

**LAB 5: DHCP and NAT in Mininet topology****Objective:**

To emulate DHCP and NAT function in MiniNet with the help of a router.

- Configure a router.
- Start a DHCP server at a router.
- Use IPtables to make a router to own NAT ability.

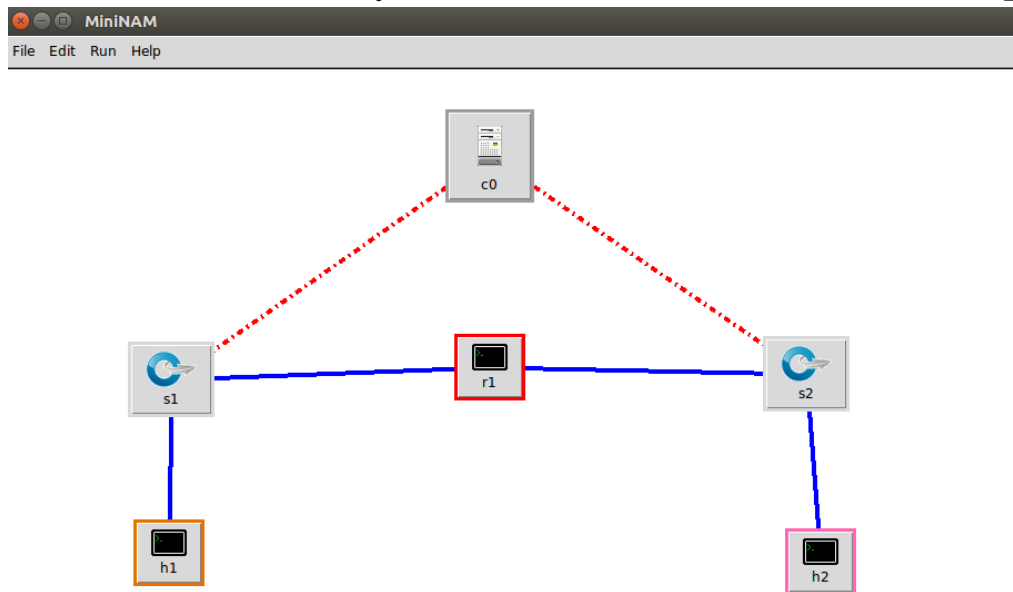
First, we will add IP address to the router interfaces and then start the DHCP server at the router which will assign the IP address to the router and finally add NAT ability to the topology.

**Steps:**

**Note:** Before starting with the lab, you need to install the DHCP server on the ubuntu machine. Use the following command to do the same:

***sudo apt-get install isc-dhcp-server***

**Step 1:** First create a topology with two hosts, two switches and a router using the code provided in the last lab. Make sure you add the controller as well so that you don't need to add flows manually in switches. **(Paste screenshot of the topology)**



**Step 2:** Add IP addresses to the router interfaces as follows:

The interface towards S1: 192.168.10.1/24

The interface towards S2: 10.0.0.1/24

Do not add IP address to the hosts since we will be using DHCP to do the same.

Also, remove any IP addresses allocated dynamically and then add above IP addresses.

**Step 3:** Enable IP forwarding on the router.

**Step 4:** Start the DHCP server on the router.

Make sure you have installed the DHCP server on Ubuntu machine using the steps given above before moving forward with the lab. Once the DHCP server is installed use separate terminal go to the **dhcpd.conf** file present in the **</etc/dhcp/>** directory. Then edit the file using any **<gedit>** and paste the following commands in the file and save the file.

```
subnet 192.168.10.0 netmask 255.255.255.0 {  
    range 192.168.10.2 192.168.10.254;  
    option broadcast-address 192.168.10.255;  
    option domain-name-servers 8.8.8.8;  
    option routers 192.168.10.1;  
    INTERFACES="r1-eth0";  
}  
subnet 10.0.0.0 netmask 255.255.255.0 {  
    range 10.0.0.2 10.0.0.253;  
    option routers 10.0.0.1;  
    option broadcast-address 10.0.0.255;  
    option domain-name-servers 8.8.8.8;  
    INTERFACES="r1-eth1";  
}
```

In this way, we can edit the range for the IP addresses to be allocated for both the hosts. Please make sure you enter the commands properly without missing any semicolon or indentations.

Once this is done, in the router xterm start the DHCP server using the following steps:

```
service isc-dhcp-server restart &  
dhcpd -f -4 -cf /etc/dhcp/dhcpd.conf &
```

```
root@martand-VirtualBox:~/MiniNAM# dhcpd -f -4 -cf /etc/dhcp/dhcpd.conf &
[1] 7287
root@martand-VirtualBox:~/MiniNAM# Internet Systems Consortium DHCP Server 4.3.3
Copyright 2004-2015 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/
Config file: /etc/dhcp/dhcpd.conf
Database file: /var/lib/dhcp/dhcpd.leases
PID file: /var/run/dhcpd.pid
Wrote 1 leases to leases file.
Listening on LPF/r1-eth1/b6:a6:58:0e:d1:5b/10.0.0.0/24
Sending on   LPF/r1-eth1/b6:a6:58:0e:d1:5b/10.0.0.0/24
Listening on LPF/r1-eth0/6e:a5:b2:6c:58:e6/192.168.10.0/24
Sending on   LPF/r1-eth0/6e:a5:b2:6c:58:e6/192.168.10.0/24
Sending on   Socket/fallback/fallback-net
```

You will see above window once the server gets started.

**Step 5:** Once DHCP server is up and running, open hosts h1 & h2 xterm and remove any IP addresses assigned to them. Then, start Wireshark through the respective host's xterm. Start packet sniffing on the <h1-eth0> and <h2-eth0>. Then on the Mininet CLI use DHCP to get IP addresses on the respective ports.

```
mininet> h1 dhclient h1-eth0
mininet> h2 dhclient h2-eth0
```

Now, check the IP address assigned to the respective ports. (**paste the screenshot of the IP address assigned to both the hosts**)

Now, check the Wireshark window of both the hosts and **paste the screenshot of the DORA messages from both the hosts.**

Now, ping from H1 to H2 using **4 count command**. Now check the Wireshark window of both the hosts, both window will have same source IP address and same destination address. **Paste the screenshot of both host's window.** Close Wireshark. This concludes the DHCP configuration of the hosts. Now, do not close the topology since we are going to implement NAT in the same topology.

**Step 6:** For NAT, use the following command in the router's xterm to enable NAT on the router.

```
root@martand-VirtualBox:/MiniNAM# iptables -t nat -A POSTROUTING -o r1-eth0 -s 10.0.0.0/24 -j MASQUERADE
root@martand-VirtualBox:/MiniNAM# iptables -t nat -A POSTROUTING -o r1-eth1 -s 192.168.10.0/24 -j MASQUERADE
```

The first command will mask the r1-eth0 which is connected to the host h1 with the gateway IP address of the other interface and vice versa using the second command. Once this is done, open Wireshark once again. Again, ping from h1 to h2 using 4 count command and check the Wireshark window.

**Paste the screenshot of both host's Wireshark window and Answer what difference did you notice between the step 5 Wireshark window of ping and step 6 Wireshark window and why.**

This concludes lab 5 i.e. NAT and DHCP in Mininet topology.