```

```
The n parameter is limited to 0..3.  The least significant
byte is 0, the most significant byte is 3.

SET CopySeqNumber[0] to byte(3, ClientSequenceNumber.LowPart)
SET CopySeqNumber[1] to byte(2, ClientSequenceNumber.LowPart)
SET CopySeqNumber[2] to byte(1, ClientSequenceNumber.LowPart)
SET CopySeqNumber[3] to byte(0, ClientSequenceNumber.LowPart)

SET CopySeqNumber[4] to byte(3, ClientSequenceNumber.HighPart)
SET CopySeqNumber[5] to byte(2, ClientSequenceNumber.HighPart)
SET CopySeqNumber[6] to byte(1, ClientSequenceNumber.HighPart)
SET CopySeqNumber[7] to byte(0, ClientSequenceNumber.HighPart)
Set CopySeqNumber[4] to CopySeqNumber[4] OR 0x80
```

6. The **ClientSequenceNumber** MUST be incremented by 1.

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

```
CALL SHA256Reset(&HashContext, Sk, sizeof(Sk));
CALL SHA256Input(HashContext, NL_AUTH_SHA2_SIGNATURE, [8 bytes]);
IF Confidentiality requested
CALL SHA256Input(HashContext, Confounder, [8 bytes]);

CALL SHA256FinalBits(HashContext, Message, size of Message;
CALL SHA256Result(HashContext, output);
SET Signature to output

Note: In the first call to SHA256Input, only the first 8-bytes
of the NL_AUTH_SHA2_SIGNATURE structure are used.
```

   Else, a signature MUST be computed using the following algorithm:

```
SET zeroes to 4 bytes of 0

CALL MD5Init(md5context)
CALL MD5Update(md5context, zeroes, [4 bytes])
CALL MD5Update(md5context, NL_AUTH_SIGNATURE, [8 bytes])
IF Confidentiality requested
     CALL MD5Update(md5context, Confounder, [8 bytes])
CALL MD5Update(md5context, Message, size of Message)
CALL MD5Final(md5context)
CALL HMAC_MD5(md5context.digest, md5context.digest length,
              Session-Key, size of Session Key, output)
SET Signature to output

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.

8. If the Confidentiality option is requested, the **Confounder** field and the data MUST be encrypted, in that order, using the same encryption algorithm.

   - If AES is negotiated, then the server MUST use AES-128 for encryption. The server MUST derive the AES key using the following algorithm:

```
FOR (I=0; I < Key Length; I++)
EncryptionKey[I] = SessionKey[I] XOR 0xf0
```

The server MUST encrypt the **Confounder** field using the initialization vector constructed by concatenating the sequence number with itself twice (thus getting 16 bytes of data). For encrypting the data, the initialization vector MUST be constructed using the last block of the encrypted **Confounder** field.

- Else, the server MUST use RC4 for encryption. The server MUST derive the RC4 key using the following algorithm:

```
SET zeroes to 4 bytes of 0

FOR (I=0; I < Key Length; I++)
     XorKey [I] = SessionKey[I] XOR 0xf0
CALL hmac md5(zeroes, [4 bytes], XorKey, size of XorKey, TmpData)
CALL hmac_md5(CopySeqNumber, size of CopySeqNumber, TmpData,
              size of TmpData, EncryptionKey)
```

The hmac_md5 function is defined in the Appendix of [RFC2104]. The server MUST use this key to initialize RC4 and encrypt the **Confounder** field and then the data. The server MUST initialize RC4 only once, before encrypting the **Confounder** field.

9. The **SequenceNumber** MUST be encrypted. If AES is negotiated, then the AES-128 algorithm MUST be used, using the SessionKey with an initialization vector constructed by concatenating the first 8 bytes of the checksum with itself twice (thus getting 16 bytes of data), otherwise the RC4 algorithm MUST be used.

    The RC4 key MUST be derived as follows:

```
SET zeroes to 4 bytes of 0

CALL hmac_md5(zeroes, [4 bytes], SessionKey, size of SessionKey, TmpData)
CALL hmac_md5(Checksum, size of Checksum, TmpData, size of TmpData,
              EncryptionKey)
```

    The NetLogon Signature token MUST then be sent to the server along with the data.

3.3.4.2.2 Receiving a Client Netlogon Signature Token

When a server receives encrypted data, it verifies the Netlogon Signature token. If AES is negotiated, a server receives an NL_AUTH_SHA2_SIGNATURE structure, otherwise it receives an NL_AUTH_SIGNATURE structure. The following steps are performed to verify the data and to decrypt with AES if negotiated, otherwise RC4 if required:

1. The **SignatureAlgorithm** bytes MUST be verified to ensure:

    - If AES is negotiated, the first byte is set to 0x13; otherwise the first byte is set to 0x77.
    - The second byte is set to 0x00.

    If either of these two is incorrect, an SEC_E_MESSAGE_ALTERED (0x8009030F) MUST be returned.

2. If the Confidentiality option is requested from the application, then the **SealAlgorithm** MUST be verified to ensure that if AES is negotiated, the first byte is set to 0x1A; otherwise the first byte is set to 0x7A. The second byte is set to 0x00.

If the Confidentiality option is not requested, then the **SealAlgorithm** MUST be verified to contain all 0xff bytes.

If either of these two is incorrect, an SEC_E_MESSAGE_ALTERED (0x8009030F) MUST be returned.

3. The **Pad** MUST be verified to contain all 0xff bytes and SEC_E_MESSAGE_ALTERED (0x8009030F) MUST be returned otherwise.

4. The **Flags** data MAY be<105> disregarded.

5. The **SequenceNumber** MUST be decrypted. If AES is negotiated, then the AES-128 algorithm MUST be used with Session Key and an initialization vector constructed by concatenating the checksum with itself (thus getting 16 bytes of data). Otherwise, the RC4 algorithm MUST be used. The RC4 key MUST be derived as follows:

```
SET zeroes to 4 bytes of 0

CALL hmac_md5(zeroes, [4 bytes], SessionKey, size of SessionKey, TmpData)
CALL hmac_md5(Checksum, size of Checksum, TmpData, size of TmpData,
              DecryptionKey)
```

6. A local copy of **SequenceNumber** MUST be computed using the following algorithm.

```
Assume byte(n, l) returns byte n of the 32-bit number l.  The n
parameter is limited to 0..3.  The least significant byte is 0,
the most significant byte is 3.

SET CopySeqNumber[0] to byte(3, ServerSequenceNumber.LowPart)
SET CopySeqNumber[1] to byte(2, ServerSequenceNumber.LowPart)
SET CopySeqNumber[2] to byte(1, ServerSequenceNumber.LowPart)
SET CopySeqNumber[3] to byte(0, ServerSequenceNumber.LowPart)

SET CopySeqNumber[4] to byte(3, ServerSequenceNumber.HighPart)
SET CopySeqNumber[5] to byte(2, ServerSequenceNumber.HighPart)
SET CopySeqNumber[6] to byte(1, ServerSequenceNumber.HighPart)
SET CopySeqNumber[7] to byte(0, ServerSequenceNumber.HighPart)
Set CopySeqNumber[4] to CopySeqNumber[4] OR 0x80
```

7. The **SequenceNumber** MUST be compared to **CopySeqNumber**. If these two do not match, SEC_E_OUT_OF_SEQUENCE MUST be returned.

8. **ServerSequenceNumber** MUST be incremented.

   If the Confidentiality option is requested, the **Confounder** and the data MUST be decrypted using RC4.

9. If the Confidentiality option is requested, the **Confounder** and the data MUST be decrypted.

   - The AES key used MUST be derived using the following algorithm:

```
FOR (I=0; I < Key Length; I++)
EncryptionKey [I] = SessionKey[I] XOR 0xf0
```

   If AES is negotiated, decrypt using an initialization vector constructed by concatenating twice the sequence number (thus getting 16 bytes of data).

   - The RC4 key used MUST be derived using the following algorithm:

```
SET zeroes to 4 bytes of 0

FOR (I=0; I < Key Length; I++)
     XorKey [I] = SessionKey[I] XOR 0xf0
CALL hmac_md5(zeroes, [4 bytes], XorKey, size of XorKey, TmpData)
CALL hmac md5(CopySeqNumber, size of CopySeqNumber, TmpData,
              size of TmpData, EncryptionKey)
```

The hmac_md5 function is specified in [RFC2104].

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

```
CALL SHA256Reset(&HashContext, Sk, sizeof(Sk));
CALL SHA256Input(HashContext, NL_AUTH_SHA2_SIGNATURE, [8 bytes]);
IF Confidentiality requested
CALL SHA256Input(HashContext, Confounder, [8 bytes]);
CALL SHA256FinalBits(HashContext, Message, size of Message);
CALL SHA256Result(HashContext, output);
SET Signature to output

Note: In the first call to SHA256Input only the first 8-bytes
of the NL_AUTH_SHA2_SIGNATURE structure are used.
```

Else a signature MUST be computed using the following algorithm:

```
SET zeroes to 4 bytes of 0

CALL MD5Init(md5context)
CALL MD5Update(md5context, zeroes, [4 bytes])
CALL MD5Update(md5context, NL_AUTH_SIGNATURE, [8 bytes])
IF Confidentiality requested
CALL MD5Update(md5context, Confounder, [8 bytes])
CALL MD5Update(md5context, Message, size of Message)
CALL MD5Final(md5context)
CALL HMAC_MD5(md5context.digest, md5context.digest length,
            Session Key, size of Session Key, output)
SET Signature to output

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

11. The first 8 bytes of the computed signature MUST be compared to the checksum. If these two do not match, the SEC_E_MESSAGE_ALTERED (0x8009030F) MUST be returned, indicating that the message was altered.

3.3.4.2.3 Generating a Server Netlogon Signature Token

If AES is negotiated, a server generates an NL_AUTH_SHA2_SIGNATURE token that contains an **HMAC-SHA256** checksum [RFC4634], a sequence number, and a **Confounder** (if confidentiality has been requested) to send data protected on the wire. The data is encrypted using the AES algorithm. If AES is not negotiated, a client generates a Netlogon Signature token that contains an HMAC-MD5 checksum ([RFC2104]), a sequence number, and a **Confounder** (if confidentiality has been requested) to send data protected on the wire. The data is encrypted using the negotiated encryption

algorithm. Note that in the algorithm that follows, the term Confidentiality is used as defined in section 3.3.1. The following steps are performed to generate the server Netlogon Signature tokens and to encrypt the data if requested.

1-4. Same as steps 1-4 in section 3.3.4.2.1.

5. The **SequenceNumber** MUST be computed using the following algorithm:

```
Assume byte(n, l) returns byte n of the 32-bit number l.
The n parameter is limited to 0..3.  The least significant
byte is 0, the most significant byte is 3.

SET CopySeqNumber[0] to byte(3, ServerSequenceNumber.LowPart)
SET CopySeqNumber[1] to byte(2, ServerSequenceNumber.LowPart)
SET CopySeqNumber[2] to byte(1, ServerSequenceNumber.LowPart)
SET CopySeqNumber[3] to byte(0, ServerSequenceNumber.LowPart)

SET CopySeqNumber[4] to byte(3, ServerSequenceNumber.HighPart)
SET CopySeqNumber[5] to byte(2, ServerSequenceNumber.HighPart)
SET CopySeqNumber[6] to byte(1, ServerSequenceNumber.HighPart)
SET CopySeqNumber[7] to byte(0, ServerSequenceNumber.HighPart)
```

6. The **ServerSequenceNumber** MUST be incremented by one. The Netlogon Signature token MUST then be sent to the client along with the data.

7-9. Same as steps 7-9 in section 3.3.4.2.1.

3.3.4.2.4 Receiving a Server Netlogon Signature Token

When a client receives encrypted data, it verifies the Netlogon Signature token. If AES is negotiated, a client receives an NL_AUTH_SHA2_SIGNATURE structure, otherwise it receives an NL_AUTH_SIGNATURE structure. The following steps are performed to verify the data and to decrypt with AES if negotiated, otherwise RC4 MUST be used if required.

1-5. Same as steps 1-5 in section 3.3.4.2.2.

6. A local copy of **SequenceNumber** MUST be computed using the following algorithm.

```
Assume byte(n, l) returns byte n of the 32-bit number l.  The n
parameter is limited to 0..3.  The least significant byte is 0,
the most significant byte is 3.

SET CopySeqNumber[0] to byte(3, ClientSequenceNumber.LowPart)
SET CopySeqNumber[1] to byte(2, ClientSequenceNumber.LowPart)
SET CopySeqNumber[2] to byte(1, ClientSequenceNumber.LowPart)
SET CopySeqNumber[3] to byte(0, ClientSequenceNumber.LowPart)

SET CopySeqNumber[4] to byte(3, ClientSequenceNumber.HighPart)
SET CopySeqNumber[5] to byte(2, ClientSequenceNumber.HighPart)
SET CopySeqNumber[6] to byte(1, ClientSequenceNumber.HighPart)
SET CopySeqNumber[7] to byte(0, ClientSequenceNumber.HighPart)
```

7. Same as step 7 in section 3.3.4.2.2.

8. **ClientSequenceNumber** MUST be incremented.

9-11. Same as steps 9-11 in section 3.3.4.2.2.

3.3.5 Timer Events

None.

3.3.6 Other Local Events

None.

3.4 Netlogon Client Details

The following sections specify data and state maintained by the Netlogon RPC client. They include details of calling Netlogon RPC methods on the client side of the client/server communication. A client in this context can be a domain member (member machine), a member server, or a DC. The provided data is to facilitate the explanation of how the protocol behaves. This section does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this document.<106>

3.4.1 Abstract Data Model

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

The Netlogon Protocol client maintains the following variables in addition to the ones described in section 3.1, Netlogon Common Details, which are part of the abstract state.

ClientCapabilities: A 32-bit set of bit flags (section 3.1.4.2) that identify the client's supported options.

domain-name (Public): For client machines, the NetBIOS name of the domain to which the machine has been joined. This Abstract Data Model element is shared with **DomainName.NetBIOS** ([MS-WKST] section 3.2.1.6). For domain controllers, the domain name to which the domain controller has a direct trust.

The Netlogon client variables which are registry keys are as follows:

RejectMD5Servers: A Boolean variable that indicates whether the client MUST reject servers that are using MD5 encryption.<107> Implementations that use the Windows registry to persistently store and retrieve the RejectMD5Servers variable SHOULD use the HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters registry path and RejectMD5Servers key.

RequireSignOrSeal: Indicates whether the client SHOULD continue session-key negotiation when the server did not specify support for Secure RPC as described in the negotiable option Y of section 3.1.4.2. Implementations that use the Windows registry [MS-GPSB] section 2.2.5 to persistently store and retrieve the RequireSignOrSeal variable SHOULD use the following:

- RegistryValueName: HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters
- RegistryValueType: 4
- RegistryValue: RequireSignOrSeal

RequireStrongKey: A Boolean variable that indicates whether the client MUST negotiate the use of a strong key during secure channel creation as described by the negotiable option O of section

3.1.4.2. <108> Implementations that use the Windows registry [MS-GPSB] section 2.2.5 to persistently store and retrieve the RequireStrongKey variable SHOULD use the following:

- RegistryValueName: HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters
- RegistryValueType: 4
- RegistryValue: RequireStrongKey

These registry keys and values MUST be exposed at a specified registry path via the Windows Remote Registry Protocol [MS-RRP]. For each abstract data model element that is loaded from the registry, there is one instance that is shared RRP and the protocol(s) that uses the abstract data model element. Any changes made to the RejectMD5Servers registry key will not be reflected in the abstract data model elements until the Netlogon server is stopped and restarted. Any changes made to the RequireStrongKey and RequireSignOrSeal registry keys will be reflected in the abstract data model elements when [MS-GPSB] a PolicyChange event is received (section 3.1.6).

When a secure channel is established, the client maintains:

ServerSessionInfo: A table indexed by *PrimaryName* with the following members:

- **PrimaryName**: The *PrimaryName* (section 3.5.4.4.1) used by the client during session-key negotiations (section 3.1.4.1).
- **ClientSequenceNumber**: See section 3.3.1 for *ClientSequenceNumber* details.
- **ServerSequenceNumber**: See section 3.3.1 for *ServerSequenceNumber* details.
- **Session-Key**: See section 3.1.4.3 for *Session-Key* computation details.
- **NegotiateFlags**: See section 3.1.1 for *NegotiateFlags* details.
- **ClientStoredCredential**: See section 3.1.1 for *ClientStoredCredential* details.
- **DomainName**: See section 3.1.1 for *ClientStoredCredential* details.
- **ConnectionStatus**: See section 3.1.1 for *ClientStoredCredential* details.
- **LastAuthenticationTry**: A FILETIME ([MS-DTYP] section 2.3.3) indicating the time when the last authentication attempt was made. The time stamp is used to determine if at least 45 seconds have passed since the last authentication attempt.

3.4.2 Timers

If the client is running on a domain controller, the client MUST create a domainControllerCacheTimer with an expiry of 15 minutes. The operation of this timer is specified in section 3.4.6.1.

3.4.3 Initialization

If the client is running on a member workstation, the client MUST initialize the **LocatedDCsCache** with one entry, as follows:

- The client MUST attempt to locate a domain controller (DC) from the client's domain by performing the steps described in section 3.1.4.10 for the domain specified by the domain-name ADM element. If a DC is successfully located, the **LocatedDCsCache** is populated based on the resulting DomainControllerInfo structure.
- If the client fails to locate a DC, the client ignores errors and MUST continue initialization.

If the client is running on a DC, the client MUST initialize the **LocatedDCsCache** for each domain trusted by the client DC, as follows:

- The client MUST get a trusted domain list by performing the external behavior consistent with locally invoking LsarEnumerateTrustedDomains ([MS-LSAD] section 3.1.4.7.8).
  - The *EnumerationContext* parameter MUST be set to 0.
  - The *PreferredMaximumLength* SHOULD be set to 4096.<109>
  - A policy handle is not needed locally.
- The client MUST attempt to locate a DC (section 3.1.4.10) for each of the domain entries of the returned trusted domain list.
  - If the client fails when attempting to locate a DC for a domain entry in the trusted domain list, the client MUST ignore errors and continue to attempt to locate DCs for the remaining domain entries in the trusted domain list.
  - For each successfully located DC, the client must add an entry to the ServerSessionInfo table with the new entry's **PrimaryName** set to **DOMAIN_CONTROLLER_INFOW.DomainControllerName** and the new entry's **DomainName** set to **DOMAIN_CONTROLLER_INFOW.DomainName**.
- For each located DC, the client MUST attempt to establish a session key with the located DC (section 3.1.4.10)

ServerSessionInfo MUST be empty.

ClientCapabilities SHOULD be initialized in an implementation-specific way to reflect the capabilities offered by that client implementation. The client SHOULD set the value according to the bit field, defined as shown in Netlogon Negotiable Options (section 3.1.4.2). Bits C, G, I, J, K, L, O, P, R, S, T, V, W, and Y SHOULD be set to 1 when a corresponding capability is supported by a given implementation.<110> Bit U SHOULD be set if the client is determined to be running on a domain controller (section 3.1.4.8). Other bits are not used and MAY be set to zero, but will be ignored upon receipt.

RejectMD5Servers MUST be initialized to FALSE.

RequireSignOrSeal SHOULD be initialized to TRUE.<111>

RequireStrongKey SHOULD be initialized to TRUE.<112>

domain-name is a shared Abstract Data Model element with **DomainName.NetBIOS** in ([MS-WKST] section 3.2.1.6).

TrustPasswordVersion MUST be initialized to 0.

3.4.4 Higher-Layer Triggered Events

Netlogon responds to a few higher-layer triggered events.

- Transport being added or removed. Whenever a new transport becomes available or unavailable, Netlogon MUST incorporate the transport event and use the DC Locator components ([MS-ADTS] section 6.3.6) to make sure that it has a valid domain controller to connect to.
- If an application calls a Netlogon method and a secure channel is not currently set up, a secure channel MUST be established before the RPC call to the server is made.

3.4.5 Message Processing Events and Sequencing Rules

For all of the method calls, the client MUST bind to the server before making the RPC call. If an application calls a Netlogon method and a secure channel is not currently set up, a secure channel MUST be established before the RPC call to the server is made. For details, see sections 3.1.4.6 and 3.1.4.7.

If the *NegotiateFlags* bit L is not set, clients calling the **NetrLogonSamLogon**/**NetrLogonSamLogonEx**/**NetrLogonSamLogonWithFlags** methods MUST have only one outstanding RPC call at a time. If the *NegotiateFlags* bit L is set, clients can have more than one concurrent RPC call.

Whenever a new transport becomes available or unavailable, Netlogon receives a notification, and it uses the DC Locator component ([MS-ADTS] section 6.3.6) to make sure that it has a valid domain controller with which to connect.

3.4.5.1 DC Location Methods

3.4.5.1.1 Calling DsrGetDcNameEx2

No client-specific events or rules are required.

3.4.5.1.2 Calling DsrGetDcNameEx

No client-specific events or rules are required.

3.4.5.1.3 Calling DsrGetDcName

No client-specific events or rules are required.<113>

3.4.5.1.4 Calling NetrGetDCName

No client-specific events or rules are required.

3.4.5.1.5 Calling NetrGetAnyDCName

No client-specific events or rules are required.

3.4.5.1.6 Calling DsrGetSiteName

No client-specific events or rules are required.

3.4.5.1.7 Calling DsrGetDcSiteCoverageW

No client-specific events or rules are required.

3.4.5.1.8 Calling DsrAddressToSiteNamesW

No client-specific events or rules are required.

3.4.5.1.9 Calling DsrAddressToSiteNamesExW

No client-specific events or rules are required.

3.4.5.1.10 Calling DsrDeregisterDnsHostRecords

The client SHOULD be prepared to handle ERROR_ACCESS_DENIED, if the server determines that the client does not have appropriate privileges.

3.4.5.1.11 Calling DsrUpdateReadOnlyServerDnsRecords

The client MUST do the following to call DsrUpdateReadOnlyServerDnsRecords.

- Use the secure channel established with a DC in the domain identified by domain-name, and pass its name as the *ServerName* parameter.<114>
- Pass the client name as the *ComputerName* parameter.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.

After the method returns, the client MUST verify the ReturnAuthenticator, as defined in section 3.1.4.5.<115>

3.4.5.2 Secure Channel Establishment and Maintenance Methods

3.4.5.2.1 Calling NetrServerReqChallenge

The client MUST do the following:

- Pass a valid domain controller name as the *PrimaryName* parameter.
- Generate 64 bits of random data to pass as the *ClientChallenge* parameter.

3.4.5.2.2 Calling NetrServerAuthenticate3

To call NetrServerAuthenticate3, the client MUST have called NetrServerReqChallenge and have a local copy of the server challenge (SC).

The client MUST set **ClientStoredCredential** to 0.

The client MUST set **ServerStoredCredential** to 0.

The client MUST compute a Netlogon credential using the algorithm described in section 3.1.4.4. The result MUST be computed using the client challenge used in the call to NetrServerReqChallenge. The computed credential is passed as the *ClientCredential* parameter.

If the server returns STATUS_ACCESS_DENIED and the client used AES:

- If RejectMD5Servers is set to FALSE and the *NegotiateFlags* parameter bit flag W is not set, the client SHOULD retry establishing the session with the MD5/DES algorithm.
- If RejectMD5Servers is set to TRUE, the client MUST fail session-key negotiation.

If RequireStrongKey is set to TRUE, and the server did not specify bit O in the *NegotiateFlags* output parameter as described in section 3.1.4.2, the client MUST fail session-key negotiation.

If RequireSignOrSeal is set to TRUE, and the server did not specify bit Y in the *NegotiateFlags* output parameter as described in section 3.1.4.2, the client MUST fail session-key negotiation.

After the call to NetrServerAuthenticate3 completes successfully, the client MUST compute the server Netlogon credential (as specified in section 3.1.4.4) and compare it with the one passed from the server for verification. The result MUST be computed using the server challenge. If the comparison fails, the client MUST fail session-key negotiation.

If the return value indicates that the method is not available on the server, the client MUST retry with a call to NetrServerAuthenticate2. If that call also fails with the method not available on the server, the client MUST retry with a call to NetrServerAuthenticate.

The client MUST compute a session key to use for encrypting further communications, as specified in section 3.1.4.3.

The client SHOULD set **ConnectionStatus** (section 3.4.5.3.1) if changed.

3.4.5.2.3 Calling NetrServerAuthenticate2

Message processing is identical to NetrServerAuthenticate3,<116> as specified in section 3.4.5.2.2, except for the following:

The *AccountRid* parameter is not present in NetrServerAuthenticate2.

3.4.5.2.4 Calling NetrServerAuthenticate

Message processing is identical to NetrServerAuthenticate3,<117> as specified in section 3.4.5.2.2, except for the following:

- The *NegotiateFlags* parameter is not present in NetrServerAuthenticate.
- The *AccountRid* parameter is not present in NetrServerAuthenticate.

3.4.5.2.5 Calling NetrServerPasswordSet2

The client MUST do the following:

- Have a secure channel that is established with a domain controller in the domain that is identified by domain-name, and pass its name as the *PrimaryName* parameter.
- Encrypt the *ClearNewPassword* parameter using the negotiated encryption algorithm (determined by bits C, O, or W, respectively, in the **NegotiateFlags** member of the **ServerSessionInfo** table entry for *PrimaryName*) and the session key established as the **encryption key**.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.

The *ClearNewPassword* parameter is constructed as follows, assuming a WCHAR-represented password of length X bytes.

If the password is for an interdomain account:

- The password is copied into the **Buffer** field of *ClearNewPassword*, which is treated as an array of bytes, starting at byte offset (512 - X).
- An NL_PASSWORD_VERSION structure, as specified in section 2.2.1.3.8, is prepared. The **PasswordVersionNumber** field of the structure is set to the value of the TrustPasswordVersion variable corresponding to the password being set. The first trust password generated has **TrustPasswordVersion** equal to one. Each time a new trust password is generated, its **TrustPasswordVersion** is computed by adding one to the value of **TrustPasswordVersion** of the previous password. The NL_PASSWORD_VERSION structure is copied into ClearNewPassword.Buffer starting at byte offset (512 - X - size of (NL_PASSWORD_VERSION)). For more information on the NL_PASSWORD_VERSION structure, see section 2.2.1.3.8.
- The first (512 - X) - size of (NL_PASSWORD_VERSION) bytes of ClearNewPassword.Buffer are filled with randomly generated data.
- ClearNewPassword.Length is set to X.

For any other type of account:

- The password is copied into the **Buffer** field of *ClearNewPassword*, which is treated as an array of bytes, starting at byte offset (512 - X).
- The first (512 - X) bytes are filled with randomly generated data.
- ClearNewPassword.Length is set to X.

After the method returns, the client MUST verify the ReturnAuthenticator as defined in section 3.1.4.5.

On receiving STATUS_ACCESS_DENIED, the client SHOULD<118> re-establish the secure channel with the domain controller.

3.4.5.2.6 Calling NetrServerPasswordSet

The client MUST do the following:

- Have a secure channel established with a DC in the domain identified by domain-name, and pass its name as the *PrimaryName* parameter.
- Pass the encrypted new password:
  1. Compute the NTOWFv1 ([MS-NLMP] section 3.3.1) of the new password.
  2. Encrypt ([MS-SAMR] section 2.2.11.1.1) the result of step 1 using the Session-Key for the secure channel as the specified key.
  3. Pass the result of step 2 as the *UasNewPassword* parameter.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.

After the method returns, the client MUST verify the ReturnAuthenticator as described in section 3.1.4.5.

On receiving STATUS_ACCESS_DENIED, the client SHOULD<119> re-establish the secure channel with the domain controller.

3.4.5.2.7 Calling NetrServerPasswordGet

The client calling this method MUST be a BDC. The client MUST do the following:

- Have a secure channel established with a domain controller in the domain identified by domain-name and pass its name as the *ServerName* parameter.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.

The client MUST decrypt the *EncryptedNtOwfPassword* return parameter that was encrypted (as described in [MS-SAMR] section 2.2.11.1.1) with the Session-Key for the secure channel as the specified key.

After the method returns, the client MUST verify the *ReturnAuthenticator* as defined in section 3.1.4.5.

On receiving STATUS_ACCESS_DENIED, the client SHOULD <120> reestablish the secure channel with the domain controller.

3.4.5.2.8 Calling NetrServerTrustPasswordsGet

The process for calling NetrServerTrustPasswordsGet is the same as that used for NetrServerGetTrustInfo, except the *TrustInfo* parameter is not specified.

See section 3.4.5.5.6, Calling NetrServerGetTrustInfo.

3.4.5.2.9 Calling NetrLogonGetDomainInfo

The client MUST do the following:

- Have a secure channel established with a domain controller in the domain identified by domain-name, and pass its name as the *ServerName* parameter.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.
- Pass the *Level* parameter set to 1 or 2.

After the method returns, the client MUST verify the *ReturnAuthenticator* as defined in section 3.1.4.5.

On receiving STATUS_ACCESS_DENIED, the client SHOULD<121> re-establish the secure channel with the domain controller.

3.4.5.2.10 Calling NetrLogonGetCapabilities

The client MUST do the following:<122>

- Have a secure channel established with a domain controller in the domain identified by domain-name, and pass its name as the *ServerName* parameter.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.

After the method returns, the client MUST verify the *ReturnAuthenticator* (section 3.1.4.5) and compare the received **Capabilities** with the negotiated flags of the current secure channel. If the negotiated flags do not match, then the client SHOULD re-establish the secure channel with the DC.<123>

Upon receiving STATUS_NOT_IMPLEMENTED, the client MUST treat this as successful confirmation that the DC does not support AES [FIPS197].<124>

On receiving STATUS_ACCESS_DENIED, the client SHOULD re-establish the secure channel with the DC. <125>

3.4.5.2.11 Calling NetrChainSetClientAttributes

The read-only domain controller MUST do the following:

- Have a secure channel established with a normal (writable) DC in the domain identified by domain-name and pass its name as the *ServerName* parameter.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.
- Pass the *dwInVersion* parameter set to 1.
- Pass the address of a valid NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1 structure as the *pmsgIn* parameter.
- Pass the *pdwOutVersion* parameter set to the address of the value 1.
- Pass the address of a valid NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1 structure as the *pmsgOut* parameter.

After the method returns, the client MUST verify the ReturnAuthenticator, as specified in section 3.1.4.5.

On receiving STATUS_ACCESS_DENIED, the client SHOULD reestablish the secure channel with the normal (writable) DC.<126><127>

3.4.5.3 Pass-Through Authentication Methods

All clients SHOULD set **ConnectionStatus** (section 3.4.5.3.1) if changed.

3.4.5.3.1 Setting ConnectionStatus

When one of the following return values is received, the client SHOULD set **ConnectionStatus** to that value:

- NERR_Success
- STATUS_NO_LOGON_SERVERS
- STATUS_ACCESS_DENIED
- STATUS_NO_TRUST_LSA_SECRET
- STATUS_NO_TRUST_SAM_ACCOUNT
- STATUS_INVALID_SERVER_STATE
- STATUS_NO_MEMORY
- STATUS_INSUFFICIENT_RESOURCES
- STATUS_DISK_FULL

3.4.5.3.2 Calling NetrLogonSamLogonEx

The client MUST do the following:

- Have a secure channel established with a domain controller in the domain identified by domain-name and pass its name as the *LogonServer* parameter.
- Pass the client name as the *ComputerName* parameter.
- If the *LogonLevel* is NetlogonInteractiveInformation or NetlogonInteractiveTransitiveInformation, then encrypt<128> the **LmOwfPassword** and **NtOwfPassword** members in the NETLOGON_INTERACTIVE_INFO structure.
- If the *LogonLevel* is NetlogonServiceInformation or NetlogonServiceTransitiveInformation, then encrypt<129> the **LmOwfPassword** and **NtOwfPassword** members in the NETLOGON_SERVICE_INFO structure.
- If the *LogonLevel* is NetlogonGenericInformation, then encrypt<130> the **LogonData** member in the NETLOGON_GENERIC_INFO structure.
- Call the method using Secure RPC, as specified in [MS-RPCE] section 3.3.1.5.2.1.

If the *NegotiateFlags* bit V is not set, then the read-only domain controller (RODC) SHOULD NOT set *ExtraFlags* C or D.

If the *NegotiateFlags* bit P is set, then the client SHOULD convert:

- NetlogonInteractiveInformation to NetlogonInteractiveTransitiveInformation
- NetlogonNetworkInformation to NetlogonNetworkTransitiveInformation

- NetlogonServiceInformation to NetlogonServiceTransitiveInformation

If the *NegotiateFlags* bit G is not set and *LogonLevel* is not NetlogonGenericInformation, then the *ValidationLevel* parameter MUST be set to 2 (NETLOGON_VALIDATION_SAM_INFO (section 2.2.1.4.11)).

The *LogonLevel*, *LogonInformation*, *ValidationLevel*, and *ValidationInformation* parameters are specified in [MS-APDS] for NTLM, Kerberos, and Digest, and in [MS-RCMP] for TLS/SSL.

To call for Generic-Passthrough to authentication packages, the *LogonLevel* parameter MUST be set to 4 (NetlogonGenericInformation), and the *ValidationLevel* parameter MUST be set to 5 (NetlogonValidationGenericInfo2). The *LogonInformation* parameter MUST be a NETLOGON_GENERIC_INFO structure, as specified in section 2.2.1.4.2.

After the method returns, the client MUST:

- If the *LogonLevel* is **NetlogonNetworkInformation** or **NetlogonNetworkTransitiveInformation**, the client MUST decrypt the *UserSessionKey* and the first two elements of the **ExpansionRoom** array in the NETLOGON_VALIDATION_SAM_INFO (section 2.2.1.4.11) or in the NETLOGON_VALIDATION_SAM_INFO2 (section 2.2.1.4.12) structure.
- Verify that it received an **authoritative response** by checking the *Authoritative* parameter. If the *Authoritative* parameter is TRUE, the client MUST treat the result as final. If the *Authoritative* parameter is FALSE, the client SHOULD retry the call at a later time or at a different domain controller.

On receiving STATUS_ACCESS_DENIED, the client SHOULD re-establish the secure channel with the DC. <131>

3.4.5.3.3 Calling NetrLogonSamLogonWithFlags

Message processing for NetrLogonSamLogonWithFlags is identical to NetrLogonSamLogon, except for the following:

- NetrLogonSamLogonWithFlags has the additional parameter *ExtraFlags*.

See section 3.4.5.3.4.

3.4.5.3.4 Calling NetrLogonSamLogon

The client MUST do the following:

- Have a secure channel established with a domain controller in the domain identified by domain-name, and pass its name as the *LogonServer* parameter.
- Pass the client name as the *ComputerName* parameter.
- If the *LogonLevel* is NetlogonInteractiveInformation or NetlogonInteractiveTransitiveInformation, then encrypt<132> the **LmOwfPassword** and **NtOwfPassword** members in the NETLOGON_INTERACTIVE_INFO structure.
- If the *LogonLevel* is NetlogonServiceInformation or NetlogonServiceTransitiveInformation, then encrypt<133> the **LmOwfPassword** and **NtOwfPassword** members in the NETLOGON_SERVICE_INFO structure.
- If the *LogonLevel* is NetlogonGenericInformation, then encrypt<134> the **LogonData** member in the NETLOGON_GENERIC_INFO structure.

- If the *LogonLevel* is **NetlogonNetworkInformation** or **NetlogonNetworkTransitiveInformation**, then encrypt the *UserSessionKey* and the first two elements of the **ExpansionRoom** array in the NETLOGON_VALIDATION_SAM_INFO (section 2.2.1.4.11) or in the NETLOGON_VALIDATION_SAM_INFO2 (section 2.2.1.4.12) structure.

- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.

If the *NegotiateFlags* bit P is set, then the client SHOULD convert:

- NetlogonInteractiveInformation to NetlogonInteractiveTransitiveInformation

- NetlogonNetworkInformation to NetlogonNetworkTransitiveInformation

- NetlogonServiceInformation to NetlogonServiceTransitiveInformation

If the *NegotiateFlags* bit G is not set and *LogonLevel* is not NetlogonGenericInformation, then the *ValidationLevel* parameter MUST be set to 2 (NETLOGON_VALIDATION_SAM_INFO (section 2.2.1.4.11)).

The *LogonLevel*, *LogonInformation*, *ValidationLevel*, and *ValidationInformation* parameters are specified in [MS-APDS] for NTLM, Kerberos, and Digest, and in [MS-RCMP] for TLS/SSL.

To call for Generic-Passthrough to authentication packages, the *LogonLevel* parameter MUST be set to 4 (NetlogonGenericInformation), and the *ValidationLevel* parameter MUST be set to 5 (NetlogonValidationGenericInfo2). The *LogonInformation* parameter MUST be a NETLOGON_GENERIC_INFO structure, as specified in section 2.2.1.4.2.

After the method returns, the client MUST:

- Verify the *ReturnAuthenticator*, as specified in section 3.1.4.5.

- Verify that it received an authoritative response by checking the *Authoritative* parameter. If the *Authoritative* parameter is TRUE, the client MUST treat the result as final. If the *Authoritative* parameter is FALSE, the client SHOULD retry the call at a later time or at a different domain controller.

On receiving STATUS_ACCESS_DENIED, the client SHOULD reestablish the secure channel with the DC.<135>

3.4.5.3.5 Calling NetrLogonSamLogoff

The client MUST do the following:

- Have a secure channel established with a domain controller in the domain identified by domain-name, and pass its name as the *LogonServer* parameter.

- Pass the client name as the *ComputerName* parameter.

- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.

After the method returns, the client MUST verify the *ReturnAuthenticator* as described in section 3.1.4.5.

On receiving STATUS_ACCESS_DENIED, the client SHOULD reestablish the secure channel with the DC.<136>

3.4.5.4 Account Database Replication Methods

3.4.5.4.1 Calling NetrDatabaseDeltas

The client calling this method MUST be a BDC. It MUST do the following:

- Pass a valid PDC name as the *PrimaryName* parameter.
- Pass the client BDC name as the *ComputerName* parameter.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.
- Pass a valid database identifier as the *DatabaseID* parameter as follows:
  - For the SAM database, the *DatabaseID* parameter MUST be 0x00000000.
  - For the SAM built-in database, the *DatabaseID* parameter MUST be 0x00000001.
  - For the LSA database, the *DatabaseID* parameter MUST be 0x00000002.
- Pass the value of the local database serial number as the *DomainModifiedCount*.
- Pass the preferred maximum length of data to be returned in the DeltaArray parameter as the *PreferredMaximumLength* parameter.

On receiving the STATUS_MORE_ENTRIES status code, the client SHOULD <137> continue calling this routine in a loop updating DomainModifiedCount until all missing database entries are received. On receiving the STATUS_SUCCESS status code, the client MUST terminate the loop. The client MAY terminate the loop early on without receiving all entries. For example, the client MAY choose to do so on a system shutdown notification.

On receiving STATUS_ACCESS_DENIED, the client SHOULD <138> reestablish the secure channel with the domain controller.

3.4.5.4.2 Calling NetrDatabaseSync2

The client calling this method MUST be a BDC. The client SHOULD<139> call this method in a loop (referred to in this section as the synchronization loop) until all database records are received as indicated by the return code STATUS_SUCCESS.

The client MUST do the following:

- Pass a valid PDC name as the *PrimaryName* parameter.
- Pass the client BDC name as the *ComputerName* parameter.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.
- Pass a valid database identifier as the *DatabaseID* parameter as follows:
  - For the SAM database, the *DatabaseID* parameter MUST be 0x00000000.
  - For the SAM built-in database, the *DatabaseID* parameter MUST be 0x00000001.
  - For the LSA database, *DatabaseID* MUST be 0x00000002.
- Set *RestartState* to NormalState unless this call is a restart of a synchronization loop, in which case set *RestartState* as follows:
  - GroupState if the last delta type of the previous synchronization loop was AddOrChangeGroup.
  - UserState if the last delta type of the previous synchronization loop was AddOrChangeUser.
  - GroupMemberState if the last delta type of the previous synchronization loop was ChangeGroupMembership.

- AliasState if the last delta type of the previous synchronization loop was AddOrChangeAlias.
- AliasMemberState if the last delta type of the previous synchronization loop was ChangeAliasMembership.

- If this is a first call in a synchronization loop, pass *SyncContext* as 0x00000000. Otherwise, pass *SyncContext* as the *SyncContext* value returned by the previous call in a synchronization loop, either continued as normal or terminated.
- Pass the preferred maximum length of data to be referenced in the *DeltaArray* parameter as the *PreferredMaximumLength* parameter.

On receiving the STATUS_MORE_ENTRIES status code, the client SHOULD<140> continue calling this routine in a loop until all missing database entries are received. On receiving the STATUS_SUCCESS status code, the client MUST terminate the loop. The client MAY terminate the loop early on without receiving all entries. For example, the client MAY choose to do so on a system shutdown notification. In that case, if the client intends to restart the synchronization loop at a later point, the client MUST maintain the state for setting the *RestartState* parameter to restart the loop as previously described.

On receiving STATUS_ACCESS_DENIED, the client SHOULD<141> re-establish the secure channel with the domain controller.

3.4.5.4.3 Calling NetrDatabaseSync

Calling this method is identical to calling NetrDatabaseSync2, as specified in section 3.4.5.4.2, except that this call does not use the *RestartState* parameter, as it doesn't support restarting the synchronization loop.

3.4.5.4.4 Calling NetrDatabaseRedo

The client calling this method MUST be a BDC. The client MUST do the following:

- Pass a valid PDC name as the *PrimaryName* parameter.
- Pass the client BDC name as the *ComputerName* parameter.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.
- Pass a valid single account object information request message as described in the CHANGELOG_ENTRY structure in section 3.5.4.6.4.
- Pass the size of the single account object information request message as the *ChangeLogEntrySize* parameter.

On receiving STATUS_ACCESS_DENIED, the client SHOULD<142> reestablish the secure channel with the domain controller.

3.4.5.5 Domain Trusts Methods

3.4.5.5.1 Calling DsrEnumerateDomainTrusts

No client-specific events or rules are required.

3.4.5.5.2 Calling NetrEnumerateTrustedDomainsEx

No client-specific events or rules are required.

3.4.5.5.3 Calling NetrEnumerateTrustedDomains

No client-specific events or rules are required.

3.4.5.5.4 Calling NetrGetForestTrustInformation

The client calling this method MUST be a DC in a different domain. If the NegotiateFlags bit T is not set, then the client SHOULD NOT call this method.

The client MUST do the following:

- Have a secure channel established with a domain controller in the domain identified by domain-name and pass its name as the *ServerName* parameter.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.

After the method returns, the client MUST verify the *ReturnAuthenticator* as described in section 3.1.4.5.

On receiving STATUS_ACCESS_DENIED, the client SHOULD<143> reestablish the secure channel with the domain controller.

3.4.5.5.5 Calling DsrGetForestTrustInformation

The client SHOULD be prepared to handle ERROR_ACCESS_DENIED, if the server determines that the client does not have appropriate privileges.

3.4.5.5.6 Calling NetrServerGetTrustInfo

The client MUST do the following:

- Have a secure channel established with a domain controller in the domain identified by domain-name, and pass its name as the *TrustedDcName* parameter.

After the method returns, the client MUST verify the *ReturnAuthenticator* as described in section 3.1.4.5.

On receiving STATUS_ACCESS_DENIED, the client SHOULD<144> reestablish the secure channel with the domain controller.

3.4.5.6 Message Protection Methods

3.4.5.6.1 Calling NetrLogonGetTrustRid

If the client requires the RID for the computer account of the calling machine, the caller MUST specify this by passing NULL for both the *ServerName* and *DomainName* parameters. Otherwise, a valid *ServerName* MUST be passed. The client SHOULD be prepared to handle ERROR_ACCESS_DENIED, if the server determines that the client does not have appropriate privileges.

3.4.5.6.2 Calling NetrLogonComputeServerDigest

The client SHOULD be prepared to handle ERROR_ACCESS_DENIED, if the server determines that the client does not have appropriate privileges.

3.4.5.6.3 Calling NetrLogonComputeClientDigest

When comparing digests, the client SHOULD compare the new password digest first. If this comparison fails, the client SHOULD compare the old password digest. If that comparison also fails, the digests do not match. The client SHOULD be prepared to handle ERROR_ACCESS_DENIED, if the server determines that the client does not have appropriate privileges.

3.4.5.6.4 Calling NetrLogonSendToSam

The client calling this method MUST be a BDC or RODC. The client MUST do the following:

- Have a secure channel established with a domain controller in the domain identified by domain-name and pass its name as the *PrimaryName* parameter.
- Encrypt the *OpaqueBuffer* parameter using the negotiated encryption algorithm (determined by bits C, O, or W, respectively, in the **NegotiateFlags** member of the **ServerSessionInfo** table entry for *PrimaryName*) and the session key established as the encryption key.
- Pass a valid client Netlogon authenticator as the *Authenticator* parameter.

After the method returns, the client MUST verify the *ReturnAuthenticator* as described in section 3.1.4.5.<145>

For details about how the *OpaqueBuffer* parameter is used, see [MS-SAMS].

3.4.5.6.5 Calling NetrLogonSetServiceBits

The client SHOULD be prepared to handle ERROR_ACCESS_DENIED, if the server determines that the client does not have appropriate privileges.

3.4.5.6.6 Calling NetrLogonGetTimeServiceParentDomain

The client SHOULD be prepared to handle ERROR_ACCESS_DENIED, if the server determines that the client does not have appropriate privileges.

3.4.5.7 Administrative Services Methods

3.4.5.7.1 Calling NetrLogonControl2Ex

The client MUST do the following:

- Supply the *Data* parameter if the client is calling with one of the following *FunctionCode* values: 0x00000005(NETLOGON_CONTROL_REDISCOVER), 0x00000006(NETLOGON_CONTROL_TC_QUERY), 0x00000008(NETLOGON_CONTROL_FIND_USER), 0x00000009(NETLOGON_CONTROL_CHANGE_PASSWORD), 0x0000000A(NETLOGON_CONTROL_TC_VERIFY). For details about the *FunctionCode* values, see section 3.5.4.9.1.

The client SHOULD be prepared to handle ERROR_ACCESS_DENIED, if the server determines that the client does not have appropriate privileges.

3.4.5.7.2 Calling NetrLogonControl2

The client MUST not use this method for calls requiring *QueryLevel* set to 4. All other client requirements are identical to NetrLogonControl2Ex (section 3.4.5.7.1).

3.4.5.7.3 Calling NetrLogonControl

No client-specific events or rules are required.

3.4.5.8 Obsolete Methods

3.4.5.8.1 Calling NetrLogonUasLogon

This method was used only by LAN Manager clients and is not currently used.

3.4.5.8.2 Calling NetrLogonUasLogoff

This method was used only by LAN Manager clients and is not currently used.

3.4.5.8.3 Calling NetrAccountDeltas

This method supports Microsoft LAN Manager products.

3.4.5.8.4 Calling NetrAccountSync

This method supports Microsoft LAN Manager products.

3.4.6 Timer Events

3.4.6.1 Timer Expiry on domainControllerCacheTimer

This event occurs whenever the domainControllerCacheTimer expires.

If the client is a domain controller (DC), the client MUST get a trusted domain list by performing the external behavior consistent with locally invoking LsarEnumerateTrustedDomains ([MS-LSAD] section 3.1.4.7.8).

- The *EnumerationContext* parameter MUST be set to 0.
- The *PreferredMaximumLength* SHOULD<146> be set to 4096.
- A policy handle is not needed locally.

The client MUST attempt to locate a DC (section 3.1.4.10) for each of the domain entries of the returned trusted domain list.

- If the client fails when attempting to locate a DC for a domain entry in the trusted domain list, the client MUST ignore errors and continue to attempt to locate DCs for the remaining domain entries in the trusted domain list.
- For each successfully located DC: If the DomainControllerInfo.Flags has bit G set, and the ServerSessionInfo table's entry **PrimaryName** field whose **DomainName** field matches the **DomainControllerInfoW.DomainName** field does not match the **DomainControllerInfoW.DomainControllerName** field, the client MUST update the name in **PrimaryName** so that it matches **DomainControllerInfoW.DomainControllerName**. The client also MUST attempt to establish a session key with the located DC (section 3.1.4.10).

3.4.7 Other Local Events

No additional local events are used on the client beyond the events maintained in the underlying RPC transport and GP notification.

When Netlogon receives a PolicyChange event ([MS-GPOD] section 2.8.2), NRPC implementations which use the Windows registry to persistently store and retrieve the RequireStrongKey and RequireSignOrSeal variables SHOULD load the new value from the HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters registry path and the RequireStrongKey and RequireSignOrSeal keys.

3.5 Netlogon Server Details

3.5.1 Abstract Data Model

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

A Netlogon Remote Protocol server maintains the following abstract variables, in addition to the ones defined in section 3.1:

NetlogonSecurityDescriptor: A security descriptor that is used for verifying access security during processing of some methods. This security descriptor MUST NOT be changed.

ServerCapabilities: A 32-bit set of bit flags (section 3.1.4.2) that identify the server's supported options.

DNSDomainName: The FQDN (2) domain name for the domain to which the server belongs. This Abstract Data Model element is shared with **DomainName.FQDN** ([MS-WKST] section 3.2.1.6).

NetbiosDomainName: The NetBIOS domain name for the domain to which the server belongs. This Abstract Data Model element is shared with **DomainName.NetBIOS** [MS-WKST] section 3.2.1.6).

DomainGuid: The GUID for the domain. This Abstract Data Model element is shared with **DomainGuid** ([MS-WKST] section 3.2.1.6).

DomainSid: The security identifier for the domain. This Abstract Data Model element is shared with **DomainSid** ([MS-WKST] section 3.2.1.6).

AllowSingleLabelDNSDomain: A Boolean that specifies whether DC location via single label DNS names is enabled.

AllowDnsSuffixSearch: A Boolean that specifies whether DC location via single-label domains using DNS suffix composition is enabled.

SiteName: The site name of the computer.

NextClostestSiteName: The name of the site that is closest to the site of the computer.

DynamicSiteName: Dynamically determined site name of the computer.

DynamicSiteNameTimeout: An implementation-specific time span that determines whether or not it is time to rediscover the site name.<147>

DynamicSiteNameSetTime: An implementation-specific timestamp indicating the time at which DynamicSiteName was determined.

ChallengeTable: A table indexed by **ComputerName** with the following members:

ComputerName: The **ComputerName** (section 3.5.4.4.1) used by the DC during session-key negotiations (section 3.1.4.1).

ClientChallenge: A pointer to a NETLOGON_CREDENTIAL (section 2.2.1.3.4) structure that contains the client challenge.

ServerChallenge: A pointer to a NETLOGON_CREDENTIAL structure that contains the server challenge response.

SecureChannelType: A NETLOGON_SECURE_CHANNEL_TYPE (section 2.2.1.3.13) enumerated value, as specified in section 2.2.1.3.13, that indicates the type of the secure channel being established.

FailedDiscoveryCache: The server SHOULD implement a cache containing a set of failed DC discovery attempts. The fields of the cache are implementation-specific but any cache implementation MUST be able to return the time when the last DC discovery attempt failed for a given domain name (see section 3.5.4.3.1 for more information).

FailedDiscoveryCachePeriod: The length of time, in seconds, for which an entry in the **FailedDiscoveryCache** is valid.

CacheEntryValidityPeriod: The length of time, in hours, for which an entry in the **LocatedDCsCache** is valid.

CacheEntryPingValidityPeriod: The length of time, in minutes, for which an entry in the **LocatedDCsCache** is considered valid without having to ping the DC represented by that cached entry.

The Netlogon server variables which are registry keys are as follows:

RejectMD5Clients: A Boolean variable that indicates whether the server MUST reject incoming clients that are using MD5 encryption.<148>

SignSecureChannel: A Boolean variable that determines whether a domain member attempts to negotiate signing for all secure channel traffic that it initiates.

TrustedDomains: A list of domain trusts (of type DS_DOMAIN_TRUSTW (section 2.2.1.6.2)) obtained by calling DsrEnumerateDomainTrusts (section 3.5.4.7.1).

When the server is a DC, it also maintains the following abstract variables:

RejectDES: A Boolean variable that indicates whether the server MUST reject incoming clients using DES encryption in ECB mode.

DnsForestName: The FQDN (2) forest name for the forest to which the domain belongs. This Abstract Data Model element is shared with **DomainName.FQDN** ([MS-WKST] section 3.2.1.6).<149>

LogonAttempts: A 32-bit unsigned integer shared from LogonAttempts ([MS-APDS] section 3.1.1).

NT4Emulator: A Boolean variable that indicates whether the server offers only the server capabilities of a Windows NT 4.0 unless the client specifically requests otherwise.<150>

RefusePasswordChange: A setting that indicates whether the server refuses client password changes. This domain-wide setting can be used to indicate to the client machines that they SHOULD avoid password changes. When TRUE, the *NegotiateFlags* bit I is sent.

DCRPCPort: The domain controller Netlogon port that is registered with the RPC endpoint mapper instead of the standard dynamic port.<151> It is read only once, at initialization.

SiteCoverage: The names of all the sites that a domain controller covers.

TrustedDomainObjectsCollection: A collection of trusted domain objects as defined and initialized in [MS-LSAD] section 3.1.1.5.

The server also maintains the following abstract variable for BDC replication:

SynchronizationComplete: A Boolean variable that indicates that database synchronization is complete.

When a secure channel is established, the server maintains:

ClientSessionInfo: A table indexed by *ComputerName* with the following members:

- **ComputerName**: The *ComputerName* (section 3.5.4.4.1) used by the DC during session-key negotiations (section 3.1.4.1).
- **ClientSequenceNumber**: See section 3.3.1 for *ClientSequenceNumber* details.
- **AccountRid**: The RID of this client's machine account.
- **ServerSequenceNumber**: See section 3.3.1 for *ServerSequenceNumber* details.
- **Session-Key**: See section 3.1.4.3 for *Session-Key* computation details.
- **NegotiateFlags**: See section 3.1.1 for *NegotiateFlags* details.
- **ServerStoredCredential**: See section 3.1.1 for *ServerStoredCredential* details.
- **SecureChannelType**: A **NETLOGON_SECURE_CHANNEL_TYPE** enumerated value, as specified in section 2.2.1.3.13, which indicates the type of secure channel being established with this client.

In addition, NetLogon stores service state information.

ServerServiceBits: A set of bit flags used to store the state of running services. If the bit is set to 0, the corresponding service is not running; otherwise, the bit is set to 1 and the corresponding service is running. The value of the bit flags is constructed from zero or more bit flags in the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	0	0	0	B	0	0	A	0	0	0	0	0	0

The meanings of the flags are described in the following table.

Value	Description
A	The time service is running.
B	The time service with clock hardware is running.
C	The Active Directory Web service is running.

3.5.2 Timers

No server protocol timers are introduced by this protocol.

3.5.3 Initialization

The server side registers an endpoint with RPC over named pipes transport, using the NETLOGON named pipe<152><153> and an endpoint with RPC over TCP/IP. When DCRPCPort is present and is not NULL, and the **server** is a domain controller, then the DC MUST also register the port listed in DCRPCPort ([MS-RPCE] section 3.3.3.3.1.4). The server side MUST register the Netlogon security support provider authentication_type constant [0x44] as the security provider ([MS-RPCE] section 3.3.3.3.1.3) used by the RPC interface.

NetlogonSecurityDescriptor: Initialized to the following value, expressed in Security Descriptor Description Language (SDDL) ([MS-DTYP] section 2.5.1):
D:(A;;CCLCSWRPWPDTLOCRRC;;;SY)(A;;CCDCLCSWRPWPDTLOCRSDRCWDWO;;;BA)(A;;CCLCSWLOCRRC;;;IU)(A;;CCLCSWLOCRRC;;;SU) S:(AU;FA;CCDCLCSWRPWPDTLOCRSDRCWDWO;;;WD)

ChallengeTable MUST be empty.

ClientSessionInfo MUST be empty.

RefusePasswordChange SHOULD be FALSE.

The **ServerCapabilities** field SHOULD be initialized to reflect the capabilities offered by that server implementation.

RejectMD5Clients SHOULD be initialized in an implementation specific way and SHOULD be FALSE. Implementations that use the Windows registry to persistently store and retrieve the RejectMD5Clients variable SHOULD use the HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters registry path and RejectMD5Clients key.

SealSecureChannel SHOULD be TRUE.

SignSecureChannel SHOULD be initialized in an implementation specific way and SHOULD be TRUE. Implementations that use the Windows registry ([MS-GPSB] section 2.2.5) to persistently store and retrieve the SignSecureChannel variable SHOULD use the following:

- RegistryValueName: HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters
- RegistryValueType: 4
- RegistryValue: SignSecureChannel

These registry keys and values MUST be exposed at a specified registry path via the Windows Remote Registry Protocol [MS-RRP]. For each abstract data model element that is loaded from the registry, there is one instance that is shared RRP and the protocol(s) that uses the abstract data model element. Any changes made to the RejectMD5Clients registry key will not be reflected in the abstract data model elements until the **Netlogon** server is stopped and restarted. Any changes made to the SignSecureChannel registry keys will be reflected in the abstract data model elements when [MS-GPSB] a PolicyChange event is received (section 3.1.6).

StrongKeySupport SHOULD be TRUE.<154>

NetbiosDomainName is a shared abstract data model element with **DomainName.NetBIOS** ([MS-WKST] section 3.2.1.6).

DomainGuid: Prior to the initialization of the Netlogon Remote Protocol, **DomainGuid** has already been initialized, as described in [MS-WKST] section 3.2.1.6, since Netlogon Remote Protocol is running on a system already joined to a domain.

DomainSid: Prior to the initialization of the Netlogon Remote Protocol, **DomainSid** has already been initialized, as described in [MS-WKST] section 3.2.1.6, since Netlogon Remote Protocol is running on a system already joined to a domain.

AllowSingleLabelDNSDomain SHOULD be set to a locally configured value.<155>

AllowDnsSuffixSearch SHOULD be set to TRUE.<156>

SiteName SHOULD be initialized from msDS-SiteName ([MS-ADTS] section 3.1.1.4.5.29) of the **computer object** if the server is a DC. If the server is not a DC, this abstract data model element SHOULD be set to a locally configured value.<157>

NextClosestSiteName SHOULD be initialized as follows: if the server is a DC, the server SHOULD invoke IDL_DRSQuerySitesByCost ([MS-DRSR] section 4.1.16), setting **NextClosestSiteName** to the site that is closest to **SiteName** but not equal to **SiteName**. If the server is not a DC, this abstract data model element SHOULD be initialized to NULL.

DynamicSiteNameSetTime MUST be set to a value such that **DynamicSiteNameSetTime** plus **DynamicSiteNameTimeout** is less than the current time.

FailedDiscoveryCachePeriod SHOULD be set to a locally configured value.<158>

CacheEntryValidityPeriod SHOULD be set to a locally configured value.<159>

CacheEntryPingValidityPeriod SHOULD be set to a locally configured value.<160>

If the NRPC server is a DC, then the following abstract data model variables are initialized:

- **DCRPCPort** SHOULD be initialized in an implementation specific way and MUST default to NULL. Implementations that use the Windows registry to persistently store and retrieve the **DCRPCPort** variable SHOULD use the HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters registry path and **DCRPCPort** key.
- **DnsForestName**: SHOULD be initialized from the fully qualified domain name (FQDN) (2) of **rootDomainNamingContext** ([MS-ADTS] section 3.1.1.3.2.16).
- The objects in **TrustedDomainObjectsCollection** are initialized as described in [MS-LSAD] section 3.1.1.5.
- The **NT4Emulator** field SHOULD be FALSE.
- **RejectDES** SHOULD be initialized in an implementation-specific way and SHOULD default to TRUE.<161> Implementations that use Windows registry to persistently store and retrieve the **RejectDES** variable SHOULD use the HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters registry path and **AllowNT4Crypto** key set to negation of the **RejectDES** variable.
- **ServerServiceBits** SHOULD be initialized to zero.
- **SiteCoverage** SHOULD be initialized in an implementation specific way and MUST default to NULL. Implementations that use the Windows registry to persistently store and retrieve the **SiteCoverage** variable SHOULD use the HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters registry path and **SiteCoverage** key.

3.5.4 Message Processing Events and Sequencing Rules

The following section specifies data and state maintained by the Netlogon RPC server. It includes details about receiving Netlogon RPC methods on the server side of the client/server communication. The provided data is to facilitate the explanation of how the protocol behaves. This section does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this document.

This protocol MUST instruct the RPC runtime, via the **strict_context_handle** attribute, to reject use of context handles created by a method of a different RPC interface than this one, as described in [MS-RPCE] section 3.

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

Methods in RPC Opnum Order

Method	Description
NetrLogonUasLogon	This method was for support of LAN Manager products, and it is no longer used. This method was introduced in LAN Manager. Opnum: 0
NetrLogonUasLogoff	This method was for support of LAN Manager products, and it is no longer used. This method was introduced in LAN Manager. Opnum: 1
NetrLogonSamLogon	The NetrLogonSamLogon method updates the user's **lastLogon** attribute for the Security Account Manager (SAM).<162> Opnum: 2
NetrLogonSamLogoff	The NetrLogonSamLogoff method handles logoff requests for the SAM.<163> Opnum: 3
NetrServerReqChallenge	The NetrServerReqChallenge method receives a client challenge and returns a server challenge.<164> Opnum: 4
NetrServerAuthenticate	The NetrServerAuthenticate method authenticates an account by verifying that the computed client credentials are the same as those provided in the previous challenge.<165> Opnum: 5
NetrServerPasswordSet	The NetrServerPasswordSet method sets a new password for an account in the User Account Subsystem (UAS).<166> Opnum: 6
NetrDatabaseDeltas	The NetrDatabaseDeltas method returns a set of recent actions performed on the Security Account Manager (SAM) database, along with the number of times the domain has been modified.<167> Opnum: 7
NetrDatabaseSync	The NetrDatabaseSync method provides an interface to synchronize a backup domain controller's Security Account Manager (SAM) database to that of the primary domain controller (PDC) by means of replication.<168> Opnum: 8
NetrAccountDeltas	The NetrAccountDeltas method supported LAN Manager BDCs, and is no longer supported.<169> Opnum: 9
NetrAccountSync	The NetrAccountSync method supported LAN Manager BDCs, and is no longer supported.<170> Opnum: 10
NetrGetDCName	The NetrGetDCName method retrieves the NetBIOS name of the PDC for a specified domain.<171> Opnum: 11
NetrLogonControl	The NetrLogonControl method executes a specific Netlogon control operation.<172> Opnum: 12
NetrGetAnyDCName	The NetrGetAnyDCName method retrieves the name of a domain controller in a specified domain.<173>

Method	Description
	Opnum: 13
NetrLogonControl2	The NetrLogonControl2 method executes a specific Netlogon control operation. This method extends NetrLogonControl by allowing an input buffer that contains data for a particular query.<174> Opnum: 14
NetrServerAuthenticate2	The NetrServerAuthenticate2 method handles logoff requests for the Security Account Manager (SAM).<175> Opnum: 15
NetrDatabaseSync2	The NetrDatabaseSync2 method is used by a BDC to request the entire database from a PDC. It can be called only by a BDC that has been previously authenticated by the PDC.<176> Opnum: 16
NetrDatabaseRedo	The NetrDatabaseRedo method is used by a SAM BDC to request information about a single account. It can be called only by a BDC that has been previously authenticated by the PDC.<177> Opnum: 17
NetrLogonControl2Ex	The NetrLogonControl2Ex method executes a specific Netlogon control operation. The introduction of this method added support for query level (4) to both NetrLogonControl2Ex and NetrLogonControl2 for retrieving user account information.<178> Opnum: 18
NetrEnumerateTrustedDomains	The NetrEnumerateTrustedDomains method returns an enumeration of trusted domain names.<179> Opnum: 19
DsrGetDcName	The DsrGetDcName method returns the current domain controller for a specified domain.<180> Opnum: 20
NetrLogonGetCapabilities	The NetrLogonGetCapabilities method returns server capabilities.<181> Opnum: 21
NetrLogonSetServiceBits	The NetrLogonSetServiceBits method indicates to Netlogon whether a domain controller is running a specified service. This is done by setting service bits.<182> Opnum: 22
NetrLogonGetTrustRid	The NetrLogonGetTrustRid method is used to obtain the RID of the account that is used by the specified server in its secure channel, to determine the **DomainName** for the specified domain.<183> Opnum: 23
NetrLogonComputeServerDigest	The NetrLogonComputeServerDigest method computes a cryptographic digest of a message.<184> Opnum: 24
NetrLogonComputeClientDigest	The NetrLogonComputeClientDigest method is used by a client to compute a cryptographic digest of a message.<185> Opnum: 25
NetrServerAuthenticate3	The NetrServerAuthenticate3 method extends NetrServerAuthenticate2, returning an account RID after

Method	Description
	authentication.<186> Opnum: 26
DsrGetDcNameEx	The DsrGetDcNameEx method returns the current domain controller for a specified domain and site.<187> Opnum: 27
DsrGetSiteName	The DsrGetSiteName method returns the site name for a specified computer.<188> Opnum: 28
NetrLogonGetDomainInfo	The NetrLogonGetDomainInfo method returns information that describes the current domain to which a specified client belongs.<189> Opnum: 29
NetrServerPasswordSet2	The NetrServerPasswordSet2 method allows an account to set a new clear text password. This method extends NetrServerPasswordSet, which specifies an encrypted one-way function (OWF) of a password.<190> Opnum: 30
NetrServerPasswordGet	The NetrServerPasswordGet method allows a BDC to get a computer account password from the PDC in the domain.<191> Opnum: 31
NetrLogonSendToSam	The NetrLogonSendToSam method allows a BDC or RODC to forward user account password changes to the PDC.<192> Opnum: 32
DsrAddressToSiteNamesW	The DsrAddressToSiteNamesW method resolves a list of socket addresses as their corresponding site names. <193> Opnum: 33
DsrGetDcNameEx2	The DsrGetDcNameEx2 method returns the current DC for a specified domain and site.<194> Opnum: 34
NetrLogonGetTimeServiceParentDomain	The NetrLogonGetTimeServiceParentDomain method returns the name of the parent domain of the current domain.<195> Opnum: 35
NetrEnumerateTrustedDomainsEx	The NetrEnumerateTrustedDomainsEx method returns a list of trusted domains from a specified server.<196> Opnum: 36
DsrAddressToSiteNamesExW	The DsrAddressToSiteNamesExW method translates a list of socket addresses into their corresponding site names and subnet names.<197> Opnum: 37
DsrGetDcSiteCoverageW	The DsrGetDcSiteCoverageW method returns a list of sites covered by a DC.<198> Opnum: 38
NetrLogonSamLogonEx	The NetrLogonSamLogonEx method provides an extension to NetrLogonSamLogon that allows for Windows NT operating system LAN Manager (NTLM) pass-through authentication.<199>

Method	Description
	Opnum: 39
DsrEnumerateDomainTrusts	The DsrEnumerateDomainTrusts method returns an enumerated list of domain trusts, filtered by a set of flags, from a specified server.<200> Opnum: 40
DsrDeregisterDnsHostRecords	The DsrDeregisterDnsHostRecords method deletes DNS entries, except for type A records registered by a DC.<201> Opnum: 41
NetrServerTrustPasswordsGet	The NetrServerTrustPasswordsGet method returns encrypted passwords for an account on a server.<202> Opnum: 42
DsrGetForestTrustInformation	The DsrGetForestTrustInformation method retrieves the trust information for the forest of the specified domain controller, or for a forest trusted by the forest of the specified DC.<203> Opnum: 43
NetrGetForestTrustInformation	The NetrGetForestTrustInformation method retrieves the trust information for the forest of which the member's domain is itself a member.<204> Opnum: 44
NetrLogonSamLogonWithFlags	The NetrLogonSamLogonWithFlags method handles logon requests for the SAM according to specific property flags.<205> Opnum: 45
NetrServerGetTrustInfo	The NetrServerGetTrustInfo method returns an information block from a specified server. The information includes encrypted passwords for a particular account and trust data.<206> Opnum: 46
OpnumUnused47	Opnum: 47
DsrUpdateReadOnlyServerDnsRecords	The DsrUpdateReadOnlyServerDnsRecords method allows an RODC to send a control command to a normal (writable) DC for site-specific and CName types of DNS records update. This method is available beginning with Windows Server 2008 operating system. Opnum: 48
NetrChainSetClientAttributes	When a read-only DC receives either the NetrServerAuthenticate3 method or the NetrLogonGetDomainInfo method, with updates requested, it invokes this method on a normal (writable) DC to update to a client's computer account object in Active Directory. This method is available beginning with Windows Server 2008. Opnum: 49

Note that gaps in the opnum numbering sequence represent opnums that MUST NOT<207> be used over the wire.

All methods MUST NOT throw an exception.

The following is a complete list of the Netlogon methods that require a secure channel to be established before they are called by a client. See section 3.1.4.1 for details about how to establish a secure channel between the client and the server:

- DsrUpdateReadOnlyServerDnsRecords

- NetrGetForestTrustInformation
- NetrLogonSamLogon
- NetrLogonSamLogonEx
- NetrLogonSamLogonWithFlags
- NetrLogonSamLogoff
- NetrLogonSendToSam
- NetrServerPasswordGet
- NetrServerPasswordSet
- NetrServerPasswordSet2
- NetrServerGetTrustInfo
- NetrServerTrustPasswordsGet
- NetrLogonGetDomainInfo
- NetrChainSetClientAttributes
- NetrDatabaseDeltas
- NetrDatabaseSync
- NetrDatabaseSync2
- NetrDatabaseRedo
- NetrAccountDeltas
- NetrAccountSync
- NetrLogonDummyRoutine1

3.5.4.1 RPC Binding Handles for Netlogon Methods

RPC binding is the process of creating a logical connection between a client and a server. The information that composes the binding between client and server is represented by a structure called a binding handle.

All Netlogon RPC methods accept an RPC binding handle as the first parameter. With the exception of the NetrLogonSamLogonEx (section 3.5.4.5.1) method, which uses an RPC primitive binding handle (see [MS-RPCE] section 3.3.2.3.1), all Netlogon RPC methods use a custom binding handle.

This type is declared as follows:

```
typedef [handle] wchar_t* LOGONSRV_HANDLE;
```

This custom binding handle is a null-terminated Unicode string of the name of the server that receives the call. The server name can be in either the NetBIOS format or the DNS format. It may or may not be prefixed with two backslashes. There is no prescriptive requirement regarding backslashes. It MAY<208> be NULL, in which case the server is the same as the client (that is, the local machine).

3.5.4.2 Determining client privileges

To determine access rights, the client access token is retrieved from the RPC transport, as described for RpcImpersonationAccessToken in [MS-RPCE] section 3.3.3.4.3.

Method Access Control Algorithm: During processing of methods that implement access checks, the server implementing this protocol SHOULD perform access security verification on the client's identity, using the algorithm specified by the Access Check Algorithm Pseudo code ([MS-DTYP] section 2.5.3.2). For this protocol, the input parameters of that algorithm are mapped as follows:

- *SecurityDescriptor*: This MUST be the NetlogonSecurityDescriptor ADM element.
- *Token / Authorization Context*: This MUST be the identity of the client from the ADM element RpcImpersonationAccessToken, retrieved as specified in [MS-RPCE] section 3.3.3.4.3.
- *Access Request mask*: This is specified by each method's processing logic and MUST be one or more of the Access Rights specified previously in section 2.2.1.4.18.
- *Object Tree*: This parameter MUST be NULL.
- *PrincipalSelfSubst SID*: This parameter MUST be NULL.

3.5.4.3 DC Location Methods

Methods in this group are used to locate a domain controller as outlined in section 1.3.

3.5.4.3.1 DsrGetDcNameEx2 (Opnum 34)

The DsrGetDcNameEx2 method returns information about a domain controller in the specified domain and site.<209> If the *AccountName* parameter is not NULL, and a DC matching the requested capabilities (as defined in the *Flags* parameter) responds during this method call, then that DC will have verified that the DC account database contains an account for the *AccountName* specified. The server that receives this call is not required to be a DC.

```
NET_API_STATUS DsrGetDcNameEx2(
  [in, unique, string] LOGONSRV_HANDLE ComputerName,
  [in, unique, string] wchar_t* AccountName,
  [in] unsigned long AllowableAccountControlBits,
  [in, unique, string] wchar_t* DomainName,
  [in, unique] GUID* DomainGuid,
  [in, unique, string] wchar_t* SiteName,
  [in] unsigned long Flags,
  [out] PDOMAIN CONTROLLER INFOW* DomainControllerInfo
);
```

ComputerName: The custom RPC binding handle (section 3.5.4.1).

AccountName: A null-terminated Unicode string that contains the name of the account that MUST exist and be enabled on the DC.

AllowableAccountControlBits: A set of bit flags that list properties of the *AccountName* account. A flag is TRUE (or set) if its value is equal to 1. If the flag is set, then the account MUST have that property; otherwise, the property is ignored. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	F	0	0	0	0	0	0	0	0	0	0	0	E	D	C	0	B	A	0	0	0	0	0	0	0	0

Where the bits are defined as:

Value	Description
A	Account for users whose primary account is in another domain. This account provides user access to the domain, but not to any domain that trusts the domain.
B	Normal domain user account.
C	Interdomain trust account.
D	Computer account for a domain member.
E	Computer account for a BDC.
F	Computer account for an RODC.<210>

All other bits MUST be set to zero and MUST be ignored on receipt.

DomainName: A null-terminated Unicode string that contains the domain name. If the string is NULL or empty (that is, the first character in the string is the null-terminator character), then the primary domain name is assumed.

DomainGuid: A pointer to a GUID structure that specifies the GUID of the domain queried. If *DomainGuid* is not NULL and the domain specified by *DomainName* cannot be found, the DC locator attempts to locate a DC in the domain that has the GUID specified by *DomainGuid*. This allows renamed domains to be found by their GUID.

SiteName: A null-terminated string that contains the name of the site in which the DC MUST be located.

Flags: A set of bit flags that provide additional data that is used to process the request. A flag is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
S	R	0	0	0	0	0	0	W	V	U	T	Q	P	O	N	M	L	K	J	I	H	G	F	E	D	C	B	0	0	0	A

Where the bits are defined as:

Value	Description
A	The server ignores any cached DC data.

Value	Description
B	The server returns a DC that supports directory service functions.
C	The server first attempts to find a DC that supports directory service functions.
D	The server returns a DC that is a global catalog server for the forest.
E	The server returns a DC that is the PDC for the domain.
F	The server uses cached DC data if available, even if the cached data is expired.
G	The server returns a DC that has an IP (either IPv4 or IPv6) address.
H	The server returns a DC that is currently running the Kerberos Key Distribution Center service.
I	The server returns a DC that is currently running the Windows Time Service.
J	The server returns a DC that is writable.
K	The server first attempts to find a DC that is a reliable time server. If a reliable time server is unavailable, the server returns a DC that is currently running the Windows Time Service.
L	The server returns a different DC in the domain, if one exists.
M	The server returns a server that is an LDAP server. The server MAY return a DC.
N	Specifies that the *DomainName* parameter is a NetBIOS name.
O	Specifies that the *DomainName* parameter is a DNS name.
P	The server attempts to find a DC in the next closest site, if a DC in the closest site is not available. If a DC in the next closest site is also not available, the server returns any available DC.<211>
Q	The server returns a DC that has a DC functional level of DS_BEHAVIOR_WIN2008 or greater, as specified in [MS-ADTS] section 6.1.4.2.
R	Specifies that the names returned in the **DomainControllerName** and **DomainName** fields of *DomainControllerInfo* are DNS names.
S	Specifies that the names returned in the **DomainControllerName** and **DomainName** fields of *DomainControllerInfo* are NetBIOS names.
T	The server returns a DC that is currently running the Active Directory Web Service.

Value	Description
U	The server returns a DC that has a DC functional level of DS_BEHAVIOR_WIN2012 or greater, as specified in [MS-ADTS] section 6.1.4.2.
V	The server returns a DC that has a DC functional level of DS_BEHAVIOR_WIN2012R2 or greater, as specified in [MS-ADTS] section 6.1.4.2.
W	The server returns a DC that has a DC functional level of DS_BEHAVIOR_WINTHRESHOLD or greater, as specified in [MS-ADTS] section 6.1.4.2.

All other bits MUST be set to zero. The server MUST return ERROR_INVALID_FLAGS if any of the unspecified bits are not zero.

DomainControllerInfo: A pointer to a DOMAIN_CONTROLLER_INFOW structure (section 2.2.1.2.1) containing data about the DC.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following *Flags* parameter validations:

- Flags D, E, and H MUST NOT be combined with each other.
- Flag N MUST NOT be combined with the O flag.
- Flag R MUST NOT be combined with the S flag.
- Flags B, Q, U, V, and W MUST NOT be combined with each other.
- Flag K MUST NOT be combined with any of the flags: B, C, D, E, or H.
- Flag P MUST NOT be set when the SiteName parameter is provided.

The server MUST return ERROR_INVALID_FLAGS for any of the previously mentioned conflicting combinations.

Additionally, the server MUST perform the following parameter validations:

- If the flag D is set and *DomainName* parameter is neither NULL nor empty, the *DomainName* is a valid NetBIOS name format or a fully qualified domain name (FQDN) (2) format, and the *DomainName* is not FQDN(2) or NetBIOS name of a trusted forest, then the server MUST return ERROR_NO_SUCH_DOMAIN. To determine the list of trusted forests, and their FQDN(2) and NetBIOS names, the server MUST use the **TrustedDomains** ADM. The domains from this collection that have the C bit set in the *Flags* field represent the trusted forests.
- If the flag N is set and *DomainName* parameter is neither NULL nor empty and the *DomainName* is NOT a valid NetBIOS name format, then the server MUST return ERROR_INVALID_DOMAINNAME.
- If the flag O is set and *DomainName* parameter is neither NULL nor empty and the *DomainName* is NOT in a valid fully qualified domain name (FQDN) (2) format and **AllowDnsSuffixSearch** is FALSE, then the server MUST return ERROR_INVALID_DOMAINNAME.
- If neither the N flag nor the O flag are specified and *DomainName* parameter is neither NULL nor empty, then the server MUST return ERROR_INVALID_DOMAINNAME if the *DomainName* is neither a valid NetBIOS name format nor a valid fully qualified domain name (FQDN) (2) format.

If the A bit in *Flags* is not set, then the server SHOULD attempt to use the **LocatedDCsCache** and **FailedDiscoveryCache** if it has them, even if the F bit in *Flags* is not set. The process for this is as follows:

- If there is no entry for the requested domain in **LocatedDCsCache**, then check if it exists in **FailedDiscoveryCache**. If an entry is found in **FailedDiscoveryCache**, then find the delta between the current time and the last failure time for that cache entry. If this delta is less than **FailedDiscoveryCachePeriod**, the server SHOULD return an error.

- If there is an entry for the requested domain in **LocatedDCsCache**, but its capabilities do not include the requested capabilities, then invalidate the cached entry and attempt to locate a DC as described below.

- If the delta between the current time and the creation time for the entry in **LocatedDCsCache** is greater than the **CacheEntryValidityPeriod** and the F bit in the *Flags* is not set, then invalidate the cached entry and attempt to locate a DC as described below.

- If the difference between the current time and the refresh time for the entry in **LocatedDCsCache** is greater than **CacheEntryPingValidityPeriod**, then the server MUST send a ping message to the DC prior to returning the value. The ping mechanism to be used, whether LDAP Ping ([MS-ADTS] section 6.3.3) or Mailslot Ping ([MS-ADTS] section 6.3.5), is determined based on the N and O bit settings in the *Flags*, as described below. If a ping of the DC fails, then it MUST invalidate the cache entry and attempt to locate a DC as described below. Otherwise update the refresh time and return the cached result.

The server MUST attempt to locate a domain controller for the domain specified by the client. The server MAY<212> implement alternate means of locating a DC: for example, a static list in a file, or the two methods detailed in "Locating a Domain Controller" in [MS-ADTS] section 6.3.6.

If the *ComputerName* parameter is not NULL, it is compared against the server's computer name. If the server is not a DC (section 3.1.4.8) and the *ComputerName* parameter does not match the server's computer name, the server MUST return STATUS_INVALID_COMPUTER_NAME. If the *ComputerName* parameter matches the server's computer name, the *ComputerName* parameter is NULL, or the server is a DC, then processing proceeds.

The server can use the DC location protocol ([MS-ADTS] section 6.3.6) to locate a DC (the located DC is known as the responding DC). There are two methods of locating a DC that the DC location protocol supports. One of the methods involves the DNS-based discovery mechanism (described below) and then the LDAP ping message, and the other method involves the mailslot ping message.

If the N bit is set in the *Flags* parameter, the mailslot message MUST be sent.

If the O bit is set in the *Flags* parameter, DNS-based discovery MUST be performed and the LDAP message MUST be sent.

- If the *DomainName* parameter is a fully qualified domain name (FQDN) (2) with a single label and **AllowDnsSuffixSearch** is TRUE and **AllowSingleLabelDNSDomain** is FALSE, then a DNS-based discovery SHOULD be attempted. The DNS SRV queries specified below SHOULD be performed by using FQDNs (2) formed by appending in turn each of the server's DNS suffixes to *DomainName*.

If neither the N bit nor the O bit are specified, then:

- If the *DomainName* parameter is a fully qualified domain name (FQDN) (2) with more than one label (as specified in [RFC1035]), or if the **AllowSingleLabelDNSDomain** field is TRUE and the *DomainName* parameter is a fully qualified domain name (FQDN) (2) with a single label, then a DNS-based discovery SHOULD be attempted and an LDAP message SHOULD be sent.

- If the DomainName parameter is a syntactically valid NetBIOS name (as specified in [MS-NBTE]), then the mailslot message MUST be sent.

If the DNS-based discovery is performed, the server identifies the candidate DCs by performing DNS SRV queries as follows:

1. Based on the value of the B, D, E, H, and M bits in the *Flags* parameter, the appropriate query is selected from those listed in [MS-ADTS] section 6.3.6. Other bits specified in the *Flags* parameter do not contribute to the selection of this query but are used to validate against the capabilities published in the ping response. The table below shows the specific query that is used for the different valid combinations of these bits:

Bits specified	Non site-specific query	Site-specific query
B=0/1, D=0, E=1, H=0, M=0/1	_ldap._tcp.pdc._msdcs.<domainname>	N/A
B=0/1, D=0, E=0, H=1, M=0/1	_kerberos._tcp.dc._msdcs.<domainname>	_kerberos._tcp.<sitename>._sites.dc._msdcs.<domainname>
B=0/1, D=1, E=0, H=0, M=1	_gc._tcp.<forestname>	_gc._tcp.<sitename>._sites.<forestname>
B=0/1, D=0, E=0, H=0, M=1	_ldap._tcp.<domainname>	_ldap._tcp.<sitename>._sites.<domainname>
B=0/1, D=1, E=0, H=0, M=0	_gc._tcp.dc._msdcs.<forestname>	_gc._tcp.<sitename>._sites.dc._msdcs.<forestname>
B=0/1, D=0, E=0, H=0, M=0	_ldap._tcp.dc._msdcs.<domainname>	_ldap._tcp.<sitename>._sites.dc._msdcs.<domainname>

2. If the SiteName parameter is not NULL, the server MUST attempt a site-specific query. For example, if the request is to locate a Key Distribution Center (KDC), the following query is used: _kerberos._tcp.<*SiteName*>._sites.dc._msdcs.<*DomainName*>.

3. If the *SiteName* parameter is NULL, the server MUST attempt to first use a site-specific query for the **SiteName** (ADM element) site where applicable. For example, if the request is to locate a KDC, the following query is used: _kerberos._tcp.<**SiteName**>._sites.dc._msdcs.<*DomainName*>. If the site-specific query does not result in any candidate domain controllers, or if the candidate domain controllers are not reachable via LDAP ping (described below), and if the P bit in the *Flags* parameter is set, and if **NextClosestSiteName** (ADM element) is not NULL, then the server MUST attempt to locate a DC in the next closest site by performing a site-specific query for **NextClosestSiteName**. If a DC in the next closest site is not available, or if the P bit in the *Flags* parameter was not set, or if **NextClosestSiteName** was NULL, the server MUST return any available DC, using a non-site-specific query to determine the candidate domain controllers. Using the same KDC example as before, the following non-site-specific query is used: _kerberos._tcp.dc._mcdcs.<*DomainName*>.

In either mechanism (described in [MS-ADTS] section 6.3.6), multiple candidate DCs can be discovered. The candidate DCs are pinged to determine availability and ability to satisfy the specified requirements.

The LDAP/mailslot ping messages are constructed as follows:

When using the LDAP ping method ([MS-ADTS] section 6.3.3), the server MUST set the parameters of the LDAP message as follows:

- The **DnsDomain** field of the message is set to the *DomainName* parameter of the **DsrGetDcNameEx2** call. If *DomainName* is NULL, the **DnsDomain** field of the message is set to **DnsDomainName** (section 3.5.1). If the *DomainName* parameter is a fully qualified domain name (FQDN) (2) with a single label and **AllowDnsSuffixSearch** is TRUE and **AllowSingleLabelDNSDomain** is FALSE, the **DnsDomain** field of the message is set to the FQDN (2) formed by appending in turn each of the server's DNS suffixes to *DomainName*.
- The **Host** field of the message is set to the *ComputerName* that is sending the message.
- The **User** field of the message is not set.
- The **AAC** field of the message is not set.
- The **DomainSid** field of the message is not set.
- If the **DomainGuid** parameter of the **DsrGetDcNameEx2** is not NULL, the **DomainGuid** field of the message is set to the *DomainGuid* parameter, else the **DomainGuid** field of the message is not set.

When using the mailslot ping method ([MS-ADTS] section 6.3.5), the server MUST set the parameters of the mailslot message as follows:

- The **UnicodeComputerName** field of the message is set to the *ComputerName* that is sending the message.
- The **UnicodeUserName** field of the message is not set.
- The **AllowableAccountControlBits** field of the message is not set.
- The **DomainSidSize** field of the message is set to 0x00000000.
- The **DomainSid** field of the message is not set.
- The **DomainGuid** field of the message is not set.

If the *AccountName* parameter is specified, the server MUST perform the following additional processing that is described in detail in [MS-ADTS]:

- The LDAP and mailslot query message fields are set as specified in [MS-ADTS] sections 6.3.3 and 6.3.5, except for the following:
  - LDAP ping message:
    - The **User** field of the message is set to the value of the *AccountName* parameter.
    - The **AAC** field of the message is mapped from the *AllowableAccountControlBits* parameter, according to the table in [MS-SAMR] section 3.1.5.14.2, where the "ProtocolUserAccountControl" column defines the **AAC** field while the "DatabaseUserAccountControl" column defines the *AllowableAccountControlBits*.
  - Mailslot message:

- The **UnicodeUserName** field of the message is set to the value of the *AccountName* parameter.
- The **AllowableAccountControlBits** field of the message is mapped from the *AllowableAccountControlBits* parameter, according to the table in [MS-SAMR] section 3.1.5.14.2, where the "ProtocolUserAccountControl" column defines the **AAC** field while the "DatabaseUserAccountControl" column defines the *AllowableAccountControlBits*.

LDAP/Mailslot ping responses from the candidate DCs are processed (in the order in which they are received) along with the flags to determine if the server queried meets all of the requirements, until a server that meets the requirements is found or an implementation-specific timeout is reached.

If the B bit in the *Flags* is set, then the server MUST return a DC that supports directory service functions.<213> To determine if a domain controller meets this requirement, the server MUST check the value of the **NETLOGON_SAM_LOGON_RESPONSE.NtVersion** field in the message and ensure that NETLOGON_NT_VERSION_5 or greater is specified. If a server that meets this requirement cannot be located, the server MUST return ERROR_NO_SUCH_DOMAIN.

If the C bit in the *Flags* is set, then the service MUST first attempt to find a DC that supports directory service functions.<214> To determine if a domain controller meets this requirement, the server MUST check the value of the **NETLOGON_SAM_LOGON_RESPONSE.NtVersion** field in the message and ensure that NETLOGON_NT_VERSION_5 or greater is specified. If a DC that supports the directory service functions is not available, the server MUST return the name of a non–directory service DC.

If the D bit in the *Flags* is set, then the server MUST return a DC that is a global catalog server for the forest of domains. To determine if a domain controller is a global catalog server, the server MUST check the value of the FG bit in the *Flags* field of the message as defined in [MS-ADTS] section 6.3.1.2.

If the E bit in the *Flags* is set, then the server MUST return a DC that is the PDC for the domain. To determine if a domain controller is a primary domain controller the server MUST check the value of the FP bit in the *Flags* field of the message as defined in [MS-ADTS] section 6.3.1.2. If a server that meets this requirement cannot be located, the server MUST return ERROR_NO_SUCH_DOMAIN.

If the G bit in the *Flags* is set, then the server MUST return a DC that has an IP (either IPv4 or IPv6) address. The IP address can be verified by examining the **DcIpAddress** field of the NETLOGON_SAM_LOGON_RESPONSE message or the **DcSockAddr** field of the NETLOGON_SAM_LOGON_RESPONSE_EX message. If a server that meets this requirement cannot be located, the server MUST return ERROR_NO_SUCH_DOMAIN.

If the H bit in the *Flags* is set, then the server MUST return a DC that is currently running the Kerberos Key Distribution Center service. To determine if a domain controller is currently running the Kerberos Key Distribution Center service, the server MUST check the value of the FK bit in the **Flags** field of the message as defined in [MS-ADTS] section 6.3.1.2. If a server that meets this requirement cannot be located, the server MUST return ERROR_NO_SUCH_DOMAIN.

If the I bit in the *Flags* is set, then the server MUST return a DC that is currently running the Windows Time Service. To determine if a domain controller is currently running an [MS-SNTP] implementation, the server MUST check the value of the FT bit in the *Flags* field of the message as defined in [MS-ADTS] section 6.3.1.2. If a server that meets this requirement cannot be located, the server MUST return ERROR_NO_SUCH_DOMAIN.

If the J bit in the *Flags* is set, then the server MUST return a DC that is writable.<215>To determine if a domain controller is writable, the server MUST check the value of the FW bit in the *Flags* field of the message as defined in [MS-ADTS] section 6.3.1.2. If a server that meets this requirement cannot be located, the server MUST return ERROR_NO_SUCH_DOMAIN.

If the K bit in the *Flags* is set, then the server returns a DC that is a reliable time server. If a reliable time server is unavailable, the server returns a DC that is a time server. To determine whether a domain controller is a reliable time server, the server MUST check the value of the FGT bit in the

Flags field of the message as defined in [MS-ADTS] section 6.3.1.2. To determine whether a domain controller is a time server, the server MUST check the value of the FT bit in the **Flags** field of the message as defined in [MS-ADTS] section 6.3.1.2. If a domain controller that meets either of these requirements cannot be located, the server MUST return ERROR_NO_SUCH_DOMAIN.

If the L bit in the **Flags** is set, then the server MUST return a DC in the domain other than the server, if one exists. This flag is ignored if the recipient if not running as a DC.

If the M bit in the *Flags* is set, then the server MUST return an LDAP server. To determine if a domain controller is an LDAP server, the server MUST check the value of the FL bit in the **Flags** field of the message as defined in [MS-ADTS] section 6.3.1.2. The server MAY return a DC. No other services are required to be present on the server returned. The server MAY return a server that has a writable config container or a writable schema container. If the D bit in the **Flags** is set, the server returned MUST be an LDAP server and a global catalog server, and may be a DC. No other services are implied to be present at the server. If this flag is specified, the B, C, E, H, I, J, and T bits in the **Flags** are ignored along with their respective processing requirements.

If the Q bit in **Flags** is set, then the server MUST return a DC that has a functional level of DS_BEHAVIOR_WIN2008 or greater. To determine the functional level of a DC, the server MUST locate the DC's nTDSDSA object in the directory and verify the **msDS-Behavior-Version** attribute as specified in [MS-ADTS] section 6.1.4.2.

If the T bit in the *Flags* is set, then the server MUST return a DC that is currently running the Active Directory Web Service.<216> To determine if a domain controller is currently running the Active Directory Web Service, the server MUST check the value of the FWS bit in the *Flags* field of the message as defined in [MS-ADTS] section 6.3.1.2. If a server that meets this requirement cannot be located, the server MUST return ERROR_NO_SUCH_DOMAIN.

If the U bit in **Flags** is set, then the server MUST return a DC that has a functional level of DS_BEHAVIOR_WIN2012 or greater. To determine the functional level of a DC, the server MUST locate the DC's nTDSDSA object in the directory and verify the **msDS-Behavior-Version** attribute as specified in [MS-ADTS] section 6.1.4.2.

If the V bit in **Flags** is set, then the server MUST return a DC that has a functional level of DS_BEHAVIOR_WIN2012R2 or greater. To determine the functional level of a DC, the server MUST locate the DC's nTDSDSA object in the directory and verify the **msDS-Behavior-Version** attribute as specified in [MS-ADTS] section 6.1.4.2.

If the W bit in **Flags** is set, then the server MUST return a DC that has a functional level of DS_BEHAVIOR_WINTHRESHOLD or greater. To determine the functional level of a DC, the server MUST locate the DC's nTDSDSA object in the directory and verify the **msDS-Behavior-Version** attribute as specified in [MS-ADTS] section 6.1.4.2.

NETLOGON_SAM_LOGON_RESPONSE_EX ([MS-ADTS] section 6.3.1.9) and NETLOGON_SAM_LOGON_RESPONSE ([MS-ADTS] section 6.3.1.8) messages are received from a DC in response to the LDAP and the mailslot messages, respectively. Using these response messages, the **DsrGetDcNameEx2** populates the returned DOMAIN_CONTROLLER_INFOW structure (section 2.2.1.2.1) as follows:

- The **DnsHostName**, **DnsDomainName**, **NetbiosComputerName**, and **NetbiosDomainName** fields are compressed and MUST be decompressed as described in [MS-ADTS] section 6.3.7.
- If the R flag is set in the *Flags* parameter:
  - The **DomainControllerInfo.DomainControllerName** field MUST be set to the value of the **DnsHostName** message field. If the **DnsHostName** field is not set in the message, the error ERROR_NO_SUCH_DOMAIN MUST be returned.

- The **DomainControllerInfo.DomainName** field MUST be set to the value of the **DnsDomainName** message field. If the **DnsDomainName** field is not set in the message, the error ERROR_NO_SUCH_DOMAIN MUST be returned.

- If the S flag is set in the *Flags* parameter:
  - The **DomainControllerInfo.DomainControllerName** field MUST be set to the value of the **NetbiosComputerName** message field.
  - The **DomainControllerInfo.DomainName** field MUST be set to the value of the **NetbiosDomainName** message field.
- If neither the R nor S flags are set in the *Flags* parameter:<217>
  - The **DomainControllerInfo.DomainControllerName** field MUST be set to either the value of the **DnsHostName** message field, or to the value of the **NetbiosComputerName** message field.<218>
  - The **DomainControllerInfo.DomainName** field MUST be set to either the value of the **DnsDomainName** message field, or to the value of the **NetbiosDomainName** message field. <219>
- If the IP address of the DC to which the message was sent is known from the underlying transport protocol, the **DomainControllerInfo.DomainControllerAddress** field MUST be set to that address. Otherwise, the field SHOULD be set from the value of the **NETLOGON_SAM_LOGON_RESPONSE_EX.DcSockAddr** message field if the **NETLOGON_SAM_LOGON_RESPONSE_EX.DcSockAddrSize** message field is not zero.
- If the IP address of the DC is not available because the aforementioned conditions are not met, the **DomainControllerInfo.DomainControllerAddress** field MUST be set to the **NETLOGON_SAM_LOGON_RESPONSE_EX.NetbiosComputerName** field.
- The **DomainControllerInfo.DomainControllerAddressType** field MUST be set to 0x00000001 if the **DomainControllerAddress** field is set to the IP address of the DC. Otherwise, the **DomainControllerInfo.DomainControllerAddressType** field MUST be set to 0x00000002 for a NETBIOS name.
- The **DomainControllerInfo.DomainGuid** field MUST be set to the **NETLOGON_SAM_LOGON_RESPONSE.DomainGuid** or the **NETLOGON_SAM_LOGON_RESPONSE_EX.DomainGuid** field.
- The **DomainControllerInfo.DnsForestName** field MUST be set to the value of the **NETLOGON_SAM_LOGON_RESPONSE.DnsForestName** or the **NETLOGON_SAM_LOGON_RESPONSE_EX.DnsForestName** fields if they are present, or to NULL if the **NETLOGON_SAM_LOGON_RESPONSE.DnsForestName** and the **NETLOGON_SAM_LOGON_RESPONSE_EX.DnsForestName** fields are not present.
- The **DomainControllerInfo.Flags** field MUST be set to the value of the **NETLOGON_SAM_LOGON_RESPONSE.Flags** or the **NETLOGON_SAM_LOGON_RESPONSE_EX.Flags** field. Additionally, the following flags are set in the **DomainControllerInfo.Flags** field:
  - The flag M MUST be set if the **DomainControllerInfo.DomainControllerName** field is set to the fully qualified domain name (FQDN) (1) of the DC.
  - The flag N MUST be set if the **DomainControllerInfo.DomainName** field is set to the fully qualified domain name (FQDN) (2) of the domain.
  - The flag O MUST be set if the **DomainControllerInfo.DnsForestName** field is set.

- The **DomainControllerInfo.DcSiteName** field MUST be set to the value of the **NETLOGON_SAM_LOGON_RESPONSE_EX.DcSiteName** field if it is present, or to NULL if the **NETLOGON_SAM_LOGON_RESPONSE_EX.DcSiteName** field is not present.
- The **DomainControllerInfo.ClientSiteName** field MUST be set to the value of the **NETLOGON_SAM_LOGON_RESPONSE_EX.ClientSiteName** field if it is present, or to NULL if the **NETLOGON_SAM_LOGON_RESPONSE_EX.ClientSiteName** field is not present.
    - If the **NETLOGON_SAM_LOGON_RESPONSE_EX.NextClosestSiteName** field is present, the value MUST be saved in the **NextClosestSiteName** ADM element.

If a satisfactory NETLOGON_SAM_LOGON_RESPONSE_NT40 ([MS-ADTS] section 6.3.1.7) response message is received from a Windows NT 4.0 DC in response to the mailslot messages, the **DsrGetDcNameEx2** call populates the returned **DOMAIN_CONTROLLER_INFOW** structure (section 2.2.1.2.1) as follows:

- The **DomainControllerInfo.DomainControllerName** field MUST be set to the **NETLOGON_SAM_LOGON_RESPONSE_NT40.UnicodeLogonServer** field.
- The **DomainControllerInfo.DomainControllerAddress** field MUST be set to the **NETLOGON_SAM_LOGON_RESPONSE_NT40.UnicodeLogonServer** field.
- The **DomainControllerInfo.DomainControllerAddressType** field MUST be set to 0x00000002.
- The **DomainControllerInfo.DomainGuid** field MUST be set to NULL.
- The **DomainControllerInfo.DomainName** field MUST be set to the **NETLOGON_SAM_LOGON_RESPONSE_NT40.UnicodeLogonServer** field.
- The **DomainControllerInfo.DnsForestName** field MUST be set to NULL.
- The **DomainControllerInfo.Flags** field MUST have the A and H flags set if the response is to a PDC query; otherwise it MUST be set to 0x00000000.
- The **DomainControllerInfo.DcSiteName** field MUST be set to NULL.
- The **DomainControllerInfo.ClientSiteName** field MUST be set to NULL.

If the *AccountName* parameter is not NULL, the response message validation adds the following check: if the DC response is received indicating the lack of an account, as specified in [MS-ADTS] sections 6.3.3 and 6.3.5, the server MUST return ERROR_NO_SUCH_USER.

If the server successfully locates a DC for the requested capabilities, then it SHOULD save the result in the **LocatedDCsCache**. If a DC for the domain cannot be located, then the server SHOULD save the result in the **FailedDiscoveryCache**.

3.5.4.3.2 DsrGetDcNameEx (Opnum 27)

The DsrGetDcNameEx method<220> is a predecessor to the DsrGetDcNameEx2 (section 3.5.4.3.1) method. The method returns information about a domain controller in the specified domain and site. All parameters of this method have the same meanings as the identically named parameters of the DsrGetDcNameEx2 method.

```
NET API STATUS DsrGetDcNameEx(
  [in, unique, string] LOGONSRV_HANDLE ComputerName,
  [in, unique, string] wchar t* DomainName,
  [in, unique] GUID* DomainGuid,
  [in, unique, string] wchar_t* SiteName,
  [in] unsigned long Flags,
  [out] PDOMAIN_CONTROLLER_INFOW* DomainControllerInfo
```

```
);
```

On receiving this call, the server MUST perform all of the processing done on receiving the **DsrGetDcNameEx2** call, except that any processing specific to the *AccountName* and *AllowableAccountControlBits* parameters is ignored. This function MUST be processed as if the *AccountName* and *AllowableControlBits* parameters were not specified.

3.5.4.3.3 DsrGetDcName (Opnum 20)

The DsrGetDcName method<221> is a predecessor to the DsrGetDcNameEx2 method (section 3.5.4.3.1). The method returns information about a domain controller in the specified domain. All parameters of this method have the same meanings as the identically named parameters of the DsrGetDcNameEx2 method, except for the *SiteGuid* parameter, detailed as follows.

```
NET_API_STATUS DsrGetDcName(
  [in, unique, string] LOGONSRV_HANDLE ComputerName,
  [in, unique, string] wchar_t* DomainName,
  [in, unique] GUID* DomainGuid,
  [in, unique] GUID* SiteGuid,
  [in] unsigned long Flags,
  [out] PDOMAIN_CONTROLLER_INFOW* DomainControllerInfo
);
```

SiteGuid: This parameter MUST be NULL and ignored upon receipt.

The **DsrGetDcName** call accepts the *SiteGuid* parameter instead of the *SiteName* parameter of the **DsrGetDcNameEx** call. On receiving this call, the server MUST perform all of the processing done on receiving the **DsrGetDcNameEx** call.

3.5.4.3.4 NetrGetDCName (Opnum 11)

The NetrGetDCName method<222> retrieves the NetBIOS name of the PDC for the specified domain.

```
NET_API_STATUS NetrGetDCName(
  [in, string] LOGONSRV_HANDLE ServerName,
  [in, unique, string] wchar t* DomainName,
  [out, string] wchar_t** Buffer
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1, that represents the connection to a domain controller.

DomainName: A null-terminated Unicode string that specifies the NetBIOS name of the domain.

Buffer: A pointer to a null-terminated Unicode string that contains the NetBIOS name of the PDC for the specified domain. The server name returned by this method is prefixed by two backslashes (\\).

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.<223>

If the *DomainName* parameter is not NULL and is not a valid NetBIOS name format, the server MUST return NERR_DCNotFound.

The server MUST attempt to locate a PDC for the domain specified by the client. The server MUST return NERR_DCNotFound if the PDC could not be located for the specified domain. The server

MAY<224> implement alternate means of locating DCs: for example, a static list in a file, or two methods detailed in [MS-ADTS] section 6.3.6.

NetrGetDcName returns the name of the discovered PDC.

3.5.4.3.5 NetrGetAnyDCName (Opnum 13)

The NetrGetAnyDCName method<225> retrieves the name of a domain controller in the specified primary or directly trusted domain. Only DCs can return the name of a DC in a specified directly trusted domain.

```
NET_API_STATUS NetrGetAnyDCName(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in, unique, string] wchar t* DomainName,
  [out, string] wchar_t** Buffer
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

DomainName: A null-terminated Unicode string that contains the name of the primary or directly trusted domain. If the string is NULL or empty (that is, the first character in the string is the null-terminator character), the primary domain name is assumed.

Buffer: A pointer to an allocated buffer that contains the null-terminated Unicode string containing the NetBIOS name of a DC in the specified domain. The DC name is prefixed by two backslashes (\\).

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.<226>

The server MUST attempt to locate a DC for the domain specified by the client. The server MAY<227> implement alternate means to locate domain controllers: for example, a static list in a file, or the two methods detailed in [MS-ADTS] section 6.3.6. If the server that receives this call is the PDC for the domain specified in DomainName, the server MUST return ERROR_NO_SUCH_DOMAIN.

If the *ServerName* parameter is not a valid binding handle (as described in section 3.5.4.1), the server MUST return ERROR_INVALID_COMPUTERNAME.

This method also returns errors based on Common Error Processing Rule E, specified in section 3.

NetrGetAnyDcName returns the name of the discovered DC.

3.5.4.3.6 DsrGetSiteName (Opnum 28)

The DsrGetSiteName method<228> returns the site name for the specified computer that receives this call.

```
NET_API_STATUS DsrGetSiteName(
  [in, unique, string] LOGONSRV_HANDLE ComputerName,
  [out, string] wchar_t** SiteName
);
```

ComputerName: The custom RPC binding handle (section 3.5.4.1).

SiteName: A null-terminated Unicode string that contains the name of the site in which the computer that receives this call resides.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.<229>

If the computer has been configured with a SiteName, it MUST return the SiteName immediately.

If the DynamicSiteNameSetTime plus the DynamicSiteNameTimeout is less than the current time (meaning that the DynamicSiteNameSetTime is older than allowed by DynamicSiteNameTimeout), then:

- The server MUST locate a domain controller in the domain. The server MAY<230> implement alternate means to locate DCs: for example, a static list in a file, or the two methods detailed in [MS-ADTS] section 6.3.6. If the server cannot locate a DC for the domain, then the server MUST return ERROR_NO_SUCH_DOMAIN.
- The server then populates the *SiteName* parameter with the NETLOGON_SAM_LOGON_RESPONSE_EX message ([MS-ADTS] section 6.3.1.9) by setting the *SiteName* parameter to NETLOGON_SAM_LOGON_RESPONSE_EX.ClientSiteName. The server stores the discovered site name in **DynamicSiteName**.
- The server sets the DynamicSiteNameSetTime to the current time.

Otherwise, **DynamicSiteName** MUST be returned immediately as the *SiteName* parameter.

If it is determined that the server that receives this call has no site name, the server MUST return ERROR_NO_SITENAME.

This method also returns errors based on Common Error Processing Rules B and C, specified in section 3.

3.5.4.3.7 DsrGetDcSiteCoverageW (Opnum 38)

The DsrGetDcSiteCoverageW method<231> returns a list of sites covered by a domain controller. Site coverage is detailed in [MS-ADTS] section 6.1.1.2.2.

```
NET_API_STATUS DsrGetDcSiteCoverageW(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [out] PNL SITE NAME ARRAY* SiteNames
);
```

ServerName: The custom RPC binding handle (section 3.5.4.1) that represents the connection to a DC.

SiteNames: A pointer to an NL_SITE_NAME_ARRAY structure (section 2.2.1.2.2) that contains an array of site name strings.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

This method returns errors based on Common Error Processing Rules A and B, specified in section 3.

The server MUST return all the sites for which the DC publishes site-specific DNS SRV records ([MS-ADTS] section 6.3.2.3).

3.5.4.3.8 DsrAddressToSiteNamesW (Opnum 33)

The DsrAddressToSiteNamesW method<232> translates a list of socket addresses into their corresponding site names. For details about the mapping from socket address to subnet/site name, see [MS-ADTS] sections 6.1.1.2.2.1 and 6.1.1.2.2.2.

```
NET_API_STATUS DsrAddressToSiteNamesW(
  [in, unique, string] LOGONSRV_HANDLE ComputerName,
  [in, range(0, 32000)] DWORD EntryCount,
  [in, size_is(EntryCount)] PNL_SOCKET_ADDRESS SocketAddresses,
  [out] PNL_SITE_NAME_ARRAY* SiteNames
);
```

ComputerName: The custom RPC binding handle (section 3.5.4.1) that represents the connection to a domain controller.

EntryCount: The number of socket addresses specified in *SocketAddresses*. The maximum value for *EntryCount* is 32000. The limit was chosen to prevent clients from being able to force large memory allocations on servers.

SocketAddresses: An array of NL_SOCKET_ADDRESS structures (section 2.2.1.2.4) that contains socket addresses to translate. The number of addresses specified MUST be equal to *EntryCount*.

SiteNames: A pointer to an NL_SITE_NAME_ARRAY structure (section 2.2.1.2.2) that contains a corresponding array of site names. The number of entries returned is equal to *EntryCount*. The fields of an entry are set to zero if the corresponding socket address does not map to any site, or if the address family of the socket address is not IPV4 or IPV6. The mapping of IP addresses to sites is specified in [MS-ADTS] section 6.1.1.2.2.1.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.<233>

This method returns errors based on Common Error Processing Rule A, specified in section 3.

The server MUST return the site names that correspond to the *SocketAddresses* parameter by using the method specified for IP address and site/subnet mapping ([MS-ADTS] section 6.1.1.2.2.2.1).

3.5.4.3.9 DsrAddressToSiteNamesExW (Opnum 37)

The DsrAddressToSiteNamesExW method<234> translates a list of socket addresses into their corresponding site names and subnet names. For details about the mapping from socket address to subnet/site name, see [MS-ADTS] sections 6.1.1.2.2.1 and 6.1.1.2.2.2.

```
NET API STATUS DsrAddressToSiteNamesExW(
  [in, unique, string] LOGONSRV_HANDLE ComputerName,
  [in, range(0, 32000)] DWORD EntryCount,
  [in, size_is(EntryCount)] PNL_SOCKET_ADDRESS SocketAddresses,
  [out] PNL SITE NAME EX ARRAY* SiteNames
);
```

ComputerName: The custom RPC binding handle (section 3.5.4.1) that represents the connection to a domain controller.

EntryCount: The number of socket addresses specified in *SocketAddresses*. The maximum value for *EntryCount* is 32000.<235>

SocketAddresses: An array of NL_SOCKET_ADDRESS structures (section 2.2.1.2.4) that contains socket addresses to translate. The number of addresses specified MUST be equal to *EntryCount*.

SiteNames: A pointer to an NL_SITE_NAME_EX_ARRAY structure (section 2.2.1.2.3) that contains an array of site names and an array of subnet names that correspond to socket addresses in *SocketAddresses*. The number of entries returned is equal to *EntryCount*. The fields of an entry are set to zero if the corresponding socket address does not map to any site, or if the address family of the socket address is not IPV4 or IPV6. The mapping of IP addresses to sites is specified in [MS-ADTS] section 6.1.1.2.2.1.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.<236>

This method returns errors based on Common Error Processing Rule A, specified in section 3.

The server MUST return the site and subnet names that correspond to the *SocketAddresses* by using the method specified for IP address and site/subnet mapping ([MS-ADTS] section 6.1.1.2.2.2.1).

3.5.4.3.10 DsrDeregisterDnsHostRecords (Opnum 41)

The DsrDeregisterDnsHostRecords method<237> deletes all of the DNS SRV records registered by a specified domain controller. For the list of SRV records that a domain registers, see [MS-ADTS] section 6.3.2.3, "SRV Records Registered by DC".

```
NET_API_STATUS DsrDeregisterDnsHostRecords(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in, unique, string] wchar_t* DnsDomainName,
  [in, unique] GUID* DomainGuid,
  [in, unique] GUID* DsaGuid,
  [in, string] wchar_t* DnsHostName
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1, that represents the connection to the DC.

DnsDomainName: A null-terminated Unicode string that specifies the fully qualified domain name (FQDN) (2)

DomainGuid: A pointer to the domain GUID. If the value is not NULL, the DNS SRV record of type _ldap._tcp.DomainGuid.domains._msdcs.DnsDomainName is also deregistered.

DsaGuid: A pointer to the objectGUID of the DC's NTDSDSA object. For details about the NTDSDSA object, see [MS-ADTS] section 6.1.1.2.2.1.2.1.1. If the value is not NULL, the CNAME [RFC1035] record of the domain in the form of DsaGuid._msdcs.DnsDomainName is also deregistered.

DnsHostName: A null-terminated Unicode string that specifies the fully qualified domain name (FQDN) (1) of the DC whose records are being deregistered.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.<238>

The server SHOULD determine if the client has sufficient privileges (as described in section 3.5.4.2) with the Access Request mask set to the NETLOGON_CONTROL_ACCESS mask.

If the client does not have sufficient privilege, the server MUST return ERROR_ACCESS_DENIED.

If the *DnsHostName* parameter is not null, the server MUST attempt to delete the DNS SRV records registered for the DC *DnsHostName*, as specified in [MS-ADTS] section 6.3.2.3.

If the *DomainGuid* parameter is not null, then the server MUST attempt to delete the domain-GUID-based SRV record.

If the *DsaGuid* parameter is not null, then the server MUST attempt to delete the domain CNAME record.

The deletion of site-specific records MUST be attempted for every site in the enterprise of the DC on which the method is executed.

Unless stated otherwise, if the attempt to delete any records documented above fails for any reason, then the server MUST ignore the error and continue message processing.

It is possible that this method call will create a time-consuming run that can generate significant network traffic for enterprises with many sites.

3.5.4.3.11 DSRUpdateReadOnlyServerDnsRecords (Opnum 48)

The DsrUpdateReadOnlyServerDnsRecords method will allow an RODC to send a control command to a normal (writable) DC for site-specific and CName types of DNS records update. For registration, site-specific records SHOULD be for the site in which RODC resides. For the types of DNS records, see [MS-ADTS] section 6.3.2.

```
NTSTATUS DsrUpdateReadOnlyServerDnsRecords(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in, string] wchar t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in, unique, string] wchar_t* SiteName,
  [in] unsigned long DnsTtl,
  [in, out] PNL_DNS_NAME_INFO_ARRAY DnsNames
);
```

ServerName: The custom RPC binding handle (as specified in section 3.5.4.1) that represents the connection to the normal (writable) DC.

ComputerName: A null-terminated Unicode string that contains the client computer NetBIOS name.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure (as specified in section 2.2.1.1.5) that contains the client authenticator that will be used to authenticate the client.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure that contains the server return authenticator.

SiteName: A pointer to a null-terminated Unicode string that contains the site name where the RODC resides.

DnsTtl: The Time To Live value, in seconds, for DNS records.

DnsNames: A pointer to an NL_DNS_NAME_INFO_ARRAY (section 2.2.1.2.6) structure that contains an array of NL_DNS_NAME_INFO structures.

Return Values: The method returns 0x00000000 (NO_ERROR) on success; otherwise, it returns a nonzero error code.

On receiving this call, the server performs the following steps:

- Verifies that the server is a normal (writable) DC; otherwise, the server MUST return STATUS_NOT_SUPPORTED.<239>
- Verifies that the caller (ComputerName) is an RODC; otherwise, the server MUST return STATUS_NOT_SUPPORTED.
- Verifies that the *Authenticator* passed, and compute the *ReturnAuthenticator*, as specified in section 3.1.4.5. If the *Authenticator* verification fails, the server MUST return STATUS_ACCESS_DENIED.
- Validates the requested DNS name type. Only site-specific and CName types are supported. For an unsupported DNS name type, sets the DNS name status to STATUS_NOT_SUPPORTED.
- Validates the site name for site-specific DNS name registration. Sets DNS name status to STATUS_ACCESS_DENIED for an invalid site name.

- Validates Ndnc domain name for the registration of NlDnsNdncDomainName DnsDomainInfoType. Sets DNS name status to STATUS_ACCESS_DENIED for an invalid Ndnc domain name.

This method can be called only by a machine that has established a secure channel with the server.

3.5.4.4 Secure Channel Establishment and Maintenance Methods

Methods in this group are used to establish the secure channel, as outlined in section 1.3.

3.5.4.4.1 NetrServerReqChallenge (Opnum 4)

The NetrServerReqChallenge method receives a client challenge and returns a server challenge.

```
NTSTATUS NetrServerReqChallenge(
  [in, unique, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar_t* ComputerName,
  [in] PNETLOGON_CREDENTIAL ClientChallenge,
  [out] PNETLOGON_CREDENTIAL ServerChallenge
);
```

PrimaryName: The custom RPC binding handle, as specified in section 3.5.4.1.

ComputerName: A Unicode string that contains the NetBIOS name of the client computer calling this method.

ClientChallenge: A pointer to a NETLOGON_CREDENTIAL structure, as specified in section 2.2.1.3.4, that contains the client challenge.

ServerChallenge: A pointer to a NETLOGON_CREDENTIAL structure, as specified in section 2.2.1.3.4, that contains the server challenge response.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- Apply Common Error Processing Rule A, specified in section 3.
- Apply Common Error Processing Rule B, specified in section 3, to the *PrimaryName* parameter.

The server MUST generate 64 bits of random data as the server challenge to be returned in the *ServerChallenge* parameter. The *ServerChallenge* is saved in the **ChallengeTable**, along with the client name passed in the *ComputerName* parameter and the client challenge passed in the *ClientChallenge* parameter.

3.5.4.4.2 NetrServerAuthenticate3 (Opnum 26)

The NetrServerAuthenticate3 method mutually authenticates the client and the server and establishes the session key to be used for the secure channel message protection between the client and the server.<240> It is called after the NetrServerReqChallenge method, as specified in section 3.5.4.4.1.

```
NTSTATUS NetrServerAuthenticate3(
  [in, unique, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar_t* AccountName,
  [in] NETLOGON_SECURE_CHANNEL_TYPE SecureChannelType,
  [in, string] wchar_t* ComputerName,
  [in] PNETLOGON_CREDENTIAL ClientCredential,
  [out] PNETLOGON_CREDENTIAL ServerCredential,
  [in, out] unsigned long* NegotiateFlags,
  [out] unsigned long* AccountRid
```

```
);
```

PrimaryName: The custom RPC binding handle, as specified in section 3.5.4.1.

AccountName: A null-terminated Unicode string that identifies the name of the account that contains the secret key (password) that is shared between the client and the server, as specified in section 1.5.<241>

SecureChannelType: A NETLOGON_SECURE_CHANNEL_TYPE enumerated value, as specified in section 2.2.1.3.13, that indicates the type of the secure channel being established by this call.

ComputerName: A null-terminated Unicode string that contains the NetBIOS name of the client computer calling this method.

ClientCredential: A pointer to a NETLOGON_CREDENTIAL structure, as specified in section 2.2.1.3.4, that contains the supplied client credentials, as specified in section 3.1.4.4.

ServerCredential: A pointer to a NETLOGON_CREDENTIAL structure, as specified in section 2.2.1.3.4, that contains the returned server credentials.

NegotiateFlags: A pointer to a 32-bit set of bit flags in little-endian format that indicate features supported. As input, the set of flags are those requested by the client and SHOULD be the same as ClientCapabilities. As output, they are the bit-wise AND of the client's requested capabilities and the server's ServerCapabilities. For more details, see section 3.1.4.2.

AccountRid: A pointer that receives the RID of the account specified by the *AccountName* parameter. ([MS-ADTS] section 3.1.1.5.2.4 describes how this RID is assigned at account creation time.) This value is stored in the **AccountRid** ADM element within the ClientSessionInfo table.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- Apply Common Error Processing Rule A, specified in section 3.
- Apply Common Error Processing Rule B, specified in section 3, to the *PrimaryName* parameter.

If the *AccountName* parameter is the name of a domain trust object, and there is a period at the end of the parameter name, the period is ignored during processing.

The server SHOULD<242> check the *SecureChannelType* parameter.

The server MUST compute the mask of supported Netlogon Options.

If **RejectDES** is set to TRUE and neither flag O nor flag W is specified by the client, the server MUST fail the session-key negotiation and return STATUS_DOWNGRADE_DETECTED.

If **RejectMD5Clients** is set to TRUE and flag W is not specified by the client, the server MUST fail the session-key negotiation and return STATUS_DOWNGRADE_DETECTED.<243>

The server MUST set **ClientStoredCredential** to 0.

The server MUST set **ServerStoredCredential** to the value of the *ClientCredential* parameter.

The server MUST compute or retrieve the NTOWFv1 (as specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1) of the client computer password and use it to compute a session key, as described in section 3.1.4.3. If the server cannot compute or retrieve the NTOWFv1 of the client computer password, it MUST return STATUS_NO_TRUST_SAM_ACCOUNT.

The server MUST compute the client Netlogon credential as described in section 3.1.4.4, and compare the result with the client Netlogon credential passed from the client for verification. The computation is performed using the *ClientChallenge* from the **ChallengeTable**. If the comparison fails, session-key negotiation fails, and the server MUST return STATUS_ACCESS_DENIED.

The server MUST compute the server Netlogon credential to be returned to the client.

The server MUST obtain the RID to be returned in the *AccountRid* parameter by performing external behavior consistent with locally invoking **SamrLookupNamesInDomain** ([MS-SAMR] section 3.1.5.11.2), using the following parameters:

- *DomainHandle* is set to the value received by performing external behavior consistent with locally invoking **SamrOpenDomain** ([MS-SAMR] section 3.1.5.1.5).
- *Count* is set to the value of 1.
- *Names* is set to an array with a length of 1, and is the only array element set to the value of <AccountName>.

If the call returns any error code other than STATUS_SUCCESS, the server MUST return that error code.

The server MUST obtain the value of the DomainHandle parameter used when invoking **SamrLookupNamesInDomain** by performing external behavior consistent with locally invoking **SamrOpenDomain** ([MS-SAMR] section 3.1.5.1.5), using the following parameters:

- *ServerHandle* is set to the value returned by performing external behavior consistent with locally invoking **SamrConnect** ([MS-SAMR] section 3.1.5.1.4).
- *DesiredAccess* is set to the value DOMAIN_LOOKUP.
- *DomainId* is set to the value of DomainSid (section 3.5.1).

If the call returns any error code other than STATUS_SUCCESS, the server MUST return that error code.

The server MUST obtain the value of the *ServerHandle* parameter used when invoking **SamrOpenDomain** by performing external behavior consistent with locally invoking **SamrConnect** ([MS-SAMR] section 3.1.5.1.4), using the following parameters:

- *ServerName* is set to the value of the NetBIOS form of the server computer name.
- *DesiredAccess* is set to the value SAM_SERVER_LOOKUP_DOMAIN.

If the call returns any error code other than STATUS_SUCCESS, the server MUST return that error code.

3.5.4.4.3 NetrServerAuthenticate2 (Opnum 15)

The NetrServerAuthenticate2 method<244> is a predecessor to the NetrServerAuthenticate3 method, as specified in section 3.5.4.4.2. All parameters of this method have the same meanings as the identically named parameters of the NetrServerAuthenticate3 method.

```
NTSTATUS NetrServerAuthenticate2(
  [in, unique, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar t* AccountName,
  [in] NETLOGON_SECURE_CHANNEL_TYPE SecureChannelType,
  [in, string] wchar t* ComputerName,
  [in] PNETLOGON_CREDENTIAL ClientCredential,
  [out] PNETLOGON_CREDENTIAL ServerCredential,
  [in, out] unsigned long* NegotiateFlags
```

```
);
```

Message processing is identical to NetrServerAuthenticate3, as specified in section 3.5.4.4.2, except for the following:

The *AccountRid* parameter is not present in NetrServerAuthenticate2.

3.5.4.4.4 NetrServerAuthenticate (Opnum 5)

The NetrServerAuthenticate method<245> is a predecessor to the NetrServerAuthenticate3 method (section 3.5.4.4.2). All parameters of this method have the same meanings as the identically named parameters of the NetrServerAuthenticate3 method.

```
NTSTATUS NetrServerAuthenticate(
  [in, unique, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar_t* AccountName,
  [in] NETLOGON_SECURE_CHANNEL_TYPE SecureChannelType,
  [in, string] wchar_t* ComputerName,
  [in] PNETLOGON_CREDENTIAL ClientCredential,
  [out] PNETLOGON_CREDENTIAL ServerCredential
);
```

Message processing is identical to NetrServerAuthenticate3, as specified in section 3.5.4.4.2, except for the following:

- The *NegotiateFlags* parameter is not present in NetrServerAuthenticate. Message processing would be identical to an invocation of NetrServerAuthenticate3 with the *NegotiateFlags* parameter set to 0.
- The *AccountRid* parameter is not present in NetrServerAuthenticate.

3.5.4.4.5 NetrServerPasswordSet2 (Opnum 30)

The NetrServerPasswordSet2 method<246> allows the client to set a new clear text password for an account used by the domain controller (as specified in section 1.5) for setting up the secure channel from the client.<247>

```
NTSTATUS NetrServerPasswordSet2(
  [in, unique, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar_t* AccountName,
  [in] NETLOGON_SECURE_CHANNEL_TYPE SecureChannelType,
  [in, string] wchar t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] PNL_TRUST_PASSWORD ClearNewPassword
);
```

PrimaryName: The custom RPC binding handle, as specified in section 3.5.4.1.

AccountName: The null-terminated Unicode string that contains the name of the account whose password is being changed.<248>

SecureChannelType: An enumerated value that describes the secure channel to be used for authentication, as specified in section 2.2.1.3.13.

ComputerName: The null-terminated Unicode string that contains the NetBIOS name of the computer making the request.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the encrypted logon credential and a time stamp.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

ClearNewPassword: A pointer to an NL_TRUST_PASSWORD structure, as specified in section 2.2.1.3.7, that contains the new password encrypted as specified in Calling NetrServerPasswordSet2 (section 3.4.5.2.5).

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- Apply Common Error Processing Rule A, specified in section 3.
- Using the *ComputerName* for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.
- Apply Common Error Processing Rule B, specified in section 3, to the *PrimaryName* parameter.

If the server *RefusePasswordChange* variable (section 3.5.1) is set and the *SecureChannelType* is WorkstationSecureChannel, the server MUST return STATUS_WRONG_PASSWORD.

The server MUST decrypt the new password supplied in the *ClearNewPassword* parameter, by using the negotiated encryption algorithm (determined by bits C, O, or W, respectively, in the **NegotiateFlags** member of the **ClientSessionInfo** table entry for *ComputerName*) and the session key established as the **decryption** key. The NTOWFv1 (as specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1) of the cleartext password MUST be computed.

The server MUST compute or retrieve (see unicodePwd, [MS-ADA3] section 2.332) the NTOWFv1 of the current client machine password, which is stored as the result of the OWF on the clear text password for the AccountName. If the current password matches the new password, success is returned to the client, but no actual password change is performed.

The server MUST change the SharedSecret abstract value to the new password supplied in the *ClearNewPassword* parameter. If the value of the **PasswordVersionPresent** field of the ClearNewPassword.Buffer parameter is equal to 0x02231968, the server MUST change the **TrustPasswordVersion** abstract value to the value of the **PasswordVersionNumber** field of the ClearNewPassword.Buffer parameter. See section 2.2.1.3.8 for more details about the type of the *ClearNewPassword* parameter.

This method can only be called by a machine that has established a secure channel with the server.

This method also returns errors based on Common Error Processing Rule D, specified in section 3.

3.5.4.4.6 NetrServerPasswordSet (Opnum 6)

The NetrServerPasswordSet method sets a new one-way function (OWF) of a password for an account used by the domain controller (as detailed in section 1.5) for setting up the secure channel from the client.

```
NTSTATUS NetrServerPasswordSet(
  [in, unique, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar_t* AccountName,
  [in] NETLOGON_SECURE_CHANNEL_TYPE SecureChannelType,
  [in, string] wchar t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
```

```
    [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] PENCRYPTED_NT_OWF_PASSWORD UasNewPassword
);
```

PrimaryName: The custom RPC binding handle, as specified in section 3.5.4.1.

AccountName: The null-terminated Unicode string that contains the name of the account whose password is being changed.<249>

SecureChannelType: An enumerated value (specified in section 2.2.1.3.13) that indicates the type of secure channel used by the client.

ComputerName: A null-terminated Unicode string that contains the NetBIOS name of the client computer calling this method.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

UasNewPassword: A pointer to an ENCRYPTED_NT_OWF_PASSWORD structure, as specified in section 2.2.1.1.4 and encrypted by the algorithm specified in section 3.4.5.2.6.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- Apply Common Error Processing Rule A, specified in section 3.
- Using the *ComputerName* for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.

If the *RefusePasswordChange* variable (section 3.5.1) is set and the *SecureChannelType* is WorkstationSecureChannel, the server MUST return STATUS_WRONG_PASSWORD.

The server MUST decrypt the new password that is supplied in the *UasNewPassword* parameter by using the inverse to the encryption algorithm that is specified in [MS-SAMR] section 2.2.11.1.1, Encrypt an NT Hash or LM Hash Value with a specified key. The session key is the specified key input, and the decryption keys are derived using the 16-byte value process, as specified in [MS-SAMR] section 2.2.11.1.4.

The server MUST compute or retrieve the NTOWFv1 (as specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1) of the current client machine password, which is stored as an OWF of the clear-text password for the account.

The server MUST compute or retrieve the NTOWFv1 of the old client machine password and compare it to the NTOWFv1 of the new password supplied in the *UasNewPassword* parameter; if they match, the server MUST return STATUS_ACCESS_DENIED.

This method can only be called by a machine that has established a secure channel with the server.

This method also returns errors based on Common Error Processing Rule D, specified in section 3.

3.5.4.4.7 NetrServerPasswordGet (Opnum 31)

The NetrServerPasswordGet method<250> allows a BDC to get a machine account password from the DC with the PDC role in the domain.

```
NTSTATUS NetrServerPasswordGet(
  [in, unique, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar t* AccountName,
  [in] NETLOGON_SECURE_CHANNEL_TYPE AccountType,
  [in, string] wchar t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [out] PENCRYPTED_NT_OWF_PASSWORD EncryptedNtOwfPassword
);
```

PrimaryName: The custom RPC binding handle, as specified in section 3.5.4.1.

AccountName: A null-terminated Unicode string that contains the name of the account to retrieve the password for.<251>

AccountType: A NETLOGON_SECURE_CHANNEL_TYPE enumerated value, as specified in section 2.2.1.3.13, that describes the secure channel to be used for authentication.

ComputerName: A null-terminated Unicode string that contains the NetBIOS name of the DC making the call.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the encrypted logon credential and a time stamp.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

EncryptedNtOwfPassword: A pointer to an ENCRYPTED_NT_OWF_PASSWORD structure, as specified in [MS-SAMR] section 2.2.3.3, that contains the OWF password of the account.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- Verify that the caller of this method is not an RODC or PDC; otherwise, the server MUST return STATUS_ACCESS_DENIED.
- Verify that AccountName is not NULL and AccountType flags are valid; otherwise, the server MUST return STATUS_INVALID_PARAMETER.
- Apply Common Error Processing Rule A, specified in section 3.
- Apply Common Error Processing Rule B, specified in section 3, to the *PrimaryName* parameter.
- The server uses the server name passed in the PrimaryName parameter to look up the domain that the server hosts. If the name is not found, the server MUST return STATUS_INVALID_COMPUTER_NAME.
- Using the *ComputerName* for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.

The server MUST retrieve the current OWF of the password for the account identified by the *AccountName* and *AccountType* parameters. If the *AccountType* is TrustedDnsDomainSecureChannel or TrustedDomainSecureChannel, then the SharedSecret of the trust will be used. All other types of

SecureChannelType that may be used require that the SharedSecret of the computer account is used.

The server MUST retrieve the current OWF of the client password and encrypt it with the key that is derived by using the session key as the specified 16-byte key. The specified 16-byte key uses the 16-byte value process, as specified in [MS-SAMR] section 2.2.11.1.4. The encrypted version of the password MUST be returned in the *EncryptedNtOwfPassword* parameter.

This method can only be called by a machine that has established a secure channel with the server.

3.5.4.4.8 NetrServerTrustPasswordsGet (Opnum 42)

The NetrServerTrustPasswordsGet method<252> returns the encrypted current and previous passwords for an account in the domain. This method is called by a client to retrieve the current and previous account passwords from a domain controller. The account name requested MUST be the name used when the secure channel was created, unless the method is called on a PDC by a DC, in which case it can be any valid account name.

```
NTSTATUS NetrServerTrustPasswordsGet(
  [in, unique, string] LOGONSRV HANDLE TrustedDcName,
  [in, string] wchar_t* AccountName,
  [in] NETLOGON SECURE CHANNEL TYPE SecureChannelType,
  [in, string] wchar_t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [out] PNETLOGON AUTHENTICATOR ReturnAuthenticator,
  [out] PENCRYPTED_NT_OWF_PASSWORD EncryptedNewOwfPassword,
  [out] PENCRYPTED NT OWF PASSWORD EncryptedOldOwfPassword
);
```

TrustedDcName: The custom RPC binding handle, as specified in section 3.5.4.1.

AccountName: The null-terminated Unicode string that contains the name of the client account in the domain for which the trust password MUST be returned.<253>

SecureChannelType: A NETLOGON_SECURE_CHANNEL_TYPE enumerated value, as specified in section 2.2.1.3.13, that indicates the type of the secure channel being established by this call.

ComputerName: The null-terminated Unicode string that contains the NetBIOS name of the client computer.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

EncryptedNewOwfPassword: A pointer to an ENCRYPTED_NT_OWF_PASSWORD structure, as specified in section 2.2.1.1.4, that contains the NTOWFv1 (as specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1) of the current password, encrypted as specified in [MS-SAMR] section 2.2.11.1.1, Encrypting an NT Hash or LM Hash Value with a specified key. The session key is the specified 16-byte key that is used to derive the password's keys. The specified 16-byte key uses the 16-byte value process, as specified in [MS-SAMR] section 2.2.11.1.4.

EncryptedOldOwfPassword: A pointer to an ENCRYPTED_NT_OWF_PASSWORD structure, as specified in section 2.2.1.1.4, that contains the NTOWFv1 (as specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1) of the previous password, encrypted as specified in [MS-SAMR] section 2.2.11.1.1, Encrypting an NT Hash or LM Hash Value with a specified key. The session key is the specified 16-byte key that is used to derive the password's keys. The specified 16-byte key uses the 16-byte value process, as specified in [MS-SAMR] section 2.2.11.1.4.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

Message processing is identical to NetrServerGetTrustInfo, as specified in section 3.5.4.7.6, except for the following:

- The *TrustInfo* parameter is not present in NetrServerTrustPasswordsGet.

3.5.4.4.9 NetrLogonGetDomainInfo (Opnum 29)

The NetrLogonGetDomainInfo method<254> returns information that describes the current domain to which the specified client belongs.

```
NTSTATUS NetrLogonGetDomainInfo(
  [in, string] LOGONSRV_HANDLE ServerName,
  [in, string, unique] wchar t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] DWORD Level,
  [in, switch is(Level)] PNETLOGON WORKSTATION INFORMATION WkstaBuffer,
  [out, switch is(Level)] PNETLOGON DOMAIN INFORMATION DomBuffer
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

ComputerName: The null-terminated Unicode string that contains the name of the client computer issuing the request.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

Level: The information level requested by the client. The *DomBuffer* parameter contains one of the following structures, based on the value of this field.

Value	Meaning
0x00000001	The *DomBuffer* contains a NETLOGON_DOMAIN_INFO structure.
0x00000002	The *DomBuffer* contains a NETLOGON_LSA_POLICY_INFO structure.

WkstaBuffer: A pointer to a NETLOGON_WORKSTATION_INFORMATION structure, as specified in section 2.2.1.3.9, that contains information about the client workstation.

DomBuffer: A pointer to a NETLOGON_DOMAIN_INFORMATION structure, as specified in section 2.2.1.3.12, that contains information about the domain or policy information.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- Apply Common Error Processing Rule A, specified in section 3.
- Verify that the *WkstaBuffer* parameter is not NULL. If it is, the server SHOULD return STATUS_INVALID_PARAMETER.<255>

- Verify that the *Level* parameter is set to 1 or 2. All other values are invalid, and STATUS_INVALID_LEVEL MUST be returned.
- Using the *ComputerName* for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.

If the *Level* parameter is set to 1, the return structure pointed to by *DomBuffer* MUST be generated as follows:

- NETLOGON_DOMAIN_INFO.PrimaryDomain.DomainName MUST be set to **NetbiosDomainName**.
- NETLOGON_DOMAIN_INFO.PrimaryDomain.DnsDomainName MUST be set to **DnsDomainName**.
- NETLOGON_DOMAIN_INFO.PrimaryDomain.DnsForestName MUST be set to **DnsForestName**.
- NETLOGON_DOMAIN_INFO.PrimaryDomain.DomainGuid MUST be set to **DomainGuid**.
- NETLOGON_DOMAIN_INFO.PrimaryDomain.DomainSid MUST be set to **DomainSid**.
- NETLOGON_DOMAIN_INFO.WorkstationFlags MUST be set with the bitwise AND of NETLOGON_WORKSTATION_INFORMATION.WorkstationInfo.WorkstationFlags and 0x3.
- NETLOGON_DOMAIN_INFO.TrustedDomainCount MUST be set to the number of elements of the trusted domain list returned by performing the external behavior consistent with locally invoking LsarEnumerateTrustedDomainsEx ([MS-LSAD] section 3.1.4.7.7). The *EnumerationContext* parameter MUST be set to 0 and *PreferredMaximumLength* SHOULD be set to 4096.<256> A policy handle is not needed locally.
- NETLOGON_DOMAIN_INFO.TrustedDomains MUST be set to a TrustedDomainCount-sized array of NETLOGON_ONE_DOMAIN_INFO structures. Each structure MUST be generated as follows:
  - NETLOGON_ONE_DOMAIN_INFO.DomainName MUST be set to the NetBIOS domain name of the trusted domain.
  - NETLOGON_ONE_DOMAIN_INFO.DnsDomainName MUST be set to the DNS domain name of the trusted domain.
  - NETLOGON_ONE_DOMAIN_INFO.DnsForestName MUST be set to NULL string.
  - NETLOGON_ONE_DOMAIN_INFO.DomainGuid MUST be set to the domain GUID of the trusted domain.
  - NETLOGON_ONE_DOMAIN_INFO.DomainSid MUST be set to the domain SID of the trusted domain.<257>
- NETLOGON_DOMAIN_INFO.SupportedEncTypes MUST be set to the value of the msDS-SupportedEncryptionTypes attribute ([MS-ADA2] section 2.458) of the *ComputerName* account. If the msDS-SupportedEncryptionTypes attribute does not exist, then set NETLOGON_DOMAIN_INFO.SupportedEncTypes to 0xFFFFFFFF.

Structure	Reference
NETLOGON_DOMAIN_INFO	For details, see section 2.2.1.3.11.
NETLOGON_WORKSTATION_INFO	For details, see section 2.2.1.3.6.
DS_DOMAIN_TRUSTSW	For details, see section 2.2.1.6.2.
NETLOGON_ONE_DOMAIN_INFO	For details, see section 2.2.1.3.10.

If the Level parameter is set to 2:

- NETLOGON_DOMAIN_INFO.LsaPolicy.LsaPolicySize MUST be set to 0.
- NETLOGON_DOMAIN_INFO.LsaPolicy.LsaPolicy MUST be set to NULL.

If the WkstaBuffer.*WorkstationInfo* pointer is NULL, no further processing occurs and NERR_Success MUST be returned.

If WkstaBuffer.*WorkstationInfo*.*WorkstationFlags* has the 0x2 bit set, NETLOGON_DOMAIN_INFO.DnsHostNameInDs is set to the dNSHostName ([MS-ADA1] section 2.185) of the client account. If there was a change in domain naming, this value holds the previous DNS host name since the AD query is done prior to changing the value. If WkstaBuffer.*WorkstationInfo*.*WorkstationFlags* does not have the 0x2 bit set, the server adds the following SPNs to the **ServicePrincipalName** attribute of the clients account:

- HOST/<Netbios name>
- HOST/<FQDN name>

WkstaBuffer.*WorkstationInfo*.*OsName* and WkstaBuffer.*WorkstationInfo*.*OsVersion* SHOULD be processed as specified in section 2.2.1.3.6. If WkstaBuffer.*WorkstationInfo*.*OsName* and WkstaBuffer.*WorkstationInfo*.*OsVersion* are not specified, then a generic string SHOULD be used to update the operatingSystem attribute ("Windows unknown version"). If WkstaBuffer.*WorkstationInfo*.*OsVersion* is specified but WkstaBuffer.*WorkstationInfo*.*OsName* is not, then a different generic string SHOULD be used to update the **operatingSystem** attribute, depending on the value of WkstaBuffer.*WorkstationInfo*.*OsVersion*.*wProductType*. If the *wProductType* is VER_NT_WORKSTATION, then the string that SHOULD be used is "Windows Workstation", otherwise the string SHOULD be "Windows Server".<258>

If WkstaBuffer.*WorkstationInfo.KerberosSupportedEncryptionTypes* is set, NETLOGON_DOMAIN_INFO.SupportedEncTypes is set to the **msDS-SupportedEncryptionTypes** attribute ([MS-ADA2] section 2.458) of the client account.

This method can only be called by a machine that has established a secure channel with the server.

3.5.4.4.10 NetrLogonGetCapabilities (Opnum 21)

The NetrLogonGetCapabilities method is used by clients to confirm the server capabilities after a secure channel has been established. <259>

```
NTSTATUS NetrLogonGetCapabilities(
  [in, string] LOGONSRV_HANDLE ServerName,
  [in, string, unique] wchar t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out] PNETLOGON AUTHENTICATOR ReturnAuthenticator,
  [in] DWORD QueryLevel,
  [out, switch_is(QueryLevel)] PNETLOGON_CAPABILITIES ServerCapabilities
);
```

ServerName: A LOGONSRV_HANDLE Unicode string handle of the server that is handling the request.

ComputerName: A string that contains the name of the computer.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure that contains the server return authenticator.

QueryLevel: Specifies the level of information to return from the domain controller being queried. A value of 0x00000001 causes return of a NETLOGON_CAPABILITIES structure that contains server capabilities.

ServerCapabilities: A pointer to a 32-bit set of bit flags that identify the server's capabilities.<260>

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

Upon receiving this call, the server MUST perform the following validation steps:<261>

- Apply Common Error Processing Rule A, specified in section 3.
- Verify that the *QueryLevel* parameter is set to 1. All other values are invalid, and STATUS_INVALID_LEVEL MUST be returned.
- Using the ComputerName for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.

If *ServerCapabilities* bit W is true, then *ServerCapabilities* MUST be set to the ServerSessionInfo.NegotiateFlags being used by the secure channel of the calling client. Otherwise, the server MUST return STATUS_NOT_IMPLEMENTED.

3.5.4.4.11 NetrChainSetClientAttributes (Opnum 49)

When an RODC receives either the NetrServerAuthenticate3 method or the NetrLogonGetDomainInfo method with updates requested, it invokes this method on a normal (writable) DC to update to a client's computer account object in Active Directory.<262><263>

```
NTSTATUS NetrChainSetClientAttributes(
  [in, string, ref] LOGONSRV_HANDLE PrimaryName,
  [in, string, ref] wchar_t* ChainedFromServerName,
  [in, string, ref] wchar_t* ChainedForClientName,
  [in, ref] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out, ref] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] DWORD dwInVersion,
  [in, ref] [switch_is(dwInVersion)]
    NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES* pmsgIn,
  [in, out, ref] DWORD* pdwOutVersion,
  [in, out, ref] [switch is(*pdwOutVersion)]
    NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES* pmsgOut
);
```

PrimaryName: The custom RPC binding handle, as specified in section 3.5.4.1.

ChainedFromServerName: The null-terminated Unicode string that contains the name of the read-only DC that issues the request.

ChainedForClientName: The null-terminated Unicode string that contains the name of the client computer that called NetrServerAuthenticate3 or NetrLogonGetDomainInfo on the RODC.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure that contains the server return authenticator.

dwInVersion: One of the NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES union types selected based on the value of the *pmsgIn* field. The value MUST be 1.

pmsgIn: A pointer to an NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES_V1 structure that contains the values to update on the client's computer account object in Active Directory on the normal (writable) DC.

pdwOutVersion: A pointer to one of the NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES union types selected based on the value of the *pmsgIn* field. The value MUST be 1.

pmsgOut: A pointer to an NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1 structure that contains information on the client workstation and the writable domain controller. For how it is populated by the server, see below.

Return Values: The method returns 0x00000000 on success.

On receiving this call, the normal (writable) DC MUST perform the following validation steps.

- Verify that the server is a normal (writable) DC machine; otherwise, the server MUST return STATUS_NOT_SUPPORTED.<264>
- Verify that the *dwInVersion* parameter is set to 1. All other values are invalid and STATUS_NOT_SUPPORTED MUST be returned.
- Verify that the *pdwOutVersion* parameter is set to 1. All other values are invalid and STATUS_NOT_SUPPORTED MUST be returned.
- Verify that the *Authenticator* passed, and compute the *ReturnAuthenticator*, as specified in section 3.1.4.5. If the *Authenticator* verification fails, the server MUST return STATUS_ACCESS_DENIED.<265>

The return structure MUST be generated as follows:

- NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES.HubName MUST be set to the NetBIOS name of the writable domain controller.
- If NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES.OldDnsHostName is not NULL, it MUST be set to the client's DNS host name, if any. If there was a change in domain naming, this value holds the previous DNS host name.
- If NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES.SupportedEncTypes is not NULL, it MUST be set to the supported encryption algorithms.

3.5.4.5 Pass-Through Authentication Methods

Methods in this group are used for generic pass-though, user logon, and user logoff as outlined in section 1.3.

3.5.4.5.1 NetrLogonSamLogonEx (Opnum 39)

The NetrLogonSamLogonEx method<266> provides an extension to NetrLogonSamLogon that accepts an extra flags parameter and uses Secure RPC ([MS-RPCE] section 3.3.1.5.2) instead of Netlogon authenticators. This method handles logon requests for the SAM accounts and allows for generic pass-through authentication, as specified in section 3.2.4.1. For more information about fields and structures used by Netlogon pass-through methods, see section 1.3.8.1.4.

```
NTSTATUS NetrLogonSamLogonEx(
  [in] handle t ContextHandle,
  [in, unique, string] wchar_t* LogonServer,
  [in, unique, string] wchar_t* ComputerName,
  [in] NETLOGON_LOGON_INFO_CLASS LogonLevel,
  [in, switch_is(LogonLevel)] PNETLOGON_LEVEL LogonInformation,
  [in] NETLOGON_VALIDATION_INFO_CLASS ValidationLevel,
```

```
  [out, switch_is(ValidationLevel)]
    PNETLOGON_VALIDATION ValidationInformation,
  [out] unsigned char* Authoritative,
  [in, out] unsigned long* ExtraFlags
);
```

ContextHandle: A primitive RPC handle that identifies a particular client/server binding, as specified in section 3.5.4.1.

LogonServer: The null-terminated Unicode string that contains the NetBIOS name of the server that will handle the logon request.

ComputerName: The null-terminated Unicode string that contains the NetBIOS name of the client computer sending the logon request.

LogonLevel: A NETLOGON_LOGON_INFO_CLASS enumerated type, as specified in section 2.2.1.4.16, that specifies the type of the logon information passed in the *LogonInformation* parameter.

LogonInformation: A pointer to a NETLOGON_LEVEL structure, as specified in section 2.2.1.4.6, that describes the logon request information.

ValidationLevel: A NETLOGON_VALIDATION_INFO_CLASS enumerated type, as specified in section 2.2.1.4.17, that contains the validation level requested by the client.

ValidationInformation: A pointer to a NETLOGON_VALIDATION structure, as specified in section 2.2.1.4.14, that describes the user validation information returned to the client. The type of the NETLOGON_VALIDATION used is determined by the value of the *ValidationLevel* parameter.

Authoritative: A pointer to a char value that represents a Boolean condition. FALSE is indicated by the value 0x00, and TRUE SHOULD<267> be indicated by the value 0x01 and MAY also be indicated by any nonzero value.

This Boolean value indicates whether the validation information is final. This field is necessary because the request might be forwarded through multiple servers. The value TRUE indicates that the validation information is an authoritative response and MUST remain unchanged. The value FALSE SHOULD indicate that the validation information is not an authoritative response and that the client can resend the request to another server.

ExtraFlags: A pointer to a set of bit flags that specify delivery settings. A flag is TRUE (or set) if its value is equal to 1. Output flags MUST be the same as input. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D	C	B	A

Where the bits are defined as:

Value	Description
A	Request MUST be passed to the domain controller at the root of the forest.
B	Request MUST be passed to the DC at the end of the first hop over a cross-forest trust.
C	Request was passed by an RODC to a DC in a different domain.<268>

Value	Description
D	Request is an NTLM authentication package request passed by an RODC.<269>

All other bits MUST be set to zero and MUST be ignored on receipt. Flags A, B, C, and D can be combined and the server SHOULD honor the flags. Flags A and B require the server to take action to deliver the request, while flags C and D are informational and implementation-specific.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- Apply Common Error Processing Rule A, specified in section 3.
- The pointer contained in the *LogonInformation* parameter MUST NOT be NULL; otherwise, the server MUST return STATUS_INVALID_PARAMETER.
- Verify that the caller is using Secure RPC ([MS-RPCE] section 3.3.1.5.2); otherwise, the server MUST return STATUS_ACCESS_DENIED.
- Verify that if bit B in *ExtraFlags* is enabled, then the domain's TAFT bit in the **trustAttributes** structure ([MS-ADTS] section 6.1.6.7.9) is also enabled; otherwise, the server MUST return STATUS_NO_SUCH_USER.
- Apply Common Error Processing Rule B, specified in section 3, to the *LogonServer* parameter.
- If the *LogonServer* parameter is not NULL, it is compared against the server's computer name. If the *LogonServer* parameter does not match the server's computer name or is NULL, the server MUST return STATUS_INVALID_COMPUTER_NAME. If the *LogonServer* parameter matches the server's computer name, processing proceeds.

If the server cannot service the request due to an implementation-specific condition, the server SHOULD return STATUS_ACCESS_DENIED.

The server uses the server name passed in the *LogonServer* parameter to look up the domain that the server hosts. If the name is not found, the server MUST return STATUS_INVALID_COMPUTER_NAME.

The server MUST decrypt data protected in transport:

- If the *LogonLevel* is **NetlogonInteractiveInformation** or **NetlogonInteractiveTransitiveInformation**, decrypt<270> the **LmOwfPassword** and **NtOwfPassword** members in the NETLOGON_INTERACTIVE_INFO (section 2.2.1.4.3) structure.
- If the *LogonLevel* is **NetlogonServiceInformation** or **NetlogonServiceTransitiveInformation**, decrypt<271> the **LmOwfPassword** and **NtOwfPassword** members in the NETLOGON_SERVICE_INFO (section 2.2.1.4.4) structure.
- If the *LogonLevel* is **NetlogonGenericInformation**, decrypt<272> the **LogonData** member in the NETLOGON_GENERIC_INFO (section 2.2.1.4.2) structure.

When the *LogonLevel* parameter is set to 4 (**NetlogonGenericInformation**), the call is for generic pass-through to authentication packages and the *ValidationLevel* parameter MUST be 5 (**NetlogonValidationGenericInfo2**) or 4 (NetlogonValidationGenericInfo). If this is not true, the server MUST return STATUS_INVALID_INFO_CLASS.<273>

If *LogonLevel* is not set to 4 (**NetlogonGenericInformation**), the ValidationLevel parameter MUST be 6 (**NetlogonValidationSamInfo4**) or 3 (**NetlogonValidationSamInfo2**) or 2

(**NetlogonValidationSamInfo**). If this is not true, the server MUST return STATUS_INVALID_INFO_CLASS.<274> The data is opaque to Netlogon, and the parameters MUST be passed to NTLM ([MS-APDS] section 3.1).

If the request is not for the domain of which the server is a member and the server is a DC, then the server MUST perform external behavior consistent with locally invoking **LsarQueryTrustedDomainInfoByName** ([MS-LSAD] section 3.1.4.7.5), using the following parameters (policy handle is not needed locally):

- *Domain* is set to the value of the *TrustedDomainName* parameter.
- *InformationClass* is set to the value of *TrustedDomainInformationEx*.

The server MUST also verify that:

- The **securityIdentifier** (Sid) field ([MS-ADTS] section 6.1.6.7.8) is not NULL,
- The **trustType** field ([MS-ADTS] section 6.1.6.7.15) is 1 or 2, and
- The **trustAttributes** field ([MS-ADTS] section 6.1.6.7.9) does not contain TRUST_ATTRIBUTE_UPLEVEL_ONLY

If **LsarQueryTrustedDomainInfoByName** succeeds and returns the domain information in *TrustedDomainInformation*, the server MUST check if it has established a secure channel with the domain. If there is not an established secure channel then the server MUST return the error code STATUS_NO_SUCH_USER. If there is an established secure channel then the server MUST call NetrLogonSamLogonEx using **LogonLevel**, **LogonInformation**, **ValidationLevel**, **ValidationInformation**, and **ExtraFlags** (**ExtraFlags** can be updated by the server before passing it to NetrLogonSamLogonEx on the DC) to the DC with which it has an established secure channel.

If an error is returned from an authentication package (in the case of generic pass-through) or from NTLM (in the case of logon), the error code MUST be propagated to the caller of this method.

If the *LogonLevel* is **NetlogonNetworkInformation** or **NetlogonNetworkTransitiveInformation**, the server MUST encrypt the *UserSessionKey* and the first two elements of the **ExpansionRoom** array in the NETLOGON_VALIDATION_SAM_INFO (section 2.2.1.4.11) or in the NETLOGON_VALIDATION_SAM_INFO2 (section 2.2.1.4.12) structure.

This method can be called only by a machine that has established a secure channel with the server.

This is the only NetrLogonSamLogon family method that uses secure channel and does not use Netlogon authenticator parameters.

3.5.4.5.2 NetrLogonSamLogonWithFlags (Opnum 45)

The NetrLogonSamLogonWithFlags method<275> handles logon requests for the SAM accounts.

```
NTSTATUS NetrLogonSamLogonWithFlags(
  [in, unique, string] LOGONSRV HANDLE LogonServer,
  [in, unique, string] wchar_t* ComputerName,
  [in, unique] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out, unique] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] NETLOGON LOGON INFO CLASS LogonLevel,
  [in, switch_is(LogonLevel)] PNETLOGON_LEVEL LogonInformation,
  [in] NETLOGON VALIDATION INFO CLASS ValidationLevel,
  [out, switch_is(ValidationLevel)]
    PNETLOGON_VALIDATION ValidationInformation,
  [out] unsigned char* Authoritative,
  [in, out] unsigned long* ExtraFlags
);
```

LogonServer: The custom RPC binding handle, as specified in section 3.5.4.1.

ComputerName: The Unicode string that contains the NetBIOS name of the client computer calling this method.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

LogonLevel: A NETLOGON_LOGON_INFO_CLASS structure, as specified in section 2.2.1.4.16, that specifies the type of logon information passed in the *LogonInformation* parameter.

LogonInformation: A pointer to a NETLOGON_LEVEL structure, as specified in section 2.2.1.4.6, that describes the logon request information.

ValidationLevel: A NETLOGON_VALIDATION_INFO_CLASS enumerated type, as specified in section 2.2.1.4.17, that contains the validation level requested by the client.

ValidationInformation: A pointer to a NETLOGON_VALIDATION structure, as specified in section 2.2.1.4.14, that describes the user validation information returned to the client. The type of the NETLOGON_VALIDATION used is determined by the value of the *ValidationLevel* parameter.

Authoritative: A pointer to a char value representing a Boolean condition. FALSE is indicated by the value 0x00; TRUE SHOULD be indicated by the value 0x01 and MAY also be indicated by any nonzero value.<276>

This Boolean value indicates whether the validation information is an authoritative response. This field is necessary because the request might be forwarded through multiple servers. A value of TRUE indicates that the validation information is final and MUST remain unchanged. The value FALSE SHOULD indicate that the validation information is not an authoritative response and that the client can resend the request to another server.

ExtraFlags: A pointer to a set of bit flags that specify delivery settings. A flag is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	D	C	B	A

Where the bits are defined as:

Value	Description
A	Request is passed to the domain controller at the root of the forest.
B	Request is passed to the DC at the end of the first hop over a cross-forest trust.
C	Request is passed by an RODC to a DC in a different domain.<277>
D	Request is an NTLM authentication package request passed by an RODC.<278>

All other bits MUST be set to zero and MUST be ignored on receipt.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

Message processing is identical to NetrLogonSamLogon, as specified in section 3.5.4.5.3, except for the following:

- NetrLogonSamLogonWithFlags contains an additional parameter named *ExtraFlags*.

3.5.4.5.3 NetrLogonSamLogon (Opnum 2)

The NetrLogonSamLogon method<279> is a predecessor to the NetrLogonSamLogonWithFlags method (section 3.5.4.5.2). All parameters of this method have the same meanings as the identically named parameters of the NetrLogonSamLogonWithFlags method.

```
NTSTATUS NetrLogonSamLogon(
  [in, unique, string] LOGONSRV_HANDLE LogonServer,
  [in, unique, string] wchar_t* ComputerName,
  [in, unique] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out, unique] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] NETLOGON_LOGON_INFO_CLASS LogonLevel,
  [in, switch is(LogonLevel)] PNETLOGON LEVEL LogonInformation,
  [in] NETLOGON_VALIDATION_INFO_CLASS ValidationLevel,
  [out, switch_is(ValidationLevel)]
    PNETLOGON_VALIDATION ValidationInformation,
  [out] unsigned char* Authoritative
);
```

Message processing is identical to NetrLogonSamLogonEx, as specified in section 3.5.4.5.1, except for the following:

- The method uses Netlogon authenticators, so instead of checking for Secure RPC, the server MUST confirm the validity of the *Authenticator* (section 3.1.4.5) that it received using the ComputerName for the secure channel to find the corresponding record in the ClientSessionInfo table. If the *Authenticator* parameter is valid, the server MUST compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.
- The ExtraFlags parameter is not processed.

This method can only be called by a machine that has established a secure channel with the server.

On receiving this call, the server MUST perform the following validation step:

- Apply Common Error Processing Rule A, specified in section 3.

3.5.4.5.4 NetrLogonSamLogoff (Opnum 3)

The NetrLogonSamLogoff updates the user **lastLogoff** attribute for the SAM accounts.

```
NTSTATUS NetrLogonSamLogoff(
  [in, unique, string] LOGONSRV HANDLE LogonServer,
  [in, unique, string] wchar_t* ComputerName,
  [in, unique] PNETLOGON AUTHENTICATOR Authenticator,
  [in, out, unique] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] NETLOGON_LOGON_INFO_CLASS LogonLevel,
  [in, switch_is(LogonLevel)] PNETLOGON_LEVEL LogonInformation
);
```

LogonServer: The custom RPC binding handle, as specified in section 3.5.4.1.

ComputerName: The Unicode string that contains the NetBIOS name of the client computer calling this method.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

LogonLevel: A NETLOGON_LOGON_INFO_CLASS structure, as specified in section 2.2.1.4.16, that identifies the type of logon information in the *LogonInformation* union.

LogonInformation: A pointer to a NETLOGON_LEVEL structure, as specified in section 2.2.1.4.6, that describes the logon information.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- The pointer contained in the *LogonInformation* parameter MUST not be NULL; otherwise, the server MUST return STATUS_INVALID_PARAMETER.
- Apply Common Error Processing Rule A, specified in section 3.
- Using the *ComputerName* for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.

The server MUST check the following parameters, and if any of them are NULL, it MUST return STATUS_INVALID_PARAMETER:

- *LogonServer*
- *ComputerName*
- *Authenticator*
- *ReturnAuthenticator*

The server MUST check the *LogonLevel* parameter, and the server MUST return STATUS_INVALID_INFO_CLASS if it is not set to 1 (**NetlogonInteractiveInformation**).

If the request is not for the domain of which the server is a member and the server is a DC, then the server MUST perform external behavior consistent with locally invoking **LsarQueryTrustedDomainInfoByName** ([MS-LSAD] section 3.1.4.7.5), using the following parameters (policy handle is not needed locally):

- **TrustedDomainName** is set to the value of the *LogonInformation.LogonInteractive.Identity.LogonDomainName* parameter
- **InformationClass** is set to the value of **TrustedDomainInformationEx**.

If the call returns STATUS_OBJECT_NAME_NOT_FOUND (0xC0000034) the server MUST return STATUS_NO_SUCH_DOMAIN. If the call returns any other error code other than STATUS_SUCCESS the server MUST return that error code.

Additionally, the server MUST also verify that:

- The **securityIdentifier** (Sid) field ([MS-ADTS] section 6.1.6.7.8) is not NULL,

- The **trustType** field ([MS-ADTS] section 6.1.6.7.15) is 1 or 2
- The **trustAttributes** field ([MS-ADTS] section 6.1.6.7.9) does not contain TRUST_ATTRIBUTE_UPLEVEL_ONLY.

If **LsarQueryTrustedDomainInfoByName** succeeds and returns the domain information in *TrustedDomainInformation*, the server MUST check if it has established a secure channel with the domain. If there is not an established secure channel then the server MUST return the error code STATUS_NO_SUCH_DOMAIN. If there is an established secure channel then the server MUST call NetrLogonSamLogoff using **LogonLevel** and **LogonInformation** to the DC with which it has established a secure channel.

Otherwise, if the server's account database is for the domain specified by **LogonInformation.LogonInteractive.Identity.LogonDomainName**, then it MAY update the **lastLogoff** attribute ([MS-ADA1] section 2.350) on the account object specified by the **LogonInformation.LogonInteractive.Identity.UserName** field.<280>

This method can only be called by a machine that has established a secure channel with the server.

3.5.4.6 Account Database Replication Methods

Methods in this group are used for database replication as outlined in section 1.3.

3.5.4.6.1 NetrDatabaseDeltas (Opnum 7)

The NetrDatabaseDeltas method returns a set of changes (or deltas) performed to the SAM, SAM built-in, or LSA databases after a particular value of the database serial number. It is used by BDCs to request database changes from the PDC that are missing on the BDC.

```
NTSTATUS NetrDatabaseDeltas(
  [in, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] DWORD DatabaseID,
  [in, out] PNLPR_MODIFIED_COUNT DomainModifiedCount,
  [out] PNETLOGON_DELTA_ENUM_ARRAY* DeltaArray,
  [in] DWORD PreferredMaximumLength
);
```

PrimaryName: The custom RPC binding handle (as specified in section 3.5.4.1) that represents the connection to the PDC.

ComputerName: The null-terminated Unicode string that contains the NetBIOS name of the BDC calling this method.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure that contains the server return authenticator.

DatabaseID: The identifier for a specific account database set as follows:

Value	Meaning
0x00000000	Indicates the SAM database.
0x00000001	Indicates the SAM built-in database.

Value	Meaning
0x00000002	Indicates the LSA database.

DomainModifiedCount: A pointer to an NLPR_MODIFIED_COUNT structure, as specified in section 2.2.1.5.26, that contains the database serial number. On input, this is the value of the database serial number on the client. On output, this is the value of the database serial number corresponding to the last element (delta) returned in the DeltaArray parameter.

DeltaArray: A pointer to a NETLOGON_DELTA_ENUM_ARRAY structure that contains an array of enumerated changes (deltas) to the specified database with database serial numbers larger than the database serial number value specified in the input value of the *DomainModifiedCount* parameter.

PreferredMaximumLength: The value that specifies the preferred maximum size, in bytes, of data to return in the *DeltaArray* parameter. This is not a hard upper limit, but serves as a guide to the server. The server SHOULD<281> stop including elements in the returned *DeltaArray* after the size of the returned data equals or exceeds the value of the *PreferredMaximumLength* parameter. It is up to the client implementation to choose the value for this parameter.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

The synchronization that this method performs is not a full synchronization; rather, a subset of database changes is returned. To perform a full synchronization, call NetrDatabaseSync.

The server that receives this call MUST do the following:

- Verify that the client is a BDC.
- Verify the client authenticator. The server MUST return status code STATUS_ACCESS_DENIED if the verification fails.
- Validate that *DatabaseID* is one of the allowed values, 0x00000000 through 0x00000002. If the *DatabaseID* is not one of these values, the server MUST return the status code STATUS_INVALID_LEVEL.
- Given the BDC database serial number, obtain all database records that are missing on the BDC and return the array of deltas, NETLOGON_DELTA_ENUM_ARRAY, for the missing records. The number of elements returned SHOULD be affected by the value of the *PreferredMaximumLength* parameter. The server SHOULD<282> stop including elements in the returned array after the size of the returned data equals or exceeds the value of the *PreferredMaximumLength* parameter. The server MAY also limit the number of elements per local configuration to avoid large array allocations.
- Compute and return the server authenticator.
- The server MUST set the value of the *DomainModifiedCount* parameter to the database serial number of the last delta returned in the array.
- If not all missing records are returned, the server MUST return the status code STATUS_MORE_ENTRIES.<283>

3.5.4.6.2 NetrDatabaseSync2 (Opnum 16)

The NetrDatabaseSync2 method returns a set of all changes applied to the specified database since its creation. It provides an interface for a BDC to fully synchronize its databases to those of the PDC. Because returning all changes in one call might be prohibitively expensive due to a large amount of data being returned, this method supports retrieving portions of the database changes in a series of

calls using a continuation context until all changes are received. It is possible for the series of calls to be terminated prematurely due to external events, such as system restarts. For that reason, the method also supports restarting the series of calls at a particular point specified by the caller. The caller MUST keep track of synchronization progress during the series of calls as detailed in this section.

```
NTSTATUS NetrDatabaseSync2(
  [in, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] DWORD DatabaseID,
  [in] SYNC_STATE RestartState,
  [in, out] unsigned long* SyncContext,
  [out] PNETLOGON_DELTA_ENUM_ARRAY* DeltaArray,
  [in] DWORD PreferredMaximumLength
);
```

PrimaryName: The custom RPC binding handle, as specified in section 3.5.4.1, that represents the connection to the PDC.

ComputerName: The null-terminated Unicode string that contains the NetBIOS name of the BDC calling this method.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

DatabaseID: The identifier for a specific database for which the changes are requested. It MUST be one of the following values.

Value	Meaning
0x00000000	Indicates the SAM database.
0x00000001	Indicates the SAM built-in database.
0x00000002	Indicates the LSA database.

RestartState: Specifies whether this is a restart of the series of the synchronization calls and how to interpret *SyncContext*. This value MUST be NormalState unless this is the restart, in which case the value MUST be set as specified in the description of the *SyncContext* parameter.

SyncContext: Specifies context needed to continue the operation. The value MUST be set to zero on the first call. The caller MUST treat this as an opaque value, unless this call is a restart of the series of synchronization calls. The value returned is to be used on input for the next call in the series of synchronization calls.

If this call is the restart of the series, the values of the *RestartState* and the *SyncContext* parameters are dependent on the **DeltaType** value received on the last call before the restart and MUST be set as follows. Find the last NETLOGON_DELTA_ENUM structure in the *DeltaArray* parameter of the call. The **DeltaType** field of this NETLOGON_DELTA_ENUM structure, as specified in section 2.2.1.5.11, is the **DeltaType** needed for the restart. The values of *RestartState* and *SyncContext* are then determined from the following table.

DeltaType	RestartState	SyncContext
AddOrChangeGroup	GroupState	The value of the RID field of the last element

DeltaType	RestartState	SyncContext
AddOrChangeUser	UserState	The value of the RID field of the last element
ChangeGroupMembership	GroupMemberState	The value of the RID field of the last element
AddOrChangeAlias	AliasState	0x00000000
ChangeAliasMembership	AliasMemberState	0x00000000
Any other value not previously listed	NormalState	0x00000000

DeltaArray: A pointer to a NETLOGON_DELTA_ENUM_ARRAY structure, as specified in section 2.2.1.5.12, that contains an array of enumerated changes (deltas) to the specified database.

PreferredMaximumLength: The value that specifies the preferred maximum size, in bytes, of data referenced in the *DeltaArray* parameter. This is not a hard upper limit, but serves as a guide to the server. The server SHOULD<284> stop including elements in the returned *DeltaArray* once the size of the returned data equals or exceeds the value of the *PreferredMaximumLength* parameter. It is up to the client implementation to choose the value for this parameter.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

The server that receives this call MUST do the following:

- Verify that the client is a BDC, the server is a PDC, and is enabled. If any of these conditions are false, the server MUST return the status code STATUS_NOT_SUPPORTED.
- Apply Common Error Processing Rule B, specified in section 3.
- Using the *ComputerName* for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.
- Validate that *DatabaseID* is one of the allowed values, 0x00000000 through 0x00000002. If the *DatabaseID* is not one of these values, the server MUST return the status code STATUS_INVALID_LEVEL.
- Given the *RestartState* parameter and the *SyncContext* parameter, obtain database records that are missing on the BDC and return the array of deltas, NETLOGON_DELTA_ENUM_ARRAY, for the missing records. The number of elements returned SHOULD be affected by the value of the *PreferredMaximumLength* parameter. The server SHOULD<285> stop including elements in the returned array once the size of the returned data equals or exceeds the value of the *PreferredMaximumLength* parameter. The server MAY also limit the number of elements per local configuration to avoid large array allocations.
- The server MUST update and return the *SyncContext* (section 2.2.1.5.29) parameter so that to continue the synchronization loop on the next client request.
- Compute and return the server authenticator.
- Initialize **SynchronizationComplete** by setting it to FALSE, and when all the missing records are sent set **SynchronizationComplete** to TRUE.
- If **SynchronizationComplete** is FALSE, the server MUST return the status code STATUS_MORE_ENTRIES.

3.5.4.6.3 NetrDatabaseSync (Opnum 8)

The NetrDatabaseSync method<286> is a predecessor to the NetrDatabaseSync2 method, as specified in section 3.5.4.6.2. All parameters of this method have the same meanings as the identically named parameters of the NetrDatabaseSync2 method.

```
NTSTATUS NetrDatabaseSync(
  [in, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar_t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] DWORD DatabaseID,
  [in] SYNC_STATE RestartState,
  [in, out] unsigned long* SyncContext,
  [out] PNETLOGON_DELTA_ENUM_ARRAY* DeltaArray,
  [in] DWORD PreferredMaximumLength
);
```

Receiving this method is identical to receiving NetrDatabaseSync2, as specified in section 3.5.4.6.2, except that this call does not use the *RestartState* parameter. NetrDatabaseSync does not support restarting the synchronization loop.

3.5.4.6.4 NetrDatabaseRedo (Opnum 17)

The NetrDatabaseRedo method is used by a BDC to request information about a single account from the PDC.

```
NTSTATUS NetrDatabaseRedo(
  [in, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar_t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in, size_is(ChangeLogEntrySize)]
    unsigned char* ChangeLogEntry,
  [in] DWORD ChangeLogEntrySize,
  [out] PNETLOGON_DELTA_ENUM_ARRAY* DeltaArray
);
```

PrimaryName: The custom RPC binding handle, as specified in section 3.5.4.1, representing the connection to the PDC.

ComputerName: The null-terminated Unicode string that contains the NetBIOS name of the BDC calling this method.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

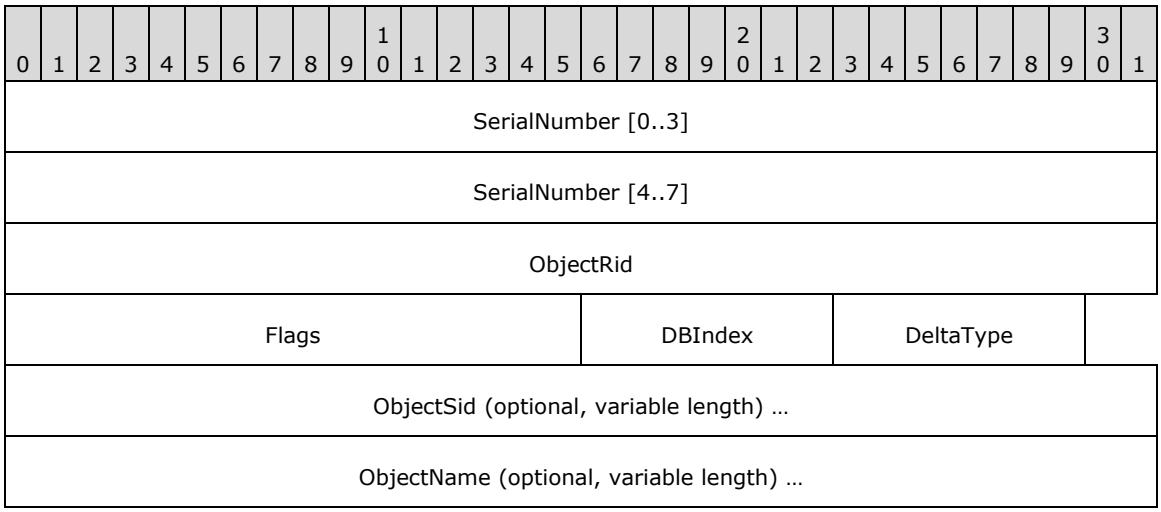
ChangeLogEntry: A pointer to a buffer that contains a CHANGELOG_ENTRY structure, specified as follows, for the account being queried.

ChangeLogEntrySize: The size, in bytes, of the buffer pointed to by the *ChangeLogEntry* parameter.

DeltaArray: A pointer to a NETLOGON_DELTA_ENUM_ARRAY structure, as specified in section 2.2.1.5.12, that contains an array of enumerated database changes for the account being queried.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

The following CHANGELOG_ENTRY structure pointed to by the *ChangeLogEntry* parameter carries information about the account object being queried.



SerialNumber: The database serial number that corresponds to this account object (64-bit integer).

ObjectRid: The RID of the object (32-bit integer).

Flags: A two-byte set of bit flags that describes the properties of the message. A flag is TRUE (or set) if its value is equal to 1. The value is constructed from zero or more bit flags from the following table, with the exception that bit C cannot be combined with bit D.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5
0	0	0	0	0	0	0	0	0	0	0	E	D	C	B	A

The flags are defined as follows.

Flag	Meaning
A	The object requires immediate replication at the moment that the object is changed.
B	The object is an account with a changed password.
C	The optional **ObjectSid** field is included in the message. Cannot be combined with flag D.
D	The optional **ObjectName** field is included in the message. Cannot be combined with flag C.
E	The object is the first object changed after a promotion of a BDC to a new PDC.

All other bits MUST be set to zero and MUST be ignored on receipt.

DBIndex: The 8-bit integer identifier of the database containing the object. MUST be one, and only one, of the following values.

Value	Meaning
0x00	The SAM database.
0x01	The SAM built-in database.

Value	Meaning
0x02	The LSA database.

DeltaType: One of the NETLOGON_DELTA_TYPE values specified in section 2.2.1.5.28.

ObjectSid: The SID of the object. Included only if flag C is set. This is an RPC_SID structure, as defined in [MS-DTYP] section 2.4.2.3.

ObjectName: The name of the object. **ObjectName** is a null-terminated Unicode string, and is included only if flag D is set.

The server that receives this call MUST do the following:

- Verify that the client is a BDC, the server is a PDC, and synchronization is enabled. If any of these conditions are false, the server MUST return the status code STATUS_NOT_SUPPORTED.
- Using the *ComputerName* for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.
- Validate the *ChangeLogEntry* parameter as a valid single account object information request message. If the *ChangeLogEntry* parameter is not valid, the server MUST return the status code STATUS_INVALID_PARAMETER.

The server uses the server name passed in the *PrimaryName* parameter to look up the domain that the server hosts. If the name is not found, the server MUST return STATUS_INVALID_COMPUTER_NAME.

Return a single delta for the requested account in the *DeltaArray* parameter.

3.5.4.7 Domain Trust Methods

Methods in this group are used to retrieve trust data, as outlined in section 1.3.

3.5.4.7.1 DsrEnumerateDomainTrusts (Opnum 40)

The DsrEnumerateDomainTrusts method<287> returns an enumerated list of domain trusts, filtered by a set of flags, from the specified server.

```
NET_API_STATUS DsrEnumerateDomainTrusts(
  [in, unique, string] LOGONSRV HANDLE ServerName,
  [in] unsigned long Flags,
  [out] PNETLOGON_TRUSTED_DOMAIN_ARRAY Domains
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

Flags: A set of bit flags that specify properties that MUST be true for a domain trust to be part of the returned domain name list. A flag is TRUE (or set) if its value is equal to 1. Flags MUST contain one or more of the following bits.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	F	E	D	C	B	A

Where the bits are defined as:

Value	Description
A	Domain is a member of the forest.
B	Domain is directly trusted by this domain.
C	Domain is the root of a **domain tree** in the forest.
D	Domain is the primary domain of the queried server.
E	Primary domain is running in native mode.
F	Domain directly trusts this domain.

All other bits MUST be set to zero.

Domains: A pointer to a NETLOGON_TRUSTED_DOMAIN_ARRAY structure, as specified in section 2.2.1.6.3, that contains a list of trusted domains.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.<288>

On receiving this call, the server MUST perform the following validation step:

- The *Flags* parameter MUST be checked to verify that at least one of the above valid bits is set. All other bits (0-24) MUST be zero. The server MUST return ERROR_INVALID_FLAGS if there are invalid bits present.

If the *ServerName* parameter is not NULL, it is compared against the server's computer name. If the *ServerName* parameter does not match the server's computer name, the server MUST return ERROR_INVALID_COMPUTERNAME. If the *ServerName* parameter matches the server's computer name or the *ServerName* parameter is NULL, then processing proceeds.

If the server is not a DC (section 3.1.4.8), the server SHOULD call **NetrLogonGetDomainInfo** to a DC in its domain, with the following parameters:

- The *NetlogonWorkstationInfo* parameter with the following elements:
  - *NetlogonWorkstationInfo.LsaPolicy.LsaPolicySize* is set to 0.
  - *NetlogonWorkstationInfo.LsaPolicy.LsaPolicy* is set to NULL.
  - *NetlogonWorkstationInfo.WorkStationFlags* has the A flag set.
  - *NetlogonWorkstationInfo.DnsHostName* set to the DNS computer name.
- Level MUST be set to 0x1.

If the server is a domain controller (section 3.1.4.8), it MUST perform behavior equivalent to locally invoking NetrLogonGetDomainInfo with the previously described parameters.

If the call returns any other error code other than STATUS_SUCCESS, then the server MUST return that error code and no further processing occurs.

If the call returns STATUS_SUCCESS, the server MUST use the returned domains in the DomBuffer.TrustedDomains parameter to build and return an array of **DS_DOMAIN_TRUSTSW** structures from the **NETLOGON_ONE_DOMAIN_INFO** structures as follows:

- If the **primary domain** is determined to not be running in **mixed mode** ([MS-ADTS] section 6.1.4.1), and the E bit is set in the *Flags* parameter, the server MUST include the primary domain (*DomBuffer.PrimaryDomain*) in the returned array.
- For each element of *DomBuffer.TrustedDomains*, if the bitwise AND of the *Flags* parameter and the *DomBuffer.TrustedDomains.TrustExtension.Flags* (*Flags* & *DomBuffer.TrustedDomains.TrustExtension[0-3]*) is true, the server MUST include the domain in the returned array.
- For each element to be included in the returned array, each field in the NETLOGON_ONE_DOMAIN_INFO structure listed in the first column of the following table is copied to the field of the DS_DOMAIN_TRUSTSW structure listed on the same line in the second column:

NETLOGON_ONE_DOMAIN_INFO element	DS_DOMAIN_TRUSTSW element
DomainName	NetBiosDomainName
DnsDomainName	DnsDomainName
DomainGuid	DomainGuid
DomainSid	DomainSid
Bytes 0 – 3 of TrustExtension	Flags
Bytes 4 – 7 of TrustExtension	ParentIndex
Bytes 8 – 11 of TrustExtension	TrustType
Bytes 12 – 15 of Trust Extension	TrustAttributes

3.5.4.7.2 NetrEnumerateTrustedDomainsEx (Opnum 36)

The NetrEnumerateTrustedDomainsEx method<289> returns a list of trusted domains from a specified server. This method extends NetrEnumerateTrustedDomains by returning an array of domains in a more flexible DS_DOMAIN_TRUSTSW structure, as specified in section 2.2.1.6.2, rather than the array of strings in DOMAIN_NAME_BUFFER structure, as specified in section 2.2.1.6.1. The array is returned as part of the NETLOGON_TRUSTED_DOMAIN_ARRAY structure, as specified in section 2.2.1.6.3.

```
NET_API_STATUS NetrEnumerateTrustedDomainsEx(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [out] PNETLOGON_TRUSTED_DOMAIN_ARRAY Domains
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

Domains: A pointer to a NETLOGON_TRUSTED_DOMAIN_ARRAY structure, as specified in section 2.2.1.6.3, that contains an array of DS_DOMAIN_TRUSTSW structures, as specified in section 2.2.1.6.2, one for each trusted domain.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.<290>

This method is a wrapper for DsrEnumerateDomainTrusts, which strips off the F flag from the returned data for backward compatibility. For details, see section 3.5.4.7.1.

3.5.4.7.3 NetrEnumerateTrustedDomains (Opnum 19)

The NetrEnumerateTrustedDomains method returns a set of NetBIOS names of trusted domains.

```
NTSTATUS NetrEnumerateTrustedDomains(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [out] PDOMAIN_NAME_BUFFER DomainNameBuffer
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

DomainNameBuffer: A pointer to a DOMAIN_NAME_BUFFER structure, as specified in section 2.2.1.6.1, that contains a list of trusted domain names. The format of domain names contained in the buffer is specified in section 2.2.1.6.1.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.<291>

The server initializes the *DomainNames* field of the DOMAIN_NAME buffer to the empty string. The server calls the NetrEnumerateTrustedDomainsEx method and for each **PDS_DOMAIN_TRUSTSW** element of the **NETLOGON_TRUSTED_DOMAIN_ARRAY**, appends the *NetbiosDomainName* field to the *DomainNames* field of the **DOMAIN_NAME_BUFFER** (section 2.2.1.6.1). Then the server terminates the *DomainNames* field with two null bytes.

For details, see section 3.5.4.7.2, Receiving NetrEnumerateTrustedDomainsEx.

3.5.4.7.4 NetrGetForestTrustInformation (Opnum 44)

The NetrGetForestTrustInformation<292> method retrieves the trust information for the forest of which the member's domain is itself a member.

```
NTSTATUS NetrGetForestTrustInformation(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in, string] wchar_t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] DWORD Flags,
  [out] PLSA_FOREST_TRUST_INFORMATION* ForestTrustInfo
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

ComputerName: The null-terminated Unicode string that contains the client computer NetBIOS name.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

Flags: MUST be set to zero and MUST be ignored on receipt.

ForestTrustInfo: A pointer to an LSA_FOREST_TRUST_INFORMATION structure, as specified in [MS-LSAD] section 2.2.7.25, that contains data for each forest trust.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- Apply Common Error Processing Rule A, specified in section 3.
- Using the *ComputerName* for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.
- Ensure that the caller is a DC in a different domain by checking that the *SecureChannelType* from ChallengeTable is TrustedDnsDomainSecureChannel or TrustedDomainSecureChannel. For all other types, this call MUST return STATUS_NOT_IMPLEMENTED.
- Apply Common Error Processing Rule B, specified in section 3, to the *ServerName* parameter.

The forest trust information for the domain hosted by *ServerName* MUST be returned.

This method can only be called by a machine that has established a secure channel with the server.

3.5.4.7.5 DsrGetForestTrustInformation (Opnum 43)

The DsrGetForestTrustInformation method<293> retrieves the trust information for the forest of the specified domain controller, or for a forest trusted by the forest of the specified DC.

```
NET_API_STATUS DsrGetForestTrustInformation(
  [in, unique, string] LOGONSRV HANDLE ServerName,
  [in, unique, string] wchar_t* TrustedDomainName,
  [in] DWORD Flags,
  [out] PLSA_FOREST_TRUST_INFORMATION* ForestTrustInfo
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

TrustedDomainName: The optional null-terminated Unicode string that contains the DNS or NetBIOS name of the trusted domain for which the forest trust information is to be gathered.

Flags: A set of bit flags that specify additional applications for the forest trust information. A flag is TRUE (or set) if its value is equal to 1.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	A

Where the bits are defined as:

Value	Description
A	Update a trusted domain object (TDO) with the information returned in ForestTrustInfo.

All other bits MUST be set to zero.

ForestTrustInfo: A pointer to an LSA_FOREST_TRUST_INFORMATION structure, as specified in [MS-LSAD] section 2.2.7.25, that contains data for each forest trust.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.<294>

On receiving this call, the server MUST perform the following validation steps:

- Apply Common Error Processing Rule A, specified in section 3.
- Apply Common Error Processing Rule B, specified in section 3.
- Verify that the client has sufficient privileges. The server SHOULD determine if the client has sufficient privileges (as specified in section 3.5.4.1) with the Access Request mask set to match the NETLOGON_FTINFO_ACCESS mask; otherwise, the server MUST return ERROR_ACCESS_DENIED.
- Verify that if the *Flags* parameter has bit A enabled, then the server is a PDC; otherwise, the server MUST return NERR_NotPrimary.
- The *Flags* parameter MUST be checked for invalid bit flags. The server MUST return ERROR_INVALID_FLAGS if any bit other than A is set.

If the *TrustedDomainName* parameter is specified, the server SHOULD <295> call the DsrGetForestTrustInformation method on a DC in the trusted domain specified by *TrustedDomainName*.

Additionally, if the *TrustedDomainName* is not NULL, the server MUST perform the additional following validation steps:

- Verify that the server has established a secure channel with the domain specified in the *TrustedDomainName* parameter, and apply Common Error Processing Rule E, specified in section 3. If the server has not established a secure channel with the domain specified in the *TrustedDomainName* parameter, then the server MUST return the error code ERROR_NO_SUCH_DOMAIN.
- Apply Common Error Processing Rule C, specified in section 3.
- The forest trust information for the domain specified by the *TrustedDomainName* parameter MUST be returned.
- The server MUST verify that the *TrustedDomainName* refers to a cross-forest trust by performing external behavior consistent with locally invoking LsarQueryTrustedDomainInfoByName ([MS-LSAD] section 3.1.4.7.5), using the following parameters (a policy handle is not needed locally):
  - *Domain* is set to the value of the *TrustedDomainName* parameter
  - *InformationClass* is set to the value of TrustedDomainInformationEx.

    If the call returns STATUS_OBJECT_NAME_NOT_FOUND the server MUST return ERROR_NO_SUCH_DOMAIN. Additionally, the server MUST verify that:
  - The **securityIdentifier** (Sid) field ([MS-ADTS] section 6.1.6.7.8) is not NULL
  - The **trustType** field ([MS-ADTS] section 6.1.6.7.15) is 1 or 2
  - The **trustAttributes** field ([MS-ADTS] section 6.1.6.7.9) does not contain TRUST_ATTRIBUTE_UPLEVEL_ONLY
  - The **trustAttributes** field ([MS-ADTS] section 6.1.6.7.9) contains TRUST_ATTRIBUTE_FOREST_TRANSITIVE.

If the server fails to verify any of the preceding conditions, the server MUST return ERROR_NO_SUCH_DOMAIN.

Otherwise, if the TrustedDomainName is NULL, the server MUST check to see if Flags bit A is set. If Flags bit A is set, the server MUST return ERROR_INVALID, and no further processing occurs.

The server MUST retrieve the forest trust information for the domain specified by the TrustedDomainName parameter:

- If the *TrustedDomainName* is NULL the server SHOULD perform external behavior equivalent to locally invoking NetrGetForestTrustInformation with the parameters specified in the previous paragraph, return the forest trust information, and stop further processing.
- Otherwise, the server SHOULD call NetrGetForestTrustInformation with the following parameters (in addition to those specified in section 3.4.5.5.4) to a PDC, in the domain specified by the *TrustedDomainName* Parameter, in order to retrieve the Trusted Forest's version of the LSA_FOREST_TRUST_INFORMATION, referred to in the rest of this section as NewTrustInfo:
  - **ServerName** is set to NULL, indicating the current server's domain.
  - **ComputerName** is set to the NetBIOS computer name of the server.
  - **Flags** is set to 0.

Otherwise, if the *TrustedDomainName* is not NULL and Flags bit A is set, the server SHOULD update the server's forest information for the domain specified by the *TrustedDomainName* parameter as follows:

- The server MUST retrieve its version of the forest trust information, referred to in the rest of this section as OldTrustInfo, by performing external behavior equivalent to locally invoking LsarQueryForestTrustInformation with the following parameters (a policy handle is not required locally):
  - **TrustedDomainName** is set to the *TrustedDomainName* parameter that was passed by the caller of DsrGetForestTrustInformation
  - **HighestRecordType** is set to ForestTrustRecordTypeLast.
- If the call returns STATUS_NOT_FOUND, the server SHOULD ignore this error and continue processing. If any other error is returned, the server SHOULD pass the error through and stop processing.
- The server SHOULD merge the OldTrustInfo LSA_FOREST_TRUST_INFORMATION with the Trusted Forest's version of the NewTrustInfo LSA_FOREST_TRUST_INFORMATION. The server SHOULD create an LSA_FOREST_TRUST_INFORMATION structure. After the merge the new version of the LSA_FOREST_TRUST_INFORMATION will result in the merged result, referred to in this section as MergedTrustInfo. The server SHOULD perform the merge using the following rules:
  - The server SHOULD iterate through the LSA_FOREST_TRUST_RECORD ([MS-LSAD] section 2.2.7.21) entries in the NewTrustInfo version of the LSA_FOREST_TRUST_INFORMATION according to the following rules. The index for the current entry in NewTrustInfo.Entries is denoted as "i":
    - If the NewTrustInfo.Entries[i].ForestTrustType is not ForestTrustTopLevelName, then ignore further rules for NewTrustInfo.Entries[i], and continue iterating through NewTrustInfo.Entries.
    - If the NewTrustInfo.Entries[i].ForestTrustData.TopLevelName is equal to the DNS domain name of the TDO, copy NewTrustInfo.Entries[i] into MergedTrustInfo.Entries, ignore

further rules for NewTrustInfo.Entries[i], and continue iterating through NewTrustInfo.Entries.

- Iterate through the LSA_FOREST_TRUST_RECORD entries in the MergedTrustInfo version of the LSA_FOREST_TRUST_INFORMATION according to the following rules. The index for the current entry in MergedTrustInfo.Entries is denoted as "m":
  - If the NewTrustInfo.Entries[i].ForestTrustData.TopLevelName is subordinate to the MergedTrustInfo.Entries[m].ForestTrustData.TopLevelName, stop iterating through MergedTrustInfo.Entries, ignore further rules for NewTrustInfo.Entries[i], and continue iterating through NewTrustInfo.Entries.
- Copy the NewTrustInfo.Entries[i] to MergedTrustInfo.Entries. The new entry in MergedTrustInfo.Entries is referred to as MergedEntry.
  - Iterate through the LSA_FOREST_TRUST_RECORD entries in the OldTrustInfo version of the LSA_FOREST_TRUST_INFORMATION according to the following rules. The index for the current entry in OldTrustInfo.Entries is denoted as "k":
    - If the OldTrustInfo.Entries[k].ForestTrustType is equal to ForestTrustTopLevelName, and the NewTrustInfo.Entries[i].ForestTrustData.TopLevelName is equal to OldTrustInfo.Entries[k].ForestTrustData.TopLevelName, copy OldTrustInfo.Entries[k].Flags to MergedEntry.Flags and copy OldTrustInfo.Entries[k].Time to MergedEntry.Time.
    - Otherwise, MergedEntry.Flags is set to LSA_TLN_DISABLED_NEW and MergedEntry.Time is set to 0.

- The server SHOULD iterate through the LSA_FOREST_TRUST_RECORD ([MS-LSAD] section 2.2.7.21) entries in the NewTrustInfo version of the LSA_FOREST_TRUST_INFORMATION according to the following rules. The index for the current entry in NewTrustInfo.Entries is denoted as "i":
  - If the NewTrustInfo.Entries[i].ForestTrustType is a ForestTrustDomainInfo, create a new LSA_FOREST_TRUST_RECORD, referred to in this section as TempEntry, and copy NewTrustInfo.Entries[i] into TempEntry. TempEntry.Flags is set to 0 and TempEntry.Time is set to 0.
  - Iterate through the LSA_FOREST_TRUST_RECORD entries in the MergedTrustInfo version of the LSA_FOREST_TRUST_INFORMATION according to the following rules. The index for the current entry in MergedTrustInfo.Entries is denoted as "m":
    - If MergedTrustInfo.Entries[m].ForestTrustType is a ForestTrustDomainInfo and TempEntry.ForestTrustData.DomainInfo.Sid is equal to MergedTrustInfo.Entries[m].ForestTrustData.DomainInfo.Sid, delete TempEntry, stop iterating through MergedTrustInfo.Entries, ignore further rules for NewTrustInfo.Entries[i], and continue iterating through NewTrustInfo.Entries.
    - Iterate through the LSA_FOREST_TRUST_RECORD Entries in the OldTrustInfo version of the LSA_FOREST_TRUST_INFORMATION according to the following rules. The index for the current entry in OldTrustInfo.Entries is denoted as "n":
      - If OldTrustInfo.Entries[n].ForestTrustType is a ForestTrustDomainInfo and TempEntry.ForestTrustData.DomainInfo.NetbiosName is equal to OldTrustInfo.Entries[n].ForestTrustData.DomainInfo.NetbiosName, copy OldTrustInfo.Entries[n].Flags into TempEntry.Flags and also copy OldTrustInfo.Entries[n].Time into TempEntry.Time.
  - Copy TempEntry into MergedTrustedInfo.Entries.

- The server SHOULD iterate through the LSA_FOREST_TRUST_RECORD ([MS-LSAD] section 2.2.7.21) entries in the OldTrustInfo version of the LSA_FOREST_TRUST_INFORMATION according to the following rules. The index for the current entry in OldTrustInfo.Entries is denoted as "i":
  - If OldTrustInfo.Entries[i].ForestTrustType is not ForestTrustDomainInfo, then ignore further rules for OldTrustInfo.Entries[i] and continue iterating through OldTrustInfo.Entries.
  - Iterate through the LSA_FOREST_TRUST_RECORD entries in the MergedTrustInfo version of the LSA_FOREST_TRUST_INFORMATION according to the following rules. The index for the current entry in MergedTrustInfo.Entries is denoted as "m":
    - If MergedTrustInfo.Entries[m].ForestTrustType is a ForestTrustDomainInfo and OldTrustInfo.Entries[m].ForestTrustData.DomainInfo.NetbiosName equals MergedTrustInfo.Entries[m].ForestTrustData.DomainInfo.NetbiosName, stop iterating through the MergedTrustInfo.Entries, ignore further rules for OldTrustInfo.Entries[i] and continue iterating through OldTrustInfo.Entries.
  - If OldTrustInfo.Entries[i].Flags has either the LSA_SID_DISABLED_ADMIN flag set or the LSA_NB_DISABLED_ADMIN flag set, copy OldTrustInfo.Entries[i] into MergedTrustInfo.Entries.
- The server SHOULD iterate through the LSA_FOREST_TRUST_RECORD ([MS-LSAD] section 2.2.7.21) entries in the OldTrustInfo version of the LSA_FOREST_TRUST_INFORMATION according to the following rules. The index for the current entry in OldTrustInfo.Entries is denoted as "i":
  - If OldTrustInfo.Entries[i].ForestTrustType is not equal to ForestTrustTopLevelNameEx, then ignore further rules for OldTrustInfo.Entries[i] and continue iterating through OldTrustInfo.Entries.
  - Iterate through the LSA_FOREST_TRUST_RECORD entries in the MergedTrustInfo version of the LSA_FOREST_TRUST_INFORMATION according to the following rules. The index for the current entry in MergedTrustInfo.Entries is denoted as "m":
    - If MergedTrustInfo.Entries[m].ForestTrustType is a ForestTrustTopLevelName and OldTrustInfo.Entries[i].ForestTrustData.TopLevelName is equal to or subordinate to MergedTrustInfo.Entries[m].ForestTrustData.TopLevelName, copy OldTrustInfo.Entries[i] into MergedTrustInfo.Entries. Stop iterating through MergedTrustInfo.Entries, but continue iterating through OldTrustInfo.Entries.

The server MUST update its version of the forest trust information for the domain specified by the TrustedDomainName parameter by performing external behavior equivalent to locally invoking LsarSetForestTrustInformation, with the following parameters (a policy handle is not needed locally):

- **TrustedDomainName** is set to the TrustedDomainName parameter that was passed by the caller of DsrGetForestTrustInformation
- **HighestRecordType** is set to ForestTrustRecordTypeLast
- **ForestTrustInfo** is set to the merged forest trust information from above, MergedTrustInfo.

If the *TrustedDomainName* is NULL:

- The forest trust information for the domain hosted by *ServerName* MUST be returned if *Flags* bit A is not set.
- The server MUST return ERROR_INVALID_FLAGS if *Flags* bit A is set.

3.5.4.7.6 NetrServerGetTrustInfo (Opnum 46)

The NetrServerGetTrustInfo method<296> returns an information block from a specified server. The information includes encrypted current and previous passwords for a particular account and additional trust data. The account name requested MUST be the name used when the secure channel was created, unless the method is called on a PDC by a domain controller, in which case it can be any valid account name.

```
NTSTATUS NetrServerGetTrustInfo(
  [in, unique, string] LOGONSRV_HANDLE TrustedDcName,
  [in, string] wchar_t* AccountName,
  [in] NETLOGON SECURE CHANNEL TYPE SecureChannelType,
  [in, string] wchar_t* ComputerName,
  [in] PNETLOGON AUTHENTICATOR Authenticator,
  [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [out] PENCRYPTED_NT_OWF_PASSWORD EncryptedNewOwfPassword,
  [out] PENCRYPTED NT OWF PASSWORD EncryptedOldOwfPassword,
  [out] PNL GENERIC RPC DATA* TrustInfo
);
```

TrustedDcName: The custom RPC binding handle, as specified in section 3.5.4.1.

AccountName: The null-terminated Unicode string that contains the name of the client account in the domain.

SecureChannelType: A NETLOGON_SECURE_CHANNEL_TYPE enumerated value, as specified in section 2.2.1.3.13, that indicates the type of the secure channel being established by this call.

ComputerName: The null-terminated Unicode string that contains the NetBIOS name of the client computer, for which the trust information MUST be returned.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

EncryptedNewOwfPassword: A pointer to an ENCRYPTED_NT_OWF_PASSWORD structure, as specified in section 2.2.1.1.4, that contains the NTOWFv1 (as specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1) of the current password, encrypted as specified in [MS-SAMR] section 2.2.11.1.1, Encrypting an NT Hash or LM Hash Value with a specified key. The session key is the specified 16-byte key that is used to derive its keys via the 16-byte value process, as specified in [MS-SAMR] section 2.2.11.1.4.

EncryptedOldOwfPassword: A pointer to an ENCRYPTED_NT_OWF_PASSWORD structure, as specified in section 2.2.1.1.4, that contains the NTOWFv1 (as specified in NTLM v1 Authentication in [MS-NLMP] section 3.3.1) of the old password, encrypted as specified in [MS-SAMR] section 2.2.11.1.1, Encrypting an NT Hash or LM Hash Value with a specified key. The session key is the specified 16-byte key that is used to derive its keys via the 16-byte value process, as specified in [MS-SAMR] section 2.2.11.1.4.

TrustInfo: A pointer to an NL_GENERIC_RPC_DATA structure, as specified in section 2.2.1.6.4, that contains a block of generic RPC data with trust information for the specified server.

Return Values: The method returns 0x00000000 to indicate success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- Apply Common Error Processing Rule A, specified in section 3.

- Using the *ComputerName* for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.

If the *TrustedDcName* parameter is not NULL, it is compared against the server's computer name. If the *TrustedDcName* parameter does not match the server's computer name, or is NULL, then the server MUST return STATUS_INVALID_COMPUTER_NAME. If the *TrustedDcName* parameter matches the server's computer name, processing proceeds.

The server MUST retrieve the OWF of the current password for the account identified by the *AccountName* and *SecureChannelType* parameters. If the *SecureChannelType* is **TrustedDnsDomainSecureChannel** or **TrustedDomainSecureChannel**, then the SharedSecret of the trust will be used and the OWF of the previous password MUST also be retrieved. All other types of *SecureChannelType* require that the SharedSecret of the computer account be used, and that an empty string MUST be used when calculating the OWF of the previous password.

The NTOWFv1 of the current and previous passwords MUST be encrypted as specified in [MS-SAMR] section 2.2.11.1.1, Encrypting an NT Hash or LM Hash Value with a specified key. The session key is the specified 16-byte key used to derive its keys via the 16-byte value process, as specified in [MS-SAMR] section 2.2.11.1.4. The encrypted versions of the NTOWFv1 for the current password and previous password MUST be returned in the parameters *EncryptedNewOwfPassword* and *EncryptedOldOwfPassword*, respectively.

If the *TrustInfo* parameter is not NULL, the structure is generated by setting NL_GENERIC_RPC_DATA.UlongEntryCount to 1 and setting NL_GENERIC_RPC_DATA.UlongData to a 32-bit value that contains the trust attributes. The trust attributes themselves are defined in [MS-LSAD] section 2.2.7.9 as the TrustAttributes member, as part of the LSAPR_TRUSTED_DOMAIN_INFORMATION_EX structure.

This method can only be called by a machine that has established a secure channel with the server.

3.5.4.8 Message Protection Methods

Methods in this group are used by components outside Netlogon to accomplish certain tasks, as outlined in section 1.3.

3.5.4.8.1 NetrLogonGetTrustRid (Opnum 23)

The NetrLogonGetTrustRid method<297> is used to obtain the RID of the account whose password is used by domain controllers in the specified domain for establishing the secure channel from the server receiving this call.

```
NET API STATUS NetrLogonGetTrustRid(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in, string, unique] wchar_t* DomainName,
  [out] unsigned long* Rid
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

DomainName: The null-terminated Unicode string that contains the DNS or NetBIOS name of the primary or trusted domain. If this parameter is NULL, this method uses the name of the primary domain of the server.

Rid: A pointer to an unsigned long that receives the RID of the account.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

The server SHOULD<298> return ERROR_ACCESS DENIED if the caller is not local.

If *ServerName* equals NULL and *DomainName* equals NULL, then the server SHOULD determine if the client has sufficient privilege (as described in section 3.5.4.2) with the Access Request mask set to NETLOGON_FTINFO_ACCESS.

Otherwise, the server SHOULD determine if the client has sufficient privilege (as described in section 3.5.4.2) with the Access Request mask set to NETLOGON_SERVICE_ACCESS.

If the client does not have sufficient privilege, the server MUST return ERROR_ACCESS_DENIED.

If *ServerName* equals NULL, then the call MUST be made to the local machine. If the *DomainName* is the same as the domain that the machine is joined to, the call MUST succeed, and the server MUST return the **AccountRid** of the machine in the domain. If the *DomainName* is a different domain, the server MUST return ERROR_NO_SUCH_DOMAIN.

If both *ServerName* and *DomainName* are NULL, the server MUST return the RID for the computer account of the caller. Otherwise, the RID for the account identified by *ServerName* and *DomainName* MUST be returned.

The server uses the server name passed in the *ServerName* parameter to look up the domain for the request. If the name is not found, the server MUST return ERROR_INVALID_COMPUTERNAME.

If the RID cannot be determined, the server SHOULD return ERROR_TRUSTED_RELATIONSHIP_FAILURE.

3.5.4.8.2 NetrLogonComputeServerDigest (Opnum 24)

The NetrLogonComputeServerDigest method<299> computes a cryptographic digest of a message by using the MD5 message-digest algorithm, as specified in [RFC1321]. This method is called by a client computer against a server and is used to compute a message digest, as specified in this section. The client MAY then call the NetrLogonComputeClientDigest method (as specified in section 3.4.5.6.3) and compare the digests to ensure that the server that it communicates with knows the shared secret between the client machine and the domain.

```
NET API STATUS NetrLogonComputeServerDigest(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in] unsigned long Rid,
  [in, size_is(MessageSize)] unsigned char* Message,
  [in] unsigned long MessageSize,
  [out] char NewMessageDigest[16],
  [out] char OldMessageDigest[16]
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

Rid: The RID of the machine account for which the digest is to be computed. The NetrLogonGetTrustRid method, as specified in section 3.5.4.8.1, is used to obtain the RID.

Message: A pointer to buffer that contains the message to compute the digest.

MessageSize: The length of the data referenced by the *Message* parameter, in bytes.

NewMessageDigest: A 128-bit MD5 digest of the current machine account password and the message in the *Message* buffer. The machine account is identified by the *Rid* parameter.

OldMessageDigest: A 128-bit MD5 digest of the previous machine account password, if present, and the message in the *Message* buffer. If no previous machine account password exists, then the current password is used. The machine account is identified by the *Rid* parameter.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

The server uses the server name passed in the *ServerName* parameter to look up the domain for the request. If the name is not found, the server MUST return ERROR_INVALID_COMPUTERNAME.

If the client does not have sufficient privilege, the server MUST return ERROR_ACCESS_DENIED.

The server MUST construct the machine account SID using the *Rid* parameter and the current domain with the format S-1-5-*current domain-Rid parameter*.

The server MUST compute or retrieve the NTOWFv1 of the current password, retrieve **lmPwdHistory** ([MS-ADA1] section 2.363), and the NTOWFv1 of the previous password (if it exists) for the machine account whose security identifier ([MS-ADA3] section 2.237) corresponds to the generated SID. If the machine account cannot be found, or the machine account does not correspond to a machine, or the machine account is disabled, the server MUST return ERROR_NO_SUCH_USER. When the server is an RODC and the NTOWFv1 of the current password cannot be retrieved, the server MUST return ERROR_NO_TRUST_LSA_SECRET.

The digest of the *Message* parameter MUST be calculated with the following algorithm, using this one-way function (OWF) of the password.

```
CALL MD5Init(md5context)
IF OWF of password is present
   CALL MD5Update(md5context, OWF of password, length of OWF of
                  password)
CALL MD5Update(md5context, Message, MessageSize)
CALL MD5Final(md5context)
SET digest to md5context.digest
```

The *NewMessageDigest* parameter MUST be computed by using the current password. The *OldMessageDigest* parameter MUST be computed by using the previous password, if it exists. If the previous password is not present, the new password MUST be used to compute the *OldMessageDigest*.<300>

Creating a message digest for the previous password allows the possibility of password replication latency to be accounted for. If the machine account password was recently changed, but the change has not propagated to the server processing this method, the server keeps the old password.

3.5.4.8.3 NetrLogonComputeClientDigest (Opnum 25)

The NetrLogonComputeClientDigest method<301> is used by a client to compute a cryptographic digest of a message by using the MD5 message-digest algorithm, as specified in [RFC1321]. This method is called by a client to compute a message digest, as specified in this section. The client SHOULD use this digest to compare against one that is returned by a call to NetrLogonComputeServerDigest. This comparison allows the client to ensure that the server that it communicates with knows the shared secret between the client machine and the domain.

```
NET_API_STATUS NetrLogonComputeClientDigest(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in, unique, string] wchar_t* DomainName,
  [in, size is(MessageSize)] unsigned char* Message,
  [in] unsigned long MessageSize,
  [out] char NewMessageDigest[16],
  [out] char OldMessageDigest[16]
```

```
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

DomainName: A pointer to a null-terminated Unicode string that contains the DNS or NetBIOS name of the trusted domain. If this parameter is NULL, the domain of which the client computer is a member is used.

Message: A pointer to a buffer that contains the message for which the digest is to be computed.

MessageSize: The length, in bytes, of the *Message* parameter.

NewMessageDigest: A 128-bit MD5 digest of the current computer account password and the message in the *Message* buffer.

OldMessageDigest: A 128-bit MD5 digest of the previous machine account password and the message in the *Message* buffer. If no previous computer account password exists, the current password is used.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

If the client does not have sufficient privilege, the server MUST return ERROR_ACCESS_DENIED.

The server MUST compute or retrieve the NTOWFv1 of the current machine password and the NTOWFv1 of the previous machine password, if it exists. If the password cannot be found, the server MUST return ERROR_NO_TRUST_LSA_SECRET.

The server MUST compute the NTOWFv1 (as specified in [MS-NLMP] section 3.3.1) of each password, if present. The digest of the *Message* parameter MUST be calculated using this OWF of the password, as follows.

```
CALL MD5Init(md5context)
IF OWF of password is present
   CALL MD5Update(md5context, OWF of password, length of OWF of
                  password)
CALL MD5Update(md5context, Message, MessageSize)
CALL MD5Final(md5context)
SET digest to md5context.digest
```

The *NewMessageDigest* parameter MUST be computed by using the current password. The *OldMessageDigest* parameter MUST be computed by using the previous password, if it exists. If the previous password is not present, the new password MUST be used to compute the *OldMessageDigest*.

Creating a message digest for the previous password allows the possibility of password replication latency to be accounted for. If the client computer password was recently changed, but the change has not propagated to the server processing this method, the client and the server will have two different passwords.

3.5.4.8.4 NetrLogonSendToSam (Opnum 32)

The NetrLogonSendToSam<302> method allows a BDC or RODC to forward user account password changes to the PDC. It is used by the client to deliver an opaque buffer to the SAM database ([MS-SAMR] (section 3.1.1)) on the server side.

```
NTSTATUS NetrLogonSendToSam(
  [in, unique, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar_t* ComputerName,
```

```
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in, size_is(OpaqueBufferSize)]
      unsigned char* OpaqueBuffer,
    [in] unsigned long OpaqueBufferSize
  );
```

PrimaryName: The custom RPC binding handle, as specified in 3.5.4.1.

ComputerName: A null-terminated Unicode string that contains the NetBIOS name of the client computer making the call.

Authenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the client authenticator.

ReturnAuthenticator: A pointer to a NETLOGON_AUTHENTICATOR structure, as specified in section 2.2.1.1.5, that contains the server return authenticator.

OpaqueBuffer: A buffer to be passed to the Security Account Manager (SAM) service on the PDC. The buffer is encrypted on the wire.

OpaqueBufferSize: The size, in bytes, of the *OpaqueBuffer* parameter.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- Apply Common Error Processing Rule A, specified in section 3.
- Using the *ComputerName* for the secure channel to find the corresponding record in the ClientSessionInfo table, verify the *Authenticator* parameter (section 3.1.4.5). If the *Authenticator* parameter is valid, compute the *ReturnAuthenticator* parameter returned (section 3.1.4.5). Otherwise, the server MUST return STATUS_ACCESS_DENIED.

If the *PrimaryName* parameter is not NULL, it is compared against the server's computer name. If the *PrimaryName* parameter does not match the server's computer name, the server MUST return STATUS_INVALID_COMPUTER_NAME. If the *PrimaryName* parameter matches the server's computer name, or the *PrimaryName* parameter is NULL, then processing proceeds.

The server MUST check whether the caller is a BDC or RODC; otherwise, it MUST return STATUS_ACCESS_DENIED. The server determines whether the caller is BDC or RODC by examining the value of *SecureChannelType* parameter in the ClientSessionInfo table. The caller is a BDC if *SecureChannelType* is ServerSecureChannel. The caller is an RODC if the *SecureChannelType* is CdcServerSecureChannel.

The server MUST decrypt the message passed in the *OpaqueBuffer* parameter using the negotiated encryption algorithm (determined by bits C, O, or W, respectively, in the **NegotiateFlags** member of the **ClientSessionInfo** table entry for *ComputerName*) and the established session key as the decryption key. The server SHOULD pass the decrypted data to the local SAM for processing. The buffer specified by *OpaqueBuffer* is completely opaque to the Netlogon Protocol.

This method can be called only by a machine that has established a secure channel with the server.

3.5.4.8.5 NetrLogonSetServiceBits (Opnum 22)

The NetrLogonSetServiceBits<303> method is used to notify Netlogon whether a domain controller is running specified services, as detailed in the following section.

```
NTSTATUS NetrLogonSetServiceBits(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in] DWORD ServiceBitsOfInterest,
  [in] DWORD ServiceBits
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1, representing the connection to a DC.

ServiceBitsOfInterest: A set of bit flags used as a mask to indicate which service's state (running or not running) is being set by this call. The value is constructed from zero or more bit flags from the following table.

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

The flags are defined as follows.

Value	Description
A	The state of the time service is being set.
B	The state of the time service with clock hardware is being set.
C	The state of the Active Directory Web service is being set.<304>

All other bits MUST be set to zero; otherwise, the error STATUS_ACCESS_DENIED is returned.

ServiceBits: A set of bit flags used as a mask to indicate whether the service indicated by *ServiceBitsOfInterest* is running or not. If the flag is set to 0, the corresponding service indicated by *ServiceBitsOfInterest* is not running. Otherwise, if the flag is set to 1, the corresponding service indicated by *ServiceBitsOfInterest* is running. The value is constructed from zero or more bit flags from the following table.

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

The flags are defined as follows.

Value	Description
A	Time service is running.
B	Time service with clock hardware is running.
C	Active Directory Web service is running.<305>

Value	Description

All other bits MUST be set to zero; otherwise, the error STATUS_INVALID_PARAMETER is returned.

If a flag is set to 1 and the same flag is set to 0 in the *ServiceBitsOfInterest* parameter, the error STATUS_INVALID_PARAMETER is returned.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

The server SHOULD<306> return ERROR_ACCESS DENIED if the caller is not local.

If the client does not have sufficient privilege, the server MUST return ERROR_ACCESS_DENIED.

The server MUST return STATUS_ACCESS_DENIED if bits other than those previously specified are passed in.

For every service state being set by this call, as indicated by *ServiceBitsOfInterest*, the state of the corresponding service ([MS-ADTS] section 6.3.1.2), as indicated by *ServiceBits*, is updated in the **ServerServiceBits** abstract data model element.

3.5.4.8.6 NetrLogonGetTimeServiceParentDomain (Opnum 35)

The NetrLogonGetTimeServiceParentDomain method<307> returns the name of the parent domain of the current domain. The domain name returned by this method is suitable for passing into the NetrLogonGetTrustRid method and NetrLogonComputeClientDigest method.

```
NET_API_STATUS NetrLogonGetTimeServiceParentDomain(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [out, string] wchar t** DomainName,
  [out] int* PdcSameSite
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

DomainName: A pointer to the buffer that receives the null-terminated Unicode string that contains the name of the parent domain. If the DNS domain name is available, it is returned through this parameter; otherwise, the NetBIOS domain name is returned.

PdcSameSite: A pointer to the integer that receives the value that indicates whether the PDC for the domain *DomainName* is in the same site as the server specified by *ServerName*. This value SHOULD<308> be ignored if *ServerName* is not a domain controller.

Value	Meaning
False 0	The PDC is not in the same site as the server specified by *ServerName*.
True 1	The PDC is in the same site as the server specified by *ServerName*.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

The server SHOULD<309> return ERROR_ACCESS DENIED if the caller is not local.

If the client does not have sufficient privilege, the server MUST return ERROR_ACCESS_DENIED.

The domain name returned MUST be determined according to the following rules:

- On a non-DC machine, the returned domain name is the name of the domain of which the *ServerName* is a member. If *ServerName* is not valid, then the server MUST return ERROR_INVALID_COMPUTERNAME.
- On a DC that is at the root of the forest, **rootDomainNamingContext** ([MS-ADTS] section 3.1.1.3.2.16) is equal to **defaultNamingContext** ([MS-ADTS] section 3.1.1.3.2.3). In this case, ERROR_NO_SUCH_DOMAIN is returned.
- On a DC that is at the root of a domain tree in the forest, the name of a trusted domain that is also at the root of a domain tree in the forest is returned.

On any other DC, the name of the domain that is directly the parent domain is returned.

The domain's information MUST be retrieved from an implementation-specific directory. Based on this retrieved information, if the domain has a DNS domain name, it MUST be returned; otherwise, the NetBIOS domain name MUST be returned. This behavior is functionally equivalent to locally invoking LsarQueryTrustedDomainInfo ([MS-LSAD] section 3.1.4.7.2) for the domain, where TrustedDomainSid is the domain SID corresponding to the appropriate domain name retrieved from a cached list, and InformationClass is TrustedDomainInformationEx (policy handle is not needed locally), to return the TrustedDomainInformationEx.Name string (DNS name) if it is present or TrustedDomainInformationEx.Flat Name string (NetBIOS name) otherwise.

The *PdcSameSite* returned MUST be determined according to the following rules:

- On a non-DC machine, the value of *PdcSameSite* is set to TRUE.
- On a DC machine, the server SHOULD determine the PDC as specified in [MS-ADTS] section 3.1.1.1.11. Then the server SHOULD determine the sites of both the server and PDC as described in [MS-ADTS] section 3.1.1.4.5.29. The server MUST compare the PDC site with its own site and if the two match, the *PdcSameSite* output parameter MUST be set to TRUE; otherwise, it MUST be set to FALSE.

3.5.4.9 Administrative Services Methods

Methods in this group are used for querying and controlling Netlogon behavior, as outlined in section 1.3.

3.5.4.9.1 NetrLogonControl2Ex (Opnum 18)

The NetrLogonControl2Ex method executes Windows-specific administrative actions that pertain to the Netlogon server operation. It is used to query the status and control the actions of the Netlogon server.

```
NET_API_STATUS NetrLogonControl2Ex(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in] DWORD FunctionCode,
  [in] DWORD QueryLevel,
  [in, switch_is(FunctionCode)] PNETLOGON_CONTROL_DATA_INFORMATION Data,
  [out, switch_is(QueryLevel)] PNETLOGON_CONTROL_QUERY_INFORMATION Buffer
);
```

ServerName: The custom RPC binding handle, as specified in section 3.5.4.1.

FunctionCode: The control operation to be performed; MUST be one of the following values.<310>

Value	Meaning
NETLOGON_CONTROL_QUERY 0x00000001	No operation; only the requested information is returned.
NETLOGON_CONTROL_REPLICATE 0x00000002	Forces a BDC to perform an immediate partial synchronization of all databases, as detailed in section 3.6.5.2.2.<311>
NETLOGON_CONTROL_SYNCHRONIZE 0x00000003	Forces a BDC to perform an immediate full synchronization of all databases.<312>
NETLOGON_CONTROL_PDC_REPLICATE 0x00000004	Forces a PDC to immediately send announcement messages to ask each BDC to replicate the database for details (see section 3.6).<313>
NETLOGON_CONTROL_REDISCOVER 0x00000005	Forces the server to rediscover a domain controller in the specified domain and to set up a secure channel to the discovered DC.
NETLOGON_CONTROL_TC_QUERY 0x00000006	Queries the status of the last usage of the secure channel to the DC.
NETLOGON_CONTROL_TRANSPORT_NOTIFY 0x00000007	Notifies the Netlogon server that a new network connection has been added, and causes the server to flush any DC cache.
NETLOGON_CONTROL_FIND_USER 0x00000008	Queries the name of a trusted domain that contains an account for a user.
NETLOGON_CONTROL_CHANGE_PASSWORD 0x00000009	Causes the server to generate a new shared secret and to set it on the account used by the DC for setting up the secure channel from the server.
NETLOGON_CONTROL_TC_VERIFY 0x0000000A	Verifies the current status of the server's secure channel to a DC in the specified domain.
NETLOGON_CONTROL_FORCE_DNS_REG 0x0000000B	Triggers the non-timer event, Force Register DNS Records, described in [MS-ADTS] section 6.3.2.2.1.<314>
NETLOGON_CONTROL_QUERY_DNS_REG 0x0000000C	Queries the status of DNS updates performed by the Netlogon server, as described in [MS-ADTS] section 6.3.2.<315>
NETLOGON_CONTROL_BACKUP_CHANGE_LOG 0x0000FFFC	This value is used for debugging purposes and does not affect the Netlogon protocol behavior.<316>
NETLOGON_CONTROL_TRUNCATE_LOG 0x0000FFFD	This value is used for debugging purposes and does not affect the Netlogon protocol behavior.<317>
NETLOGON_CONTROL_SET_DBFLAG 0x0000FFFE	This value is used for debugging purposes and does not affect the Netlogon protocol behavior.<318>
NETLOGON_CONTROL_BREAKPOINT 0x0000FFFF	This value is used for debugging purposes and MUST be used only with **checked builds**.<319> Calling NetrLogonControl2Ex with this function code does not affect the Netlogon protocol behavior.<320>

QueryLevel: Information query level requested by the client. The buffer returned in the *Buffer* parameter contains one of the following structures, based on the value of this field.

Value	Buffer Contents
0x00000001	A NETLOGON_INFO_1 structure is returned.
0x00000002	A NETLOGON_INFO_2 structure is returned.
0x00000003	A NETLOGON_INFO_3 structure is returned.
0x00000004	A NETLOGON_INFO_4 structure is returned.<321>

Data: NETLOGON_CONTROL_DATA_INFORMATION structure, as specified in section 2.2.1.7.1, that contains specific data required by the query.

Buffer: NETLOGON_CONTROL_QUERY_INFORMATION structure, as specified in section 2.2.1.7.6, that contains the specific query results, with a level of verbosity as specified in *QueryLevel*.

Return Values: The method returns 0x00000000 on success; otherwise, it returns a nonzero error code.

On receiving this call, the server MUST perform the following validation steps:

- The server uses the server name passed in the *ServerName* parameter to look up the domain for the request. If the name is not found, the server MUST return ERROR_INVALID_COMPUTERNAME.
- If the client does not have sufficient privilege, the server MUST return ERROR_ACCESS_DENIED.
- The *QueryLevel* parameter MUST contain a value between 1 and 4; otherwise, the server MUST return ERROR_INVALID_LEVEL.
  - When the *QueryLevel* parameter is set to 0x00000004, the *FunctionCode* parameter MUST be set to NETLOGON_CONTROL_FIND_USER (0x00000008); otherwise, the server MUST return ERROR_INVALID_PARAMETER.
  - When the *QueryLevel* parameter is set to 0x00000002, the *FunctionCode* parameter MUST be set to NETLOGON_CONTROL_REDISCOVER (0x00000005), NETLOGON_CONTROL_TC_QUERY (0x00000006), or NETLOGON_CONTROL_TC_VERIFY (0x0000000A); otherwise, the server MUST return ERROR_INVALID_PARAMETER.
- When the FunctionCode parameter is set to:
  - NETLOGON_CONTROL_FIND_USER (0x00000008), the *QueryLevel* parameter MUST be set to 0x00000004; otherwise, the server MUST return ERROR_INVALID_PARAMETER.
  - NETLOGON_CONTROL_TC_VERIFY (0x0000000A), the *QueryLevel* parameter MUST be set to 0x00000002; otherwise, the server MUST return ERROR_INVALID_PARAMETER.
  - NETLOGON_CONTROL_QUERY_DNS_REG (0x0000000C), the *QueryLevel* parameter MUST be set to 0x00000001; otherwise, the server MUST return ERROR_INVALID_LEVEL.
- The server MUST verify the *Data* parameter for the NETLOGON_CONTROL_REDISCOVER (0x00000005), NETLOGON_CONTROL_TC_QUERY (0x00000006), NETLOGON_CONTROL_FIND_USER (0x00000008), NETLOGON_CONTROL_CHANGE_PASSWORD (0x00000009), and NETLOGON_CONTROL_TC_VERIFY (0x0000000A) function codes:
  - If the parameter is NULL, the server MUST return ERROR_INVALID_PARAMETER.
  - For the NETLOGON_CONTROL_REDISCOVER (0x00000005), NETLOGON_CONTROL_TC_QUERY (0x00000006), NETLOGON_CONTROL_CHANGE_PASSWORD (0x00000009), and NETLOGON_CONTROL_TC_VERIFY (0x0000000A) function codes, if the parameter does not contain a valid domain name in the trust list, the server MUST return ERROR_NO_SUCH_DOMAIN.

- For the NETLOGON_CONTROL_FIND_USER (0x00000008) function code, if the parameter does not contain a valid user name, the server MUST return NERR_UserNotFound.

For other function codes, the *Data* parameter is ignored.

Based on the *FunctionCode* parameter provided by the client, the server MUST complete the following before populating the return structure:

- NETLOGON_CONTROL_QUERY: Nothing.
- NETLOGON_CONTROL_REPLICATE: Return ERROR_NOT_SUPPORTED.<322>
- NETLOGON_CONTROL_SYNCHRONIZE: Return ERROR_NOT_SUPPORTED.<323>
- NETLOGON_CONTROL_PDC_REPLICATE: Return ERROR_NOT_SUPPORTED.<324>
- NETLOGON_CONTROL_REDISCOVER: Force the server to rediscover DCs in the domain name provided in the **TrustedDomainName** field of the *Data* parameter and to set up a secure channel (section 3.1) to the discovered DC. DC rediscovery is the same as initial DC discovery (section 3.1.4.10). If a DC discovery and establishment of a secure channel to the DC fails, the error ERROR_NO_LOGON_SERVERS is returned.
- NETLOGON_CONTROL_TC_QUERY: Provide return data based on the DC in the domain name provided in the **TrustedDomainName** field of the *Data* parameter.
- NETLOGON_CONTROL_TRANSPORT_NOTIFY: In order to allow the server to immediately retry establishing a secure session over the new network connection that became available, the server SHOULD set the **LastAuthenticationTry** member of every entry in the ServerSession table maintained by the Netlogon client on the server's machine to zero, enumerating across every entry in the table. Also, if the server has a DC cache, the server SHOULD flush the **LocatedDCsCache** and **FailedDiscoveryCache**.
- NETLOGON_CONTROL_FIND_USER: Query the name of a trusted domain that contains an account for a user with the user name provided in the **UserName** field of the *Data* parameter. The server MUST be a DC; otherwise, return ERROR_NOT_SUPPORTED.
- NETLOGON_CONTROL_CHANGE_PASSWORD: Generate a new shared secret for the domain name provided in the **TrustedDomainName** field of the *Data* parameter. The server MUST update the **SharedSecret** (section 3.1.1). If the **TrustedDomainName** field of the *Data* parameter is a trust name and the server is not a PDC ([MS-ADTS] section 6.1.5.3), the server MUST return ERROR_INVALID_DOMAIN_ROLE.
- NETLOGON_CONTROL_TC_VERIFY: Call any Netlogon method that requires a secure channel (section 3.1.4.6) to the DCC in the domain name provided in the **TrustedDomainName** field of the *Data* parameter.
- NETLOGON_CONTROL_FORCE_DNS_REG: The DC SHOULD re-register all of its DNS records ([MS-ADTS] section 6.3.2).<325>
- NETLOGON_CONTROL_QUERY_DNS_REG: Query the status of DNS updates performed by the Netlogon server.<326>
- NETLOGON_CONTROL_BACKUP_CHANGE_LOG: Nothing.
- NETLOGON_CONTROL_TRUNCATE_LOG: Nothing.
- NETLOGON_CONTROL_SET_DBFLAG: Nothing.
- NETLOGON_CONTROL_BREAKPOINT: Nothing.

The following describes the output generated in the *Buffer* parameter based on the *FunctionCode* and *QueryLevel* requested.

For *QueryLevel* 1, the return structure MUST be generated as follows:

- **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo1.netlog1_flags** MUST be set to the **netlog1_flags** values that are applicable to the server. See NETLOGON_INFO_1 (section 2.2.1.7.2) for a description of the netlog1_flags field.
- If the FunctionCode parameter has the value NETLOGON_CONTROL_QUERY_DNS_REG (0x0000000C), and any DNS registration or deregistration ([MS-ADTS] section 6.3.2) errors occurred on the last completed update, then the NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo1.netlog1_flags G bit MUST be set. Otherwise, the NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo1.netlog1_flags G bit MUST NOT be set.
- If this is a non-PDC computer, **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo1.netlog1_pdc_connection_status** MUST be set to the current connection status of the PDC, which is stored in the **ConnectionStatus** field of the **ServerSessionInfo** table. This field MUST be set to zero if this server is the PDC.
- If *FunctionCode* NETLOGON_CONTROL_PDC_REPLICATE (0x00000004) is supported <327> and **ntMixedDomain** is set to zero, the server MUST return ERROR_NOT_SUPPORTED. Otherwise, the server SHOULD return ERROR_SUCCESS.

For *QueryLevel* 2, the return structure MUST be generated as follows:

- **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_flags** MUST be set to the **netlog2_flags** values that are applicable to the server. For a description of the **netlog2_flags** member, see 2.2.1.7.3.

  NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_pdc_connection_status MUST be set as follows.

  - Call NetrServerGetTrustInof to the DC with which it has an established secure channel for the domain specified in the *Data.TrustedDomainName* parameter received.

    - If the server returns STATUS_NOT_SUPPORTED, then NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_pdc_connection_status MUST be set to the value of the ConnectionStatus field from the ServerSessionInfo table.

    - If the server returns anything else and ServerSessionInfo.ConnectionStatus is not STATUS_SUCCESS, then **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_pdc_connection_status** MUST be set to the value of **ConnectionStatus** field from the **ServerSessionInfo** table.

    - Otherwise, the **ConnectionStatus** field of the **ServerSessionInfo** table is STATUS_SUCCESS and the following rules apply:

      1. If the *TrustInfo* value returned by NetrServerGetTrustInfo is not NULL and the *ULongEntryCount* value is greater than 0, then process the first ULONG element in the *UlongData* array as follows:

         - If the TRUST_ATTRIBUTE_FOREST_TRANSITIVE (0x00000008) bit is set, and if the server processing the element is either of the following:

- Workstation: **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_pdc_connection_status** MUST be set to STATUS_DOMAIN_TRUST_INCONSISTENT.

- Domain controller (DC): If the D flag is not set in the TrustedDomains.TrustAttributes for the domain specified in the *Data.TrustedDomainName* parameter received, then **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_pdc_connection_status** MUST be set to STATUS_DOMAIN_TRUST_INCONSISTENT.

- Otherwise, if the server processing the element is a domain controller (DC) and the D flag is set in the TrustedDomains.TrustAttributes for the domain specified in the *Data.TrustedDomainName* parameter received, then **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_pdc_connection_status** MUST be set to STATUS_DOMAIN_TRUST_INCONSISTENT.

2. Verify that the SharedSecret stored locally is the same as what was returned by NetrServerGetTrustInfo in EncryptedNewOwfPassword and EncryptedOldOwfPassword. If the SecureChannelType returned by NetrServerGetTrustInfo is **TrustedDnsDomainSecureChannel** or **TrustedDomainSecureChannel**, then verify using the local trust secrets. For all other types of *SecureChannelType* values, verify using the **SharedSecret** of the computer account. If verification fails, then **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_pdc_connection_status** MUST be set to STATUS_WRONG_PASSWORD.

3. If **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_pdc_connection_status** has not been set, then it MUST be set to STATUS_SUCCESS.

NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_trusted_dc_name MUST be set to the name of the DC with which the computer has a secure channel established, which is stored in the **DCName** field of the **ServerSessionInfo** table.

NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo2.netlog2_tc_connection_status MUST be set to the status of the secure channel, which is stored in the ConnectionStatus field of the ServerSessionInfo table.

For *QueryLevel* 3, the return structure MUST be generated as follows:

- **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo3.netlog3_flags** MUST be set to zero.

- **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo3.netlog3_logon_attempts** MUST be set to LogonAttempts.

- **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo3.netlog3_reserved1** through **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo3.netlog3_reserved5** MUST be set to zero.

For *QueryLevel* 4, the return structure MUST be generated as follows:

- **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo4.netlog4_trusted_domain_name** MUST be set to the trusted domain that the user was found in. **NETLOGON_CONTROL_QUERY_INFORMATION.NetlogonInfo4.netlog4_trusted_dc_name** MUST be set to the DC in the trusted domain.

  In addition to the above, the returned *Buffer* structure contains undefined data of varied size at the end, which MUST be ignored.

3.5.4.9.2 NetrLogonControl2 (Opnum 14)

The NetrLogonControl2 method is a predecessor to the NetrLogonControl2Ex method (section 3.5.4.9.1) and was updated to have the same functionality when NetrLogonControl2Ex was added. All parameters of this method have the same meanings as the identically named parameters of the NetrLogonControl2Ex method.

```
NET_API_STATUS NetrLogonControl2(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in] DWORD FunctionCode,
  [in] DWORD QueryLevel,
  [in, switch_is(FunctionCode)] PNETLOGON_CONTROL_DATA_INFORMATION Data,
  [out, switch_is(QueryLevel)] PNETLOGON_CONTROL_QUERY_INFORMATION Buffer
);
```

All restrictions on parameter values in the NetrLoginControl2Ex method (section 3.5.4.9.1) apply. Extra restrictions are applied to the values of the *QueryLevel* parameter as follows:

- If the *QueryLevel* parameter is set to 0x00000004, the error ERROR_INVALID_LEVEL is returned.

Message processing is identical to NetrLogonControl2Ex (section 3.5.4.9.1).

3.5.4.9.3 NetrLogonControl (Opnum 12)

The NetrLogonControl method is a predecessor to the NetrLogonControl2Ex method, as specified in section 3.5.4.9.1. All parameters of this method have the same meanings as the identically named parameters of the NetrLogonControl2Ex method.

```
NET_API_STATUS NetrLogonControl(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in] DWORD FunctionCode,
  [in] DWORD QueryLevel,
  [out, switch_is(QueryLevel)] PNETLOGON_CONTROL_QUERY_INFORMATION Buffer
);
```

All restrictions on parameter values in the NetrLogonControl2Ex method (section 3.5.4.9.1) apply. Extra restrictions are applied to the values of the *FunctionCode*<328> and *QueryLevel* parameters as follows:

- The value of *QueryLevel* parameter is restricted to 0x00000001. If 0x00000002 is used, the error ERROR_NOT_SUPPORTED is returned; if any value larger than 0x00000002 is used, the error ERROR_INVALID_LEVEL is returned.

Message processing is identical to NetrLogonControl2Ex, as specified in section 3.5.4.9.1, except for the following:

- The *Data* parameter of **NetrLogonControl2Ex** is set to NULL.

3.5.4.10 Obsolete Methods

Methods in this group are obsolete, as outlined in section 1.3.

3.5.4.10.1 NetrLogonUasLogon (Opnum 0)

```
NET_API_STATUS NetrLogonUasLogon(
  [in, unique, string] LOGONSRV_HANDLE ServerName,
  [in, string] wchar_t* UserName,
  [in, string] wchar_t* Workstation,
  [out] PNETLOGON_VALIDATION_UAS_INFO* ValidationInformation
```

```
);
```

The NetrLogonUasLogon method was for the support of LAN Manager products and SHOULD<329> be rejected with an error code.

3.5.4.10.2 NetrLogonUasLogoff (Opnum 1)

```
NET_API_STATUS NetrLogonUasLogoff(
  [in, unique, string] LOGONSRV HANDLE ServerName,
  [in, string] wchar_t* UserName,
  [in, string] wchar_t* Workstation,
  [out] PNETLOGON LOGOFF UAS INFO LogoffInformation
);
```

The NetrLogonUasLogoff method was for the support of LAN Manager products and SHOULD<330> be rejected with an error code.

3.5.4.10.3 NetrAccountDeltas (Opnum 9)

```
NTSTATUS NetrAccountDeltas(
  [in, unique, string] LOGONSRV HANDLE PrimaryName,
  [in, string] wchar_t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] PUAS INFO 0 RecordID,
  [in] DWORD Count,
  [in] DWORD Level,
  [out, size_is(BufferSize)] unsigned char* Buffer,
  [in] DWORD BufferSize,
  [out] unsigned long* CountReturned,
  [out] unsigned long* TotalEntries,
  [out] PUAS INFO 0 NextRecordId
);
```

The NetrAccountDeltas method was for the support of LAN Manager products and SHOULD<331> be rejected with an error code.

3.5.4.10.4 NetrAccountSync (Opnum 10)

```
NTSTATUS NetrAccountSync(
  [in, unique, string] LOGONSRV_HANDLE PrimaryName,
  [in, string] wchar_t* ComputerName,
  [in] PNETLOGON_AUTHENTICATOR Authenticator,
  [in, out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
  [in] DWORD Reference,
  [in] DWORD Level,
  [out, size_is(BufferSize)] unsigned char* Buffer,
  [in] DWORD BufferSize,
  [out] unsigned long* CountReturned,
  [out] unsigned long* TotalEntries,
  [out] unsigned long* NextReference,
  [out] PUAS_INFO_0 LastRecordId
);
```

The NetrAccountSync method was for the support of LAN Manager products and SHOULD<332> be rejected with an error code.

3.5.5 Timer Events

None.

3.5.6 Other Local Events

When Netlogon receives a PolicyChange event ([MS-GPOD] section 2.8.2), NRPC implementations which use the Windows registry to persistently store and retrieve the SignSecureChannel variable SHOULD load the new value from the HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters registry path and SignSecureChannel key.

3.6 Netlogon NT Replication Details

Netlogon replication is a single master replication in which the PDC serves as the replication master. The PDC maintains a state for each BDC that includes the database serial number of the BDC database. The PDC periodically sends announcement messages to BDCs with out-of-sync database serial numbers to notify them about database changes accumulated during the period. In response, BDCs receiving the message update their database by making synchronization calls to the PDC using RPC. The PDC updates the database serial number in the local state information for the BDC after processing the synchronization call from that BDC.

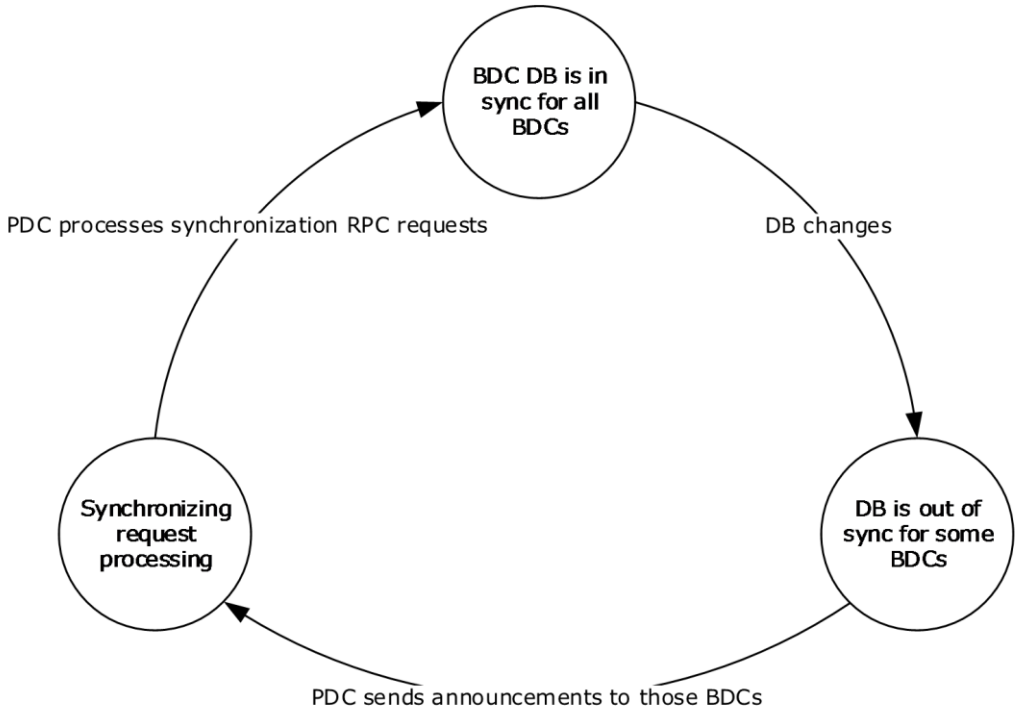


Figure 8: PDC States

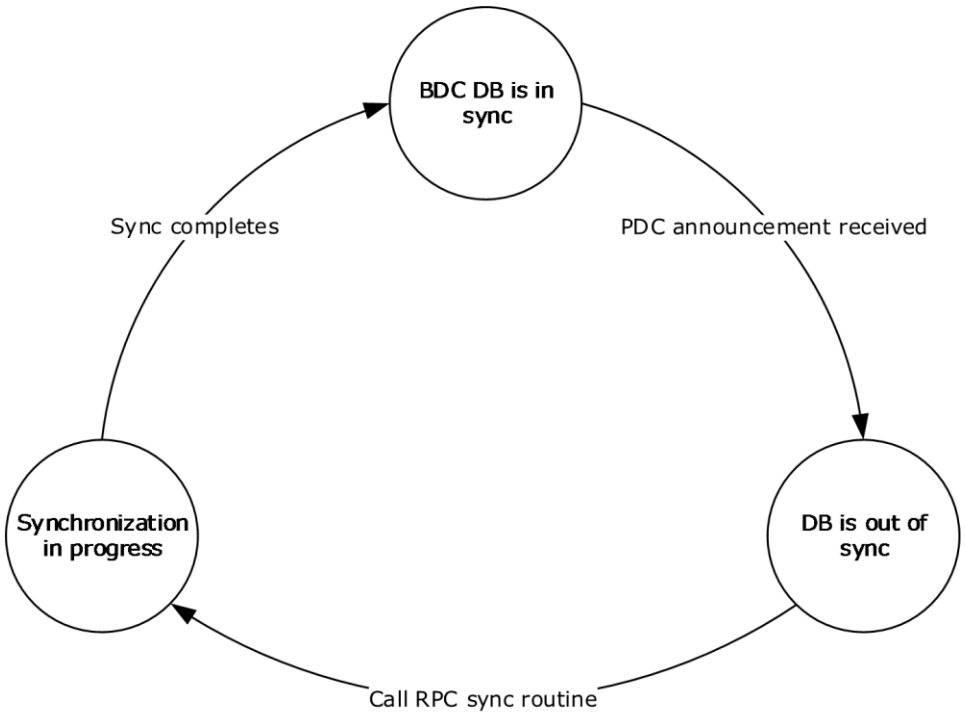


Figure 9: BDC States

3.6.1 Abstract Data Model

The following section describes data organization and state maintained for purposes of Netlogon replication. The described organization is provided to explain how the protocol behaves. This document does not mandate that implementations adhere to this model as long as their external behavior is consistent with that described in this document.

Each DC in the domain maintains the following set of data.

AbstractDomainName: The name of the domain.

AbstractDomainSid: The SID of the domain.

AbstractPrimaryDCName: The name of the PDC.

AbstractBuiltinDatabaseCreationTime: The QWORD time stamp in UTC for the SAM built-in database creation time.

AbstractBuiltinDatabaseSerialNumber: The database serial number of the SAM built-in database.

AbstractSamDatabaseCreationTime: The QWORD time stamp in UTC for the SAM database creation time.

AbstractSamDatabaseSerialNumber: The database serial number of the SAM database.

AbstractLsaDatabaseCreationTime: The QWORD time stamp in UTC for the LSA database creation time.

AbstractLsaDatabaseSerialNumber: The database serial number of the LSA database.

Additionally, the PDC maintains the following set of data.

AbstractPulse: A setting on the PDC that specifies the period, in seconds, at which the announcement message will be sent periodically by the PDC to BDCs needing synchronization in the domain.

AbstractRandom: A setting on the PDC that indicates the amount of time, in seconds, that the BDC recipient of the message should wait before contacting the PDC with a synchronization request.

AbstractPulseConcurrency: A setting on the PDC indicating the number of outstanding messages the PDC has sent to BDCs that haven't yet contacted the PDC with a synchronization request.

AbstractMaximumPulse: A setting on the PDC indicating a timeout value. If the last announcement message sent to a BDC was more than this value ago, the PDC will send a message to that BDC, as specified below.

AbstractBdcDatabaseSerialNumbers: An array of numbers that the PDC maintains to track database serial numbers for corresponding databases on BDCs.

Additionally, the BDC maintains the following set of data.

AbstractFullSamSynchronizationNeeded: A Boolean setting on the BDC that indicates whether full synchronization of the SAM database is needed. If TRUE, the BDC needs to perform full synchronization. If FALSE, the BDC needs to perform partial synchronization.

AbstractFullBuiltinSynchronizationNeeded: A Boolean setting on the BDC that indicates whether full synchronization of the SAM built-in database is needed. If TRUE, the BDC needs to perform full synchronization. If FALSE, the BDC needs to perform partial synchronization.

AbstractFullLsaSynchronizationNeeded: A Boolean setting on the BDC that indicates whether full synchronization of the LSA database is needed. If TRUE, the BDC needs to perform full synchronization. If FALSE, the BDC needs to perform partial synchronization.

3.6.2 Timers

A timer is maintained on PDC to periodically notify BDCs of the changes to the database state. The protocol does not mandate any particular time-out value for the timer.<333>

A timer is maintained on the BDC to start synchronization requests with the expiration time as described in section 3.6.3.

3.6.3 Initialization

The PDC MUST register the RPC endpoint. The PDC timer MUST be initialized to expire in AbstractPulse seconds. BDCs MUST create the \MAILSLOT\NET\NETLOGON mailslot, as specified in section 2.1. BDCs MUST initialize their BDC timers to never expire.

3.6.4 Message Processing Events and Sequencing Rules

3.6.4.1 Message Processing on PDC

After the PDC protocol initialization, the PDC MUST prepare an initial announcement message as follows:

- Set **LowSerialNumber** to the low DWORD part of AbstractSamDatabaseSerialNumber.

- Set **DateAndTime** to the value of AbstractSamDatabaseCreationTime expressed as the number of seconds elapsed since midnight of January 1, 1970.
- Set **Pulse** to the value of AbstractPulse.
- Set **Random** to the value of AbstractRandom.
- Set **PrimaryDCName** to the value of AbstractPrimaryDCName encoded in the OEM character set.
- Set **DomainName** to the value of AbstractDomainName encoded in the OEM character set.
- Optionally set **Pad** to 0x00 to make the next field in the message 2-byte aligned.
- Set **UnicodePrimaryDCName** to the value of AbstractPrimaryDCName encoded in Unicode.
- Set **UnicodeDomainName** to the value of AbstractDomainName encoded in Unicode.
- Set **DBCount** to 0x3.
- Set three **DBChangeInfo** fields as follows:
  - Set **DBIndex** of the 1st **DBChangeInfo** field to 0x0.

    Set **LargeSerialNumber** of the 1st DBChangeInfo field to the value of AbstractSamDatabaseSerialNumber.

    Set **DateAndTime** of the 1st **DBChangeInfo** field to the value of AbstractSamDatabaseCreationTime.
  - Set **DBIndex** of the 2nd **DBChangeInfo** field to 0x1.

    Set **LargeSerialNumber** of the 2nd **DBChangeInfo** field to the value of AbstractBuiltinDatabaseSerialNumber.

    Set **DateAndTime** of the 2nd **DBChangeInfo** field to the value of AbstractBuiltinDatabaseCreationTime.
  - Set **DBIndex** of the 3rd **DBChangeInfo** field to 0x2.

    Set **LargeSerialNumber** of the 3rd **DBChangeInfo** field to the value of AbstractLsaDatabaseSerialNumber.

    Set **DateAndTime** of the 3rd **DBChangeInfo** field to the value of AbstractLsaDatabaseCreationTime.
- Set **DBCount** to 0x3.
- Set **DomainSidSize** to the size in bytes of AbstractDomainSid.
- Set **DomainSid** to the value of AbstractDomainSid.

The PDC MUST send the message to all BDCs configured in the domain. In response to this message, the PDC MUST expect BDCs to synchronize their database by calling NetrDatabaseSync, NetrDatabaseSync2, or NetrDatabaseDeltas, as described below. For details about calling this method, see Calling NetrDatabaseSync2 in section 3.4.5.4.2.

In processing the NetrDatabaseDeltas call, the PDC MAY<334> indicate to the caller that it's unable to fulfill the partial synchronization request due to local conditions The BDC MUST handle the error by performing full synchronization as described below.

When processing NetrDatabaseSync, NetrDatabaseSync2, or NetrDatabaseDeltas calls, the PDC MUST update the AbstractBdcDatabaseSerialNumbers element corresponding to the database of the BDC

making the call to be equal to the value of the database serial number for the last database record returned by the call.

3.6.4.2 Message Processing on BDC

Upon receiving an announcement message, the BDC MUST process the message as follows.

- The BDC MUST validate the message to fully conform to the format of the announcement message, and extract all of the message fields.
- The BDC MUST validate that the value of **DomainName** is equal to the value of AbstractDomainName encoded in the OEM character set. If the value is different, the BDC MUST ignore the message as invalid.
- The BDC MUST validate that the value of **DomainSid** is equal to the value of AbstractDomainSid. If the value is different, the BDC MUST ignore the message as invalid.
- The BDC MUST determine that a synchronization request is needed if one of the following conditions is true:
  - The value of **DateAndTime** of one of the **DBChangeInfo** fields is not equal to the local value of the corresponding abstract database creation time (AbstractSamDatabaseCreationTime, AbstractBuiltinDatabaseCreationTime, or AbstractLsaDatabaseCreationTime). If this condition is true, the BDC MUST set to TRUE the corresponding Boolean value (AbstractFullSamSynchronizationNeeded, AbstractFullBuiltinSynchronizationNeeded, or AbstractFullLsaSynchronizationNeeded) to indicate that a full synchronization is needed for the corresponding database.
  - The value of **LargeSerialNumber** of one of the **DBChangeInfo** fields is not equal to the local value of the corresponding abstract database serial number (AbstractSamDatabaseSerialNumber, AbstractBuiltinDatabaseSerialNumber, or AbstractLsaDatabaseSerialNumber). If this condition is true, the BDC MUST set to FALSE the corresponding Boolean value (AbstractFullSamSynchronizationNeeded, AbstractFullBuiltinSynchronizationNeeded, or AbstractFullLsaSynchronizationNeeded) to indicate that a partial (delta) synchronization is needed for the corresponding database.
- If a synchronization request is needed, the BDC MUST set the BDC timer to expire in the amount of time equal to a random value between zero and the value of the Random field.

3.6.5 Timer Events

3.6.5.1 Timer Events on PDC

When the PDC timer expires, the PDC MUST prepare the announcement message (as specified in section 2.2.1.5.1) using the current database state, and send the message to BDCs that need synchronization. A BDC needs database synchronization if one of the following conditions is true:

- The announcement is forced as a result of administrative action.

  The announcement SHOULD<335> be forced if this is a new BDC configured in the domain.
- The BDC database serial number is less than the PDC database serial number for the corresponding database as indicated by an AbstractBdcDatabaseSerialNumbers element corresponding to the BDC and the database. To prevent sending messages to slow or unreachable BDCs, this condition MAY<336> be augmented to require that the BDC finishes processing the previous announcement (if any), or it is timed out before the PDC sends a new announcement message.

- More than AbstractMaximumPulse seconds passed since the BDC was sent the previous announcement message.

To reduce the load on the PDC from synchronization requests following the PDC announcement, the PDC MAY<337> choose to send messages only if the current value of AbstractPulseConcurrency is less than a certain value defined as a configuration setting.

The PDC resets its timer to expire in the AbstractPulse seconds.

3.6.5.2 Timer Events on BDC

When the BDC timer expires, the BDC MUST synchronize all its databases as follows.

3.6.5.2.1 Full Synchronization

Full database synchronization is performed if the corresponding Boolean value (AbstractFullSamSynchronizationNeeded, AbstractFullBuiltinSynchronizationNeeded, or AbstractFullLsaSynchronizationNeeded) is TRUE. If F is set in the NegotiatedFlags, the BDC MUST call NetrDatabaseSync2; otherwise the BDC will call NetrDatabaseSync until all changes are obtained for the corresponding database. After successfully receiving the changes, the BDC MUST update local database to bring it in sync with the PDC. The BDC MUST update the value of the abstract database serial number for the corresponding database (AbstractSamDatabaseSerialNumber, AbstractBuiltinDatabaseSerialNumber, or AbstractLsaDatabaseSerialNumber) and the abstract database creation time (AbstractSamDatabaseCreationTime, AbstractBuiltinDatabaseCreationTime, or AbstractLsaDatabaseCreationTime) to equal to the corresponding value from the PDC as follows:

- The values are set depending on the value of the **DeltaType** field of the last NETLOGON_DELTA_ENUM (section 2.2.1.5.11) element in the **Deltas** field of the NETLOGON_DELTA_ENUM_ARRAY (section 2.2.1.5.12) structure that is one of the following values:
  - If **DeltaType** is AddOrChangeDomain, the abstract database serial number and the abstract database creation time values MUST set to the **DomainModifiedCount** and **DomainCreationTime** fields, respectively, of the NETLOGON_DELTA_DOMAIN structure (section 2.2.1.5.10).
  - If **DeltaType** is AddOrChangeLsaPolicy, the abstract database serial number and the abstract database creation time values MUST be set to the **ModifiedId** and **DatabaseCreationTime** fields, respectively, of the NETLOGON_DELTA_POLICY structure (section 2.2.1.5.19).

3.6.5.2.2 Partial Synchronization

Partial database synchronization is performed if the corresponding Boolean value (AbstractFullSamSynchronizationNeeded, AbstractFullBuiltinSynchronizationNeeded, or AbstractFullLsaSynchronizationNeeded) is FALSE. In that case, the BDC MUST call NetrDatabaseDeltas in a loop until all changes are obtained for the corresponding database. After successfully receiving the changes, the BDC MUST update the local database to bring it in sync with the PDC. The BDC sets the value of the abstract database serial number for the corresponding database (AbstractSamDatabaseSerialNumber, AbstractBuiltinDatabaseSerialNumber, or AbstractLsaDatabaseSerialNumber) to the value of the *DomainModifiedCount* parameter returned by the last NetrDatabaseDeltas call in the replication loop.

If a NetrDatabaseDeltas call returns a status code 0xC0000134, the BDC MUST fully synchronize its entire database as described above. The BDC MAY<338> choose to perform full synchronization on other status codes indicating error conditions.

For either synchronization type, the BDC resets its timer to never expire at the end of processing.

3.6.6 Other Local Events

Administrative actions MAY<339> cause full database synchronization for all or some BDCs. For example, a configuration change promoting a server to a BDC SHOULD result in full database synchronization for that BDC. Similarly, a configuration change to elect a new PDC SHOULD result in full database synchronization for all BDCs. If the accounts database becomes corrupt, it SHOULD be recovered via a full synchronization request.

4 Protocol Examples

The Netlogon Remote Protocol methods are simple client/server RPC methods in which the client calls the method and the server returns a response. In establishing the connection with the server, the methods have two flows of operation:

- Not requiring a session key establishment.
- Requiring a session key establishment (often referred to as establishing a secure channel).

If a method does not require a session key establishment, the flow of operations will be as specified in section 3.1.4.7. The server will return a response whenever a method is called by the client.

When a method requires a session key establishment, the flow of operations to establish a secure channel will be as specified in section 3.1.4.6. RPC will use the Netlogon SSP to protect the method. The Netlogon SSP protects the data using the negotiated session key. The server will return a response whenever a method is called by the client.

The following section describes an example of pass-through authentication to illustrate the function of this protocol and values that can be used to test session key validation cryptography.

4.1 NetrLogonSamLogon with Secure Channel

When a secure channel is required, a number of additional steps are taken in the process of executing the method. For example, if a client calls the NetrLogonSamLogon method to execute an interactive account logon, the execution of the method involves several steps.

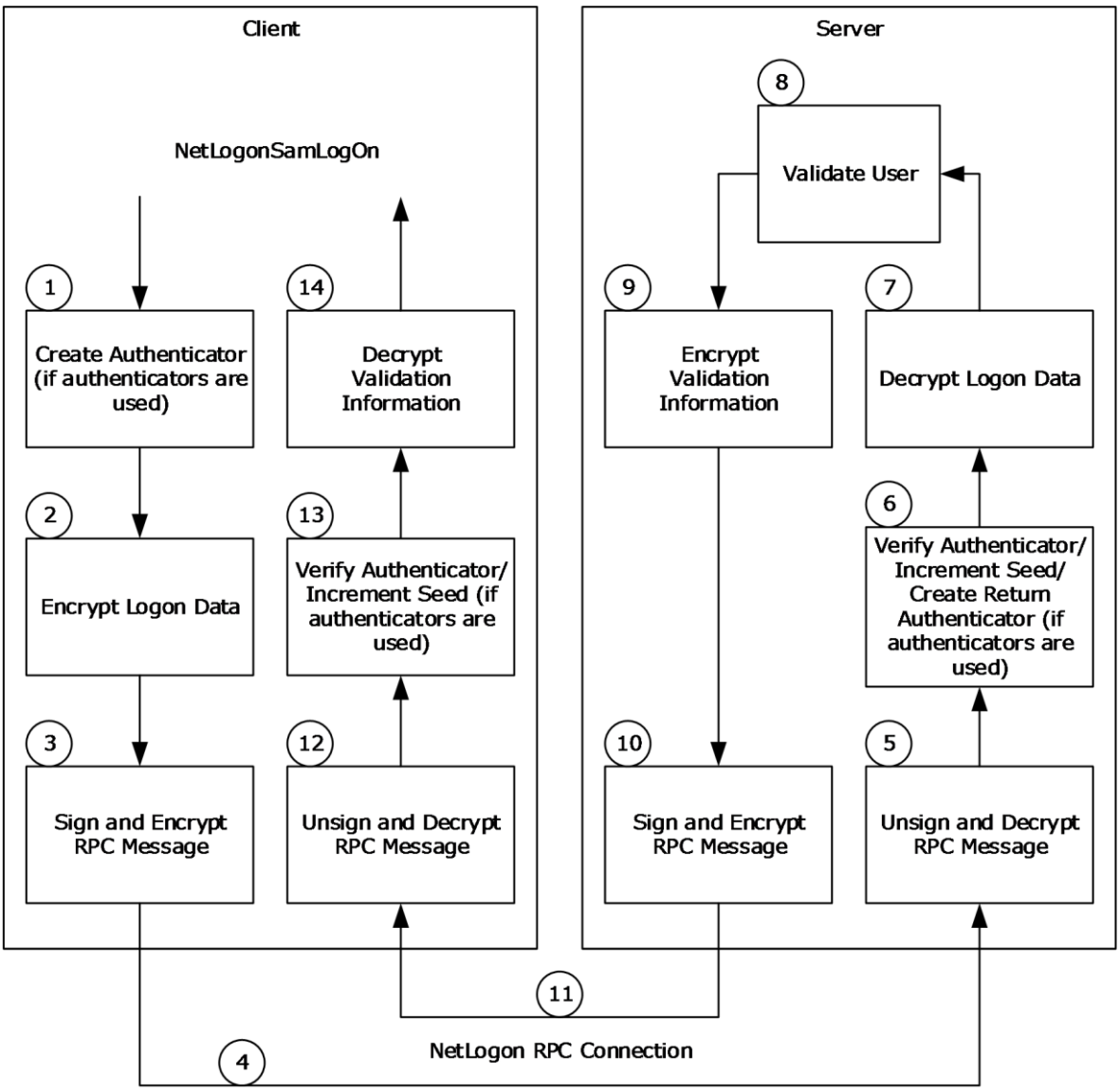


Figure 10: Secure channel execution of NetrLogonSamLogon

NetrLogonSamLogon involves the following steps:

1. If the Netlogon RPC call is using authenticators, the following steps are also performed.

    1. The client creates an authenticator. An authenticator is represented by a NETLOGON_AUTHENTICATOR structure.

    2. The client fills in the timestamp field of the structure with the number of seconds since 00:00:00 on January 1, 1970 (UTC). The client then adds this value to the current authentication seed to produce a new seed value.

3. The client computes the credential based on the new authentication seed, the session key, and the client challenge, per the calculation specified in the previous Netlogon Credentials section.

2. If the *LogonLevel* parameter of the NetrLogonSamLogon method contained one of a set of particular values, the client encrypts the logon data using the session key with the negotiated encryption algorithm. The following table defines the *LogonLevel* parameter value and the data that is encrypted.

LogonLevel value	Data encrypted
NetlogonInteractiveInformation (1)	The **LmOwfPassword** and **NtOwfPassword** fields of the NETLOGON_INTERACTIVE_INFO structure that was passed in the *LogonInformation* parameter.
NetlogonInteractiveTransitiveInformation (5)	The **LmOwfPassword** and **NtOwfPassword** fields of the NETLOGON_INTERACTIVE_INFO structure that was passed in the *LogonInformation* parameter.
NetlogonServiceInformation (3)	The **LmOwfPassword** and **NtOwfPassword** fields of the NETLOGON_SERVICE_INFO structure that was passed in the *LogonInformation* parameter.
NetlogonServiceTransitiveInformation (7)	The **LmOwfPassword** and **NtOwfPassword** fields of the NETLOGON_SERVICE_INFO structure that was passed in the *LogonInformation* parameter.
NetlogonGenericInformation (4)	The contents of the **LogonData** buffer of the NETLOGON_GENERIC_INFO structure that was passed in the *LogonInformation* parameter.

This step is not performed for any other *LogonLevel* parameter values.

3. The client signs and encrypts the RPC message. The data is first passed to RPC, where it is formatted according to the RPC standard. RPC then calls back to Netlogon to encrypt the RPC data buffer. The encryption of the RPC data buffer includes the following steps. (The checksum algorithm used is the negotiated checksum algorithm. The encryption algorithm used is the negotiated encryption algorithm.)

    1. Create and initialize a signature. A signature is represented by an NL_AUTH_SIGNATURE structure.

    2. Generate random data for the confounder in the signature.

    3. Assign the sequence number in the signature based on the nonce, and increment the nonce.

        Note The nonce is initialized to zero and is used to maintain the sequence number for the calls over the secure channel.

    4. Calculate the checksum of the first 8 bytes of the signature.

    5. Calculate the checksum of the 8 bytes that make up the confounder in the signature.

    6. Create an encryption key by using exclusive OR to join the session key with 0x0F0F0F0F.

    7. Encrypt the confounder using the encryption key.

    8. Calculate the checksum of the caller's message.

    9. Encrypt the caller's message using the encryption key.

    10. Finalize the checksum and assign it to the checksum in the signature.

11. Encrypt the sequence number in the signature using the session key.

4. The client sends the data over the Netlogon RPC connection.

5. The server verifies the signature and decrypts the RPC message. The decryption of the RPC message includes the following steps:

    1. Decrypt the sequence number in the signature using the session key.

    2. Compare the sequence number with the nonce, and increment the nonce.

    3. Calculate the checksum of the first 8 bytes of the signature.

    4. Create an encryption key by XOR'ing the session key with 0x0F0F0F0F.

    5. Decrypt the confounder using the encryption key.

    6. Calculate the checksum of the 8 bytes that make up the confounder in the signature.

    7. Decrypt the caller's message using the encryption key.

    8. Calculate the checksum of the caller's message.

    9. Finalize the checksum and compare it with the checksum in the signature.

6. If the Netlogon RPC call is using authenticators, the server verifies the received authenticator and creates a return authenticator. To verify the received authenticator, the server adds the time stamp value in the authenticator to the current authentication seed to produce a new seed value. The server then computes the client's credential based on the new authentication seed, the session key, and the client challenge, per the calculation specified in the previous Netlogon Credentials section. Finally, the server checks whether the resulting credential is equal to the credential in the received authenticator. If successful, the server adds 1 to the authentication seed. Then the server creates a return authenticator. The server computes the credential for the return authenticator based on the new authentication seed, the session key, and the server challenge, per the calculation specified in the previous Netlogon Credentials section.

7. If the *LogonLevel* parameter of the NetrLogonSamLogon method contained one of a set of particular values, the server decrypts the logon data, using the session key with the negotiated decryption algorithm. The following table defines the *LogonLevel* parameter values and the data that is decrypted.

LogonLevel value	Data decrypted
1	The **LmOwfPassword** and **NtOwfPassword** fields of the NETLOGON_INTERACTIVE_INFO structure that was passed in the *LogonInformation* parameter.
5	The **LmOwfPassword** and **NtOwfPassword** fields of the NETLOGON_INTERACTIVE_INFO structure that was passed in the *LogonInformation* parameter.
3	The **LmOwfPassword** and **NtOwfPassword** fields of the NETLOGON_SERVICE_INFO structure that was passed in the *LogonInformation* parameter.
7	The **LmOwfPassword** and **NtOwfPassword** fields of the NETLOGON_SERVICE_INFO structure that was passed in the *LogonInformation* parameter.
4	The contents of the **LogonData** buffer of the NETLOGON_GENERIC_INFO structure that was passed in the *LogonInformation* parameter.

This step is not performed for any other *LogonLevel* parameter values.

8. The server executes its implementation of the NetrLogonSamLogon method to validate the user. The resulting validation information is returned in a NETLOGON_VALIDATION union.

9. If the *LogonLevel* parameter of the NetrLogonSamLogon method contained one of the following values, the server encrypts the validation information:

   - NetlogonNetworkInformation
   - NetlogonNetworkTransitiveInformation
   - NetlogonGenericInformation

   The validation data is encrypted using the session key with the negotiated encryption algorithm. The data that is encrypted depends on the value that was passed in the *ValidationLevel* parameter of the NetrLogonSamLogon method. The following table defines the *ValidationLevel* parameter values and the data that is encrypted.

ValidationLevel value	Data encrypted
2	The **UserSessionKey** and **ExpansionRoom** fields of the NETLOGON_VALIDATION_SAM_INFO structure, as specified in section 2.2.1.4.11, that was passed in the *ValidationInformation* parameter.
3	The **UserSessionKey** and **ExpansionRoom** fields of the NETLOGON_VALIDATION_SAM_INFO2 structure, as specified in section 2.2.1.4.12, that was passed in the *ValidationInformation* parameter.
5	The contents of the **ValidationData** buffer of the NETLOGON_VALIDATION_GENERIC_INFO2 structure, as specified in section 2.2.1.4.8, that was passed in the *ValidationInformation* parameter.

   This step is not performed for any other *LogonLevel* parameter values.

10. The server signs and encrypts the RPC response message. The server performs the same steps as the client performed in step 3.

11. The server sends the response back to client over the Netlogon RPC connection.

12. The client unsigns and decrypts the RPC message. The client performs the same steps as the server performed in step 5.

13. If the Netlogon RPC call is using authenticators, the client verifies the return authenticator. To verify the return authenticator, the client adds 1 to the authentication seed to produce a new seed value. The client then computes the server's credential based on the new authentication seed, the session key, and the server challenge, per the calculation specified in the previous Netlogon Credentials section. Finally, the client checks whether the resulting credential is equal to the credential in the return authenticator.

14. If the *LogonLevel* parameter of the NetrLogonSamLogon method contained one of the following values, the client decrypts the validation information:

    - NetlogonNetworkInformation
    - NetlogonNetworkTransitiveInformation
    - NetlogonGenericInformation

    The validation data is decrypted using the session key with the negotiated decryption algorithm. The data that is decrypted depends on the value that was passed in the *ValidationLevel* parameter

of the NetrLogonSamLogon method. The following table defines the *ValidationLevel* parameter value and the data that is decrypted.

ValidationLevel value	Data decrypted
2	The **UserSessionKey** and **ExpansionRoom** fields of the NETLOGON_VALIDATION_SAM_INFO structure, as specified in section 2.2.1.4.11, that was passed in the *ValidationInformation* parameter.
3	The **UserSessionKey** and **ExpansionRoom** fields of the NETLOGON_VALIDATION_SAM_INFO2 structure, as specified in section 2.2.1.4.12, that was passed in the *ValidationInformation* parameter.
5	The contents of the **ValidationData** buffer of the NETLOGON_VALIDATION_GENERIC_INFO2 structure, as specified in section 2.2.1.4.8, that was passed in the *ValidationInformation* parameter.

This step is not performed for all other *LogonLevel* parameter values.

The execution of all other Netlogon methods requiring a secure channel is similar to the previous example.

4.2 Cryptographic Values for Session Key Validation

The following values were obtained from a Kernel debugger dump. They can be used when validating session key negotiation code.

Clear-text **SharedSecret** (machine password):

```
0000000: 2e 00 2f 00 2c 00 6e 00 4c 00 3e 00 4f 00 4c 00  ../.,.n.L.>.O.L.
0000010: 5a 00 36 00 73 00 74 00 5e 00 58 00 4b 00 65 00  Z.6.s.t.^.X.K.e.
0000020: 4d 00 25 00 2e 00 49 00 2d 00 74 00 45 00 60 00  M.%...I.-.t.E.`.
0000030: 57 00 56 00 6a 00 43 00 5b 00 30 00 36 00 3f 00  W.V.j.C.[.0.6.?.
0000040: 5d 00 3a 00 51 00 76 00 5f 00 54 00 6e 00 55 00  ].:.Q.v. .T.n.U.
0000050: 6f 00 3a 00 3a 00 42 00 77 00 2c 00 67 00 60 00  o.:.:.B.w.,.g.`.
0000060: 76 00 23 00 4a 00 4d 00 36 00 4d 00 71 00 53 00  v.#.J.M.6.M.q.S.
0000070: 50 00 75 00 55 00 28 00 6e 00 71 00 34 00 3e 00  P.u.U.(.n.q.4.>.
0000080: 79 00 6a 00 5b 00 64 00 5c 00 2b 00 56 00 70 00  y.j.[.d.\.+.V.p.
0000090: 52 00 5f 00 79 00 78 00 75 00 63 00 21 00 67 00  R. .y.x.u.c.!.g.
00000a0: 30 00 54 00 36 00 35 00 76 00 7a 00 57 00 41 00  0.T.6.5.v.z.W.A.
00000b0: 42 00 5f 00 42 00 22 00 69 00 3c 00 3c 00 53 00  B._.B.".i.<.<.S.
00000c0: 2b 00 34 00 27 00 5e 00 3a 00 21 00 2c 00 3b 00  +.4.'.^.:.!.,.;.
00000d0: 25 00 47 00 73 00 2d 00 28 00 22 00 3a 00 20 00  %.G.s.-.(.".:. .
00000e0: 6d 00 3e 00 21 00 43 00 4c 00 66 00 6e 00 4e 00  m.>.!.C.L.f.n.N.
```

OWF of **SharedSecret**:

```
0000000: 31 a5 90 17 0a 35 1f d5-11 48 b2 a1 0a f2 c3 05  1....5...H......
```

Client Challenge:

```
0000000: 3a 03 90 a4 6d 0c 3d 4f                          :...m.=O
```

Server Challenge:

```
0000000: 0c 4c 13 d1 60 41 c8 60                          .L..`A.`
```

Session Key:

```
0000000: ee fe 8f 40 00 7a 2e eb-68 43 d0 d3 0a 5b e2 e3  ...@.z..hC...[..
```

4.2.1 ASCII MD4 Testing

The following cryptographic values are provided to test using the session key to produce MD4 outputs with ASCII inputs.

Input:

```
0000000: 74 65 73 74                                     test
```

Output:

```
0000000: db 34 6d 69 1d 7a cc 4d c2 62 5d b1 9f 9e 3f 52  .4mi.z.M.b]...?R
```

4.2.2 UNICODE MD4 Testing

The following cryptographic values are provided to test using the session key to produce MD4 outputs with UNICODE inputs.

Input:

```
0000000: 74 00 65 00 73 00 74 00                         t.e.s.t.
```

Output:

```
0000000: 0c b6 94 88 05 f7 97 bf 2a 82 80 79 73 b8 95 37  ........*..ys..7
```

5 Security Considerations

5.1 Security Considerations for Implementers

Security considerations for both unauthenticated RPC and Secure RPC, as used in this protocol, are as specified in [MS-RPCE] sections 5.1 and 5.2.

When the Netlogon Remote Protocol secure channel was originally implemented, only certain security-sensitive RPC call arguments, such as passwords, were encrypted. This mechanism involved passing extra parameters, known as authenticators, as RPC call arguments; these are used for authenticating the RPC calls. Later, support was added to sign and encrypt the entire RPC message with the help of a new Netlogon Remote Protocol security package. However, the encryption and validation of individual security-sensitive parameters, and the use of authenticators that are passed as RPC-call arguments for authenticating the calls, were preserved in the existing RPC calls, even though these were redundant at that point.

On receiving the DsrDeregisterDnsHostRecords call, the server SHOULD control access to this method. Because DsrDeregisterDnsHostRecords deletes DNS records for any specific DC, the client should have administrative privileges (such as those Administrator, Local System, Account Operator, or System Operator accounts have) for the call to succeed.

One of the new RPC calls that was added later, NetrLogonSamLogonEx, does not use authenticators. Instead, it encrypts the entire RPC message when encryption is requested. NetrLogonSamLogonEx is currently the only RPC call that is made over a secure channel that does not use authenticators. The presence of authenticators is determined by the Netlogon Remote Protocol call that was made.

To prevent remote denial of service (DoS) attacks, the server can delete the stored *ServerChallenge*, client name and client challenge used for the NetrServerReqChallenge method after a couple of minutes.

To prevent information disclosure, the server SHOULD control access to the DsrGetForestTrustInformation method to authenticated users.

To prevent information disclosure, the client SHOULD be a registered user of the corporate forest for the local computer account RID and limited to only those clients (such as local system or members of the local administrators group) that need the RID for a trust account for the NetrLogonGetTrustRid call to succeed.

On receiving the NetrLogonComputeServerDigest call, the server should control access to this method. Because NetrLogonComputeServerDigest is an administrative method, the client should have administrative privileges (such as those the local administrators group, local system, or local service have) for the call to succeed.

On receiving the NetrLogonComputeClientDigest call, the server should control access to this method. Because NetrLogonComputeClientDigest is an administrative method, the client should have administrative privileges (such as those the local administrators group, local system, or local service have) for the call to succeed.

On receiving the NetrLogonSetServiceBits call, the server should control access to this method. Because NetrLogonSetServiceBits is an administrative method, the client should have administrative privileges (such as those the local administrators group, local system, or local service have) for the call to succeed.

On receiving the NetrLogonGetTimeServiceParentDomain call, the server should control access to this method to determine whether the caller can access the parent domain. To prevent information disclosure, the client should have administrative privileges (such as those the local administrators group, local system, or local service have) for the call to succeed.

The server SHOULD control access to the NetrLogonControl2Ex method to determine whether the caller can manage the Netlogon service (the caller requires administrative privileges such as those the local administrators group, local system, or local service have).

The following sections specify security considerations for implementers of the Netlogon Remote Protocol.

5.2 Index of Security Parameters

Security parameter	Section
SealSecureChannel	3.1.1
Session Key Parameters	3.1.1
Netlogon Negotiable Options	3.1.4.2
Session-Key Computation	3.1.4.3
Netlogon Credential Computation	3.1.4.4
Netlogon Authenticator Computation and Verification	3.1.4.5
Session-Key Negotiation	3.1.4.1
Integrity	3.3.1
Sequence Detect	3.3.1
Confidentiality	3.3.1
Netlogon Security Context Establishment	3.3.4.1
NL_AUTH_MESSAGE	3.3.4.1
Signing and Encrypting	3.3.4.2
NL_AUTH_SIGNATURE	3.3.4.2
domain-name	3.4.1

6 Appendix A: Full IDL

For ease of implementation, the full IDL is provided, where "ms-dtyp.idl" refers to the IDL found in [MS-DTYP] Appendix A.

The syntax uses the **IDL** syntax extensions defined in [MS-RPCE] sections 2.2.4 and 3.1.1.5.1. For example, as noted in [MS-RPCE] section 2.2.4.9, a pointer_default declaration is not required and pointer_default(unique) is assumed.

```
import "ms-dtyp.idl";
[
    uuid(12345678-1234-ABCD-EF00-01234567CFFB),
    version(1.0),
    ms_union,
    pointer_default(unique)
]

interface logon
{
    typedef struct _STRING{
        USHORT Length;
        USHORT MaximumLength;
        [size is(MaximumLength), length is(Length) ] CHAR * Buffer;
    } STRING, *PSTRING;

    typedef struct _OLD_LARGE_INTEGER{
        ULONG LowPart;
        LONG HighPart;
    } OLD LARGE INTEGER, *POLD LARGE INTEGER;

    typedef struct  CYPHER BLOCK{
        CHAR data[8];
    } CYPHER_BLOCK, *PCYPHER_BLOCK;

    typedef struct  NT OWF PASSWORD{
        CYPHER BLOCK data[2];
    }NT_OWF_PASSWORD, *PNT_OWF_PASSWORD,
     ENCRYPTED_NT_OWF_PASSWORD, *PENCRYPTED_NT_OWF_PASSWORD;

    typedef struct  LM OWF PASSWORD{
        CYPHER_BLOCK data[2];
    } LM OWF PASSWORD, *PLM OWF PASSWORD,
      ENCRYPTED_LM_OWF_PASSWORD, *PENCRYPTED_LM_OWF_PASSWORD;

    typedef DWORD NET_API_STATUS;
    typedef [handle] wchar t * LOGONSRV HANDLE;

    typedef struct  NLPR SID INFORMATION{
        PRPC_SID SidPointer;
    } NLPR_SID_INFORMATION, *PNLPR_SID_INFORMATION;

    typedef struct  NLPR SID ARRAY{
        ULONG Count;
        [size is(Count)] PNLPR SID INFORMATION Sids;
    } NLPR SID ARRAY, *PNLPR SID ARRAY;

    typedef struct _NLPR_CR_CIPHER_VALUE{
        ULONG Length;
        ULONG MaximumLength;
        [size_is(MaximumLength), length_is(Length)]
             UCHAR * Buffer;
    } NLPR_CR_CIPHER_VALUE, *PNLPR_CR_CIPHER_VALUE;

    typedef struct _NLPR_LOGON_HOURS{
        USHORT UnitsPerWeek;
        [size_is(1260), length_is((UnitsPerWeek+7)/8)]
             UCHAR * LogonHours;
```

```
} NLPR_LOGON_HOURS, *PNLPR_LOGON_HOURS;

typedef struct _NLPR_USER_PRIVATE_INFO{
    UCHAR SensitiveData;
    ULONG DataLength;
    [size is(DataLength)] UCHAR * Data;
} NLPR_USER_PRIVATE_INFO, *PNLPR_USER_PRIVATE_INFO;

typedef struct _NLPR_MODIFIED_COUNT{
    OLD_LARGE_INTEGER ModifiedCount;
} NLPR MODIFIED COUNT, *PNLPR MODIFIED COUNT;

typedef struct _NLPR_QUOTA_LIMITS{
    ULONG PagedPoolLimit;
    ULONG NonPagedPoolLimit;
    ULONG MinimumWorkingSetSize;
    ULONG MaximumWorkingSetSize;
    ULONG PagefileLimit;
    OLD LARGE INTEGER Reserved;
} NLPR_QUOTA_LIMITS,
  *PNLPR_QUOTA_LIMITS;

typedef struct  NETLOGON DELTA USER{
    RPC_UNICODE_STRING UserName;
    RPC_UNICODE_STRING FullName;
    ULONG UserId;
    ULONG PrimaryGroupId;
    RPC_UNICODE_STRING HomeDirectory;
    RPC UNICODE STRING HomeDirectoryDrive;
    RPC_UNICODE_STRING ScriptPath;
    RPC UNICODE STRING AdminComment;
    RPC_UNICODE_STRING WorkStations;
    OLD_LARGE_INTEGER LastLogon;
    OLD LARGE INTEGER LastLogoff;
    NLPR_LOGON_HOURS LogonHours;
    USHORT BadPasswordCount;
    USHORT LogonCount;
    OLD_LARGE_INTEGER PasswordLastSet;
    OLD_LARGE_INTEGER AccountExpires;
    ULONG UserAccountControl;
    ENCRYPTED_NT_OWF_PASSWORD EncryptedNtOwfPassword;
    ENCRYPTED LM OWF PASSWORD EncryptedLmOwfPassword;
    UCHAR NtPasswordPresent;
    UCHAR LmPasswordPresent;
    UCHAR PasswordExpired;
    RPC UNICODE STRING UserComment;
    RPC_UNICODE_STRING Parameters;
    USHORT CountryCode;
    USHORT CodePage;
    NLPR_USER_PRIVATE_INFO PrivateData;
    SECURITY_INFORMATION SecurityInformation;
    ULONG SecuritySize;
    [size_is(SecuritySize)] UCHAR * SecurityDescriptor;
    RPC UNICODE STRING ProfilePath;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC UNICODE STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_USER,
  *PNETLOGON DELTA USER;

typedef struct  NETLOGON DELTA GROUP{
    RPC_UNICODE_STRING Name;
    ULONG RelativeId;
    ULONG Attributes;
    RPC_UNICODE_STRING AdminComment;
```

```
    SECURITY_INFORMATION SecurityInformation;
    ULONG SecuritySize;
    [size_is(SecuritySize)] UCHAR * SecurityDescriptor;
    RPC_UNICODE_STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_GROUP,
  *PNETLOGON_DELTA_GROUP;

typedef struct _NETLOGON_DELTA_GROUP_MEMBER {
    [size_is(MemberCount)] ULONG * Members;
    [size_is(MemberCount)] ULONG * Attributes;
    ULONG MemberCount;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_GROUP_MEMBER,
  *PNETLOGON_DELTA_GROUP_MEMBER;

typedef struct _NETLOGON_DELTA_ALIAS{
    RPC_UNICODE_STRING Name;
    ULONG RelativeId;
    SECURITY_INFORMATION SecurityInformation;
    ULONG SecuritySize;
    [size_is(SecuritySize)] UCHAR * SecurityDescriptor;
    RPC_UNICODE_STRING Comment;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_ALIAS,
  *PNETLOGON_DELTA_ALIAS;

typedef struct _NETLOGON_DELTA_ALIAS_MEMBER{
    NLPR_SID_ARRAY Members;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_ALIAS_MEMBER,
  *PNETLOGON_DELTA_ALIAS_MEMBER;

typedef struct  NETLOGON_DELTA_DOMAIN{
    RPC_UNICODE_STRING DomainName;
    RPC_UNICODE_STRING OemInformation;
    OLD_LARGE_INTEGER ForceLogoff;
    USHORT MinPasswordLength;
    USHORT PasswordHistoryLength;
    OLD_LARGE_INTEGER MaxPasswordAge;
    OLD_LARGE_INTEGER MinPasswordAge;
    OLD_LARGE_INTEGER DomainModifiedCount;
    OLD_LARGE_INTEGER DomainCreationTime;
    SECURITY_INFORMATION SecurityInformation;
    ULONG SecuritySize;
    [size_is(SecuritySize)] UCHAR * SecurityDescriptor;
    RPC_UNICODE_STRING DomainLockoutInformation;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG PasswordProperties;
```

```
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_DOMAIN,
  *PNETLOGON_DELTA_DOMAIN;

typedef struct _NETLOGON_DELTA_RENAME_GROUP{
    RPC_UNICODE_STRING OldName;
    RPC_UNICODE_STRING NewName;
    RPC_UNICODE_STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_RENAME_GROUP,
  *PNETLOGON_DELTA_RENAME_GROUP;

typedef struct _NETLOGON_DELTA_RENAME_USER{
    RPC_UNICODE_STRING OldName;
    RPC_UNICODE_STRING NewName;
    RPC_UNICODE_STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_RENAME_USER,
  *PNETLOGON_DELTA_RENAME_USER;

typedef struct _NETLOGON_DELTA_RENAME_ALIAS{
    RPC_UNICODE_STRING OldName;
    RPC_UNICODE_STRING NewName;
    RPC_UNICODE_STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_RENAME_ALIAS,
  *PNETLOGON_DELTA_RENAME_ALIAS;

typedef struct _NETLOGON_DELTA_POLICY{
    ULONG MaximumLogSize;
    OLD_LARGE_INTEGER AuditRetentionPeriod;
    UCHAR AuditingMode;
    ULONG MaximumAuditEventCount;
    [size_is(MaximumAuditEventCount + 1)]
        ULONG * EventAuditingOptions;
    RPC_UNICODE_STRING PrimaryDomainName;
    PRPC_SID PrimaryDomainSid;
    NLPR_QUOTA_LIMITS QuotaLimits;
    OLD_LARGE_INTEGER ModifiedId;
    OLD_LARGE_INTEGER DatabaseCreationTime;
    SECURITY_INFORMATION SecurityInformation;
    ULONG SecuritySize;
    [size_is(SecuritySize)] UCHAR * SecurityDescriptor;
    RPC_UNICODE_STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
```

```
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_POLICY,
  *PNETLOGON_DELTA_POLICY;

typedef struct  NETLOGON DELTA TRUSTED DOMAINS{
    RPC_UNICODE_STRING DomainName;
    ULONG NumControllerEntries;
    [size_is(NumControllerEntries)]
         PRPC_UNICODE_STRING ControllerNames;
    SECURITY INFORMATION SecurityInformation;
    ULONG SecuritySize;
    [size_is(SecuritySize)] UCHAR * SecurityDescriptor;
    RPC_UNICODE_STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC UNICODE STRING DummyString4;
    ULONG TrustedPosixOffset;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_TRUSTED_DOMAINS,
  *PNETLOGON DELTA TRUSTED DOMAINS;

typedef struct _NETLOGON_DELTA_ACCOUNTS{
    ULONG PrivilegeEntries;
    ULONG PrivilegeControl;
    [size_is(PrivilegeEntries)]
         ULONG * PrivilegeAttributes;
    [size_is(PrivilegeEntries)] PRPC_UNICODE_STRING PrivilegeNames;
    NLPR QUOTA LIMITS QuotaLimits;
    ULONG SystemAccessFlags;
    SECURITY_INFORMATION SecurityInformation;
    ULONG SecuritySize;
    [size_is(SecuritySize)] UCHAR * SecurityDescriptor;
    RPC UNICODE STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_ACCOUNTS,
  *PNETLOGON_DELTA_ACCOUNTS;

typedef struct _NETLOGON_DELTA_SECRET{
    NLPR CR CIPHER VALUE CurrentValue;
    OLD_LARGE_INTEGER CurrentValueSetTime;
    NLPR_CR_CIPHER_VALUE OldValue;
    OLD_LARGE_INTEGER OldValueSetTime;
    SECURITY INFORMATION SecurityInformation;
    ULONG SecuritySize;
    [size is(SecuritySize)] UCHAR * SecurityDescriptor;
    RPC_UNICODE_STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
    RPC UNICODE STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON DELTA SECRET,
  *PNETLOGON_DELTA_SECRET;

typedef struct _NETLOGON_DELTA_DELETE_GROUP{
    [string] wchar_t * AccountName;
    RPC_UNICODE_STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
```

```
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_DELETE_GROUP,
  *PNETLOGON_DELTA_DELETE_GROUP;

typedef struct _NETLOGON_DELTA_DELETE_USER{
    [string] wchar t * AccountName;
    RPC_UNICODE_STRING DummyString1;
    RPC_UNICODE_STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DELTA_DELETE_USER,
  *PNETLOGON_DELTA_DELETE_USER;

typedef enum  NETLOGON DELTA TYPE{
    AddOrChangeDomain = 1,
    AddOrChangeGroup = 2,
    DeleteGroup = 3,
    RenameGroup = 4,
    AddOrChangeUser = 5,
    DeleteUser = 6,
    RenameUser = 7,
    ChangeGroupMembership = 8,
    AddOrChangeAlias = 9,
    DeleteAlias = 10,
    RenameAlias = 11,
    ChangeAliasMembership = 12,
    AddOrChangeLsaPolicy = 13,
    AddOrChangeLsaTDomain = 14,
    DeleteLsaTDomain = 15,
    AddOrChangeLsaAccount = 16,
    DeleteLsaAccount = 17,
    AddOrChangeLsaSecret = 18,
    DeleteLsaSecret = 19,
    DeleteGroupByName = 20,
    DeleteUserByName = 21,
    SerialNumberSkip = 22
} NETLOGON DELTA TYPE;

typedef [switch type(NETLOGON DELTA TYPE)] union
     _NETLOGON_DELTA_UNION{
    [case(AddOrChangeDomain)]
         PNETLOGON_DELTA_DOMAIN DeltaDomain;
    [case(AddOrChangeGroup)]
         PNETLOGON_DELTA_GROUP DeltaGroup;
    [case(RenameGroup)]
         PNETLOGON_DELTA_RENAME_GROUP DeltaRenameGroup;
    [case(AddOrChangeUser)]
         PNETLOGON DELTA USER DeltaUser;
    [case(RenameUser)]
         PNETLOGON DELTA RENAME USER DeltaRenameUser;
    [case(ChangeGroupMembership)]
         PNETLOGON_DELTA_GROUP_MEMBER DeltaGroupMember;
    [case(AddOrChangeAlias)]
         PNETLOGON DELTA ALIAS DeltaAlias;
    [case(RenameAlias)]
         PNETLOGON DELTA RENAME ALIAS DeltaRenameAlias;
    [case(ChangeAliasMembership)]
         PNETLOGON_DELTA_ALIAS_MEMBER DeltaAliasMember;
    [case(AddOrChangeLsaPolicy)]
         PNETLOGON_DELTA_POLICY DeltaPolicy;
```

```
    [case(AddOrChangeLsaTDomain)]
         PNETLOGON_DELTA_TRUSTED_DOMAINS DeltaTDomains;
    [case(AddOrChangeLsaAccount)]
         PNETLOGON_DELTA_ACCOUNTS DeltaAccounts;
    [case(AddOrChangeLsaSecret)]
         PNETLOGON DELTA SECRET DeltaSecret;
    [case(DeleteGroupByName)]
         PNETLOGON_DELTA_DELETE_GROUP DeltaDeleteGroup;
    [case(DeleteUserByName)]
         PNETLOGON_DELTA_DELETE_USER DeltaDeleteUser;
    [case(SerialNumberSkip)]
         PNLPR_MODIFIED_COUNT DeltaSerialNumberSkip;
    [default] ;
} NETLOGON_DELTA_UNION,
  *PNETLOGON_DELTA_UNION;

typedef [switch type(NETLOGON DELTA TYPE)] union
     _NETLOGON_DELTA_ID_UNION{
    [case(AddOrChangeDomain,
          AddOrChangeGroup,
          DeleteGroup,
          RenameGroup,
          AddOrChangeUser,
          DeleteUser,
          RenameUser,
          ChangeGroupMembership,
          AddOrChangeAlias,
          DeleteAlias,
          RenameAlias,
          ChangeAliasMembership,
          DeleteGroupByName,
          DeleteUserByName )] ULONG Rid;
    [case(AddOrChangeLsaPolicy,
          AddOrChangeLsaTDomain,
          DeleteLsaTDomain,
          AddOrChangeLsaAccount,
          DeleteLsaAccount)] PRPC_SID Sid;
    [case(AddOrChangeLsaSecret,
          DeleteLsaSecret)] [string] wchar_t * Name;
    [default] ;
} NETLOGON_DELTA_ID_UNION,
  *PNETLOGON DELTA ID UNION;

typedef struct _NETLOGON_DELTA_ENUM{
    NETLOGON_DELTA_TYPE DeltaType;
    [switch is(DeltaType)] NETLOGON DELTA ID UNION DeltaID;
    [switch_is(DeltaType)] NETLOGON_DELTA_UNION DeltaUnion;
} NETLOGON DELTA ENUM,
  *PNETLOGON_DELTA_ENUM;

typedef struct _NETLOGON_DELTA_ENUM_ARRAY{
    DWORD CountReturned;
    [size_is(CountReturned)] PNETLOGON_DELTA_ENUM Deltas;
} NETLOGON DELTA ENUM ARRAY,
  *PNETLOGON_DELTA_ENUM_ARRAY;

typedef struct  NETLOGON LOGON IDENTITY INFO{
    RPC_UNICODE_STRING LogonDomainName;
    ULONG ParameterControl;
    OLD_LARGE_INTEGER Reserved;
    RPC_UNICODE_STRING UserName;
    RPC_UNICODE_STRING Workstation;
} NETLOGON LOGON IDENTITY INFO,
  *PNETLOGON_LOGON_IDENTITY_INFO;

typedef struct _NETLOGON_INTERACTIVE_INFO{
    NETLOGON_LOGON_IDENTITY_INFO Identity;
    LM_OWF_PASSWORD LmOwfPassword;
    NT_OWF_PASSWORD NtOwfPassword;
```

```
} NETLOGON_INTERACTIVE_INFO,
  *PNETLOGON_INTERACTIVE_INFO;

typedef enum _NETLOGON_LOGON_INFO_CLASS{
    NetlogonInteractiveInformation = 1,
    NetlogonNetworkInformation = 2,
    NetlogonServiceInformation = 3,
    NetlogonGenericInformation = 4,
    NetlogonInteractiveTransitiveInformation = 5,
    NetlogonNetworkTransitiveInformation = 6,
    NetlogonServiceTransitiveInformation = 7
} NETLOGON_LOGON_INFO_CLASS;

typedef struct _NETLOGON_SERVICE_INFO{
    NETLOGON_LOGON_IDENTITY_INFO Identity;
    LM_OWF_PASSWORD LmOwfPassword;
    NT OWF PASSWORD NtOwfPassword;
} NETLOGON_SERVICE_INFO,
  *PNETLOGON SERVICE INFO;

typedef struct{
    CHAR data[8];
} LM CHALLENGE;

typedef struct _NETLOGON_NETWORK_INFO{
    NETLOGON_LOGON_IDENTITY_INFO Identity;
    LM_CHALLENGE LmChallenge;
    STRING NtChallengeResponse;
    STRING LmChallengeResponse;
} NETLOGON_NETWORK_INFO,
  *PNETLOGON NETWORK INFO;

typedef struct _NETLOGON_GENERIC_INFO{
    NETLOGON LOGON IDENTITY INFO Identity;
    RPC_UNICODE_STRING PackageName;
    ULONG DataLength;
    [size_is(DataLength)] UCHAR * LogonData;
} NETLOGON_GENERIC_INFO,
  *PNETLOGON_GENERIC_INFO;

typedef [switch_type(NETLOGON_LOGON_INFO_CLASS)] union
      NETLOGON LEVEL{
    [case(NetlogonInteractiveInformation)]
        PNETLOGON_INTERACTIVE_INFO LogonInteractive;
    [case(NetlogonInteractiveTransitiveInformation)]
        PNETLOGON INTERACTIVE INFO LogonInteractiveTransitive;
    [case(NetlogonServiceInformation)]
        PNETLOGON SERVICE INFO LogonService;
    [case(NetlogonServiceTransitiveInformation)]
        PNETLOGON_SERVICE_INFO LogonServiceTransitive;
    [case(NetlogonNetworkInformation)]
        PNETLOGON NETWORK INFO LogonNetwork;
    [case(NetlogonNetworkTransitiveInformation)]
        PNETLOGON NETWORK INFO LogonNetworkTransitive;
    [case(NetlogonGenericInformation)]
        PNETLOGON_GENERIC_INFO LogonGeneric;
    [default]
        ;
} NETLOGON LEVEL,
  * PNETLOGON_LEVEL;

typedef enum _NETLOGON_VALIDATION_INFO_CLASS{
    NetlogonValidationUasInfo = 1,
    NetlogonValidationSamInfo = 2,
    NetlogonValidationSamInfo2 = 3,
    NetlogonValidationGenericInfo = 4,
    NetlogonValidationGenericInfo2 = 5,
    NetlogonValidationSamInfo4 = 6
} NETLOGON_VALIDATION_INFO_CLASS;
```

```
typedef struct _GROUP_MEMBERSHIP{
    ULONG RelativeId;
    ULONG Attributes;
} GROUP_MEMBERSHIP,
  *PGROUP MEMBERSHIP;

typedef struct _USER_SESSION_KEY{
    CYPHER_BLOCK data[2];
} USER_SESSION_KEY,
  *PUSER SESSION KEY;

typedef struct _NETLOGON_SID_AND_ATTRIBUTES{
    PRPC_SID Sid;
    ULONG Attributes;
} NETLOGON_SID_AND_ATTRIBUTES,
  *PNETLOGON SID AND ATTRIBUTES;

typedef struct  NETLOGON VALIDATION SAM INFO{
    OLD_LARGE_INTEGER LogonTime;
    OLD_LARGE_INTEGER LogoffTime;
    OLD_LARGE_INTEGER KickOffTime;
    OLD LARGE INTEGER PasswordLastSet;
    OLD_LARGE_INTEGER PasswordCanChange;
    OLD_LARGE_INTEGER PasswordMustChange;
    RPC_UNICODE_STRING EffectiveName;
    RPC_UNICODE_STRING FullName;
    RPC_UNICODE_STRING LogonScript;
    RPC UNICODE STRING ProfilePath;
    RPC_UNICODE_STRING HomeDirectory;
    RPC UNICODE STRING HomeDirectoryDrive;
    USHORT LogonCount;
    USHORT BadPasswordCount;
    ULONG UserId;
    ULONG PrimaryGroupId;
    ULONG GroupCount;
    [size_is(GroupCount)] PGROUP_MEMBERSHIP GroupIds;
    ULONG UserFlags;
    USER_SESSION_KEY UserSessionKey;
    RPC UNICODE STRING LogonServer;
    RPC_UNICODE_STRING LogonDomainName;
    PRPC SID LogonDomainId;
    ULONG ExpansionRoom[10];
} NETLOGON_VALIDATION_SAM_INFO,
  *PNETLOGON_VALIDATION_SAM_INFO;

typedef struct _NETLOGON_VALIDATION_SAM_INFO2{
    OLD LARGE INTEGER LogonTime;
    OLD_LARGE_INTEGER LogoffTime;
    OLD_LARGE_INTEGER KickOffTime;
    OLD_LARGE_INTEGER PasswordLastSet;
    OLD LARGE INTEGER PasswordCanChange;
    OLD_LARGE_INTEGER PasswordMustChange;
    RPC UNICODE STRING EffectiveName;
    RPC_UNICODE_STRING FullName;
    RPC_UNICODE_STRING LogonScript;
    RPC UNICODE STRING ProfilePath;
    RPC_UNICODE_STRING HomeDirectory;
    RPC UNICODE STRING HomeDirectoryDrive;
    USHORT LogonCount;
    USHORT BadPasswordCount;
    ULONG UserId;
    ULONG PrimaryGroupId;
    ULONG GroupCount;
    [size is(GroupCount)] PGROUP MEMBERSHIP GroupIds;
    ULONG UserFlags;
    USER_SESSION_KEY UserSessionKey;
    RPC_UNICODE_STRING LogonServer;
    RPC_UNICODE_STRING LogonDomainName;
```

```
    PRPC_SID LogonDomainId;
    ULONG ExpansionRoom[10];
    ULONG SidCount;
    [size_is(SidCount)] PNETLOGON_SID_AND_ATTRIBUTES ExtraSids;
} NETLOGON_VALIDATION_SAM_INFO2,
  *PNETLOGON VALIDATION SAM INFO2 ;

typedef struct _NETLOGON_VALIDATION_GENERIC_INFO2{
    ULONG DataLength;
    [size_is(DataLength)] UCHAR * ValidationData;
} NETLOGON VALIDATION GENERIC INFO2,
  *PNETLOGON_VALIDATION_GENERIC_INFO2;

typedef struct _NETLOGON_VALIDATION_SAM_INFO4 {
    OLD_LARGE_INTEGER LogonTime;
    OLD_LARGE_INTEGER LogoffTime;
    OLD LARGE INTEGER KickOffTime;
    OLD_LARGE_INTEGER PasswordLastSet;
    OLD LARGE INTEGER PasswordCanChange;
    OLD_LARGE_INTEGER PasswordMustChange;
    RPC_UNICODE_STRING EffectiveName;
    RPC_UNICODE_STRING FullName;
    RPC UNICODE STRING LogonScript;
    RPC_UNICODE_STRING ProfilePath;
    RPC_UNICODE_STRING HomeDirectory;
    RPC_UNICODE_STRING HomeDirectoryDrive;
    unsigned short LogonCount;
    unsigned short BadPasswordCount;
    unsigned long UserId;
    unsigned long PrimaryGroupId;
    unsigned long GroupCount;
   [size_is(GroupCount)] PGROUP_MEMBERSHIP GroupIds;
    unsigned long UserFlags;
    USER SESSION KEY UserSessionKey;
    RPC_UNICODE_STRING LogonServer;
    RPC UNICODE STRING LogonDomainName;
    PRPC_SID LogonDomainId;
    unsigned char LMKey[8];
    ULONG UserAccountControl;
    ULONG SubAuthStatus;
    OLD_LARGE_INTEGER LastSuccessfulILogon;
    OLD LARGE INTEGER LastFailedILogon;
    ULONG FailedILogonCount;
    ULONG Reserved4[1];
    unsigned long SidCount;
   [size is(SidCount)] PNETLOGON SID AND ATTRIBUTES ExtraSids;
    RPC_UNICODE_STRING DnsLogonDomainName;
    RPC UNICODE STRING Upn;
    RPC_UNICODE_STRING ExpansionString1;
    RPC_UNICODE_STRING ExpansionString2;
    RPC_UNICODE_STRING ExpansionString3;
    RPC UNICODE STRING ExpansionString4;
    RPC_UNICODE_STRING ExpansionString5;
    RPC UNICODE STRING ExpansionString6;
    RPC_UNICODE_STRING ExpansionString7;
    RPC_UNICODE_STRING ExpansionString8;
    RPC UNICODE STRING ExpansionString9;
    RPC_UNICODE_STRING ExpansionString10;
} NETLOGON VALIDATION SAM INFO4,
*PNETLOGON_VALIDATION_SAM_INFO4;

typedef [switch_type(enum _NETLOGON_VALIDATION_INFO_CLASS)] union
      NETLOGON VALIDATION{
    [case(NetlogonValidationSamInfo)]
        PNETLOGON VALIDATION SAM INFO ValidationSam;
    [case(NetlogonValidationSamInfo2)]
        PNETLOGON_VALIDATION_SAM_INFO2 ValidationSam2;
    [case(NetlogonValidationGenericInfo2)]
        PNETLOGON_VALIDATION_GENERIC_INFO2 ValidationGeneric2;
```

```
        [case(NetlogonValidationSamInfo4)]
            PNETLOGON_VALIDATION_SAM_INFO4 ValidationSam4;
        [default]
            ;
    } NETLOGON_VALIDATION,
      *PNETLOGON VALIDATION;

    typedef [switch_type(DWORD)] union
         _NETLOGON_CONTROL_DATA_INFORMATION{
         [case(5,6,9,10)] [string] wchar_t * TrustedDomainName;
         [case(65534)] DWORD DebugFlag;
         [case(8)] [string] wchar_t *UserName;
         [default]
             ;
    } NETLOGON_CONTROL_DATA_INFORMATION,
      *PNETLOGON_CONTROL_DATA_INFORMATION;

    typedef struct _NETLOGON_INFO_1{
        DWORD netlog1 flags;
        NET_API_STATUS netlog1_pdc_connection_status;
    } NETLOGON_INFO_1,
      *PNETLOGON_INFO_1;

    typedef struct _NETLOGON_INFO_2{
        DWORD netlog2_flags;
        NET_API_STATUS netlog2_pdc_connection_status;
        [string] wchar_t * netlog2_trusted_dc_name;
        NET_API_STATUS netlog2_tc_connection_status;
    } NETLOGON INFO 2,
      *PNETLOGON_INFO_2;

    typedef struct _NETLOGON_INFO_3{
        DWORD netlog3_flags;
        DWORD netlog3 logon attempts;
        DWORD netlog3_reserved1;
        DWORD netlog3 reserved2;
        DWORD netlog3_reserved3;
        DWORD netlog3_reserved4;
        DWORD netlog3_reserved5;
    } NETLOGON INFO 3,
      *PNETLOGON_INFO_3;

    typedef struct _NETLOGON_INFO_4{
        [string] wchar_t * netlog4_trusted_dc_name;
        [string] wchar_t * netlog4_trusted_domain_name;
    } NETLOGON INFO 4,
      *PNETLOGON_INFO_4;

    typedef [switch_type(DWORD)] union
         _NETLOGON_CONTROL_QUERY_INFORMATION{
        [case(1)] PNETLOGON_INFO_1 NetlogonInfo1;
        [case(2)] PNETLOGON INFO 2 NetlogonInfo2;
        [case(3)] PNETLOGON_INFO_3 NetlogonInfo3;
        [case(4)] PNETLOGON INFO 4 NetlogonInfo4;
        [default] ;
    } NETLOGON_CONTROL_QUERY_INFORMATION,
      *PNETLOGON CONTROL QUERY INFORMATION;

    typedef enum  SYNC STATE{
        NormalState = 0,
        DomainState = 1,
        GroupState = 2,
        UasBuiltInGroupState = 3,
        UserState = 4,
        GroupMemberState = 5,
        AliasState = 6,
        AliasMemberState = 7,
        SamDoneState = 8
    } SYNC_STATE,
```

```
  *PSYNC_STATE;

typedef struct _DOMAIN_NAME_BUFFER{
    ULONG DomainNameByteCount;
    [unique, size_is(DomainNameByteCount)]
         UCHAR * DomainNames;
} DOMAIN_NAME_BUFFER,
  *PDOMAIN_NAME_BUFFER;

typedef struct _NETLOGON_LSA_POLICY_INFO{
    ULONG LsaPolicySize;
    [size_is(LsaPolicySize)] UCHAR * LsaPolicy;
} NETLOGON_LSA_POLICY_INFO,
  *PNETLOGON_LSA_POLICY_INFO;

typedef struct _NETLOGON_ONE_DOMAIN_INFO{
    RPC UNICODE STRING DomainName;
    RPC_UNICODE_STRING DnsDomainName;
    RPC UNICODE STRING DnsForestName;
    GUID DomainGuid;
    PRPC_SID DomainSid;
    RPC_UNICODE_STRING TrustExtension;
    RPC UNICODE STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG DummyLong1;
    ULONG DummyLong2;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_ONE_DOMAIN_INFO,
  *PNETLOGON ONE DOMAIN INFO;

typedef struct _NETLOGON_DOMAIN_INFO{
    NETLOGON ONE DOMAIN INFO PrimaryDomain;
    ULONG TrustedDomainCount;
    [size is(TrustedDomainCount)]
         PNETLOGON_ONE_DOMAIN_INFO TrustedDomains;
    NETLOGON_LSA_POLICY_INFO LsaPolicy;
    RPC_UNICODE_STRING DnsHostNameInDs;
    RPC UNICODE STRING DummyString2;
    RPC_UNICODE_STRING DummyString3;
    RPC UNICODE STRING DummyString4;
    ULONG WorkstationFlags;
    ULONG SupportedEncTypes;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_DOMAIN_INFO,
  *PNETLOGON DOMAIN INFO;

typedef [switch_type(DWORD)] union
    _NETLOGON_DOMAIN_INFORMATION{
    [case(1)] PNETLOGON DOMAIN INFO DomainInfo;
    [case(2)] PNETLOGON_LSA_POLICY_INFO LsaPolicyInfo;
} NETLOGON DOMAIN INFORMATION,
  *PNETLOGON_DOMAIN_INFORMATION;

typedef struct  NETLOGON WORKSTATION INFO{
    NETLOGON_LSA_POLICY_INFO LsaPolicy;
    [string] wchar t * DnsHostName;
    [string] wchar_t * SiteName;
    [string] wchar_t * Dummy1;
    [string] wchar_t * Dummy2;
    [string] wchar t * Dummy3;
    [string] wchar_t * Dummy4;
    RPC UNICODE STRING OsVersion;
    RPC_UNICODE_STRING OsName;
    RPC_UNICODE_STRING DummyString3;
    RPC_UNICODE_STRING DummyString4;
    ULONG WorkstationFlags;
```

```
    ULONG KerberosSupportedEncryptionTypes;
    ULONG DummyLong3;
    ULONG DummyLong4;
} NETLOGON_WORKSTATION_INFO,
  *PNETLOGON_WORKSTATION_INFO;

typedef [switch_type(DWORD)] union
    _NETLOGON_WORKSTATION_INFORMATION{
    [case(1)] PNETLOGON_WORKSTATION_INFO WorkstationInfo;
    [case(2)] PNETLOGON_WORKSTATION_INFO LsaPolicyInfo;
} NETLOGON WORKSTATION INFORMATION,
  *PNETLOGON_WORKSTATION_INFORMATION;

typedef struct _NL_SOCKET_ADDRESS{
    [size_is(iSockaddrLength)] UCHAR * lpSockaddr;
    ULONG iSockaddrLength;
} NL SOCKET ADDRESS,
  *PNL_SOCKET_ADDRESS;

typedef struct _NL_SITE_NAME_ARRAY{
    ULONG EntryCount;
    [size_is(EntryCount)] PRPC_UNICODE_STRING SiteNames;
} NL SITE NAME ARRAY,
  *PNL_SITE_NAME_ARRAY;

typedef struct _DS_DOMAIN_TRUSTSW{
    [string] wchar_t * NetbiosDomainName;
    [string] wchar_t * DnsDomainName;
    ULONG Flags;
    ULONG ParentIndex;
    ULONG TrustType;
    ULONG TrustAttributes;
    PRPC_SID DomainSid;
    GUID DomainGuid;
} DS_DOMAIN_TRUSTSW,
  *PDS DOMAIN TRUSTSW;

typedef struct _NETLOGON_TRUSTED_DOMAIN_ARRAY{
    DWORD DomainCount;
    [size is(DomainCount)] PDS DOMAIN TRUSTSW Domains;
} NETLOGON_TRUSTED_DOMAIN_ARRAY,
  *PNETLOGON TRUSTED DOMAIN ARRAY;

typedef struct _NL_SITE_NAME_EX_ARRAY{
    ULONG EntryCount;
    [size is(EntryCount)] PRPC UNICODE STRING SiteNames;
    [size_is(EntryCount)] PRPC_UNICODE_STRING SubnetNames;
} NL SITE NAME EX ARRAY,
  *PNL_SITE_NAME_EX_ARRAY;

typedef struct _NL_GENERIC_RPC_DATA{
    ULONG UlongEntryCount;
    [size_is(UlongEntryCount)] ULONG * UlongData;
    ULONG UnicodeStringEntryCount;
    [size_is(UnicodeStringEntryCount)]
         PRPC_UNICODE_STRING UnicodeStringData;
} NL GENERIC RPC DATA,
  *PNL_GENERIC_RPC_DATA;

typedef struct _NETLOGON_VALIDATION_UAS_INFO{
    [string] wchar_t * usrlog1_eff_name;
    DWORD usrlog1_priv;
    DWORD usrlog1 auth flags;
    DWORD usrlog1_num_logons;
    DWORD usrlog1 bad pw count;
    DWORD usrlog1_last_logon;
    DWORD usrlog1_last_logoff;
    DWORD usrlog1_logoff_time;
    DWORD usrlog1_kickoff_time;
```

```
    DWORD usrlog1_password_age;
    DWORD usrlog1_pw_can_change;
    DWORD usrlog1_pw_must_change;
    [string] wchar_t * usrlog1_computer;
    [string] wchar_t * usrlog1_domain;
    [string] wchar_t * usrlog1_script_path;
    DWORD usrlog1_reserved1;
} NETLOGON_VALIDATION_UAS_INFO,
  *PNETLOGON_VALIDATION_UAS_INFO;

typedef struct  NETLOGON_LOGOFF_UAS_INFO{
    DWORD Duration;
    USHORT LogonCount;
} NETLOGON_LOGOFF_UAS_INFORMATION,
  *PNETLOGON_LOGOFF_UAS_INFO;

// This structure has been replaced by NETLOGON_CAPABILITIES.
// See the behavior notes associated with the description of
// NetrLogonGetCapabilities for details.
//typedef [switch_type(DWORD)] union{
//    [case(1)] ULONG Dummy;
//} NETLOGON_DUMMY1,
//  *PNETLOGON_DUMMY1;

typedef
[switch_type(DWORD)]
  union _NETLOGON_CAPABILITIES {
  [case(1)]
    ULONG ServerCapabilities;
} NETLOGON_CAPABILITIES,
 *PNETLOGON_CAPABILITIES;

typedef struct _NETLOGON_CREDENTIAL{
    CHAR data[8];
} NETLOGON_CREDENTIAL,
  *PNETLOGON_CREDENTIAL;

typedef struct _NETLOGON_AUTHENTICATOR{
    NETLOGON_CREDENTIAL Credential;
    DWORD Timestamp;
} NETLOGON_AUTHENTICATOR,
 *PNETLOGON_AUTHENTICATOR;

typedef  enum _NETLOGON_SECURE_CHANNEL_TYPE{
  NullSecureChannel = 0,
  MsvApSecureChannel = 1,
  WorkstationSecureChannel = 2,
  TrustedDnsDomainSecureChannel = 3,
  TrustedDomainSecureChannel = 4,
  UasServerSecureChannel = 5,
  ServerSecureChannel = 6,
  CdcServerSecureChannel = 7
} NETLOGON_SECURE_CHANNEL_TYPE;

typedef struct _UAS_INFO_0{
    CHAR ComputerName[16];
    ULONG TimeCreated;
    ULONG SerialNumber;
} UAS_INFO_0,
  *PUAS_INFO_0;

typedef struct _DOMAIN_CONTROLLER_INFOW{
    [string,unique] wchar_t *DomainControllerName;
    [string,unique] wchar_t *DomainControllerAddress;
    ULONG DomainControllerAddressType;
    GUID DomainGuid;
    [string,unique] wchar_t *DomainName;
    [string,unique] wchar_t *DnsForestName;
    ULONG Flags;
```

```
    [string,unique] wchar_t *DcSiteName;
    [string,unique] wchar_t *ClientSiteName;
} DOMAIN_CONTROLLER_INFOW,
  *PDOMAIN_CONTROLLER_INFOW;

typedef struct  NL TRUST PASSWORD{
    WCHAR Buffer[256];
    ULONG Length;
} NL_TRUST_PASSWORD,
  *PNL_TRUST_PASSWORD;

typedef struct _NL_PASSWORD_VERSION{
    ULONG ReservedField;
    ULONG PasswordVersionNumber;
    ULONG PasswordVersionPresent;
} NL_PASSWORD_VERSION,
  *PNL PASSWORD VERSION;

typedef enum  LSA FOREST TRUST RECORD TYPE {
    ForestTrustTopLevelName = 0,
    ForestTrustTopLevelNameEx = 1,
    ForestTrustDomainInfo = 2,
} LSA FOREST TRUST RECORD TYPE;

typedef RPC_UNICODE_STRING LSA_RPC_UNICODE_STRING,
*PLSA_RPC_UNICODE_STRING;

typedef struct _LSA_FOREST_TRUST_DOMAIN_INFO{
    PRPC SID Sid;
    LSA_RPC_UNICODE_STRING DnsName;
    LSA RPC UNICODE STRING NetbiosName;
} LSA_FOREST_TRUST_DOMAIN_INFO,
  *PLSA_FOREST_TRUST_DOMAIN_INFO;

typedef struct _LSA_FOREST_TRUST_BINARY_DATA{
    [range(0, 131072)] ULONG Length;
    [size_is( Length )] UCHAR * Buffer;
} LSA_FOREST_TRUST_BINARY_DATA,
  *PLSA_FOREST_TRUST_BINARY_DATA;

typedef struct _LSA_FOREST_TRUST_RECORD{
    ULONG Flags;
    LSA_FOREST_TRUST_RECORD_TYPE ForestTrustType;
    LARGE_INTEGER Time;
    [switch_type( LSA_FOREST_TRUST_RECORD_TYPE ),
         switch is( ForestTrustType )] union {
    [case( ForestTrustTopLevelName,
           ForestTrustTopLevelNameEx )]
         LSA_RPC_UNICODE_STRING TopLevelName;
    [case( ForestTrustDomainInfo )]
         LSA_FOREST_TRUST_DOMAIN_INFO DomainInfo;
    [default] LSA FOREST TRUST BINARY DATA Data;
    } ForestTrustData;
} LSA FOREST TRUST RECORD,
  *PLSA_FOREST_TRUST_RECORD;

typedef struct  LSA FOREST TRUST INFORMATION{
    [range(0, 4000)] ULONG RecordCount;
    [size is( RecordCount )] PLSA FOREST TRUST RECORD * Entries;
} LSA_FOREST_TRUST_INFORMATION,
  *PLSA_FOREST_TRUST_INFORMATION;

// Opnum 0
NET_API_STATUS
NetrLogonUasLogon (
    [in,unique,string] LOGONSRV_HANDLE ServerName,
    [in, string] wchar_t * UserName,
    [in, string] wchar_t * Workstation,
    [out] PNETLOGON_VALIDATION_UAS_INFO *ValidationInformation
```

```
    );

// Opnum 1
NET_API_STATUS
NetrLogonUasLogoff (
    [in,unique,string] LOGONSRV HANDLE ServerName,
    [in, string] wchar_t * UserName,
    [in, string] wchar_t * Workstation,
    [out] PNETLOGON_LOGOFF_UAS_INFO LogoffInformation
    );

// Opnum 2
NTSTATUS
NetrLogonSamLogon (
    [in,unique,string] LOGONSRV_HANDLE LogonServer,
    [in,string,unique] wchar_t * ComputerName,
    [in,unique] PNETLOGON AUTHENTICATOR Authenticator,
    [in,out,unique] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] NETLOGON LOGON INFO CLASS LogonLevel,
    [in,switch_is(LogonLevel)] PNETLOGON_LEVEL LogonInformation,
    [in] NETLOGON_VALIDATION_INFO_CLASS ValidationLevel,
    [out,switch_is(ValidationLevel)]
         PNETLOGON VALIDATION ValidationInformation,
    [out] UCHAR * Authoritative
    );

// Opnum 3
NTSTATUS
NetrLogonSamLogoff (
    [in,unique,string] LOGONSRV_HANDLE LogonServer,
    [in,string,unique] wchar t * ComputerName,
    [in,unique] PNETLOGON_AUTHENTICATOR Authenticator,
    [in,out,unique] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] NETLOGON LOGON INFO CLASS LogonLevel,
    [in,switch_is(LogonLevel)] PNETLOGON_LEVEL LogonInformation
);

// Opnum 4
NTSTATUS
NetrServerReqChallenge (
    [in,unique,string] LOGONSRV_HANDLE PrimaryName,
    [in, string] wchar t * ComputerName,
    [in] PNETLOGON_CREDENTIAL ClientChallenge,
    [out] PNETLOGON_CREDENTIAL ServerChallenge
    );

// Opnum 5
NTSTATUS
NetrServerAuthenticate (
    [in,unique,string] LOGONSRV_HANDLE PrimaryName,
    [in,string] wchar_t * AccountName,
    [in] NETLOGON SECURE CHANNEL TYPE SecureChannelType,
    [in, string] wchar_t * ComputerName,
    [in] PNETLOGON CREDENTIAL ClientCredential,
    [out] PNETLOGON_CREDENTIAL ServerCredential
    );

// Opnum 6
NTSTATUS
NetrServerPasswordSet (
    [in,unique,string] LOGONSRV_HANDLE PrimaryName,
    [in,string] wchar_t * AccountName,
    [in] NETLOGON SECURE CHANNEL TYPE SecureChannelType,
    [in, string] wchar_t * ComputerName,
    [in] PNETLOGON AUTHENTICATOR Authenticator,
    [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] PENCRYPTED_NT_OWF_PASSWORD UasNewPassword
    );
```

```
// Opnum 7
NTSTATUS
NetrDatabaseDeltas (
    [in, string] LOGONSRV_HANDLE PrimaryName,
    [in, string] wchar_t * ComputerName,
    [in] PNETLOGON AUTHENTICATOR Authenticator,
    [in,out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] DWORD DatabaseID,
    [in, out] PNLPR_MODIFIED_COUNT DomainModifiedCount,
    [out] PNETLOGON_DELTA_ENUM_ARRAY *DeltaArray,
    [in] DWORD PreferredMaximumLength
    );

// Opnum 8
NTSTATUS
NetrDatabaseSync (
    [in, string] LOGONSRV HANDLE PrimaryName,
    [in, string] wchar_t * ComputerName,
    [in] PNETLOGON AUTHENTICATOR Authenticator,
    [in,out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] DWORD DatabaseID,
    [in, out] ULONG * SyncContext,
    [out] PNETLOGON DELTA ENUM ARRAY *DeltaArray,
    [in] DWORD PreferredMaximumLength
    );

// Opnum 9
NTSTATUS
NetrAccountDeltas (
    [in, unique, string] LOGONSRV_HANDLE PrimaryName,
    [in, string] wchar t * ComputerName,
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [in,out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] PUAS INFO 0 RecordId,
    [in] DWORD Count,
    [in] DWORD Level,
    [out, size_is(BufferSize)] UCHAR * Buffer,
    [in] DWORD BufferSize,
    [out] ULONG * CountReturned,
    [out] ULONG * TotalEntries,
    [out] PUAS_INFO_0 NextRecordId
    );

// Opnum 10
NTSTATUS
NetrAccountSync (
    [in, unique, string] LOGONSRV_HANDLE PrimaryName,
    [in, string] wchar t * ComputerName,
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [in,out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] DWORD Reference,
    [in] DWORD Level,
    [out, size_is(BufferSize) ] UCHAR * Buffer,
    [in] DWORD BufferSize,
    [out] ULONG * CountReturned,
    [out] ULONG * TotalEntries,
    [out] ULONG * NextReference,
    [out] PUAS_INFO_0 LastRecordId
    );

// Opnum 11
NET_API_STATUS
NetrGetDCName (
    [in, string] LOGONSRV_HANDLE ServerName,
    [in, unique, string] wchar t *DomainName,
    [out, string] wchar_t **Buffer
    );

// Opnum 12
```

```
NET_API_STATUS
NetrLogonControl(
    [in, unique, string] LOGONSRV_HANDLE ServerName,
    [in] DWORD FunctionCode,
    [in] DWORD QueryLevel,
    [out,switch is(QueryLevel)]
         PNETLOGON_CONTROL_QUERY_INFORMATION Buffer
    );

// Opnum 13
NET API STATUS
NetrGetAnyDCName (
    [in, unique, string] LOGONSRV_HANDLE ServerName,
    [in, unique, string] wchar_t *DomainName,
    [out, string] wchar_t **Buffer
    );

// Opnum 14
NET API STATUS
NetrLogonControl2(
    [in, unique, string] LOGONSRV_HANDLE ServerName,
    [in] DWORD FunctionCode,
    [in] DWORD QueryLevel,
    [in,switch_is(FunctionCode)]
         PNETLOGON_CONTROL_DATA_INFORMATION Data,
    [out,switch_is(QueryLevel)]
         PNETLOGON_CONTROL_QUERY_INFORMATION Buffer
    );

// Opnum 15
NTSTATUS
NetrServerAuthenticate2 (
    [in,unique,string] LOGONSRV_HANDLE PrimaryName,
    [in,string] wchar t * AccountName,
    [in] NETLOGON_SECURE_CHANNEL_TYPE SecureChannelType,
    [in, string] wchar t * ComputerName,
    [in] PNETLOGON_CREDENTIAL ClientCredential,
    [out] PNETLOGON_CREDENTIAL ServerCredential,
    [in,out] ULONG * NegotiateFlags
    );

// Opnum 16
NTSTATUS
NetrDatabaseSync2 (
    [in, string] LOGONSRV_HANDLE PrimaryName,
    [in, string] wchar t * ComputerName,
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [in,out] PNETLOGON AUTHENTICATOR ReturnAuthenticator,
    [in] DWORD DatabaseID,
    [in] SYNC_STATE RestartState,
    [in, out] ULONG * SyncContext,
    [out] PNETLOGON DELTA ENUM ARRAY *DeltaArray,
    [in] DWORD PreferredMaximumLength
    );

// Opnum 17
NTSTATUS
NetrDatabaseRedo(
    [in, string] LOGONSRV HANDLE PrimaryName,
    [in, string] wchar_t * ComputerName,
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [in,out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in, size is(ChangeLogEntrySize)]
         UCHAR * ChangeLogEntry,
    [in] DWORD ChangeLogEntrySize,
    [out] PNETLOGON_DELTA_ENUM_ARRAY *DeltaArray
    );

// Opnum 18
```

```
NET_API_STATUS
NetrLogonControl2Ex(
    [in, unique, string] LOGONSRV_HANDLE ServerName,
    [in] DWORD FunctionCode,
    [in] DWORD QueryLevel,
    [in,switch is(FunctionCode)]
         PNETLOGON_CONTROL_DATA_INFORMATION Data,
    [out,switch_is(QueryLevel)]
         PNETLOGON_CONTROL_QUERY_INFORMATION Buffer
    );

// Opnum 19
NTSTATUS
NetrEnumerateTrustedDomains (
    [in, unique, string] LOGONSRV_HANDLE ServerName,
    [out] PDOMAIN_NAME_BUFFER DomainNameBuffer
    );

// Opnum 20
NET_API_STATUS
DsrGetDcName(
    [in, unique, string ] LOGONSRV_HANDLE ComputerName,
    [in, unique, string] wchar t * DomainName,
    [in, unique] GUID *DomainGuid,
    [in, unique] GUID *SiteGuid,
    [in] ULONG Flags,
    [out] PDOMAIN_CONTROLLER_INFOW *DomainControllerInfo
    );

//This method has been replaced by NetrLogonGetCapabilities.
//See the behavior notes associated with the description of
// NetrLogonGetCapabilities for details.
//NTSTATUS
//NetrLogonDummyRoutine1(
//    [in, string] LOGONSRV_HANDLE ServerName,
//    [in, string, unique] wchar t* ComputerName,
//    [in] PNETLOGON_AUTHENTICATOR Authenticator,
//    [in, out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
//    [in] DWORD QueryLevel,
//    [out, switch is(QueryLevel)] PNETLOGON DUMMY1 Buffer
//);

// Opnum 21
NTSTATUS
NetrLogonGetCapabilities(
    [in, string] LOGONSRV HANDLE ServerName,
    [in, string, unique] wchar_t* ComputerName,
    [in] PNETLOGON AUTHENTICATOR Authenticator,
    [in, out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] DWORD QueryLevel,
    [out, switch_is(QueryLevel)] PNETLOGON_CAPABILITIES ServerCapabilities
);

// Opnum 22
NTSTATUS
NetrLogonSetServiceBits(
    [in, unique, string] LOGONSRV HANDLE ServerName,
    [in] DWORD ServiceBitsOfInterest,
    [in] DWORD ServiceBits
    );

// Opnum 23
NET API STATUS
NetrLogonGetTrustRid(
    [in, unique, string] LOGONSRV HANDLE ServerName,
    [in,string,unique] wchar_t * DomainName,
    [out] ULONG * Rid
    );
```

```
// Opnum 24
NET_API_STATUS
NetrLogonComputeServerDigest(
    [in, unique, string] LOGONSRV_HANDLE ServerName,
    [in] ULONG Rid,
    [in, size is(MessageSize)] UCHAR * Message,
    [in] ULONG MessageSize,
    [out] CHAR NewMessageDigest[16],
    [out] CHAR OldMessageDigest[16]
    );

// Opnum 25
NET_API_STATUS
NetrLogonComputeClientDigest(
    [in, unique, string] LOGONSRV_HANDLE ServerName,
    [in,string,unique] wchar_t * DomainName,
    [in, size is(MessageSize)] UCHAR * Message,
    [in] ULONG MessageSize,
    [out] CHAR NewMessageDigest[16],
    [out] CHAR OldMessageDigest[16]
    );

// Opnum 26
NTSTATUS
NetrServerAuthenticate3 (
    [in,unique,string] LOGONSRV_HANDLE PrimaryName,
    [in,string] wchar_t * AccountName,
    [in] NETLOGON_SECURE_CHANNEL_TYPE SecureChannelType,
    [in, string] wchar t * ComputerName,
    [in] PNETLOGON_CREDENTIAL ClientCredential,
    [out] PNETLOGON CREDENTIAL ServerCredential,
    [in,out] ULONG * NegotiateFlags,
    [out] ULONG * AccountRid
    );

// Opnum 27
NET_API_STATUS
DsrGetDcNameEx(
    [in, unique, string ] LOGONSRV_HANDLE ComputerName,
    [in, unique, string] wchar t * DomainName,
    [in, unique] GUID *DomainGuid,
    [in, unique, string] wchar t * SiteName,
    [in] ULONG Flags,
    [out] PDOMAIN_CONTROLLER_INFOW *DomainControllerInfo
    );

// Opnum 28
NET API STATUS
DsrGetSiteName(
    [in, unique, string ] LOGONSRV_HANDLE ComputerName,
    [out, string] wchar_t **SiteName
    );

// Opnum 29
NTSTATUS
NetrLogonGetDomainInfo(
    [in, string] LOGONSRV HANDLE ServerName,
    [in,string,unique] wchar_t * ComputerName,
    [in] PNETLOGON AUTHENTICATOR Authenticator,
    [in,out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] DWORD Level,
    [in,switch_is(Level)] PNETLOGON_WORKSTATION_INFORMATION WkstaBuffer,
    [out,switch is(Level)] PNETLOGON DOMAIN INFORMATION DomBuffer
    );

// Opnum 30
NTSTATUS
NetrServerPasswordSet2 (
    [in,unique,string] LOGONSRV_HANDLE PrimaryName,
```

```
    [in,string] wchar_t * AccountName,
    [in] NETLOGON_SECURE_CHANNEL_TYPE SecureChannelType,
    [in, string] wchar_t * ComputerName,
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] PNL_TRUST_PASSWORD ClearNewPassword
    );

// Opnum 31
NTSTATUS
NetrServerPasswordGet (
    [in,unique,string] LOGONSRV_HANDLE PrimaryName,
    [in,string] wchar_t * AccountName,
    [in] NETLOGON_SECURE_CHANNEL_TYPE AccountType,
    [in, string] wchar_t * ComputerName,
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [out] PENCRYPTED_NT_OWF_PASSWORD EncryptedNtOwfPassword
    );

// Opnum 32
NTSTATUS
NetrLogonSendToSam (
    [in,unique,string] LOGONSRV_HANDLE PrimaryName,
    [in, string] wchar_t * ComputerName,
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in,size_is(OpaqueBufferSize)] UCHAR * OpaqueBuffer,
    [in] ULONG OpaqueBufferSize
    );

// Opnum 33
NET_API_STATUS
DsrAddressToSiteNamesW(
    [in,unique,string] LOGONSRV_HANDLE ComputerName,
    [in, range(0,32000)] DWORD EntryCount,
    [in,size_is(EntryCount)] PNL_SOCKET_ADDRESS SocketAddresses,
    [out] PNL_SITE_NAME_ARRAY *SiteNames
    );

// Opnum 34
NET API STATUS
DsrGetDcNameEx2(
    [in, unique, string ] LOGONSRV_HANDLE ComputerName,
    [in, unique, string] wchar_t * AccountName,
    [in] ULONG AllowableAccountControlBits,
    [in, unique, string] wchar_t * DomainName,
    [in, unique] GUID *DomainGuid,
    [in, unique, string] wchar_t * SiteName,
    [in] ULONG Flags,
    [out] PDOMAIN_CONTROLLER_INFOW *DomainControllerInfo
    );

// Opnum35
NET_API_STATUS
NetrLogonGetTimeServiceParentDomain(
    [in, unique, string] LOGONSRV HANDLE ServerName,
    [out, string] wchar_t **DomainName,
    [out] int * PdcSameSite
    );

// Opnum 36
NET API STATUS
NetrEnumerateTrustedDomainsEx (
    [in, unique, string] LOGONSRV HANDLE ServerName,
    [out] PNETLOGON_TRUSTED_DOMAIN_ARRAY Domains
    );

// Opnum 37
```

```
NET_API_STATUS
DsrAddressToSiteNamesExW(
    [in,unique,string] LOGONSRV_HANDLE ComputerName,
    [in, range(0,32000)] DWORD EntryCount,
    [in,size_is(EntryCount)] PNL_SOCKET_ADDRESS SocketAddresses,
    [out] PNL SITE NAME EX ARRAY *SiteNames
    );

// Opnum 38
NET_API_STATUS
DsrGetDcSiteCoverageW(
    [in,unique,string] LOGONSRV_HANDLE ServerName,
    [out] PNL_SITE_NAME_ARRAY *SiteNames
    );

// Opnum 39
NTSTATUS
NetrLogonSamLogonEx (
    [in] handle t ContextHandle,
    [in,unique,string] wchar_t * LogonServer,
    [in,unique,string] wchar_t * ComputerName,
    [in] NETLOGON_LOGON_INFO_CLASS LogonLevel,
    [in,switch is(LogonLevel)] PNETLOGON LEVEL LogonInformation,
    [in] NETLOGON_VALIDATION_INFO_CLASS ValidationLevel,
    [out,switch_is(ValidationLevel)]
         PNETLOGON_VALIDATION ValidationInformation,
    [out] UCHAR * Authoritative,
    [in,out] ULONG * ExtraFlags
    );

// Opnum 40
NET_API_STATUS
DsrEnumerateDomainTrusts (
    [in, unique, string] LOGONSRV HANDLE ServerName,
    [in] ULONG Flags,
    [out] PNETLOGON TRUSTED DOMAIN ARRAY Domains
    );

// Opnum 41
NET API STATUS
DsrDeregisterDnsHostRecords (
    [in, unique, string] LOGONSRV HANDLE ServerName,
    [in, unique, string] wchar_t * DnsDomainName,
    [in, unique] GUID *DomainGuid,
    [in, unique] GUID *DsaGuid,
    [in, string] wchar t * DnsHostName
    );

// Opnum 42
NTSTATUS
NetrServerTrustPasswordsGet (
    [in,unique,string] LOGONSRV HANDLE TrustedDcName,
    [in,string] wchar_t * AccountName,
    [in] NETLOGON SECURE CHANNEL TYPE SecureChannelType,
    [in, string] wchar_t * ComputerName,
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [out] PNETLOGON AUTHENTICATOR ReturnAuthenticator,
    [out] PENCRYPTED_NT_OWF_PASSWORD EncryptedNewOwfPassword,
    [out] PENCRYPTED NT OWF PASSWORD EncryptedOldOwfPassword
    );

// Opnum 43
NET API STATUS
DsrGetForestTrustInformation (
    [in, unique, string] LOGONSRV HANDLE ServerName,
    [in, unique, string] wchar_t * TrustedDomainName,
    [in] DWORD Flags,
    [out] PLSA_FOREST_TRUST_INFORMATION * ForestTrustInfo
    );
```

```
// Opnum 44
NTSTATUS
NetrGetForestTrustInformation (
    [in,unique,string] LOGONSRV_HANDLE ServerName,
    [in, string] wchar t * ComputerName,
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] DWORD Flags,
    [out] PLSA_FOREST_TRUST_INFORMATION * ForestTrustInfo
    );

// Opnum 45
NTSTATUS
NetrLogonSamLogonWithFlags (
    [in,unique,string] LOGONSRV_HANDLE LogonServer,
    [in,string,unique] wchar t * ComputerName,
    [in,unique] PNETLOGON_AUTHENTICATOR Authenticator,
    [in,out,unique] PNETLOGON AUTHENTICATOR ReturnAuthenticator,
    [in] NETLOGON_LOGON_INFO_CLASS LogonLevel,
    [in,switch_is(LogonLevel)] PNETLOGON_LEVEL LogonInformation,
    [in] NETLOGON_VALIDATION_INFO_CLASS ValidationLevel,
    [out,switch is(ValidationLevel)]
         PNETLOGON_VALIDATION ValidationInformation,
    [out] UCHAR * Authoritative,
    [in,out] ULONG * ExtraFlags
    );

// Opnum 46
NTSTATUS
NetrServerGetTrustInfo (
    [in,unique,string] LOGONSRV_HANDLE TrustedDcName,
    [in,string] wchar_t * AccountName,
    [in] NETLOGON SECURE CHANNEL TYPE SecureChannelType,
    [in, string] wchar_t * ComputerName,
    [in] PNETLOGON AUTHENTICATOR Authenticator,
    [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [out] PENCRYPTED_NT_OWF_PASSWORD EncryptedNewOwfPassword,
    [out] PENCRYPTED_NT_OWF_PASSWORD EncryptedOldOwfPassword,
    [out] PNL GENERIC RPC DATA *TrustInfo
    );

// Opnum 47
//Local only method
NTSTATUS
OpnumUnused47 (
    void
    );

typedef struct _NL_DNS_NAME_INFO{
    ULONG Type;
    [string] wchar t * DnsDomainInfo;
    ULONG DnsDomainInfoType;
    ULONG Priority;
    ULONG Weight;
    ULONG Port;
    UCHAR Register;
    ULONG Status;
} NL DNS NAME INFO,
  *PNL_DNS_NAME_INFO;

typedef struct _NL_DNS_NAME_INFO_ARRAY{
    ULONG EntryCount;
    [size_is(EntryCount)] PNL_DNS_NAME_INFO DnsNamesInfo;
} NL DNS NAME INFO ARRAY,
  *PNL_DNS_NAME_INFO_ARRAY;

// Opnum 48
NTSTATUS
```

```
        DsrUpdateReadOnlyServerDnsRecords (
            [in, unique, string] LOGONSRV_HANDLE ServerName,
            [in, string] wchar_t * ComputerName,
            [in] PNETLOGON_AUTHENTICATOR Authenticator,
            [out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
            [in, unique, string] wchar t * SiteName,
            [in] ULONG DnsTtl,
            [in, out] PNL_DNS_NAME_INFO_ARRAY DnsNames
            );

       typedef struct  NL OSVERSIONINFO V1{
            DWORD dwOSVersionInfoSize;
            DWORD dwMajorVersion;
            DWORD dwMinorVersion;
            DWORD dwBuildNumber;
            DWORD dwPlatformId;
            wchar t szCSDVersion[128];
            USHORT wServicePackMajor;
            USHORT wServicePackMinor;
            USHORT wSuiteMask;
            UCHAR wProductType;
            UCHAR wReserved;
       } NL OSVERSIONINFO V1;

       typedef struct _NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES_V1{
            [unique,string] wchar_t * ClientDnsHostName;
            [unique] NL_OSVERSIONINFO_V1 *OsVersionInfo_V1;
            [unique,string] wchar_t * OsName;
       } NL IN CHAIN SET CLIENT ATTRIBUTES V1;

       typedef [switch type(DWORD)] union{
            [case(1)] NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES_V1 V1;
      } NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES;

       typedef struct _NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1{
            [unique,string] wchar t *HubName;
            [unique,string] wchar_t **OldDnsHostName;
            [unique] ULONG * SupportedEncTypes;
       } NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES_V1;

       typedef [switch_type(DWORD)] union{
            [case(1)] NL OUT CHAIN SET CLIENT ATTRIBUTES V1 V1;
       } NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES;

        // Opnum 49
        NTSTATUS
        NetrChainSetClientAttributes(
            [in,string,ref] LOGONSRV HANDLE PrimaryName,
            [in,string,ref] wchar_t * ChainedFromServerName,
            [in,string,ref] wchar_t * ChainedForClientName,
            [in,ref] PNETLOGON_AUTHENTICATOR Authenticator,
            [in,out,ref] PNETLOGON AUTHENTICATOR ReturnAuthenticator,
            [in] DWORD dwInVersion,
            [in,ref] [switch is(dwInVersion)]
                  NL_IN_CHAIN_SET_CLIENT_ATTRIBUTES  *pmsgIn,
            [in,out,ref] DWORD * pdwOutVersion,
            [in,out,ref] [switch is(*pdwOutVersion)]
                  NL_OUT_CHAIN_SET_CLIENT_ATTRIBUTES *pmsgOut
            );
    }
```

7 Appendix B: Product Behavior

The information in this specification is applicable to the following Microsoft products or supplemental software. References to product versions include released service packs.

Note: Some of the information in this section is subject to change because it applies to an unreleased, preliminary version of the Windows Server operating system, and thus may differ from the final version of the server software when released. All behavior notes that pertain to the unreleased, preliminary version of the Windows Server operating system contain specific references to Windows Server 2016 Technical Preview as an aid to the reader.

- Windows NT operating system
- Windows 2000 operating system
- Windows XP operating system
- Windows Server 2003 operating system
- Windows Vista operating system
- Windows Server 2008 operating system
- Windows 7 operating system
- Windows Server 2008 R2 operating system
- Windows 8 operating system
- Windows Server 2012 operating system
- Windows 8.1 operating system
- Windows Server 2012 R2 operating system
- Windows 10 operating system
- Windows Server 2016 Technical Preview operating system

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

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

<1> Section 1.3.3: This is achieved in Windows via replication of the account database among domain controllers so that each DC in the domain has the same copy of the database. On Windows NT 4.0 operating system domain controllers, this replication is performed by the Netlogon replication protocol. Starting with Windows 2000, the replication is performed by the Active Directory replication service (see [MS-ADTS]).

<2> Section 1.3.3: The synchronization between DCs running Windows 2000 or Windows Server 2003 is performed by the Active Directory replication service [MS-ADTS]. The synchronization involving a DC running Windows NT 4.0 is performed by the Netlogon service.

<3> Section 1.3.3: In Windows NT 4.0, a single DC in a domain was designated the primary domain controller, or PDC. The PDC was the only domain controller that accepted changes to the account

information it stored. A Windows NT 4.0 domain had zero or more backup domain controllers, or BDCs.

<4> Section 1.3.3: Netlogon replication requires the PDC to run Windows NT Server 4.0 operating system, Windows 2000 Server operating system, or Windows Server 2003, while BDCs must run Windows NT Server 4.0. Windows Server 2008 will not support replication to Windows NT 4.0 BDCs.

<5> Section 1.3.7.2: By default, Netlogon changes the machine account password every 30 days. The value is configurable with a minimum of one day and maximum of 1,000,000 days.

<6> Section 2.2.1.1.2: The value is ignored by the Windows NT 4.0 implementation.

<7> Section 2.2.1.2.1: This structure is introduced in Windows 2000 and is not present in Windows NT.

<8> Section 2.2.1.2.1: IPv6 is supported starting with Windows Vista and is not supported in Windows NT, Windows 2000, Windows XP, or Windows Server 2003.

<9> Section 2.2.1.2.1: For Windows NT, Windows 2000 Server, Windows XP, and Windows Server 2003, this will be an IPv4 address. For all other versions of Windows, this address can be an IPv4 or IPv6 address.

<10> Section 2.2.1.2.1: Windows NT-based domain controllers do not have a domain GUID.

<11> Section 2.2.1.2.1: Read-only DC is not supported in Windows 2000 and Windows Server 2003 DCs.

<12> Section 2.2.1.2.1: Writable domain controller is not supported in Windows 2000 and Windows Server 2003. The concept of designating a DC as writable was added when read-only DCs were created.

<13> Section 2.2.1.2.1: Added in Windows 7 and Windows Server 2008 R2; also present in Windows Server 2003 and Windows Server 2008 when Active Directory Management Gateway Service is installed.

<14> Section 2.2.1.2.1: Windows NT-based domain controllers do not have an associated site.

<15> Section 2.2.1.2.5: Added in Windows Server 2008.

<16> Section 2.2.1.2.6: Added in Windows Server 2008.

<17> Section 2.2.1.3.3: The NL_AUTH_SHA2_SIGNATURE structure is not supported by Windows NT, Windows 2000, Windows XP, Windows Server 2003, or Windows Vista.

<18> Section 2.2.1.3.6: This structure was introduced in Windows 2000, and is not present in Windows NT.

<19> Section 2.2.1.3.6: The name of the client's operating system is used. The following are the strings used by Windows:

- For Windows 2000 Professional operating system SKUs: "Windows 2000"
- For Windows 2000 Server SKUs: "Windows 2000 Server"
- For Windows XP Professional operating system SKUs: "Windows XP Professional"
- For Windows Server 2003 SKUs: "Windows Server 2003"
- For Windows Vista, Windows 7, Windows 8, Windows 8.1, and Windows 10 SKUs: The name of the product is used. For example, for Windows 7 Ultimate operating system, the string "Windows 7 Ultimate" is used.

- For Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview SKUs: the name of the product is used. For example, for Windows Server 2008 Enterprise, the string "Windows Server 2008 Enterprise" is used.

<20> Section 2.2.1.3.6: Not supported in Windows NT, Windows 2000, and Windows Server 2003.

<21> Section 2.2.1.3.7: This structure was introduced in Windows 2000 Server and is not present in Windows NT.

<22> Section 2.2.1.3.8: This structure was introduced in Windows 2000 Server and is not present in Windows NT.

<23> Section 2.2.1.3.9: This structure was introduced in Windows 2000 and is not present in Windows NT.

<24> Section 2.2.1.3.10: This structure was introduced in Windows 2000 and is not present in Windows NT.

<25> Section 2.2.1.3.11: This structure was introduced in Windows 2000 and is not present in Windows NT.

<26> Section 2.2.1.3.11: SupportedEncTypes was added in Windows Vista and Windows Server 2008. Windows Server 2003 and client and server versions of Windows NT, Windows 2000, and Windows XP ignore this field.

<27> Section 2.2.1.3.12: This structure was introduced in Windows 2000 and is not present in Windows NT.

<28> Section 2.2.1.3.13: This DC type is available in Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview.

<29> Section 2.2.1.3.13: Added in Windows Server 2008, and supported in Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview.

<30> Section 2.2.1.3.14: This union is supported in Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<31> Section 2.2.1.3.15: The normal (writable) DC cannot be a Windows Server 2003 or a Windows 2000 Server DC.

<32> Section 2.2.1.3.15: Added in Windows Server 2008. The Netlogon server ignores this value.

<33> Section 2.2.1.3.16: The normal (writable) DC cannot be a Windows 2000 Server or a Windows Server 2003 domain controller.

<34> Section 2.2.1.3.16: Added in Windows Server 2008.

<35> Section 2.2.1.3.17: Support for version 1 was added in Windows Server 2008.

<36> Section 2.2.1.3.18: The normal (writable) DC cannot be a Windows 2000 Server or a Windows Server 2003 DC.

<37> Section 2.2.1.3.18: The read-only domain controller (RODC) that invoked the method NetrChainSetClientAttributes will attempt to replicate the computer account object from **HubName** to itself, ignoring errors.

<38> Section 2.2.1.3.18: Added in Windows Server 2008.

<39> Section 2.2.1.3.19: Added in Windows Server 2008.

<40> Section 2.2.1.4.16: The NetlogonInteractiveInformation type is not supported in Windows Vista.

<41> Section 2.2.1.4.16: The NetlogonNetworkInformation type is not supported in Windows Vista.

<42> Section 2.2.1.4.16: The NetlogonServiceInformation type is not supported in Windows Vista.

<43> Section 2.2.1.4.16: The NetlogonGenericInformation type is not supported in Windows Vista.

<44> Section 2.2.1.4.16: The NetlogonInteractiveTransitiveInformation type is not supported in Windows Vista.

<45> Section 2.2.1.4.16: The NetlogonNetworkTransitiveInformation type is not supported in Windows Vista.

<46> Section 2.2.1.4.16: The NetlogonServiceTransitiveInformation type is not supported in Windows Vista.

<47> Section 2.2.1.4.17: Windows NT 4.0, Windows 2000, Windows XP, Windows Server 2003, Windows Server 2008, Windows 7, and Windows Server 2008 R2: NETLOGON_VALIDATION_INFO_CLASS enumeration has **NetlogonValidationUasInfo** type defined. This value is used by LAN Manager in support of LAN Manager products, and is beyond the scope of this document.

<48> Section 2.2.1.4.17: Windows NT 4.0, Windows 2000, Windows XP, Windows Server 2003, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview: NETLOGON_VALIDATION_INFO_CLASS enumeration has **NetlogonValidationUasInfo** type defined. This value is used by LAN Manager in support of LAN Manager products, and is beyond the scope of this document.

<49> Section 2.2.1.4.17: The **NetlogonValidationSamInfo** type is not supported in Windows Vista.

<50> Section 2.2.1.4.17: The **NetlogonValidationSamInfo2** type is not supported in Windows Vista.

<51> Section 2.2.1.4.17: The **NetlogonValidationGenericInfo** type is not supported in Windows Vista.

<52> Section 2.2.1.4.17: The **NetlogonValidationGenericInfo2** type is not supported in Windows Vista.

<53> Section 2.2.1.4.17: The **NetlogonValidationSamInfo4** type is not supported in Windows Vista.

<54> Section 2.2.1.5.1: The recipient of the message waits for the indicated number of seconds before contacting the sender.

<55> Section 2.2.1.5.22: Starting with Windows 2000, **NumControllerEntries** is always set to zero in this structure.

<56> Section 2.2.1.5.22: Starting with Windows 2000, **ControllerNames** is always set to NULL in this structure.

<57> Section 2.2.1.5.28: In Windows NT 4.0 replication, this type requires NegotiateFlag=0x00000010. For more information, see the Capability Negotiation bullet in section 1.7 and the NegotiateFlags field description in sections 3.5.4.4.3 (NetrServerAuthenticate2) and 3.5.4.4.2 (NetrServerAuthenticate3).

<58> Section 2.2.1.5.28: In Windows NT 4.0 replication, this type requires NegotiateFlag=0x00000010. For more information, see the Capability Negotiation bullet in section 1.7

and the NegotiateFlags field description in sections 3.5.4.4.3 (NetrServerAuthenticate2) and 3.5.4.4.2 (NetrServerAuthenticate3).

<59> Section 2.2.1.5.28: In Windows NT 4.0 replication, this type requires NegotiateFlag=0x00000010. For more information, see the Capability Negotiation bullet in section 1.7 and the NegotiateFlags field description in sections 3.5.4.4.3 (NetrServerAuthenticate2) and 3.5.4.4.2 (NetrServerAuthenticate3).

<60> Section 2.2.1.6.2: Windows NT does not support this structure.

<61> Section 2.2.1.6.2: Windows NT.

<62> Section 2.2.1.6.2: Windows 2000, Windows Server 2003, Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview.

<63> Section 2.2.1.6.3: This structure was introduced in Windows 2000 and is not present in Windows NT.

<64> Section 2.2.1.6.4: This structure was introduced in Windows XP and is not present in Windows NT or Windows 2000.

<65> Section 2.2.1.7.2: Flags A, B, C, and D are available in all versions of Windows. Flags E, F, and G were introduced in Windows 2000 and are not available in Windows NT.

<66> Section 2.2.1.7.2: This flag is set only in the query response from a Windows NT 4.0-based backup domain controller.

<67> Section 2.2.1.7.2: This flag can be set only in the query response from a Windows NT 4.0-based backup domain controller.

<68> Section 2.2.1.7.2: This flag can be set only in the query response from a Windows NT 4.0-based backup domain controller.

<69> Section 2.2.1.7.2: This flag can be set only in the query response from a Windows NT 4.0–based backup domain controller.

<70> Section 2.2.1.7.2: This flag can be set only in the query response from a domain controller running Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, or Windows Server 2016 Technical Preview.

<71> Section 2.2.1.7.2: This flag can be set only in the query response from a domain controller running Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, or Windows Server 2016 Technical Preview.

<72> Section 2.2.1.7.2: This flag can be set only in the query response from a domain controller running Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, or Windows Server 2016 Technical Preview.

<73> Section 2.2.1.7.3: Flags A and B are not available for use in Windows NT. Flag C was introduced in Windows Server 2003.

<74> Section 2.2.1.7.3: This flag cannot be set in the query response from a server running Windows NT.

<75> Section 2.2.1.7.3: This flag cannot be set in the query response from a server running Windows NT.

<76> Section 2.2.1.7.3: This flag cannot be set in the query response from a server running Windows NT.

<77> Section 2.2.1.8.4: Windows never uses this structure.

<78> Section 3: In Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview, the server defaults to the primary domain if the name is not found.

<79> Section 3.1.1: In Windows 2000 Server, Windows Server 2003, Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview, for computer accounts in a domain, the OWF of the shared secret is stored in the **unicodePwd** attribute of the computer account object in Active Directory ([MS-ADTS] section 6.4.2). For trusts with Windows 2000, Windows Server 2003, Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview domains, the shared secret is stored in the **trustAuthIncoming** attribute ([MS-ADTS] section 6.1.6.7.10) and the **trustAuthOutgoing** attribute ([MS-ADTS] section 6.1.6.7.11) of the trusted domain object (TDO) that contains trust information in Active Directory ([MS-ADTS] section 6.1.6.9.1). Depending on the **AuthType** either the shared secret (TRUST_AUTH_TYPE_CLEAR) or NTOWFv1 (TRUST_AUTH_TYPE_NT4OWF) is stored. For trusts with Windows NT 4.0 domains, the OWF of the shared secret is stored in the **trustAuth** attribute of the corresponding TDO for the Windows NT 4.0 domain.

<80> Section 3.1.1: In Windows NT 4.0 ([MS-SAMR] section 3.1.1.3), the OWF of the shared secret is stored as an attribute of the computer account object (for domain members) or the interdomain trust account object (for domain trusts).

<81> Section 3.1.1: Windows uses the Netlogon Remote Protocol to change the machine account password every 30 days by default.

<82> Section 3.1.1: For trusts with Windows 2000, Windows Server 2003, Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview domains, the trust password version is stored in the TRUST_AUTH_TYPE_VERSION of the **trustAuthIncoming** attribute ([MS-ADTS] section 6.1.6.7.10) and the **trustAuthOutgoing** attribute ([MS-ADTS] section 6.1.6.7.11) of the TDO that contains trust information in Active Directory ([MS-ADTS] section 6.1.6.9.1). The trust password version is not maintained for Windows NT 4.0 domains.

<83> Section 3.1.4.1: Supported in Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<84> Section 3.1.4.1: Supported in Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<85> Section 3.1.4.1: Supported in Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<86> Section 3.1.4.2: Added in Windows 2000 Server; not supported in Windows NT.

<87> Section 3.1.4.2: Added in Windows 2000 Server; not supported in Windows NT.

<88> Section 3.1.4.2: Added in Windows 2000 Server; not supported in Windows NT.

<89> Section 3.1.4.2: Added in Windows 2000 Server; not supported in Windows NT.

<90> Section 3.1.4.2: Added in Windows 2000 Server; not supported in Windows NT.

<91> Section 3.1.4.2: Added in Windows 2000 Server; not supported in Windows NT.

<92> Section 3.1.4.2: Added in Windows 2000 Server; not supported in Windows NT.

<93> Section 3.1.4.2: Added in Windows 2000 Server; not supported in Windows NT.

<94> Section 3.1.4.2: Added in Windows 2000 Server; not supported in Windows NT.

<95> Section 3.1.4.2: Added in Windows XP; not supported in Windows NT or Windows 2000.

<96> Section 3.1.4.2: Added in Windows XP and supported in Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2.

<97> Section 3.1.4.2: Added in Windows Vista and supported in Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<98> Section 3.1.4.2: Supported in Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<99> Section 3.1.4.2: Added in Windows NT 4.0 operating system Service Pack 2 (SP2).

<100> Section 3.1.4.6: For Windows NT, the client binds to the RPC server using named pipes. For Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview, the client binds to the RPC server using TCP. If RPC returns an error indicating that the protocol sequence is not supported, then the client binds to the RPC server using named pipes.

<101> Section 3.1.4.6: Windows NT 4.0 operating system Service Pack 4 (SP4) does not support Secure RPC and does not perform a secure bind.

<102> Section 3.1.4.6: Windows caches and reuses the binding for subsequent RPC calls to the server.

<103> Section 3.3: The Windows Netlogon SSP is not provided for use by other applications. It has neither the full functionally of public SSPs nor access from non-LSA applications.

<104> Section 3.3: This Netlogon capability was added in Windows NT 4.0 operating system Service Pack 6 (SP6).

<105> Section 3.3.4.2.2: Windows disregards the **Flags** data.

<106> Section 3.4: Netlogon runs only on machines joined to a domain ([MS-ADTS] section 6.4). Upon startup, it locates a domain controller and establishes a secure channel to it. It is used for secure communication between the client and the domain controller and for passing sensitive data between the two entities. Starting with Windows 2000 Server, Netlogon also registers the service principal names (SPNs) for the computer that it runs on. It registers the SPNs of the form "HOST/NetBIOSName" and "HOST/Full.Dns.Name", which updates the **servicePrincipalName** attribute of the computer account object in Active Directory.

<107> Section 3.4.1: Supported in Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<108> Section 3.4.1: This ADM element does not exist in Windows NT.

<109> Section 3.4.3: All versions of Windows use 4096. Other implementations can use any value.

<110> Section 3.4.3: Implementations that use the Windows registry to persistently store and retrieve the settings for **ClientCapabilities** bit O SHOULD use the HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters registry path and the **SignSecureChannel** and **SealSecureChannel** values to indicate if bit O should be set. If either of these registry values are set to 0x1 then bit O SHOULD be set. Implementations that use the Windows registry to persistently store settings for **ClientCapabilities** bit U SHOULD use the HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters registry path and NeutralizeNt4Emulator key to indicate if bit U should be set. If this registry value is set to 0x1 then bit U SHOULD be set.

<111> Section 3.4.3: Windows NT 4.0 SP4, Windows 2000, Windows XP, Windows Server 2003, Windows Vista, and Windows Server 2008 initialize RequireSignOrSeal to FALSE.

<112> Section 3.4.3: Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview initialize RequireStrongKey to FALSE.

<113> Section 3.4.5.1.3: All applications available as part of Windows set the *SiteGuid* parameter to NULL.

<114> Section 3.4.5.1.11: The ServerName is a normal (writable) DC, but is not a Windows Server 2003 or a Windows 2000 Server DC.

<115> Section 3.4.5.1.11: The client has to be an RODC.

<116> Section 3.4.5.2.3: This method was only used in Windows NT 3.5 operating system and Windows NT 4.0.

<117> Section 3.4.5.2.4: This method was only used in Windows NT Server 3.1 operating system.

<118> Section 3.4.5.2.5: Windows clients re-establish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<119> Section 3.4.5.2.6: Windows clients re-establish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<120> Section 3.4.5.2.7: Windows clients re-establish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<121> Section 3.4.5.2.9: Windows clients reestablish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<122> Section 3.4.5.2.10: NetrLogonGetCapabilities is not supported by Windows NT, Windows 2000, Windows XP, Windows Server 2003, Windows Vista, or Windows Server 2008 clients.

<123> Section 3.4.5.2.10: Supported by Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<124> Section 3.4.5.2.10: For Windows DCs, this error means the DC is a Windows NT, Windows Server 2003, or Windows Server 2008 machine.

<125> Section 3.4.5.2.10: Windows clients re-establish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<126> Section 3.4.5.2.11: The normal (writable) DC cannot be a Windows 2000 Server or a Windows Server 2003 DC.

<127> Section 3.4.5.2.11: The client reestablishes the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<128> Section 3.4.5.3.2: For all versions of Windows except Windows NT 3.1 operating system, encrypt by using the negotiated encryption algorithm and the session key.

For Windows NT 3.1, encrypt as follows.

```
InitLMKey(KeyIn, KeyOut)
      KeyOut[0] = KeyIn[0] >> 0x01;
     KeyOut[1] = ((KeyIn[0]&0x01)<<6) | (KeyIn[1]>>2);
     KeyOut[2] = ((KeyIn[1]&0x03)<<5) | (KeyIn[2]>>3);
     KeyOut[3] = ((KeyIn[2]&0x07)<<4) | (KeyIn[3]>>4);
     KeyOut[4] = ((KeyIn[3]&0x0F)<<3) | (KeyIn[4]>>5);
     KeyOut[5] = ((KeyIn[4]&0x1F)<<2) | (KeyIn[5]>>6);
     KeyOut[6] = ((KeyIn[5]&0x3F)<<1) | (KeyIn[6]>>7);
     KeyOut[7] = KeyIn[6] & 0x7F;
     ((DWORD*)KeyOut)[0] <<= 1;
     ((DWORD*)KeyOut)[1] <<= 1;
     ((DWORD*)KeyOut)[0] &= 0xfefefefe;
     ((DWORD*)KeyOut)[1] &= 0xfefefefe;

Assume bytes(s, e, l) returns bytes from s to e of the byte
array l. Assume concat(a1, a2) returns byte array containing
the bytes of array a1 followed by the bytes from byte array a2.

LMDESECB(Input, Sk, Output)
     SET k1 to bytes(0, 7, Sk)
     CALL InitLMKey(k1, k3)
     SET k2 to bytes(8, 15, Sk)
     CALL InitLMKey(k2, k4)
     SET i1 to bytes(0, 7, Input)
     SET i2 to bytes(8, 15, Input)
     CALL DES ECB(i1, k3, &output1)
     CALL DES_ECB(i2, k4, &output2)
     SET Output to concat(output1, output2)
```

<129> Section 3.4.5.3.2: For all versions of Windows except Windows NT 3.1, encrypt using the negotiated encryption algorithm and the session key.

For Windows NT 3.1, encrypt as follows.

```
InitLMKey(KeyIn, KeyOut)
      KeyOut[0] = KeyIn[0] >> 0x01;
     KeyOut[1] = ((KeyIn[0]&0x01)<<6) | (KeyIn[1]>>2);
     KeyOut[2] = ((KeyIn[1]&0x03)<<5) | (KeyIn[2]>>3);
     KeyOut[3] = ((KeyIn[2]&0x07)<<4) | (KeyIn[3]>>4);
     KeyOut[4] = ((KeyIn[3]&0x0F)<<3) | (KeyIn[4]>>5);
     KeyOut[5] = ((KeyIn[4]&0x1F)<<2) | (KeyIn[5]>>6);
     KeyOut[6] = ((KeyIn[5]&0x3F)<<1) | (KeyIn[6]>>7);
     KeyOut[7] = KeyIn[6] & 0x7F;
     ((DWORD*)KeyOut)[0] <<= 1;
     ((DWORD*)KeyOut)[1] <<= 1;
     ((DWORD*)KeyOut)[0] &= 0xfefefefe;
     ((DWORD*)KeyOut)[1] &= 0xfefefefe;

Assume bytes(s, e, l) returns bytes from s to e of the byte
array l. Assume concat(a1, a2) returns byte array containing
the bytes of array a1 followed by the bytes from byte array a2.

LMDESECB(Input, Sk, Output)
     SET k1 to bytes(0, 7, Sk)
     CALL InitLMKey(k1, k3)
     SET k2 to bytes(8, 15, Sk)
     CALL InitLMKey(k2, k4)
     SET i1 to bytes(0, 7, Input)
     SET i2 to bytes(8, 15, Input)
     CALL DES_ECB(i1, k3, &output1)
     CALL DES_ECB(i2, k4, &output2)
```

```
      SET Output to concat(output1, output2)
```

<130> Section 3.4.5.3.2: For all versions of Windows except Windows NT 3.1, encrypt using the negotiated encryption algorithm and the session key.

For Windows NT 3.1, encrypt as follows.

```
InitLMKey(KeyIn, KeyOut)
      KeyOut[0] = KeyIn[0] >> 0x01;
     KeyOut[1] = ((KeyIn[0]&0x01)<<6) | (KeyIn[1]>>2);
     KeyOut[2] = ((KeyIn[1]&0x03)<<5) | (KeyIn[2]>>3);
     KeyOut[3] = ((KeyIn[2]&0x07)<<4) | (KeyIn[3]>>4);
     KeyOut[4] = ((KeyIn[3]&0x0F)<<3) | (KeyIn[4]>>5);
     KeyOut[5] = ((KeyIn[4]&0x1F)<<2) | (KeyIn[5]>>6);
     KeyOut[6] = ((KeyIn[5]&0x3F)<<1) | (KeyIn[6]>>7);
     KeyOut[7] = KeyIn[6] & 0x7F;
     ((DWORD*)KeyOut)[0] <<= 1;
     ((DWORD*)KeyOut)[1] <<= 1;
     ((DWORD*)KeyOut)[0] &= 0xfefefefe;
     ((DWORD*)KeyOut)[1] &= 0xfefefefe;

Assume bytes(s, e, l) returns bytes from s to e of the byte
array l. Assume concat(a1, a2) returns byte array containing
the bytes of array a1 followed by the bytes from byte array a2.

LMDESECB(Input, Sk, Output)
     SET k1 to bytes(0, 7, Sk)
     CALL InitLMKey(k1, k3)
     SET k2 to bytes(8, 15, Sk)
     CALL InitLMKey(k2, k4)
     SET i1 to bytes(0, 7, Input)
     SET i2 to bytes(8, 15, Input)
     CALL DES_ECB(i1, k3, &output1)
     CALL DES_ECB(i2, k4, &output2)
     SET Output to concat(output1, output2)
```

<131> Section 3.4.5.3.2: Windows clients reestablish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<132> Section 3.4.5.3.4: For all versions of Windows except Windows NT 3.1, encrypt by using the negotiated encryption algorithm and the session key.

For Windows NT 3.1, encrypt as follows.

```
InitLMKey(KeyIn, KeyOut)
      KeyOut[0] = KeyIn[0] >> 0x01;
     KeyOut[1] = ((KeyIn[0]&0x01)<<6) | (KeyIn[1]>>2);
     KeyOut[2] = ((KeyIn[1]&0x03)<<5) | (KeyIn[2]>>3);
     KeyOut[3] = ((KeyIn[2]&0x07)<<4) | (KeyIn[3]>>4);
     KeyOut[4] = ((KeyIn[3]&0x0F)<<3) | (KeyIn[4]>>5);
     KeyOut[5] = ((KeyIn[4]&0x1F)<<2) | (KeyIn[5]>>6);
     KeyOut[6] = ((KeyIn[5]&0x3F)<<1) | (KeyIn[6]>>7);
     KeyOut[7] = KeyIn[6] & 0x7F;
     ((DWORD*)KeyOut)[0] <<= 1;
     ((DWORD*)KeyOut)[1] <<= 1;
     ((DWORD*)KeyOut)[0] &= 0xfefefefe;
     ((DWORD*)KeyOut)[1] &= 0xfefefefe;

Assume bytes(s, e, l) returns bytes from s to e of the byte
array l. Assume concat(a1, a2) returns byte array containing
the bytes of array a1 followed by the bytes from byte array a2.

LMDESECB(Input, Sk, Output)
```

```
      SET k1 to bytes(0, 7, Sk)
      CALL InitLMKey(k1, k3)
      SET k2 to bytes(8, 15, Sk)
      CALL InitLMKey(k2, k4)
      SET i1 to bytes(0, 7, Input)
      SET i2 to bytes(8, 15, Input)
      CALL DES_ECB(i1, k3, &output1)
      CALL DES_ECB(i2, k4, &output2)
      SET Output to concat(output1, output2)
```

<133> Section 3.4.5.3.4: For all versions of Windows except Windows NT 3.1, encrypt by using the negotiated encryption algorithm and the session key.

For Windows NT 3.1, encrypt as follows.

```
InitLMKey(KeyIn, KeyOut)
      KeyOut[0] = KeyIn[0] >> 0x01;
     KeyOut[1] = ((KeyIn[0]&0x01)<<6) | (KeyIn[1]>>2);
     KeyOut[2] = ((KeyIn[1]&0x03)<<5) | (KeyIn[2]>>3);
     KeyOut[3] = ((KeyIn[2]&0x07)<<4) | (KeyIn[3]>>4);
     KeyOut[4] = ((KeyIn[3]&0x0F)<<3) | (KeyIn[4]>>5);
     KeyOut[5] = ((KeyIn[4]&0x1F)<<2) | (KeyIn[5]>>6);
     KeyOut[6] = ((KeyIn[5]&0x3F)<<1) | (KeyIn[6]>>7);
     KeyOut[7] = KeyIn[6] & 0x7F;
     ((DWORD*)KeyOut)[0] <<= 1;
     ((DWORD*)KeyOut)[1] <<= 1;
     ((DWORD*)KeyOut)[0] &= 0xfefefefe;
     ((DWORD*)KeyOut)[1] &= 0xfefefefe;

Assume bytes(s, e, l) returns bytes from s to e of the byte
array l. Assume concat(a1, a2) returns byte array containing
the bytes of array a1 followed by the bytes from byte array a2.

LMDESECB(Input, Sk, Output)
     SET k1 to bytes(0, 7, Sk)
     CALL InitLMKey(k1, k3)
     SET k2 to bytes(8, 15, Sk)
     CALL InitLMKey(k2, k4)
     SET i1 to bytes(0, 7, Input)
     SET i2 to bytes(8, 15, Input)
     CALL DES_ECB(i1, k3, &output1)
     CALL DES_ECB(i2, k4, &output2)
     SET Output to concat(output1, output2)
```

<134> Section 3.4.5.3.4: For all versions of Windows except Windows NT 3.1, encrypt using the negotiated encryption algorithm and the session key.

For Windows NT 3.1, encrypt as follows.

```
InitLMKey(KeyIn, KeyOut)
      KeyOut[0] = KeyIn[0] >> 0x01;
     KeyOut[1] = ((KeyIn[0]&0x01)<<6) | (KeyIn[1]>>2);
     KeyOut[2] = ((KeyIn[1]&0x03)<<5) | (KeyIn[2]>>3);
     KeyOut[3] = ((KeyIn[2]&0x07)<<4) | (KeyIn[3]>>4);
     KeyOut[4] = ((KeyIn[3]&0x0F)<<3) | (KeyIn[4]>>5);
     KeyOut[5] = ((KeyIn[4]&0x1F)<<2) | (KeyIn[5]>>6);
     KeyOut[6] = ((KeyIn[5]&0x3F)<<1) | (KeyIn[6]>>7);
     KeyOut[7] = KeyIn[6] & 0x7F;
     ((DWORD*)KeyOut)[0] <<= 1;
     ((DWORD*)KeyOut)[1] <<= 1;
     ((DWORD*)KeyOut)[0] &= 0xfefefefe;
     ((DWORD*)KeyOut)[1] &= 0xfefefefe;

Assume bytes(s, e, l) returns bytes from s to e of the byte
```

```
array 1. Assume concat(a1, a2) returns byte array containing
the bytes of array a1 followed by the bytes from byte array a2.

LMDESECB(Input, Sk, Output)
     SET k1 to bytes(0, 7, Sk)
     CALL InitLMKey(k1, k3)
     SET k2 to bytes(8, 15, Sk)
     CALL InitLMKey(k2, k4)
     SET i1 to bytes(0, 7, Input)
     SET i2 to bytes(8, 15, Input)
     CALL DES ECB(i1, k3, &output1)
     CALL DES_ECB(i2, k4, &output2)
     SET Output to concat(output1, output2)
```

<135> Section 3.4.5.3.4: Windows clients reestablish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<136> Section 3.4.5.3.5: Windows clients reestablish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<137> Section 3.4.5.4.1: On receiving the STATUS_MORE_ENTRIES status code, the client continues calling this routine in a loop updating DomainModifiedCount until all missing database entries are received. On receiving the STATUS_SUCCESS status code, the client terminates the loop. The client terminates the loop without receiving all entries upon receiving a system shutdown notification.

<138> Section 3.4.5.4.1: Windows clients reestablish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<139> Section 3.4.5.4.2: Windows clients call this method in a loop until all database records are received.

<140> Section 3.4.5.4.2: On receiving the STATUS_MORE_ENTRIES status code, Windows clients continue calling this routine in a loop until all missing database entries are received. The client terminates the loop on a computer shutdown notification.

<141> Section 3.4.5.4.2: Windows clients re-establish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<142> Section 3.4.5.4.4: Windows clients reestablish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<143> Section 3.4.5.5.4: Windows clients reestablish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<144> Section 3.4.5.5.6: Windows clients reestablish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<145> Section 3.4.5.6.4: Windows clients reestablish the secure channel with the domain controller upon receiving STATUS_ACCESS_DENIED.

<146> Section 3.4.6.1: All versions of Windows use 4096. Other implementations can use any value.

<147> Section 3.5.1: In Windows implementations, the default DynamicSiteNameTimeout value is 5 minutes, and the allowed range is 0 minutes to 49 days.

<148> Section 3.5.1: Supported in Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<149> Section 3.5.1: This value is configured as described in [MS-WKST].

<150> Section 3.5.1: The ADM element does not exist in Windows NT.

<151> Section 3.5.1: DCRPCPort is supported in Windows Server 2003, Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview.

<152> Section 3.5.3: The named pipe LSASS is also known by the alias NETLOGON. The client can use this alias to establish an RPC over named pipes connection. The Netlogon security package functionality was added in Windows 2000 and is present in Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, and Windows Server 2008 R2.

<153> Section 3.5.3: The named pipe LSASS is also known by the alias NETLOGON. The client can use this alias to establish an RPC-over-named pipes connection. The Netlogon security package functionality was added in Windows 2000.

<154> Section 3.5.3: Windows NT 4.0 initializes this value to FALSE.

<155> Section 3.5.3: In Windows implementations, this can be configured using the following registry path:

- Registry path: HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters
- RegistryValueName: AllowSingleLabelDNSDomain
- RegistryType: DWORD
- Acceptable values: 0 = Disabled, 1 = Enabled
- Default value if not explicitly configured: 0.

<156> Section 3.5.3: Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, and Windows Server 2008 R2 always consider AllowDnsSuffixSearch to be FALSE.

<157> Section 3.5.3: Windows uses the HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Netlogon\Parameters registry path and SiteName value.

<158> Section 3.5.3: In Windows implementations, this can be configured using the following registry path:

- Registry path: HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Netlogon\Parameters
- RegistryValueName: NegativeCachePeriod
- RegistryType: DWORD
- AllowedRange: 0 - 604800 (7 days)
- Default value if not explicitly configured: 45 seconds

<159> Section 3.5.3: In Windows implementations, the value is 12 hours, unless changed by an administrator.

<160> Section 3.5.3: In Windows implementations, the value is 30 minutes, unless changed by an administrator.

<161> Section 3.5.3: In Windows NT, Windows 2000, Windows XP, Windows Server 2003, and Windows Vista, RejectDES is always FALSE.

<162> Section 3.5.4: NetrLogonSamLogon is available starting with Windows NT Server 3.1.

<163> Section 3.5.4: NetrLogonSamLogoff is available starting with Windows NT Server 3.1.

<164> Section 3.5.4: NetrServerReqChallenge is available starting with Windows NT Server 3.1.

<165> Section 3.5.4: NetrServerAuthenticate is available starting with Windows NT Server 3.1.

<166> Section 3.5.4: NetrServerPasswordSet is available starting with Windows NT Server 3.1.

<167> Section 3.5.4: NetrDatabaseDeltas is available starting with Windows NT Server 3.1.

<168> Section 3.5.4: NetrDatabaseSync is available starting with Windows NT Server 3.1.

<169> Section 3.5.4: NetrAccountDeltas was introduced in LAN Manager.

<170> Section 3.5.4: NetrAccountSync was introduced in LAN Manager.

<171> Section 3.5.4: NetrGetDCName is available starting with Windows NT Server 3.1.

<172> Section 3.5.4: NetrLogonControl is available starting with Windows NT Server 3.1.

<173> Section 3.5.4: NetrGetAnyDCName is available starting with Windows NT Server 3.1.

<174> Section 3.5.4: NetrLogonControl2 is available starting with Windows NT Server 3.1.

<175> Section 3.5.4: NetrServerAuthenticate2 is available starting with Windows NT Server 3.5 operating system.

<176> Section 3.5.4: NetrDatabaseSync2 is available starting with Windows NT Server 3.5, but is not available in Windows 7 or Windows Server 2008 R2.

<177> Section 3.5.4: NetrDatabaseRedo is available starting with Windows NT Server 3.5, but is not available in Windows 7 or Windows Server 2008 R2.

<178> Section 3.5.4: NetrLogonControl2Ex is available starting with Windows NT 4.0.

<179> Section 3.5.4: NetrEnumerateTrustedDomains is available starting with Windows NT 4.0.

<180> Section 3.5.4: DsrGetDcName is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<181> Section 3.5.4: NetrLogonGetCapabilities is not supported by Windows NT, Windows 2000, Windows XP, Windows Server 2003, Windows Vista, or Windows Server 2008 clients. In these Windows versions, a method named NetrLogonDummyRoutine1 is associated with RPC opnum 21, which has no protocol-specific relevance. See the behavior notes associated with section 3.5.4.4.10 for details.

<182> Section 3.5.4: NetrLogonSetServiceBits is available in Windows 2000, Windows 2000 Server, Windows XP, and Windows Server 2003.

<183> Section 3.5.4: NetrLogonGetTrustRid is available in Windows 2000, Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<184> Section 3.5.4: NetrLogonComputeServerDigest is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<185> Section 3.5.4: NetrLogonComputeClientDigest is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<186> Section 3.5.4: NetrServerAuthenticate3 is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<187> Section 3.5.4: DsrGetDcNameEx is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<188> Section 3.5.4: DsrGetSiteName is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<189> Section 3.5.4: NetrLogonGetDomainInfo is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<190> Section 3.5.4: NetrServerPasswordSet2 is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<191> Section 3.5.4: NetrServerPasswordGet is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<192> Section 3.5.4: NetrLogonSendToSam is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<193> Section 3.5.4: DsrAddressToSiteNamesW is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<194> Section 3.5.4: DsrGetDcNameEx2 is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<195> Section 3.5.4: NetrLogonGetTimeServiceParentDomain is available in Windows 2000, Windows 2000 Server, Windows XP, and Windows Server 2003.

<196> Section 3.5.4: NetrEnumerateTrustedDomainsEx is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<197> Section 3.5.4: DsrAddressToSiteNamesExW is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2,

Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<198> Section 3.5.4: DsrGetDcSiteCoverageW is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<199> Section 3.5.4: NetrLogonSamLogonEx is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<200> Section 3.5.4: DsrEnumerateDomainTrusts available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<201> Section 3.5.4: DsrDeregisterDnsHostRecords is available in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<202> Section 3.5.4: NetrServerTrustPasswordsGet is available starting with Windows 2000 Server operating system Service Pack 4 (SP4).

<203> Section 3.5.4: DsrGetForestTrustInformation is available starting with Windows 2000 Server SP4.

<204> Section 3.5.4: NetrGetForestTrustInformation is available starting with Windows 2000 Server SP4.

<205> Section 3.5.4: NetrLogonSamLogonWithFlags is available starting with Windows 2000 Server SP4.

<206> Section 3.5.4: NetrServerGetTrustInfo is available starting with Windows 2000 Server SP4.

<207> Section 3.5.4: Gaps in the opnum numbering sequence apply to Windows as follows.

Opnum	Description
47	Windows uses this method only locally, never remotely.

<208> Section 3.5.4.1: If the string is NULL, the server is considered to be the same as the client (that is, the local computer).

<209> Section 3.5.4.3.1: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<210> Section 3.5.4.3.1: Added in Windows Server 2008.

<211> Section 3.5.4.3.1: Added in Windows Vista, and supported in Windows 7, Windows Server 2008, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<212> Section 3.5.4.3.1: Windows implements both the LDAP Ping ([MS-ADTS] section 6.3.3) and the Mailslot Ping ([MS-ADTS] section 6.3.5) methods and uses them to locate a DC ([MS-ADTS] section 6.3.6).

<213> Section 3.5.4.3.1: Windows 2000, Windows Server 2003, Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview DCs support directory service functions.

<214> Section 3.5.4.3.1: Windows 2000, Windows Server 2003, Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview DCs support directory service functions.

<215> Section 3.5.4.3.1: A DC is writable when:

- It is a Windows 2000, Windows Server 2003, Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, or Windows Server 2016 Technical Preview DC, and it hosts a writable copy of the directory service.
- It is a Windows NT DC, and it hosts a writable copy of SAM.

A Windows NT DC is writable only if it is a PDC. All Windows 2000, Windows Server 2003, Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview DCs are writable unless they are RODCs.

<216> Section 3.5.4.3.1: Added in Windows 7 and Windows Server 2008 R2.

<217> Section 3.5.4.3.1: If neither the R nor S flag is specified, Windows returns the type of name that matches the type of the *DomainName* parameter.

<218> Section 3.5.4.3.1: In Windows, if neither the R nor S flags are set in the *Flags* parameter, the behavior is as follows:

- If only one of the **DnsHostName** or **NetbiosComputerName** fields is set in the message, the **DomainControllerName** field is set to that value.
- Otherwise, if both the **DnsHostName** and **NetbiosComputerName** fields are set in the message:
  - If the *DomainName* parameter is equal to the **DnsDomainName** message field, the **DomainControllerName** field is set to the value of the **DnsHostName** message field.
  - If the *DomainName* parameter is equal to the **NetbiosDomainName** message field, the **DomainControllerName** field is set to the value of the **NetbiosComputerName** message field.
  - If the *DomainName* parameter is NULL:
    - If the DC responded to the LDAP message, the **DomainControllerName** field is set to the value of the **DnsHostName** message field.
    - If the DC responded to the mailslot message, the **DomainControllerName** field is set to the value of the **NetbiosComputerName** message field.

<219> Section 3.5.4.3.1: In Windows, if neither the R nor S flags are set in the *Flags* parameter, the behavior is as follows:

- If only one of the **DnsDomainName** or **NetbiosDomainName** fields is set in the message, the **DomainName** field is set to that value.
- Otherwise, if both the **DnsDomainName** and **NetbiosDomainName** fields are set in the message:

- If the *DomainName* parameter of the **DsrGetDcNameEx2** call is equal to the **DnsDomainName** message field, the **DomainName** field is set to the value of the **DnsDomainName** message field.
- If the *DomainName* parameter of the **DsrGetDcNameEx2** call is equal to the **NetbiosDomainName** message field, the **DomainName** field is set to the value of the **NetbiosDomainName** message field.
- If the *DomainName* parameter of the **DsrGetDcNameEx2** call is NULL:
  - If the DC responded to the LDAP message, the **DomainName** field is set to the value of the **DnsDomainName** message field.
  - If the DC responded to the mailslot message, the **DomainName** field is set to the value of the **NetbiosDomainName** message field.

<220> Section 3.5.4.3.2: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<221> Section 3.5.4.3.3: Supported in Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<222> Section 3.5.4.3.4: This method was used in Windows NT Server 3.1 and is supported in Windows NT Server 3.1 versions. It was superseded by the DsrGetDcNameEx2 method (section 3.5.4.3.1) as of Windows 2000.

<223> Section 3.5.4.3.4:

Return Value/Code	Description
0x00000035 ERROR_ BAD_ NETPATH	The network path was not found.

<224> Section 3.5.4.3.4: Windows implements both the LDAP ping-based method ([MS-ADTS] section 6.3.3) and the mailslot message-based method ([MS-ADTS] section 6.3.5), and uses those two methods to locate a DC ([MS-ADTS] section 6.3.6).

<225> Section 3.5.4.3.5: This method was introduced in Windows NT Server 3.1 and is supported in Windows NT Server 3.1 versions. It was superseded by the DsrGetDcNameEx2 method (section 3.5.4.3.1) in Windows 2000.

<226> Section 3.5.4.3.5:

Return Value/Code	Description
0x00000712 ERROR_DOMAIN_TRUST_INCONSISTENT	The name or security ID (SID) of the domain specified is inconsistent with the trust information for that domain.

<227> Section 3.5.4.3.5: Windows implements both the LDAP ping-based method ([MS-ADTS] section 6.3.3) and the mailslot ping method ([MS-ADTS] section 6.3.5), and uses those two methods to locate a DC ([MS-ADTS] section 6.3.6).

<228> Section 3.5.4.3.6: Supported in Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<229> Section 3.5.4.3.6:

Return Value/Code	Description
0x0000077F ERROR_NO_SITENAME	No site name is available for this machine.

<230> Section 3.5.4.3.6: Windows implements both the LDAP Ping method ([MS-ADTS] section 6.3.3) and the Mailslot Ping method ([MS-ADTS] section 6.3.5), and uses those two methods to locate a DC ([MS-ADTS] section 6.3.6).

<231> Section 3.5.4.3.7: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<232> Section 3.5.4.3.8: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<233> Section 3.5.4.3.8:

Return Value/Code	Description
0x00000008 ERROR_NOT_ENOUGH_MEMORY	Not enough storage is available to process this command.
0x00000057 ERROR_INVALID_PARAMETER	One of the parameters is invalid. This error value is returned if the value of *EntryCount* passed to **DsrAddressToSiteNamesW** is zero.

<234> Section 3.5.4.3.9: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<235> Section 3.5.4.3.9: To avoid large memory allocations, the number of 32,000 was chosen as a reasonable limit for the maximum number of socket addresses that this method accepts.

<236> Section 3.5.4.3.9:

Return Value/Code	Description
0x00000008 ERROR_NOT_ENOUGH_MEMORY	Not enough storage is available to process this command.
0x00000057 ERROR_INVALID_PARAMETER	One of the parameters is invalid. This error value is returned if the value of *EntryCount* passed to **DsrAddressToSiteNamesExW** is zero.

<237> Section 3.5.4.3.10: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<238> Section 3.5.4.3.10:

Return Value/Code	Description
0x00000032 ERROR_NOT_SUPPORTED	The request is not supported. This error value is returned when **DsrDeregisterDnsHostRecords** is called on a machine that is not a DC.

<239> Section 3.5.4.3.11: The normal (writable) DC cannot be a Windows 2000 Server or a Windows Server 2003 DC.

<240> Section 3.5.4.4.2: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<241> Section 3.5.4.4.2: In Windows, all machine account names are the name of the machine with a "$" (dollar sign) appended.

<242> Section 3.5.4.4.2: For Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview, if the value is 5 (UasServerSecureChannel), the server always returns an access-denied error because this functionality is no longer supported. Windows NT 4.0 has configuration parameter options allowing UAS compatibility mode, and if this mode is enabled, the error is not returned and further processing occurs. Otherwise, it returns an access-denied error.

<243> Section 3.5.4.4.2: Supported only in Windows Server 2008 R2.

<244> Section 3.5.4.4.3: This method was used in Windows NT 3.5 and Windows NT 4.0. In Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview, it was superseded by the NetrServerAuthenticate3 method (section 3.5.4.4.2).

<245> Section 3.5.4.4.4: This method was used in Windows NT Server 3.1. In Windows NT Server 3.5, it was superseded by the NetrServerAuthenticate2 method (section 3.5.4.4.3). In Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview, the NetrServerAuthenticate2 method (section 3.5.4.4.3) was superseded by the NetrServerAuthenticate3 method (section 3.5.4.4.2).

<246> Section 3.5.4.4.5: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<247> Section 3.5.4.4.5: A domain member uses this function to periodically change its machine account password. A PDC uses this function to periodically change the trust password for all directly trusted domains. By default, the period is 30 days in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows

8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<248> Section 3.5.4.4.5: In Windows, all machine account names are the name of the machine with a "$" (dollar sign) appended.

<249> Section 3.5.4.4.6: In Windows, all machine account names are the name of the machine with a "$" (dollar sign) appended.

<250> Section 3.5.4.4.7: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<251> Section 3.5.4.4.7: For machine accounts, the account name is the machine name appended with a "$" character.

<252> Section 3.5.4.4.8: Supported in Windows 2000 Server SP4, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<253> Section 3.5.4.4.8: In Windows, all machine account names are the name of the machine with a "$" (dollar sign) appended.

<254> Section 3.5.4.4.9: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<255> Section 3.5.4.4.9: Not supported in Windows NT, Windows 2000, Windows Server 2003 and Windows Server 2008.

<256> Section 3.5.4.4.9: All versions of Windows use 4096. Other implementations can use any value.

<257> Section 3.5.4.4.9: For Windows 2000, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview, NETLOGON_ONE_DOMAIN_INFO.TrustExtension MaximumLength and Length are set to the size 0x10, and Buffer points to a buffer containing the following fields of a DS_DOMAIN_TRUSTSW structure: Flags, ParentIndex, TrustType, TrustAttributes.

<258> Section 3.5.4.4.9: If both WkstaBuffer.*WorkstationInfo*.*OsVersion* and WkstaBuffer.*WorkstationInfo*.*OsName* are unspecified, Windows 2000, Windows XP, and Windows Server 2003 use the generic string "Windows 2000" to update the **operatingSystem** attribute. If only WkstaBuffer.*WorkstationInfo*.*OsName* is unspecified, Windows 2000, Windows XP, and Windows Server 2003 use the generic string "Windows 2000 Professional" when WkstaBuffer.*WorkstationInfo*.*OsVersion*.*wProductType* is VER_NT_WORKSTATION, and otherwise use the string "Windows 2000 Server" to update the **operatingSystem** attribute.

<259> Section 3.5.4.4.10: NetrLogonGetCapabilities is supported by Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

In Windows NT, Windows 2000, Windows XP, Windows Server 2003, Windows Vista, and Windows Server 2008, RPC opnum 21 is associated with the following RPC method, which does not perform any protocol-relevant function:

```
NTSTATUS NetrLogonDummyRoutine1(
```

```
    [in, string] LOGONSRV_HANDLE ServerName,
    [in, string, unique] wchar_t* ComputerName,
    [in] PNETLOGON_AUTHENTICATOR Authenticator,
    [in, out] PNETLOGON_AUTHENTICATOR ReturnAuthenticator,
    [in] DWORD QueryLevel,
    [out, switch is(QueryLevel)] PNETLOGON DUMMY1 Buffer
  );
```

The return type and parameters for NetrLogonDummyRoutine1 take on the same data representation as those for NetrLogonGetCapabilities.

<260> Section 3.5.4.4.10: The ServerCapabilities field is not supported by Windows NT, Windows 2000, Windows XP, Windows Server 2003, Windows Vista, or Windows Server 2008. These operating systems supported a dummy buffer field:

[out, switch_is(QueryLevel)] PNETLOGON_DUMMY1 Buffer

Buffer: A pointer to a byte buffer.

<261> Section 3.5.4.4.10: Windows NT, Windows 2000, Windows XP, Windows Server 2003, Windows Vista, and Windows Server 2008 do no processing for this call, and always return 0xC0000002 (STATUS_NOT_IMPLEMENTED).

<262> Section 3.5.4.4.11: First supported in Windows Server 2008.

<263> Section 3.5.4.4.11: The normal (writable) DC cannot be a Windows 2000 Server or a Windows Server 2003 DC.

<264> Section 3.5.4.4.11: The normal (writable) DC cannot be a Windows 2000 Server or a Windows Server 2003 DC.

<265> Section 3.5.4.4.11: STATUS_ACCESS_DENIED is returned if the read-only domain controller, ChainedFromServerName, does not have permission to replicate the secrets for the client's computer account identified by ChainedForClientName.

<266> Section 3.5.4.5.1: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<267> Section 3.5.4.5.1: Windows uses the value 0x01 as the representation of TRUE and 0x00 for FALSE.

<268> Section 3.5.4.5.1: Added in Windows Server 2008, and supported in Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview.

<269> Section 3.5.4.5.1: Added in Windows Server 2008, and supported in Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview.

<270> Section 3.5.4.5.1: For all versions of Windows except Windows NT 3.1, decrypt by using the negotiated decryption algorithm and the session key.

For Windows NT 3.1, decrypt as follows.

```
InitLMKey(KeyIn, KeyOut)
     KeyOut[0] = KeyIn[0] >> 0x01;
     KeyOut[1] = ((KeyIn[0]&0x01)<<6) | (KeyIn[1]>>2);
     KeyOut[2] = ((KeyIn[1]&0x03)<<5) | (KeyIn[2]>>3);
     KeyOut[3] = ((KeyIn[2]&0x07)<<4) | (KeyIn[3]>>4);
     KeyOut[4] = ((KeyIn[3]&0x0F)<<3) | (KeyIn[4]>>5);
```

```
     KeyOut[5] = ((KeyIn[4]&0x1F)<<2) | (KeyIn[5]>>6);
     KeyOut[6] = ((KeyIn[5]&0x3F)<<1) | (KeyIn[6]>>7);
     KeyOut[7] = KeyIn[6] & 0x7F;
     ((DWORD*)KeyOut)[0] <<= 1;
     ((DWORD*)KeyOut)[1] <<= 1;
     ((DWORD*)KeyOut)[0] &= 0xfefefefe;
     ((DWORD*)KeyOut)[1] &= 0xfefefefe;

Assume bytes(s, e, l) returns bytes from s to e of the byte
array l. Assume concat(a1, a2) returns byte array containing
the bytes of array a1 followed by the bytes from byte array a2.

LMDESECB(Input, Sk, Output)
     SET k1 to bytes(0, 7, Sk)
     CALL InitLMKey(k1, k3)
     SET k2 to bytes(8, 15, Sk)
     CALL InitLMKey(k2, k4)
     SET i1 to bytes(0, 7, Input)
     SET i2 to bytes(8, 15, Input)
     CALL DES_ECB(i1, k3, &output1)
     CALL DES_ECB(i2, k4, &output2)
     SET Output to concat(output1, output2)
```

<271> Section 3.5.4.5.1: For all versions of Windows except Windows NT 3.1, decrypt by using the negotiated decryption algorithm and the session key.

For Windows NT 3.1, decrypt as follows.

```
InitLMKey(KeyIn, KeyOut)
     KeyOut[0] = KeyIn[0] >> 0x01;
     KeyOut[1] = ((KeyIn[0]&0x01)<<6) | (KeyIn[1]>>2);
     KeyOut[2] = ((KeyIn[1]&0x03)<<5) | (KeyIn[2]>>3);
     KeyOut[3] = ((KeyIn[2]&0x07)<<4) | (KeyIn[3]>>4);
     KeyOut[4] = ((KeyIn[3]&0x0F)<<3) | (KeyIn[4]>>5);
     KeyOut[5] = ((KeyIn[4]&0x1F)<<2) | (KeyIn[5]>>6);
     KeyOut[6] = ((KeyIn[5]&0x3F)<<1) | (KeyIn[6]>>7);
     KeyOut[7] = KeyIn[6] & 0x7F;
     ((DWORD*)KeyOut)[0] <<= 1;
     ((DWORD*)KeyOut)[1] <<= 1;
     ((DWORD*)KeyOut)[0] &= 0xfefefefe;
     ((DWORD*)KeyOut)[1] &= 0xfefefefe;

Assume bytes(s, e, l) returns bytes from s to e of the byte
array l. Assume concat(a1, a2) returns byte array containing
the bytes of array a1 followed by the bytes from byte array a2.

LMDESECB(Input, Sk, Output)
     SET k1 to bytes(0, 7, Sk)
     CALL InitLMKey(k1, k3)
     SET k2 to bytes(8, 15, Sk)
     CALL InitLMKey(k2, k4)
     SET i1 to bytes(0, 7, Input)
     SET i2 to bytes(8, 15, Input)
     CALL DES ECB(i1, k3, &output1)
     CALL DES_ECB(i2, k4, &output2)
     SET Output to concat(output1, output2)
```

<272> Section 3.5.4.5.1: For all versions of Windows except Windows NT 3.1, decrypt by using the negotiated decryption algorithm and the session key.

For Windows NT 3.1, decrypt as follows.

```
InitLMKey(KeyIn, KeyOut)
     KeyOut[0] = KeyIn[0] >> 0x01;
     KeyOut[1] = ((KeyIn[0]&0x01)<<6) | (KeyIn[1]>>2);
     KeyOut[2] = ((KeyIn[1]&0x03)<<5) | (KeyIn[2]>>3);
     KeyOut[3] = ((KeyIn[2]&0x07)<<4) | (KeyIn[3]>>4);
     KeyOut[4] = ((KeyIn[3]&0x0F)<<3) | (KeyIn[4]>>5);
     KeyOut[5] = ((KeyIn[4]&0x1F)<<2) | (KeyIn[5]>>6);
     KeyOut[6] = ((KeyIn[5]&0x3F)<<1) | (KeyIn[6]>>7);
     KeyOut[7] = KeyIn[6] & 0x7F;
     ((DWORD*)KeyOut)[0] <<= 1;
     ((DWORD*)KeyOut)[1] <<= 1;
     ((DWORD*)KeyOut)[0] &= 0xfefefefe;
     ((DWORD*)KeyOut)[1] &= 0xfefefefe;

Assume bytes(s, e, l) returns bytes from s to e of the byte
array l. Assume concat(a1, a2) returns byte array containing
the bytes of array a1 followed by the bytes from byte array a2.

LMDESECB(Input, Sk, Output)
     SET k1 to bytes(0, 7, Sk)
     CALL InitLMKey(k1, k3)
     SET k2 to bytes(8, 15, Sk)
     CALL InitLMKey(k2, k4)
     SET i1 to bytes(0, 7, Input)
     SET i2 to bytes(8, 15, Input)
     CALL DES_ECB(i1, k3, &output1)
     CALL DES_ECB(i2, k4, &output2)
     SET Output to concat(output1, output2)
```

<273> Section 3.5.4.5.1: Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview support verifying whether a correct combination of LogonLevel and ValidationLevel is supplied. The data is opaque to Netlogon and MUST be passed unexamined to the package specified by the **PackageName** field of the NETLOGON_GENERIC_INFO structure. For more information, see section 3.2.4.1.

<274> Section 3.5.4.5.1: Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview support verifying whether a correct combination of LogonLevel and ValidationLevel is supplied.

<275> Section 3.5.4.5.2: Supported in Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<276> Section 3.5.4.5.2: Windows uses the value of 0x01 as the representation of TRUE and 0x00 for FALSE.

<277> Section 3.5.4.5.2: Added in Windows Vista and supported in Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<278> Section 3.5.4.5.2: Added in Windows Vista and supported in Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<279> Section 3.5.4.5.3: This method was used in Windows NT 4.0. It was superseded by the NetrLogonSamLogonWithFlags method (section 3.5.4.5.2) in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<280> Section 3.5.4.5.4: Windows NT servers support logoff updates.

<281> Section 3.5.4.6.1: The server stops including elements in the returned *DeltaArray* after the size of the returned data equals or exceeds the value of the *PreferredMaximumLength* parameter.

<282> Section 3.5.4.6.1: The server limits the number of records to approximately 1,000 records per call.

<283> Section 3.5.4.6.1: The server maintains and updates a state that indicates the client progress in the synchronization protocol, as described in section 3.6.

<284> Section 3.5.4.6.2: Windows stops including elements in the returned *DeltaArray* once the size of the returned data equals or exceeds the value of the *PreferredMaximumLength* parameter.

<285> Section 3.5.4.6.2: Windows limits the number of records to approximately 1,000 records per call.

<286> Section 3.5.4.6.3: This method was used prior to Windows NT 4.0. It was superseded by the NetrDatabaseSync2 method, as specified in section 3.5.4.6.2, in Windows NT 4.0.

<287> Section 3.5.4.7.1: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<288> Section 3.5.4.7.1:

Return Value/Code	Description
0x0000051F ERROR_NO_LOGON_SERVERS	There are currently no logon servers available to service the logon request.
0x000006FA ERROR_NO_TRUST_LSA_SECRET	The workstation does not have a trust secret.
0x000006FB ERROR_NO_TRUST_SAM_ACCOUNT	The security database on the server does not have a computer account for this workstation trust relationship.

<289> Section 3.5.4.7.2: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<290> Section 3.5.4.7.2:

Return Value/Code	Description
0x0000051F ERROR_NO_LOGON_SERVERS	There are currently no logon servers available to service the logon request.
0x000006FA ERROR_NO_TRUST_LSA_SECRET	The workstation does not have a trust secret.
0x000006FB ERROR_NO_TRUST_SAM_ACCOUNT	The security database on the server does not have a computer account for this workstation trust relationship.

<291> Section 3.5.4.7.3:

Return Value/Code	Description
0x0000051F ERROR_NO_LOGON_SERVERS	There are currently no logon servers available to service the logon request.
0x000006FA ERROR_NO_TRUST_LSA_SECRET	The workstation does not have a trust secret.
0x000006FB ERROR_NO_TRUST_SAM_ACCOUNT	The security database on the server does not have a computer account for this workstation trust relationship.

<292> Section 3.5.4.7.4: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<293> Section 3.5.4.7.5: Supported in Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<294> Section 3.5.4.7.5:

Return Value/Code	Description
0x00000001 ERROR_INVALID_FUNCTION	Incorrect function.

<295> Section 3.5.4.7.5: If the *TrustedDomainName* parameter is specified, the server calls the NetrGetForestTrustInformation method on a DC in the domain specified by the parameter.

<296> Section 3.5.4.7.6: Supported in Windows XP and Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<297> Section 3.5.4.8.1: Supported in Windows 2000, Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<298> Section 3.5.4.8.1: Windows NT, Windows 2000, Windows XP, and Windows Server 2003 allow the call to succeed. Other versions of Windows will return ERROR_ACCESS_DENIED if not local.

<299> Section 3.5.4.8.2: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<300> Section 3.5.4.8.2: When the previous password is not present, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2016 Technical Preview use an uninitialized value to compute the *OldMessageDigest* parameter.

<301> Section 3.5.4.8.3: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows

Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<302> Section 3.5.4.8.4: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<303> Section 3.5.4.8.5: Not supported in Windows NT.

<304> Section 3.5.4.8.5: This flag was added in Windows 7.

<305> Section 3.5.4.8.5: This flag was added in Windows 7.

<306> Section 3.5.4.8.5: Windows NT, Windows 2000, Windows XP, and Windows Server 2003 allow the call to succeed. Other versions of Windows will return ERROR_ACCESS_DENIED if not local.

<307> Section 3.5.4.8.6: Supported in Windows 2000 Server, Windows XP, Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview.

<308> Section 3.5.4.8.6: The Netlogon client ignores this value if *ServerName* is not a domain controller.

<309> Section 3.5.4.8.6: Windows NT, Windows 2000, Windows XP, and Windows Server 2003 allow the call to succeed. Other versions of Windows will return ERROR_ACCESS_DENIED if not local.

<310> Section 3.5.4.9.1: The following restrictions apply to the values of the *FunctionCode* parameter in Windows NT 4.0, Windows 2000, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, and Windows Server 2016 Technical Preview. There are no restrictions in Windows Server 2003, Windows Vista, and Windows Server 2008.

The following values are not supported on Windows NT 4.0:

- NETLOGON_CONTROL_CHANGE_PASSWORD (0x00000009)
- NETLOGON_CONTROL_TC_VERIFY (0x0000000A)
- NETLOGON_CONTROL_FORCE_DNS_REG (0x0000000B)
- NETLOGON_CONTROL_QUERY_DNS_REG (0x0000000C)
- NETLOGON_CONTROL_BACKUP_CHANGE_LOG (0x0000FFFC)
- NETLOGON_CONTROL_TRUNCATE_LOG (0x0000FFFD)
- NETLOGON_CONTROL_SET_DBFLAG (0x0000FFFE)
- NETLOGON_CONTROL_BREAKPOINT (0x0000FFFF)

The error ERROR_NOT_SUPPORTED is returned if one of these values is used.

The following values are not supported on Windows 2000 Server:

- NETLOGON_CONTROL_TC_VERIFY (0x0000000A)
- NETLOGON_CONTROL_FORCE_DNS_REG (0x0000000B)
- NETLOGON_CONTROL_QUERY_DNS_REG (0x0000000C)

The error ERROR_NOT_SUPPORTED is returned if one of these values is used.

The following values are not supported on Windows 7 or Windows Server 2008 R2:

- NETLOGON_CONTROL_REPLICATE (0x00000002)
- NETLOGON_CONTROL_SYNCHRONIZE (0x00000003)
- NETLOGON_CONTROL_PDC_REPLICATE (0x00000004)
- NETLOGON_CONTROL_BACKUP_CHANGE_LOG (0x0000FFFC)

The error ERROR_NOT_SUPPORTED is returned if one of these values is used.

<311> Section 3.5.4.9.1: Only supported on servers that are Windows NT 4.0 BDCs; otherwise, the ERROR_NOT_SUPPORTED error is returned from a server that is not a Windows NT 4.0 BDC.

<312> Section 3.5.4.9.1: Only supported on servers that are Windows NT 4.0 BDCs; otherwise, the ERROR_NOT_SUPPORTED error is returned from a server that is not a Windows NT 4.0 BDC.

<313> Section 3.5.4.9.1: Windows NT, Windows XP, Windows Server 2003, Windows Vista, and Windows Server 2008 support NETLOGON_CONTROL_PDC_REPLICATE (0x00000004).

<314> Section 3.5.4.9.1: The server is a Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, or Windows Server 2016 Technical Preview DC; otherwise, the ERROR_NOT_SUPPORTED error is returned.

<315> Section 3.5.4.9.1: The server is a Windows Server 2003, Windows Vista, Windows Server 2008, Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, or Windows Server 2016 Technical Preview DC; otherwise, the ERROR_NOT_SUPPORTED error is returned. The server implementation decides how the DNS update status is recorded.

<316> Section 3.5.4.9.1: In Windows, the server copies to a backup file the contents of a file that contains a cache of database changes.

<317> Section 3.5.4.9.1: In Windows, the server truncates the contents of a debug file that contains debugging information about the Netlogon service operations.

<318> Section 3.5.4.9.1: In Windows, the server sets the level of verbosity of output into the debug file that contains debugging information about the Netlogon service operations. The level of verbosity to set is specified in the **DebugFlag** field of the *Data* parameter.

<319> Section 3.5.4.9.1: In Windows, if the NetrLogonControl2Ex method is called with the function code NETLOGON_CONTROL_BREAKPOINT and the operating system is not a checked build, the method returns ERROR_NOT_SUPPORTED.

<320> Section 3.5.4.9.1: In Windows, the server breaks into the debugger if it is attached to the computer that supports debugging.

<321> Section 3.5.4.9.1: Not supported in Windows NT

<322> Section 3.5.4.9.1: Windows NT 4.0 BDCs force an immediate partial synchronization of all databases.

<323> Section 3.5.4.9.1: Windows NT 4.0 BDCs force an immediate full synchronization of all databases.

<324> Section 3.5.4.9.1: Windows NT 4.0 PDCs immediately send announcement messages to request each BDC to replicate the database.

<325> Section 3.5.4.9.1: Windows NT and Windows 2000 DCs MUST return ERROR_NOT_SUPPORTED.

<326> Section 3.5.4.9.1: Windows NT and Windows 2000 DCs MUST return ERROR_NOT_SUPPORTED.

<327> Section 3.5.4.9.1: Windows NT, Windows XP, and Windows Server 2003 support *FunctionCode* NETLOGON_CONTROL_PDC_REPLICATE (0x00000004).

<328> Section 3.5.4.9.3: The *FunctionCode* parameter is restricted to the following values:

Windows NT 4.0:

- NETLOGON_CONTROL_QUERY (0x00000001)
- NETLOGON_CONTROL_REPLICATE (0x00000002)
- NETLOGON_CONTROL_SYNCHRONIZE (0x00000003)
- NETLOGON_CONTROL_PDC_REPLICATE (0x00000004)

If any other value is used, the error code ERROR_NOT_SUPPORTED is returned.

Windows 2000, Windows XP, Windows Server 2003, Windows Vista, and Windows Server 2008:

- NETLOGON_CONTROL_QUERY (0x00000001)
- NETLOGON_CONTROL_REPLICATE (0x00000002)
- NETLOGON_CONTROL_SYNCHRONIZE (0x00000003)
- NETLOGON_CONTROL_PDC_REPLICATE (0x00000004)
- NETLOGON_CONTROL_BACKUP_CHANGE_LOG (0x0000FFFC)
- NETLOGON_CONTROL_TRUNCATE_LOG (0x0000FFFD)
- NETLOGON_CONTROL_BREAKPOINT (0x0000FFFF)

If any other value is used, the error code ERROR_NOT_SUPPORTED is returned.

Windows 7, Windows Server 2008 R2, Windows 8, Windows Server 2012, Windows 8.1, Windows Server 2012 R2, Windows 10, or Windows Server 2016 Technical Preview:

- NETLOGON_CONTROL_QUERY (0x00000001)
- NETLOGON_CONTROL_TRUNCATE_LOG (0x0000FFFD)
- NETLOGON_CONTROL_BREAKPOINT (0x0000FFFF)

If any other value is used, the error code ERROR_NOT_SUPPORTED is returned.

<329> Section 3.5.4.10.1: The Netlogon server implementation of this method is present in all versions of Windows covered by this document. The Netlogon client implementations in all versions of Windows covered by this document ignore this method.

<330> Section 3.5.4.10.2: The Netlogon server implementation of this method is present in all versions of Windows covered by this document. The Netlogon client implementations in all versions of Windows covered by this document ignore this method.

<331> Section 3.5.4.10.3: The Netlogon server returns STATUS_NOT_IMPLEMENTED.

<332> Section 3.5.4.10.4: The Netlogon server returns STATUS_NOT_IMPLEMENTED.

<333> Section 3.6.2: The default time-out is 5 minutes. The time-out may be configured between 1 minute and 2 days, inclusive.

<334> Section 3.6.4.1: To indicate such local condition, the PDC returns a value of 0xC0000134 as the return value of the NetrDatabaseDeltas call. For example, the PDC maintains partial database state cached in memory that the PDC may use for processing partial synchronization requests. If the cached information is not available (for example if the cache gets flushed), the PDC returns the error code 0xC0000134.

<335> Section 3.6.5.1: The announcement can be forced if this is a new BDC configured in the domain.

<336> Section 3.6.5.1: A separate timer is used on the PDC to time out announcements sent to the BDCs. A BDC is deemed as processing the announcement request until it finishes the processing by completing a synchronization request as described below. During that time, no additional announcements are sent to the BDC. If a BDC doesn't respond with a synchronization request within the time-out period as set by the timer, the announcement is deemed as timed out.

<337> Section 3.6.5.1: The PDC sends messages only if the current value of AbstractPulseConcurrency is less than a certain value defined as a configuration setting.

<338> Section 3.6.5.2.2: The BDC performs a full synchronization on receiving any error code other than STATUS_SUCCESS or STATUS_ACCESS_DENIED.

<339> Section 3.6.6: In all of the above scenarios, Netlogon performs a full database synchronization.

8 Change Tracking

This section identifies changes that were made to this document since the last release. Changes are classified as New, Major, Minor, Editorial, or No change.

The revision class **New** means that a new document is being released.

The revision class **Major** means that the technical content in the document was significantly revised. Major changes affect protocol interoperability or implementation. Examples of major changes are:

- A document revision that incorporates changes to interoperability requirements or functionality.
- The removal of a document from the documentation set.

The revision class **Minor** means that the meaning of the technical content was clarified. Minor changes do not affect protocol interoperability or implementation. Examples of minor changes are updates to clarify ambiguity at the sentence, paragraph, or table level.

The revision class **Editorial** means that the formatting in the technical content was changed. Editorial changes apply to grammatical, formatting, and style issues.

The revision class **No change** means that no new technical changes were introduced. Minor editorial and formatting changes may have been made, but the technical content of the document is identical to the last released version.

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

- New content added.
- Content updated.
- Content removed.
- New product behavior note added.
- Product behavior note updated.
- Product behavior note removed.
- New protocol syntax added.
- Protocol syntax updated.
- Protocol syntax removed.
- New content added due to protocol revision.
- Content updated due to protocol revision.
- Content removed due to protocol revision.
- New protocol syntax added due to protocol revision.
- Protocol syntax updated due to protocol revision.
- Protocol syntax removed due to protocol revision.
- Obsolete document removed.

Editorial changes are always classified with the change type **Editorially updated**.

Some important terms used in the change type descriptions are defined as follows:

- **Protocol syntax** refers to data elements (such as packets, structures, enumerations, and methods) as well as interfaces.
- **Protocol revision** refers to changes made to a protocol that affect the bits that are sent over the wire.

The changes made to this document are listed in the following table. For more information, please contact dochelp@microsoft.com.

Section	Tracking number (if applicable) and description	Major change (Y or N)	Change type
2.2.1.2.1 DOMAIN_CONTROLLER_INFOW	Updated content for Windows 10 and Windows Server 2016 Technical Preview operating systems.	Y	Content update.
2.2.1.2.1 DOMAIN_CONTROLLER_INFOW	72365 : Revised bit layout (bits 15 and 16) for the Flags field, and added description for bit 16 - DS_BEHAVIOR_WIN2012R2 .	Y	Content update.
2.2.1.3.7 NL_TRUST_PASSWORD	69504 : Updated the random data size in the diagram illustrating the domain trust password buffer format.	Y	Content update.
2.2.1.3.15 NL_OSVERSIONINFO_V1	69505 : Updated wProductType values.	N	Content update.
2.2.1.3.15 NL_OSVERSIONINFO_V1	Updated content for Windows 10 and Windows Server 2016 Technical Preview operating systems.	Y	Content update.
3.5.4.3.1 DsrGetDcNameEx2 (Opnum 34)	72365 : Updated return values for the Flags parameter.	N	Content update.
3.5.4.3.1 DsrGetDcNameEx2 (Opnum 34)	Updated content for Windows 10 and Windows Server 2016 Technical Preview.	Y	Content update.
3.5.4.4.9 NetrLogonGetDomainInfo (Opnum 29)	71069 : Added text to describe how the SupportedEncTypes field of the of the NETLOGON_DOMAIN_INFO structure is used.	Y	Content update.
7 Appendix B: Product Behavior	Updated the product applicability list and product behavior notes to include Windows 10 operating system.	Y	Content update.
7 Appendix B: Product Behavior	Updated the product behavior notes to include Windows Server 2016 Technical Preview operating system.	Y	Product behavior note updated.

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