Configuring a LAN with DHCP and VLANs

The Cisco 819, Cisco 860 and Cisco 880 Integrated Services Routers (ISRs) support clients on both physical LANs and virtual LANs (VLANs). The routers can use the Dynamic Host Configuration Protocol (DHCP) to enable automatic assignment of IP configurations for nodes on these networks.

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Figure 1: Physical and Virtual LANs with DHCP Configured on the Cisco Router

1. Fast Ethernet LAN (with multiple networked devices)
DHCP

DHCP, which is described in RFC 2131, uses a client/server model for address allocation. As an administrator, you can configure your Cisco 800 series router to act as a DHCP server, providing IP address assignment and other TCP/IP-oriented configuration information to your workstations. DHCP frees you from having to manually assign an IP address to each client.

When you configure a DHCP server, you must configure the server properties, policies, and DHCP options.

Note: Whenever you change server properties, you must reload the server with the configuration data from the Network Registrar database.

Note: Cisco 800 Series Routers do not support DHCP snooping.

VLANs

The Cisco 819, Cisco 860 and Cisco 880 routers support four Fast Ethernet ports on which you can configure VLANs.

VLANs enable networks to be segmented and formed into logical groups of users, regardless of the user’s physical location or LAN connection.

Configuring DHCP and VLANs

The procedures in this chapter assume you have already configured basic router features, as well as PPPoE or PPPoA with NAT. If you have not performed these configurations tasks, see the Basic Router Configuration and Configuring a VPN Using Easy VPN and an IPSec Tunnel as appropriate for your router.

Configuring DHCP

Perform these steps to configure your router for DHCP operation, beginning in global configuration mode:

<table>
<thead>
<tr>
<th></th>
<th>Router and DHCP server—Cisco 819, Cisco 860, or Cisco 880 ISR—connected to the Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>VLAN 1</td>
</tr>
<tr>
<td>4</td>
<td>VLAN 2</td>
</tr>
</tbody>
</table>
SUMMARY STEPS

1. ip domain name name
2. ip name-server server-address1 [server-address2...server-address6]
3. ip dhcp excluded-address low-address [high-address]
4. ip dhcp pool name
5. network network-number [mask | prefix-length]
6. import all
7. default-router address [address2...address8]
8. dns-server address [address2...address8]
9. domain-name domain
10. exit

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>ip domain name name</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config)# ip domain smallbiz.com</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>ip name-server server-address1 [server-address2...server-address6]</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config)# ip name-server 192.168.11.12</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>ip dhcp excluded-address low-address [high-address]</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config)# ip dhcp excluded-address 192.168.9.0</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>ip dhcp pool name</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config)# ip dhcp pool dpool1 \n Router(config-dhcp)#</td>
</tr>
<tr>
<td><strong>Step 5</strong></td>
<td>network network-number [mask</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-dhcp)# network 10.10.0.0 \n 255.255.255.0</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
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</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>Imports DHCP option parameters into the DHCP portion of the router database.</td>
</tr>
<tr>
<td>import all</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>Router(config-dhcp)# import all</td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td>Specifies up to eight default routers for a DHCP client.</td>
</tr>
<tr>
<td>default-router address [address2...address8]</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>Router(config-dhcp)# default-router 10.10.10.10</td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td>Specifies up to eight DNS servers available to a DHCP client.</td>
</tr>
<tr>
<td>dns-server address [address2...address8]</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>Router(config-dhcp)# dns-server 192.168.35.2</td>
</tr>
<tr>
<td><strong>Step 9</strong></td>
<td>Specifies the domain name for a DHCP client.</td>
</tr>
<tr>
<td>domain-name domain</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>Router(config-dhcp)# domain-name cisco.com</td>
</tr>
<tr>
<td><strong>Step 10</strong></td>
<td>Exits DHCP configuration mode and enters global configuration mode.</td>
</tr>
<tr>
<td>exit</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td>Router(config-dhcp)# exit</td>
</tr>
</tbody>
</table>

**Configuration Example: DHCP**

The following configuration example shows a portion of the configuration file for the DHCP configuration described in this chapter:

```
ip dhcp excluded-address 192.168.9.0
!  
ip dhcp pool dpool1
  import all
  network 10.10.0.0 255.255.255.0
default-router 10.10.10.10
dns-server 192.168.35.2
domain-name cisco.com
!  
ip domain name smallbiz.com
ip name-server 192.168.11.12
```

**Verifying Your DHCP Configuration**

Use the following commands to view your DHCP configuration:

- `show ip dhcp import`—Displays the optional parameters imported into the DHCP server database.
• show ip dhcp pool—Displays information about the DHCP address pools.
• show ip dhcp server statistics—Displays the DHCP server statistics, such as the number of address pools, bindings, and so forth.

Router# show ip dhcp import
Address Pool Name: dpool1
Router# show ip dhcp pool
Pool dpool1:
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next) : 0 / 0
  Total addresses : 254
  Leased addresses : 0
  Pending event : none
  1 subnet is currently in the pool:
  Current index  IP address range  Lease addresses
  10.10.0.1 10.10.0.1 - 10.10.0.254 0

Router# show ip dhcp server statistics
Memory usage 15419
Address pools 1
Database agents 0
Automatic bindings 0
Manual bindings 0
Expired bindings 0
Malformed messages 0
Secure arp entries 0
Message Received
  BOOTREQUEST 0
  DHCPDISCOVER 0
  DHCPREQUEST 0
  DHCPDECLINE 0
  DHCPRELEASE 0
  DHCPINFORM 0
Message Sent
  BOOTREPLY 0
  DHCPOFFER 0
  DHCPACK 0
  DHCPNAK 0
Router#

Configuring VLANs

Perform these steps to configure VLANs on your router, beginning in global configuration mode:

SUMMARY STEPS

1. vlan vlan_id
2. exit

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 vlan vlan_id</td>
<td>Enters VLAN configuration mode.</td>
</tr>
</tbody>
</table>

Example:

Router# config t
Router(config)#vlan 2
Assigning a Switch Port to a VLAN

Perform these steps to assign a switch port to a VLAN, beginning in global configuration mode:

**SUMMARY STEPS**

1. `interface switch port id`
2. `switchport access vlan vlan-id`
3. `end`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td><code>interface switch port id</code></td>
<td>Specifies the switch port that you want to assign to the VLAN.</td>
</tr>
<tr>
<td>Example:</td>
<td><code>Router(config)#interface FastEthernet 2</code></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td><code>switchport access vlan vlan-id</code></td>
<td>Assigns a port to the VLAN.</td>
</tr>
<tr>
<td>Example:</td>
<td><code>Router(config-if)# switchport access vlan 2</code></td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td><code>end</code></td>
<td>Exits interface mode and returns to privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td><code>Router(config-if)#end</code></td>
<td></td>
</tr>
</tbody>
</table>

Verifying Your VLAN Configuration

Use the following commands to view your VLAN configuration.
• **show**—Entered from VLAN database mode. Displays summary configuration information for all configured VLANs.

• **show vlan-switch**—Entered from privileged EXEC mode. Displays detailed configuration information for all configured VLANs.

Router# vlan database
Router(vlan)# show
VLAN ISL Id: 1
  Name: default
  Media Type: Ethernet
  VLAN 802.10 Id: 100001
  State: Operational
  MTU: 1500
  Translational Bridged VLAN: 1002
  Translational Bridged VLAN: 1003

VLAN ISL Id: 2
  Name: VLAN0002
  Media Type: Ethernet
  VLAN 802.10 Id: 100002
  State: Operational
  MTU: 1500

VLAN ISL Id: 3
  Name: red-vlan
  Media Type: Ethernet
  VLAN 802.10 Id: 100003
  State: Operational
  MTU: 1500

VLAN ISL Id: 1002
  Name: fddi-default
  Media Type: FDDI
  VLAN 802.10 Id: 101002
  State: Operational
  MTU: 1500
  Bridge Type: SRB
  Translational Bridged VLAN: 1
  Translational Bridged VLAN: 1003

VLAN ISL Id: 1003
  Name: token-ring-default
  Media Type: Token Ring
  VLAN 802.10 Id: 101003
  State: Operational
  MTU: 1500
  Bridge Type: SRB
  Ring Number: 0
  Bridge Number: 1
  Parent VLAN: 1005
  Maximum ARE Hop Count: 7
  Maximum STE Hop Count: 7
  Backup CRF Mode: Disabled
  Translational Bridged VLAN: 1
  Translational Bridged VLAN: 1002

VLAN ISL Id: 1004
  Name: fddinet-default
  Media Type: FDDI Net
  VLAN 802.10 Id: 101004
  State: Operational
  MTU: 1500
  Bridge Type: SRB
  Bridge Number: 1
  STP Type: IBM

VLAN ISL Id: 1005
  Name: trnet-default
  Media Type: Token Ring Net
  VLAN 802.10 Id: 101005
  State: Operational
  MTU: 1500
  Bridge Type: SRB
  Bridge Number: 1
  STP Type: IBM
Router# show vlan-switch

<table>
<thead>
<tr>
<th>VLAN Name</th>
<th>Status</th>
<th>Ports</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>default</td>
<td>active Fa0, Fa1, Fa3</td>
</tr>
<tr>
<td>2</td>
<td>VLAN0002</td>
<td>active Fa2</td>
</tr>
<tr>
<td>1002</td>
<td>fddi-default</td>
<td>active</td>
</tr>
<tr>
<td>1003</td>
<td>token-ring-default</td>
<td>active</td>
</tr>
<tr>
<td>1004</td>
<td>fddinet-default</td>
<td>active</td>
</tr>
<tr>
<td>1005</td>
<td>trnet-default</td>
<td>active</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>Parent</th>
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<th>BridgeNo</th>
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<th>BrdgMode</th>
<th>Trans1</th>
<th>Trans2</th>
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<tbody>
<tr>
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</table>