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Open Enterprise Server 24.4
DNS/DHCP Services Administration Guide for Linux

October 2024

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Contents

About This Guide 9

1 Understanding DNS and DHCP Services 11

1.1 DNS . . . 11
1.1.1 DNS Hierarchy . . . 12
1.1.2 DNS Name Service . . . 15
1.1.3 Resource Records . . . 18
1.1.4 DNS Structure . . . 19
1.2 DNS Service . . . 22
1.2.1 eDirectory and DNS . . . 23
1.2.2 eDirectory Schema Extensions for DNS . . . 26
1.2.3 Dynamic DNS . . . 28
1.2.4 Zone Transfer . . . 30
1.2.5 Dynamic Reconfiguration . . . 31
1.2.6 Fault Tolerance . . . 31
1.2.7 Cluster Support . . . 31
1.2.8 Notify . . . 32
1.2.9 Load Balancing . . . 32
1.2.10 Forwarding . . . 33
1.2.11 No-Forwarding . . . 33
1.2.12 Benefits of Integrating a DNS Server with eDirectory . . . 34
1.2.13 rndc Support . . . 34
1.2.14 Managing DNS Objects Using Java Management Console . . . 35
1.3 DHCP . . . 39
1.3.1 DHCP and BOOTP . . . 39
1.3.2 IP Address Allocation . . . 41
1.3.3 Virtual LAN Environments . . . 42
1.4 OES DHCP Service . . . 42
1.4.1 DHCP Options . . . 43
1.4.2 eDirectory Objects for DHCP . . . 45
1.4.3 Java Management Console for DHCP (OES Linux) . . . 48
1.5 What's Next . . . 52

2 What's New or Changed in DNS and DHCP 53

3 Planning Your DNS/DHCP Implementation 55

3.1 Resource Requirements . . . 55
3.2 eDirectory Guidelines . . . 55
3.3 Planning a DNS Strategy . . . 56
3.3.1 Planning Zones . . . 57
3.3.2 Using the OES DNS Server as a Primary Name Server . . . 57
3.3.3 Using the OES DNS Server as a Secondary Name Server . . . 57
3.3.4 Configuring a DNS Server to Forward Requests . . . 58
3.3.5 Setting Up the Forward Zone Type . . . 58
3.3.6 Setting Up the in-addr.arpa Zone . . . 59

3.3.7 Registering Your DNS Server with Root Servers . . . 59
3.4 Planning a DHCP Strategy . . . 59
3.4.1 Network Topology . . . 60
3.4.2 eDirectory Implementation . . . 60
3.4.3 Lease Considerations . . . 61
3.4.4 IP Address Availability . . . 63
3.4.5 Hostnames . . . 64

4 Running DNS/DHCP Services in a Virtualized Environment 65

5 Comparing Linux and NetWare 67

5.1 DNS on NetWare versus DNS on Linux . . . 67
5.1.1 Management Interface . . . 67
5.1.2 Commands . . . 67
5.1.3 Filenames and Paths . . . 68
5.1.4 Installation Difference . . . 69
5.1.5 Features Not Supported . . . 69
5.2 DHCP on NetWare versus DHCP on Linux . . . 69
5.2.1 Commands . . . 69
5.2.2 Filenames and Paths . . . 70
5.2.3 Features Not Supported . . . 70
5.3 Limitations . . . 70
5.4 What's Next . . . 71

6 Installing and Configuring DHCP 73

6.1 Planning Your Installation . . . 73
6.1.1 Prerequisites . . . 73
6.1.2 eDirectory Permissions . . . 73
6.1.3 Recommendations . . . 74
6.2 Installing DHCP . . . 75
6.3 Setting Runtime Credentials . . . 77
6.4 Post Installation . . . 78
6.5 Verifying the Installation . . . 78
6.6 What's Next . . . 79

7 Administering and Managing DHCP 81

7.1 Using the Java Management Console to Manage DHCP (OES Linux) . . . 81
7.1.1 Installing Java Management Console . . . 82
7.1.2 Service Management . . . 84
7.1.3 Server Management . . . 85
7.1.4 Starting or Stopping a DHCP Server . . . 85
7.1.5 Shared Network Management . . . 85
7.1.6 Subnet Management . . . 86
7.1.7 Pool Management . . . 86
7.1.8 Host Management . . . 87
7.1.9 Class Management . . . 88
7.1.10 Zone Management . . . 88
7.1.11 TSIG Key Management . . . 89
7.1.12 Failover Peer Management . . . 89
7.1.13 Managing DHCP (OES Linux) Objects in the Java Management Console . . . 91

7.1.14 Importing and Exporting the DHCP Configuration . . . 94
7.1.15 Viewing Dynamic Leases . . . 96
7.1.16 Deleting Dynamic Leases . . . 97
7.2 Starting the DHCP Server . . . 98
7.3 Stopping the DHCP Server . . . 98
7.4 What's Next . . . 98

8 Configuring DHCP with OES Cluster Services for the NSS File System 99

8.1 Benefits of Configuring DHCP for High Availability . . . 99
8.2 Prerequisites . . . 99
8.3 Installation and Configuration . . . 99
8.3.1 Prerequisites . . . 100
8.3.2 Verifying the OES Cluster Services Setup . . . 100
8.3.3 Installing and Configuring a Cluster . . . 100
8.3.4 DHCP Load, Unload, and Monitor Scripts . . . 102
8.4 Loading and Unloading the DHCP Server . . . 105
8.4.1 Loading the DHCP Server . . . 105
8.4.2 Unloading the DHCP Server . . . 105
8.5 What's Next . . . 105

9 Configuring DHCP with OES Cluster Services for the Linux File System 107

9.1 Benefits of Configuring DHCP for High Availability . . . 107
9.2 DHCP Installation and Configuration . . . 107
9.2.1 Prerequisites . . . 107
9.2.2 Configuring DHCP on the Shared Disk . . . 108
9.2.3 Configuring the dhcpd.conf File . . . 108
9.2.4 Creating a dhcpd.leases File . . . 108
9.2.5 OES Cluster Services Configuration and Setup . . . 109
9.3 What's Next . . . 116

10 Security Guidelines for DHCP 117

10.1 Best Practices . . . 117
10.2 What's Next . . . 117

11 Installing and Configuring DNS 119

11.1 Planning the Installation . . . 119
11.1.1 Prerequisites . . . 119
11.1.2 eDirectory Permissions . . . 119
11.2 Installing the DNS Server . . . 121
11.3 Setting Runtime Credentials . . . 122
11.4 Verifying Installation . . . 123
11.5 What's Next . . . 123

12 Migrating DNS/DHCP from NetWare to OES 125

13 Administering and Managing a DNS Server 127

13.1 Using the Java Management Console to Manage DNS . . . 127

13.1.1 Installing the Java Management Console 127
13.1.2 DNS Server Management 128
13.1.3 Zone Management 130
13.1.4 Resource Record Management 137
13.1.5 DNS Key Management 138
13.2 Configuring Roles for a OES DNS Server 140
13.2.1 Configuring a DNS Server to Forward Queries to Root Name Servers 141
13.2.2 Configuring a DNS Server as a Cache-Only Server 141
13.2.3 Configuring Child (Sub) Zone Support 141
13.2.4 Configuring a Multi-Homed Server 142
13.2.5 Configuring Dynamic DNS 142
13.3 novell-named Command Line Options 142
13.3.1 Description of Command Line Options 144
13.4 Viewing Debug Logs in Syslog 145
13.5 Configuring Log-Level using Java Management Console 146
13.5.1 Setting Log-Level using Command Line 146
13.5.2 Setting Log-Level using rndc Command 147
13.5.3 Setting Log-Level using Java Console 147
13.6 Changing Proxy Users 147
13.7 Starting the DNS Server 148
13.8 Running DNS Server in chroot Mode 148
13.9 Running DNS Server as a Non-Root User 149
13.10 Stopping the DNS Server 149
13.11 What's Next 149

14 Configuring DNS with OES Cluster Services 151

14.1 Prerequisites 151
14.2 Installation and Configuration 151
14.2.1 Verifying the OES Cluster Services Setup 151
14.2.2 Installing and Configuring a Cluster 152
14.2.3 DNS Load, Unload, and Monitor Scripts 154
14.3 Loading and Unloading the DNS Server 156
14.3.1 Loading the DNS Server 157
14.3.2 Unloading the DNS Server 157
14.4 What's Next 157

15 Security Considerations for DNS 159

15.1 Logging 159
15.2 Commands 159
15.3 Cryptographic Algorithms 159
15.4 Best Practices 159
15.5 What's Next 160

16 DNS/DHCP Advanced Features 161

16.1 Configuring the ICE Zone Handler 161
16.1.1 Modifying the ice.conf File 161
16.1.2 Enabling Clear-Text Passwords 162
16.1.3 Importing Configuration and Script Files 162
16.1.4 Exporting Configuration and Script Information 164

16.2 What's Next 165

17 DNS-DSfW Integration 167

17.1 Normal eDirectory with DNS 167
17.2 DSfW with DNS 168
17.2.1 Changes for DNS 168
17.2.2 Local DNS Server Installation 168
17.3 DSfW with Remote DNS (Child Domains) 169
17.3.1 DSfW on a Remote DNS Server 169
17.4 Scenarios 169
17.5 FAQs 170
17.6 What's Next 171

18 Troubleshooting DNS and DHCP Services 173

18.1 DHCP 173
18.1.1 OMAPI Connection to the DHCP Server Fails 173
18.1.2 DHCP Does Not Come Up After Upgrading to OES 2018 or later if Service Proxy is Configured 174
18.1.3 The dhcpd server Fails to Start and Reports an Unknown Key Error 174
18.1.4 DHCP Pools Run Out of Available IP Addresses in Subnets With PXE Clients 174
18.1.5 DHCP Server Fails to Start After Upgrade to OES 2018 or later 175
18.1.6 DHCP Server Fails to Load and Records a "Cannot find host LDAP entry DHCP" Error in the Log File 175
18.1.7 Installing an OES Server Inside a Container With a Separate Partition on an Existing Tree That Already has DHCP Server Installed on it Results in a Constraint Violation Error. . . 176
18.1.8 The dhcpd.log file is Empty 176
18.1.9 The DHCP Server Failed to Start 176
18.1.10 The DHCP Server Displays "Unknown Error" on the Console 177
18.1.11 Permission Denied to DHCP Server 177
18.1.12 DHCP Server Displays "Cannot Create New Lease File: Permission Denied" or "/usr/sbin/dhcpd: U<89>Ã¥S<83>Ã¬^T<8b>E^LÃ¨hÃ»ÃºÃ¿<81>Ã9^[^C: Unknown error 3218701597" 178
18.1.13 segfault dhcpd - You get an error "dhcpd: Can't create new lease file: Permission denied" and "dhcpd[8249]: segfault at 0000000000000000 rip 00002abbf999db7f rsp 00007fffb18ea5e0 error 4" 178
18.2 DNS 178
18.2.1 DNS Does Not Come Up After Upgrading to OES 2018 or later if Service Proxy is Configured 179
18.2.2 Loading of Zone Data and Configuration Files to the Configured Volume Might Fail in Cluster Environment 179
18.2.3 novell-named is Unable to Access eDirectoy 180
18.2.4 DNS Loads Zone Database from the File Despite eDirectory Availability 180
18.2.5 Failed to Configure DNS Server 180
18.2.6 Insufficient Permissions for LDAP Admin User 180
18.2.7 Failed to create the DNS Server Object for the Virtual NCP Server 180
18.2.8 novell-named Failed to Start 181
18.2.9 rcnovell-named and rcnamed interfere in Their Individual status/stop Query Functionality 181
18.2.10 The DNS Server Failed to Load and Provides Critical Error Messages for NWCallsInit/ NWCLXInit/NWNetInit 182

18.2.11 Error Message When You Add RootServInfo That Gives an Undefined Attribute 182
18.2.12 Removal of DNS Schema Post Usage of Remove Schema Option of dns-maint 182
18.2.13 Dynamic DNS (DDNS) Fails To Work After Migrating From NetWare to OES 182
18.2.14 DNS Fails to Start with a Fatal Error 182
18.3 Java Console 183
18.3.1 DNS DHCP Java Console Might not Launch When Default Java of the System is Set to OpenJDK 17.x.. 183
18.3.2 Java Console on SLED 11 SP3 Does not Display Chinese Characters Properly 183
18.3.3 Unable to select Resource Record type as Key While Adding Update Policy Option 183
18.3.4 adhoc Option for ddns-update-style not Supported in DHCP Server for OES 11 SP1 and Later 184
18.3.5 Java Console Login Fails Even With Correct Credentials 184
18.3.6 Configuration Files That Were Exported Using Old Java Console Throws an Error When Imported into the New Java Console 185
18.4 What's Next 185

19 Linux Notes 187

19.1 DNS Notes 187
19.2 What's Next 187

A Appendix 189

A.1 Supported RFCs 189
A.2 Types of Resource Records 190
A.3 DHCP Option Descriptions 192
A.3.1 Assigning Options 198
A.4 DNS Root Servers 199
A.5 DNS Server Configuration Utility 200
dns-inst 201
A.6 DNS Server Maintenance Utility 202
dns-maint 203
A.7 DHCP Server Maintenance Utility 207
dhcp-maint 208
A.8 Post-Install Maintenance Tools 211

B Glossary 213

About This Guide

This document describes the concepts of the Domain Name System (DNS) and the Dynamic Host Configuration Protocol (DHCP), the setup and configuration of these services, and how to use DNS and DHCP Services in Open Enterprise Server 24.4.

This guide is divided into the following sections:

- Chapter 1, “Understanding DNS and DHCP Services,” on page 11
- Chapter 2, “What’s New or Changed in DNS and DHCP,” on page 53
- Chapter 3, “Planning Your DNS/DHCP Implementation,” on page 55
- Chapter 4, “Running DNS/DHCP Services in a Virtualized Environment,” on page 65
- Chapter 5, “Comparing Linux and NetWare,” on page 67
- Chapter 6, “Installing and Configuring DHCP,” on page 73
- Chapter 7, “Administering and Managing DHCP,” on page 81
- Chapter 8, “Configuring DHCP with OES Cluster Services for the NSS File System,” on page 99
- Chapter 9, “Configuring DHCP with OES Cluster Services for the Linux File System,” on page 107
- Chapter 10, “Security Guidelines for DHCP,” on page 117
- Chapter 11, “Installing and Configuring DNS,” on page 119
- Chapter 12, “Migrating DNS/DHCP from NetWare to OES,” on page 125
- Chapter 13, “Administering and Managing a DNS Server,” on page 127
- Chapter 14, “Configuring DNS with OES Cluster Services,” on page 151
- Chapter 15, “Security Considerations for DNS,” on page 159
- Chapter 16, “DNS/DHCP Advanced Features,” on page 161
- Chapter 17, “DNS-DSfW Integration,” on page 167
- Chapter 18, “Troubleshooting DNS and DHCP Services,” on page 173
- Chapter 19, “Linux Notes,” on page 187
- Appendix A, “Appendix,” on page 189
- Appendix B, “Glossary,” on page 213

Audience

The audience for this document is network administrators. This documentation is not intended for users of the network.

Feedback

We want to hear your comments and suggestions about this manual and the other documentation included with this product. Please use the `comment on this topic` link at the bottom of each page of the online documentation.

Documentation Updates

For the most recent version of this guide, see the *DNS/DHCP Services for Linux Administration Guide (https://www.microfocus.com/documentation/open-enterprise-server/23.4)*.

1 Understanding DNS and DHCP Services

DNS/DHCP Services in Open Enterprise Server (OES) integrates the Domain Name System (DNS) and Dynamic Host Configuration Protocol (DHCP) services into NetIQ eDirectory. Integrating these services into eDirectory provides centralized administration and enterprise-wide management of DNS and DHCP services.

DNS and DHCP services can be managed by using the Java Management Console.

NOTE: An OES DNS server can only be managed by using the Java management Console utility. The DNS YaST plug-in does not support managing an OES DNS server.

For more detailed overview information, see the following:

- Section 1.1, “DNS,” on page 11
- Section 1.2, “DNS Service,” on page 22
- Section 1.3, “DHCP,” on page 39
- Section 1.4, “OES DHCP Service,” on page 42
- Section 1.5, “What’s Next,” on page 52

1.1 DNS

DNS is a distributed database system that provides hostname-to-IP resource mapping (usually the IP address) and other information for computers on a network. Any computer on the Internet can use a DNS server to locate any other computer on the Internet.

DNS is made up of two distinct components: the hierarchy and the name service. The DNS hierarchy specifies the structure, naming conventions, and delegation of authority in the DNS service. The DNS name service provides the actual name-to-address mapping mechanism.

For more information, see:

- “DNS Hierarchy” on page 12
- “DNS Name Service” on page 15
- “DNS Resolver” on page 17
- “Resource Records” on page 18
- “DNS Structure” on page 19

DNS/DHCP supports the standards of the Internet Request For Comments (RFCs). For more information, see Appendix A, “Appendix,” on page 189.

1.1.1 DNS Hierarchy

DNS uses a hierarchy to manage its distributed database system. The DNS hierarchy, also called the domain namespace, is an inverted tree structure, much like eDirectory. Each node in the tree has a text label, which is zero to 63 characters long. The label (zero length) is reserved and is used for the root.

The DNS tree has a single domain at the top of the structure called the root domain. A period or dot (.) is the designation for the root domain. Below the root domain are the top-level domains that divide the DNS hierarchy into segments.

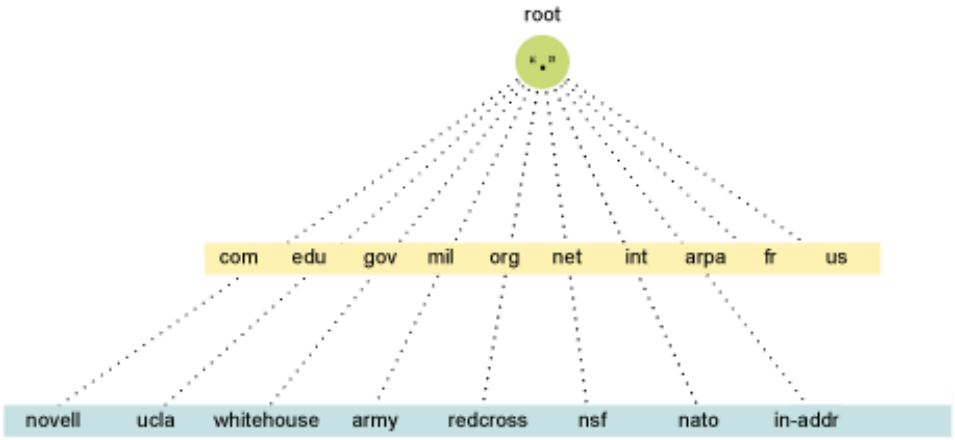
There are three types of top level domains (TLDs): Generic, Country Code, and Infrastructure. Below the top-level domains, the domain namespace is further divided into subdomains representing individual organizations:

- "Generic TLD" on page 12
- "Country Code TLD" on page 13
- "Infrastructure TLD" on page 13
- "Domains and Subdomains" on page 13
- "Domain Names" on page 14
- "in-addr.arpa Domain" on page 15
- "Domain Delegation" on page 15

A list of TLDs is available at the Internet Assigned Numbers Authority Web site (http://www.iana.org).

The DNS hierarchy is shown in the illustration below.

Figure 1-1 *DNS Hierarchy*



Generic TLD

The following table shows the top-level DNS domains and the organization types that use them:

Table 1-1 *DNS Domains and Organization Types*

Domain	Used by
.com	Commercial organizations, such as novell.com
.edu	Educational organizations, such as ucla.edu
.gov	Governmental agencies, such as whitehouse.gov
.mil	Military organizations, such as army.mil
.org	Nonprofit organizations, such as redcross.org
.net	Networking entities, such as nsf.net
.int	International organizations, such as nato.int

Country Code TLD

Top-level domains organize domain namespace geographically.

Table 1-2 *Country Code Domains*

Domain	Used by
.fr	France
.in	India
.jp	Japan
.us	United States

Infrastructure TLD

The arpa (Address and Routing Parameter Area) TLD is used extensively for Internet infrastructure. It contains subdomains such as in-addr.arpa and ipv6.arpa.

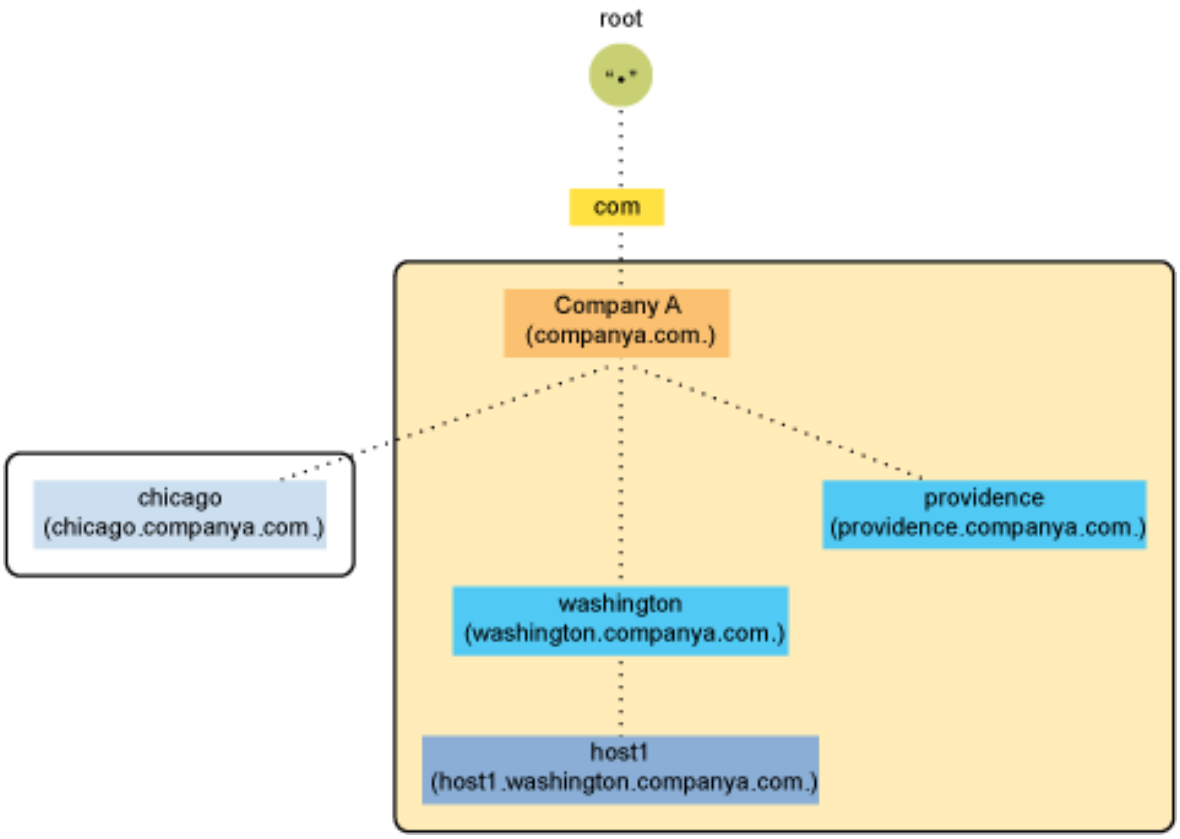
Domains and Subdomains

A domain is a subtree of the DNS tree. Each node on the DNS tree represents a domain. Domains under the top-level domains represent individual organizations or entities. These domains can be further divided into subdomains to ease administration of an organization's host computers.

For example, Company A creates a domain called companya.com under the *com* top-level domain. Company A has separate LANs for its locations in Chicago, Washington, and Providence. Therefore, the network administrator for Company A decides to create a separate subdomain for each division, as shown in Figure 1-2, "Domains and Subdomains," on page 14.

Any domain in a subtree is considered part of all domains above it. Therefore, chicago.companya.com is part of the companya.com domain, and both are part of the .com domain.

Figure 1-2 *Domains and Subdomains*



Domain Names

The domain name represents the position of an entity within the structure of the DNS hierarchy. The domain name of a node is the list of the labels on the path from the node to the root of the tree. Domain names are not case sensitive and their length is limited to 255 characters. Valid characters for domain names according to RFC 1034/RFC 1035 are a-z (case insensitive), 0-9, and hyphens. Each label in the domain name is delimited by a period. For example, the domain name for the Providence domain within Company A is providence.companya.com, as shown in Figure 1-2 on page 14.

NOTE: OES DNS supports the underscore character in domain names using the check-names option for coexistence with Windows DNS servers.

Each computer that uses DNS is given a DNS hostname that represents the computer's position within the DNS hierarchy. Therefore, the hostname for host1 in Figure 1-2 on page 14 is host1.washington.companya.com.

The domain names in the figure end with a period, representing the root domain. Domain names that end with a period are called fully qualified domain names (FQDNs).

in-addr.arpa Domain

The in-addr.arpa domain (or zone) provides the mapping of IP addresses to names within a zone, enabling a client (or resolver) to request a hostname by providing an IP address. This function, also known as reverse lookup, is used by some security-based applications.

The file that stores the in-addr.arpa data contains pointer (PTR) records and additional name server records, including the Start of Authority (SOA) records, which are similar to the other DNS zone files. Within the in-addr.arpa zone file, IP addresses are listed in reverse order, and *in-addr.arpa* is appended to the address. A query for a host with an IP address of 10.10.11.1 requires a PTR query with the target address of 1.11.10.10.in-addr.arpa.

Domain Delegation

Domain delegation gives authority to an organization for a domain. Having authority for a domain means that the organization's network administrator is responsible for maintaining the DNS database of hostname and address information for that domain. Domain delegation helps in distributing the DNS namespace.

A Division can be made between any two adjacent nodes in the namespace. After all divisions are made, each group of connected namespace is considered as a separate zone. The zone is authoritative for all names in the connected region, and these cuts are managed by domain delegation. All the host information for a zone is maintained in a single authoritative database.

For example, in Figure 1-2 on page 14, the companya.com. domain is delegated to company A, creating the companya.com. zone. There are three subdomains within the companya.com. domain:

- chicago.companya.com
- washington.companya.com
- providence.companya.com

The company A administrator maintains all host information for the zone in a single database and also has the authority to create and delegate subdomains.

For example, if company A's Chicago location has its own network administrator, they could make a division between the chicago.companya.com domain and the companya.com domain and then delegate the chicago.companya.com zone. Then companya.com would have no authority over chicago.companya.com. Company A would have two domains:

- companya.com, which has authority over the companya.com, washington.companya.com, and providence.companya.com domains
- chicago.companya.com, which has authority over the chicago.companya.com domain

1.1.2 DNS Name Service

DNS uses the name service component to provide the actual name-to-IP address mapping that enables computers to locate each other on a network. The name service uses a client/server mechanism in which clients query name servers for host address information.

- "Name Servers" on page 16
- "Root Name Servers" on page 17

- "DNS Resolver" on page 17
- "Name Resolution" on page 17
- "Caching" on page 18

Name Servers

Name servers are information repositories that make up the domain database. The database is divided into sections called zones, which are distributed among the name servers. The name servers answer queries by using data in their zones or caches. A DNS name server can be either a primary name server or a secondary name server.

In addition to local host information, name servers maintain information about how to contact other name servers. Name servers in an intranet are able to contact each other and retrieve host information. If a name server does not have information about a particular domain, the name server relays the request to other name servers up or down the domain hierarchy until it receives an authoritative answer for the client's query.

All name servers maintain information about contacting name servers that are available in other parts of the DNS namespace. This process of maintaining information is called linking to the existing DNS hierarchy. This is done by providing information about the root name servers. The administrator also enters information into the database about name servers in the lower-level domains. For example, when creating a subdomain, the administrator provides the name server information of the subzone.

- "Primary Name Servers" on page 16
- "Secondary Name Servers" on page 16
- "Forward Name Servers" on page 16

Primary Name Servers

One DNS name server in each administrative zone maintains the read-write copies of hostname database and address information for an entire domain. This name server is the primary name server, and the domain administrator updates it with hostnames and addresses as changes occur. Primary and secondary name servers are also called masters and slaves.

Secondary Name Servers

Secondary name servers have read-only copies of the primary name server's DNS database. Secondary name servers provide redundancy and load balancing for a domain.

Periodically, and when a secondary name server starts, the secondary name server contacts the primary name server and requests a full or incremental copy of the primary name server's DNS database. This process is called zone transfer.

If necessary, a primary name server can also function as a secondary name server for another zone.

Forward Name Servers

The Forward DNS server forwards all queries to another DNS server and caches the results. Unlike primary and secondary zones, there is no functional difference between a designated server and other servers.

Root Name Servers

Root name servers contain information for the name servers in all top-level domains. The root server plays a very significant role in resolving DNS queries. It returns a list of the designated authoritative name servers for the appropriate top-level domain.

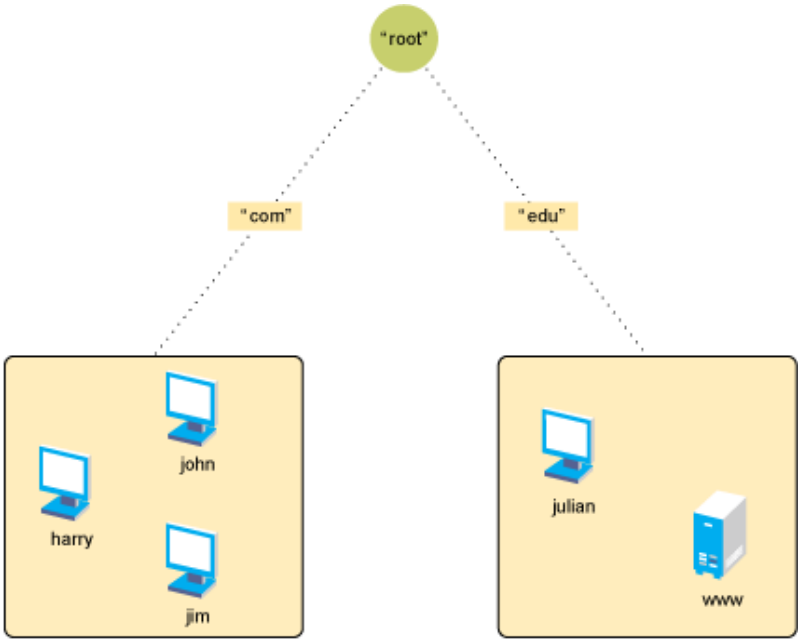
DNS Resolver

DNS resolvers are client programs. They interface user programs to domain name servers. A resolver receives a request from a user program and returns the desired information. It basically does a name-to-address, address-to-name, and general lookup.

Name Resolution

DNS is a distributed database with multiple servers that maintain different parts of the same tree. The links between the servers are through root server and domain delegation, as shown in the following figure.

Figure 1-3 *DNS Namespace*



DNS queries can be resolved in two ways:

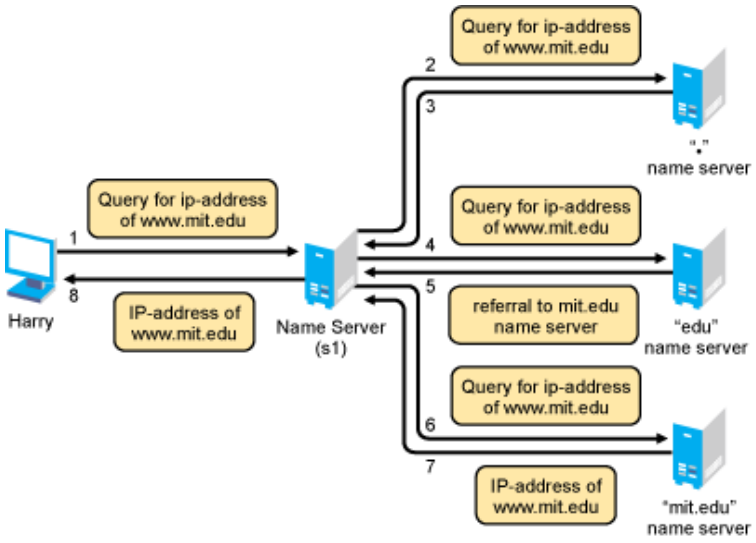
- **Iterative query:** An iterative request from a client expects the best actual answer or referral that the DNS server can immediately provide, without contacting other DNS servers.

  For example, in Figure 1-4 on page 18, Harry initiates an iterative query for the A record of www.mit.edu. After receiving this query, the name server (s1) might return the answer, if the answer is available in the cache. If the answer is not available, the server returns a referral [NS and A rrs] to the other DNS servers that are closer to the names queried by the client.

- **Recursive query:** A recursive request from a client expects the actual answer that the DNS server can provide either from its own cache or by contacting other DNS servers.

  For example, in Figure 1-3 on page 17 and Figure 1-4 on page 18, Harry initiates a recursive query for the A record of www.mit.edu. After receiving this query, the name server (s1) contacts the root server to resolve this query and gets the referrals (name server info) for the .edu zone. Now, s1 again initiates a query for A record of www.mit.edu to the name server (using the referrals received) of edu.zone and will get the referrals for mit.edu.zone. Server s1 will again initiate a query for the A record of www.mit.edu to the name server (using the referrals received) and gets the A record. This A record is returned to Harry.

Figure 1-4 *Name Resolution*



Caching

Caching is a mechanism to improve the performance of query resolution. The cache memory is empty when a server first starts. This cache is built as it starts resolving queries. It caches all the answers and referrals during recursive queries, and the cached data remains in the cache memory until the Time-To-Live (TTL) expires. The TTL specifies the time interval that the entries can be cached before they are discarded.

1.1.3 Resource Records

Resource records (RRs) contain the host information maintained by the name servers and make up the DNS database. Different types of records contain different types of host information. For example, an Address A record provides the name-to-address mapping for a given host, and Start of Authority (SOA) record specifies the start of authority for a given zone.

A DNS zone must contain several types of resource records in order for DNS to function properly. Other RRs can be present, but the following records are required for standard DNS:

- **Name Server (NS):** Binds a domain name with a hostname for a specific name server.

  The DNS zone must contain NS records (for itself) for each primary and secondary name server of the zone. It must also contain NS records of the lower-level zones (if any) to provide links within the DNS hierarchy.

- **Start of Authority (SOA):** Indicates the start of authority for the zone.

  The name server must contain only one SOA record, specifying its zone of authority.

For example, the name server for a zone must contain the following:

- An SOA record identifying its zone of authority
- An NS record for the primary name server within the zone
- An NS record for each secondary name server within the zone
- NS records for delegated zones, if any
- A records for the NS record (if applicable)

For more information about Resource Record types and their RDATA (Resource Record data), see Section A.2, “Types of Resource Records,” on page 190.

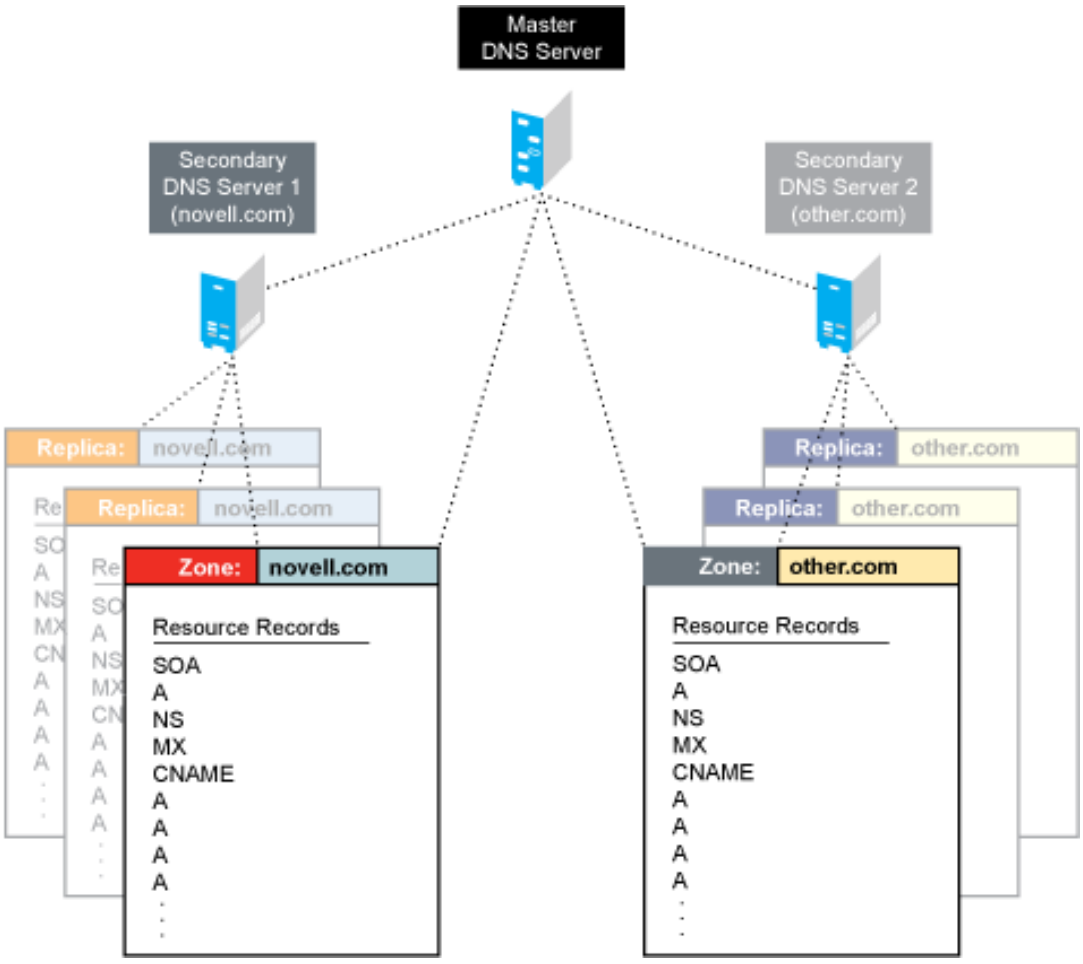
1.1.4 DNS Structure

DNS is administered by building a database of information that includes all the resource records of a zone into a text file called a master file. The administration of these files is difficult and cumbersome. Initial versions of the DNS server used Btrieve as its database. Other vendors also use large files to store information required for a DNS zone.

Figure 1-5 represents a traditional DNS strategy. A zone, such as novell.com, uses a primary DNS server to handle queries about the entities within it. A DNS server supports more than one zone, and it has at least one secondary server for backup (redundancy) or load-sharing purposes. The primary DNS server provides DNS name service for two zones: novell.com and other.com. The secondary DNS server 1 provides backup support for the novell.com zone, and the secondary DNS server 2 provides backup support for the other.com zone. When changes occur to the DNS database, the master files corresponding to that zone at the secondary server are updated by zone transfers.

The file storing the resource records for a zone might have hundreds or thousands of entries for different types of resources, such as users’ addresses, hosts, name servers, mail servers, and pointers to other resources.

Figure 1-5 *DNS Structure*



The next section provides details on the following:

- “DNS Master File” on page 20
- “Master File Directives” on page 21

DNS Master File

A DNS master file is a text file that contains resource records that describe a zone. When you build a zone, the DNS objects and their attributes translate into resource records for that zone.

You can import a DNS master file if it conforms to IETF RFCs 1034, 1035, and 1183 and is in BIND master file format. A sample DNS master file is shown in the following example:

```
$ORIGIN companya.com.
@ soa ns.companya.com. admin.novell.com (
1996091454 /* SOA sr no */
3600 /* Zone Refresh interval*/
300 /* Zone retry interval */
604800 /* Zone Expire interval */
86400) /* Zone Minimum TTL */
ns ns1.companya.com.
ns ns2.companya.com.
mx 5 companya.com.
$ORIGIN companya.com.
ns1 a 123.45.67.89
ns2 a 123.45.68.103; End of file
```

Master File Directives

The master file directives include $GENERATE, $ORIGIN, $INCLUDE, and $TTL.

- **$GENERATE:** Enables you to create a series of resource records that differ from each other only by an iterator.

  The syntax is:

  ```
  $GENERATE range lhs type rhs [comment]
  ```

  Range: Can be set to start-stop or start-stop/step. All values for start, stop, and step must be positive.

  lhs: The owner name of the records to be created. The $ symbols in the lhs are replaced by the iterator value. Using \$ allows a $ symbol in the output. A $ can be optionally followed by a modifier as $[{offset[,width[,base]]}].

  A modifier can have an offset, a width, and a base. The offset is used to change the value of the iterator, base specifies the output format in which the values are printed, and width is used for padding. The available base values are decimal (d), octal (o), and hexadecimal (x or X). The default modifier is ${0, 0, d}. If the lhs is not absolute, the current value of $ORIGIN is appended to the name.

  Type: The resource record type. The supported types are PTR, CNAME, DNAME, A, AAAA, and NS.

  rhs: The domain name. Processed similarly to lhs.

  For example,

  ```
  $ORIGIN 0.0.192.IN-ADDR.ARPA
  $GENERATE 1-2 0 NS SERVER$.EXAMPLE.com
  ```

  is equivalent to

  ```
  0.0.0.192.IN-ADDR.ARPA NS server1.example.com
  0.0.0.192.IN-ADDR.ARPA NS server2.example.com
  ```

- **$ORIGIN:** Enables you to set the domain name as the origin. The origin is appended to all domain names in the zone data file that do not end with a dot.

  The syntax is:

```
$ORIGIN domain-name [comment]
```

For example,

```
$ORIGIN example.com.
WWW CNAME Web server
```

is equivalent to

```
WWW.EXAMPLE.COM. CNAME webserver.example.com.
```

NOTE: If the $ORIGIN directive is not already included, make sure you include this directive at the start of the zone file.

- **$INCLUDE:** Enables you to include another file in the current file. The included file can be read and processed as if it were present in the current file at that point. The domain name can also be specified with the $INCLUDE directive to process the file included with $ORIGIN set to that value. If the origin is not specified, the current $ORIGIN is used.

  After the included file is processed, the origin and the domain name values are reset to their previous values before processing the included file.

  The syntax is:

  ```
  $INCLUDE filename [origin] [comment]
  ```

  NOTE: The $INCLUDE directive is not supported through the management utilities.

- **$TTL:** Enables you to set the default time to live for the subsequent resource records without any TTL values. The time range for TTL is from 0 to 214748367 seconds. If the $TTL value is not present in the master file, SOA minimum TTL is used as the default.

  The syntax is:

  ```
  $TTL default-ttl [comment]
  ```

1.2 DNS Service

- Section 1.2.1, “eDirectory and DNS,” on page 23
- Section 1.2.2, “eDirectory Schema Extensions for DNS,” on page 26
- Section 1.2.3, “Dynamic DNS,” on page 28
- Section 1.2.4, “Zone Transfer,” on page 30
- Section 1.2.5, “Dynamic Reconfiguration,” on page 31
- Section 1.2.6, “Fault Tolerance,” on page 31
- Section 1.2.7, “Cluster Support,” on page 31
- Section 1.2.8, “Notify,” on page 32
- Section 1.2.9, “Load Balancing,” on page 32
- Section 1.2.10, “Forwarding,” on page 33
- Section 1.2.11, “No-Forwarding,” on page 33
- Section 1.2.12, “Benefits of Integrating a DNS Server with eDirectory,” on page 34

- Section 1.2.13, “rndc Support,” on page 34
- Section 1.2.14, “Managing DNS Objects Using Java Management Console,” on page 35

The OES DNS service provides the following DNS features:

- All DNS configuration is stored in eDirectory, facilitating enterprise-wide management.
- An OES DNS server can be a secondary name server to a zone (DNS data loaded into eDirectory through a zone transfer), or it can be a primary name server.
- DNS data can be imported using a BIND Master file to populate eDirectory for convenient upgrades from BIND implementations of DNS.
- DNS data can be exported from eDirectory into BIND Master file format.
- Root server information is stored in eDirectory and shared by all eDirectory-based DNS servers.
- Zone transfers are made to and from OES servers. Full Zone Transfer-In (AXFR) and Incremental Zone Transfer-In (IXFR) are supported when the server is a designated secondary. Any type of server can perform a zone-out transfer.
- An OES DNS server can be authoritative for multiple domains.
- OES DNS servers maintain a cache of data from eDirectory so they can quickly respond to queries.
- An OES DNS server can act as a caching or forwarder server. Forwarding can be configured both at server and zone level. A forwarder specifies how the behavior of queries is controlled if the server is not authoritative and the answers do not exist in the cache
- An OES DNS server supports fault tolerance when there is an eDirectory service outage.
- OES DNS servers support multihoming.
- OES DNS server software supports shuffling responses to queries that have multiple resource records.
- OES DNS servers support dynamic reconfiguration (automatic detection of the configuration and data changes).

1.2.1 eDirectory and DNS

The DNS software in Open Enterprise Server integrates DNS information into eDirectory.

Integrating DNS with eDirectory greatly simplifies network administration by enabling you to enter all configuration information into one distributed database. The DNS configuration information is replicated just like any other data in eDirectory.

By integrating DNS into eDirectory, the concept of a primary or secondary has been shifted away from the server to the zone itself. After you have configured the zone, the data is available to any of the OES DNS servers you select to make authoritative for the zone. The OES DNS server takes advantage of the peer-to-peer nature of eDirectory by replicating the DNS data.

The OES DNS Service interoperates with other DNS servers. The OES DNS server can act as either a master DNS server or a secondary DNS server in relation to non-OES DNS servers. The OES DNS server can act as the master DNS server and transfer data to non-OES secondary servers. Alternatively, one OES DNS server can act as a secondary DNS server and get transferred data from a non-OES master server. All OES DNS servers can then access the data through eDirectory replication.

DNS is integrated into eDirectory by extending the eDirectory schema and creating new eDirectory objects to represent zones, resource records, and DNS name servers. Integrating these new objects into eDirectory simplifies the administration of DNS, enabling centralized administration and configuration.

A Zone object is an eDirectory container object that holds RRSet objects, which are leaf objects. A DNS server object is a leaf object. For detailed information about these objects, see “Understanding DNS and DHCP Services” on page 11.

In traditional DNS, all data changes are made on a single primary name server. When changes are made, the secondary name servers request transfers of the changes from the primary name server. This process is called a zone transfer. The master-slave approach has several disadvantages, the most significant being that all changes must be made at the primary server.

Using the primary and secondary zone concept, the approach allows changes from anywhere in the network through eDirectory, which is not dependent on one server. Zone data is stored within eDirectory and is replicated just like any other data in the eDirectory tree.

Our implementation of DNS supports the traditional primary-secondary DNS name server approach to moving DNS data in and out of eDirectory. Although all OES servers can recognize DNS data after the data is placed in the directory through eDirectory replication, only one server is required for a zone transfer. The server assigned to perform this function in a secondary zone is called the Zone-in (Designated Secondary) DNS server.

In a secondary zone, the Zone-in server is responsible for requesting a zone transfer of data from the external primary name server. The Zone-in server determines which data has changed for a zone and then makes updates to eDirectory so that other servers are aware of the changes.

A Forward zone, acts as a forwarder and forwards all queries on zones to primary or secondary servers of the zone.

The Designated DNS (DDNS) server is a server identified by the network administrator to perform certain tasks for a primary zone. The DDNS server for a primary zone is the only server in that zone that receives dynamic updates from a DHCP server to perform Dynamic DNS (DDNS) updates. These updates cause additions and deletions of resource records and updates to the zone’s serial number.

Figure 1-6 illustrates an OES server as the primary and secondary DNS name server and also illustrates primary and secondary zones within eDirectory. In this example, there are two zones. Any of the OES DNS servers assigned to a zone is able to respond authoritatively to queries for the zone. For each zone, one server is designated by the administrator to act as the DDNS server. S1 is the Designated Primary DNS server for Zone 1 and S3 is a Passive Primary server. S1 accepts the Dynamic updates from the DHCP server. S2 is the Zone In (Designated Secondary) server and S4 is the Passive Secondary server for the secondary zone zone2, called the Foreign Zone. S2 occasionally requests zone transfers from the foreign server and places the modified zone data into eDirectory, where any of the OES servers can respond to queries for it. S3 and S4 will get the latest data through eDirectory.

Figure 1-6 *OES Server As a Primary/Secondary DNS Server*

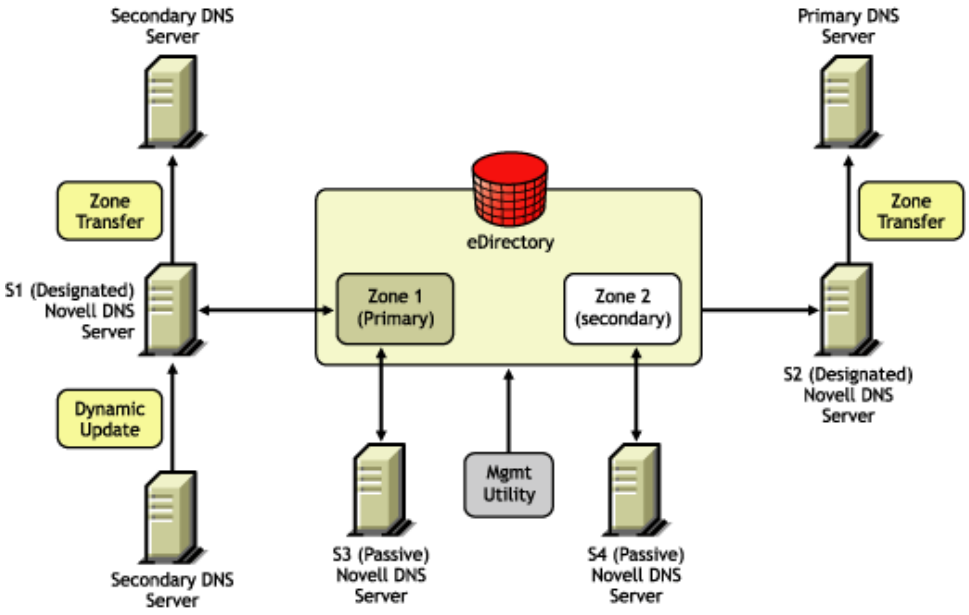
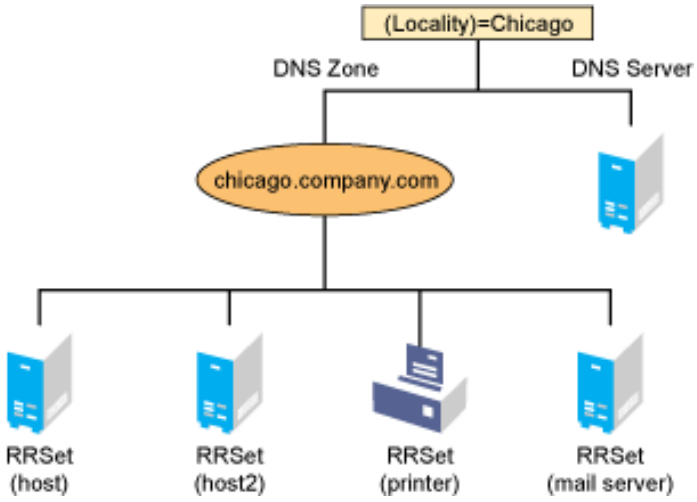


Figure 1-7 shows a representation of eDirectory objects within a DNS zone.

Figure 1-7 *DNS Zone*



1.2.2 eDirectory Schema Extensions for DNS

The eDirectory schema extension defines additional objects needed for DNS.

- "DNS eDirectory Objects and Attributes" on page 26

DNS eDirectory Objects and Attributes

When you select the OES DNS Service during the OES installation, the eDirectory schema is extended to enable the creation of DNS objects and the following objects are created:

- DNS-DHCP (Locator object)
- DNSDHCP-Group (Group object)
- RootServInfo

Only one copy of these objects exists in the context that is specified during OES installation. The DNS servers, DHCP servers, and Management Console must have access to these objects.

The DNSDHCP-Group object is a standard eDirectory group object. The DNS servers gain rights to DNS data within the tree through the Group object.

The DNS-DHCP Locator object is created during the OES installation, if the DNS option is chosen. The creator of the Locator object grants Read and Write rights to this object to the network administrators.

The DNS-DHCP Locator object contains global defaults, DNS options, and a list of DNS servers and zones in the tree. Java Management Console uses the Locator object contents instead of searching the entire tree to display these objects. The Locator object is hidden by the Java Management Console.

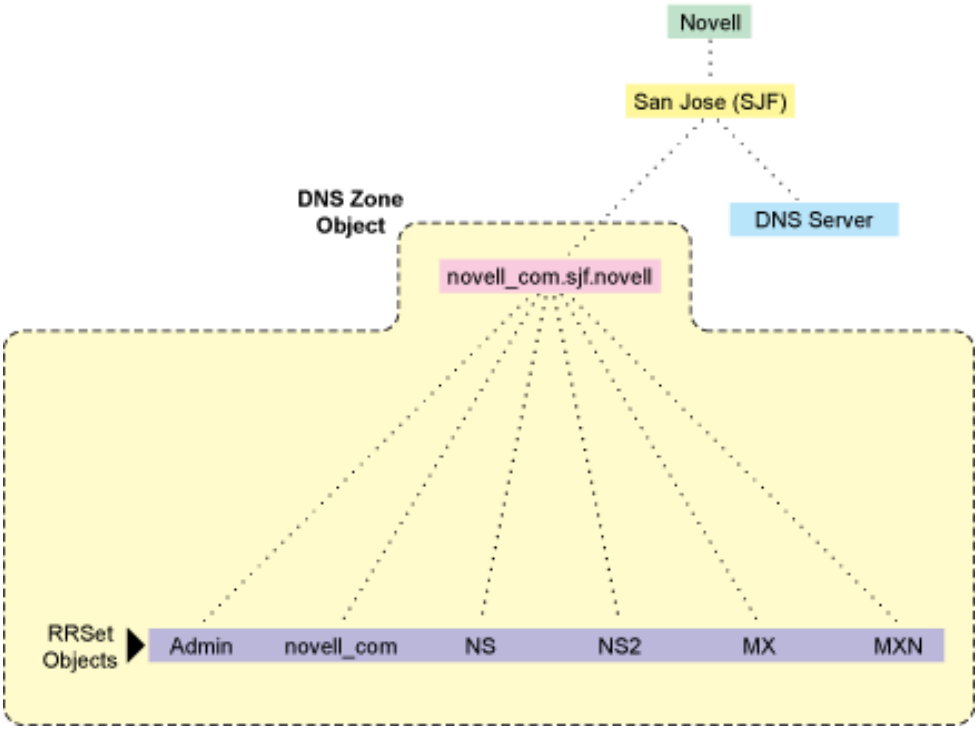
The RootServInfo is a Zone object, which is an eDirectory container object that contains resource records for the DNS root servers. The resource record sets contain Name Server records and Address records of name servers that provide pointers for DNS queries to the root servers. The RootServInfo object is the equivalent of the BIND `db.root` file.

The following new eDirectory objects are also required for DNS:

- "DNS Server Object" on page 27
- "DNS Zone Object" on page 27
- "DNS Resource Record Set Object" on page 28
- "DNS Resource Records" on page 28

Figure 1-8 shows an example of a tree with DNS objects.

Figure 1-8 *eDirectory Objects for DNS*



DNS Server Object

The DNS server object (or dnipDNSServer object) is created during installation. It is created in same context as the NCP server, contains DNS server configuration parameters, and includes the following:

- Zone List
- DNS Server IP Address
- Domain Name of the DNS Server
- DNS Server Options
- Forwarding List
- No-Forwarding List
- Key List
- Access Control List for zone transfer, query, recursion, notify, etc.
- Other additional advanced options to fine-tune the DNS server

DNS Zone Object

The DNS Zone object is a container object that contains all the data for a single DNS zone. A Zone object is the first level of the DNS zone description. A Zone object can be contained under an Organization (O), Organizational Unit (OU), a Country (C), or a Locality (L).

Multiple DNS zones can be represented within eDirectory by using separate, independent DNS Zone objects. A network administrator can support multiple DNS zones on a single OES server by creating multiple DNS Zone objects and assigning the server to serve those zones.

The DNS Zone object contains data that correlates to a DNS Start of Authority (SOA) resource record (RR) and a member list of all eDirectory-based DNS servers that serve the zone.

The DNS namespace hierarchy is not represented within the eDirectory hierarchy. A zone and its child zone might appear as peers within the eDirectory hierarchy, even though they have a parent-child relationship within the DNS hierarchy.

DNS object names are created using the DNS Zone names.

Valid characters for domain names according to RFC 1034/RFC 1035 are a-z (case insensitive), 0-9, and hyphens. For example, the name of the Zone object for newyork.companya.com zone, which exists in an eDirectory context sjf.us., shall be newyork_companya_com.sjf.us

---

NOTE: OES DNS supports underscore character in domain names and Resource Records using OES DNS server check-names statement for co-existence with Windows DNS servers.

DNS Resource Record Set Object

The DNS Resource Record Set (RRSet) object is an eDirectory leaf object contained within a DNS Zone object. An RRSet object represents an individual domain name within a DNS zone. Its required attributes are a DNS domain name and resource records (RRs).

Each domain name within a DNS zone object has an RRSet object. Each RRSet object has one or more resource records beneath it that contain additional information about the zone data.

DNS Resource Records

A DNS resource record (RR) is an attribute of an RRSet that contains the resource record type and data of a single RR. RRs are configured beneath their respective RRSet objects. Resource records describe their associated RRset object.

The most common resource records are Address (A) records, which map a domain name to an IP address, and Pointer (PTR) records, which map an IP address to a domain name within an in-addr.arpa zone.

1.2.3 Dynamic DNS

Dynamic DNS (DDNS) provides a way to dynamically update DNS with resource records from applications such as DHCP servers, and DNS clients. DDNS eliminates the need for any additional configuration of DNS for each host address change. A OES DNS server supports the following DDNS mechanisms:

- Novell DDNS, a mechanism by which NetWare DHCP servers update OES DNS servers
- RFC 2136-based dynamic updates

All changes made to a zone through dynamic updates are stored in the zone's journal file. This file is automatically created by the server in a binary format when the first dynamic update takes place. The journal file name has the `.jnl` extension. This file is also used for IXFR. We recommend that you do not edit the contents of the journal file.

- “Novell DDNS” on page 29
- “2136 Dynamic Update” on page 29

Novell DDNS

The Dynamic DNS (DDNS) feature of the OES DNS service provides a way to update DNS with accurate Address (A) records and Pointer (PTR) records for address assignments made by a DHCP server. Address (A) records map a domain name to an IP address. A Pointer (PTR) record specifies a domain name that points to some location in the domain namespace. These resource records are required for both name-to-address and address-to-name resolutions.

When DDNS is active, the DHCP server updates the DDNS server for the zone, adding or deleting the corresponding Address and Pointer records. The DHCP server also notifies the DDNS server when leases expire, causing the A and PTR records to be deleted.

When the DHCP server grants a lease to a client that is subject to DDNS updates, the DHCP server updates its IP address database and eDirectory to store the transaction. The DHCP server also contacts the DNS server and submits a request for a DNS update.

For DDNS updates, the DNS server requires the fully qualified domain name (FQDN) and the IP address of the client. The DHCP server knows the IP address, but it must assemble the FQDN from the hostname and the subnet's domain name.

The DNS server usually maintains two resource records for each client. One maps FQDNs to IP addresses using A records. The other maps the IP address to the FQDN using PTR records. When DDNS is enabled and a client receives an address from the DHCP server, the DNS server updates both of these records.

When a client loses or ends its lease and is subject to DDNS updates, the DNS server receives the DDNS update request and deletes the PTR and A records associated with the client.

NOTE: While using the OES DHCP server, both the forward and reverse zones must be designated primary on a single server.

2136 Dynamic Update

An OES DNS server supports dynamic updates complying the RFC 2136 standards. This support provides the ability to update various types of resource records into DNS under certain specified conditions. Dynamic update is fully described in RFC 2136.

- A 2136 dynamic update can be enabled or disabled on a zone-by-zone basis, by specifying the allow-update filter for the zone. It grants permission to the clients to update any record or name in the zone.
- DNS Key provides a means of authentication for dynamic DNS updates and for queries to a secured DNS Server. DNS Key uses shared secret keys as a cryptographically secure means of authenticating a DNS update/query.

1.2.4 Zone Transfer

Zone transfer is essential for maintaining up-to-date zone data in the server. When an OES server is designated as primary, all the changes made by the designated primary to eDirectory are reflected in the eDirectory replicas, using the eDirectory sync property. When an OES server is designated secondary, zone transfer is needed for receiving the most up-to-date zone data from any primary servers.

The designated secondary server sends a zone-in request after the refresh time interval or after receiving a notification from the primary server. The zone transfer-in requests are not triggered if the eDirectory services are not available.

The final step in a successful zone transfer-in is to update the SOA serial number. The passive secondary servers compare the eDirectory SOA serial number with their own copy to determine whether there is a need to synchronize the data from eDirectory.

The following types of zone transfers are supported:

- “Full-Zone Transfer-In” on page 30
- “Incremental Zone Transfer-In” on page 30

NOTE: No zone transfers-in are initiated if it fails while the zone transfer is taking place. The changed data is overwritten during the next zone transfer.

Full-Zone Transfer-In

The secondary server receives a full zone transfer-in (AXFR) into a different zone database. After the complete zone data is received, the server replaces the old database with the new one, and tries to identify the difference between the existing zone database and the new database that is received. This difference is then applied to eDirectory for better performance.

For more information on DNS AXFR, refer to RFC 1034.

Incremental Zone Transfer-In

Incremental zone transfer-in (IXFR) is considered to be a more efficient zone transfer mechanism than AXFR because it transfers only the changed data of the zone. Incremental zone transfer (IXFR) transfers only the modified data, using the journal file maintained by the DNS server. When a server gets an IXFR request (which has the current SOA serial number of the requester), the server looks into the JNL file to identify the modified data, then sends the data to the requester. For more information on DNS IXFR, refer to RFC 1995.

1.2.5 Dynamic Reconfiguration

An OES DNS server supports dynamic reconfiguration. The DNS server automatically detects and updates any change in the server's or zone's configuration data. This enables the server to configure itself with these changes without having the administrator intervene to stop and restart the server. Also, out-of-band data changes (creating, modifying, deleting RRs through management utility) are addressed.

The dynamic reconfiguration is also used to monitor the availability of eDirectory with respect to the individual zones, and to detect and log changes that can be used for fault tolerance.

1.2.6 Fault Tolerance

An OES DNS server supports fault tolerance during an eDirectory service outage. The DNS server loads the configuration and zone data from eDirectory during startup. Also, the dynamic updates received for zone data are updated to eDirectory. It is essential for the DNS server to maintain backup copies of eDirectory so it can get to the zone database during eDirectory unavailability.

The DNS server supports standard DNS queries during fault tolerance mode. However, dynamic updates and zone-in transfers are not supported during this mode because eDirectory cannot be updated.

NOTE: During fault tolerance mode operation, eDirectory might not be available for all zones. Operations other than dynamic update and zone-in are supported for zones that are unavailable.

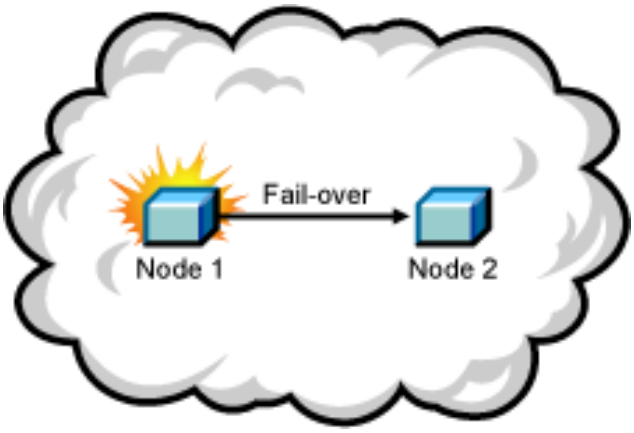
1.2.7 Cluster Support

An OES DNS server supports cluster services with active-passive and cluster-safe modes. When a DNS server is run on any node, it uses a DNS server object in eDirectory. The cluster-enabled DNS service uses the same DNS server object for the other nodes during a node outage.

When there is a node (node1) outage, clustering enables a DNS server to automatically bring up any other node (node2), using the same server object that was used before the outage. The DNS server object contains a reference to the virtual NCP server, which is used to locate the DNS server object. For more information, see Chapter 14, “Configuring DNS with OES Cluster Services,” on page 151.

The OES DNS server supports only NSS file systems.

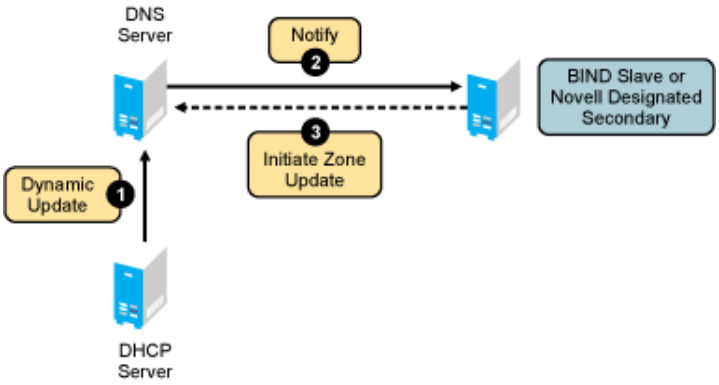
Figure 1-9 *Cluster Support*



1.2.8 Notify

DNS Notify is a mechanism that allows master name servers to notify their slave servers of changes to a zone's data. In response to a notification from a master server, the slave verifies which SOA serial number for the zone (sent through the notify mechanism) is the newer compared to the current SOA serial number. If the serial number is newer, a zone transfer is initiated. For OES DNS servers, receiving Notify is valid only for designated secondary servers. Passive servers receive the latest data through eDirectory replication.

Figure 1-10 *Notify*



For more information on DNS notify, refer to RFC 1996.

1.2.9 Load Balancing

If all resolvers querying for a name get the same response, and if all of them contact the same host, that host becomes overloaded. Primitive load balancing can be achieved in DNS by using multiple records for one name. When a resolver queries for these records, the DNS server shuffles them and responds to the query with the records in a different order.

For example, suppose you have three Web servers with these three different IP addresses:

www 3600 IN A 10.10.0.1

3600 IN A 10.10.0.2

3600 IN A 10.10.0.3

The DNS server randomly shuffles the RRs so that clients randomly receive records in the order 1, 2,3; 2, 3, 1; and 3, 1, 2. Most clients use the first record returned and discard the rest.

1.2.10 Forwarding

The name server can forward some or all of the queries that it cannot satisfy from its authoritative data or cache to another name server; this is commonly referred to as a forwarder.

Forwarders are typically used when all servers at a given site should not be allowed to interact directly with the rest of the Internet servers. A typical scenario involves a number of internal DNS servers and Internet firewall servers unable to pass packets through the firewall. They forward to the server that can do it, which queries the Internet DNS servers on the internal server's behalf. An added benefit of using the forwarding feature is that the central machine develops a much more complete cache of information that all of the clients can take advantage of. Forwarding occurs only on those queries for which the server is not authoritative and does not have the answer in its cache.

A forwarding list is a list of IP addresses for the DNS servers to forward the queries to. For example, if a name server is configured to forward queries to 10.10.10.2, all queries that do not have resolutions to the name server are forwarded to 10.10.10.2. (See “DNS Namespace” on page 17). Forwarding is also possible at the zone level. When forwarders are configured at the zone level, they override the forwarders list configured at server level.

NOTE: The forwarding list syntax is different from the Bind 9.2 syntax for forwarders.

1.2.11 No-Forwarding

No-Forwarding is blocking queries to the list of DNS domains. The No-Forward list is the list of domain names whose unresolved queries are not forwarded to other DNS servers.

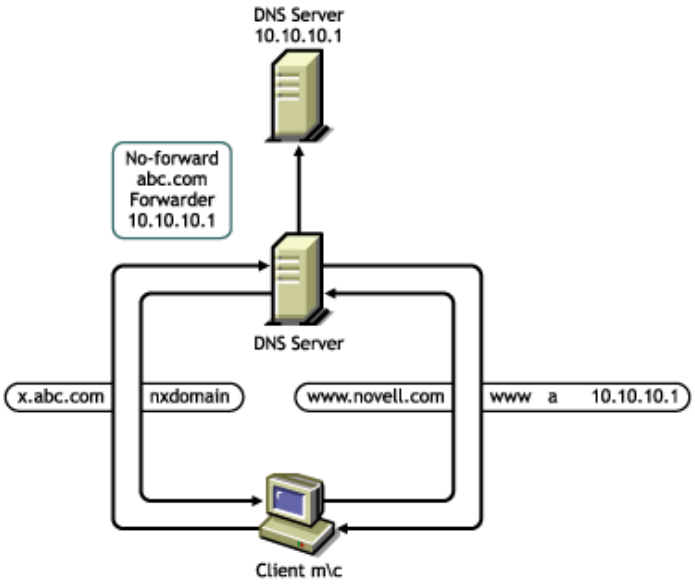
On a query from the client, the authoritative database is first checked. If the domain name is not found, the No-Forward list is checked. If the No-Forward list contains the entry, the query is not answered and the response `domain does not exist` (NXDOMAIN) is sent to the client. See “Name Resolution” on page 18.

For example, having the domain name “abc.com” in the No-Forward list blocks the queries to “abc.com”, “support.abc.com”, or any other subdomain of abc.com.

Wildcard characters are not supported in the No-Forward list. An asterisk or a root domain in the No-Forward list cannot be used to block queries to all domain names.

For example, developer.*.com cannot be used to block the queries to developer.novell.com or developer.xyz.com, etc.

Figure 1-11 *No-Forwarding*



1.2.12 Benefits of Integrating a DNS Server with eDirectory

The primary benefits of integrating a DNS server with eDirectory include:

- Centralized eDirectory-based DNS configuration and management. Configuration must typically be done on a per-server basis with non-OES DNS servers.
- DNS data is centrally managed in eDirectory, so all servers associated with a zone become primary or secondary. You get the benefit of all zones being primary, as opposed to a single zone being primary.
- DNS zone data is replicated through eDirectory replication, which eliminates the need for explicit DNS replication.
- Decentralized Administration of DNS is possible without accessing the DNS Server console or file system.

1.2.13 rndc Support

BIND includes the rndc utility that allows you to administer the named daemon, locally or remotely, with command line statements. The rndc program uses the `/etc/rndc.conf` file for its configuration options, which can be overridden with command line options.

For more details on the options supported by `rndc`, enter `rndc` at the command prompt.

The following rndc commands are not supported:

- `restart`
- `recursing`
- `flushname name [view]`
- `flush [view]`

1.2.14 Managing DNS Objects Using Java Management Console

This section provides information about managing DNS objects using the Java Management Console.

Java Management Console

The Java Management Console can be used to configure and manage eDirectory-based DNS objects. It is supported on Windows (XP and Vista), and Linux. It is an independent executable Java application. To launch Java Console:

On Windows: Click **Start > Programs > DNS-DHCP Management Console > DNSDHCP.** It can also be launched by double-clicking the **DNSDHCP** shortcut icon created on the desktop.

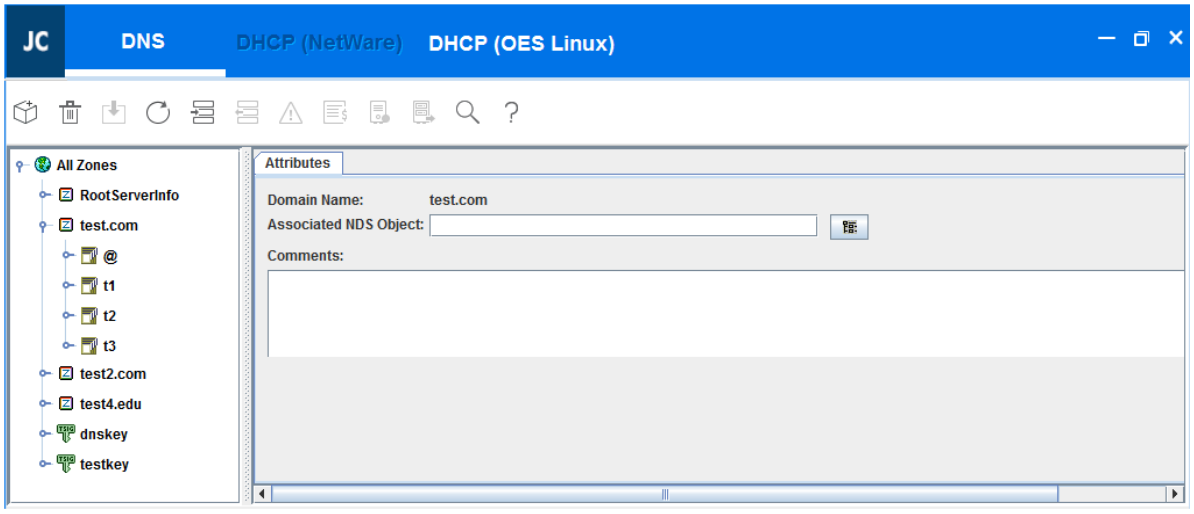
On Linux: Open a terminal console and run the command `./dnsdhcp-jc-launch.sh` from the location `/opt/novell/dnsdhcp/console/`.

When the Java Management Console is launched, it prompts you to select a tree as the target eDirectory context.

To manage objects in a different eDirectory tree, the administrator must exit the utility, change the context to the other eDirectory tree, and launch the utility again. The current eDirectory tree name is displayed in the utility's caption bar.

The Java Management Console manages one tree at a time. You can manage both DHCP and DNS services in the Java Management Console. Figure 1-12 shows the main user interface window for DNS services.

Figure 1-12 *DNS Java-based Management Console User Interface*



For more information, see:

- “DNS Service” on page 36
- “Toolbar” on page 36
- “Status Bar” on page 37
- “Server Status” on page 38
- “Object Creation Rules” on page 38

DNS Service

DNS objects can be accessed via the **DNS Service** tab. There are three panes within each tab page. The left pane displays the managed DNS objects in tree form. The right pane displays the detailed information about the selected object in the left or bottom pane. The bottom pane lists the DNS servers configured to provide necessary services.

Resources are organized according to the object hierarchy and the implicit ordering of objects. In the DNS Services pane, all zones or resource records within a zone are listed in alphanumeric order.

All DNS objects are created as eDirectory objects and are subject to Linux Administrator conventions. Therefore, when creating a new object, you should always name the object first in each Create dialog box.

The Create dialog box of these objects has browsing capability in the eDirectory tree, so an administrator with Write or Supervisor rights can select a specific context.

A newly created object's button on the toolbar is context-sensitive in relation to the selected item in either service's left tree pane. Your rights to the DNS objects are not verified until you perform an update, delete, or create against the target objects.

The DNS objects available in the new object dialog's creation list box depend on the selected object in the left tree pane. The following table lists the rules for each container object.

Table 1-3 *Rules for Container Objects*

Selected Object	Objects that can be created
All Zones	DNS Server, Zone, and DNS Key
DNS Server	DNS Server, Zone, and DNS Key
Zone	DNS Server, Zone, Resource Record, and DNS Key
RRSet	DNS Server, Zone, Resource Record, and DNS Key
Resource Record	DNS Server, Zone, Resource Record, and DNS Key

After a new DNS object has been created, the Java Management Console grants the objects Read and Write rights to the Locator object.

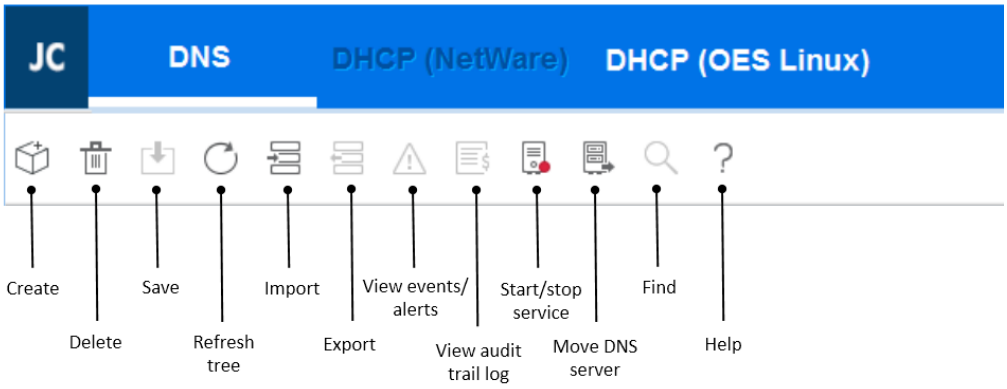
For fast and efficient searching, the distinguished names of newly created zones, DNS servers, and subnets are added to the corresponding attribute of the Locator object. Renaming or deleting these objects is automatically performed by eDirectory because of the built-in feature for eDirectory distinguished names.

After a new DNS object has been created, the Java Management Console gives you the choice of staying in its current focus or setting the focus on the newly created object. The utility also displays its detailed information page in the right pane. This feature is provided as a convenience to administrators and can be used by selecting the **Define Additional Properties** check box.

Toolbar

The Management Console offers no menu items. All functions are provided by the toolbar. The functions that are relevant for the item selected in the left tree pane or bottom server pane are highlighted to show their availability.

Figure 1-13 *Toolbar*



If you position the cursor over the icon, the icon's name appears. The following table lists, when the toolbar buttons are enabled in relationship to the selected object.

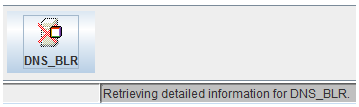
Table 1-4 *Period when the Toolbar Buttons are Enabled*

Toolbar Button	Enabled
Create	When Our Network, Subnet, Subnet Address Range, IP Address, Shared Network, All Zones, Zone, DNS Server, RRSet, or Resource Record is the selected object
Delete	When Subnet, Subnet Address Range, Shared Network, Zone, RRSet, Resource Record, or DNS Server is selected
Save	When fields have been changed for updates or changes
Refresh tree	Always enabled
Import	Always enabled
Export	When a zone is selected (except for forward zone)
View events/alerts	When DNS server is selected
View audit trail log	When DNS server is selected
Start/stop service	When DNS server is selected
Move DNS server	When DNS server is selected
Find	When Zone, Resource record, DNS key is selected
Help	Always enabled

Status Bar

The status bar displays two fields in the bottom pane of the Management Console. The first field shows the current database access interface in progress. The second field displays the current selected object or operation status. Figure 1-14 shows the status bar and the DNS server icon. The status bar is at the bottom of the figure.

Figure 1-14 *DNS Status Bar*

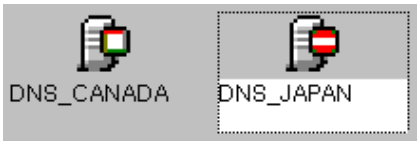


Server Status

Server icons are displayed in the lower portion of the Management Console.

Figure 1-15 shows icons representing two DNS servers. Both servers are operational, `novell-named` has been loaded and each can communicate with the Java Management Console, but the operation of the server on the right (DNS_JAPAN) has been suspended.

Figure 1-15 *DNS Server Icons*



Object Creation Rules

These are certain rules that govern the creation and manipulation of objects in the Linux DNS object hierarchy.

The DNS Zone object and DNS server object can be created in the context of an Organization (O), Organizational Unit (OU), Locality (L), or Country (C).

Some objects such as DNS key and DNS zone can be created in any context. For fast and efficient search operations, the distinguished names of the newly created zones and DNS servers are added to the corresponding attribute of the Locator object. Renaming or deleting these objects is automatically performed by eDirectory because of the built-in feature for eDirectory distinguished names.

Java Console lets you create zone objects under Country, Locality, Organization, Organizational unit, and domain containers.

Java Console does not let you select Country and Locality domain containers. You need to specify them manually. After you specify these contexts manually, Java Console creates zone objects under these containers.

Locator object cannot be created from Java Console. However, during installation if these contexts are specified, then you can create the locator object.

Locator object can be created in the Top, tree root, and domain containers along with existing Country, Locality, Organization, and Organizational Unit containers.

DNSServer object is always created under NCP server container. You cannot select a separate container for server object from Java Console.

1.3 DHCP

The Dynamic Host Configuration Protocol (DHCP) uses a client/server structure to provide configuration parameters to hosts. DHCP consists of a protocol for providing host-specific configuration parameters from a DHCP server (or collection of DHCP servers) to a host and a mechanism to allocate network addresses to a host. DHCP uses the UDP port 67 for sending data to the server and UDP port 68 for sending data to the client.

NOTE: In this document, the term *host* represents a client in the network with statically assigned IP address. It is identified by a host name.

When the DHCP server is loaded, it reads its configuration information from eDirectory and stores the information in its cache. When the DHCP server assigns IP addresses to clients, it updates the `dhcpd.leases` file with the addresses allocated.The network administrator can view the entries in the `/var/lib/dhcp/db/dhcpd.leases` file to see how the IP addresses have been allocated.

For more information, see:

- Section 1.3.1, “DHCP and BOOTP,” on page 39
- Section 1.3.2, “IP Address Allocation,” on page 41
- Section 1.3.3, “Virtual LAN Environments,” on page 42

DHCP provides for both static and dynamic configuration of IP clients. Static configuration enables you to assign a specific IP address and configuration to a client with a specific machine or MAC address. When DHCP assigns IP addresses dynamically, IP clients are assigned an IP address that is chosen from a range of available addresses. You can use dynamic address assignments when you are not concerned about which IP address a particular client uses. Each IP client that requests an address assignment can also use the other DHCP configuration parameters.

DHCP can limit the amount of time a DHCP client can use an IP address. This is known as the lease time. You can use the lease time to allow a large number of clients to use a limited number of IP addresses.

DHCP is based on BOOTP and maintains some backward compatibility. OES DHCP servers can be configured to respond to requests from BOOTP clients.

For more information, see:

- Section 1.3.1, “DHCP and BOOTP,” on page 39
- Section 1.3.2, “IP Address Allocation,” on page 41
- Section 1.3.3, “Virtual LAN Environments,” on page 42

1.3.1 DHCP and BOOTP

- “Similarities and Differences” on page 40
- “Using a BOOTP Relay Agent” on page 40

Similarities and Differences

DHCP is based on the Bootstrap Protocol (BOOTP) and maintains some backward compatibility. BOOTP was designed for manual configuration of the host information in a server database. The support for BOOTP is extended to provide Dynamic BOOTP support. A pool of addresses can be set up for BOOTP address assignment so that each BOOTP address does not need to be configured separately.

From the clients' point of view, DHCP is an extension of BOOTP, enabling existing BOOTP clients to interoperate with DHCP servers without requiring any change to the client initialization software. Some new, additional options optimize DHCP client-server interaction.

There are two primary differences between BOOTP and DHCP. DHCP defines methods through which clients receive IP addresses for a specified period of time, enabling serial reassignment of addresses to different clients. There is no concept of a lease time in BOOTP; address assignments (even in Dynamic BOOTP) are permanent. In addition, DHCP provides a method for a client to acquire all of the IP configuration parameters it requires to operate.

If multiple servers service a single subnet, only the principal server can be designated as an automatic BOOTP server.

Another difference between the two protocols is a change in terminology to clarify the meaning of the Vendor Extension field in BOOTP messages. With DHCP, this field is called the Option field.

Using a BOOTP Relay Agent

A BOOTP relay agent (also known as a forwarder) is an Internet host that passes DHCP messages between DHCP clients and DHCP servers in a subnet environment. The forwarder usually resides on an IP router; however, any OES server on a subnet can run the bootpfwd. The DHCP service in DNS/DHCP Services provides relay agent functions as specified in the BOOTP protocol specification (Internet RFC 951).

When a client starts, it sends a UDP broadcast message, called a Discover packet, to address 0xFFFFFFFF over port 67 requesting an address.

The forwarder has an IP address on the network and acts like a DHCP server, listening for Discover packets from clients on its LAN that are meant for a DHCP server. The forwarder must be configured with the destination address of the actual DHCP server on a different LAN segment that will provide DHCP service.

The DHCP server must be configured to serve the subnet on which the forwarder is located. The DHCP server must have a subnet address range to provide service.

After receiving a Discover packet from a client, the forwarder reformats the packet and sends it to the DHCP server. The DHCP server responds to the forwarder with an Offer packet containing an address for the client.

When the forwarder receives the Offer packet from the DHCP server, the forwarder contacts the client and provides the IP address and lease information.

1.3.2 IP Address Allocation

Allocation of IP addresses, either temporary or permanent, is one of the two primary services provided by DHCP. The client requests an IP address, and the DHCP server (or collection of DHCP servers) provides an address and guarantees not to give that address to another client within a specified time. Additionally, the server tries to return the same address to the client each time the client requests an address. The period of time over which an IP address is allocated to a client is called a lease.

A client acquires a lease for a fixed period of time. The length of the lease can be a number of hours or days, or it can be for an indefinite period.

After a lease for an IP address has been granted, a client can issue a request to extend its lease. The client can also issue a message to the server to release the address back to the server when the address is no longer required.

If a network has a limited number of IP addresses and must reassign them, the DHCP server reassigns an address when the lease has expired. The server uses configuration information to choose addresses to reuse. For example, the server might choose the least recently assigned address for reassignment. After receiving an address assignment, the host determines whether the address is in use by another host before accepting the address.

To minimize the chance of address duplication, the DHCP server can be configured to ping an address to test its validity before assigning it to a host. If the server receives a response from another device (indicating ownership of the address), the current address assignment is withdrawn so that another address can be assigned to the host.

DHCP supports three methods of IP address allocation:

- “Dynamic BOOTP Allocation” on page 41
- “Dynamic DHCP Allocation” on page 41
- “Manual Allocation” on page 42

A network can use one or more of these methods. The network administrator decides which methods to use.

Dynamic BOOTP Allocation

Dynamic BOOTP enables a DHCP server to assign permanent addresses to BOOTP clients from a pool of addresses. No manual configuration of the client is required prior to address allocation.

Dynamic DHCP Allocation

Dynamic DHCP allocation is the only method enabling automatic reuse of addresses no longer required by a client. Dynamic DHCP allocation is useful for assigning an address to a client that is connected temporarily to the network or for sharing a limited number of IP addresses among a group of clients that do not require permanently assigned IP addresses.

Dynamic DHCP allocation is also useful for assigning an IP address to a new client installed on a network on which IP addresses are scarce and must be reclaimed when older hosts are removed. An additional benefit of dynamic DHCP allocation is that when a client’s lease is renewed, the DHCP server refreshes the client’s configuration.

Manual Allocation

Manual or static allocation is used to assign addresses to DHCP or BOOTP clients. A specific IP address is assigned to the client based on an identifier such as the client's identifier or MAC address.

Manual allocation of DHCP eliminates the error-prone method of manually configuring hosts with IP addresses in networks for which IP address management without DHCP is desired. Manual allocation can be permanent or set to expire at a future time. When you manually allocate addresses, you can also create corresponding DNS Resource Records, thereby eliminating another error-prone activity. For more information on creating resource records refer to Section 13.1.4, "Resource Record Management," on page 137.

1.3.3 Virtual LAN Environments

In environments using a virtual LAN (VLAN), multiple subnets might be defined on one physical subnet. For example, one physical subnet might contain several Class C addresses to form a larger address range than allowed for a Class C address. To accommodate a VLAN environment, a shared network object must be configured on the DHCP server to bind the multiple subnets together.

If a forwarder forwards client requests from a physical subnet with multiple subnet bindings and these subnets are bound to a single shared network, the collection of addresses available in configured subnet address ranges is available to all clients (DHCP or BOOTP) on that physical subnet. This is the primary use of the shared network object.

Clients that are on the same subnet as the DHCP server do not need to be configured for the shared network if the server is bound to all local subnet addresses, or if the server has an address on each local subnet.

1.4 OES DHCP Service

- Section 1.4.1, "DHCP Options," on page 43
- Section 1.4.2, "eDirectory Objects for DHCP," on page 45
- Section 1.4.3, "Java Management Console for DHCP (OES Linux)," on page 48

An OES DHCP server automatically assigns IP addresses and other configuration information to clients upon request or when the clients are restarted. Automatic assignment of configuration information reduces the amount of work required to configure and manage a large IP network.

In addition, integrating DHCP with eDirectory enables you to enter all configuration information into one distributed database. This greatly simplifies network administration and provides for the replication of DHCP configuration information.

The OES DHCP Service provides the following features:

- All DHCP configuration is managed in eDirectory, facilitating enterprise-wide management.
- DHCP options can be set at the following levels:
  - Service level
  - Shared Network level
  - Subnet level
  - Pool level

- Host level
- Class level

- You can deny service to unwanted devices by creating Host objects identified with the MAC address of the device and setting deny booting for the host.
- The DHCP software updates `/var/lib/dhcp/db/dhcpd.leases` file to record all address assignments to clients.
- You can use Dynamic DNS (DDNS) to update DNS with information about addresses assigned and rescinded.
- The DHCP software enables the server to cache addresses and other configuration information from eDirectory for quick response.
- You can configure the DHCP server to ping an address to verify that no other device is using it before assigning the address to a client.
- It provides fault tolerance as follows:
  - A server can survive a temporary local eDirectory service outage and recover automatically.
  - DHCP configuration is replicated like other eDirectory data.
- The DHCP server can work with any DNS server.
- The Failover Peer protocol support allows two DHCP servers to share a common address pool that ensures continuous availability of the network.
- The import or export DHCP service is supported to transfer the DHCP service configuration from files in Linux dhcpd.conf format into eDirectory or from eDirectory to a text file in a dhcpd.conf format.

The OES DHCP service supports the standards of the following RFCs:

- RFC 2131: Dynamic Host Configuration Protocol
- RFC 2132: DHCP Options and BOOTP Vendor Extensions
- RFC 2241: DHCP Options and Directory Services
- RFC 2242: NetWare/IP Domain Name and Information

OES DHCP Services also supports the BOOTP standards of the following RFCs:

- RFC 1497: BOOTP Vendor Information Extensions
- RFC 1534: Interoperation Between BOOTP and DHCP
- RFC 1542: Clarifications and Extensions for the Bootstrap Protocol

1.4.1 DHCP Options

- “DHCP Options for eDirectory” on page 44
- “NetWare/IP Options” on page 44
- “DHCP eDirectory Objects” on page 44

The OES DHCP service supports vendor options, DHCP options, and BOOTP parameters as defined in Internet RFC 2132 with a few exceptions. A table listing the option codes and names is found in Section A.3, “DHCP Option Descriptions,” on page 192.

DHCP Options for eDirectory

Three DHCP options for eDirectory are defined. These options eliminate the need to provide this information each time users log in.

Option 85 provides the IP address of one or more eDirectory servers for the client to contact for access to the eDirectory database. Option 86 provides the name of the eDirectory tree the client will be contacting. Option 87 provides the eDirectory context the client should use.

For detailed information about using these options, refer to Internet 'RFC 2241', *DHCP Options for Novell Directory Services.*

NetWare/IP Options

Option codes 62 and 63 in the DHCP packet for NetWare/IP are used. Option 62 contains the NetWare/IP domain name.

Option 63, the IPX Compatibility option, contains general configuration information such as the primary DSS, the preferred DSS, and the nearest servers. Option 63 also provides additional information in the form of suboptions, listed in the table below.

Table 1-5 *Suboptions Codes and Meaning*

Suboption Codes	Meaning
5	If the value of this field is 1, the client should perform a NetWare Nearest Server Query to find out its nearest NetWare/IP server.
6	Provides a list of up to five addresses of NetWare Domain SAP/RIP servers.
7	Provides a list of up to five addresses of the nearest NetWare/IP servers.
8	Indicates the number of times a NetWare/IP client should attempt to communicate with a given DSS server at startup.
9	Indicates the amount of delay in seconds between each NetWare/IP client attempt to communicate with a given DSS server at start-up.
10	If the value is 1, the NetWare/IP client should support NetWare/IP Version 1.1 compatibility.
11	Identifies the Primary Domain SAP/RIP Service server (DSS) for this NetWare/IP domain.

Refer to Internet 'RFC 2242' and NetWare IP Domain Name and Information for detailed information about using these NetWare/IP options.

DHCP eDirectory Objects

When you select OES DHCP Services during the OES installation, the eDirectory schema is extended to enable the creation of DHCP objects and the following objects are created:

- dhcpLocator (Locator object)
- DHCPGroup (Group object)

Only one copy of these objects exists in the context that is specified during OES installation. The DNS servers, DHCP servers, and the Management Console must have access to these objects.

The DHCPGroup object is a standard eDirectory group object. This object is used to grant the necessary rights to the eDirectory user used by the DHCP server to access the DHCP objects

The dhcpLocator object is created during the OES installation and has references to dhcpServer and dhcpService objects. The creator of the Locator object grants Read and Write permissions to this object to the network administrators.

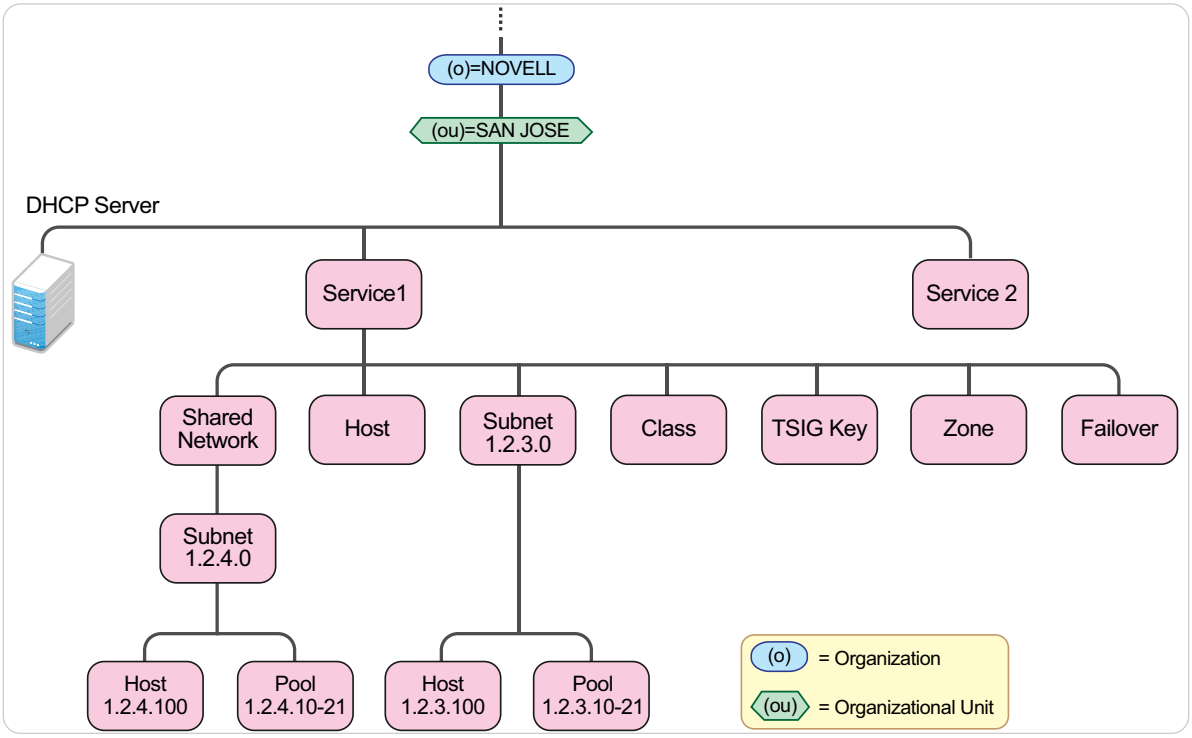
1.4.2 eDirectory Objects for DHCP

The following eDirectory objects are supported in DHCP:

- “DHCP Service” on page 46
- “DHCP Server” on page 46
- “Shared Network” on page 47
- “Subnet” on page 47
- “Pool” on page 47
- “Class” on page 47
- “Host” on page 48
- “Zone” on page 48
- “TSIG Key” on page 48
- “Failover” on page 48

Figure 1-16 shows a basic configuration of the DHCP objects. This structure might be used for a small to medium-size network.

Figure 1-16 *eDirectory Objects for DHCP*



DHCP Service

The DHCP Service object is a container object that contains the DHCP configuration for the entire network, a subset of the network, or a single server. It is made up of configuration details of shared networks, subnets, classes, pools and hosts. Depending on your organizational needs, there can be more than one DHCP Service object in the network.

Java Console enables you to create service objects with the same name if they are located in different containers. However, it is recommended to create service objects with unique names since Java Console displays only service object name instead of the FQDN. Therefore, it is difficult to distinguish between service objects with the same name.

DHCP Server

The DHCP Server object serves one or more DHCP service objects. Each DHCP server can be associated with one or more DHCP services depending on the needs of your organization. In a typical scenario, there must be one DHCP Server object configured for every system running DHCP Service.

Keeping the DHCP server and its configuration details as separate entities provides much-needed flexibility in associating and switching between DHCP servers and configurations.

Shared Network

All subnets that share the same physical network can be grouped under a Shared Network object.

Some installations have physical networks on which more than one IP subnet operates. For example, if there is a site-wide requirement that 8-bit subnet masks be used, but a department with a single physical Ethernet network expands to the point where it has more than 254 nodes, it might be necessary to run two 8-bit subnets on the same Ethernet until a new physical network can be added. In this case, the subnet declarations for these two networks must be enclosed in a shared-network declaration.

A shared network object must be created under a service object.

Subnet

The Subnet object enables you to distribute IP addresses and DHCP options to each network.

Because the DHCP Service object is the fundamental object of the hierarchy of the network, a subnet object must be created under a service element in the hierarchy. If your organizational setup requires the subnet object to be grouped under a shared network, create the subnet object under a service-shared network hierarchy.

The subnet statement is used to provide dhcpd with enough information to tell whether or not an IP address is on that subnet. It can also be used to provide subnet-specific parameters and to specify what addresses can be dynamically allocated to clients booting on that subnet.

Pool

The pool declaration can be used to specify a pool of addresses that are treated differently than another pool of addresses, even on the same subnet. It is also possible to set up entirely different subnets for known and unknown clients. You can create multiple pool objects under a Subnet object. The pool object must be created under a service-shared network-subnet or service-subnet hierarchy.

You can create multiple pool objects under a Subnet object.

Class

The Class object helps in segregating clients into classes, and these clients can be treated differently depending on the class they are in. This separation can be done either with a conditional statement, or with a match statement within the class declaration. It is also possible to create automatic subclasses based on the contents of the client packet. You can also set a limit on the number of clients within a class or subclass.A subclass is a class with the same name as a regular class, but with a specific submatch expression

To group clients into different classes based on conditional expression, you can specify a match expression within a class statement in the following manner:

```
match if substring (option dhcp-client-identifier, 1, 3) = "RAS";
```

A subclass is a class with the same name as a regular class, but with a specific submatch expression that is hashed for quick matching. To automatically create lease-limited subclasses based on client parameters, use the `spawn with` statement.

The option value sent by the client is checked with the dynamically created subclasses for the specified class and if a match is found, the client will be classified under that subclass and treated accordingly.

If no match is found, the server creates a new subclass and logs the information in the lease file, and the client is classified in this new subclass. After classification, it is processed according to the rule set for the class.

Host

The Host object represents a client in the network with statically assigned IP address. It is identified by a host name.

The DHCP Management Utility can be used to configure host objects that are manually assigned. When configuring an individual host object, you can provide specific options that override global options or those set at the subnet/service level.

Zone

The DHCP Zone object contains the references to Domain Name System (DNS).

A DHCP server uses this information to perform dynamic updates for the zone objects. A DNS server must be configured to allow updates for the zone that the DHCP server is updating.

TSIG Key

A TSIG key is used for authenticating dynamic updates to a DNS server. TSIG uses shared secret keys as a cryptographically secure means of authenticating a DNS update.

Failover

The Failover Peer protocol allows only two DHCP servers to share a common address pool. This ensures continuous availability of the network. The process defines the role of a primary server and a secondary server.

Each server has about half of the available IP addresses in the Pool at any given time for allocation. During a prolonged failure of the primary server, the secondary server recovers all the addresses that the primary server had available for allocation, and begins to reuse them.

1.4.3 Java Management Console for DHCP (OES Linux)

The Java Management Console can be used to configure and manage DHCP (OES Linux) objects based on eDirectory. It is an independent executable Java application. To launch Java Console:

On Windows: Click **Start > Programs > DNS-DHCP Management Console > DNSDHCP.** It can also be launched by double-clicking the **DNSDHCP** shortcut icon created on the desktop.

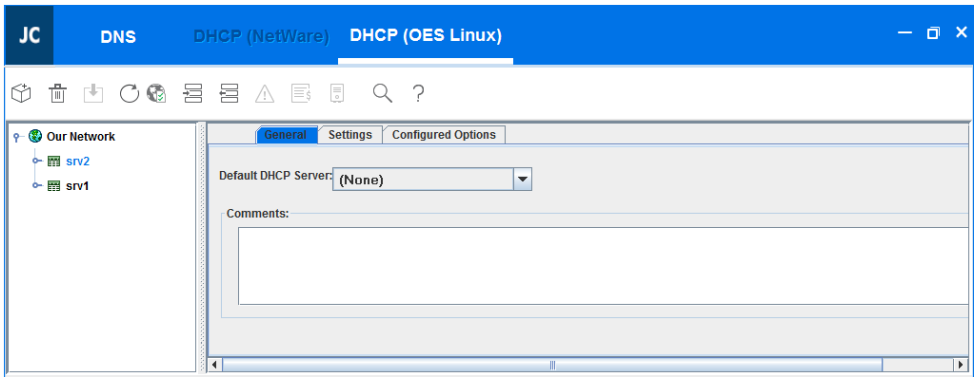
On Linux: Open a terminal console and run the command `./dnsdhcp-jc-launch.sh` from the location `/opt/novell/dnsdhcp/console/`.

When the Java Management Console is launched, it prompts you to select a tree as the target eDirectory context.

You must log in to the desired eDirectory tree before launching the Java Management Console. To manage objects in a different eDirectory tree, you must exit the utility, change the context to the other eDirectory tree, and launch the utility again. The current eDirectory tree name is displayed in the utility's title bar.

The Java Management Console manages one tree at a time. Figure 1-17 shows the main user interface window for DHCP (OES Linux) Services.

Figure 1-17 *DHCP (OES Linux) Java-based Management Console User Interface*



For more information, see:

- “DHCP (OES Linux)” on page 49
- “Toolbar” on page 50
- “Status Bar” on page 51
- “Server Status” on page 51
- “Object Creation Rules” on page 52

DHCP (OES Linux)

DHCP objects can be accessed via the **DHCP (OES Linux)** tab. There are three panes within each tab page. The left pane displays the managed DHCP objects in tree form. The right pane displays detailed information about the object that is selected in the left or bottom pane. The bottom pane lists the Linux DHCP servers configured to provide necessary services.Resources are organized according to the object hierarchy and the implicit ordering of objects. In the left pane, all the DHCP Service objects are listed in alphanumeric order.All of the objects are created as eDirectory objects and are subject to Linux Administrator conventions. Therefore, when creating a new object, you should always name the object first in each Create dialog box.The Create dialog box for these objects has browsing capability in the eDirectory tree, so an administrator with Write or Supervisor rights can select a specific context.A newly created object's button on the toolbar is context-sensitive in relation to the selected item in either service's left tree pane. Your rights to the objects are not verified until you perform an update, delete, or create against the target objects.The DHCP objects available in the new object dialog’s creation list box depend on the selected object in the left tree pane.

After a new DHCP object has been created, the Java Management Console grants the objects Read and Write rights to the dhcpLocator object.

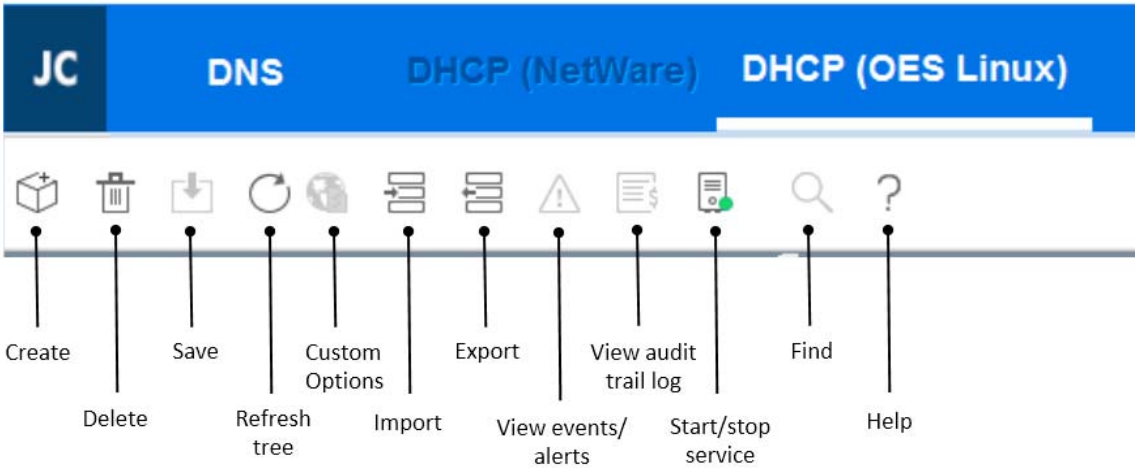
For fast and efficient searching, the distinguished names of newly created Service objects and Server objects are added to the corresponding attribute of the dhcpLocator object. Renaming or deleting these objects is automatically performed by eDirectory because of the built-in feature for eDirectory distinguished names.

After a new DHCP object has been created, the Java Management Console gives you the choice of staying in its current focus or setting the focus on the newly created object. The utility also displays its detailed information in the right pane. This feature is provided as a convenience to administrators and can be used by selecting the **Define Additional Properties** check box.

Toolbar

The Management Console offers no menu items. All functions are provided by the toolbar. The functions that are relevant for the item selected in the left tree pane or bottom server pane are highlighted to show their availability.

Figure 1-18 *DHCP (OES Linux) Toolbar*



If you position the cursor over the icon, the icon's name appears. The following table lists when each toolbar button is enabled in relationship to the selected object.

Table 1-6 *Period when the Toolbar Buttons are Enabled*

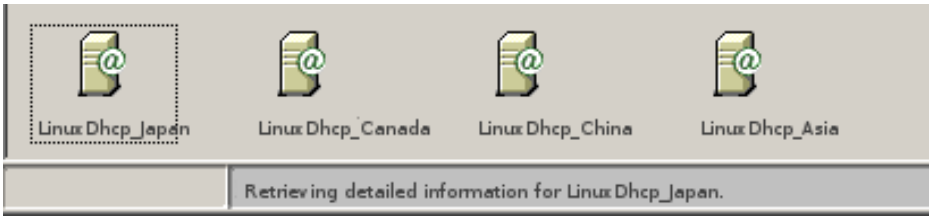
Toolbar Button	Enabled
Create	Always enabled
Delete	Always enabled
Save	When fields have been changed for updates or changes
Refresh tree	Always enabled
Custom Options	When DHCP service is selected
Import	Always enabled
Export	Always enabled
Start service Stop Service	When DHCP server is selected
Find	When Service, Subnet, TSIG key,Zone, shared network, class, host, failover peer is selected
Help	Always enabled

NOTE: If you use the **Custom Options** button to add a new option, you need to specify information in the **Description** field. The **Description** field can contain only alphanumeric characters and the special character "-". You cannot use spaces in the **Description** field.

Status Bar

The status bar displays in the bottom pane of the Management Console. When an object is selected, the status of that object is displayed in the status bar. Figure 1-19 displays the status bar for the Server LinuxDHCP_Japan server.

Figure 1-19 *DHCP (OES Linux) Status Bar*



Server Status

The icon for the Linux DHCP Server changes depending on its status. Table 1-7, “DHCP (OES Linux) Server Icons,” on page 52 explains the various DHCP (OES Linux) server icons along with their states.

Table 1-7 DHCP (OES Linux) Server Icons

Icon	Description of the DHCP Server State
	Indicates that the process to find out the DHCP server state has not been initiated.
	Indicates that the DHCP server is inactive. This icon is displayed when sfcbd is up and dhcpd is down.
	Indicates that the server is active. This icon is displayed when both sfcbd and dhcpd are up and running.
	Indicates that there has been a communication failure while trying to identify the DHCP server status.
	This animated icon indicates that a process is on to identify the status of the DHCP server.

Object Creation Rules

These are certain rules that govern the creation and manipulation of objects in the Linux DHCP object hierarchy.

The DHCP Server object and DHCP service object can be created in the context of an Organization (O),Organizational Unit (OU), Locality (L), or Country (C).

For fast and efficient search operations, the distinguished names of the newly created service and DHCP servers are added to the corresponding attribute of the Locator object. Renaming or deleting these objects is automatically performed by eDirectory because of the built-in feature for eDirectory distinguished names.

Locator object cannot be created from Java Console. However, during installation if these contexts are specified, then you can create the locator object.

Locator object can be created in the Top, tree root, and domain containers along with existing Country, Locality, Organization, and Organizational Unit containers.

DHCP Server object is always created under NCP server container. You cannot select a separate container for server object from Java Console.

DHCP pool object can only be created under a DHCP subnet object and a DHCP subnet object can only be created under a DHCP service object.

1.5 What's Next

The next section covers the enhancements in DNS/DHCP Services.

- Chapter 2, "What's New or Changed in DNS and DHCP," on page 53

2 What’s New or Changed in DNS and DHCP

Domain Name System (DNS) and the Dynamic Host Configuration Protocol (DHCP) services in OES 24.4 has been modified for bug fixes. There are no new features or enhancements in OES 24.4.

3 Planning Your DNS/DHCP Implementation

This section provides information to plan and design your implementation of DNS and DHCP in order to maximize capabilities of these services on OES 2018 or later.

- Section 3.1, “Resource Requirements,” on page 55
- Section 3.2, “eDirectory Guidelines,” on page 55
- Section 3.3, “Planning a DNS Strategy,” on page 56
- Section 3.4, “Planning a DHCP Strategy,” on page 59

3.1 Resource Requirements

The CPU requirements for DNS on an OES server varies depending on whether you are serving a few static zones without caching or whether you are serving an enterprise DNS.

The memory of the server must be sufficient to accommodate the cache and zones loaded off disk. The `max-cache-size` option can be used to limit the amount of memory used by the cache, at the expense of reducing cache hit rates and creating more DNS traffic. It is still a good practice to have enough memory to load all zones and cache data into the memory. However, the best way to determine this for a given installation is to watch the name server in operation. After a few weeks, the server process should reach a relatively stable size where entries are expiring from the cache as fast as they are being inserted. Ideally, the resource limits should be set higher than this stable size.

3.2 eDirectory Guidelines

Consider the following eDirectory guidelines to maintain optimal performance when providing DNS and DHCP services on your OES network:

- Where to locate the DNS and DHCP Group and Locator objects. See “Understanding DNS and DHCP Services” on page 11 for more information about these objects.
- Where to locate the DNS and DHCP servers
- What replication strategy to employ
- How to provide fault tolerance

We recommend the following:

- Place the DNS and DHCP objects in a separate partition that is accessible from and replicated to all points of the network where OES DNS and DHCP servers are located. For details on the objects in DNS and DHCP, see “DNS eDirectory Objects and Attributes” on page 26 and “DHCP eDirectory Objects” on page 44.

  This is required because all OES DNS and DHCP servers and the Java Management Console require access to these objects.

- Plan to create an Organizational Unit (OU) container object near the top of your eDirectory tree. The location of this container object should be easily and widely accessible. Locate the DNS and DHCP Group and Locator objects under the container object.
- Plan to create an Administrator Group object under the container object near the top of the eDirectory tree. An administrator group should have Read and Write permissions to both DNS and DHCP Locator object attributes except the global data and options fields. Members of this group can use Java Console to modify DHCP objects and manage DNS objects.

  IMPORTANT: A network administrator can access only his or her administrative domain, which might not include the DNS and DHCP Locator objects. By creating an administrative group, you enable administrators who are group members to use the Java Management Console.

- Plan to locate your DNS and DHCP servers at locations where they are geographically close to the hosts that require their services. Plan to also have one DHCP server in each partition of your network to minimize any WAN communications problems caused by normal load, configuration changes, or replication.
- Replicate the partition containing the DNS and DHCP Group and Locator objects to all parts of the network that use DNS and DHCP services. This ensures access in the event of system unavailability or hardware problems.

  When planning your DNS replication strategy, consider that replication is employed for load balancing when you provide multiple name servers within the DNS zone.

  Well-planned replication is the best way to provide fault tolerance for DNS and DHCP services.

3.3 Planning a DNS Strategy

To provide load balancing, fault tolerance, and robustness to your DNS implementation, install and operate a primary name server and at least one secondary name server.

When you configure your zone, the primary name server contains the most up-to-date information about the zone and all the hosts within it.

A secondary name server receives its zone data from the primary name server. When it starts and at periodic intervals, the secondary name server queries the primary name server to determine whether the information it contains has been changed. If the zone information in the secondary name server is older than the zone information in the primary name server, a zone transfer occurs and the secondary name server receives the zone information from the primary name server.

For more information, see the following:

- “Planning Zones” on page 57
- “Using the OES DNS Server as a Primary Name Server” on page 57
- “Using the OES DNS Server as a Secondary Name Server” on page 57
- “Configuring a DNS Server to Forward Requests” on page 58
- “Setting Up the in-addr.arpa Zone” on page 59
- “Registering Your DNS Server with Root Servers” on page 59

3.3.1 Planning Zones

If you are running a primary name server and providing DNS service for a zone, the size or geography of your network might require that you create subzones within the zone. Although there is no limitation on the size of a zone when you configure DNS, we recommend that you do not create very large zones. An OES DNS server can support very large zones, but the higher the number of resource records in a zone, the greater the impact on DNS query resolution for that zone. Managing small zones is simpler and more efficient. You can divide your zones into smaller subzones based on the geographic locations or organizational structures.

Keep the zone data as a separate partition and replicate the partition to all places on your network where you have a name server for the zone. Doing so enables independent replication of the zone data and also provides a degree of fault tolerance in case of server down time.

3.3.2 Using the OES DNS Server as a Primary Name Server

You must install the OES DNS server as a primary name server to have authoritative control over your zone and to take advantage of Dynamic DNS (DDNS), which is the dynamic updating of DNS by DHCP.

When operating a OES DNS server as a primary name server, you can use the Java Management Console to make configuration changes. When you operate a primary name server, the zone data can receive dynamic updates from DHCP servers. Non-OES secondary name servers can obtain data from the OES primary name server.

3.3.3 Using the OES DNS Server as a Secondary Name Server

If you plan to operate secondary DNS servers that use OES DNS and DHCP Services software and that connect to a non-OES master name server, one OES secondary name server must be specified as the Designated Secondary or zone in server. The Designated Secondary server receives zone transfer information from the non-OES master server and provides updates to eDirectory. Other OES secondary name servers can then access the information within eDirectory.

You might connect a OES secondary name server to a non-OES master name server for the following reasons:

- You are using a master DNS server and do not want to designate it as a primary name server because of the responsibility it entails.
- This approach is easy to implement in your existing DNS model.
- You want to install more secondary name servers to provide better load balancing.
- You want to gradually make the transition to operating a primary name server.

3.3.4 Configuring a DNS Server to Forward Requests

If a name server cannot answer a query, it must query a remote server. You can configure primary or secondary name servers to act as forwarders. When you designate a server to be a forwarder, all off-site queries are first sent to the forwarder.

Forwarders that handle the off-site queries develop a robust cache of information. The forwarder probably can answer any given query with information from its cache, eliminating the need to make an outside query to a remote server.

When you decide to make a server a forwarder, configure the other servers in your zone to direct their queries through the forwarder. When a forwarder receives a query, it checks its cache for the information. If the information is unavailable, the forwarder issues a query to the root server.

For more information, see:

- “Forwarding Requests” on page 58
- “Restricting Forwarding (No-Forwarding)” on page 58

Forwarding Requests

When you configure your name servers, you must provide information about where to forward requests that the servers cannot answer.

Even if you are using forwarders, a name server that does not receive a timely response from its forwarder eventually attempts to query a root server directly.

Restricting Forwarding (No-Forwarding)

If you have a primary name server with subdomains below it and the primary name server is not aware of the subdomains, the name server sends queries to external name servers.

You can configure your primary name server not to forward queries for specified internal subdomains to external name servers. Instead, the primary name server sends a negative response to any queries for the internal subdomains.

If you want to restrict some external domains, you can use No-Forwarding. You can configure your servers not to forward queries to the specified external domains and the server sends a negative response to queries for those external domain.

3.3.5 Setting Up the Forward Zone Type

If the name server is configured to serve forward zones, all queries for these zones are forwarded to the IP address configured in the Forward list of the zone. For example, if example.com is configured as a Forward Zone and is configured to forward queries to 10.10.10.3, all queries for example.com are forwarded to 10.10.10.3

3.3.6 Setting Up the in-addr.arpa Zone

Just as the data in your name server provides mapping of names to Internet addresses, the in-addr.arpa zone provides mapping of addresses to names. However, in the structure of the in-addr.arpa zone, the IP address appears in reverse. For example, an IP address of 100.20.30.4 in the san-jose.novell.com domain is *4.30.20.100.in-addr.arpa* in the in-addr.arpa subdomain.

3.3.7 Registering Your DNS Server with Root Servers

If you plan to operate a primary DNS name server, you must register your name server with your parent domain. Not all name servers need to be registered, but we recommend registering one-third to one-half of your name servers (up to a maximum of 10) with the parent domain. These servers are queried by servers outside your domain. The remaining name servers are queried only by hosts within your domain that are configured to query them.

If you provide DNS service for other domains and provide an authoritative name server for those domains, you must also register those domains.

To register a domain or subdomain, you must contact the network administrators of the parent domain (com, for example) and the in-addr.arpa domain. Provide the administrators with the name of the domain name server and the name of the domain and any subdomains for which it is authoritative. If you are setting up a new domain, you also need to provide the IP address of any server you want to register.

InterNIC is the organization that registers domain names for the root, com, org, net, edu, and gov domains. To obtain the form for domain registration from InterNIC, contact them at InterNIC (http://www.internic.net/) You can also obtain the form for in-addr.arpa domain registration from the same location.

Detailed information about the registration process is available from the InterNIC Web site. You can also use the InterNIC Web site to research domain names to ensure that the name you want is not already registered and to obtain additional information and help.

3.4 Planning a DHCP Strategy

When planning your implementation of DHCP, consider the following:

- Your existing network topology (how you set up your routers and subnets) provides a basic configuration for the distribution DHCP resources such as Shared Network, Subnet, Pool, Host and Class objects.
- Your existing eDirectory implementation should be incorporated into your planning. Place the Locator object near the top of your eDirectory tree where it can be easily accessed by all servers.
- The length of time you set for your leases affects traffic on the network.

For more information, see the following:

- “Network Topology” on page 60
- “eDirectory Implementation” on page 60
- “Lease Considerations” on page 61

- “IP Address Availability” on page 63
- “Hostnames” on page 64

3.4.1 Network Topology

Your existing network topology provides a basic configuration for the distribution of DHCP resources. There are two paths. However it depends on whether you are migrating from an existing DHCP solution or you are installing and configuring DHCP for the first time. See the following section:

- “Installing the DHCP Service for the First Time” on page 60

Installing the DHCP Service for the First Time

If you are planning to use DHCP for the first time, you must gather a significant amount of information. You need to make a list of all hosts to be served by the DHCP server. You must include all devices that use network addresses in every segment of your network. You must also compile lists of IP address assignments.

Organize your lists of hosts and IP addresses by geographic location. For example, if your network is spread over a WAN, make a list for each location to help you organize the distribution of DHCP resources.

You must have a list of all permanently assigned network addresses. You might also want to make a list of devices that are to be denied IP addresses and those hosts that are to receive strict limitations on leases.

After you gather the necessary information, you need to create the necessary objects to represent this information. This is done by creating pools for contiguous network addresses and other, more specific information. You will probably have a separate pool for each LAN segment of your network. You will also create objects of subnets and DHCP servers. Although there is no limitation on the size or number of subnets when you configure DHCP, we recommend that the IP address in each subnet is not more than 2048. An OES DHCP server can support several large subnets in a DHCP configuration. However, the greater the number of IP addresses, the greater the impact on DHCP run-time performance.

3.4.2 eDirectory Implementation

Plan to create an Organizational Unit (OU), Country (C), or Locality (L) container object near the top of your eDirectory tree.

Plan to locate the Locator objects under the container object. The Locator objects must be easily accessible to all the servers on the network.

Create Subnet objects to represent each LAN segment. Then create one or more pool objects to represent all of your contiguous strings of IP addresses.

For fast access and availability, a DHCP server should be on the same LAN as or geographically close to the writable partitions the DHCP server uses.

3.4.3 Lease Considerations

- "Lease Length" on page 61
- "Controlling Client Access to Leases" on page 63

In deciding how long to set your client leases, consider the following factors:

- Your site's and clients' usage patterns
- Your network's goals
- Availability of servers
- Availability of network (IP) addresses

Another important consideration is that clients attempt to renew their leases halfway through the lease duration. The longer the lease, the longer it takes for client configuration changes to be registered with the DHCP server. It also takes longer for the server to realize that a previously assigned address is no longer in use.

Another issue to consider concerns outages and access to the DHCP server. If a client loses access to its DHCP server before renewing its lease, it must stop using the network after the lease expires. If a client is turned on and connected to the network at the time of the outage, however, the lease does not expire.

The longest lease provided by a DHCP server determines the length of time you might have to wait before configuration changes can be propagated within a network. This length of time could mean manually restarting every client or waiting the amount of time required for all leases to be renewed before the changes take effect. If your site policy is to turn off workstation power at the end of the day, clients could acquire configuration changes at least once per day.

NOTE: All lease considerations refer to DHCP clients or devices only. For clients or devices that use BOOTP, you must bring down the device and restart it to acquire any new configuration changes.

Lease Length

When considering the length of leases, ask these questions:

- Will the default of three days work well in your environment?

  The default of three days provides a good balance between a long-lease and a short-lease duration.

- Do you have more clients than IP addresses?

  If you have more clients than IP addresses, keep leases short to allow access to more users. A short lease could be two to four hours, or even a matter of days.

  If your site's usage pattern shows that all clients request an address every day and you have half as many addresses as users, lease times in hours or minutes would provide access to more users.

- Do you provide support for remote access?

  If your site has mobile users or provides remote access to clients, plan to provide service for these clients on a specific subnet. Providing support, including special options the clients might require, makes network administration of the clients easier.

- Do you support a minimum lease time?

  If your site's usage pattern indicates that your users typically use an address for only one or two hours, that should be your minimum lease time.

- How many clients do you plan to support?

  Shorter leases support more clients, but shorter leases also increase the load on the DHCP server and network bandwidth. A lease of two hours is long enough to serve most users, and the network load should be negligible. A lease of one hour or less might increase network load to a point that requires attention.

- How fast are your communications connections between your clients and the DHCP server?

  By locating a DHCP server in close proximity to its users, the network load should be negligible over LAN connections. If a DHCP server must communicate over WAN links to provide service to clients, slowdowns and time-outs might occur.

- How long does your typical server outage last?

  If your typical server outage lasts two hours, a lease of four hours would avoid loss of lease to clients that were active at the time of the server outage.

  We recommend setting your lease times to twice the length of a typical server outage.

  The same recommendation applies to communications line outages. If a communications line is down long enough that leases expire, you might see a significant network load when the service is restored.

- How long can your clients operate without access to the DHCP server?

  If you have users who require a lease for important job functions, consider lease times for them that are twice the length of a maximum server outage. For example, if your DHCP server were to go down on Friday evening and require the entire workday Monday to be restored, that would be an outage of three days. In this case, a six-day lease might be appropriate.

- Do you have users who advertise their IP addresses for services they render?

  If you have users who are setting up Web pages or archiving data for others to access, they want addresses that do not change. You might want to assign permanent addresses for these users instead of assigning long lease times.

  The relevant length of time is the maximum amount of time you want to allow a client to keep an address, even if the host computer is turned off. For example, if an employee takes a four-week vacation and you want the employee to keep his or her address, a lease of eight weeks or longer is required.

The following table lists examples of lease times and the reasons these times were chosen.

Table 3-1 *Examples of Lease Times*

Lease Time	Reason
15 minutes	Keeps the maximum number of addresses free when there are more users than available addresses, but results in significant traffic and frequent updates to eDirectory
6 hours	Covers a DHCP server outage of 3 hours
12 hours	Ensures that retraction of an address assignment takes less than one day
3 days	Used by many sites simply because of software defaults
6 days	Allows for a weekend server outage without losing leases
4 months	Enables students to keep their address over a summer vacation, for example

Controlling Client Access to Leases

There is usually a trade-off when you attempt to control specific client access to leases. Typically, you manually configure each client and dedicate an IP address permanently to each client. However, OES's DHCP server provides control based on the client's hardware address.

3.4.4 IP Address Availability

- "Identifying Your Addresses" on page 63
- "Subnetting Your Addresses" on page 63
- "Assigning Addresses Manually" on page 64

Identifying Your Addresses

If you have been using a previous version of OES DHCP, another vendor's product, or another method of tracking your IP address information, information about your addresses should be close at hand. To prevent communication problems, we recommend verifying the accuracy of your IP address records by performing a site audit.

If you are unsure of the range of your IP addresses, contact your Internet Service Provider (ISP) or check other records you have on file.

Subnetting Your Addresses

One of the more difficult configuration tasks is configuring your routers if you have multiple subnets. Each might require one or more subnets, depending on your router configuration. Create a Subnet object for each LAN segment that requires dynamic IP address assignment.

Assigning Addresses Manually

Your site might have devices, such as servers and printers, that have addresses assigned by means other than DHCP. Assign addresses to these devices manually.

You must also provide these devices with any specific configuration information they might require. If you want to provide configuration using DHCP, the device must be capable of acting as a DHCP client. You can assign a static address to a device and still provide configuration information through DHCP.

To ensure that the assigned addresses are not used by DHCP, use Java Console to exclude the addresses from assignment. You can use the utility to exclude entire range of IP addresses from address assignment. For example, to exclude IP addresses in the range 192.168.10.10 to 192.168.10.20, follow the steps given below:

1. Create a pool of IP address in the range 192.168.10.10 to 192.168.10.20. For more information about creating a pool, Section 7.1.7, “Pool Management,” on page 86.
2. Select the **General** tab of the created pool and select the **Excluded** option from the **Range Type** list.

3.4.5 Hostnames

Every host on your network that uses the Internet or that can be reached from the Internet should have a name. Each resource record has a hostname field.

The following simple rules are used for hostnames to conform to accepted Internet standards:

- Hostnames are called labels and can have alphabetic and numeric characters.
- A hyphen is allowed if it separates two character strings.
- Labels might not be all numbers, but they can have a leading digit.
- Labels must begin and end only with a letter or digit.

4 Running DNS/DHCP Services in a Virtualized Environment

DNS/DHCP Services runs in a virtualized environment just as it does on a physical server running on OES and requires no special configuration or other changes.

To get started with KVM virtualization, see the Introduction to KVM Virtualization (https://documentation.suse.com/sles/15-SP4/html/SLES-all/cha-kvm-intro.html) in the *SLES Virtualization Guide* (https://documentation.suse.com/sles/15-SP4/html/SLES-all/book-virtualization.html) guide.

To get started with Xen virtualization, see Introduction to Xen Virtualization (https://documentation.suse.com/sles/15-SP4/html/SLES-all/cha-xen-basics.html) in the *SLES Virtualization Guide* (https://documentation.suse.com/sles/15-SP4/html/SLES-all/book-virtualization.html) guide.

For information on setting up virtualized OES, see "Installing OES on a VM" in the *Installation Guide*.

To get started with third-party virtualization platforms, such as Hyper-V from Microsoft and the different VMware product offerings, refer to the documentation for the product that you are using.

5 Comparing Linux and NetWare

This section describes differences between DNS and DHCP Services on Netware versus DNS/DHCP on Linux. The audience for this section is mainly administrators who are familiar with DHCP on NetWare and intend to move to the new solution available with OES.

- Section 5.1, “DNS on NetWare versus DNS on Linux,” on page 67
- Section 5.2, “DHCP on NetWare versus DHCP on Linux,” on page 69
- Section 5.3, “Limitations,” on page 70
- Section 5.4, “What’s Next,” on page 71

5.1 DNS on NetWare versus DNS on Linux

- Section 5.1.1, “Management Interface,” on page 67
- Section 5.1.2, “Commands,” on page 67
- Section 5.1.3, “Filenames and Paths,” on page 68
- Section 5.1.4, “Installation Difference,” on page 69
- Section 5.1.5, “Features Not Supported,” on page 69

5.1.1 Management Interface

- “Java Console” on page 67

Java Console

The Management Console is a Java application that provides a graphical user interface to manage the objects created to support DNS and DHCP. The Management Console functions as a standalone utility.

For customers who are moving from Netware to Linux, the management interfaces remain the same as before.

5.1.2 Commands

The following table provides details on difference between commands used to administer DNS Server.

Table 5-1 Commands to Administer DNS Server

Feature	NetWare	Linux

Starting the DNS Server	`load named`	`rcnovell-named start`
		or
		`systemctl start novell-named.service`

Stopping the DNS Server	`unload named`	`rcnovell-named stop`
		or
		`systemctl stop novell-named.service`

Checking the status of the DNS Server	`m named`	`rcnovell-named status`
		or
		`/systemctl status novell-named.service`

Journal log size	`jsize`	Specify using Java Console, **DNS Server Object> Advanced tab > max-journal-size** field.

Unsupported Command Line Parameters

On NetWare, the following command line parameters can be used to administer the DNS Server. In the new solution on OES, the parameters are not supported:

- [-dc categories]
- [-mstats]

For additional details on using novell-named, see Section 13.3, “novell-named Command Line Options,” on page 142

5.1.3 Filenames and Paths

In OES, the binary names and paths of the files have changed. The following table explains the differences:

Table 5-2 Difference Between NetWare and Linux Binary Names and Paths

Files	On NetWare	On Linux
Server Binaries	`sys:/system/named.nlm`	`/opt/novell/named/bin/novell-named`
*.db file	`sys:/etc/named/*.db`	`/etc/opt/novell/named/*.db`
*.jnl file	`sys:/etc/named/*.jnl`	`/etc/opt/novell/named/*.jnl`
stat files	`sys:/etc/named/named.sta`	`/var/opt/novell/log/named/named.stats`

Files	On NetWare	On Linux
Log file	`sys:/named.run`	`/var/opt/novell/log/named/named.run`
Log Extension file	N/A	`/opt/novell/named/extns/log/queries_answers.extn`

5.1.4 Installation Difference

- "Installing on NetWare" on page 69
- "Installing on Linux" on page 69

Installing on NetWare

On NetWare, installation was managed using the `dnipinst.nlm` utility. This utility also provides the capability to perform upgrade.

Installing on Linux

On OES, DNS and DHCP services can be installed through YaST. This method also installs the dependencies.

5.1.5 Features Not Supported

- Auditing
- Monitoring
- SNMP
- Screen Logging
- Zone Information

5.2 DHCP on NetWare versus DHCP on Linux

This section addresses the differences between Linux and NetWare. The audience for this section is mainly administrators who are familiar with DHCP on NetWare and intend to move to the new solution on OES.

- Section 5.2.1, "Commands," on page 69
- Section 5.2.2, "Filenames and Paths," on page 70
- Section 5.2.3, "Features Not Supported," on page 70

5.2.1 Commands

The following table provides details on command used to administer DHCP Server.

Table 5-3 *Commands to Administer DHCP Server*

Command	On NetWare	On Linux

Starting the DHCP Server	`load dhcpsrvr`	`rcnovell-dhcpd start`
		or
		`systemctl start dhcpd.service`

Stopping the DHCP Server	`unload dhcpsrvr`	`rcnovell-dhcpd stop`
		or
		`systemctl stop dhcpd.service`

Checking the status of the DHCP Server	`m dhcpsrvr`	`rcnovell-dhcpd status`
		or
		`systemctl status dhcpd.service`

5.2.2 Filenames and Paths

Table 5-4 *Filenames and Paths*

Files	On NetWare	On Linux
`Configuration file`	NA	`/etc/dhcpd.conf`
`Startup Log`	NA	`/var/log/dhcp-ldap-startup.log` This is the dump of DHCP configurations read from eDirectory, when the DHCP Server comes up
Server Log	NA	`/var/log/dhcpd.log`

5.2.3 Features Not Supported

- SNMP Support
- Auditing

5.3 Limitations

The YaST plug-in supports only SUSE Linux Enterprise Server (SLES) DNS servers. If you want to manage an OES DNS server, use the Java Management Console.

5.4 What's Next

The next section describes methods to install and configure DHCP.

- Chapter 6, "Installing and Configuring DHCP," on page 73

6 Installing and Configuring DHCP

This section describes how to install and configure the OES DHCP service on Open Enterprise Server.

- Section 6.1, “Planning Your Installation,” on page 73
- Section 6.2, “Installing DHCP,” on page 75
- Section 6.3, “Setting Runtime Credentials,” on page 77
- Section 6.4, “Post Installation,” on page 78
- Section 6.5, “Verifying the Installation,” on page 78
- Section 6.6, “What’s Next,” on page 79

6.1 Planning Your Installation

Before you start the installation process for DHCP, review the following:

- Section 6.1.1, “Prerequisites,” on page 73
- Section 6.1.2, “eDirectory Permissions,” on page 73
- Section 6.1.3, “Recommendations,” on page 74

6.1.1 Prerequisites

- Java Management Console is required for creation of the DHCP Service object. For details see Section 1.4.2, “eDirectory Objects for DHCP,” on page 45.

IMPORTANT: Do not install any of the following service combinations on the same server as OES DHCP. Although not all of the combinations cause pattern conflict warnings, OpenText does not support any of the combinations shown.

- Xen Virtual Machine Host Server

6.1.2 eDirectory Permissions

- “First-Time Installation on an eDirectory Tree” on page 74
- “Installing on an eDirectory Tree Where a DHCP Server Already Exists (Separate Container)” on page 74

First-Time Installation on an eDirectory Tree

If you are installing OES DHCP Server on an eDirectory tree for the first time, you require the following rights on the Server, Locator, and Group containers at the eDirectory level before you start the DHCP installation.

- Create permission at the entry level of the container for the following:
  - DHCP Server Object Container
  - Locator Object Container (dhcpLocator)
  - Group Object Container (DHCPGroup)
  - DHCP Proxy User Object Container

Installing on an eDirectory Tree Where a DHCP Server Already Exists (Separate Container)

If you are installing DHCP Server on an eDirectory tree, make sure that you have the following permissions:

- Create permissions at the entry level of the container for the following objects:
  - DHCP Server Object Container
  - DHCP Proxy User Object Container
- Read and Write permissions for the existing objects at attribute level of the objects.
  - Locator Object Container (dhcpLocator)
  - Group Object Container (DHCPGroup)
- To retrieve the existing Locator and Group objects context, specify the following rights:

  Read and compare rights at the attribute level and browse rights at the entry level of the container where DHCP Locator and Group objects are present.

Table 6-1 *eDirectory Object and Attribute Permissions*

DHCP Objects and Attributes	Permissions
dhcpLocator	Read, Write
DHCPGroup	Read, Write
DHCP Server object	Create
Proxy User	Create rights at the entry level of the proxy user container

6.1.3 Recommendations

- Create the dhcpLocator object and the DHCPGroup object at the top of the eDirectory tree.
- Replicate the eDirectory tree on the server running DHCP so that the search for the objects is fast.

NOTE: In the eDirectory tree, multiple copies of dhcpLocator object and the DHCPGroup object can exist. If the dhcpLocator and DHCPGroup objects already exist, then Read permissions for the DHCPGroup object and Write permissions for the dhcpLocator object are required.

- While installing the DHCP server on every node, it is recommended that you mention the same proxy user in the OES Credential Store. This will avoid creation and maintenance of multiple proxy users in the Directory.

6.2 Installing DHCP

YaST Install

There is a predefined system of installing components along with the associated dependencies. For a service to function properly, all the dependent products must be installed. Pattern deployment provides patterns for different services. Selecting a pattern automatically selects and installs its dependencies:

1. In the YaST install, on the **Installation Settings** page, click Software to go to the Software Selections and System Tasks page.
2. Under the OES Services option, select **OES DHCP**.
3. Click **Accept**.

   After the installation is done, the system reboots for the changes to take effect.
4. Follow the on-screen instructions, specifying configuration parameters in each of the pages shown below. Refer Table 6-2 for details on the fields.

Table 6-2 *Fields - Configuration Parameters and Details*

Configuration Parameter	Details
DHCP Server Context	Specify a context for the DHCP Server object. For example: o=novell
DHCP Server Object Name	Specify the name of the Server object that these DHCP services will be running on. For example: DHCP_servername. This is the DHCP server object that contains a list of DHCP Services (configuration) served by the DHCP Server.
Locator Context	Specify the context for the DHCP Locator object. For example: o=novell. The DHCP Locator object has references to dhcpServer and dhcpService objects.
Group Context	Specify the context for the DHCP Group object. For example: o=novell. This object is used to grant the necessary rights to the eDirectory user used by the DHCP server to access the DHCP objects.
Log File Location	Specify the path and filename for the DHCP server to dump the configurations it reads from eDirectory. Specify the path manually or click **Browse** to locate the log. The default path is `/var/log/dhcp-ldap-startup.log`.
LDAP Method	Select **Static** if you do not want the DHCP server to query the LDAP server for host details. Select **Dynamic** if you want the DHCP server to query for host details from the LDAP server for every request. Selecting the dynamic LDAP method ensures that the responses you receive to queries are accurate, but the server takes a longer time to respond.
Referrals	Select **Chase Referral** if you want the DHCP server to follow referrals. Otherwise, select the **Do Not Chase Referral** option. A referral is a message that the LDAP server sends to the LDAP client informing it that the server cannot provide complete results and that more data might be on another LDAP server.
eDirectory Server address or host name	The IP address shown is the default LDAP server for this service. If you do not want to use the default, select a different LDAP server in the list. If you are installing into an existing tree, ensure that the server you select has a master replica or read/write replica of eDirectory. If you need to add another LDAP server to the list, add it by using the LDAP Configuration for Open Enterprise Services dialog box.
Use secure channel for configuration	This option is selected by default. When you are configuring DHCP services, it ensures that all configuration is transferred over a secure channel. Deselecting this option lets a user with fewer privileges configure LDAP services.

Configuration Parameter	Details
LDAP User Name with Context	Specify a distinguished name and context for an LDAP user. For example: cn=joe, o=novell. This user should be an eDirectory user that can access the DHCP server. During eDirectory configuration, if you have selected the **Use Common Proxy User as default for OES Products** check box, then the proxy user and password fields are populated with common proxy user name and password.
LDAP User Password	Type a password for the LDAP user.
LDAP port for DHCP Server	Select a port for the LDAP operations to use.
Use secure channel for DHCP Server	This option is selected by default to ensure that the data transferred between DHCP server and LDAP server is secure and private. If you deselect this option, the data transferred is in clear text format.
Request Certificate	Specifies the checks to perform on the server certificate in a SSL/TLS session. Select one of the following options:Never: The server does not ask the client for a certificate.Allow: The server requests for a client certificate but if a certificate is not provided or a wrong certificate is provided, the session still proceeds normally.Try: The server requests the certificate. If none is provided, the session proceeds normally. If a certificate is provided and it cannot be verified, the session is immediately terminated.Hard: The server requests a CA certificate and a valid certificate must be provided, or the session is immediately terminated.
LDAP CA File	The LDAP CA file contains CA certificates
LDAP client certificate	The LDAP client certificate contains the client certificate. The client is a user, service, or any client.
LDAP client Key file	The LDAP client key file contains the key file for the client certificate.

5 Click **Next** to complete the installation process.

6.3 Setting Runtime Credentials

The Runtime Admin name and Runtime Admin password are stored in the OES Credential Store, which is later used by the DHCP Server for eDirectory authentication. The Runtime Admin credentials are stored with root (install user) and dhcpd user permissions. There can only be one Runtime User credential for DHCP stored in OES Credential Store.

NOTE: In cluster setup, Runtime Credentials must be set on all the nodes in the DHCP cluster.

To set the runtime credentials, execute the following command:

```
oescredstore -s -n dhcp-ldap -u <username> -p <password>
```

For example, to set the credentials of the runtime admin *dhcpadmin*, execute the following command:

```
oescredstore -s -n dhcp-ldap -u cn=dhcpadmin,o=novell -p Password
```

6.4 Post Installation

If DHCP fails to start and throws an error “No subnet declaration for ethx”, subnet declaration for the interface to which DHCP listens is missing in the configuration.

Declare the same subnet as the DHCP listening interface.

For example, if DHCP is listening on the eth0 interface 192.168.1.1, then declare a subnet for 192.168.1.0.

NOTE: If you decide not to manage this subnet by this DHCP server, leave the subnet declaration empty i.e, do not create any pools within this subnet.

If you have multiple network interfaces on different subnets, the DHCP service will listen to only `eth0` by default. Besides defining the subnet in the DNS/DHCP console, you can edit the `/etc/sysconfig/dhcpd` file and modify the `DHCPD_INTERFACE="eth0"` parameter to `DHCP_INTERFACE="eth0 eth1"`.

6.5 Verifying the Installation

After the installation is done, you can verify the installation by using the following procedure:

1. Use iManager to check for the presence of the following objects in the eDirectory tree:
   - **dhcpLocator:** This object is in the Locator context specified during installation.
   - **DHCPGroup:** This object is in the Group context specified during installation.
2. Use Java Console to check for the presence of the following object:

   DHCP_<hostname>: This object is in the DHCP server context specified during installation.

   The schema is extended only during the first installation. For subsequent installs, you only need to verify DHCP Server object creation.
3. Check the following parameters in the `/etc/dhcpd.conf` file:

   ```
   ldap-server
   ldap-port
   ldap-ssl
   ldap-base-dn
   ldap-method
   ldap-debug-file
   ldap-dhcp-server-cn
   ldap-referrals
   ```

   The `dhcpd.conf` file cannot be modified using Java Console. After you install and configure DHCP for the first time, if you want to modify any parameters of the `dhcpd.conf` file, you must manually update the `dhcpd.conf` file to make the change.
4. (Conditional) If you selected **Use Secure Channel for DHCP Server** option and **Request Certificate** as **Never**, check the `ldap_tls_reqcert` parameter included in the `dhcpd.conf` file.

5 (Conditional) If you selected **Use Secure Channel for DHCP Server** option and **Request Certificate** as **Try/Allow/Hard**, check the following parameters and the availability of the following certificate files:

```
ldap-tls-reqcert
ldap--tls-ca-file
ldap-tls-cert
ldap-tls-key
```

6.6 What's Next

The next section describes methods to administer the DHCP server and manage it through Java Console.

- Chapter 7, "Administering and Managing DHCP," on page 81

7 Administering and Managing DHCP

The following sections indicate the steps that need to be executed to configure and manage a DHCP server:

- Section 7.1, “Using the Java Management Console to Manage DHCP (OES Linux),” on page 81
- Section 7.2, “Starting the DHCP Server,” on page 98
- Section 7.3, “Stopping the DHCP Server,” on page 98
- Section 7.4, “What’s Next,” on page 98

7.1 Using the Java Management Console to Manage DHCP (OES Linux)

This section provides details on using the Java Management Console for DHCP (OES Linux) to manage objects in eDirectory.

- Section 7.1.1, “Installing Java Management Console,” on page 82
- Section 7.1.2, “Service Management,” on page 84
- Section 7.1.3, “Server Management,” on page 85
- Section 7.1.4, “Starting or Stopping a DHCP Server,” on page 85
- Section 7.1.5, “Shared Network Management,” on page 85
- Section 7.1.6, “Subnet Management,” on page 86
- Section 7.1.7, “Pool Management,” on page 86
- Section 7.1.8, “Host Management,” on page 87
- Section 7.1.9, “Class Management,” on page 88
- Section 7.1.10, “Zone Management,” on page 88
- Section 7.1.11, “TSIG Key Management,” on page 89
- Section 7.1.12, “Failover Peer Management,” on page 89
- Section 7.1.13, “Managing DHCP (OES Linux) Objects in the Java Management Console,” on page 91
- Section 7.1.14, “Importing and Exporting the DHCP Configuration,” on page 94
- Section 7.1.15, “Viewing Dynamic Leases,” on page 96
- Section 7.1.16, “Deleting Dynamic Leases,” on page 97

IMPORTANT: Make a forced exit from Java Management console if you observe any of the following three scenarios:

- Unable to reach eDirectory after establishing a connection.

- If there is any network interruption.
- Viewing of leases takes more time than usual.

7.1.1 Installing Java Management Console

Install the Java Management Console on client computers to administer DNS and DHCP services.

- "Installing Java Console on Windows" on page 82
- "Installing Java Console on Linux" on page 82
- "Starting Java Console" on page 83
- "Logging in to Java Console" on page 83
- "Command Line Options" on page 83

Installing Java Console on Windows

1. Download Java Console for windows from the Unified Management Console (UMC) home page or the Application Delivery Marketplace (https://www.microfocus.com/marketplace/appdelivery).

   The filename for 32-bit Windows is `dnsdhcp32.msi` and for 64-bit Windows is `dnsdhcp64.msi`.
2. Double-click the downloaded Java file to start the installation and follow the on-screen instructions to complete rest of the setup process.

NOTE: Java Console is not supported on Windows XP SP3 64-bit platform.

IMPORTANT: Java Runtime Environment (JRE 1.8 or later) is required for running Java Console on Windows. Download JRE from the web if it is not available on your Windows.

Installing Java Console on Linux

1. Download Java Console for Linux from the UMC home page or the Application Delivery Marketplace (https://www.microfocus.com/marketplace/appdelivery).

   The zip filename for 32-bit Linux is `dnsdhcp-jc-i586.tar.gz` and for 64-bit Linux is `dhsdhcp-jc-x86_64.tar.gz`
2. Untar these files using the `tar -xzvf <filename>` command.

   The 32-bit RPM is `novell-dnsdhcp-jc-1.4.6-0.X.i586.rpm` and the 64-bit RPM is `novell-dnsdhcp-jc-1.4.6-0.X.x86_64.rpm`.
3. Install the Java Console with the `rpm -ivh <rpm name>` command.

NOTE: Ignore the following warning message during installation, "novell-dnsdhcp-jc-1.4.6-0.XX.X.x86_64.rpm: Header V3 RSA/SHA256 Signature, key ID <XXXXXXXX>: NOKEY".

Starting Java Console

Starting the Console on Windows: Double-click the **dnsdhcp** icon on the desktop or click **Start** > **All Programs** > **DNS-DHCP Management Console** > **DNSDHCP** to launch the login window.

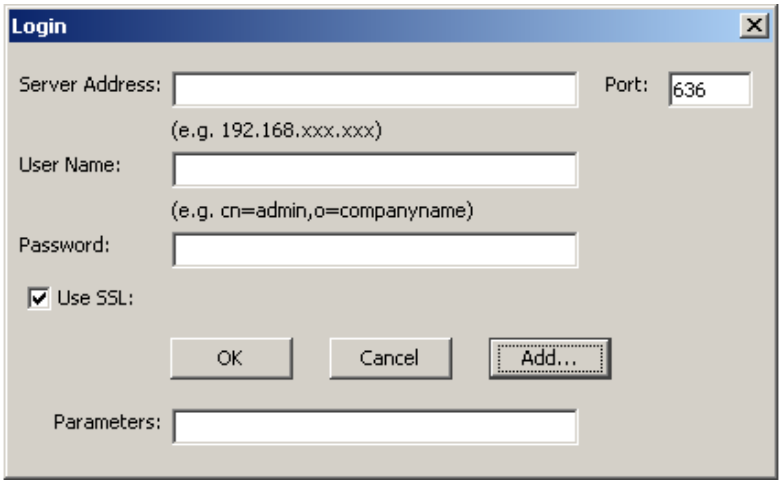
Starting the Console on Linux (Gnome): In Gnome, double-click the DNSDHCP icon in **Computer** > **Applications** > **More Applications > DNSDHCP** to launch the login window.

Starting the Console on Linux (KDE): In KDE, double-click the icon in **System > Network > DNSDHCP Management Console**.

Logging in to Java Console

1 Launch the Java Console login window. The following window is displayed for Windows:

A similar login window is displayed for Linux.



2 Specify the IP address of the server in the **Server Address** field.

3 Specify the **User Name** and **Password** to log in to this server.

4 For a secured login, select the **Use SSL** check box.

5 (Optional) Click **Add** to specify the command line options in the **Parameters** field.

Command Line Options

The following are the command line options that can be specified while launching the Java Management console:

Table 7-1 Command Line Options

Option	Use
-c	Specifies the context in which the DNS/DHCP locator object is present. When you use this option, you can eliminate the search for the DNS/DHCP Locator object and obtain a quicker startup for the DNS/DHCP Java Management Console. For example, if the context in which the locator object is present is `ou=wgp,o=novell`, then using -c option you can specify the following: -c ou=wgp,o=novell. `-c ou=wgp,o=novell` The -c option is used to specify the netware tree context in which the locator object is present.
-s	Limits the administrative scope of the DNS Java Management console. If you manage only objects under the ctp.novell context, you can set the option as –s ctp.novell and launch the Management Console. With this option set, you can view only those DNS objects that are under the ctp.novell eDirectory context. Using this option might improve the server performance because not all DNS objects are read. If you do not set this option, all the DNS objects in the tree are displayed.
-l	Specifies the Locator context. The -l option is used to specify the linux tree context in which locator object is present. For example, if the context in which the locator object is present is `ou=wgp,o=novell`, then using -l option you can specify the following: -l ou=wgp,o=novell. `-l ou=wgp,o=novell`
-p	Specifies the Port.

7.1.2 Service Management

The Service object acts as a container object for subnet, shared network, host, zone, class, and TSIG key.

To create a service

1. Click the **DHCP (OES Linux)** tab of Java Management Console window main panel.
2. Click **Create** on the toolbar to open the **Create New DHCP Object** window.
3. Select **Service** in the **Create New DHCP Object window**, then click **OK**. The Create Service window opens.
4. Specify the **service name**.
5. Specify the eDirectory context or use the browse button to select the context.
6. Select the default DHCP server from the drop-down list.
7. Click **Create**. The DHCP (OES Linux) Service object is created on the left pane of Java Management Console.

You can manage the DHCP (OES Linux) Service on the right pane of the Java Management Console by using the **General**, **Settings**, and **Configured Options** tabs.

For more information on managing objects, see Section 7.1.13, “Managing DHCP (OES Linux) Objects in the Java Management Console,” on page 91.

7.1.3 Server Management

The Dynamic Host Configuration Protocol (DHCP) uses the client/server structure to allocate network addresses to a host. The DHCP server reads its configuration information from eDirectory and stores the information in its cache.

To create a server

1. Click **the DHCP (OES Linux)** tab of the Java Management Console.
2. Click **Create** on the toolbar to open the **Create New DHCP Object** window.
3. Select **DHCP Server** in the **Create New DHCP Object** window, then click **OK**. The Create Server window opens.
4. Specify the server name.
5. Specify the eDirectory context or browse to select the context.
6. Click **Create**.

   The server is now created and added to the **Default DHCP Server** list.

You can manage the DHCP (OES Linux) server on the right pane of the Java Management Console by using the **General** and **Settings** tabs.

For more information on managing objects, see Section 7.1.13, “Managing DHCP (OES Linux) Objects in the Java Management Console,” on page 91.

7.1.4 Starting or Stopping a DHCP Server

1. Click Start/Stop Service on the toolbar.

Depending on the state of the DHCP Server, one of the following operations occurs:

- Start action: If the DHCP Server is in Stop mode, the Server is started.
- Stop action: If the DHCP Server is in Start mode, the Server is stopped.

You must ensure that you have configured the IP address of a DHCP server to start or stop the server. To configure the IP address of the DHCP server, select the **General** tab of the server object, then click **Add** to specify the IP address.

7.1.5 Shared Network Management

All subnets that share the same physical network can be grouped under a Shared Network object.

To create a shared network object:

1. Click the **DHCP (OES Linux)** tab of the Java Management Console.
2. Select the service for which the shared network needs to be created.

3 Click **Create** on the toolbar to open the **Create New DHCP Object** window.

4 Select **shared network** from the **Create New DHCP Object window**, then click **OK**.The Create Shared Network window opens.

5 Specify the name of the Shared Network object.

6 Click **Create**.The Shared Network is now created.

You can manage the DHCP (OES Linux) Shared Network on the right pane of the Java Management Console by using the **General**, **Settings**, and **Configured Options** tabs.

For more information on managing objects, see Section 7.1.13, “Managing DHCP (OES Linux) Objects in the Java Management Console,” on page 91.

7.1.6 Subnet Management

The Subnet object is the most fundamental DHCP object. It enables you to distribute IP addresses and DHCP options to each network.

The Subnet object acts as a container object for Host and Pool objects.

A Subnet object's specific DHCP options and configuration parameters apply to the entire subnet and override global options.

To create a Subnet

1 Click the **DHCP (OES Linux)** tab of the Java Management Console.

2 Select the shared network or the service for which the subnet needs to be created.

3 Click **Create** on the toolbar to open the **Create New DHCP Object** window.

4 Select **Subnet** from the **Create New DHCP Object** window, then click OK.

5 Specify a unique **Subnet Address** and **Subnet Mask** in the fields provided.

6 Click **Create**.

The Subnet is created.

You can manage the DHCP (OES Linux) Subnet on the right pane of the Java Management Console by using the **General**, **Lease**, **Settings**, **Configured Options, and IP Address Utilization** tabs.

For more information on managing objects, see Section 7.1.13, “Managing DHCP (OES Linux) Objects in the Java Management Console,” on page 91.

7.1.7 Pool Management

A Pool is a designated range of IP addresses used to specify a range type assignment.

The Pool object represents a range of addresses for dynamic address assignment or for exclusion from the address assignment.

To create a Pool

1. Click the **DHCP (OES Linux)** tab of the Java Management Console.
2. Select a service or a shared network from the list where you want to create a pool. All of the subnets created under the service and the service or shared network hierarchy are displayed. Select the subnet under which you want to create the pool.
3. Click **Create** on the toolbar to open the **Create New DHCP Object** window.
4. Select pool from the **Create New DHCP Object** window, then click **OK**. The Create Pool window opens.
5. Specify the name of the pool.
6. Specify the **Start Address**.
7. Specify the **End Address**.
8. Click **Create**.

   The pool is created.

You can manage the DHCP (OES Linux) Pool on the right pane of the Java Management Console by using the **General**, **Settings**, **Configured Options, and IP Address Utilization** tabs.

For more information on managing objects, see Section 7.1.13, “Managing DHCP (OES Linux) Objects in the Java Management Console,” on page 91.

7.1.8 Host Management

Hosts are a system of domain names in the network. They are used to identify DHCP clients. Host objects have an associated IP address.

For clients with statically assigned addresses or for installation where only known clients are served, each client must have a host.

Creating a Host

1. Click the **DHCP (OES Linux)** tab of the Java Management Console.
2. Select the service or the subnet where you want to create the host.
3. Click **Create** on the toolbar to open the **Create New DHCP Object** window.
4. Select host from the **Create New DHCP Object** window, then click **OK**. The Create Host window opens.
5. Specify the name by which you want to identify the host in the **Host Name** field.
6. Specify the IP address of the host in the **Host IP Address** field.
7. Specify the client identifier. This uniquely identifies the client.
8. Select the MAC type from the drop-down list.
9. Specify the hardware address of the NIC (Network Interface Card) in the **MAC Address** field.
10. Click **Create**. The host is now created below the required service.

You can manage the DHCP (OES Linux) host on the right pane of the Java Management Console by using the **General**, **Lease**, **Settings**, and **Configured Options** tabs.

For more information on managing objects, see Section 7.1.13, “Managing DHCP (OES Linux) Objects in the Java Management Console,” on page 91.

7.1.9 Class Management

The Class object helps in segregating clients into classes. These clients are treated differently depending on the class they are in.

To create a Class

1. Click the **DHCP (OES Linux)** tab of the Java Management Console.
2. Select the service for which the class needs to be created.
3. Click **Create** on the toolbar to open the **Create New DHCP Object** window.
4. Select **Class** from the **Create New DHCP Object** window, then click **OK**. The Create Class window opens.
5. Specify the name of the class in the **Class Name** field.
6. Click **Create**.

   The Class is created for the specified Service.

You can manage the DHCP (OES Linux) Class on the right pane of the Java Management Console by using the **General**, **Settings**, and **Configured Options** tabs.

For more information on managing objects, see Section 7.1.13, “Managing DHCP (OES Linux) Objects in the Java Management Console,” on page 91.

7.1.10 Zone Management

The DHCP Zone object defines the Domain Name System (DNS).

A DHCP server uses this information to perform dynamic updates for the zone objects. A DNS server must be configured to allow updates for the zone that the DHCP server is updating.

To create a Zone

1. Click the **DHCP (OES Linux)** tab of the Java Management Console.
2. Select the service for which the Zone needs to be created.
3. Click **Create** on the toolbar. The **Create New DHCP Object** window opens.
4. Select the zone from the **Create New DHCP Object** window, then click **OK**. The Create Zone window opens.
5. Specify the name of the zone in the **Zone Name** field.
6. In the **DNS Server IP Address** field, specify the IP address of the DNS server that will receive updates from an authorized DHCP server.
7. Click **Create**.

   The zone is created for the specified service.

You can manage the DHCP (OES Linux) zone on the right pane of the Java Management Console by using the **General** tab.

For more information on managing objects, see Section 7.1.13, “Managing DHCP (OES Linux) Objects in the Java Management Console,” on page 91.

7.1.11 TSIG Key Management

TSIG key can be used to secure DDNS updates between DNS and DHCP servers. For a successful secure DDNS update between DNS and DHCP servers, you must ensure the following:

- Zones (both forward and reverse) are assigned TSIG key.
- Both DNS and DHCP key name and it's secret must be the same.

Creating a TSIG key

1. Click the **DHCP (OES Linux)** tab of the Java Management Console.
2. Select the service for which the TSIG key needs to be created.
3. Click **Create** on the toolbar. The **Create New DHCP Object** window opens.
4. Select **TSIG** from the **Create New DHCP Object** window, then click **OK**. The Create TSIG Key window opens.
5. Specify the name of the TSIG key in the **TSIG Key Name** field.
6. Specify the name of the algorithm in the **Algorithm** field.
7. Specify the **Secret key**.

   NOTE: The number of characters in the secret key must be in multiples of 4.

8. Click **Create**.

   The TSIG key is now created below the specified service.

You can manage the DHCP (OES Linux) TSIG key on the right pane of the Java Management Console by using the **General** tab.

For more information on managing objects, see Section 7.1.13, “Managing DHCP (OES Linux) Objects in the Java Management Console,” on page 91.

7.1.12 Failover Peer Management

The Failover Peer protocol allows only two DHCP servers to share a common address pool. This ensures continuous availability. The process defines a role of a Primary Server and a Secondary Server.

Each server has about half of the available IP addresses in the Pool at any given time for allocation. During a prolonged failure of the primary server, the secondary server recovers all the addresses that the primary server had available for allocation, and begins to reuse them.

- “Creating a Failover Peer” on page 90
- “Managing a Failover Peer” on page 90

Creating a Failover Peer

1. Click the **DHCP (OES Linux)** tab of the Java Management Console.
2. Create a **Service** "To create a service" on page 84. For example, myService1. Assign the service to one of the two DHCP servers in the tree.
3. Create a second Service. For example, myService2. Assign the service to the second DHCP server in the tree.
4. Create two identical subnets (one for each Service) "To create a Subnet" on page 86. When you create a subnet, a drop-down menu allows you to select the service to be assigned to the each subnet.
5. Create two identical pools (one under each Subnet) "To create a Pool" on page 87. When creating the pool, select the appropriate service.
6. Create a Failover object under each service. The name of the Failover object under each service must be identical. For example, if a failover object named FailOver1 is created under service DHCPService1, then under DHCPService2, the failover object created should also be named as FailOver1. If the failover object names are not identical, DHCP server will fail to start.

   The same port can be used for the primary and secondary servers. As the RFC does not currently specify a reserved port for DHCP Failover Peer setups, specify the port(s) of your choice that is unused

   - On the left pane of the Java Management Console, select the Service for which you want to create the Failover.
   - Click **Create** on the toolbar. The **Create New DHCP Object** window opens.
   - Select **Failover Peer**, then click **OK**.
   - Specify a name to identify the Failover.
   - Specify the **Primary Server IP Address**.
   - Specify the port number of the primary server in the **Primary Port** field.
   - Specify the **Secondary Server IP Address**.
   - Specify the port number of the secondary server in the **Secondary Port** field.
   - Specify the **Max Client Lead Time**. This is the length of time for which a lease may be renewed by either server without contacting the other. (Specify this on the Primary Server; it cannot be specified on the Secondary Server).
   - Specify the Failover Split. This specifies the split between the Primary and Secondary Servers for the purpose of load balancing.
   - Click **Create**. The Failover Peer is now created.
7. Edit each pool involved in the failover and choose the Failover Peer from the drop down list.
8. Restart DHCP and monitor `/var/log/message` for any errors.

Managing a Failover Peer

You can manage the Failover Peer by using the **General** tab in the right pane of the Java Management Console:

- **Primary Server IP Address:** Modify the primary server IP Address appropriately if required.
- **Primary Port:** Modify the port number of the primary Server if required.

- **Secondary Server IP Address:** Modify the secondary server IP Address appropriately if required.
- **Secondary Port:** Modify the port number of the secondary server if required.
- **Failover Split:** Specify the split between the primary and secondary for the purpose of load balancing.
- **Max Client Lead Time:** The length of time for which a lease can be renewed by either server without contacting the other. (Specify this on the primary; and it cannot be specified on the secondary).
- **Unacked Updates:** Notifies the primary server of the number of messages it can send before it receives from the Failover secondary server.
- **Response Delay:** Refers to the amount of information that needs to be processed.
- **Load Balance Time:** Refers to the time (seconds) set so that if one of the failover peers is in a state where it responds to the failover messages but does not respond to some client requests, the other failover peer takes over its client load automatically as the clients retry.
- **Comments:** Specify comments if any.

7.1.13 Managing DHCP (OES Linux) Objects in the Java Management Console

You can manage the DHCP (OES Linux) objects by using the tabs on the right pane of the Java Management Console. The following description provide more information about the tabs:

- "General Tab" on page 91
- "Settings Tab" on page 91
- "Configured Options Tab" on page 92
- "Lease Type Tab" on page 92
- "IP Address Utilization Tab" on page 93

General Tab

Use the **General** tab to select the preferred Server object and add comments for the DHCP (OES Linux) object. This tab must be used to manage a Service.

1. Select a server from the default **DHCP** drop-down list. The selected server is now associated with the service.
2. Type your comments about the service in the **Comments** field.
3. Click **OK** to save the settings.

Settings Tab

These settings are used to define the configuration for an object.

To add or modify a setting:

1. Click **Modify**. The Modify DHCP Settings dialog box opens.
2. Select a setting from the **Settings Name** list.

3 Click **Add**. To add the entire list, Click **Add All**.

4 Click **OK** to add the settings.

To remove setting name:

1 Select the setting from the **Settings Name** list, then click **Remove**.

or

To remove all the settings, click **Remove All**.

To delete a setting:

1 Select the setting from the list, then click **Delete**.

or

To remove multiple settings, use Ctrl+Shift to select the settings you want to remove, then click **Delete**.

Configured Options Tab

You can define values for the predefined options that are declared in the **Available Option** list.For example, **Time Offset** is a predefined option in the **Available DHCP Option** list. Use the **Configured Options** task to set a value for the **Time Offset** option.

To add a configured option:

1 Click **Modify**. The Modify DHCP Options dialog box is displayed.

2 Select an option from the **Option Name** list.

3 Click **Add**.To add the entire list, Click **Add All**.

4 Click **OK**.

To remove a setting:

1 Select the option from the **Option Name** list, then click **Remove**.

or

To remove all the options, click **Remove All**.

To delete a setting:

1 To delete an option, select the option from the list, then click **Delete**.

or

To remove multiple options, use Ctrl+Shift to select the options you want to remove, then click **Delete**.

Lease Type Tab

The Lease Type specifies the length of time for an address assignment. A lease type can be either permanent or timed. This tab must be used to manage the subnet and host objects.

Permanent leases never expire; the client is assigned an IP address for an indefinite period.

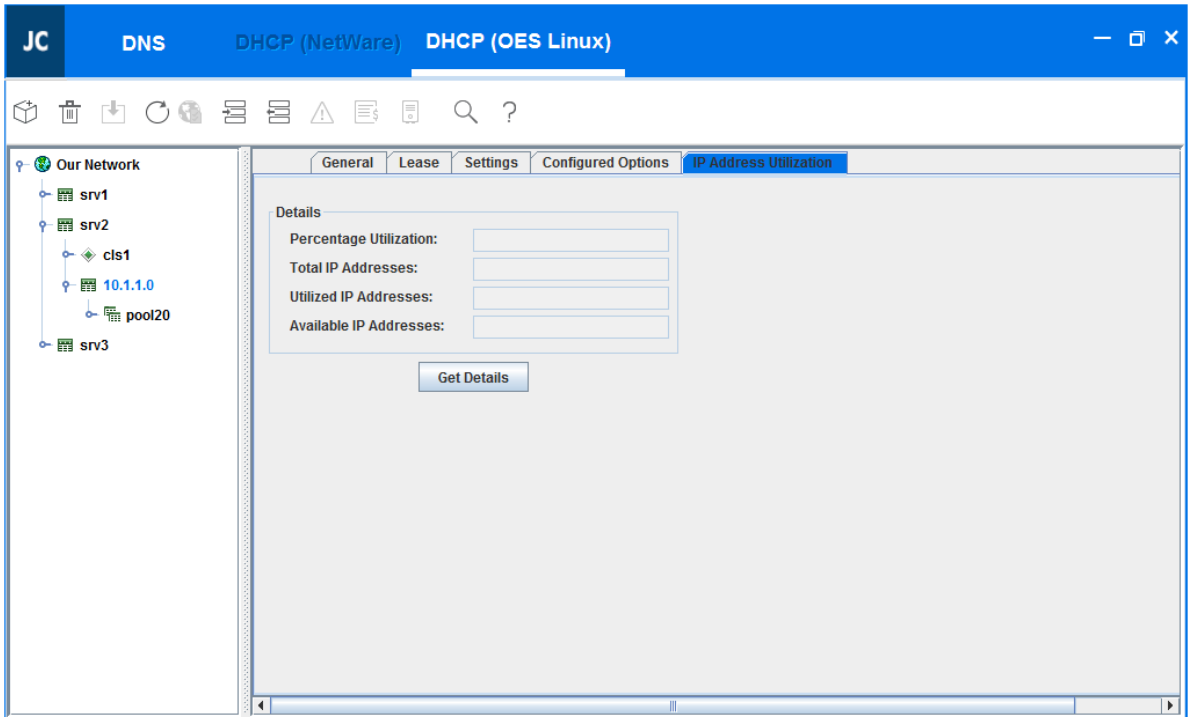
Timed leases are defined in days, hours, or minutes. Timed leases expire, unless the client renews the lease.

Set Boot Parameter Option

Select this option to specify the **Server Address**, **Server Name**, and **Boot File Name** for the BOOTP service. This information is provided at boot time. If the **Boot Parameter** option is selected, you need to specify the entire boot sequence.

IP Address Utilization Tab

The **IP Address Utilization** tab displays the details for IP addresses in a subnet or a pool.



- **Percentage Utilization:** The IP addresses that are in use as a percentage of the total IP addresses available in the subnet or pool.This value is equal to (Utilized IP Addresses / Total IP Addresses) * 100.
- **Total IP Addresses:** The total number of IP addresses available in the subnet or pool, including the subnet or pool start and end addresses.
- **Utilized IP Addresses:** The number of IP addresses that are currently assigned to static hosts and dynamic hosts from this subnet. Or, for a pool, the number of IP addresses that are currently assigned to dynamic hosts.
- **Available IP Addresses:** The total number of IP addresses that are currently available for assignment in the network.This value is equal to (Total IP Addresses - Utilized IP Addresses).

You can view the details either by selecting a particular subnet or by selecting a server object which serves one or more subnets.

To determine the utilization of the IP addresses of a subnet

1. In the DHCP (OES Linux) tab, select the subnet for which you want the utilization details.
2. In the Subnet property pages, click the **IP Address Utilization** tab.
3. Click **Get Details** to view the IP address utilization details of the subnet.

To determine the IP address utilization of the subnets serviced by a particular DHCP server

1. In the **DHCP (OES Linux)** tab, select the appropriate DHCP server.
2. On the DHCP server property page, click the **General** tab.
3. From the subnets displayed under the **Subnets Serviced by This Server list**, select one or more subnets to view the IP address utilization details:
    1. Select the Select All option to view the details for all of the subnets or select Clear All option to clear the selection.
    2. Check the following boxes to view only those subnets whose percentage utilization is more than or less than a particular value:
        - Show only subnets with percentage utilization more than
        - Show only subnets with percentage utilization less than

        When the option is selected and a value is configured, only those subnets whose percentage utilization is more than or less than the configured value are displayed.
4. Click **Show Utilization**.

    The IP address utilization details of the selected subnets are displayed.

    You must wait for the complete details of all subnets to be loaded into the table. The status bar displays **Done** when the complete subnet details are loaded.

    The details of the summarized utilization are also displayed. The summary details are sum of the values of all the subnets (except the percentage utilization).
5. Click **Save** to save the utilization details to a file.

To determine the utilization of the IP addresses of a pool:

1. In the DHCP (OES Linux) tab, select the pool for which you want the utilization details.
2. In the Pool property pages, click the **IP Address Utilization** tab.
3. Click **Get Details** to view the IP address utilization details of the pool.

7.1.14 Importing and Exporting the DHCP Configuration

The import or export operation is used to transfer the DHCP service configuration from files into eDirectory or from eDirectory to a text file in a `dhcpd.conf` format respectively. Only Linux DHCP configuration files should be used to import or export the DHCP configuration.

NOTE: Before importing a DHCP configuration file, check the syntax of the file with the `rcnovell-dhcpd check-syntax` or `systemctl check-syntax novell-dhcpd.service` command. The command reads `/etc/dhcpd.conf` and checks the syntax.

- "Importing the DHCP Configuration" on page 95
- "Exporting the DHCP Configuration" on page 95

Importing the DHCP Configuration

The configuration file to import should be in DHCP V3 format. Importing the Linux DHCP configuration file overwrites the associated DNS server's settings.

To import the DHCP files:

1. Click the **DHCP (OES Linux)** tab of the Java Management Console.
2. Click **Import DHCP Database** on the toolbar.
3. Click **Browse** to select or specify the path for the DHCP database file.
4. Click **Next** to open the Import - File Input window.
5. Specify the service name in the **Service Name** text box.
6. In the Select NDS Context text box, browse to select or enter specify the context where the service is to be created.
7. (Optional) Select a **Default DHCP Server** from the drop-down list.
8. Click **Import**.
9. Click **Finish** to complete the import operation.

If the import program encounters any error, the **Details** button is enabled in the error window. Click **Details** to view the error details.

Exporting the DHCP Configuration

The file is exported in a `dhcpd.conf` format. These files can be imported anywhere and can also be imported back to eDirectory by using the DNS/DHCP Java-based Management Console Utility.

1. Click the **DHCP (OES Linux)** tab of the Java Management Console.
2. Click **Export DHCP Database** on the toolbar to open the **Export - DHCP** window.
3. Specify the name of a destination file or browse to select a filename from the dialog box, then click **Next**.
4. Select the services by using the Export DHCP - Service List window.
5. Click **Export** to store your information in a file.
6. Click **Finish** to complete the export.

   If the export program encounters any error, the **Details** button is enabled in the error window. Click **Details** to view the error details.

7.1.15 Viewing Dynamic Leases

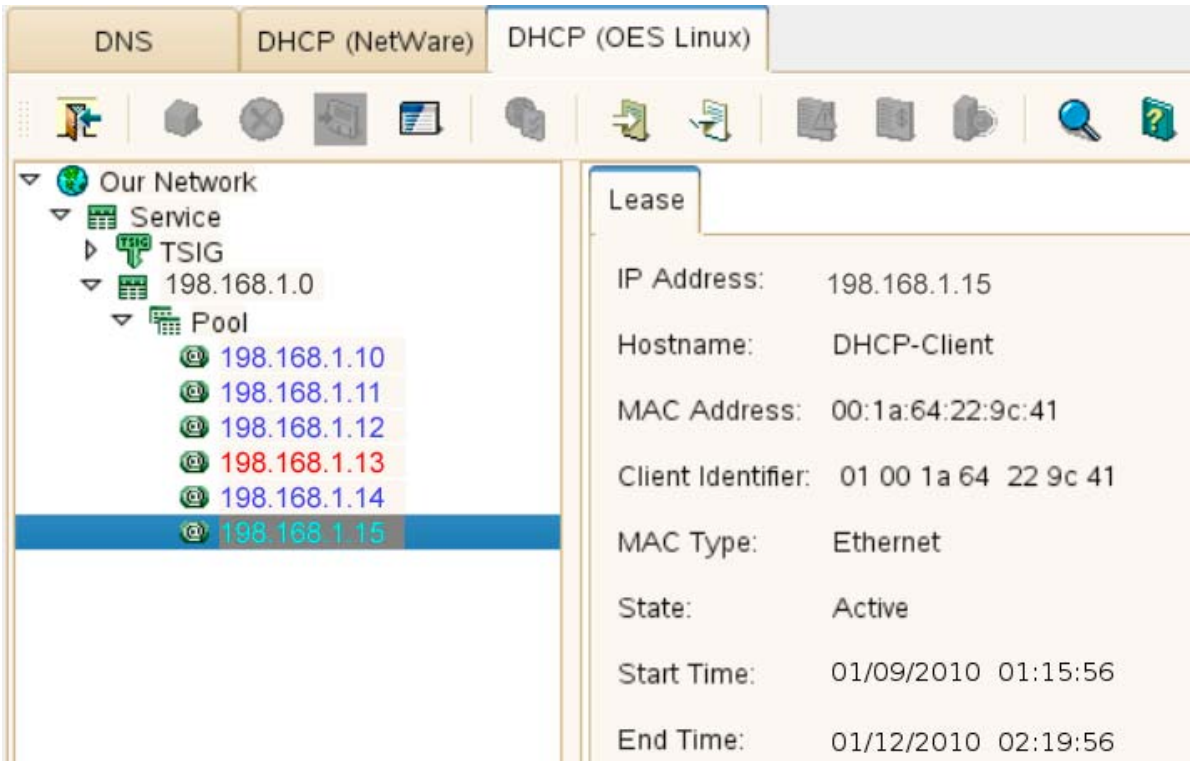
A DHCP-enabled client obtains a lease for an IP address from a DHCP server. Before the lease expires, the DHCP server must renew the lease for the client or the client must obtain a new lease.

Configuring steps to view leases

Configure the following parameter to view leases:

- Configure omapi-key
  - Create a TSIG Key with service object as the container.
  - Select the server object which is associated with the service.
  - Select the **Settings** tab of the server object.
  - Click **Modify**. The Modify DHCP Settings dialog box displays. From the list of available settings select omapi-key.
  - From the drop-down, select the new TSIG key and click **OK**.
- Configure omapi-port
  - Select the **Settings** tab of the server object.
  - If omapi-port setting is not added to the server object, select it from the list of available settings and set it to the value of 7911 (Default omapi port or any other port).
  - Make sure that 7911 (or any other port configured as omapi-port) is added in the list of allowed services in firewall.
- Configure DHCP Server IP address
  - Select the **General** tab of the server object.
  - Click **Add**.
  - Add the DHCP server IP address in the dialog box.

Restart the DHCP Server. You can now view the Active/Abandoned leases under the Pool object, in Java Management Console. The Active leases are blue in color and the Abandoned leases are red in color.



To determine the lease data, select the appropriate IP address of the lease displayed below the pool. The following details are displayed:

- **IP Address:** The IP address leased to the client by the DHCP server.
- **Hostname:** The hostname of the leased client.
- **MAC Address:** The MAC address of the network interface on which the lease is used. It is specified as a series of hexadecimal octets, separated by colons.
- **Client Identifier:** An arbitrary value that is used to identify a client instead of the hardware type and client hardware address. The client identifier is recorded as a colon-separated hexadecimal list or as a quoted string.
- **MAC Type:** MAC types such as Ethernet, FDDI, and token ring.
- **State:** Lists the state of the lease as Active or Abandoned. Active leases are colored blue and the abandoned leases are colored red.
- **Start Time:** The date and time when the client lease begins.
- **End Time:** The date and time when the lease expires.

NOTE: Lease times are specified in Universal Coordinated Time (UTC).

7.1.16 Deleting Dynamic Leases

1. Click the **DHCP (OES Linux)** tab of the Java Management Console.
2. Under the pool object, select the lease that you want to delete.
3. Click the Delete button.

4 Click **Yes** to confirm the deletion.

5 Release the lease from the client machine:

On Windows: `# ipconfig /release`

On Linux: `# ifconfig eth0 down`

7.2 Starting the DHCP Server

1 Start the server with the `rcnovell-dhcpd start` or `systemctl start dhcpd.service` command.

2 Check the status of the server by using the `rcnovell-dhcpd status` or `systemctl status dhcpd.service` command.

7.3 Stopping the DHCP Server

To stop the DHCP server, use the `rcnovell-dhcpd stop` or `systemctl stop dhcpd.service` command.

7.4 What's Next

The next section provides information on configuring DHCP with cluster services.

- Chapter 8, "Configuring DHCP with OES Cluster Services for the NSS File System," on page 99.

8 Configuring DHCP with OES Cluster Services for the NSS File System

- Section 8.1, “Benefits of Configuring DHCP for High Availability,” on page 99
- Section 8.2, “Prerequisites,” on page 99
- Section 8.3, “Installation and Configuration,” on page 99
- Section 8.4, “Loading and Unloading the DHCP Server,” on page 105
- Section 8.5, “What’s Next,” on page 105

8.1 Benefits of Configuring DHCP for High Availability

An Open Enterprise Server DHCP server automatically assigns IP addresses and other configuration information to clients upon request or when the clients are restarted. If for some reason the OES DHCP server is not accessible, clients lose their ability to connect to the network because they cannot obtain an IP address.

You can help prevent this problem by configuring DHCP with OES Cluster Services, which ensures that the IP address range required by users to connect to the network is highly available. This is possible because the DHCP server is automatically started, stopped, and restarted on different servers in the cluster by OES Cluster Services.

Before you attempt to implement this solution, familiarize yourself with how Cluster Services works. For information, see the *OES Cluster Services for Linux Administration Guide*.

8.2 Prerequisites

The following OES services are required to cluster DHCP services:

- eDirectory
- OES Cluster Services
- OES Storage Services
- OES NCP Services

8.3 Installation and Configuration

- Section 8.3.1, “Prerequisites,” on page 100
- Section 8.3.2, “Verifying the OES Cluster Services Setup,” on page 100
- Section 8.3.3, “Installing and Configuring a Cluster,” on page 100
- Section 8.3.4, “DHCP Load, Unload, and Monitor Scripts,” on page 102

8.3.1 Prerequisites

- The DHCP server should be installed on all the nodes in cluster or on the nodes identified for running DHCP.

  NOTE: In cluster setup, Runtime Credentials must be set on all the nodes in the DHCP cluster. For more information, see Section 11.3, “Setting Runtime Credentials,” on page 122.

- Create a shared NSS pool and volume for the DHCP server and cluster-enable the shared pool. You will configure the cluster resource later for DHCP services. For information, see “Configuring and Managing Cluster Resources for Shared NSS Pools and Volumes” in the *OES Cluster Services for Linux Administration Guide*. You need a unique, static IP address in the same IP subnet as the cluster to assign as the IP address for this DHCP cluster resource.

8.3.2 Verifying the OES Cluster Services Setup

To ensure that the OES Cluster Services is set up properly:

1. Log in to iManager.
2. In Roles and Tasks, select **Clusters > My Clusters**, then select the cluster.

   If the cluster does not appear in your personalized list of clusters to manage, you can add it. Click **Add**, browse and select the cluster, then click **OK**. Wait for the cluster to appear in the list and report its status, then select the cluster.
3. Click the **Cluster Options** tab.
4. Select the check box next to the Cluster resource object that you created for the shared NSS pool, then click the Details link.
5. Click the **Preferred Nodes** tab to view a list of the nodes that are assigned as the preferred nodes for failover and migration.

After executing these steps, you can mount the shared volume on the preferred nodes by using the Client for Open Enterprise Server. The shared volume is mounted on the preferred node so that the directories and lease files are created. This process also assigns rights to the shared volume.

8.3.3 Installing and Configuring a Cluster

1. Ensure that association between the DHCP Server object and the DHCP Service object is set by using Java Console.
2. Use Java Management Console for DHCP to create a DHCP Subnet and a DHCP Pool object. For details see Section 7.1.6, “Subnet Management,” on page 86 and Section 7.1.7, “Pool Management,” on page 86.
3. The DHCP server by default uses the `dhcpd` user that is created in the local system during installation process. If you want to use another user, create the user by using the **Security and Users > User Management** option in YaST.

   After creating the user, update `/etc/sysconfig/dhcpd` file, then set the value of the variable DHCPD_RUN_AS to the new user.
4. Click the **Users > Create User** task in iManager to open the Create User window. Specify the details and click **OK** to create user dhcpd or the new user in eDirectory.

5 The user created in Step 4 needs to be LUM-enabled. To do this, click the **Linux User Management > Enable Users for Linux** task. This opens the Enable Users for Linux window. Search for and select the user created in Step 4, then click **OK** to select the user.

   5a Make sure that every user belongs to a primary group. To add a user to a group, search for an **Existing eDirectory Group object**.

   5b Select the DHCPGroup object from the list.

   5c Select the workstations to which the Linux-enabled user should have access.

   5d Click **Next** to confirm the selection.

   The user is now Linux-enabled, included in the DHCP Group, and granted access to cluster nodes.

   5e Update the UID of the user created above to the dhcpd user's default UID. Select **Modify User** task in iManager. Select the user, go to Linux Profile tab of the user and Modify User ID to the dhcpd user's default UID.

6 Mount the shared volume on one of the nodes in the cluster.

7 Execute the following command at the command prompt:

```
/opt/novell/dhcp/bin/ncs_dir.sh <MountPath> <FQDN of Username with tree-name>
```

The MountPath parameter indicates the target directory in the volume where DHCP-specific directories are created.

For example, `/opt/novell/dhcp/bin/ncs_dir.sh /media/nss/DHCPVOL/cn=dhcpd.o=novell.T=MyTree`;

When the script is executed, it creates the following folders:

- `/media/nss/DHCPVOL/etc`
- `/media/nss/DHCPVOL/var/lib/dhcp/db`

The script also takes care of assigning permissions for these directories.

8 Copy the `/etc/dhcpd.conf` file to `/media/nss/DHCPVOL/etc` directory and modify the LDAP attributes as required.

For example, `ldap-server "192.168.0.1"`; `ldap-dhcp-server-cn "DHCP_acme"`;

Set the *ldap-server* attribute with the shared NSS pool IP Address.

Set the *ldap-dhcp-server-cn* attribute with the name of the DHCP server object that you want to use.

9 To hardlink, enable the shared volume on which the `dhcpd.conf` and `dhcpd.leases` files are hosted eg.DHCPVOL.

Invoke nsscon in the linux terminal and execute the following command:

```
/hardlinks=VolName
```

10 To ensure that hard links are enabled, execute the following commands in the shared volume:

```
touch testfile.txt
ln testfile.txt testlink.txt
unlink testlink.txt
rm testfile.txt
```

If the hard link was successfully enabled, these commands execute without errors.

11 Open a terminal on the node where the shared volume is mounted and execute the following command at the prompt:

```
dhcpd -cf /media/nss/DHCPVOL/etc/dhcpd.conf -lf /media/nss/DHCPVOL/var/lib/dhcp/db/dhcpd.leases
```

This step ensures that the DHCP server can work on a cluster setup with shared volumes.

Stop the server by executing the following command at the prompt: `killproc -p /var/lib/dhcp/var/run/dhcpd.pid -TERM /usr/sbin/dhcpd`

12 In iManager, select Clusters > My Cluster, select the cluster, then select the Cluster Options tab.

Select the DHCP Cluster resource that was created as part of "Prerequisites" on page 99 and click **Details**. The Cluster Pool Properties are displayed. Click the **Scripts** tab. You can now view or edit the load or unload scripts.

If you modify a script, click **Apply** to save your changes before you leave the page. Changes do not take effect until you take the resource offline, and bring it online again.

12a Click **Load Script**.

12b Ensure that the DHCP load script is same as specified in "DHCP Load Script" on page 102. Click **Apply** if you make changes.

12c Click **Unload Script**.

12d Ensure that the DHCP unload script is same as specified in "DHCP Unload Script" on page 103. Click **Apply** if you make changes.

12e Click **Monitor Script**.

12f Ensure that the DHCP monitor script is the same as specified in "Configuring the DHCP Monitor Script" on page 105. Click **Apply** if you make changes.

12g Click **OK** to save the changes.

13 Set the DHCP resource online. Select the Cluster Manager tab, select the check box next to the DHCP resource, then click **Online**.

8.3.4 DHCP Load, Unload, and Monitor Scripts

- "DHCP Load Script" on page 102
- "DHCP Unload Script" on page 103
- "DHCP Monitor Script" on page 104

DHCP Load Script

The load script contains commands to start the DHCP service.The load script appears similar to the following example:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuncs
exit_on_error nss /poolact=DHCPPOOL
exit_on_error ncpcon mount DHCPVOL=254
exit_on_error add_secondary_ipaddress 10.10.2.1
exit_on_error ncpcon bind --ncpservername=DHCPCLUSTER-DHCPPOOL-SERVER --
ipaddress=10.10.2.1
exit 0
```

Configuring the DHCP Load Script

1 Add the following line to the script before `exit 0` to load DHCP:

```
exit_on_error /opt/novell/dhcp/bin/cluster_dhcpd.sh -m <MOUNT_POINT>
```

For example: `MOUNT_POINT= /media/nss/DHCPVOL`

2 Click **Next** and continue with the unload script configuration.

DHCP Unload Script

The unload script contains commands to stop the DHCP service. The unload script appears similar to the following example:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuncs
ignore_error ncpcon unbind --ncpservername=DHCPCLUSTER-DHCPPOOL-SERVER --
ipaddress=10.10.2.1
ignore_error del_secondary_ipaddress 10.10.2.1
ignore_error nss /pooldeact=DHCPPOOL
exit 0
```

Configuring the DHCP Unload Script

Add the following line after the `./opt/novell/ncs/lib/ncsfuncs` statement:

```
ignore_error killproc -p /var/lib/dhcp/var/run/dhcpd.pid -TERM /usr/sbin/
dhcpd
```

The path for the `dhcpd.pid` file changed between OES 11 and OES 11 SP1. In OES 11, the DHCP process ID is located in `/var/run/dhcpd.pid`. In OES 11 SP1 and later versions, the DHCP process ID is located in `/var/lib/dhcp/var/run/dhcpd.pid`. During a cluster upgrade from OES 11 to OES 11 SP1 and later, you must change the path for `dhcpd.pid`. For more information, see "Changing the Path for dhcpd.pid" on page 103".

Changing the Path for dhcpd.pid

During a cluster upgrade from OES 11 to OES 11 SP1 and later versions, you must modify the location of the `dhcpd.pid` file in the unload script from `/var/run/dhcpd.pid` to `/var/lib/dhcp/var/run/dhcpd.pid`. After you modify the script, you should bring the resource online only on OES 11 SP1 and later nodes.

1 In your OES 11 cluster, upgrade one or more nodes to OES 11 SP1 and later.

At least one of the upgraded nodes should appear in the DHCP resource's preferred nodes list. If it is not, you can modify the resource's preferred nodes list. For information about how to set preferred nodes, see "Configuring Preferred Nodes and Node Failover Order for a Resource using iManager" in the *OES Cluster Services for Linux Administration Guide*".

2 Cluster migrate the DHCP resource to an OES 11 SP1 and later node in its preferred nodes list:

2a Log in as the root user to the OES 11 node where the resource is running, then open a terminal console.

2b At the command prompt, enter

```
cluster migrate <dhcp_resource_name> <oes11sp1_node_name>
```

The DHCP resource goes offline on the OES 11 node and comes online on the specified OES 11 SP1 and later node.

3 Log in to iManager, click **Clusters**, select the cluster, then click the **Cluster Manager** tab.

4 On the Cluster Manager tab, select the check box next to the DHCP resource, then click **Offline**.

5 At a command prompt on the OES 11 SP1 and later cluster node, manually stop the DHCP process by entering:

```
killproc -p /var/lib/dhcp/var/run/dhcpd.pid -TERM /usr/sbin/dhcpd
```

You must do this because the path in the old unload script is different from the path in OES 11 SP1 and later versions.

6 In iManager, click the **Cluster Options** tab, then click the DHCP resource link to open its Properties page.

7 Modify the path for the `dhcpd.pid` file in the unload script for the DHCP resource:

7a Click the **Scripts** tab, then click **Unload Script**.

7b Look for the following line in the DHCP unload script from OES 11:

```
ignore_error killproc -p /var/run/dhcpd.pid -TERM /usr/sbin/dhcpd
```

7c Change it to the following for OES 11 SP1 and later versions:

```
ignore_error killproc -p /var/lib/dhcp/var/run/dhcpd.pid -TERM /
usr/sbin/dhcpd
```

7d Click **Apply** to save the script changes.

8 Click the **Preferred Nodes** tab, remove the OES 11 nodes from the **Assigned Nodes** list, then click **Apply**.

After the unload script change, you want the DHCP resource to fail over only to OES 11 SP1 and later nodes. This is necessary to ensure a graceful shutdown of the `dhcpd.pid` when the DHCP resource fails over to a different node. For information about how to set preferred nodes, see "Configuring Preferred Nodes and Node Failover Order for a Resource using iManager" in the *OES Cluster Services for Linux Administration Guide*.

9 Click **OK** to save your changes and close the resource's Properties page.

10 Bring the DHCP resource online again. Click the **Cluster Manager** tab, select the check box next to the DHCP resource, then click **Online**.

The resource will come online on the OES 11 SP1 and later node that is listed as its most preferred node if the node is available.

DHCP Monitor Script

The monitor script contains commands to monitor the DHCP service. The monitor script appears similar to the following example:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuncs
exit_on_error status_fs /dev/pool/POOL1 /opt/novell/nss/mnt/.pools/
DHCPPOOL nsspool
exit_on_error status_secondary_ipaddress 10.10.2.1
exit_on_error ncpcon volume DHCPVOL
exit 0
```

Configuring the DHCP Monitor Script

1 Add the following before `exit 0` :

```
rcnovell-dhcpd status
if test $? != 0; then
     exit_on_error /opt/novell/dhcp/bin/cluster_dhcpd.sh -m
<MOUNT_POINT>
fi
exit_on_error rcnovell-dhcpd status
```

8.4 Loading and Unloading the DHCP Server

After updating the load and unload scripts of the virtual NCP server, DHCP server is now loaded and unloaded along with the virtual NCP Server.

8.4.1 Loading the DHCP Server

1 Log in to iManager.

2 In Roles and Tasks, locate and select the Clusters > My Clusters task, then select the cluster.

If the cluster does not appear in your personalized list of clusters to manage, you can add it. Click **Add**, browse and select the cluster, then click **OK**. Wait for the cluster to appear in the list and report its status, then select the cluster.

3 On the Cluster Manager page, select the check box for the DHCP cluster resource, then click **Online**.

8.4.2 Unloading the DHCP Server

1 Log in to iManager.

2 In Roles and Tasks, locate and select the Clusters > My Clusters task, then select the cluster.

If the cluster does not appear in your personalized list of clusters to manage, you can add it. Click **Add**, browse and select the cluster, then click **OK**. Wait for the cluster to appear in the list and report its status, then select the cluster.

3 On the Cluster Manager page, select the check box for the DHCP cluster resource, then click Offline. After a few seconds you see the server status as **Offline**, indicating that the server has been unloaded.

8.5 What's Next

The next section provides information on configuring DHCP with OES Cluster Services for the Linux file system.

- Chapter 9, "Configuring DHCP with OES Cluster Services for the Linux File System," on page 107

9 Configuring DHCP with OES Cluster Services for the Linux File System

- Section 9.1, “Benefits of Configuring DHCP for High Availability,” on page 107
- Section 9.2, “DHCP Installation and Configuration,” on page 107
- Section 9.3, “What’s Next,” on page 116

9.1 Benefits of Configuring DHCP for High Availability

An Open Enterprise Server DHCP server automatically assigns IP addresses and other configuration information to clients upon request or when the clients are restarted. If for some reason the OES DHCP server is not accessible, clients lose their ability to connect to the network because they cannot obtain an IP address. Configuring DHCP with OES Cluster Services helps ensure the IP address range required by users to connect to the network is highly available. This is possible because the DHCP server is automatically started, stopped, and restarted on different servers in the cluster by OES Cluster Services.

Before you attempt to implement this solution, familiarize yourself with how Cluster Services works. For information, see the *OES Cluster Services for Linux Administration Guide*.

9.2 DHCP Installation and Configuration

- Section 9.2.1, “Prerequisites,” on page 107
- Section 9.2.2, “Configuring DHCP on the Shared Disk,” on page 108
- Section 9.2.3, “Configuring the dhcpd.conf File,” on page 108
- Section 9.2.4, “Creating a dhcpd.leases File,” on page 108
- Section 9.2.5, “OES Cluster Services Configuration and Setup,” on page 109

9.2.1 Prerequisites

- OES Cluster Services
- DHCP must be installed on every server

NOTE: In cluster setup, Runtime Credentials must be set on all the nodes in the DHCP cluster. For more information, see Section 11.3, “Setting Runtime Credentials,” on page 122.

OES Cluster Services 2.0 provides a DHCP resource template, which facilitates configuring DHCP with a shared Linux POSIX volume in a cluster environment. Use the instructions in “Configuring and Managing Cluster Resources for Shared LVM Volume Groups” in the *OES Cluster Services for Linux Administration Guide*. Afterwards, cluster-enable the shared volume by using the DHCP template.

For details on installing the DHCP server, see Chapter 6, “Installing and Configuring DHCP,” on page 73.

For details on Cluster Services, see “Overview of OES Cluster Services”.

9.2.2 Configuring DHCP on the Shared Disk

To configure DHCP to use shared storage, you need to create a shared directory (file system or disk) on the shared disk system and create mount points to that shared file system on each cluster server that will run DHCP.

1. Use LVM to create a file system on the shared disk system.

   Enter `yast2 disk` at the terminal console to access the LVM tools in YaST Expert Partitioner.

2. On each cluster node that runs DHCP, create the directory path that is used as the mount point. At a terminal console prompt, log in as the `root` user, then enter `mkdir /mnt/dhcp`.

3. Log in as the `root` user and mount the shared disk (file system) that was created in Step 1.

   For example, depending on the mount point and directory names, you could enter a command similar to the following to mount the shared disk:

   ```
   mount /dev/volgroup/clustervol /mnt/dhcp
   ```

4. At the root of the shared disk you just created (`/mnt/dhcp`), enter the following commands to create the directories specified:

   ```
   mkdir etc
   ```

   ```
   mkdir -p var/lib/dhcp/db
   ```

   The db directory must be owned by the user that is used in `/etc/sysconfig/dhcpd` in the parameter `DHCPD_RUN_AS="dhcpd"`. Also, all the four directories must have permissions of `drwxr-xr-x`.

9.2.3 Configuring the dhcpd.conf File

1. Copy the `dhcpd.conf` file from the `/etc` directory on one of the OES cluster servers to the `etc` directory you created on the shared disk in Step 4 on page 108.

   This would be the `/mnt/dhcp/etc` directory if you used the same directory names as those given in the example above.

2. Modify the LDAP attributes as required. For example, `ldap-server` *`192.168.0.1`*; `ldap-dhcp-server-cn` DHCP_acme;

9.2.4 Creating a dhcpd.leases File

A `dhcpd.leases` file is necessary for DHCP to function. The DHCP daemon requires this file before it starts. The file can be empty, and it must reside in the `var/lib/dhcp/db` directory you created in Step 4 on page 108.

One way to create the empty file is to use the `touch` command. For example, if you used the directory names listed in the example above, you could enter the following to create an empty `dhcpd.leases` file:

```
touch /mnt/dhcp/var/lib/dhcp/db/dhcpd.leases
```

9.2.5 OES Cluster Services Configuration and Setup

After DHCP is properly installed and configured, you must create and configure a DHCP resource in OES Cluster Services. This includes configuring DHCP load and unload scripts, setting DHCP start, failover, and failback modes, and assigning the DHCP resource to specific servers in your cluster.

- "Creating a DHCP Cluster Resource" on page 109
- "Configuring DHCP Load, Unload, and Monitor Scripts" on page 110
- "Setting DHCP Start, Failover, and Failback Modes" on page 115
- "View or Edit DHCP Resource Server Assignments" on page 116

Creating a DHCP Cluster Resource

OES Cluster Services includes a DHCP resource template, which greatly simplifies the process for creating a DHCP cluster resource. Much of the DHCP cluster resource configuration is performed automatically by the DHCP resource template.

To create a DHCP cluster resource:

1. Ensure that the shared disk (file system) you created and mounted in Step 2 on page 108 is unmounted.

   If you used the directory names specified in the example, you can enter `unmount /mnt/dhcp` to unmount the shared disk.

2. Open your Internet browser and enter the URL for iManager.

   The URL is http://*server_ip_address*/nps/iManager.html. Replace *server_ip_address* with the IP address or DNS name of a server in the cluster or with the IP address for Apache-based services.

3. Enter your username and password.

4. In Roles and Tasks, select **Clusters > My Clusters**, then select the cluster.

   If the cluster does not appear in your personalized list of clusters to manage, you can add it. Click **Add**, browse and select the cluster, then click **OK**. Wait for the cluster to appear in the list and report its status, then select the cluster.

5. On the Cluster Manager page, click **New**.

6. Specify Resource as the resource type you want to create by clicking the **Resource** radio button, then click **Next**.

7. Specify a name for the DHCP resource.

   Do not use periods in cluster resource names. Client for Open Enterprise Server interpret periods as delimiters. If you use a space in a cluster resource name, that space is converted to an underscore.

8. Type the DHCP template name in the **Inherit From Template** field, or browse and select it from the list.

9. Select the **Define Additional Properties** check box, click **Next**, then continue with "Configuring DHCP Load, Unload, and Monitor Scripts" on page 110.

   The DHCP resource template configures the DHCP resource by automatically creating DHCP load and unload scripts, setting failover and failback modes, and assigning DHCP as a resource to all nodes in the cluster.

Configuring DHCP Load, Unload, and Monitor Scripts

Table 9-1 *Sample Values for DHCP Load and Unload Scripts*

Variable	Template Value	Description
Resource_IP	a.b.c.d	IP address of the virtual cluster server for this cluster resource.
MOUNT_FS	ext3	The file system type you made on the LVM volume.
VOLGROUP_NAME	myclustervg01	The name you gave to the cluster segment manager.
MOUNT_POINT	/mnt/dhcp	The mount location for the LVM volume you created. This example shows a mount location with a directory named the same as the LVM volume name. You can mount the LVM volume anywhere.
MOUNT_DEV	/dev/ $VOLGROUP_NAME/ myclustervol01	The Linux path for the LVM volume you created.

- "Load Script Configuration" on page 110
- "Unload Script Configuration" on page 112
- "Monitor Script" on page 114

Load Script Configuration

The DHCP load script page should already be displayed. The load script contains commands to start the DHCP service. You must customize some commands for your specific DHCP configuration.

NOTE: The scripts in this section are based on the template values in Table 9-1. Make sure to substitute the sample values with the ones you used in your solution.

The load script appears similar to the following example:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuncs

# define the IP address
RESOURCE_IP=10.10.189.136
# define the file system type
MOUNT_FS=ext3
#define the volume group name
VOLGROUP_NAME=myclustervg01
# define the device
MOUNT_DEV=/dev/$VOLGROUP_NAME/myclustervol01
# define the mount point
MOUNT_POINT=/mnt/myclustervol01

#activate the volume group
exit_on_error vgchange -a ey $VOLGROUP_NAME

# mount the file system
exit_on_error mount_fs $MOUNT_DEV $MOUNT_POINT $MOUNT_FS

# add the IP address
exit_on_error add_secondary_ipaddress $RESOURCE_IP

# load the DHCP server
exit_on_error /opt/novell/dhcp/bin/cluster_dhcpd.sh -m $MOUNT_POINT

exit 0
```

Configuring the DHCP Load Script:

Add the following line to the script before `exit 0` to load DHCP:

```
exit_on_error /opt/novell/dhcp/bin/cluster_dhcpd.sh -m $MOUNT_POINT
```

NOTE: You must add this line only for OES versions prior to OES 11 SP1 May 2013 patch. For later OES versions, this line is automatically added to the load script.

To customize the DHCP load script for your specific configuration:

1. View and, if necessary, edit the following lines for your specific container name, device, and mount point:

   ```
   #define the container name
   container_name=name
   # define the device
   MOUNT_DEV=/dev/volgroup/clustervol
   # define the mount point
   MOUNT_POINT=/mnt/dhcp
   ```

2. Edit the following line to assign a unique IP address to the DHCP cluster resource:

   ```
   RESOURCE_IP=a.b.c.d
   ```

   Replace <*a.b.c.d*> with the IP address you want to assign to the DHCP cluster resource.

The IP address for the DHCP cluster resource allows clients to reconnect to that address regardless of which server is hosting it.

3 Click **Next** and continue with the Unload Script Configuration.

Unload Script Configuration

The DHCP unload script page should now be displayed. The unload script contains commands to stop the DHCP service. You must customize some commands for your specific DHCP configuration.

NOTE: The scripts in this section are based on the template values in Table 9-1. Make sure to substitute the sample values with the ones you used in your solution.

The unload script appears similar to the following example:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuncs

# define the IP address
RESOURCE_IP=10.10.189.136
# define the file system type
MOUNT_FS=ext3
#define the volume group name
VOLGROUP_NAME=myclustervg01
# define the device
MOUNT_DEV=/dev/$VOLGROUP_NAME/myclustervol01
# define the mount point
MOUNT_POINT=/mnt/myclustervol01

# request dhcpd stop
ignore_error killproc -p /var/lib/dhcp/var/run/dhcpd.pid -TERM /usr/sbin/
dhcpd

# del the IP address
ignore_error del_secondary_ipaddress $RESOURCE_IP

#unmount the volume
sleep 10 # if not using SMS for backup, please comment out this line
exit_on_error umount_fs $MOUNT_DEV $MOUNT_POINT $MOUNT_FS

#deactivate the volume group
exit_on_error vgchange -a n $VOLGROUP_NAME

# return status
exit 0
```

Configuring the DHCP unload script:

Add the line `ignore_error killproc -p /var/lib/dhcp/var/run/dhcpd.pid -TERM /usr/sbin/dhcpd` before the following:

```
# del the IP address
ignore_error del_secondary_ipaddress $RESOURCE_IP
```

NOTE: You must add this line only for OES versions prior to OES 11 SP1 May 2013 patch. For later OES versions, this line is automatically added to the unload script.

The path for the `dhcpd.pid` file changed between OES 11 and OES 11 SP1. In OES 11, the DHCP process ID is located in `/var/run/dhcpd.pid`. In OES 11 SP1 and later versions, the DHCP process ID is located in `/var/lib/dhcp/var/run/dhcpd.pid`. During a cluster upgrade from OES 11 to OES 11 SP1 and later, you must change the path for `dhcpd.pid`. For more information see "Changing the Path for dhcpd.pid" on page 113.

Changing the Path for dhcpd.pid

During a cluster upgrade from OES 11 to OES 11 SP1 and later versions, you must modify the location of the `dhcpd.pid` file in the unload script from `/var/run/dhcpd.pid` to `/var/lib/dhcp/var/run/dhcpd.pid`. After you modify the script, you should bring the resource online only on OES 11 SP1 and later nodes.

1. In your OES 11 cluster, upgrade one or more nodes to OES 11 SP1 and later.

   At least one of the upgraded nodes should appear in the DHCP resource's preferred nodes list. If it is not, you can modify the resource's preferred nodes list. For information about how to set preferred nodes, see "Configuring Preferred Nodes and Node Failover Order for a Resource using iManager" in the *OES Cluster Services for Linux Administration Guide*".

2. Cluster migrate the DHCP resource to an OES 11 SP1 and later node in its preferred nodes list:

   2a Log in as the root user to the OES 11 node where the resource is running, then open a terminal console.

   2b At the command prompt, enter

   ```
   cluster migrate <dhcp_resource_name> <oes11sp1_node_name>
   ```

   The DHCP resource goes offline on the OES 11 node and comes online on the specified OES 11 SP1 and later node.

3. Log in to iManager, click **Clusters**, select the cluster, then click the **Cluster Manager** tab.

4. On the Cluster Manager tab, select the check box next to the DHCP resource, then click **Offline**.

5. At a command prompt on the OES 11 SP1 and later cluster node, manually stop the DHCP process by entering:

   ```
   killproc -p /var/lib/dhcp/var/run/dhcpd.pid -TERM /usr/sbin/dhcpd
   ```

   You must do this because the path in the old unload script is different from the path in OES 11 SP1 and later versions.

6. In iManager, click the **Cluster Options** tab, then click the DHCP resource link to open its Properties page.

7. Modify the path for the `dhcpd.pid` file in the unload script for the DHCP resource:

   7a Click the **Scripts** tab, then click **Unload Script**.

   7b Look for the following line in the DHCP unload script from OES 11:

   ```
   ignore_error killproc -p /var/run/dhcpd.pid -TERM /usr/sbin/dhcpd
   ```

   7c Change it to the following for OES 11 SP1 and later versions:

```
ignore_error killproc -p /var/lib/dhcp/var/run/dhcpd.pid -TERM /
usr/sbin/dhcpd
```

7d Click **Apply** to save the script changes.

8 Click the **Preferred Nodes** tab, remove the OES 11 nodes from the **Assigned Nodes** list, then click **Apply**.

After the unload script change, you want the DHCP resource to fail over only to OES 11 SP1 and later nodes. This is necessary to ensure a graceful shutdown of the `dhcpd.pid` when the DHCP resource fails over to a different node. For information about how to set preferred nodes, see "Configuring Preferred Nodes and Node Failover Order for a Resource using iManager" in the *OES Cluster Services for Linux Administration Guide*.

9 Click **OK** to save your changes and close the resource's Properties page.

10 Bring the DHCP resource online again. Click the **Cluster Manager** tab, select the check box next to the DHCP resource, then click **Online**.

The resource will come online on the OES 11 SP1 and later node that is listed as its most preferred node if the node is available.

To customize the DHCP unload script for your specific configuration:

1 View and, if necessary edit the container name, device, and mount point in the applicable lines of the unload script.

2 Replace <*a.b.c.d*> with the same IP address you specified in the load script, then click **Next**.

The page to set Start, Failover, and Failback modes is now displayed

3 Continue with "Monitor Script" on page 114.

Monitor Script

The monitor script contains commands to monitor the DHCP service. The monitor script appears similar to the following example:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuncs

# define the IP address
RESOURCE_IP=a.b.c.d
# define the file system type
MOUNT_FS=ext3
#define the volume group name
VOLGROUP_NAME=name
# define the device
MOUNT_DEV=/dev/$VOLGROUP_NAME/dhcp
# define the mount point
MOUNT_POINT=/mnt/dhcp
```

```
#check the logical volume
exit_on_error status_lv $MOUNT_DEV

# check the file system
exit_on_error status_fs $MOUNT_DEV $MOUNT_POINT $MOUNT_FS

# check the IP address
exit_on_error status_secondary_ipaddress $RESOURCE_IP

# check dhcpd
exit_on_error rcnovell-dhcpd status

# return status
exit 0
```

Configuring the DHCP Monitor Script:

1 Replace the line `exit_on_error rcnovell-dhcpd status` with the following:

```
rcnovell-dhcpd status
if test $? != 0; then
     exit_on_error /opt/novell/dhcp/bin/cluster_dhcpd.sh -m
<MOUNT_POINT>
fi
exit_on_error rcnovell-dhcpd status
```

2 Continue with "Setting DHCP Start, Failover, and Failback Modes" on page 115.

Setting DHCP Start, Failover, and Failback Modes

1 The DHCP resource template sets the DHCP resource Start mode and Failover mode to Auto and the Failback Mode to Disable.

- If the DHCP resource Start mode is set to Auto, the DHCP server automatically loads on a designated server when the cluster is first brought up. If the DHCP Start mode is set to Manual, you can manually start DHCP on a specific server when you want, instead of having it automatically start when servers in the cluster are brought up.
- If the DHCP Failover mode is set to Auto, the DHCP server automatically moves to the next server in the Assigned Nodes list in the event of a hardware or software failure. If the DHCP Failover mode is set to Manual, you can intervene after a failure occurs and before the DHCP server is started on another node.
- If the DHCP Failback mode is set to Disable, the DHCP server continues running on the node it has failed to. If the DHCP Failback Mode is set to Auto, the DHCP server automatically moves back to its preferred node when the preferred node is brought back online. Set the DHCP Failback mode to Manual to prevent the DHCP server from moving back to its preferred node when that node is brought back online, until you are ready to allow it to happen.

2 View or change the DHCP resource Start, Failover, and Failback modes, then click **Next** and continue with "View or Edit DHCP Resource Server Assignments" on page 116.

View or Edit DHCP Resource Server Assignments

The page to view or change DHCP resource server assignments should now be displayed. The DHCP resource template automatically assigns the DHCP resource to all nodes in the cluster. The order of assignment is the order the nodes appear in the resource list.

To view or edit DHCP resource node assignments or change the server failover order:

1. From the list of unassigned nodes, select the server you want the resource assigned to, then click the right-arrow button to move the selected server to the **Assigned Nodes** list.

   Repeat this step for all servers you want assigned to the resource. You can also use the left-arrow button to unassign servers from the resource.
2. Click the up-arrow and down-arrow buttons to change the failover order of the servers assigned to the resource or volume.
3. Click **Apply** or **Finish** to save node assignment changes.

9.3 What's Next

The next section describes security issues and recommendations for DHCP on an Open Enterprise Server.

- Chapter 10, "Security Guidelines for DHCP," on page 117

10 Security Guidelines for DHCP

This section describes security issues and recommendations for DHCP on an Open Enterprise Server. It is intended for security administrators or anyone who is using DHCP for Linux and is responsible for the security of the system. It requires a basic understanding of the DHCP protocol. It also requires the organizational authorization and the administrative rights to effect the configuration recommendations.

- Section 10.1, “Best Practices,” on page 117
- Section 10.2, “What’s Next,” on page 117

10.1 Best Practices

- During the DHCP Server installation, ensure that the **Use secure channel for configuration** option is selected. This ensures that the authentication mechanism is secured.
- You should not run the DHCP server as a `root` user. Instead, use the -user and -group command line option.
- To run DHCP server in a more secure environment, use the -chroot command line option.
- To restrict access, use the apparmor profile in `/etc/apparmor.d/usr.sbin.dhcpd`, which restricts access to directories depending on user permissions.
- You should store user credentials like usernames and passwords in OES Credential Store instead of the `/etc/dhcpd.conf` file.
- If you are setting up DHCP servers, you should include the authoritative statement at the top of the configuration file. This ensures that the DHCP server sends DHCPNAK messages to misconfigured clients.
- Decide the lease time to be allocated based on your environment. Allocate larger lease time for known-clients and a shorter lease time for unknown clients.

10.2 What’s Next

The next section describes how to install and configure the OES DNS service on Open Enterprise Server.

- Chapter 11, “Installing and Configuring DNS,” on page 119

11 Installing and Configuring DNS

This section describes how to install and configure the OES DNS service on Open Enterprise Server.

- Section 11.1, “Planning the Installation,” on page 119
- Section 11.2, “Installing the DNS Server,” on page 121
- Section 11.3, “Setting Runtime Credentials,” on page 122
- Section 11.4, “Verifying Installation,” on page 123
- Section 11.5, “What’s Next,” on page 123

11.1 Planning the Installation

Before you install the OES DNS service, review the following:

- Section 11.1.1, “Prerequisites,” on page 119
- Section 11.1.2, “eDirectory Permissions,” on page 119

11.1.1 Prerequisites

- The DNS schema is extended for the specified LDAP host.

IMPORTANT: Do not install any of the following service combinations on the same server as OES DNS. Although not all of the combinations cause pattern conflict warnings, any of the combinations shown are not supported.

- DHCP and DNS server
- Xen Virtual Machine Host Server

11.1.2 eDirectory Permissions

- “First-Time Installation on an eDirectory Tree” on page 119
- “Installing on an eDirectory Tree where one or more DNS Servers already exists (In the Same or Separate Container)” on page 120

First-Time Installation on an eDirectory Tree

If you are installing OES DNS Server on an eDirectory tree for the first time, you need to have the following create permissions for the Server, Locator, Group, RootServerInfo, and NCP Server containers at the eDirectory level before you start the DNS installation:

- Create permission at the entry level of the container for the following:
  - DNS Server Object Container

- Locator Object Container (DNS-DHCP)
- Group Object Container (DNSDHCP-Group)
- DNS Proxy User Object Container

- Read and Write permissions for the NCP Server Objects for DNS Server object creation.
- Write permission at the root of the tree for extending the DNS schema.

For example: If the container for Server object is ou=Server,o=acme, the container for the Locator object, Group object, Proxy User, RootServerInfo object and for the NCP Server object is o=acme1, then the user should have create permissions at the entry level on o=acme and o=acme1.

Installing on an eDirectory Tree where one or more DNS Servers already exists (In the Same or Separate Container)

If you are installing OES DNS Server on an eDirectory tree make sure that you have the following permissions:

- Create permission at the entry level of the container for the following objects:
  - DNS Server Object Container
  - Proxy User Object Container
- Read and Write permissions for the existing objects at the attribute level of the objects.
  - Group Object
  - Locator Object
  - NCP Server Object
- Create permission at the entry level of the RootServerInfo objects.
- To retrieve the existing Locator and RootServer Info object context, specify the following rights:

  Read and compare rights at the attribute level and browse rights at the entry level of the container where NCP server, DNS Locator and Group, and RootServer Info objects are present.

Table 11-1 *Permissions for DNS Objects and Attributes*

DNS Objects and Attributes	Permissions
DNS-DHCP (Locator object)	Read, Write
DNSDHCP-Group (Group object)	Read, Write
RootServerInfo object	Create
NCP Server object	Read, Write
DNS Server object	Create rights at the entry level of the DNS Server object container
Proxy User	Create rights at the entry level of the proxy user container

11.2 Installing the DNS Server

DNS can be installed on your system by using a YaST install:

YaST Install

This YaST Install is a predefined system of installing components along with the associated dependencies. For a service to function properly, all the dependent products must be installed. Pattern deployment provides patterns for different services. Selecting a pattern automatically selects and installs its dependencies.

1. Follow the instructions in the "Installing OES as a New Installation" chapter to go to the **Software Selections and Systems Tasks** page.
2. In the YaST install, on the **Installation Settings** page, click **Software** to go to the **Software Selections and System Tasks** page.
3. Under the OES Services option, select **OES DNS**. Click **Accept**.
4. Specify options for configuring a DNS server
   - **4a** Specify an IP address of an LDAP server from the **Directory server address** list. By default, the IP address of the default LDAP server for this service is displayed.

     If you are installing into an existing tree, ensure that the server you select has a master replica or read/write replica of eDirectory. If you need to add another LDAP server to the list, add it using the LDAP Configuration for Open Enterprise Services dialog.
   - **4b** Specify a context for the local NCP Server object.
   - **4c** The **Use Secure LDAP Port** check box is selected by default to ensure that the data transferred by this service is secure and private. If you deselect this option, the transferred data is in clear text format.
   - **4d** Specify where the proxy user's credentials are to be stored. It is recommended to use OES Credential Store.
   - **4e** Click **Next** to proceed.
5. Specify the following:
   - **5a** If you are configuring DNS in an existing tree where DNS is already configured and you want to use the existing Locator, Root Server Info, Group and Proxy User contexts, you can select the **Get context information from existing DNS server** check box and provide the IP of an NCP server hosting the existing DNS server and click **Retrieve**. This will fetch the contexts of the Locator, Root Server Info, Group and Proxy User contexts. Make sure the NCP server hosting the existing DNS server is running before hitting **Retrieve**.If you do not wish to use existing contexts, you can provide those manually.
   - **5b** Specify the context for the DNS Locator object in the **OES DNS Services Locator Object Context** field. The Locator object contains global defaults, DHCP options, and a list of all DNS and DHCP servers, subnets, and zones in the tree.
   - **5c** Specify the context for the DNS Services root server in the **OES DNS Services Root Server Info Context** field.
   - **5d** Specify the context for the DNS Group object in the **OES DNS Services Group Object Context** field. This object is used to grant DNS servers the necessary rights to other data within the eDirectory tree.

5e Specify the fully distinguished, typeful name of an eDirectory user in the **Proxy User for DNS Management** field. This user is used to authenticate to eDirectory to access information for DNS during runtime. The user must have eDirectory read, write, and browse rights under the specified context. If the user does not exist, it will be created in the specified context.

During eDirectory configuration, if you have selected the **Use Common Proxy User as default for OES Products** check box, then the proxy user and password fields are populated with common proxy user name and password.

5f Type the password for the eDirectory user that you specified for accessing DNS. This field is disabled, if you have selected the **Use Common Proxy User as default for OES Products** check box during eDirectory configuration.

6 Specify details to create DNS server object

6a Select the **Create the DNS Server object** to create a DNS server object in the eDirectory tree associated with the NCP Server.

6b Type the unique hostname for the DNS Server object in the **Host Name** field.

6c Type the domain name for the Server object in the **Domain Name for DNS Server** field and click **Next**.

7 Click **Next** to complete the installation process.

11.3 Setting Runtime Credentials

The Runtime Admin name and Runtime Admin password are stored in the OES Credential Store, which is later used by the DNS Server for eDirectory authentication. The Runtime Admin credentials are stored with root (install user) and named user permissions. There can only be one Runtime User credential for DNS stored in OES Credential Store.

NOTE: In cluster setup, Runtime Credentials must be set on all the nodes in the DNS cluster.

To set the runtime credentials, execute the following command:

```
oescredstore -s -n dns-ldap -u <username> -p <password>
```

For example, to set the credentials of the runtime admin *dnsadmin*, execute the following command:

```
oescredstore -s -n dns-ldap -u cn=dnsadmin,o=novell -p Password
```

If you want to run `novell-named` as any non-root user other than named, you need to set the credentials of Runtime Admin for that non-root user because OES Credential Store allows you to read the credentials only as the user who stored it (the non-root user must be an eDirectory user and a member of the dhcp Group object) by executing the following commands:

```
su <non-root user>
```

```
oescredstore -s -n dns-ldap -u <username> -p <password>
```

This sets the user name and password in OES Credential Store for DNS Server.

Copy the `/etc/opt/novell/named/.named.cred` to same directory under the `chroot -t dir` and change the user and group ownership from `named:named` to the `-u` user and its group.

11.4 Verifying Installation

After the installation is done, you can verify the installation. Verify that OES Credential Store is updated with the new run time admin credentials using oescredstore option.

1 Use iManager to check for the presence of the following objects in the eDirectory tree and verify whether these objects are created in the following contexts:

- DNS-DHCP: This object will be in the Locator Object Context specified during installation.
- DNSDHCP-GROUP: This object will be in the Group Object Context specified during installation.
- RootServerInfo: This object will be in the Root Server Info context specified during installation.
- dnipDNSServerVersion: A version attribute with the value of OES DNS Server 6.0.0 is added to the NCP Server object.

NOTE: In a single tree, multiple instances of DNS-DHCP, DNSDHCPGROUP, RootServerInfo, and dnipDNS Server objects can exist.

11.5 What's Next

The next section provides information on migration of DNS/DHCP from Netware to OES.

- Chapter 12, "Migrating DNS/DHCP from NetWare to OES," on page 125

12 Migrating DNS/DHCP from NetWare to OES

The OES Migration Tool has a plug-in architecture and is made up of Linux command line utilities with a GUI wrapper. You can migrate DNS/DHCP to an OES server through either the GUI Migration Tool or through the command line utilities.

To get started with migration, see "Planning for Migration" in the *Migration Tool Administration Guide*.

- For more information on migrating DHCP, see "Migrating DHCP to OES 24.4" in the *Migration Tool Administration Guide*.
- For more information on migrating DNS, see "Migrating DNS to OES 24.4" in the *Migration Tool Administration Guide*.

13 Administering and Managing a DNS Server

- Section 13.1, “Using the Java Management Console to Manage DNS,” on page 127
- Section 13.2, “Configuring Roles for a OES DNS Server,” on page 140
- Section 13.3, “novell-named Command Line Options,” on page 142
- Section 13.4, “Viewing Debug Logs in Syslog,” on page 145
- Section 13.5, “Configuring Log-Level using Java Management Console,” on page 146
- Section 13.6, “Changing Proxy Users,” on page 147
- Section 13.7, “Starting the DNS Server,” on page 148
- Section 13.8, “Running DNS Server in chroot Mode,” on page 148
- Section 13.9, “Running DNS Server as a Non-Root User,” on page 149
- Section 13.10, “Stopping the DNS Server,” on page 149
- Section 13.11, “What’s Next,” on page 149

13.1 Using the Java Management Console to Manage DNS

This section provides information about configuring DNS by using the Java-based Management Console.

- Section 13.1.1, “Installing the Java Management Console,” on page 127
- Section 13.1.2, “DNS Server Management,” on page 128
- Section 13.1.3, “Zone Management,” on page 130
- Section 13.1.4, “Resource Record Management,” on page 137
- Section 13.1.5, “DNS Key Management,” on page 138

IMPORTANT: Make a forced exit from Java Management console if you observe any of the following two scenarios:

- Unable to reach eDirectory after establishing a connection.
- If there is any network interruption.

13.1.1 Installing the Java Management Console

Install the Java Management Console on client computers to administer DNS and DHCP services. To install Java Management Console, see Section 7.1.1, “Installing Java Management Console,” on page 82.

13.1.2 DNS Server Management

DNS server management involves the following tasks:

- "Creating a DNS Server Object" on page 128
- "Viewing or Modifying a DNS Name Server Object" on page 128
- "Deleting a DNS Server" on page 130
- "Starting or Stopping a DNS Server" on page 130
- "Moving a DNS Server" on page 130

Creating a DNS Server Object

1. Click the **DNS Service** tab of the Management Console.
2. Click **Create** on the toolbar.
3. Select **DNS Server** in the Create New DNS Object dialog box, then click **OK**.

   The Create New DNS Server dialog box is displayed, prompting you to select an NCP Server object.
4. Specify the desired server's name or use the browse button to select the server.
5. Specify the server's domain name.
6. Click the **Define Additional Properties** check box to view the newly created server property pages.
7. Click **Create**.

   The DNS Server object is created and displayed in the lower pane of the Management Console.

Viewing or Modifying a DNS Name Server Object

To modify an existing DNS Name Server object, click the object's icon in the lower pane of the DNS Service window to display detailed information in the right pane. A DNS Name Server object's detailed information window displays seven tab pages:

- **Zones:** On this page, the zone list contains a list of all zones and the role each zone serves for the selected DNS Name Server object.

  To change the zone information, you must modify the specific Zone object. This information cannot be modified from the server page.

  The **DNS Server IP Address** field is read-only and is received from the DNS server.
- **Forwarding List:** This page displays a list of all forwarding IP addresses.
  - To add an address to the list, click **Add**. Specify the IP address in the Add Forward IP Address field, then click **OK**.
  - To delete an address from the list, select an IP address and click **Delete**.

- **No-Forward List** This page displays a list of all domain names to which queries are not sent.
  - To add a domain name to the No-Forward List, click **Add**. Specify the domain name in the **No-Forward Name** field, then click **OK**.
  - To delete a domain name from the list, select the domain name from the list and click **Delete**.
- **Options** This page allows you to configure maximum cache size and maximum recursion for a new DNS server.
- **Key List**

  Available DNS Keys: Displays a list of DNS keys that are available in the eDirectory tree. These keys can be associated with the DNS server.

  Selected DNS Keys: Displays a list of DNS keys that are associated with the DNS server.
  - To add the DNS Key, select the key, then click **Add**.
  - To remove the DNS key, select the key, then click **Remove**.
  - To add all the keys, click Add **All**.
  - To remove all the keys, click **Remove All**.

  NOTE: To add or remove multiple keys, use the Ctrl key to select the keys. Then click **Add** or **Remove**.

- **Control Lists** This page displays various lists that can be configured to control the behavior of the DNS server. You can configure the zone out filter, allow recursion, query filter as address match lists. You can also configure the also notify and black listed servers as a list of IP addresses.
  - To add an element to the address match list, click **Add**. Specify the element to be added and click **OK.**

    To delete elements from the list, select the element to be deleted and click **Delete**.
  - To add an address into the list, click **Add**. Specify the IP address and click **OK.**

    To delete an address from the list, select the address to be deleted and click **Delete**.
- **Advanced** This page displays all advanced configuration options. It displays the configured values and the default values for each option. The default value that is displayed is the value that the server assumes if it is not configured.
  - To modify the options, click **Modify** and specify the new value, then click **OK**.
  - To clear the configured values, select the option, then click **Clear**.

  The log-level allows you to specify the required DNS log-level which can range between 0 to 10.
  - 0 - Indicates default log value where critical, errors, warnings, and information logs are enabled.
  - 3 - Indicates security logs are enabled.
  - 10 - Indicates maximum log level.

  The allow-notify and listen-on options are multi-valued. You can also specify a port value, which is optional for listen-on.
  - To add an element to the list, specify the address, then click **Add**. This populates the list with the new entry.
  - To delete elements from the list, select the elements to be deleted, then click **Delete**.

- Click **Modify** to modify the configured elements.
- Click **OK** to populate the **Configured Value** column with the elements.

Deleting a DNS Server

1. Select the DNS server from the lower pane of the Management Console.
2. Click **Delete** on the toolbar and confirm the deletion.

Starting or Stopping a DNS Server

The DNS server (`novell-named`) must be loaded before you can start or stop the server activity.

The Start/Stop service can be used to load zone data along with the modified configuration without unloading and reloading the DNS server. When you stop the DNS server by using this option, it is still loaded in the memory. However, no services are provided. You can use the Java Management Console to update the zone data. When you restart the DNS server by using this option, the server is reconfigured with the new configuration settings and the zone data is also reloaded.

This option can also be used to remotely start and stop the DNS server.

1. Select the DNS server from the lower pane of the Management Console.
2. Click Start/Stop Service on the toolbar.
3. Depending on the state of the DNS Server module, one of the following operations occurs:
   - Start action: If the DNS Server module is loaded but is in Stop mode, it is started.
   - Stop action: If the DNS Server module is loaded and is in Start mode, it is stopped.

Moving a DNS Server

This task enables you to move the DNS Services from one NCP server to another NCP server. You can also convert a DNS server to a cluster-enabled DNS server by moving it to a virtual NCP server.

1. Select the DNS server name from the bottom panel of the Management Console.
2. Click the **Move DNS Server** icon on the toolbar.
3. In the Move DNS Server dialog box, select the NCP server that the DNS services will be moved to, then click **Move**.

NOTE: A message is displayed indicating the successful completion of Move operation.

13.1.3 Zone Management

The following sections give details on zone management information.

- “Creating a Zone Object” on page 131
- “Creating an IN-ADDR.ARPA Object” on page 131
- “Viewing or Modifying a Zone Object” on page 132
- “Associating a Zone to Specific DNS Servers” on page 135

- "Deleting a Zone Object" on page 135
- "Importing a Zone Object" on page 136
- "Exporting a Zone Object" on page 136

Creating a Zone Object

The DNS Zone object is an eDirectory container object that is made up of Resource Record Set (RRSet) objects and resource records.

To create a zone object:

1. Click the **DNS Service** tab of the Management Console.
2. Click **Create** on the toolbar, select **Zone**, then click **OK**.
3. Click **Create New Zone** to create a forward zone.
4. Use the browse button to select the eDirectory context for the zone.
5. Specify a name for the Zone object in the **Zone Domain Name** field.
6. Select the zone type.

   Novell DNS servers act as primary or secondary depending on the zone type that you select.
7. If you select the zone type as secondary, specify the IP address of the master DNS server that will provide zone out transfers for this secondary zone.

   Select a DNS server to act as an authoritative DNS server for this zone.
8. Click **Create**.

   A message is displayed indicating that the new zone has been created. If you have created a primary zone, you are reminded to create the Address record for the host server domain name and corresponding Pointer record in the IN-ADDR.ARPA zone (if you have not already done so).

Creating an IN-ADDR.ARPA Object

After you create a DNS server object, you can use the Management Console to create and set up an IN-ADDR.ARPA Zone object.

1. Click the **DNS Service** tab of the Management Console.
2. Click **Create** on the toolbar, select **Zone**, then click **OK**.

   The Create Zone dialog box is displayed. The default setting is to create a new primary zone.
3. Select **Create IN-ADDR.ARPA**.
4. Use the browse button to select the eDirectory context for the zone.
5. Specify the network address in the **Network Address** field.

   For example, specify 143.72.155 only for 155.72.143.IN-ADDR.ARPA.

   After you specify the IP address, it is reversed and prepended to .INADDR. ARPA and reflected in the **Zone Domain Name** field.
6. Under the Zone Type, select **Primary** or **Secondary**.

   If you select **Secondary**, you must specify the IP address of the DNS Name server that will provide zone out transfers to this zone.

7 In the **Assign Authoritative DNS Server** field, select a DNS server.

After you have selected an authoritative DNS server, the **Name Server Host Name** field is filled with the name of the authoritative DNS server.

8 Click **Create**.

Viewing or Modifying a Zone Object

To modify an existing Zone object, click the Zone object to be modified in the left pane of the DNS Service window. A Zone object's detailed information window displays the following tab pages:

- **Attributes:** This page allows you to configure the zone type and zone servers.
  - To change a primary zone to a secondary zone, click the **secondary zone** box and specify the IP address of the primary DNS server in the **Zone Master IP Address** field.
  - To assign a server to the zone, select the server to which the zone should be assigned from the Available DNS Servers and click **Add**. The server is then displayed in the **Authoritative DNS Servers** field. To delete a DNS server assignment to a zone, select the server to be removed from the **Authoritative DNS Servers** field, then click **Remove**.
  - To configure one of the DNS servers as the designated server for the zone, select the server from the **Designated Primary** field in the case of a primary zone. This server is responsible for DHCP updates for the zone.

    For a secondary zone, select the server from the **Designated Secondary** field. This server is responsible for receiving the zone-in transfers.
  - You can specify new comments or modify existing comments for the zone.
- **Forwarding List:** Use this tab to specify the IP addresses of DNS servers to which queries are forwarded from a zone, when it is unable to resolve queries from an authoritative data or cache. Unresolved queries are sent to these servers before they are sent to root servers.

  You can configure a forwarding list as an Empty Forwarder or IP Addresses:
  - To configure an Empty Forwarder click **Add**, then select **Empty Forwarder** option. An empty forwarder specifies that no forwarding is done for the zone. If this field is configured, each DNS server servicing this zone will not forward the queries of this zone.
  - To configure IP address of a forwarder, click **Add** and select the **Forwarder Address** option.
  - To delete, select the forwarder and click **Delete**.
- **Zone Out Filter:** This page allows you configure the zone out filters for the zone.
  - To add an entry into the list, click **Add**.

    Specify the **subnet address** and the **subnet mask** for the network, then click **OK**.
  - To delete the elements in the list, select the elements to be deleted, then click **Delete**.
- **SOA Information:** This page allows you to configure the zone master, e-mail address, serial number, refresh, retry, expire, and minimum TTL values.
- **Key List:** This page allows you to associate the DNS TSIG keys with the Zone.

NOTE: In earlier versions, key association was a must before updating a policy. Now, it is not required for SAM because the keys are negotiated at run time. Because of this, no checking is done to validate the identity field for SAM-based updates.

Available DNS Keys: Displays a list of DNS TSIG keys that are available in the eDirectory tree. These keys can be associated with the Zone.

Selected DNS Keys: Displays a list of DNS TSIG keys that are associated with the Zone.

- To add the DNS TSIG key, select the key, then click **Add**.
- To remove the DNS TSIG key, select the key, then click **Remove**.
- To add all the keys, click **Add All**.
- To remove all the keys, click **Remove All**.

NOTE: To add or remove multiple keys, use the Ctrl key to select the keys. Then click **Add** or **Remove**.

- **Control Lists:** This page displays various lists that can be configured for the zone. You can configure the query filter, also notify, and allow update options.

  The query filter and allow update options can be configured as address match lists.

  - To add an element, click **Add**. Specify the element to be added, then click **OK**.
  - To delete elements from the list, select the element to be deleted, then click **Delete.**

  The also notify option can be configured as a list of IP addresses.

  - To add an address to the list, click **Add**. Specify the IP address, then click **OK**.
  - To delete an address from the list, select the address to be deleted, then click **Delete**.

  The update policy option specifies the policy to update the measure to implement security for a zone object. This is implemented by the default DNS server administering the zone. Addition of TSIG Key at server level and zone level for Secured updates to DNS Zones and servers. The keys are added to the KeyList for DNS Zones and DNS servers by the user for associating with the ACLs.The update policy is a five-token string where each token has a definite function to perform. It can be configured by specifying the following syntax:

  ```
  Permission Identity MatchType TName RR
  ```

  - To add an update policy, click **Add**. Specify the following values:
    - **Permission**: Refers to a grant or deny option.
    - **Identity**: Refers to the name of the key used to sign the update. Identity field may have Wildcard characters. Only "*" is the allowed wildcard character. As a valid entry for Identity field, only valid keyCN is allowed, "*", or "*" followed by "." and a character string, matching atleast one of the associated Keys for the DNS zone. Any invalid value entry will throw an error.
    - **MatchType**:

      The **MatchType** can be one of the following:

      - name: Matches when the domain name being updated is the same as the name in the name field.
      - subdomain: Matches when the domain name being updated is a subdomain of the name in the name field (The domain name must still be in the zone.)

- wildcard: Matches when the domain name being updated matches the wildcard expression in the name field.
- self: Matches when the domain name being updated is the same as the name in the identity (not name) field; that is when the domain name being updated is the same as the name of the key used to sign the update. If nametype is self, then the name field is ignored; however you must include the name field when using a nametype of self.

- **TName**: Specify the **TName**, which is the domain name appropriate to the MatchType specified. For Update Policy entries with the **MatchType** field mentioned as **wildcard**, only wildcard entries are allowed for the **Tname** field. Otherwise character strings are not allowed.
- (Optional): Specify the **RR** (Resource Record) which can contain any valid record type.

NOTE: Creation of keys with same CN is not allowed in the same Linux tree.

- **Advanced** This page displays all advanced configuration options for the zone. It displays the configured values for each option. If any option is not configured at the zone level, the default behavior is server-specific. The value configured for the zone overrides the server value. If no value is configured at the server, the default value specified for the server is used.

  The following are the advanced options for the zone:

  - **allow-notify:** Specifies the list of hosts that are allowed to notify the slaves of zone changes in addition to the zone masters. You can configure this option only for a secondary zone.

    Allow-notify specified at the server level is overridden by the settings of this zone.
  - **check-names:** Verifies if any resource record for a zone is in compliance with RFC 952 and RFC 1123 and take the defined action.
  - **forward:** Specifies the forwarder address. This option can be configured only if the Forwarding list is not empty. A value of first, which is the default, causes the server to query the forwarders first, and if that does not answer the query, the server then looks for the answer in itself. If only is specified, the server queries only the forwarders.
  - **max-journal-size:** Sets a maximum size in bytes for the journal file. This should be configured only for a Linux zone.

    NOTE: All changes made to a zone by using dynamic update are written to the zone's journal file. The server periodically flushes the complete contents of the updated zone to its zone file approximately every 15 minutes. When a server is restarted after a shutdown, it replays the journal file to incorporate into the zone any updates that took place after the last zone file update.The dynamic reconfig interval settings are immaterial for a max-journal-size event triggering.

  - **notify:** Specifies if the notification of any zone data changes must be sent to a slave server. You can select from the following options:
    - Yes: Notification is sent to all the name servers of the zone when the zone data changes.
    - Explicit: Notification is sent explicitly to the servers specified in the also-notify list when the zone data changes.
    - No: Notification is not sent.

    Notify specified at the server level will be overridden by the settings of this zone.

- **notify-source:** Specifies the local source address. You also have the option to specify the UDP ports that are used to send notify messages. The local source address must appear in the masters list of the slave server or in the allow-notify list. The slave should also be configured to receive notify messages from this address.

  Notify-source specified at the server level is overridden by the settings of this zone.

- **transfer-source:** Specifies the local addresses that are bound to the IPv4 TCP connections used by the zones that are transferred inbound by the server. It also specifies the source IPv4 address and optionally, the UDP port. The UDP port is used to refresh queries and forward any dynamic updates.

  If you have not set a value, it defaults to a system-controlled value, usually the address of the interface closest to the remote end.

  Transfer-source specified at the server level is overridden by the settings of this zone

- **zone-statistics:** Specifies the statistical information that is dumped to the statistics-file for all zones in the server. Values can be either Yes or No. If you set the value to Yes, the server collects statistical data on all zones in the server. Zone-statistics specified at the server level is overridden by the settings of this zone.

Modifying Advanced Zone Options

- To modify the option, click **Modify**, specify the value, then click **OK**.
- To add an element, specify the address, then click **Add**. This populates the new entry into the list.
- To delete elements from the list, select the elements to be deleted, then click **Delete**. Click **OK** to populate the **Configured Value** column with the elements.
- To clear the configured values for the options, select the option, then click **Clear**.

Associating a Zone to Specific DNS Servers

A DNS server can be configured to serve only the queries by specifying the role of a zone as secondary or passive secondary.

To associate the existing DNS zone to a specific DNS server and specify the role of the zone by using the Java Management Console:

- In the Java Management Console, select the zone that you want to configure for a specific DNS server.
- In the Attributes page of this zone, select the **Authoritative DNS Server** for this zone as the specific DNS server that will serve this zone.
- Click **Save**.

Deleting a Zone Object

1. Select the Zone object you want to delete.
2. Click **Delete** on the toolbar.

   A warning message is displayed to confirm the zone deletion. You can also delete subzones by selecting the option from the message window.

NOTE: Creation, modification or deletion of a forward zone is not supported.

Importing a Zone Object

Use the Import dialog box to convert BIND-formatted DNS files and transfer them into the eDirectory database.

NOTE: Reimporting the same configuration file does not work for DNS Java Console for a DSfW server.

To import a Zone object:

1. Click the **DNS Service** tab of the Management Console.
2. Click **Import DNS Database** on the toolbar.
3. Specify the DNS BIND formatted filename in the field provided. You can browse to select filenames from the File Selection dialog box.
4. Click **Next** to select the context where the zone object should be created.
5. Click **Next** to select the server name that manages the zone.

   You can select an existing DNS server or an NCP server where the DNS server object will be created. The selected DNS server must have DNS/DHCP services installed on it. If you select this zone type as **primary**, this DNS server acts as a designated primary; or if you select zone type as **secondary**, it acts as a designated secondary.

   If you do not want to assign a DNS server for this zone at this point, leave this field blank.
6. Click **Next** to specify this zone type.

   If you select the zone type as **primary**, Novell DNS servers act as primary servers for this zone; if you select **secondary**, they act as secondary DNS servers.
7. Click **Next** to view the configuration that you have selected.
8. Click **Import** to start the import operation.

   If the import operation encounters any errors while transferring data, the **Details** button is enabled. Click **Details** to view the errors.

   If some resource records are not transferred because of incorrect data, you can create them by clicking **Create** on the toolbar.
9. Click **Finish** to complete the import operation.

Exporting a Zone Object

Use the Export dialog box to copy the eDirectory database to a text file. The text file enables you to save the DNS zone data to BIND master file format files. These files can be imported to other applications, including BIND servers, or they can be imported back into the eDirectory database by using the Management Console.

1. Click the **DNS Service** tab of the Management Console.
2. In the DNS Service window, select the zone you want to export and click **Export Database** on the toolbar.

3 In the Export - DNS window, specify the name of the destination file or browse to select a filename from the dialog box.

4 Click **Export** to export the database into a file.

NOTE: Importing or exporting of forward zone is not supported.

13.1.4 Resource Record Management

- "Creating Resource Records" on page 137
- "Viewing or Modifying Resource Records" on page 138
- "Deleting Resource Records" on page 138

Creating Resource Records

A resource record is a piece of information about a domain name that contains information about a particular piece of data within the domain.

Every domain name in the zone has a corresponding RRset object under that zone container object. An RRset is not created directly. Initially, when a resource record is created and is assigned a unique domain name within a zone, the corresponding RRset is created first; then, the RR is associated with the RRset.

If you select an existing RRset and click **Create** on the toolbar to create a new RR, the Management Console sets the new RR domain name to read-only and assigns the newly created resource record to the selected RRset. Resource records cannot be created in a secondary zone. All changes to the resource record data should be done at the master server; the secondary servers receive the changes through zone transfers.

To create resource records:

1 In the DNS Service window, select the zone in which the resource record will be created. If you want to add another resource record to an already existing RRset, select that RRset.

2 Click **Create** on the toolbar.

3 In the Create New DNS Object window, select the resource record, then click **OK**.

4 Provide information in the fields:

If you have selected an RRset, the owner name field is filled with the RRset name. This field does not need to be edited.

If you have selected a zone and want to create a new RRset, specify the domain name of that resource record in the owner name field.

The zone name part of the domain name already filled. Only the remaining portion needs to be filled.

If you are creating a resource record to zone domain name, the owner name field does not need to be filled because the zone domain name is already present.

5 In the Create Resource Record window, select the RR type to be created.

6 Select **Create corresponding PTR record** to create the resource record in the corresponding reverse zone

7 Specify the required data for the selected resource record, then click **Create**.

The Resource Record created successfully message appears.

8 In the Resource Record Create window, click **Repeat** to continue creating a new resource record.

NOTE: Start of Authority (SOA) is defined as part of a Zone object attribute. A Pointer (PTR) record is created automatically when any new A resource record is created and if a primary INADDR.ARPA zone exists to which the IP address belongs. Similarly, an A type resource is created when any new PTR record is created and if a primary zone exists to which the domain name pointed by PTR record belongs.

Several resource record types correspond with a variety of data stored in the domain namespace. For a list and description of resource record types, see Section A.2, “Types of Resource Records,” on page 190.

Viewing or Modifying Resource Records

When you select an existing resource record in the left pane of the DNS Service window, the detailed information for the object is displayed in the right pane. You can modify the resource record data and save changes by clicking **Save** on the toolbar.

You can modify resource record data for all resource records except the A, A6, and AAAA records.

Deleting Resource Records

You can delete one, more than one, or all resource records and RRsets, using the multi-select deletion feature in the Java Management Console. RRsets and resource records in a secondary zone cannot be deleted. They should be deleted from a primary server.

1 Click the **DNS Service** tab of the Management Console.

2 From **All Zones**, select the domain that contains the host or RRSet.

3 Select the item to be deleted.

You can delete either the entire RRSet or one or more resource records in the RRSet.

To delete one or more objects:

- Press the Shift key and select the objects.
- Click **Delete**.

NOTE: When the A and PTR type resource records are deleted, the corresponding PTR and A resource records also deleted.

13.1.5 DNS Key Management

A DNS server supports secure updates and secure queries by using the TSIG-key mechanism. TSIG key can be used with allow-update or update policy to secure updates between a DNS server and its client. For a successful secure DNS update you must ensure the following:

- TSIG key is created and assigned properly to the zone.
- Client sends the update information with TSIG key and it's secret.

The DNS Key Management role consists of tasks that allow you to create, modify, and delete DNS Key objects. A DNS key provides a means of authentication for dynamic DNS updates and for queries to a secured DNS server. A DNS key uses shared secret keys as a cryptographically secure means of authenticating a DNS update/query.

NOTE: DNS keys can now be created with '.' and '_' in their names.

Unsupported dnssec-keygen features

- **-a:** RSA, RSAMD5, DH, DSA, RSASHA1 are not supported by novell-named.
- **-n:** ZONE nametype.
- **-f:** setting the flag in DNSKEY record.
- **-p:** protocol support is not affirmed as it is used in conjunction with DNSKEY for DNSSEC.

```
Example:
dnssec-keygen -v
Usage:
dnssec-keygen -a HMAC-MD5 -b 218 -n HOST mykey
Version: 9.3.4
Required options:
-a algorithm: RSA | RSAMD5 | DH | DSA | RSASHA1 | HMAC-MD5
-b key size, in bits:
RSAMD5: [512..4096]
RSASHA1: [512..4096]
DH: [128..4096]
DSA: [512..1024] and divisible by 64
HMAC-MD5: [1..512]
-n nametype: ZONE | HOST | ENTITY | USER | OTHER
name: owner of the key
```

The following sections give details on DNS key management:

- "Creating a DNS Key" on page 139
- "Modifying a DNS Key" on page 140
- "Deleting a DNS Key" on page 140

Creating a DNS Key

1. Click Create on the toolbar.
2. In the **Create New DNS Record** window, select the DNS Key, then click **OK**.
3. In the **Create DNS Key** window, specify a name to identify the DNS key in the **DNS key Name** field.
4. Specify the Algorithm used to hash the DNS data. The HMAC-MD5 algorithm is the only supported algorithm for the DNS key.
5. Specify the Secret Key generated by the dnssec-keygen. This is used by the DNS server to encrypt/decrypt the hashed data. Secret-456errt4545= is the secret key generated by dnssec-keygen.

   The secret key provided must be Base64 encoded, or the DNS server fails to start.

6 Specify or browse to select the **NDS context**.

7 Click **Create**. The DNS key is now created.

Example: `DNS KeyName-Key1,Alorithm-HMAC-MD5,Key Secret-456errt4545=`

Modifying a DNS Key

When you select an existing DNS key in the left pane of the DNS Service window, the detailed information for the object is displayed in the right pane. You can modify the DNS key data and save changes by clicking **Save** on the toolbar.

You can modify DNS key data such as secret key, and the associated Comments.

Deleting a DNS Key

You can delete one, more than one, or all DNS keys, using the multi-select deletion feature in the Java Management Console.

NOTE: Deleting DNS key objects, deletes the references to key objects (if any) in Zone and DNS server objects.

To delete one key:

1 Click the **DNS Service** tab of the Management Console.

2 Select the DNS key to be deleted.

3 Click on the toolbar.

4 Click **Yes** to confirm the deletion in the **Delete Record** window.

To delete more than one DNS key:

1 Click the **DNS Service** tab of the Management Console.

2 Select the DNS key to be deleted.

3 Press the Shift key and select the Keys.

4 Click on toolbar. Click **Yes** to confirm the deletion in the **Delete Record** window.

NOTE: For further details, please refer to the dnssec-keygen man page.

13.2 Configuring Roles for a OES DNS Server

- Section 13.2.1, “Configuring a DNS Server to Forward Queries to Root Name Servers,” on page 141
- Section 13.2.2, “Configuring a DNS Server as a Cache-Only Server,” on page 141
- Section 13.2.3, “Configuring Child (Sub) Zone Support,” on page 141
- Section 13.2.4, “Configuring a Multi-Homed Server,” on page 142
- Section 13.2.5, “Configuring Dynamic DNS,” on page 142

OES DNS servers act in the following roles for a zone:

- **Designated Primary server/Passive Primary server:** The role played by the server for a zone depends on the zone type. If the zone type is primary, the server acts as a designated primary server or a passive primary server. All servers that are managing a primary zone act as primary servers for that zone, and among all the primary servers, one server can be assigned as a designated primary server for that zone. All other servers are called passive primary servers.The designated primary server accepts dynamic updates for that zone. All primary servers respond to queries for this zone and notify slave servers of this zone about changes in data that can occur due to dynamic update or changes by users.
- **Designated Secondary server/Passive Secondary server:** If the zone type is secondary, the server acts either as a designated secondary or a passive secondary. All servers that are managing a secondary zone act as secondary (or slave) servers for the zone, and among all of the secondary servers, one server can be assigned as a designated secondary server. All other secondary servers are called passive secondary servers. The designated secondary server is the one that does zone-in transfer for the zone from the master server and writes the data into eDirectory.

13.2.1 Configuring a DNS Server to Forward Queries to Root Name Servers

When you install OES, the root server information is automatically loaded into your system. No additional steps are required to configure your system to forward queries to the root name servers.

13.2.2 Configuring a DNS Server as a Cache-Only Server

A cache-only name server is a domain name system (DNS) server that is not authoritative for any particular domain. Its only function is to look up names for clients and cache them.

A cache-only server should be located between the clients that require address resolution and any DNS name servers that communicate over the Internet. Configure DNS clients to forward their queries to the cache-only server, and configure the cache-only server to forward its queries to a DNS server (or servers) attached directly to the Internet.

To configure a server to function as a cache-only server, follow the instructions to create a DNS server in “Creating a Zone Object” on page 131. After you create the DNS server object, do not assign it to any zone. Configure this server to forward its queries to a DNS server connected to the Internet. You can do this by specifying the DNS server IP address in the Forwarders option.

13.2.3 Configuring Child (Sub) Zone Support

If you create a child zone, you must configure the glue records to associate the child zones with the parent zone.

The parent zone should contain an NS record for the child zone domain name. An NS resource record specifies a domain name for an authoritative name server for the specified class and domain. If the child zone name server domain name belongs to the parent zone or the child zone, the parent zone should have an A record for that name server domain name. For details on Resource Records, see Section A.2, “Types of Resource Records,” on page 190

When configured as described above, queries to the parent zone name server for names within the child zone are returned with the child zone's referral records. The requester can then query the child zone's name server directly.

13.2.4 Configuring a Multi-Homed Server

A multi-homed server is a server with more than one IP address. In an Internet environment, a multi-homed server is a single server connected to multiple data links, which might be on different networks.

If you have a DNS server with more than one IP address, and if you have specified one of the IP addresses in the listen-on option of the server, make sure the same IP address is used in the A record for the DNS server domain name.

13.2.5 Configuring Dynamic DNS

Novell Dynamic DNS (DDNS), is a mechanism by which NetWare DHCP servers update DNS servers with address and pointer records for addresses and hostnames that are assigned using the DDNS feature. To use DDNS, the following configuration must already exist:

- The DNS Zone object to receive DHCP updates must be created. For all networks that are served by the DNS server, the DNS zones must have reverse zones configured. For more information on configuring the reverse zones by using the Java Management Console, see "Creating an IN-ADDR.ARPA Object" on page 131.
- Subnet Address Range objects that use the DDNS must be set to range type Dynamic BOOTP and DHCP or Dynamic DHCP.

To activate the DDNS feature:

1. Select the Subnet object of the Subnet Address Range on which you want to activate DDNS, then specify a zone in the DNS Zone for Dynamic Update.
2. Select the desired Subnet Address Range and ensure that the range type is set to **Dynamic BOOTP and DHCP** or **Dynamic DHCP**.
3. Set the DNS update option to **Always Update**.
4. Click **Save**.

13.3 novell-named Command Line Options

All command line options for DNS server are optional.

If the DNS server is loaded without any options, default values for all of the options, wherever applicable, are used.

To start a DNS server, enter the following command at the server console prompt:

`rcnovell-named start` or `systemctl start novell-named.service`

Command line options can be specified in two different scenarios:

- Load: This is the first time the DNS server is loaded.
- Suspend state: The server can be suspended using the management utilities. The server remains loaded, but it supports only a limited set of services. It does not support any updates and dynamic reconfiguration.

Table 13-1 *Command Line Options*

Command Line Options	Syntax	Default Value
Debug	-d *level* **NOTE:** Add ***-d 10*** to set the highest level of debug information	0
Fault Tolerance	-F on|off	On
Run the server in foreground	-f	NA
Run the server in foreground and enable all logging to `stderr`	-g	NA
Number of Log versions	-L	1
Number of CPUs	-n	Number off CPUs on the machine
DNS Port	-p *portnumber*	53
Dynamic Reconfiguration	-r on|off	On
Replace Characters	-R *character*	NA
Memory usage statistics	-s	NA
chroot	-t	NA
Setuid	-u	named
Cluster Enabling	-V mountpoint **NOTE:** The -V option must point to the NCP volume name.	NA
Zone Update	-z	off
Usage Display	?	NA

Command line options can be specified only at load time. These options control the behavior that can be set only once for a particular running session of the DNS server. If you specify an invalid value for such an option at load time, the server exits.

Syntax: `novell-named[-d debuglevel][-f][-g][-F fault tolerance][-n number_of_cpus][-p port][-s][-t chrootdir][-u username][-L number_of_log_versions][-r dynamic reconfiguration][-R replacechar][-V mountpoint][-z]`

13.3.1 Description of Command Line Options

Debugging Level Syntax: –d *level*

This option sets the level of information to be logged. If `-d` is specified, all the debug messages of type information /notice/warning/error/critical are logged for all categories. Setting the log level to higher number captures all the logging details over the preceding levels.

All the messages are logged in the `/var/opt/novell/log/named/named.run` file.

Run the Server in foreground Syntax: -f

Enables you to run the server in foreground.

Fault Tolerance Syntax: –F on|off

When this option is set to on, the DNS server can start using the backup files if eDirectory is inaccessible. If off is specified for a new load, the DNS server does not service the zones for which eDirectory is not available.

Run the server in the foreground and force all logging to stderr. Syntax: -g

Enables you to run the server in the foreground and force all logging to stderr.

Number of Log Versions Syntax: -L

Specifies the number of log file versions to create.

Number of CPUs Syntax: -n

Creates #cpus worker threads to take advantage of multiple CPUs. If not specified, novell-named will try to determine the number of CPUs present and create one thread per CPU. If it is unable to determine the number of CPUs, a single worker thread will be created.

DNS Port Syntax: –p *port_number*

The port specified in this option is used by the DNS server to listen for queries. The values for this option can be in the range 1-65535. The default port number is 53.

Dynamic Reconfiguration Syntax: –r on|off

If dynamic reconfiguration is enabled, the DNS server periodically checks the configuration data for the server and zones. As part of this activity, it automatically detects added, deleted, and modified zones. This option has no effect on periodically checking the directory for changes in the zone data. Even if the dynamic reconfiguration is set to off, periodic detection of zone data occurs. The default period for dynamic reconfiguration is 15 minutes.

Replace Characters Syntax: –R *characters*

A set of characters that are not allowed in the hostnames. The current list is ~!@#$%^&*+=?'`:;,"<>\/()[]{}|. This option can be used to add characters to this list. If these characters are found in the hostnames, the DNS server replaces these characters with a dash (-) before storing them in eDirectory. This option is included for backward compatibility and only allows adding one more character to the existing list.

Memory Usage Statistics Syntax: -s

Writes memory usage statistics to stdout on exit.

chroot Syntax: -t

chroot() to directory after processing the command line arguments, but before reading the configuration file. novell-named expects the directory specified to already exist and the `/etc/opt/novell/named` directory structure should be created under the chroot dir. In the absence of chroot directory, the installation (YaST) creates this directory structure at root level. All the db files, journal file and conf files are created under this directory. In a cluster setup, the directory structure has to be created under the mountpoint specified with the `-V` option.

Log file named.run is created under `/var/opt/novell/log/named` with respect to chroot directory. novell-named expects this directory structure to be created at load time. In the absence of chroot directory, the installation (YaST) creates this directory structure at root level. In a cluster setup this directory structure should be created under mountpoint. In case chroot is mentioned, it expects this structure to be created under chroot directory. All logging information goes to this named.run and not to `/var/log/messages`.

Setuid Syntax:

setuid() to user after completing privileged operations, such as creating sockets that listen on privileged ports.

NOTE: On Linux, novell-named uses the kernel's capability mechanism to drop all root privileges except the ability to bind() to a privileged port and set process resource limits. This means that the -u option only works when novell-named is run on kernel 2.2.18 or later, or kernel 2.3.99-pre3 or later, since previous kernels did not allow privileges to be retained after setuid().

Cluster Enabling Syntax: –V *mount_point*

This option enables clustering, by providing a volume other than `/opt/novell/named/bin/`. The volume name specified as the argument should exist and be mounted on the Linux server.

Example: `Load novell-named –V` *new_volume*

If new volume exists and is mounted on the Linux server, the DNS server stores all files to this volume.

Zone Update: -z on/off

This option is optional. Setting this option to on, ensures that the DNS zone is updated one after the other. The default value is off. For example, if two simultaneous DDNS requests are received, one from NetWare DHCP server and another from SLES DHCP server, then this option updates the DNS zone one after the other.

Usage Display Syntax: –?

13.4 Viewing Debug Logs in Syslog

All the debug messages are available in the `/var/opt/novell/log/named/named.run` file if you have enabled the debug settings.

Use `novell-named` to add an extension framework for controlling the DNS server behavior. It has a log extension installed in the path `/opt/novell/named/extns/log/queries_answers.extn`.

By default, the log extension is disabled. So, you must first enable log extension in `/opt/novell/named/bin/start-novell-named` to view important debug log messages.

1. Remove ***-n*** option to enable log extension.

   ```
   export -n NAMED_SELECTIVE_SYSLOG_EXTENTION_PATH="/var/opt/novell/log/named/extn/queries_answers.extn"
   ```

2. Add ***-d 10*** to set the highest level of debug information.

   ```
   RUNTIME_ARGUMENTS=`echo "${OES_NAMED_ARGUMENTS}" | sed 's/-u named//g'`
   ${NAMED_BIN} ${NAMED_ARGS} -u named -D ${RUNTIME_ARGUMENTS} -d 10
   ```

If required, you can enable multi-line messages in syslog for better readability. Use `$EscapeControlCharactersOnReceive` in the syslog configuration file. For detailed information, see RSyslog Documentation.

13.5 Configuring Log-Level using Java Management Console

1. Launch the Java Management Console. See, “Java Management Console” on page 35.
2. Click the DNS Name Server object in the lower pane of the DNS Service window to display detailed information in the right pane.

   A DNS Name Server object's detailed information window displays seven tab pages.
3. Navigate to **Advanced** page to specify the required log-level.

   Advanced page displays the default value that the server assumes if the log-level attribute is not configured. The DNS log level can range between 0 to 10.

   - 0 - Indicates default log value where critical, errors, warnings, and information logs are enabled.
   - 3 - Indicates security logs are enabled.
   - 10 - Indicates maximum log level.

Scenarios where log-level setting specified using `-d`, `rndc`, or Java Console takes precedence over the existing log-level settings

- Section 13.5.1, “Setting Log-Level using Command Line,” on page 146
- Section 13.5.2, “Setting Log-Level using rndc Command,” on page 147
- Section 13.5.3, “Setting Log-Level using Java Console,” on page 147

13.5.1 Setting Log-Level using Command Line

- If the administrator has already set the log-level using `-d` option in `novell-named.service` or DNS load script, this takes the precedence of the log-level setting and any modification performed on log-level using Java Console is not considered.
- If the administrator has already set the log-level using Java Console and the administrator changes the log-level using `-d (/opt/novell/named/bin/novell-named -u named -D -d <>)`option then the command line takes the precedence of the log-level setting used for that particular instance.

13.5.2 Setting Log-Level using rndc Command

- If the administrator configures the log-level using Java Console and later modifies it using `rndc` command. In this scenario, the log-level set using `rndc` command takes precedence of the log-level setting used for that particular instance.

13.5.3 Setting Log-Level using Java Console

- If the DNS server is running with a specific log-level (for instance, 3) and the administrator changes the log-level (for instance, 5). During dynamic reconfiguration or `novell-named-restart`, the newly modified log-level (5) takes precedence.
- If the administrator changes the log-level in the Java Console to a higher value when the log-level is set to zero using `rndc` command or `-d` option. During dynamic reconfiguration or `novell-named-restart`, the higher log-level set from the Java Console takes precedence.

13.6 Changing Proxy Users

Credentials are stored either in OES Credential Store or in the Local File. When the eDirectory credentials of the DNS proxy user change, the OES Credential Store or the local file (a file used on the local system) must be updated with these changes.

Changing Credentials in OES Credential Store

If the credentials are stored in OES Credential Store, the credentials must be updated in the OES Credential Store storage of both the `root` user and the `named` user. This is done by using `oescredstore` or `dns-inst/dns-maint`.

- **Updating through oescredstore:**
  - To update the credentials in OES Credential Store for the `root` user, log in as the `root` user or change to the `root` user by using `su` command. Then use the following command to update OES Credential Store:

    ```
    oescredstore -s -n dns-ldap -u username -p password
    where username = <cn=admin, o=novell>, password = <secret>
    ```

    This updates the credentials in root OES Credential Store storage.
  - To update the credentials in OES Credential Store of the named user, change your login to the named user using the `su named` command. Then use the following command to update the OES Credential Store:

    ```
    oescredstore -s -n dns-ldap -u username -p password
    where username = <cn=admin, o=novell>, password = <secret>
    ```

    This updates the credentials in the named OES Credential Store storage.
- **Updating through dns-inst/dns-maint:** The dns-inst/dns-maint utility is also used to update the OES Credential Store credentials. Use the following syntax:

  ```
  dns-inst <Credential storage (0->file, 1->CASA)>
  dns-maint <Credential storage (0->file, 1->CASA)>
  ```

For example:

```
dns-maint -ca <Acme-tree> Acme.com 636 cn=admin,o=Acme secret cn=dns-
admin,o=dns-domain secret 1 ou=Sales,o=Acme ou=Finance,o=Acme o=acme
o=acme 1 acme-host acme.americas.com 0
```

Changing Credentials in the Local File

If credentials are stored in the local file, then the credentials are updated using the `dns-inst` or the `dns-maint` utility. Use the following syntax:

```
dns-inst <Credential storage (0->file, 1->CASA)>
```

or

```
dns-maint <Credential storage (0->file, 1->CASA)>
```

For more information, see Section A.5, “DNS Server Configuration Utility,” on page 200 and Section A.6, “DNS Server Maintenance Utility,” on page 202.

13.7 Starting the DNS Server

1. Ensure that the DNS Server object is created.

   For details on creating a server object using Java Management Console, see “Creating a DNS Server Object” on page 128.

2. Before starting `novell-named`, check to see if the following daemons are active:

   ```
   systemctl status ndsd.service
   systemctl status novell-xregd.service
   ```

3. Load `novell-named` by using the following script or command:

   ```
   rcnovell-named start
   ```

   or

   ```
   systemctl start novell-named.service
   ```

4. To check the status of the server, use the following command/script:

   ```
   rcnovell-named status
   ```

   or

   ```
   systemctl status novell-named.service
   ```

13.8 Running DNS Server in chroot Mode

To load `novell-named` with `-t` (chroot) option, make sure that the following directories are created under the chroot directory with permissions to user specified with `-u` option:

- The configuration file directory - `/etc/opt/novell/named`
- The log file directory - `/var/opt/novell/log/named`
- The pid directory - `/var/opt/novell/run/named`
- `/etc/rndc.key`

In addition to this, edit the load command with the chroot path in the `novell-named.service` file.

13.9 Running DNS Server as a Non-Root User

The named user is created during installation of BIND. When you load `novell-named` with `rcnovell-named start` or `systemctl start novell-named.service`, DNS server reuses the named user to run the DNS service daemon.

If you want to run the DNS service daemon with any other non-root user:

1. In YaST, create a user using the **Security and Users > User Management** option in YaST.
2. Set Runtime credentials for the user created in Step 1, Section 11.3, “Setting Runtime Credentials,” on page 122
3. To load novell-named with -t (chroot) option, make sure that the following directories are created under the chroot directory with permissions to user specified with -u option:
   - The configuration file directory `/etc/opt/novell/named`
   - The log file directory `/var/opt/novell/log/named`
   - The pid directory `/var/opt/novell/run/named`
   - `/etc/rndc.key`

   NOTE: In cluster setup, Runtime Credentials must be set on all the nodes in the DNS cluster.
4. Edit `novell-named.service` and modify the `checkAndCopyConfigFiles` function and make relevant changes for user name and group.
5. Start the DNS server using `rcnovell-named start` or `systemctl start novell-named.service` command.

13.10 Stopping the DNS Server

To stop the DNS server, use the following command:

`rcnovell-named stop` or `systemctl stop novell-named.service`

13.11 What’s Next

The next section describes steps to cluster a DNS server.

- Chapter 14, “Configuring DNS with OES Cluster Services,” on page 151

14 Configuring DNS with OES Cluster Services

OES DNS server is a distributed database system that provides hostname-to-IP resource mapping (usually the IP address) and other information for computers on a network. If for some reason the OES DNS server is not accessible, clients lose their ability to connect to the network because DNS lookups will fail. This is possible because the DNS server is automatically started, stopped, and restarted on different servers in the cluster by OES Cluster Services. You can prevent this problem by configuring DNS with OES Cluster Services, which ensures that name resolution required by users to connect to the network is highly available.

Before you attempt to implement this solution, familiarize yourself with how Cluster Services works. For information, see the *OES Cluster Services for Linux Administration Guide*.

- Section 14.1, “Prerequisites,” on page 151
- Section 14.2, “Installation and Configuration,” on page 151
- Section 14.3, “Loading and Unloading the DNS Server,” on page 156
- Section 14.4, “What’s Next,” on page 157

14.1 Prerequisites

- eDirectory
- OES Cluster Services
- OES Storage Services (NSS)
- The DNS server should be installed on all the nodes in cluster or on the nodes identified for running DNS
- Create a NSS Shared Disk partition and cluster-enable it. For more information, refer to “Configuring and Managing Cluster Resources for Shared NSS Pools and Volumes” in the *OES Cluster Services for Linux Administration Guide*.

14.2 Installation and Configuration

- Section 14.2.1, “Verifying the OES Cluster Services Setup,” on page 151
- Section 14.2.2, “Installing and Configuring a Cluster,” on page 152
- Section 14.2.3, “DNS Load, Unload, and Monitor Scripts,” on page 154

14.2.1 Verifying the OES Cluster Services Setup

To ensure that OES Cluster Services is set up properly:

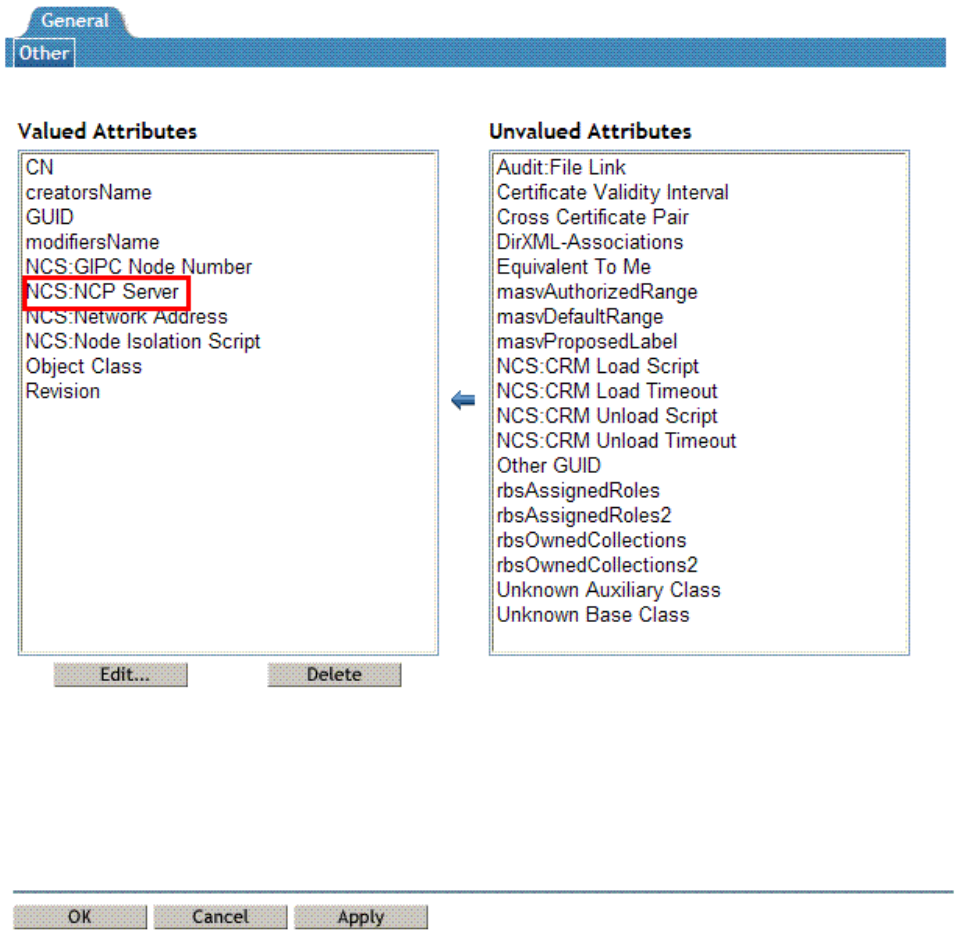
1 In iManager, click the **View Objects** button.

This view contains browsing and searching functionality to find objects, including a Tree View.

2 All the cluster nodes are listed inside the cluster object. Select the cluster node object within the cluster object for which you want to set the server attribute, then click Edit. This opens the Modify Object window.

   Do not select the NCP server object.

3 Ensure that the NCS: NCP Server attribute is included in the **Valued Attribute** list. If the NCS:NCP Server attribute is in the **Unvalued Attribute** list, use the ← button to move the attribute to the **Valued Attribute** list as illustrated in the following figure.



4 Select the NCS:NCP Server attribute from the **Valued Attributes** list. Click **Edit**.

5 The Edit Attribute window is displayed. Ensure that the value of the NCS:NCP attribute is set as the name of the Physical NCP Server.

6 Click **Apply** to save and exit.

14.2.2 Installing and Configuring a Cluster

1 A DNS server by default uses the named user that is created in the local system during the installation process. If you want to use a user other than the named user, create the user using the **Security and Users> User Management** option in YaST.

2 In iManager, click the **Users > Create User** task to open the Create User window. Specify the details and click **OK** to create a new user.

3 The user created in Step 2 needs to be LUM-enabled. The default user (named) also needs to be LUM-enabled. To do this, click the **Linux User Management > Enable Users for Linux** task. This opens the Enable Users for Linux window. Search for and select the named user or the user created in Step 2, then click **OK** to select the user.

   3a Every user must belong to a primary group. To add a user to a group, search for an **Existing eDirectory Group object**.

   3b Select the DNSDHCP-Group object from the list.

   3c Select the workstations to which the Linux-enabled user should have access.

   3d Click **Next** to confirm the selection.

   The user is now Linux-enabled, included in the DNSDHCP-GROUP, and granted access to cluster nodes.

   3e Update the UID of the user created above to the named user's default UID.

   Select **Modify User** task in iManager. Select the user, go to **Linux Profile** tab of the user and **Modify User ID** to 44 that is named user's default UID.

4 Mount the shared volume on one of the nodes in the cluster.

5 Execute the following command at the command prompt:

   `/opt/novell/named/bin/ncs_dir.sh MountPath [Username]` It creates the following directory:

   `<mountpath>/etc/opt/novell/named`

   The MountPath parameter indicates the target directory in the volume where named specific directories are created.

   For example, `/opt/novell/named/bin/ncs_dir.sh /media/nss/DNSVOL/cn=named.o=novell.T=MyTree`

   When the script is executed, it creates the following directories:

   - `/media/nss/DNSVOL/etc/opt/novell/named`

   The script also assigns rights and ownership to these directories to the named user.

   `rights -f /media/nss/<Volumename>/etc/opt/novell/named -r rwfcem trustee username.context.treename`

   In cluster environment, the login directs to `/var/opt/novell/log/named/named.run` on the local volume where DNS server is running.

NOTE: By default the `ncs_dir.sh` script assigns permissions to the `named` user. If you want to use another user instead of named, modify the `ncs_dir.sh` script. Follow Step 2 and Step 3 for named user.

---

6 Create the DNS server on a Virtual NCP server.

   Add DNS-DHCPGroup or Proxy user as trustee of the Virtual NCP Server with the following rights:

   - All Attribute rights - Compare, Read
   - Entry Rights - Browse

7 Stop the novell-named service using `rcnovell-named stop` or `systemctl stop novell-named.service`.

8 Disable the start of novell-named service at boot time using `systemctl disable novell-named.service`.

9 Run the DNS Server by using the following command:

- `/opt/novell/named/bin/novell-named -u <username> -d <debug log level> -V <shared volume>`

This step ensures that DNS server can work on a cluster that is set up with shared volumes. However, kill this process again before you continue.

NOTE: Using the -V parameter, you must specify only the volume name and not the volume path.

---

10 In iManager, select the Clusters > My Cluster task, then select the cluster.

If the cluster does not appear in your personalized list of clusters to manage, you can add it. Click **Add**, browse and select the cluster, then click **OK**. Wait for the cluster to appear in the list and report its status, then select the cluster.

11 Select Cluster Options, then select the Cluster resource and click **Details**. The Cluster Pool Properties are displayed. Click the Scripts tab.

Click the Load Script, Unload Script, or Monitor Script links to view or modify the scripts. If you modify a script, click **Apply** to save your changes before you leave the page. Changes do not take effect until you take the resource offline, and bring it online again.

11a Click **Load Script**.

11b Ensure that the DNS load script is same as the script specified in "DNS Load Script" on page 154. Click **Apply** if you make changes.

11c Click **Unload Script**.

11d Ensure that the DNS unload script is same as the script specified in "DNS Unload Script" on page 155 and paste it in the Unload Script editor just before the `exit 0` statement. Click **Apply** if you make changes.

11e Click **Monitor Script**.

11f Ensure that the DNS monitor script is the same as the script specified in "Configuring the DNS Monitor Script" on page 156. Click **Apply** if you make changes.

11g Click **OK** to save the changes.

12 Set the DNS resource online by using the **Clusters > Cluster Manager** task in iManager. If the resource is in a comatose state, you must take the resource offline before it can be brought online again.

14.2.3 DNS Load, Unload, and Monitor Scripts

- "DNS Load Script" on page 154
- "DNS Unload Script" on page 155
- "DNS Monitor Script" on page 156

DNS Load Script

The load script contains commands to start the DNS service.The load script appears similar to the following example:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuncs
exit_on_error nss /poolact=DNSPOOL
exit_on_error ncpcon mount DNSVOL=254
exit_on_error add_secondary_ipaddress IP address of the secondary
server
exit_on_error ncpcon bind --ncpservername=Virtual NCP server name
--ipaddress=secondary server IP address
exit_on_error /opt/novell/named/bin/novell-named -u named -V Volume Name
exit 0
```

Configuring DNS Load Script

To customize the DNS load script for your specific configuration:

1. Add the following line to the DNS load script after the `ncpcon bind` line:

   ```
   exit_on_error export LD_LIBRARY_PATH=/opt/novell/xad/
   lib64:$LD_LIBRARY_PATH
   ```

   ```
   #!/bin/bash
   . /opt/novell/ncs/lib/ncsfuncs
   exit_on_error nss /poolact=DNSPOOL
   exit_on_error ncpcon mount DNSVOL=254
   exit_on_error add_secondary_ipaddress IP address of the secondary
   server
   exit_on_error ncpcon bind --ncpservername=Virtual NCP server name
   --ipaddress=secondary server IP address

   exit_on_error export LD_LIBRARY_PATH=/opt/novell/xad/
   lib64:$LD_LIBRARY_PATH

   exit_on_error /opt/novell/named/bin/novell-named -u named -V Volume
   Name
   exit 0
   ```

2. Edit the following line to assign a volume name:

   ```
   exit_on_error /opt/novell/named/bin/novell-named -u named -V volume
   name
   ```

Replace *volume name* with the name of the volume and *secondary server IP address* with the IP address of the secondary server.

DNS Unload Script

The unload script contains commands to stop the DNS service. The unload script appears similar to the following example:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuncs
ignore_error killproc -p /var/opt/novell/run/named/named.pid -TERM
/opt/novell/named/bin/novell-named
ignore_error ncpcon unbind --ncpservername=NCP server name
--ipaddress=IP address of the secondary server
ignore_error del_secondary_ipaddress IP address of the secondary server
ignore_error nss /pooldeact=DNSPOOL
exit 0
```

Configuring DNS Unload Script

To configure DNS unload script, add the following command:

```
ignore_error killproc -p /var/opt/novell/run/named/named.pid -TERM
/opt/novell/named/bin/novell-named
```

DNS Monitor Script

The monitor script contains commands to monitor the DNS service. The monitor script appears similar to the following example:

```
#!/bin/bash
. /opt/novell/ncs/lib/ncsfuncs
exit_on_error status_fs /dev/pool/POOL1 /opt/novell/nss/mnt/.pools/DNSPOOL
nsspool
exit_on_error status_secondary_ipaddress 10.10.10.100
exit_on_error ncpcon volume DNSVOL
exit 0
```

Configuring the DNS Monitor Script

1 Add the following before `exit 0`

```
rcnovell-named status
if test $? != 0; then
     exit_on_error /opt/novell/named/bin/novell-named -u named -V
<Volume Name>
fi
exit_on_error rcnovell-named status
```

14.3 Loading and Unloading the DNS Server

After updating the load and unload scripts of the virtual NCP Server, the DNS server is now loaded and unloaded along with the virtual NCP Server.

- Section 14.3.1, “Loading the DNS Server,” on page 157
- Section 14.3.2, “Unloading the DNS Server,” on page 157

14.3.1 Loading the DNS Server

You can load the virtual NCP server and DNS server by using iManager.

1. Click **Cluster > Cluster Manager** task in iManager. This opens up the Cluster Manager window.
2. Click the **Search** icon to open the eDirectory Object Selector. Browse or search the list to locate and select the cluster object. The Cluster state is displayed.
3. Select the check box next to the DNS Cluster and select **Online**. Select the cluster node where you want the resource to load, then click **OK** to load the resource on that node.

   After a few seconds you see the server status as **Online,** indicating that the server has been loaded.

After the Virtual NCP server is successfully loaded on a node, use the `rcnovell-named status` or `systemctl status novell-named.service` command to check the status of the server.

14.3.2 Unloading the DNS Server

1. Click the **Cluster > Cluster Manager** task in iManager. This opens up the Cluster Manager window.
2. Click the **Search** icon to open the eDirectory Object Selector. Browse or search the list to locate the cluster object. The Cluster state is displayed.
3. Select the check box next to the DNS Cluster and select **Offline.** After a few seconds you see the server status as **Offline,** indicating that the server has been unloaded.

14.4 What's Next

The next section discusses the security issues and recommendations for DNS on an Open Enterprise Server.

- Chapter 15, "Security Considerations for DNS," on page 159

15 Security Considerations for DNS

This section describes security issues and recommendations for DNS on an Open Enterprise Server 2023 server. It is intended for security administrators or anyone who is using DNS for Linux and is responsible for the security of the system. It requires a basic understanding of the DNS protocol. It also requires the organizational authorization and the administrative rights to effect the configuration recommendations.

- Section 15.1, “Logging,” on page 159
- Section 15.2, “Commands,” on page 159
- Section 15.3, “Cryptographic Algorithms,” on page 159
- Section 15.4, “Best Practices,” on page 159
- Section 15.5, “What’s Next,” on page 160

15.1 Logging

`novell-named` supports different log levels. For more information on the debug levels, see Section 13.3, “novell-named Command Line Options,” on page 142.

For more detailed logging information, see *BIND 9 Administrator Reference Manual*.

15.2 Commands

The DNS server can be administered by using command line options. For details, see Chapter 13, “Administering and Managing a DNS Server,” on page 127.

15.3 Cryptographic Algorithms

AES from Open SSL implementation is used for encryption and decryption of proxy user credentials.

15.4 Best Practices

- It is preferable to run the DNS server installation process with the YaST tool. For details on the DNS Server installation process, see Chapter 11, “Installing and Configuring DNS,” on page 119
- During the DNS server installation ensure that the **Use secure channel for configuration** option is selected. This ensures that the authentication mechanism is secured.
- To load `novell-named` with the `-t` (chroot) option, make sure that the following directories are created under the chroot directory with permissions to the user specified with the `-u` option:
  - The configuration file directory - `/etc/opt/novell/named`

- The log file directory - `/var/opt/novell/log/named`
- The pid directory - `/var/opt/novell/run/named`

- By default novell-named is loaded by using the existing non-root user, which is named. You should load `novell-named` with the `-u`<non-root user> option.
- It is recommended to load named with a log level specific for your needs. For more details, see Section 13.3, “novell-named Command Line Options,” on page 142
- You should configure Apparmor profiles for `novell-named` according to your needs. The default profile is stored at `/etc/apparmor.d/opt.novell.named.bin.novell-named` and includes only minimal configuration.

  After making changes to the profile, reload Apparmor with the `rcapparmor` command.
- Zone security factors: To secure DNS, BIND provides different options. This includes IP-based access control and secure queries using Keys (recommended). The allow-query option is used to restrict queries to a particular set of hosts or keys.
  - For non-authoritative zones (zones not served by the server, so the responses are cached), restrict the query access at the server level (using allow-query) to your own network.
  - For authoritative zones (zones served by the server), access can be restricted either to your local network or to any other network.

NOTE: Restrict DNS zone transfers to only the servers that absolutely need it.

15.5 What’s Next

The next section discusses potential issues and workarounds for OES DNS and DHCP services.

- Chapter 16, “DNS/DHCP Advanced Features,” on page 161

16 DNS/DHCP Advanced Features

This section describes how to configure the Import-Convert-Export (ICE) zone handler.

- Section 16.1, “Configuring the ICE Zone Handler,” on page 161
- Section 16.2, “What’s Next,” on page 165

16.1 Configuring the ICE Zone Handler

- Section 16.1.1, “Modifying the ice.conf File,” on page 161
- Section 16.1.2, “Enabling Clear-Text Passwords,” on page 162
- Section 16.1.3, “Importing Configuration and Script Files,” on page 162
- Section 16.1.4, “Exporting Configuration and Script Information,” on page 164

16.1.1 Modifying the ice.conf File

The source and destination handlers available to the application, with other information such as the version of the handlers and the modes in which they operate, must be provided in the `ice.conf` file in the `/etc/opt/novell/eDirectory/conf/` directory. You modify the `ice.conf` file by appending the zone handler information.

```
[Zone]
Version: 1.0
Mode: FromFile, FromServer, ToFile
Module name: zone
Flags: 1
```

The mode is used to convey the information about the functionality supported by the handler. In the example above, the mode is FromFile, FromServer, ToFile because the zone handler can read from the file, read from the server, and write to the file.

The LDAP handler is used to write to the directory. Ensure that `ice.conf` also contains the following:

```
[LDAP]
Version: 1.0
Mode: FromServer, ToServer
Module Name: ldaphdlr
Flags: 1
```

The module name specifies the handler name. Flags specifies the flags that should be sent to the destination handler. Currently, the only flag available is for LBURP.

16.1.2 Enabling Clear-Text Passwords

Clear-text passwords should be enabled in the LDAP group object to avoid LDAP bind operation failure. You can do this by using iManager.

16.1.3 Importing Configuration and Script Files

You can use the ICE zone handler, (`named.conf` file) along with the corresponding zone master files can be migrated to eDirectory, or a script file can be formed in a particular format. This script file is used to migrate the zone master files of the desired zones, without changing the server and zone configuration information.

The import operation generates an output script file that indicates the status of the zone import with a “done:” token at the beginning of zones imported successfully. If an import fails for a particular zone, the corresponding output script file generated not have a “done:” token for that particular zone and the script file can be reused to import the failed zone later.

Command Line Parameters for ICE Zone Import

`ice –S ZONE –f <input file> [–t scr | conf] –x < zone context> –b <DNS server DN> [–l <log file name>] [–r] [–s <LDAP server name>] [–p <port no>] [–d <bind dn>] [–w <password>] –D {Destination Handler with options}`

Options	Descriptions
-f <input file>	The absolute name of the input file. The input file can be either a configuration file (typically `named.conf`) or a script file. The type of the file passed is specified with the `–t` option.
-t {scr | conf}	The type of the file passed with the `–f` option. `scr` is used to indicate that a script file is being passed and `conf` is used to indicate that a configuration file is being passed. scr is the default option used when `–t` is not specified.
-l <log file name>	The name of the log file where the messages are logged. By default, the `/etc/opt/novell/named/zoneimp.log` file is created. If any error is encountered, the important messages are printed on the ICE screen.
-x <zone context>	The context under which the zone objects are created.
-b <DNS Server DN>	The distinguished name of the DNS server in eDirectory. The imported zones are associated with this DNS server. This is required to link the imported zone objects to the DNS server and vice versa.
-r	The zone object, if already present, should be replaced. If this option is not specified, the existing zone objects are not disturbed.
-s <LDAP server name>	The LDAP server name or IP address to which the zone and configuration information are imported. The default is the local machine (127.0.0.1/ ”local host”). **NOTE:** The server name specified here should be the same as the name specified in the destination LDAP handler options (`–s` option).

Options	Descriptions
-p <port no>	The port number where the LDAP server is listening. The default value is 389. **NOTE:** The port number specified here should be the same as the port specified in the destination LDAP handler options (`-p` option).
-d <bind dn>	The distinguished name with which you want to bind to the LDAP server. **NOTE:** The fully distinguished name specified here should be the same as the name specified in the destination LDAP handler options (`-d` option).
-w <password>	The password for the Bind DN. **NOTE:** The password specified here should be the same as the password specified in the destination LDAP handler options (`-w` option). If you do not specify the password for bind DN, only those LDAP operations that do not need authentication will pass and the rest will fail.

Example for Command Line Options: `ice -S ZONE -f /home/user/db/named.conf -t conf -s 164.10.1.1 -x o=novell -b cn=DNS_MYSERVER,o=novell -d cn=admin,o=novell -w mypassword -D LDAP -s 164.10.1.1 -d cn=admin,o=novell -w mypassword`

Script File Format: A typical line from a script file contains the following fields.

```
<type of zone> <zone name> [master server IP] <master file name> [zone context] [comments] /* end of line */
```

Type of Zone: Primary or Secondary.

Zone Name: The domain name for which the resource records are to be imported.

Master Server IP: The IP address of the master server, if the zone is a secondary zone.

Master File Name: The file that contains the resource records.

Zone Context: The context where the zone object should be created.

Comments: Any ASCII pattern, the first character being a semicolon (;)

For example, `primary novell.com /home/user/db/novell.com.db; primary zone secondary novell.com 164.1.1.1 /home/user/db/novell.com.db;`

Named.conf File Format: The handler supports BIND 9.2 `named.conf` format only. It interoperates with extended attributes in the `named.conf` file. That is, it ignores those attributes during import. The existing BIND4 and BIND8 conf files must be converted to BIND9 format before passing them to this utility.

16.1.4 Exporting Configuration and Script Information

You can use the ICE zone handler, to export the DNS server, zone configuration information, and data from eDirectory and write it to the files.

- "Command Line Parameters for ICE Zone Export" on page 164

Command Line Parameters for ICE Zone Export

- "Source Handler Options" on page 164
- "Destination Handler Options:" on page 165

Source Handler Options

```
ice –S ZONE –s<source server> [–p<source LDAP port>] [–d<user name in source server>] [–w<password for source server>] <[–b <DNS Server DN>] [–x <Zone context>]> [–F <LDAP filter>] –D {Destination Handler with options}
```

Options	Descriptions
-s <server name>	Specify the LDAP server name or IP address to which the zone and configuration information. The default is the local machine (127.0.0.1/"local host")
	The server name specified here should be the same as specified in the destination LDAP handler options (–s option).
-p <port no>	Specify the port number where the server is listening. The default value is 389.
	The port number specified here should be the same as specified in the destination LDAP handler options (–p option).
-d <bind dn>	Specify the distinguished name with which you want to bind to the LDAP server.
	The fully distinguished name specified here should be the same as specified in the destination LDAP handler options (–d option).
-w <password>	Specify the password for the Bind DN.
	The password specified here should be the same as specified in the destination LDAP handler options (–w option). If you do not specify the password for bind DN, only those LDAP operations that do not need authentication will pass and the rest will fail.
-b <DNS Server DN>	Specify the FDN of the DNS server object.
	The handler uses this information to read the configuration information and also to detect zone objects that fall under the administrative domain of this server.
	If –b option is not specified, the configuration information is not exported and only the zone master files will be formed.

Options	Descriptions
-x <Zone Context>	Specify the context, from which the zone objects will be exported. x or b option must be specified. If b option is specified without the x option, all zones belonging to that DNS server will be exported. If both these options are specified, the configuration information is exported from the specified DNS server and the zone data with configuration from the specified zone objects.
-F <LDAP filter>	Specify the LDAP-compliant filter. This acts in conjunction with the –x option described above to specify the zone objects to export. The default value is objectClass=* The –F options works only with the –x option, to export all zones under the given context that match the given filter, and not when both –b and –x are specified.

Destination Handler Options:

`D ZONE –p <path>`

<path> is the path where the output files are created. The files that are created are `named.conf` and the zone master files, with the corresponding names of the zone objects as they are in the eDirectory.

By default, all zone information is created in the current directory if the -p option is not specified.

For example, `ice –S ZONE –b cn=DNS_MYSERVER,o=novell –s 164.99.1.1 –p 389 –d cn=admin,o=novell –w mypassword –D ZONE –p /home/user/db/`

16.2 What's Next

The next section provides information on installing DNS with the Domain Services for Windows pattern.

- Chapter 17, "DNS-DSfW Integration," on page 167

17 DNS-DSfW Integration

Domain Services for Windows (DSfW), a component of Open Enterprise Server (OES), creates seamless cross-authentication capabilities between Windows/Active Directory and OES /eDirectory servers. This suite of technologies allows customers with Windows networking environments to set up one or more “virtual” Active Directory domains in an eDirectory tree. Users can then log in and authenticate to both eDirectory and Active Directory from a Windows workstation without requiring multiple logins or having the Client for Open Enterprise Server installed.

These technologies also enable the user to access File and Print services without a Client for Open Enterprise Server on their windows workstations. Administrators can use Microsoft management console to manage users and groups in the directory.

Active Directory implementation is based on domain naming standards. Service registration and queries are processed through a DNS server. Microsoft integrates its own directory-based DNS, and DHCP services Active Directory deployments.

In DSfW, bind was used as the DNS server. With DNS-DSfW integration, bind is replaced by novell-bind to be used as the DNS server.

As a part of this integration, the following changes are observed in the installation scenarios:

IMPORTANT: In a Domain Services for Windows (DSfW) environment, if the services persist difficulties, then the novell-named, ntpd, and nscd AppArmor profiles should be loaded in complain mode.

- Section 17.1, “Normal eDirectory with DNS,” on page 167
- Section 17.2, “DSfW with DNS,” on page 168
- Section 17.3, “DSfW with Remote DNS (Child Domains),” on page 169
- Section 17.4, “Scenarios,” on page 169
- Section 17.5, “FAQs,” on page 170
- Section 17.6, “What’s Next,” on page 171

17.1 Normal eDirectory with DNS

For more information on eDirectory with DNS installation, refer Section 11.2, “Installing the DNS Server,” on page 121

IMPORTANT: DNS loads zone database from the file despite eDirectory availability. Hence, the administrators should not modify the files on the local system.

17.2 DSfW with DNS

- Section 17.2.1, “Changes for DNS,” on page 168
- Section 17.2.2, “Local DNS Server Installation,” on page 168

17.2.1 Changes for DNS

Domain Services for Windows no longer uses bind from the SUSE Linux Enterprise Server. Novell-bind is installed by default when the DSfW pattern is selected. DSfW configures novell-bind on the forest root domain (FRD) by default.The first DSfW server in the eDirectory tree (forest root domain) has novell-bind configured.

Additional domain controllers have novell-bind configured; However, it is not required for DSfW to function. Existing novell-bind servers in the tree can be configured as a forward lookup server with novell-bind on the DSfW server.

DSfW configuration will configure novell-bind on other Domain Controllers if the **Configure this server to be a primary DNS server** option is selected. DSfW automatically populates the zone information whenever a domain controller or domain is configured. Administrators do not require a different utility.

On OES Cluster Services, OES DNS is bound to a virtual NCP server and not to physical nodes. Because of this dependency, DSFW provisioning is not automated for OES Cluster Services.

For more information on DSfW, see the *Domain Services for Windows Administration Guide*.

17.2.2 Local DNS Server Installation

For all the supported DSFW scenarios with local DNS, an installation screen for DNS is not used. All the inputs are gathered by eDirectory installation page and is passed to DNS.

Local DNS server installation can be determined by the status of the check box in the DSfW installation page. If the box is selected, the installation for the local DNS server proceeds. YaST collates the input and then calls the dns-inst utility to install the DNS server after configuring eDirectory (ndsconfig call) but before calling ndsdcinit to install DsfW. The order of the call is:

- ndsconfig (to configure eDirectory).
- extend the DNS schema
- dns-inst (to configure the DNS server)
- ndsdcinit (to configure DSfW)

YaST displays the DNS server input page with the following changes:

- The eDirectory server IP address is grayed out and the field is populated with the local server IP address.
- The contexts are dimmed for the Locator, Group object, rootserverinfo, and NCP server object. This is similar to the Server context; that is, ou=novell. For example, In *Domain name in DC format,* if the domain being installed is widget.com, then the server context is ou=novell,dc=widget,dc=com.

- The DNS Host Name and Domain Name for DNS Server can be edited. However, populate the host name from `/etc/hosts` as the default value and the domain name from `/etc/resolv.conf` or from `/etc/hosts`.
- **DNS Proxy User:** The DNS screen displays a proxy user or DNS admin.

17.3 DSfW with Remote DNS (Child Domains)

In this scenario, DNS is not installed on the local system and remote DNS is used to serve the child domain.

- Section 17.3.1, “DSfW on a Remote DNS Server,” on page 169

17.3.1 DSfW on a Remote DNS Server

YaST determines the remote DNS server configuration only when the **Configure this server as DNS server** option is not selected by the user. In this case, YaST does not call dns-inst utility to configure the DNS server on the local machine, but it gets the details of the remote DNS server by displaying a new screen to the user. This new screen prompts for the following objects:

- Locator object (DNS-DHCP): Fully qualified DN
- DNS group object (DNSDHCP-GROUP): Fully qualified DN

While calling the utility, YaST needs to pass the following objects to `ndsdcinit`:

- Locator object FQDN
- DNS group FQDN
- Local or remote server configuration (LOCAL_DNS)

17.4 Scenarios

Table 17-1 *Local and Remote DNS scenarios*

Case	Local DNS	Remote DNS
Non-named mapped FRD	Yes	No
Non-named mapped child	Yes	Yes
Name-mapped FRD	Yes	Yes
Name-mapped child domain	Yes	Yes
Additional Domain Controller	Yes	Yes

The following items provide more information on DSfW configuration with DNS:

- FRD servers are always configured with DNS.
- For non-name mapped FRD installation, the locator, group, and rootserverinfo objects are created within the novell container under the domain context. These contexts cannot be edited.

- For named mapped FRD, the contexts for locator, group, and rootserverinfo are not populated.
  - If it is the first DNS server in the tree, then by default these objects are created under the novell container within the domain context.
  - If it is not the first DNS server in the tree, then the context pointing to the existing locator, group, and rootserver must be entered.

  Entering different context results in multiple instances of these objects, which leads to management difficulties.
- For child domains, the DNS server can be either local or one of the parent or grandparent DNS servers. For remote DNS servers, the locator and group object contexts are required as inputs.
- DNS is not installed for additional domain controllers.
- For workstations to join the domain, an Update Policy must be enabled on the zone. Allow-update and update policies are mutually exclusive, so allow-update cannot be used on these zones.

NOTE: While binding to a DSfW server, admin name and context for authentication must be in X500 format and not in the domain name format. The ports should be 1389 for non-secure or 1636 for secure. For example: cn=admin,o=adminusers,dc=acme,dc=com.

Table 17-2 *DNS Deployment Scenarios*

Deployment Scenarios	Description
Non-name Mapped FRD	The DSfW service is configured for the new tree. The DNS server is configured on the local server. Because this is a new eDirectory tree being configured for DSfW-DNS, it does not require remote DNS server configuration.
Non-name Mapped Child	The DNS server is configured locally or configured to point to the remote DNS server (parent DNS server) in the tree.
Name Mapped FRD	DSfW is configured for an existing eDirectory tree. The DNS server is either configured locally or is configured to point to the remote DNS server in the tree.
Name Mapped Child Domain	The DNS server is configured for the child domain on the local server or it is configured to point to the remote DNS server (parent DNS server) in the tree.
Additional Domain Controller	The DNS server is configured locally or is configured to point to the remote DNS server.

17.5 FAQs

How Can I Configure DSfW DNS as a Primary DNS Server for any Other Non-OES DNS Server?

OES DNS can work and co-exist with any DNS server such as Windows, Linux, and NetWare.

Does OES DNS Handle Interoperability?

OES DNS works with all DHCP servers, such as Linux, NetWare, and Windows. With the support for GSS-TSIG-based updates added for OES, SLES BIND and Novell BIND can be only implementations supporting secure updates from Microsoft DHCP servers.

Why Does DNS Load the Zone Database from the File Despite eDirectory Availability?

The zone database files are modified without updating the SOA serial number. DNS compares the SOA serial number from the file as well as eDirectory. When the serial numbers are same, DNS loads the zone from the file instead of eDirectory. If there is a difference in the serial numbers, DNS ignores the file and reads from eDirectory. This improves the DNS load time performance.

Action: If an administrator modifies the zone database files, the SOA serial number should also be modified.

Action: Remove the zone database files and load DNS. The zone database is read from eDirectory and dumped into the files.

17.6 What's Next

The next section provides methods to troubleshoot various DNS and DHCP services.

- Chapter 18, "Troubleshooting DNS and DHCP Services," on page 173

18 Troubleshooting DNS and DHCP Services

This section discusses potential issues and workarounds for OES DNS and DHCP services on OES.

- Section 18.1, “DHCP,” on page 173
- Section 18.2, “DNS,” on page 178
- Section 18.3, “Java Console,” on page 183
- Section 18.4, “What’s Next,” on page 185

18.1 DHCP

- Section 18.1.1, “OMAPI Connection to the DHCP Server Fails,” on page 173
- Section 18.1.2, “DHCP Does Not Come Up After Upgrading to OES 2018 or later if Service Proxy is Configured,” on page 174
- Section 18.1.3, “The dhcpd server Fails to Start and Reports an Unknown Key Error,” on page 174
- Section 18.1.4, “DHCP Pools Run Out of Available IP Addresses in Subnets With PXE Clients,” on page 174
- Section 18.1.5, “DHCP Server Fails to Start After Upgrade to OES 2018 or later,” on page 175
- Section 18.1.6, “DHCP Server Fails to Load and Records a “Cannot find host LDAP entry DHCP” Error in the Log File,” on page 175
- Section 18.1.7, “Installing an OES Server Inside a Container With a Separate Partition on an Existing Tree That Already has DHCP Server Installed on it Results in a Constraint Violation Error.,” on page 176
- Section 18.1.8, “The dhcpd.log file is Empty,” on page 176
- Section 18.1.9, “The DHCP Server Failed to Start,” on page 176
- Section 18.1.10, “The DHCP Server Displays “Unknown Error” on the Console,” on page 177
- Section 18.1.11, “Permission Denied to DHCP Server,” on page 177
- Section 18.1.12, “DHCP Server Displays “Cannot Create New Lease File: Permission Denied” or “/usr/sbin/dhcpd: U<89>Ã¥S<83>Ã¬^T<8b>E^LÃ¨hÃ»ÃºÃ¿<81>Ã9^[^C: Unknown error 3218701597",” on page 178
- Section 18.1.13, “segfault dhcpd - You get an error “dhcpd: Can't create new lease file: Permission denied” and “dhcpd[8249]: segfault at 0000000000000000 rip 00002abbf999db7f rsp 00007fffb18ea5e0 error 4”,” on page 178

18.1.1 OMAPI Connection to the DHCP Server Fails

Cause: The DNS/DHCP Management Console cannot authenticate with the DHCP server using OMAPI when the TSIG key name exceeds 15 characters. This length limitation causes the connection to fail.

Action: Use a TSIG key name that is 15 characters or lesser to establish a successful OMAPI connection.

18.1.2 DHCP Does Not Come Up After Upgrading to OES 2018 or later if Service Proxy is Configured

Cause: DHCP service configured with service proxy fails to come up after upgrading to OES 2018 or later. This is because the service proxy users are not migrated to OES Credential Store (OCS).

Action: To resolve this issue, perform the following:

1. Login as root user.
2. Run `yast2 novell-dhcp` and then enter eDirectory user password.
3. Specify the LDAP user password.
4. Click **Next** and continue with DHCP configuration.
5. Start the DHCP service by using the following command:

   ```
   systemctl start dhcpd.service
   ```
6. Verify the DHCP service is up and running by using the following command:

   ```
   systemctl status dhcpd.service
   ```
7. Verify the service entry is present in OES Credential Store by using the following command:

   ```
   oescredstore -l
   ```

18.1.3 The dhcpd server Fails to Start and Reports an Unknown Key Error

When you start the dhcpd process on the terminal, an error is reported that contains the following text:

```
unknown key <key_name>
```

Here key_name is the TSIG key that is defined in java console.

This error is received because the TSIG key with the same name is associated with different services. To avoid this error, you must associate a different key with each service and ensure that the keyname is also unique for each service.

For example, assume that there are two services in Java Console named "Employee" and "Students". Both these services have their own pools, subnets, and one TSIG key associated with each service. If the TSIG keyname is same across both the services, the DHCP server might fail to start. To avoid this error, ensure that the keyname is different for both these services.

18.1.4 DHCP Pools Run Out of Available IP Addresses in Subnets With PXE Clients

In a network with PXE clients, the embedded PXE client on the Network Interface Card (NIC) of a system leases an IP address from the DHCP server during the PXE client startup. After the PXE client preboot process is completed, the leased IP address is no longer required but is not released. The IP

address is released only after the lease time expires. When the operating system is loaded, the DHCP client of the operating system will also send a DHCP request with the same client hardware address, but a different client identifier.

Since the client identifier of the operating system's DHCP client and the PXE client are different, dhcpd will lease two different IP addresses to the same device. To facilitate the release of the IP address leased to the PXE client, you must reduce the default lease time for the IP addresses allocated to PXE clients during preboot.

1. Create a class. For more information, see Section 7.1.9, “Class Management,” on page 88.
2. Select the newly created class to modify it. In the **Conditional Expression** field, add the following string:

   ```
   match if substring (option vendor-class-identifier, 0, 9) =
   "PXEClient";
   default-lease-time 240;
   max-lease-time 300;
   ```

   This will set the default lease time to 4 minutes and maximum lease time to 5 minutes. You must ensure that you set the default-lease-time and max-lease-time to a small value to facilitate the release of the IP address.

18.1.5 DHCP Server Fails to Start After Upgrade to OES 2018 or later

After an upgrade to OES 2018 or later, the DHCP server may fail to start if the value of the DHCPD_INTERFACE variable gets updated to eth-id<mac address> format. The following error message is displayed in this case:

```
No subnet declaration for eth-id-<mac address>
```

To start the DHCP server, modify the value of the DHCPD_INTERFACE in the `/etc/sysconfig/dhcpd` file to an interface name such as `eth0` or `eth1`.

18.1.6 DHCP Server Fails to Load and Records a “Cannot find host LDAP entry DHCP” Error in the Log File

Cause: The DHCP Server and DHCP Service objects do not exist.

Action: Use Java Console to create the DHCP Server and DHCP Service object.

Cause: The DHCP server and DHCP Service have been created but the association between both of these objects is not set.

Action: Set the DHCP server and DHCP Service association.

18.1.7 Installing an OES Server Inside a Container With a Separate Partition on an Existing Tree That Already has DHCP Server Installed on it Results in a Constraint Violation Error.

Cause: The Locator object contains a reference to the DHCP servers installed on the eDirectory tree. Information for the newly installed DHCP Server is added to the Locator object. Because of the delay in synchronizing the replica, the Locator object does not find the newly installed DHCP server object inside its own replica.

Action: To resolve this problem, perform one of the following actions:

- Delete the replica and reinstall the DHCP server.
- While configuring the newly installed DHCP server, provide the IP address of the OES machine where eDirectory is installed.

18.1.8 The dhcpd.log file is Empty

Cause: The `dhcpd.log` file was probably deleted and the file you see now is the new file.

Action: Execute the `rcsyslog restart` command

Cause: The `syslog-ng.conf` file has been modified

Action: Check the `/etc/syslog-ng/syslog-ng.conf` file for the following lines:

```
filter f_dhcpd {facility(daemon) and match('^dhcpd:');};
destination dhcpmessages {file(var/log/dhcpd.log);};
log {source(src); filter(f_dhcpd); destination(dhcpmessages);};
```

Action: If you want to log only to the `/var/log/dhcpd.log` file, then edit `syslog-ng.conf` files

Restart the syslog daemon by using the `rcsyslog restart` command.

18.1.9 The DHCP Server Failed to Start

Cause: The DHCP server might have been blocked by the AppArmor process.

Action: Run AppArmor in complain mode to see if DHCP server has been blocked. For details on running AppArmor in complain mode, see the *Novell AppArmor Administration Guide*

Cause: No credentials are set in OES Credential Store.

Action: Verify the credentials set in OES Credential Store by using the `oescredstore -l` command in the console. If no information is displayed, then set the OES Credential Store credentials by using the following command:

```
oescredstore -s -n dhcp-ldap -u <username> -p <password>
```

For example, to set the credentials of the runtime admin *dhcpadmin*, execute the following command:

```
oescredstore -s -n dhcp-ldap -u cn=dhcpadmin,o=novell -p Password
```

Store the username and password details in the `/etc/dhcpd.conf` file.

For example,

```
ldap-username "cn=runtimeuser,o=novell";
ldap-password "novell";
```

Cause: Wrong credentials are set in OES Credential Store.

Action: Reset the OES Credential Store credentials by using the oescredstore tool.

To retrieve the password, run the following commands:

DNS: `/opt/novell/named/bin/dns_retrieve_proxy_cred PassWord <file_name>`

DHCP: `/opt/novell/dhcp/bin/dhcp_retrieve_proxy_cred PassWord <file_name>`

NOTE: The retrieved password is stored in the file that you specify.

Cause: DHCP fails to start and throws an error “No subnet declaration for ethx”. Subnet declaration for the interface to which DHCP listens is missing in the configuration.

Action: Declare the same subnet as the DHCP listening interface.

Example 18-1 *Example:*

If DHCP is listening on the eth0 interface 192.168.1.1, then declare a subnet for 192.168.1.0.

NOTE: If you decide not to manage this subnet by this DHCP server, leave the subnet declaration empty i.e, do not create any pools within this subnet.

18.1.10 The DHCP Server Displays “Unknown Error” on the Console

Cause: The details for user (`- user`) and group (`-group`) passed as command line arguments do not exist on the local machine.

Action: In the `/etc/sysconfig/dhcpd` file, set the value of `DHCPD_RUN_AS` as the local system user.

For example, `DHCPD_RUN_AS=<user>`.

The <user> parameter corresponds to the local system user. You can create a local system user using the **Security and Users> User Management** option in YaST.

18.1.11 Permission Denied to DHCP Server

Cause: The DHCP server might have been blocked by the AppArmor process.

Action: Run AppArmor in complain mode to see if DHCP server has been blocked. For details on running AppArmor in complain mode, see the *Novell AppArmor Administration Guide*

18.1.12 DHCP Server Displays “Cannot Create New Lease File: Permission Denied” or “/usr/sbin/dhcpd: U<89>Ã¥S<83>Ã¬^T<8b>E^LÃ¨hÃ»ÃºÃ¿<81>Ã9^[^C: Unknown error 3218701597"

Cause: Permission to `/var/run/novell-lum/.nam_nss_sock` is not granted to DHCP or nscd in the Apparmor profile.

Action: Edit the Apparmor profile of the DHCP server and include `/var/run/novell-lum/.nam_nss_sock` with read and write permissions.

18.1.13 segfault dhcpd - You get an error “dhcpd: Can't create new lease file: Permission denied” and “dhcpd[8249]: segfault at 0000000000000000 rip 00002abbf999db7f rsp 00007fffb18ea5e0 error 4”

Cause: The db directory might not be owned by the user that is used in `/etc/sysconfig/dhcpd` in the parameter `DHCPD_RUN_AS="dhcpd"`.

Action: Verify that there is a dhcpd user. For details on resolution see *TID 7001158*

18.2 DNS

- Section 18.2.1, “DNS Does Not Come Up After Upgrading to OES 2018 or later if Service Proxy is Configured,” on page 179
- Section 18.2.2, “Loading of Zone Data and Configuration Files to the Configured Volume Might Fail in Cluster Environment,” on page 179
- Section 18.2.3, “novell-named is Unable to Access eDirectoy,” on page 180
- Section 18.2.4, “DNS Loads Zone Database from the File Despite eDirectory Availability,” on page 180
- Section 18.2.5, “Failed to Configure DNS Server,” on page 180
- Section 18.2.6, “Insufficient Permissions for LDAP Admin User,” on page 180
- Section 18.2.7, “Failed to create the DNS Server Object for the Virtual NCP Server,” on page 180
- Section 18.2.8, “novell-named Failed to Start,” on page 181
- Section 18.2.9, “rcnovell-named and rcnamed interfere in Their Individual status/stop Query Functionality,” on page 181
- Section 18.2.10, “The DNS Server Failed to Load and Provides Critical Error Messages for NWCallsInit/NWCLXInit/NWNetInit,” on page 182
- Section 18.2.11, “Error Message When You Add RootServInfo That Gives an Undefined Attribute,” on page 182
- Section 18.2.12, “Removal of DNS Schema Post Usage of Remove Schema Option of dns-maint,” on page 182

- Section 18.2.13, “Dynamic DNS (DDNS) Fails To Work After Migrating From NetWare to OES,” on page 182
- Section 18.2.14, “DNS Fails to Start with a Fatal Error,” on page 182

18.2.1 DNS Does Not Come Up After Upgrading to OES 2018 or later if Service Proxy is Configured

Cause: DNS service configured with service proxy fails to come up after upgrading to OES 2018 or later. This is because the service proxy users are not migrated to OES Credential Store (OCS).

Action: To resolve this issue, perform the following:

1. Login as root user.
2. Run `yast2 novell-dns` and then enter eDirectory user password.
3. Specify the DNS proxy user password.
4. Click **Next** and continue with DNS configuration.
5. Verify the DNS service is up and running by using the following command:

   ```
   systemctl status novell-named.service
   ```
6. Verify the service entry is present in OES Credential Store by using the following command:

   ```
   oescredstore -l
   ```

18.2.2 Loading of Zone Data and Configuration Files to the Configured Volume Might Fail in Cluster Environment

Cause: NIT is unable to fetch the updated UID of the named user. This causes failure of novell-named service start on cluster nodes.

Action:

- Verify the UID of the named user using the command `nitconfig getuserinfo fromname <named-user-context>`.

  For example, `nitconfig getuserinfo fromname .cn=named.o=dnsclustzorg.T=CLUST-TREE.`
- If the UID is not shown as 44, execute the following commands:

  `namconfig cache_refresh` to refresh the cache.

  `systemctl restart novell-nit.service` to restart NIT daemon.
- To ensure that the named UID is shown as 44, execute the command `nitconfig getuserinfo fromname <named-user-context>` again.

18.2.3 novell-named is Unable to Access eDirectoy

If novell-named is unable to access eDirectory and reports the error: `NWCallsInit failed with error code:-1`, you must verify if the rcnovell-xregd service is started by executing the following command:

`rcnovell-xregd status` or `systemctl status novell-xregd.service`

If the service is running and you still observe this error then you need to rebuild the xtier registry. For more information, refer to *TID 7008478*.

18.2.4 DNS Loads Zone Database from the File Despite eDirectory Availability

Cause: The zone database files are modified without updating the SOA serial number. DNS compares the SOA serial number from the file as well as eDirectory. When the serial numbers are same, DNS loads the zone from the file instead of eDirectory. If there is a difference in the serial numbers, it ignores the file and reads from eDirectory. This improves the DNS load time performance.

Action: If administrator modifies the zone database files, the SOA serial number also requires to be modified.

Action: Remove the zone database files and load DNS. The zone database is read from eDirectory and dumped into the files.

18.2.5 Failed to Configure DNS Server

Cause: The DNS schema is not synchronized in the eDirectory tree.

Action: If you are attaching the Linux server to an existing NetWare tree where DNS is not installed, make sure you extend the DNS schema before installing DNS on the Linux tree. If you are attaching the Linux server to an existing NetWare tree where DNS is installed, make sure the RootServerInfo object on NetWare does not have redundant create and delete permissions for the DNSDHCP-Group object at the entry level permissions.

18.2.6 Insufficient Permissions for LDAP Admin User

Cause: The LDAP user has insufficient permissions for eDirectory objects.

Action: Ensure that adequate permissions are assigned to the user as per Section 6.1.2, “eDirectory Permissions,” on page 73

18.2.7 Failed to create the DNS Server Object for the Virtual NCP Server

Cause: Preferred nodes are not set to the Virtual NCP server

Action: Set the association between the preferred node and the Virtual NCP server.

If DNS Server fails to load with the following log:

- **Critical:** Unable to read Locator reference from NCP server

- **Error:** Error occurred when getting the Virtual NCP server IP address

Cause: DNS Server is unable to retrieve the Locator reference from NCP Server.

Action: Add DNS-DHCPGroup or Proxy user as trustee of the NCP Server with the following rights:

All Attribute rights - Compare, Read

Entry Rights - Browse

18.2.8 novell-named Failed to Start

Cause: The daemons required for `novell-named` to start have not been loaded.

Action: Make sure you have loaded all the dependent daemons. For a list of dependent daemons, see Section 13.7, “Starting the DNS Server,” on page 148

Cause: No credentials are set in OES Credential Store.

Action: Verify the credentials set in OES Credential Store by using the `oescredstore -l` command in the console. If no information is displayed, set the OES Credential Store credentials by using the following command:

```
oescredstore -s -n dns-ldap -u <username> -p <password>
```

For example, to set the credentials of the runtime admin *dnsadmin*, execute the following command:

```
oescredstore -s -n dns-ldap -u cn=dnsadmin,o=novell -p Password
```

To reset the OES Credential Store credential for DNS, use dns-maint, dns-inst, or YaST2 to reset the existing user password. However, for an existing DNS runtime user in eDirectory, you must have the correct password before trying to reset. For a new DNS runtime user and update to the OES Credential Store, use dns-maint, dns-inst, or YaST2.

Cause: On the Cluster setup, the `/etc/rndc.key` file is not same on all the cluster nodes.

Action: Ensure that the `/etc/rndc.key` file is same by copying it across all the nodes on the cluster setup.

Cause: You are loading `novell-named` with the chroot (`-t`) option.

Action: Include the `sys_chroot` capability in the DNS AppArmor profile.Restart AppArmour using `rcapparmor reload` command.

Cause: `novell-named` might have been blocked by the AppArmor process.

Action: Run AppArmor in complain mode to see if `novell-named` has been blocked. For details on running AppArmor in complain mode, see the *Novell AppArmor Administration Guide*

18.2.9 rcnovell-named and rcnamed interfere in Their Individual status/ stop Query Functionality

Cause: novell-named and BIND DNS (named) both leverage rndcbin to perform the start, stop, and status queries. rndc, a popular Linux command line tool, remotely manages DNS. novell-bind continued to support the same feature. For the query operations (start/stop/status), rndcbin sends a

command to standard DNS control port and waits for the response. However, it does not check which DNS server is listening on this port. If both the servers are loaded in your system (which is highly unlikely), the server that starts first gets the control port access and listens to it. The status is shown for the server that is loaded and that acquired control over the port. This is because bind-based rndc does not expect two DNS servers running in the system.This behavior is an rndc restriction and is the way DNS servers dictate the control port.

Action: Running two DNS servers on same system is highly unlikely. Leveraging rndcbin for query functionality either for named or novell-named doesn't cause an issue, provided you explicitly ensure that only one DNS server is running on the system. This ensures that the rndcbin queries correctly identify the DNS server on the system.

18.2.10 The DNS Server Failed to Load and Provides Critical Error Messages for NWCallsInit/NWCLXInit/NWNetInit

Cause: novell-xregd is not running.

Action: Load novell-xregd if it is not running. Then load novell-named again.

18.2.11 Error Message When You Add RootServInfo That Gives an Undefined Attribute

Error: `[bash] ShellCommand.cc(shellcommand):78. Adding DNS RootServerInfo object failed error_code:17:error_message: Undefined attribute type`

Cause: This is a schema synchronization issue.

Action: Ensure that the schema is extended properly, wait for the schema synchronization to occur, then try it again.

18.2.12 Removal of DNS Schema Post Usage of Remove Schema Option of dns-maint

Action: See Troubleshooting Schema in the NetIQ eDirectory Administration Guide.

18.2.13 Dynamic DNS (DDNS) Fails To Work After Migrating From NetWare to OES

Action: See TID 7003923 for more information.

18.2.14 DNS Fails to Start with a Fatal Error

Cause: After installing and configuring the DNS server, starting the server fails. It exits with a fatal error. This occurs as eDirectory does not respond on NCP port 524.

Action: Open the `/etc/hosts` file and remove the loopback interface entries. Remove all entries such as 127.0.0.2, 12.0.0.3, and so on, except 127.0.0.1.

18.3 Java Console

- Section 18.3.1, “DNS DHCP Java Console Might not Launch When Default Java of the System is Set to OpenJDK 17.x.,” on page 183
- Section 18.3.2, “Java Console on SLED 11 SP3 Does not Display Chinese Characters Properly,” on page 183
- Section 18.3.3, “Unable to select Resource Record type as **Key** **While Adding Update Policy Option,” on page 183**
- Section 18.3.4, “adhoc Option for ddns-update-style not Supported in DHCP Server for OES 11 SP1 and Later,” on page 184
- Section 18.3.5, “Java Console Login Fails Even With Correct Credentials,” on page 184
- Section 18.3.6, “Configuration Files That Were Exported Using Old Java Console Throws an Error When Imported into the New Java Console,” on page 185

18.3.1 DNS DHCP Java Console Might not Launch When Default Java of the System is Set to OpenJDK 17.x.

To resolve this issue, do the following:

1. Check the existing default Java version using the following command:

   ```
   update-alternatives --config java
   ```

2. If the default Java version is OpenJDK 17.x, change it to OpenJDK 18.0.

18.3.2 Java Console on SLED 11 SP3 Does not Display Chinese Characters Properly

Records created using Chinese characters are not displayed correctly. Java Console on SLED 11 SP3 displays garbage characters instead of Chinese. To resolve this, select **YaST>System>Language** and then select the **Traditional Chinese** option.

18.3.3 Unable to select Resource Record type as Key While Adding Update Policy Option

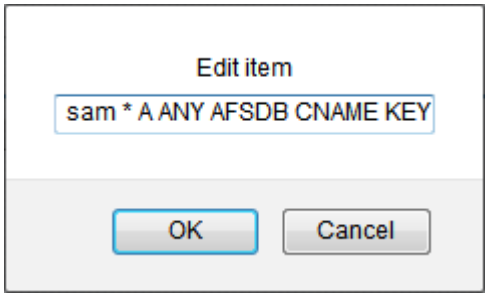
Using Java Console you cannot create a **Key** resource record. Therefore, while adding an Update Policy for a zone, the resource record list will not display the **key** resource record.

To create an update policy for a zone containing 'key' resource record, do the following:

1. Log in to iManager.
2. Click **View objects**.
3. In the tree tab, browse to the container in which the zone is present.
4. Click on the container and then select the checkbox next to the DNS zone.
5. Click Edit.
6. Select the dnipUpdatePolicy Attribute from the Valued Attributes list and click **Edit**.

7 Click Edit item.

8 In the Edit Item field, add the Key resource record type.



9 Click OK.

18.3.4 adhoc Option for ddns-update-style not Supported in DHCP Server for OES 11 SP1 and Later

Cause: The latest version of SLES DHCP (4.2.3-P2) does not support **adhoc** as a ddns-update-style. Therefore, this option has been deprecated in Java Console for OES 11 SP1 and later.

18.3.5 Java Console Login Fails Even With Correct Credentials

Error: Login failed. Please specify the correct inputs.

Cause: Invalid username or password.

Action: Enter the correct username with context and password.

Cause: Certificate stored on local system is invalid.

or

Cause: Java Console on local system is reinstalled or the server is reinstalled or upgraded.

Action: Remove `jssecacerts-<user>` file from user home directory and restart Java Console.

On Linux the file is located at `~/.novell/DNSDHCP` where `.novell` is a hidden folder.

On Windows XP the file is located at `C:\Documents and Settings\<user name>\Novell\DNSDHCP\` where `Novell` is a hidden folder.

On Windows Vista the file is located at `C:\Users\<user name>\Novell\DNSDHCP\` where `Novell` is a hidden folder.

or

Cause: DNS server might be down and throws an error “Login failed. Please specify correct inputs.”

Action: Enter the correct username and password or restart Java Console.

18.3.6 Configuration Files That Were Exported Using Old Java Console Throws an Error When Imported into the New Java Console

Error: Unable to Import.

Cause: DHCP configuration file was exported using Java Console installed from an earlier version of OES or NetWare system. Importing this file using OES 11 SP2 or later Java Console is not supported.

Action: Import and Export of DHCP configuration file should be performed using same version of Java Console.

18.4 What's Next

The next section provides information on the various issues and limitations that are specific to the DNS service on OES.

- Chapter 19, "Linux Notes," on page 187

19 Linux Notes

This section describes the various issues and limitations that are specific to the DNS service on OES.

- Section 19.1, “DNS Notes,” on page 187
- Section 19.2, “What’s Next,” on page 187

19.1 DNS Notes

- If you are attaching the target server to an existing tree where a DNS server is not installed, you need to extend the DNS schema on the eDirectory tree before installing DNS on Linux.

19.2 What’s Next

The next sections provide details on the following:

- Section A.1, “Supported RFCs,” on page 189
- Section A.2, “Types of Resource Records,” on page 190
- Section A.3, “DHCP Option Descriptions,” on page 192
- Section A.4, “DNS Root Servers,” on page 199
- Section A.5, “DNS Server Configuration Utility,” on page 200
- Section A.6, “DNS Server Maintenance Utility,” on page 202
- Section A.7, “DHCP Server Maintenance Utility,” on page 207

A Appendix

This section provides the following information:

- Section A.1, “Supported RFCs,” on page 189
- Section A.2, “Types of Resource Records,” on page 190
- Section A.3, “DHCP Option Descriptions,” on page 192
- Section A.4, “DNS Root Servers,” on page 199
- Section A.5, “DNS Server Configuration Utility,” on page 200
- Section A.6, “DNS Server Maintenance Utility,” on page 202
- Section A.7, “DHCP Server Maintenance Utility,” on page 207
- Section A.8, “Post-Install Maintenance Tools,” on page 211

A.1 Supported RFCs

DNS/DHCP services supports the following RFCs:

- RFC 819—Domain Naming Convention for Internet User Applications
- RFC 920—Domain Requirements
- RFC 974—Mail Routing and Domain System
- RFC 1032—Domain Administrator’s Guide
- RFC 1033—Domain Administrator’s Operations Guide
- RFC 1034—Domain Names - Concepts and Facilities
- RFC 1035—Domain Names - Implementation and Specification
- RFC 1036—Standard Interchange of USENET Messages
- RFC 1101—DNS Encoding of Network Names and other Types
- RFC 1122—Requirements for Internet Hosts - Communications Layers
- RFC 1123—Requirements for Internet Hosts - Application and Support
- RFC 1183—New DNS RR Definitions
- RFC 1535—A Security Problem and Proposed Correction with Widely Deployed DNS Software
- RFC 1536—Common DNS Implementation Errors and Suggested Fixes
- RFC 1537—Common DNS Data File Configuration Errors
- RFC 1591—Domain Name System Structure and Delegation
- RFC 1597—Address Allocation for Private Internets
- RFC 1627—Network 10 Considered Harmful (Some Practices Shouldn’t Be Codified)
- RFC 1884—IP Version 6 Addressing Architecture
- RFC 1876—Location Information in the DNS

- RFC 1886—DNS Extensions to Support IP Version 6
- RFC 1912—Common DNS Operations and Configurations Errors
- RFC 1995—Incremental Zone Transfer in DNS
- RFC 1996—A mechanism for Prompt Notification of Zone Changes (DNS NOTIFY)
- RFC 2010—Operations Criteria for Root Name servers
- RFC 2136—Dynamic Updates in the DNS
- RFC 2137—Secure Domain Name System (DNS) Dynamic Update
- RFC 2163—Using the Internet DNS to distribute MIXER Conformant Global Address Mapping (MCGAM)
- RFC 2308—Negative Caching of DNS Queries (DNS NCACHE)
- RFC 2317—Classless IN-ADDR.ARPA delegation
- RFC 2672—Non-Terminal DNS Name Redirection
- RFC 2782—A DNS RR for specifying the location of services (DNS SRV)
- RFC 2874—DNS Extensions to Support IPv6 Address Aggregation and Renumbering

A.2 Types of Resource Records

A resource record (RR) contains data associated with domain names. This data is represented by and is subordinate to the resource record set (RRset) of a zone container.

The following types of resource records can be created:

- **A6:** Maps a domain name to an IPv6 address.

  Specify the following for this option:

  - Prefix Length: This can be any value between 0 and 128.
  - Address Suffix: The address suffix need not be specified if the prefix length is 128.
  - Prefix Name: The domain name of the server. This need not be specified if the prefix length is 0.
- **A:** Maps a domain name to an IP address.

  You must specify the 32-bit IPv4 address that maps to the associated domain for this option.
- **AAAA:** A 128-bit IPv6 address that is encoded in the data portion of the resource record in the network byte order.
- **AFSDB:** The AFS system uses DNS to map from a domain name to the name of an AFS cell database server. It contains the following data:
  - Subtype: A 16-bit integer.
  - Hostname: The domain name of the host server.
- **CNAME:** Specifies the canonical or primary name for the owner. Because the owner name is an alias, you must specify the domain name of the aliased host if you select this option.
- **DNAME:** Specifies an alternate name to map the entire subtree of the domain namespace.

  You must specify the target domain name for this option.

- **HINFO:** Specifies host information in the form of the following parameters:
  - CPU: A character string that specifies the CPU type.
  - OS: A character string that specifies the operating system type.
- **ISDN:** An ISDN (Integrated Service Digital Network) number is a telephone number integrating the telephone and data network service to a common service. It contains the following parameters:
  - ISDN Address: A character string specifying the ISDN address.
  - Sub Address: A character string specifying the subaddress. This parameter is optional.
- **LOC:** Specifies the location information in the globe. If you select this option, you must specify the following:
  - Latitude: Specify the degree of the latitude, minutes, and seconds of the globe enclosing the specified host. Select the direction.
  - Longitude: Specify the degree of the latitude, minutes, and seconds of the globe enclosing the specified host. Select the direction.
  - Altitude: Specify the altitude of the globe enclosing the specified host in meters.
  - Size: Specify the diameter of the globe enclosing the specified host in meters.
  - Horizontal precision: Specify the horizontal precision of the globe enclosing the specified host in meters.
  - Vertical precision: Specify the vertical precision of the globe enclosing the specified host in meters.
- **MB:** Specifies the domain name of the mailbox address.
- **MG:** A domain name that specifies a mailbox that is a member of the mail group specified by the domain name.
- **MINFO:** Specifies mailbox or mail list information in the form of the following parameters:
  - Responsible MailBox: A domain name that specifies the mailbox that is responsible for the mailing list or mailbox.
  - Error Message MailBox: A domain name that specifies the mailbox that is to receive error messages related to the mailing list or mailbox.
- **MR:** A domain name that specifies the mailbox that is the proper rename of the specified mailbox.
- **MX:** Specifies a mail exchange resource record in the form of the following parameters:
  - Preference: A 16-bit integer that specifies the preference given to this resource record among others at the same owner.
  - Exchange: A domain name that specifies a host willing to act as a mail exchange for the owner name.
- **NS:** Specifies a domain name for an authoritative name server for the specified class and domain.
- **PTR:** A domain name that points to some location in the domain namespace.
- **PX:** Contains X.400 mail mapping information with the following parameters:
  - Preference: A 16-bit integer that specifies the preference given to this resource record among others at the same owner.

- MAP822: A domain name element containing the RFC822 part of the MCGAM.
- MAPX400: A domain name element containing the value derived from the X.400 part of the MCGAM.

- **RP:** Provides a standard method of associating responsible person identification with any name in the DNS with the following parameters:
  - Responsible Person's Mailbox: A domain name that specifies the mailbox for the responsible person.
  - TXT-RR Domain Name: A domain name for the TXT RRs that exist.
- **RT:** Specifies the routing information with the following parameters:
  - Preference: A 16-bit integer representing the preference of the route.
  - Intermediate: The domain name of a host that serves as an intermediate in reaching the host specified by the owner.
- **SRV:** Specifies the location of services with the following parameters:
  - Service: The symbolic name of the desired service.
  - Proto: The TCP and UDP are the most useful values for this field.
  - Priority: The priority of the target host.
  - Weight: A load balancing mechanism when selecting a target host among those that have the same priority.
  - Port: The port on the target host running the service.
  - Target: The domain name of the target host.
- **TXT:** Specifies text data in the form of a character string.
- **WKS:** Describes the well-known services supported by a protocol on a particular host with the following parameters:
  - Address: A 32-bit Internet address.
  - Protocol: An 8-bit IP protocol number.
  - Available Services: A variable-length bitmap.
- **X25:** Specifies a PSDN (Public Switched Data Network) address.

A.3 DHCP Option Descriptions

The following table describes the DHCP option codes and names:

Table A-1 *DHCP Option Codes and Names*

Code	Option Name	Description
1	Subnet Mask	The subnet mask option specifies the client's subnet mask as per RFC 950. If no subnet mask option is provided, the DHCP server uses the subnet mask from the subnet declaration for the network on which an address is being assigned.

Code	Option Name	Description
2	Time Offset	Specifies the offset time of client's subnet in seconds. This is expressed as a two's complement 32-bit integer preference value. Two types of offset can be set: positive and negative. A positive offset indicates a location to the east of the zero meridian and a negative offset indicates a location to the west of the zero meridian.
3	Router	Specifies the routers on the client's subnet as a list of IP addresses. The routers should be listed in the order of preference.
4	Time Server	Specifies a list of RFC time servers available to the client. The servers should be listed in the order of preference
5	Name Server	Specifies a list of IEN 116 [7] name servers available to the client. The name servers should be listed in the order of preference.
6	Domain Name Server	Specifies a list of DNS name servers available to the client. The DNS servers should be listed in the order of preference.
7	Log Server	Specifies a list of MIT-LCS UDP log servers available to the client. The log servers should be listed in the order of preference.
8	Cookie Server	Specifies a list of RFC 865 cookie servers available to the client. The cookie servers should be listed in the order of preference.
9	LPR Server	Specifies a list of RFC 1179 line printer servers available to the client. The LPR servers should be listed in the order of preference.
10	Impress Server	Specifies a list of Imagen Impress servers available to the client. The impress servers should be listed in the order of preference.
11	Resource Location Server	Specifies a list of RFC 887 resource location servers available to the client. The resource location servers should be listed in the order of preference.
12	Host Name	The Host object represents a client in the network with a statically assigned IP address and is identified by a host name.
13	Boot File Size	Specifies the length of the boot image for the client, in 512-octet blocks. The length is specified as an unsigned 16-bit integer.
14	Merit Dump File	Specifies the location of a file where the core image of the client should be dumped if the client crashes.
16	Swap Server	Specifies the IP address of the swap server for the client.
17	Root Path	Specifies the path name for the client's root disk.
18	Extension Paths	

Code	Option Name	Description
19	IP Forwarding Enable/Disable	Specifies whether the client should forward an IP address. Values can be either True or False. True indicates that IP forwarding should be enabled and False indicates that IP forwarding should be disabled.
20	Non-Local Source Routing	Specifies whether the client should forward datagrams with non-local source routing. Values can be either True or False. True indicates to enable datagram forwarding and False indicates to disable datagram forwarding.
21	Policy Filter	Specifies the policy filters for non-local source routing. The policy filters consist of a list of IP addresses and masks that filter the incoming source routes.
22	Maximum Datagram Re-assembly size	Specifies the maximum size of the datagram that the client should reassemble.
23	Default IP Time-to-live	Specifies the time-to-live used by the client on outgoing datagrams.
24	Path MTU Aging Time-out	Specifies the time-out (in seconds) used when the aging path MTU values are discovered by the mechanism defined in RFC 1191.
25	Path MTU Plateau Table	Specifies a table of MTU sizes used when performing path MTU discovery as defined in RFC 1191.
26	Interface MTU	Specifies the MTU used on this interface. The minimum value for the MTU is 68.
27	All subnets are local	Specifies whether the client can assume that all subnets of IP network connected to the client use the same MTU as the subnet of the network to which the client is directly connected. Values can be either True or False. True indicates that all subnets share the same MTU. False indicates that some subnets of the network that is directly connected have smaller MTU values.
28	Broadcast Address	Specifies the broadcast address being used on the client's subnet.
29	Perform Mask Discovery	Specifies whether the client should perform subnet mask discovery by using ICMP. Values can be either True or False. True indicates that the client should perform subnet mask discovery. False indicates that the client should not perform subnet mask discovery.
30	Mask Supplier	Specifies whether the client should respond to subnet mask requests by using ICMP. Values can be either True or False. True indicates that the client should respond and False indicates that the client should not respond.

Code	Option Name	Description
31	Perform Router Discovery	Specifies whether the client should solicit routers by using the Router Discovery mechanism as defined in RFC 1256. Values can be either True or False. True indicates that the client should perform router discovery and False indicates that the client should not perform router discovery.
32	Router Solicitation Address	Specifies the IP address to which the client can send router solicitation requests.
33	Static Route	Specifies a list of static routes that the client can install in its routing cache. Multiple routes to the same destination are listed in descending order. Static routes consists of a list of IP address in pairs. The first address in the pair is the destination address and the second is the router for the destination.
34	Trailer Encapsulation	Specifies whether the client can negotiate encapsulating trailers when using the ARP protocol. Values can be either True or False. True indicates that the client should use trailers and False indicates that the client should not use trailers.
35	ARP Cache Time-out	Specifies the time-out (in seconds) for ARP cache entries.
36	Ethernet Encapsulation	Specifies whether the client can use Ethernet version 2.0 (RFC 894) or IEE 802.3 (RFC 1042) encapsulation if it is an Ethernet interface. Values can be either True or False. True indicates that the client should use RFC 1042 encapsulation and False indicates that the client should use RFC 894 encapsulation.
37	TCP Default TTL	Specifies the default TTL that the client should use when sending TCP segments.
38	TCP Keep-alive interval	Specifies the interval (in seconds) that the TCP client should wait before sending a keep-alive message on a TCP connection.
39	TCP Keep-alive garbage	Specifies whether the client should send TCP keep-alive messages with a garbage octet for compatibility with older implementations. Values can be either True or False. True indicates that a garbage octet should be sent and False indicates that a garbage octet should not be sent.
40	NIS Domain	Specifies the NIS domain name of the client.
41	NIS Servers	Specifies a list of the NIS server's IP addresses available to the client. The NIS servers should be listed in the order of preference.
42	Network Time Protocol Servers	Specifies a list of IP addresses indicating Network Time Protocol Servers (NTP servers) available to the client. The NTP servers should be listed in the order of preference.
43	Vendor Specific Option	Specifies the vendor-specific information that can be used by the clients and servers.
44	NetBIOS over TCP/IP options-name server	Specifies a list of RFC 1001 and RFC 1002 NetBIOS over TCP/IP name servers listed in order of preference.

Code	Option Name	Description
45	NetBIOS over TCP/IP options-datagram distribution server	Specifies a list of RFC 1001 and RFC 1002 NetBIOS over Datagram Distribution servers listed in order of preference.
46	NetBIOS over TCP/IP options-node type	Allows NetBIOS over TCP/IP clients that can be configured as described in RFC 1001 and RFC 1002. Node types include B-node, P-node, M-node, and H-node.
47	NetBIOS over TCP/IP options-Scope	Specifies the NetBIOS over TCP/IP scope parameter for the client as specified in RFC 1001 and RFC 1002.
48	X Window System Font Server	Specifies a list of X Window System Font servers available to the client. These servers should be listed in order of preference.
49	X Window System Display Manager	Specifies a list of IP addresses of systems that use the X Window System Display Manager and are available to the client. The IP addresses should be listed in order of preference.
58	Renewal (T1) Time	Specifies the time interval from the address assignment until the client reaches the renewing state.
59	Renewal (T2) Time	Specifies the time interval from the address assignment until the client reaches the rebinding state.
60	Vendor Class Identifier	Specifies the vendor type and configuration of a DHCP client.
62	NWIP Domain Name	Enables the server to convey the NetWare/IP domain name used by the NetWare/IP product.
63-05	Perform NSQ Broadcast	Specifies whether the client should perform a NetWare Nearest Server Query (NSQ) to find out its nearest NetWare/IP server. Values can be either True or False. True indicates that the client should perform a NetWare NSQ and False indicates that the client should not perform a NetWare NSQ.
63-06	Preferred DSS	Specifies a list of addresses for a NetWare Domain SAP/RIP Server (DSS).
63-07	Nearest NWIP Server(s)	Specifies a list of addresses for the Nearest NetWare/IP (NWIP) servers.
63-08	Number of Auto Retries	Specifies the number of times a NetWare/IP client can attempt to communicate with a DSS server at startup.
63-09	Auto Retry Interval	Specifies the delay interval (in seconds) that each NetWare/IP client uses when attempting to communicate with a DSS server at startup.
63-10	Support NWIP 1.1	Specifies whether the NetWare/IP client should support NetWare/IP version 1.1. This is required only if it contacts a NetWare/IP version 1.1 server. Values can either be True or False. True indicates that the client should support NetWare/IP version 1.1 and False indicates that the client should not support NetWare/IP version 1.1.

Code	Option Name	Description
63-11	Primary DDS	Specifies the Primary Domain SAP/RIP Service server (DSS) for the NetWare/IP domain. The NetWare/IP administration utility uses this as the Primary DSS server when configuring a secondary DSS server.
64	NIS+ Domain	Specifies the name of the client's NIS+ domain.
65	NIS Servers	Specifies a list of IP addresses indicating Network Information Service (NIS)+ servers available to the client. The NIS+ servers should be listed in order of preference.
66	TFTP Server Name	Specifies the name of the TFTP server for the client.
67	Boot File Name	Specifies the name of the boot file for the client.
68	Mobile IP Home Agent	Specifies a list of IP addresses that indicates the mobile IP home agents available to the client. These agents should be listed in order of preference.
69	SMTP Server	Specifies a list of Simple Mail Transport Protocol (SMTP) servers available to the client. The SMTP servers should be listed in order of preference.
70	POP3 Server	Specifies a list of POP3 servers available to the client. The POP3 servers should be listed in order of preference.
71	NNTP Server	Specifies a list of Network News Transport Protocol (NNTP) servers available to the client. The NNTP servers should be listed in order of preference.
72	WWW Server	Specifies a list of World Wide Web (WWW) servers available to the client. The WWW servers should be listed in order of preference.
73	Default Finger Server	Specifies a list of Finger servers available to the client. The Finger servers should be listed in order of preference
74	Default IRC Server	Specifies a list of Internet Relay Chat (IRC) servers available to the client. The IRC servers should be listed in order of preference.
75	Street Talk Server	Specifies a list of StreetTalk servers available to the client. The StreetTalk servers should be listed in order of preference.
76	Street Talk Directory Assistance server	Specifies a list of StreetTalk Directory Assistance (STDA) servers available to the client. The STDA servers should be listed in order of preference.
78	SLP Directory Agent	Specifies a list of IP addresses for Directory Agents. The Directory Agents should be listed in order of preference.
79	SLP Service Scope	Specifies the scope that an agent is configured to use.
82-01	Agent Circuit ID	This sub-option can be added by DHCP relay agents that terminate switched or permanent circuits. It encodes an agent-local identifier of the circuit from which a DHCP client-to-server packet was received. It is intended for use by agents in relaying DHCP responses to the proper circuit.

Code	Option Name	Description
82-02	Agent Remote ID	This sub-option can be added by DHCP relay agents that terminate switched or permanent circuits and have mechanisms to identify the remote host end of the circuit.
82-04	Agent DOCSIS Device Class	Specifies the Device Class encoding within the payload of the Device Class Identification Request (DCI-REQ) message. The relay agent must pass the Device Class value unchanged to the DHCP server.
85	NDS Servers	Specifies one or more NDS servers for the client to contact to access the NDS database. The NDS servers should be listed in order of preference.
86	NDS Tree Name	Specifies the name of the NDS tree that the client contacts.
87	NDS Context	Specifies the initial NDS context that the client should use.

A.3.1 Assigning Options

DHCP and BOOTP options can be assigned at these levels:

- DHCP Service
- Shared Network
- Subnet
- Pool
- Host
- Class

The DHCP server's options inheritance rules specify that options assigned at the lowest level override options set at a higher level. For example, options have been assigned at these levels for the client on the subnet, as shown in the following table.

Table A-2 *Options at Different Levels for the Client on the Subnet*

Level	Option	Value
Service	1, Subnet Mask	255.255.0.0
	3, Router	132.57.3.8
	4, Time Server	129.23.120.5
Subnet	1, Subnet Mask	255.254.0.0
	5, Name Server	10.73.57.251
	7, Log Server	10.73.58.2
	13, Boot File Size	1024
Host	7, Log Server	Null

Level	Option	Value
	13, Boot File Size	256

The following table lists the effective options for the client with the IP address referred to in the preceding table.

Table A-3 *Options for the Client with IP Address*

Option	Value
1, Subnet Mask	255.254.0.0
3, Router	132.57.3.8
4, Time Server	129.23.120.5
5, Name Server	10.73.57.251
7, Log Server	Null
13, Boot File Size	256

A.4 DNS Root Servers

The `/etc/opt/novell/named/root.hint` file contains information about DNS root servers. When the DNS services are installed, the RootSrvrInfo Zone object is created by reading the contents from this file. The RootSrvrInfo zone holds information on the root name servers needed to initialize the cache of Internet domain name servers. The **rootsrvr.dat** file is the OpenText version of **named.root**, which is made available by InterNIC registration services.

```
under anonymous FTP as
file                /domain/named.root
on server           FTP.RS.INTERNIC.NET
-OR-
under Gopher at     RS.INTERNIC.NET
under menu          InterNIC Registration Services (NSI)
submenu             InterNIC Registration Archives
file                named.root
```

The related version number of Root Zone is 2004012900 and was last updated on Jan 29, 2004.

The data for the root servers is as follows:

SOA and NS RRs

```
$ORIGIN RootServerInfo.
@         SOA server. root. (
2004012900 3600 3600 604800 86400 )
.                       3600000     NS    A.ROOT-SERVERS.NET.
.                       3600000     NS    B.ROOT-SERVERS.NET.
.                       3600000     NS    C.ROOT-SERVERS.NET.
.                       3600000     NS    D.ROOT-SERVERS.NET.
.                       3600000     NS    E.ROOT-SERVERS.NET.
.                       3600000     NS    F.ROOT-SERVERS.NET.
.                       3600000     NS    G.ROOT-SERVERS.NET.
.                       3600000     NS    H.ROOT-SERVERS.NET.
.                       3600000     NS    I.ROOT-SERVERS.NET.
.                       3600000     NS    J.ROOT-SERVERS.NET.
.                       3600000     NS    K.ROOT-SERVERS.NET.
.                       3600000     NS    L.ROOT-SERVERS.NET.
.                       3600000     NS    M.ROOT-SERVERS.NET.
```

Glue RRs

```
A.ROOT-SERVERS.NET.      3600000      A     198.41.0.4
B.ROOT-SERVERS.NET.      3600000      A     192.228.79.201
C.ROOT-SERVERS.NET.      3600000      A     192.33.4.12
D.ROOT-SERVERS.NET.      3600000      A     128.8.10.90
E.ROOT-SERVERS.NET.      3600000      A     192.203.230.10
F.ROOT-SERVERS.NET.      3600000      A     192.5.5.241
G.ROOT-SERVERS.NET.      3600000      A     192.112.36.4
H.ROOT-SERVERS.NET.      3600000      A     128.63.2.53
I.ROOT-SERVERS.NET.      3600000      A     192.36.148.17
J.ROOT-SERVERS.NET.      3600000      A     192.58.128.30
K.ROOT-SERVERS.NET.      3600000      A     193.0.14.129
L.ROOT-SERVERS.NET.      3600000      A     199.7.83.42
M.ROOT-SERVERS.NET.      3600000      A     202.12.27.33
```

NOTE: Please check the Root Server IP addresses to see that they include the latest IP addresses for all the root zones; otherwise, update the `root.hint` file with the latest update from the InterNIC site (http://www.internic.net/zones/named.root) and run the `/opt/novell/named/bin/dns-inst` tool to update the root server addresses after deleting the existing root zones from eDirectory

---

A.5 DNS Server Configuration Utility

- "dns-inst" on page 201

dns-inst

The DNS server configuration utility.

Description

dns-inst is the utility to create the DNS server object in the eDirectory tree associated with the NCP server.

Currently, the OES DNS server configuration utility uses `/opt/novell/named/schema/DNIP.SCH` to extend the DNS schema in the eDirectory tree.

NOTE: In a cluster setup, you cannot create the DNS server object on all the nodes because it needs to refer to the virtual NCP server. The Create Server option cannot be used in cluster setup, it can be used in normal scenarios. Cluster setup requires manual DNS Server object creation.

Syntax

Configuration Option

```
dns-inst <LDAP host name or IP> <LDAP port number> <Admin DN> <password>
<eDirectory user DN for DNS> <password> <Credential storage (0->file, 1-
>CASA)> <DNS Locator object container name> <DNS group object container
name> <RootServerInfo container name> <Local NCP server context> <Create
DNS server object (1->create)*> <Host Name*> <Domain Name for DNS Server*>
<Secure LDAP or Not (0 -> non-SSL, 1->SSL)>
```

* parameters are optional.

Example

```
dns-inst Acme.com 389 cn=admin,o=Acme secret cn=dns-admin,o=dns-domain
secret 1 ou=Sales,o=Acme ou=Finance,o=Acme o=acme o=acme 1 acme-host
acme.americas.com 0
```

Other Parameters for Server Object Creation

The following parameters are optional. If you do not want to create DNS server object, then do not consider these parameters.

- **Create DNS server object:** The value is 1 for object creation.
- **Host Name:** Specify a unique hostname for the DNS Server object, such as acme-host.
- **Domain Name for DNS Server:** Specify a domain name for the Server object, such as acme.americas.com.

Definitions

- **LDAP host name:** The IP address of the default LDAP server for the service.

- **LDAP port number:** The secure or non-secure LDAP port to connect to the LDAP server.
- **Admin DN:** The LDAP administrator distinguished name to authenticate against the LDAP host.
- **password:** The password for the LDAP Admin.
- **eDirectory user DN for DNS:** The user authenticates to eDirectory to access information for DNS during runtime. The user must have eDirectory read, write, and browse rights under the specified context.
- **Credential Storage:** Specifies the proxy user's credentials location. It is recommended to use OES Credential Store.
- **DNS Locator object container name:** The context/container for the DNS Locator object. For example: o=novell. The DNS Locator object contains global defaults, DHCP options, and a list of all DNS and DHCP servers, subnets, and zones in the tree.
- **DNS group object container name:** The context for the DNS Group object. For example: o=novell. This object is used to grant DNS servers the necessary rights to other data within the eDirectory tree.
- **RootServerInfo container name:** The context for the DNS Services RootServerInfo object. For example: o=novell. The RootServerInfo Zone is an eDirectory container object that contains resource records for the DNS root servers.
- **Local NCP server context:** Specify a context for the local NCP Server object. The DNS Server reference is stored in this object. For example: o=novell.
- **Secure LDAP or Not (0 -> non-SSL, 1 -> SSL):** Set this option to 1 to ensure that the data transferred by this service is secure and private. Set this option to 0 to transfer the data in clear text format.

A.6 DNS Server Maintenance Utility

- "dns-maint(8)" on page 203

dns-maint(8)

Name

`dns-maint` - The DNS server maintenance utility.

Description

dns-maint is the utility to create and maintain the DNS server object in the eDirectory tree associated with the NCP server.

NOTE: In a cluster setup, you cannot create the DNS server object on all the nodes because it needs to refer to virtual NCP server. The Create Server option cannot be used in cluster setup; it can be used only in normal scenarios. Cluster setup requires manual DNS Server object creation.

Syntax

DNS Configuration Options

Default Option

```
dns-maint <LDAP host name or IP> <LDAP port number> <Admin DN> <Admin
password> <DNS Proxy user DN> <DNS Proxy user password> <Credential storage
(0->file, 1->CASA)> <DNS Locator object container name> <DNS group object
container name> <RootServerInfo container name> <Local NCP server context>
<Create DNS server object (1->create)*> <Host Name*> <Domain Name for DNS
Server*> <Secure LDAP or Not (0 -> non-SSL, 1->SSL)>
```

* parameters are optional.

Advanced option

Configure All

```
dns-maint -ca <Tree-name> <LDAP host name> <LDAP port number> <Admin DN>
<Admin password> <DNS Proxy user DN> <DNS Proxy user password> <Credential
storage (0->file, 1->CASA)> <DNS Locator object container name> <DNS group
object container name> <RootServerInfo container name> <Local NCP server
context> <Create DNS server object (1->create)*> <Host Name*> <Domain Name
for DNS Server*> <Secure LDAP or Not (0 -> non-SSL, 1->SSL)>
```

* parameters are optional. If the DNS runtime admin already exists in the tree, then the Advanced option will reset the existing user password to the specified password in the command. The password is reset only in OES Credential Store but not in eDirectory. Because of this inconsistency DNS service might not work properly.

Currently, dns-maint uses `/opt/novell/named/schema/DNIP.SCH` to extend the DNS schema in eDirectory tree.

IMPORTANT: In the Default and Advanced options for dns-maint, if you choose to configure an existing eDirectory user that is already configured in OES Credential Store, this option will not let you change the user password in OES Credential Store. Use the oescredstore tool to change the user password incase it is changed in the eDirectory.

Other Parameters for Server Object Creation

The following parameters are optional. If you do not want to create a DNS server object, do not consider these parameters.

- **Create DNS server object:** The value is 1 for object creation.
- **Host Name:** Specify a unique hostname for the DNS Server object. For example, acme-host.
- **Domain Name for DNS Server:** Specify a domain name for the Server object. For example, acme.americas.com.

Object and Schema Removal Options

Remove All

```
dns-maint -ra <LDAP host name> <LDAP port number> <Admin DN> <DNS Locator
object container name> <Delete Common Objects=1 Do not delete Common
Objects=0> <Secure LDAP or Not (0 -> non-SSL, 1->SSL)>
```

Remove Schema

```
dns-maint -rs <LDAP host name> <LDAP port number> <Admin DN> <Secure LDAP
or Not (0 -> non-SSL, 1->SSL)>
```

WARNING: During installation, removing DNS in Domain Services for Windows setup means that DSfW Services fails or demands reconfiguration to some other DNS server. Reconfiguring DNS on the DSFW setup is not possible because of its integration with DSfW. To reconfigure, you need to completely re-run the DSfW-DNS install script to re-populate the DNS zones and resource records in the tree. dns-maint should not be used to remove all (-ra), reconfig (-ca), or remove schema (-rs) for a DSfW deployment.

Options

Usage Options:

-ca, Configure All

```
dns-maint -ca <Tree-name> <LDAP host name> <LDAP port number> <Admin
DN> <Admin password> <DNS Proxy user DN> <DNS Proxy user password>
<Credential storage (0->file, 1->CASA)> <DNS Locator object container
name> <DNS group object container name> <RootServerInfo container name>
<Local NCP server context> <Create DNS server object (1->create)*>
<Host Name*> <Domain Name for DNS Server*> <Secure LDAP or Not (0 ->
non-SSL, 1->SSL)>
```

* parameters are optional. If the DNS runtime admin already exists in the tree, then the Configure All option resets the existing user password to the specified password in the command. The password is reset only in the OES Credential Store but not in eDirectory. Because of this inconsistency, the DNS service might not work properly.

The Configure All option extends the DNS schema in the tree, refreshes the tree, and creates DNS objects such as DNSDHCP-Group, DNS-DHCP (Locator), and RootServerInfo in the specified input context in the tree.

It also creates the Runtime Admin (Proxy User) if it does not exist in the tree, and adds it to the OES Credential Store.

For secure updates, specify the SSL port number for the LDAP and SSL option as 1.

For non-secure updates, specify the SSL option as 0.

For example:

```
dns-maint -ca <Acme-tree> Acme.com 636 cn=admin,o=Acme secret cn=dns-
admin,o=dns-domain secret 1 ou=Sales,o=Acme ou=Finance,o=Acme o=acme
o=acme 1 acme-host acme.americas.com 0
```

`-ra`, Remove All

```
dns-maint -ra <LDAP host name> <LDAP port number> <Admin DN> <DNS
Locator object container name> <Delete Common Objects=1 Do not delete
Common Objects=0> <Secure LDAP or Not (0 -> non-SSL, 1->SSL)>
```

The Remove All option removes the Rootserverinfo, Zone objects, resource record details of the zones, and the DNS-Server objects from the tree for the specified DNS Locator object.

1. To delete the Group Object and the Locator Object, specify the option as 1
2. To retain the Group Object and the Locator Object, specify the option as 0

It removes the DNS credentials from OES Credential Store. It removes the `.conf`, `.db`, `.jnl`, `.pid` files from the system from their respective directories (`/etc/opt/novell/named`, `/var/opt/novell/log/named`, `/var/opt/novell/run/named`) under the current user root.

For secure updates, specify the SSL port number for the LDAP and SSL option as 1.

For non secure updates, specify the SSL option as 0.

For example:

```
dns-maint -ra Acme.com 636 cn=admin,o=Acme ou=Sales,o=Acme 1
```

`-rs`, Remove Schema

```
dns-maint -rs <LDAP host name> <LDAP port number> <Admin DN> <Secure
LDAP or Not (0 -> non-SSL, 1->SSL)>
```

The Remove Schema option uses the `/opt/novell/named/schema/DNIP.SCH` schema file to remove schema from eDirectory tree by using the `/opt/novell/named/bin/removeschema.sh` script.

If the DNS schema is not in use, the Remove Schema option removes the DNS schema from the tree.

For secure updates, specify the SSL port number for the LDAP and SSL option as 1.

For non-secure updates, specify the SSL option as 0.

For example:

```
dns-maint -rs Acme.com 636 cn=admin,o=Acme
```

-d, Deleting of Empty Resource Records

```
dns-maint -d <LDAP host name> <LDAP port number> <Admin DN> <Secure LDAP
or Not (0 -> non-SSL, 1->SSL)> <Read from Locator (0->No, 1->Yes)>
<Locator FDN> <Zone List> <Date (Optional)>
```

This lets you delete the empty resource records of the zones in the eDirectory tree. You can delete empty resource records of the list of zones by specifying a command line parameter or by using the zone list in the Locator object.

The Locator object FDN and the zone list are mutually exclusive; only one can be present at a time. If the Locator object is present, then the zone list is read from it. The empty resource records of all the zones present in the zone list are deleted. Otherwise, a semicolon-separated list of zones(FQDN) for which you want to delete the empty resource records should be provided.

The date is optional. It is used to delete the RRs not used since the date mentioned. Specify the date in yyyy/mm/dd format.

For example:

```
dns-maint -d Acme.com 636 cn=admin,o=Acme 1 0
"cn=zone1,o=acme;cn=zone2,o=acme"
```

or

```
dns-maint -d Acme.com 636 cn=admin,o=Acme 1 0
"cn=zone1,o=acme;cn=zone2,o=acme" "2006/02/24"
```

Definitions

1. **LDAP host name:** The IP address of the default LDAP server for the service.
2. **LDAP port number:** The secure or non-secure LDAP port to connect to the LDAP server.
3. **Admin DN:** LDAP administrator distinguished name to authenticate against the LDAP host.
4. **password:** Password for the LDAP Admin.
5. **eDirectory user DN for DNS:** The user authenticates to eDirectory to access information for DNS during runtime. The user must have eDirectory read, write, and browse rights under the specified context.
6. **Credential Storage:** Specifies the proxy user's credential location. It is recommended to use OES Credential Store.
7. **DNS Locator object container name:** The context/container for the DNS Locator object. For example: o=novell. The DNS Locator object contains global defaults, DNS options, and a list of all DNS and DHCP servers, subnets, and zones in the tree.
8. **DNS Group pbject container name:** The context for the DNS Group object. For example: o=novell. This object is used to grant DNS servers the necessary rights to other data within the eDirectory tree.

9. **RootServerInfo container name:** The context for the DNS Services RootServerInfo object. For example: o=novell. The RootServerInfo Zone is an eDirectory container object that contains resource records for the DNS root servers.
10. **Local NCP server context:** Specify a context for the local NCP Server object. The DNS Server reference is stored in this object. For example: o=novell.
11. **Secure LDAP or Not (0 -> non-SSL, 1 -> SSL):** Set this option to 1 to ensure that the data transferred by this service is secure and private. Set this option to 0, to transfer the data in clear text format.
12. **Tree name:** eDirectory tree name of your NCP server.
13. **Delete Common Objects=1 Do not delete Common Objects=0:** This option specifies the DNS objects to be deleted from the eDirectory Tree.
    - To delete the Group Object and the Locator Object, specify the option as 1.
    - To retain the Group Object and the Locator Object, specify the option as 0.

    The Group Objects and the Locator Objects are common for DNS and DHCP services on NetWare. Cleaning up these objects from dns-maint is not recommended if you want to clean up only the DNS objects and then retain the DHCP objects in the tree.The Delete Common Objects=1 Do not delete Common Objects=0 option gives you the choice to delete or retain the common objects for DNS-DHCP in the tree.

A.7 DHCP Server Maintenance Utility

- "dhcp-maint(8)" on page 208

dhcp-maint(8)

Name

`dhcp-maint` - The DHCP server maintenance utility.

Description

`dhcp-maint` is the utility to create and maintain the DHCP configuration.

Syntax

DHCP Configuration Options

DHCP Default Configuration Option

```
dhcp-maint <LDAP host name or IP> <LDAP port number> <Admin DN> <Admin
password> <server object container name> <Locator object container name>
<group object container name> <server object name> <Secure LDAP or Not (0 -
> non-SSL, 1->SSL)> <DHCP Proxy user DN> <DHCP Proxy user password>
```

DHCP Advanced Configuration Option

Configure All

```
dhcp-maint -ca <LDAP host name or IP> <LDAP port number> <Admin DN> <Admin
password> <server object container name> <locator object container name>
<group object container name> <server object name> <Secure LDAP or Not (0 -
> non-SSL, 1->SSL)> <DHCP Proxy user DN> <DHCP Proxy user password>
```

If the DHCP runtime admin already exists in the tree, then the Advanced option resets the existing user password to the specified password in the command. The password is reset only in the OES Credential Store but not in eDirectory. Because of this inconsistency, the DHCP service might not work properly.

IMPORTANT: In the default and advanced options for dhcp-maint, if you choose to configure an existing user by using dhcp-maint, ensure that you provide the correct password for this user. A wrong/new password creates OES Credential Store corruption for this user and causes DHCP server load failure.

Edit Server Object

```
dhcp-maint -es <LDAP host name or IP> <LDAP port number> <Admin DN> <Admin
password> <server object container name> <server object name> <Secure LDAP
or Not 0 -> non-SSL, 1->SSL)>
```

Object and Schema Removal Options

Remove All

```
dhcp-maint -ra <LDAP host name or IP> <LDAP port number> <Admin DN>
<Locator object container name> <Delete Group=1 Locator=2 Both=3 None=0>
<Secure LDAP or Not (0 -> non-SSL, 1->SSL)>
```

Remove Schema

```
dhcp-maint -rs <LDAP host name or IP> <LDAP port number> <Admin DN> <Secure
LDAP or Not (0 -> non-SSL, 1->SSL)>
```

Options

Usage Options

-ca, Configure All

```
dhcp-maint -ca <LDAP host name or IP> <LDAP port number> <Admin DN>
<Admin password> <server object container name> <locator object
container name> <group object container name> <server object name>
<Secure LDAP or Not (0 -> non-SSL, 1->SSL)> <DHCP Proxy user DN> <DHCP
Proxy user password>
```

The Configure All option extends the DHCP schema in the tree, refreshes the tree, and creates DHCP objects such as DHCPGroup, dhcpLocator, and DHCP Server in the specified input context in the tree.

It also creates the Runtime Admin (Proxy User) if it does not exist in the tree and adds it to the OES Credential Store store.

For a secure connection, specify the SSL port number for LDAP and SSL option as 1.

For a non-secure connection, specify the SSL option as 0.

If the DHCP runtime admin already exists in the tree, the Advanced option resets the existing user password to the specified password in the command. The password is reset only in the OES Credential Store store but not in eDirectory. Because of this inconsistency, the DHCP service might not work properly.

For example:

```
dhcp-maint -ca Acme.com 636 cn=admin,o=Acme secret ou=Sales,o=Acme
ou=Finance,o=Acme o=Acme dhcp_ncpserver 1 cn=dhcp-admin,o=Acme
secretou=Sales,o=Acme ou=Finance,o=Acme o=Acme o=Acme 0
```

-es, Edit Server Object

```
dhcp-maint -es <LDAP host name or IP> <LDAP port number> <Admin DN>
<Admin password> <server object container name> <server object name>
<Secure LDAP or Not (0 -> non-SSL, 1->SSL)>
```

Modifies the syntax of the DHCP statement `client-updates ignore` to `ignore client-updates`.

If the syntax of the DHCP statement in your DHCP server is `client-updates ignore`, you can use this option to change the syntax to `ignore client-updates`.

For example:

```
dhcp-maint -es Acme.com 636 cn=admin,o=Acme secret ou=Sales,o=Acme
ou=Finance,o=Acme dhcp_ncpserver 1
```

`-ra`, Remove All

```
dhcp-maint -ra <LDAP host name or IP> <LDAP port number> <Admin DN>
<locator object container name> <Delete Group=1 Locator=2 Both=3
None=0> <Secure LDAP or Not (0 -> non-SSL, 1->SSL)>
```

The Remove All option removes all the DHCP configuration objects like service, subnet, host, pool, failover peer, DHCP Server etc from the tree for the specified Locator object.

1. To delete the Group Object, specify the option as 1.
2. To delete the Locator Object, specify the option as 2.
3. To delete both the Locator and the Group Objects, specify the option as 3.
4. Specify 0 for no deletions.

The Remove All option performs a complete cleanup of eDirectory for DHCP and no check is done for local or remote server. After the cleanup it removes the DHCP files (`dhcpd.log`, `dhcpd.conf`, `dhcpd.pid`) from the local machine from their respective directories (`/var/log, /etc, /var/lib/dhcp/var/run`). The DHCP OES Credential Store credentials are also removed from the local OES Credential Store only.

NOTE: The server connected here is for LDAP bind and should not be considered as cleanup for the remote server.

To delete files and OES Credential Store credentials on a remote system, dhcp-maint should be run on that system locally. However, the OES Credential Store credentials can also be removed by using the oescredstore tool.

For a secure connection, specify the SSL port number for the LDAP and SSL options as 1.

For a non-secure connection, specify the SSL option as 0.

For example:

```
dhcp-maint -ra Acme.com 636 cn=admin,o=Acme o=Acme 3 1
```

`-rs`, Remove Schema

```
dhcp-maint -rs <LDAP host name> <LDAP port number> <Admin DN> <Secure
LDAP or Not (0 -> non-SSL, 1->SSL)>
```

If the DHCP schema is not in use, then the Remove Schema option removes the DHCP schema from the tree.

For a secure connection, specify the SSL port number for the LDAP and SSL options as 1.

For a non-secure connection, specify the SSL option as 0.

For example:

```
dhcp-maint -rs Acme.com 636 cn=admin,o=Acme
```

Definitions

1. **LDAP host name or IP:** The IP address of the default LDAP server for the service.
2. **LDAP port number:** The secure or non-secure LDAP port to connect to the LDAP server.
3. **Admin DN:** The LDAP administrator distinguished name to authenticate against the LDAP host.
4. **password:** The password for the LDAP Admin.
5. **eDirectory user DN for DHCP:** The user authenticates to eDirectory to access information for DHCP during runtime. The user must have eDirectory read, write, and browse rights under the specified context.
6. **locator object container name:** The context/container for the DHCP Locator object. For example: o=novell. The DHCP Locator object contains global defaults, DHCP options, and a list of all DHCP servers, subnets, and zones in the tree.
7. **group object container name:** The context for the DHCP Group object. For example: o=novell. This object is used to grant DHCP servers the necessary rights to other data within the eDirectory tree.
8. **Secure LDAP or Not (0 -> non-SSL, 1 -> SSL):** Set this option to 1 to ensure that the data transferred by this service is secure and private. Set this option to 0, to transfer the data in clear text format.
9. **Delete Group=1 Locator=2 Both=3 None=0:** This option specifies the DHCP objects to be deleted from the eDirectory tree.
    a. To delete the DHCPGroup Object, specify the option as 1.
    b. To delete the dhcpLocator Object, specify the option as 2.
    c. To delete both the DHCPGroup and dhcpLocator Objects, specify the option as 3.

    The Delete Group=1 Locator=2 Both=3 None=0 option gives you the choice to retain or delete the common objects for DNS-DHCP in the tree.

A.8 Post-Install Maintenance Tools

For any post-install operations using dns-maint and dhcp-maint, ports 1389/1636 should be used to avoid any issues because of changed behavior of the DSFW server. Many access/search errors happen if you run dns-maint and dhcp-maint to use 389/636.

B Glossary

This section describes the most commonly used terms in DNS/DHCP Services.

Additional Options: An attribute of the DNS server and the zone, which allows fine-tuning of options for server performance. The values specified at the zone level override the values specified in the DNS server.

Additional from Auth: Controls the behavior of an authoritative server when answering queries that have additional data, or when following CNAME and DNAME chains. When this option is set to yes, and when a query is being answered from authoritative data, the additional data section of the reply is filled in with data from other authoritative zones.

Additional from Cache: Controls the behavior of an authoritative server when answering queries that have additional data, or when following CNAME and DNAME chains. When this option is set to yes, and when a query is being answered from authoritative data, the additional data section of the reply is filled in using data from the cache.

Allow Notify: Specifies the hosts that are allowed to notify slaves of a zone change in addition to the zone masters. This can be configured only for a secondary zone.

Allow Recursion: A list of IP addresses or networks from which the DNS server accepts queries recursively. If a value is not specified, the default is to allow recursive queries from all hosts.

Also Notify: A list of IP addresses of name servers that are also sent notify messages when a new copy of the zone is loaded, in addition to the servers listed in the zone's NS records. This is primarily meant to converge stealth servers. The default is an empty list (no additional notification list). The value specified in the zone overrides the value specified in the server.

Authoritative: DNS data that is served by the resident DNS server. The server can be either primary or secondary. This is the DNS data that belongs to a resident domain and is managed by the administrator of that domain, or it is the DNS data that is imported through a zone transfer.

Blacklist servers: These are fake servers; the DNS server does not answer queries from or forward queries to these servers. This list is maintained in the dnipBlacklistServers attribute of the DNS server object in eDirectory.

Bulk Zone Export: An action that transfers one or more zones' configuration and data from eDirectory to files. This can be done by using the Import-Convert-Export (ICE) utility, which uses ICE zone handlers.

Bulk Zone Import: An action that transfers one or more zones' configuration and data from files to eDirectory. This can be done using the Import-Convert-Export (ICE) utility, which uses ICE zone handlers.

Cleaning Interval: With this option set, the server removes expired resource records from the cache after every cleaning interval. If it is set to 0, no periodic cleaning occurs.

Cluster: OES DNS cluster services is a server clustering solution that provides high availability and manageability of critical network resources including data, applications, and services. It is enabled for eDirectory and supports failover, fallback, and migration (load balancing) of individual managed services.

Co-existence: Both the old and new servers interoperate on the same eDirectory configuration. The underlying platform / configuration is the same and allows different versions of the server to work on it. Co-existence of a new DNS server with a current DNS server allows customers to do a phased upgrade and migration from old DNS servers to new DNS servers.

Designated Primary Server: The master primary server, which serves a primary zone and honors zone-out transfer requests. It is the only primary server in the zone that accepts dynamic updates. There is only one designated primary server per zone.

Designated Secondary Server: The master secondary server, which serves a secondary zone and honors zone-out transfer requests. It is the only secondary server in the zone that performs in-bound zone transfer requests to the primary server in the zone. There is only one designated secondary server per zone.

Dynamic Reconfiguration: Detects the changes in the DNS server and DNS Zone configuration data and applies it from eDirectory to the DNS server in-memory while the DNS server is in running mode (without shutting down the server).

Dynamic Update - Novell proprietary: The OES DHCP server sends the updates to DNS server by using a Novell proprietary update format. The proprietary dynamic update message has a different format from the standard RFC 2136 and also has security signature associated with the message. There is a logic for establishing credentials for each connection from DHCP to DNS. After the credentials are established, the DHCP server sends the actual packet of DNS data for update to the DNS server.

Dynamic Update - RFC 2136: The new DNS servers accept dynamic update requests in standard RFC 2136 format. For more information, refer to RFC 2136 (http://www.ietf.org/rfc/rfc2136.txt?number=2136).

Event: The occurrence of an action on an object of interest.

Fault tolerance: Handles temporary disruptions of eDirectory unavailability, with graceful degradation in functionality. This can be categorized as:

- **Full Fault Tolerance:** The state when eDirectory is down and access to the DNS server object is broken. The server does not accept the following:
  - Dynamic Update
  - Zone-in
  - Notify

  No write operation can be performed until eDirectory is up.

  The server resolves only normal queries and zone-out transfers. Full Fault-Tolerance mode is applicable to all zones that are being serviced by the DNS server.
- **Partial Fault Tolerance:** The state when eDirectory is up but access to some zones is broken (because some eDirectory partitions are down or are not accessible). The server does not accept:
  - Dynamic Update

- Zone-in
- Notify

No write operation to these zones is performed until the partition is down

The server only resolves normal queries for this zone. The queries are resolved only until the expiration for a secondary zone and forever for a primary zone.

Forward: This option can be configured only if the forwarding list is not empty. A value of First, which is the default, causes the server to query the forwarders first. If that does not answer the query, the server then looks for the answer. If Only is specified, the server queries only the forwarders.

Empty Forwarder: This option is used for domain delegation (child zones). With an Empty Forward list, global forwarders are ignored and NS records are used for domain delegation.

Forwarder: A DNS server that forwards queries to other DNS servers, if the requested information is not found on the local server.

FQDN: Fully qualified distinguished name

Group: The DNS/DHCP Group object is a standard eDirectory group object. The DNS and DHCP servers gain the rights to DNS and DHCP data within the tree through the Group object.

ICE: The Import-Convert-Export utility to import or export the DNS server, zone configuration information, and data to or from the eDirectory database.

Journal Log: All changes made to a zone through dynamic update are stored in the zone's journal log. The server automatically creates this log when the first dynamic update takes place. The extension .jnl is appended to the name of the corresponding zone to form the journal log file. The journal log is in a binary format and should not be edited manually.

Lame TTL: Sets the number of seconds to cache a lame server indication (these are misconfigurations in the remote servers, discovered by the DNS service when trying to query those servers during resolution). 0 disables caching (not recommended). The maximum value is 1800 (30 minutes).

Listen On: Specifies the interfaces and ports that the server answers queries from. It takes an optional port and an address match list. If a port is not specified, port 53 is used.

Locator: The DNS/DHCP Locator object contains a reference to global defaults and DHCP options, and list of all DNS and DHCP servers, subnets, and zones in the tree.

Maximum Cache Size: The maximum amount of memory (in bytes) used for the server's cache. When the amount of data in the cache reaches this limit, the server causes records to expire prematurely so that the limit is not exceeded. The default is 0 (unlimited cache).

Maximum Cache TTL: Sets the maximum time for which the server caches ordinary (positive) answers.

Maximum NCache TTL: Sets a maximum retention time for negative answers in the server. The server stores negative answers to reduce network traffic and increase performance. The maximum value is 7 days.

Maximum Recursion Lookups: The maximum number of simultaneous recursive lookups that the server performs on behalf of the clients. This allows you to set limits on the servers' resource consumption The default value is 1000.

NOTE: Each recursive client uses about 20 KB of memory

Minimal Responses: Allows the server to add records to the authority sections, and optionally to the additional section depending on the value set for this option. If this is set to No, the server adds records to both the authority and additional sections when generating responses. If this is set to Yes, the server adds records only to the authority section when generating responses. The performance of the server increases if this option is set to No.

Non-Authoritative: DNS data that is not served by the resident DNS server. This is the DNS data that belongs to a foreign domain and is not managed by the resident DNS administrator. This data is cached through responses to forwarded queries.

Notify: When this option is set to yes, DNS notify messages are sent when the contents of a zone for which the server is authoritative changes. The messages are sent to the servers listed in the zone's NS records (except the master server identified in the SOA MNAME field), and to any servers listed in the also-notify option.

Notify Source: Determines the local source address, and optionally the UDP port that is used to send notify messages. The slave should also be configured to receive notify messages from this address.

Novell Dynamic Reconfigure: Specifies the time interval at which dynamic reconfiguration takes place. The minimum value is 10 minutes and the maximum is 24 hours.

Out-of-band update: Any update to DNS Zone data in eDirectory that by-passes the DNS server (that is, all updates except dynamic updates).

Passive Primary Server: A DNS server that serves a primary zone and honors zone-out transfer requests. This server is passive because it cannot update the zone data. There can be multiple passive primary servers serving the same primary zone.

Passive Secondary Server: A DNS server that serves a secondary zone and does not issue in-bound zone transfer requests to the primary server of the zone. It answers queries to the zone and honors zone-out transfers requests to the zone. There can be multiple passive secondary servers serving the secondary zone.

Performance: This parameter measures the throughput of the server in handling requests and is indicated as the response time for processing concurrent requests (queries, updates, zone transfers, etc.).

Primary Zone: A zone that is authoritative and is serviced by a designated primary DNS server and one or more passive primary DNS servers.

Provide IXFR: Determines whether the local server, acting as the master, responds with an incremental zone transfer when the given remote server, a slave, requests it. If it is set to Yes, incremental transfer is provided whenever possible. If it is set to No, all transfers to the remote server are non-incremental (AXFR). The default is Yes.

Query Filter: List of IP addresses or networks from which the DNS server accepts queries. If this option is not specified, the default is to allow queries from all hosts. The value specified for this option in the zone overrides the value specified in the server.

Query Source: Specifies the address and port used for querying other name servers, if the server does not know the answer to a query.

Recursion: If this option is set to Yes, and a DNS query requests recursion, then the server attempts to do everything required to answer the query. If this option is set to No and the server does not already know the answer, it returns a referral response.

Role: An object in the iManager framework that is associated with user objects in eDirectory.

Roll Back: To revert to the previous state if a transaction fails.

RootSrvrInfo: The RootSrvrInfo Zone is a Zone object, which is an eDirectory container object that contains RRsets for the DNS Root servers. The RootSrvrInfo Zone object is the equivalent of the BIND `db.root` file.

Request IXFR: Determines whether the local server, acting as a slave, requests incremental zone transfers from the given remote server, a master. The default is True.

RR Set Order: Permits ordering of the records in a multiple record response in an RRset. Currently, OES DNS server supports two orders: random-cyclic and fixed. The default is random-cyclic.

Scalability: This parameter measures how the server scales with load in terms of the number of zones, number of RRs per zone, number of DNS queries, and zone transfers or dynamic updates handled by the server in a typical deployment scenario. It also identifies the limits of the parameters to which the server offers consistent performance without degradation.

Scope settings: Setting the scope and context of Locator object in the eDirectory tree enables better search responses for DNS-DHCP objects. This avoids searching the entire tree by limiting the search within the current scope set.

Secondary Zone: A zone that is serviced by a designated secondary DNS server and one or more passive secondary DNS servers.

Serial Query Rate: Through this option, the slave servers periodically query master servers to find out if the zone serial numbers have changed. Each such query uses a small amount of the slave server's network bandwidth. In order to limit the amount of bandwidth used, limit the rate at which queries are sent. The value of the serial-query-rate option is an integer, which is the maximum number of queries sent per second.

Slave Server: A DNS server that answers queries from its authoritative data and cached data, but relies completely on the forwarders for external information. It does not contact other servers if the forwarders do not give it an answer. A slave server can be a primary or secondary for its authoritative data.

Task: A task is an object in the iManager framework that is associated with a role object in eDirectory. Each task describes some action that a role can play to create, modify, or delete objects in eDirectory.

TCP Clients: Specifies the maximum number of simultaneous client TCP connections that the server accepts.

Transaction support: The DNS server supports transaction for a dynamic update request. This means committing the update to eDirectory, in-memory rbt (red-black tree) database, and in the journal log. If the transaction to any of these fails, the update is rolled back and a negative response is sent to the dynamic update request.

Transfer Format: Through this option, zone transfers can be done using two different formats, one-answer and many-answers. This option is used on the master server to determine which format it sends. One-answer uses one DNS message per resource record transferred; many-answers places as many resource records as possible into a message. Many-answers is more efficient.

Transfers In: Specifies the maximum number of inbound zone transfers that can run concurrently. Increasing the transfers-in might speed up the convergence of slave zones, but it might also increase the load on the local system.

Transfers Out: Specifies the maximum number of outbound zone transfers that can run concurrently. The zone transfer requests that are in excess of the limit are refused.

Transfers per NS: Specifies the maximum number of inbound zone transfers that can be transferred concurrently from a given remote name server. Increasing the value of this option might speed up the convergence of slave zones, but it might also increase the load on the remote name server.

Transfer Source: Determines the local address that is bound to the IPv4 TCP connections used to fetch the zones transferred inbound by the server. It also determines the source IPv4 address, and optionally the UDP port, used for the refresh queries and forwarded dynamic updates.

Update Filter: List of IP addresses or networks from which the DNS server accepts dynamic DNS updates for primary zones. The default is to deny updates from all hosts. This attribute is effective only on a primary designated server.

Write-through: Writing the dynamic update data immediately to eDirectory (primary data), server in-memory, and the journal log at the time of request (that is, before replying to the dynamic update request).

Zone Export: Transfers a single zone configuration/data from eDirectory into a file. This can be done with the DNS/DHCP Management utilities.

Zone Import: Transfers a single zone configuration and data from a file into eDirectory. This can be done with the DNS/DHCP Management utilities.

Zone-in: Zone data received by a secondary server from a primary server.

Zone-out: Transfer of data from a primary server to a secondary server.

Zone Statistics: If this option is set to ON, the DNS server collects statistical data on all zones in the server.