

Lesson 11: Deploying and Configuring the DHCP Service

MOAC 70-410: Installing and Configuring Windows Server 2012

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

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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:

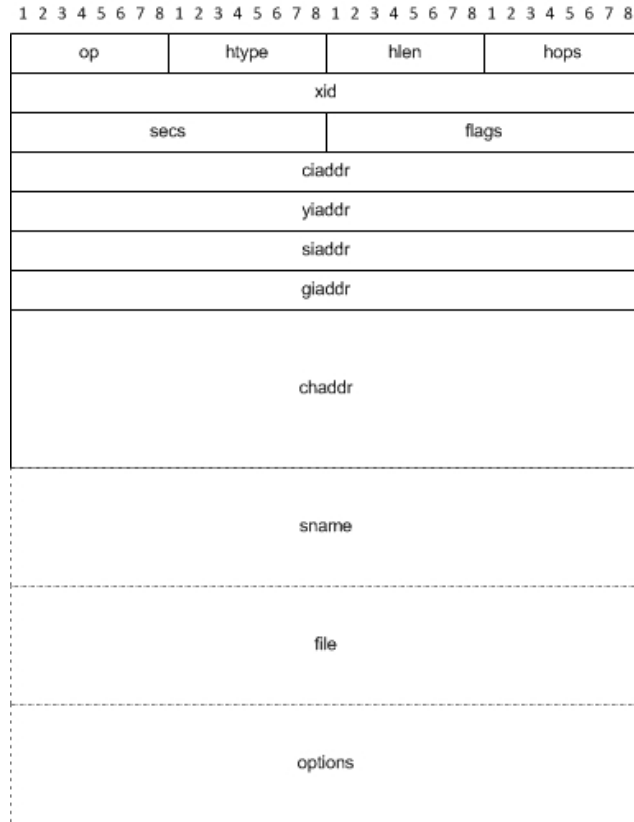
- **DHCP server application:** Responds to client requests for TCP/IP configuration settings.
- **DHCP client:** Issues requests to servers and applies the TCP/IP configuration settings it receives to the local computer.
- **DHCP communications protocol:** Defines the formats and sequences of the messages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

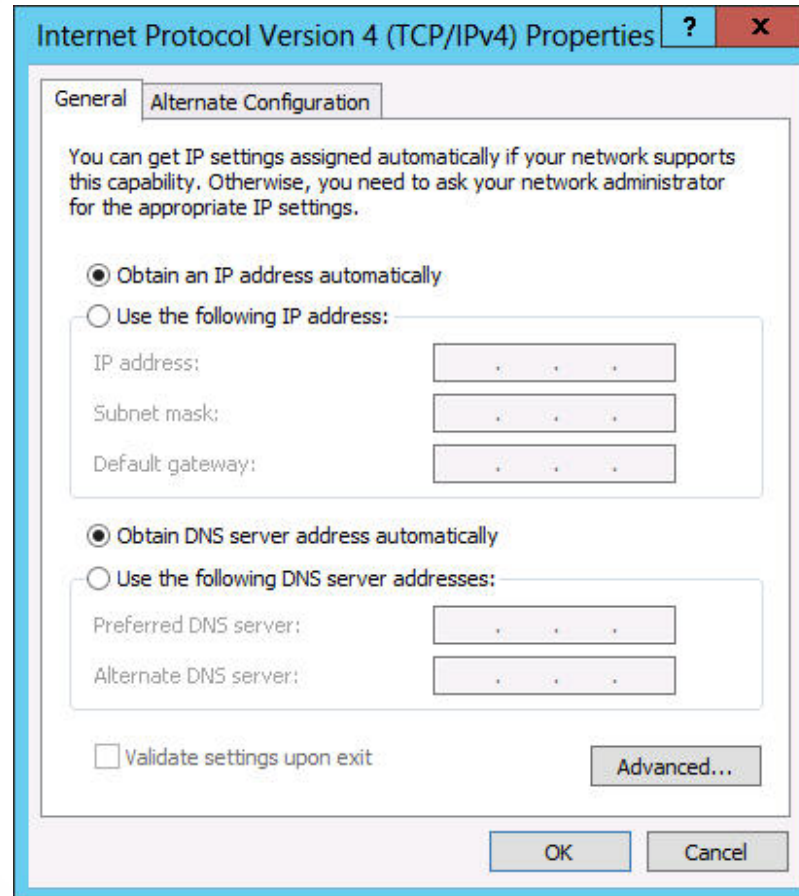
The DHCP communication protocol defines eight different message types:

- **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)

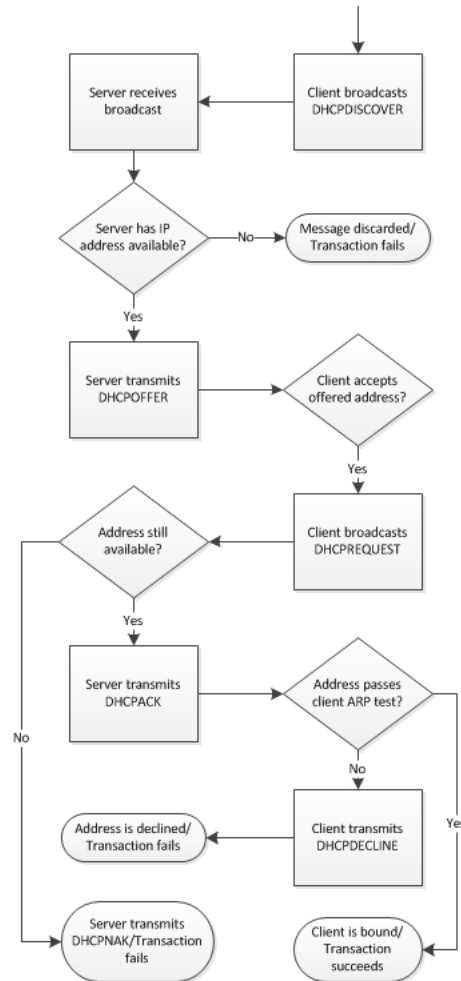
- **DHCPACK:** Used by servers to acknowledge a client's acceptance of an offered IP address.
- **DHCPNAK:** Used by servers to reject a client's acceptance of an offered IP address.
- **DHCPRELEASE:** Used by clients to terminate an IP address lease.
- **DHCPINFORM:** Used by clients to obtain additional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

DHCP Communications



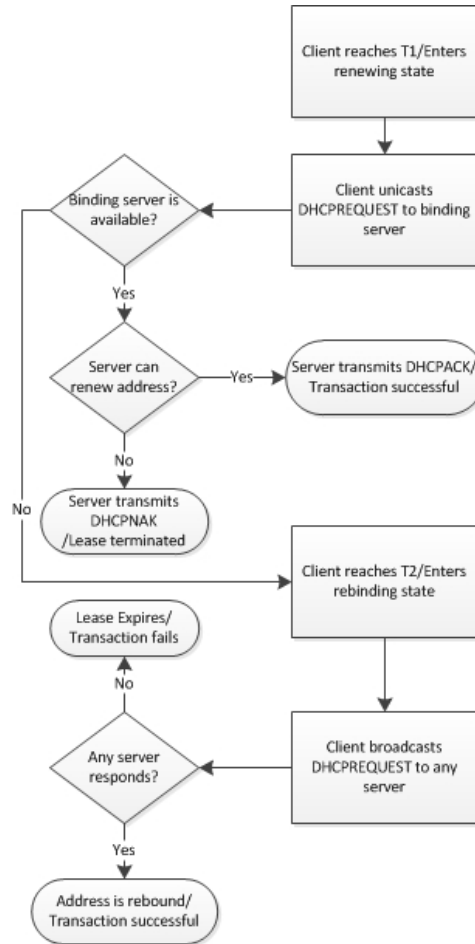
The Internet Protocol Version 4 (TCP/IPv4) Properties sheet

DHCP Lease Negotiation



The DHCP IP address assignment process

DHCP Lease Renewal



The DHCP IP address renewal process

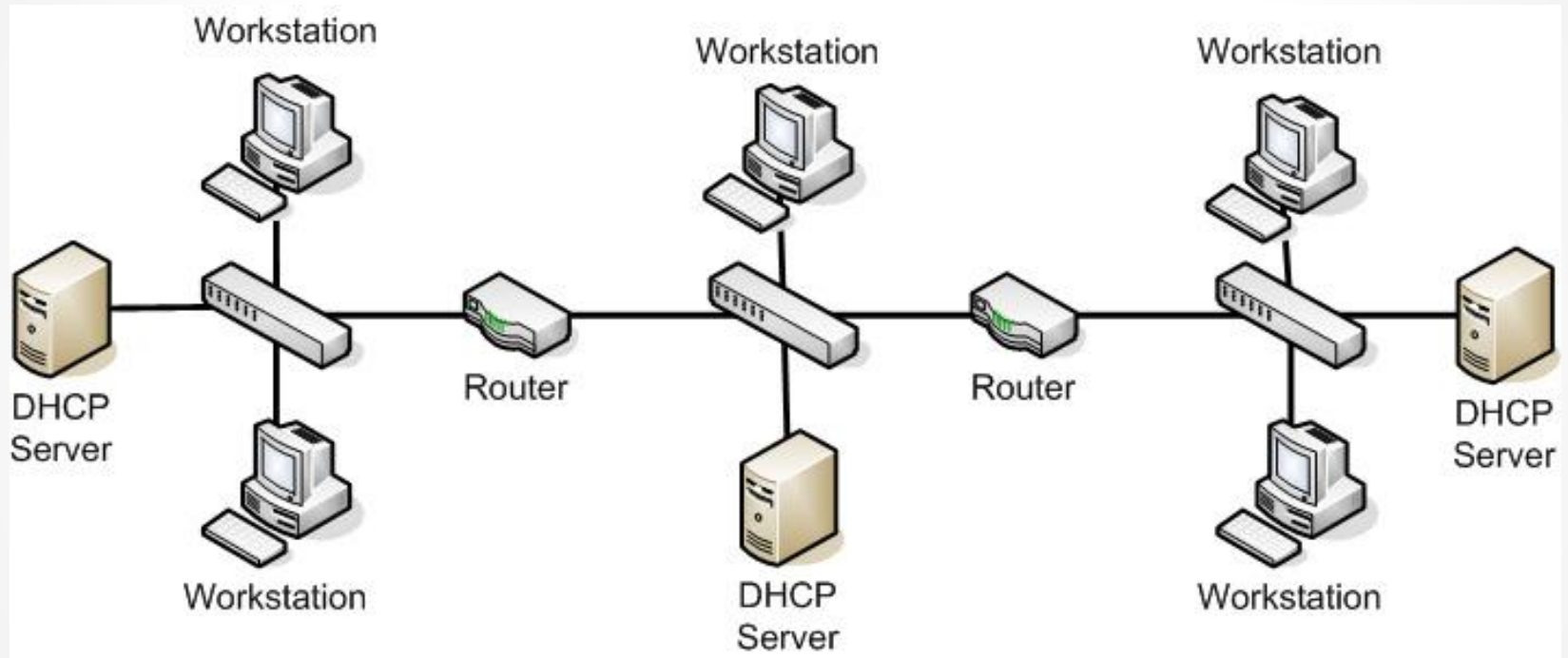
Designing a DHCP Infrastructure

Lesson 11: Deploying and Configuring the
DHCP Service

Designing a DHCP Infrastructure

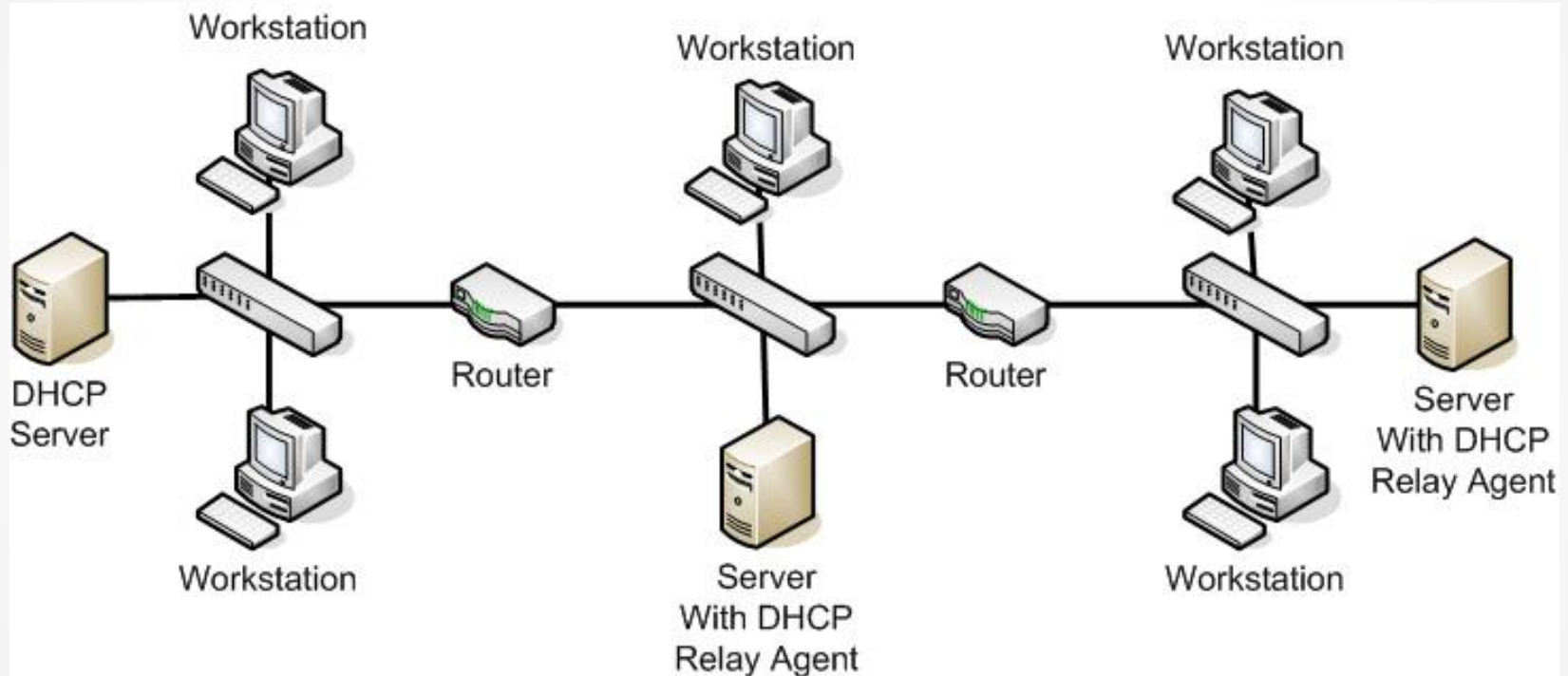
- The Windows Server 2012 DHCP Server service is theoretically capable of supporting many thousands of clients.
- Virtually all enterprise networks require more than one DHCP server.
- DHCP relies on broadcast messages, which have limitations.

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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DHCP Service

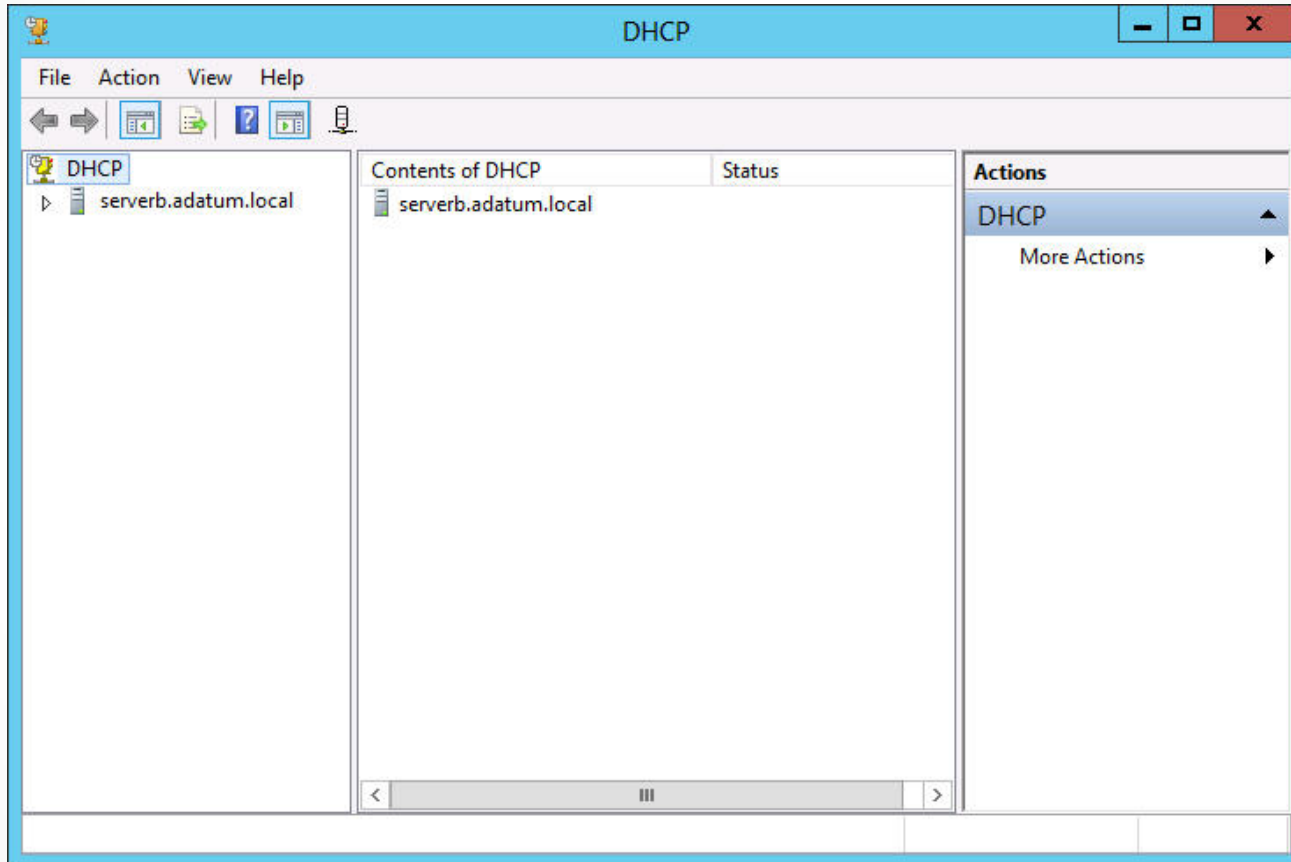
Deploying a DHCP Server

- 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

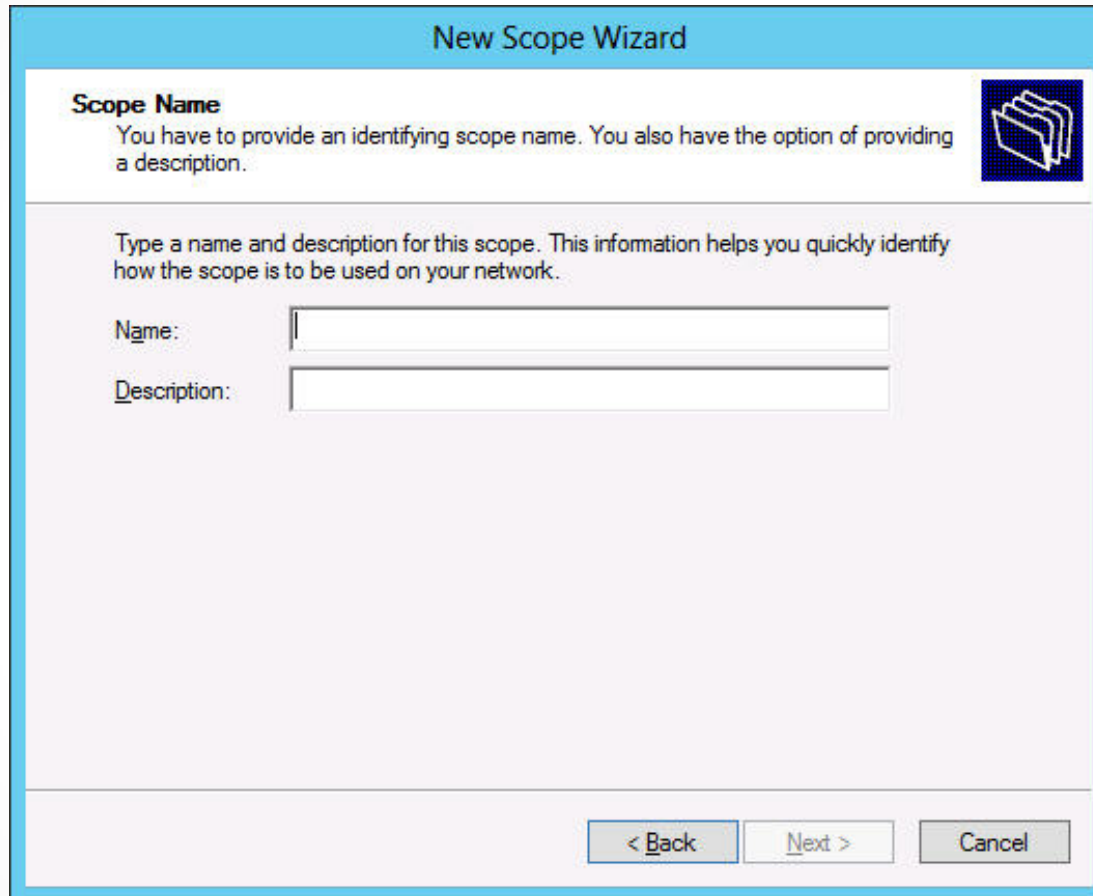
- A scope is a range of IP addresses on a particular subnet that are selected for allocation by a DHCP server.
- Create a scope using the DHCP snap-in for Microsoft Management Console (MMC).

Create a DHCP Scope



The DHCP console

Create a DHCP Scope



New Scope Wizard

Scope Name
You have to provide an identifying scope name. You also have the option of providing a description.

Type a name and description for this scope. This information helps you quickly identify how the scope is to be used on your network.

Name:

Description:

< Back Next > Cancel

The Scope Name page in the DHCP console

Create a DHCP Scope

New Scope Wizard

IP Address Range
You define the scope address range by identifying a set of consecutive IP addresses.

Configuration settings for DHCP Server
Enter the range of addresses that the scope distributes.

Start IP address:

End IP address:

Configuration settings that propagate to DHCP Client

Length:

Subnet mask:

< Back Next > Cancel

The Address Range page in the DHCP console

Create a DHCP Scope

The screenshot shows a window titled "New Scope Wizard" with a sub-header "Add Exclusions and Delay". Below the sub-header is a descriptive paragraph: "Exclusions are addresses or a range of addresses that are not distributed by the server. A delay is the time duration by which the server will delay the transmission of a DHCP OFFER message." To the right of this text is a folder icon. Below the text is a instruction: "Type the IP address range that you want to exclude. If you want to exclude a single address, type an address in Start IP address only." There are two input fields: "Start IP address:" and "End IP address:". Below these is an "Add" button. Below the "Add" button is a list box labeled "Excluded address range:" with a "Remove" button to its right. Below the list box is a "Subnet delay in milli second:" label and a spinner box containing the number "0". At the bottom of the window are three buttons: "< Back", "Next >", and "Cancel".

The Add Exclusions and Delay page in the DHCP console

Create a DHCP Scope

New Scope Wizard

Lease Duration 

The lease duration specifies how long a client can use an IP address from this scope.

Lease durations should typically be equal to the average time the computer is connected to the same physical network. For mobile networks that consist mainly of portable computers or dial-up clients, shorter lease durations can be useful. Likewise, for a stable network that consists mainly of desktop computers at fixed locations, longer lease durations are more appropriate.

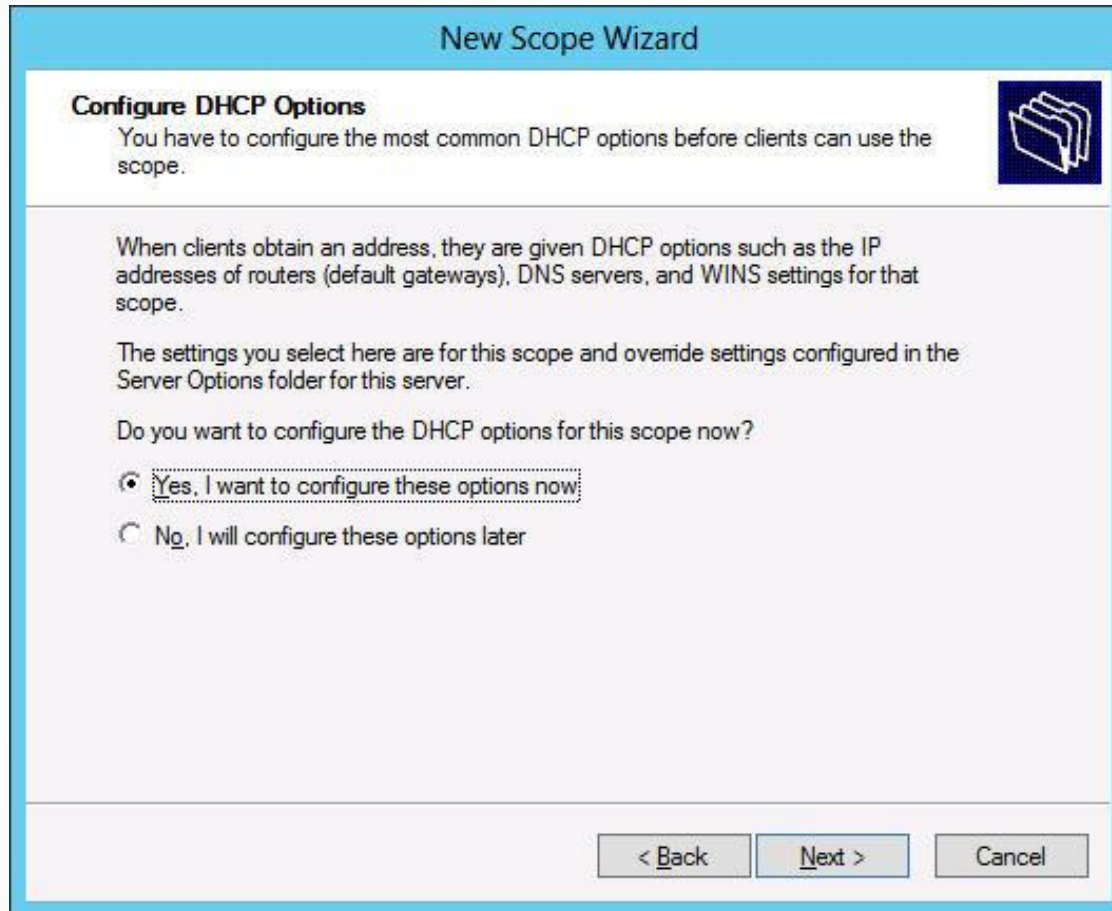
Set the duration for scope leases when distributed by this server.

Limited to:

Days: Hours: Minutes:

The Lease Duration page in the DHCP console

Create a DHCP Scope



The screenshot shows a window titled "New Scope Wizard" with a light blue header. The main content area has a white background and is titled "Configure DHCP Options" in bold. Below the title, there is a paragraph of text: "You have to configure the most common DHCP options before clients can use the scope." To the right of this text is a small icon of a folder. Below this is another paragraph: "When clients obtain an address, they are given DHCP options such as the IP addresses of routers (default gateways), DNS servers, and WINS settings for that scope." This is followed by another paragraph: "The settings you select here are for this scope and override settings configured in the Server Options folder for this server." Below that is a question: "Do you want to configure the DHCP options for this scope now?" There are two radio button options: the first is selected and labeled "Yes, I want to configure these options now:" and the second is labeled "No, I will configure these options later". At the bottom of the window, there are three buttons: "< Back", "Next >", and "Cancel".

Configure DHCP Options

You have to configure the most common DHCP options before clients can use the scope.

When clients obtain an address, they are given DHCP options such as the IP addresses of routers (default gateways), DNS servers, and WINS settings for that scope.

The settings you select here are for this scope and override settings configured in the Server Options folder for this server.

Do you want to configure the DHCP options for this scope now?

Yes, I want to configure these options now:

No, I will configure these options later

< Back Next > Cancel

The Configure DHCP Options page in the DHCP console

Create a DHCP Scope



The screenshot shows a window titled "New Scope Wizard" with a blue header. The main content area is titled "Router (Default Gateway)" and includes the instruction: "You can specify the routers, or default gateways, to be distributed by this scope." Below this, it says "To add an IP address for a router used by clients, enter the address below." There is an "IP address:" label followed by a text input field with a dotted cursor. To the right of the input field are four buttons: "Add", "Remove", "Up", and "Down". At the bottom of the window are three buttons: "< Back", "Next >", and "Cancel". A folder icon is visible in the top right corner of the wizard's content area.

The Router (Default Gateway) page in the DHCP console

Create a DHCP Scope

New Scope Wizard

Domain Name and DNS Servers
The Domain Name System (DNS) maps and translates domain names used by clients on your network.

You can specify the parent domain you want the client computers on your network to use for DNS name resolution.

Parent domain:

To configure scope clients to use DNS servers on your network, enter the IP addresses for those servers.

Server name:	<input type="text"/>	IP address:	<input type="text" value="10.0.0.2"/>	<input type="button" value="Add"/>
	<input type="button" value="Resolve"/>			<input type="button" value="Remove"/>
				<input type="button" value="Up"/>
				<input type="button" value="Down"/>

The Domain Name and DNS Servers page in the DHCP console

Create a DHCP Scope



The screenshot shows a window titled "New Scope Wizard" with a light blue header. Below the header, the section is titled "Activate Scope" in bold. Underneath, a subtitle reads "Clients can obtain address leases only if a scope is activated." To the right of this text is a small icon of a folder. The main area of the wizard contains the question "Do you want to activate this scope now?" followed by two radio button options: "Yes, I want to activate this scope now" (which is selected) and "No, I will activate this scope later". At the bottom of the window, there are three buttons: "< Back", "Next >", and "Cancel".

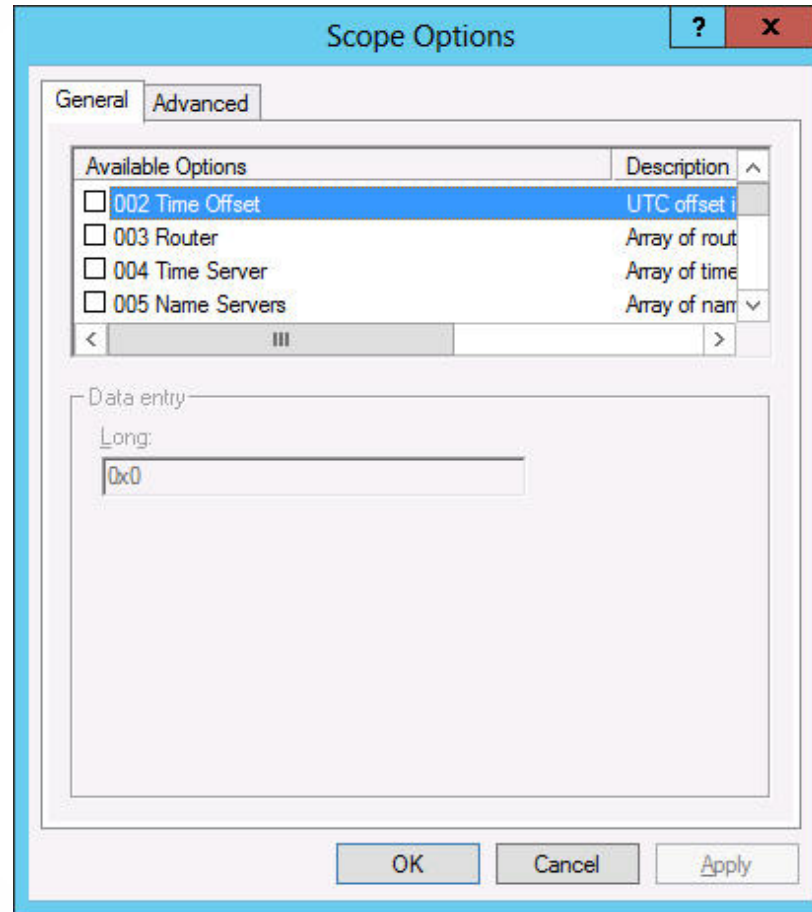
The Activate Scope page in the DHCP console

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

New Reservation

Provide information for a reserved client.

Reservation name:

IP address:

MAC address:

Description:

Supported types

- Both
- DHCP
- BOOTP

Add Close

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

Predefined Options and Values

Option class: DHCP Standard Options

Option name: 002 Time Offset

Add... Edit... Delete

Description: UTC offset in seconds

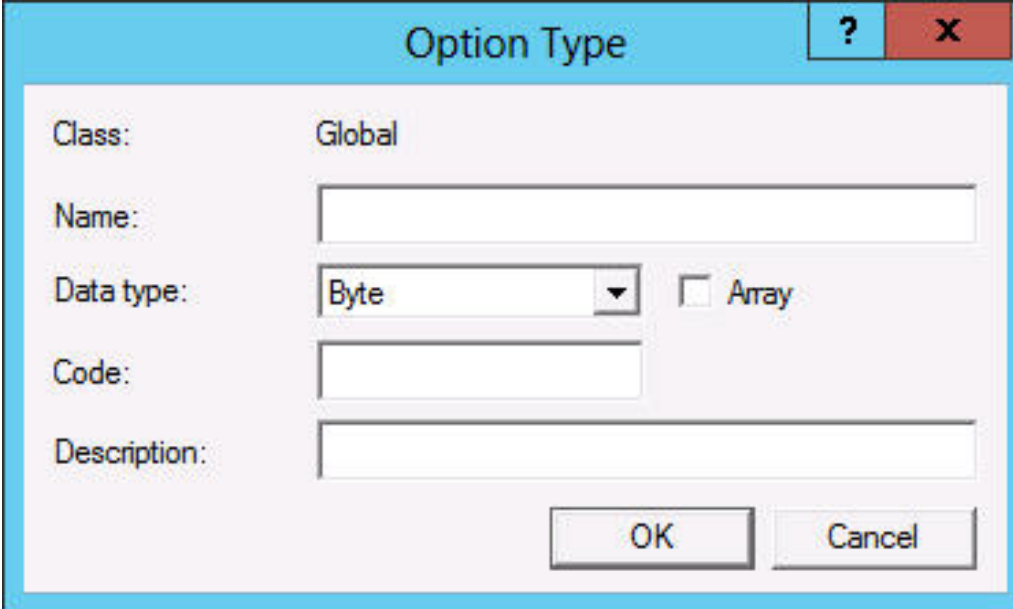
Value

Long: 0x0

OK Cancel

The Predefined Options and Values dialog box

Configure a Custom DHCP Option



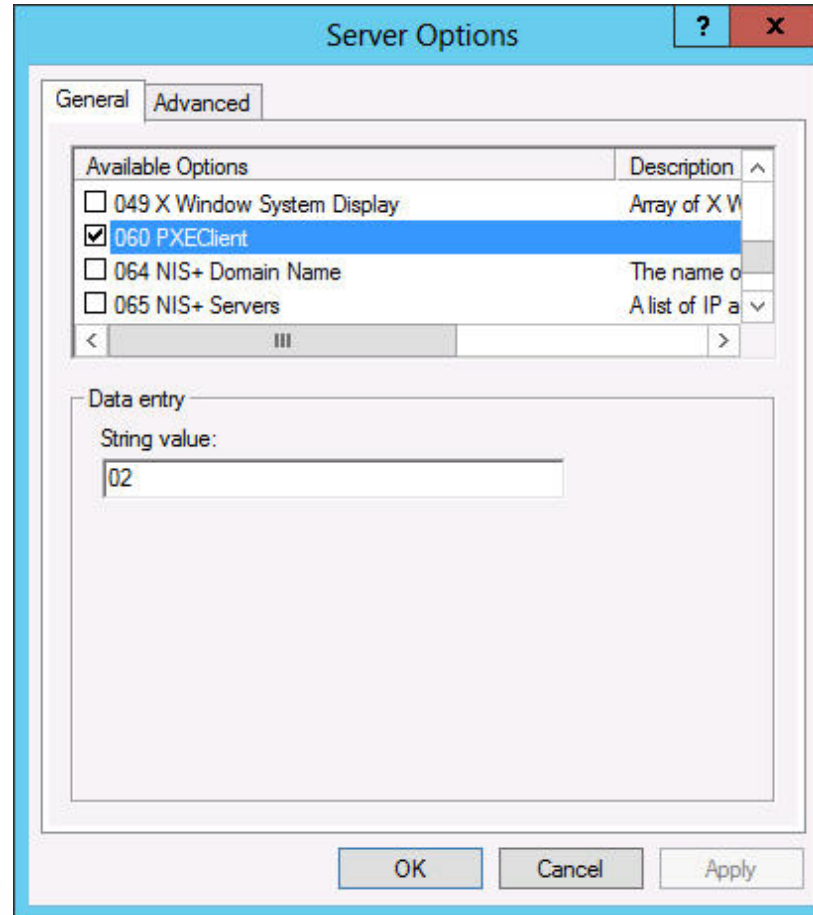
The image shows a dialog box titled "Option Type" with a light blue border. The title bar is light blue and contains a question mark icon and a red close button with a white 'X'. The main area has a light pink background and contains the following fields:

- Class:** A text field containing the word "Global".
- Name:** An empty text input field.
- Data type:** A dropdown menu currently showing "Byte" with a downward arrow, followed by an unchecked checkbox labeled "Array".
- Code:** An empty text input field.
- Description:** A larger empty text input field.

At the bottom right of the dialog box are two buttons: "OK" and "Cancel".

The Option Type dialog box

Configure a Custom DHCP Option

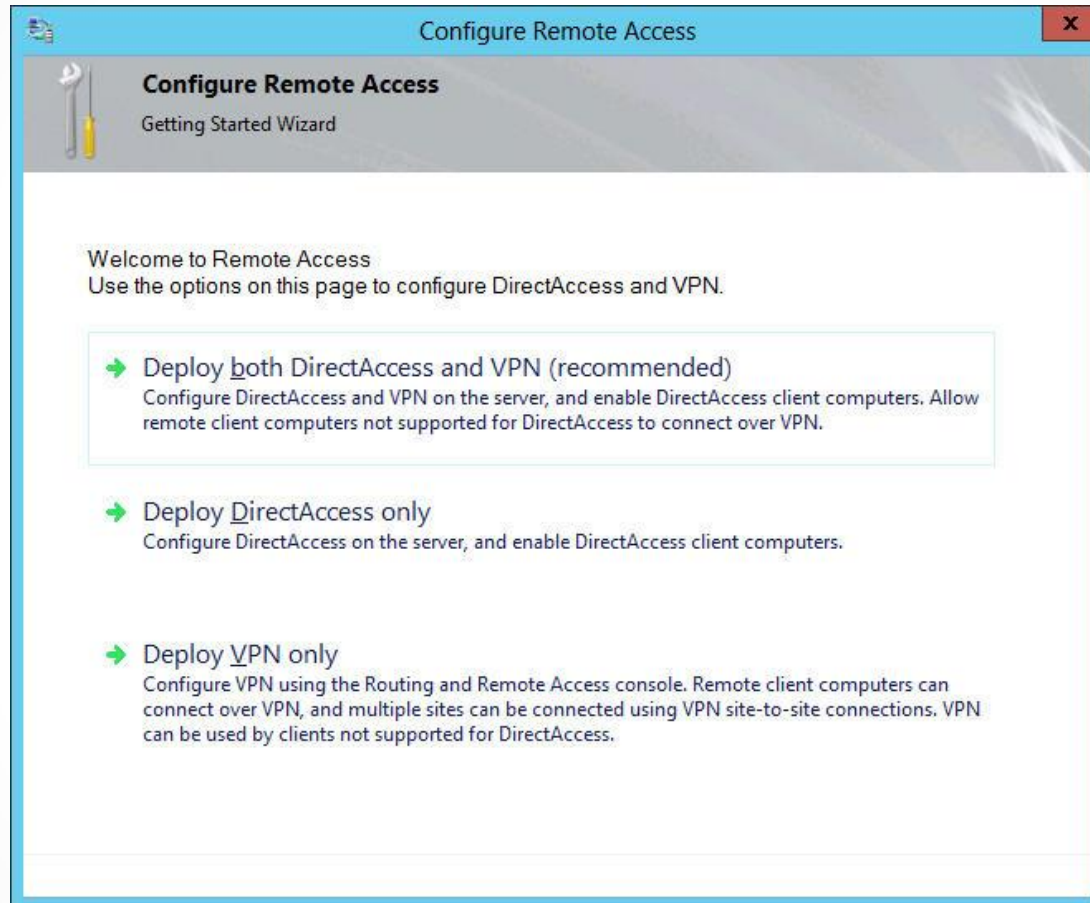


The Server Options dialog box

Deploying a DHCP Relay Agent

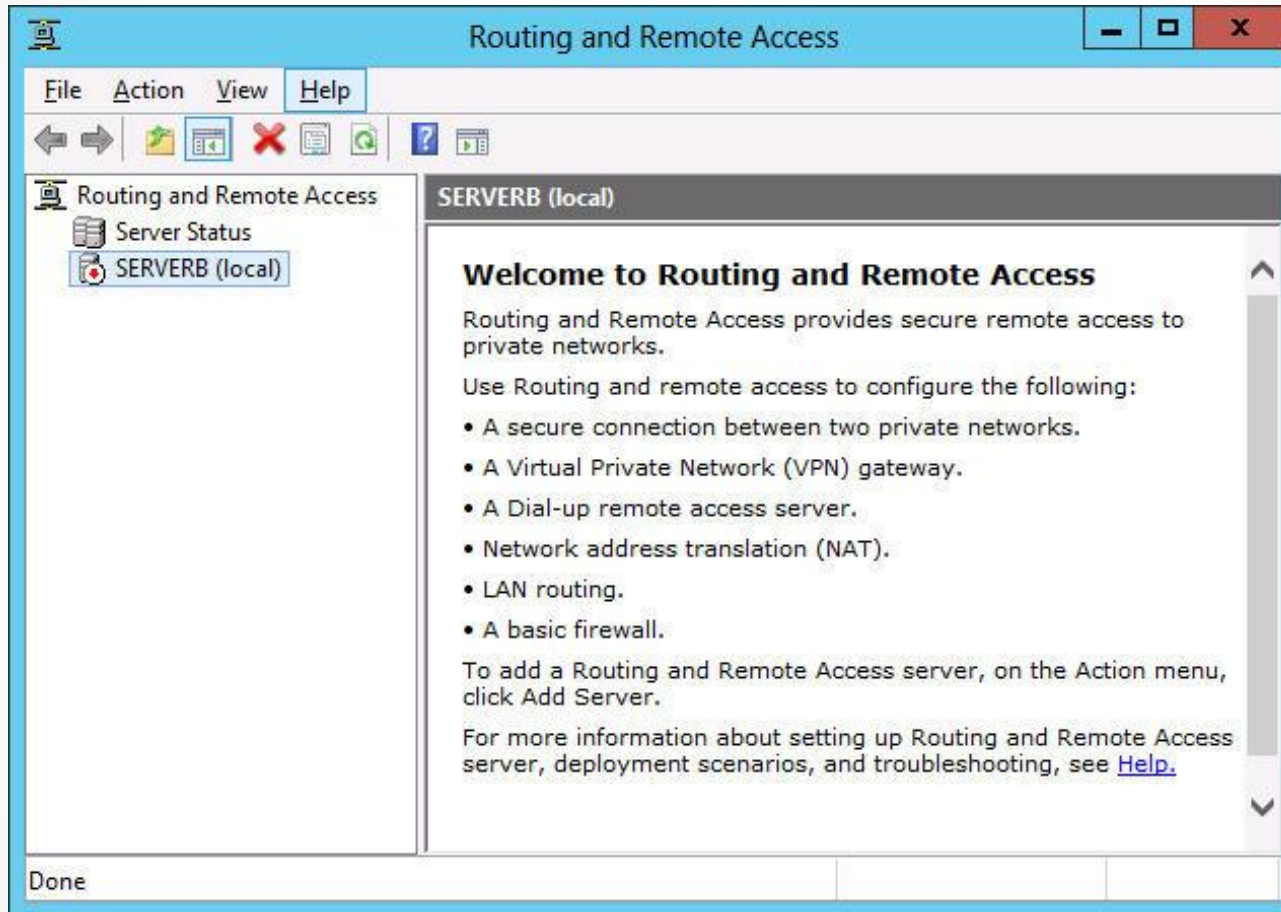
- If you create a centralized or hybrid DHCP infrastructure, you will need a DHCP relay agent on every subnet that does not have a DHCP server on it.
- Many routers are capable of functioning as DHCP relay agents, but when they cannot, you can configure a Windows Server 2012 computer to function as a 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 screenshot shows a window titled "Routing and Remote Access Server Setup Wizard". Inside, there is a section labeled "Configuration" with the text: "You can enable any of the following combinations of services, or you can customize this server." Below this, there are five radio button options:

- Remote access (dial-up or VPN)**
Allow remote clients to connect to this server through either a dial-up connection or a secure virtual private network (VPN) Internet connection.
- Network address translation (NAT)**
Allow internal clients to connect to the Internet using one public IP address.
- Virtual private network (VPN) access and NAT**
Allow remote clients to connect to this server through the Internet and local clients to connect to the Internet using a single public IP address.
- Secure connection between two private networks**
Connect this network to a remote network, such as a branch office.
- Custom configuration**
Select any combination of the features available in Routing and Remote Access.

At the bottom left, there is a blue hyperlink: [For more information](#). At the bottom right, there are three buttons: "< Back", "Next >", and "Cancel".

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

Deploy a DHCP Relay Agent

The screenshot shows a window titled "Routing and Remote Access Server Setup Wizard". The main content area is titled "Custom Configuration" and contains the following text: "When this wizard closes, you can configure the selected services in the Routing and Remote Access console." Below this, it says "Select the services that you want to enable on this server." and lists five options, each with an unchecked checkbox: "VPN access", "Dial-up access", "Demand-dial connections (used for branch office routing)", "NAT", and "LAN routing". At the bottom left of the content area is a blue hyperlink "For more information". At the bottom right are three buttons: "< Back", "Next >", and "Cancel".

Routing and Remote Access Server Setup Wizard

Custom Configuration
When this wizard closes, you can configure the selected services in the Routing and Remote Access console.

Select the services that you want to enable on this server.

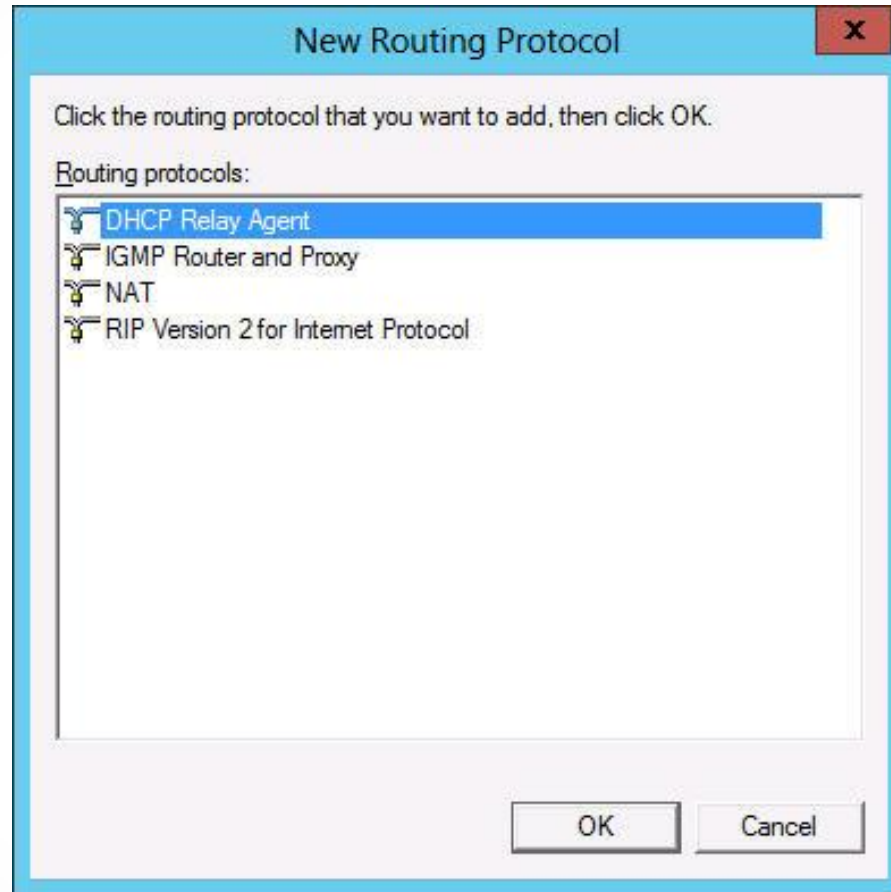
- VPN access
- Dial-up access
- Demand-dial connections (used for branch office routing)
- NAT
- LAN routing

[For more information](#)

< Back Next > Cancel

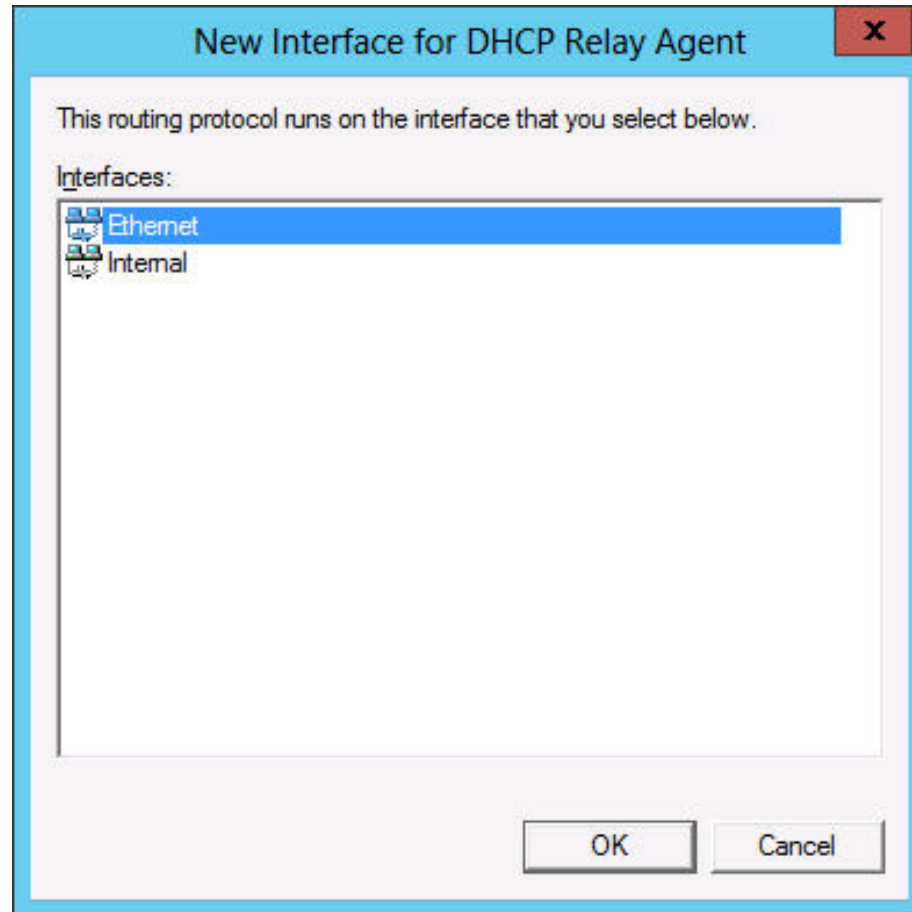
The Custom Configuration page of the Routing and Remote Access Server Setup Wizard

Deploy a DHCP Relay Agent



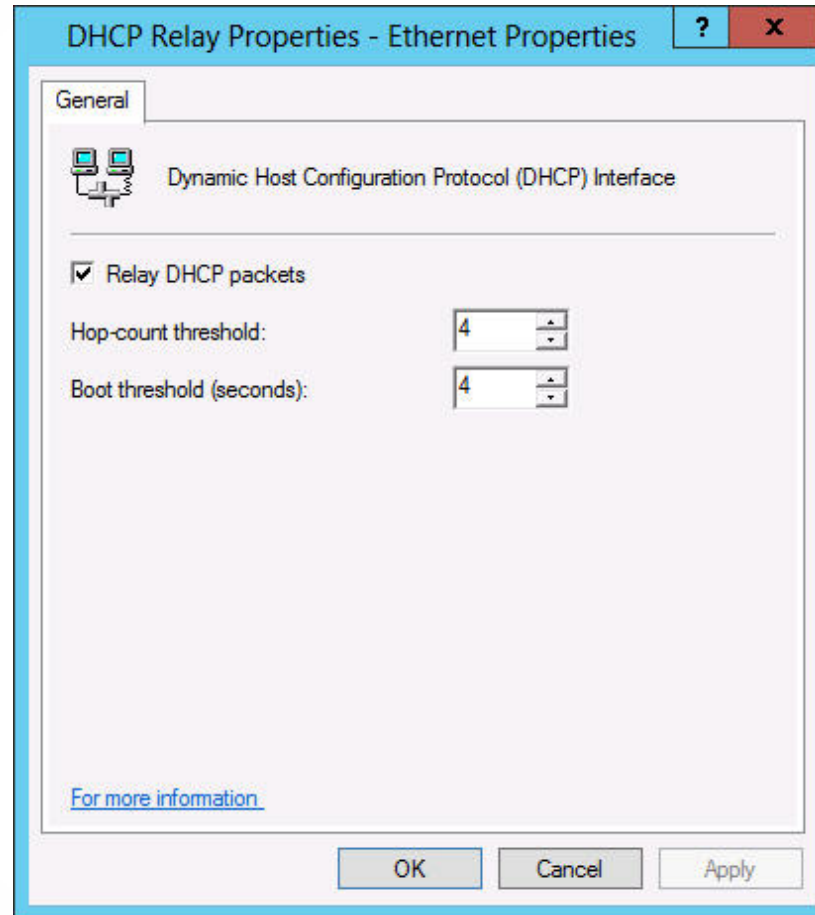
The New Routing Protocol dialog box

Deploy a DHCP Relay Agent



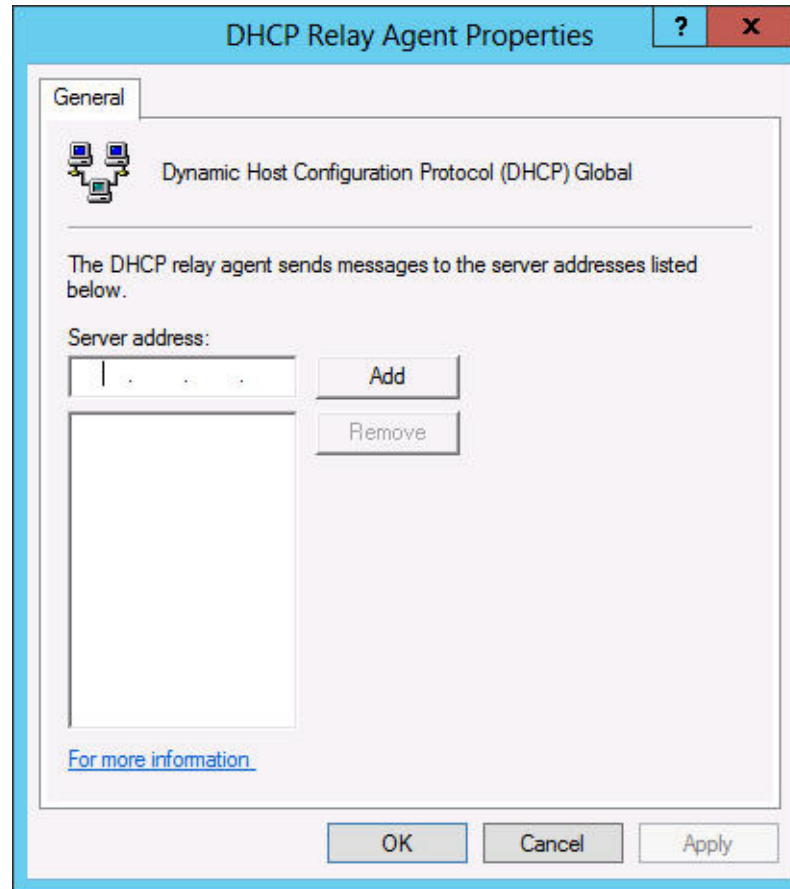
The New Interface For DHCP Relay Agent dialog box

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.

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