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FiberstoreOS

IP Service Configuration Guide

Contents

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1 Configuring ARP

1.1 Overview

The Address Resolution Protocol (ARP) is a protocol used to dynamically map between Internet host addresses and Ethernet addresses.

ARP caches Internet-Ethernet address mappings. When an interface requests a mapping for an address not in the cache, ARP queues the message, which requires the mapping, and broadcasts a message on the associated network requesting the address mapping. If a response is provided, the new mapping is cached and any pending message is transmitted. ARP will queue at most one packet while waiting for a response to a mapping request; only the most recently transmitted packet is kept. If the target host does not respond after 3 requests, the host is considered to be down, allowing an error to be returned to transmission attempts during this interval. If a target host does not send message for a period (normally one hour), the host is considered to be uncertainty, and several requests (normally 6, 3 unicast and 3 broadcast) will send to the host before delete the ARP entry.

ARP entries may be added, deleted or changed manually. Manually added entries may be temporary or permanent.

1.2 Configuring ARP

In this configuration example, interface eth-0-1 assigned with address 11.11.11.1/24, on subnet 11.11.11.0/24, there are two hosts, and their IP addresses are 11.11.11.2, 11.11.11.3, MAC address are 001a-a011-eca2, 001a-a011-eca3. ARP entry of host 11.11.11.2 is added manually, the entry of host 11.11.11.3 is added dynamically.

Time-out period of ARP entries for interface eth-0-1 configure to 20 minutes, ARP request retry delay on interface eth-0-1 configure to 2 seconds.

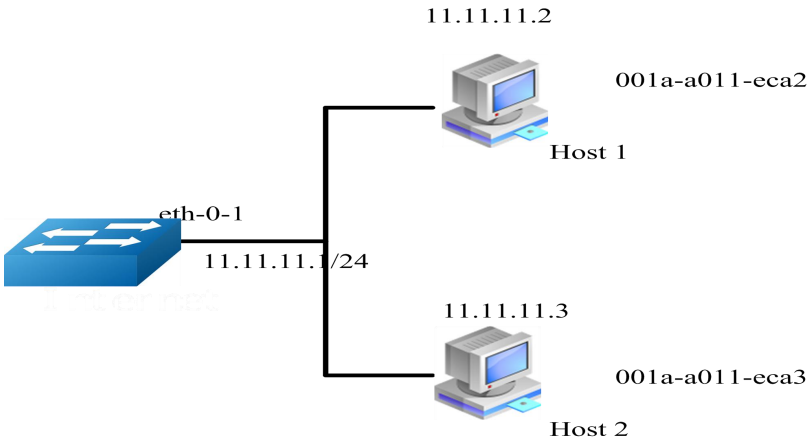

Figure 1-1 ARP Topology

Switch# configure terminal	Enter configuration commands, one per line. End with CNTL/Z
Switch(config)# interface eth-0-1	Enter the interface mode
Switch(config-if)# no switchport	Configure the port to layer 3 port.
Switch(config-if)# ip address 11.11.11.1/24	Add IP address
Switch(config-if)# arp timeout 1200	Assign ARP age timeout value to interface eth-0-1
Switch(config-if)# arp retry-interval 2	Assign ARP request retry delay value to interface eth-0-1
Switch(config)# arp 11.11.11.2 001a.a011.eca2	Add Static ARP entry

1.3 Validation commands

Switch# show ip arp

```
Protocol    Address          Age (min)  Hardware Addr   Interface
Internet    11.11.11.2             -   001a.a011.eca2   eth-0-1
```

Switch# show ip arp summary

```
 1 IP ARP entries, with 0 of them incomplete
(Static:0,  Dyamic:0, Interface:1)
 ARP Pkt Received is: 0
 ARP Pkt Send number is: 0
 ARP Pkt Dicard number is: 0
```

Switch# show interface eth-0-1

```
Interface eth-0-1
  Interface current state: Administratively DOWN
  Hardware is Ethernet, address is 6c02.530c.2300 (bia 6c02.530c.2300)
```

```
  Bandwidth 1000000 kbits
  Index 1 , Metric 1 , Encapsulation ARPA
  Speed - Auto , Duplex - Auto  , Media type is 1000BASE_T
  Link speed type is autonegotiation, Link duplex type is autonegotiation
  Input flow-control is off, output flow-control is off
  The Maximum Frame Size is 1534 bytes
  VRF binding: not bound
  Label switching is disabled
  No virtual circuit configured
  VRRP master of :  VRRP is not configured on this interface
  ARP timeout 00:20:00,  ARP retry interval 2s
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes
    Received 0 unicast, 0 broadcast, 0 multicast
    0 runts, 0 giants, 0 input errors, 0 CRC
    0 frame, 0 overrun, 0 pause input
    0 input packets with dribble condition detected
    0 packets output, 0 bytes
    Transmitted 0 unicast, 0 broadcast, 0 multicast
0 underruns, 0 output errors, 0 pause output
```

2 Configuring Proxy ARP

2.1 Overview

Proxy ARP, the most common method for learning about other routes, enables an Ethernet host with no routing information to communicate with hosts on other networks or subnets. The host assumes that all hosts are on the same local Ethernet and that they can use ARP to determine their MAC addresses. If a switch receives an ARP request for a host that is not on the same network as the sender, the switch evaluates whether it has the best route to that host. If it does, it sends an ARP reply packet with its own Ethernet MAC address, and the host that sent the request sends the packet to the switch, which forwards it to the intended host. Proxy ARP treats all networks as if they are local and performs ARP requests for every IP address.

Proxy ARP can be separated to 2 parts: Proxy ARP and local Proxy ARP.

Local Proxy ARP is always used in the topology where the Device is enabled port isolate but still need to do communicating via routing. Internet Control Message Protocol (ICMP) redirects are disabled on interfaces where the local proxy ARP feature is enabled.

2.2 Configuring ARP Proxy

2.2.1 Topology

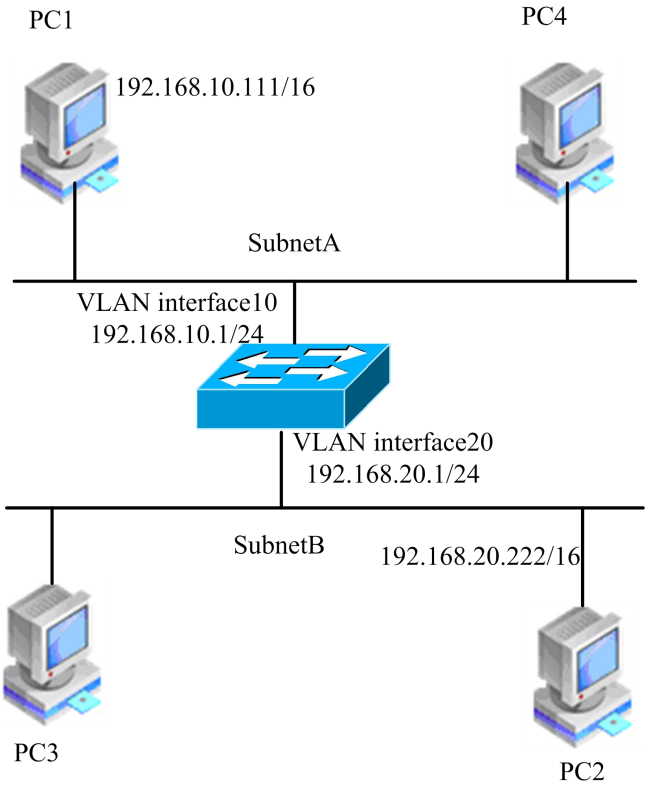

Figure 2-1 ARP Proxy topology

2.2.2 Configuration

As seen in the above topology, PC1 is belonged to VLAN10 and PC2 is belonged to VLAN20. If ARP proxy feature is not enabled, then PC1 and PC2 can not communicate with each other.

As following, these steps are shown to enable ARP proxy feature for both VLAN interface 10 and VLAN interface 20.

Switch# configure terminal	Enter the Configure mode
Switch(config)# vlan database	Enter the VLAN database mode
Switch(config-vlan)# vlan 10,20	Create VLAN 10, VLAN 20
Switch(config-vlan)# exit	Exit the VLAN database mode
Switch(config)# interface eth-0-22	Enter the interface mode
Switch(config-if)# switchport access vlan 10	Configure the native VLAN 10 for this port
Switch(config-if)# no shutdown	Linkup the port
Switch(config-if)# exit	Exit the interface mode

Switch(config)# interface eth-0-23	Enter the interface mode
Switch(config-if)# switchport access vlan 20	Configure the native VLAN 10 for this port
Switch(config-if)# no shutdown	Linkup the port
Switch(config-if)# exit	Exit the interface mode
Switch(config)# interface vlan 10	Create layer3 VLAN interface 10 and enter interface mode
Switch(config-if)# ip address 192.168.10.1/24	Configure the IP address for the interface
Switch(config-if)# proxy-arp enable	Enable ARP Proxy
Switch(config-if)# exit	Exit the interface mode
Switch(config)# interface vlan 20	Create layer3 VLAN interface 20 and enter interface mode
Switch(config-if)# ip address 192.168.20.1/24	Configure the IP address for the interface
Switch(config-if)# proxy-arp enable	Enable ARP Proxy
Switch(config-if)# exit	Exit the interface mode

2.2.3 Validation Commands

Output result in Switch

Switch# show ip interface vlan 10

```
Interface vlan10
  Interface current state: UP
  Internet address(es):
    192.168.10.1/24 broadcast 192.168.10.255
  Joined group address(es):
    224.0.0.1
  The maximum transmit unit is 1500 bytes
  ICMP error messages limited to one every 1000 milliseconds
  ICMP redirects are always sent
  ICMP unreachables are always sent
  ICMP mask replies are always sent
  ARP timeout 01:00:00,  ARP retry interval 1s
  ARP Proxy is enabled, Local ARP Proxy is disabled
  VRRP master of :  VRRP is not configured on this interface
```

Switch# show ip interface vlan 20

```
Interface vlan20
  Interface current state: UP
  Internet address(es):
    192.168.20.1/24 broadcast 192.168.20.255
  Joined group address(es):
    224.0.0.1
  The maximum transmit unit is 1500 bytes
  ICMP error messages limited to one every 1000 milliseconds
```

```
  ICMP redirects are always sent
  ICMP unreachables are always sent
  ICMP mask replies are always sent
  ARP timeout 01:00:00,  ARP retry interval 1s
  ARP Proxy is enabled, Local ARP Proxy is disabled
  VRRP master of :  VRRP is not configured on this interface
```

Switch# show ip arp

```
Protocol    Address          Age (min)  Hardware Addr   Interface
Internet    192.168.10.1           -   7cc3.11f1.aa00  vlan10
Internet    192.168.10.111         5   0cf9.11b6.6e2e  vlan10
Internet    192.168.20.1           -   7cc3.11f1.aa00  vlan20
Internet    192.168.20.222         6   5a94.031f.2357  vlan20
```

Output result in host PC1

[uml: ~]$ ifconfig eth0

```
eth0      Link encap:Ethernet  HWaddr 0C:F9:11:B6:6E:2E
          inet addr:192.168.10.111  Bcast:192.168.255.255  Mask:255.255.0.0
          UP BROADCAST RUNNING MULTICAST  MTU:1600  Metric:1
          RX packets:11 errors:0 dropped:0 overruns:0 frame:0
          TX packets:10 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:588 (588.0 b)  TX bytes:700 (700.0 b)
          Interrupt:5
```

[uml: ~]$ arp –a

```
? (192.168.20.222) at 7c:c3:11:f1:aa:00 [ether] on eth0
```

[uml: ~]$ route -v

```
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.0.0     *               255.255.0.0     U     0      0        0 eth0
```

[uml: ~]$ ping 192.168.20.222

```
PING 192.168.20.222 (192.168.20.222) 56(84) bytes of data.
64 bytes from 192.168.20.222: icmp_seq=0 ttl=63 time=189 ms
64 bytes from 192.168.20.222: icmp_seq=1 ttl=63 time=65.2 ms
^C
--- 192.168.20.222 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1000ms
rtt min/avg/max/mdev = 65.209/127.226/189.244/62.018 ms, pipe 2
```

Output result in host PC2

[uml: ~]$ ifconfig eth0

```
eth0      Link encap:Ethernet  HWaddr 5A:94:03:1F:23:57
          inet addr:192.168.20.222  Bcast:192.168.255.255  Mask:255.255.0.0
          UP BROADCAST RUNNING MULTICAST  MTU:1600  Metric:1
          RX packets:14 errors:0 dropped:0 overruns:0 frame:0
          TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:784 (784.0 b)  TX bytes:1174 (1.1 KiB)
          Interrupt:5
```

[uml: ~]$ arp -a

```
? (192.168.10.111) at 7c:c3:11:f1:aa:00 [ether] on eth0
```

[uml: ~]$ route -v

```
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
192.168.0.0     *               255.255.0.0     U     0      0        0 eth0
```

[uml: ~]$ ping 192.168.10.111

```
PING 192.168.10.111 (192.168.10.111) 56(84) bytes of data.
64 bytes from 192.168.10.111: icmp_seq=0 ttl=63 time=53.8 ms
64 bytes from 192.168.10.111: icmp_seq=1 ttl=63 time=65.8 ms
^C
--- 192.168.10.111 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1007ms
rtt min/avg/max/mdev = 53.832/59.842/65.852/6.010 ms, pipe 2
```

2.3 Configuring Local ARP Proxy

2.3.1 Topology

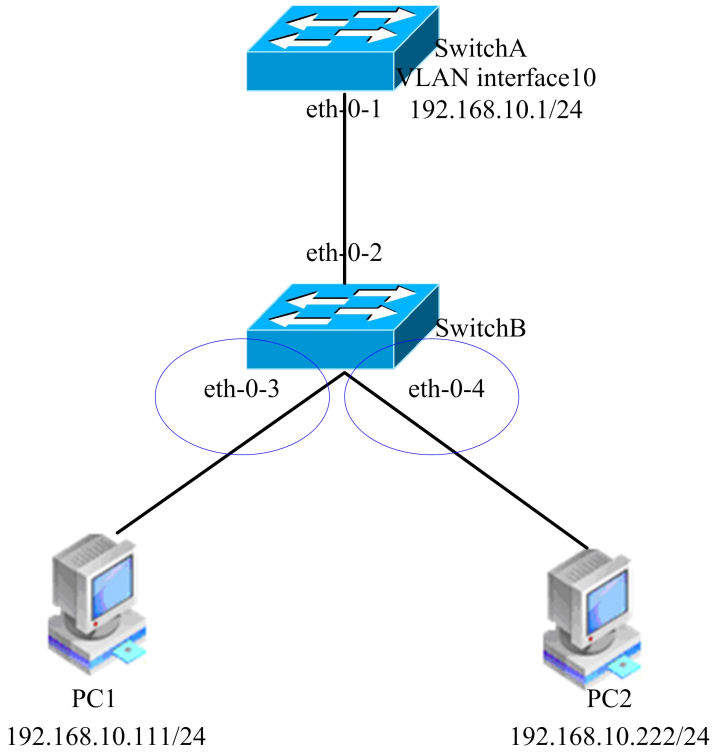

Figure 2-2 Local ARP Proxy topology

2.3.2 Configuration

As the above topology, eth-0-2, eth-0-3 and eth-0-4 are belonging to VLAN 10. eth-0-3 and eth-0-4 are both in port isolate group 1, and eth-0-2 is in port isolate group 3, so packets received in eth-0-3 can not flood to eth-0-4, but packets received in eth-0-2 can flood to both eth-0-3 and eth-0-4. PC1 is connecting with port eth-0-3 and PC2 is connecting with port eth-0-4.

Configure as the following step for communicating with PC1 and PC2.

Switch B

Switch# configure terminal	Enter the Configure mode
Switch(config)# vlan database	Enter the VLAN database mode
Switch(config-vlan)# vlan 10	Create VLAN 10
Switch(config-vlan)# exit	Exit the VLAN database mode
Switch(config)# interface eth-0-3	Enter the interface mode

Switch(config-if)# switchport access vlan 10	Configure the native VLAN 10 for this port
Switch(config-if)# no shutdown	Linkup the port
Switch(config)# interface eth-0-4	Enter the interface mode
Switch(config-if)# switchport access vlan 10	Configure the native VLAN 10 for this port
Switch(config-if)# no shutdown	Linkup the port
Switch(config)# interface eth-0-2	Enter the interface mode
Switch(config-if)# switchport access vlan 10	Configure the native VLAN 10 for this port
Switch(config-if)# no shutdown	Linkup the port
Switch(config)# port-isolate mode l2	Set the port isolate mode
Switch(config-if)# interface eth-0-3	Enter the interface mode
Switch(config-if)# port-isolate group 1	Configure the port belong to port isolate group 1
Switch(config-if)#exit	Exit the interface mode
Switch(config)# interface eth-0-4	Enter the interface mode
Switch(config-if)# port-isolate group 1	Configure the port belong to port isolate group 1
Switch(config-if)#exit	Exit the interface mode
Switch(config)# interface eth-0-2	Enter the interface mode
Switch(config-if)# port-isolate group 3	Configure the port belong to port isolate group 3
Switch(config-if)#exit	Exit the interface mode

Switch A

Switch# configure terminal	Enter the Configure mode
Switch(config)# vlan database	Enter the VLAN database mode
Switch(config-vlan)# vlan 10	Create VLAN 10
Switch(config-vlan)# exit	Exit the VLAN database mode
Switch(config)# interface eth-0-1	Enter the interface mode
Switch(config-if)# switchport access vlan 10	Configure the native VLAN 10 for this port
Switch(config-if)# no shutdown	Linkup the port
Switch(config)# interface vlan 10	Create layer3 VLAN interface 10 and enter interface mode
Switch(config-if)# ip address 192.168.10.1/24	Configure the IP address for the interface
Switch(config-if)# local-proxy-arp enable	Enable local ARP proxy
Switch(config-if)# exit	Exit the interface mode

2.3.3 Validation

Output result in Switch A

Switch# show ip arp

```
Protocol    Address          Age (min)  Hardware Addr   Interface
Internet    192.168.10.1           -   eeb4.2a8d.6c00  vlan10
Internet    192.168.10.111         0   34b0.b279.5f67  vlan10
Internet    192.168.10.222         0   2a65.9618.57fa  vlan10
```

Switch # show ip interface vlan 10

```
Interface vlan10
  Interface current state: UP
  Internet address(es):
    192.168.10.1/24 broadcast 192.168.10.255
  Joined group address(es):
    224.0.0.1
  The maximum transmit unit is 1500 bytes
  ICMP error messages limited to one every 1000 milliseconds
  ICMP redirects are never sent
  ICMP unreachables are always sent
  ICMP mask replies are always sent
  ARP timeout 01:00:00,  ARP retry interval 1s
  ARP Proxy is disabled, Local ARP Proxy is enabled
  VRRP master of :  VRRP is not configured on this interface
```

Output result in host PC1

[uml: ~]$ ifconfig eth0

```
eth0      Link encap:Ethernet  HWaddr 34:B0:B2:79:5F:67
          inet addr:192.168.10.111  Bcast:192.168.10.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1600  Metric:1
          RX packets:22 errors:0 dropped:0 overruns:0 frame:0
          TX packets:28 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1344 (1.3 KiB)  TX bytes:2240 (2.1 KiB)
          Interrupt:5
```

[uml: ~]$ arp -a

```
? (192.168.10.222) at ee:b4:2a:8d:6c:00 [ether] on eth0
```

[uml: ~]$ ping 192.168.10.222

```
PING 192.168.10.222 (192.168.10.222) 56(84) bytes of data.
64 bytes from 192.168.10.222: icmp_seq=0 ttl=63 time=131 ms
64 bytes from 192.168.10.222: icmp_seq=1 ttl=63 time=159 ms
--- 192.168.10.222 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 131.078/145.266/159.454/14.188 ms, pipe 2
```

Output result in host PC2

[uml: ~]$ ifconfig eth0

```
eth0      Link encap:Ethernet  HWaddr 2A:65:96:18:57:FA
          inet addr:192.168.10.222  Bcast:192.168.10.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1600  Metric:1
          RX packets:19 errors:0 dropped:0 overruns:0 frame:0
          TX packets:20 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1148 (1.1 KiB)  TX bytes:1524 (1.4 KiB)
          Interrupt:5
```

[uml: ~]$ arp -a

```
? (192.168.10.111) at ee:b4:2a:8d:6c:00 [ether] on eth0
```

[uml: ~]$ ping 192.168.10.111

```
PING 192.168.10.111 (192.168.10.111) 56(84) bytes of data.
64 bytes from 192.168.10.111: icmp_seq=0 ttl=63 time=198 ms
64 bytes from 192.168.10.111: icmp_seq=1 ttl=63 time=140 ms
64 bytes from 192.168.10.111: icmp_seq=2 ttl=63 time=146 ms
--- 192.168.10.111 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2008ms
rtt min/avg/max/mdev = 140.196/161.959/198.912/26.267 ms, pipe 2
```

3 Configuring DHCP Client

3.1 Overview

Dynamic Host Configuration Protocol(DHCP) client can acquire IP address and configuration dynamically from DHCP server by DHCP. If client and server is on the same physical subnet, client can communicate with server directly, otherwise they need DHCP relay agent which is used to forward DHCP messages.

DHCP client can request IP address from DHCP server by broadcasting DHCP messages. After received IP address and lease correspond to it, client will configure itself and set the expired time. When half past the lease, client will sent DHCP messages for a new lease to use the IP address continually. If it success, DHCP client will renew the lease.

DHCP client can send option request to server, which may be one or several of router, static-route, classless-static-route, classless-static-route-ms, tftp-server-address, dns-nameserver , domain-name, netbios-nameserver and vendor-specific. By default, options include router, static-route, classless-static-route, classless-static-route-ms, tftp-server-address will be requested from server. We can cancel one or several of these option requests by command.

3.2 Topology

Figure 3-1 DHCP Client Topology

This figure is the networking topology for testing DHCP client functions. We need one DHCP server and one Switch to construct the test bed.

3.3 Configuration

Configure interface eth-0-1

Switch# configure terminal	Enter the Configure mode
Switch(config)# interface eth-0-1	Enter the Interface Configure mode
Switch(config-if)# no switchport	Change the port to L3 port
Switch(config-if)# no shutdown	Make sure the port is enabled
Switch(config-if)# no dhcp client request static-route	Cancel static-route option request
Switch(config-if)# ip address dhcp	Enable DHCP client
Switch(config-if)# exit	Exit the Interface Configure mode

3.4 Validation

Check interface configuration

Switch# show running-config interface eth-0-1

```
Building configuration...
!
interface eth-0-1
 no switchport
 ip address dhcp
 no dhcp client request static-route
!
```

Check all DHCP client status

Switch# show dhcp client verbose

```
DHCP client informations:
============================================================
eth-0-1 DHCP client information:
  Current state: BOUND
  Allocated IP: 4.4.4.199 255.255.255.0
  Lease/renewal/rebinding: 1187/517/1037 seconds
  Lease from 2011-11-18 05:59:59 to 2011-11-18 06:19:59
  Will Renewal in 0 days 0 hours 8 minutes 37 seconds
  DHCP server: 4.4.4.1
  Transaction ID: 0x68857f54
  Client ID: switch-7e39.3457.b700-eth-0-1
```

Show DHCP client statistics

Switch# show dhcp client statistics

```
DHCP client packet statistics:
============================================================
DHCP OFFERS     received: 1
DHCP ACKs       received: 2
DHCP NAKs       received: 0
DHCP Others     received: 0
DHCP DISCOVER       sent: 1
DHCP DECLINE        sent: 0
DHCP RELEASE        sent: 0
DHCP REQUEST        sent: 2
DHCP packet send failed: 0
```

4 Configuring DHCP Relay

4.1 Overview

DHCP relay agent is any host that forwards DHCP packets between clients and servers. Relay agents are used to forward requests and replies between clients and servers when they are not on the same physical subnet. Relay agent forwarding is distinct from the normal forwarding of an IP router, where IP datagram are switched between networks somewhat transparently. By contrast, relay agents receive DHCP messages and then generate a new DHCP message to send out on another interface. The relay agent sets the gateway address (girder field of the DHCP packet) and, if configured, adds the relay agent information option (option82) in the packet and forwards it to the DHCP server. The reply from the server is forwarded back to the client after removing option 82.

4.2 Topology

This figure is the networking topology for testing DHCP relay functions. We need two Linux boxes and one Switch to construct the test bed.

- Computer A is used as DHCP server.
- Computer B is used as DHCP client.
- Switch is used as DHCP relay agent.

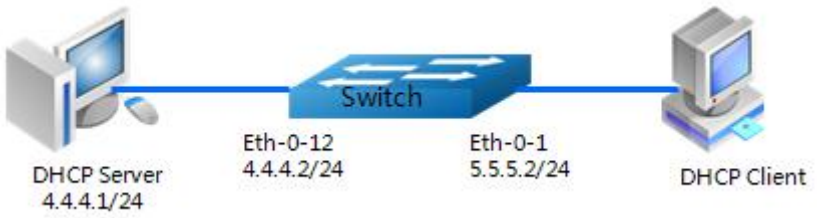

Figure 4-1 DHCP Relay Topology

4.3 Configuration

Configure interface eth-0-12

Switch# configure terminal	Enter the Configure mode
Switch(config)# interface eth-0-12	Enter the Interface Configure mode
Switch(config-if)# no switchport	Change the port to L3 port
Switch(config-if)# ip address 4.4.4.2/24	Set ip address
Switch(config-if)# no shutdown	Make sure the port is enabled
Switch(config-if)# exit	Exit the Interface Configure mode

Configure DHCP server groups

Switch(config)# dhcp-server 1 4.4.4.1	Create a dhcp-server group

Configure interface eth-0-1

Switch(config)# interface eth-0-1	Enter the Interface Configure mode
Switch(config-if)# no switchport	Change the port to L3 port
Switch(config-if)# ip address 5.5.5.2/24	Set ip address
Switch(config-if)# no shutdown	Make sure the port is up
Switch(config-if)# dhcp relay information trusted	Set interface to dhcp relay trusted
Switch(config-if)# dhcp-server 1	Specify the dhcp server
Switch(config-if)# exit	Exit the Interface Configure mode

Enable DHCP Relay global service

Switch(config)# service dhcp enable	Enable dhcp services
Switch(config)# dhcp relay	Enable dhcp relay feature

4.4 Validation

Check the interface configuration

Switch# show running-config interface eth-0-12

```
!
interface eth-0-12
 no switchport
 ip address 4.4.4.2/24
!
```

Switch# show running-config interface eth-0-1

```
!
interface eth-0-1
 no switchport
 dhcp relay information trusted
 dhcp-server 1
 ip address 5.5.5.2/24
!
```

Check the dhcp service status

Switch# show services

```
Networking services configuration:
Service Name          Status
================================================================
dhcp                    enable
dhcpv6                  disable
```

Check the dhcp server group configuration

Switch# show dhcp-server

```
DHCP server group information:
================================================================
group 1 ip address list:
[1] 4.4.4.1
```

Check the dhcp relay statistics

Switch# show dhcp relay statistics

```
DHCP relay packet statistics:
================================================================
Client relayed packets:  20
Server relayed packets:  20

Client error packets:     20
Server error packets:     0
Bogus GIADDR drops:       0
Bad circuit ID packets:   0
Corrupted agent options:  0
Missing agent options:    0
Missing circuit IDs:      0
```

Check your computer ip address from DHCP server

Ipconfig/all

```
Dhcp Enabled. . . . . . . . . . . : Yes
Autoconfiguration Enabled . . . . : Yes
IP Address. . . . . . . . . . . . : 5.5.5.1
Subnet Mask . . . . . . . . . . . : 255.255.255.0
Default Gateway . . . . . . . . . : 5.5.5.2
DHCP Server . . . . . . . . . . . : 4.4.4.1
DNS Servers . . . . . . . . . . . : 4.4.4.1
```

5 Configuring DHCP server

5.1 Overview

A DHCP server is an Internet host that returns configuration parameters to DHCP clients 。 DHCP server can provide IP address and network configuration for DHCP client by DHCP. For provide DHCP service，DHCP server need to be configured first. For example, IP address pool need be create , default gateway should be set in a pool, and some network parameters for DHCP client should be set before DHCP working. After DHCP server start to work, it will find a valid IP address from pool for DHCP client when receiving client's request. Meantime it also send network configuration parameters to client. The IP address assigned by DHCP server have a period of validity(lease), so DHCP client need to renew its lease before the lease expired for reserving current IP address by sending DHCP REQUEST message.

If DHCP server was in the same subnet with client,it can normal work after connect to subnet. Otherwise DHCP relay was needed for server providing DHCP service ,which can help to forward DHCP message between server and client .

Main options supported by DHCP server include bootfile-name, dns-server, domain-name, gateway, netbios-name-server, netbios-node-type, tftp-server-address. Besides these, some raw options were also be supported ,which were set with option code.

5.2 Topology

Figure 5-1：DHCP server

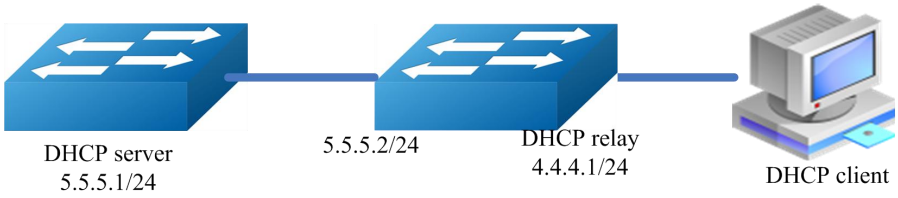

Figure 5-2：DHCP server with relay

These figures are the networking topology for testing DHCP server functions.

5.3 Configuration

Configure DHCP Server(dut1)for topology 1

Switch#configure terminal	Enter the Configure mode
Switch(config)#service dhcp enable	Enable DHCP service
Switch(config)#dhcp server	Enable DHCP server
Switch(config)#dhcp pool pool5	Create pool5，Enter DHCP Configure mode
Switch(dhcp-config)#network 5.5.5.0/24	Configure assigned address
Switch(dhcp-config)#gateway 5.5.5.1	Configure default router
Switch(dhcp-config)#exit	Exit DHCP Configure mode
Switch(config)#interface eth-0-9	Enter the Interface Configure mode
Switch (config-if)#no switchport	Change the port to L3 port
Switch (config-if)# no shutdown	Make sure the port is enabled
Switch (config-if)# ip address 5.5.5.1/24	Configure IP address
Switch (config-if)# dhcp server enable	Enable DHCP server on interface
Switch (config-if)#exit	Exit the Interface Configure mode

Configure DHCP Server(dut1)for topology 2

Switch#configure terminal	Enter the Configure mode
Switch(config)#service dhcp enable	Enable DHCP service
Switch(config)#dhcp server	Enable DHCP server
Switch(dhcp-config)#dhcp pool pool4	Create pool4
Switch(dhcp-config)#network 4.4.4.0/24	Configure assigned address
Switch(dhcp-config)#gateway 4.4.4.1	Configure default router
Switch(dhcp-config)#exit	Exit DHCP Configure mode
Switch(config)#ip route 4.4.4.0/24 5.5.5.2	Add route to 4.4.4.0

Switch(config)#interface eth-0-9	Enter the Interface Configure mode
Switch (config-if)#no switchport	Change the port to L3 port
Switch (config-if)# no shutdown	Make sure the port is enabled
Switch (config-if)# ip address 5.5.5.1/24	Configure IP address
Switch (config-if)# dhcp server enable	Enable DHCP server on interface
Switch (config-if)#exit	Exit the Interface Configure mode

Configure DHCP client(dut2)for topology 1

Switch#configure terminal	Enter the Configure mode
Switch(config)#interface eth-0-9	Enter the Interface Configure mode
Switch (config-if)#no switchport	Change the port to L3 port
Switch (config-if)# no shutdown	Make sure the port is enabled
Switch (config-if)# ip address dhcp	Enable DHCP client
Switch (config-if)#exit	Exit the Interface Configure mode

Configure DHCP client(dut3)for topology 2

Switch#configure terminal	Enter the Configure mode
Switch(config)#interface eth-0-17	Enter the Interface Configure mode
Switch (config-if)#no switchport	Change the port to L3 port
Switch (config-if)# no shutdown	Make sure the port is enabled
Switch (config-if)# ip address dhcp	Enable DHCP client
Switch (config-if)#exit	Exit the Interface Configure mode

Configure DHCP relay(dut2)for topology 2

Switch#configure terminal	Enter the Configure mode
Switch(config)#service dhcp enable	Enable DHCP service
Switch(config)#dhcp relay	Enable DHCP relay
Switch(config)#dhcp-server 1 5.5.5.1	Configure DHCP server group
Switch(config)#interface eth-0-17	Enter the Interface Configure mode
Switch (config-if)#no switchport	Change the port to L3 port
Switch (config-if)# no shutdown	Make sure the port is enabled
Switch (config-if)# ip address 4.4.4.1/24	Configure IP address
Switch (config-if)# dhcp-server 1	Select dhcp server group
Switch (config-if)#interface eth-0-9	Enter the Interface Configure mode
Switch (config-if)#no switchport	Change the port to L3 port
Switch (config-if)# no shutdown	Make sure the port is enabled

Switch (config-if)# ip address 5.5.5.2/24	Configure IP address
Switch (config-if)#exit	Exit the Interface Configure mode

5.4 Validation

Check configuration：

Switch# show running-config

```
            ……
!
service dhcp enable
temperature 0 0 0
            ……
!
interface eth-0-9
 no switchport
 dhcp server enable
 ip address 5.5.5.1/24!
              ……
!
ip route 4.4.4.0/24 5.5.5.2
!
dhcp server
dhcp pool pool4
 network 4.4.4.0/24
 gateway 4.4.4.1
dhcp pool pool5
 network 5.5.5.0/24
 gateway 5.5.5.1
            ……
```

For topology 1:

Check DHCP client status:

Switch# show dhcp client verbose

```
DHCP client informations:
============================================================
eth-0-9 DHCP client information:
  Current state: BOUND
  Allocated IP: 5.5.5.2 255.255.255.0
  Lease/renewal/rebinding: 1194/546/1044 seconds
  Lease from 2012-02-04 07:40:12 to 2012-02-04 08:00:12
  Will Renewal in 0 days 0 hours 9 minutes 6 seconds
  DHCP server: 5.5.5.1
  Transaction ID: 0x45b0b27b
  Default router: 5.5.5.1
  Classless static route:
    Destination: 5.5.4.0, mask: 255.255.255.0, Nexthop: 5.5.5.1
```

```
  TFTP server addresses: 5.5.5.3
```

Client ID: switch-6e6e.361f.8400-eth-0-9Show DHCP server statistics

Switch# show dhcp server statistics

```
DHCP server packet statistics:
============================================================
Message Received:
BOOTREQUEST:  0
DHCPDISCOVER:  1
DHCPREQUEST:  1
DHCPDECLINE:  0
DHCPRELEASE:  0
DHCPINFORM:  0

Message Sent:
BOOTREPLY:  0
DHCPOFFER:  1
DHCPACK:  1
DHCPNAK:  0
```

Show DHCP server information：

Switch# show dhcp server binding all

```
 IP address       Client-ID/              Lease expiration              Type
                  Hardware address
 5.5.5.2          6e:6e:36:1f:84:00       Sat 2012.02.04 08:00:12       Dynamic
```

```
Switch# show dhcp server interfaces
List of DHCP server enabled interface(s):
DHCP server service status: enabled
Interface Name
============================================================
eth-0-9
```

For topology 2:

Check DHCP client status:

Switch# show dhcp client verbose

```
DHCP client informations:
============================================================
eth-0-17 DHCP client information:
  Current state: BOUND
  Allocated IP: 4.4.4.5 255.255.255.0
  Lease/renewal/rebinding: 1199/517/1049 seconds
  Lease from 2012-02-06 05:23:09 to 2012-02-06 05:43:09
  Will Renewal in 0 days 0 hours 8 minutes 37 seconds
  DHCP server: 5.5.5.1
  Transaction ID: 0x192a4f7d
```

```
  Default router: 4.4.4.1
  Classless static route:
    Destination: 5.5.4.0, mask: 255.255.255.0, Nexthop: 4.4.4.1
  TFTP server addresses: 5.5.5.3
  Client ID: switch-3c9a.b29a.ba00-eth-0-17
```

Show DHCP server statistics

Switch# show dhcp server statistics

```
DHCP server packet statistics:
============================================================
Message Received:
BOOTREQUEST:  0
DHCPDISCOVER:  1
DHCPREQUEST:  1
DHCPDECLINE:  0
DHCPRELEASE:  0
DHCPINFORM:  0

Message Sent:
BOOTREPLY:  0
DHCPOFFER:  1
DHCPACK:  1
DHCPNAK:  0
```

Show DHCP server information：

Switch# show dhcp server binding all

```
IP address       Client-ID/              Lease expiration              Type
                  Hardware address
 4.4.4.5          3c:9a:b2:9a:ba:00      Mon 2012.02.06 05:43:09       Dynamic
Switch# show dhcp server interfaces
List of DHCP server enabled interface(s):
DHCP server service status: enabled
Interface Name
============================================================
eth-0-9
```

6 Configuring DNS

6.1 Overview

The DNS protocol controls the Domain Name System (DNS), a distributed database with which you can map hostnames to IP addresses. When you configure DNS on your switch, you can substitute the hostname for the IP address with all IP commands, such as ping, telnet, connect, and related Telnet support operations.

IP defines a hierarchical naming scheme that allows a device to be identified by its location or domain. Domain names are pieced together with periods (.) as the delimiting characters.

To keep track of domain names, IP has defined the concept of a domain name server, which holds a cache (or database) of names mapped to IP addresses. To map domain names to IP addresses, you must first identify the hostnames, specify the name server that is present on your network, and enable the DNS.

6.2 Topology

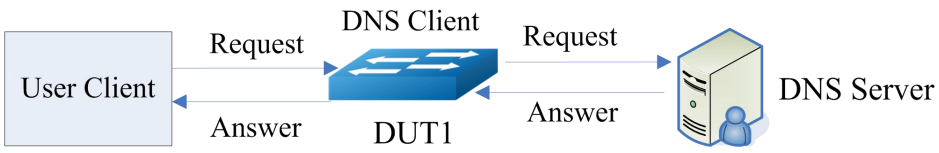

Figure 6-1 DNS Topology

6.3 Configurations

Switch# configure terminal	Enter the Configure mode

Switch(config)#dns domain server1	Define a default domain name that the software uses to complete unqualified hostnames (names without a dotted-decimal domain name)
Switch(config)# dns server 202.100.10.20	To add a name server to the list of Domain Name System (DNS) name servers to be used for a DNS view to resolve internally generated DNS queries
Switch(config)# ip host www.example1.com 192.0.2.141	To define static hostname-to-address mappings in the Domain Name System (DNS) hostname cache for a DNS view

6.4 Validation

Switch# show dns server

```
Current DNS name server configuration:
     Server                  IP Address
------------------------------------------------------------------
1    nameserver              202.100.10.20
```