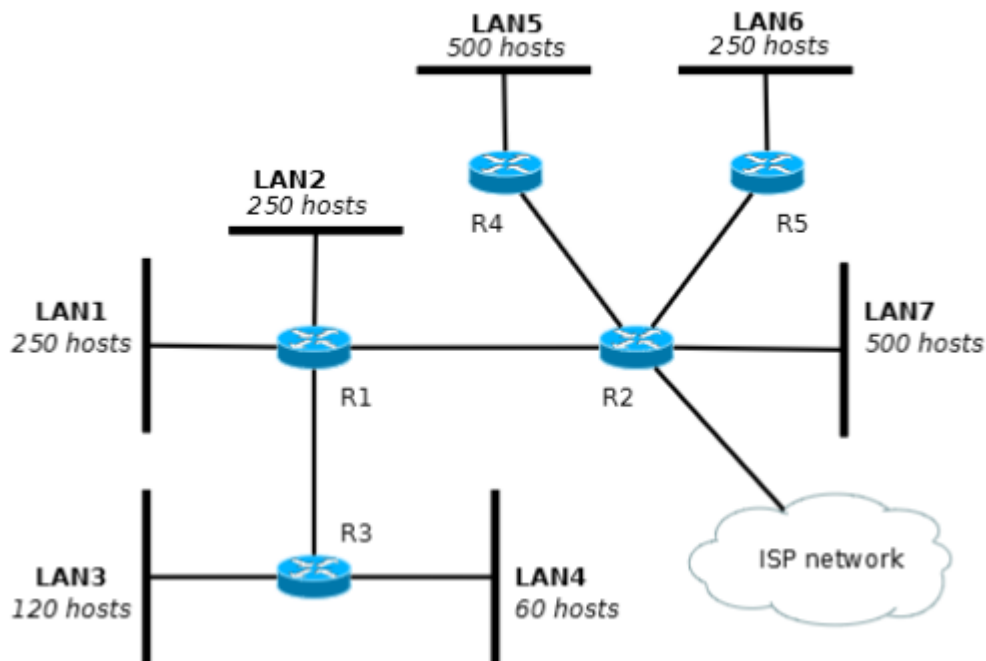


## 4.1 IP address Planning

### Aim:

To define a IPv4 address

### Network diagram:



### Process:

Only one prefix 37.SN.40.0/21 is needed for the IP address planning here.

## 4.3 Static Routing Configuration

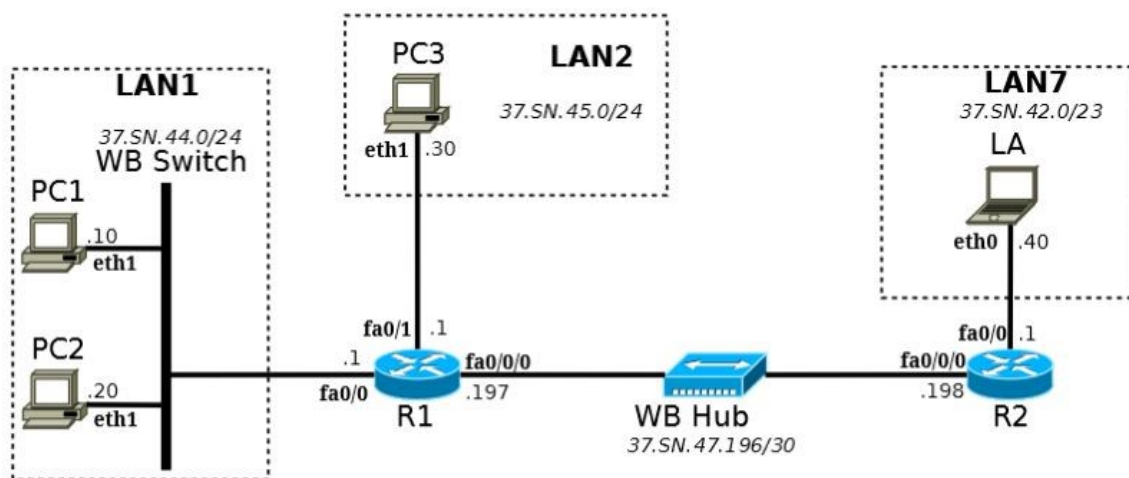
### Aim:

To manually add static entries to routers' routing table.

## Components Used:

Components	Quantities
PC	3
Laptop	1
Switch	1
Router	2
Hub	1

## Network diagram:



## Setup:

LAN1 has PC1 & PC2 connected via a switch. LAN7 has laptop. The two routers are interconnected to the Hub. PC3 is also connected to the hub. The interface fa0/1 of R1 is unplugged.

## Process:

The default gateway is set and the eth0 interface is used for SLC to manage the router.

```
team12@netlab-wb2pc1:~  
File Edit View Terminal Tabs Help  
*Jan 31 22:06:11.075: %SYS-5-CONFIG_I: Configured from console by console  
R1WB2#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
R1WB2(config)#sh ip int br  
% Invalid input detected at '^' marker.  
R1WB2(config)#^Z  
R1WB2#conf t  
*Jan 31 22:06:44.595: %SYS-5-CONFIG_I: Configured from console by c  
R1WB2#sh ip int br  
Interface IP-Address OK? Method Status Prot  
FastEthernet0/0 37.12.44.1 YES manual up up  
FastEthernet0/0.2 192.168.12.30 YES NVRAM up up  
FastEthernet0/0.3 192.168.12.130 YES NVRAM up up  
FastEthernet0/1 37.12.45.1 YES manual administratively down down  
FastEthernet0/0/0 37.12.47.197 YES manual up up  
R1WB2#
```

**Fig 4.2.1 Router configuration using SLC**

The routing table of each router is checked using **show ip route** command in privileged EXEC mode and the laptop tries pinging to PC1

```
team12@netlab-wb2pc1:~  
File Edit View Terminal Tabs Help  
R2WB2 con0 is now available  
  
Press RETURN to get started.  
  
R2WB2>  
Returning to command line  
[mgmtswitch]> logout  
Logging out...  
  
Connection to 192.168.1.250 closed by remote host.  
Connection to 192.168.1.250 closed.  
[team12@netlab-wb2pc1 ~]$ ping 37.12.42.40  
PING 37.12.42.40 (37.12.42.40) 56(84) bytes of data.  
From 37.12.44.1 icmp_seq=1 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=2 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=3 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=4 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=5 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=6 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=7 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=8 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=9 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=10 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=11 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=12 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=13 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=14 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=15 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=16 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=17 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=18 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=19 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=20 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=21 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=22 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=23 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=24 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=25 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=26 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=27 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=28 Destination Host Unreachable  
From 37.12.44.1 icmp_seq=29 Destination Host Unreachable  
  
--- 37.12.42.40 ping statistics ---  
29 packets transmitted, 0 received, 100% packet loss, time 28000ms  
[team12@netlab-wb2pc1 ~]$
```

**Fig 4.2.2 Failed ping from PC1 to laptop**

```
team12@netlab-wb2pc1:~
File Edit View Terminal Tabs Help
R1WB2(config-if)#ip address 37.12.44.1 255.255.255.0
R1WB2(config-if)#interface fa 0/1
R1WB2(config-if)#ip address 37.12.45.1 255.255.255.0
R1WB2(config-if)#interface fa 0/0/0
R1WB2(config-if)#interface fa 0/0/0
R1WB2(config-if)#ip address 37.12.47.197 255.255.255.252
R1WB2(config-if)#^Z
R1WB2#
*Jan 31 22:06:11.075: %SYS-5-CONFIG_I: Configured from console by console
R1WB2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1WB2(config)#sh ip int br

% Invalid input detected at '^' marker.

R1WB2(config)#^Z
R1WB2#conf t
*Jan 31 22:06:44.595: %SYS-5-CONFIG_I: Configured from console by c
R1WB2#sh ip int br
Interface                                IP-Address      OK? Method Status      Prot
ocol
FastEthernet0/0                          37.12.44.1      YES manual up          up
FastEthernet0/0.2                        192.168.12.30   YES NVRAM  up          up
FastEthernet0/0.3                        192.168.12.130  YES NVRAM  up          up
FastEthernet0/1                          37.12.45.1      YES manual administratively down down
FastEthernet0/0/0                        37.12.47.197    YES manual up          up
R1WB2#
```

**Fig 4.2.3 Directly connected route of R1**

```
team12@netlab-wb2pc1:~
File Edit View Terminal Tabs Help
Press RETURN to get started.

R1WB2>
Returning to command line
[mgmtswitch]> logout
Logging out...

Connection to 192.168.1.250 closed by remote host.
Connection to 192.168.1.250 closed.
[team12@netlab-wb2pc1 ~]$ sudo ifconfig eth0 192.168.2.21
[team12@netlab-wb2pc1 ~]$ ssh -l team2 192.168.1.250
ssh: connect to host 192.168.1.250 port 22: No route to host
[team12@netlab-wb2pc1 ~]$ ssh -l team2 192.168.1.250
ssh: connect to host 192.168.1.250 port 22: No route to host
[team12@netlab-wb2pc1 ~]$ sudo ifconfig eth0 192.168.2.21/24
[team12@netlab-wb2pc1 ~]$ ssh -l team2 192.168.1.250
ssh: connect to host 192.168.1.250 port 22: No route to host
[team12@netlab-wb2pc1 ~]$ sudo ifconfig eth0 192.168.1.21/24
[team12@netlab-wb2pc1 ~]$ ssh -l team2 192.168.1.250
Password:

Welcome to the SecureLinux Console Manager
Model Number: SLC16
For a list of commands, type 'help'.

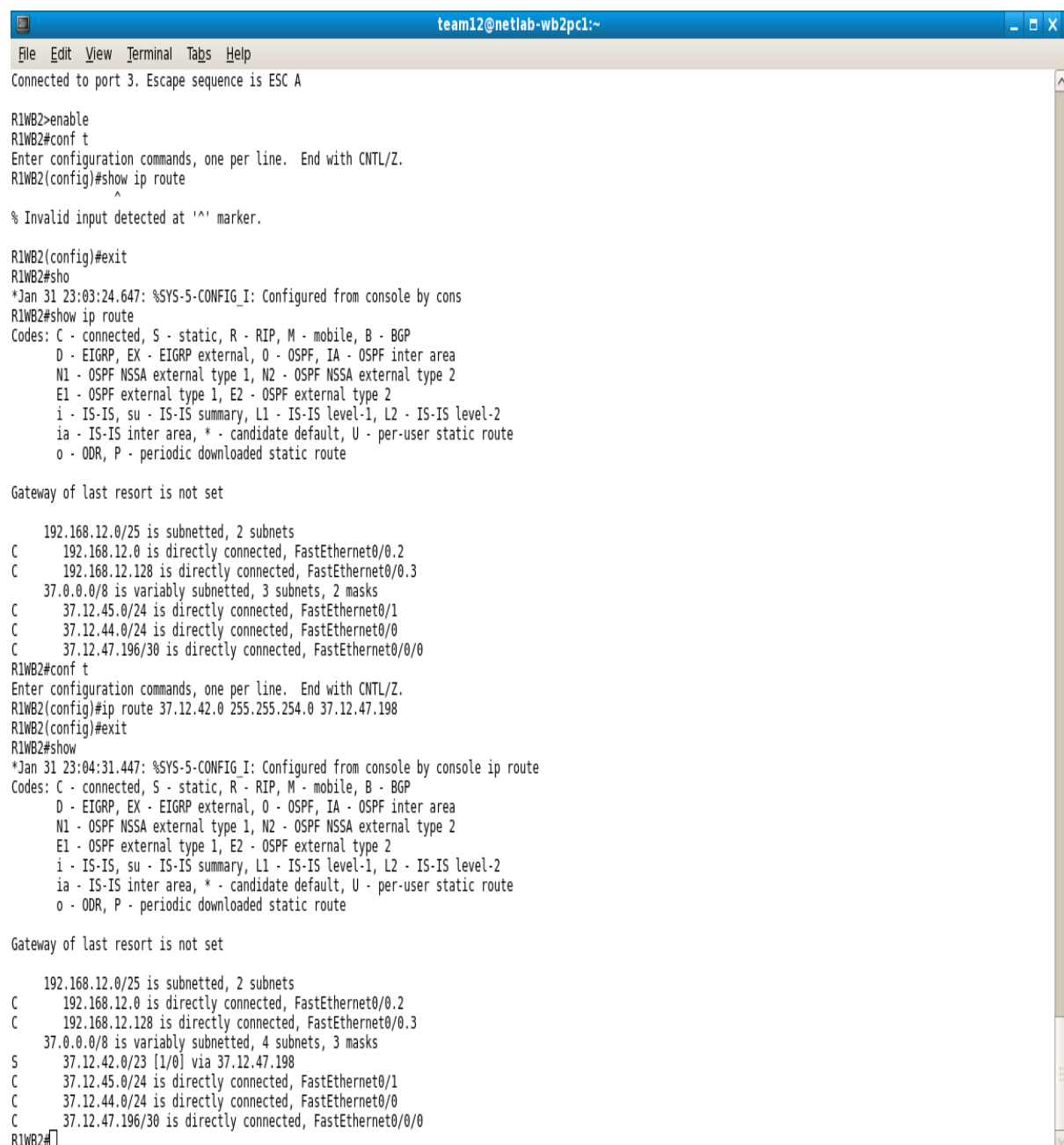
[mgmtswitch]> connect direct deviceport r2m2
Connecting to Device Port r2m2.
Connected to port 4. Escape sequence is ESC A

R2WB2#sh ip int br
Interface                                IP-Address      OK? Method Status      Protocol
FastEthernet0/0                          37.12.42.1      YES manual up          up
FastEthernet0/1                          unassigned      YES NVRAM  administratively down down
FastEthernet0/0/0                        37.12.47.198    YES manual up          up
R2WB2#^Z
R2WB2#^Z
R2WB2#exit
```

**Fig 4.2.4 Directly connected route of R2**

The above two figures show the directly connected routes of R1 and R2. Now, the static route is added by using the following command in global configuration mode

**ip route <destination network> <netmask> <next hop address>**



```
team12@netlab-wb2pc1:~
File Edit View Terminal Tabs Help
Connected to port 3. Escape sequence is ESC A

R1WB2>enable
R1WB2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1WB2(config)#show ip route
^
% Invalid input detected at '^' marker.

R1WB2(config)#exit
R1WB2#sho
*Jan 31 23:03:24.647: %SYS-5-CONFIG_I: Configured from console by cons
R1WB2#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default, U - per-user static route
        o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

    192.168.12.0/25 is subnetted, 2 subnets
C       192.168.12.0 is directly connected, FastEthernet0/0.2
C       192.168.12.128 is directly connected, FastEthernet0/0.3
    37.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       37.12.45.0/24 is directly connected, FastEthernet0/1
C       37.12.44.0/24 is directly connected, FastEthernet0/0
C       37.12.47.196/30 is directly connected, FastEthernet0/0/0
R1WB2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1WB2(config)#ip route 37.12.42.0 255.255.254.0 37.12.47.198
R1WB2(config)#exit
R1WB2#sho
*Jan 31 23:04:31.447: %SYS-5-CONFIG_I: Configured from console by console ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default, U - per-user static route
        o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

    192.168.12.0/25 is subnetted, 2 subnets
C       192.168.12.0 is directly connected, FastEthernet0/0.2
C       192.168.12.128 is directly connected, FastEthernet0/0.3
    37.0.0.0/8 is variably subnetted, 4 subnets, 3 masks
C       37.12.42.0/23 [1/0] via 37.12.47.198
C       37.12.45.0/24 is directly connected, FastEthernet0/1
C       37.12.44.0/24 is directly connected, FastEthernet0/0
C       37.12.47.196/30 is directly connected, FastEthernet0/0/0
R1WB2#
```

**Fig 4.2.5 Static route configuration for R1**

```
team12@netlab-wb2pc1:~
File Edit View Terminal Tabs Help
R2WB2(config)#exit
R2WB2#show ip route
*Jan 31 22:29:25.377: %SYS-5-CONFIG I: Configured from console by console
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        I - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default, U - per-user static route
        o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

37.0.0.0/8 is variably subnetted, 3 subnets, 3 masks
C       37.12.42.0/23 is directly connected, FastEthernet0/0
S       37.12.45.0/24 [1/0] via 37.12.47.197
C       37.12.47.196/30 is directly connected, FastEthernet0/0/0
R2WB2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2WB2(config)#ip route 37.12.44.0 255.255.255.0 37.12.47.197
R2WB2(config)#exit
R2WB2#show ip route
*Jan 31 22:30:15.841: %SYS-5-CONFIG I: Configured from console by console
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        I - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default, U - per-user static route
        o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

37.0.0.0/8 is variably subnetted, 4 subnets, 3 masks
C       37.12.42.0/23 is directly connected, FastEthernet0/0
S       37.12.45.0/24 [1/0] via 37.12.47.197
S       37.12.44.0/24 [1/0] via 37.12.47.197
C       37.12.47.196/30 is directly connected, FastEthernet0/0/0
R2WB2#exit
```

**Fig 4.2.6 Static route configuration for R2**

Now the **ping** command is used to verify the connectivity between LAN1 and LAN7. Then, **tracert** is also used to study the path followed.

```
team12@netlab-wb2pc1:~
File Edit View Terminal Tabs Help
+ host The host to traceroute to
+ packetlen Specify an alternate probe packet length (default is 40).
+ Useless for TCP SYN

[team12@netlab-wb2pc1 ~]$ ping 37.12.42.40
PING 37.12.42.40 (37.12.42.40) 56(84) bytes of data.
64 bytes from 37.12.42.40: icmp_seq=1 ttl=62 time=0.738 ms
64 bytes from 37.12.42.40: icmp_seq=2 ttl=62 time=0.636 ms
64 bytes from 37.12.42.40: icmp_seq=3 ttl=62 time=0.625 ms
64 bytes from 37.12.42.40: icmp_seq=4 ttl=62 time=0.632 ms
64 bytes from 37.12.42.40: icmp_seq=5 ttl=62 time=0.655 ms
64 bytes from 37.12.42.40: icmp_seq=6 ttl=62 time=0.712 ms
64 bytes from 37.12.42.40: icmp_seq=7 ttl=62 time=0.610 ms
64 bytes from 37.12.42.40: icmp_seq=8 ttl=62 time=0.638 ms
64 bytes from 37.12.42.40: icmp_seq=9 ttl=62 time=0.647 ms
64 bytes from 37.12.42.40: icmp_seq=10 ttl=62 time=0.683 ms
64 bytes from 37.12.42.40: icmp_seq=11 ttl=62 time=0.648 ms
64 bytes from 37.12.42.40: icmp_seq=12 ttl=62 time=0.639 ms
64 bytes from 37.12.42.40: icmp_seq=13 ttl=62 time=0.624 ms
64 bytes from 37.12.42.40: icmp_seq=14 ttl=62 time=0.707 ms
64 bytes from 37.12.42.40: icmp_seq=15 ttl=62 time=0.639 ms
64 bytes from 37.12.42.40: icmp_seq=16 ttl=62 time=0.637 ms
64 bytes from 37.12.42.40: icmp_seq=17 ttl=62 time=0.638 ms
64 bytes from 37.12.42.40: icmp_seq=18 ttl=62 time=0.643 ms
64 bytes from 37.12.42.40: icmp_seq=19 ttl=62 time=0.656 ms
64 bytes from 37.12.42.40: icmp_seq=20 ttl=62 time=0.668 ms
64 bytes from 37.12.42.40: icmp_seq=21 ttl=62 time=0.691 ms
64 bytes from 37.12.42.40: icmp_seq=22 ttl=62 time=0.641 ms
64 bytes from 37.12.42.40: icmp_seq=23 ttl=62 time=0.615 ms
64 bytes from 37.12.42.40: icmp_seq=24 ttl=62 time=0.632 ms
64 bytes from 37.12.42.40: icmp_seq=25 ttl=62 time=0.693 ms
64 bytes from 37.12.42.40: icmp_seq=26 ttl=62 time=0.639 ms
64 bytes from 37.12.42.40: icmp_seq=27 ttl=62 time=0.633 ms
64 bytes from 37.12.42.40: icmp_seq=28 ttl=62 time=0.630 ms
64 bytes from 37.12.42.40: icmp_seq=29 ttl=62 time=0.690 ms
64 bytes from 37.12.42.40: icmp_seq=30 ttl=62 time=0.617 ms
64 bytes from 37.12.42.40: icmp_seq=31 ttl=62 time=0.622 ms
64 bytes from 37.12.42.40: icmp_seq=32 ttl=62 time=0.639 ms
64 bytes from 37.12.42.40: icmp_seq=33 ttl=62 time=0.594 ms
64 bytes from 37.12.42.40: icmp_seq=34 ttl=62 time=0.640 ms
64 bytes from 37.12.42.40: icmp_seq=35 ttl=62 time=0.642 ms
64 bytes from 37.12.42.40: icmp_seq=36 ttl=62 time=0.628 ms
64 bytes from 37.12.42.40: icmp_seq=37 ttl=62 time=0.640 ms
64 bytes from 37.12.42.40: icmp_seq=38 ttl=62 time=0.644 ms
64 bytes from 37.12.42.40: icmp_seq=39 ttl=62 time=0.636 ms
64 bytes from 37.12.42.40: icmp_seq=40 ttl=62 time=0.682 ms
64 bytes from 37.12.42.40: icmp_seq=41 ttl=62 time=0.624 ms
64 bytes from 37.12.42.40: icmp_seq=42 ttl=62 time=0.632 ms
64 bytes from 37.12.42.40: icmp_seq=43 ttl=62 time=0.635 ms
64 bytes from 37.12.42.40: icmp_seq=44 ttl=62 time=0.672 ms
64 bytes from 37.12.42.40: icmp_seq=45 ttl=62 time=0.637 ms
64 bytes from 37.12.42.40: icmp_seq=46 ttl=62 time=0.609 ms
64 bytes from 37.12.42.40: icmp_seq=47 ttl=62 time=0.653 ms
64 bytes from 37.12.42.40: icmp_seq=48 ttl=62 time=0.665 ms
64 bytes from 37.12.42.40: icmp_seq=49 ttl=62 time=0.648 ms
64 bytes from 37.12.42.40: icmp_seq=50 ttl=62 time=0.618 ms
```

**Fig 4.2.7 Successful ping from PC1 to laptop**

```
team12@netlab-wb2pc1:~  
File Edit View Terminal Tabs Help  
is 53)  
-P prot --protocol=prot Use raw packet of protocol prot for tracerouting  
-V --version Print version info and exit  
--help Read this help and exit  
  
Arguments:  
+ host The host to traceroute to  
packetlen Specify an alternate probe packet length (default is 40).  
Useless for TCP SYN  
[team12@netlab-wb2pc1 ~]$ tracert 37.12.42.40  
The specified type of tracerouting is allowed for superuser only  
[team12@netlab-wb2pc1 ~]$ sudo tracert 37.12.42.40  
Password:  
Sorry, user team12 is not allowed to execute '/bin/tracert 37.12.42.40' as root  
on netlab-wb2pc1.  
[team12@netlab-wb2pc1 ~]$ sudo traceroute 37.12.42.40  
Password:  
[team12@netlab-wb2pc1 ~]$ sudo traceroute 37.12.42.40  
Password:  
traceroute to 37.12.42.40 (37.12.42.40), 30 hops max, 40 byte packets  
1 (37.12.44.1) 1.015 ms 1.539 ms 1.864 ms  
2 (37.12.47.198) 1.450 ms 1.686 ms 1.946 ms  
3 (37.12.42.40) 1.024 ms 1.016 ms 1.005 ms  
[team12@netlab-wb2pc1 ~]$
```

**Fig 4.2.8 Traceroute**

## 4.3 Configure DHCP server in Linux

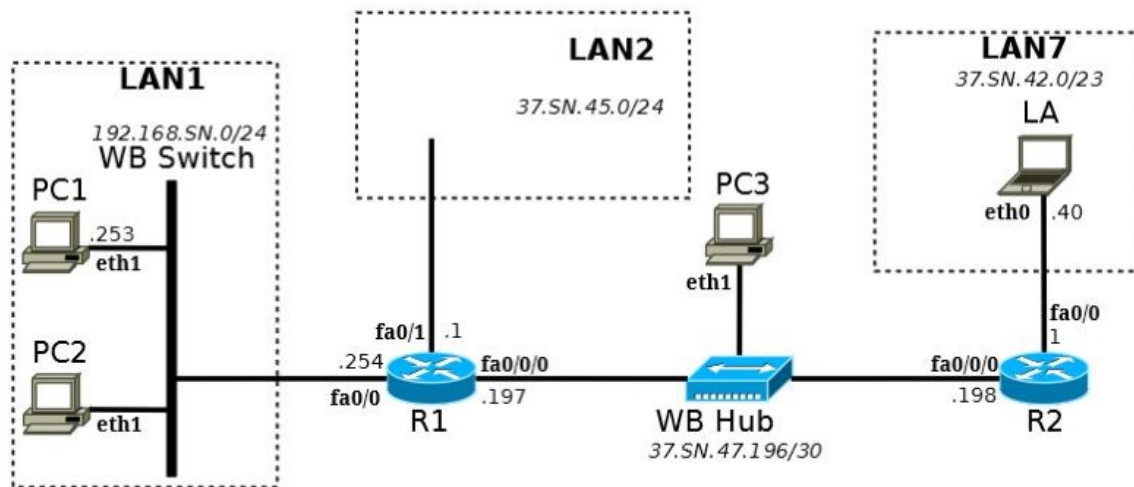
### Aim:

To configure Linux machine as a DHCP server.

### Components Used:

Components	Quantities
PC	3
Laptop	1
Switch	1
Router	2
Hub	1

## Network diagram:



## Setup:

LAN1 has PC1 & PC2 connected via a switch. LAN7 has laptop. The two routers are interconnected to the Hub. PC3 is also connected to the hub. The interface fa0/1 of R1 is unplugged.

## Process:

The IP address of fa0/0 of R1 to **192.168.SN.254/24**. The DHCP server IP address is set to **192.168.SN.253/24**. In the Linux, dhcpd daemon is configured and the IP address in the range of 192.168.SN.1 to 192.168.SN.250 with netmask 255.255.255.0 is got.

The DHCP server on PC1 can be started using the command **sudo /etc/init.d/dhcpd start** and wireshark is ran on PC1 and laptop



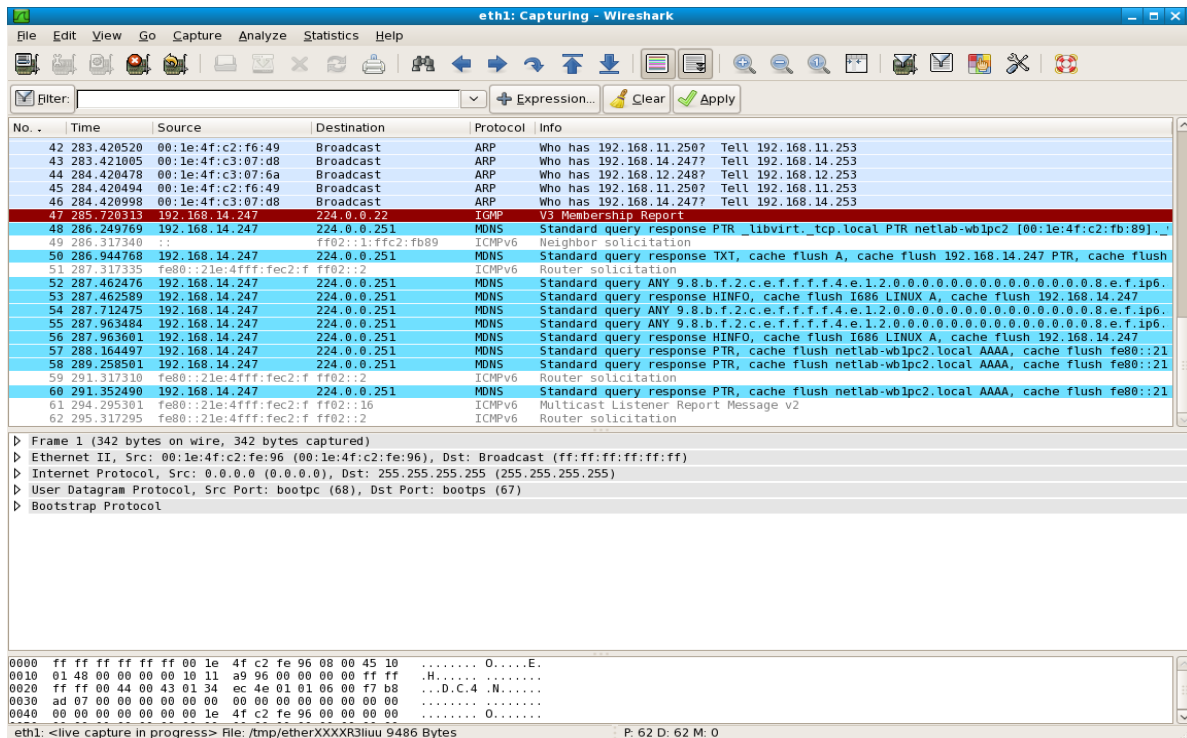


Fig 4.3.1 Wireshark in PC1

The DHCP client is ran on PC2 using the command **sudo dhclient eth1** and the output is observed. To stop the DHCP client, a DHCPRELEASE message must be sent using **sudo dhclient -r eth1**

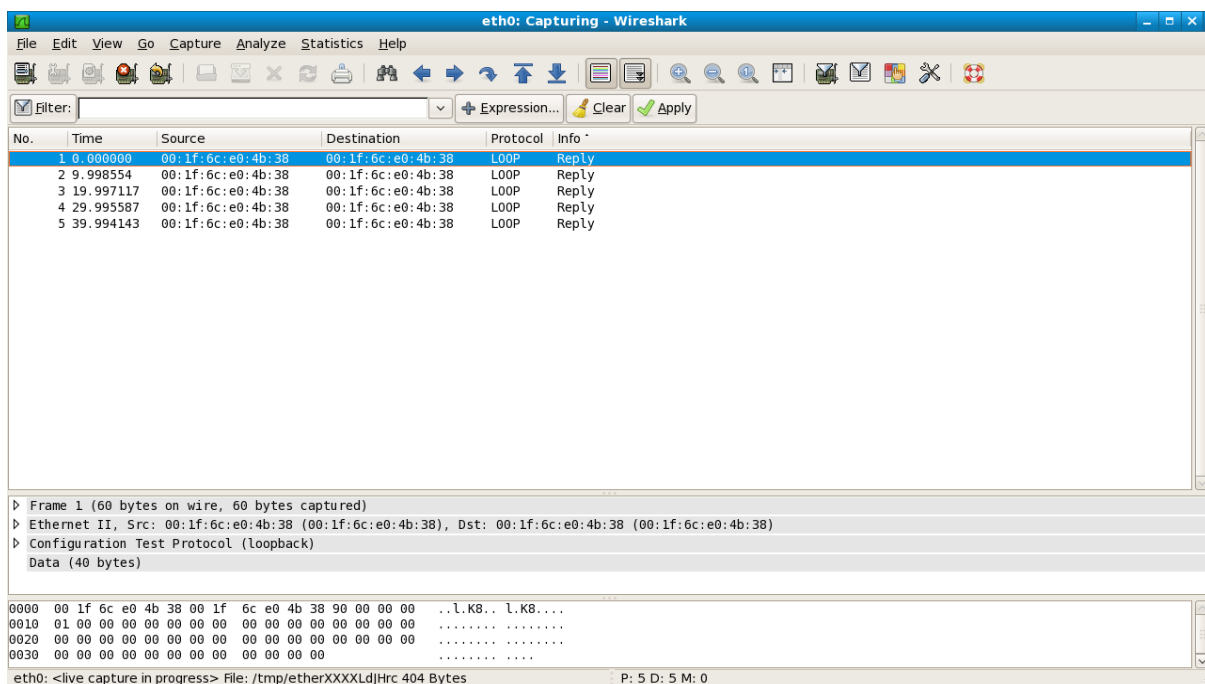
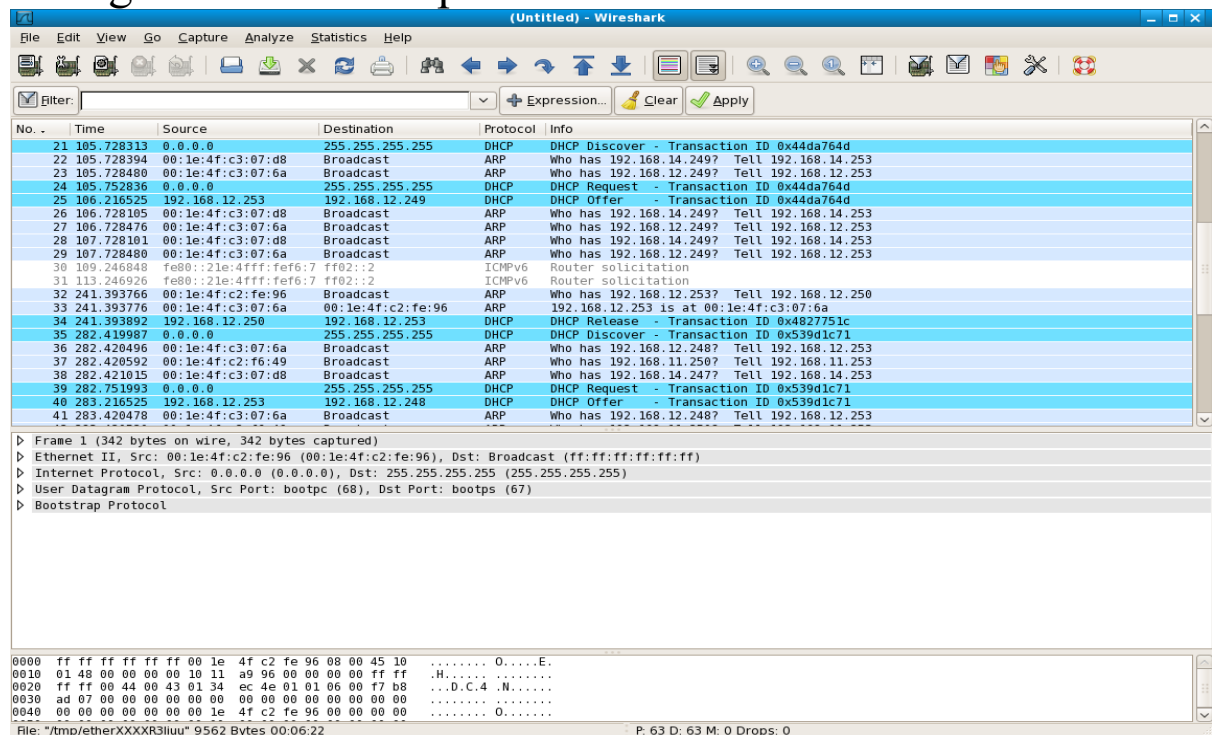
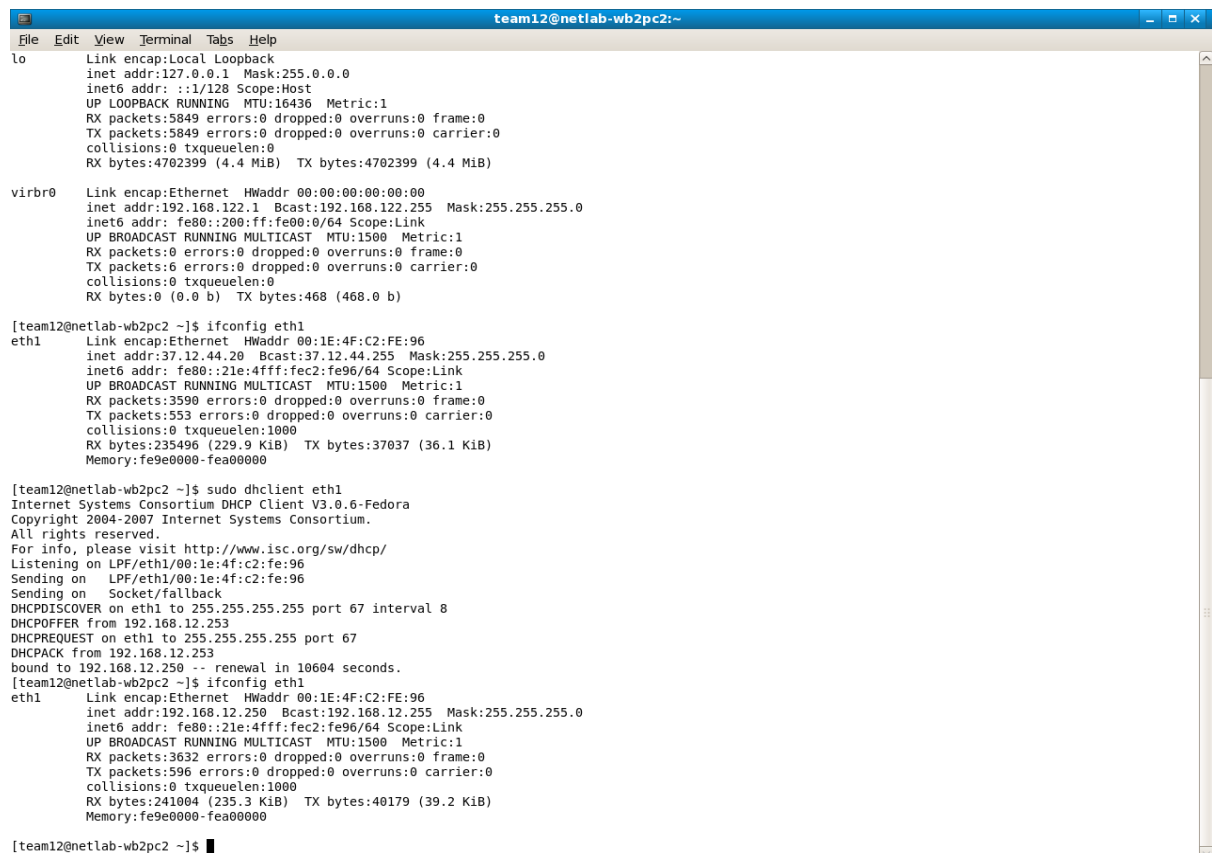


Fig 4.3.2 Wireshark in Laptop

The DHCP traffic captured by Wireshark and the configuration file is reported.



**Fig 4.3.3 DHCP traffic in Laptop**



**Fig 4.3.4 Configuration file**

## **4.4 Configure NAT**

### **4.4.1 Provide outbound connections**

#### **Aim:**

To configure outbound NAT on R1 so that source IP address is changed one of the IP address in a predefined pool.

#### **Process:**

Ping from PC2 to laptop is tried and an error message is got. The following commands are executed,

**access-list 1 permit 192.168.SN.0 0.0.0.255**

**ip nat pool myPool 37.SN.44.1 37.SN.44.1 prefix-length 24**

The above commands are executed in global configuration mode. Then its switched to interface configuration mode and the commands below are done.

**interface fa0/0**

**ip nat inside**

**interface fa0/0/0**

**ip nat outside**

Then its again changed to global configuration mode and NAT is enabled.

**exit**

**ip nat inside source list 1 pool myPool overload**

Laptop is pinged from PC2 and the traffic is captured using Wireshark on both PC2 and PC3.

(Untitled) - Wireshark

File Edit View Go Capture Analyze Statistics Help

Filter: Expression... Clear Apply

No.	Time	Source	Destination	Protocol	Info
1	0.000000	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
2	0.000739	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
3	0.999983	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
4	1.000704	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
5	1.999996	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
6	2.000719	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
7	3.000004	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
8	3.000764	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
9	3.999987	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
10	4.000737	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
11	4.999986	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
12	5.000749	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
13	5.999983	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
14	6.000721	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
15	6.999987	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
16	7.000737	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply

Frame 3 (98 bytes on wire (98 bytes captured) on interface 0: Ethernet II, Src: 00:1e:4f:c2:fe:96 (00:1e:4f:c2:fe:96), Dst: 00:1f:ca:0e:fb:60 (00:1f:ca:0e:fb:60) Internet Protocol, Src: 192.168.14.248 (192.168.14.248), Dst: 37.12.42.40 (37.12.42.40) Internet Control Message Protocol

0000 00 1f ca 0e fb 60 00 1e 4f c2 fe 96 08 00 45 00 ..... 0....E.  
0010 00 54 00 00 40 00 00 01 1b d5 c0 a8 0e f8 25 0c .T..@.?. ....%.  
0020 2a 28 08 00 05 7d 02 1c 00 1d a2 22 91 58 c3 cb \*(...). ....\*X..  
0030 0e 00 08 09 0a 0b 0c 0d 0e 0f 10 11 12 13 14 15 .....  
File: /tmp/etherXXXXTGssLa\* 96 KB 00:06:32 P: 860 D: 860 M: 0 Drops: 0

Fig 4.4.1.1 Wireshark traffic captured in PC2

(Untitled) - Wireshark

File Edit View Go Capture Analyze Statistics Help

Filter: Expression... Clear Apply

No.	Time	Source	Destination	Protocol	Info
1	0.000000	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
2	0.000346	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
3	0.999862	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
4	1.000362	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
5	2.000021	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
6	2.000318	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
7	2.999852	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
8	3.000345	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
9	4.000016	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
10	4.000331	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
11	4.999814	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
12	5.000282	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
13	5.999978	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
14	6.000292	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
15	6.999798	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
16	7.000296	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
17	7.701182	00:1d:45:47:28:9f	00:1d:45:47:28:9f	CDP/VTP/DTP/PAGP/UD CDP	Device ID: R2WB2 Port ID: FastEthernet0/0/0
18	7.999825	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
19	8.000258	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
20	8.999759	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
21	9.000244	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
22	9.999951	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
23	10.000242	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
24	10.999737	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
25	11.000228	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
26	11.999709	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
27	12.000220	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
28	12.999786	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
29	13.000223	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
30	13.999885	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
31	14.000192	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
32	14.999752	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
33	15.000178	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
34	15.999874	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
35	16.000182	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
36	16.999725	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
37	17.000179	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply
38	17.999841	192.168.14.248	37.12.42.40	ICMP	Echo (ping) request
39	18.000124	37.12.42.40	192.168.14.248	ICMP	Echo (ping) reply

0000 00 1d 45 47 28 9f 00 1a 6c 70 56 3b 08 00 45 00 ..EG(... lpv;...E.  
0010 00 54 00 00 40 00 00 3f 01 1c d5 c0 a8 0e f8 25 0c .T..@.?. ....%.  
0020 2a 28 08 00 05 7d 02 1c 00 1d a2 22 91 58 c3 cb \*(...). ....\*X..  
File: /tmp/etherXXXXXhfmz6\* 96 KB 00:06:40 P: 853 D: 853 M: 0 Drops: 0

Fig 4.4.1.2 Wireshark traffic captured in PC3

In the privileged EXEC mode, the current status of the NAT table is checked using **show ip nat translations [verbose]** and the entire content of the current NAT table is cleared using **clear ip nat translation \***

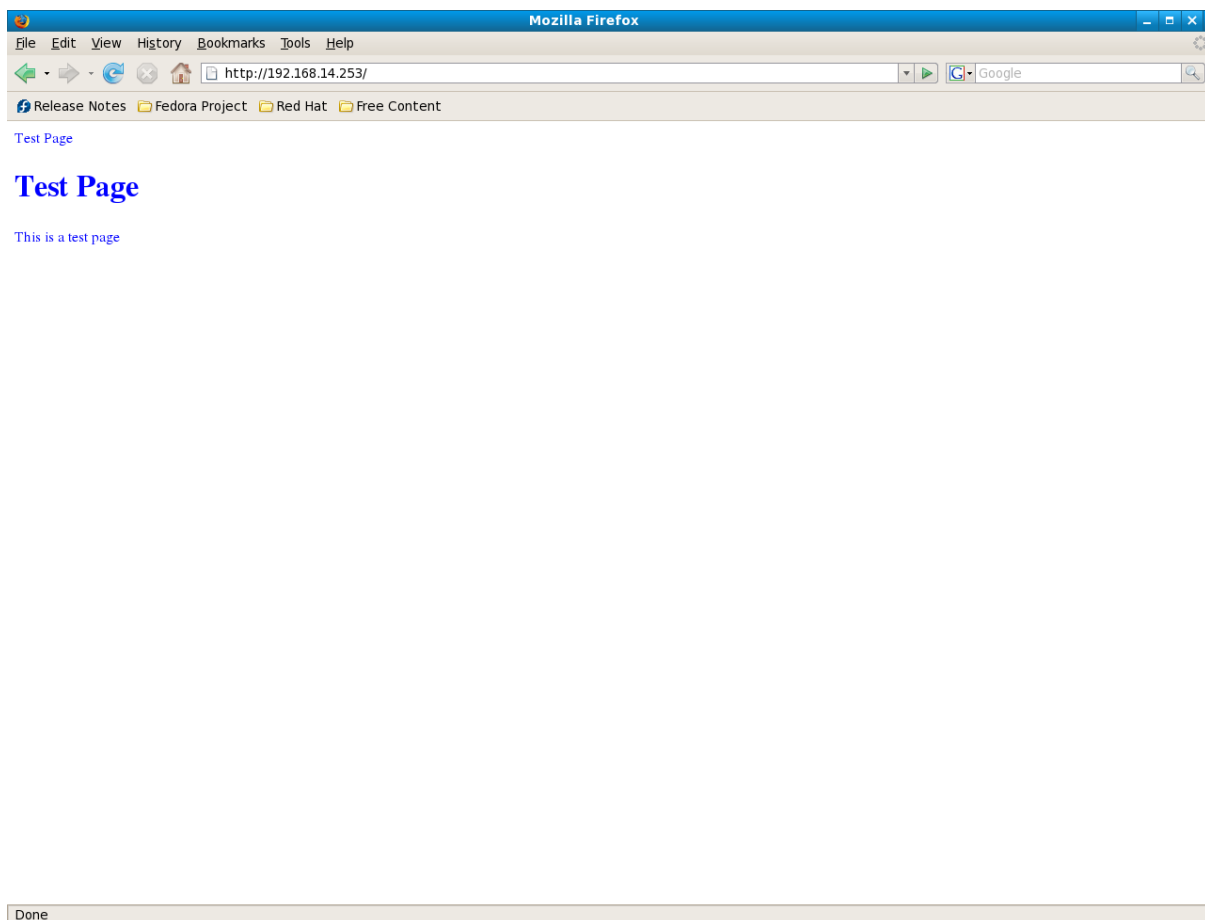
## 4.4.2 Provide inbound NAT

### Aim:

To configure port forwarding

### Process:

The webserver is started on PC1 using the command **sudo /etc/init.d/httpd start** and from PC2 webpage with IP address <http://192.168.SN.253> is opened

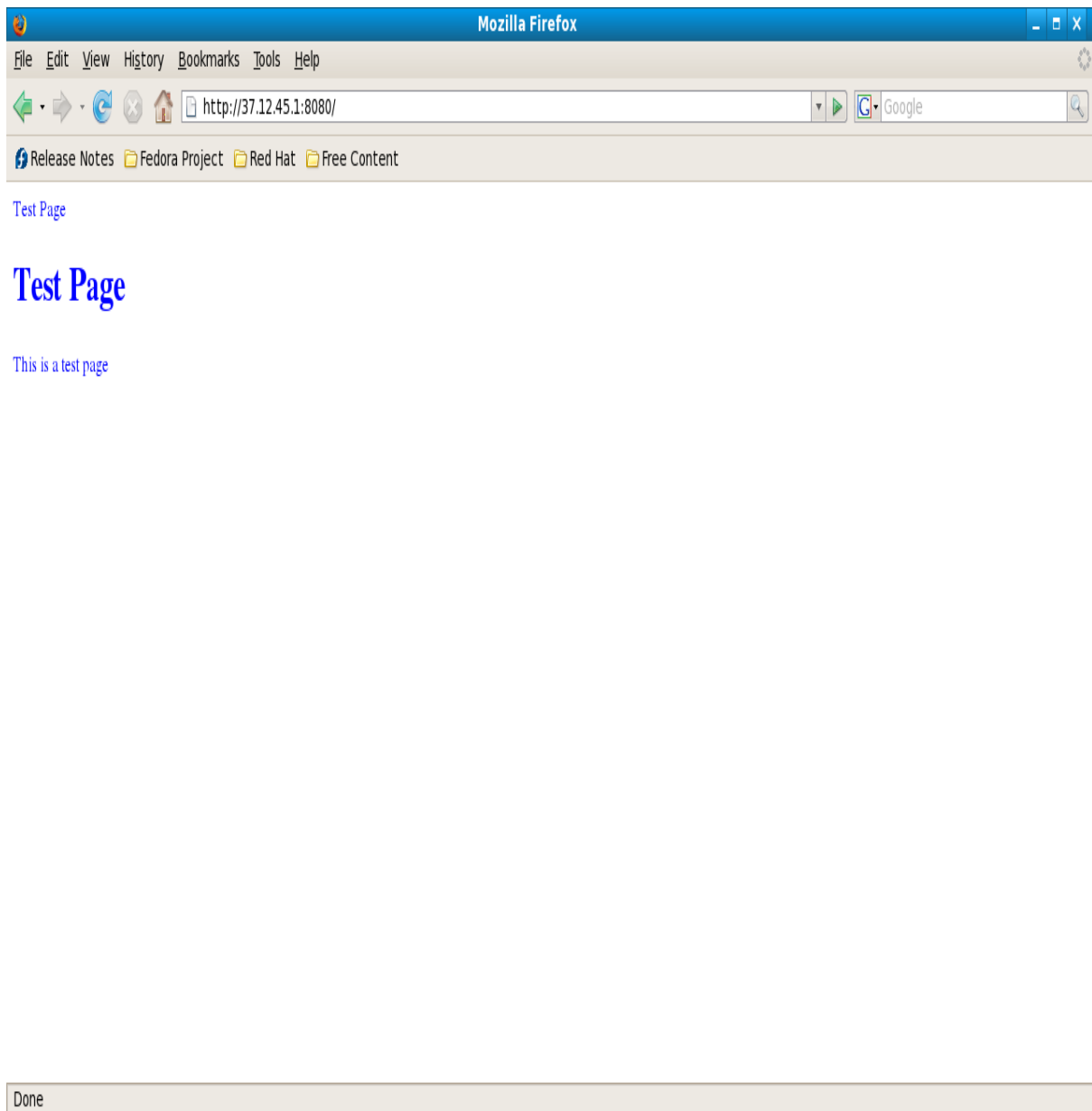


**Fig 4.4.2.1 Webpage in PC2**

But the webpage cannot be opened from Laptop since there is no way for using service hosted on internal server PC1. This problem is solved using port forwarding as below

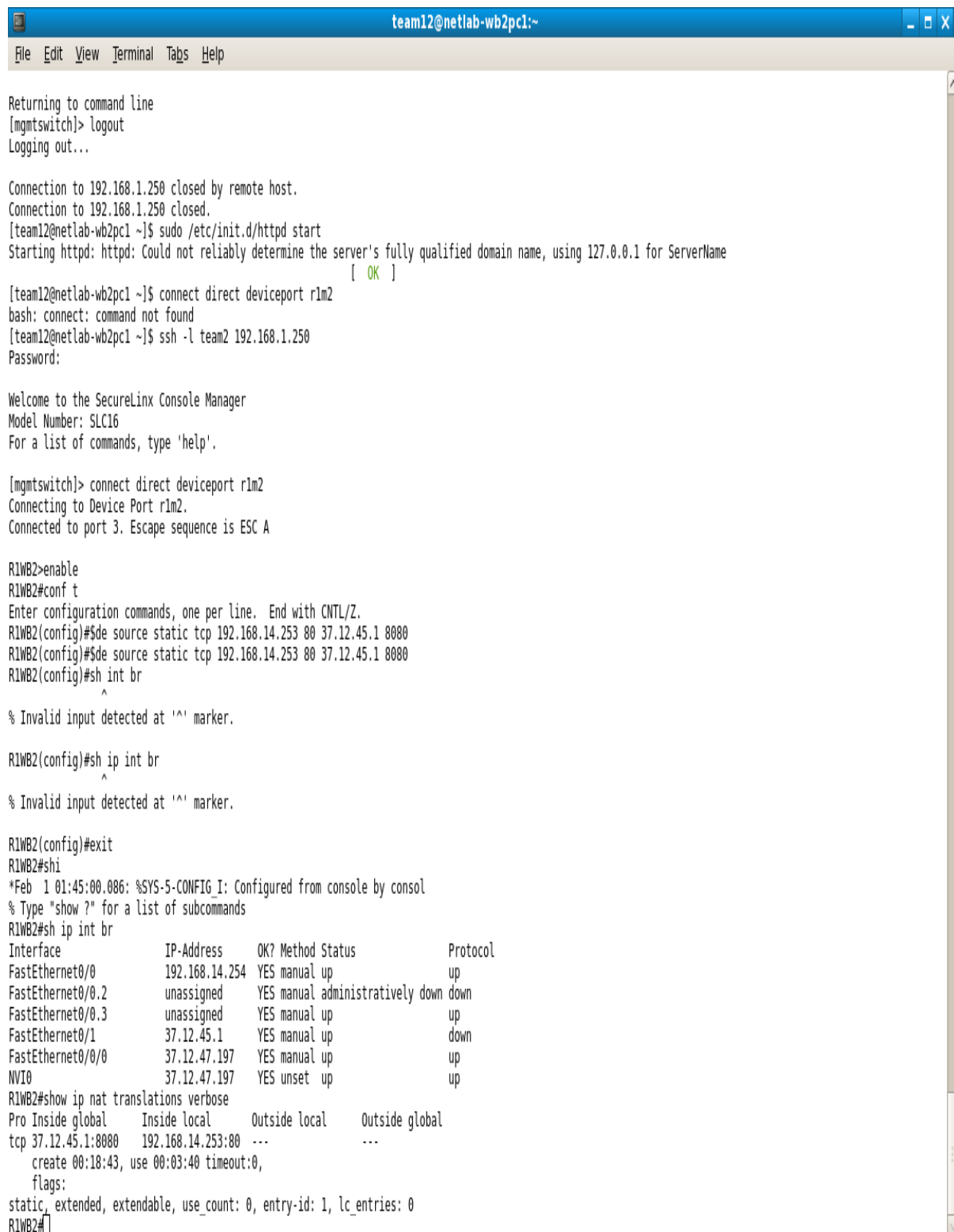
**ip nat inside source static tcp 192.168.SN.253 80 37.SN.45.1 8080**

Now the webpage hosted on PC1 can be opened in Laptop using the url <http://37.SN.45.1:8080>



**Fig 4.4.2.2 Webpage opened in Laptop**

## Then the status of NAT table on R1 is reported



```
team12@netlab-wb2pc1:~  
File Edit View Terminal Tabs Help  
  
Returning to command line  
[mgmtswitch]> logout  
Logging out...  
  
Connection to 192.168.1.250 closed by remote host.  
Connection to 192.168.1.250 closed.  
[team12@netlab-wb2pc1 ~]$ sudo /etc/init.d/httpd start  
Starting httpd: httpd: Could not reliably determine the server's fully qualified domain name, using 127.0.0.1 for ServerName  
[ OK ]  
[team12@netlab-wb2pc1 ~]$ connect direct deviceport r1m2  
bash: connect: command not found  
[team12@netlab-wb2pc1 ~]$ ssh -l team2 192.168.1.250  
Password:  
  
Welcome to the SecureLinux Console Manager  
Model Number: SLC16  
For a list of commands, type 'help'.  
  
[mgmtswitch]> connect direct deviceport r1m2  
Connecting to Device Port r1m2.  
Connected to port 3. Escape sequence is ESC A  
  
R1WB2>enable  
R1WB2#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
R1WB2(config)#$de source static tcp 192.168.14.253 80 37.12.45.1 8080  
R1WB2(config)#$de source static tcp 192.168.14.253 80 37.12.45.1 8080  
R1WB2(config)#sh int br  
^  
% Invalid input detected at '^' marker.  
  
R1WB2(config)#sh ip int br  
^  
% Invalid input detected at '^' marker.  
  
R1WB2(config)#exit  
R1WB2#shi  
*Feb 1 01:45:00.086: %SYS-5-CONFIG I: Configured from console by console  
% Type "show ?" for a list of subcommands  
R1WB2#sh ip int br  
Interface IP-Address OK? Method Status Protocol  
FastEthernet0/0 192.168.14.254 YES manual up up  
FastEthernet0/0.2 unassigned YES manual administratively down down  
FastEthernet0/0.3 unassigned YES manual up up  
FastEthernet0/1 37.12.45.1 YES manual up down  
FastEthernet0/0/0 37.12.47.197 YES manual up up  
NVI0 37.12.47.197 YES unset up up  
R1WB2#show ip nat translations verbose  
Pro Inside global Inside local Outside local Outside global  
tcp 37.12.45.1:8080 192.168.14.253:80 --- ---  
create 00:18:43, use 00:03:40 timeout:0,  
flags:  
static, extended, extendable, use_count: 0, entry-id: 1, lc_entries: 0  
R1WB2#
```

**Fig 4.4.2.3 R1 NAT table status**

The output of **show run** which is validated in privileged EXEC mode is done for both the routers.

```
team12@netlab-wb2pc1:~
File Edit View Terminal Tabs Help
R1WB2(config)#sde source static tcp 192.168.14.253 80 37.12.45.1 8080
R1WB2(config)#sde source static tcp 192.168.14.253 80 37.12.45.1 8080
R1WB2(config)#sh int br
% Invalid input detected at '^' marker.
R1WB2(config)#sh ip int br
% Invalid input detected at '^' marker.
R1WB2(config)#exit
R1WB2#sh
*Feb 1 01:45:00.086: %SYS-5-CONFIG_I: Configured from console by console
% Type "show ?" for a list of subcommands
R1WB2#sh ip int br
Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 192.168.14.254 YES manual up up
FastEthernet0/0.2 unassigned YES manual administratively down down
FastEthernet0/0.3 unassigned YES manual up up
FastEthernet0/1 37.12.45.1 YES manual up down
FastEthernet0/0/0 37.12.47.197 YES manual up up
NVI0 37.12.47.197 YES unset up up
R1WB2#show ip nat translations verbose
Pro Inside global Inside local Outside local Outside global
tcp 37.12.45.1:8080 192.168.14.253:80 ---
create 00:18:43, use 00:03:40 timeout:0,
flags:
static, extended, extendable, use_count: 0, entry-id: 1, lc_entries: 0
R1WB2#show run
Building configuration...

Current configuration : 1561 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname R1WB2
!
boot-start-marker
boot system flash:c2800nm-adventerprisek9-mz.124-24.T8.bin
boot-end-marker
!
logging message-counter syslog
!
no aaa new-model
!
!
!
dot11 syslog
ip source-route
!
--More--
```

**Fig 4.4.2.4 Output of show run in R1**

```
team12@netlab-wb2pc1:~
File Edit View Terminal Tabs Help

R1WB2 con0 is now available

Press RETURN to get started.

R1WB2>
Returning to command line
[mgmtswitch]> connect direct deviceport r2m2
Connecting to Device Port r2m2.
Connected to port 4. Escape sequence is ESC A

R2WB2>enable
R2WB2#show run
Building configuration...

Current configuration : 1034 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname R2WB2
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
!
!
!
ip cef
!
!
ip auth-proxy max-nodata-conns 3
--More--
```

**Fig 4.4.2.5 Output of show run in R2**