Configuring a LAN with DHCP and VLANs

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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.

The figure below shows a typical deployment scenario with two physical LANs connected by the router and two VLANs.

Figure 1: Physical and Virtual LANs with DHCP Configured on the Cisco Router
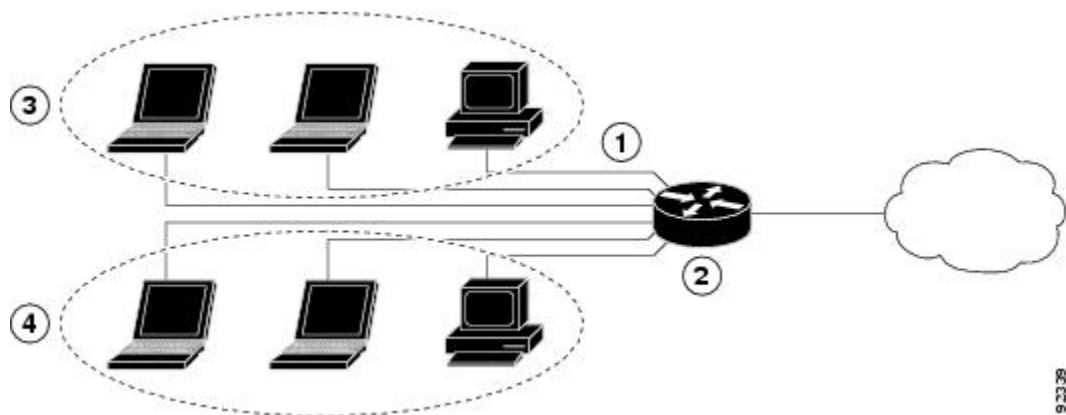
1	Fast Ethernet LAN (with multiple networked devices)

2	Router and DHCP server—Cisco 819, Cisco 860, or Cisco 880 ISR—connected to the Internet
3	VLAN 1
4	VLAN 2

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

Note 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:

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

	Command or Action	Purpose
Step 1	**ip domain name** *name* **Example:** Router(config)# ip domain smallbiz.com	Identifies the default domain that the router uses to complete unqualified hostnames (names without a dotted-decimal domain name).
Step 2	**ip name-server** *server-address1 [server-address2...server-address6]* **Example:** Router(config)# ip name-server192.168.11.12	Specifies the address of one or more Domain Name System (DNS) servers to use for name and address resolution.
Step 3	**ip dhcp excluded-address** *low-address [high-address]* **Example:** Router(config)# ip dhcp excluded-address 192.168.9.0	Specifies IP addresses that the DHCP server should not assign to DHCP clients. In this example, we are excluding the router address.
Step 4	**ip dhcp pool** *name* **Example:** Router(config)# ip dhcp pool dpool1 Router(config-dhcp)#	Creates a DHCP address pool on the router and enters DHCP pool configuration mode. The *name* argument can be a string or an integer.
Step 5	**network** *network-number [mask	prefix-length]* **Example:** Router(config-dhcp)#network 10.10.0.0 255.255.255.0	Defines subnet number (IP) address for the DHCP address pool, optionally including the mask.

	Command or Action	Purpose
Step 6	**import all** **Example:** Router(config-dhcp)# import all	Imports DHCP option parameters into the DHCP portion of the router database.
Step 7	**default-router** *address [address2...address8]* **Example:** Router(config-dhcp)#default-router 10.10.10.10	Specifies up to eight default routers for a DHCP client.
Step 8	**dns-server** *address [address2...address8]* **Example:** Router(config-dhcp)# dns-server 192.168.35.2	Specifies up to eight DNS servers available to a DHCP client.
Step 9	**domain-name** *domain* **Example:** Router(config-dhcp)#domain-name cisco.com	Specifies the domain name for a DHCP client.
Step 10	**exit** **Example:** Router(config-dhcp)# exit	Exits DHCP configuration mode and enters global configuration mode.

Configuration Example: DHCP

The following configuration example shows a portion of the configuration file for the DCHP 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                    Leased 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

	Command or Action	Purpose

Step 1	**vlan** *vlan_id*
	
	Example:
	
	`Router# config t`
	`Router(config)#vlan 2`
		Enters VLAN configuration mode.

	Command or Action	**Purpose**

Step 2	**exit**
	
	Example:
	
	`Router(config-`
	`vlan)#exit`
		Updates the VLAN database, propagates it throughout the administrative domain, and returns to global configuration mode.

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

	Command or Action	**Purpose**
Step 1	**interface** *switch port id* **Example:** `Router(config)#interface FastEthernet 2`	Specifies the switch port that you want to assign to the VLAN.
Step 2	**switchport access vlan** *vlan-id* **Example:** `Router(config-if)# switchport access vlan 2`	Assigns a port to the VLAN.
Step 3	**end** **Example:** `Router(config-if)#end`	Exits interface mode and returns to privileged EXEC mode.

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
```

Configuring a LAN with DHCP and VLANs

```
Router# show vlan-switch
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0, Fa1, Fa3
2    VLAN0002                         active    Fa2
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        1002   1003
2    enet  100002     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        1      1003
1003 tr    101003     1500  1005   0      -        -    srb      1      1002
1004 fdnet 101004     1500  -      -      1        ibm  -        0      0
1005 trnet 101005     1500  -      -      1        ibm  -        0      0
```