Lab12.1

DHCP

Introduzione

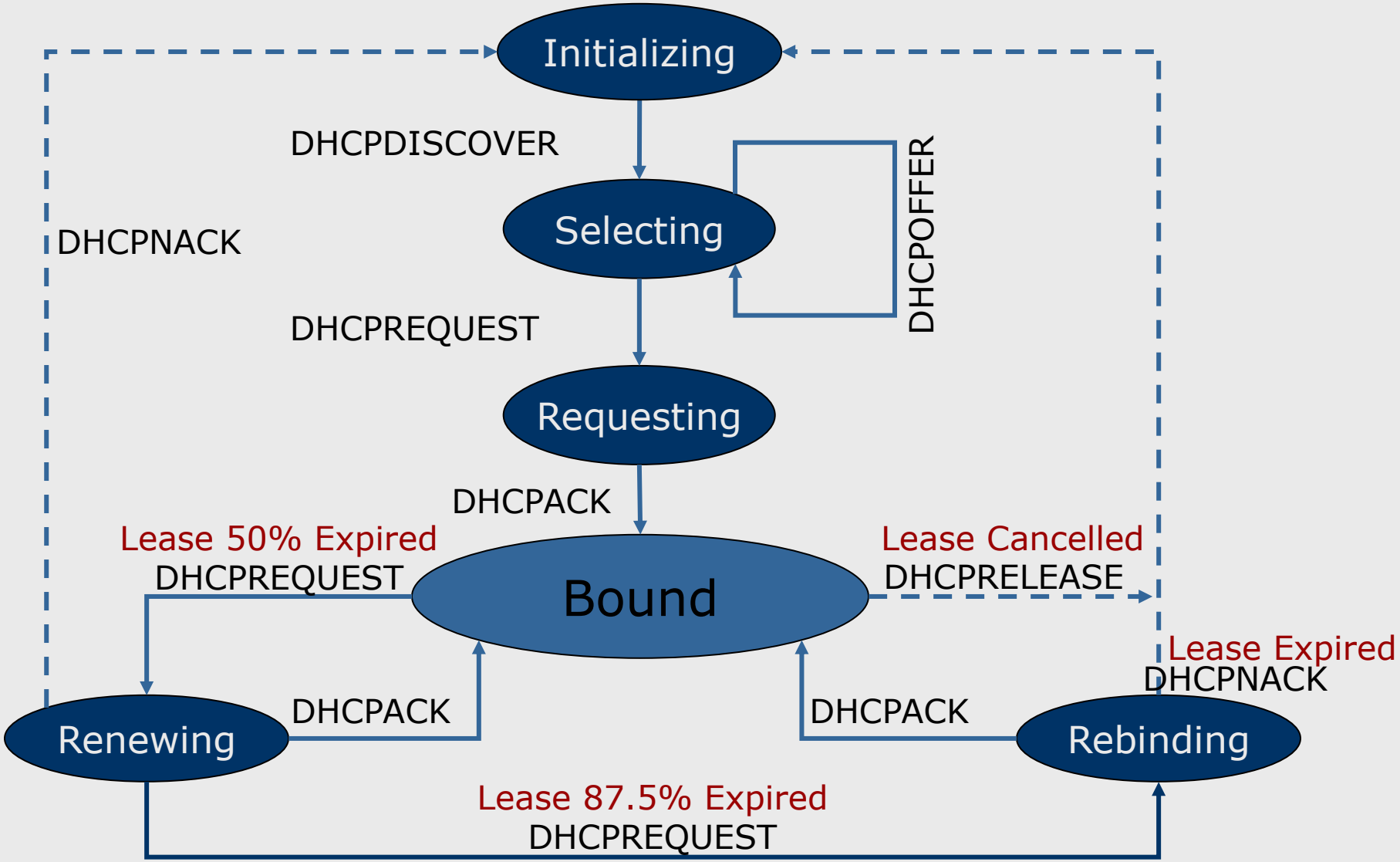
- Problem: “dynamic” assignment of IP addresses
  - Example 1: host diskless
  - Example 2: guest or temporary host (e.g., notebook)
  - Example 3: host connected to an ISP

- Solutions
  - Reverse ARP
  - BOOTP
  - **Dynamic Host Configuration Protocol** (DHCP) – [RFC 2131]

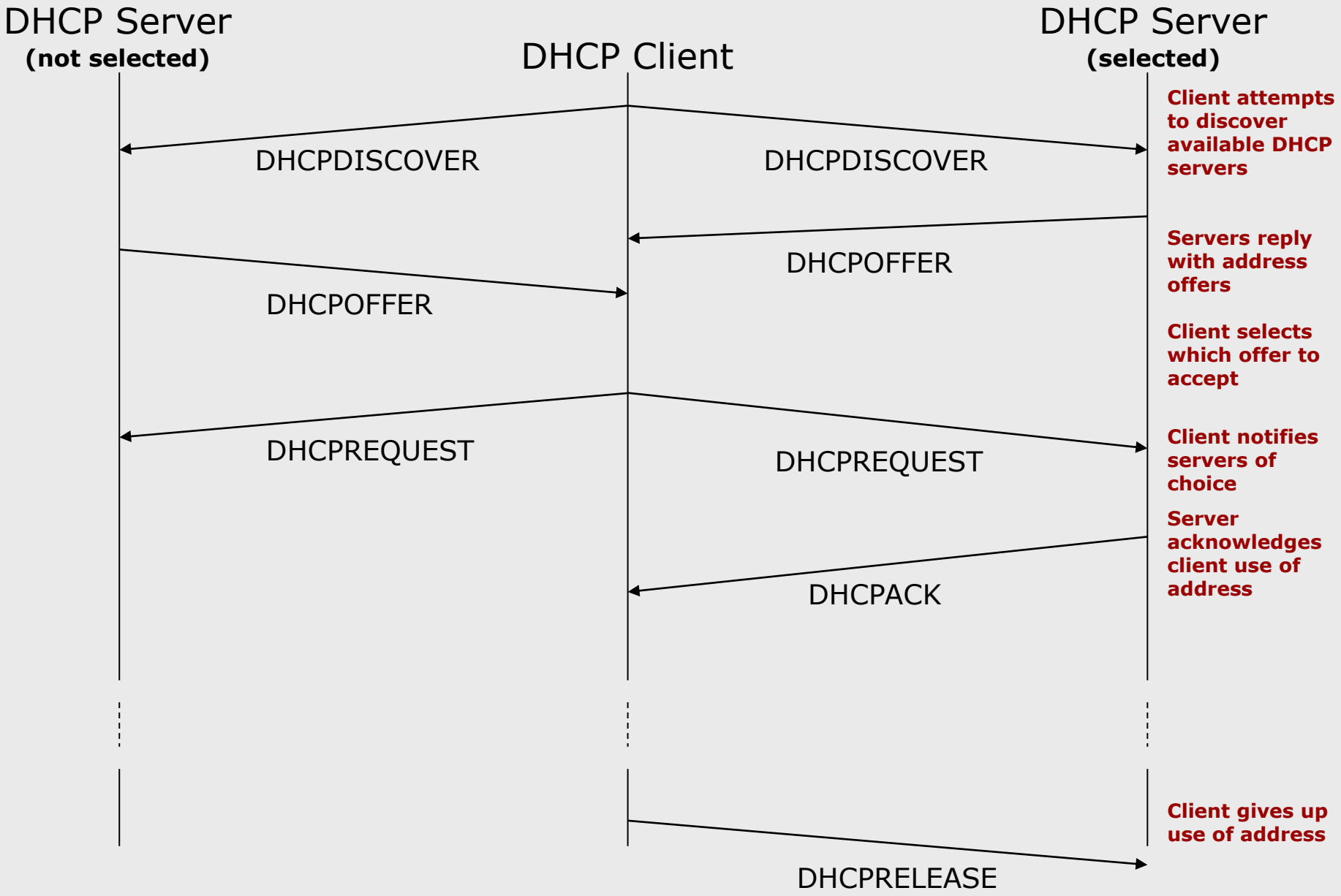
DHCP

- Consists of
  - A protocol for providing configuration parameters to a host from a DHCP server
  - A mechanism for address allocation
- Three allocation modes
  - **manual**
    The administrator assigns the address to the host, the server provides the information to the host
  - **automatic**
    the DHCP server permanently assigns an IP address to a host (auto-configuration)
  - **dynamic**
    the server assigns the IP address to a host for a limited amount of time (***leasing***)
- DHCP message format is compatible with BOOTP
  - Relevant for *relay agent* operation

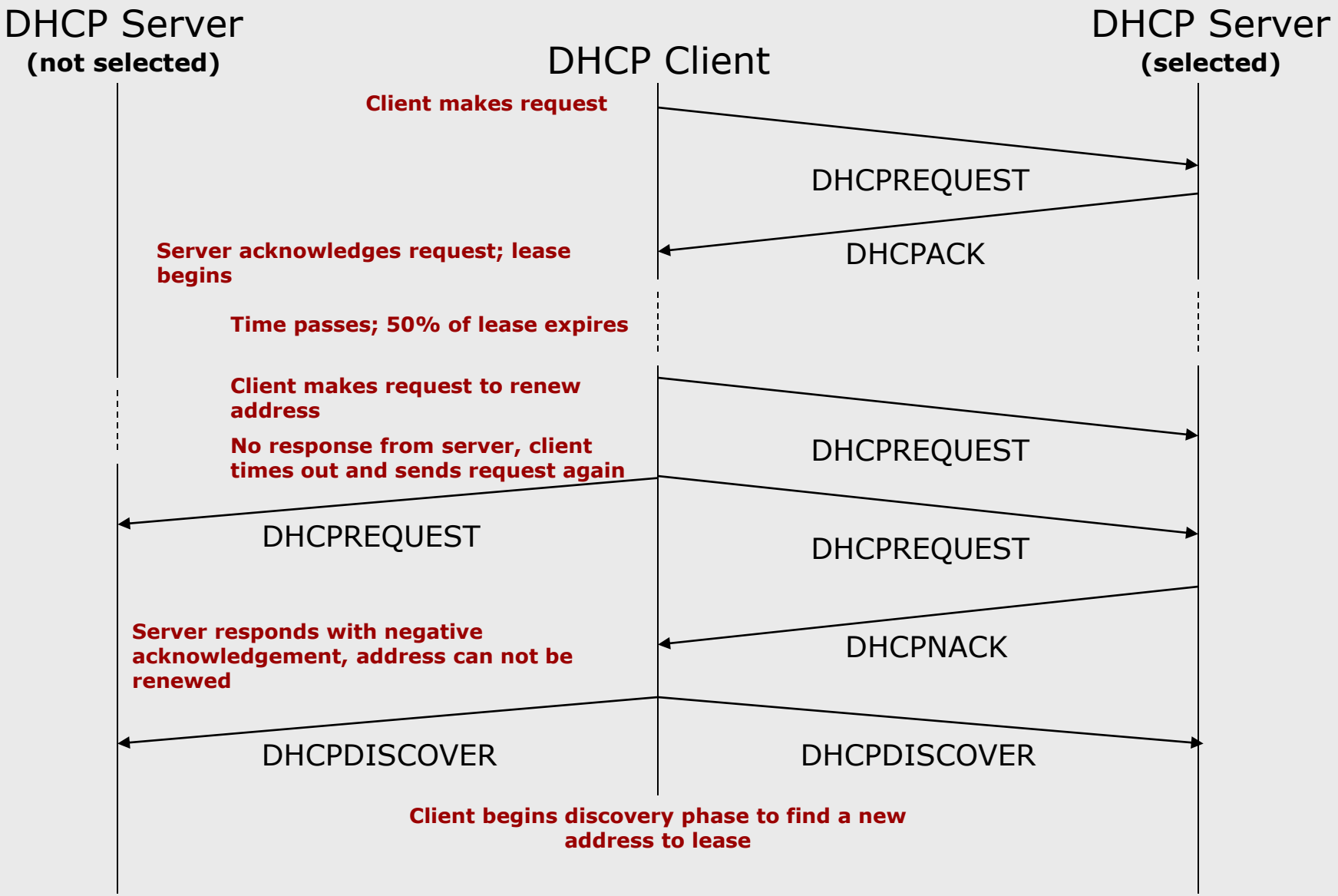
DHCP state diagram



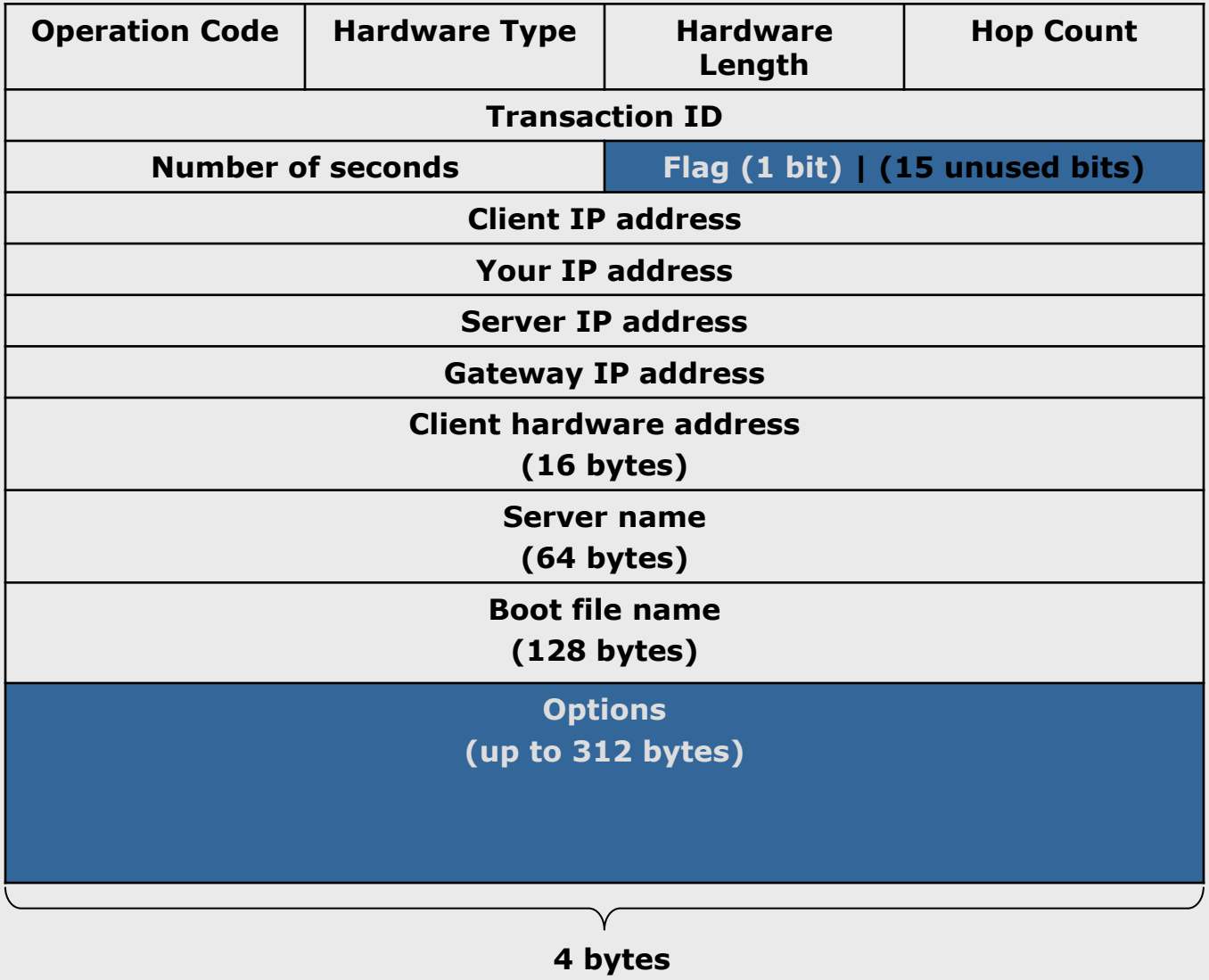
Address allocation



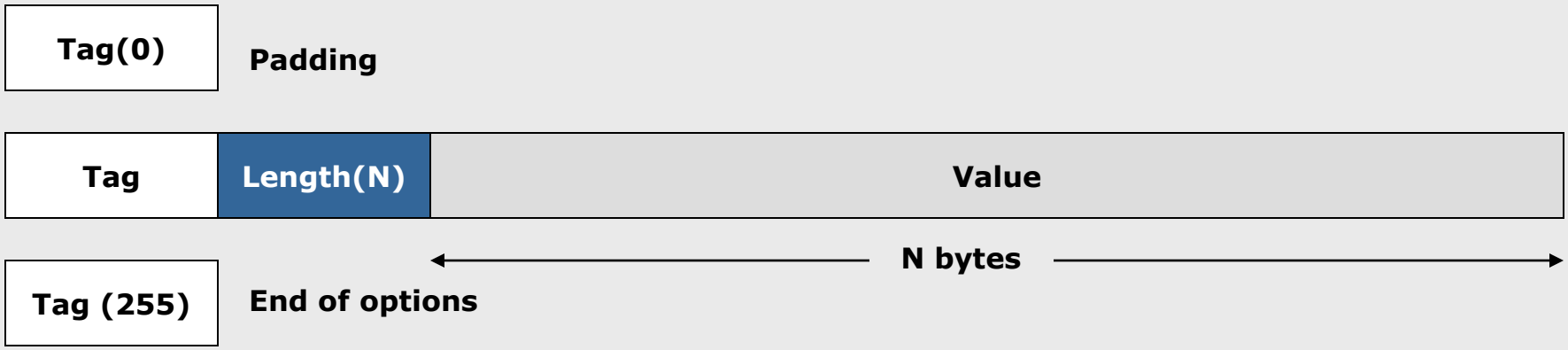
Renewal



DHCP – PDU format



Options



1 Subnet Mask	13 Boot File size
37 TCP Default TTL	72 WWW Server
69 SMTP Server	61 Client Identifier
54 Server Identifier	66 TFTP Server
3 Time server	**53 DHCP Message**
4 DNS name server	55 Parameter Request List

Message type

- Identified by the value of option 53
  - DHCPDISCOVER (1)
  - DHCPOFFER (2)
  - DHCPREQUEST (3)
  - DHCPDECLINE (4)
  - DHCPACK (5)
  - DHCPNACK (6)
  - DHCPRELEASE (7)
  - DHCPINFORM (8)

Configure a DHCP server on a router

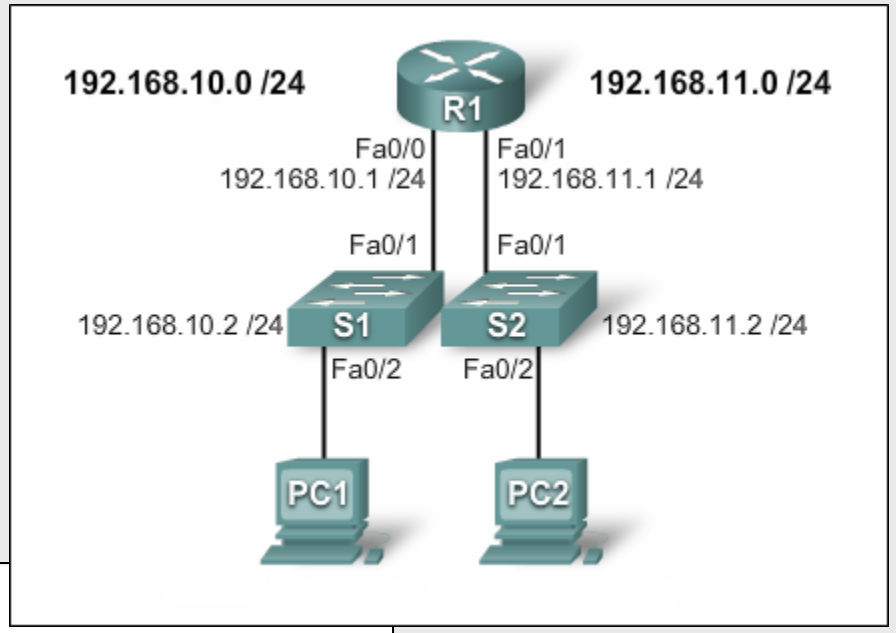
- Define a range of addresses that DHCP has not to allocate
  - static addresses reserved for the router interface, switch management IP address, servers, and local network devices
- Create the DHCP pool
- Configure the specifics of the pool

```
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)# domain-name span.com
R1(dhcp-config)# end
```

Required Tasks	Command
Define the address pool	`network network-number [mask | /prefix-length]`
Define the default router or gateway	`default-router address [address2...address8]`

Optional Tasks	Command
Define a DNS server.	`dns-server address [address2...address8]`
Define the domain name	`domain-name domain`
Define the duration of the DHCP lease	`lease { days [hours] [minutes] | infinite}`
Define the NetBIOS WINS server	`netbios-name-server address [address2...address8]`

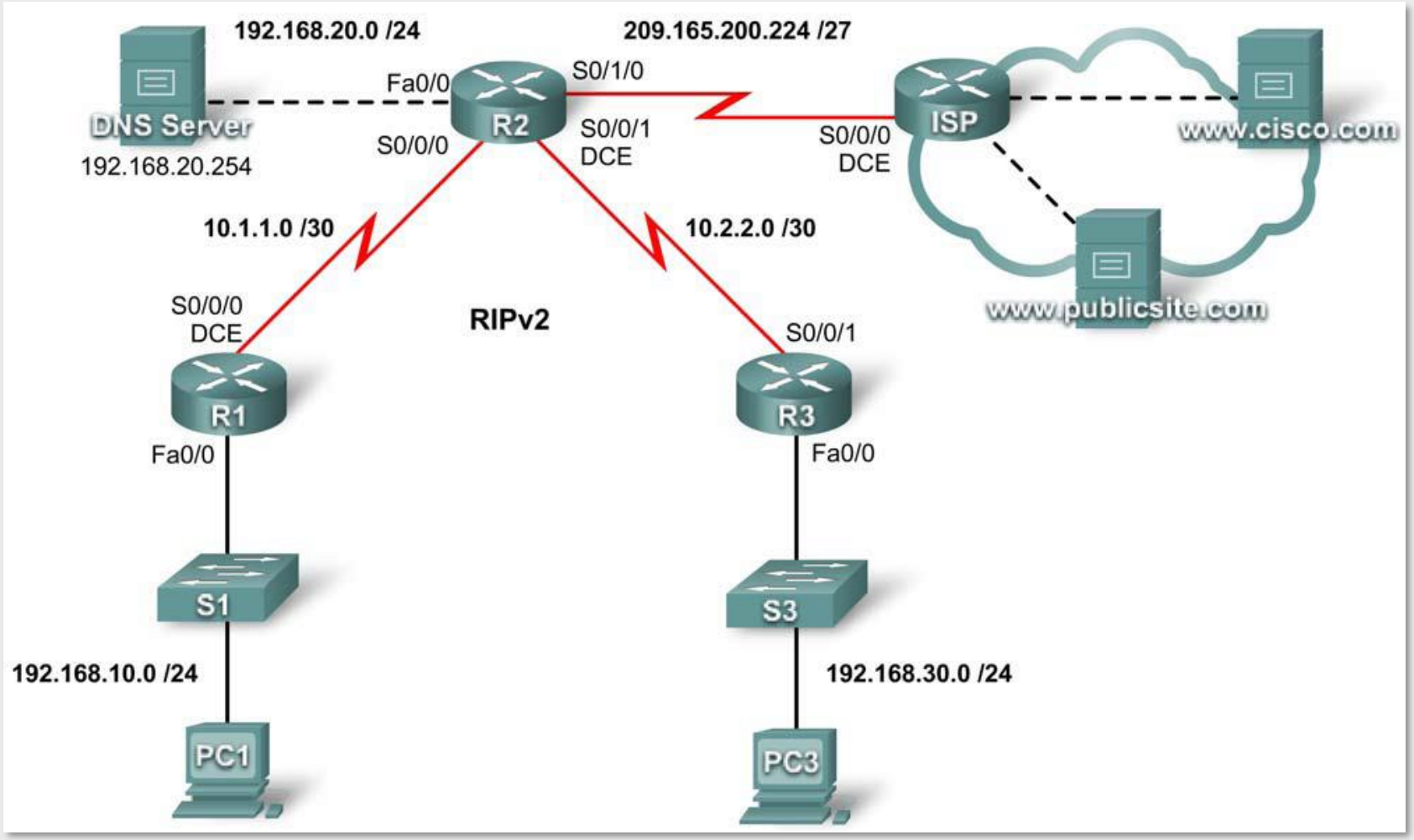
Verify DHCP service status




```
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       Oct 03 2007 05:05 PM    Automatic
```

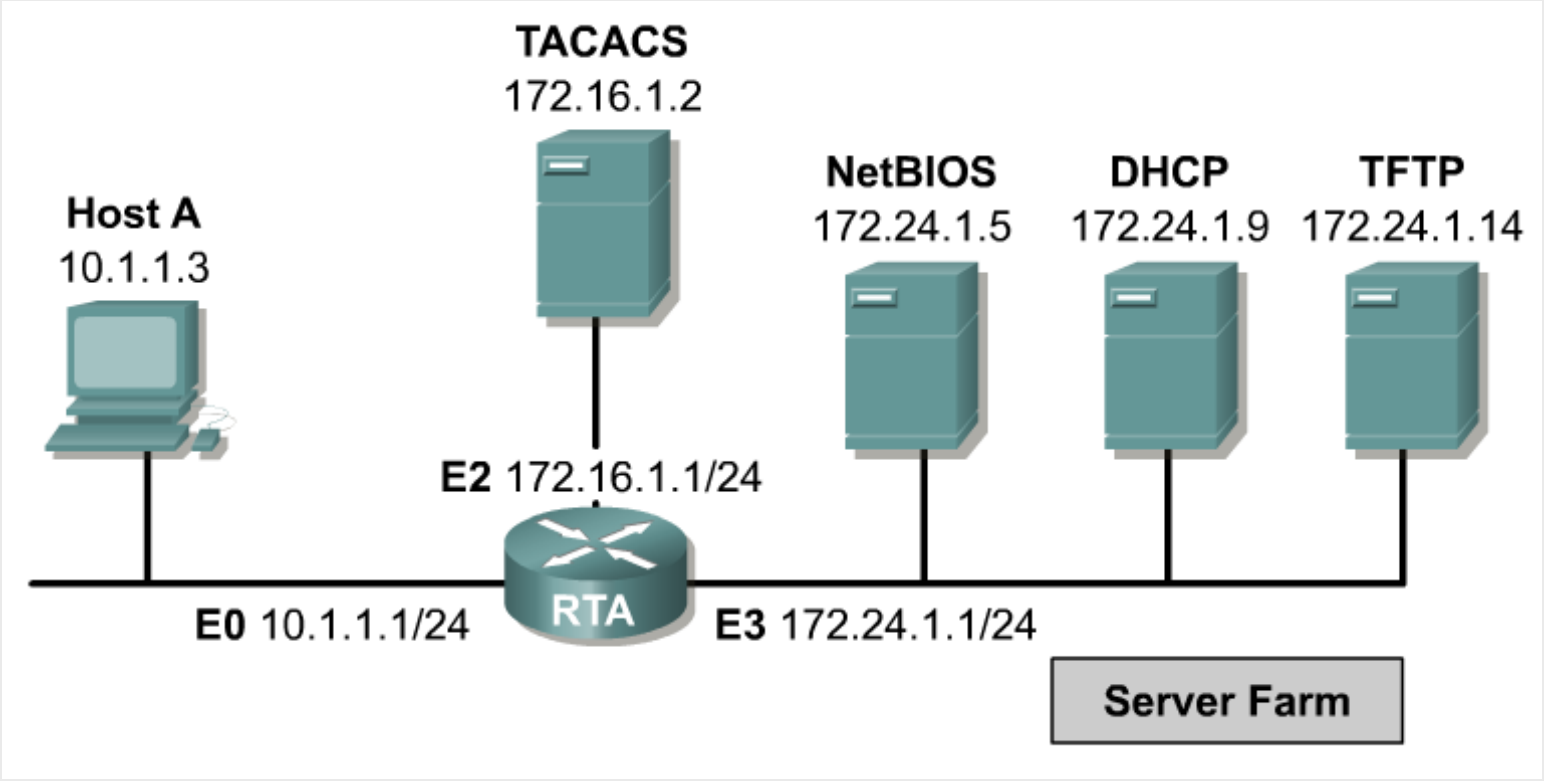
```
R1#show ip dhcp pool

Pool LAN-POOL-1 :
 Utilization mark (high/low)    : 100 / 0
 Subnet size (first/next)       : 0 / 0
 Total addresses                : 254
 Leased addresses               : 1
 Pending event                  : none
 1 subnet is currently in the pool :
 Current index        IP address range                    Leased addresses
 192.168.10.11        192.168.10.1     - 192.168.10.254    1
```

Lab activity

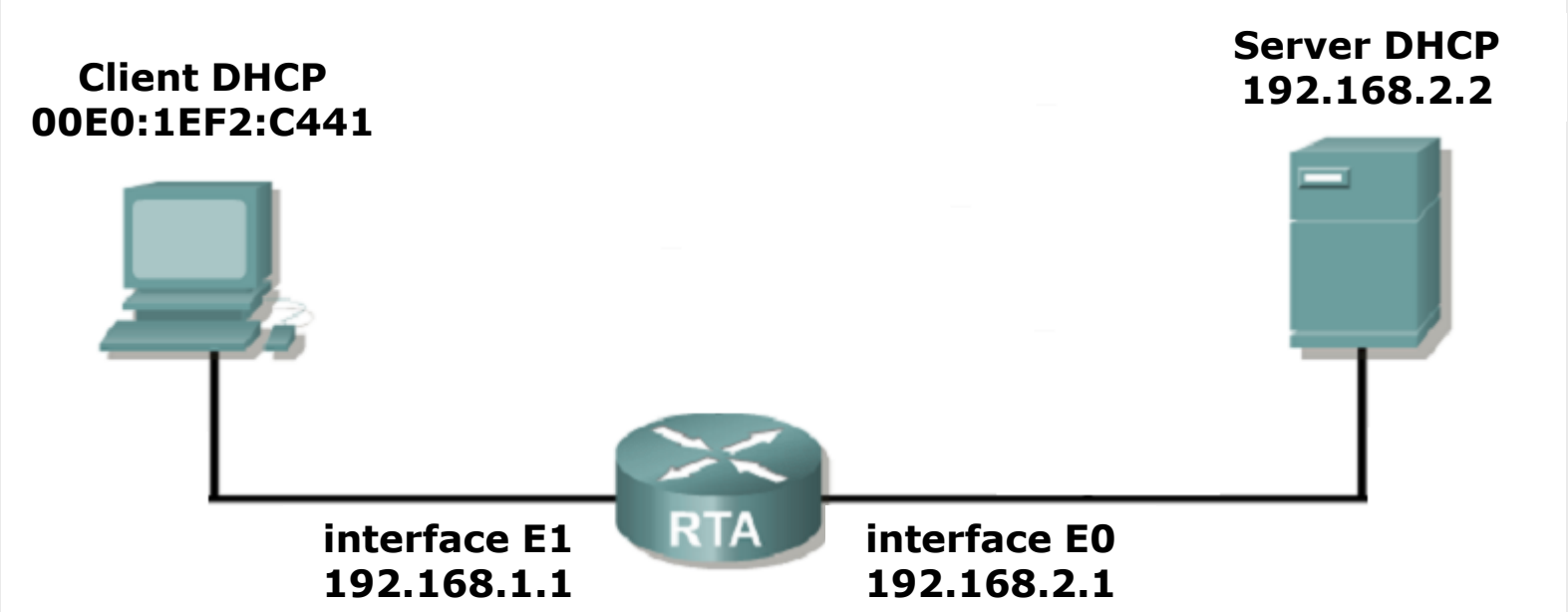


Relay agents

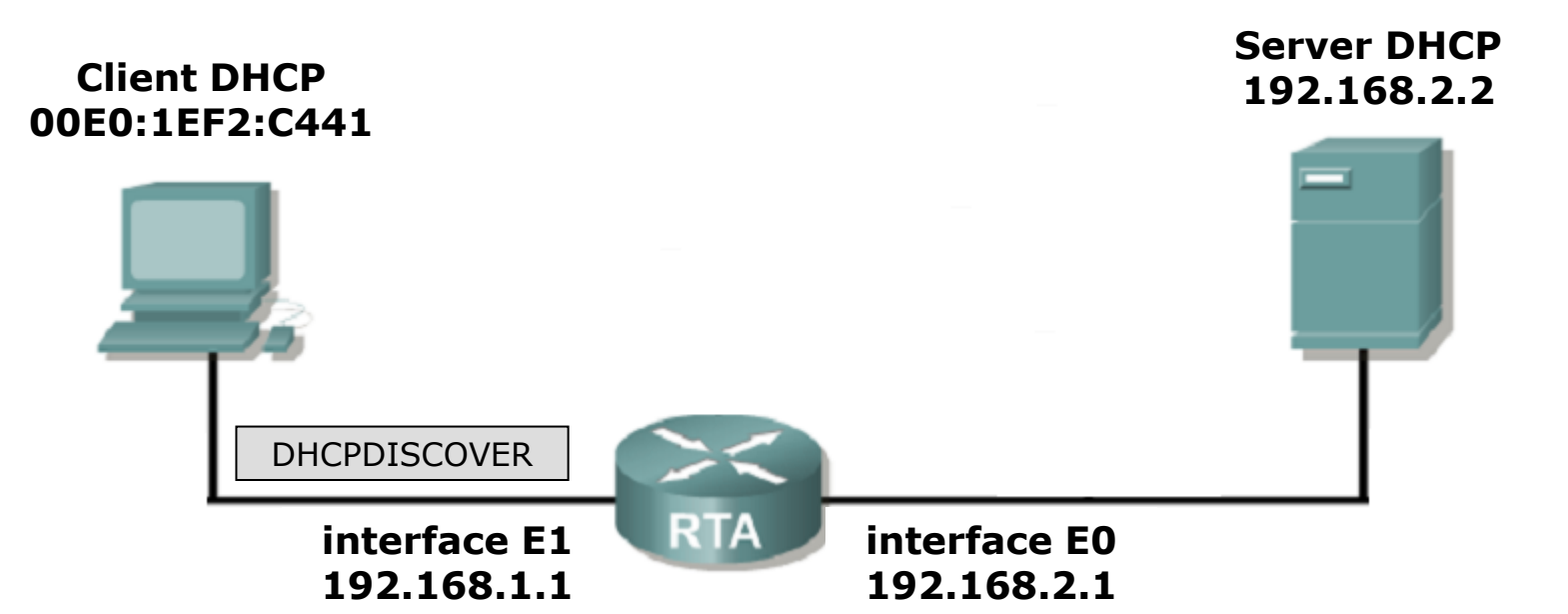
- DHCP uses the IP broadcast address
- Not reasonable to have a DHCP server per VLAN
- Use of *relay agents*



DHCP Relay - example

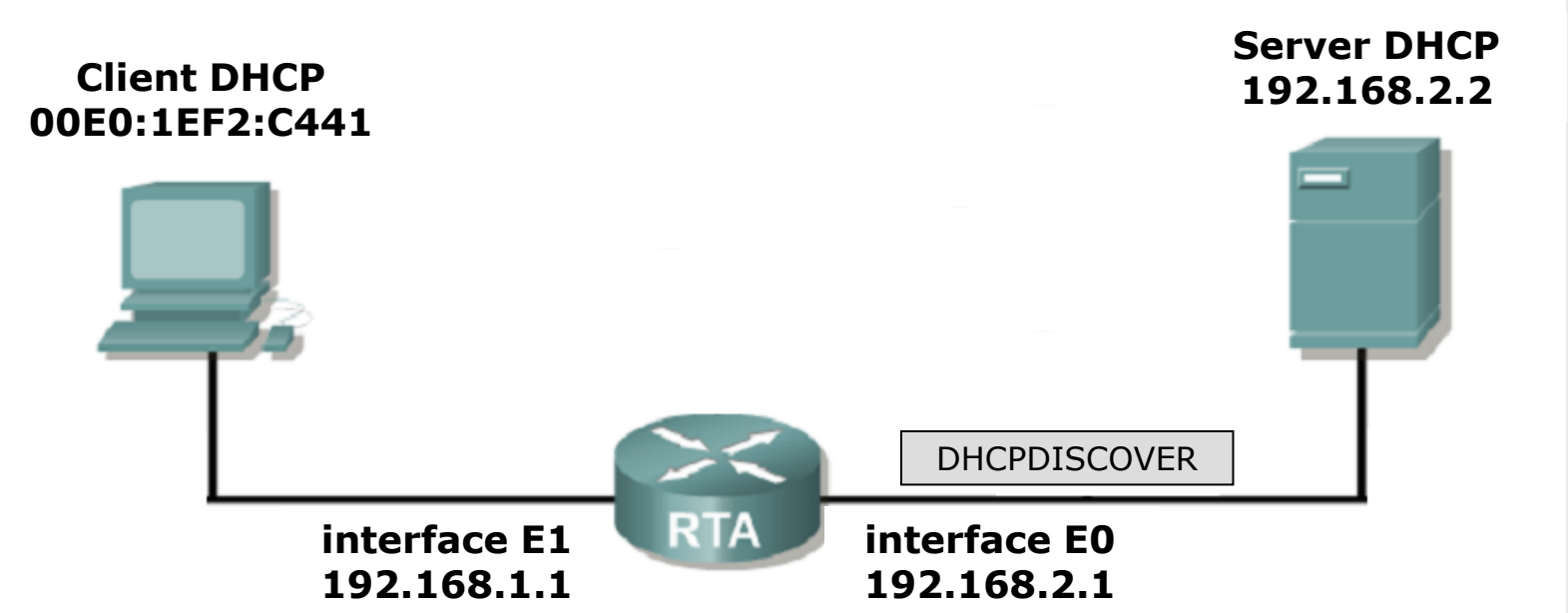


DHCP Relay - example



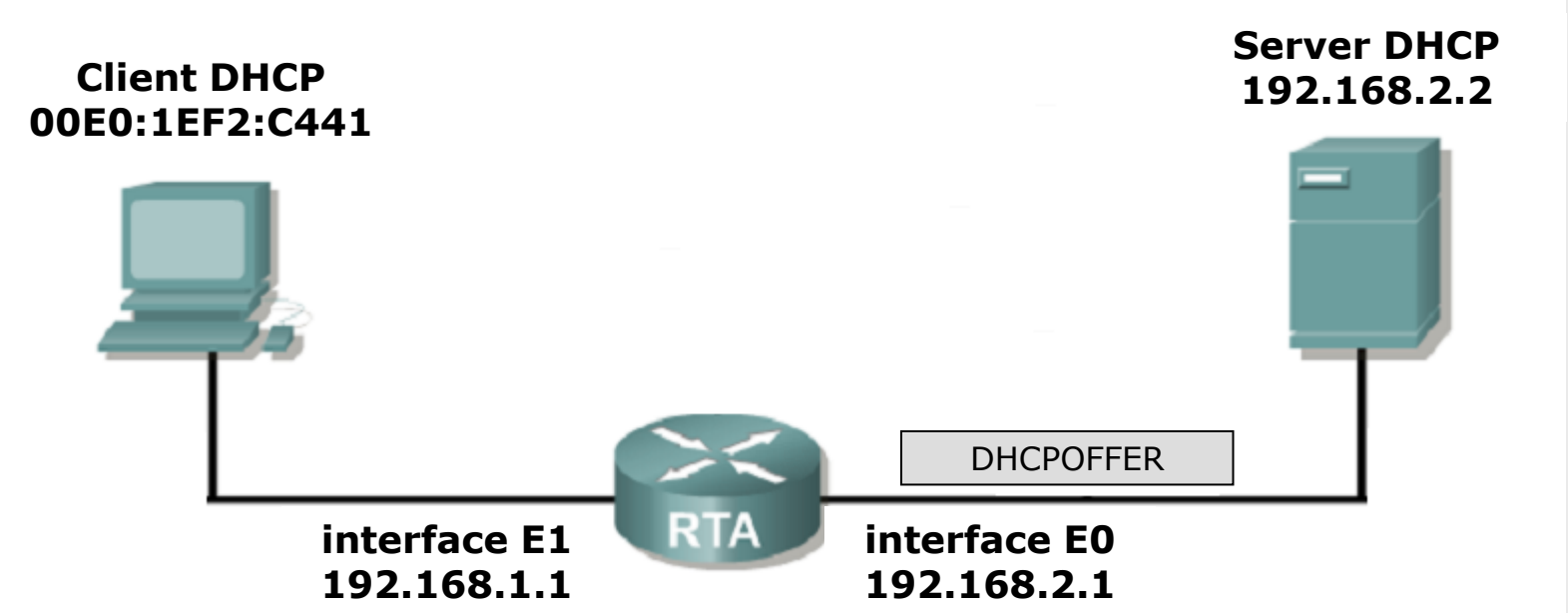
Packet	Your IP Address	Server IP Address	GI Address	Packet Source MAC Address	Packet Source IP Address	Packet Destination MAC Address	Packet Destination IP Address
1. DHCPDISCOVER is sent from client.	0.0.0.0	0.0.0.0	0.0.0.0	00E0.1EF2.C441	0.0.0.0	ffff.ffff.ffff (broadcast)	255.255.255.255

DHCP Relay - example



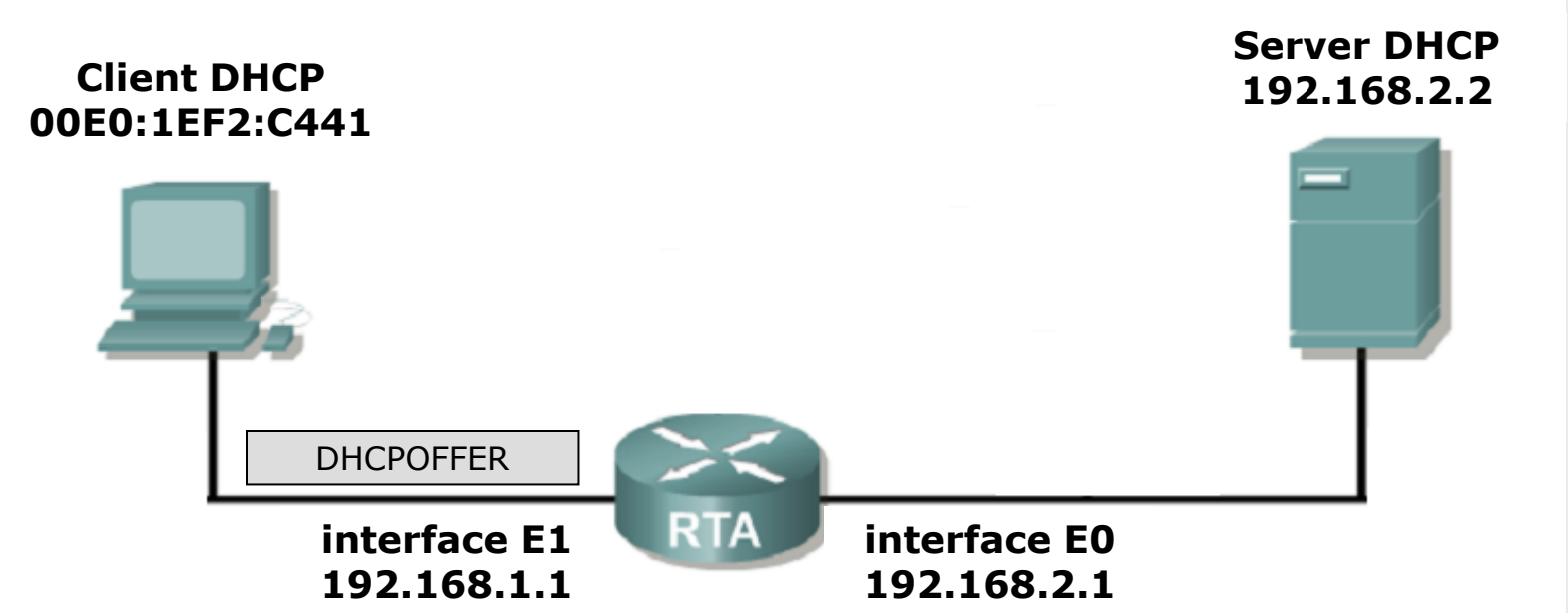
Packet	Your IP Address	Server IP Address	GI Address	Packet Source MAC Address	Packet Source IP Address	Packet Destination MAC Address	Packet Destination IP Address
2. The router receives the DHCPDISCOVER on the E1 interface. The router recognizes that this packet is a DHCP UDP broadcast. The router will now act as a DHCP/BootP Relay Agent and fill in the Gateway IP address field with **the incoming interface IP address**, change the source IP address to an incoming interface IP address, and forward the request directly to the DHCP server.	0.0.0.0	0.0.0.0	192.168.1.1	Interface E0 MAC Address	192.168.1.1	MAC Address of DHCP Server	192.168.2.2

DHCP Relay - example



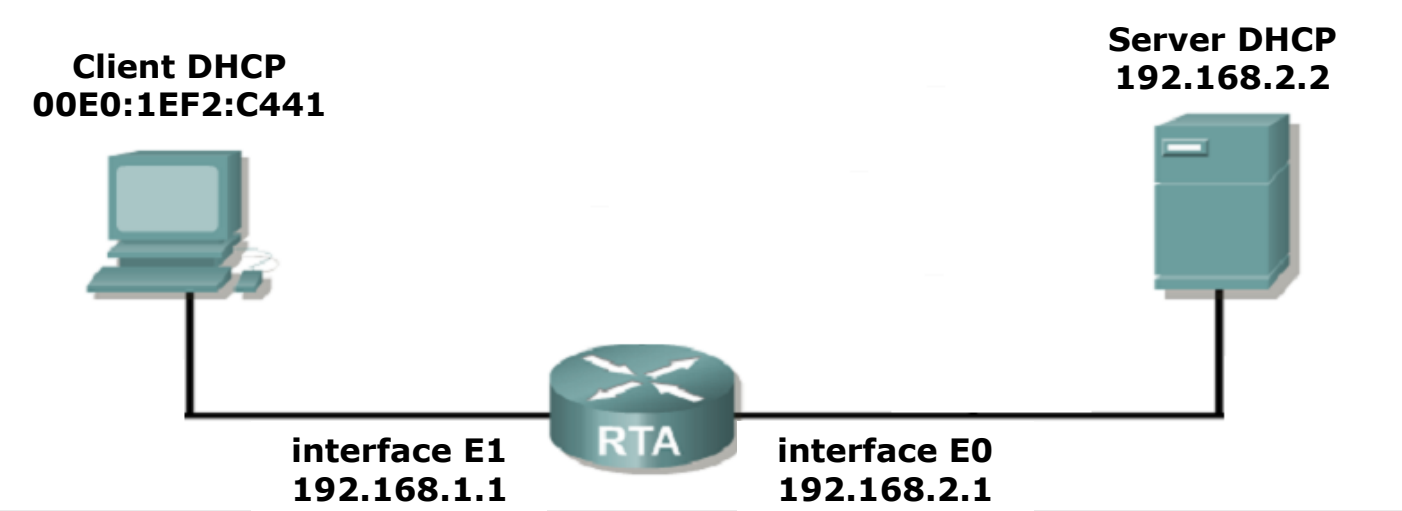
Packet	Your IP Address	Server IP Address	GI Address	Packet Source MAC Address	Packet Source IP Address	Packet Destination MAC Address	Packet Destination IP Address
3. The DHCP server has received the DHCPDISCOVER and is sending a DHCPOFFER to the DHCP Relay Agent.	192.168.1.2	192.168.2.2	192.168.1.1	MAC Address of DHCP Server	192.168.2.2	Interface E0 MAC Address	**192.168.1.1**

DHCP Relay - example



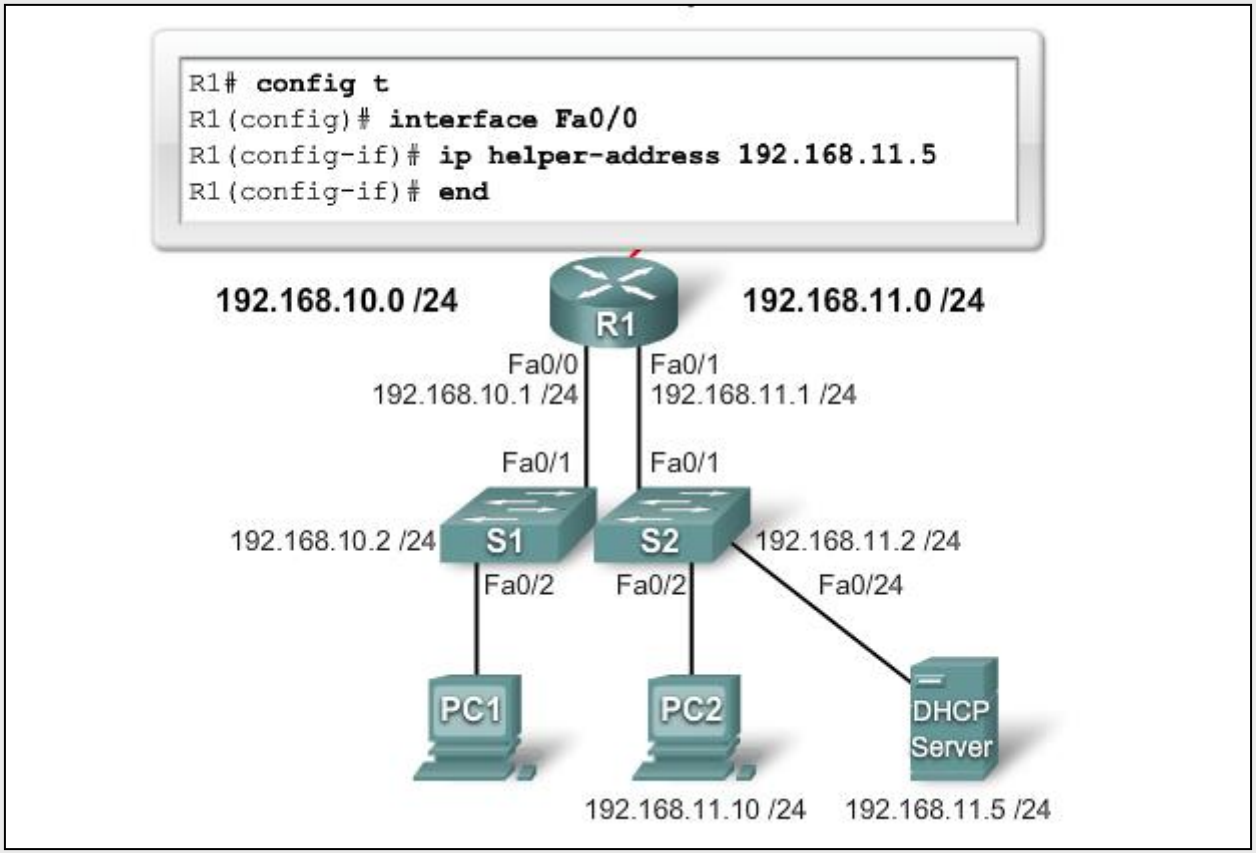
Packet	Your IP Address	Server IP Address	GI Address	Packet Source MAC Address	Packet Source IP Address	Packet Destination MAC Address	Packet Destination IP Address
4. The DHCP Relay Agent receives a DHCPOFFER, and will forward the DHCPOFFER broadcast on the local LAN.	192.168.1.2	192.168.2.2	192.168.1.1	Interface E1 MAC Address	192.168.1.1	ffff.ffff.ffff (broadcast)	255.255.255.255

DHCP Relay - example



Packet	Your IP Address	Server IP Address	GI Address	Packet Source MAC Address	Packet Source IP Address	Packet Destination MAC Address	Packet Destination IP Address
5. DHCPREQUEST sent from client.	0.0.0.0	0.0.0.0	0.0.0.0	00E0.1EF2.C441	0.0.0.0	ffff.ffff.ffff (broadcast)	255.255.255.255
6. The router receives the DHCPREQUEST on the E1 Interface. The router recognizes that this packet is DHCP UDP broadcast. The router will now act as a DHCP Relay Agent and fill in the Gateway IP address field with the incoming interface IP Address, change the source IP address to an incoming interface IP address, and forward the request directly to the DHCP server.	0.0.0.0	0.0.0.0	192.168.1.1	Interface E0 MAC Address	192.168.1.1	MAC Address of DHCP Server	192.168.2.2
7. The DHCP server has received the DHCPREQUEST and is sending a DHCPACK to the DHCP/BootP Relay Agent.	192.168.1.2	192.168.2.2	192.168.1.1	MAC Address of DHCP Server	192.168.2.2	Interface E0 MAC Address	**192.168.1.1**
8. The DHCP/BootP Relay Agent receives the DHCPACK, and will forward the DHCPACK broadcast on the local LAN. The client will accept the ACK and use the client's IP address.	192.168.1.2	192.168.2.2	192.168.1.1	Interface E1 MAC Address	192.168.1.1	ffff.ffff.ffff (broadcast)	255.255.255.255

Configure a DHCP relay

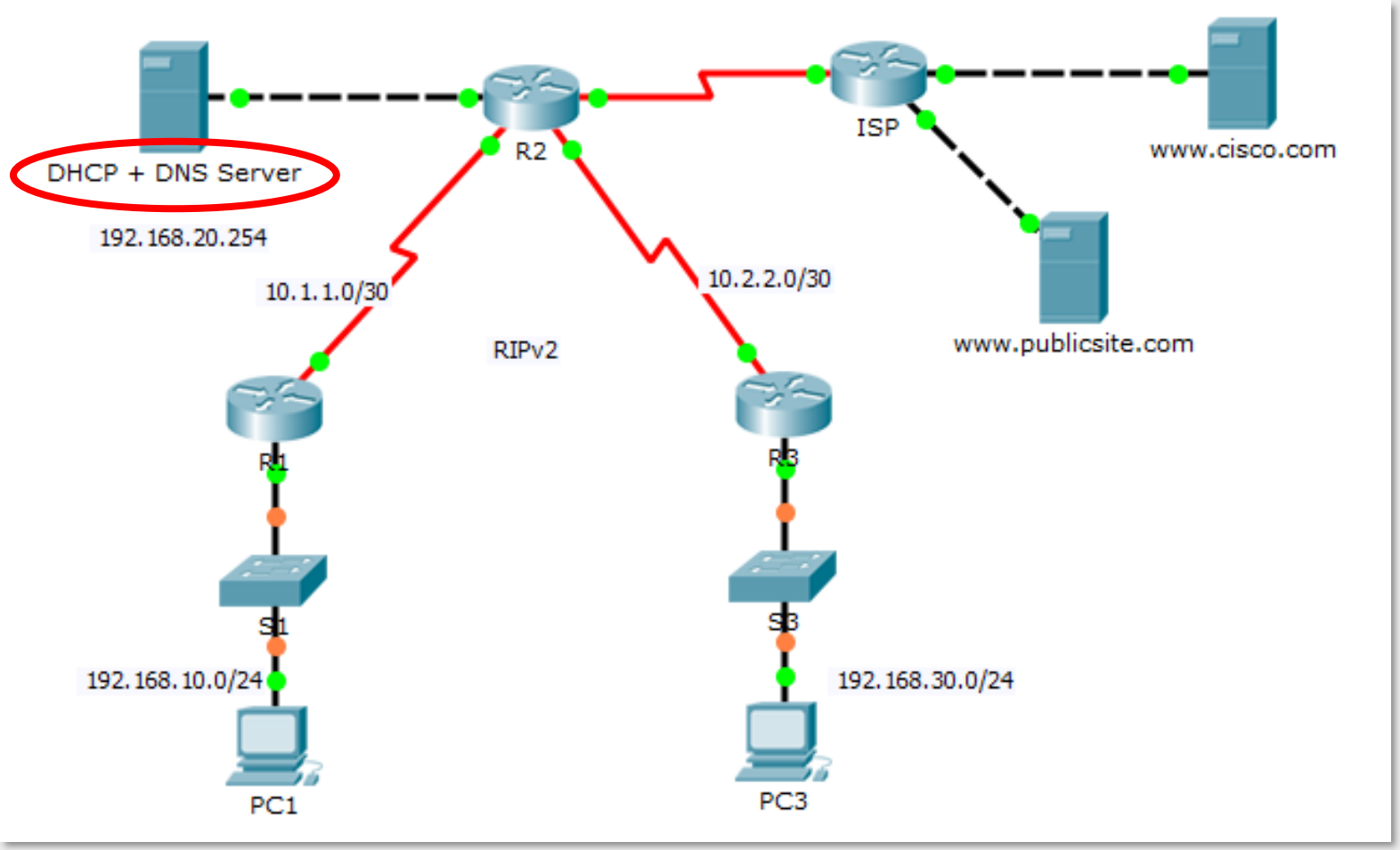


Troubleshoot DHCP configuration

- Resolve IP address conflicts
  - **`show ip dhcp conflict`** command
- Verify physical connectivity
  - Router interface up
- Test network connectivity by configuring a client workstation with a static IP address
- Verify whether DHCP clients obtain IP address on the same subnet or VLAN as DHCP server
- Verify that the router is receiving DHCP requests

```
R2# access-list 100 permit ip host 0.0.0.0 host 255.255.255.255
R2# debug ip packet detail 100
IP packet debugging is on (detailed) for access list 100
R2#
00:16:46: IP: s=0.0.0.0 (Ethernet4/0), d=255.255.255.255, len 604, rcvd 2
00:16:46: UDP src=68, dst=67
00:16:46: IP: s=0.0.0.0 (Ethernet4/0), d=255.255.255.255, len 604, rcvd 2
00:16:46: UDP src=68, dst=67
```

Lab activity



Lab activity