

Novell NetWare® 6

6.0

www.novell.com

DNS/DHCP MANAGEMENT UTILITY
ADMINISTRATION GUIDE



Novell®

Legal Notices

Novell, Inc. makes no representations or warranties with respect to the contents or use of this documentation, and specifically disclaims any express or implied warranties of merchantability or fitness for any particular purpose. Further, Novell, Inc. reserves the right to revise this publication and to make changes to its content, at any time, without obligation to notify any person or entity of such revisions or changes.

Further, Novell, Inc. makes no representations or warranties with respect to any software, and specifically disclaims any express or implied warranties of merchantability or fitness for any particular purpose. Further, Novell, Inc. reserves the right to make changes to any and all parts of Novell software, at any time, without any obligation to notify any person or entity of such changes.

This product may require export authorization from the U.S. Department of Commerce prior to exporting from the U.S. or Canada.

Copyright © 1993-2001 Novell, Inc. All rights reserved. No part of this publication may be reproduced, photocopied, stored on a retrieval system, or transmitted without the express written consent of the publisher.

U.S. Patent No. 5,157,663; 5,349,642; 5,455,932; 5,553,139; 5,553,143; 5,572,528; 5,594,863; 5,608,903; 5,633,931; 5,652,859; 5,671,414; 5,677,851; 5,692,129; 5,701,459; 5,717,912; 5,758,069; 5,758,344; 5,781,724; 5,781,724; 5,781,733; 5,784,560; 5,787,439; 5,818,936; 5,828,882; 5,832,274; 5,832,275; 5,832,483; 5,832,487; 5,850,565; 5,859,978; 5,870,561; 5,870,739; 5,873,079; 5,878,415; 5,878,434; 5,884,304; 5,893,116; 5,893,118; 5,903,650; 5,903,720; 5,905,860; 5,910,803; 5,913,025; 5,913,209; 5,915,253; 5,925,108; 5,933,503; 5,933,826; 5,946,002; 5,946,467; 5,950,198; 5,956,718; 5,956,745; 5,964,872; 5,974,474; 5,983,223; 5,983,234; 5,987,471; 5,991,771; 5,991,810; 6,002,398; 6,014,667; 6,015,132; 6,016,499; 6,029,247; 6,047,289; 6,052,724; 6,061,743; 6,065,017; 6,094,672; 6,098,090; 6,105,062; 6,105,132; 6,115,039; 6,119,122; 6,144,959; 6,151,688; 6,157,925; 6,167,393; 6,173,289; 6,192,365; 6,216,123; 6,219,652; 6,229,809. Patents Pending.

Novell, Inc.
1800 South Novell Place
Provo, Utah 84606
U.S.A.

www.novell.com

Novell DNS/DHCP Management Utility Administration Guide
September 2001
103-000164-001

Online Documentation: To access the online documentation for this and other Novell products, and to get updates, see www.novell.com/documentation.

Novell Trademarks

NetWare is a registered trademark of Novell, Inc. in the United States and other countries.

NetWare Core Protocol and NCP are trademarks of Novell, Inc.

Novell is a registered trademark of Novell, Inc. in the United States and other countries.

Novell eDirectory is a trademark of Novell, Inc.

Third-Party Trademarks

All third-party trademarks are the property of their respective owners.

Contents

About This Guide	13
Conventions	13
Documentation Conventions	13
Trademark Conventions	13
1 Understanding	15
Overview of DNS/DHCP Services	15
DNS	16
DHCP	18
DNS/DHCP Management Utility	20
Understanding the eDirectory Schema Extension	21
DNS/DHCP Global eDirectory Objects	21
New eDirectory Objects for DNS	22
DNS Zone Object	23
DNS Resource Record Set Object	23
DNS Resource Records	23
DNS Server Object	24
eDirectory Objects for DHCP	24
Subnet Object	25
Address Range Object	25
IP Address Object	26
DHCP Server Object	26
Subnet Pool Object	26
Understanding DNS	27
DNS Hierarchy	27
Domains and Subdomains	29
Domain Names	30
Domain Delegation	30
IN-ADDR.ARPA Domain	31
DNS Name Service	31
Name Servers	31
Resource Records	32
Traditional DNS	34
DNS within eDirectory	36
DNS Master File	38
Understanding DHCP	39
IP Address Allocation	40
Dynamic BOOTP Allocation	40
Dynamic DHCP Allocation	40

Manual Allocation	41
Lease Options	41
Managing the Database	42
DHCP Options	43
Assigning Options	43
DHCP Options for eDirectory	44
NetWare/IP Options	45
Dynamic DNS	46
Compatibility with BOOTP	47
Using a BOOTP Relay Agent	47
Virtual LAN Environments	48
SNMP Event Generation	49
DHCP Auditing	50
Console and Debug Logs	50
Understanding the DNS/DHCP Management Utility	51
Overview of Interface Interaction	52
The DNS/DHCP Management Utility Interface	52
Taskbar	53
Roles and Tasks	54
Object Creation Rules	55
2 Planning	57
eDirectory Considerations	57
Planning a DNS Strategy	58
Planning Zones	59
Novell DNS Server as a Primary Name Server	59
Novell DNS Server as a Secondary Name Server (to a Non-Novell Master)	59
Configuring a DNS Server to Forward Requests	60
Forwarding Requests for Unknown Addresses	60
Restricting Forwarding	61
Setting Up the IN-ADDR.ARPA Zone	61
Registering Your DNS Server with Root Servers	61
Planning a DHCP Strategy	62
Network Topology	62
Migrating from Another DHCP Solution	62
Initiating the DHCP Service	63
eDirectory Implementation	63
Lease Considerations	64
Considering the Length of Leases	65
Controlling Client Access to Leases	67
IP Address Availability	67
Identifying Your Addresses	67
Subnetting Your Addresses	68
Assigning Addresses Manually	68

Representing Addresses in eDirectory	68
Restricting Address Assignment to Clients	68
Hostnames	69
3 Setting Up	71
Configuring DNS	71
Required eDirectory Rights to Manage DNS/DHCP Configuration	71
DNS/DHCP Scope Settings	73
Importing DNS Configuration Information	74
Setting Up DNS	74
DNS Prerequisites	75
Loading the DNS Server	75
Configuring Clients to Use DNS	75
Detailed DNS Configuration	76
Creating a DNS Server Object	76
Modifying a DNS Server Object	77
Starting/Stopping the DNS Server	78
Creating a Zone Object	78
Creating a Primary DNS Zone Object	79
Creating a Secondary DNS Zone Object	79
Creating an IN-ADDR.ARPA Object	80
Creating a Primary IN-ADDR.ARPA Zone Object	80
Creating a Secondary IN-ADDR.ARPA Zone Object	81
Modifying a Zone Object	82
Creating Resource Records	83
Modifying Resource Records	84
Configuring DNS Features	85
Configuring an eDirectory Server to Forward Queries to Root Name Servers	85
Configuring a Cache-Only Server	85
Configuring to Support Child Zones	86
Configuring DHCP	86
Importing DHCP Configuration Information	87
Setting Up DHCP	88
DHCP Prerequisites	88
Setting Global DHCP Preferences	88
Setting Global DHCP Options	89
Setting Global DHCP Defaults	89
Viewing the DHCP Options Table	90
Creating a DHCP Server Object	91
Creating a Subnet Object	91
Creating Subnet Address Ranges	92
Creating IP Address Objects	92
Loading the DHCP Server	93
Configuring Clients to Use DHCP	94

Detailed DHCP Configuration	94
Modifying a DHCP Server Object	95
Starting/Stopping the DHCP Server	96
Modifying an Existing Subnet Object	97
Modifying a Subnet Address Range Object	98
Modifying an Existing IP Address Object	100
Creating a Subnet Pool Object	101
Modifying a Subnet Pool Object	102
Configuring Special Features	102
Configuring a DNS Server to be Authoritative for Multiple Zones	103
Configuring a Multi-Homed Server.	103
Configuring Dynamic DNS.	103
Configuring Multiple Logical Networks.	104
Configuring for Auditing	104
Configuring DNS Auditing	105
Viewing the DNS Audit Trail Log.	105
Viewing the DNS Event Log	106
Configuring DHCP Auditing	108
Viewing the DHCP Audit Trail Log.	108
Viewing the DHCP Event Log	110
NAMED Command Line Options	111
DHCPDVR Command Line Options	112
4 Optimizing	115
Optimizing DNS Performance	115
Optimizing DHCP Performance	115
5 Managing	117
DNS/DHCP Management Utility.	117
Installing the DNS/DHCP Management Utility.	118
Prerequisites.	118
Launching the DNS/DHCP Management Utility	118
Using the DNS/DHCP Management Utility	119
Managing DNS	119
Managing DHCP	120
Events and Alerts	120
Auditing Server Activity	121
6 Troubleshooting	123
DNS	123
Troubleshooting Checkpoints	123
Common Configuration Problems	124
Common Operational Problems	125
Troubleshooting Windows 95 TCP/IP Problems.	128

Using the "-F" Command Line Option for DNIPINST.NLM	134
Server Access to DNS/DHCP Locator Object Not Required	134
DHCP	135
Troubleshooting Checkpoints.	135
Common Operational Problems	136
Releasing and Renewing DHCP Addresses	139

About This Guide

This document describes the concepts of the Domain Naming System (DNS) and the Dynamic Host Configuration Protocol (DHCP), the setup and configuration of these functions, and how to use Novell DNS/DHCP Services in NetWare® 6.

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

Conventions

Documentation Conventions

In Novell documentation, a greater-than symbol (>) is used to separate actions within a step and items in a cross-reference path.

Trademark Conventions

In this documentation, a trademark symbol (®, ™, etc.) denotes a Novell trademark. An asterisk (*) denotes a third-party trademark.

1

Understanding

This chapter describes the eDirectory™ schema extension, the Domain Name System (DNS), and the Dynamic Host Control Protocol (DHCP) server, and it explains their eDirectory-related functions. This chapter also provides information about the DNS/DHCP Management Utility.

Overview of DNS/DHCP Services

Novell® DNS/DHCP Services in NetWare® 6 integrates the Domain Name System (DNS) and Dynamic Host Configuration Protocol (DHCP) into the eDirectory database. Integrating these services into eDirectory provides centralized administration and enterprise-wide management of network (IP) addresses, configuration, and hostnames.

The DNS/DHCP Management Utility provides a Web interface to manage the objects created to support DNS and DHCP. The DNS/DHCP Management Utility functions as a Web-based utility and runs in a browser window. It does not require a Novell client or any installed component as a prerequisite. It shares a common interface with other utilities that are based on the eDirectory Management (iManage) framework, and is thus tightly integrated with Netware 6.

NOTE: In this document, the term *host* refers to a network device that requires an IP address and might have a hostname.

For more overview information, refer to:

- ♦ “DNS” on page 16
- ♦ “DHCP” on page 18
- ♦ “DNS/DHCP Management Utility” on page 20

DNS

The DNS software in Novell DNS/DHCP Services integrates DNS information into the eDirectory database. Previously, DNS used Btrieve* as its database for configuration information. Integrating DNS with eDirectory moves all the information currently held in Btrieve files into eDirectory.

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

Integrating DNS with eDirectory also enables an update interaction between DNS and DHCP through the Dynamic DNS (DDNS) feature. When a host is assigned an IP address by DHCP, the DNS information can be automatically updated to associate the hostname with the new address when the DDNS feature is active.

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

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

Novell DNS/DHCP Services provides the following DNS features:

- ♦ All DNS configuration is done in eDirectory, facilitating enterprise-wide management.
- ♦ A Novell DNS server can be a secondary name server to another zone (DNS data loaded into eDirectory through a zone transfer), or it can be a primary name server (on which you configure DNS data using the DNS/DHCP Management Utility).
- ♦ DNS data can be read in from 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 eDirectory through Novell servers and include interoperability with non-eDirectory-based DNS.
- ◆ A Novell DNS server can be authoritative for multiple domains.
- ◆ Novell DNS servers maintain a cache of data from eDirectory so they can quickly respond to queries.
- ◆ A Novell DNS server can act as a caching or forwarding server instead of an authoritative server for zones.
- ◆ Novell DNS/DHCP Services supports multihoming.
- ◆ Novell DNS/DHCP Services software supports round-robin processing of responses to queries with multiple Address records (A records) for a domain name.

The DNS software in Novell DNS/DHCP Services conforms to BIND 4.9.5 and supports the standards of the Internet Request For Comments (RFCs) in the following list:

- ◆ 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 1713—Tools for DNS Debugging
- ♦ RFC 1884—IP Version 6 Addressing Architecture
- ♦ RFC 1886—DNS Extensions to Support IP Version 6
- ♦ RFC 1912—Common DNS Operations and Configurations Errors
- ♦ RFC 2010—Operations Criteria for Root Name Servers
- ♦ RFC 2052—A DNS RR for Specifying the Location of Services (DNS SRV)

DHCP

A NetWare 6 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.

Furthermore, 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.

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 assignment 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. Novell DHCP servers can be configured to respond to requests from BOOTP clients.

Novell DNS/DHCP Services provides the following DHCP features:

- ♦ All DHCP configuration is done in eDirectory, facilitating enterprise-wide management.
- ♦ DHCP options can be set at three levels:
 - ♦ Enterprise level
 - ♦ Subnet level
 - ♦ Specific client level
- ♦ The configuration utility has import/export functions that support the following:
 - ♦ Populating eDirectory from an existing Novell DHCP Server 2.0 DHCPTAB file or from a BOOTPTAB file (for Novell BOOTP)
 - ♦ Saving configuration information out of eDirectory
- ♦ You can configure the level of SNMP event trap generation using the DNS/DHCP Management Utility for all events, major events only, or no events.
- ♦ Client assignment policy options (to support mobile clients that move around the network) include:
 - ♦ Allow Duplicate
 - ♦ Delete Duplicate
 - ♦ No Duplicate
- ♦ You can use the DNS/DHCP Management Utility to maintain a hardware exclusion list to deny service to unwanted devices by their MAC addresses.
- ♦ The DHCP software updates eDirectory to record all address assignments to LAN 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.

- ♦ The DHCP software has one DHCP server NetWare Loadable Module™ (NLM™) file that supports both LAN and remote access clients.
- ♦ 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.
- ♦ 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.
- ♦ DHCP auditing can help diagnose problems. Each incidence of address deletion, addition, and rejection is recorded.

Novell DNS/DHCP Services supports the features that were previously provided by Novell DHCP Server 2.0 and supports the standards of the RFCs in the following list:

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

Novell DNS/DHCP Services also supports the BOOTP standards of the RFCs in the following list:

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

Refer to **“DHCP Options” on page 43** for a list of all supported DHCP options.

DNS/DHCP Management Utility

The DNS/DHCP Management Utility is a Web-based utility used to configure and manage eDirectory-based DNS and DHCP. eDirectory is used as a database to store the administered IP address and name service objects.

The DNS/DHCP Management Utility can run on any browser workstation and does not require a Novell client or any installed component as a prerequisite.

It operates within the common eDirectory Management Framework (iManage) and is thus tightly integrated with Netware 6.

For more detailed information about the DNS/DHCP Management Utility, refer to [“Understanding the DNS/DHCP Management Utility” on page 51](#).

Understanding the eDirectory Schema Extension

The eDirectory schema extension defines additional objects needed for DNS and DHCP.

For more information, refer to:

- ♦ [“DNS/DHCP Global eDirectory Objects” on page 21](#)
- ♦ [“New eDirectory Objects for DNS” on page 22](#)
- ♦ [“eDirectory Objects for DHCP” on page 24](#)

DNS/DHCP Global eDirectory Objects

When you select Novell DNS/DHCP Services during NetWare 6 installation, the eDirectory schema is extended to enable the creation of DNS and DHCP objects, and the following objects are created:

- ♦ DNS/DHCP Locator object
- ♦ DNS/DHCP Group object
- ♦ RootSrvrInfo Zone

Only one copy of these objects exists in an eDirectory tree. The DNS servers, DHCP servers, and DNS/DHCP Management Utility must have access to these objects.

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. When the DNS/DHCP Management Utility is used to create DNS and DHCP servers, the servers have the rights required to access data.

The DNS/DHCP Locator object contains global defaults, DHCP options, and lists of all DNS and DHCP servers, subnets, and zones in the tree. The DNS/DHCP Management Utility can display these objects without having to search the tree by using the Locator object. The Locator object is basically hidden by the DNS/DHCP Management Utility.

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

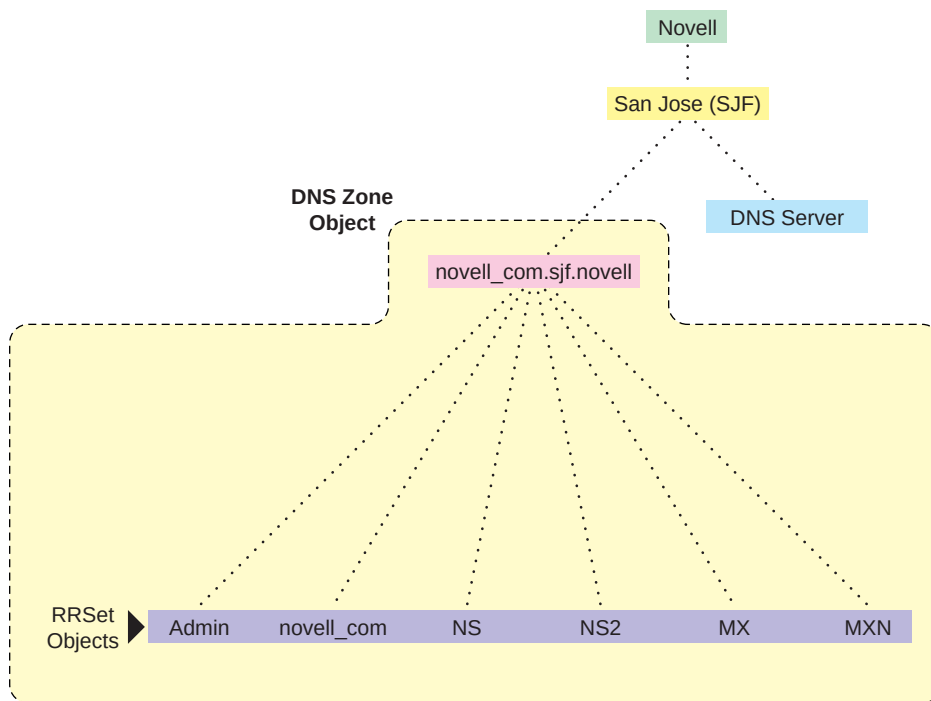
New eDirectory Objects for DNS

The following new eDirectory objects support DNS:

- DNS Zone object
- DNS Resource Record Set object
- DNS Name Server object

Figure 1 shows an example of a tree of DNS objects.

Figure 1 eDirectory Objects for DNS



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 domains can be represented within eDirectory by using separate, independent DNS Zone objects. A network administrator can support multiple DNS domains on a single NetWare 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), a member list of all eDirectory-based DNS servers that serve the zone, and Dynamic DNS (DDNS) server information.

The DNS name space 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 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, a DNS address class, and a Time-to-Live (TTL) record.

Each domain name within a DNS zone object has an RRSet object. Each RRSet object has one or more resource records beneath it containing additional information about the domain, including a description of the object and version information.

DNS Resource Records

A DNS resource record (RR) is an attribute of an RRSet that contains the resource records 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.

DNS Server Object

The DNS Server object (or Service object) is different from the NetWare Core Protocol™ (NCP™) Server object. A DNS Server object can be contained in an Organization (O), Organizational Unit (OU), Country (C), or Locality (L). The DNS Server object contains DNS server configuration parameters, including the following:

- ♦ Zone List
- ♦ DNS Server IP Address
- ♦ Domain Name of the DNS Server
- ♦ DNS Server Options
- ♦ Forwarding List
- ♦ No Forwarding List

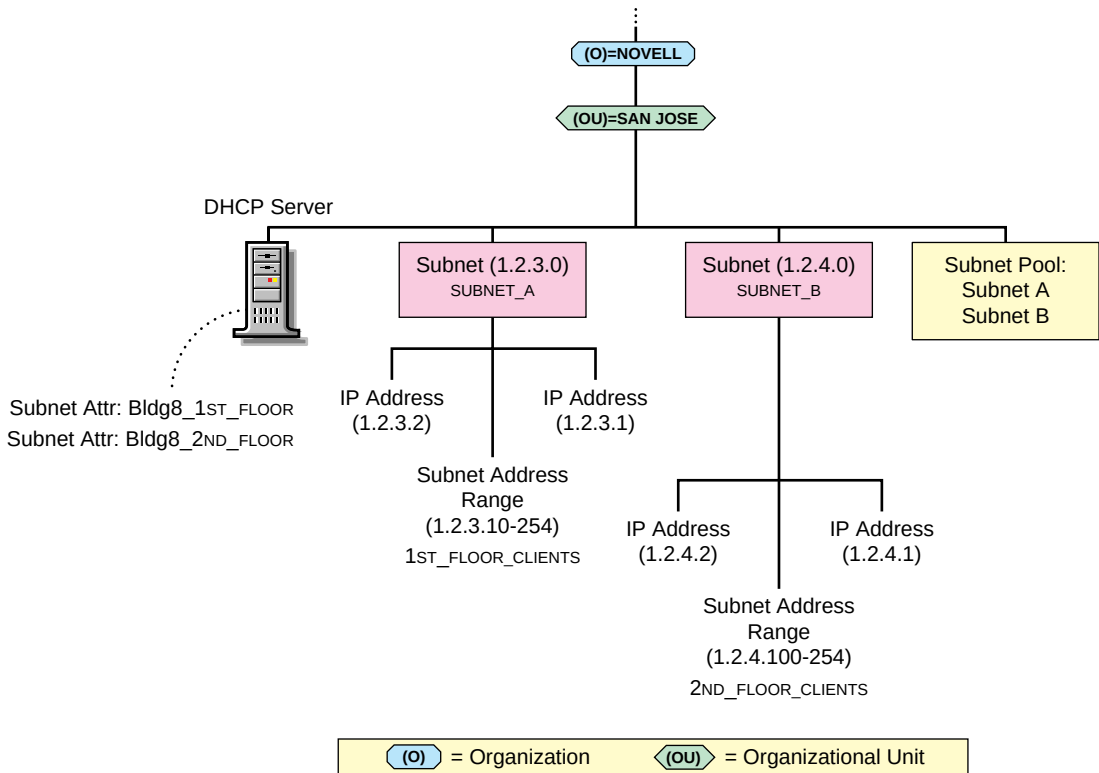
eDirectory Objects for DHCP

The following new eDirectory objects support DHCP:

- ♦ Subnet object
- ♦ Address Range object
- ♦ IP Address object
- ♦ DHCP Server object
- ♦ Subnet Pool object

Figure 2 on page 25 shows a basic configuration of the DHCP objects. This structure might be used for a small to medium size network.

Figure 2 eDirectory Objects for DHCP



Subnet Object

The Subnet object represents a subnet and is the most fundamental DHCP object. The Subnet object can be contained in an Organization (O), an Organizational Unit (OU), a Country (C), or a Locality (L). The Subnet object acts as a container object for the IP Address and Address Range objects. A Subnet object's specific DHCP options and configuration parameters apply to the entire subnet and override global options.

Address Range Object

The Address Range object is primarily used to denote a range of addresses to create a pool of addresses for dynamic address assignment or to identify a range of addresses to be excluded from address assignment. Optionally, the Address Range object stores the start of a hostname that can be assigned to clients when addresses are assigned.

You can use multiple Address Range objects under a Subnet object. You can also specify different range types, such as a range for dynamic address assignment, a range for BOOTP clients, or a range to be excluded from the subnet.

IP Address Object

The IP Address object represents a single IP address. The IP Address object must include an address number and an assignment type. The address can be assigned manually, automatically, or dynamically, or it can be excluded from DHCP address assignment.

You must use the DNS/DHCP Management Utility to configure IP Address objects that are manually assigned or excluded from assignment. For dynamically or automatically assigned client addresses, DHCP creates an IP Address object under the subnet where the address is assigned.

An IP address can be assigned to a client based on the client's MAC address. These IP Address objects can also receive specific DHCP options.

When configuring an individual IP Address object, you can provide specific options that override global options or those set at the subnet level. When you create or modify an IP Address object manually, you can also create the necessary DNS resource records.

DHCP Server Object

The DHCP Server object represents the DHCP server and contains a multivalued attribute listing of the subnet ranges the DHCP server is servicing. The DHCP server also contains all server-specific configuration and policy information. A DHCP Server object can be contained in an O, OU, C, or L.

Subnet Pool Object

The Subnet Pool object provides support for multiple subnets through a DHCP or BOOTP forwarder by identifying a pool of subnets for remote LAN address assignments. A Subnet Pool object can be contained in an O, OU, C, or L.

DHCP servers are not required to be on the local subnet to which they assign addresses. If desired, they can be deployed centrally and service remote subnets. Initial DHCP/BOOTP Discover requests, however, are not sent to a

DHCP server unless a DHCP/BOOTP forwarder that is on the same computer as the client has been configured to forward the addresses.

The Subnet Pool object contains a list of subnet object references and comments.

Understanding DNS

The Domain Name System (DNS) is a distributed database system that provides hostname-to-IP resource mapping (usually the IP address) and other information for computers on an internetwork. 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, refer to:

- ♦ [“DNS Hierarchy” on page 27](#)
- ♦ [“DNS Name Service” on page 31](#)
- ♦ [“Traditional DNS” on page 34](#)
- ♦ [“DNS within eDirectory” on page 36](#)

DNS Hierarchy

DNS uses a hierarchy to manage its distributed database system. The DNS hierarchy, also called the domain name space, is an inverted tree structure, much like eDirectory.

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.

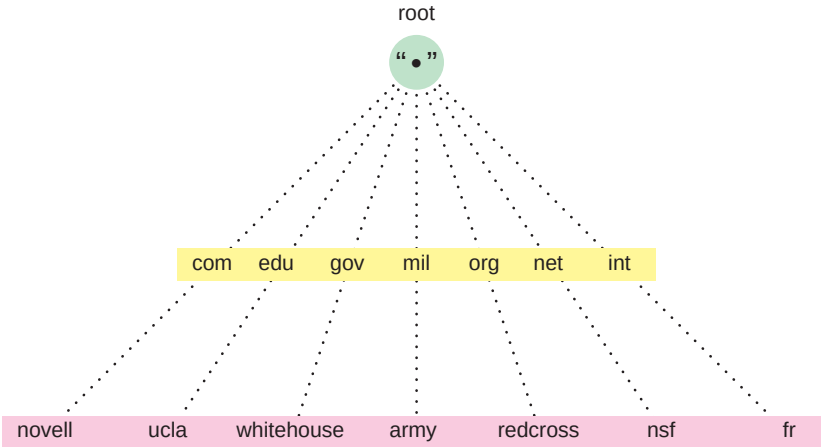
Listed below are the top-level DNS domains and the types of organizations that use them. Below the top-level domains, the domain name space is further divided into subdomains representing individual organizations.

Table 1 **Top-Level DNS Domains**

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

Additional top-level domains organize domain name space geographically. For example, the top-level domain for France is fr. **Figure 3, “DNS Hierarchy,”** on **page 28** illustrates the DNS hierarchy.

Figure 3 **DNS Hierarchy**



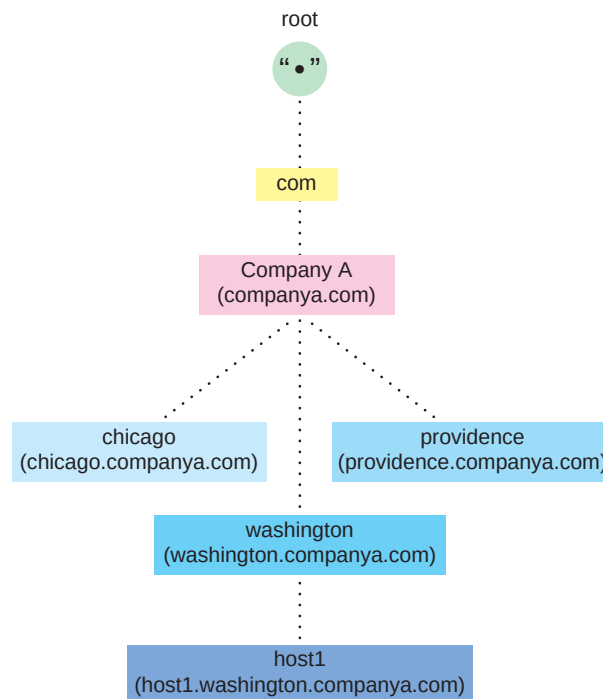
Domains and Subdomains

A domain is a label 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 4, “Domains and Subdomains,” on page 29](#).

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 4 Domains and Subdomains



Domain Names

The domain name represents an entity's position within the structure of the DNS hierarchy. A domain name is simply a list of all domains in the path from the local domain to the root. 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 4, “Domains and Subdomains,” on page 29](#) and the list below.

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

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 4 on page 29](#) is host1.washington.companya.com.

Domain Delegation

Domain delegation gives an organization authority 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.

A group of domains and subdomains for which an organization has authority is called a zone. All host information for a zone is maintained in a single, authoritative database.

For example, 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 authority to create and delegate subdomains.

For example, Company A's Chicago location has its own network administrator. The companya.com administrator delegates the chicago.companya.com zone to the Chicago location and no longer has authority over it. Company A now has two zones: companya.com and chicago.companya.com.

- ♦ `companya.com`, which has authority over `companya.com`, `washington.companya.com`, and `providence.companya.com` zones
- ♦ `chicago.companya.com`, which has authority over the `chicago.companya.com` zone

IN-ADDR.ARPA Domain

The IN-ADDR.ARPA domain (or zone) provides mapping of IP addresses to names within a zone, enabling a client (or resolver) to request a hostname by providing an IP address. Some security-based applications require this function, also known as reverse-lookup.

The file that stores the IN-ADDR.ARPA data is made up of Pointer records and additional name server records, including Start of Authority (SOA) records, similar to 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 1.2.3.4 would require a PTR query with the target address of 4.3.2.1.in-addr.arpa.

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 an internetwork. The name service uses a client-server mechanism in which clients query name servers for host address information.

Name Servers

DNS name servers maintain a database of information about hosts in a specific zone. Each DNS zone must include a name server containing authoritative information about all hosts within the zones it supports. 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 internetwork 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.

Primary Name Servers

One DNS name server in each administrative zone maintains an authoritative database of hostname 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.

All name servers maintain information about how to contact name servers that are at higher or lower levels within the DNS hierarchy. The process of maintaining information about name servers in higher-level domains is called linking to the existing DNS hierarchy. The administrator also enters information into the database about name servers in lower-level domains when creating a subdomain.

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 up, the secondary name server contacts the primary name server and requests a complete copy of the primary name server's DNS database. This process is called a zone transfer.

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

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 record provides the name-to-address mapping for a given host, while a Start of Authority (SOA) record specifies the start of authority for a given zone.

A DNS zone must contain several types of resource records 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 each primary and secondary name server in the zone. The DNS zone must contain NS records to link the zone to higher- and lower-level zones within the DNS hierarchy.

- ♦ Start of Authority (SOA)—Indicates the start of authority for the zone. The name server must contain one SOA record specifying its zone of authority.
- ♦ Canonical name (CNAME)—Specifies the canonical or primary name for the owner. The owner name is an alias.
- ♦ Address (A)—Provides the IP address for the zone.

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
- ♦ An A record that maps each name server specified in the NS records to an IP address

Table 2 lists the types of resource records and their field differences.

Table 2 Resource Record Types and Field Differences

RR Type	Field Differences
A	IP Address, eDirectory context, comments, and version
AAAA	IPV6 address
AFSDB	Subtype and hostname fields
CNAME	Domain name of aliased host
HINFO	CPU and OS fields of up to 256 characters each
ISDN	ISDN address and subaddress fields
MB	Mailbox address domain name
MG	Mail group member domain name
MINFO	Responsible mailbox and error message mailbox
MR	Mail rename mailbox
MX	Reference and exchange fields
NS	DNS server domain name

RR Type	Field Differences
PTR	Domain name
PX	Preference, Map 822 (domain name), and Map x400 fields (domain name in X.400 syntax)
RP	Responsible person's mailbox and TXT RR domain name
RT	Preference and Intermediate fields
SRV	Service, proto, priority, weight, port, and target fields
TXT	Text field for up to 256 characters in multiple strings
WKS	Protocol and bit map fields
X25	PSDN address

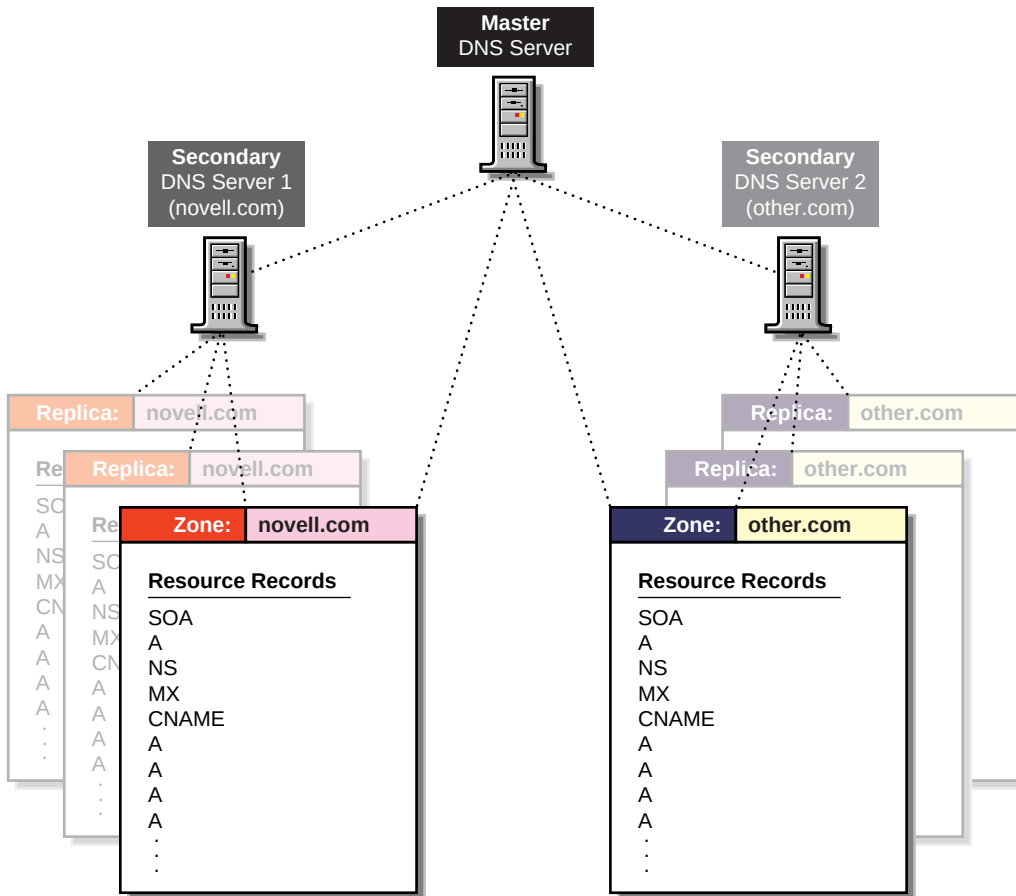
Traditional DNS

In the past, DNS has been administered by building a database of information that includes all of a zone's resource records into a textual file. Novell's earlier support of DNS used Btrieve as its database. Other vendors also use large files to store the information required for a DNS zone. The administration of these files is difficult and cumbersome.

Figure 5 on page 35 represents a traditional DNS strategy. A zone, such as novell.com, uses a master DNS server to handle queries about the entities within it. A DNS server might support more than one zone, and it would probably have at least one secondary server for backup (redundancy) or load-sharing purposes. The master DNS server provides DNS name service for two zones: novell.com and other.com. The secondary DNS server provides backup support for the novell.com zone, and the other secondary DNS server provides backup support for the other.com zone.

Additionally, each name server maintains separate copies of the zone data for primary and secondary support. When changes occur, all of these files require updating with zone transfers, which greatly increases network bandwidth use.

Figure 5 Traditional DNS Structure



The file storing the RRs 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.

When a client initiates a request to resolve a domain name to an IP address (perhaps by using an Internet browser or by sending e-mail), the client sends a query to the name server specified in the client's configuration. The name server that receives the query searches its authoritative zone information for the desired record. If the record cannot be found, the name server will forward the query up the hierarchy to the name server above it for resolution.

When updates are made to the master name server, the entire contents of the database file must be copied to any secondary name servers.

DNS within eDirectory

Novell has integrated DNS into eDirectory by extending the eDirectory schema and creating new eDirectory objects to represent zones, RRsets, 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, refer to [“New eDirectory Objects for DNS” on page 22](#).

By integrating DNS into eDirectory, Novell has shifted away from the traditional concept of primary or secondary DNS name servers to the concept of a primary or secondary zone.

In traditional DNS, all configuration changes are made on a single primary name server. When changes have been 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, Novell's 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.

Novell's DNS supports the traditional primary-secondary DNS name server approach to moving DNS data in and out of eDirectory. Although all Novell 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 DNS transfer.

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.

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 DNS updates from a NetWare 6 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 6 illustrates a Novell server as the primary DNS name server and primary and secondary zones within eDirectory. In this example, there are two primary zones. Any of the Novell DNS servers assigned to a zone are able to respond to queries for the zone. For each zone, one server is designated by the administrator to act as the DDNS server. In this example, Server1 is the Designated DNS server for Zone 1 and Server3 is the Zone In server for the secondary zone called Foreign Zone. Server 2 provides DNS services for Zone 1 and Zone 2, but does not perform DDNS updates or zone transfers. Server 3 occasionally requests zone transfers from the foreign server and places the modified zone data into eDirectory, where any of the Novell servers can respond to queries for it.

Figure 6 Novell Server As a Primary DNS Server

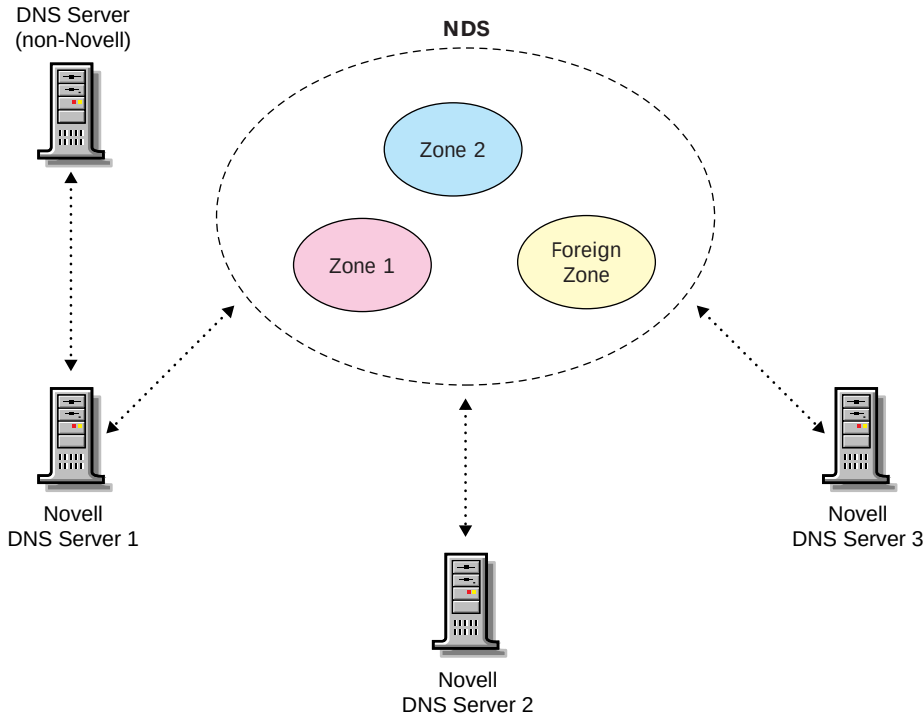
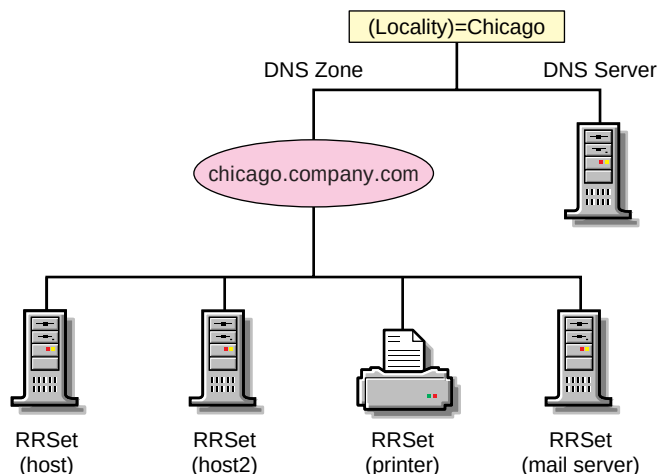


Figure 7 shows a representation of eDirectory objects within a DNS zone.

Figure 7 DNS Zone



DNS Master File

A DNS master file contains resource records that describe a zone. When you use the DNS/DHCP Management Utility to build a zone, the DNS objects and their attributes translate into resource records for that zone.

You can use the DNS/DHCP Management Utility to import a DNS master file if it conforms to IETF RFCs 1035, 1036, and 1183 and is in BIND master file format. A sample DNS master file is shown in the following example.

```
$ORIGIN sjf.novell.com. @ soa
sjfns.sjf.novell.com. Smith.novell.com (
1996091454 3600 300 604800 86400 ) ns
sjfns.sjf.novell.com. ns ns.novell.com. mx
5 sjf-mx.idz.sjf.novell.com. $ORIGIN
sjf.novell.com.sjfns a 123.45.67.89bsmith a
123.45.68.103; End of file
```

Understanding 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.

NOTE: In this document, the term host refers to a network device that requires an IP address and might have a hostname.

When the DHCP server is loaded, it reads its configuration information from eDirectory and stores the information in its cache. As the DHCP server assigns addresses to clients, it updates eDirectory, adding IP address objects or modifying their eDirectory status information. The DHCP server can be configured to maintain an audit log of this activity. For information about maintaining an audit log of DHCP server activity, refer to [“Configuring DHCP Auditing” on page 108](#).

The network administrator can use the DNS/DHCP Management Utility to view objects to see how addresses have been assigned.

For more information, refer to:

- ◆ [“IP Address Allocation” on page 40](#)
- ◆ [“Managing the Database” on page 42](#)
- ◆ [“DHCP Options” on page 43](#)
- ◆ [“Dynamic DNS” on page 46](#)
- ◆ [“Compatibility with BOOTP” on page 47](#)
- ◆ [“Using a BOOTP Relay Agent” on page 47](#)
- ◆ [“SNMP Event Generation” on page 49](#)
- ◆ [“DHCP Auditing” on page 50](#)

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.

DHCP supports three methods of IP address allocation:

- ♦ Dynamic BOOTP allocation
- ♦ Dynamic DHCP allocation
- ♦ Manual (or static) allocation

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 will be 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 to dynamic DHCP allocation is that when a client's lease is renewed, the DHCP server refreshes the client's configuration.

Manual Allocation

Use Manual or static allocation to assign addresses to DHCP or BOOTP clients using the DNS/DHCP Management Utility. A specific IP address is assigned to the client based on an identifier such as the client's hardware 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.

Lease Options

A client acquires a lease for a fixed period of time. The length of the lease could be a number of hours or days, or it could 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 scarcity of IP addresses and must reassign them, the DHCP server will reassign 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.

IMPORTANT: Address duplication sometimes occurs with Windows 95 clients. If a Windows 95 client receives a response indicating that the assigned address is in use by another device, a message indicates the IP address conflict. However, the client does not send a DHCPDECLINE message as required by RFC 1534, section 4.4.1.

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.

Managing the Database

The Lease Time attribute of the Subnet object enables a dynamic DHCP client to specify a lease time for the entire subnet. Lease expiration time can be modified for each manual IP address allocation.

An IP address can be returned to a DHCP server for one of the following reasons:

- The address is explicitly released by a DHCP client.
- The address is implicitly released because the lease has expired.
- An assigned lease is canceled by the DNS/DHCP Management Utility.

If a DHCP client requests an IP address on the same subnet again before the previously assigned address expires, the same address is provided. If the IP address assignment is for a different subnet but the client already has a valid IP address entry in the DHCP server database, three possible actions can occur, depending on the IP Address Assignment Policy attribute of the DHCP server. The three possible actions are listed in [Table 3](#).

Table 3 IP Address Assignment Policy

IP Assignment Policy	DHCP Server Action
Delete Duplicate	If the client moves to another subnet supported by the same DHCP server, delete any previous IP address assigned to the client, release the original address back to the pool, and assign a new address.
Allow Duplicate	If the client moves to another subnet, assign the new address and leave the old address unchanged in the database.
No Duplicate	If the client moves to another subnet and the old address is still valid, do not assign a new address.

The address deletion might delete a permanent IP object that is dynamically or manually assigned. Therefore, a client with a Delete Duplicate policy can have a walking manual IP object, but it cannot walk out of the service scope of a single DHCP server. For a DHCP server to assign an address to a walking manual IP object, the address assignment must be from a DHCP server's reserved Subnet Address Range with Range Type set to Dynamic DHCP, Dynamic BOOTP and DHCP, or Dynamic DHCP with Automatic Hostname Generation.

The DHCP SRVR.NLM software supports local address assignments that obtain IP addresses from multiple local subnets. For example, a DHCP server might have multiple IP addresses bound to one of its network interface cards. Each address is a server address on a separate subnet. No special configuration of the eDirectory database is required.

The DHCP SRVR.NLM software also supports remote address assignments that obtain IP addresses from multiple remote subnets. This feature requires all such subnets to be identified with a Subnet Pool object.

DHCP Options

Novell DNS/DHCP Services supports vendor options, DHCP options, and BOOTP parameters as defined in Internet RFC 2132 with a few exceptions. Novell DNS/DHCP Services supports new options defined for NetWare over TCP/IP and existing NetWare/IP options.

NOTE: The following options are not supported in this release of Novell DNS/DHCP Services: 56, 57, 60, 66, and 67. Although options 66 and 67 are not supported, the equivalent BOOTP parameter function is provided.

Assigning Options

DHCP and BOOTP options can be assigned at three levels:

- ♦ Globally
- ♦ At the subnet level
- ♦ IP address level

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 all three levels for the client on the subnet, as shown in [Table 4](#).

Table 4 Example of DHCP Options Assignment

Level	Option	Value
Global	1, Subnet Mask	255.255.0.0
	3, Router	132.57.3.8
	4, Time Server	129.23.120.5

Level	Option	Value
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
IP Address	7, Log Server	Null
	13, Boot File Size	256

Table 5 lists the effective options for the client with the IP address referred to in the preceding table.

Table 5 Client's Effective Options

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

DHCP Options for eDirectory

Novell has defined three DHCP options for eDirectory. 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.

Refer to Internet RFC 2241, *DHCP Options for Novell Directory Services*, for more detailed information about using these options in NetWare 6.

NetWare/IP Options

Novell uses option codes 62 and 63 in the DHCP packet for Netware/IP. Option 62 contains the Netware/IP domain name.

Option 63, the IPX Compatibility option, contains general configuration information such as the primary DSS, preferred DSS, and the nearest servers. Option 63 provides additional information in the form of sub-options, listed in [Table 6](#).

Table 6 **IPX Compatibility Suboptions**

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.
12	Identifies network number of the virtual IPX network created by the IPX Compatibility feature.
13	The IPX Stale Time suboption specifies the minimum interval in minutes that must expire before hosts try to refresh their Migration Agent addressing information.
14	Specifies the addresses of one or more Migration Agent servers for the IP nodes to use for communicating with IPX Nodes.

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

Dynamic DNS

The Dynamic DNS (DDNS) feature of Novell DNS/DHCP Services 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 name space. These resource records are required so that both name-to-address and address-to-name DNS resolutions can be made. DDNS eliminates the need for further error-prone configuration of DNS for each host address change.

Enable DDNS by configuring a subnet address range with the Always Update parameter set to on. You must also specify a zone reference in the Subnet object so that the DHCP server can determine which zone to update.

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. If a lease is renewed, no action occurs because none is necessary.

Only subnet address ranges whose assignment type is either Dynamic DHCP or Dynamic BOOTP and DHCP can use the Dynamic DNS update feature. For a DDNS update to occur, the Always Update parameter of the range must be enabled and a DNS zone must be specified to link the Zone object to the subnet. When these conditions are met, the DHCP server initiates a dynamic DNS update when assigning an address to a client.

When the DHCP server grants a lease to a client that is subject to DDNS updates, the server updates its 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.

Compatibility with BOOTP

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. Novell has extended support for BOOTP to provide Dynamic BOOTP support. A pool of addresses can be set up for BOOTP address assignment so that each BOOTP address does not have 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 clients' initialization software. Some new, additional options optimize DHCP client-server interaction.

There are two primary differences between DHCP and BOOTP. 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. Additionally, DHCP provides a method for a client to acquire all the IP configuration parameters it requires to operate.

If multiple servers service a single subnet, only one server, 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 Novell server on a subnet can run the BOOTPFWD.NLM. The DHCP service in Novell DNS/DHCP Services provides relay agent functions as specified in the BOOTP protocol specification (Internet RFC 951).

When a client starts up, 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.

NOTE: The BOOTP protocol, unlike DHCP, does not provide a mechanism for a client to accept only a single offer of an IP address; therefore, the DNS/DHCP Management Utility allows only the server that is specified as the default server in a Subnet object to be assigned to any address ranges that include BOOTP addresses. If you want to assign other servers to the address ranges, you should change the address range type so that it doesn't include BOOTP. If the range type includes BOOTP, you will not be allowed to change the DHCP server assigned to the range.

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 Subnet Pool 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 subnet pool, the collection of addresses available in configured subnet address ranges are available to all clients (DHCP or BOOTP) on that physical subnet. This is the primary use of the subnet pool.

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

SNMP Event Generation

You can use the DNS/DHCP Management Utility to set up SNMP event generation in the case of critical, major, warning, or minor events. The default setting is Major, which causes the server to log all major and critical events.

Critical events are those that cannot or should not be ignored by the network administrator. Major events denote a significant change in the state of the server processing. Warning and Minor events are logged for maintenance and diagnosis only. Warning and Minor events should not be turned on unless a problem has developed.

All Critical and some Major events are logged on the local server console.

The following warning events can be logged or trapped for SNMP event generation:

- ◆ An eDirectory update to the subnet failed, causing degraded operation (incomplete transactions are logged to a local file named DHCPLOG.LOG).
- ◆ SNMP recovered from an internal fault and the error code was logged.
- ◆ A subnet was not configured and addresses are not available, causing degraded operation.

The following minor events are logged and/or trapped for SNMP event generation:

- ◆ A Decline was generated against an IP address.
- ◆ All logged file transactions have been reprocessed (operational).

Major events are logged or trapped for SNMP event generation. For example, when the DHCP SRVR NLM is loaded and the server is operational and ready for LAN-based clients.

The following events are logged or trapped for SNMP event generation:

- ◆ The logger cannot open the recovery log file or is having difficulty opening it. (The server is inoperative.)
- ◆ The main thread cannot process lease expiration. (The server is inoperative.)

DHCP Auditing

Auditing can be used to perform an analysis of historical data and to help diagnose operational difficulties. Auditing uses a Btrieve database to store and manage data enabling meaningful trend analysis.

When auditing is enabled, every incidence of address deletion, addition, and rejection is recorded in the audit log. The beginning and end of each session is marked to help make sense of the audit log. The beginning session contains records defining the session in terms of addresses already assigned.

Additionally, other major events or alert situations that cause SNMP traps are also audited. Other incoming DHCP requests are also logged, including honored renewal requests and those rejected or dropped.

Console and Debug Logs

The following types of console log entries are generated by both DNS and DHCP:

- ♦ Load success or failure
- ♦ Unload results normal or abnormal
- ♦ Major SNMP events

For each NetWareAlert message generated, an entry is provided in the / SYSTEM/SYS\$LOG file.

The DHCP server provides a foreground screen log of every packet received and each reply generated to maintain continuity with the DHCP 2.0 server. The screen provides a useful real-time indication of DHCP 3.0 server operations.

The DHCP server has a debug log feature (primarily used by Novell technical support and engineering groups) that records the exchange of DHCP messages to a screen log or the DHCP SRVR.LOG file (in ASCII text) in the server's \ETC\DHCP directory. When loading the DHCP SRVR, the administrator can use one of three flags to activate the debug log feature. [Table 7, “Debug Log - Use of Flags,” on page 51](#) explains the use of the flags.

Table 7 Debug Log - Use of Flags

Flag	Use
-d1	Turns on a background screen log of DHCP packets
-d2	Turns on a background screen log of Debug statements and DHCP packets
-d3	Turns on a background screen log of Debug statements and DHCP packets and writes the log to the server's \\ETC\DHCP\DHCP\SRVR.LOG file

Understanding the DNS/DHCP Management Utility

This section provides information about the DNS/DHCP Management Utility, the Web-based utility used to configure and manage eDirectory-based DNS and DHCP.

The DNS/DHCP Management Utility can run on any browser workstation and does not require the Novell client or any installed component as a prerequisite. It operates within the common eDirectory Management framework and is thus tightly integrated with Netware 6.

Separate Web-based utilities provide configuration and management for the two major functions of the DNS/DHCP Management Utility: IP address management and name service management. Each utility is self-contained and can provide the functions necessary to conduct address or name management.

eDirectory is used as a database to store the administered IP address and name service objects.

The Locator object is created at the time of Netware 6 installation, if you choose the DNS/DHCP option. The Locator object serves as the catalog for most of the DNS and DHCP objects; therefore, the DNS/DHCP Management Utility is not required to search or scan the entire eDirectory tree to collect all the DNS and DHCP objects for initial tree display.

The creator of the Locator object should grant Read and Write rights to this object to the network administrators. They will use the DNS/DHCP Management Utility to create, update, or delete any DNS or DHCP objects. This allows the contents of the Locator object to be updated when necessary.

For more information, refer to [“Overview of Interface Interaction” on page 52](#).

Overview of Interface Interaction

The DNS/DHCP Management Utility manages one eDirectory tree at a time.

When the DNS/DHCP Management Utility is started in the browser, the first interface screen you see is the login screen. You are prompted to enter your username, password, eDirectory context and the eDirectory tree whose objects you wish to manage.

Administration authentication in the DNS/DHCP Management Utility is based on the common authentication mechanism provided by the underlying eDirectory Management Framework (iManage) architecture.

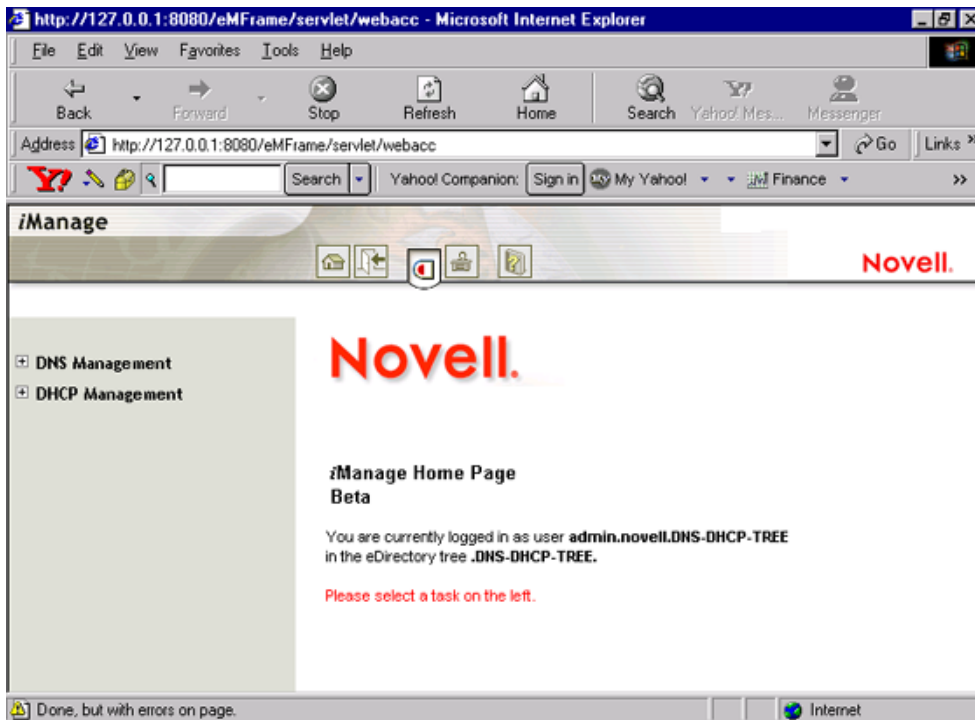
To manage objects in a different eDirectory tree, you must log in to the utility again, specifying the eDirectory tree you want to access. Your login identity is displayed on the top of the screen.

The DNS/DHCP Management Utility Interface

The DNS/DHCP Management Utility is a Web-based utility and runs within a Web browser window.

In the DNS/DHCP Management Utility, DNS and DHCP administration are role-based services managed through a set of predefined roles and tasks.

Figure 8 The DNS/DHCPManagement Utility Interface



The main screen has three parts: a taskbar on the top of the screen that displays icons for top-level management functions and is part of the common iManage-based utilities in Netware 6, a left panel that displays roles, tasks and other administrative functions, and a main panel that allows you to manage role-based and administrative tasks. For more information on the taskbar, refer to “Taskbar” on page 53. For more information on roles and tasks, refer to “Roles and Tasks” on page 54.

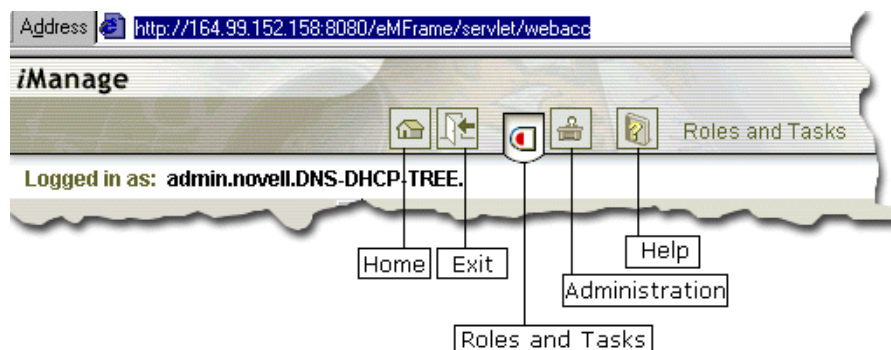
Taskbar

The DNS/DHCP Management Utility shares a common taskbar with other Netware 6 products that are based on the eDirectory Management Framework. Figure 9 on page 54 shows the iManage taskbar. The taskbar displays the following icons:

- ◆ Home: Takes you to the home page of the utility
- ◆ Exit: Allows you to logout of the utility

- ♦ Roles and Tasks: Displays the roles and tasks on the left panel
- ♦ Administration: Enables you to carry out role installation and role management
- ♦ Help: Launches global help for the utility

Figure 9 The iManage Taskbar



Each button on the taskbar has roll-over help associated with it; if you position the cursor over the icon, the icon's name appears on the task bar, to the right of the Help icon.

Roles and Tasks

The DNS and DHCP services have been logically organized into roles and tasks in a way that is intuitive to network administrators. Each role consists of a set of tasks arranged in a hierarchical and top-down manner that is easy to administer.

To view the roles, click the Roles and Tasks icon on the taskbar.

At the top level, there are two roles that you can install and manage: DNS Management and DHCP Management. The tasks under each of these roles are logically arranged in a top-down manner. A role, depending on its current state, is preceded by a plus or a minus sign. An administrator can expand a role such as DNS Management to see the tasks it contains or collapse it for a more concise view. This can be done by clicking the plus/minus sign next to the role.

The organization of roles and tasks follows the containership rules of object creation and manipulation in DNS and DHCP. For example, if you expand the DNS Management role on the left pane, the logical tasks this role contains

appear under it. At the top is the task DNS Server Management . This is followed by DNS/DHCP Scope Settings that allows you to specify the location of the Locator object, and the administrative scope for the session. At the following level is Zone Management, which provides the next level of DNS entity management that is, managing zones handled by DNS Servers. Finally Resource Record Management allows you to manage resource records contained within a zone.

Each task is associated with a set of operations that appear in a drop-down menu on the main panel when you click on the task..

For example, to create a new DNS zone, click DNS Management > Zone Management. This launches the Zone Management window on the main panel of the screen. Select Create Zone from the drop-down menu and click OK. This opens the Create New Zone window where you can proceed with the task of creating a new zone.

Object Creation Rules

There are certain rules that govern the creation and manipulation of objects in the DNS/DHCP object hierarchy.

Subnet and Subnet Pool objects can be created under O, OU, L, or C objects. Subnet Address Range and IP Address objects must be created beneath the Subnet container object. However, because of the IP address of an IP Address object, the subnet address range and IP Address objects can be contained within a subnet address range's address block. The DNS Zone object, DNS Server object, and DHCP Server object can be created in the context of an O, OU, L, or C.

All DNS and DHCP objects are created as NDS objects and are subject to NetWare Administrator convention.

Some objects, such as DHCP server, DNS server, DNS zone, Subnet, and Subnet Pool, can be created in any context.

After a new DNS or DHCP object has been created, the DNS/DHCP Management Utility 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, subnets, and DHCP servers are added to the corresponding attribute of the Locator object. Renaming or deleting these objects is automatically performed by NDS because of the built-in feature for NDS distinguished names.

2

Planning

This chapter provides a summary of issues for you to consider as you plan and design your implementation of and maximize the DNS and DHCP capabilities of the Novell® DNS/DHCP Services software.

eDirectory Considerations

When installed and configured, the DNS and DHCP servers extend the eDirectory™ schema to create new objects with which to administer and control their services. The DNS/DHCP Group and Locator objects are central to Novell's implementation of DNS and DHCP.

For information on installing the DNS/DHCP Management Utility, refer to [“Installing the DNS/DHCP Management Utility” on page 118](#).

We recommend that you place the DNS/DHCP Group, DNS/DHCP Locator, and the RootServerInfo Zone objects in a separate partition that is accessible from and replicated to all points of the network where Netware® 6 DNS/DHCP servers are located. Although changes to the DNS/DHCP Group and Locator objects occur infrequently (only when you add or delete new servers, zones, or subnets), all Netware 6 DNS/DHCP servers and the DNS/DHCP Management Utility require access to these objects.

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

- ♦ Where to locate the DNS/DHCP Group and Locator objects
- ♦ Where to locate DNS and DHCP servers
- ♦ What replication strategy to employ
- ♦ How to provide fault tolerance

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/DHCP Group and Locator objects and the RootServerInfo Zone object under the container object.

Plan to create an Administrator Group object under this container also. An administrator group should have Read and Write rights to all DNS/DHCP Locator object attributes except the global data and options fields. Members of this group can use the DNS/DHCP Management Utility to create and modify DNS and DHCP objects.

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

Plan to locate your DNS and DHCP servers at locations where they are geographically close to the hosts that require their services. Plan to 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/DHCP Group and Locator objects to all parts of the network that use DNS/DHCP services to ensure 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/DHCP services.

Planning a DNS Strategy

Plan to install and operate a primary name server and at least one secondary name server. Secondary name servers provide load balancing and robustness to your DNS implementation.

When you configure your zone, the primary name server is considered authoritative for the zone, meaning that it 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 up 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.

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 creating subzones within the zone.

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 the case of server down time.

Novell DNS Server as a Primary Name Server

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

When operating the Novell DNS server as a primary name server, you use the DNS/DHCP Management Utility to make configuration changes. When you operate a primary name server, the zone data can receive dynamic updates from DHCP servers. Non-Novell secondary name servers can transfer data in from the Novell primary name server.

Novell DNS Server as a Secondary Name Server (to a Non-Novell Master)

If you plan to operate secondary DNS servers using Novell DNS/DHCP Services software to a non-Novell master name server, one Novell secondary name server must be specified as the Dynamic DNS (DDNS) or *zone in* server. The DDNS server receives zone transfer information from the non-Novell master server and provides updates to eDirectory. Other Novell secondary name servers can then access the information within eDirectory.

Reasons for operating a Novell secondary name server to a non-Novell master name server include:

- ♦ 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.

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, refer to:

- ♦ [“Forwarding Requests for Unknown Addresses” on page 60](#)
- ♦ [“Restricting Forwarding” on page 61](#)

Forwarding Requests for Unknown Addresses

When you configure your name servers, you provide information about where to forward requests that the servers cannot answer. If you are configuring to use forwarders, you provide the names and IP addresses of servers above your location in your domain. Configure your other name servers to issue queries to the forwarders for queries they 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

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 to not 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.

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 would be *4.30.20.100.in-addr.arpa* in the IN-ADDR.ARPA subdomain.

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 your 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 (and 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 <http://rs.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.

Planning a DHCP Strategy

This section provides information to help you plan your DHCP strategy. When planning your implementation of DHCP, consider the following issues:

- ♦ Your existing network topology, that is, how you set up your routers and subnets, provides a basic configuration for the distribution of DHCP resources such as Subnet objects, Subnet Address Range objects, and IP Address 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.

Network Topology

Your existing network topology provides a basic configuration for the distribution of DHCP resources. There are two paths, however, depending on whether you are migrating from an existing DHCP solution or you are installing and configuring DHCP for the first time.

For more information, refer to:

- ♦ “Migrating from Another DHCP Solution” on page 62
- ♦ “Initiating the DHCP Service” on page 63

Migrating from Another DHCP Solution

You can import your existing Novell DHCP 2.0 database or BOOTP-based configuration files using the DNS/DHCP Management Utility. The import function enables you to specify the context into which you import the data.

Initiating the DHCP Service

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 subnet address ranges for contiguous network addresses and other, more specific information. You will probably have a separate subnet address range for each LAN segment of your network. You will also create objects of subnets and DHCP servers.

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 DNS/DHCP Group and Locator objects under the container object.

The DNS/DHCP Locator object must be easily accessible to all DHCP servers on the network. Plan to have multiple routes for DHCP servers to access the DNS/DHCP Group object.

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

Place the NetWare Core Protocol™ (NCP™) servers that will provide DHCP service near the data to be updated and close to a writable partition. 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.

When a DHCP server makes or modifies address assignments, the database is updated. The partition where this database is stored should have at least two writable replicas. Only one replica might be unsafe because of fault tolerance

considerations, but three might be too costly in terms of eDirectory performance.

Lease Considerations

Many factors must be considered when you decide how long to set your client leases. Issues you must consider include the following:

- ♦ 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 half-way 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 workstation power off 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.

For more information, refer to:

- ♦ [“Considering the Length of Leases” on page 65](#)
- ♦ [“Controlling Client Access to Leases” on page 67](#)

Considering the Length of Leases

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 users than IP addresses?

If you have more users than IP addresses, keep leases short to allow access to more users. A short lease could be 15 to 30 minutes, 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 covers that situation.

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

If you have users 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 (three weeks or two months, for example).

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.

Table 8 lists examples of lease times and reasons why these times were chosen.

Table 8 **Lease Time Examples**

Lease Time	Rationale
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

Lease Time	Rationale
6 hours	Covers a DHCP server outage of 6 hours
12 hours	Ensures that retraction of address assignment takes less than one day
3 days	Used by many sites simply because of software defaults
6 days	Affords 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 usually is a trade-off when an attempt is made to control specific client access to leases. Typically, you would manually configure each client and dedicate an IP address permanently to each client. Novell's DHCP server, however, provides control based on the client's hardware address.

IP Address Availability

This section describes how to identify your IP addresses, how to subnet your addresses, what to do with addresses assigned by other sources, and how to restrict address assignments to clients.

Identifying Your Addresses

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

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

Subnetting Your Addresses

One of the more difficult configuration tasks concerns 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 also must 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 using DHCP.

To ensure that the assigned addresses are not used by DHCP, use the DNS/DHCP Management Utility to exclude the addresses from assignment. You can use the utility to exclude single addresses or entire ranges from address assignment.

Representing Addresses in eDirectory

IP addresses are represented by IP Address objects under Subnet container objects. Novell DNS/DHCP Services stores address information and attributes of these objects, such as hostnames, hardware addresses, the time when an address lease will expire, and fully qualified domain names (FQDNs), in eDirectory. You can view this information using the DNS/DHCP Management Utility.

Restricting Address Assignment to Clients

By using static address assignment, you can ensure that a device, capable of acting as a BOOTP or DHCP client, receives the same address from the DHCP server each time it is started. You can also explicitly exclude an address assignment to a device based on the device's hardware address. This is done by setting DHCP Global Preferences. To invoke the DHCP Global Preferences window, click DHCP Global Configuration > DHCP Global Preferences.

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.

Some simple rules are required for hostnames for conformance 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.

3

Setting Up

This document provides information about configuring DNS and DHCP, and importing and exporting database information.

Configuring DNS

The DNS/DHCP Management Utility provides a common Web-based interface for configuring both DNS and DHCP.

For information on installing the DNS/DHCP Management Utility, refer to [“Installing the DNS/DHCP Management Utility” on page 118](#).

For DNS configuration instructions, refer to:

- ♦ [“Importing DNS Configuration Information” on page 74](#)
- ♦ [“Setting Up DNS” on page 74](#)
- ♦ [“Detailed DNS Configuration” on page 76](#)
- ♦ [“Configuring DNS Features” on page 85](#)

Required eDirectory Rights to Manage DNS/DHCP Configuration

To manage Novell® DNS/DHCP Services, administrators require sufficient eDirectory™ rights, depending on the type of operation to be performed.

Administrators who will add new objects and modify existing objects require Add rights to the appropriate eDirectory container object. The following table summarizes rights requirements for creating new configuration objects and modifying existing objects.

DNS/DHCP Objects	Object Rights	All Property Rights
Locator object	Browse	Supervisor
Group object	Browse	Supervisor
Existing objects	Supervisor	Supervisor

Administrators who manage a given set of DHCP subnets or DNS zones require rights to create or delete IP addresses, ranges of addresses, or resource record sets. The following table lists the rights requirements of administrators who perform these tasks.

DNS/DHCP Objects	Object Rights	All Property Rights
Locator object	Browse	Read
Group object	Browse	Read
Existing objects	Browse, Create, Delete	Supervisor

Administrators or users who need to view DNS/DHCP configuration require rights as summarized in the following table.

DNS/DHCP Objects	Object Rights	All Property Rights
Locator object	Browse	Read
Group object	Browse	Read
Existing objects	Browse	Read

DNS/DHCP Scope Settings

For better performance results with the DNS/DHCP Management Utility particularly in a distributed DNS/DHCP set-up, you should configure the DNS/DHCP Scope Settings for the session before you proceed with other administrative tasks.

If you do not configure the DNS/DHCP Scope Settings for the session, you will receive a warning before every task you attempt to perform that the Scope Settings are not set. You can however, still proceed with the task.

Setting the scope of the DNS/DHCP services involves two specifications for the session: the eDirectory context of the Locator object, and the administrative scope of the session. Specifying the eDirectory context of the Locator object at the start of the session significantly improves performance because it eliminates the need to search for the Locator object. Specifying the administrative scope of the session also improves performance significantly because it restricts the retrieval of DNS/DHCP objects for viewing to the scope you specify.

The DNS/DHCP Scope Settings you configure for a session last as long as the session lasts. If you start a fresh session, you have to configure the DNS/DHCP Scope Settings afresh.

IMPORTANT: If you configure DNS/DHCP Scope Settings for a session for either DNS Management or DHCP Management, the settings apply across the session to both roles.

To configure DNS/DHCP Scope Settings, complete the following steps:

- 1** Click DNS Management or DHCP Management > DNS/DHCP Scope Settings to open the DNS/DHCP Scope Settings window.
- 2** Enter the eDirectory context of the DNS/DHCP Locator object.
- 3** Enter the eDirectory context of the container object that will provide the administrative scope of the current session.

NOTE: If you enter only the eDirectory context of the DNS/DHCP Locator object and not the administrative scope of the current session, you can proceed with administrative tasks without inviting a warning message. Performance however, is further optimized if you also define the administrative scope.

- 4** Click OK.

Importing DNS Configuration Information

You can use the Novell DNS/DHCP Management Utility to import existing DNS configuration information. The DNS information should be in DNS BIND Master file format.

To import existing DNS configuration information using the Management Utility, complete the following steps:

- 1** Open the DNS/DHCP Management Utility in a browser window.
- 2** Click DNS Management > Import DNS File.
This opens the Zone Management window in the main panel.
- 3** Select Import Zone from the drop-down menu > Click OK.
This opens the Import DNS Zone window.
- 4** Enter the eDirectory context of the server or browse to select it.
- 5** From the Select DNS Server name, select a target DNS Server that will subsequently manage the zone data.
- 6** Choose either Primary or Secondary to specify the Zone type. If you choose Secondary as Zone type, you must type the IP address of the zone server so that zone transfers can take place.
- 7** Enter the DNS BIND formatted filename in the DNS Bind File field. You can also browse to select the file to import from the Choose File dialog box.
- 8** Click OK to import the file.
- 9** Click Import.

Setting Up DNS

This section provides the following procedures required to accomplish a basic DNS setup:

- ♦ [“DNS Prerequisites” on page 75](#)
- ♦ [“Loading the DNS Server” on page 75](#)
- ♦ [“Configuring Clients to Use DNS” on page 75](#)
- ♦ [“Creating a DNS Server Object” on page 76](#)
- ♦ [“Creating a Primary DNS Zone Object” on page 79](#)

DNS Prerequisites

The following steps must be completed before setting up DNS:

1. Install Novell Netware® 6 on the selected server or servers.
2. Install iManage on the Netware machine.
3. Install Internet Explorer 5.0.

Loading the DNS Server

After you have created and set up a DNS Server object and a DNS Zone object, enter the following command at the DNS server console:

LOAD NAMED

After NAMED.NLM is loaded, the DNS server can respond to queries for the zone. For more detailed information about NAMED.NLM command line options, refer to [“NAMED Command Line Options” on page 111](#).

After NAMED.NLM is loaded, you can use the DNS/DHCP Management Utility to start and stop the DNS Server. For more information on starting and stopping the DNS server, refer to [“Starting/Stopping the DNS Server” on page 78](#).

Configuring Clients to Use DNS

NOTE: This section does not describe how to enable all the available features. For detailed configuration information, refer to [“Detailed DNS Configuration” on page 76](#).

To configure Windows NT or Windows 95 client workstations to use DNS, complete the following steps:

- 1** At the client desktop, click Start > Settings > Control Panel, and then double-click Network.

The Network window opens, listing the network components installed on the client workstation.

- 2** Select TCP/IP, then click Properties.

The TCP/IP Properties window is displayed.

- 3** Click the DNS Configuration tab.
- 4** Provide a hostname and domain name for each client.

- 5** Enter the IP address of DNS servers for this client in the search order of preference, then click OK.

The client can now send DNS queries to the DNS name server.

Detailed DNS Configuration

This section provides detailed information about configuring DNS objects using the DNS/DHCP Management Utility. All the procedures in this section assume that you have already launched the utility and used the eMFrame administration options to install the two role-based services, DNS Management and DHCP Management. The procedures in this section are:

- ♦ “Creating a DNS Server Object” on page 76
- ♦ “Modifying a DNS Server Object” on page 77
- ♦ “Creating a Zone Object” on page 78
- ♦ “Creating a Primary DNS Zone Object” on page 79
- ♦ “Creating a Secondary DNS Zone Object” on page 79
- ♦ “Creating an IN-ADDR.ARPA Object” on page 80
- ♦ “Creating a Primary IN-ADDR.ARPA Zone Object” on page 80
- ♦ “Creating a Secondary IN-ADDR.ARPA Zone Object” on page 81
- ♦ “Modifying a Zone Object” on page 82
- ♦ “Creating Resource Records” on page 83
- ♦ “Modifying Resource Records” on page 84

Creating a DNS Server Object

Use the DNS/DHCP Management Utility to create and set up a DNS Server object for each DNS server you plan to operate.

To create and set up a DNS Server object, complete the following steps:

- 1** Click DNS Management > DNS Server Management to open the DNS Server Management window in the main panel.
- 2** Select Create Server from the drop-down menu > click OK to open the Create DNS Server window.
- 3** Enter a server name, or browse to select a server from the eDirectory tree.

- 4** Enter a unique host name for the DNS server object.
- 5** Enter a domain name for the server object.
- 6** Click Create.

A message indicates that the new DNS server was created.

Modifying a DNS Server Object

After you create a DNS Server object you can modify its configuration parameters. To do so, complete the following steps:

- 1** Click DNS Management > DNS Server Management to open the DNS Server Management window in the main panel.
- 2** Select Modify Server from the drop-down menu > click OK to open the Modify DNS Server window.
- 3** Select the DNS Server.
- 4** Click OK.

You are led through a set of steps that allow you to modify the following DNS Server configuration parameters:

- ♦ List of Zones: Lists the names of the zones that the server controls. This field cannot be edited.
- ♦ DNS Server IP Address: Lists the set of domains and subdomains that the server controls. This field cannot be edited.
- ♦ DNS Server Domain name: Lists the domain name of the DNS server.
- ♦ DNS Server Comments: You can type comments about the DNS server in this box. This is an optional parameter.
- ♦ Forward List: Specifies a list of IP addresses of DNS servers.
 - To add servers to the Forward List, click Add > Enter the IP Address of the server > click OK.
 - To remove servers from the Forward List, select the IP Address of the server from the Forward List > Click Delete.
- ♦ No Forward List: Specifies a list of hostnames whose unresolved queries will not be forwarded to other DNS servers.
 - ♦ To add servers to the No Forward List, click Add > Enter the name of the server > click OK.
 - ♦ To remove servers from the Forward List, select the domain name of the server from the No Forward List > Click Delete.

- ♦ Events Log: Specifies the degree of event data the server is to collect. Major or critical events denote a significant change in the state of server processing. To configure the event log, choose from the following options:
 - ♦ None: Turns off event logging (default)
 - ♦ Major Events: Logs only critical events
 - ♦ All: Logs both major and minor events
- ♦ Audit Log: Check Enable Audit Trail Log to log audit trails and events.

Starting/Stopping the DNS Server

- 1** Click DNS Management > DNS Server Management to open the DNS Server Management window in the main panel.
- 2** Select Start/Stop Server from the drop-down menu > click OK to open the DNS Server Start/Stop Services window.
- 3** Select the DNS server.
- 4** Click OK.
- 5** Depending on the state of the DNS Server module, any one of the following will now appear:
 - ♦ Failure notification message: This appears if the DNS Server module (NAMED.NLM) is not loaded. In order to start the server, load the DNS Server module through the system console.
 - ♦ Start button: If the DNS Server module is loaded but in STOP mode, click to start the DNS server.
 - ♦ Stop button: If the DNS Server module is loaded but in START mode, click to stop the DNS server.

NOTE: To use the Start/Stop DNS service, NAMED.NLM must be loaded.

Creating a Zone Object

The DNS Zone object is an eDirectory container object that comprises Resource Record Set (RRSet) objects and resource records. This section provides information about how to create a Secondary DNS Zone object and an IN-ADDR.ARPA Zone object. For information about how to create a Primary DNS Zone object, refer to [“Creating a Primary DNS Zone Object” on page 79](#).

Creating a Primary DNS Zone Object

After you create a DNS Server object, use the DNS/DHCP Management Utility to create and set up a Primary DNS zone. For information about how to create a secondary DNS Zone object refer to “[Creating a Secondary DNS Zone Object](#)” on page 79. For information about how to create an IN-ADDR.ARPA Zone object, refer to “[Creating an IN-ADDR.ARPA Object](#)” on page 80.

To create a primary DNS Zone object, complete the following steps:

- 1** Click DNS Management > Zone Management to open the Zone Management window in the main panel.
- 2** Select Create Zone from the drop-down menu > click OK to open the Create DNS Zone window.
- 3** Choose Create New Zone.
- 4** Enter the eDirectory context for the zone or browse to select it.
- 5** Enter a name for the zone object.
- 6** Under Zone Type, choose Primary (default).
- 7** Select a DNS server from the Assign Authoritative DNS Server drop-down menu.

or

Enter a unique host name in the Name Server Host Name box and optionally, select a domain from the Domain drop-down menu.

- 8** Click Create.

A message indicates that the new primary zone has been created.

Creating a Secondary DNS Zone Object

After you create a DNS Server object, you can use the DNS/DHCP Management Utility to create and set up Secondary DNS Zone object. To create a Secondary DNS Zone object, you must provide the IP address of the DNS server that will perform zone in transfers for the secondary zone.

To create a secondary DNS Zone object, complete the following steps:

- 1** Click DNS Management > Zone Management to open the Zone Management window in the main panel.
- 2** Select Create Zone from the drop-down menu > click OK to open the Create DNS Zone window.

- 3** Choose Create New Zone.
 - 4** Enter the eDirectory context for the zone or browse to select it.
 - 5** Enter a name for the zone object.
 - 6** Under Zone Type, choose Secondary.
 - 7** Enter the IP address of the DNS server that will provide zone out transfers for this secondary zone.
 - 8** Select a DNS server from the Assign Authoritative DNS Server drop-down menu. This is an optional parameter.
- or
- Enter a unique host name in the Name Server Host Name box and optionally, select a domain from the Domain drop-down menu.
- 9** Click Create.

A message indicates that the new secondary zone has been created.

Creating an IN-ADDR.ARPA Object

After you create a DNS Server object, you can use the DNS/DHCP Management Utility to create and set up an IN-ADDR.ARPA Zone object. An IN-ADDR.ARPA can be either a Primary IN-ADDR.ARPA Zone object or a Secondary IN-ADDR.ARPA Zone object. For more information about creating a Primary IN-ADDR.ARPA Zone object, refer to [“Creating a Primary IN-ADDR.ARPA Zone Object” on page 80](#). For more information about creating a Secondary IN-ADDR.ARPA Zone object, refer to [“Creating a Secondary IN-ADDR.ARPA Zone Object” on page 81](#).

Creating a Primary IN-ADDR.ARPA Zone Object

To create a Primary IN-ADDR.ARPA Zone object, complete the following steps:

- 1** Click DNS Management > Zone Management to open the Zone Management window in the main panel.
- 2** Select Create Zone from the drop-down menu > click OK to open the Create DNS Zone window.
- 3** Choose Create IN-ADDR.ARPA.
- 4** Enter the eDirectory context for the zone or browse to select it.

- 5** Enter the IP address of the zone in the Zone Domain Name field. The IN-ADDR.ARPA zone name is displayed.
- 6** Under Zone Type, choose Primary (default).
- 7** Select a DNS server from the Assign Authoritative DNS Server drop-down menu.

or

Enter a unique host name in the Name Server Host Name box and optionally, enter a domain name or select it from the Domain drop-down menu.
- 8** Click Create.

A message indicates that the new Primary IN-ADDR.ARPA Zone object has been created.

Creating a Secondary IN-ADDR.ARPA Zone Object

To create a Secondary IN-ADDR.ARPA Zone object, complete the following steps:

- 1** Click DNS Management > Zone Management to open the Zone Management window in the main panel.
- 2** Select Create Zone from the drop-down menu > click OK to open the Create DNS Zone window.
- 3** Choose Create IN-ADDR.ARPA.
- 4** Enter the eDirectory context for the zone or browse to select it.
- 5** Enter the IP address of the zone in the Zone Domain Name field. The IN-ADDR.ARPA zone name is displayed.
- 6** Under Zone Type, choose Secondary.
- 7** Select a DNS server from the Assign Authoritative DNS Server drop-down menu.

or

Enter a unique host name in the Name Server Host Name box and optionally, enter a domain name or select it from the Domain drop-down menu.
- 8** Type the IP Address of the DNS server that will provide zone-out transfers for this secondary zone.

9 Click Create.

A message indicates that the new Secondary IN-ADDR.ARPA Zone object has been created.

Modifying a Zone Object

After you have created a Zone object, you can modify it and provide more detailed configuration information.

To modify a new Zone object's attributes, complete the following steps:

- 1** Click DNS Management > Zone Management to open the Zone Management window in the main panel.
- 2** Select Modify Zone from the drop-down menu > click OK to open the Modify DNS Zone window.
- 3** Select the DNS Zone object from the drop-down menu.
- 4** Click OK.

You can now modify the following DNS Zone configuration parameters:

- ♦ Zone Type: Specifies whether the zone will be a Primary or a Secondary zone.
- ♦ Zone Master IP Address: To change a Primary zone to a Secondary zone, click the Secondary zone box and provide the IP address of the Primary DNS Server in the Zone Master IP Address field.
- ♦ Available DNS Servers: Specify the server to which the zone is to be assigned > click Add. The server will then be displayed in the Authoritative DNS Servers field.
- ♦ Authoritative DNS Servers: To delete a DNS server assignment to a zone, select the server to be removed from the field, then click Remove.
- ♦ Add All: Click this to add available DNS servers to a zone.
- ♦ Remove All: Click this to remove available DNS servers from a zone.
- ♦ Designated DNS Server: Designates a server for the zone if more than one DNS server is assigned to a zone. This server will be responsible for getting DHCP updates for the zone, if the zone is a Primary zone.
- ♦ Comments: Use this field to provide comment information about the zone. This is an optional parameter.

- ♦ **Modify Zone Out Filter:** Specifies a list of IP addresses or networks authorized to do zone out transfers from this zone. Use the Add and Delete buttons to add or remove particular IP addresses and networks.
- ♦ **Zone Master:** Specifies the name of the DNS zone.
- ♦ **E-mail Address:** Specifies the e-mail address for the zone.
- ♦ **Serial Number:** Use this field to set a date and revision number for the Start of Authority.
- ♦ **Interval values:** Choose from the following values:
 - **Refresh:** Enables the user to specify, in minutes, the time in which the secondary name server downloads a copy of the zone data to the primary name server. The default is 180 minutes.
 - **Retry:** Specifies, in minutes, the time that a secondary name server waits after a failed download before it tries to download the zone database again. The default is 60 minutes.
 - **Expire:** Specifies, in hours, the time that a secondary name server continues to try to download a zone database. The default is 168 hours.
 - **Minimal TTL:** Specifies, in hours, the minimum TTL for a resource record. This parameter determines how long a DNS server retains an address mapping in cache. The default is 24 hours.

Creating Resource Records

A resource record is a piece of information about a domain name. Each resource record contains information about a particular piece of data within the domain.

To create a new resource record, complete the following steps:

- 1** Click **DNS Management > Resource Record Management** to open the Resource Record Management window in the main panel.
- 2** Select **Create Resource Record** from the drop-down menu > click **OK** to open the Create Resource Record window.
- 3** From the **Select Domain Name** drop-down menu, select the domain where the resource record is to be created.
- 4** Optionally, from the **Select Host Name** drop-down menu, select the name of the host server. This binds a domain name with a hostname for a specific name server.
- 5** Click **OK** to specify the Resource Record type.

- 6** Choose the Resource Record Type (RR Type) from the available options under the Others drop-down menu and enter appropriate Resource Record data corresponding to the type chosen.
- 7** Click Create.

For more information on Resource Record Types, refer to [Table 2, “Resource Record Types and Field Differences,” on page 33](#).

NOTE: Start of Authority (SOA) is defined as part of a Zone object's attributes, and a Pointer (PTR) record is created automatically when any new A resource record or IPv6 (AAAA) resource record is created if the IN-ADDR.ARPA zone exists.

Modifying Resource Records

To modify a resource record, complete the following steps:

- 1** Click DNS Management > Resource Record Management to open the Resource Record Management window in the main panel.
- 2** Select Modify Resource Record from the drop-down menu > click OK to open the Modify RR Set - Resource Record window.
- 3** From the Select Domain drop-down menu, select the domain that contains the host or RR Set.
- 4** From the Select Host drop-down menu, select the host or RR Set that contains the Resource Record.
- 5** You can modify the properties of either the entire RR Set or a single record in the RR Set.

To modify the RR Set, complete the following steps:

- ◆ Click Modify RR Set to open the Modify RR Set window.
- ◆ Enter the name of the eDirectory object to be associated with the RR Set in the Associated eDirectory Object box, or browse to select it.
- ◆ Optionally, type comments about the RR Set object in the Comments box.
- ◆ Click Done to close the Modify RR Set window.

To modify a single Resource Record, complete the following steps:

- ◆ From the Select Resource Record drop-down menu, select the Resource Record.
- ◆ Click OK to view the domain, the hostname and the Type information associated with the Resource Record.

- ♦ You can now modify the Resource Record Data of all but the following types of resource records:
 - A (or IPv4)
 - AAAA (or IPv6)

6 Click Done to save the changes.

Configuring DNS Features

This section provides procedures to help you configure the DNS features of Novell DNS/DHCP Services. The procedures in this section are:

- ♦ [“Configuring an eDirectory Server to Forward Queries to Root Name Servers” on page 85](#)
- ♦ [“Configuring a Cache-Only Server” on page 85](#)
- ♦ [“Configuring to Support Child Zones” on page 86](#)

Configuring an eDirectory Server to Forward Queries to Root Name Servers

When you install Netware 6, the root server information is automatically loaded into your system. No procedure is required to configure your system to forward queries to the root name servers.

Configuring a Cache-Only Server

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 DNS Server Object” on page 76](#). After you have created the DNS Server object, do not assign any zones for it to serve. Configure this server to forward its queries to a DNS server

Configuring to Support Child Zones

If you are supporting child zones, you must configure the glue logic or glue records to associate the child zones with the parent zone.

The parent zone contains a referral to the child zone, meaning that its zone information contains an Name Server (NS) record that names the zone server for the child zone and an Address record that specifies the IP address for the child zone's DNS name server.

When configured, queries to the parent zone 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.

Configuring DHCP

To manage an organization's IP address database, you must define the global address pool in the form of Class A, B, and C network addresses. The addresses available to a network are managed by the DNS/DHCP Management Utility and logically organized into the following types of objects:

- ♦ Subnet
- ♦ Subnet Address Range
- ♦ IP Address
- ♦ DHCP Server
- ♦ Subnet Pool

The Novell DHCP server views an organization's network as a collection of DHCP objects.

For DHCP configuration instructions, refer to:

- ♦ [“Importing DHCP Configuration Information” on page 87](#)
- ♦ [“Setting Up DHCP” on page 88](#)

Importing DHCP Configuration Information

You can use the DNS/DHCP Management Utility to import existing DHCP configuration information. The DHCP information should be in DHCP version 2.0 or 3.0 file format.

To import existing DHCP configuration information, complete the following steps:

- 1** Open the DNS/DHCP Management Utility in a browser window.
- 2** Click DHCP Management > Global DHCP Configuration to open the Global DHCP Configuration window in the main panel.
- 3** Select Import DHCP Configuration from the drop-down menu > Click OK to open the Import DHCP Configuration File window.
- 4** Enter the eDirectory context or browse to select it.
- 5** Enter the name of the DHCP Configuration File or browse to select it.
- 6** Click OK.
- 7** The DHCP Subnet configuration information is displayed.
 - ♦ To add an available DHCP Subnet to the list of selected subnets, click Add.
 - ♦ To include all available DHCP Subnets to the list of selected subnets, click Add All.
 - ♦ To delete a subnet from the list of selected subnets, click Remove.
 - ♦ To delete all subnets from the list of selected subnets, click Remove All.
- 8** Click OK.

The selected subnets are now imported.

Setting Up DHCP

This section provides the following procedures required to accomplish a basic DHCP setup:

- ♦ [“DHCP Prerequisites” on page 88](#)
- ♦ [“Setting Global DHCP Options” on page 89](#)
- ♦ [“Creating a DHCP Server Object” on page 91](#)
- ♦ [“Creating a Subnet Object” on page 91](#)
- ♦ [“Creating Subnet Address Ranges” on page 92](#)
- ♦ [“Creating IP Address Objects” on page 92](#)
- ♦ [“Loading the DHCP Server” on page 93](#)
- ♦ [“Configuring Clients to Use DHCP” on page 94](#)

This section does not describe how to enable all the available features. For more information refer to [“Detailed DHCP Configuration” on page 94](#)

DHCP Prerequisites

The following steps must be completed prior to setting up DHCP:

1. Load Netware 6 on the selected server or servers.
2. Install iManage.
3. Install Internet Explorer 5.0.

Setting Global DHCP Preferences

You can use Global Preferences to add, delete, or modify global data, such as global DHCP options and global DHCP defaults. For more information about setting global DHCP options, refer to [“Setting Global DHCP Options” on page 89](#). For more information about setting global DHCP defaults, refer to [“Setting Global DHCP Defaults” on page 89](#). For more information about configuring the DHCP Options Table, refer to [“Viewing the DHCP Options Table” on page 90](#).

Setting Global DHCP Options

To define a global DHCP option:

- 1** Click DHCP Management > Global DHCP Configuration to open the Global DHCP Configuration window in the main panel.
- 2** Select Set Global Preferences from the drop-down menu > click OK to open the Global DHCP Preferences window.
- 3** Click Modify to open the DHCP Options window.
- 4** The DHCP Options you can configure globally are listed in the Available DHCP Options list box. To configure an option, complete the following steps:
 - ♦ Select it from the Available DHCP Options list box and click Add.
 - ♦ Enter the required supporting information as prompted.
- 5** Click Done to close the DHCP Options window.

The global DHCP Option you added or configured now appears in the Global DHCP Options list.

To remove a global DHCP option

- 1** Click DHCP Management > Global DHCP Configuration to open the Global DHCP Configuration window in the main panel.
- 2** Select Set Global Preferences from the drop-down menu > click OK to open the Global DHCP Preferences window.
- 3** Check the Select column of the DHCP option you want to remove and click Delete.

The global DHCP Option you deleted is now removed from the Global DHCP Options list.

Setting Global DHCP Defaults

To define a global DHCP default:

- 1** Click DHCP Management > Global DHCP Configuration to open the Global DHCP Configuration window in the main panel.
- 2** Select Set Global Preferences from the drop-down menu > Click OK to open the Global DHCP Preferences window.

- 3 Click Next to open the Excluded Hardware Addresses list in the Global DHCP Defaults window.

This list contains the MAC addresses of clients that should not receive IP addresses from DHCP servers. These exclusions apply to all DHCP servers in the eDirectory tree.

- 4 Click Next to open the Included Hardware Addresses list in the Global DHCP Defaults window.

This list contains the MAC addresses of clients that will receive IP addresses from DHCP servers.

IMPORTANT: The Excluded and Included Hardware Addresses lists are mutually exclusive. You are expected to configure only one of these lists and ensure that the other list is empty.

- 5 Click Add > Enter the MAC Address of the client > Specify the hardware type.
- 6 Click OK.

The MAC address is added to the Excluded Hardware Addresses list.

Viewing the DHCP Options Table

The DHCP Options Table provides a list of parameters that can be defined for use on the network. After an option is defined, you can assign a value to the option using Global DHCP Options.

To view a DHCP option:

- 1 Click DHCP Management > Global DHCP Configuration to open the Global DHCP Configuration window in the main panel.
- 2 Select Set Global Preferences from the drop-down menu > click OK to open the Global DHCP Preferences window.
- 3 Click Next > Next to open the DHCP Options Table window that lists both the system-defined and user-defined DHCP options.
- 4 Click Done to return to the home page.

Creating a DHCP Server Object

You use the DNS/DHCP Management Utility to create and set up a DHCP Server object. A DHCP Server object can be created or located under any of the following objects:

- ♦ Organization (O)
- ♦ Organization Unit (OU)
- ♦ Country (C)
- ♦ Locality (L)

To create and set up a DHCP server object, complete the following steps:

- 1** Click DHCP Management > DHCP Server Management to open the DHCP Server Management window in the main panel.
- 2** Select Create Server from the drop-down menu > click OK to open the Create DHCP Server window.
- 3** Enter the name of the server or browse to select it.
- 4** Click Create.

A message indicates that the new DHCP Server Object has been created.

Creating a Subnet Object

You use the DNS/DHCP Management Utility to create and set up a DHCP Subnet object for each of the subnets to which you will assign addresses.

To create and set up a Subnet object, complete the following steps:

- 1** Click DHCP Management > Subnet Management to open the Subnet Management window in the main panel.
- 2** Select Create Subnet from the drop-down menu > click OK to open the Create Subnet window.
- 3** Enter a unique subnet name.
- 4** Select the eDirectory context where the new subnet record will be stored.
- 5** Enter a subnet address, a subnet mask, and the name of a default DHCP server in the fields provided.

The default DHCP server field designates the principal DHCP server for a subnet. This server is assigned all address ranges created under the

subnet, unless a different server is specified when the range is created. The default server also is the only server that responds to BOOTP requests for the subnet.

6 Click Create.

A message indicates that the new subnet has been created.

IP address objects are simultaneously created to exclude routing and broadcast addresses.

Creating Subnet Address Ranges

You use the DNS/DHCP Management Utility to create and set up Subnet Address Range objects for each pool of addresses you want to be dynamically assigned by DHCP.

To create and set up a Subnet Address Range object, complete the following steps:

- 1** Click DHCP Management > Address Range Management to open the Address Range Management window in the main panel.
- 2** Select Create Address Range from the drop-down menu > click OK to open the Create Subnet Address Range window.
- 3** From the drop-down menu, select the subnet for which the address range is required.
- 4** In the Address Range Name field, type the name of the Subnet Address Range.
- 5** Type the Start Address and End Address to specify the lower and upper limits of the subnet address range.
- 6** Click Create.

A message indicates that the new subnet address range has been created.

Creating IP Address Objects

You use the DNS/DHCP Management Utility to create and set up any IP Address objects to be assigned to specific devices or to be excluded from dynamic assignment. Create an IP Address object for each such device or address. Assigning a specific address to a client requires you to specify the client's media-access control (MAC) address or Client ID.

If you have set up subnets and subnet address ranges, you are not required to set up individual IP addresses unless you want to perform manual address assignment or exclude addresses from assignment.

To create and set up an IP Address object, complete the following steps:

- 1** Click DHCP Management > IP Address Management to open the IP Address Management window in the main panel.
- 2** Select Create IP Address from the drop-down menu > click OK to open the Create IP Address window.
- 3** From the drop-down menu select the subnet for which the IP address will be created.
- 4** Enter the IP address.
- 5** Choose an assignment type for the IP address object. Assignment types for an IP Address object are Dynamic, Manual and Exclusion. If the IP address is dynamically assigned by the DHCP server, it will be automatically displayed.

Valid types that can be created manually are Manual and Exclusion. A manual assignment type must have either a MAC Type or a Client Identifier for the IP address object to be created.

Client Identifier uniquely identifies the client.

MAC Type specifies the MAC address type.

MAC Address specifies the hardware address of the NIC (Network Interface Card).

- 6** Click Create.

A message is displayed indicating that the new IP Address object has been created.

Loading the DHCP Server

To load a DHCP Server object, complete the following steps:

- 1** Create a DHCP Server object. For more information, refer to [“Creating a DHCP Server Object” on page 91](#).
- 2** Create a Subnet object, and assign a default DHCP server to it. For more information, refer to [“Creating a Subnet Object” on page 91](#).
- 3** Enter the following command at the DHCP server console:

LOAD DHCPSEVR

After you load DHCP_{SRVR}.NLM, the DHCP server can respond to client requests and assign IP addresses. For information about other command line options, refer to [“DHCP_{SRVR} Command Line Options” on page 112](#).

After DHCP_{SRVR}.NLM is loaded, you can use the DNS/DHCP Management Utility to start and stop the DHCP Server. For more information on starting and stopping the DHCP server, refer to [“Starting/Stopping the DHCP Server” on page 96](#).

Configuring Clients to Use DHCP

To configure Windows 95 and Windows NT* client workstations to use DHCP, complete the following steps:

- 1 At the client desktop, click Start > Settings > Control Panel, and then double-click Network.

The Network window is displayed, listing the network components installed on the client workstation.

- 2 Click TCP/IP and click Properties.

The TCP/IP Properties window opens.

- 3 Select Obtain an IP Address Automatically > click OK.

The next time the client starts up, it will send a request to the DHCP server for an IP address.

IMPORTANT: Any client configuration settings override the configuration received from a DHCP server. The only exception is the hostname parameter set on the DNS Configuration tab of TCP/IP Properties window.

Detailed DHCP Configuration

This section provides detailed information about configuring DHCP objects using the DNS/DHCP Management Utility.

Refer to [“Setting Up DHCP” on page 88](#) for information about setting up DHCP and creating DHCP objects. The following sections provide detailed information about modifying DHCP objects:

- ♦ [“Modifying a DHCP Server Object” on page 95](#)
- ♦ [“Modifying an Existing Subnet Object” on page 97](#)
- ♦ [“Modifying a Subnet Address Range Object” on page 98](#)

- ♦ “Modifying an Existing IP Address Object” on page 100
- ♦ “Creating a Subnet Pool Object” on page 101
- ♦ “Modifying a Subnet Pool Object” on page 102

Modifying a DHCP Server Object

Refer to “Creating a DHCP Server Object” on page 91 for information about creating a DHCP Server object. After a DHCP Server object has been created, you can modify its configuration parameters by completing the following steps:

- 1** Click DHCP Management > DHCP Server Management to open the DHCP Server Management window in the main panel.
- 2** Select Modify Server from the drop-down menu > click OK to open the Modify DHCP Server window.
- 3** Select the DHCP Server object from the drop-down menu.
- 4** Click OK.

You are led through a set of steps by which you can modify the following parameters:

- ♦ Subnet Address Range Serviced by the Server: This displays information about the range of addresses that can be dynamically assigned by the server.
- ♦ Subnet Serviced by the Server: This displays information about the subnet to which the server can assign addresses.
- ♦ Comments: You can type comments about the DHCP server in this box. This is an optional parameter.
- ♦ Set SNMP Traps Option: SNMP traps control DHCP server event trapping. Choose from the following options:
 - None: Turns off SNMP traps
 - Major Events: Traps only critical events (default)
 - All: Traps both major and minor events

Management applications such as Novell ManageWise[®] software help you monitor traps.

- ♦ Audit Trail and Alerts Option: Auditing allows you to analyze historical data and diagnose operational difficulties. Choose from the following options:
 - None: Disables auditing
 - Major Events: Audits only major events such as SNMP traps (default)
 - All: Audits all events
- ♦ Enable Audit Trail Log: Check this to log audit trails and events.
- ♦ Mobile User Option: The DHCP server can be configured to support mobile users such as laptop users. Choose from the following options:
 - No Mobile Users Allowed: Disables support for mobile users
 - Allow Mobile Users but Delete Previously Assigned Address: Deletes previously assigned addresses while granting an address to a mobile user (default)
 - Allow Mobile Users but Do Not Delete Previously Assigned Address: Caches previously assigned addresses while granting an address to a mobile user
- ♦ Ping Address: Check this to ping an address to ensure that the address is not in use before it is assigned. Note that enabling ping increases traffic on the network.

Starting/Stopping the DHCP Server

- 1** Click DHCP Management > DHCP Server Management to open the DHCP Server Management window in the main panel.
- 2** Select Start/Stop Server from the drop-down menu > click OK to open the DHCP Server Start/Stop Services window.
- 3** Select the server from the Select DHCP Server drop-down menu.
- 4** Click OK.
- 5** Depending on the state of the DHCP Server module, any one of the following will now appear:
 - ♦ Failure notification message: This appears if the DHCP Server module (DHCP SRVR.NLM) is not loaded. In order to start the server, load the DHCP Server module through the system console.
 - ♦ Start button: If the DHCP Server module is loaded but in STOP mode, click to start the DHCP server.

- ♦ Stop button: If the DHCP Server module is loaded but in START mode, click to stop the DHCP server.

NOTE: To use the Start/Stop DHCP service, DHCP SRVR.NLM must be loaded.

Modifying an Existing Subnet Object

For information about creating a Subnet object, refer to [“Creating a Subnet Object” on page 91](#). After a subnet object has been created, you can modify its configuration parameters by completing the following steps:

- 1** Click DHCP Management > Subnet Management to open the Subnet Management window in the main panel.
- 2** Select Modify Subnet from the drop-down menu > click OK to open the Modify Subnet window.
- 3** Select the Subnet object from the drop-down menu.
- 4** Click OK.

You are led through a set of steps by which you can modify the following parameters:

- ♦ DNS Zone for Dynamic Update: Specifies the DNS zone where dynamic updating will occur. The specified DNS zone is then notified of any changes to the subnet.
- ♦ Domain Name: Specifies the domain name that will be combined with the hostname received from the client computer. This name will be given to DNS during dynamic DNS update. The domain name must be part of the zone specified for dynamic DNS.
- ♦ Subnet Pool Preference: Specifies the subnet pool to be used by the subnet. This parameter setting is optional. Subnet pools enable the DHCP server to assign addresses to multiple logical networks on a single physical network. A subnet pool groups logical networks.
- ♦ Default DHCP Server: Specifies a default DHCP server that will assign address ranges for the subnet. This server is also the only server that will respond to BOOTP requests for the subnet.
- ♦ Comments: Provides an area for comment information about the subnet. This is an optional parameter.
- ♦ Lease Type: Specifies the length of time for an address assignment. A lease type can be permanent or timed. Permanent leases never expire; the client is assigned an IP address for an indefinite period. Timed leases are defined in days, hours, and minutes. Timed leases expire, unless the client renews the lease.

- ♦ Set Boot Parameter Options: Check this to specify the Server Address, Server Name, and Boot File Name for the BOOTP service. This information, provided at boot time, includes the address and name of a server the client can contact for a boot image, as well as a boot filename.
- ♦ Other DHCP Options: To configure an option, complete the following steps:
 - ♦ Click Modify to open the DHCP options page that list the available DHCP Options.
 - ♦ Select the DHCP option and provide the necessary DHCP information.
 - ♦ Click Add.

To remove a DHCP option:

- ♦ Check the Select column of the DHCP option you want to remove > click Delete

Modifying a Subnet Address Range Object

Refer to [“Creating Subnet Address Ranges” on page 92](#) for information about creating a Subnet Address Range object. After a Subnet Address Range object has been created, you can modify its configuration parameters by completing the following steps:

- 1** Click DHCP Management > Address Range Management to open the Address Range Management window in the main panel.
- 2** Select Modify Address Range from the drop-down menu > click OK to open the Modify Subnet Address Range window.
- 3** From the Select Subnet drop-down menu, select the subnet that contains the address range to be modified.
- 4** From the Select Address Range drop-down menu, select the address range to be modified.
- 5** Click OK.

You are led through a set of steps by which you can modify the following address range parameters:

- ♦ Range Type: indicates the range of addresses used by the DHCP server in response to requests from clients.

From the Select Range Type drop-down menu, choose one of the following:

- ♦ **Dynamic DHCP:** A range of addresses used by the DHCP server to assign addresses to clients making only DHCP requests. If the Dynamic DHCP range type is assigned, the DNS Update Option parameter can be enabled. If Always Update is selected, the DHCP server will update DNS as dynamic addresses are assigned and released
- ♦ **Dynamic BOOTP:** A range of addresses used by the DHCP server to assign addresses to clients making only BOOTP requests.
- ♦ **Dynamic BOOTP and DHCP:** A range of addresses used by the DHCP server to assign addresses to clients making either DHCP or BOOTP requests. If the Dynamic BOOTP and DHCP range type is assigned, the DNS Update Option parameter can be enabled. If Always Update is selected, the DHCP server will update DNS as dynamic addresses are assigned and released.
- ♦ **Dynamic DHCP with Automatic Host Name Generation:** A range of addresses used by the DHCP server to assign addresses to clients making only DHCP requests. Hostnames for this pool will be generated and entered into the DNS system. Hostnames are provided to clients as a DHCP option. If you choose this option, ensure that you create the corresponding IN-ADDR.ARPA zone.
- ♦ **Excluded:** A range of addresses that is excluded by the DHCP server while assigning IP addresses.

If the Dynamic DHCP with Automatic Host Name Generation range type is assigned, the Auto Host Name Starts With parameter can be set. This parameter appends a unique integer to the hostname, generating a unique hostname for each client.

Additionally, the name of the DHCP Server can be specified by selecting it from the DHCP Server drop-down menu.

- ♦ **Comments:** Type your comments about the Subnet Address Range in this box. This is an optional parameter.

Modifying an Existing IP Address Object

Refer to [“Creating IP Address Objects” on page 92](#) for information about creating IP Address objects. After an IP Address object has been created, you can modify its configuration parameters by completing the following steps:

- 1** Click DHCP Management > IP Address Management to open the IP Address Management window in the main panel.
- 2** Select Modify IP Address from the drop-down menu > click OK to open the Modify IP Address window.
- 3** Select the subnet that contains the IP address to be modified.
- 4** Select the IP Address.
- 5** Click OK.

You are led through a set of steps by which you can modify the following IP Address object parameters:

- ♦ Assignment Type: Specifies Exclusion or Manual IP address assignment types.
 - Exclusion: Address objects are created to identify IP addresses to be excluded from DHCP server address assignment. An Excluded assignment type designates that the IP address will not be used.
 - Manual: Address objects are created to identify an IP address to be assigned to a device. A client identifier or MAC address must be configured for the manual address so that the DHCP server can identify the appropriate client. Manual assignment types specify client identifiers, MAC types, MAC addresses, or hostname parameters.
- ♦ Client Identifier: Uniquely identifies the client.
- ♦ MAC Type: Specifies the MAC address type.
 - 15, Frame Relay
 - 16, Asynchronous Transfer Mode (ATM)
 - 17, HDLC
 - 18, Fibre Channel
 - 19, Asynchronous Transfer Mode (ATM)
 - 20, Serial Line
 - 21, Asynchronous Transfer Mode (ATM)

- ♦ **MAC Address:** Specifies the hardware address of the NIC (Network Interface Card).
- ♦ **Host Name:** Specifies the name of the host server.
- ♦ **Associated eDirectory Object :** Use this field to select another object in the eDirectory database to maintain a reference to. For example, identify a user who typically uses the device associated with this address.
- ♦ **Comments:** You can type comments about the address object in this box. This is an optional parameter.
- ♦ **Lease Expiration Option:** A lease type can be permanent or timed. Permanent leases never expire; the client is assigned an IP address for an indefinite period. Timed leases are defined in days, hours, and minutes. Timed leases expire, unless the client renews the lease.
- ♦ **Last Used:** Displays when the IP address was last used.
- ♦ **Other DHCP Options:** Use this to add, delete, update, or specify default DHCP options for a manually assigned address type. Default is used to display DHCP options inherited from global preferences and the Subnet object that the address object is under.

Creating a Subnet Pool Object

A Subnet Pool object is a logical group of related Subnet objects of the same type. A Subnet Pool object can be created or located under any of the following objects:

- ♦ Organization (O)
- ♦ Organization Unit (OU)
- ♦ Country (C)
- ♦ Locality (L)

To create a new Subnet Pool object, complete the following steps:

- 1** Click DHCP Management > Subnet Pool Management to open the Subnet Pool Management window in the main panel.
- 2** Select Create Subnet Pool from the drop-down menu > click OK to open the Create Subnet Pool window.
- 3** Enter a unique subnet pool name in the Subnet Pool Name field.

- 4** Enter the eDirectory context where the subnet pool record will be placed.
- 5** Click OK.

A message indicates that the new subnet pool object has been created.

Modifying a Subnet Pool Object

Refer to [“Creating a Subnet Pool Object” on page 101](#) for information about creating subnet pool objects. After a subnet pool object has been created, you can modify its configuration parameters by completing the following steps:

- 1** Click DHCP Management > Subnet Pool Management to open the Subnet Pool Management window in the main panel.
- 2** Select Modify Subnet Pool from the drop-down menu > click OK to open the Modify Subnet Pool window.
- 3** Select the subnet object.
- 4** Click OK.

You can modify the Subnet Type configuration parameter. You can add a subnet to a subnet pool or remove a subnet from the pool.

To add a subnet to a subnet pool, complete the following steps:

- ♦ Click Add.
- ♦ Select the subnet.
- ♦ Click OK.

To remove a subnet from a subnet pool, complete the following steps:

- ♦ Select the subnet.
- ♦ Click Delete.

Configuring Special Features

This section describes how to configure Netware 6 to use the special features of Novell DNS/DHCP Services. The following configuration tasks are described:

- ♦ [“Configuring a DNS Server to be Authoritative for Multiple Zones” on page 103](#)
- ♦ [“Configuring a Multi-Homed Server” on page 103](#)

- ♦ “Configuring Dynamic DNS” on page 103
- ♦ “Configuring Multiple Logical Networks” on page 104

Configuring a DNS Server to be Authoritative for Multiple Zones

A Netware 6 DNS server can be authoritative for multiple zones. There is no limit to the number of zones a Netware 6 server can support other than those mentioned in “Optimizing DNS Performance” on page 115. Those limitations have to do with the total number of objects.

When you configure a zone, the Assign Authoritative DNS Server field in the Create New Zone task is the one that specifies the DNS server that will support the zone.

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 may be on different networks.

When using a DNS server with more than one IP address, you must use an address that is bound to the server, and that address must match the address used in the NS and A resource records for the zone.

NOTE: An NS resource record specifies a domain name for an authoritative name server for the specified class and domain.

Configuring Dynamic DNS

Dynamic DNS (DDNS) provides automatic updating of DNS with Address and Pointer records for addresses and hostnames assigned using the DDNS feature. To use DDNS, the following configuration must already exist:

- ♦ The DNS Zone object to receive DHCP updates must already be created.
- ♦ Subnet Address Range objects that will use DDNS must be set to range type Dynamic BOOTP and DHCP or Dynamic DHCP.

To activate the DDNS feature, complete the following steps:

- 1 Select the Subnet object of the Subnet Address Range on which you want to activate DDNS and 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.

Configuring Multiple Logical Networks

When you configure multiple logical networks, also known as virtual local area networks (VLANs), you associate each individual LAN or Subnet object with a Subnet Pool object. The Subnet object you associate with the Subnet Pool object can be created prior to creating the Subnet Pool object, or an existing subnet can be modified.

To configure multiple logical networks or VLANs, complete the following steps:

- 1** Create a Subnet Pool object.

For detailed information about creating a Subnet Pool object, refer to [“Creating a Subnet Pool Object” on page 101](#).
- 2** Select a Subnet object or create and configure a new Subnet object.
- 3** Click Subnet Pool Management > Modify Subnet Pool and add the subnet to the subnet pool with which to associate the subnet object.
- 4** Click OK.
- 5** Repeat [Step 2](#) through [Step 4](#) for each subnet you want to associate with the Subnet Pool object.

Configuring for Auditing

You configure DNS and DHCP for auditing by using the DNS/DHCP Management Utility as described in:

- ♦ [“Configuring DNS Auditing” on page 105](#)
- ♦ [“Viewing the DNS Audit Trail Log” on page 105](#)
- ♦ [“Viewing the DNS Event Log” on page 106](#)
- ♦ [“Configuring DHCP Auditing” on page 108](#)
- ♦ [“Viewing the DHCP Audit Trail Log” on page 108](#)
- ♦ [“Viewing the DHCP Event Log” on page 110](#)

Configuring DNS Auditing

To configure a DNS server to audit activities, complete the following steps:

- 1** Click DNS Management > DNS Server Management to open the DNS Server Management window in the main panel.
- 2** Select Modify Server from the drop-down menu > click OK to open the Modify DNS Server window.
- 3** Select the DNS Server.
- 4** Click OK.
- 5** Click Next > Next > and select Major Events or All under Event Log.
- 6** Check the Enable Audit Trail Log check box.
- 7** Click OK.

Viewing the DNS Audit Trail Log

- 1** Click DNS Management > DNS Server Management to open the DNS Server Management window in the main panel.
- 2** Select Audit Trail Log from the drop-down menu > Click OK to open the DNS Server Audit Trail Log window
- 3** Select the server from the Select DNS Server drop-down menu.
- 4** Modify the Starting Date and Ending Date in the appropriate fields, if you want to filter the Audit Period.

The following date formats are accepted:

mm-dd-yyyy
mm/dd/yyyy
mm.dd.yyyy
mm dd yyyy
mmm dd yyyy
mddyyyy
m-d-yyyy
m/d/yyyy
m.d.yyyy
m d yyyy
mmm d yyyy
m-d-yy

m/d/yy
m.d.yy
m d yy
mmm d yy

where yy represents the last two digits of the year and mmm the first three letters of the name of the month, for example Jan, Feb etc.

5 Click OK.

This opens the DNS Audit Trail Log table that lists the following data:

- ♦ Entry Time: Date and time the event occurred.
- ♦ Type: Type of event.
- ♦ IP Address: IP Address at which the event occurred.
- ♦ Domain Name: Domain Name at which the event occurred.

6 To define a view filter on the Audit Trail Log, click the Display Options button.

You can now filter events on the following parameters:

- ♦ Start Date: to set a start date for monitoring the DNS audit trail.
- ♦ End Date: to set an end date for monitoring the DNS audit trail.
- ♦ Agent Ready. The SNMP (Simple Network Mail Protocol) agent is ready to receive or transmit requests.
- ♦ Query Received. The DNS server acknowledges the receipt of a query by making an entry in the log file.
- ♦ Query Forwarded. The DNS server forwards a query to a client or another DNS server.
- ♦ Response Received. The DNS server responds to a query from a client or another DNS server.

Viewing the DNS Event Log

- 1** Click DNS Management > DNS Server Management to open the DNS Server Management window in the main panel.
- 2** Select Event Log from the drop-down menu > Click OK to open the DNS Event Log window.
- 3** Select the server from the Select DNS Server drop-down menu.

- 4** Modify the Starting Date and Ending Date in the appropriate fields, if you want to filter the Audit Period.

The following date formats are accepted:

mm-dd-yyyy
mm/dd/yyyy
mm.dd.yyyy
mm dd yyyy
mmm dd yyyy
mdddyyyy
m-d-yyyy
m/d/yyyy
m.d.yyyy
m d yyyy
mmm d yyyy
m-d-yy
m/d/yy
m.d.yy
m d yy
mmm d yy

where yy represents the last two digits of the year and mmm the first three letters of the name of the month, for example Jan, Feb etc.

- 5** Click OK.

This opens the DNS Event Log table that lists the following data:

- ♦ Entry Time: Date and time the event occurred.
- ♦ Severity: Severity of the event - critical, major, warning and informational.
- ♦ State: State of the server - operational, degraded and inoperative.
- ♦ Description: Description of the event that occurred.

- 6** To define a view filter on the DNS Event Log, click the Display Options button.

You can now filter events on the following parameters:

- ♦ Start and end date settings regulate the time recorded by the event logger.

- ♦ Severity options define which event levels are recorded: critical, major, warning, and informational.
- ♦ State settings define the condition of events recorded: operational, degraded, and inoperative.

Configuring DHCP Auditing

You can configure a DHCP server for auditing using the Audit Trail and Alerts Option.

To configure a DHCP server to audit activities, complete the following steps:

- 1** Click DHCP Management > DHCP Server Management to open the DHCP Server Management window in the main panel.
- 2** Select Modify Server from the drop-down menu > click OK to open the Modify DHCP Server window.
- 3** Select the DHCP Server from the Select DHCP Server Name drop-down menu.
- 4** Click OK > Next > and check the Enable Audit Trail Log check box.
- 5** Click OK.

Viewing the DHCP Audit Trail Log

- 1** Click DHCP Management > DHCP Server Management to open the DHCP Server Management window in the main panel.
- 2** Select Audit Trail Log from the drop-down menu > click OK to open the DHCP Server Audit Trail Log window.
- 3** Select the server from the Select DNS Server drop-down menu.
- 4** Modify the Starting Date and Ending Date in the appropriate fields, if you want to filter the Audit Period.

The following date formats are accepted:

mm-dd-yyyy
 mm/dd/yyyy
 mm.dd.yyyy
 mm dd yyyy
 mmm dd yyyy
 mmdyyy

m-d-yyyy
m/d/yyyy
m.d/yyyy
m d yyyy
mmm d yyyy
m-d-yy
m/d/yy
m.d.yy
m d yy
mmm d yy

where yy represents the last two digits of the year and mmm the first three letters of the name of the month, for example Jan, Feb etc.

5 Click OK.

This opens the DHCP Audit Trail Log table that lists the following data:

- ♦ Entry Time
- ♦ IP Address
- ♦ Type
- ♦ Status
- ♦ Host name
- ♦ Hardware Address
- ♦ Client ID
- ♦ Lease Type

6 To define a view filter on the DHCP Audit Trail Log, click the Display Options button.

You can now filter events on the following parameters:

- ♦ Start Date: to set a start date for monitoring the DHCP audit trail.
- ♦ End Date: to set an end date for monitoring the DHCP audit trail.
- ♦ Transaction Type: manual, dynamic, automatic, exclusion, unauthorised or IPCP, and Fix Host Dynamic.

Viewing the DHCP Event Log

- 1** Click DHCP Management > DHCP Server Management to open the DHCP Server Management window in the main panel.
- 2** Select Event Log from the drop-down menu > click OK to open the DHCP Event Log window.
- 3** Select the server from the Select DHCP Server drop-down menu.
- 4** Modify the Starting Date and Ending Date in the appropriate fields, if you want to filter the Audit Period.

The following date formats are accepted:

mm-dd-yyyy
mm/dd/yyyy
mm.dd.yyyy
mm dd yyyy
mmm dd yyyy
mddyyyy
m-d-yyyy
m/d/yyyy
m.d.yyyy
m d yyyy
mmm d yyyy
m-d-yy
m/d/yy
m.d.yy
m d yy
mmm d yy

where yy represents the last two digits of the year and mmm the first three letters of the name of the month, for example Jan, Feb etc.

- 5** Click OK.

This opens the DHCP Event Log table that lists the following data:

- ♦ Entry Time: Date and Time the event occurred.
- ♦ Severity: Severity of the event (critical, major, warning and informational).
- ♦ State: State of the server (operational, degraded, and inoperative).
- ♦ Description: Description of the event that occurred.

- 6** To define a view filter on the DHCP Events Log, click the Display Options button.

You can now filter events on the following parameters:

- ◆ Start Date: to set a start date for monitoring the DHCP Event Log.
- ◆ End Date: to set an end date for monitoring the DHCP Event Log.
- ◆ Severity defines the severity level of the event: critical, major, warning, and informational.
- ◆ State settings define the condition of events recorded: operational, degraded, and inoperative.

NAMED Command Line Options

To start a DNS server, enter the following command at the server console prompt:

LOAD NAMED

The command line parameters listed in the following table are also supported.

Table 9 **NAMED Command Line Options**

Parameter	Function
-a	Turns on auto-detect of new zones (default setting)
-b	Turns off auto-detect of new zones
-f <script.txt> [context]	Creates multiple zones using a text file in BIND bootfile format; specifying context enables zones to be created anywhere in the eDirectory tree
-h	Displays help information
-l	Enables a DNS server to login as an administrator to acquire rights required to create and delete zones from the command line
-m <file.dat> [context]	Imports file.dat and creates a new primary zone; specifying context enables zones to be created anywhere in the eDirectory tree

Parameter	Function
-q	Disables verbose mode for debug messages (default setting)
-r <zone name>	Deletes and removes an existing zone from the zone database
-rp <characters>	Replaces listed characters with a dash (-) in host names for which resource records are dynamically created
-s [zone name]	Prints status information; zone name is optional
-u <file.dat>	Imports file.dat and updates the contents of a previously created zone
-v	Enables verbose mode for debug messages
-zi <zone name>	Forces named zone for zone-in transfer

You can issue the **LOAD NAMED** command repeatedly to invoke different command line options. The NAMED.NLM software is loaded only on the first instance.

DHCPSTRVR Command Line Options

To start a DHCP server, enter the following command at the server console prompt:

LOAD DHCPSTRVR

The command line parameters listed in the following table are also supported.

Table 10 DHCPSTRVR Command Line Options

Parameter	Function
-d1	Turns on a background screen log of DHCP packets
-d2	Turns on a background screen log of Debug statements and DHCP packets

Parameter	Function
-d3	Turns on a background screen log of Debug statements and DHCP packets and writes the log to the server's \ETC\DHCPSTRVR.LOG file
-h	Displays command line syntax
-py	Specifies the global polling interval in y minutes
-s	Forces server to read from and write to the master replica

4

Optimizing

You can optimize the performance of Novell® DNS/DHCP Services software by using state-of-the-art servers. We highly recommend that you use a server with a 200 MHz (or higher) Pentium* processor with 64 MB of memory. If your network configuration is large, more memory might provide improved performance.

For optimum performance, the designated server should be the most powerful server available. The designated server is the only server in a given tree that performs Dynamic DNS updates and zone transfers of secondary zone information.

The I/O subsystem of the servers can also be an issue for server performance. If you use both DNS and DHCP functions of Netware® 6, you will increase the number of eDirectory™ objects and thereby increase the disk space requirements of your SYS: volume.

Because the DNS and DHCP servers cache the required eDirectory data from disk into system memory, access to this information is not slowed.

Optimizing DNS Performance

Although there is no limit to the size of a zone when you configure DNS, we recommend that you limit the size of any zone to no more than 5,000 objects. If you have a zone with more than 5,000 objects, dividing the objects between two zones will improve performance.

Optimizing DHCP Performance

Although there is no limit to the size or number of subnets when you configure DHCP, we recommend that you limit the number of objects within a single

subnet to no more than 2,048. A Novell DHCP server can support several large subnets in a DHCP-only configuration. However, the higher the number of IP Address objects supported, the greater the impact on DHCP server run-time performance.

5

Managing

This document provides information about installing and using the DNS/DHCP Management Utility to perform management tasks.

DNS/DHCP Management Utility

The DNS/DHCP Management Utility is a Web-based utility that enables network administrators to set up and manage DNS (DNS Service) and DHCP (DHCP Service) and the eDirectory™ objects created for DNS and DHCP.

IMPORTANT: Before you can use the DNS/DHCP Management Utility, the eDirectory schema must be extended to create the DNS/DHCP Group and Locator objects and to create the RootSrvrInfo zone. The eDirectory schema is extended when you activate Novell® DNS/DHCP Services from the Customize Server window during the installation of Netware® 6.

The DNS/DHCP Management Utility provides the following management functions from the browser workstation:

- ♦ Importing and exporting configuration to and from eDirectory
- ♦ Creating, updating, reading, or browsing configuration information
- ♦ Viewing DNS and DHCP server status, events, and alerts

After the software installation, existing DNS information is converted to master file format and can be imported to the server where Netware 6 has been installed. You must use the DNS/DHCP Management Utility to import any existing DHCP information. If you have no existing configuration information to import, you must use the DNS/DHCP Management Utility to create the necessary objects to support your network. If you have imported configuration information, use the DNS/DHCP Management Utility to create the DNS and DHCP server objects prior to operation.

Installing the DNS/DHCP Management Utility

Prerequisites

Hardware Requirements

- ☐ Pentium II processor. Pentium III recommended.
- ☐ SVGA display
- ☐ 256 MB of RAM (minimum)
- ☐ 50 MB DOS partition (minimum). 1GB recommended.
- ☐ 50 MB of available disk space (minimum). 1GB recommended.
- ☐ SYS volume of size 2 GB (minimum); 4 GB default.

Software Requirements

- ☐ Novell Netware[®] 6
- ☐ iManage
- ☐ Internet Explorer 5.0 and above

Launching the DNS/DHCP Management Utility

To launch the DNS/DHCP Management Utility, complete the following steps:

- 1** Open Internet Explorer from any machine running Windows 95/98/NT/2000.
- 2** Type the following URL in the address bar of the Internet Explorer window:

`https://xxx.xxx.xxx.xxx:2200/eMFrame/iManage.html`

where xxx.xxx.xxx.xxx is the IP Address of the Netware machine.
- 3** To login to the DNS/DHCP Management Utility, enter the following details:
 - username
 - eDirectory context
 - password
 - eDirectory tree
- 4** Click the Roles and Tasks icon in the taskbar.

The DNS/DHCP Management Utility roles appear in the left pane.

To manage DNS services, click DNS Management and choose from the available options.

To manage DHCP services, click DHCP Management and choose from the available options.

Using the DNS/DHCP Management Utility

You must have sufficient rights to use the DNS/DHCP Management Utility. All network administrators must have Read and Write rights to the container where the DNS/DHCP Locator and Group objects are located.

Administrators also must have Read and Write rights to the specific containers they manage. For example, if your company has offices in Chicago, Washington, and Providence, all administrators would require Read and Write rights to the container storing the Locator and Group objects. However, the administrator in Chicago would require Read and Write rights only to the Chicago part of the tree for the following objects:

- ♦ DNS and DHCP server objects
- ♦ DNS Zone object
- ♦ Subnet container object
- ♦ Subnet Pool object

It might be convenient to create an eDirectory group object for administrators and grant that object the necessary rights.

Managing DNS

Managing DNS is managing primary and secondary zones. When beginning configuration, it might be better to import the data, especially if you have a large zone. Doing so reduces the chances of error.

If you are using Dynamic DNS (DDNS), when a client receives an address assignment from the DHCP server, a request is made to update eDirectory. The only way to override DDNS is by using the DNS/DHCP Management Utility.

After you have installed and configured your zones, you must still use the DNS/DHCP Management Utility to assign a DNS server to service the zones.

Managing DHCP

After configuring your DHCP servers and beginning to provide DHCP services, you can also perform auditing or generate SNMP traps.

Deciding which DHCP options to use depends on your implementation. Refer to [“DHCP Options” on page 43](#) for information about available DHCP and BOOTP options.

Managing DDNS is complicated because each Subnet Address Range type requires a different configuration. Each type's configuration requirements are described later in this chapter.

It is important to understand the difference between static (or manual) and dynamic address assignment. If you use static address assignment, you must use the DNS/DHCP Management Utility to assign permanent IP addresses to the clients in your tree. If you are using dynamic address assignment, the DHCP server assigns the address to a client when it starts.

You can deny address assignment to clients based on hardware address-based exclusion.

Events and Alerts

You can configure the DNS and DHCP servers to maintain a history of server activity in the events log. Events are activities that are considered significant, such as the loading or unloading of the server or problems the server encounters. The events logged depend on the parameters set on the server.

You can configure DNS and DHCP servers to log major events, all events, or none (the default).

Event logs can be saved for future reference. When you are logging events, it is important to pay attention to the event log size. Event logs grow rapidly, especially if you are experiencing or researching problems. Event logs should be maintained or purged regularly to control the amount of disk space used. You can launch the CSAUDIT management utility by typing **CSAUDIT** at the server console.

Refer to [“Configuring for Auditing” on page 104](#) for information about configuring event logging and viewing the event logs.

Auditing Server Activity

The audit trail log records a history of activity logged by DNS and DHCP servers. You can use the Audit Trail log to diagnose network trends. A DNS audit trail would include a history of DNS queries and the hosts requesting them. A DHCP audit trail would include a history of address assignments, including which host had an address during a given period of time and a list of addresses that had already been in use when pinged.

Refer to “[Configuring DNS Auditing](#)” on page 105 for information about configuring a DNS server for auditing. Refer to “[Configuring DHCP Auditing](#)” on page 108 for information about configuring a DHCP server for auditing.

6

Troubleshooting

This chapter contains troubleshooting information for DNS and DHCP.

DNS

This section provides the following troubleshooting information for DNS:

- ◆ “Troubleshooting Checkpoints” on page 123
- ◆ “Common Configuration Problems” on page 124
- ◆ “Common Operational Problems” on page 125
- ◆ “Troubleshooting Windows 95 TCP/IP Problems” on page 128
- ◆ “Using the “-F” Command Line Option for DNIPINST.NLM” on page 134
- ◆ “Server Access to DNS/DHCP Locator Object Not Required” on page 134

Troubleshooting Checkpoints

If you experience problems related to DNS or TCP/IP, you can use the following steps to begin troubleshooting.

1. Run the WINIPCFG utility to determine your IP address, then ping your address from a functioning client.

If you do not receive a response, your client's TCP/IP stack is not functioning. One of the following problems might be the cause:

- ◆ The client's TCP/IP stack might be incorrectly configured.
- ◆ The client did not receive an IP address from DHCP properly.

- ◆ The IP address is already in use by another client.
2. Ping an IP address on your local network.

If this approach fails, one of the following conditions might be the cause:

 - ◆ The client you pinged is not operational.
 - ◆ The LAN is experiencing problems.
 - ◆ Your client's TCP/IP stack is experiencing problems.
 3. Ping an address on a different network or on the internet.

If this approach fails but the preceding steps were successful, the problem is probably related to your router or your client's default router. If you are using DHCP, the default router configured for the DHCP server for each client is probably incorrectly configured.
 4. Verify name resolution within your network. Ping a domain name within your company's network.

If this approach fails, the default DNS server configured for your TCP/IP stack is invalid, or the DNS server is not functioning. If you are using DHCP, the DNS server that is configured on the DHCP server is not properly configured.
 5. Verify name resolution through the internet. Ping a host on the internet, such as novell.com.

If this approach fails, your company's DNS server (that forwards DNS requests to the Internet) is not functioning, or the Internet DNS server to which your DNS server forwards requests is not functioning.

Common Configuration Problems

If you experience problems with DNS, check the following configuration problems.

1. Check the consistency of glue records that are shared between parent and child zones. Make sure that Name Server (NS) and Address (A) records within the parent zone match those in the child zone.
2. Keep the IP addresses of the root name servers configured in the RootServerInfo zone updated. Changes to this information are not automatically propagated through a domain; you must enter them manually. The most recent update of root name server information is available through FTP at <ftp://rzs.internic.net/domain/named/root>.

3. Verify consistency between Pointer records in the IN-ADDR.ARPA domain and other domains.
4. If you change the IP address of a name server, ensure that the parent zone reflects that change.
5. Verify that you have configured a name server to correctly serve every zone.
6. Verify that zone transfers are occurring properly. Ensure that the secondary name server can identify the primary name server.
7. If you cannot access a particular host, verify that PTR records exist. When you create a zone, always select Yes when prompted to create a companion zone. If you created a companion zone, verify that the IP address and hostname are correct.

Common Operational Problems

Internet RFC 1912 provides information about common operational errors found in both the operation of DNS servers and the data the DNS servers contain. The following list describes the most common operational errors that occur.

- ♦ Problem—Hosts cannot access a particular system. You changed the IP address for this system recently, but the secondary name server has not yet been updated.

Cause—The Start of Authority (SOA) record's serial number was not properly incremented. Without the serial number increment, the secondary name server does not recognize when a change has been made. This is usually not a problem with eDirectory™-based DNS because the serial number is incremented automatically. With UNIX systems, failure to increment the serial number is the most common cause of DNS errors. The secondary server does not automatically test for changes in the SOA record. Any changes in the SOA record must be accompanied by a change in the SOA record serial number.

Solution—Do not change the SOA record serial number manually with eDirectory-based DNS. If the primary server is not eDirectory-based, you might need to change the serial number manually for the secondary server to recognize that a change has occurred.

- ♦ Problem—You cannot access a particular host.

Cause 1—When you created a new zone, the PTR records were not created or the PTR records have been deleted or changed.

Solution 1—When you configure a zone, always select Yes when prompted to create a companion zone. If you created a companion zone, verify that the IP address and hostname are correct. Checkers can easily catch neglected PTRs. For further information, refer to RFCs 1537 and 1713.

Cause 2—The host is down or is unreachable.

Solution 2—Use PING to locate the connectivity problem. If the problem exists in your domain, make the necessary repairs to restore connectivity.

Cause 3—The name server for that domain is not configured with information for the host.

Solution 3—Configure the name server for that domain with information for the host.

- ♦ Problem—You cannot access a host in a different domain using its domain name, but you can access it using its IP address.

Cause—The IP address or CNAME alias entry of the host's primary or secondary name server was changed, but the parent domain was not informed of the change. The address information in the glue record maintained by the parent domain has become invalid. Another possible cause is that the original address information in the glue record for the local zone is invalid or missing.

Solution—When you configure a new zone, always enter the IP address when prompted. Verify that all parent zones have the same address information.

- ♦ Problem—Nonlocal hosts cannot find the primary domain server for a subdomain and, therefore, cannot access hosts in that subdomain.

Cause—The IP address of a subdomain's primary server does not match the hostname and IP address configured in the parent domain for the subdomain's primary server.

Solution—Verify that the hostname and IP address for the subdomain's primary server configured in the parent domain is valid and matches the information configured in the subdomain.

- ♦ Problem—A particular host cannot access other hosts.

Cause—The `resolv.cfg` file (or equivalent) of the host does not contain the correct domain name or name server address.

Solution—Enter the correct domain name or name server address in the hosts's resolv.cfg file (or equivalent).

- ♦ Problem—Hosts cannot access an entire external domain.

Cause 1—The root name server information is invalid; therefore, the root servers are unreachable. For non-eDirectory systems running DNS, changes to this information are not automatically propagated through a domain; you must enter the changes manually.

Solution 1—Verify that the IP addresses of the root name servers configured in the RootServerInfo zone are correct. The most recent update of root name server information is available through FTP at <ftp://rzs.internic.net/domain/named/root>.

Cause 2—The hostname or IP address was not resolved because the delegation to the zone is incorrect.

Solution 2—Configure the correct hostname or IP address information for the zone in eDirectory.

Cause 3—The hostname or IP address was resolved to the wrong value.

Solution 3—Change the hostname or IP address information for the zone to the correct value in eDirectory.

Cause 4—The name server information of the primary name server of the domain is incorrect or missing in the root name servers.

Solution 4—Verify that the domain is properly registered with the INTERNIC, the organization that configures the name server information of the domain.

Cause 5—The name server for the domain is down or is unreachable.

Solution 5—Use PING to locate the connectivity problem. If the problem exists in your domain, make the necessary repairs to restore connectivity.

Cause 6—The root name server for the domain is down or is unreachable.

Solution 6—Use PING to locate the connectivity problem. If the problem exists in your domain, make the necessary repairs to restore connectivity.

Cause 7—You do not have sufficient rights to access the zone.

Solution 7—Contact the network administrator for the zone and obtain sufficient rights to access the zone.

- ♦ Problem: After you create or modify a Resource Record object, the change is not reflected in the server cache and the zone transfer fails.

Cause 1: The Zone SOA serial number is not automatically updated after the modification is made.

Solution 1: After you modify the Resource Record, change the Zone SOA serial number manually.

Cause 2: The server cache is not atomically refreshed after modifications are made.

Solution 2: Unload the NAMED.NLM module and reload it to refresh the DNS server settings.

- ♦ Problem: The client is not assigned an IP address.

Cause: The DHCP Server object is not properly configured.

Solution: Make sure you have created the DHCP Server object, at least one Subnet object, and one Subnet Address Range object. Verify that when you load the DHCP Server module, DHCP SRVR.NLM, a message from the Netware system console indicates that the IP database is loaded.

Troubleshooting Windows 95 TCP/IP Problems

This section provides assistance for those troubleshooting TCP/IP problems on Windows 95* clients. You should have a basic understanding of TCP/IP and how it is configured for Windows 95.

Using WINIPCFG

The WINIPCFG utility displays a client's current TCP/IP configuration. To execute this utility, click Start > Run, enter **wipcfg**, and click Enter.

If the client's IP address was statically assigned and configured, the information that was entered under TCP/IP Protocols in the control panel's Network settings is displayed.

If the client was configured to obtain an address using DHCP, the information displayed was received from the DHCP server that assigned the IP address.

WINIPCFG provides the following information about the client:

- ♦ Network adapter address
- ♦ Assigned IP address
- ♦ Subnet mask
- ♦ Default gateway (default router)

- ◆ Hostname
- ◆ DNS Server

If the client has obtained an address from a DHCP server, click **More Info** to identify the DHCP server, when the lease began, and when it expires. Four additional buttons provide the following functions:

- ◆ **Renew**—Sends a DHCPREQUEST to the DHCP server, updates the lease, and updates any assigned values such as a default gateway or DNS server.
- ◆ **Release**—Sends a DHCPRELEASE to the DHCP server indicating that the client is giving up its IP address and that the server is free to assign that address to another client.
- ◆ **Renew All**—Sends a DHCPREQUEST to all network interfaces to which the Windows 95 client is configured.
- ◆ **Release All**—Sends a DHCPRELEASE to all network interfaces to which the Windows 95 client is configured.

If you want another IP address to be assigned to the client, select **RELEASE**, then select **RENEW**.

Using PING

PING is the most basic utility available to test, verify, and troubleshoot TCP/IP connectivity within a network. PING sends an ICMP packet to a specific host with a small amount of data and expects that host to respond with the same data packet. If you receive a response, both TCP/IP and connectivity between the two hosts are operational. If you do not receive a response, one of the following conditions exists:

- ◆ The host is not up.
- ◆ A router between the connections is not up.
- ◆ The client's TCP/IP stack is not functioning.

To run PING, from a DOS prompt enter the command followed by a hostname or IP address, such as the following:

```
C:\> ping www.novell.com >
```

If TCP/IP is operational and connectivity exists between the hosts, you will receive the following type of response:

```
Pinging www.novell.com [137.65.2.5] with 32 bytes of
data:Reply from 137.65.2.5: bytes=32 time=27ms
TTL=59Reply from 137.65.2.5: bytes=32 time=22ms
TTL=59Reply from 137.65.2.5: bytes=32 time=31ms
TTL=59
```

If you use the IP address of the host, you will receive the same type of reply.

Using the host's domain name is a good way to determine the host's IP address, and doing so also causes the client to request DNS name resolution before sending the ICMP packet. This approach is an excellent way to determine if DNS name resolution is working. If it is not working, you will receive a message such as the following:

```
Unable to resolve www.novell.com.
```

If DNS name resolution is not working, one of the following conditions might be the cause:

- ♦ The DNS server or DNS domain name is not configured properly on the client.
- ♦ If using DHCP, the DNS server and/or domain name are not properly configured on the DHCP server.
- ♦ The DNS server to which you send DNS name resolution requests is not functioning.

The PING command has the following syntax:

```
ping [-t] [-a] [-n count] [-l size] [-f] [-i TTL] [-v TOS]
[-r count] [-s count] [[-j host] | [-k host-list]] [-w timeout]
destination list
```

Table 11, “PING Options,” on page 130 explains the use of the PING options.

Table 11 **PING Options**

Option	Meaning
-t	Ping specified host until interrupted
-a	Resolve addresses to hostnames
-n count	Number of echo requests to send
-l size	Send buffer size

Option	Meaning
-f	Set Don't Fragment flag in packet
-i TTL	Time-To-Live value
-v TOS	Type of service
-r count	Record route for count hops
-s count	Time stamp for count hops
-j host-list	Loose source route along host-list
-k host-list	Strict source route along host-list
-w timeout	Timeout in milliseconds to wait for each reply

NOTE: You can find unauthorized addresses in an exported DHCP configuration by searching for IP Address objects with an Assignment Type value of 32. Use FIND in a text editor to quickly identify addresses that have been marked as unauthorized.

Using TRACERT

TRACERT can be very useful when you are resolving network-wide TCP/IP problems. TRACERT traces the route to a specific host and displays all hops that occur to search for the target host.

To run TRACERT, from a DOS prompt enter the command followed by a hostname or IP address, such as the following:

```
C:\> tracert www.novell.com
```

The TRACERT command has the following syntax:

```
tracert [-d] [-h maximum_hops] [-j host-list] [-w timeout] target_name
```

Table 12, “TRACERT Options,” on page 132 explains the use of the TRACERT options.

Table 12 TRACERT Options

Option	Meaning
-d	Do not resolve addresses to host names
-h maximum_hops	Maximum number of hops to search for target
-j host-list	Loose source route along host-list
-w timeout	Timeout in milliseconds to wait for each reply

Using ARP

ARP is an advanced utility that should be used only by those who have a detailed understanding of TCP/IP and must troubleshoot complex problems. The ARP command enables you to display and modify the ARP cache of a client.

Following are three examples of use of the ARP command:

```
ARP -s inet_addr eth_addr [if_addr]
ARP -d inet_addr [if_addr]
ARP -a [inet_addr] [-N if_addr]
```

Table 13, “ARP Options,” on page 132 explains the use of the ARP options.

Table 13 ARP Options

Option	Meaning
-a	Displays current ARP entries by interrogating the current protocol data. If inet_addr is specified, the IP and physical addresses for the specified host are displayed.
-g	Displays current ARP entries by interrogating the current protocol data. If inet_addr is specified, the IP and physical addresses for the specified host are displayed.
inet_addr	Specifies an Internet address.
-N if_addr	Displays the ARP entries for the network interface specified by if_addr.
-d	Deletes the host specified by inet_addr.

Option	Meaning
-s	Adds the host and associates the internet address inet_addr with the physical address eth_addr. The physical address is given as six hexadecimal bytes separated by hyphens. The entry is permanent.
eth_addr	Specifies a physical address.
if_addr	If present, specifies the Internet address of the interface whose address translation table should be modified. If not present, the first applicable interface is used.

Using NETSTAT

NETSTAT is an advanced utility that should be used only by those who have a detailed understanding of TCP/IP and must troubleshoot very complex problems. NETSTAT displays protocol statistics and current TCP/IP network connections.

The NETSTAT command has the following syntax:

```
NETSTAT [-a] [-e] [-n] [-s] [-p proto] [-r]
[interval]
```

Table 14, “NETSTAT Options,” on page 133 explains the use of the NETSTAT options.

Table 14 **NETSTAT Options**

Option	Meaning
-a	Displays all connections and listening ports, but not those of the server side.
-e	Displays Ethernet statistics. This might be combined with the -s option.
-n	Displays addresses and port numbers in numerical form.
-p proto	Shows connections for the protocol specified by proto (either TCP or UDP). If used with the -s option to display per protocol statistics, proto can be TCP, UDP, or IP.
-r	Displays the contents of the routing table.
-s	Displays per protocol statistics. By default, statistics are shown for TCP, UDP, and IP. The -p option can be used to specify a subset of the default.

Option	Meaning
interval	Redisplays selected statistics, pausing interval seconds between each display. Press Ctrl+C to stop redisplaying statistics. If omitted, NETSTAT prints the current configuration information once.

If you suspect that a LAN card is malfunctioning, use the -e option while troubleshooting. The -e option displays Ethernet statistics, including discards and errors.

The -a option provides a detailed display of the active TCP connections of the port number and network host communicating with that port. This information is useful when you are attempting to relate TCP port numbers of the various servers with which the client is communicating.

Using the "-F" Command Line Option for DNIPINST.NLM

DNIPINST.NLM is a backup method of extending the schema and creating the DNS/DHCP Locator and Group objects and the RootSrvrInfo zone. DNIPINST.NLM can be used if problems occurred during the Netware 6 installation process. Most administrators will not need to use this NLM.

You can use the "-F" command line option in the DNIPINST.NLM to re-create the DNS/DHCP configuration objects if the initial attempt to set up Novell DNS/DHCP Services fails during the configuration object creation stage.

When a failure occurs during the object creation phase, we recommend that you delete the DNS-DHCP (DNS/DHCP Locator), DNSDHCP-GROUP (DNS/DHCP Group), and the RootSrvrInfo objects (if they have been created), then use DNIPINST.NLM with the "-F" flag. When the "-F" command line option is specified, an initial console message confirms the action and the eDirectory login window appears. After a successful login, the object eDirectory context query window is displayed. You can enter the data and create the objects. If a schema extension error occurs, execute DNIPINST.NLM in the regular mode.

Server Access to DNS/DHCP Locator Object Not Required

The requirement that the DNS and DHCP servers always have access to the DNS/DHCP Locator object has been relaxed.

The DHCP server can load without having access to the DNS/DHCP Locator object. However, the first time the server loads it requires access to the DNS/

DHCP Locator object to obtain a copy of any global configuration from the object. The DHCP server saves a copy of the global configuration in SYS:\ETC\DHCP\DHCPLOC.TAB.

In subsequent loads, the DHCP server will try to obtain the global configuration information from the DNS/DHCP Locator object. If the information is not available, the DHCP server will read the information from the last saved copy of SYS:\ETC\DHCP\DHCPLOC.TAB. Each time the DHCP server loads and the DNS/DHCP Locator object is available, the DHCP server updates the DHCPLOC.TAB file.

The DNS server also does not require access to the DNS/DHCP Locator object. It has been enhanced to require access to the DNS/DHCP Locator object only if the NAMED command line arguments are specified to create zones in eDirectory. The DNS server no longer requires access to the RootSrvrInfo zone stored in eDirectory. The DNS server now first tries to find the RootSrvrInfo zone in eDirectory, but if it is not available, the DNS server uses the copy of the information found in SYS:\ETC\DNS\ROOTSRVR.DAT.

DHCP

This section provides the following troubleshooting information for DHCP:

- ◆ [“Troubleshooting Checkpoints” on page 135](#)
- ◆ [“Common Operational Problems” on page 136](#)
- ◆ [“Releasing and Renewing DHCP Addresses” on page 139](#)

Troubleshooting Checkpoints

1. Verify that IP hosts with DHCP-assigned parameters operate the same as when you manually configured them.

If an IP host does not operate the same as when it was manually configured, verify that the parameters assigned by DHCP are the same as those when the host was manually configured.

If a node is intermittently inoperable, verify that the node is not using the same IP address as another IP host. If a duplicate IP address exists, verify that there is only one DHCP server for the subnet. Also verify that the IP addresses assigned by the DHCP server are not being used by manual nodes.

2. Verify that all DHCP hosts can obtain a DHCP lease when required.

If DHCP hosts cannot obtain a DHCP lease when required, verify that enough leases exist to accommodate all hosts that use DHCP. If there are too few leases, obtain more IP addresses and configure more leases or reduce the lease time to a few hours. This ensures that more leases are made available to other clients that are waiting to use the IP addresses.

If a Windows 95 client cannot acquire a lease and responds with the message `Unable to obtain an IP network address` the client requires a longer timeout. This problem might occur when the client and DHCP server are separated by one or more routers. To increase the timeout for Windows 95 clients, obtain a patch from Microsoft. The patch is dated 2/12/96 and includes a file named VDHCP.386. The patch itself is named DCHCPUPD.EXE.

3. Verify that the number of leases available for clients does not decrease when you are using mobile clients.

If the number of leases available for clients decreases when you are using mobile clients, verify that the mobile clients' lease is released when the client connects from a remote office or that the mobile client can use the same lease and the same IP address at the new location.

- ♦ If the remote office is on a subnet different from that of the local office and the subnet is serviced by a different DHCP server, verify that the lease is released by the first server within a reasonable amount of time after the mobile client moves to the remote office. If the lease is not released quickly enough, reduce the lease time.
- ♦ If the remote office is on a subnet different from that of the local office and the subnet is serviced by the same DHCP server, verify that the `IPAssignmentPolicy` attribute of the DHCP server object in `eDirectory` is set to `DELETE_DUPLICATE`. This ensures that only one lease is in use at a time because the original lease is deleted when the mobile client requests a new lease.
- ♦ If the remote office is on the same subnet as that of the local office, the mobile client should use the same IP address. If the mobile client does not use the same IP address, verify that there is only one DHCP server for the subnet.

Common Operational Problems

The following list describes the most common operational errors that occur.

- ♦ Problem—A node is intermittently inoperable.

Cause—An unauthorized DHCP server has been configured by someone attempting to control or disrupt your network. The unauthorized DHCP server is assigning IP addresses and other configuration parameters that have already been assigned to other nodes by an authorized DHCP server. The result is that nodes are assigned duplicate IP addresses or incorrect configuration parameters. Incorrect configuration parameters can interfere with a node's ability to communicate to the network in any number of ways. Incorrect parameters can even be used to cause a node to connect to a server that is controlled by an unauthorized user, thereby allowing the unauthorized user to take control of the client.

Solution—Find the unauthorized DHCP server and disable it or disconnect it from the network.

- ♦ **Problem**—A Windows 95 client cannot acquire a lease and responds with the message **Unable to obtain an IP network address**

Cause—The Windows 95 DHCP client has a two-second timeout for the time between when it accepts an offer of an IP address in a message sent to the server and the time it expects an acknowledgment of that acceptance in a reply from the server. Other clients, such as Windows NT*, have a four-second timeout.

Solution—Obtain the DCHCPUPD.EXE patch from Microsoft that changes the timeout on Windows 95 clients from two seconds to four seconds. The patch is dated 2/12/96 and includes a file named VDHCP.386.

- ♦ **Problem**—The use of mobile clients causes fewer leases to be available.

Cause 1—The mobile clients' lease is not released when the mobile client moves to a remote office. This can occur when the remote office is on a subnet different from that of the local office and the remote subnet is serviced by a different DHCP server.

Solution 1—Determine the lease time assigned to this client. If the lease is not released quickly enough, reduce the lease time. Otherwise, have the client manually release the old IP address before it leaves the local office.

Cause 2—The mobile client uses two leases at the same time because it cannot use the same lease and the same IP address at the new location.

Solution 2—Use one of the following solutions:

- ♦ If the remote office is on a subnet different from that of the local office and the subnet is serviced by the same DHCP server, verify that the IPAssignmentPolicy attribute of the DHCP server object in

eDirectory is set to DELETE_DUPLICATE. This ensures that only one lease is in use at a time because the original lease is deleted when the mobile client requests a new lease.

- ♦ If the remote office is on the same subnet as that of the local office, the client should use the same IP address. If the client does not use the same IP address, verify that there is only one DHCP server for the subnet.

- ♦ Problem—Clients work properly when manually configured, but some functions do not work when using DHCP.

Cause—One or more global client parameters were not configured properly in DHCP.

Solution—Verify that all parameters assigned by DHCP are properly configured.

- ♦ Problem—At a site with a limited number of leases, many clients cannot obtain a lease. The leases are not being efficiently shared by all clients that must use them.

Cause—Clients are not releasing the leases when they are finished using them because the lease time is too long.

Solution—Reduce the lease time to a few hours so that leases can be made available to other clients that are waiting to use the IP addresses.

Otherwise, you might need to purchase more IP addresses and configure more or larger address ranges to make more IP addresses available.

- ♦ Problem—It is difficult to identify and manage network resources when using dynamic DHCP assignments.

Cause—The IP addresses of the clients might change if you use DHCP continually over a period of time and the lease period is set to a reasonably low value.

Solution—Use static DHCP assignments when you want to use a specific IP address assigned to the client for identification and management.

- ♦ Problem—DHCP SRVR.NLM is loaded and the trace screen has been activated with the -d flag, but there is no evidence of interaction between the server and clients, and clients are not receiving IP address assignments.

Cause—The server is not physically linked to the client's communications media or the server did not bind its IP protocol to the interface card, which shares physical media access with the client.

Solution—Check the server's physical connections. Load INETCFG to ensure that proper binding exists.

- ♦ Problem—DHCP SRVR.NLM is loaded and the trace screen shows client packets being received, but the server is not responding and the REQUEST packets are dropped.

Cause—The server's configuration for its local interfaces does not match the configuration within the Directory for the same server.

Solution—Load INETCFG and check to see if the server has a legal IP address on each local subnet it serves. Also check that each local subnet is properly configured using the DNS/DHCP Management Utility.

Releasing and Renewing DHCP Addresses

When a host is powered on, it is *leased* an IP address for a period of time, depending on the configuration settings of the subnet from which the address is assigned. If the machine is moved to another network while the original IP address lease is still valid, the user must release the lease. Other situations might also require that a lease be released, such as the use of a laptop computer in different locations of a given network.

Windows 95

To manually release and renew a DHCP-assigned IP address in Windows 95, complete the following steps:

1 Select Start, then Run.

2 Type `wiipcfg` and press Enter.

The IP Configuration dialog box is displayed.

3 Click Release All.

The IP Address, Subnet Mask, and Default Gateway fields should display no addresses.

4 Click Renew All.

New addresses should appear in the IP Address, Subnet Mask, and Default Gateway fields.

5 Click OK to close WINIPCFG.

Windows NT

To manually release and renew a DHCP-assigned IP address in Windows NT, complete the following steps:

1 Select Start > Programs > MS-DOS Command Prompt.

2 From the DOS prompt, execute the command

```
ipconfig /release
```

A message is displayed indicating that the assigned IP address has been successfully released.

3 From the DOS prompt, execute the command

```
ipconfig /renew
```

A message is displayed indicating the new IP address that has been assigned.

To review DHCP settings,

4 From the DOS prompt, execute the following command to review DHCP settings:

```
inconfig /all
```