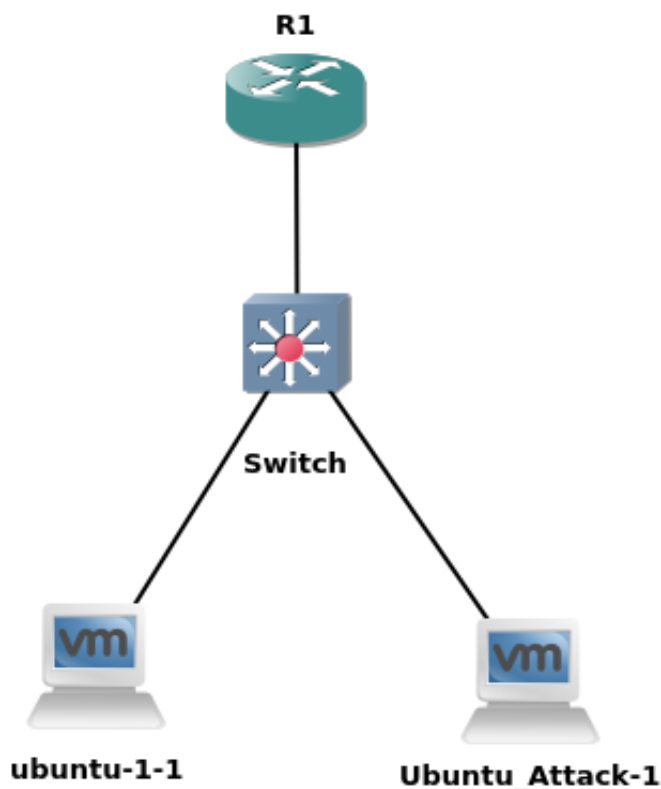# LAB3: Stateful DHCPv6

Lab Environment

Please continue from the previous lab (Stateless DHCPv6) or open the GNS3 project file:

`IPv6_Stateful_DHCPv6.gns3`

- The lab topology has:

    - 1xRouter
    - 1xSwitch
    - 1xUbuntu (Desktop) client VM
    - 1xUbuntu (Server) attacker VM, with THC-IPv6 toolset already installed (we will not use the toolset for this lab)

Configure the router:

1. Remove the previous stateless DHCPv6 server config from the router

```
no ipv6 dhcp pool STATELESS-DHCPv6
```

2. Also remove the binding from the interface facing the clients

```
interface fa0/0.100
 no ipv6 dhcp server STATELESS-DHCPv6
 no ipv6 nd other-config-flag
```

3. Configure the stateful DHCPv6 server

```
ipv6 dhcp pool STATEFUL-DHCPv6
 address prefix 2406:6400:0:200::/64
 dns-server 2406:6400::1
 domain-name apnic.net
```

4. Bind the DHCPv6 pool to the interface towards to the client:

```
interface FastEthernet0/0.100
 ipv6 dhcp server STATEFUL-DHCPv6
 ipv6 nd prefix 2406:6400:0:100::/64 infinite infinite no-autoconfig
 ipv6 nd managed-config-flag
```

   ○ Here, we are setting the `M-flag` (managed-config) in the RA, which tells the clients to obtain all addressing information from the DHCPv6 server.
   ○ the DHCPv6 server will maintain records (binding) of every IPv6 address assigned to clients
   ○ we are also disabling the default A-flag (auto-config) for the IPv6 prefix configured on the router interface (else, the clients would still use SLAAC to configure their addresses from the RA)

5. Verify your configuration with the following outputs:

```
show ipv6 interface
! look at ND stats and different multicast groups joined (anything different?)

show ipv6 route
! shows the ipv6 routing table

show ipv6 neighbors
!list the neigbors
```

6. To see the ICMPv6 ND and DHCPv6 messages

```
debug ipv6 nd
debug ipv6 dhcp
```

   ○ you could also use packet capture if you have wireshark on your host machine, as shown below:

```
right-click on any link on GNS3 topology, and click "start capture"
```

7. Save your configurations

```
wr
```

Configure the switch:

1. The switch configuration is same as before (no changes necessary)

The Client VMs
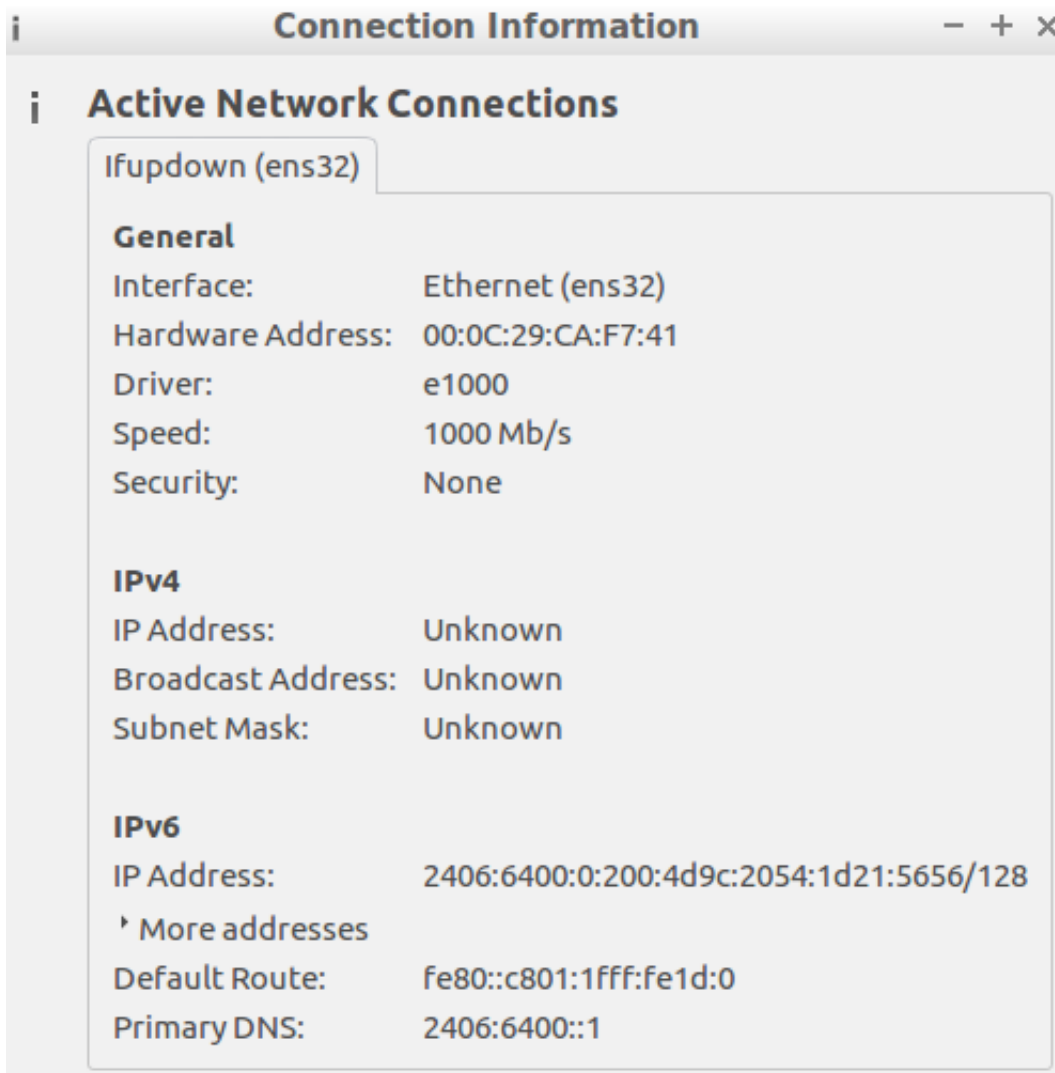
1. Toggle the interface ens32

```
sudo ifconfig ens32 down/up
```

2. Verify that the IPv6 address computed using the stateful DHCPv6 pool prefix (2406:6400:0:200::/64) due to the M-flag in the RA

```
ifconfig

#the address should look something like 2406:6400:0:200:x:x:x:x
#where the x:x:x:x (64-bit interface ID) is generated randomly by the DHCPv6 s
erver
#but you will see only one globally scoped address
```

3. Verify stateful information (IPv6 address prefix and dns server in this case) are obtained from the DHCPv6 server: you can see it from the `Connection Information` dropdown menu

Connection Information — + ✕

Active Network Connections

Ifupdown (ens32)

General

Interface:	Ethernet (ens32)
Hardware Address:	00:0C:29:CA:F7:41
Driver:	e1000
Speed:	1000 Mb/s
Security:	None

IPv4

IP Address:	Unknown
Broadcast Address:	Unknown
Subnet Mask:	Unknown

IPv6

IP Address:	2406:6400:0:200:4d9c:2054:1d21:5656/128
▸ More addresses	
Default Route:	fe80::c801:1fff:fe1d:0
Primary DNS:	2406:6400::1

Verification:

- Since you had enabled IPv6 ND and DHCPv6 debugging on the router, you should see both ICMPv6 ND and DHCPv6 messages being exchanged between the router and the IPv6 clients.
- You should see something like below on your router (analyse and understand the messages! Ask your instructors if you dont understand).
- Specifially, look for the flags in RA messages and DHCPv6 messages
- If you cant see the DHCPv6 messages, configure the interface to get IPv6 address using dhcp (`/etc/network/interfaces`)

```
ICMPv6-ND: Received RS on FastEthernet0/0.100 from FE80::D323:CA62:5A85:49F3
ICMPv6-ND: Sending solicited RA on FastEthernet0/0.100
ICMPv6-ND: Request to send RA for FE80::C801:1FFF:FE1D:0
ICMPv6-ND: Setup RA from FE80::C801:1FFF:FE1D:0 to FF02::1 on FastEthernet0/0.
100
ICMPv6-ND: Setup RA common:Managed address configuration
ICMPv6-ND:  MTU = 1500
ICMPv6-ND:    prefix = 2406:6400:0:100::/64 onlink
ICMPv6-ND:      4294967295/4294967295 (valid/preferred)
```

```
IPv6 DHCP: Received SOLICIT from FE80::D323:CA62:5A85:49F3 on FastEthernet0/0.
100
IPv6 DHCP: Using interface pool STATEFUL-DHCPv6
IPv6 DHCP: Looking up pool 2406:6400:0:200::/64 entry with username '0004230A9
F864B1ED037CD83DDD51952741229CAF741'
IPv6 DHCP: Poolen
IPv6 DHCP: Found address 2406:6400:0:200:4D9C:2054:1D21:5656 in binding for FE
80::D323:CA62:5A85:49F3, IAID 29CAF741
IPv6 DHCP: Updating binding address entry for address 2406:6400:0:200:4D9C:205
4:1D21:5656
IPv6 DHCP: Setting timer on 2406:6400:0:200:4D9C:2054:1D21:5656 for 60 seconds
IPv6 DHCP_AAA: Retrieved subblock; It has AAA DNS_SERVERS=0
IPv6 DHCP: Source Address from SAS FE80::C801:1FFF:FE1D:0
IPv6 DHCP: Sending ADVERTISE to FE80::D323:CA62:5A85:49F3 on FastEthernet0/0.1
00
ICMPv6-ND: DELETE -> INCMP: FE80::D323:CA62:5A85:49F3
ICMPv6-ND: Sending NS for FE80::D323:CA62:5A85:49F3 on FastEthernet0/0.100
ICMPv6-ND: Resolving next hop FE80::D323:CA62:5A85:49F3 on interface FastEther
net0/0.100
ICMPv6-ND: Received NA for FE80::D323:CA62:5A85
R1#:49F3 on FastEthernet0/0.100 from FE80::D323:CA62:5A85:49F3
ICMPv6-ND: Neighbour FE80::D323:CA62:5A85:49F3 on FastEthernet0/0.100 : LLA 00
0c.29ca.f741
ICMPv6-ND: INCMP -> REACH: FE80::D323:CA62:5A85:49F3
IPv6 DHCP: Received REQUEST from FE80::D323:CA62:5A85:49F3 on FastEthernet0/0.
100
IPv6 DHCP: Using interface pool STATEFUL-DHCPv6
IPv6 DHCP: Looking up pool 2406:6400:0:200::/64 entry with username '0004230A9
F864B1ED037CD83DDD51952741229CAF741'
IPv6 DHCP: Poolentry for user found
IPv6 DHCP: Found address 2406:6400:0:200:4D9C:2054:1D21:5656 in binding for FE
80::D323:CA62:5A85:49F3, IAID 29CAF741
IPv6 DHCP: Updating binding address entry for address 2406:6400:0:200:4D9C:205
4:1D21:5656
IPv6 DHCP: Setting timer on 2406:6400:0:200:4D9C:2054:1D21:5656 for 172800 sec
onds
IPv6 DHCP_AAA: Retrieved subblock; It has AAA DNS_SERVERS=0
IPv6 DHCP: Source Address from SAS FE80::C801:1FFF:FE1D:0
IPv6 DHCP: Sending REPLY to FE80::D323:CA62:5A85:49F3 on FastEthernet0/0.100
ICMPv6-ND: Received NS for FE80::C801:1FFF:FE1D:0 on FastEthernet0/0.100 from
FE80::D323:CA62:5A85:49F3
ICMPv6-ND: Sending NA for FE80::C801:1FFF:FE1D:0 on FastEthernet0/0.100
```

- Check the DHCPv6 binding on the router:

```
R1# sh ipv6 dhcp binding

Client: FE80::F70F:B9CA:B12C:C99F
  DUID: 00041B39AA82CFFE758748DF1136706A2E45
  Username : unassigned
  VRF : default
  IA NA: IA ID 0x29B75A4B, T1 43200, T2 69120
    Address: 2406:6400:0:200:518:8825:CEA8:D404
            preferred lifetime 86400, valid lifetime 172800
            expires at Jan 04 2019 02:38 PM (171876 seconds)
```