Distributed Systems Course
Prelab

Throughout the labs, you will learn how to implement an application running over distributed machines. You will apply the concepts seen during the lectures to solve the typical problems of consistency, event ordering, and fault-tolerance. More specifically, you will work on a distributed message-board (or blackboard): users can post, update, and delete messages. Messages must be visible by all users, and displayed in the same order (from newest to oldest) everywhere. Each lab will add additional complexity to your distributed application: first, we will make a simple system, that we will improve with leader election, eventual consistency, and finally byzantine fault-tolerance.

The labs require you to use the following tools:

- **Python** 3.x
- **Mininet**, a network emulator
- **Bottle**, a RESTful web framework

This prelab will introduce you to these three main building blocks. If you haven't used Python before, we strongly recommend you to learn the basics of the language before the real labs start. We will go through the basics of Bottle, as you'll need to create a RESTful application, and explain how to setup Mininet.

Submitting the prelab is mandatory. Check iLearn for the deadline and submission system.

1 Python

Google offers a basic Python course at `https://developers.google.com/edu/python/`.

- Visit the course and learn basic Python's features if you are not familiar with it.
- If you are not familier with Python, finish all three basic exercises in the Google's Python course `https://developers.google.com/edu/python/exercises/basic`, i.e., string1.py, list1.py and wordcount.py. You do not need to submit anything, but we assume that you know how to program in Python from this point on.

2 Bottle

To create (simple) web servers and REST APIS, we will use the *Bottle* framework.

- Install Bottle: pip3 install bottle

- Read and test `http://bottlepy.org/docs/dev/tutorial.html#quickstart-hello-world`.

You should understand the basic structure of a web API using bottle now.

- Create a web server using Bottle. Your server should have three URIs: '/', '/hello' and '/input' On the index page ('/'), display a link to /hello and /input. On '/hello', display your names. On '/input', your server should serve POST requests, and display all POST parameters received. You need to **submit** your python script.

3 Mininet

Mininet is a network emulator which creates a network of virtual hosts, switches, controllers, and links. It enables you to create and manage custom network topologies with several hosts, all in the same physical machine. Mininet is a full-blown emulator with many capabilities, but in this course we will use it for a single purpose: to create and connect multiple servers for your Python code to run on.

Visit `http://mininet.org` to learn more about Mininet. Then complete the following tasks:

- **Install Mininet.** In this link `http://mininet.org/download/` you will find information on how to setup Mininet on your machine. We recommend following option 1 (VM installation). That includes:
  - Download and install VirtualBox from `https://www.virtualbox.org/wiki/Downloads`.
  - Download and install a UNIX distribution (recommended, Ubuntu Desktop version `https://ubuntu.com/download/desktop`), you can follow this tutorial if you have never used virtualbox before `https://brb.nci.nih.gov/seqtools/installUbuntu.html` (recommended, 2 GB of RAM and 15 GB of storage).
  - Download the mininet repository: *git clone https://www.github.com/mininet/mininet.git mininet*
  - Install mininet: *cd mininet*, followed by *bash util/install.sh -a*
- **Read the walkthrough.** An introduction to Mininet can be found here `http://mininet.org/walkthrough/`. It shows how to run Mininet using simple typologies and run basic commands on the hosts.
- **Test topologies.** Start a default topology with two hosts and a switch (*sudo mn* should do just that), start a ping from h1 to h2 and mark down the results. Then start Mininet again with *sudo mn --link tc,bw=10,delay=10ms* and do the same ping. Do you see different values in round trip time? **Submit** a screenshot of the two pings.

4 Frequently Asked Questions

1. *After installing mininet, ifconfig is not found.*
   Please install the net-tools package, using *sudo apt install net-tools.*
2. *File not found: /etc/network/interfaces.*
   Create the file using *sudo nano /etc/network/interfaces*, with a space as only character. then, run *sudo mn -c* to clean mininet temp files.
3. *Running firefox as root in a regular user session is not permitted.*
   Within xterm, start firefox with your own user account using *sudo -u yourusername firefox.*