Lesson 11: Deploying and Configuring the DHCP Service

MOAC 70-410: Installing and Configuring Windows Server 2012

Microsoft Official Academic Course

WILEY

Overview

- Exam Objective 4.2: Deploy and Configure Dynamic Host Configuration Protocol (DHCP) Service
- Understanding DHCP
- Designing a DHCP Infrastructure
- Deploying a DHCP Server
- Using PXE

Understanding DHCP

Lesson 11: Deploying and Configuring the DHCP Service

Understanding DHCP

The **Dynamic Host Configuration Protocol (DHCP)** service:

- Automatically configures the IP address and other TCP/IP settings on network computers by assigning addresses from a pool (called a **scope**) and reclaiming them when they are no longer in use.
- Saves time.
- Prevents configuration errors.

Understanding DHCP

DHCP consists of three components:

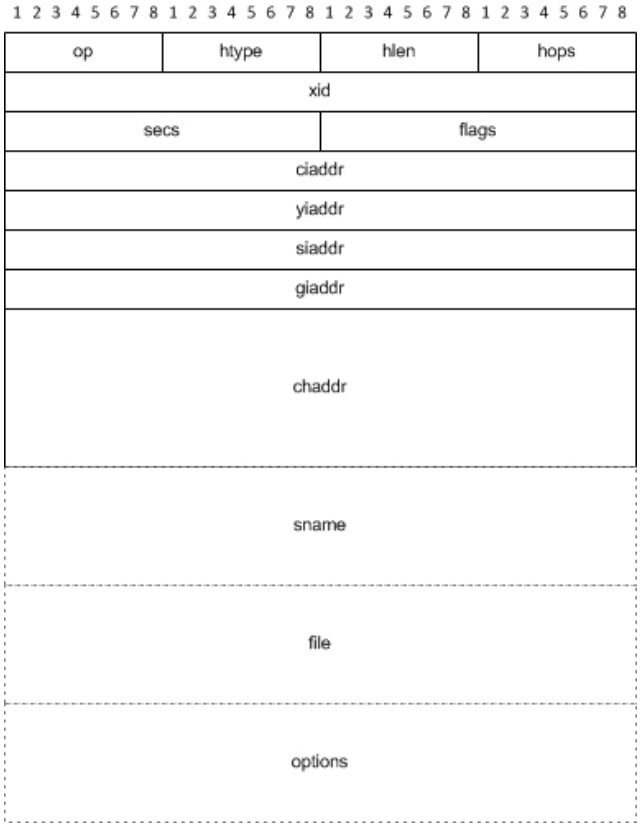
- **DHCP server application**: Responds to client requests for TCP/IP configuration settings.
- **DHCP client**: Issues requests to servers and applies the TCP/IP configuration settings it receives to the local computer.
- **DHCP communications protocol**: Defines the formats and sequences of the messages exchanged by DHCP clients and servers.

Understanding DHCP

Three different IP address allocation methods:

- **Dynamic allocation:** The DHCP server assigns an IP address to a client computer from a scope, for a specified length of time. DHCP servers only lease addresses to clients with this method.
- **Automatic allocation:** The DHCP server permanently assigns an IP address to a client computer from a scope. It is essentially dynamic allocation with an indefinite lease.
- **Manual allocation:** The DHCP server permanently assigns a specific IP address to a specific computer on the network. It is called a reservation. You use manually allocated addresses for computers that must have the same IP address at all times.

DHCP Packets



The DHCP packet format

DHCP Options

There are many other TCP/IP parameters that can be configured by DHCP besides the IP address:

- Magic cookie
- Option format
- DHCP Message Type option
- Pad option
- Option Overload option
- Vendor-Specific Information option
- End option

BOOTP Vendor Information Extensions

- **Subnet Mask:** Specifies which bits of the IP address identify the host system and which bits identify the network where the host system resides.
- **Router:** Specifies the IP address of the router (or default gateway) on the local network segment the client should use to transmit to systems on other network segments.
- **Domain Name Server:** Specifies the IP addresses of the servers the client will use for DNS name resolution.
- **Host Name:** Specifies the DNS host name the client system will use.
- **Domain name:** Specifies the name of the DNS domain on which the system will reside.

IP Layer Parameters

These options affect the functionality of the IP protocol on the client system:

- **IP Forwarding Enable/Disable:** Specifies whether IP forwarding (i.e., routing) should be enabled on the client system.
- **Default IP Time-to-Live:** Specifies the time-to-live value the client should use in its outgoing IP datagrams.
- **Interface MTU:** Specifies the maximum transfer unit to be used by the Internet Protocol on this network interface only.

DHCP Extensions (1)

These options provide parameters that govern the DHCP lease negotiation and renewal processes:

- **Requested IP Address**: Used by the client to request a particular IP address from the server.
- **IP Address Lease Time**: Specifies the duration of a dynamically allocated IP address lease.
- **Server Identifier**: Specifies the IP address of the server involved in a DHCP transaction; used by the client to address unicasts to the server.

DHCP Extensions (2)

- **Parameter Request List**: Used by the client to send a list of requested configuration options (identified by their code numbers) to the server.
- **Message**: Carries an error message from the server to the client in a DHCPNAK message.
- **Renewal (T1) time value**: Specifies the time period that must elapse before an IP address lease enters the renewing state.
- **Rebinding (T2) time value**: Specifies the time period that must elapse before an IP address lease enters the rebinding state.

DHCP Message Types (1)

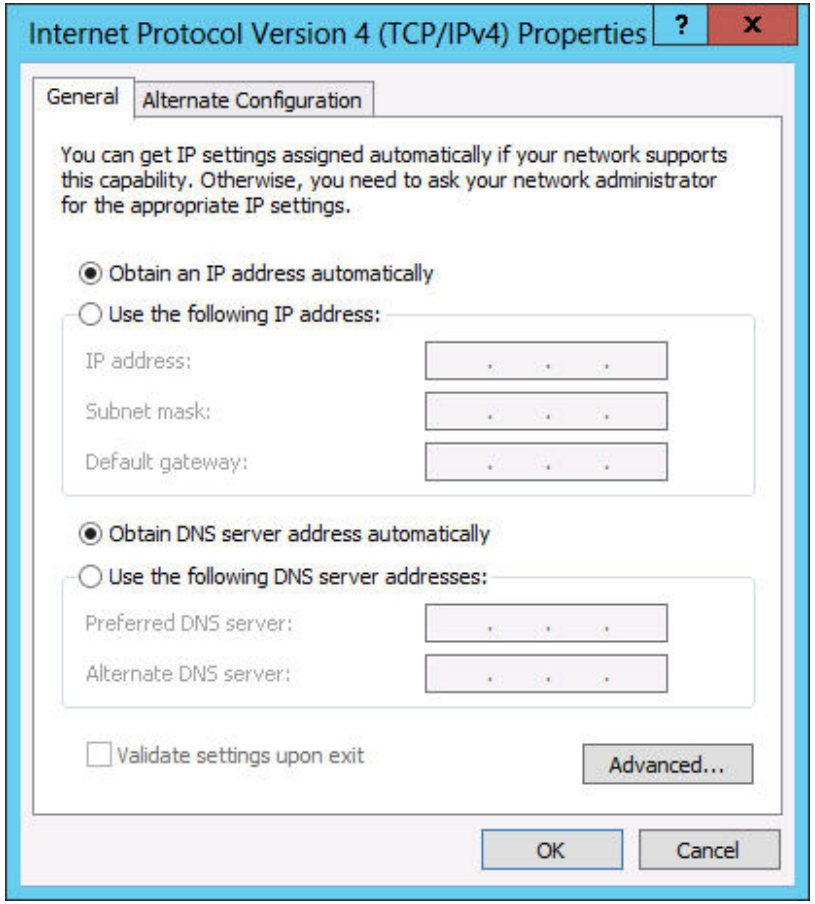
The DHCP communication protocol defines eight different message types:

- **DHCPDISCOVER:** Used by clients to request configuration parameters from a DHCP server.
- **DHCPOFFER:** Used by servers to offer IP addresses to requesting clients.
- **DHCPREQUEST:** Used by clients to accept or renew an IP address assignment.
- **DHCPDECLINE:** Used by clients to reject an offered IP address.

DHCP Message Types (2)

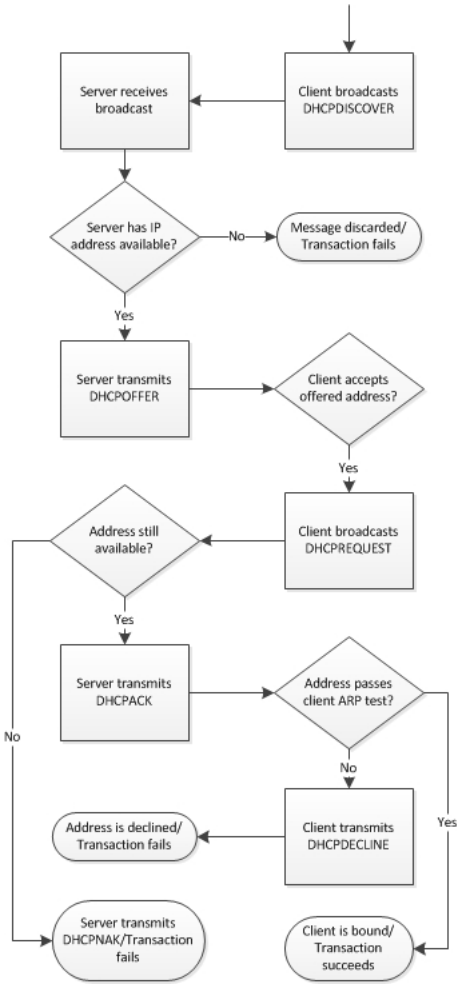
- **DHCPACK:** Used by servers to acknowledge a client's acceptance of an offered IP address.
- **DHCPNAK:** Used by servers to reject a client's acceptance of an offered IP address.
- **DHCPRELEASE:** Used by clients to terminate an IP address lease.
- **DHCPINFORM:** Used by clients to obtain additional TCP/IP configuration parameters from a server.

DHCP Communications



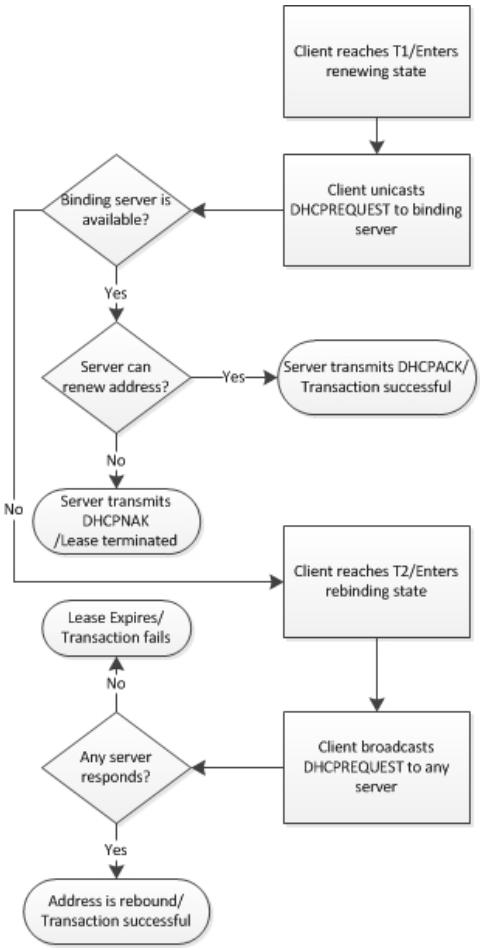
The Internet Protocol Version 4 (TCP/IPv4) Properties sheet

DHCP Lease Negotiation



The DHCP IP address assignment process

DHCP Lease Renewal



The DHCP IP address renewal process

Designing a DHCP Infrastructure

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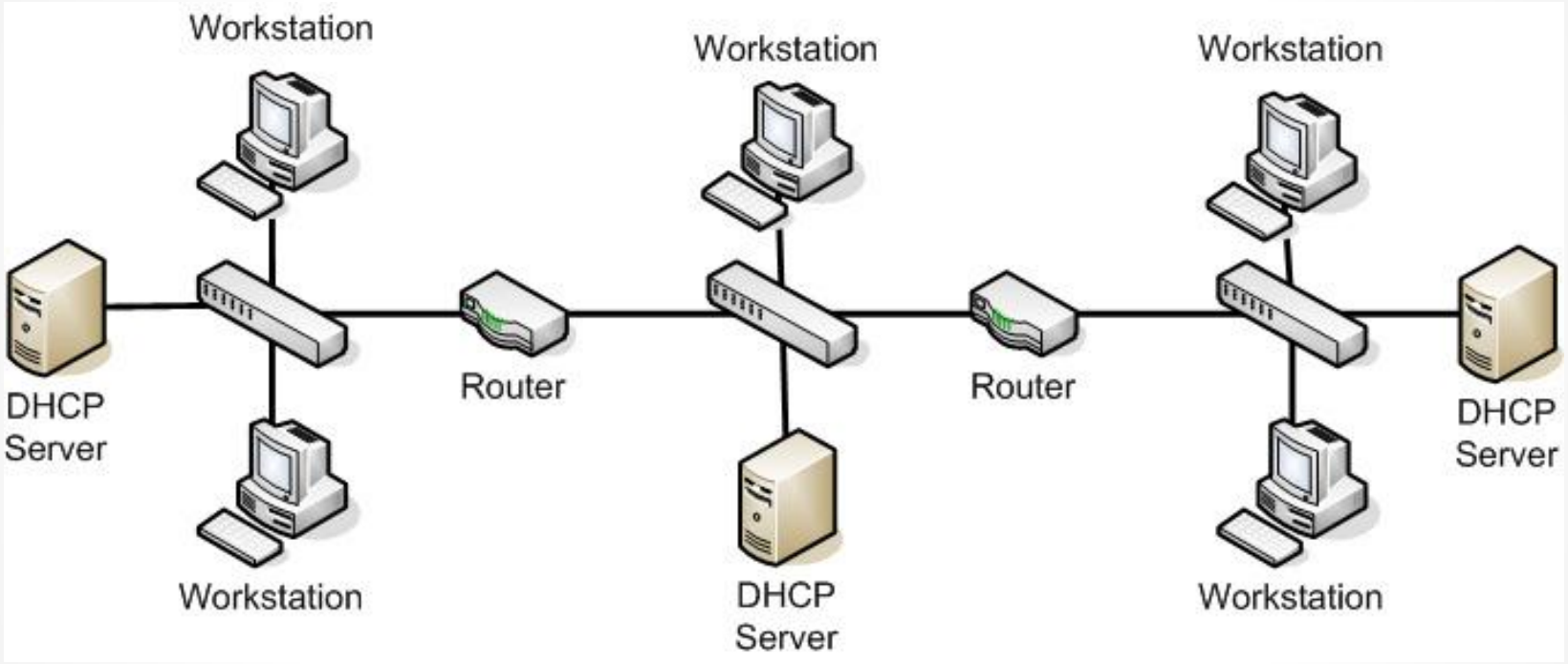
Designing a DHCP Infrastructure

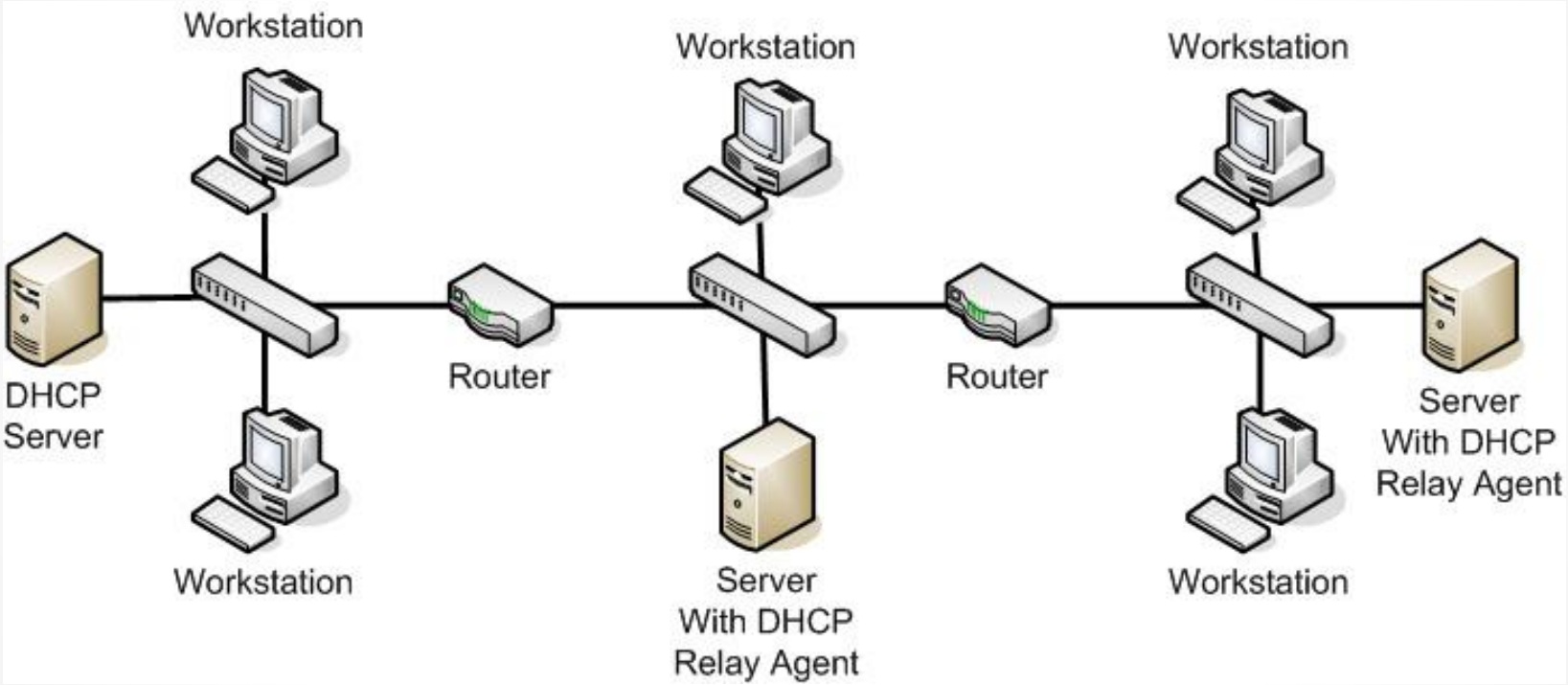
- The Windows Server 2012 DHCP Server service is theoretically capable of supporting many thousands of clients.
- Virtually all enterprise networks require more than one DHCP server.
- DHCP relies on broadcast messages, which have limitations.

Using a Distributed DHCP Infrastructure



A distributed DHCP infrastructure

Using a Centralized DHCP Infrastructure



A centralized DHCP infrastructure

Using a Hybrid DHCP Infrastructure

- The distributed and centralized DHCP infrastructure represents the extremes at opposite ends of the design spectrum.
- The ideal solution resides somewhere between them.
- A hybrid DHCP infrastructure uses multiple DHCP servers on different subnets, but it does not necessarily require a DHCP server on every subnet.

Regulating DHCP Network Traffic

Several factors can effect network traffic and you can make configuration choices that will change the amount of traffic generated by DHCP:

- Place DHCP servers close to the clients.
- Adjust the lease duration so there are fewer renewals.
- Make the lease duration unlimited.

Deploying a DHCP Server

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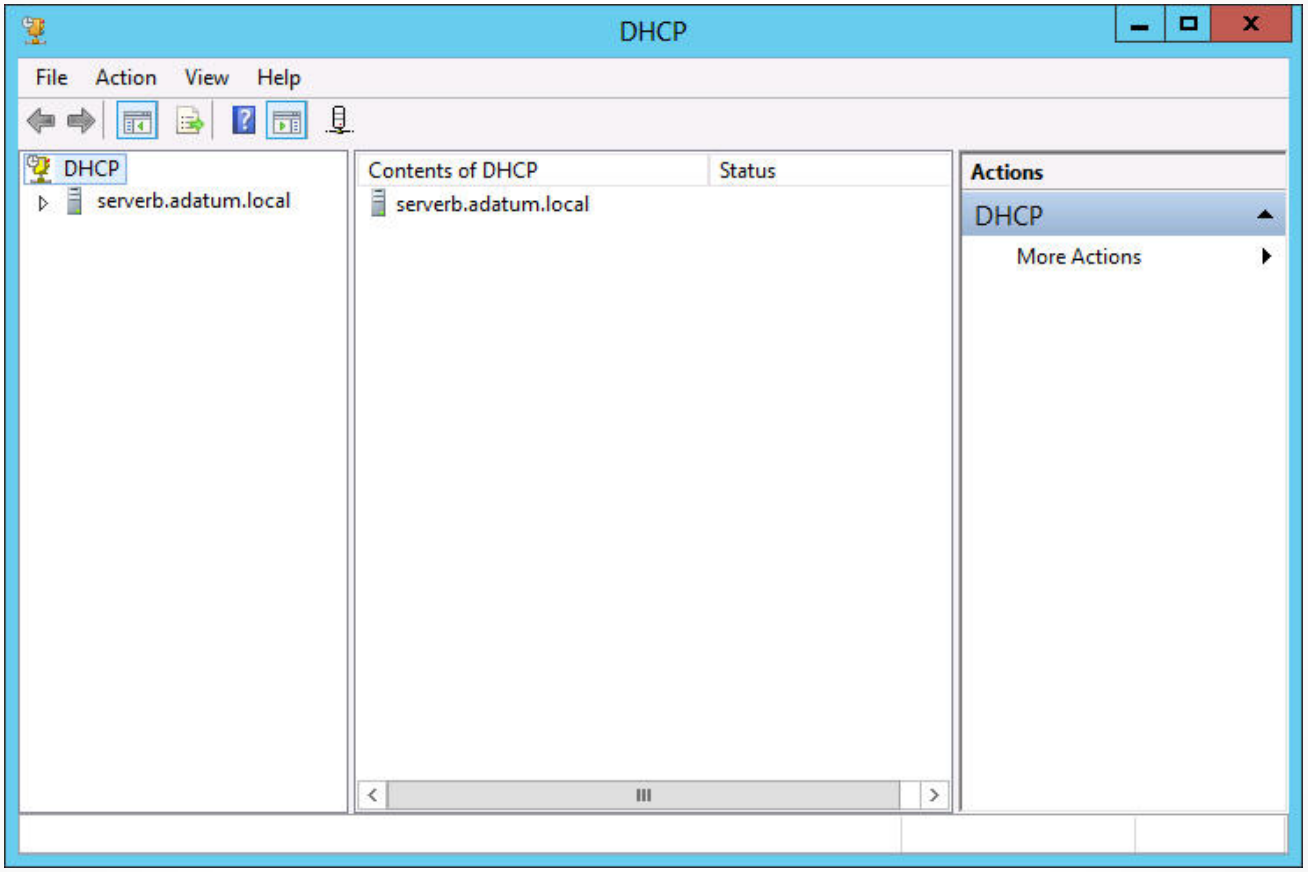
Deploying a DHCP Server

- The DHCP Server service is packaged as a role in Windows Server 2012.
- Install the role, through the Add Roles and Features Wizard in Server Manager.
- DHCP servers operate independently, so you must install the service and configure scopes on every computer that will function as a DHCP server.

Creating a Scope

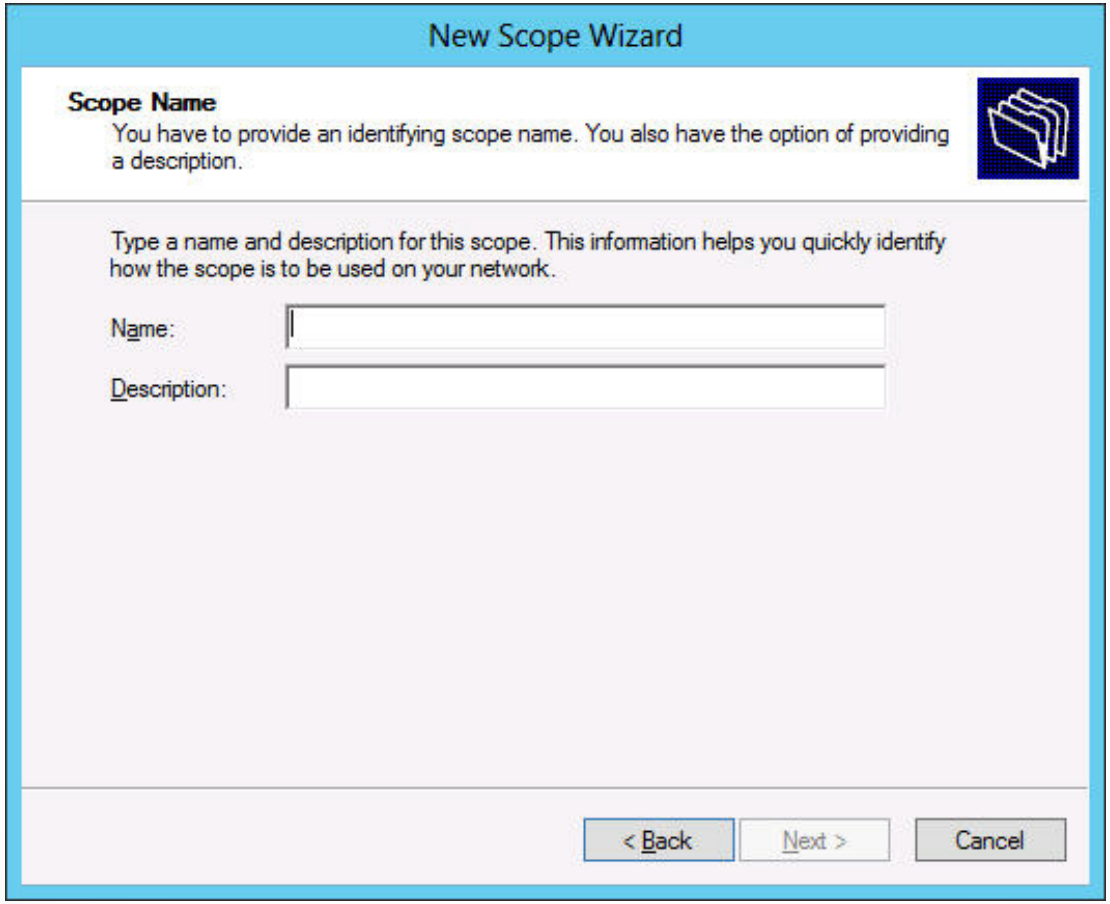
- A scope is a range of IP addresses on a particular subnet that are selected for allocation by a DHCP server.
- Create a scope using the DHCP snap-in for Microsoft Management Console (MMC).

Create a DHCP Scope



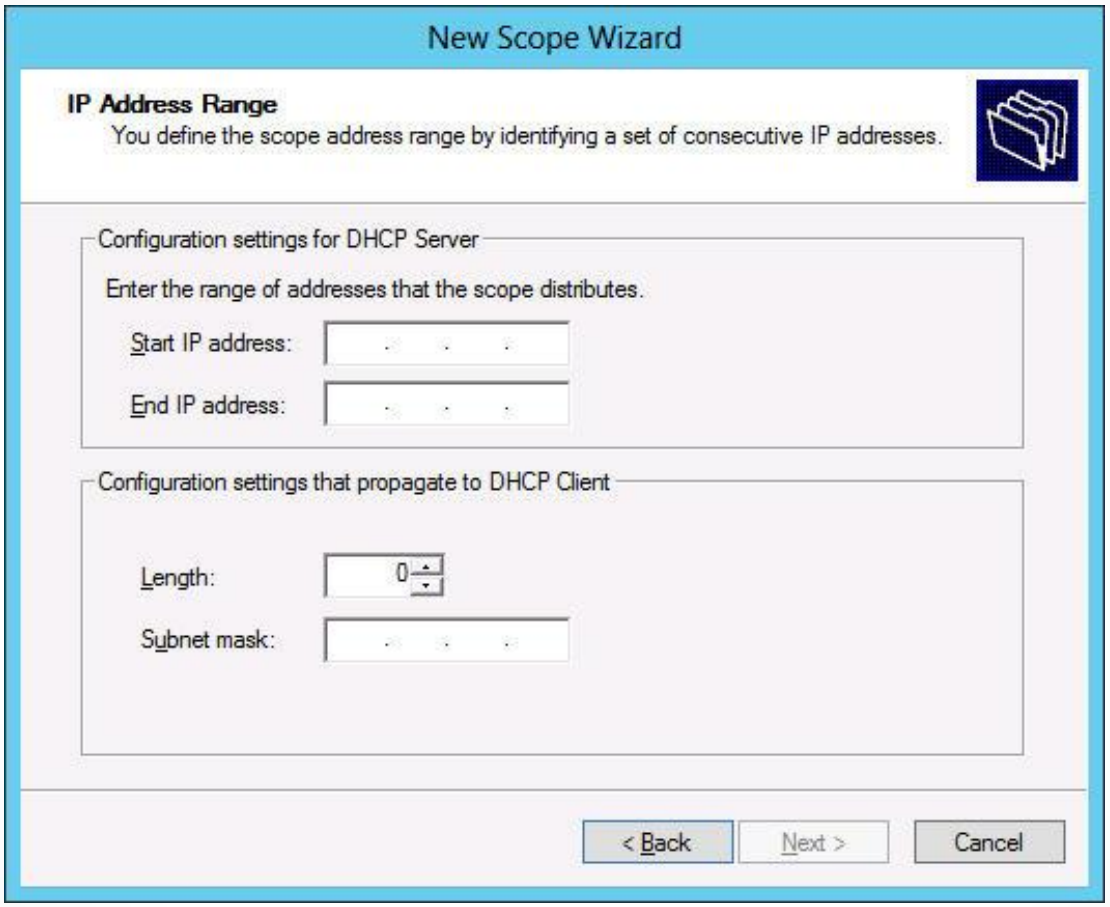
The DHCP console

Create a DHCP Scope



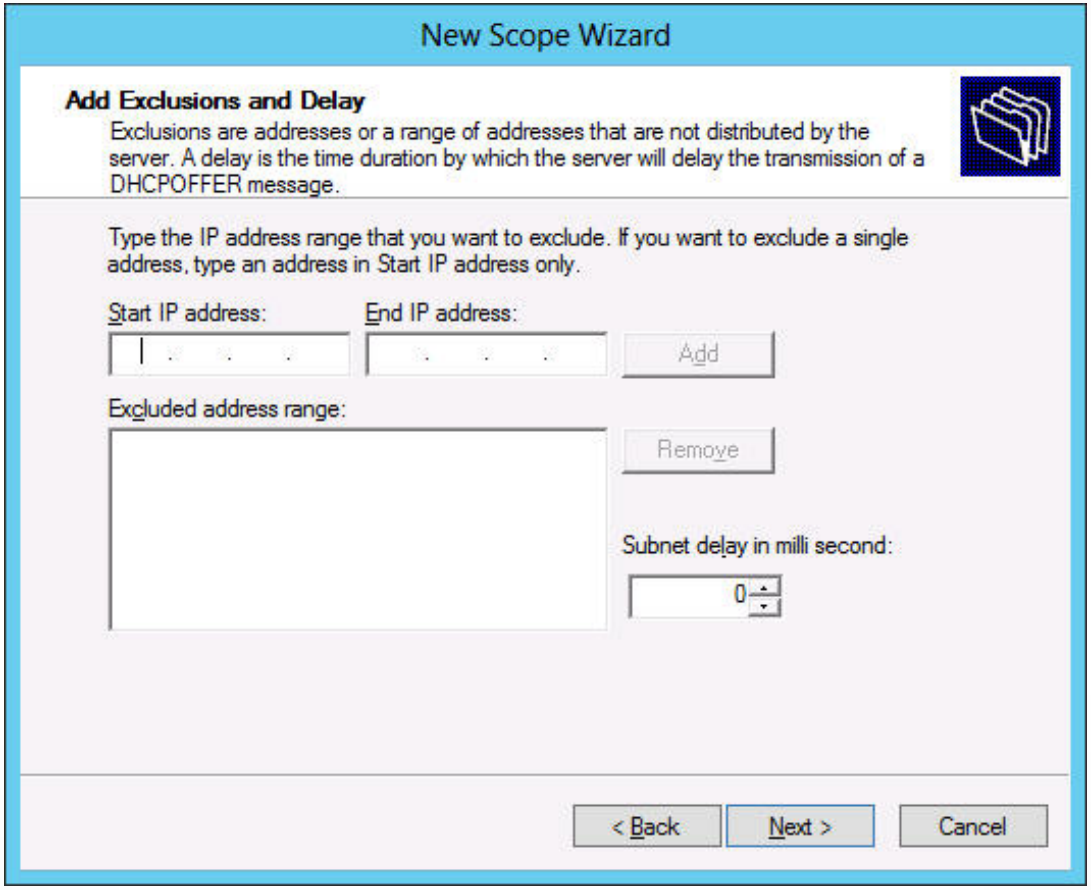
The Scope Name page in the DHCP console

Create a DHCP Scope



The Address Range page in the DHCP console

Create a DHCP Scope

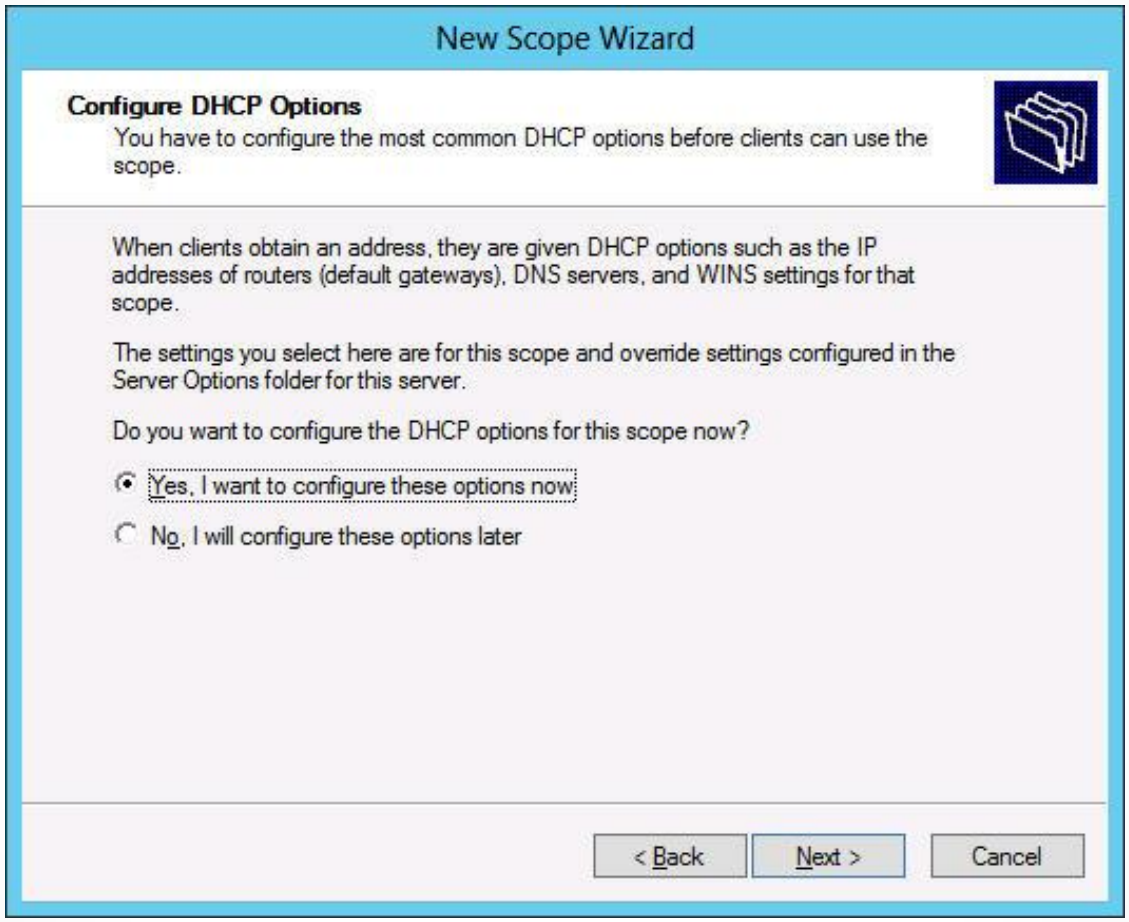


The Add Exclusions and Delay page in the DHCP console

Create a DHCP Scope

The Lease Duration page in the DHCP console

Create a DHCP Scope

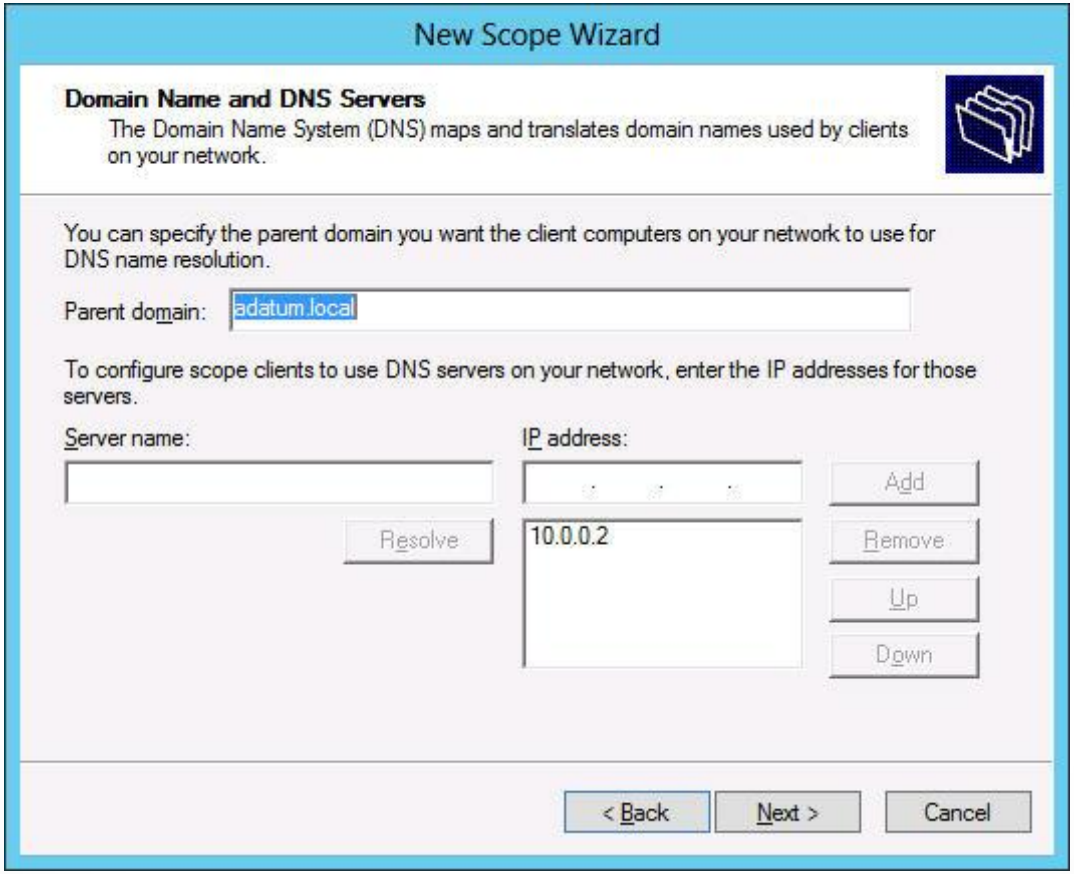


The Configure DHCP Options page in the DHCP console

Create a DHCP Scope

The Router (Default Gateway) page in the DHCP console

Create a DHCP Scope



The Domain Name and DNS Servers page in the DHCP console

Create a DHCP Scope

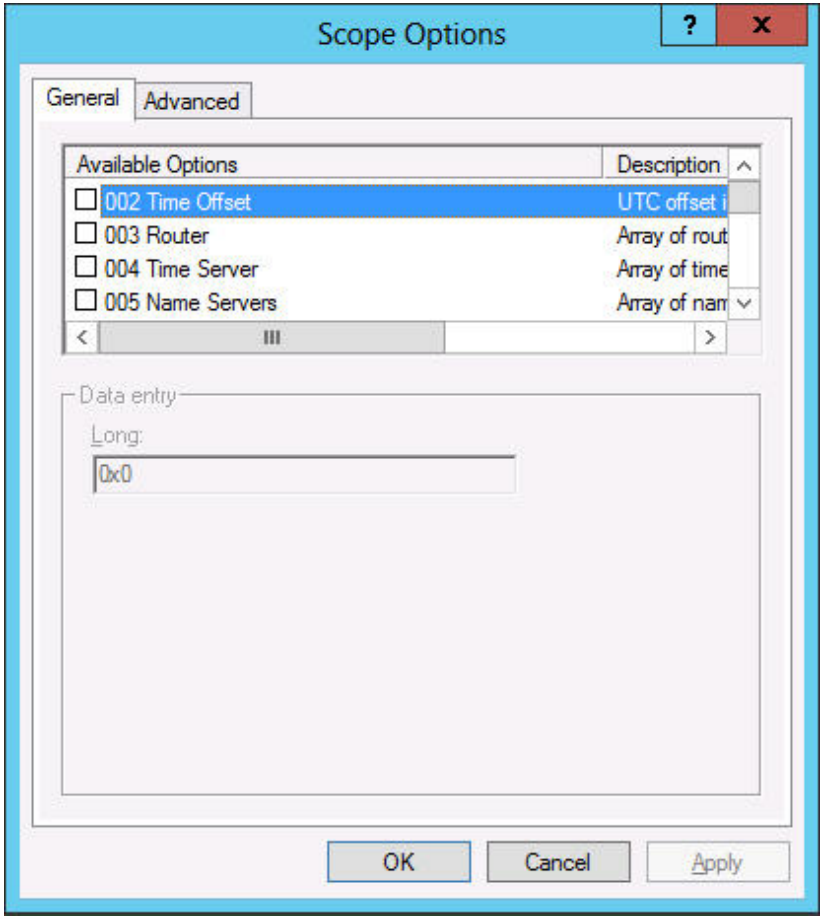
The Activate Scope page in the DHCP console

Configuring DHCP Options

The Windows DHCP server supports two kinds of options:

- **Scope options:** Supplied only to DHCP clients receiving addresses from a particular scope.
- **Server options:** Supplied to all DHCP clients receiving addresses from the server.

Configuring DHCP Options

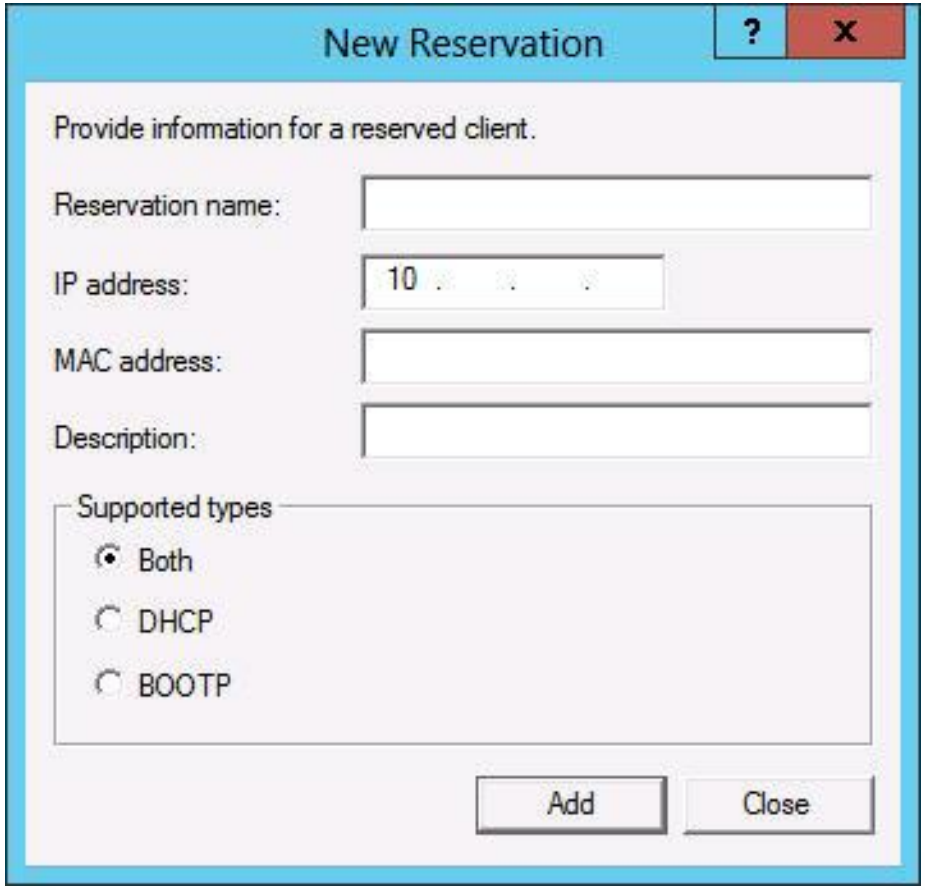


The Scope Options dialog box

Creating a Reservation

- A **reservation** is a manually allocated address.
- Used for computers whose IP addresses must remain the same (static), like domain controllers, DNS servers, and Internet web servers.
- Allows you to manage all of your IP addresses through DHCP.

Creating a Reservation



A DHCP server's New Reservation dialog box

Using PXE

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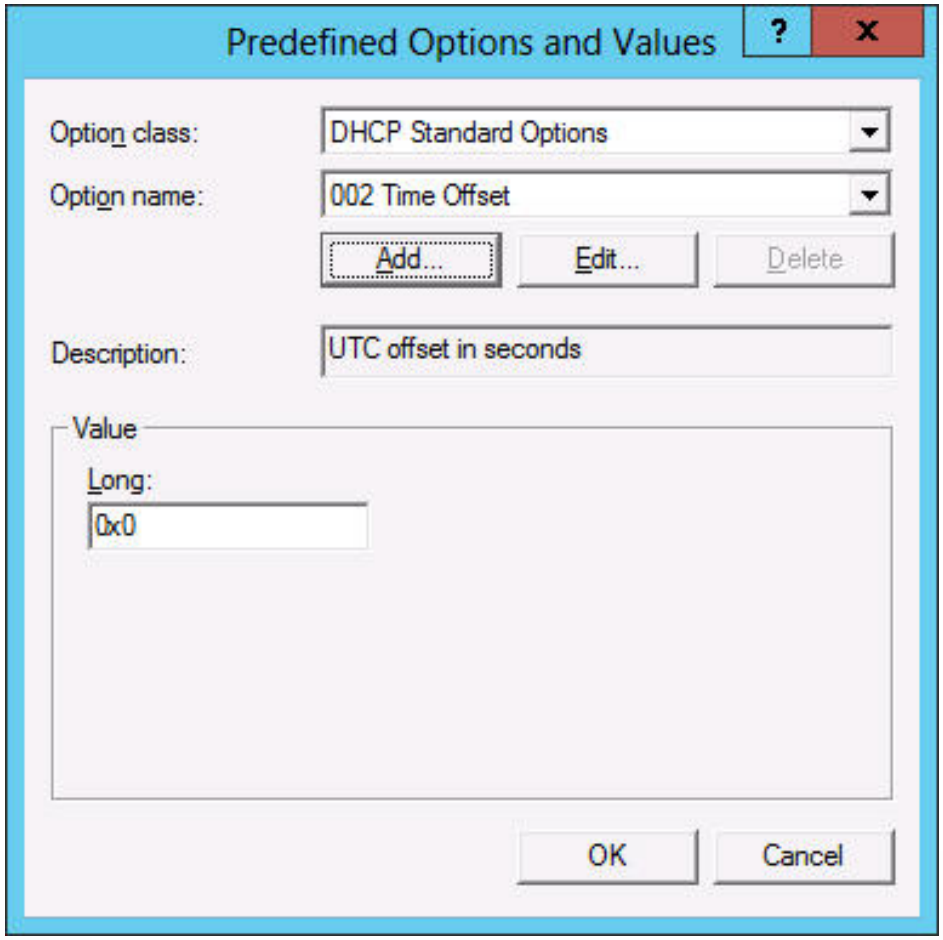
Using PXE

- The **Pre-boot Execution Environment (PXE)** is a feature built into many network interface adapters that enables them to connect to a DHCP server over the network and obtain TCP/IP client settings, even when the computer has no operating system.
- DHCP can also supply the workstation with an option specifying the location of a boot file that the system can download and use to start the computer and initiate a Windows operating system installation.

Using PXE with WDS

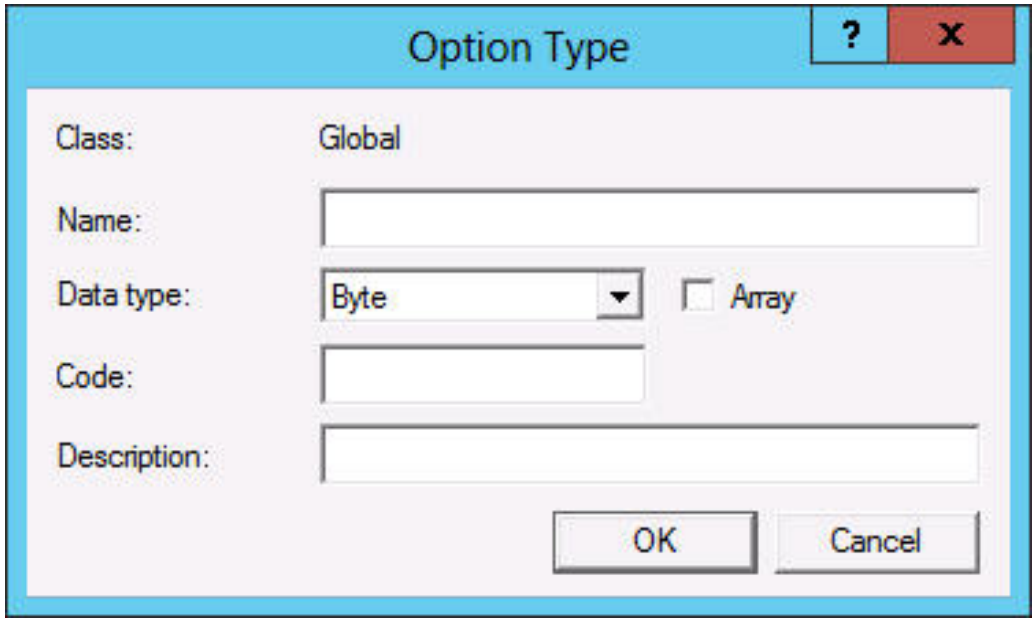
- Windows Deployment Services (WDS) enables administrators to manage image files that remote workstations can use to start up and install Windows.
- For a PXE adapter to access WDS images, the DHCP server on the network must have a custom PXEClient option (option 60) configured with the location of the WDS server on the network.

Configure a Custom DHCP Option



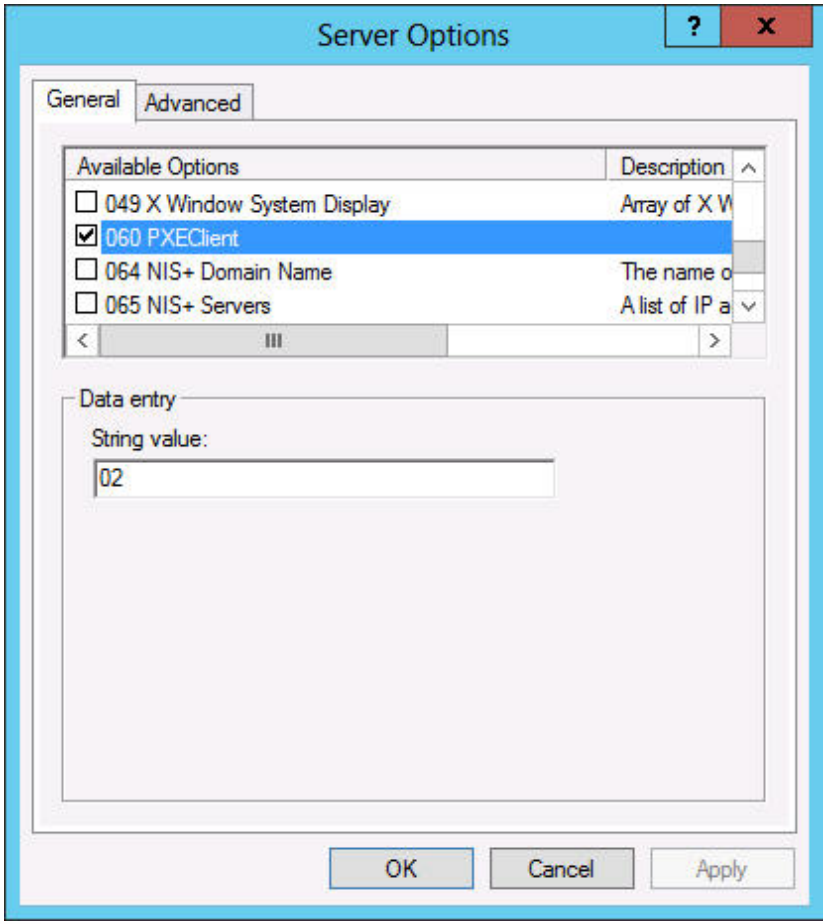
The Predefined Options and Values dialog box

Configure a Custom DHCP Option



The Option Type dialog box

Configure a Custom DHCP Option

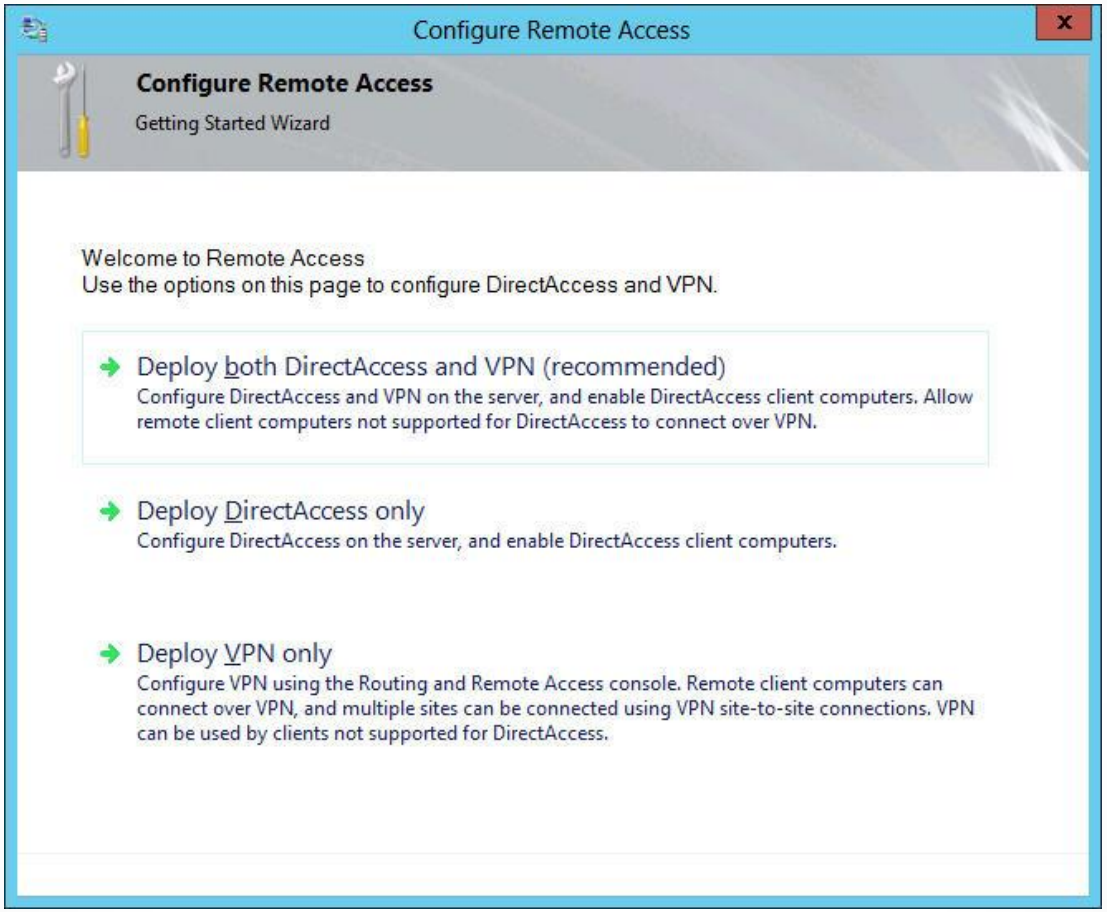


The Server Options dialog box

Deploying a DHCP Relay Agent

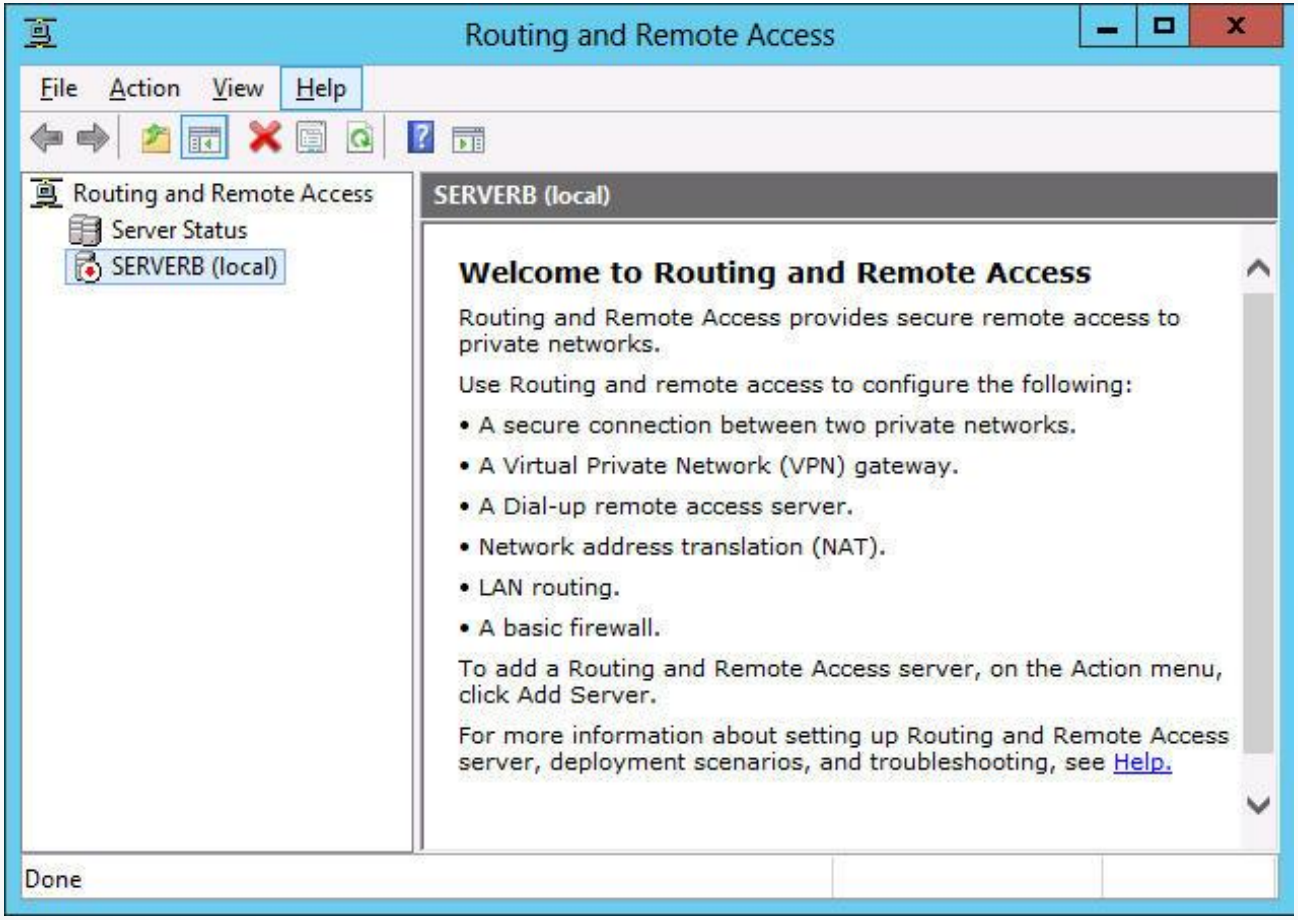
- If you create a centralized or hybrid DHCP infrastructure, you will need a DHCP relay agent on every subnet that does not have a DHCP server on it.
- Many routers are capable of functioning as DHCP relay agents, but when they cannot, you can configure a Windows Server 2012 computer to function as a relay agent.

Deploy a DHCP Relay Agent



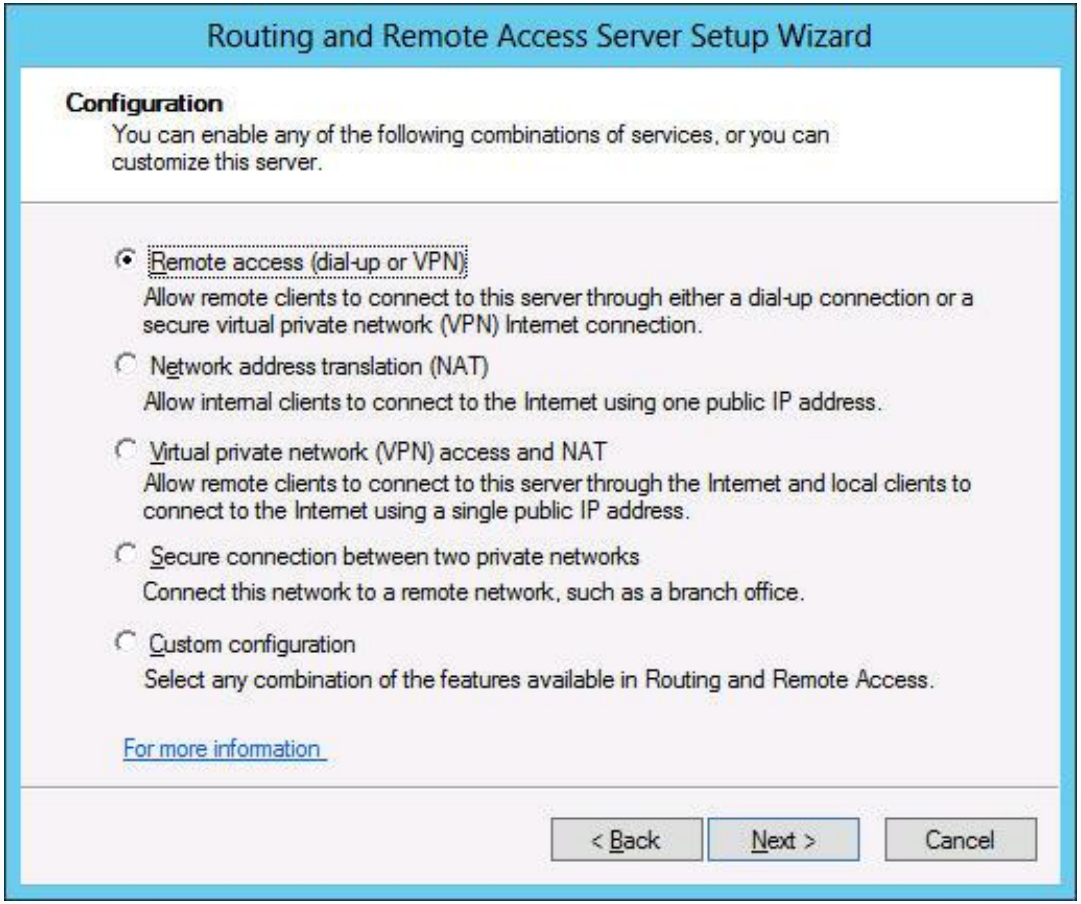
The Configure Remote Access—Getting Started Wizard

Deploy a DHCP Relay Agent



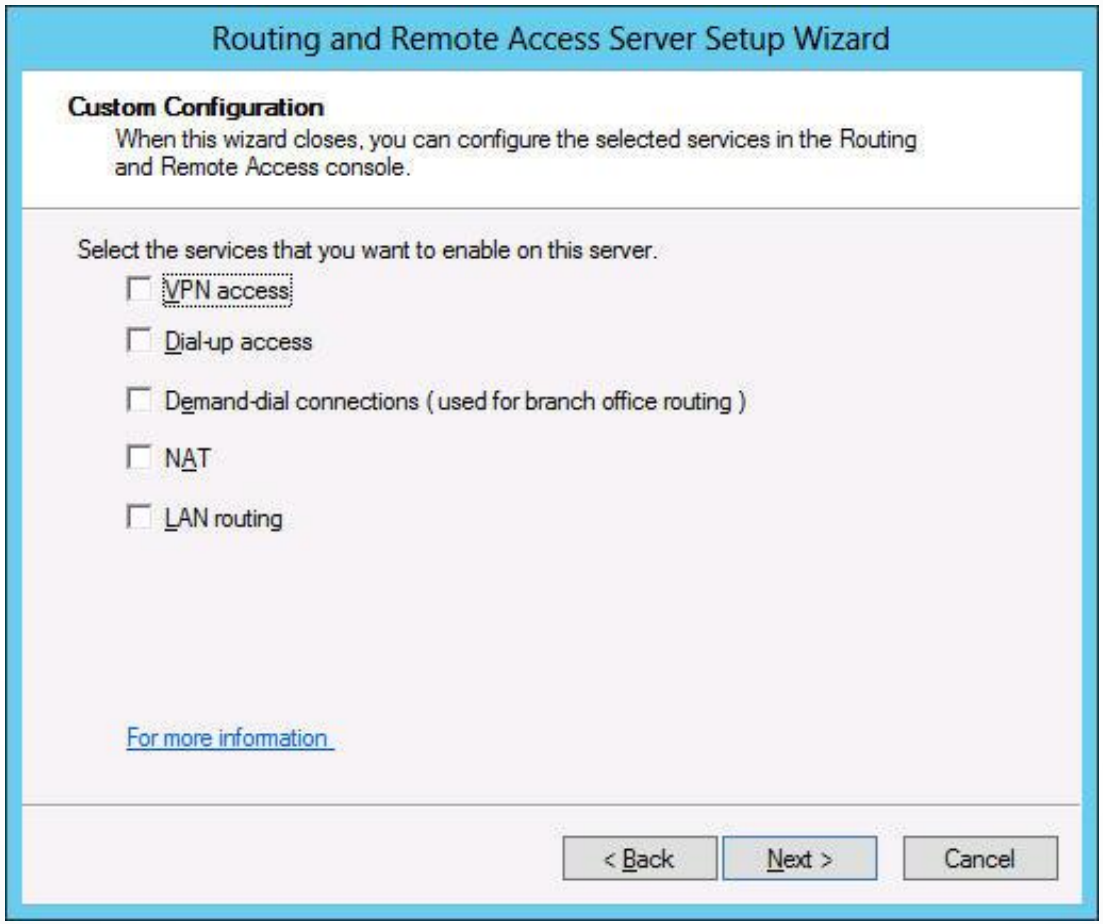
The Routing and Remote Access console

Deploy a DHCP Relay Agent



The Configuration page of the Routing and Remote Access Server Setup Wizard

Deploy a DHCP Relay Agent

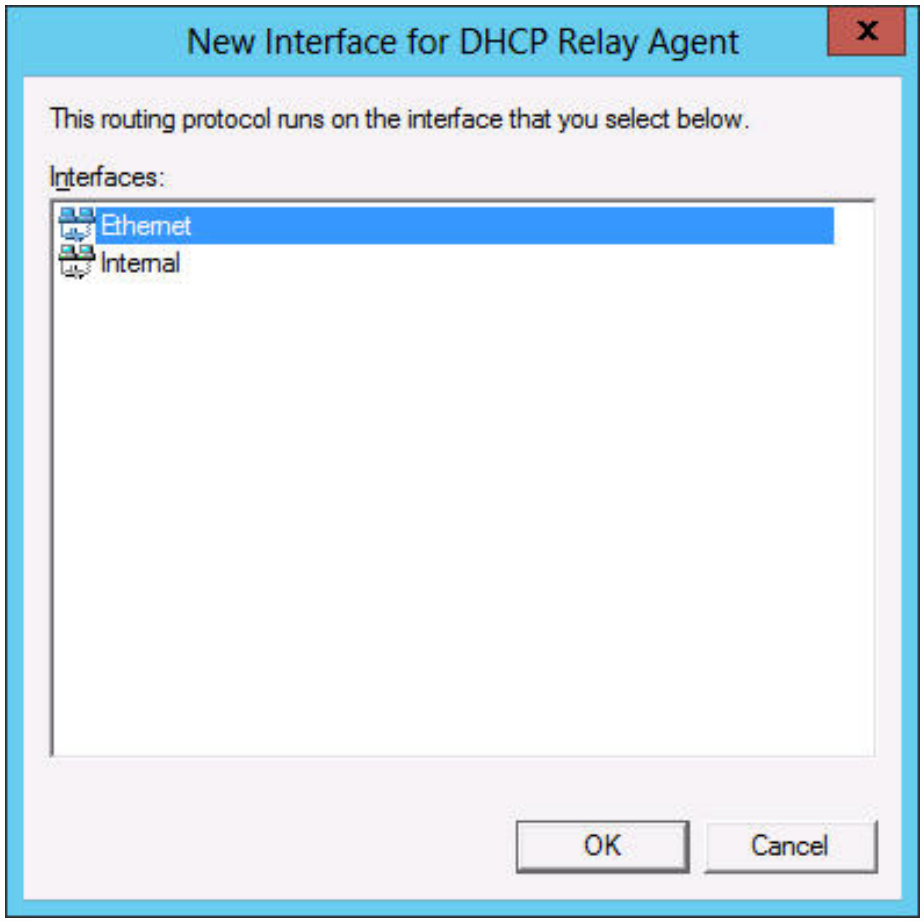


The Custom Configuration page of the Routing and Remote Access Server Setup Wizard

Deploy a DHCP Relay Agent

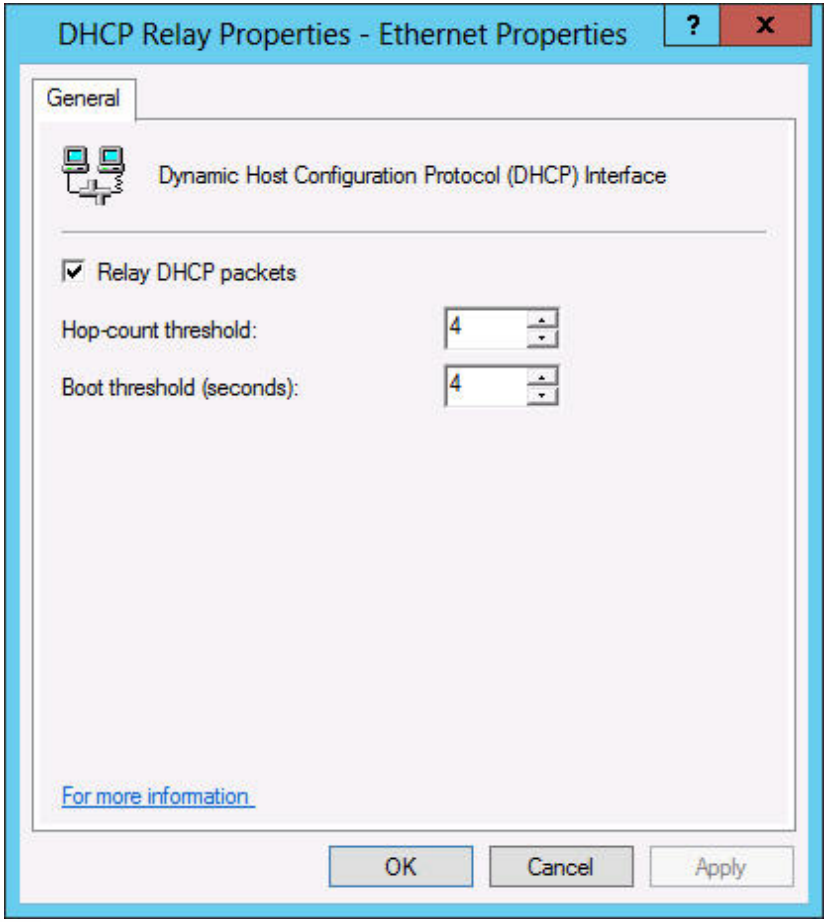
The New Routing Protocol dialog box

Deploy a DHCP Relay Agent



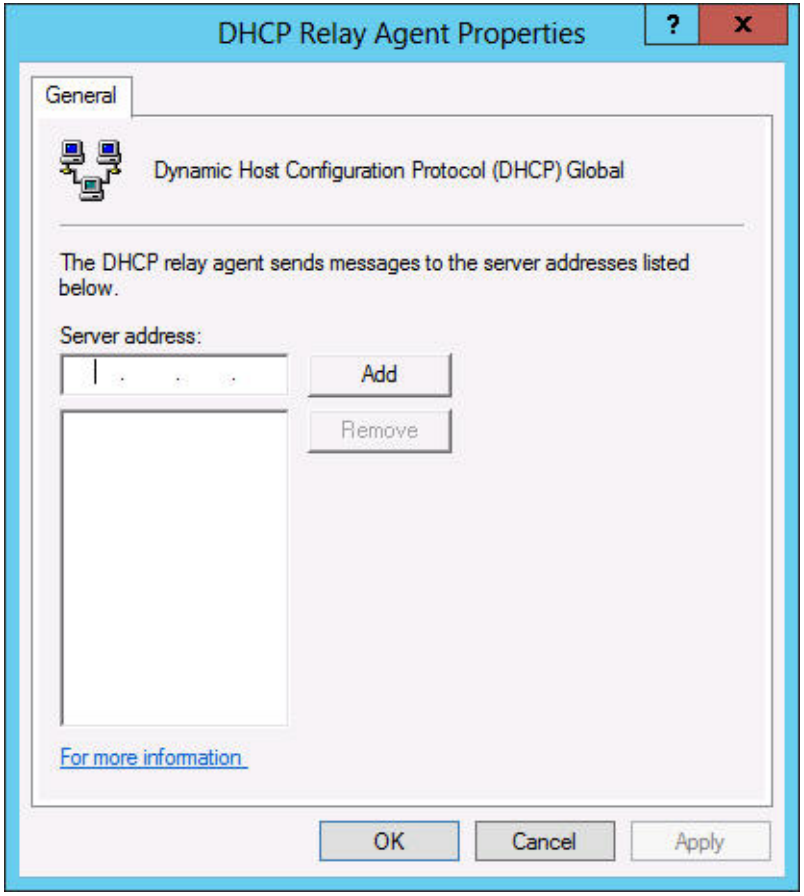
The New Interface For DHCP Relay Agent dialog box

Deploy a DHCP Relay Agent



The DHCP Relay Properties sheet for a selected interface

Deploy a DHCP Relay Agent



The DHCP Relay Agent Properties sheet

Lesson Summary

- The Dynamic Host Configuration Protocol (DHCP) is a service that automatically configures the Internet Protocol (IP) address and other TCP/IP settings on network computers by assigning addresses from a pool (called a scope) and reclaiming them when they are no longer in use.
- DHCP consists of three components: a **DHCP server application**, which responds to client requests for TCP/IP configuration settings; a **DHCP client**, which issues requests to server and applies the TCP/IP configuration settings it receives to the local computer; and a **DHCP communications protocol**, which defines the formats and sequences of the messages exchanged by DHCP clients and servers.

Lesson Summary

- The DHCP standards define three different IP address allocation methods: **dynamic allocation**, in which a DHCP server assigns an IP address to a client computer from a scope for a specified length of time; **automatic allocation**, in which the DHCP server permanently assigns an IP address to a client computer from a scope; and **manual allocation**, in which a DHCP server permanently assigns a specific IP address to a specific computer on the network.
- In a distributed DHCP infrastructure, you install at least one DHCP server on each of your subnets, so all your clients have access to a local DHCP server. In a centralized DHCP infrastructure, the DHCP servers are all placed in a single location, such as a server closet or data center. To enable the broadcast traffic on each subnet to reach the DHCP servers, you must install a DHCP relay agent on each subnet.