SWINBURNE UNIVERSITY OF TECHNOLOGY

TNE20002 / TNE70003

Topic 6 DHCP V1.0

Dynamic Host Configuration Protocol (DHCP)

All devices

PCs, switches, IPhones, printers, servers etc

need an IP address

to connect to a network

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Dynamic Host Configuration Protocol (DHCP)

Static IP addresses

- Devices such as routers, servers, printers, photocopiers etc, need an address that will not change

- Static address assignment is required

Dynamic IP addresses

- PCs, Laptops in an organization often change locations, physically and logically:
  - Dynamic address assignment is required
  - Can use any IP address within the range of the Host IP addresses in the subnet.

DHCP

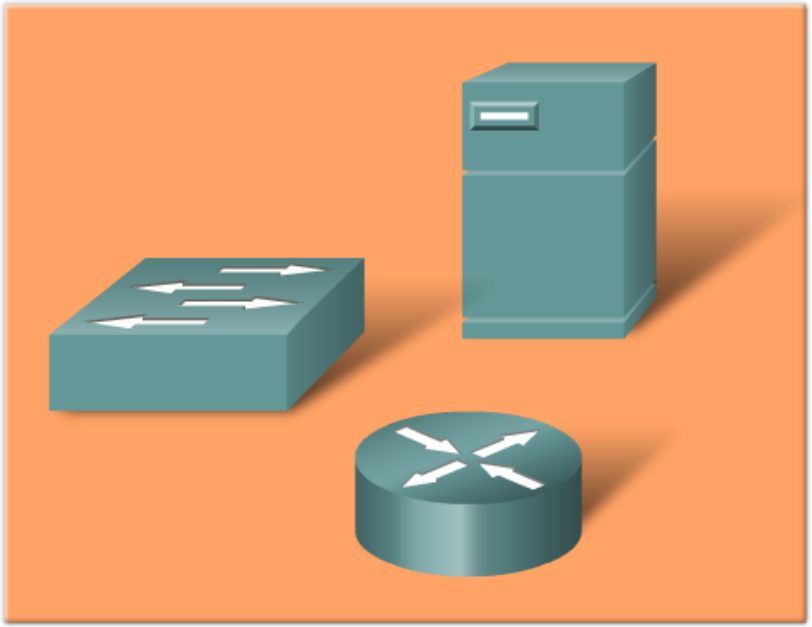
Address Allocation

MAD !

DHCP Address Allocation - MAD

Automatic

Manual



Network devices that remain in the same place (logically and physically) are assigned static IP addresses.

Dynamic

Network devices that are added, moved or changed (physical and logical) need new addresses. Manual configuration is unwieldy.

DHCP - Address Allocation Techniques - MAD

Manual

The IP address for the client is pre-allocated

by the administrator

and

DHCP conveys the IP address

to the client.

DHCP - Address Allocation Techniques - MAD

Automatic

DHCP selects from an address pool,

automatically assigns

a permanent IP address to a client

with no lease period.

DHCP - Address Allocation Techniques - MAD

Dynamic

DHCP selects from an address pool

and leases the IP address to the client

for a limited period of time.

DHCP Operation

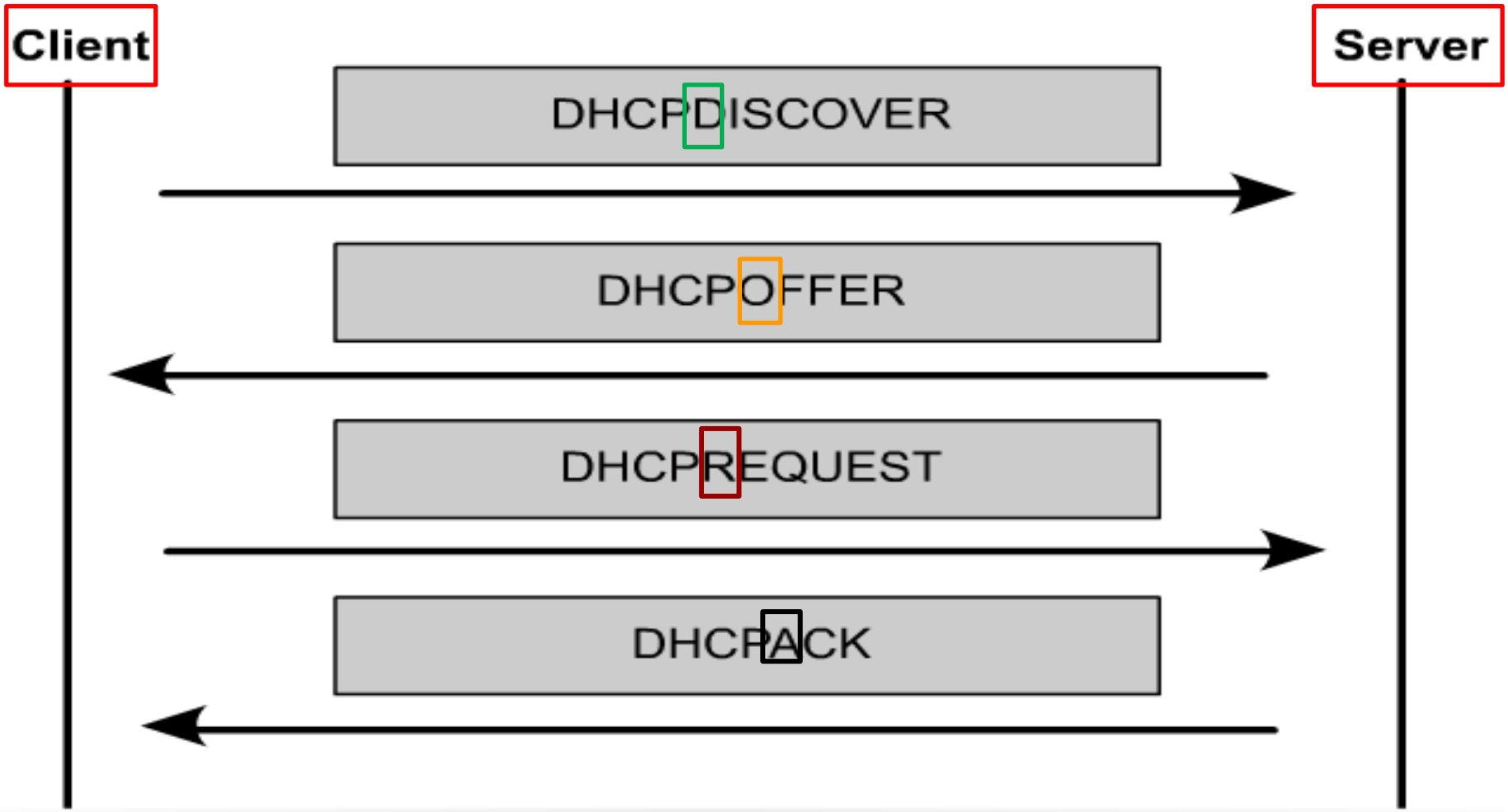
DORA

Discover, Offer,

Request, Acknowledge

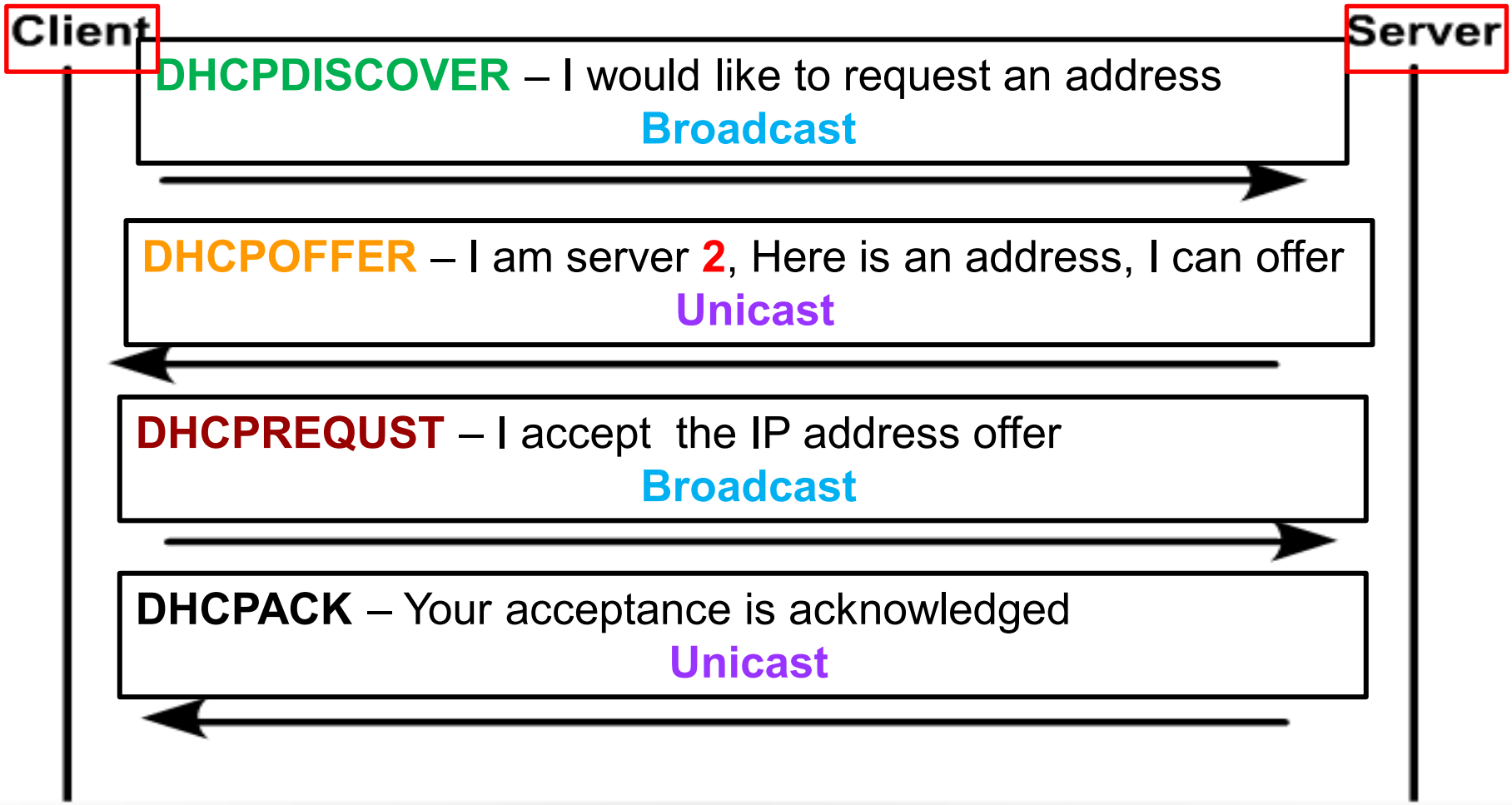
Client Action

DHCP Operation – Four Messages - DORA



DHCP messages in the order they are transmitted

DHCP Operation – Four Messages - DORA



DHCP messages in the order they are transmitted

DHCP Operation – Obtaining a Lease – Discover

1. DHCP Discover (to Server)

- Client (PC) broadcasts DHCPDISCOVER message
- DHCPDISCOVER finds DHCP server(s)
- Uses layer 2 (FF:FF:FF:FF:FF:FF) and layer 3 broadcast addresses to communicate with server(s)

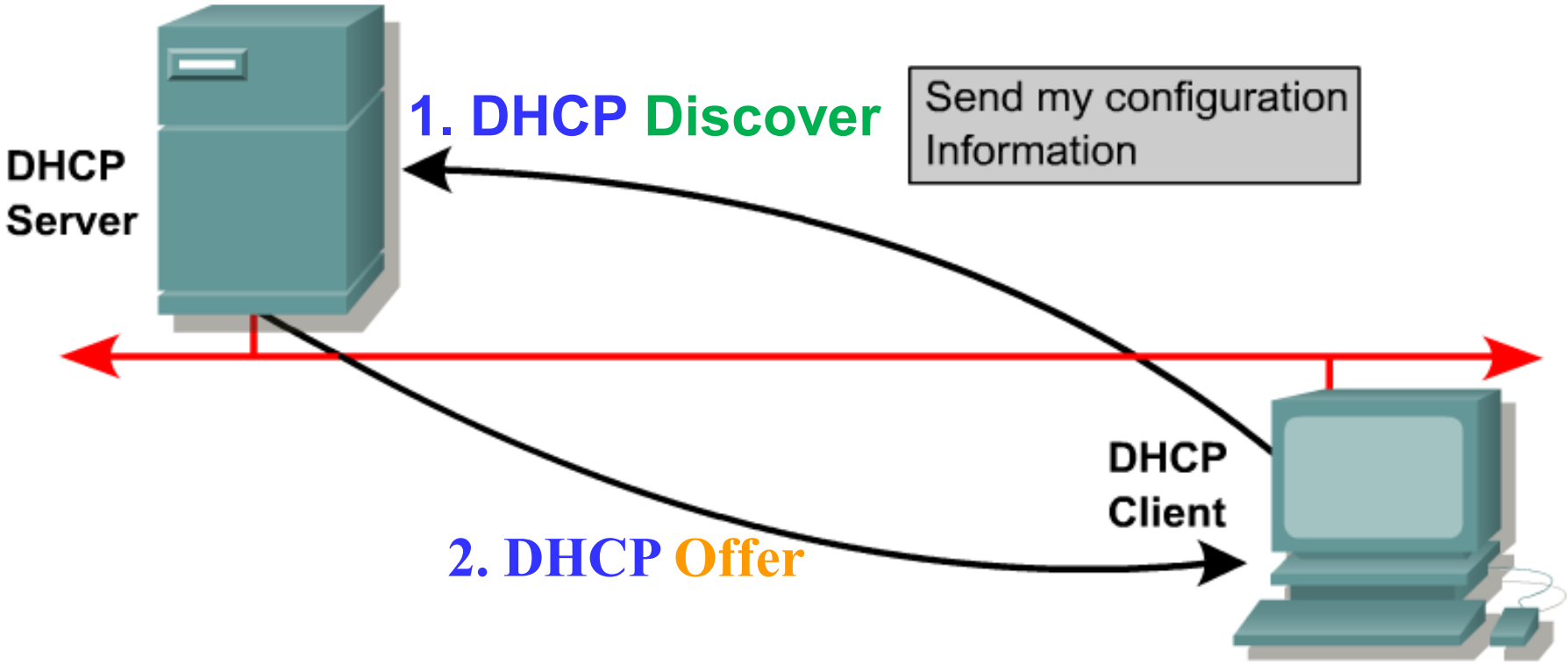
DHCP Operation – Obtaining a Lease – Offer

2. DHCP Offer (to Client)

- **DHCP Server**
  - finds available IP address to lease
  - creates and ARP entry in its ARP table consisting of the MAC address of requesting host and the leased IP address
  - Sends DHCP**OFFER** message to Client

- Unicast using server's layer 2 MAC address as source and client's layer 2 MAC address as destination

DHCP Operation - Messages Discover and Offer

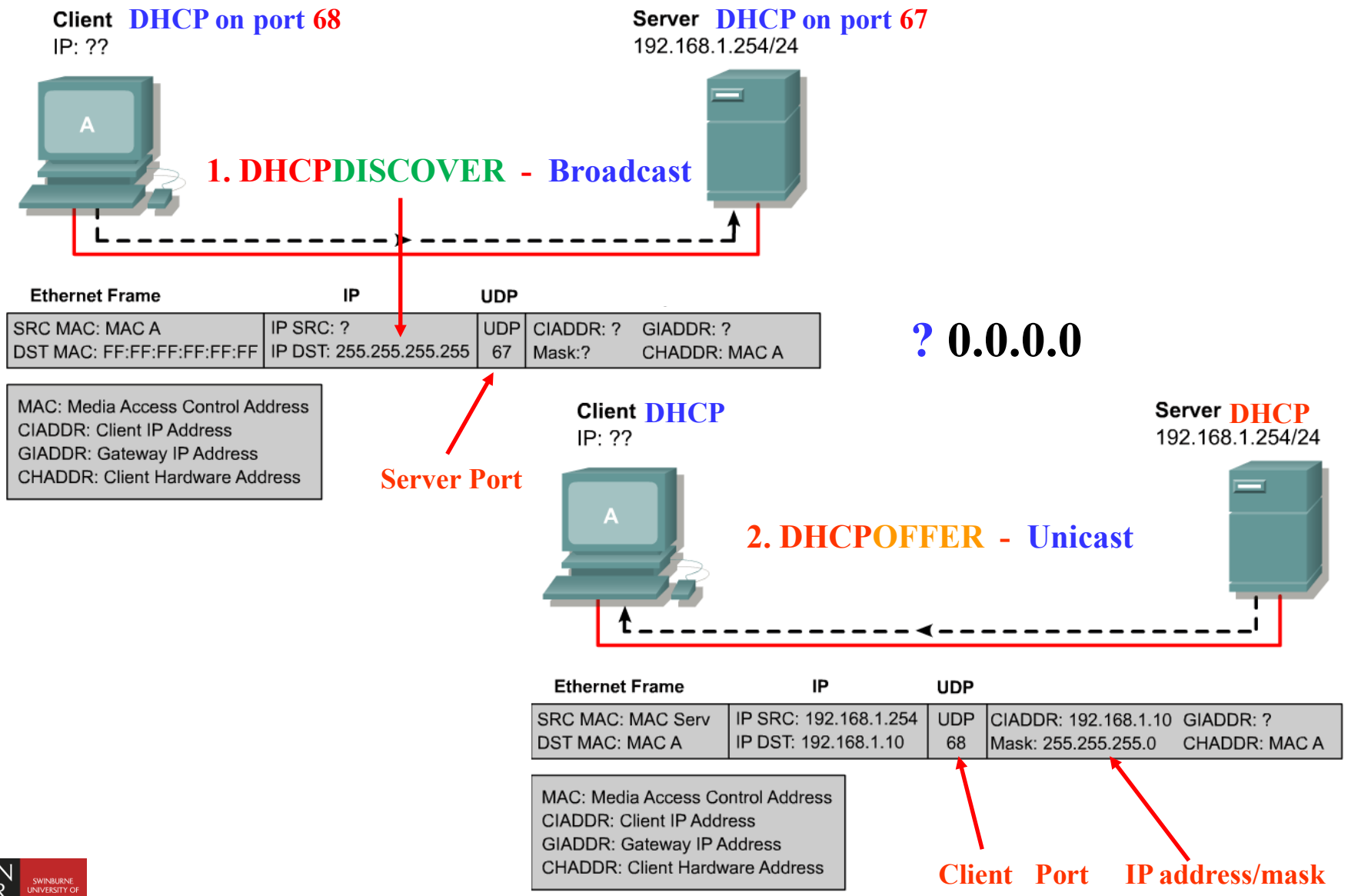


Here is Your Configuration:

- IP Address: 192.204.18.7
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.204.18.1
- DNS Servers: 192.204.18.8, 192.204.18.9
- Lease Time: 5 days

Offer Details

DHCP Operation – Messages Discover and Offer



DHCP – Obtaining a Lease – Request

3. DHCP Request (to Server)

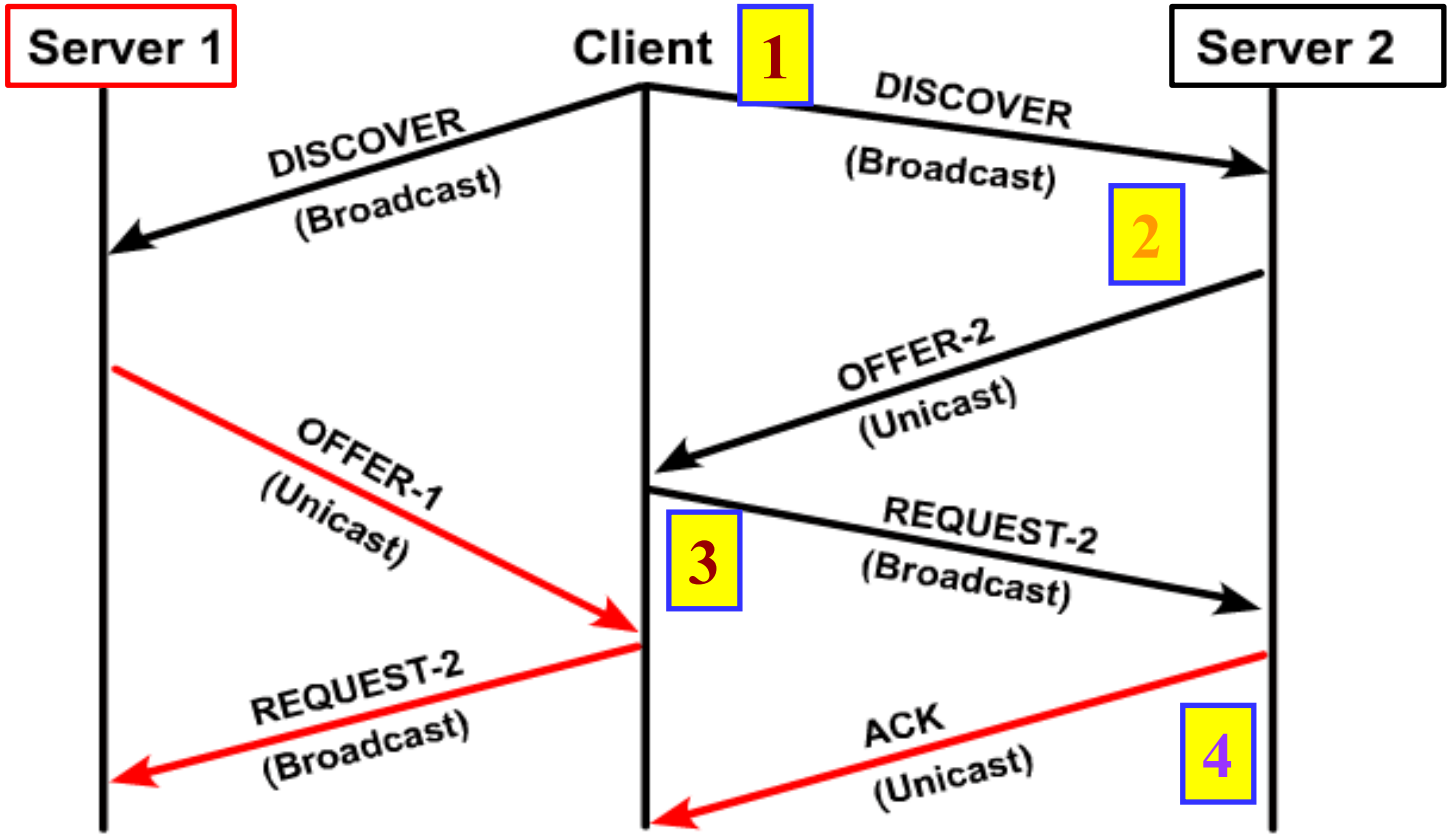
- Client broadcasts DHCP**REQUEST** message, two purposes:
  - Requests IP lease information be verified to ensure assignment is still valid
  - Serves as a binding acceptance notice to the selected server and an implicit decline to any other DHCP servers that may have given the client an offer

DHCP – Obtaining a Lease – Acknowledge

4. DHCP ACK (to Client)

- Server replies with unicast DHCP**ACK**

DHCP Operation – DORA Messages 1, 2, 3 and 4



- DHCP client broadcasts DHCPDISCOVER packet on local subnet
- DHCP servers send OFFER packet with lease information
- DHCP client selects lease and broadcasts DHCPREQUEST packet
- Selected DHCP server sends DHCP ACK packet

DHCP – Client Action

- Client checks IP address is not a Duplicate within Subnet
- Client sends ARP request (does any host within the subnet have this IP address ?) using new IP address
- If no other hosts in subnet reply, the IP address is not a duplicate, hence it can use the IP address

Configuring DHCP

```
Router(config)#ip dhcp pool pool-name1
```

Specify the DHCP pool

```
Router(dhcp-config)#network ip-address mask
```

Specify the range of addresses in the pool

- Creates an IP DHCP pool, and gives it a name
- Multiple DHCP pools can be created on one server
- Specify the IP range of addresses using an IP network address and mask

The **network** statement **enables** DHCP on **any router interfaces belonging** to that **network**.

- The router will act as a DHCP server on that interface.
- It is also the pool of addresses that the DHCP server will use.
- Pool **NaMe** (vs **nAmE**) is case sensitive

Configuring DHCP

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

```
Router(config)#ip dhcp excluded-address 172.16.12.1 172.16.12.10
Router(config)#ip dhcp excluded-address 172.16.12.254
```

```
Router(config)#ip dhcp pool subnet12
Router(dhcp-config)#network 172.16.12.0 255.255.255.0
Router(dhcp-config)#default-router 172.16.12.254
Router(dhcp-config)#dns-server 172.16.1.2
Router(dhcp-config)#netbios-name-server 172.16.1.3
Router(dhcp-config)#domain-name foo.com
```

- The **ip dhcp excluded-address** command configures the router to exclude an individual address or range of addresses when assigning addresses to clients.
- IP configuration values such as the default gateway can be set.

Configuring DHCP – Manual Allocation

- Manually allocating an IP address to a printer, photocopier etc

- Router(config)# ip dhcp pool subnet12
- Router(dhcp-config)# host 172.16.12.5 255.255.255.0
- Router(dhcp-config)# client-identifier <*unique-identifier*>

- The *unique-identifier* of the client - the printer, is specified in dotted hexadecimal notation, for example, 01b7.0813.8811.66, where 01 represents the Ethernet media type, followed by client's MAC address
- When this printer's DHCP Client requests an IP address it will receive 172.16.12.5

Configuring a Cisco Router as a DHCP Server

- The **Enabling** the DHCP service:
  - To enable the service:

```
Router(config)#service dhcp
```

  - To disable the service:

```
Router(config)#no service dhcp
```

Configuring DHCP - Options

Command	Description
network *network-number* [*mask* | *prefix-length*]	Specifies the subnet network number and mask of the DHCP address pool. The prefix length specifies the number of bits that compromise the address prefix. The prefix is an alternative way of specifying the network mask of the client. The prefix length must be preceded by a forward slash (/).
default-router *address* [*address2...address8*]	Specifies the IP address of the default gateway for a DHCP client. Although one address is required, up to eight addresses can be specified in one command line.
dns-server *address* [*address2...address8*]	Specifies the IP address of a DNS server that is available to a DHCP client. Although one address is required, up to eight addresses can be specified in one command line.
netbios-name-server *address* [*address2...address8*]	Specifies the NetBios WINS server that is available to a Microsoft DHCP client. Although one address is required, up to eight addresses can be specified in one command line.
domain-name *name*	Specifies the domain name for the client.
lease {*days* [*hours*] [*minutes*] | infinite}	Specifies the duration of the lease. The default is a one-day lease.

Verifying and Troubleshooting DHCP

```
Router#show ip dhcp binding
IP address      Hardware address    Lease expiration       Type
172.16.12.11    0100.10a4.97f4.6d   Mar 02 1993 12:38 AM   Automatic
Router#
```

```
Router#debug ip dhcp server events
Router#
00:22:53: DHCPD:checking for expired leases.
00:22:23: DHCPD: assigned IP address 172.16.13.11 to client
0100.10a4.97f4.6d
00:22:49: DHCPD:retured 172.16.13.11 to address pool remote.
00:22:59: DHCPD: assigned IP address 172.16.13.11 to client
0100.10a497f4.6d.
```

Verifying and Troubleshooting DHCP

- show ip dhcp server statistics

- show ip dhcp pool

DHCP Relay

The

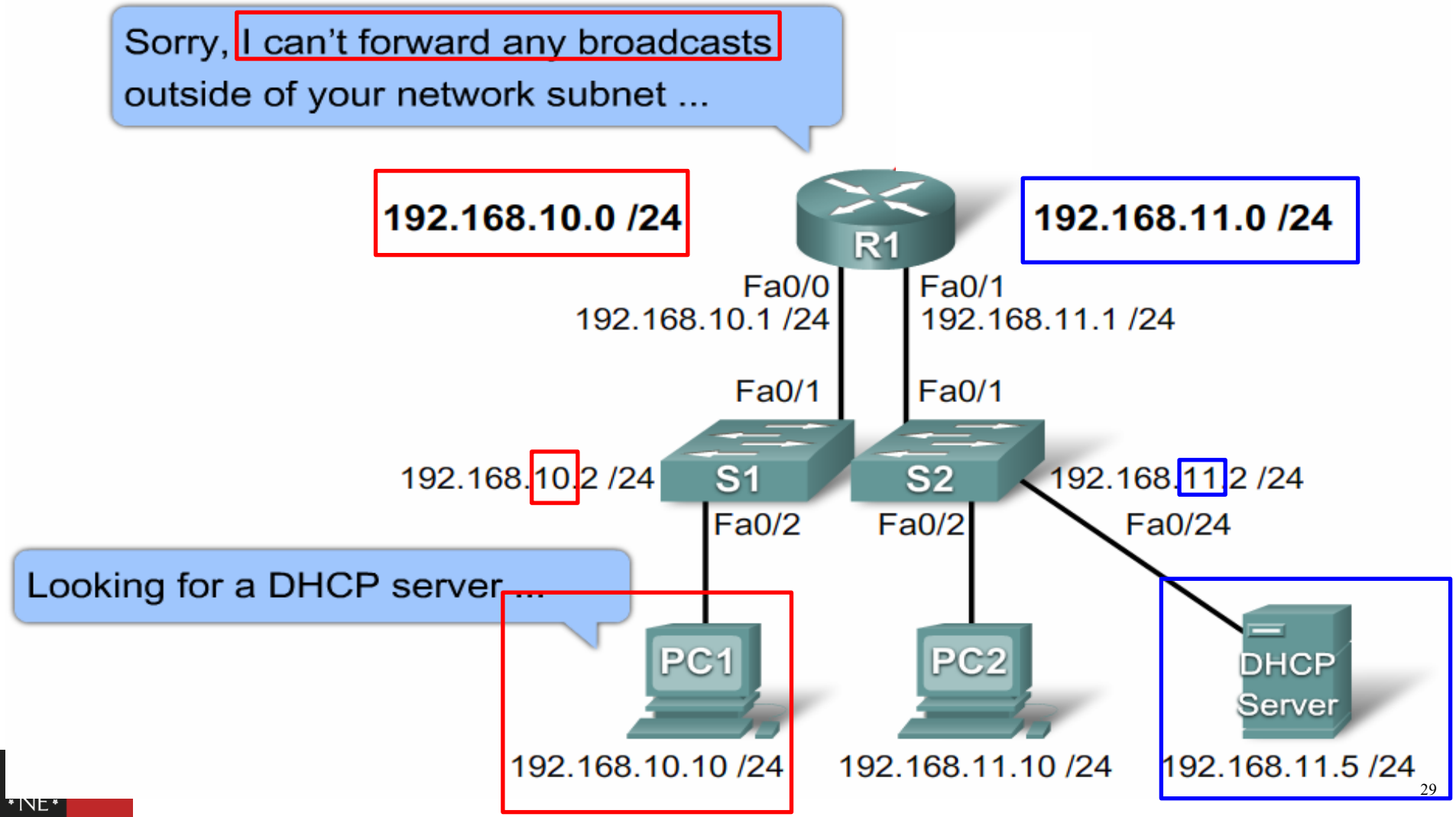
DHCP Server

is in a

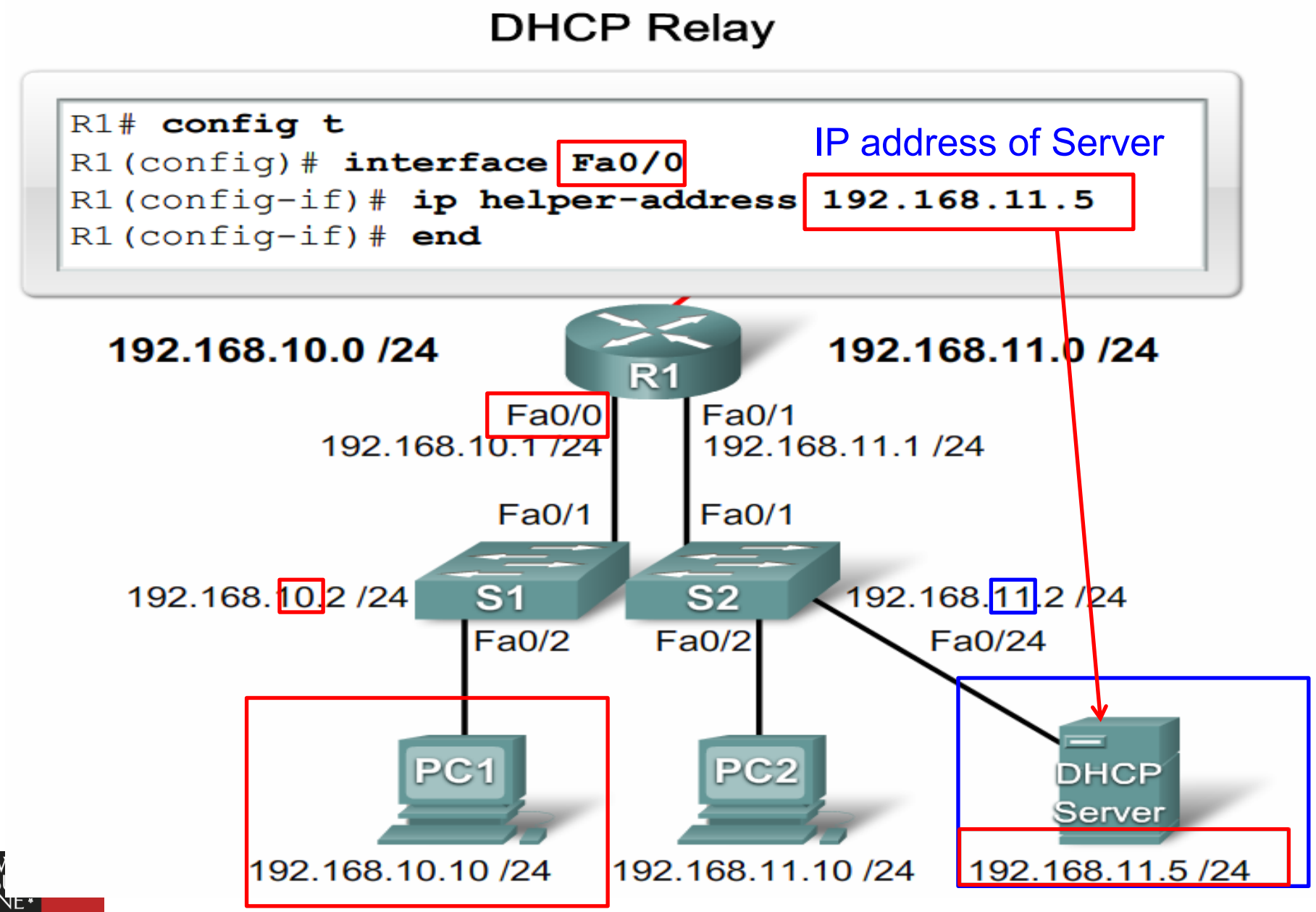
different

subnet

DHCP Relay – DHCP Server in a different subnet



DHCP Relay – DHCP Server in a different subnet



DHCP Explained | Step by Step - YouTube

THE END