

# CS 550 Programming Assignment #1

## A Simple Napster Style Peer to Peer File Sharing System

### **Instructions:**

- Due date: 11:25AM on Tuesday, 03/01/11
- You may work individual or in groups of two for this assignment; your groups could be different than your course project.
- Please post your questions to the mailing list [cs550-s11@datasys.cs.iit.edu](mailto:cs550-s11@datasys.cs.iit.edu).
- Both hardcopy and softcopy are required (India students and remote students only need to submit softcopy). Please drop your hardcopy to TA's mailbox (2nd floor of computer science department), and submit the softcopy to "Digital Drop Box" on Blackboard (see section 3).
- Name your file as this rule: "LastName\_FirstName\_[HW or PA number]". E.g. "John\_Doe\_HW1". (HW for Written Assignment, PA for Programming Assignment).
- For all programming assignments and projects, please submit the hardcopy of your documentation only. You don't need to submit the hardcopy of your source code. In the meantime, please zip all files (source code, documentation and etc.) and submit it to BB.
- Late submission will be penalized at 20% per day.

## 1 The problem

This project has two purposes: first to get you familiarize with sockets/RPCs/RMIs, processes, threads; second to learn the design and internals of a Napster-style peer-to-peer (P2P) file sharing system.

You can be creative with this project. You are free to use any programming languages (C, C++, Java, etc) and any abstractions such as sockets, RPCs, RMIs, threads, events, etc. that might be needed. Also, you are free to use any machines (PC, UNIX, etc).

In this project, you need to design a simple P2P system that has two components:

1. **A central indexing server.** This server indexes the contents of all of the peers that register with it. It also provides search facility to peers. In our simple version, you don't need to implement sophisticated searching algorithms; an exact match will be fine. Minimally, the server should provide the following interface to the peer clients:
  - registry(peer id, file name, ...) -- invoked by a peer to register all its files with the indexing server. The server then builds the index for the peer. Other sophisticated algorithms such as automatic indexing are not required, but feel free to do whatever is reasonable. You may provide optional information to the server to make it more 'real', such as the clients' bandwidth, etc.
  - search(file name) -- this procedure should search the index and return all the matching peers to the requestor.
2. **A peer.** A peer is both a client and a server. As a client, the user specifies a file name with the indexing server using "lookup". The indexing server returns a list of all other peers that hold the file. The user can pick one such peer and the client then connects to this peer and downloads the file. As a server, the peer waits for requests from other peers and sends the requested file

when receiving a request. Minimally, the peer server should provide the following interface to the peer client:

- obtain(file name) -- invoked by a peer to download a file from another peer.

Other requirements:

- Both the indexing server and a peer server should be able to accept multiple client requests at the same time. This could be easily done using threads. Be aware of the thread synchronizing issues to avoid inconsistency or deadlock in your system.
- No GUIs are required. Simple command line interfaces are fine.

## 2 Evaluation and Measurement

Deploy at least 3 peers and 1 indexing server. They can be setup on the same machine (different directories) or different machines. Each peer has in its shared directory (all of which are indexed at the indexing server) at least 10 text files of varying sizes (for example 1k, 2k, ..., 10k). Make sure some files are replicated at more than one peer sites (so your query will give you multiple results to select).

Do a simple experiment study to evaluate the behavior of your system. Compute the average response time per client search request by measuring the response time seen by a client, such as 1000 sequential requests. Also, measure the response times when multiple clients are concurrently making requests to the indexing server, for instance, you can vary the number of concurrent clients (N) and observe how the average response time changes, make necessary plots to support your conclusions.

## 3 What you will submit

When you have finished implementing the complete assignment as described above, you should submit your solution to 'digital drop box' on blackboard. Each program must work correctly and be detailed in-line documented. You should hand in:

1. **Output file:** A copy of the output generated by running your program. When it downloads a file, have your program print a message "display file 'foo'" (don't print the actual file contents if they are large). When a peer issues a query (lookup) to the indexing server, having your program print the returned results in a nicely formatted manner.
2. **Design Doc:** A separate (typed) design document (named design.pdf or design.txt) of approximately 2-4 pages describing the overall program design, and design tradeoffs considered and made. Also describe possible improvements and extensions to your program (and sketch how they might be made).
3. **Program list:** A program listing containing in-line documentation.
4. **Manual:** A detailed manual describing how the program works. The manual should be able to instruct users other than the developer to run the program step by step. The manual should contain at least a test case which will generate the output matching the content of the output file you provided in 1.
5. **Verification:** A separate description (named test.pdf or test.txt) of the tests you ran on your program to convince yourself that it is indeed correct. Also describe any cases for which your program is known not to work correctly.
6. **Performance results.**
7. **Source code:** All of the source code listed in 3.

Please put all of the above into one .zip or .tar file, and upload it to 'digital drop box' on blackboard'. The name of .zip or .tar should follow this format:

Student1\_Student2\_PA1.{zip|tar}; note that Student should be substituted with LastName\_FirstName.

Please do NOT email your files to the professor and TA!!

If you do the programming on BABBAGE machine, it's important to leave your source code in your BABBAGE account.

In the meantime, you are required to submit a hardcopy of all your documentation files except the source code. Please drop your hardcopy to TA's mailbox (2nd floor of computer science department) by deadline.

## 4 Grading policy for all programming assignments

- Program Listing
  - works correctly (including the quality or effectiveness of manual)----- 50%
  - in-line documentation ----- 15%
- Design Document
  - quality of design ----- 15%
  - understandability of doc ----- 10%
- Thoroughness of test cases ----- 10%

Grades for late programs will be lowered 20 points per day late.