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

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Revision Summary

Date	Revision History	Revision Class	Comments

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binary large object (BLOB)
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Distributed File System (DFS) client target failover
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site
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DFS namespace name: **DFS path** **DFS path**

DFS server: **DFS** **DFS referral**
DFS

DFS target: **DFS root target** **DFS link target**

host name:

share name: **share**

site cost:
sites
site

target set: **DFS referral** **DFS**
targets **DFS targets**
DFS targets **site** **DFS client**
DFS targets **DFS target**
DFS targets **site cost** **DFS client's**
DFS targets

MAY, SHOULD, MUST, SHOULD NOT, MUST NOT:

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name **DFS**

Server Message Block (SMB)

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namespaces

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DFS namespaces

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-
-
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Parameter	Value	Reference
OptionalSupport		
Flags2		

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host name

domain name
DFS namespace name

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-

-

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-

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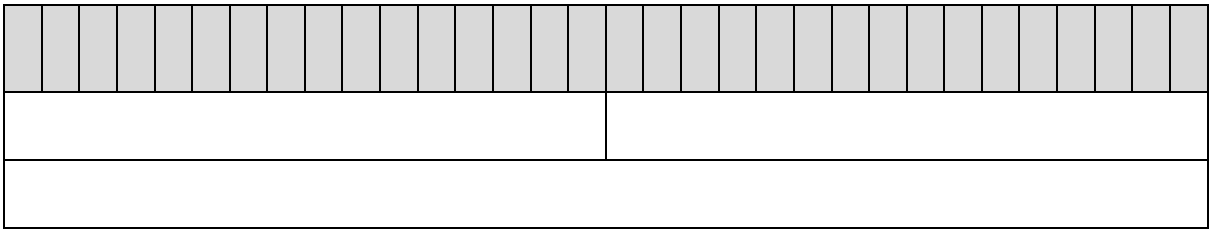
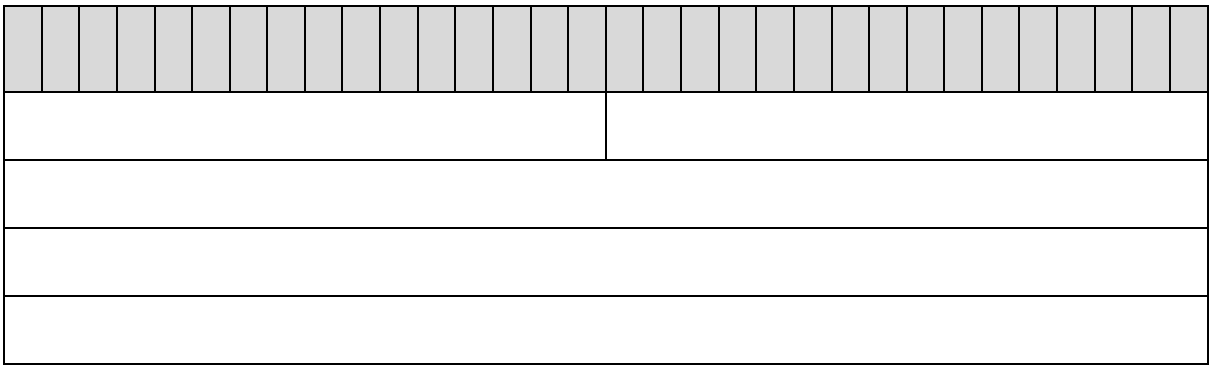
2.2.2 REQ_GET_DFS_REFERRAL



MaxReferralLevel (2 bytes):

RequestFileName (variable): **Unicode**

2.2.3 REQ_GET_DFS_REFERRAL_EX



MaxReferralLevel (2 bytes):

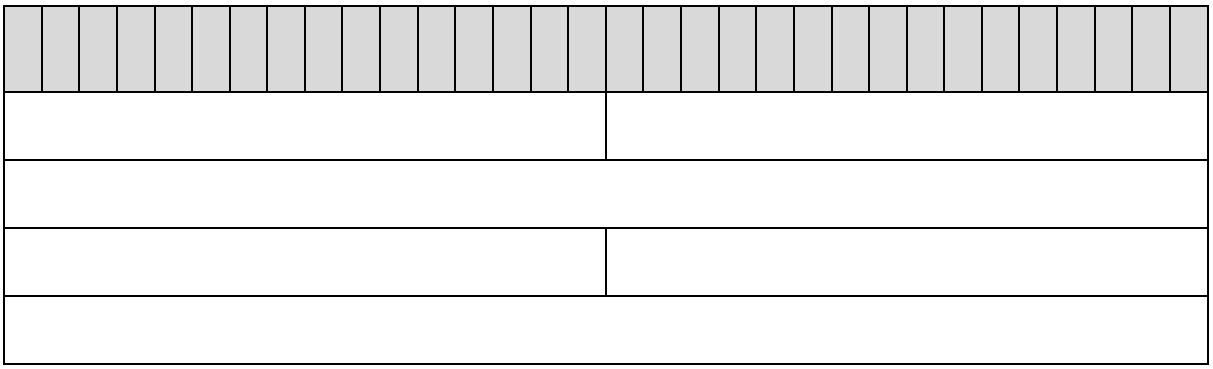
RequestFlags (2 bytes):

Value	Meaning

RequestDataLength (4 bytes): **RequestData**

RequestData (variable):

2.2.3.1 RequestData



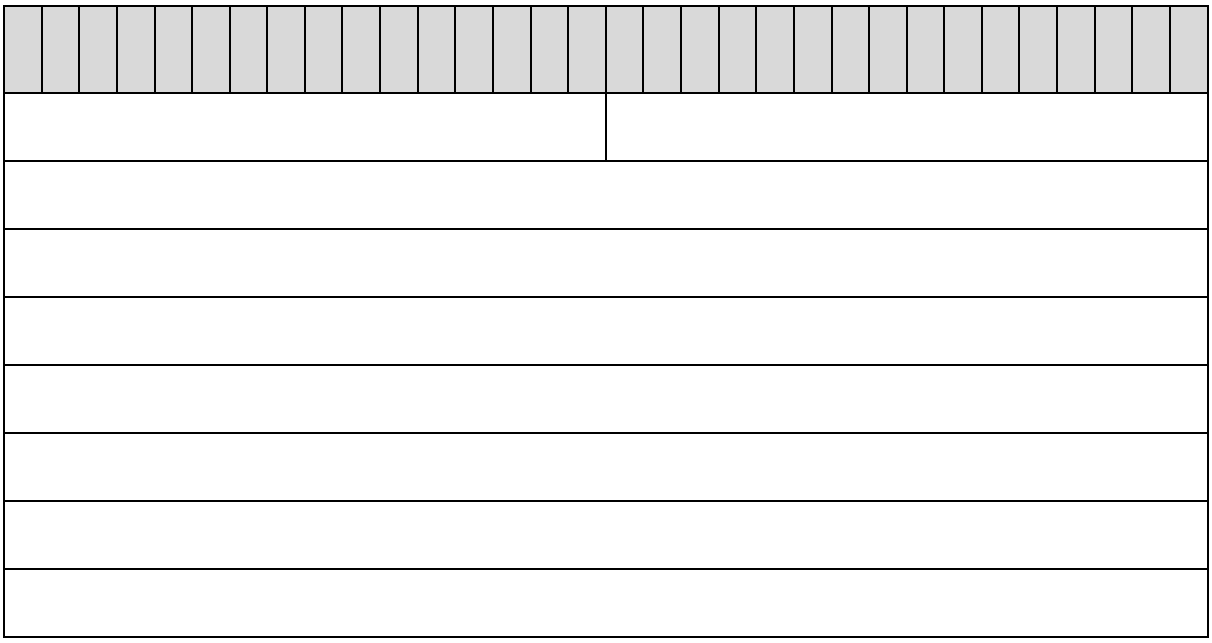
RequestFileNameLength (2 bytes):

RequestFileName (variable):

SiteNameLength (2 bytes):

SiteName (variable):

2.2.4 RESP_GET_DFS_REFERRAL



PathConsumed (2 bytes):

NumberOfReferrals (2 bytes):

ReferralHeaderFlags (4 bytes):

Value	Meaning

Value	Meaning
	DFS client target failback

ReferralEntries (variable):

NumberOfReferrals

StringBuffer (variable):

Padding (variable):

2.2.5 Referral Entry Types

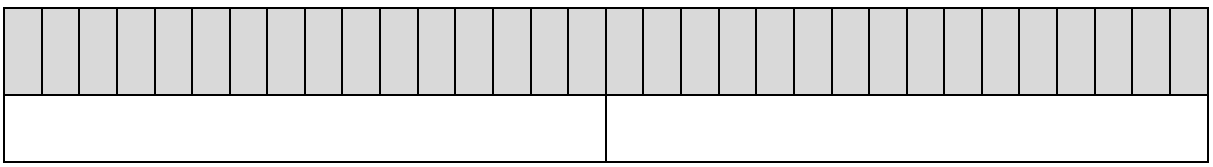
VersionNumber **VersionNumber**

VersionNumber

N *N*
N *N*
N

Size **Size**
Size

2.2.5.1 DFS_REFERRAL_V1



VersionNumber (2 bytes):

Size (2 bytes):

ServerType (2 bytes):

Value	Meaning

ReferralEntryFlags (2 bytes):

ShareName (variable):

2.2.5.2 DFS_REFERRAL_V2

VersionNumber (2 bytes):

Size (2 bytes):

ServerType (2 bytes):

Value	Meaning

ReferralEntryFlags (2 bytes):

Proximity (4 bytes):

TimeToLive (4 bytes):

DFSPathOffset (2 bytes):

DFSAlternatePathOffset (2 bytes):

NetworkAddressOffset (2 bytes):

2.2.5.3 DFS_REFERRAL_V3

ReferralEntryFlags

VersionNumber (2 bytes):

Size (2 bytes):

ServerType (2 bytes):

Value	Meaning

ReferralEntryFlags (2 bytes):

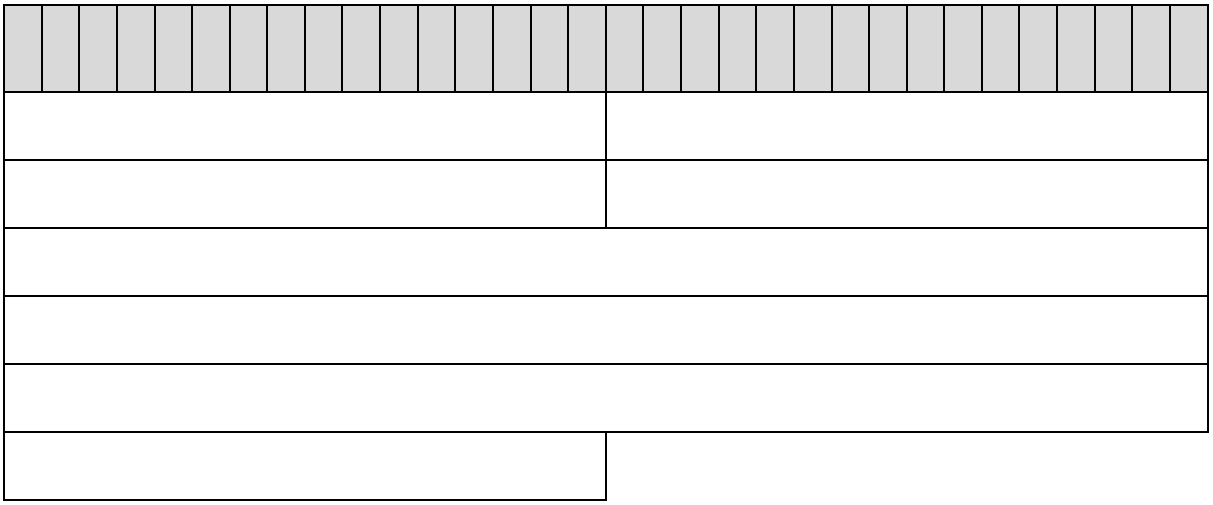
Value	Meaning

TimeToLive (4 bytes):

ReferralEntryFlags

2.2.5.3.1 NameListReferral Flag Set to 0

ReferralEntryFlags



DFSPathOffset (2 bytes):

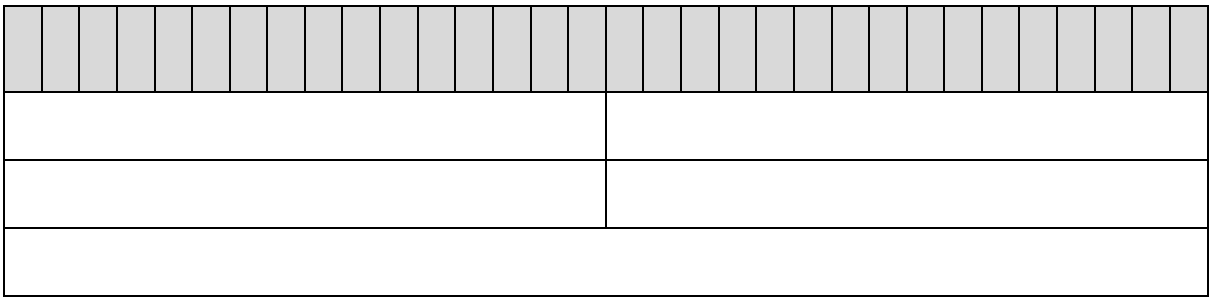
DFSAlternatePathOffset (2 bytes):

NetworkAddressOffset (2 bytes):

ServiceSiteGuid (16 bytes):

2.2.5.3.2 NameListReferral Flag Set to 1

ReferralEntryFlags



SpecialNameOffset (2 bytes):

NumberOfExpandedNames (2 bytes):

ExpandedNameOffset (2 bytes):

Padding (variable):

2.2.5.4 DFS_REFERRAL_V4

VersionNumber

ReferralEntryFlags

Value	Meaning
	target set

ReferralEntryFlags

3 Protocol Details

3.1 DFS Client Details

3.1.1 Abstract Data Model

- **BootstrapDC:**
- **DomainCache:**
- **ReferralCache:**

DFSPathOffset

ServerType

TimeToLive

TimeToLive

NetworkAddressOffset

3.1.2 Timers

BootstrapDCTimer:

3.1.3 Initialization

3.1.4 Higher-Layer Triggered Events

3.1.4.1 User/Application Initiated I/O Operation on a UNC Path

-
- **Path**
- **UserCredentials**
- **MaxOutputSize**

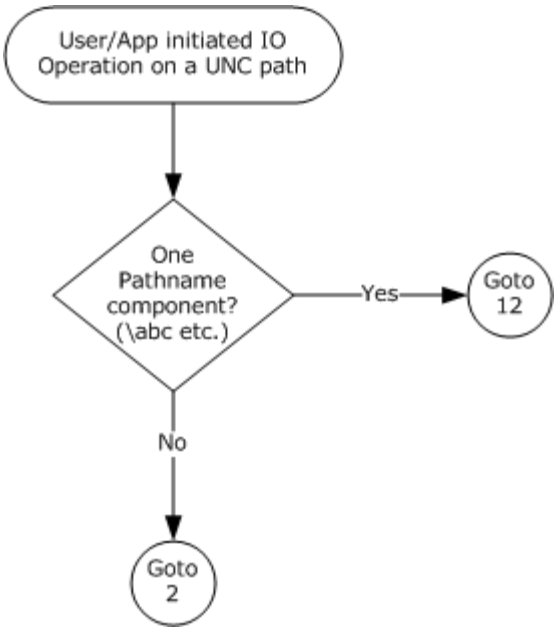


Figure 1: DFS path resolution – initial steps

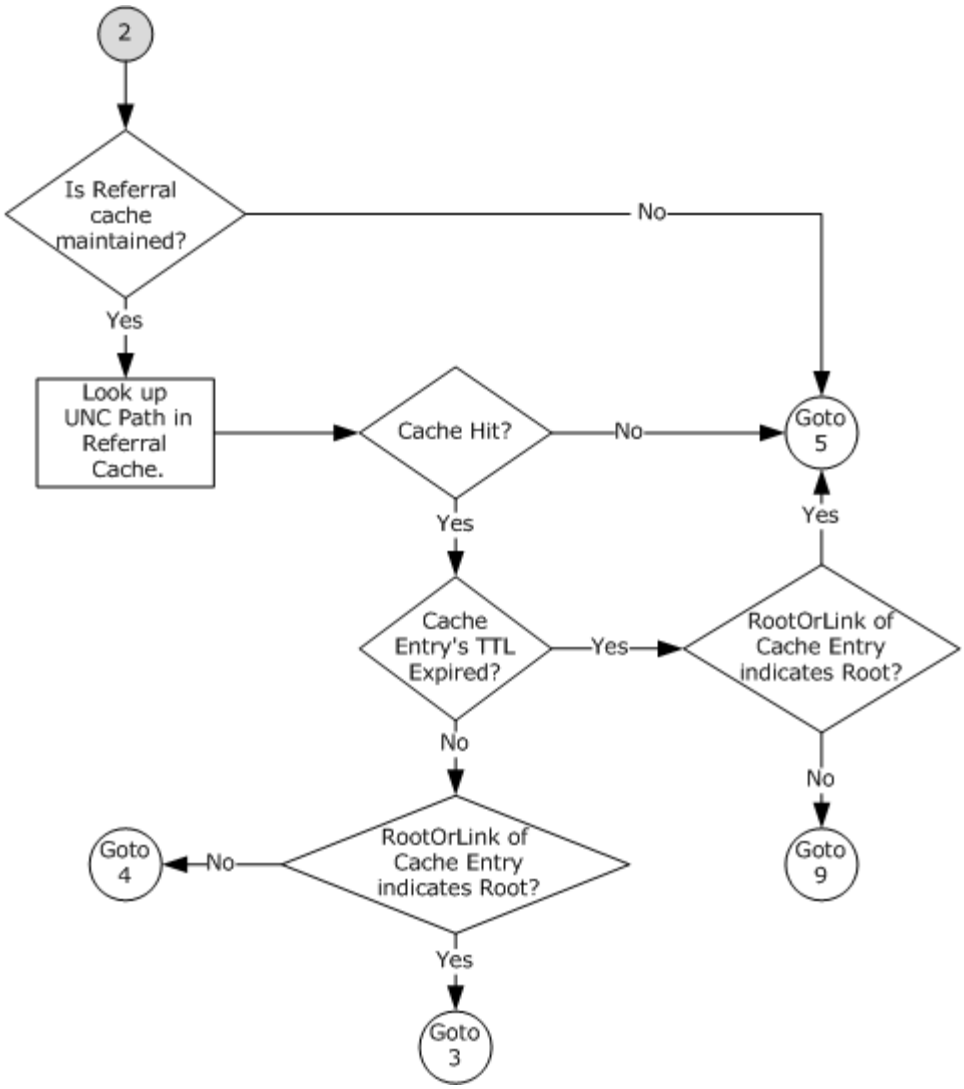


Figure 2: DFS path resolution – connection 2

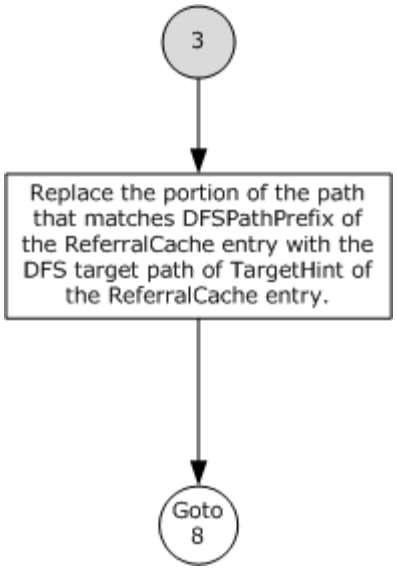


Figure 3: DFS path resolution - connection 3

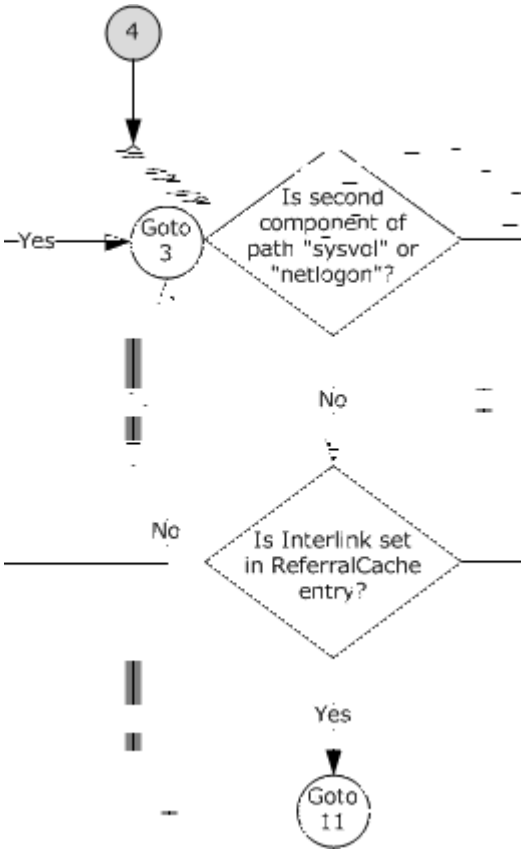


Figure 4: DFS path resolution - connection 4

Figure 5: DFS path resolution - connection 5

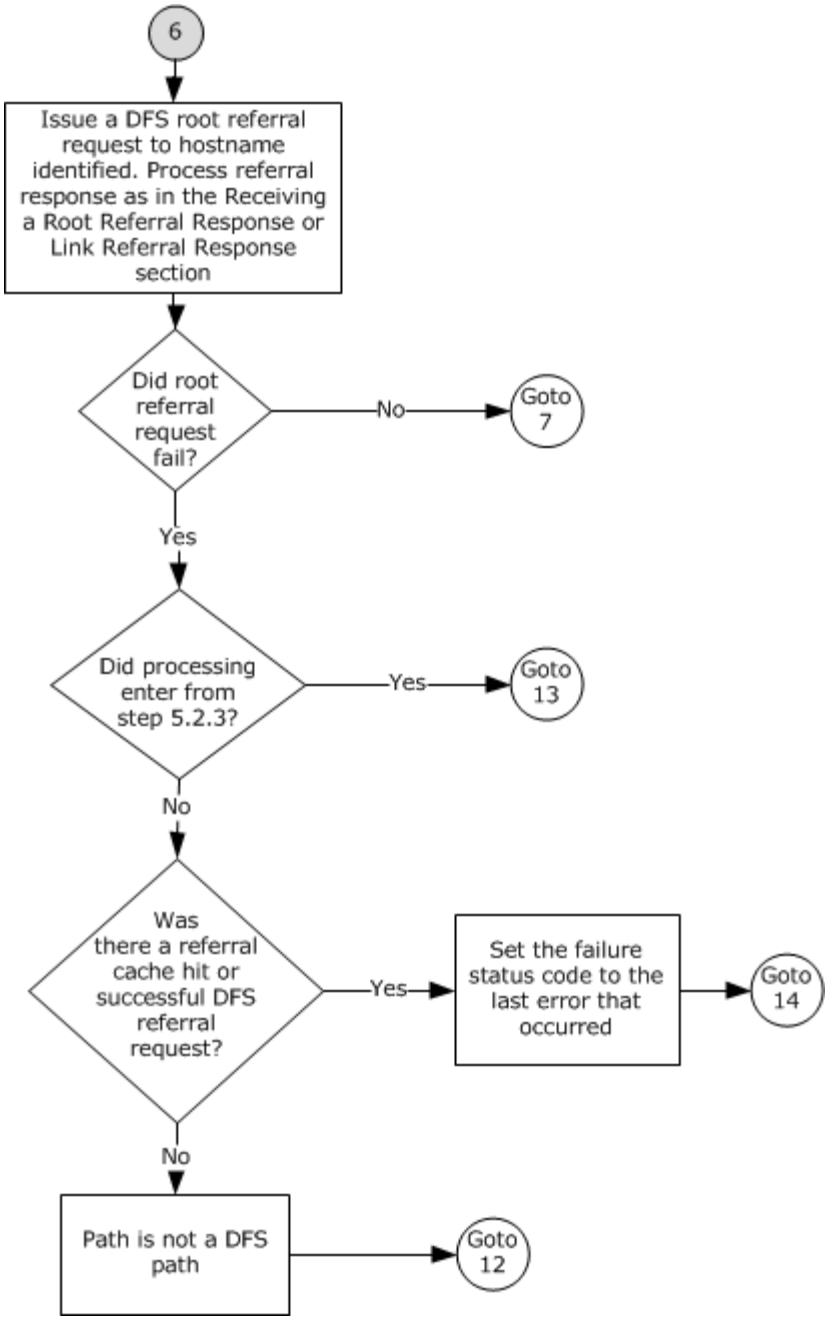


Figure 6: DFS path resolution - connection 6

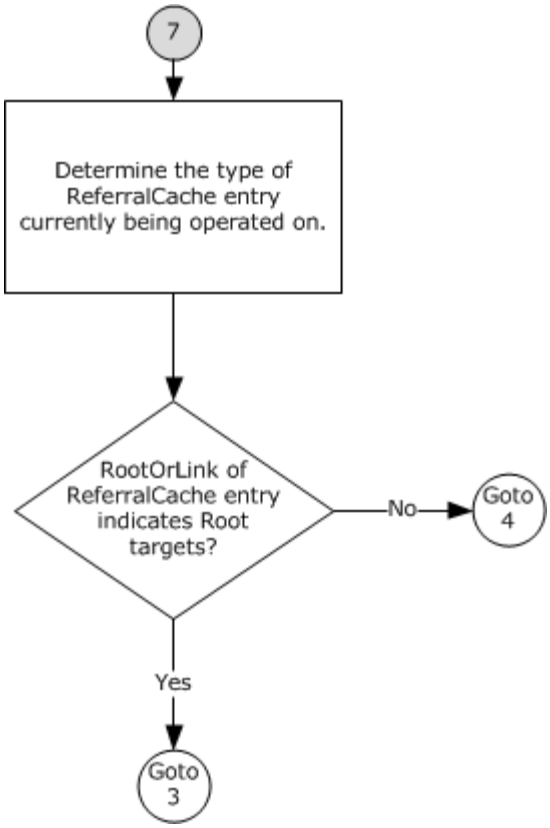


Figure 7: DFS path resolution - connection 7

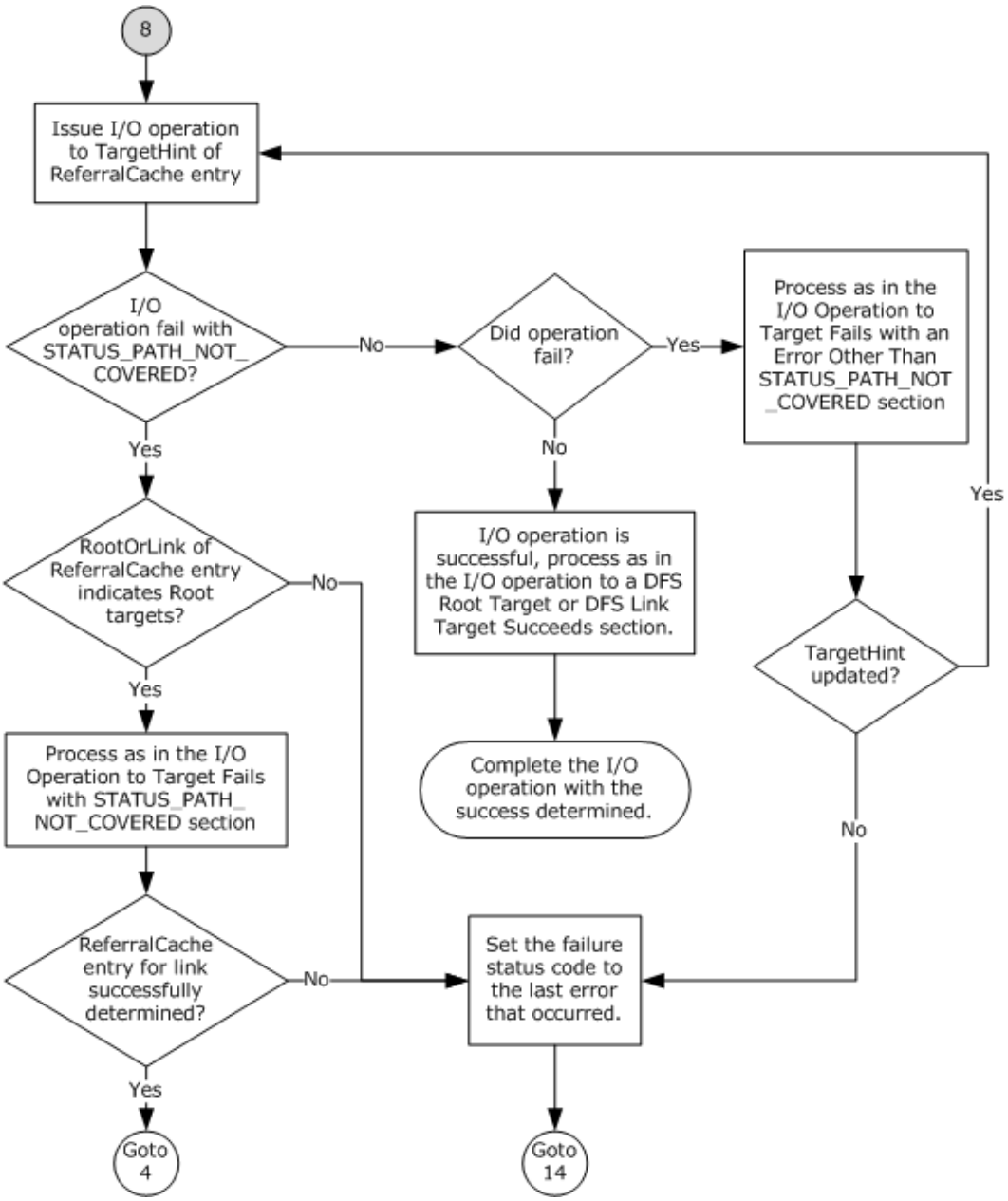


Figure 8: DFS path resolution - connection 8

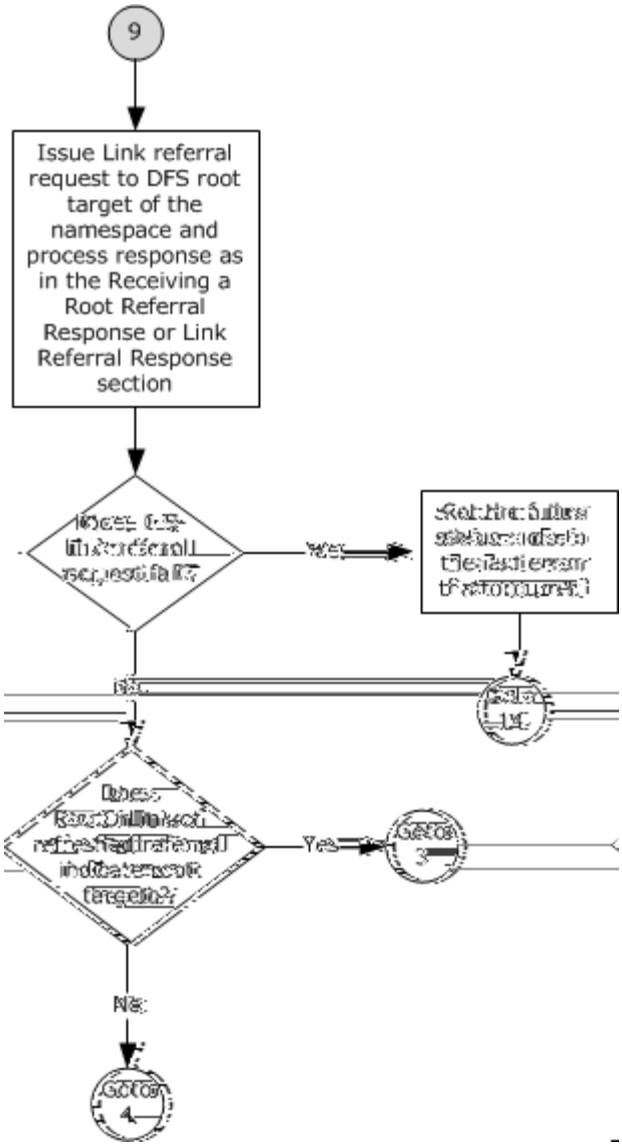


Figure 9: DFS path resolution - connection 9

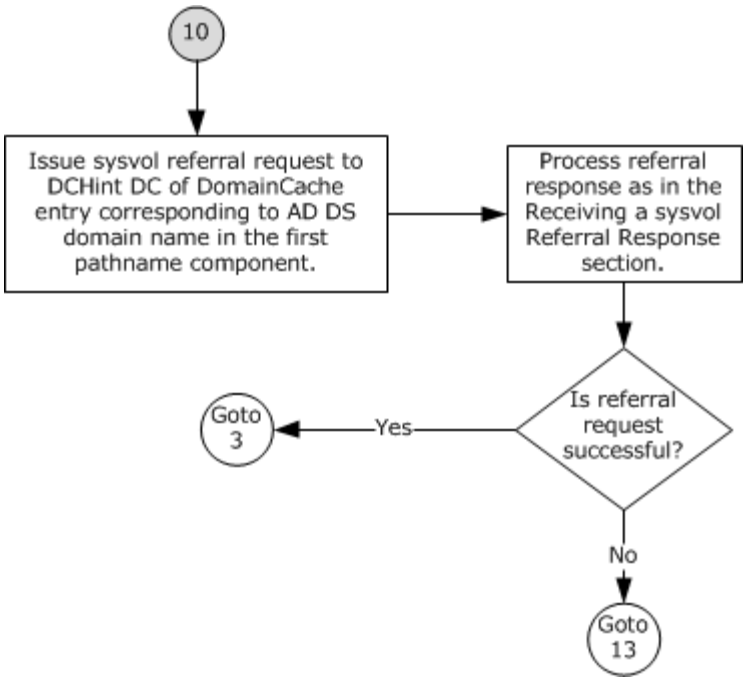


Figure 10: DFS path resolution - connection 10

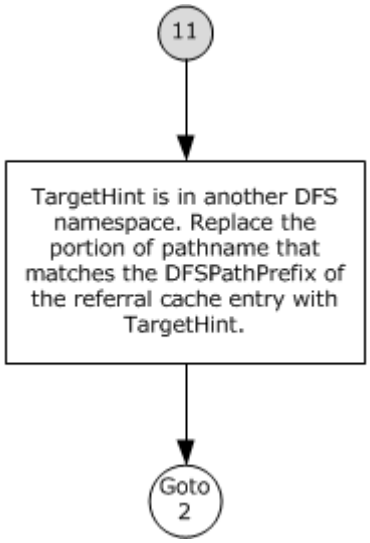


Figure 11: DFS path resolution - connection 11

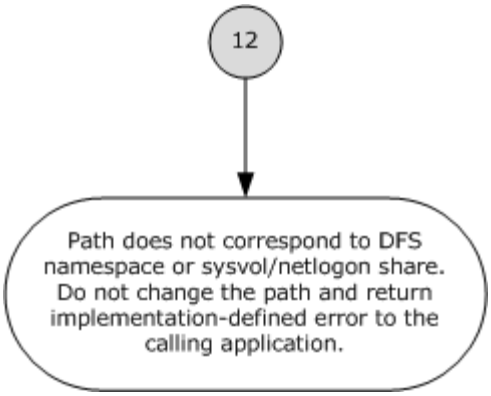


Figure 12: DFS path resolution - connection 12

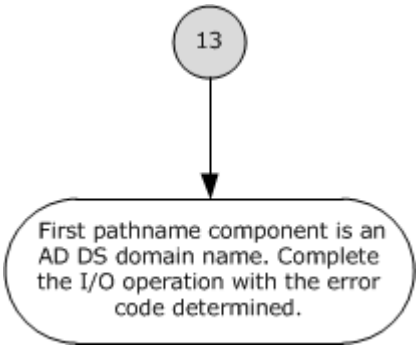


Figure 13: DFS path resolution - connection 13

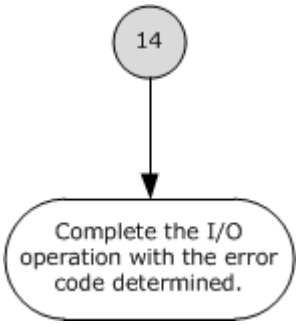


Figure 14: DFS path resolution - connection 14

-
-

-
-

BootstrapDC **UserCredentials** **MaxOutputSizeff** **Path**

UserCredentials **MaxOutputSize** **Path**

-
-
-

TargetHint **UserCredentials**
MaxOutputSize **Pathf**

UserCredentials **MaxOutputSize** **Path**

3.1.4.2 Sending a DFS Referral Request to the Server

- **Type**
- **HostName**
- **UserCredentials**
- **MaxOutputSize**
- **Path**

HostName **UserCredentials** **ClientGenericContext**

REQ_GET_DFS_REFERRAL_EX

-
-
- **Path**
-

REQ_GET_DFS_REFERRAL

-

- **Path**

REQ_GET_DFS_REFERRAL_EX **REQ_GET_DFS_REFERRAL**

Type	RequestFileName	MaxReferralLevel

3.1.5 Message Processing Events and Sequencing Rules

3.1.5.1 I/O Operation to Target Fails with STATUS_PATH_NOT_COVERED

UserCredentials **MaxOutputSize** **Path**

SpecialNameOffset

3.1.5.4.2 Receiving a DC Referral Response

NumberOfReferrals

ReferralEntryFlags

NumberOfExpandedNames

NumberOfExpandedNames

ExpandedNameOffset

ExpandedNameOffset

SpecialNameOffset

3.1.5.4.3 Receiving a Root Referral Response or Link Referral Response

NumberOfReferrals

-

-

-

ServerType

NetworkAddressOffset

DFSPathOffset

ServerType

-
  -
  -
-
-
-
-

3.1.5.4.4 Receiving a sysvol Referral Response

3.1.5.4.5 Determining Whether a Referral Response is an Interlink

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-

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BootstrapDCTimer:

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DFSNamespaceList:

DFSMetadataCache:

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-
-

3.2.1.2 Algorithm for sorting target sites in referral response based on site cost

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-
-

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3.2.3 Initialization

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-

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-

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IpAddress

Buffer

IsExtendedReferral

MaxOutputResponse

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MaxReferralLevel

-

-

Padding

3.2.5.2 Receiving a Domain Referral Request

3.2.5.3 Receiving a DC Referral Request

3.2.5.4 Receiving a sysvol Referral Request

3.2.5.5 Receiving a Root Referral Request or Link Referral Request

-
-

□ □ **Prefix** **ShortPrefix**

- **ReferralTTL**

□ □ □

-
- **Type**

-

□ □ □

- **NameSpaceElement.Properties**

-
  -
  -
  -
-
-
-
-
-

- **PathConsumed**

  PathConsumed

PathConsumed

- **NumberOfReferrals**
-
-
-
- **TargetFailback**

  TargetFailback

  TargetFailback
-
- **VersionNumber**

  MaxReferralLevel
- **Size** **Size**

  Size
- **ServerType**

  ServerType
- **NameListReferral**
-
- **TimeToLive**

  TimeToLive
-
  - **DFSPathOffset**

-
  - **DFSPathOffset**
  - **DFSAlternatePathOffset**

    DFSPathOffset **8.3 name** **DFSPathOffset**
- **NetworkAddressOffset**
-

3.2.6 Timer Events

3.2.7 Other Local Events

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3.3.1 Abstract Data Model

SelfFirst

3.3.2 Timers

3.3.3 Initialization

SelfFirst

3.3.4 Higher-Layer Triggered Events

3.3.5 Message Processing Events and Sequencing Rules

3.3.5.1 Receiving a DFS Referral Request

3.3.5.2 Receiving a Domain Referral Request

-
-
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-
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-
-

- **PathConsumed**

- **NumberOfReferrals**

- **ReferralServers** **StorageServers**

- **VersionNumber**
- **Size**
  Size

  Size
- **NameListReferral** **ReferralEntryFlags**
- **TimeToLive**
  TimeToLive
- **SpecialNameOffset**

- **ExpandedNameOffset**
-

3.3.5.3 Receiving a DC Referral Request

-
-

- **PathConsumed**
- **NumberOfReferrals**
-
- **VersionNumber**
- **Size**
  Size
- **NameListReferral** **ReferralEntryFlags**
- **TimeToLive**
  TimeToLive
- **SpecialNameOffset**
- **NumberOfExpandedNames**
- **ExpandedNameOffset**
-
-
-

SelfFirst

3.3.5.4 Receiving a sysvol Referral Request

-
-
-
-
-
-
-
-
-
-

SelfFirst

- **PathConsumed**
- **NumberOfReferrals**

- **MaxReferralLevel** **ReferralServers** **StorageServers** **ReferralServers** **StorageServers**
- **TargetFailback** **TargetFailback**
-
- **VersionNumber** **MaxReferralLevel**
- **Size** **Size** **Size**
- **NameListReferral**
- **TargetSetBoundary**
- **TimeToLive** **TimeToLive**
- **DFSPathOffset**
- **DFSAlternatePathOffset** **DFSPathOffset** **DFSPathOffset**
- **NetworkAddressOffset**
-

3.3.5.5 Receiving a Root Referral Request or Link Referral Request

3.3.6 Timer Events

3.3.7 Other Local Events

4 Protocol Examples

4.1 Domain Referral

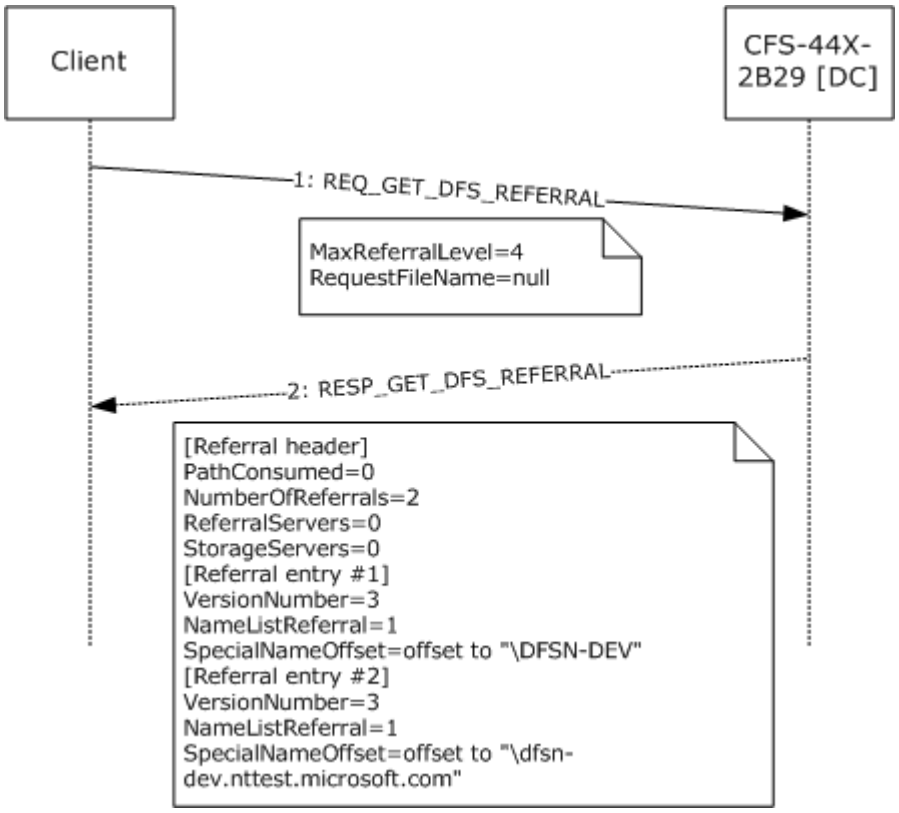

Figure 15: Domain referral sequence

MaxReferralLevel

VersionNumber

SpecialNameOffset

4.2 DC Referral

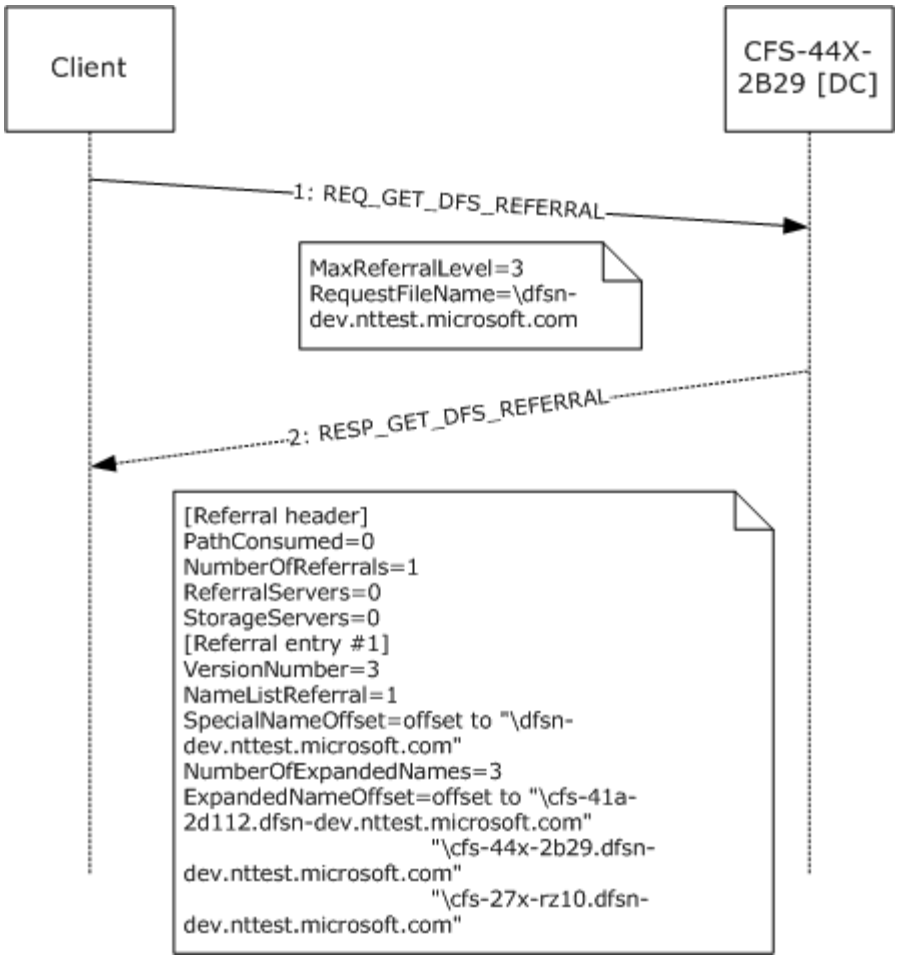

Figure 16: Domain controller referral

MaxReferralLevel

VersionNumber

SpecialNameOffset

NumberOfExpandedNames

ExpandedNameOffset

4.3 Domain-Based DFS Root Referral

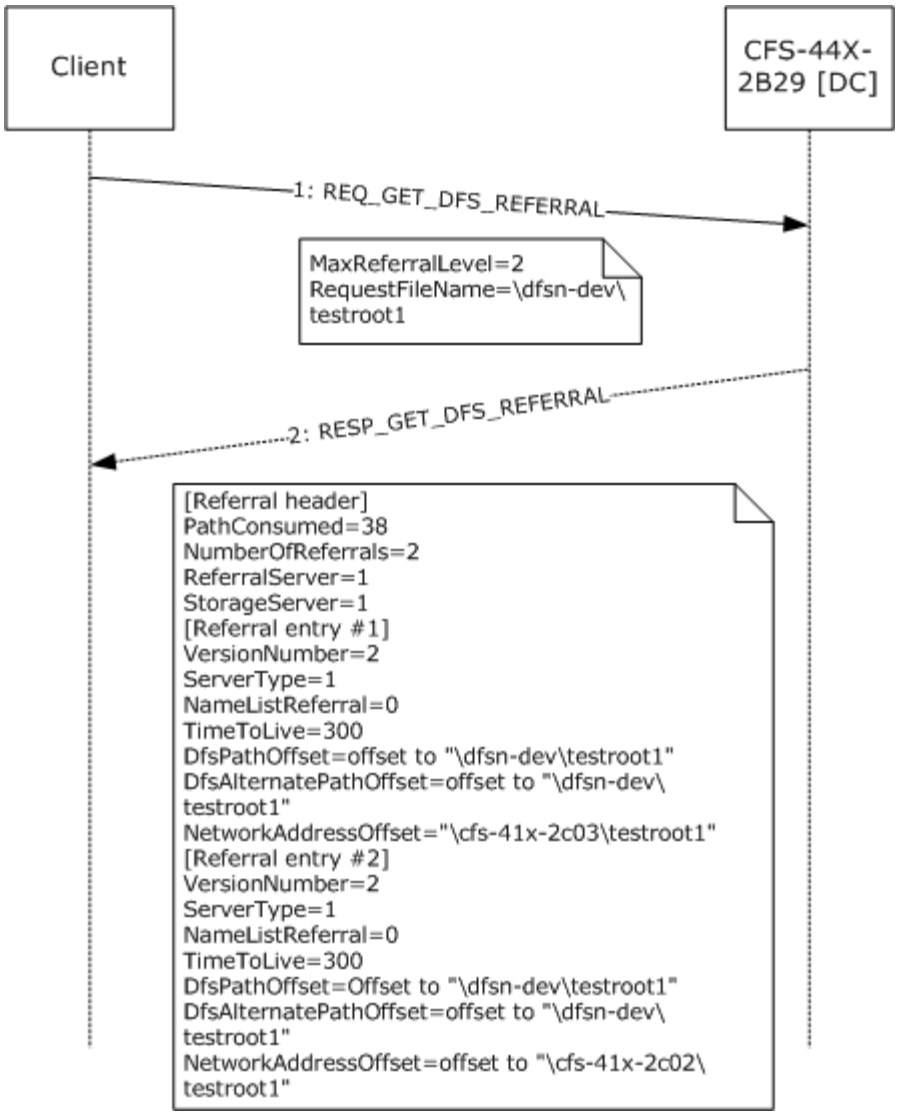

Figure 17: Domain-based DFS root referral

MaxReferralLevel

ServerType

NetworkAddressOffset

4.4 Domain-Based DFS Link Referral

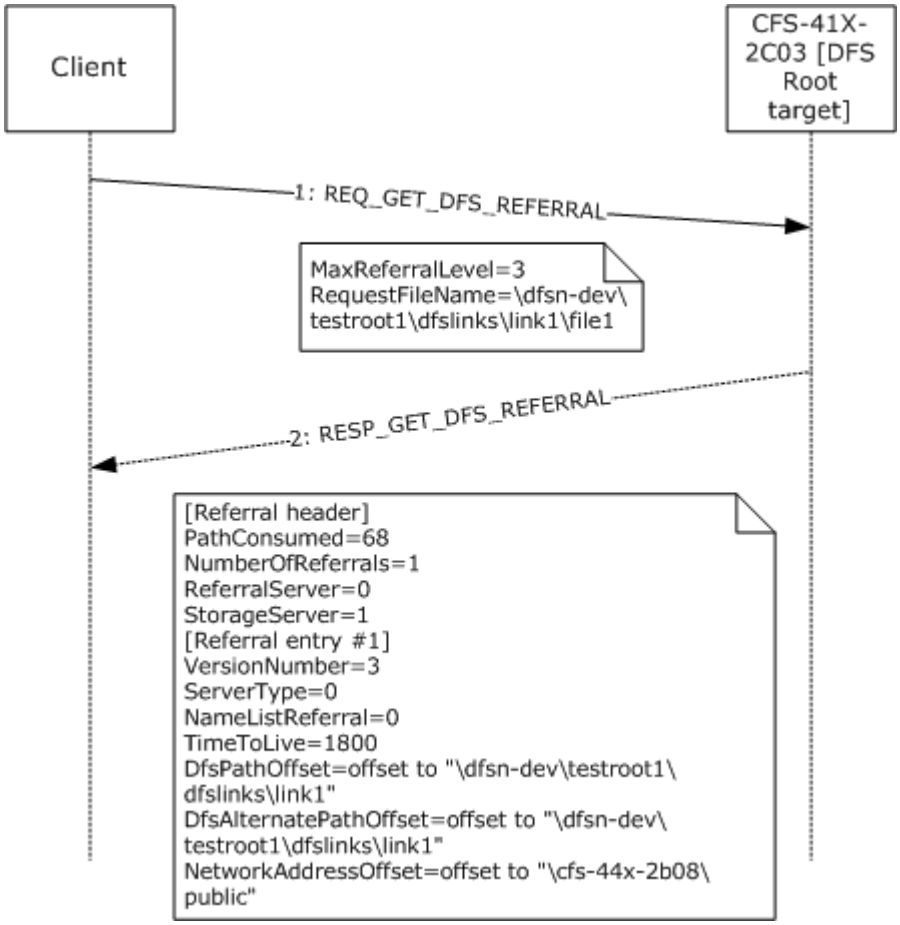

Figure 18: Domain-based DFS link referral

MaxReferralLevel

ServerType

NetworkAddressOffset

4.5 Domain-Based DFS Root Referral Packet Trace

MaxReferralLevel **RequestFileName**

```
ETHERNET: EType - Internet IP (IPv4)
IP: Protocol = TCP - Transmission control; Packet ID - 48186; Total IP
Length = 154; Options = NO Options
TCP: Control Bits: .AP..., len: 114, seq:1634334697-1634334811,
ack:2251252280, win:64498, src: 2086 dst: 139 (NBT Session)
NBT: SS: Session Message, Len: 110
SMB: C transact2 NT Get DFS Referral
        SMB: Command = C transact2
                SMB: Word count = 15
                SMB: Total param count = 42
                SMB: Total data count = 0
                SMB: Max param count = 0
                SMB: Max data count = 4096
                SMB: Max setup words = 0 (0x0)
                SMB: Transact Flags Summary = 0 (0x0)
                        SMB:.............0 = Leave session intact
                        SMB:.............0. = Response required
                SMB: Transact timeout = 0 (0x0)
                SMB: Parameter count = 42 (0x2A)
                SMB: Parameter offset = 68 (0x44)
                SMB: Data count = 0 (0x0)
                SMB: Data offset = 0 (0x0)
                SMB: Setup count = 1
                SMB: Setup words
                SMB: Transact2 function = TRANS2_DFS_GET_REFERRAL
                SMB: Byte count = 45
                SMB: Parameter bytes
                SMB: Transaction parameters
                        SMB: DFS Max Referral Level = 3 (0x3)
                        SMB: DFS Request Filename =\dfsn-dev\testroot1
00000: 00 D0 04 3C D8 00 00 B0 D0 C2 01 3C 08 00 45 00
00010: 00 9A BC 3A 40 00 80 06 76 EF 9D 3B FD 44 0A C1
00020: 21 F3 08 26 00 8B 61 69 F7 E9 86 2F 62 38 50 18
00030: FB F2 C7 C0 00 00 00 00 00 6E FF 53 4D 42 32 00
00040: 00 00 00 18 07 C8 00 00 00 00 00 00 00 00 00 00
00050: 00 00 02 20 B8 0B 00 38 40 01 0F 2A 00 00 00 00
00060: 00 00 10 00 00 00 00 00 00 00 00 00 00 2A 00 44
00070: 00 00 00 00 00 01 00 10 00 2D 00 00 00 00 03 00
00080: 5C 00 64 00 66 00 73 00 6E 00 2D 00 64 00 65 00
00090: 76 00 5C 00 74 00 65 00 73 00 74 00 72 00 6F 00
000A0: 6F 00 74 00 31 00 00
```

Figure 19: REQ_DFS_GET_REFERRAL packet trace

PathConsumed

NumberOfReferrals

NetworkAddressOffset

```
ETHERNET: EType - Internet IP (IPv4)
IP: Protocol - TCP - Transmission control; Packet ID = 12850; Total IP Length - 352; Options = NO Options
TCP: control Bits: .AP..., len: 312, seq:2251252280-2251252592, ack:1634334811, win:64482,
src: 139 (NBT session) dst: 2086
NBT: SS: Session Message, Len: 308
SMB: R transact2 NT Get DFS Referral (response to frame 48)
        SMB: Command = C transact2
                SMB: Word count = 10
                SMB: Total parm count = 0
                SMB: Total data count = 252
                SMB: Parameter count = 0 (0x0)
                SMB: Parameter offset = 56 (0x38)
                SMB: Parameter Displacement = 0 (0x0)
                SMB: Data count = 252 (0XFC)
                SMB: Data offset = 56 (0x38)
                SMB: Data Displacement = (0x0)
                SMB: Setup count = 0
                SMB: Byte Count = 253
                SMB: Byte parameters
                SMB: Transaction data
                        SMB: DFS Path consumed = 38 (0x26)
                        SMB: DFS Number of Referrals = 2 (0x2)
                        SMB: DFS Server Function = 3 (0x3)
                                SMB: .....1 = Referral Server
                                SMB: .....1. = Storage Server
                        SMB: DFS version 3 Referral
                                SMB: DFS Version Number = 3 (0x3)
                                SMB: DFS Server Type = DFS root target
                                SMB: DFS TimeToLive = 300 (0x12C)
                                SMB: DFS Filename =\dfsn-dev\testroot1
                                SMB: DFS 8.3 Filename =\dfsn-dev\teszroot1
                                SMB: DFS Sharename =\cfs-41x-2c03\testroot1
                        SMB: DFS Servicesire GUID = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
                        SMB: DFS version 3 Referral
                                SMB: DFS Version Number = 3 (0x3)
                                SMB: DFS Server Type = DFS root target
                                SMB: DFS TimeToLive = 300 (0x12C)
                                SMB: DFS Filename =\dfsn-dev\testrootl
                                SMB: DFS 8.3 Filename =\dfsn-d\testroot1
                                SMB: DFS Sharename =\cfs-41x-2c02\testrootl
                        SMB: DFS Servicesite GUID = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00000: 00 B0 D0 C2 01 3C 00 D0 04 3C 08 00 08 00 45 00
00010: 01 60 32 32 40 00 7E 06 02 32 0A C1 21 F3 9D 3B
00020: FD 44 00 B8 0B 26 B6 2F 62 38 61 69 F8 5B 50 18
00030: FB E2 38 87 00 00 00 00 01 34 FF 53 4D 42 32 00
00040: 00 00 00 98 07 C8 00 00 00 00 00 00 00 00 00 00
00050: 00 00 02 20 B8 0B 00 38 40 01 0A 00 00 FC 00 00
00060: 00 00 00 38 00 00 00 FC 00 38 00 00 00 00 00 FD
00070: 00 00 26 00 02 00 03 00 00 00 03 00 22 00 01 00
00080: 00 00 2C 01 00 00 44 00 6C 00 94 00 00 00 00 00
00090: 00 00 00 00 00 00 00 00 00 00 00 00 03 00 22 00
000A0: 01 00 00 00 2C 01 00 00 22 00 4A 00 12 00 00 00
000B0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 5C 00
000C0: 64 00 66 00 73 00 6E 00 2D 00 64 00 65 00 76 00
000D0: 5C 00 74 00 65 00 73 00 74 00 72 00 6F 00 6F 00
000E0: 74 00 31 00 00 00 5C 00 64 00 66 00 73 00 6E 00.
000F0: 2D 00 64 00 65 00 76 00 5C 00 74 00 65 00 73 00
00100: 74 00 72 00 6F 00 6F 00 74 00 31 00 00 00 5C 00
00110: 63 00 66 00 73 00 2D 00 34 00 31 00 78 00 2D 00
00120: 32 00 63 00 30 00 33 00 5C 00 74 00 65 00 73 00
00130: 74 00 72 00 6F 00 6F 00 74 00 31 00 00 00 5C 00
00140: 63 00 66 00 73 00 2D 00 34 00 31 00 78 00 2D 00
00150: 32 00 63 00 30 00 32 00 5C 00 74 00 65 00 73 00
00160: 74 00 72 00 6F 00 6F 00 74 00 31 00 00 00
```

Figure 20: RESP_GET_DFS_REFERRAL packet trace

4.6 Standalone DFS Root Referral

Figure 21: DFS root referral between client and server

MaxReferralLevel

ServerType

NetworkAddressOffset

5 Security

5.1 Security Considerations for Implementers

5.2 Index of Security Parameters

6 Appendix A: Product Behavior

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TimeToLive

TimeToLive

Status Code	Support Notes

Status Code	Support Notes

Status Code	Support Notes

Status Code	Support Notes

Status Code	Support Notes

Status Code	Support Notes

-
-

Windows server version	Highest DFS referral version

29□

MaxReferralLevel

TimeToLive

DFSAlternatePathOffset
DFSPathOffset **DFSPathOffset**
DFSAlternatePathOffset

DFSPathOffset **DFSAlternatePathOffset**

7 Change Tracking

8 Index

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