INTRODUCTION

This document contains IPv6 exercises to be carried out over Ubuntu Linux platforms connected on the same LAN.

Some basic skills are required, like IPv4 basic knowledge and minimum linux knowledge.

The IPv6 Lab is composed by the following exercises:

1. Check IPv6 is installed on linux platform (ifconfig and proc/ information)
2. IPv6 network configuration
3. IPv6 pings and packet capture (wireshark), check Neighbor table
4. Configure static routing, check routes table
5. Enable RAs (radvd), check addresses and capture packets
6. Enable DHCPv6 server and clients, check addresses and capture packets
7. Connect to a web server over IPv6

EXERCISES

1. Check IPv6 is installed on linux platform

IPv6 is supported since kernel version 2.4.x. To check your kernel version:

```
#uname –a
```

IPv6 support started as a module (lsmod command shows running modules) but actually is built in the kernel and activated by default on last Linux distributions.

You can also look for /proc/net/if_inte6 file or other IPv6-related files in the /proc system to know if IPv6 is supported on your Linux distribution.

To check interfaces and if they have IPv6 addresses use one of the following commands:

```
# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:1c:c4:db:48:c3
          inet addr:192.168.100.204  Bcast:192.168.100.255  Mask:255.255.255.0
          inet6 addr: 2001:db8:1234:5678:21c:c4ff:fedb:48c3/64 Scope:Global
          inet6 addr: fe80::21c:c4ff:fedb:48c3/64 Scope:Link
          inet6 addr: 2001:db8:100::204/64 Scope:Global
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:631 errors:0 dropped:0 overruns:0 frame:0
          TX packets:118 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:60473 (59.0 KB)  TX bytes:17026 (16.6 KB)
          Interrupt:17

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
```

```
# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 16436 qdisc noqueue
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast qlen 1000
    link/ether 00:1c:c4:db:48:c3 brd ff:ff:ff:ff:ff:ff
    inet 192.168.100.204/24 brd 192.168.100.255 scope global eth0
    inet6 2001:db8:1234:5678:21c:c4ff:fedb:48c3/64 scope global tentative dynamic
       valid_lft 86399sec preferred_lft 14399sec
    inet6 2001:db8:100::204/64 scope global
       valid_lft forever preferred_lft forever
    inet6 fe80::21c:c4ff:fedb:48c3/64 scope link
       valid_lft forever preferred_lft forever
```

2. IPv6 network configuration

The **/etc/network/interfaces** file contains the network configuration information. We will configure a static IPv6 address **2001:db8:ffff::xxxx:1** where xxxx will be assigned by the teacher. An example of interfaces file:

```
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface (IPv4)
auto eth0
iface eth0 inet static
  address 192.168.21.xxx  ----> CHANGE xxx !!!
  netmask 255.255.255.0
  gateway 192.168.21.1

# Also IPv6 is configured in the interface
iface eth0 inet6 static
   address 2001:db8:ffff::xxxx:1 ------> CHANGE xxxx !!!
   netmask 64
   # Disable autoconfiguration:
   # up echo 0 > /proc/sys/net/ipv6/conf/eth0/autoconf
   # Gateway is known by means of RAs
   # (/proc/sys/net/ipv6/conf/all/accept_ra).
   # If no RAs are received and accepted:
   # gateway 2001:db8:ffff::100:1

# in case of dinamic IPv4 config (DHCP)
# iface eth0 inet dhcp

# in case of IPv6 SLAAC
# iface eth0 inet6 manual
```

After saving the file we have to restart the network on the host:

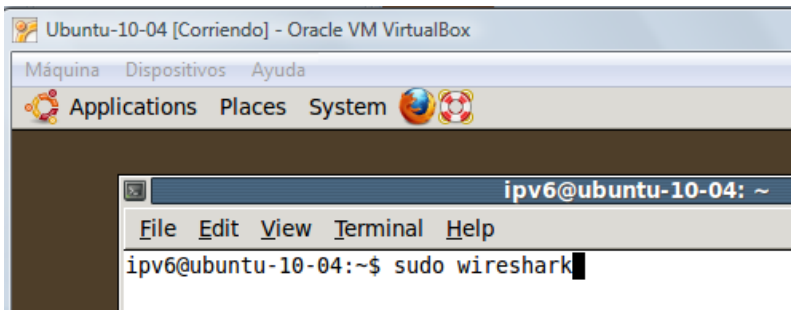
```
#sudo /etc/init.d/networking restart
```

3. IPv6 pings and packet capture

First we need to check if wireshark is installed and working. If not installed:

```
#sudo apt-get install wireshark
```

Wireshark needs root privileges to capture packets on interfaces, and also needs graphical environment. So, in a terminal window launch wireshark using sudo:



Check Neighbor table using:

```
# ip -6 neigh show
```

Capture packets using wireshark and try to find NS and NA packets.

Make ping to other hosts' link-local and statically configured addresses:

```
#ping6 ::1

#ping6 -I eth0 fe80::2e0:81ff:fe05:4657

#ping6 2001:db8:ffff::100
```

Check Neighbor table after the pings. Do you see differences? Do you see that each entry has a status?

4. Configure static routing

4.1 Check routes table using one of the following commands:

```
# ip -6 route show

# route -A inet6
```

4.2 Configure an static route using as gateway 2001:db8:a:b::1 for the prefix 2001:db8:b:c::/64, using one of the following commands:

```
# sudo ip -6 route add 2001:db8:b:c::/64 via 2001:db8:ffff::1

# sudo route -A inet6 add 2001:db8:b:c::/64 gw 2001:db8:ffff::1
```

Check routes table

4.3 Delete the previously added route using:

```
# sudo ip -6 route del 2001:db8:b:c::/64 via 2001:db8:ffff::1
```

Check routes table

5. Enable RAs (radvd)

Check addresses on your interfaces.

The teacher will start to send RAs on the link. Capture packets with wireshark and try to see RS and RA packets.

Check addresses on your interfaces. Do you see something different?

Check if you already have radvd daemon installed, if not install it using:

```
#sudo apt-get install radvd
```

Configure radvd to announce your own prefix (provided by the teacher). You have to:

5.1 Enable forwarding on the host (it will act like a router from now on):

```
echo 1 > /proc/sys/net/ipv6/conf/all/forwarding
```

You could edit /etc/sysctl.conf and uncomment `#net.ipv6.conf.all.forwarding=1` to make this change permanent.

5.2 Create the radvd config file **/etc/radvd.conf**:

```
interface eth0
{
        AdvSendAdvert on;
        MinRtrAdvInterval 3;
        MaxRtrAdvInterval 5;
        AdvHomeAgentFlag off;
        AdvManagedFlag off;
        AdvOtherConfigFlag off;

        prefix 2001:db8:1234:xxxx::/64  ----> CHANGE xxxx !!!
        {
             AdvAutonomous on;
             AdvRouterAddr off;
        };
};
```

5.3 Launch radvd daemon:

```
#sudo /etc/init.d/radvd start
```

Check addresses on your interfaces and capture packets with wireshark and try to see RS and RA packets.

5.4 Disable autoconfiguration on eth0

You can try to avoid all the autoconfiguration mess and just keep your static IPv6 address, disabling the autoconfiguration on the eth0 interface. Just edit /etc/network/interfaces and uncomment:

```
   # up echo 0 > /proc/sys/net/ipv6/conf/eth0/autoconf
```

Restart networking function (#sudo /etc/init.d/networking restart). Check if you don't get your interface autoconfigured. Check if you still get a default route obtained by means of RAs. How many default routes do you get?

5.5 Stop your radvd daemon:

```
#sudo /etc/init.d/radvd stop
```

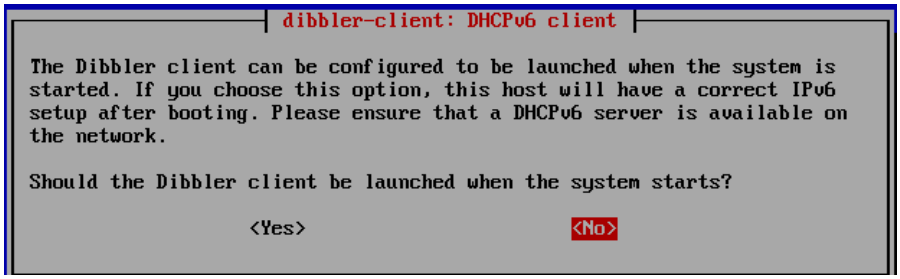
6. Enable DHCPv6 client (stateless DHCPv6)

6.1 Check what are the DNS servers configured on your host: /etc/resolv.conf

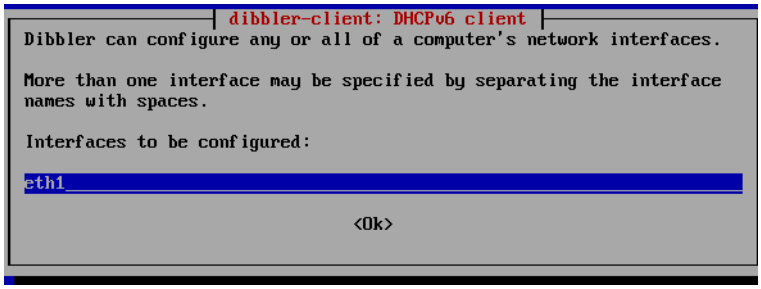
Capture packets and try to find DHCPv6 packets.

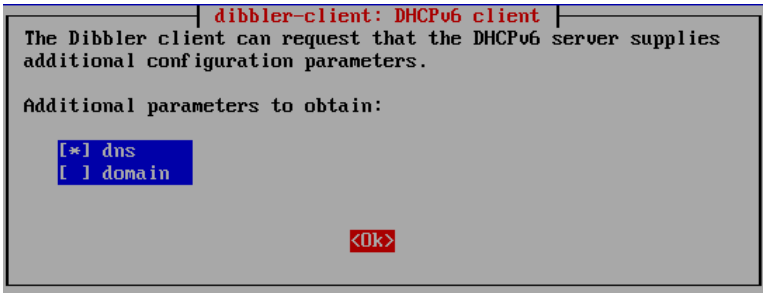
6.2 Install a DHCPv6 client

```
#sudo apt-get install dibbler-client
```



When asked configure the right interface, probably eth0:





We just want to receive the DNS server from DHCPv6, this is called stateless DHCPv6. The configuration file /etc/dibbler/client.conf will have something like:

```
iface eth0
{
#ia
```

```
option dns-server
# option domain
}
```

Start the client:

```
#sudo /etc/init.d/dibbler-client start
```

Capture DHCPv6 packets.

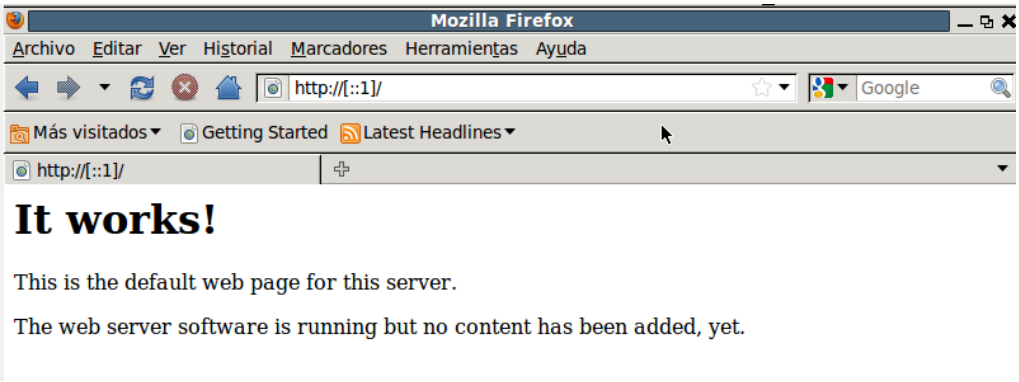
Check /etc/resolv.conf

7. Connect to a web server over IPv6

Check that you have a web server listening on port 80:

```
# netstat –tan
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address  Foreign Address      State
...
tcp6   0      0      :::80        :::*          LISTEN
```

Check you have firefox (or other browser) installed and open it. You can use literals for the IPv6 addresses. To connect to the web server on your own host (http://[::1]):



and to web the server on other hosts (http://[2001:db8:ffff::100]):

EXTRA PRACTICES

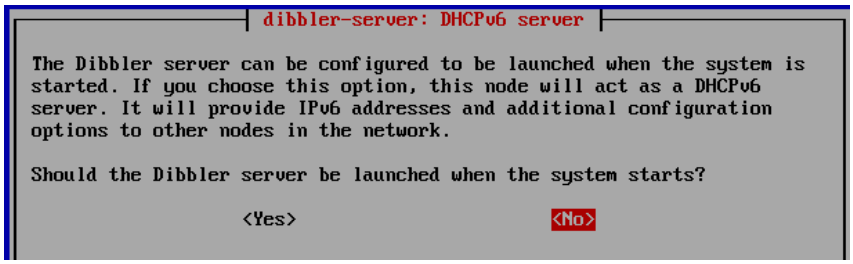
8. Enable DHCPv6 Server

8.1 Edit /etc/radvd.conf and change:

```
        AdvOtherConfigFlag on;
```

8.2 Install dibbler DHCPv6 server:

```
#sudo apt-get install dibbler-server
```




```
#sudo cp /etc/dibbler/server.conf  /etc/dibbler/server.conf.orig
```

8.3 Edit the configuration file /etc/dibbler/server.conf:

```
stateless

iface eth0 {
        option dns-server 2001:db8:a:b::xxxx:1234  ---> CHANGE xxxx !!!
        option lifetime 1800
}
```

8.4 Start the server:

```
#sudo /etc/init.d/dibbler-server start
```

You could check server log at /var/log/dibbler/dibbler-server.log

8.5 Capture packets to see your server's DHCPv6 packets

There only will be DHCPv6 packets if there are some DHCPv6 clients running and making requests.

REFERENCES

[1] Voyage Linux: http://linux.voyage.hk

[2] Wireshark: http://www.wireshark.org

[3] Ubuntu: http://www.ubuntu.com

[4] radvd: http://v6web.litech.org/radvd/

[5] Dibbler (DHCPv6): http://klub.com.pl/dhcpv6/