

39. DHCP (Dynamic Host Configuration Protocol)

THE PURPOSE OF DHCP

- DHCP is used to allow HOSTS to automatically / dynamically learn various aspects of their NETWORK configuration; without MANUAL / STATIC configuration
 - It is an ESSENTIAL part of modern NETWORKS
 - When you connect a phone / laptop to WiFi, do you ask your NETWORK admin which IP ADDRESS, SUBNET MASK, DEFAULT GATEWAY, etc the phone / laptop should use ?
 - Typically used for CLIENT devices (workstations, phones, etc)
 - DEVICES (such as ROUTERS, SERVERS, etc) are usually MANUALLY configured
 - In small NETWORKS (such as Home NETWORKS), the ROUTER typically acts as the DHCP SERVER for HOSTS in the LAN
 - In LARGE NETWORKS, the DHCP SERVER is usually a Windows / Linux SERVER
-

BASIC FUNCTIONS OF DHCP

Note: ALL the IPs are the same because this is Jeremy's Home ROUTER (it provides all these services)

Command `ipconfig /release`

Wireshark capture of the `ipconfig /release` mechanism

Command `ipconfig /renew`

Renewing Process has FOUR messages:

1) DHCP DISCOVER

- Are there any DHCP Servers in this NETWORK? I need an IP ADDRESS ?

NOTE the use of DHCP Reserved Ports 67 and 68

2) DHCP OFFER:

- How about THIS IP ADDRESS ?
- The DHCP OFFER message can be either BROADCAST or UNICAST
- NOTE OPTIONS at the bottom : Message Type, Server ID, Lease Time, Subnet, etc.

3) DHCP REQUEST

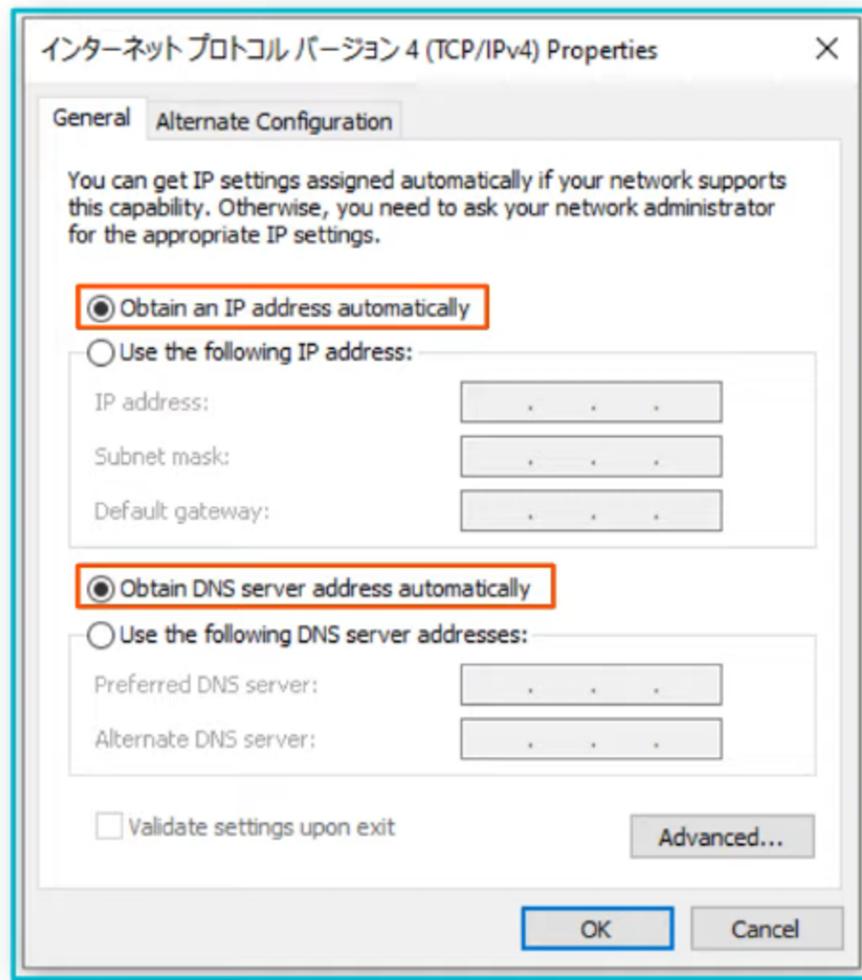
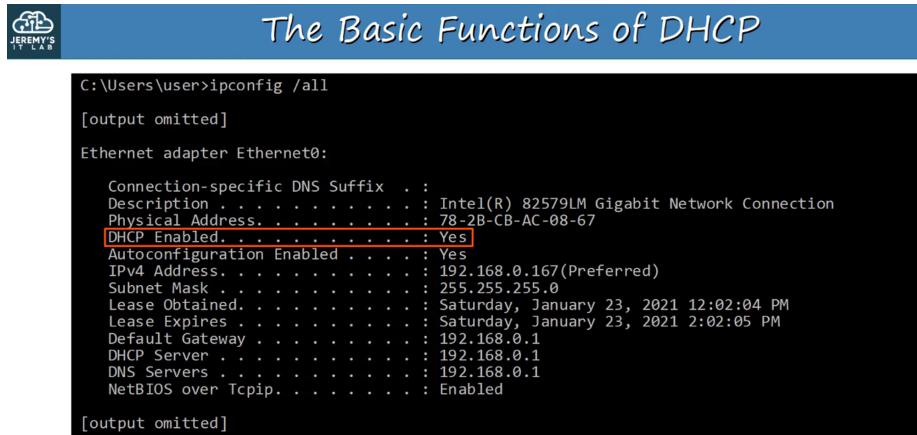


Figure 1: image



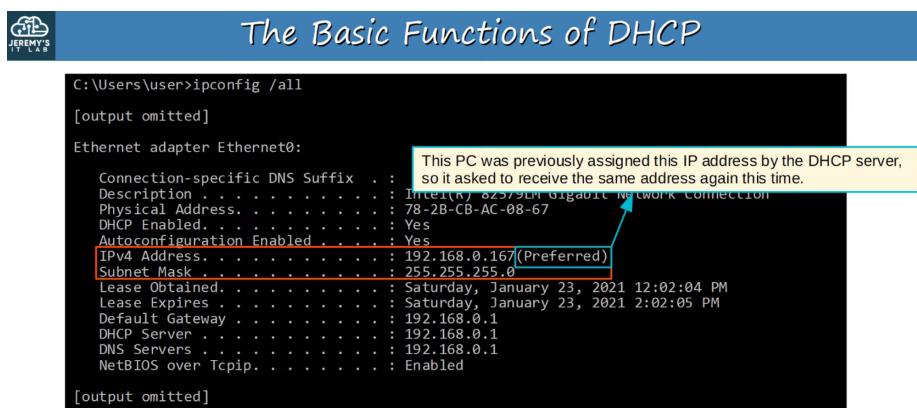
```
C:\Users\user>ipconfig /all
[output omitted]

Ethernet adapter Ethernet0:

  Connection-specific DNS Suffix . :
  Description . . . . . : Intel(R) 82579LM Gigabit Network Connection
  Physical Address. . . . . : 78-2B-CB-AC-08-67
  DHCP Enabled. . . . . : Yes
  Autoconfiguration Enabled . . . . . : Yes
  IPv4 Address. . . . . : 192.168.0.167(Preferred)
  Subnet Mask . . . . . : 255.255.255.0
  Lease Obtained. . . . . : Saturday, January 23, 2021 12:02:04 PM
  Lease Expires . . . . . : Saturday, January 23, 2021 2:02:05 PM
  Default Gateway . . . . . : 192.168.0.1
  DHCP Server . . . . . : 192.168.0.1
  DNS Servers . . . . . : 192.168.0.1
  NetBIOS over Tcpip. . . . . : Enabled

[output omitted]
```

Figure 2: image



```
C:\Users\user>ipconfig /all
[output omitted]

Ethernet adapter Ethernet0:

  Connection-specific DNS Suffix . :
  Description . . . . . : Intel(R) 82579LM Gigabit Network Connection
  Physical Address. . . . . : 78-2B-CB-AC-08-67
  DHCP Enabled. . . . . : Yes
  Autoconfiguration Enabled . . . . . : Yes
  IPv4 Address. . . . . : 192.168.0.167(Preferred)
  Subnet Mask . . . . . : 255.255.255.0
  Lease Obtained. . . . . : Saturday, January 23, 2021 12:02:04 PM
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  DNS Servers . . . . . : 192.168.0.1
  NetBIOS over Tcpip. . . . . : Enabled

[output omitted]
```

Figure 3: image

The Basic Functions of DHCP

```
C:\Users\user>ipconfig /all
[output omitted]

Ethernet adapter Ethernet0:

  Connection-specific DNS Suffix . :
  Description . . . . . : Intel(R) 82579LM Gigabit Network Connection
  Physical Address. . . . . : 78-2B-CB-AC-08-67
  DHCP Enabled. . . . . : Yes
  Autoconfiguration Enabled . . . . . : Yes
  IPv4 Address. . . . . : 192.168.0.167(Preferred)
  Subnet Mask . . . . . : 255.255.255.0
  Lease Obtained. . . . . : Saturday, January 23, 2021 12:02:04 PM
  Lease Expires . . . . . : Saturday, January 23, 2021 2:02:05 PM
  Default Gateway . . . . . : 192.168.0.1
  DHCP Server . . . . . : 192.168.0.1
  DNS Servers . . . . . : 192.168.0.1
  NetBIOS over Tcpip. . . . . : Enabled

[output omitted]
```

DHCP server 'lease' IP address to clients.
 These leases are usually not permanent, and the client must give up
 the address at the end of the lease.



Figure 4: image

The Basic Functions of DHCP

```
C:\Users\user>ipconfig /all
[output omitted]

Ethernet adapter Ethernet0:

  Connection-specific DNS Suffix . :
  Description . . . . . : Intel(R) 82579LM Gigabit Network Connection
  Physical Address. . . . . : 78-2B-CB-AC-08-67
  DHCP Enabled. . . . . : Yes
  Autoconfiguration Enabled . . . . . : Yes
  IPv4 Address. . . . . : 192.168.0.167(Preferred)
  Subnet Mask . . . . . : 255.255.255.0
  Lease Obtained. . . . . : Saturday, January 23, 2021 12:02:04 PM
  Lease Expires . . . . . : Saturday, January 23, 2021 2:02:05 PM
  Default Gateway . . . . . : 192.168.0.1
  DHCP Server . . . . . : 192.168.0.1
  DNS Servers . . . . . : 192.168.0.1
  NetBIOS over Tcpip. . . . . : Enabled

[output omitted]
```

Figure 5: image

```

ipconfig /release
Windows IP Configuration
[output omitted]
Ethernet adapter Ethernet0:
  Connection-specific DNS Suffix . :
  Default Gateway . . . . . :
[output omitted]

```

Figure 6: image

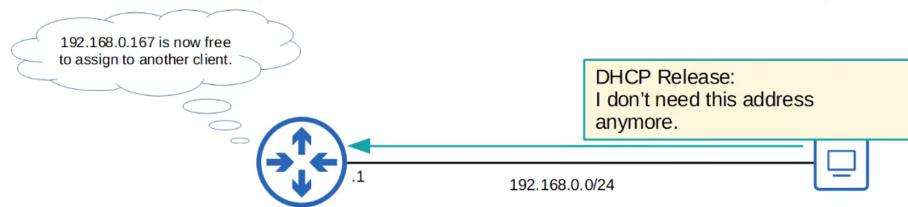


Figure 7: image

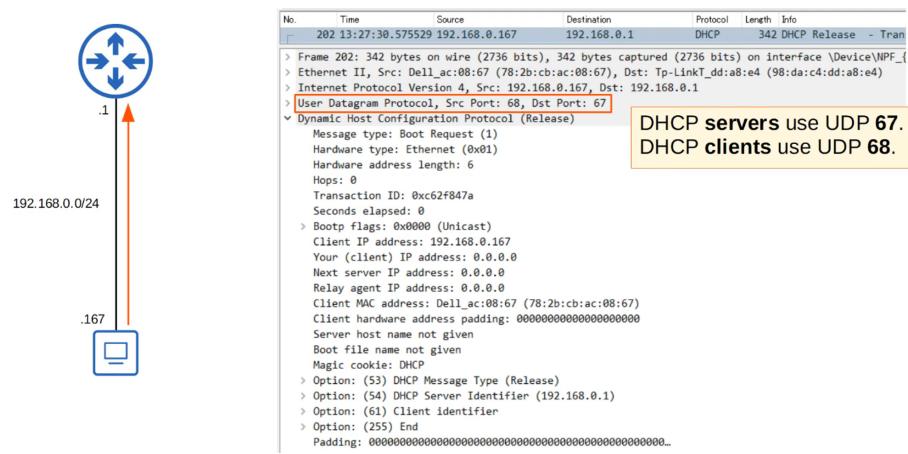


Figure 8: image

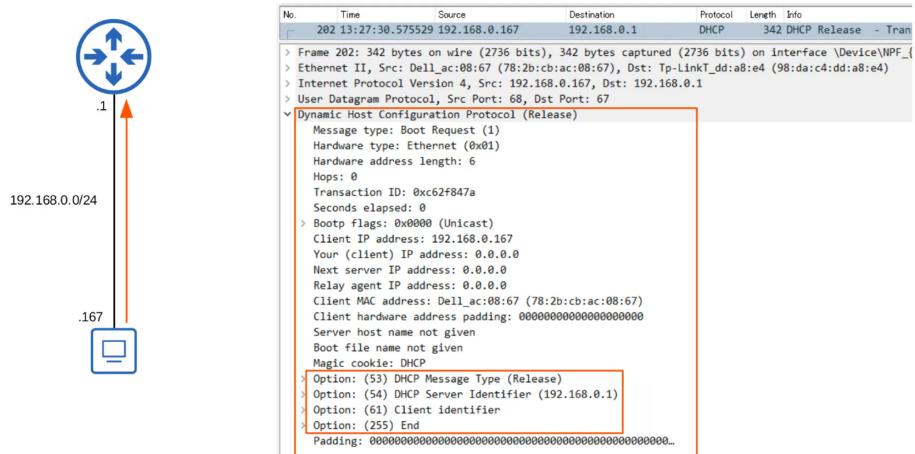


Figure 9: image

The terminal window title is "ipconfig /renew". The output shows the following configuration for the Ethernet adapter:

```
C:\Users\user>ipconfig /renew
C:\Users\user>ipconfig /all

Ethernet adapter Ethernet0:

Connection-specific DNS Suffix . :
Description . . . . . : Intel(R) 82579LM Gigabit Network Connection
Physical Address. . . . . : 78-2B-CB-AC-08-67
DHCP Enabled. . . . . : Yes
Autoconfiguration Enabled . . . . . : Yes
IPv4 Address. . . . . : 192.168.0.167(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained. . . . . : Saturday, January 23, 2021 3:07:39 PM
Lease Expires . . . . . : Saturday, January 23, 2021 5:07:38 PM
Default Gateway . . . . . : 192.168.0.1
DHCP Server . . . . . : 192.168.0.1
DNS Servers . . . . . : 192.168.0.1
NetBIOS over Tcpip. . . . . : Enabled
```

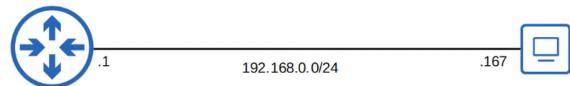


Figure 10: image

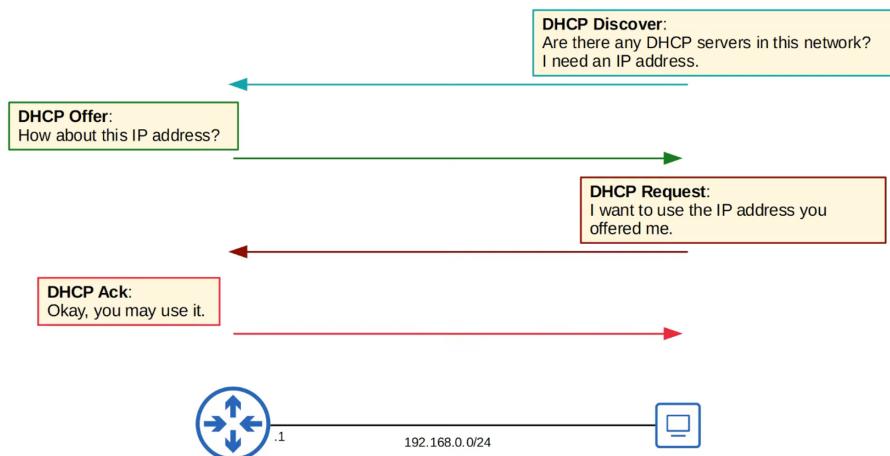


Figure 11: image

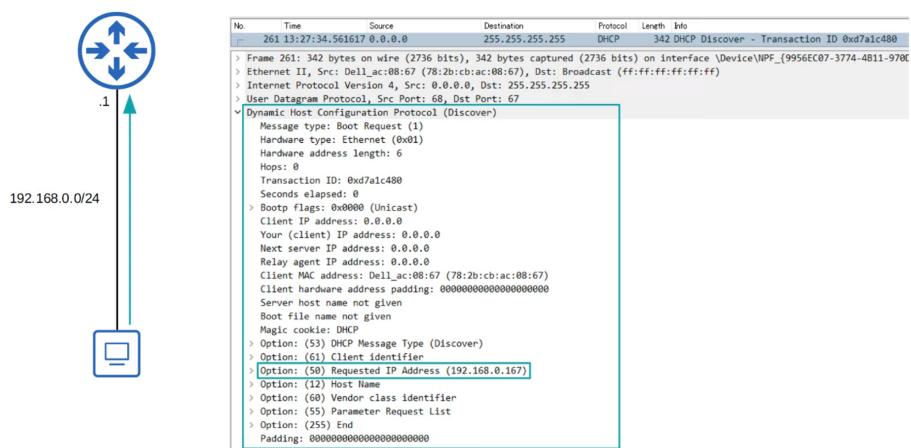


Figure 12: image

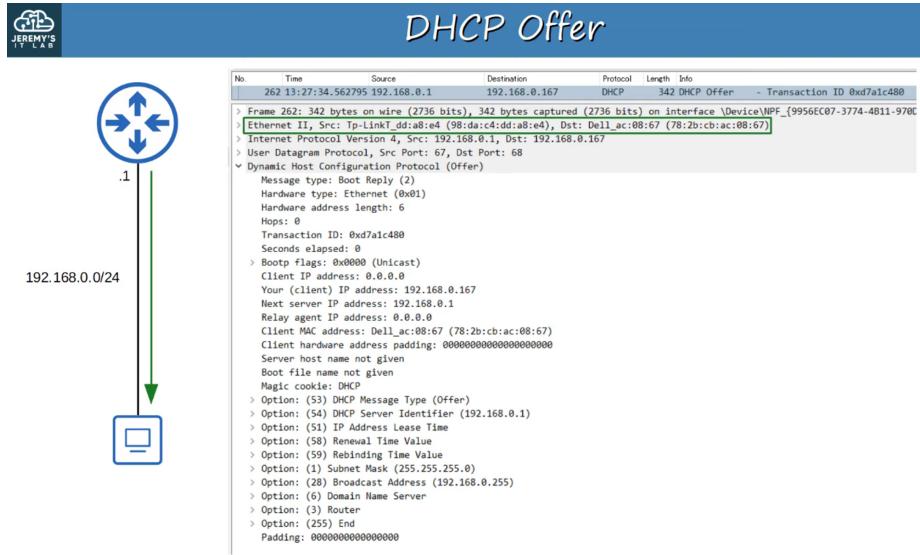


Figure 13: image

- I want to use the IP ADDRESS that was offered
- 4) DHCP ACK
- Okay! You may use THAT ADDRESS

 DHCP
 RE-
 NEW
 PRO-
 CESS
 SUM-
 MARY

DHCP RELAY

- Some NETWORK engineers might choose to configure each ROUTER to act as the DHCP SERVER for its connected LANS
- However, large enterprises often choose to use a CENTRALIZED DHCP SERVER
- If the SERVER is centralized, it won't receive the DHCP CLIENTS' Broadcast DHCP messages
- To FIX this, you can configure a ROUTER to act as a DHCP RELAY AGENT

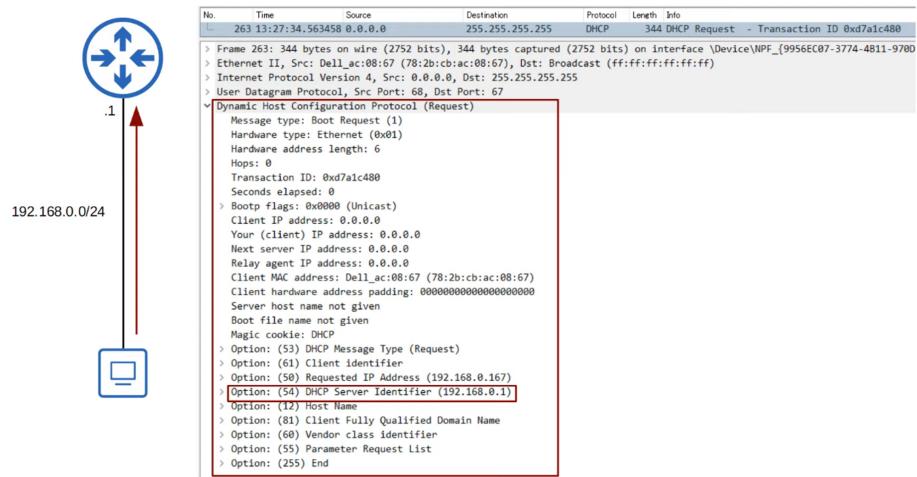


Figure 14: image

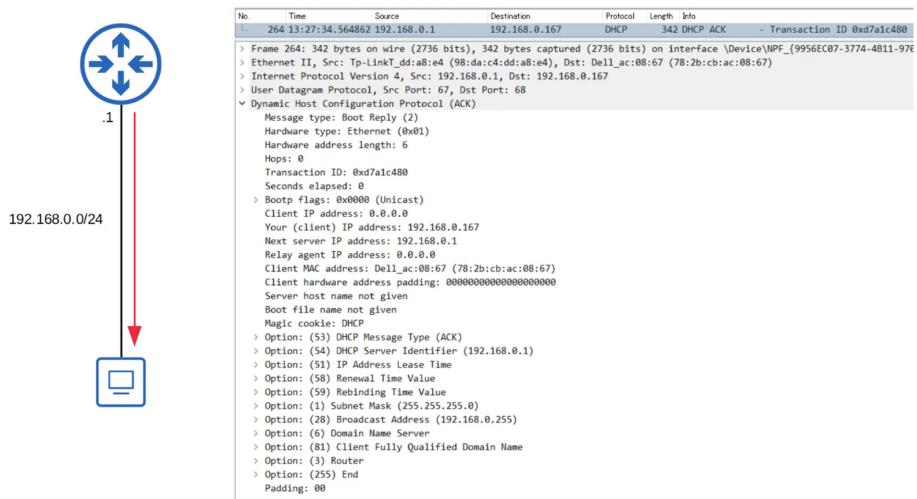


Figure 15: image

- The ROUTER will forward the clients' Broadcast DHCP messages to the remote DHCP SERVER as a Unicast messages

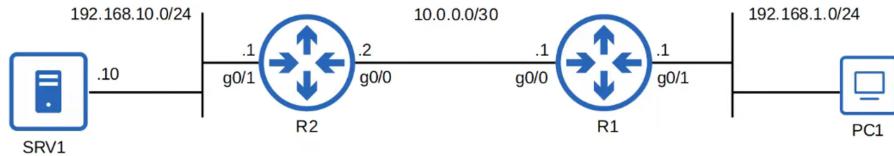


Figure 16: image

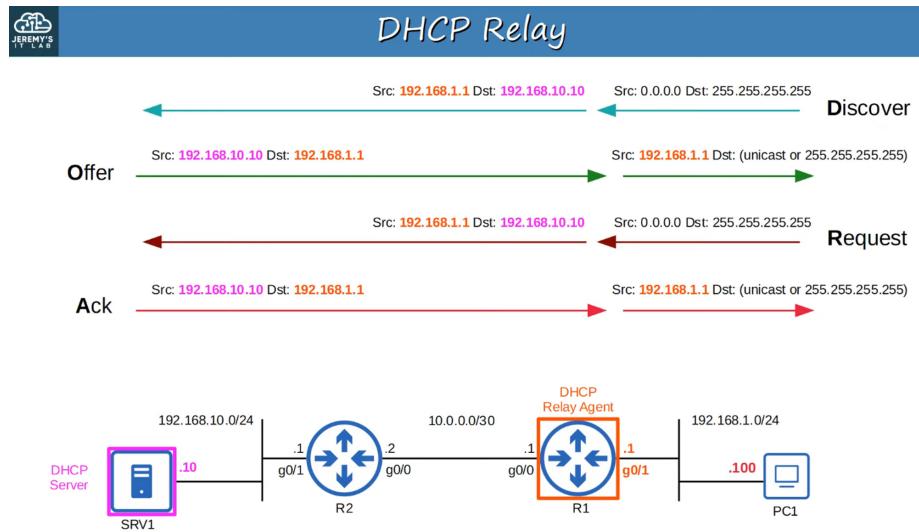


Figure 17: image

CONFIGURING DHCP IN CISCO IOS

Commands for configuring DHCP SERVERS in Cisco IOS

Command `show ip dhcp binding`

DHCP RELAY AGENT CONFIGURATION IN IOS

RELAY AGENT MUST HAVE CONNECTIVITY WITH DHCP SERVER

DHCP CLIENT CONFIGURATION IN IOS

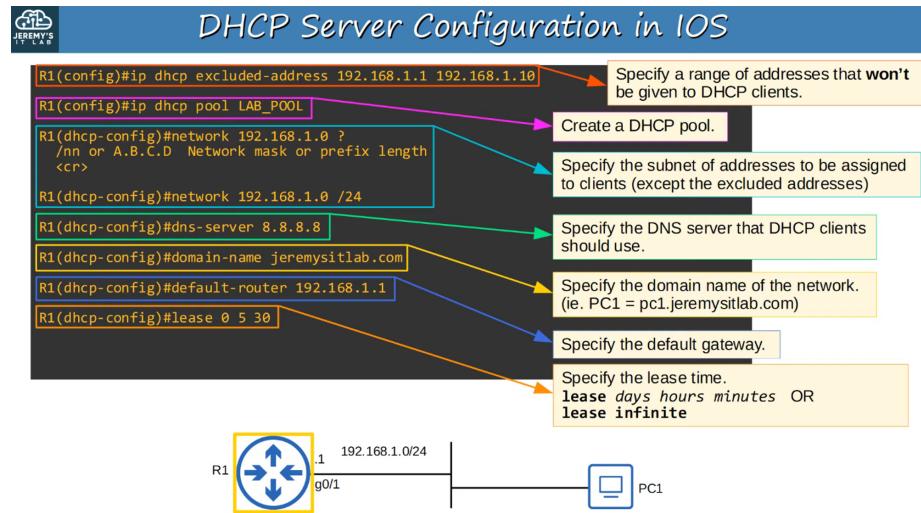


Figure 18: image

R1#show ip dhcp binding				
Bindings from all pools not associated with VRF:				
IP address	Client-ID/ Hardware address/ User name	Lease expiration	Type	
192.168.1.11	0100.0c29.e727.39	Jan 24 2021 10:52 AM	Automatic	

Figure 19: image

```
C:\Users\user>ipconfig /all
Ethernet adapter Ethernet0:

Connection-specific DNS Suffix . : jeremysitlab.com
Description . . . . . : Intel(R) PRO/1000 MT Network Connection #2
Physical Address. . . . . : 00-0C-29-E7-27-39
DHCP Enabled. . . . . : Yes
Autoclient Configuration Enabled. . . . . : Yes
IPv4 Address. . . . . : 192.168.1.11(Preferred)
Subnet Mask . . . . . : 255.255.255.0
Lease Obtained. . . . . : Saturday, January 24, 2021 2:22:35 PM
Lease Expires . . . . . : Saturday, January 24, 2021 7:52:35 PM
Default Gateway . . . . . : 192.168.1.1
DHCP Server . . . . . : 192.168.1.1
DNS Servers . . . . . : 8.8.8.8
NetBIOS over Tcpip. . . . . : Enabled
```

Figure 20: image



DHCP Relay Agent Configuration in IOS

```
R1(config)#interface g0/1
R1(config-if)#ip helper-address 192.168.10.10
R1(config-if)#do show ip interface g0/1
GigabitEthernet0/1 is up, line protocol is up
  Internet address is 192.168.1.1/24
  Broadcast address is 255.255.255.255
  Address determined by non-volatile memory
  MTU is 1500 bytes
  Helper address is 192.168.10.10
[output omitted]
```

Configure the interface connected to the subnet of the client devices.

Configure the IP address of the DHCP server as the 'helper' address.

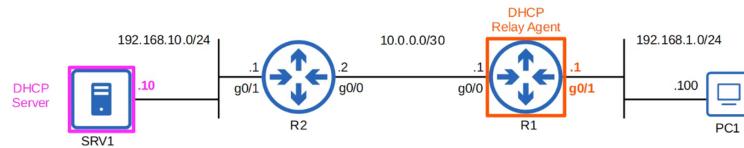


Figure 21: image



DHCP Client Configuration in IOS

```
R2(config)#interface g0/1
R2(config-if)#ip address dhcp
R2(config-if)#do sh ip interface g0/1
GigabitEthernet0/1 is up, line protocol is up
  Internet address is 192.168.10.1/24
  Broadcast address is 255.255.255.255
  Address determined by DHCP
[output omitted]
```

Use the **ip address dhcp** mode to tell the router to use DHCP to learn its IP address.

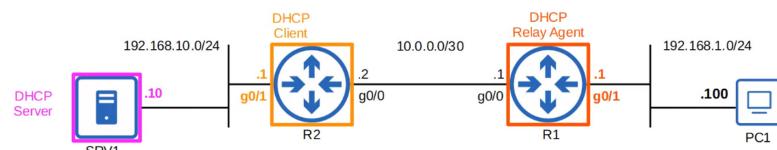


Figure 22: image

COMMANDS SUMMARY

The screenshot shows a slide titled "Command Summary" from "JEREMY'S IT LAB". The slide contains several command examples:

- User-level commands:
 - C:\Users\user> ipconfig /release
 - C:\Users\user> ipconfig /renew
- Router configuration commands (enclosed in a red box):
 - R1(config)# ip dhcp excluded-address *low-address* *high-address*
 - R1(config)# ip dhcp pool *pool-name*
 - R1(dhcp-config)# network *ip-address* {/prefix-length | *subnet-mask*}
 - R1(dhcp-config)# dns-server *ip-address*
 - R1(dhcp-config)# domain-name *domain-name*
 - R1(dhcp-config)# default-router *ip-address*
 - R1(dhcp-config)# lease {*days hours minutes* | infinite}
 - R1# show ip dhcp binding
- Interface configuration commands (enclosed in a blue box):
 - R1(config-if)# ip helper-address *ip-address* [DHCP relay agent]
 - R1(config-if)# ip address *dhcp* [DHCP client]

Figure 23: image