

Dynamic IP Address Allocation

DHCP (Dynamic Host Configuration Protocol)

What is DHCP?

- ▶ Clients should require **no manual configuration** by the user to **connect** to the network.
 - Each client should be able to **discover** appropriate **configuration** information dynamically.
 - IP address, DNS servers, WINS servers, etc.
- ▶ This is normally accomplished through the use of a Dynamic Host Configuration Protocol
 - Uses UDP
 - Ports 67 and 68

DHCP

▶ DHCP

- Requires little or no administrative overhead, after initial configurations of the DHCP server.
- Dynamically maps IP addresses to MAC addresses.
- Addresses can be leased for a predefined amount of time before the lease expires and must be renewed by the client.
- Allows 30 configuration parameters.

Normal DHCP Operation



Client IP: 192.168.1.10/24
Gateway: 192.168.1.1
DNS: 192.168.1.6

DHCPDISCOVER

Broadcast for a DHCP Server

DHCPOFFER

MAC **unicast** with configuration information

DHCPREQUEST

Broadcast requesting configuration information sent in DHCPOFFER

DHCPACK

Acknowledge configuration information and begins **lease**



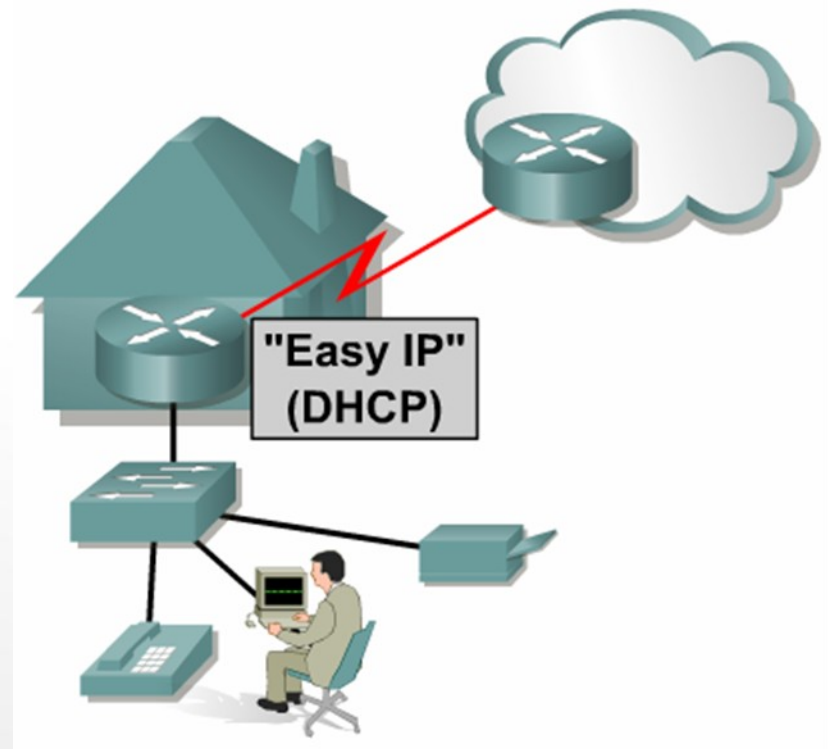
Pool: 192.168.1.0/24
Gateway: 192.168.1.1
DNS Server: 192.168.1.6

DHCP – a client-server protocol

- ▶ DHCP operates in a Client/Server environment and uses the following messages
 - ▶ **DHCPDISCOVER** : Client request for server
 - ▶ **DHCPOFFER**: DHCP server replies to client with configuration information
 - ▶ **DHCPREQUEST**: Client requests the use of configuration information from one of the DHCP servers that sent an offer
 - ▶ **DHCPNAK**
 - DHCP server declines Client request to use configuration information
 - **DHCPACK**:
 - from DHCP server acknowledges that Client can now begin to use configuration information
 - ▶ **DHCPRELEASE**
 - Client requests a release of its DHCP configuration

Cisco IOS DHCP Feature: “Easy IP”

- ▶ A Cisco router can be configured as a DHCP server.
 - Cisco calls this IOS feature “Easy IP”
 - This feature is helpful for small, remote LANs such as home offices with only one router and a few clients.
 - In a large, campus network, you would not want to use a router as a DHCP server.



Steps to Configure Easy IP

1. Configure a named DHCP pool
2. Configure network/subnet mask pool
3. Configure the default gateway
4. Configure addresses to exclude from the DHCP address pool
5. Configure other needed information
 - Such as DNS server, Domain Name, NetBIOS Server

DHCP Pool

```
Router(config)#ip dhcp pool name
```

- ▶ Like NAT, a DHCP **pool** must be **named** before you can enter DHCP configuration mode.
 - The argument *name* identifies the DHCP pool in the running configuration and distinguishes this pool from other pools.
 - More than one DHCP pool can be defined on a router.

The Pool of Addresses

```
Router (dhcp-config) #network net_address  
subnet_mask
```

- ▶ The *net_address* defines a network or subnet that will be used as a pool of addresses to assign IP address to clients.
 - You must also define the subnet mask.

The Default Gateway

```
Router (dhcp-config) #default-router  
ip_address
```

- ▶ The *ip_address* is the address of the default gateway clients will use to send packets destined for remote networks.
 - In a simple Easy IP configuration, this is the IP address of the interface that is directly connected to the LAN with clients needing DHCP service.
 - You also need to exclude this IP address in the `ip dhcp excluded-address` command.

Excluded Addresses

```
Router(config)#ip dhcp excluded-address  
address_1 [address_n]
```

- ▶ The address(es) configured with this command will not be assigned by Easy IP to clients.
 - The argument *address_1* is a single IP address that will be excluded.
 - If configured, the *address_n* optional argument defines a range of excluded IP addresses between and including *argument_1* to *argument_n*.

Other DHCP Optional Configurations

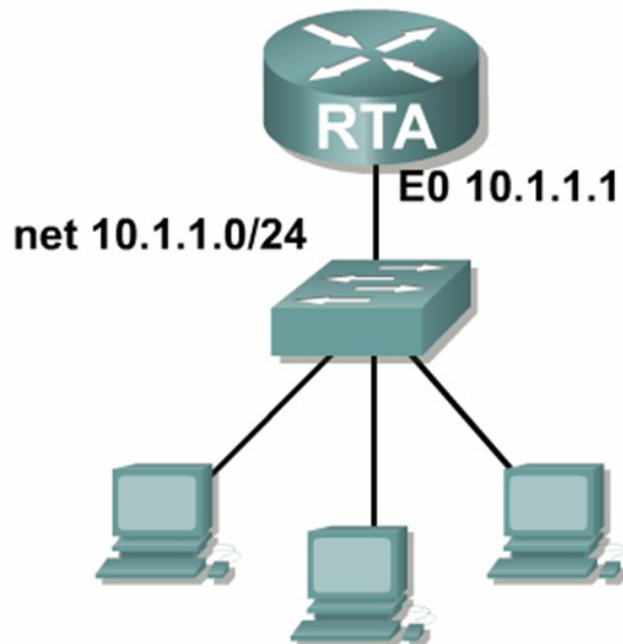
```
Router (dhcp-config) #dns-server  
    ip_address
```

```
Router (dhcp-config) #netbios-name-server  
    ip_address
```

```
Router (dhcp-config) #domain-name name
```

DCHP Configuration Example

```
RTA(config)#ip dhcp excluded-address 10.1.1.1  
RTA(config)#ip dhcp pool RTA_LAN  
RTA(dhcp-config)#network 10.1.1.0 255.255.255.0  
RTA(dhcp-config)#default-router 10.1.1.1
```



Forwarding DHCP Messages

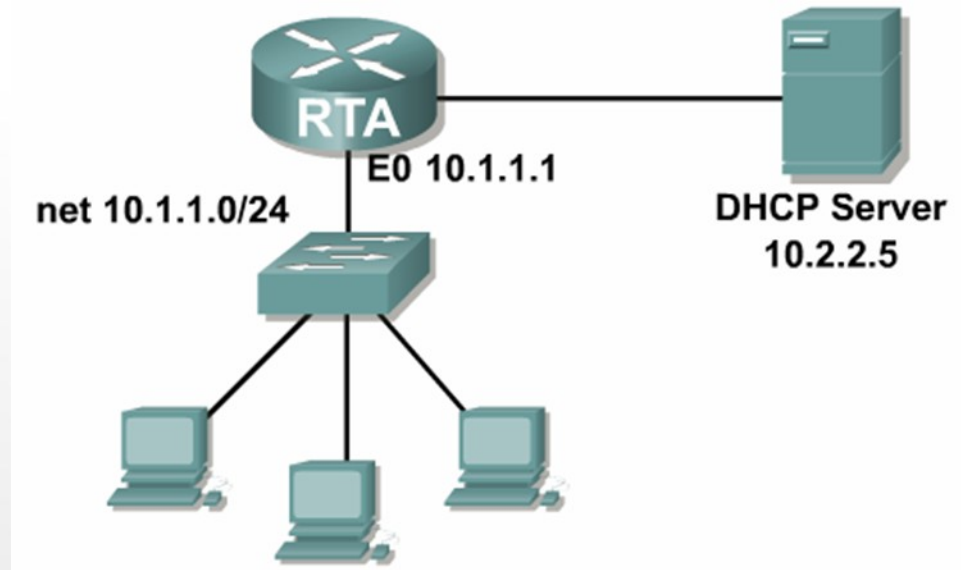
```
Router (config) #ip helper-address  
dhcp_server_ip
```

- ▶ Routers normally block all broadcasts, including a broadcasted DHCP message.
 - If the router is not the DHCP server, you must configure the router to forward the DHCP messages to a *dhcp_server_ip*.

DCHP Configuration Example

```
RTA(config)#ip helper-address 10.2.2.5
```

- ▶ The ip helper-address command configures the router to forward eight UDP services:
 - Time
 - TACACS
 - DNS
 - BOOTP/DHCP Server
 - BOOTP/DHCP Client
 - TFTP
 - NetBIOS Name Service
 - NetBIOS datagram Service



Verify DHCP Configuration

- ▶ Use the following commands to verify and troubleshoot your DHCP configuration:
 - **show running-config**
 - view the DHCP configuration
 - **show ip dhcp binding**
 - displays IP to MAC address bindings and lease expiration date and time
 - **show ip dhcp server statistics**
 - displays a count of the number and type of DHCP messages sent and received
 - **debug ip dhcp server events**
 - watch interactions between the DHCP server and clients