Lab 1: Introduction and Hands-On

50.012 Networks

Hand-out: September 14
Hand-in: September 20

1 Objectives

- Get familiar with Linux command line
- Investigate bandwidth, latency, loss in SUTD network
- Find out about your IP address, subnet
- Find out your route into the internet
- Find out other subnets at SUTD

2 Introduction

The goal of this lab is to get familiar (again) with basic tools to investigate your local network. In particular, we are going to use ls, cd, mkdir, rm, ifconfig, . . .

3 Introduction to Lab PCs/ Xubuntu

- Each machine should have a user with name "student" and password "password". Log in as that user.
- Click on the top left icon to open an application menu, and select "Settings"/"Users and Groups"
- Create a new user with a name of your choice, which you will use for the rest of the term
- After creating the user, click on the "Account type/change" link and set the new user's account type to administrator
- Now logout (by using the application menu again), and re-login as the new user

4 Linux Command Line

- In Linux, the command line (or terminal) is usually used for many tasks. A large number of useful commands exist, that enable the user to quickly perform simple and complex tasks.
- We will start by opening a terminal (similar to `cmd` in Windows). For this class, we will use `xfce4-terminal`. You can open it by pressing Alt+F2 and typing `xfce4-terminal`. Or you can use the keyboard shortcut by pressing Ctrl+Alt+T.

4.1 Find the usage of commands

If you don't know how to use the shell commands, you can use command `man` (which stands for MANual)to show the usage of them.

```
$ man <command name>
```

If you want to quite while reading the manual of the command, press q

4.2 Finding where you are

The `pwd` command (which stands for Present Working Directory) is an example for a basic command in Linux. By typing the command and hitting enter, you will be informed of which directory you currently in.

```
$ pwd
```

4.3 Change the directory

The `cd` command allows you to change your current directory to any accessible directory on the system.

```
$ cd <directory>
```

Using the command `cd` without applying any parameter will bring you back to your home directory.

4.4 Listing the contents of a directory

The ls command can be used to view the contents of the current directory.

```
$ ls [option] <filename>
```

To know more about the field `[option]`, use the command `man ls` . It is frequently used with the options `-al` to list hidden files as well (their name start with .), and provide more information. Type `cd /`, `ls` and `ls -al` in the command line, what is the result?

4.5 File access control in Linux

Linux uses per-file access control. There are three different types of access to a file: reading (r), writing (w), and execution (x). These three types of access can be set for the file owner, a group of users, and everyone else. As a result, the access rights for each of those three classes of users can be described in a short string, e.g "r-x" for read and execution rights. The rights of all three types of users together yield a longer string, e.g. "rw-r–r–" for a file which can be read and written by the owner, but only read by everyone else.

Try using `ls -al` and `cd` to look around on your system, and see who has what kind of access control to which file. The content of `/etc/` could be especially interesting.

4.6 locate, less

Command `locate` can be used to search files in Xubuntu. For example, if you want to find all text files, you can use:

```
$ locate *.txt
```

Command `less` can be used to display the content of file. Example:

```
$ less myfile.txt
```

Another way to display file is to use command `cat`, example:

```
$ cat myfile.txt
```

4.7 grep

Command `grep` can be used to search for strings or patterns in text files. For example, if you want to find all occurences of "foo" in file A.txt

```
$ grep foo A.txt
```

Command `grep` can be also be used to filter output of other commands using *piping* symbol "|". The following will locate all python scripts on the current machine, but display only the ones in the home directory. Depending on the content of your home directory, the output might be empty.

```
$ locate *.py | grep home
```

4.8 touch

`touch` is a standard Unix program used to change a file's access and modification timestamps. It is also used to create a new empty file. You can use command `man touch` to see more detail.

```
 $ touch myfile.txt
```

Touch doesn't modify the contents of `myfile.txt`; it just updates the timestamp of the file to the computer's current date and time, whatever that happens to be. Or, if myfile.txt does not exist it is created, with zero length.

4.9 mkdir

`mkdir` can be used to create directories. To create `dir1` in the current location, type:

```
$ mkdir dir1
```

5 Basic Networking

5.1 Setting up your system

- There are two ways to configure the network setup of your machine: by using "network-manager" or the command line
- Start by clicking on the network icon in the top right (either arrows, or wifi symbol)
- You should see the wired and wireless networks listed
- Make sure to disconnect from the wired and wireless networks network for now
- Type `ifconfig` on the terminal to find the current configuration of your devices
- Connect to `SUTD_Student`, using your username and password, with "Wifi Security" set to "WPA2 Enterprise", Autentication set to "PEAP" version 1, and inner authentication "MSCHAPv2". Ideally, don't store your password permanently on the machine.
- You should have internet access now.
- Type `ifconfig` on the terminal to find the current configuration of your devices
  - Which network device is used?
  - Which IP address did you get?
  - What is the (subnet) Mask?
- Use `ping` to contact an overseas website, e.g., ping wired.com. What is your round-trip-time (delay)?
- Use `tracepath` to look up the route your traffic takes to reach wired.com
  - Up to which point are you still in SUTD network?
  - Can you see where the connection is passing through the undersea cable?
- Using websites like `http://www.monitis.com`, you can also see visualizations of the path taken
  - For example, use 202.94.70.1 as target (one of SUTD's addresses?)
  - What is the IP address of the SUTD website?

5.2 Setting up a Local Area Network (LAN)

- Disconnect from `SUTD_Student`
- Disconnect your LAN cable
- Connect your lab PC with the supplied short cable to the small switch on your desk
- Choose an IP address in the range 10.0.1.1 - 10.0.1.254 (more on what that means later)
  - For example, you can choose `10.0.1.6` as your IP address
  - Make sure that your neighbors don't have the exact same IP
  - Then, set your IP with

```
$ sudo ifconfig eth0  <your_ip> netmask 255.255.255.0
```

- Test if you can reach your neighbors with

```
$ ping <your_neighbors_ip>
```

- You can stop the ping with CTRL-C
- You should be able to reach everyone connected to the same switch
  - What is the time reported?
- Start connecting your switch to neighboring switches.
  - Can you reach everyone's machines?
  - What happens if the same IP is used by two machines?

6 File management Ubuntu commands

This section is intended to show useful commands for you. The following does not need to be part of the report

6.1 Copying files and directories}

To copy files, you can use the `mv` or `cp` commands. The command line

```
$ mv file1 file2
```

allows one to move `file1` to `file2`. After the move, `file1` will no longer exist. Command `cp` on the other hand copies one file to another.

```
$ cp file1 file2
```

Note that if `file2` does not exist, it will be created; however if it does exist, it will be overwritten. There is NO undo command in Linux. The following does the same as the above, but if `file2` exists, you will be prompted before overwriting

```
$ cp -i file1 file2
```

If you want to copy file1 into directory dir1:

```
$  cp file1 dir1/
```

The following would do the same as the above, copy file1 into dir1, but under a different name:

```
$ cp file1 dir1/file2
```

You can also copy multiple files into one directory with a single command:

```
$ cp file1 file2 file3 dir1/
```

For copying directories, you can use the `cp` and `mv` commands just like you use them with files. If you want to use `cp` copy directory, you need to use `-r`

```
$ cp -r dir1 dir2
```

6.2 Deleting files and directories

The `rm` command is used for removing files. To remove a file:

```
$ rm file1
```

If you use the `-i` option, you'll be prompted before removing the file:

```
$ rm -i file1
```

You can also delete more files at once:

```
$ rm file1 file2
```

There are two commands you can use for removing directories. If the directory is empty, you can use `rmdir`:

```
$ rmdir dir1
```

Or you can use `rm` with the `-r` switch to recursively delete.

```
$ rm -r dir1
```

7 Sudo and program installation using apt

This section is intended to show useful commands for you. The following does not need to be part of the report

7.1 Sudo and root

Your normal user does not have administrator rights (e.g. to install software system wide). In Linux, the administrator account is called “root” or “superuser”. Your system is set up to allow you to perform commands as root by using `sudo` in front of the command. Example: `less /etc/shadow` as normal user fails :

```
$ less /etc/shadow
/etc/shadow: Permission denied
```

The reason for this is your missing read rights on the file:

```
$ ls -al /etc/shadow
-rw-r----- 1 root shadow 1166 Aug 11 13:22 /etc/shadow
```

But you can see the content using `sudo`:

```
$ sudo less /etc/shadow
```

You will be asked to enter a password, enter the password you chose earlier.

7.2 apt-get

You can easily install applications on the command line if you are connected to the internet. For example, to install GEdit, a simple visual editor, type the following and confirm the installation:

```
$ sudo apt-get install gedit
```

8 What to Hand in

8.1 eDimension submission:

Please provide a writeup (in PDF format with your name on top) that includes the following information:

- Your local machine IP address, and Mask
- Using tracepath, what is your estimate on the "border" between SUTD network and the Internet?
- Can you give an example for a link through an underwater cable?
- Do you experience link loss? why/why not?
- A brief summary of your experience with the LAN setup using the switch. What worked, what did not work?