

DHCP



# Questions...

- What does DHCP stand for?
- Why do we need DHCP on a network?
- What devices can distribute DHCP addresses?
- What parameters can we distribute using DHCP on a router?

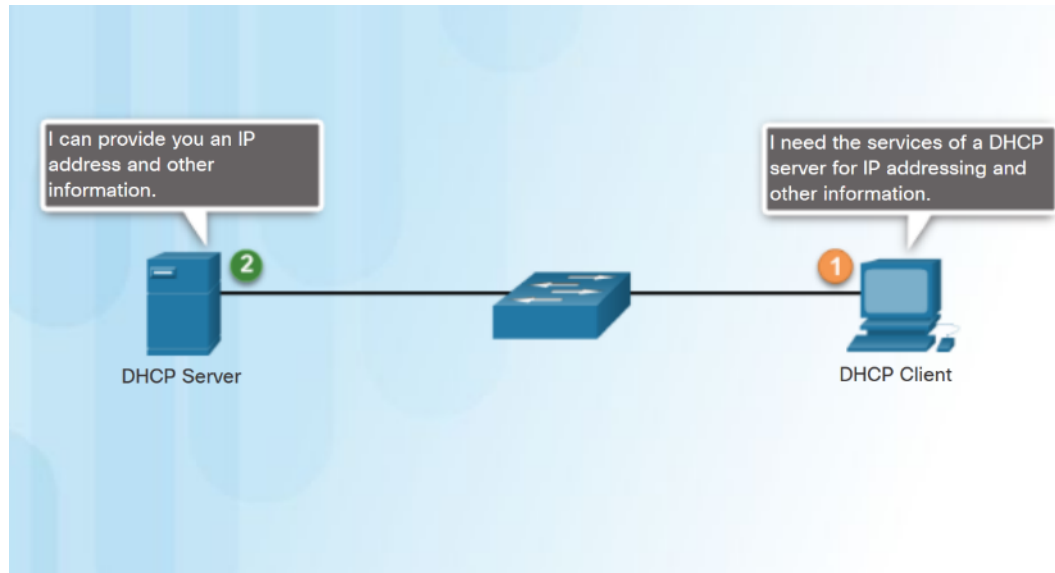
# Objectives

- DHCPv4
  - Implement DHCPv4 to operate across multiple LANs in a small to medium-sized business network.
  - Explain how DHCPv4 operates in a small- to medium-sized business network.
  - Configure a router as a DHCPv4 server.
  - Configure a router as a DHCPv4 client.
  - Troubleshoot a DHCP configuration for IPv4 in a switched network.

# DHCPv4

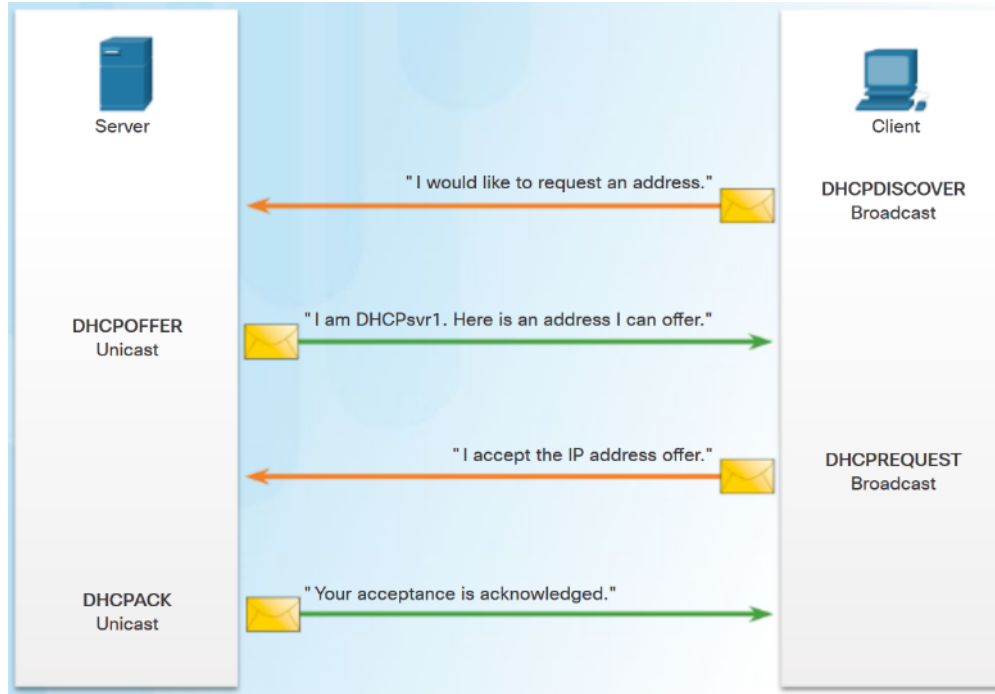
# Introducing DHCPv4

- DHCPv4 assigns IPv4 addresses and other network configuration information dynamically.
  - A dedicated DHCPv4 server is scalable and relatively easy to manage.
  - A Cisco router can be configured to provide DHCPv4 services in a small network.



# DHCPv4 Operation

## DHCPv4 Operation



- Four step process for a client to obtain a lease:

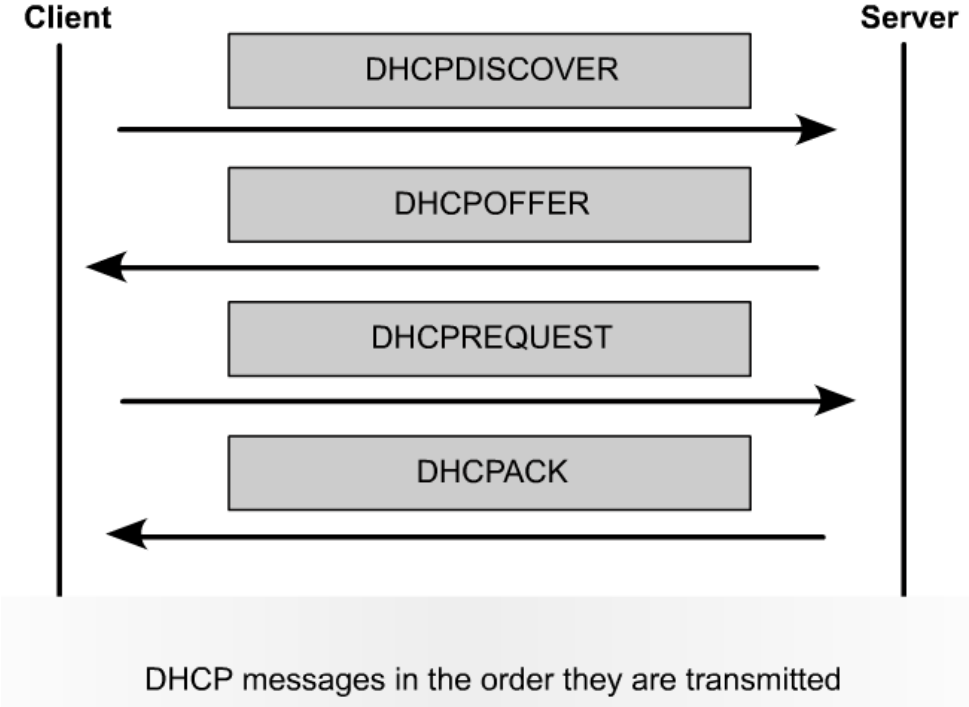
1. **DHCP Discover (DHCPDISCOVER)** - client uses Layer 2 and Layer 3 broadcast addresses to find a DHCP server.

2. **DHCP Offer (DHCPOFFER)** - DHCPv4 server sends the binding DHCPOFFER message to the requesting client as a unicast.

3. **DHCP Request (DHCPREQUEST)** – the client sends back a broadcast DHCPREQUEST in response to the servers offer.

4. **DHCP Acknowledgment (DHCPACK)** – the server replies with a unicast DHCPACK message.

# DHCP Process - DORA



# DHCPv4 Message Format

## ▪ DHCPv4 messages:

- If sent from the client, use UDP source port 68 and destination port 67.
- If sent from the server, use UDP source port 67 and destination port 68.

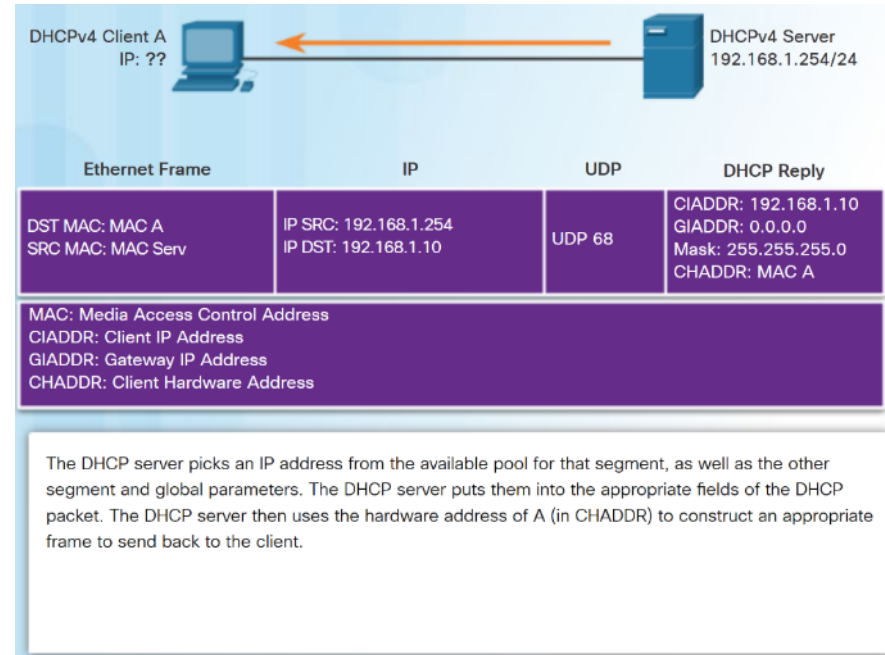
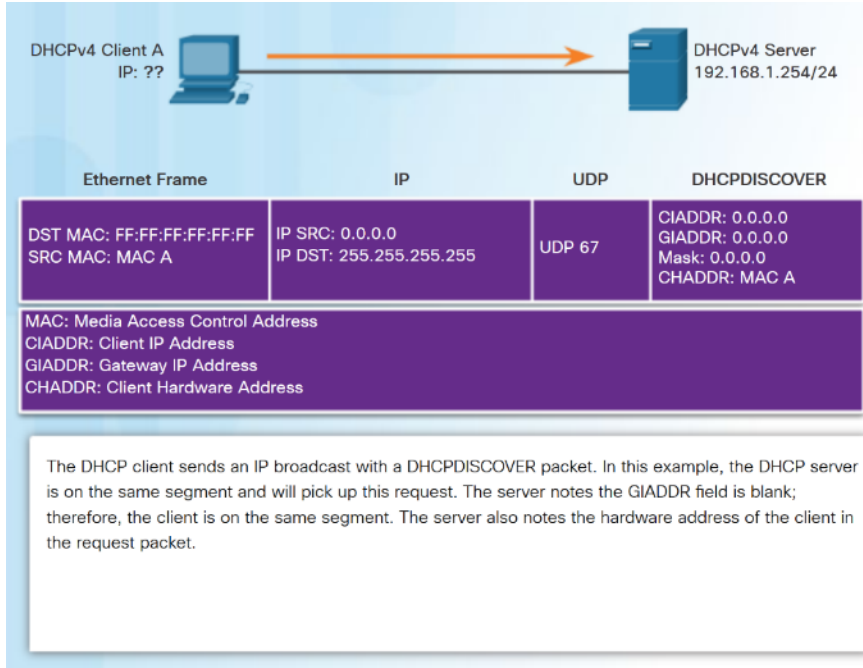
8	16	24	32
OP Code (1)	Hardware Type (1)	Hardware Address Length (1)	Hops (1)
Transaction Identifier			
Seconds - 2 bytes		Flags - 2 bytes	
Client IP Address (CIADDR) - 4 bytes			
Your IP Address (YIADDR) - 4 bytes			
Server IP Address (SIADDR) - 4 bytes			
Gateway IP Address (GIADDR) - 4 bytes			
Client Hardware Address (CHADDR) - 16 bytes			
Server Name (SNAME) - 64 bytes			
Boot Filename - 128 bytes			
DHCP Options - variable			

Format and fields of a DHCPv4 Message



# DHCPv4 Operation

## DHCPv4 Discover and Offer Messages



# Configuring a Basic DHCPv4 Server

- Configuring a Cisco router as a DHCPv4 server:
  - Excluding IPv4 Addresses – **ip dhcp excluded-address** can exclude a single address or a range of addresses from being assigned.
  - Configuring a DHCPv4 Pool - **ip dhcp pool *pool-name*** command creates a pool with the specified name and puts the router in DHCPv4 configuration mode.
  - Address pool assigned using **network** command.
  - Default gateway assigned using **default-router** command.
  - Other commands are optional.

```
R1 (config) # ip dhcp excluded-address 192.168.10.1 192.168.10.9
R1 (config) # ip dhcp excluded-address 192.168.10.254
R1 (config) # ip dhcp pool LAN-POOL-1
R1 (dhcp-config) # network 192.168.10.0 255.255.255.0
R1 (dhcp-config) # default-router 192.168.10.1
R1 (dhcp-config) # dns-server 192.168.11.5
R1 (dhcp-config) # domain-name example.com
R1 (dhcp-config) # end
R1 #
```

## Lab 1 - Configuring Basic DHCPv4 on a Router

### Lab 1- Configuring Basic DHCPv4 on a Router

#### Topology



#### Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0	192.168.0.1	255.255.255.0	N/A
PC0	NIC	DHCP	DHCP	DHCP

#### Objectives

# Configuring a Basic DHCPv4 Server

## Verifying DHCPv4

```
R1# show running-config | section dhcp
ip dhcp excluded-address 192.168.10.1 192.168.10.9
ip dhcp excluded-address 192.168.10.254
ip dhcp excluded-address 192.168.11.1 192.168.11.9
ip dhcp excluded-address 192.168.11.254
ip dhcp pool LAN-POOL-1
 network 192.168.10.0 255.255.255.0
 default-router 192.168.10.1
 dns-server 192.168.11.5
 domain-name example.com
ip dhcp pool LAN-POOL-2
 network 192.168.11.0 255.255.255.0
 default-router 192.168.11.1
 dns-server 192.168.11.5
 domain-name example.com
R1#
```

```
R1# show ip dhcp binding
Bindings from all pools not associated with VRF:
IP address      Client-ID/      Lease expiration    Type
Hardware address/
User name
192.168.10.10   0100.e018.5bdd.35  May 28 2013 01:06 PM Automatic
192.168.11.10   0100.b0d0.d817.e6  May 28 2013 01:10 PM Automatic

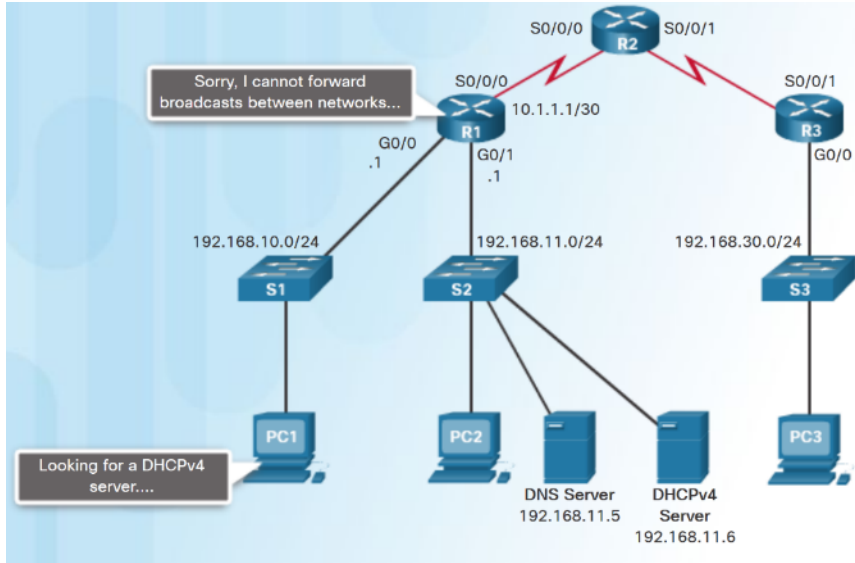
R1# show ip dhcp server statistics
Memory usage      25307
Address pools     2
Database agents   0
Automatic bindings 2
Manual bindings   0
Expired bindings  0
Malformed messages 0
Secure arp entries 0

Message           Received
BOOTREQUEST       0
DHCPDISCOVER      8
DHCPREQUEST       3
DHCPDECLINE       0
DHCPRELEASE       0
DHCPIFORM         0
```

- Verify DHCPv4 configuration using the **show running-config | section dhcp** command. (note this | is not available in PT 6.2)
- Verify the operation of DHCPv4 using the **show ip dhcp binding** command.

# Configuring a Basic DHCPv4 Server


## DHCPv4 Relay



```
R1(config)# interface g0/0
R1(config-if)# ip helper-address 192.168.11.6
R1(config-if)# end
R1# show ip interface g0/0
GigabitEthernet0/0 is up, line protocol is up
Internet address is 192.168.10.1/24
Broadcast address is 255.255.255.255
Address determined by setup command
MTU is 1500 bytes
Helper address is 192.168.11.6
<output omitted>
```

- DHCPDISCOVER messages are sent as broadcast messages.
- Routers do not forward broadcasts.
- A Cisco IOS helper address is configured so that the router acts as a relay agent forwarding the message to the DHCPv4 server.

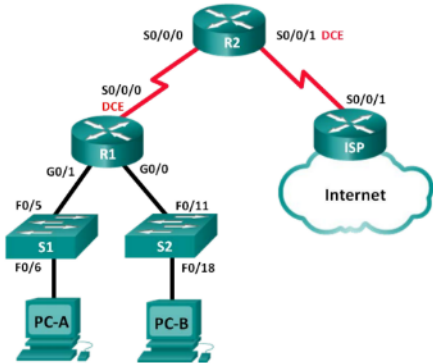
## Lab 2 - Configuring Basic DHCPv4 on a Router

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### Lab - Configuring Basic DHCPv4 on a Router

**Topology**

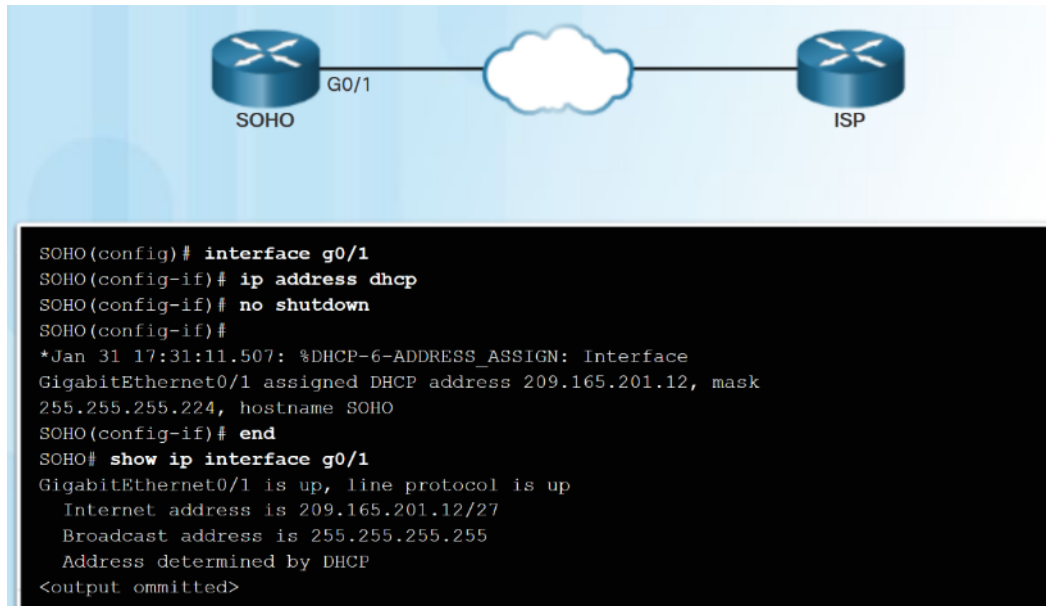


**Addressing Table**

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0	192.168.0.1	255.255.255.0	N/A
	G0/1	192.168.1.1	255.255.255.0	N/A
	S0/0/0 (DCE)	192.168.2.253	255.255.255.252	N/A
R2	S0/0/0	192.168.2.254	255.255.255.252	N/A
	S0/0/1 (DCE)	209.165.200.226	255.255.255.224	N/A
ISP	S0/0/1	209.165.200.225	255.255.255.224	N/A
PC-A	NIC	DHCP	DHCP	DHCP
PC-B	NIC	DHCP	DHCP	DHCP

# Configuring a Router as DHCPv4 Client

- Small office/home office (SOHO) and branch sites often have to be configured as DHCPv4 clients.
- Use the **ip address dhcp interface** configuration mode command.



# Configuring a Wireless Router as a DHCPv4 Client

The screenshot shows the configuration interface for a Cisco Wireless-N Broadband Router (WRT300N) with firmware version v0.93.3. The main menu includes Setup, Wireless Security, Access Restrictions, Applications & Gaming, Administration, and Status. The 'Setup' menu is expanded to show 'Internet Setup', 'Basic Setup', 'DDNS', 'MAC Address Clone', and 'Advanced Routing'. The 'Internet Setup' section is active, showing 'Internet Connection type' set to 'Automatic Configuration - DHCP'. Below this, there are fields for 'Host Name', 'Domain Name', and 'MTU' (set to 1500). A 'Help...' link is visible on the right side of the page.

- Wireless routers are set to receive IPv4 addressing information automatically from the ISP.



# Troubleshooting Tasks

Troubleshooting Task 1:	Resolve address conflicts.
Troubleshooting Task 2:	Verify physical connectivity.
Troubleshooting Task 3:	Test with a static IPv4 address.
Troubleshooting Task 4:	Verify switch port configuration.
Troubleshooting Task 5:	Test from the same subnet or VLAN.

```
R1# show ip dhcp conflict
IP address Detection Method Detection time
192.168.10.32 Ping Feb 16 2013 12:28 PM
192.168.10.64 Gratuitous ARP Feb 23 2013 08:12 AM
```

# Verify Router DHCPv4 Configuration

```
R1# show running-config | section interface GigabitEthernet0/0
interface GigabitEthernet0/0
 ip address 192.168.10.1 255.255.255.0
 ip helper-address 192.168.11.6
 duplex auto
 speed auto
R1#

R1# show running-config | include no service dhcp
R1#
```

- Verify DHCPv4 Relay - use **show running-config** command to verify that the ip helper address is configured.
- Verify DHCPv4 configuration - use the **show running-config | include no service dhcp** command to verify dhcp is enabled because there is no match for the **no service dhcp**.

# Summary

# DHCP

- Implement DHCPv4 to operate across multiple LANs in a small to medium-sized business network.

# New Terms and Commands

- Dynamic Host Configuration Protocol (DHCP)
- DHCPv4
- lease
- DHCPDISCOVER message
- DHCPOFFER message
- DHCPREQUEST message
- DHCPACK message
- DHCP Options
- client IPv4 address (CIADDR)
- default gateway address (GIADDR)
- Cisco IOS helper address
- DHCPv4 relay agent



Reference: Modified from Cisco Networking Academy site