

## Assignment 03

- Title : DHCP Server
- Problem Statement:  
Install & configure DHCP server & write a program (C++, Python, Java) to install software on remote machine.
- Objectives:
  - 1) To learn DHCP protocol
  - 2) To study installation & configuration of DHCP server.
- Software & hardware packages:  
Python 3.7 interpreter.  
Editor.  
Ubuntu 20.04  
DHCP Server Setup  
i/o devices.
- Theory:  
DHCP stands for Dynamic Host Configuration protocol it is a standardized network protocol which lets a DHCP client to lease network config. params such as IP address, network masks, DNS, default gateways, proxy servers, etc.



Each host to obtain IP address dynamically will upon boot send a DHCP request. DHCP client is obliged to maintain a communication with the DHCP server and renew its IP address regularly.

DHCP server keeps a record of all leased IP addresses. & calls them "dhcp.leases" which can be found in '/var/lib/dhcp' directory.

- DHCP operation:

- 1) The DHCP server uses a passive open command on UDP port number 67 & waits for a client.
- 2) A booted client issues an active open command on port 68. The message is encapsulated in a UDP user datagram.
- 3) The server responds with either a broadcast or a unicast message using UDP source port number 67 & destination port no. 68.

- DHCP messages:

The DHCP employs a connection less service model using user datagram. UDP port 67 is the destination port of a server & UDP port no. 68 is used by the client.



DHCP operations fall into 4 phases

- 1) Service discovery
- 2) IP lease offer
- 3) IP request
- 4) IP lease acknowledgement

#### - DHCP discovery

A DHCP client sends request to its last known IP address, if the client remains connected, the server may grant the request.

#### - DHCP offer:

When a DHCPDISCOVER message from a client, which is an IP address lease request, the server reserves an IP address for the client & makes a lease offer by sending a DHCP offer message to the client.

#### - DHCP Request:

In response to DHCP offer, the client replies with a DHCP request, broadcast to the server requesting IP address.

A client can receive multiple DHCP offers but will select only one. Servers are then informed when client has chosen & then they retract their offer requests.



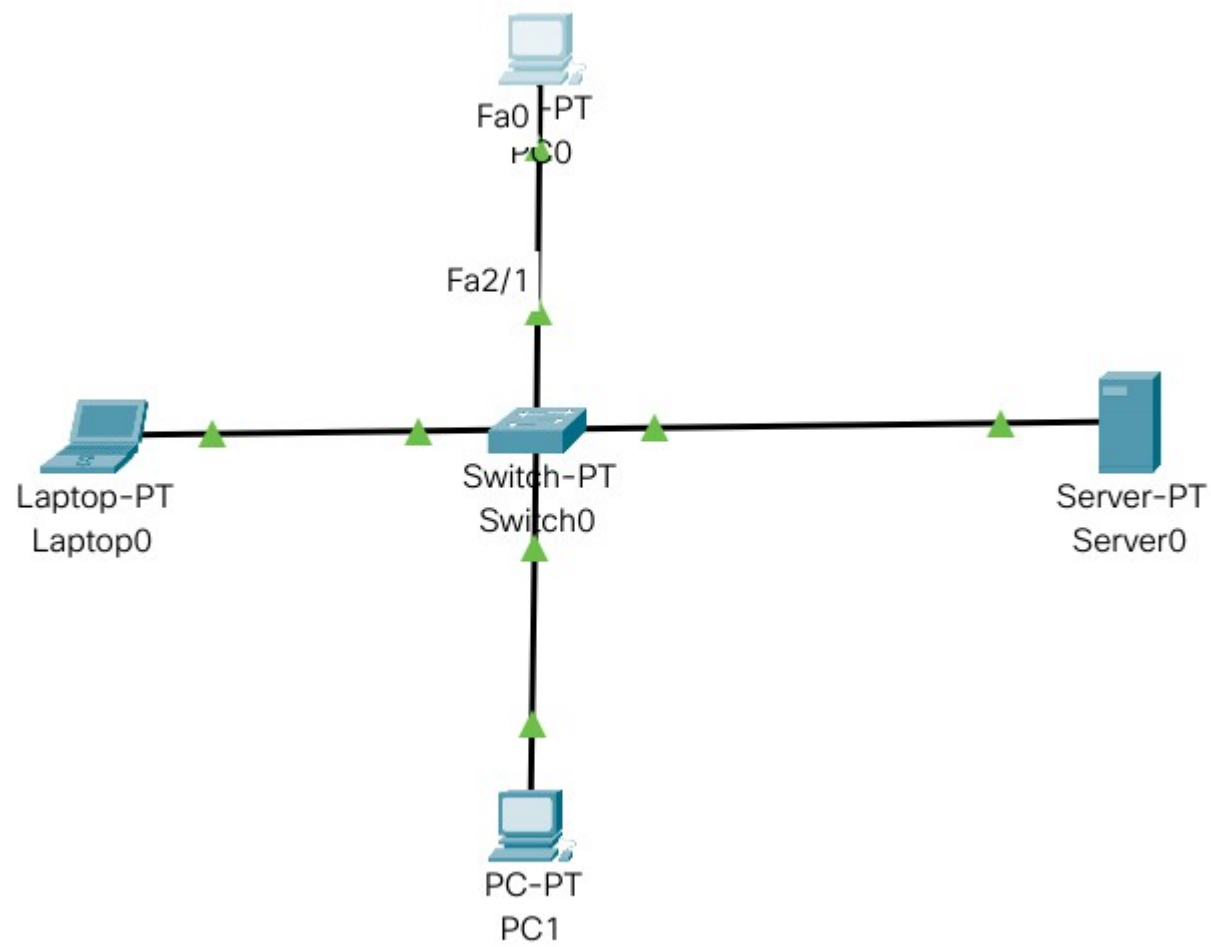
### - DHCP Acknowledgement:

When DHCP server receives DHCP request message from client the config process enters its final phase the acknowledgement phase involves sending a DHCPACK packet to the client. This includes the lease duration.

After client obtains an IP address it should probe the address to prevent conflicts.

### Conclusion:

By this assignment we have studied the DHCP protocol concepts & we have installed & configured DHCP server using packet traces simulation.



Network Topology

Server0

Physical Config Services Desktop Programming Attributes

IP Configuration X

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.1.1

Subnet Mask 255.255.255.0

Default Gateway 192.168.1.254

DNS Server 0.0.0.0

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address /

Link Local Address FE80::210:11FF:FEDE:B9DB

Default Gateway

DNS Server

802.1X

☐ Use 802.1X Security

Authentication MD5

Username

Password

☐ Top

Server Static IP configuration

Server0

Physical

Config

Services

Desktop

Programming

Attributes

SERVICES

HTTP

DHCP

DHCPv6

TFTP

DNS

SYSLOG

AAA

NTP

EMAIL

FTP

IoT

VM Management

Radius EAP

DHCP

Interface

FastEthernet0

Service

On

Off

Pool Name

serverPool192

Default Gateway

192.168.1.254

DNS Server

0.0.0.0

Start IP Address :

192

168

1

0

Subnet Mask:

255

255

255

0

Maximum Number of Users :

255

TFTP Server:

0.0.0.0

WLC Address:

0.0.0.0

Add

Save

Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
serverPool192	192.168.1....	0.0.0.0	192.168.1.0	255.255.25...	255	0.0.0.0	0.0.0.0
serverPool	0.0.0.0	0.0.0.0	192.168.1.0	255.255.25...	255	0.0.0.0	0.0.0.0

☐ Top

DHCP Server Configuration

PDU Information at Device: PC0

OSI Model

Outbound PDU Details

PDU Formats

IP

0

4

8

16

20

24

Bits

VER:4

IHL:5

DSCP:0x00

TL:62

ID:0x0011

FLAGS:0x0

FRAG OFFSET:0x000

TTL:128

PRO:0x11

CHKSUM

SRC IP:0.0.0.0

DST IP:255.255.255.255

DATA (VARIABLE LENGTH)

UDP

0

16

Bits

SOURCE PORT:68

DESTINATION PORT:67

LENGTH:0x002a

CHECKSUM:0

DATA (VARIABLE LENGTH)

DHCP

0

8

16

24

Bytes

OP:0x0000000000000001

HW TYPE:1

HW LEN:6

HOPS:0

TRANSACTION ID

SECS:0

FLAGS:0x00000000000000000000000000000000

0000000

CLIENT ADDRESS:0.0.0.0

YOUR CLIENT ADDRESS:0.0.0.0

SERVER ADDRESS:0.0.0.0

RELAY AGENT ADDRESS:0.0.0.0

CLIENT HARDWARE ADDRESS:00D0.FF67.77B5

SERVER HOSTNAME (64 BYTES)

FILE (128 BYTES)

OPTIONS (312 BYTES)

DHCP Discover Packet

PDU Information at Device: Switch0

OSI Model

Inbound PDU Details

Outbound PDU Details

PDU Formats

IP

0 4 8 16 20 24 Bits

VER:4	IHL:5	DSCP:0x00	TL:66
ID:0x0037		FLAGS:0x0	FRAG OFFSET:0x000
TTL:128	PRO:0x11	CHKSUM	
SRC IP:192.168.1.1			
DST IP:255.255.255.255			
DATA (VARIABLE LENGTH)			

UDP

0 16 Bits

SOURCE PORT:67	DESTINATION PORT:68
LENGTH:0x002e	CHECKSUM:0
DATA (VARIABLE LENGTH)	

DHCP

0 8 16 24 Bytes

OP:0x0000000000000002	HW TYPE:1	HW LEN:6	HOPS:0
TRANSACTION ID			
SECS:0	FLAGS:0x000000000000000000000000000000000008000		
CLIENT ADDRESS:0.0.0.0			
YOUR CLIENT ADDRESS:192.168.1.2			
SERVER ADDRESS:192.168.1.1			
RELAY AGENT ADDRESS:0.0.0.0			
CLIENT HARDWARE ADDRESS:00D0.FF67.77B5			
SERVER HOSTNAME (64 BYTES)			
FILE (128 BYTES)			
OPTIONS (312 BYTES)			

DHCP Offer Packet



PDU Information at Device: Switch0

OSI Model

Inbound PDU Details

Outbound PDU Details

PDU Formats

IP

0

4

8

16

20

24

Bits

VER:4

IHL:5

DSCP:0x00

TL:77

ID:0x0013

FLAGS:0x0

FRAG OFFSET:0x000

TTL:128

PRO:0x11

CHKSUM

SRC IP:0.0.0.0

DST IP:255.255.255.255

DATA (VARIABLE LENGTH)

UDP

0

16

Bits

SOURCE PORT:68

DESTINATION PORT:67

LENGTH:0x0039

CHECKSUM:0

DATA (VARIABLE LENGTH)

DHCP

0

8

16

24

Bytes

OP:0x0000000000000001

HW TYPE:1

HW LEN:6

HOPS:0

TRANSACTION ID

SECS:0

FLAGS:0x00000000000000000000000000000000

0008000

CLIENT ADDRESS:0.0.0.0

YOUR CLIENT ADDRESS:192.168.1.2

SERVER ADDRESS:192.168.1.1

RELAY AGENT ADDRESS:0.0.0.0

CLIENT HARDWARE ADDRESS:00D0.FF67.77B5

SERVER HOSTNAME (64 BYTES)

FILE (128 BYTES)

OPTIONS (312 BYTES)

DHCP Request Packet

PDU Information at Device: Switch0

OSI Model

Inbound PDU Details

Outbound PDU Details

PDU Formats

IP

0

4

8

16

20

24

Bits

VER:4	IHL:5	DSCP:0x00	TL:66
ID:0x0038		FLAGS:0x0	FRAG OFFSET:0x000
TTL:128	PRO:0x11	CHKSUM	
SRC IP:192.168.1.1			
DST IP:255.255.255.255			
DATA (VARIABLE LENGTH)			

UDP

0

16

Bits

SOURCE PORT:67	DESTINATION PORT:68
LENGTH:0x002e	CHECKSUM:0
DATA (VARIABLE LENGTH)	

DHCP

0

8

16

24

Bytes

OP:0x0000000000000002	HW TYPE:1	HW LEN:6	HOPS:0
TRANSACTION ID			
SECS:0	FLAGS:0x00000000000000000008000		
CLIENT ADDRESS:0.0.0.0			
YOUR CLIENT ADDRESS:192.168.1.2			
SERVER ADDRESS:192.168.1.1			
RELAY AGENT ADDRESS:0.0.0.0			
CLIENT HARDWARE ADDRESS:00D0.FF67.77B5			
SERVER HOSTNAME (64 BYTES)			
FILE (128 BYTES)			
OPTIONS (312 BYTES)			

DHCP Acknowledgement Packet