

**DRONACHARYA**  
College of Engineering

## **Computer Science & Engineering**

Data Communication and Computer  
Networks

(MTCSE-101-A)

DHCP

# Dynamic Host Configuration Protocol (DHCP)

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- Each host must have an Internet Protocol (IP) address and a subnet mask, and if communicating outside the local subnet, each must also have a default gateway.
- Each IP address must be valid and unique within the host's internetwork.
- Manually managing IP addresses is a complex tedious task.
- The Dynamic Host Configuration Protocol (DHCP) simplifies this process by automating the assigning, tracking, and reassigning of IP addresses.

# Dynamic Host Configuration Protocol (DHCP)

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- DHCP is based heavily on BOOTP.
- DHCP can dynamically allocate an IP address from a pool of addresses and then reclaim it when it is no longer needed.
- Because this process is dynamic, no duplicate addresses are assigned by a properly configured DHCP server, and administrators can move computers between subnets without manually configuring them.

# Dynamic Host Configuration Protocol (DHCP)

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- Each Microsoft Windows Server 2008 edition (the Standard Edition, Enterprise Edition, and Datacenter Edition) include the DHCP Server service.
- DHCP is an optional installation.
- All Microsoft Windows clients automatically install the DHCP Client service as part of TCP/IP, including Windows Server 2008, Windows Server 2008, Microsoft Windows Vista, and Microsoft Windows XP.

# Dynamic Host Configuration Protocol (DHCP)

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- Four Key benefits to DHCP:
  - Centralized administration of IP configuration.
  - Dynamic host configuration.
  - Seamless IP host configuration.
  - Flexibility and scalability.

# DHCP Terminology

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- ***DHCP client*** - A computer that obtains its configuration information from DHCP.
- ***DHCP server*** - A computer that provides DHCP configuration information to multiple clients.
  - The IP addresses and configuration information that the DHCP server makes available to the client are defined by the DHCP administrator.

# DHCP Terminology

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- ***DHCP lease*** - This defines the duration for which a DHCP server assigns an IP address to a DHCP client.
  - The lease duration can be any amount of time between 1 minute and 999 days, or it can be unlimited.
  - The default lease duration is eight days.



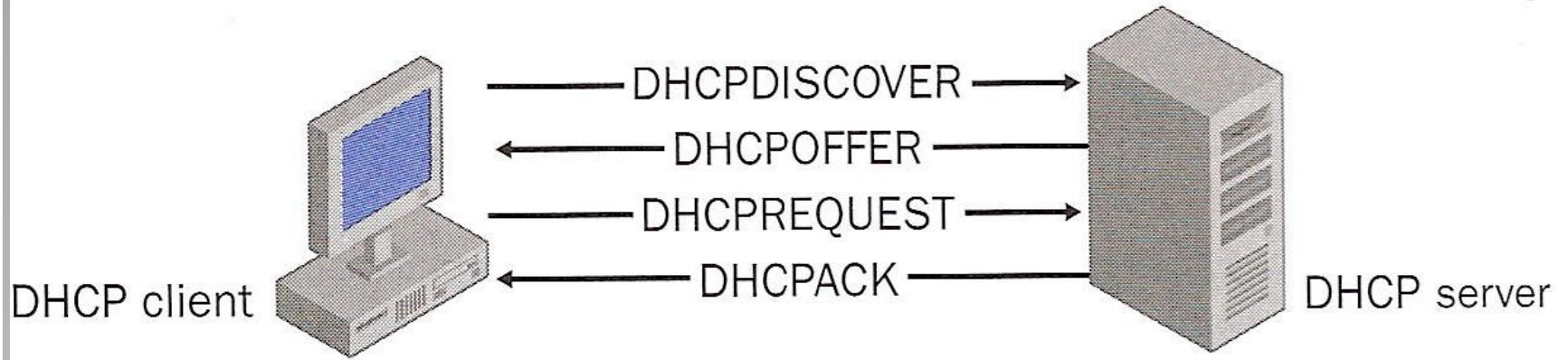
# DHCP Messages

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- All DHCP messages are carried in ***User Datagram Protocol (UDP)*** datagrams using the well-known port numbers 67 (from the server) and 68 (to the client).
- UDP operates at the Transport Layer of the OSI model and is a low-overhead protocol because it does not use any type of packet acknowledgement.

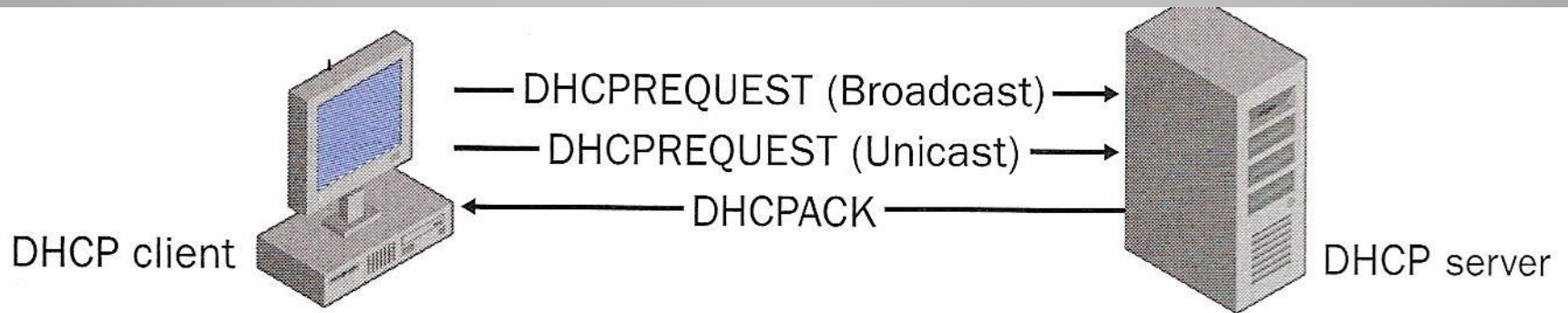
# DHCP Messages

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# DHCP Lease Renewal

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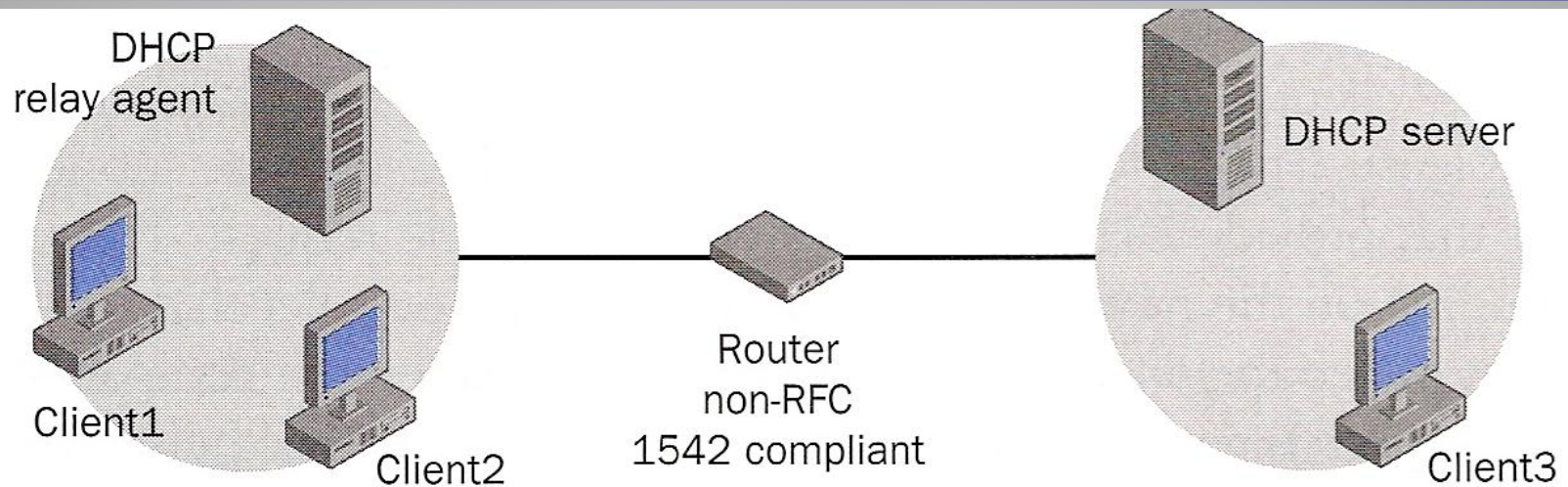


# DHCP Relay Agent

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- DHCP relies heavily on broadcast messages.
- Broadcast messages are generally limited to the subnet in which they originate and are not forwarded to other subnets.
- A *DHCP relay agent* is either a host or an IP router that listens for DHCP (and BOOTP) client messages being broadcast on a subnet and then forwards those DHCP messages to a DHCP server.
- The DHCP server sends DHCP response messages back to the relay agent, which then broadcasts them onto the subnet for the DHCP client.
- Using DHCP relay agents eliminates the need to have a DHCP server on every subnet.

# DHCP Relay Agent



1. Client1 broadcasts a DHCPDISCOVER packet
2. Relay agent forwards DHCPDISCOVER packet to DHCP server
3. Server sends a DHCPOFFER packet to the DHCP relay agent
4. Relay agent broadcasts the DHCPOFFER packet
5. Client1 broadcasts a DHCPREQUEST packet
6. Relay agent forwards the DHCPREQUEST packet to the DHCP server
7. Server broadcasts a DHCPACK packet which is picked up by DHCP relay agent
8. Relay agent broadcasts the DHCPACK packet

# Automatic Private IP Addressing (APIPA)

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- If the DHCP client is unable to locate a DHCP server and is not configured with an alternate configuration, the computer configures itself with a **169.254.0.0/255.255.0.0** address.
- The auto-configured computer then tests to verify that the IP address it has chosen is not already in use by using a gratuitous ARP broadcast.
- If the chosen IP address is in use, the computer randomly selects another address. The computer makes up to 10 attempts to find an available IP address.

# Installing the DHCP Server Role

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- Adding the DHCP server role is largely wizard-driven via the Server Manager console and allows you to configure basic DHCP settings at the same time that you install the role.
- To add DHCP Server Role on a Server Core Installation of Windows Server 2008, use the following command:

```
Start /w ocsetup DHCPServerCore
```

# Authorizing a DHCP Server

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- In implementations of DHCP prior to Windows 2000, any user could create a DHCP server on the network, an action that could lead to conflicts in IP address assignments.
- In Windows Server 2000 and later, an unauthorized DHCP server (also referred to as a ***rogue DHCP server***) is simply a DHCP server that has not been explicitly listed in the Active Directory Domain Service as an authorized server.
- You must ***authorize*** a DHCP server in Active Directory before the server can issue leases to DHCP clients.



# Authorizing a DHCP Server

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- Press Ctrl+Alt+Delete on the Windows Server 2008 computer.
- In the DHCP console, right-click DHCP and then click Manage Authorized Servers.
- In the Manage Authorized Servers dialog box, select Authorize.
- In the Authorize DHCP Server dialog box, key the name or IP address of the DHCP server to be authorized and then click OK.
- The computer will list the IP and full computer name and then ask for confirmation.
  - Click OK to continue.

# DHCP Scope

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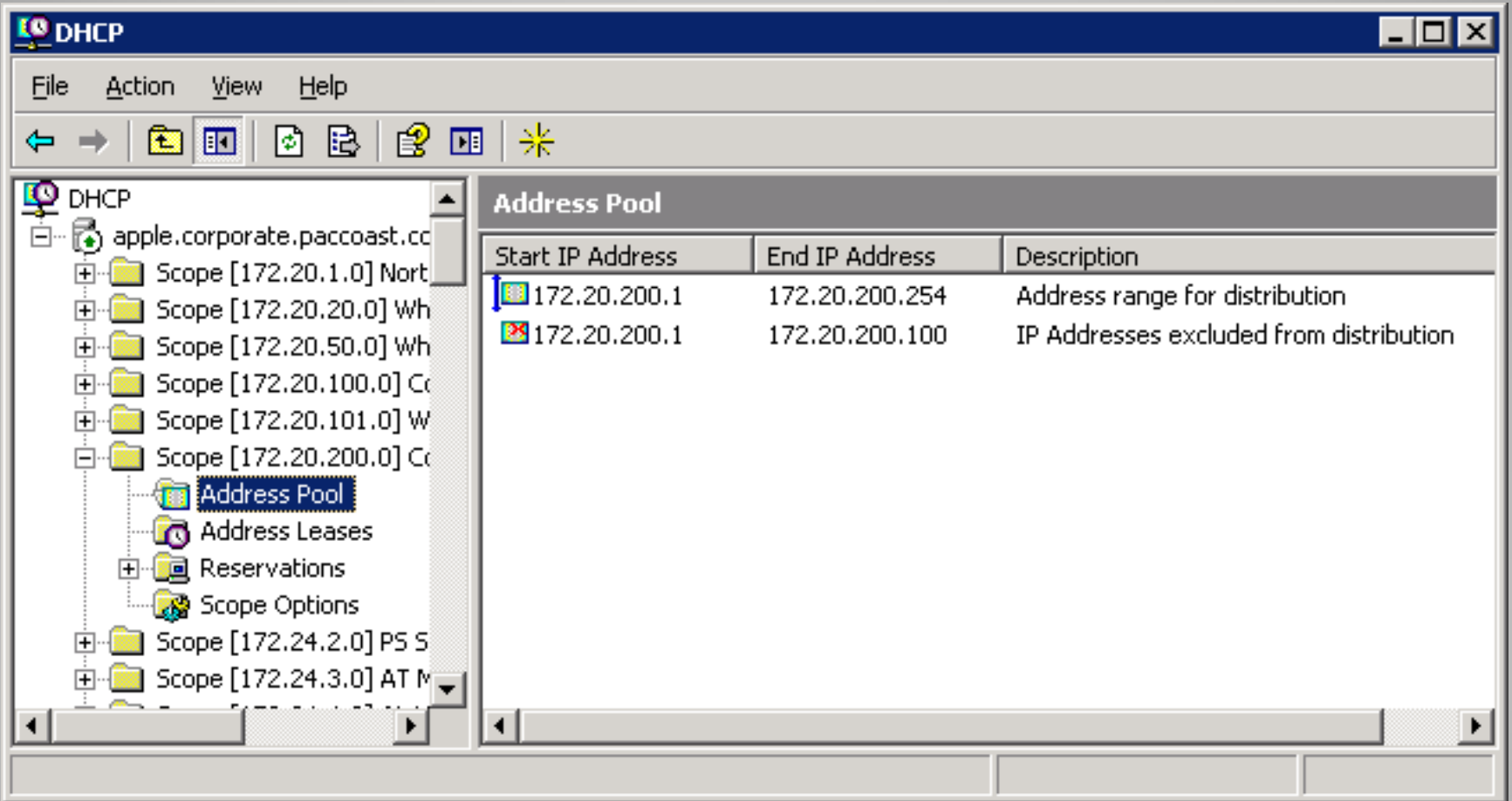
- Determines which IP addresses are allocated to clients.
- Defines a set of IP addresses and associated configuration information that can be supplied to a DHCP client.
- A scope must be defined and activated before DHCP clients can use the DHCP server for dynamic TCP/IP configuration.
- You can configure as many scopes on a DHCP server as needed for your network environment.

# DHCP Scope

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- The IP addresses defined in a DHCP scope must be contiguous and are associated with a subnet mask.
  - If the addresses you want to assign are not contiguous, you must create a scope encompassing all the addresses you want to assign and then exclude specific addresses or address ranges from the scope.
  - You can create only one scope per subnet on a single DHCP server.

# DHCP Scope



The screenshot displays the DHCP console interface. The left pane shows a tree view of DHCP scopes, with the 'Address Pool' sub-item under the scope [172.20.200.0] selected. The right pane shows the configuration for the selected address pool in a table format.

Start IP Address	End IP Address	Description
172.20.200.1	172.20.200.254	Address range for distribution
172.20.200.1	172.20.200.100	IP Addresses excluded from distribution

# Available Address Pool

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- Once a DHCP scope is defined and exclusion ranges are applied, the remaining addresses form what is called an ***available address pool*** within the scope.
- Pooled addresses can then be dynamically assigned to DHCP clients on the network.

# Superscope

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- A DHCP *superscope* is an administrative grouping of scopes that is used to support *multinets*, or multiple logical subnets (subdivisions of an IP network) on a single network segment (a portion of the IP internetwork bounded by IP routers).
- Superscopes contain only a list of member scopes or child scopes that can be activated together.

# DHCP Reservation

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- Network administrators can use DHCP *reservations* for DHCP-enabled hosts that need to have static IP addresses on your network.
- Reservations must be created within a scope and must not be excluded from the scope.
- An IP address is set aside, or reserved, for a specific network device that has the Media Access Control (MAC) address (the hard-coded hexadecimal hardware address associated with a Network Interface Card) associated with that IP address.

# DHCP Reservation

- You can find the MAC address with the ipconfig /all command.


```
Ethernet adapter Local Area Connection:  
    Connection-specific DNS Suffix . :  
    Description . . . . . : Realtek RTL8139/810  
Ethernet NIC  
    Physical Address . . . . . : 00-C0-9F-8E-82-00  
    Dhcp Enabled . . . . . : No  
    IP Address . . . . . : 192.168.3.100  
    Subnet Mask . . . . . : 255.255.255.0  
    Default Gateway . . . . . : 192.168.3.1  
    DNS Servers . . . . . : 4.2.2.2
```



# DHCP Reservation

[172.20.200.46] LASERAR.corporate.paccoast.com Properties ? X

General | DNS

 Reserved Client

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Reservation name:

IP address:

MAC address:

Description:

Supported types

Both

DHCP only

BOOTP only

OK Cancel Apply

# DHCP Options

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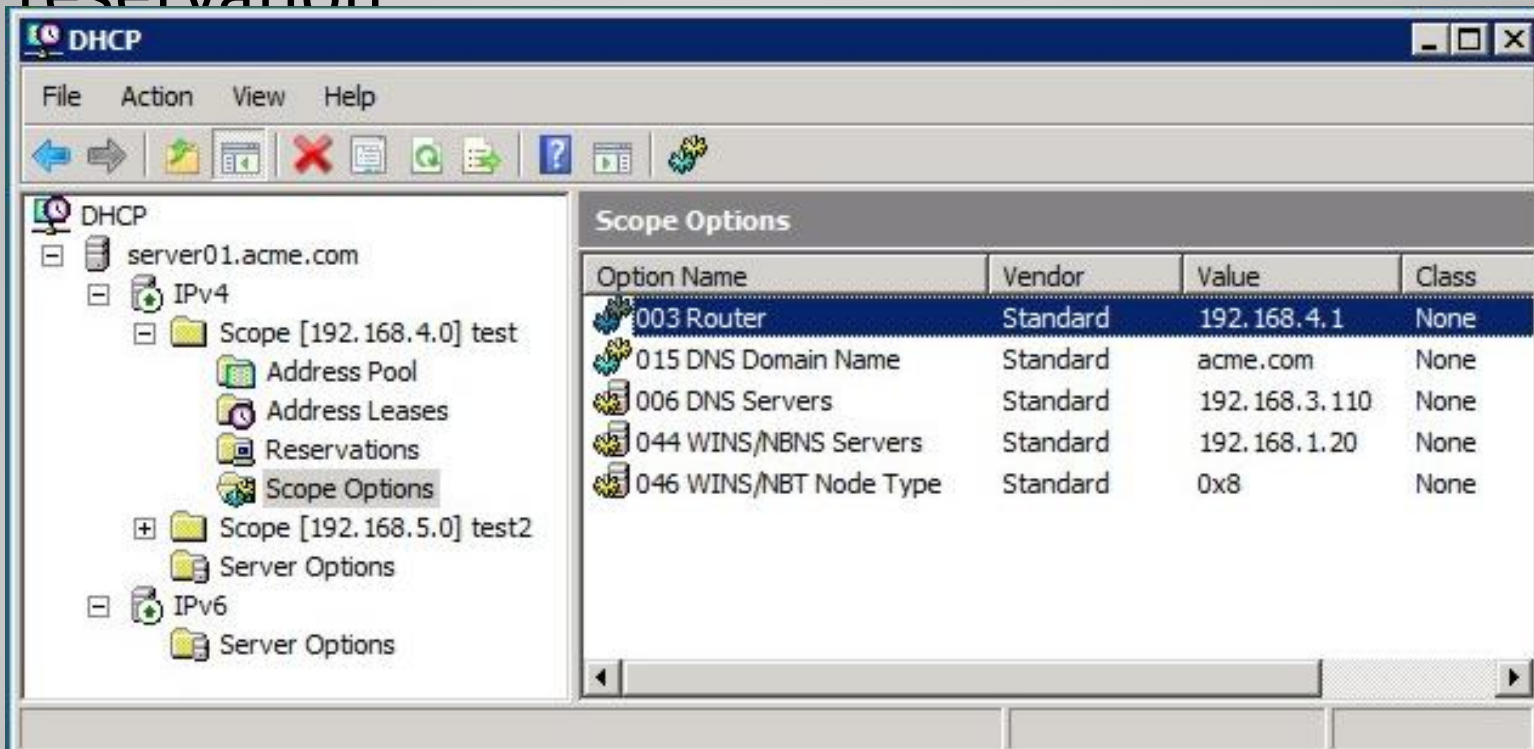
- DHCP options are additional client-configuration parameters that a DHCP server can assign when serving leases to DHCP clients.
- DHCP options are configured using the DHCP console and can apply to scopes and reservations.

# DHCP Options

OPTION	DESCRIPTION
Router (default gateway)	The addresses of any default gateway or router. This router is commonly referred to as the default gateway.
Domain name	A DNS domain name defines the domain to which a client computer belongs. The client computer can use this information to update a DNS server so that other computers can locate the client.
DNS and WINS servers	The addresses of any DNS and WINS servers for clients to use for network communication.

# DHCP Options

- DHCP options can be assigned to all scopes, one specific scope, or to a specific machine reservation



The screenshot shows the DHCP console interface. The left pane displays a tree view of the DHCP server configuration. The right pane shows the 'Scope Options' table for the selected scope.

Option Name	Vendor	Value	Class
003 Router	Standard	192.168.4.1	None
015 DNS Domain Name	Standard	acme.com	None
006 DNS Servers	Standard	192.168.3.110	None
044 WINS/NBNS Servers	Standard	192.168.1.20	None
046 WINS/NBT Node Type	Standard	0x8	None

# DHCP Options

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- There are four types of DHCP options in Windows Server 2008:
  - **Server options** apply to all clients of the DHCP server. Use these options for parameters common across all scopes on the DHCP server.
  - **Scope options** apply to all clients within a scope and are the most often used set of options. Scope options override server options.
  - **Class options** provide DHCP parameters to DHCP clients based on type — either vendor classes or user classes.
  - **Client options** apply to individual clients. Client options override all other options (server, scope, and class).

# Backup and Restore the DHCP Database

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- Windows Server 2008 DHCP servers support automatic and manual backups.
- To provide fault tolerance in the case of a failure, it is important to back up the DHCP database.
  - This enables you to restore the database from the backup copy if the hardware fails.
- To backup, right-click the server in the DHCP console and click Backup.
- To restore the DHCP database, right-click the server and click Restore.

# Summary

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- DHCP is a simple, standard protocol that makes TCP/IP network configuration much easier for the administrator by dynamically assigning IP addresses and providing additional configuration information to DHCP clients automatically.
- Additional configuration information is provided in the form of options and can be associated with reserved IPs to a vendor or user class, to a scope, or to an entire DHCP server.

# Summary

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- Because DHCP is a key component in your organization, you must manage and monitor it.
- DHCP management consists of backing up and restoring the database as well as reconciling, compacting, and, in some cases, removing the database.
- APIPA is useful for providing addresses to single-segment networks that do not have a DHCP server.