

Name 1: _____
Name 2: _____

Group number: _____

COMPUTER NETWORKING

LAB EXERCISES (TP) 4

IPv6

December 14, 2009

Abstract

In this TP you will revisit some of the basic networking tools that were introduced in TP1, only this time you will use them for troubleshooting an IPv6 network. The goal of this lab is to let you check in practice the IPv6 concepts that were introduced during the lectures. Similarly to TP1, you will learn how to configure static IPv6 routes in order to achieve the “native” IPv6 interconnection of a company network distributed over several sites, where each site has a local IPv6 network. In addition to that, you will learn how to enable communication between a local machine, with a private IPv4 address, and machines that belong to the IPv6 Internet (and have only IPv6 addresses), using a point-to-point tunnel. Finally, you will see that a machine with a public IPv4 address can easily communicate with any IPv6 machine on the Internet through publicly available 6to4 gateways.

1 ORGANIZATION OF THE TP

Each group of two students works on one workspace. During the TP (part on building a company network, Section 2) you will have to collaborate with a group from another workspace belonging to the same central hub. Before starting this part, you should choose the workspace to collaborate with and synchronize the rest of the work with them.

1.1 TP REPORT

Write your answers in this document during the TP. That will be your TP report (one per group). Don't forget to write your names and group number on the first page of the report.

2 IPV6 - NATIVE CONNECTIVITY

In this section you will learn how to statically (manually) configure routing entries of the routers in order to achieve IPv6 interconnection of a company network distributed over several sites, where each site has a

Local Area Network (LAN). You will also use *wireshark* to observe which traffic is sent (or not) in some scenarios. This will help you to find what is configured correctly and what has to be configured additionally in order to achieve connectivity.

A group will use the two PCs at their work space to form a LAN that corresponds to a company site LAN. The groups will interconnect the sites by having each group connect their router PC to the central hub and configure it manually, so that two workstation PCs at different LANs are able to communicate. The central hub implements an Ethernet network that simulates a Wide Area Network (WAN) of the company. In this section we do not use the “EPFL” hubs.

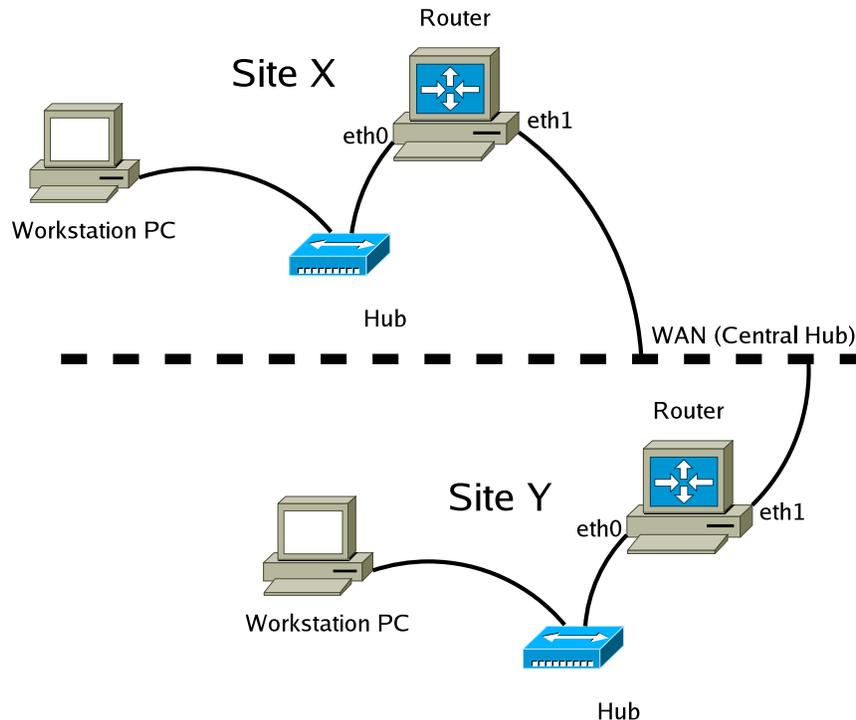
Organizational note: For some tests in this section you will have to cooperate and synchronize with another group connected to the same central hub (the backup solution is that you do the job of two groups).

2.1 PUT BOTH PCs INTO A PROPER INITIAL NON-CONFIGURED STATE

In order to put the machines into a clean initial non-configured state, click twice on the Network Workspace Manager icon that you can find on the desktop of each machine. From the menu that opens select “Load from Disk” and choose “lab-1-default: IEW default configuration for lab1”.

2.2 WIRING

Wire your PCs as shown in the following figure:



Wiring of the hardware equipment for the lab

2.3 ADDRESSING SCHEME

We use the following convention for writing IPv6 addresses in the continuation of this document:

- X - the number of your workspace (01, 02, ..., 10, 11, ...)

- *Y* - the number of the workspace you collaborate to
- *_* - you should find out which value should be used instead of *_*

Identify your workspace number (the workspace number is written on the white stickers tagged to the computers).

What is your workspace number? What is the number of the workspace you collaborate with?

- For the local network at your site, we will use the subnet 2001:468:181:f0X::/64 (X is the number of your workspace with a leading zero if X<10). As in lab 1, the host identifier should be 1 to indicate the router PC and 2 for the workstation PC.
- The network address of the interconnection network is 2001:468:181:f100::/64. On this network, the host identifier of the router's IPv6 address corresponds to the number of the workspace it belongs to.

Write down the IPv6 addresses you will use for the interfaces according to this addressing scheme.

Workstation PC:

Router PC LAN (eth0):

Router PC WAN (eth1):

2.4 CONFIGURING AND TESTING OF THE LAN

The commands used for configuring interfaces, defining static routes and displaying the content of the IPv6 routing table are similar to the ones used in TP1 for IPv4. Namely:

ifconfig network interface configuration

route manually manipulate the routing tables and display routing information

ping6 instead of `ping`

traceroute6 instead of `traceroute`

The syntax of these commands is slightly different for IPv6. In order to apply them to IPv6 correctly you will first have to check the man pages of these commands.

What is the command used to display the content of the IPv6 routing table?

Now configure the interfaces of the workstation (one interface) and the router (two interfaces). Bring the interfaces up prior to configuring them.

Write down the commands you used.

Workstation PC:

Router PC LAN (eth0):

Router PC WAN (eth1):

Additionally, in order to activate IPv6 forwarding in the kernel you should use the following command:

```
#sysctl -w net.ipv6.conf.all.forwarding=1
```

Start *wireshark* on all configured interfaces of your two machines.

ping the other workstation's local interface using `ping6` command.

What is the *ping* error message? What traffic has been captured by the analyzer?

ping message:

Captured traffic:

What can you deduce? What is the additional thing that needs to be done in order to be able to reach the workstation of group Y? Write down the commands you used.

Verify that your solution works, by `ping`ing again the local interface of the workstation of the group that you cooperate with.

3 IPV6 - CONNECTING TO THE IPV6 INTERNET USING 6TO4 GATEWAYS

Most ISPs still do not provide native IPv6 connectivity to their clients, i.e., they do not have IPv6 addresses to assign. However, it is possible to access IPv6 addresses on the Internet even in cases when a native IPv6 address is not assigned by the local ISP. This can be achieved by using point-to-point tunnels towards the servers of several companies that provide such services (go6.net, Teredo, SixXS...) or by using 6to4 gateways. In this section you will use `ssh` to connect to a machine with a public IPv4 address that can be translated into a 6to4 address). From this machine you will then be able to access IPv6 hosts on the Internet, using a 6to4 gateway.

3.1 PUT YOUR MACHINE INTO A PROPER INITIAL NON-CONFIGURED STATE

Click twice on the Network Workspace Manager icon that you can find on the desktop of each machine. From the menu that opens select "Load from Disk" and choose "lab-1-default: IEW default configuration for lab1".

3.2 WIRING AND CONFIGURATION

For this part of the lab you will only need the workstation. Connect it to the epfl hub and configure the interface, default route and DNS so that you can reach the IPv4 Internet.

Use the IP address 192.168.X.2/16 for your workstation's interface. Then, for default gateway and DNS server use 192.168.100.100.

Now you should be able to access the Internet. Try:

```
# ping -c 1 www.google.com
```

What is the IPv4 address that all 6to4 gateways use?

Issue a traceroute command to this address.

In which company's network is the machine responding to this query located?

From your workstation, you will `ssh` to a machine with a public IPv4 address. This machine is already configured to use 6to4 translation (if you would like to know how to do this check the Linux IPv6 howto document on the Internet). Therefore, it has access to the IPv6 Internet. Type:

```
# ssh root@192.168.100.31
```

The machine you connected to has more than one IP address.

What is its public IPv4 address? What is the corresponding 6to4 IPv6 address? How can you tell that an IPv6 address is a 6to4 address?

The program `tcpdump` is used to capture traffic pretty much as `wireshark`, but without the graphical interface. In order to start `tcpdump`, open a new terminal, `ssh` to the same machine again, and start `tcpdump` on the appropriate interface (the public IP address) to monitor traffic on that interface.

```
# tcpdump -i eth??
```

If needed, use the `-vv` option for more detailed output.

In the first terminal, ping `ipv6.google.com`:

```
# ping6 ipv6.google.com
```

What is the destination IP address of the ICMP packets you see in `tcpdump`? What type of DNS record is sent by the DNS server in response to the DNS request issued by the local machine?

Start `wget` on `ipv6.google.com` and observe the traffic on `tcpdump`.

What transport protocol is being used? Draw a picture of an IP packet showing all the network and transport layer headers, in the correct order.

Traceroute to `www.kame.net`. Use the appropriate version of the traceroute command! Write the IPv6 addresses of the intermediate hops. In which country is `www.kame.net` located?