

Labs (Draft)

Introduction

The labs below need to be completed in the first half of the semester, before you attempt the term paper.

Each lab ends with a milestone. If I accept your milestone then that respective lab counts as a mark of 100. If I don't accept your milestone then I will state what needs to be improved, and if the due date has not passed then you may resubmit. Resubmissions only once per week per lab.

1 Linux installation

1.1 Task

Install a Linux for your use in the course. The distribution you use does not matter much. Consider, though, that support is often better for large, standard distributions like Debian, SuSe, Ubuntu.

A live CD is not sufficient, even if you have a USB stick to tweak the installation and save files. That is because the combination of reading-from-CD and writing-to-USB will make the system too slow to run our network simulator. Choose one of the following options:

- If you have an own computer or laptop, you may convert your entire installation to Linux, or make it dual-boot, or use any option below.
- If your computer can boot from USB, you may install Linux on a USB stick. I suggest you buy a new USB stick for that, preferably USB 3.0. A workable size should be 32 GiB.
- If you use a lab computer or otherwise share a computer, you may install VMWare and create a Linux in it.

1.2 Milestone

1. Join a virtual class in the Linux you booted and share your screen.
2. Save the collection of your mount points in a file `yoursurname.txt` by issuing the command `mount > yoursurname.txt`. Upload this file to e-learning, assessment "Practical milestone 1".

For every installation, I will accept a milestone only once—If you share a computer with another student, you need to install a new Linux to gain the marks.

2 ns-3 installation

2.1 Task

Install the network simulator ns-3 on your Linux distribution, and run the standard tests. There are no binaries (that is, executable files) available for download. To install the simulator, you need to download the source files in C++ and Python and compile and build them individually for your Linux installation.

The tutorial on www.nsnam.org outlines several different ways to install ns-3. For simplicity I recommend that you use the method of

1. Cloning the GitHub ns-3 project
2. Executing the download script
3. Compiling and building with `waf`

Updating / installing the prerequisites requires `root` access and should be done in the administrator account. Before installing any new packages, upgrade the existing system first (for Debian for instance with `apt-get update`, then `apt-get upgrade`).

Prerequisite software are the packages `git`, `python3` (from version 3.6) and `g++` (from version 7). For each of these packages,

1. Check if they are installed (e.g. `which g++` The command `which` gives the location of the binary as output. No output means: not installed)
2. Check if their version is recent enough (e.g. `g++ --version`)
3. Update or install if necessary (e.g. for Debian `apt-get install g++`)

Installing ns-3 should be done in an ordinary user account, not as `root`. Once all prerequisites are installed, go ahead as follows (details in the tutorial):

1. Login to an ordinary user account.
2. Create a work directory. The entire path must not contain spaces
`mkdir /home/peter/WLT`
3. Enter the work directory
`cd WLT`
4. Clone the project from GitHub
`git clone https://gitlab.com/nsnam/ns-3-allinone.git`
5. Enter the directory that has been created
`cd ns-3-allinone`
6. Run the download script
`python3 download.py`
7. Enter the developer directory
`cd ns-3-dev`

8. Configure the building environment
`./waf configure`
9. Compile ns-3 and run tests
`./test.py`
10. Run simulation HelloWorld
`./waf --run hello-sim`

Steps 6 and 9 will take some time, depending on your Internet access speed and processing power.

2.2 Milestone

1. Join a virtual class, share your screen, and run a simulation of your choice.
2. Save the configuration of your **waf** building environment in a file `yoursurname.txt` by issuing the commands `./waf clean` and `./waf configure > yoursurname.txt`. Upload this file to e-learning, assessment "Practical milestone 2".

For every installation, I will accept a milestone only once—If you share a computer with another student, you need to install a new instance of ns-3 (in another user account) to gain the marks.

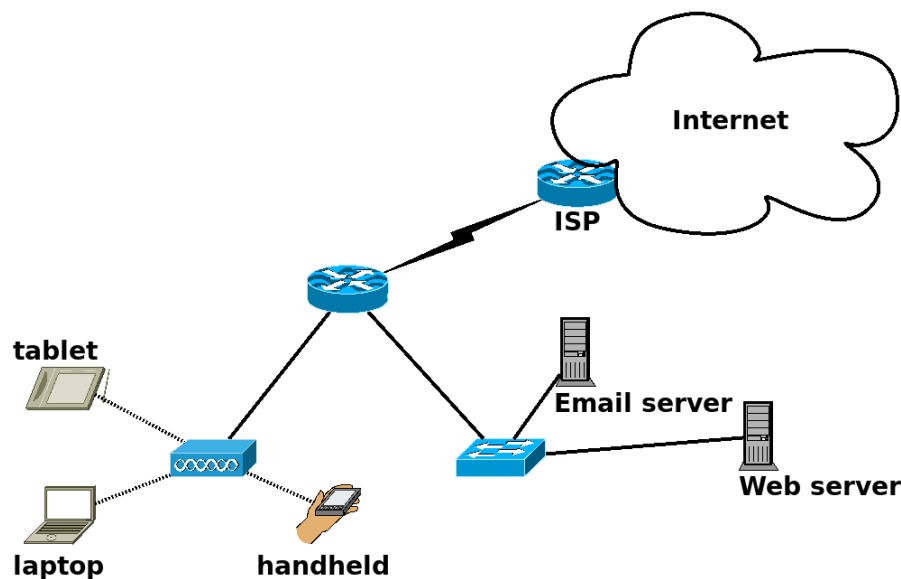
3 ns-3 tutorial and basic skills

3.1 Task

Learn how to create a simulation on ns-3. Complete the ns-3 tutorial on www.nsnam.org (also available as pdf on e-learning). Focus on the coverage until the `third.cc` example, where wireless Ethernet is covered.

3.2 Milestone

Simulate the topology below. Let the handheld device and the web server both ping the ISP router, and display the output on screen. **Comment your code** in a way that it can be understood by others. Upload the simulation code on e-learning, file name `yoursurname.cc`, assessment "Practical milestone 3".



I will accept the same simulation only once—If you did the coding in a group (max 3), submit only one simulation file, and state the names of the authors as comment in the first lines of the code.

4 Analysis of ns-3 output

4.1 Task

Learn how to create, evaluate, and analyse the output of ns-3 simulations.

4.2 Milestone

TBA