

# COM SCI 118 Winter 2016

## Computer Network Fundamentals

### **Project 1: Concurrent Web Server using BSD Sockets**

#### 1. Goal

In this project, we are going to develop a Web server in C/C++. Also, we will take the chance to learn a little bit more about how the Web browser and server work behind the scene.

#### 2. Lab Working Environment

You need a plain-text editor to create the source code. You can use vi/pico/emacs in Unix/Linux systems. Since C/C++ is a cross-platform language, you should be able to compile and run your code on any machine with C/C++ compiler and BSD socket library installed.

Students should use Linux OS to finish the project. A virtual machine image of Ubuntu OS for your working environment is provided. The account information is cs118/cs118 and root/cs118. It is recommended that doing the projects or at least testing them in this provided environment, because:

- C/C++ compiler (gcc, g++) and BSD socket library on those workstations have been verified.
- Your submitted code will be tested and evaluated on them.

You need to install VirtualBox.

Windows workstations are NOT recommended. They have their own idiosyncracies which may be too much for this simple project. Also, TAs will not be able to help you on any of these platforms.

#### 3. Instructions

1. Read Chapter 2 of the textbook carefully. The textbook will help you to understand how HTTP works. You can also use the socket programming materials covered by your TA to learn more on the C/C++ socket programming. The key differences are highlighted below:

- You must program in C/C++ (not Java). Examples of socket programming Client/Server code in C are available on the course CCLE Website. They are also put in the folder /home/cs118/workspace in the provided Ubuntu virtual machine image.
  - Instead of using port 80 or 8080 or 6789 for the listening socket, you should pick your own to avoid conflicts. It is suggested not to use port numbers 0-1024 (these are reserved ports).
2. The project consists of Part A and Part B, which are specified as following:
    - Part A: Implement a “Web Server” that dumps request messages to the console. This is a good chance to observe how HTTP works. So start a browser, e.g. Microsoft Internet Explore (browser is the client side), connect to your server, record the request message, and find out what the fields in the message mean by looking up in the textbook or RFC 1945.
    - Part B: Based on the code you have done in Part A, add one more function to the “Web server”, that is, the “Web server” parses the HTTP request from the browser, creates an HTTP response message consisting of the requested file preceded by header lines, then sends the response directly to the client.
  3. Pay attention to the following issues when you are implementing the project:
    - If you are running the browser and server on the same machine, you may use localhost or 127.0.0.1 as the name of the machine.
    - Make sure your “Content-Type” function recognizes at least html files. We will worry about other types of files later.
  4. After you’re done with every part (Part A and Part B), you need to test your server. You first put a html file in the directory of your server, or more exactly, where you run your server. Connect to your server from a browser with the URL of `http://<machine name>:<port number>/<html file name>` and see if it works. For your server in Part A, you should be able to see the HTTP request format in the console of your server machine. For your server in Part B, your browser should be able to show the content of the requested html file.
  5. Back to the “Content-Type” function. Add in the support for GIF and JPEG images. Your browser should be able to correctly show these MIME files.

## 4. Materials to turn in

Your source code files (e.g. webserver.c) A report of your project (pdf or word format) should not exceed 6 pages (except from source codes). In the report:

- Give a high-level description of your server's design
- What difficulties did you face and how did you solve them?
- Include a brief manual in the report to explain how to compile and run your source code (if TAs can't compile and run your source code by reading your manual, the project is considered not to be finished).
- Include and briefly explain some sample outputs of your client-server (e.g. in Part A you should be able to see an HTTP request) You do not have to write a lot of details about the code, but just adequately comment your source code. The cover page of the report should include the name of the course and project, your partner's name, and student id.

## 5. Project Submission

Project due date is **11:59pm on Friday, Feb. 5<sup>th</sup>**. Late submission is allowed by Sunday, Feb 7<sup>th</sup> (10% deduction on Saturday, 20% deduction on Sunday). Put all your files into a directory, named "project1UID" where UID is the UCLA ID. The directory "project1 UID" should include the following files:

- Your Web Server code (e.g. webserver.c). The code of the server can be more than one file.
- Your report (report.doc, report.pdf).
- A Makefile. The TAs will only type "make" to compile your code.
- A README file which will contain Student names and Student IDs.