

### Exercise 8: HTTP and Forwarding

Date: 2020-11-05

As with all lab exercises, this exercise is not directly assessed. It is intended to complement the material presented in lectures and may turn up in the exam. You are encouraged to complete it in your own time if you do not finish during the scheduled exercise class time.

Please split off into your Tutorial Group Teams channels and start a meeting at the beginning of the class. While you are not explicitly asked to collaborate this week, you can use the meeting for discussion during the class. I will rotate around the class and pop in on meetings.

The aim of this exercise class is to go into further depth in the material covered in week 08, and the week 09 tutorial.

## 1 HTTP operation

Copy the shell script:

[https://studres.cs.st-andrews.ac.uk/CS2003/Examples/CS2003-Examples-wk08/curl\\_time.sh](https://studres.cs.st-andrews.ac.uk/CS2003/Examples/CS2003-Examples-wk08/curl_time.sh)

to your own filespace, e.g. to copy it into your home directory (although I suggest keeping your filespace a bit tidier!), then:

```
$ cp /cs/studres/CS2003/Examples/CS2003-Examples-wk08/curl_time.sh ~
```

Run the file (note that it may take a while to complete):

```
$ ./curl_time.sh
```

1. Note the two values of real time that are reported. Examine the contents of the shell script. Explain the difference in the two times reported.
2. Adapt the shell script so that it can use an even newer protocol version.

## 2 IP forwarding

For this question you will find the lecture slides useful:

[https://studres.cs.st-andrews.ac.uk/CS2003/Lectures/cs2003\\_net-10\\_addressing.pdf](https://studres.cs.st-andrews.ac.uk/CS2003/Lectures/cs2003_net-10_addressing.pdf)

You might also find the `IPNetMask` program useful:

<https://studres.cs.st-andrews.ac.uk/CS2003/Examples/CS2003-Examples-wk08/IPNetMask.java>

or again, on the School machines this can be found at

`/cs/studres/CS2003/Examples/CS2003-Examples-wk08/IPNetMask.java`

1. For the forwarding table entries A--D below:

	destination	mask
A	121.16.0.0	16
B	121.16.20.0	24
C	121.16.16.0	20
D	0.0.0.0	0

find which would be used for each of the following destination addresses:

121.16.20.2  
121.17.20.4  
121.16.6.6  
121.16.17.8  
121.16.21.10  
120.16.20.12

2. Log into your host server. Use the `ip` command to list all of the network interfaces:

```
$ ip link show
```

You should see a loopback interface `lo` as well as some other virtual interfaces that can be ignored. *Aside*: if you just want to list the physical devices, `ip` does not have a mechanism to do this, but you could interrogate the `/sys/` filesystem directly, e.g.,

```
$ find /sys/class/net -type l -not -lname '*virtual*' -printf '%f\n'
```

Of the remaining devices we are only interested in the devices that are up. We can find these by looking in the output of `ip` for those with state UP:

```
$ ip link show | grep "state UP"
```

This gives me the Ethernet interface named `eno1` on `klovio`, but you might find something different.

Next, look at the IPv4 routing table. There are two (or more) possible ways to do this:

```
$ ip route show
$ netstat -4rn
```

You should see that the Ethernet interface is the default route for the local subnet as well as everything else.

*Another aside:* if you have not come across it yet, `grep` is a command-line program for searching text. The “re” in the name stands for “regular expression”, and as you might expect you can search using regular expressions as we covered in week 5. So if you wanted to search for IPv4 addresses in the output of `ip`, you could do something like:

```
$ ip route show | grep -E -o "[0-9]{1,3}\.[0-9]{1,3}\.[0-9]{1,3}\.[0-9]{1,3}"
```

### 3 IP addressing for a site

You might again find the `IPNetMask` program useful:

<https://studres.cs.st-andrews.ac.uk/CS2003/Examples/CS2003-Examples-wk08/IPNetMask.java>

You have a new office site to set up for a company with three departments, each which needs to run its own network, but the four departments should have connectivity between them.

- All departments need connectivity to the Internet.
- Each department could have up to 200 systems running (clients and internal servers).
- A set of 24 servers must be accessible directly to customers via the Internet, as well as internally to the clients in each department.

Explain, with a diagram, how you would configure structure and addressing for this network if:

1. you were allocated the prefix `134.24.144.0/22` for the new office site.
2. you were allocated the prefix `134.24.144.0/27` for the new office site.

Tristan Henderson, with thanks to Saleem Bhatti