

CS 455/555: Programming Project 1

Chat Server with Sockets

100 points

Due date on Canvas

1 Setup

Before starting on the project, please make sure you have accepted the team assignment via GitHub. The details are in the Canvas assignment named "Team Repository Setup."

2 Introduction

In this project, we will build a simplified chat server that can support multiple clients over the Internet. There are a gazillion chat programs out there using various protocols. One such popular protocol is IRC (Internet Relay Chat). We will implement a simplified version of this protocol in this project.

3 Protocol Design

3.1 IRC Protocol

Here is a very simplified version of the IRC protocol, which is a text-based protocol.

command	description
/connect <server-name> [port#]	Connect to named server (port# optional)
/nick <nickname>	Pick a nickname (should be unique among active users)
/list	List channels and number of users
/join <channel>	Join a channel, all text typed is sent to all users on the channel
/leave [<channel>]	Leave the current (or named) channel
/quit	Leave chat and disconnect from server
/help	Print out help message
/stats	Ask server for some stats

The full IRC protocol is fully described in RFC 1459. RFCs (Request For Comments) are the official documents of Internet specifications, communications protocols, procedures, and events. If you are curious, check out the RFC 1459 in the link below:

<http://tools.ietf.org/html/rfc1459.html>

3.2 Object-based Protocol

A client can accept the IRC commands but all communication with the server is using objects. Design an object-based protocol that gives the same functionality as the subset of IRC given earlier. Note that you will not only have objects that deliver commands but you will also need objects that deliver events.

4 Chat Server

The name of the main chat server class must be *ChatServer*, It should accept the following command line arguments:

```
java ChatServer -p <port#> -d <debug-level>
```

where debug level of 0 is normal (only error messages are reported) and at level 1 all events are reported. When testing in the lab, choose a port number in the range assigned to your team.

It is recommended to develop the server in the following stages. Note that you won't necessarily write the code for each version but thinking in stages will make it easier to design the multi-channel, multithreaded server that we want to develop.

- **Single Channel, Single-threaded Server:** First, focus on implementing a server that is single-threaded and only supports a single channel.
- **Multiple Channel, Single-threaded Server:** Once you have a single-threaded single-channel server working, then add multiple channels.
- **Multiple Channel, Multi-threaded Server** Add multiple threads (for example, one thread per client).
- Limit the number of threads to four or use a thread pool to limit denial-of-service attacks.

Notes:

- The chat server should shut itself down if it has been idle for more than three minutes.
- Add a *shutdown hook*, so if the user uses Ctrl-c on the server, it shuts down gracefully. For example, it can send a message to all users on all channels before shutting down. It can also prints its stats before shutting down.

5 Chat Client

Develop a simple text-based chat client to demonstrate the functionality of your server. The client should support the subset of IRC commands shown earlier. The name of the main client class must be *ChatClient*. It takes no command line arguments (as we can specify server name and port number via the connect command).

```
java ChatClient
```

6 Extra Credit

- Use colored terminal fonts!
- Use JSON objects instead of Java objects.
- Develop a Web-based GUI Client. You would want to use JSON objects for web-based client.

7 Documentation

- Create a demo video (five to ten minutes) with the following requirements:
 - For recording the video, you can use Zoom or Panopto (the university has site licenses for both via your Boise State account). Or you can record on your local machine and upload to Youtube or Google drive. Please do not add your video to Github as Github will reject large files. Instead, just add a link to your video to the README.md file.
 - Make sure to use larger fonts for viweability. Make sure to use light mode (instead of dark mode) to make it easier for me to see. Recall that Zoom/Panopto/Youtube will make the resolution less.
 - Makes sure to start with team# and the names of the team members.
 - The video must have participation from all team members and must have an audio track (no silent movies, please!).
 - The video shows various features and scenarios in action for the chat server and clients.
 - The video does a quick walk through the code.
- The README.md file must have at least the following elements:
 - Project number and title, team members, course number and title, semester and year.
 - A file/folder manifest to guide reading through the code.
 - A section on building and running the server/clients.
 - A section on how you tested it.
 - A web link to the demo video.
 - A section on observations/reflection on your development process and the roles of each team members.

8 Required Files

- Manage your project using your team git repository for the course. The project folder (named p1) has already been created for you in the repository.
- There must be a file named [README .md](#) in the project folder with contents as described earlier in the Documentation section.
- Make sure to have professional javadoc comments. No need to generate the javadocs though as I can do that myself.
- The project must have a [Makefile](#). You can use any build system underneath (like gradle, maven, ant etc) but the Makefile should trigger it to generate the project.
- All the source code, build files et al.

9 AI Usage

Students may use Gen AI but must demonstrate understanding through explanation, modification or extensions of solutions. For example, clearly annotate what code was generated by AI, what tools were used, and provide a explanation of how it works (in your video or via comments in code), why it was chosen, and what modifications or extensions were made.

10 Submitting the Project

You should be using Git throughout the project with commits along the way. When you are ready to submit the project, open up a terminal or console and navigate to the team projects repository for the class. Navigate to the subdirectory that contains the files for the project.

- Clean up your directory and remove any auto-generated files such as .class files
`make clean`
- Add and commit your changes to Git (this would be specific to your project)
`git add README.md (other files and folders that needed to be added)`
- Commit your changes to Git
`git commit -a -m "Finished project p1"`
- Create a new branch for your code
`git branch p1_branch`
- Switch to working with this new branch
`git checkout p1_branch`
(You can do both steps in one command with `git checkout -b p1_branch`)
- Push your files to the GitHub server
`git push origin p1_branch`
- Switch back to the master branch
`git checkout master`
- Here is an example workflow for submitting your project. Replace `p1` with the appropriate project name (if needed) in the example below.

```
[amit@localhost p1(master)]$ git checkout -b p1_branch
Switched to a new branch 'p1_branch'
```

```
[amit@localhost p1(p1_branch)]$ git push origin p1_branch
Total 0 (delta 0), reused 0 (delta 0)
To git@nullptr.boisestate.edu:amit
 * [new branch]      p1_branch -> p1_branch
```

```
[amit@localhost p1(p1_branch)]$ git checkout master
Switched to branch 'master'
Your branch is up-to-date with 'origin/master'.
```

- Help! I want to submit my code again! No problem just checkout the branch and hack away!

```
[amit@localhost p1(master)]$ git branch -r
  origin/HEAD -> origin/master
  origin/master
  origin/p1_branch

[amit@localhost p1(master)]$ git checkout p1_branch
Branch p1_branch set up to track remote branch p1_branch from origin.
Switched to a new branch 'p1_branch'

[amit@localhost p1(p1_branch)]$ touch newfile.txt
[amit@localhost p1(p1_branch)]$ git add newfile.txt

[amit@localhost p1(p1_branch)]$ git commit -am "Adding change to branch"
[p1_branch 1e32709] Adding change to branch
 1 file changed, 0 insertions(+), 0 deletions(-)
 create mode 100644 newfile.txt

[amit@localhost p1(p1_branch)]$ git push origin p1_branch
Counting objects: 3, done.
Delta compression using up to 4 threads.
Compressing objects: 100% (2/2), done.
Writing objects: 100% (3/3), 286 bytes | 0 bytes/s, done.
Total 3 (delta 0), reused 0 (delta 0)
To git@nullptr.boisestate.edu:amit
 36139d1..1e32709 p1_branch -> p1_branch

[amit@localhost amit(p1_branch)]$ git checkout master
Switched to branch 'master'
Your branch is up-to-date with 'origin/master'.
[amit@localhost amit(master)]$
```

- We highly recommend reading the section on branches from the Git book here: [Git Branches in a Nutshell](#)