University of Ontario Institute of Technology

Faculty of Engineering and Applied Science

SOFE 4790 / CSCI 4640 – Distributed Systems

Lab Overview

General Lab Instructions

All the labs for SOFE 4790 / CSCI 4640 will be performed virtually. This means that you can do the labs on your time and do not have to be done during the prescribed lab time. The lab time though will be used to present your results to the Teaching Assistant (TA). You will see that the labs have portions in them that require you to demonstrate your results to the TA. Note that these demonstrations generally require several computers networked either through the campus network or a Local Area Network (LAN). Note: some students have leveraged the use of their own VPN environment like Hamachi (https://secure.logmein.com/products/hamachi2/) but I have not found this to be necessary. If you wish to run the demonstration on a LAN the lab has switches that can be used to create a LAN.

The following labs are tentatively planned for this session. Please note that this list is tentative, if any changes occur, you will be informed in class and the following table will be updated accordingly.

Lab No	Title
0	Lab preparation
1	Client / Server Communications
2	Remote Method Invocation
3	Map Reduce I
4	Map Reduce II
5	Web Applications and Services

About the working environment

For most of the labs you can do these by leveraging the standard Eclipse environment that uses the Java J2SE API. This can be downloaded from http://www.eclipse.org

Alternatively, it would be fine if you prefer to work in Linux. You should still be able to do all the labs without a problem.

For the Web Service lab, you will be using the play framework, an open source light weight web application framework; it is written in Scala and Java, and makes use of a number of Java libraries. Play can be downloaded from https://www.playframework.com/

Notes about LANs and IP addresses

If you have not taken a fundamental networking course at this point you will have to read this important paragraph explaining routable IP addresses.

In order for 2 computers to communicate to each other they must be located using their IP addresses. Unfortunately some IP addresses are non-routable from outside of their own Local Area Network (LAN) meaning that connections cannot be made to them and packets cannot be sent directly to them from outside of the LAN without some Network Translation Table (NAT). Typically these addresses are used in home, business, and the UOIT campus. For example, all 192.*.*.* and 10.*.*.* networks are non-routable. So in fact nearly all IP addresses on the UOIT campus are non routable because they utilize the

10.*.*.* set of addresses. So you should perform these labs on the same LAN to minimize the chance that the computers cannot communicate with each other. That means do them within the university campus or within a home campus LAN.

Some of the labs will require you to write programs for your laptop to communicate with another machine. You can either use your home computer, or run these programs with other classmates' laptops on the campus LAN.

Notes about Subnets and Wireless LANs

When performing the labs it is necessary to always check to see if the computers can communicate with each other. An easy way to check this is by using the DOS *ping* command. Unfortunately this command is sometimes blocked across campus subnets and particularly in wireless networks because periodic use of ping can generate a lot of network traffic. The failure of a ping command does not necessarily mean that a connection cannot occur between two computers in a LAN but the success of the *ping* command at least confirms that the problem is more likely in your program and not in the network connectivity.

Determining a Workstation's IP address

Steps:
- Open a Windows Console on one of the workstations.
- From the console window type **ipconfig/all**
  - This will print out the properties of all the interfaces on the workstation.
- If you are connected through the wireless network you should use the IP address for the wireless network connection, otherwise if you are using a cable you should use the IP address for the LAN connection.

Lab 0 – Trying out Java UDP/TCP API

You will now run a few short programs to try out the Java UDP and TCP API. This will be the basis of the work you will do in the next lab. Please *go over the code* to make sure you understand what is going on.

The diagram below shows the communication between a server process and a client process using sockets. The client can send a message to the server, either using UDP or TCP. You are provided with four short sample programs: TCPServer.java, TCPClient.java, UDPServer.java, UDPClient.java. You should go over the code and execute the programs so that they are able to run successfully. First run the server program, then run the corresponding client program, with the appropriate arguments. The message you type as an argument to the client program should be successfully sent to the server and echoed onto the screen.

Internet address = 138.37.94.248   Internet address = 138.37.88.249
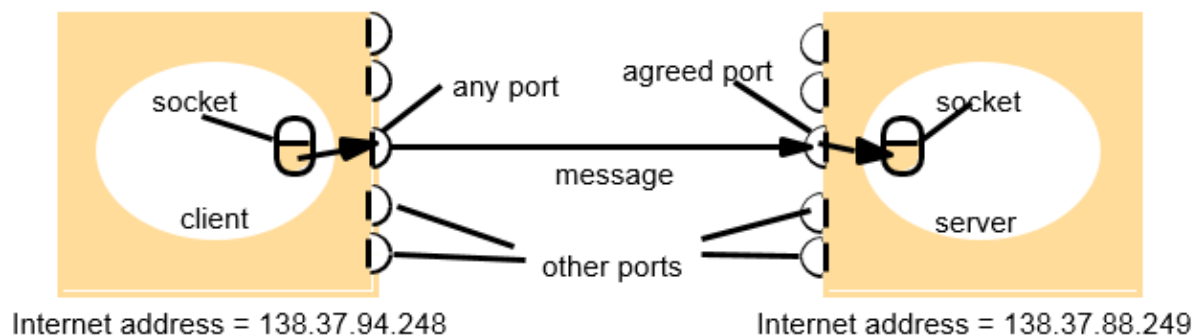
Testing your programs

You should take the opportunity during this preparatory lab session to find one or more classmates to keep as future contact. For future labs where you might need more than one machine to send messages to each other, two or three of you can test your programs out using each other's laptops. Start with this preparatory lab, run the programs to communicate with processes running on your labmates' laptops.

Important: The labs are **independent** work. You must work **individually** on the labs and write the programs required.