Project Milestone #3

Dmitry Kulakov <dkulakov2014@my.fit.edu>
Xiaohan Yang <xiaohan2014@my.fit.edu>
Nicholas Zynko <nzynko2008@my.fit.edu>

March 23, 2017

1. Introduction

This document describes the specifications for the C++ concurrent server that stores a set of peers and gossip messages in a sqlite database. This server can recognize commands both over TCP and UDP on the same port. The following three types of messages are accepted by the server:

- *GOSSIP:[SHA256_HASH]:DATE:[MESSAGE]%*
- *PEER:[NAME]:PORT=[PORT_NUM]:IP=[IP]%*
- *PEERS?*

The GOSSIP command stores the message, date and hash in a GOSSIP table, with the hash acting as a primary key to prevent duplicate messages. It also broadcasts the message to all the known peers over a udp socket. The PEER command stores the known peer as a primary key along with its port number and ip address. The PEERS? command lists the total number of peers, and lists the peers currently in the database.

2. Technologies Used:

- Gdb and ncat were used for the purposes of debugging the program and testing the connections.
- The sha256 hashing library was obtained under fair use from Stephan Bromme (http://create.stephan-brumme.com/disclaimer.html)

3. Architecture

2.1. Overall

This C++ program is designed to allow the server to get the port number to listen on and file path to sqlite database. The TCP thread is used to listen the incoming connections and spawns a thread for a new connection; The UDP thread is used to listen the incoming datagrams without spawning a new thread to handle them.

2.2. Variables

This project contains the following global variables (including default values):

- #define MAX_CALLS 5
    - Defines the maximum number of calls that the server will accept when it is listening for sockets
- #define MAXLINE 512
    - The maximum number of bytes in allowed in a buffer
- PathSeparator
    - Used to distinguish betwe
- Inr tcpfd, udpfd, confd
    -
- sqlite3 *db
    - The global reference to the sqlite database
- string latestGossip
    - Contains the lastest gossip message to be broadcast

2.3. Functions

This project contains the following functions:

- void signal_stop (int a)
    - Called upon hearing the control-C or control-Z signal, used to close all available file descriptors and database connections to prevent zombie processes from lingering after the server is shut down.

- void udp_handler(int sockfd, sockaddr* client, socklen_t client_len)
    - Creates and handles the udp connection. Calls the reader method on information that it receives from the client, and also sends the list of peers to the client if the result returned from the reader is not null.

- void tcp_handler (int confd)
    - Creates and handles the udp connection. Calls the reader method on information that it receives from the client, and also sends the list of peers to the client if the result returned from the reader is not null.

- char *reader (string fulltext)
    - Parses the user's commands and stores them in the sqlite database. Returns a reference to the result of the select statement from the callback method, which can be used to send all the available peers.

- void sig_child (int signo)
    - The method called when a child is forked by the main process.

- static int callback (void * result, int argc, char ** argv, char **azColName)
    - Called during the sqlite3_exec method call in order to structure the output of the select statement after a PEERS? command is received. The void * result holds the result of the select statement, and can be found in the reader method after the exec finishes.

- static int gossipCallback(void *NotUsed, int argc, char **argv, char **azColName)
    - Called during the sqlite3_exec method for broadcasting after a GOSSIP message was received.

- void broadcast (string message, string address, int port)
    - Sends messages to all known peers over udp socket.

- int setup_database (char *filePath)
    - Sets up sqlite database for storing gossip information and peers.

- int main (int argc, char *argv[])
    - Opens the sockets for tcp and udp connections and selects between the two as messages arrive over the two sockets. Calls udp_handler or tcp_handler based on the file descriptor which is receiving input.

4. User Manual

This project can be run by the following commands:

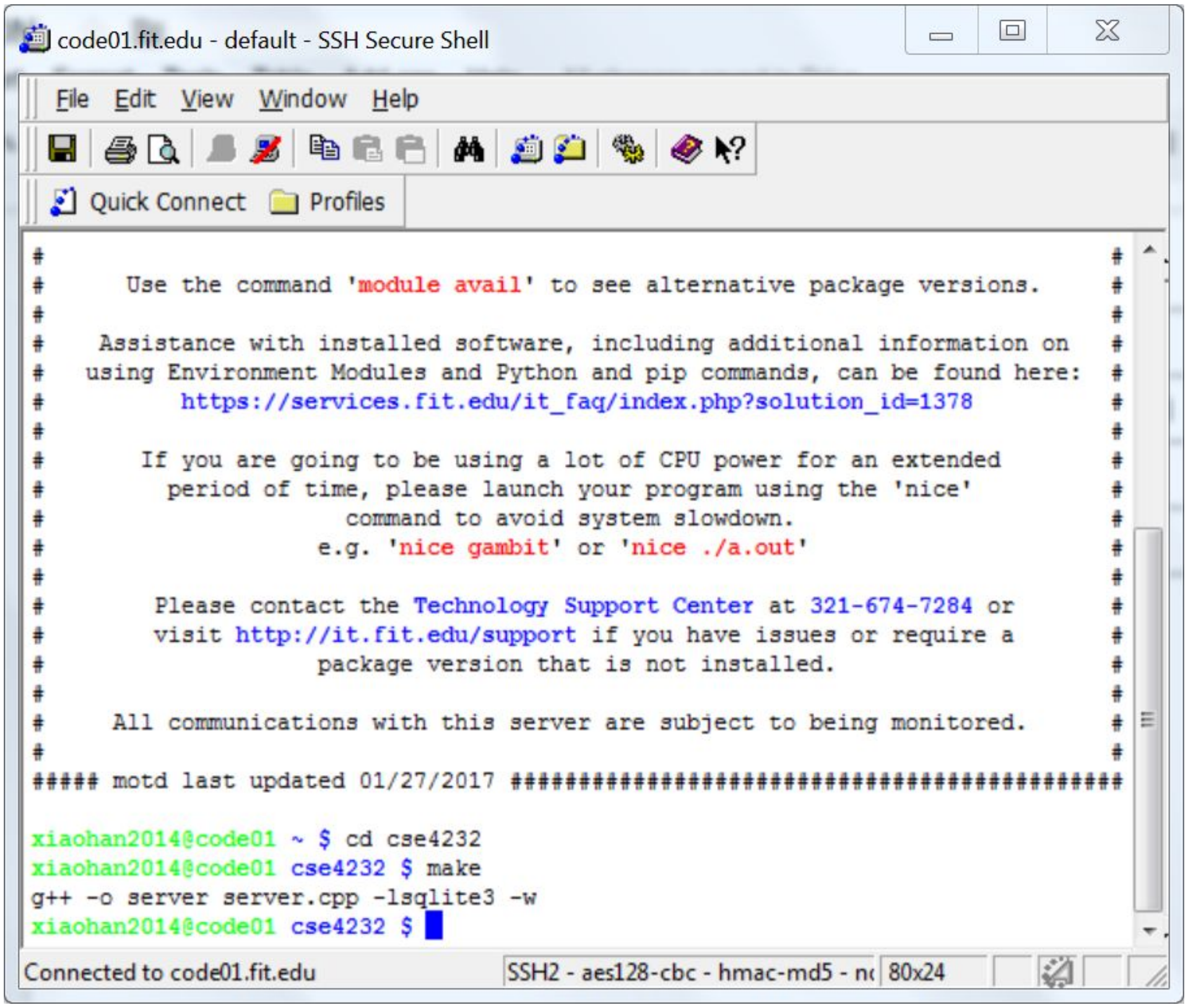
Usage: /server -d name_of_db -p portnum	
-d name_of_db	Assigns the name of the database file to be used

-p portnumber	Assigns the port to be used
-u	Switches to UDP, the default is TCP

To compile the code run, simply type **make**
To run the program, execute **./run.sh [-d <filepath>] [-p <port>]**

5. Snapshots

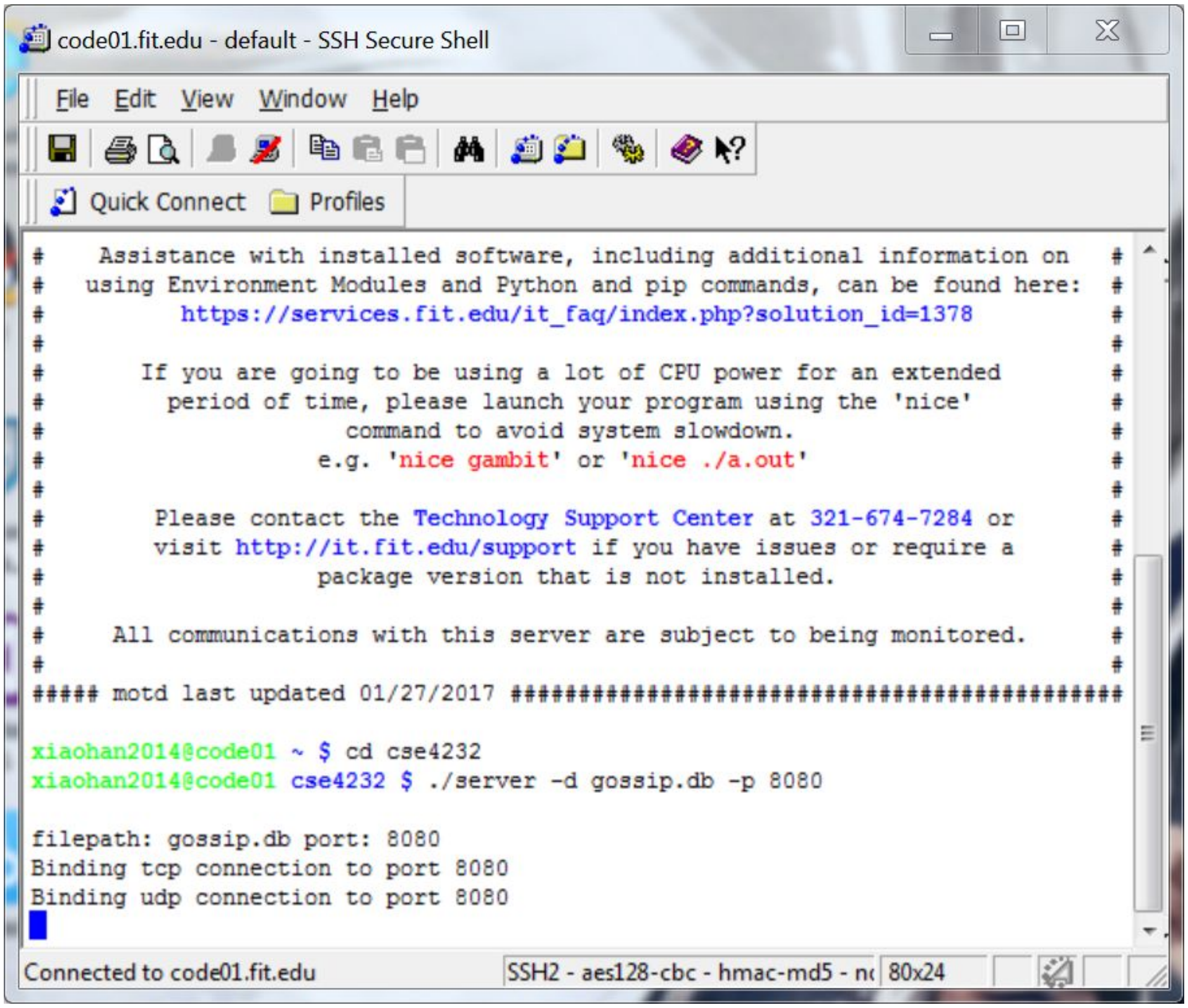
- Compile the project.


code01.fit.edu - default - SSH Secure Shell
File Edit View Window Help
Quick Connect
Profiles

```
#                                                                              #
#     Use the command 'module avail' to see alternative package versions.      #
#                                                                              #
#    Assistance with installed software, including additional information on   #
#   using Environment Modules and Python and pip commands, can be found here:  #
#          https://services.fit.edu/it_faq/index.php?solution_id=1378          #
#                                                                              #
#        If you are going to be using a lot of CPU power for an extended       #
#          period of time, please launch your program using the 'nice'         #
#                    command to avoid system slowdown.                         #
#                  e.g. 'nice gambit' or 'nice ./a.out'                        #
#                                                                              #
#         Please contact the Technology Support Center at 321-674-7284 or      #
#         visit http://it.fit.edu/support if you have issues or require a      #
#                  package version that is not installed.                      #
#                                                                              #
#     All communications with this server are subject to being monitored.      #
#                                                                              #
##### motd last updated 01/27/2017 #############################################

xiaohan2014@code01 ~ $ cd cse4232
xiaohan2014@code01 cse4232 $ make
g++ -o server server.cpp -lsqlite3 -w
xiaohan2014@code01 cse4232 $
```

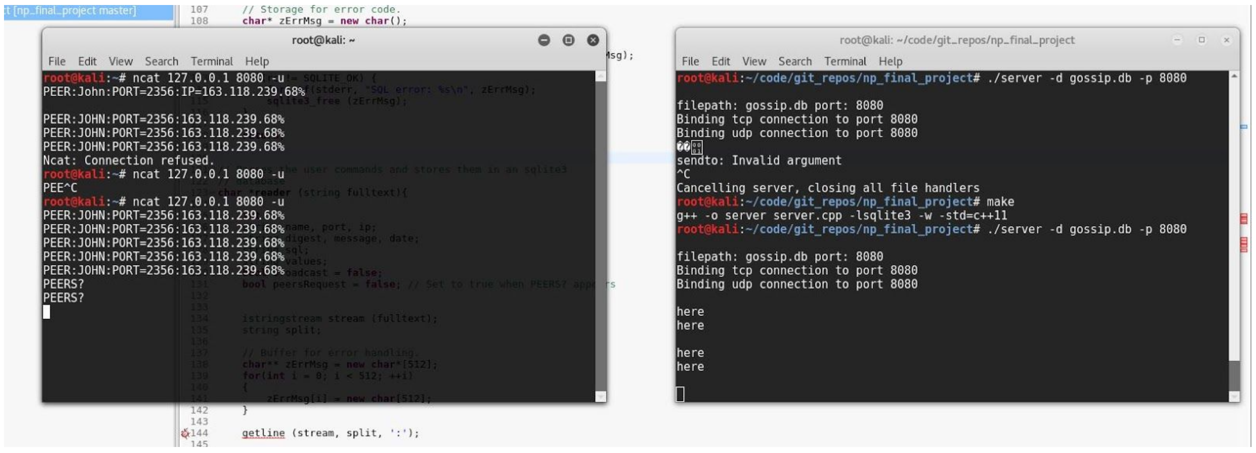
Connected to code01.fit.edu | SSH2 - aes128-cbc - hmac-md5 - n | 80x24

- Connect to the server


code01.fit.edu - default - SSH Secure Shell
File Edit View Window Help
Quick Connect
Profiles
Connected to code01.fit.edu
SSH2 - aes128-cbc - hmac-md5 - n
80x24

```
#    Assistance with installed software, including additional information on   #
#   using Environment Modules and Python and pip commands, can be found here:   #
#          https://services.fit.edu/it_faq/index.php?solution_id=1378           #
#                                                                               #
#        If you are going to be using a lot of CPU power for an extended        #
#          period of time, please launch your program using the 'nice'          #
#                       command to avoid system slowdown.                       #
#                     e.g. 'nice gambit' or 'nice ./a.out'                      #
#                                                                               #
#        Please contact the Technology Support Center at 321-674-7284 or        #
#        visit http://it.fit.edu/support if you have issues or require a        #
#                     package version that is not installed.                    #
#                                                                               #
#      All communications with this server are subject to being monitored.     #
#                                                                               #
##### motd last updated 01/27/2017 ##############################################

xiaohan2014@code01 ~ $ cd cse4232
xiaohan2014@code01 cse4232 $ ./server -d gossip.db -p 8080

filepath: gossip.db port: 8080
Binding tcp connection to port 8080
Binding udp connection to port 8080
```

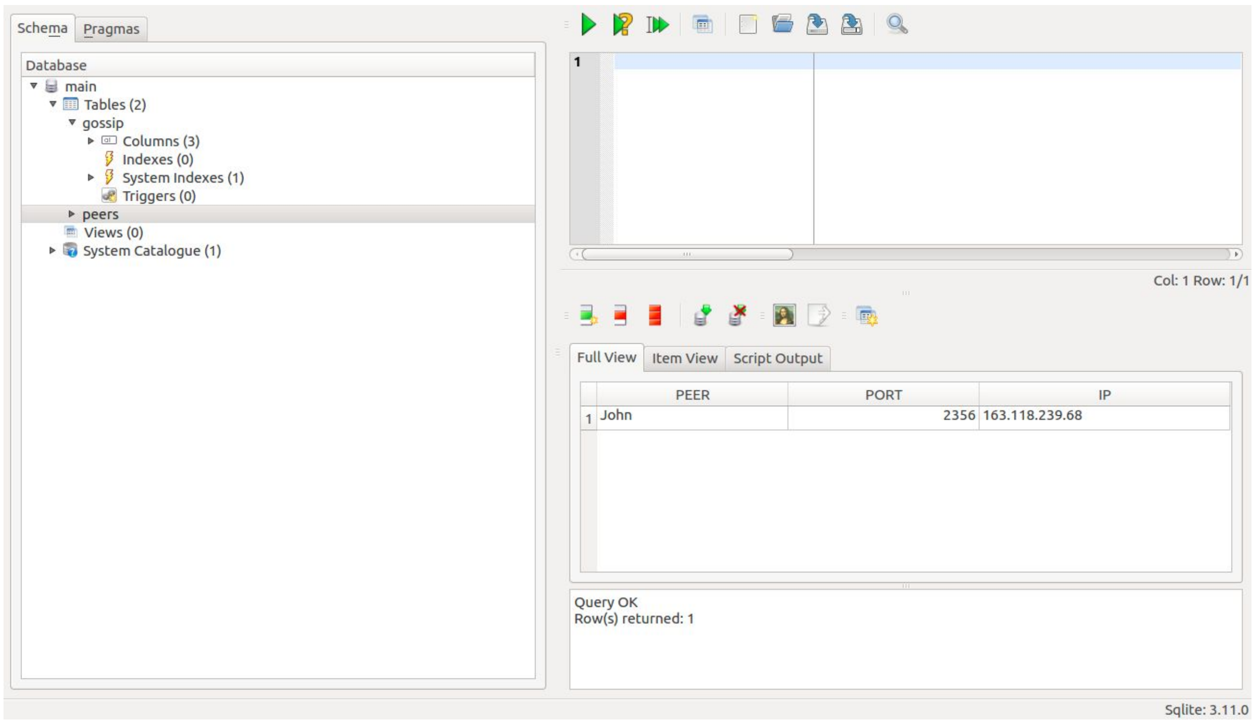
- Connect to the client


root@kali: ~
File Edit View Search Terminal Help
root@kali: ~/code/git_repos/np_final_project
File Edit View Search Terminal Help

```
root@kali:~# ncat 127.0.0.1 8080 -u
PEER:John:PORT=2356:IP=163.118.239.68%

PEER:JOHN:PORT=2356:163.118.239.68%
PEER:JOHN:PORT=2356:163.118.239.68%
PEER:JOHN:PORT=2356:163.118.239.68%
Ncat: Connection refused.
root@kali:~# ncat 127.0.0.1 8080 -u
PEE^C
root@kali:~# ncat 127.0.0.1 8080 -u
PEER:JOHN:PORT=2356:163.118.239.68%
PEER:JOHN:PORT=2356:163.118.239.68%
PEER:JOHN:PORT=2356:163.118.239.68%
PEER:JOHN:PORT=2356:163.118.239.68%
PEER:JOHN:PORT=2356:163.118.239.68%
PEERS?
PEERS?
```

```
root@kali:~/code/git_repos/np_final_project# ./server -d gossip.db -p 8080

filepath: gossip.db port: 8080
Binding tcp connection to port 8080
Binding udp connection to port 8080
��
sendto: Invalid argument
^C
Cancelling server, closing all file handlers
root@kali:~/code/git_repos/np_final_project# make
g++ -o server server.cpp -lsqlite3 -w -std=c++11
root@kali:~/code/git_repos/np_final_project# ./server -d gossip.db -p 8080

filepath: gossip.db port: 8080
Binding tcp connection to port 8080
Binding udp connection to port 8080

here
here

here
here
```

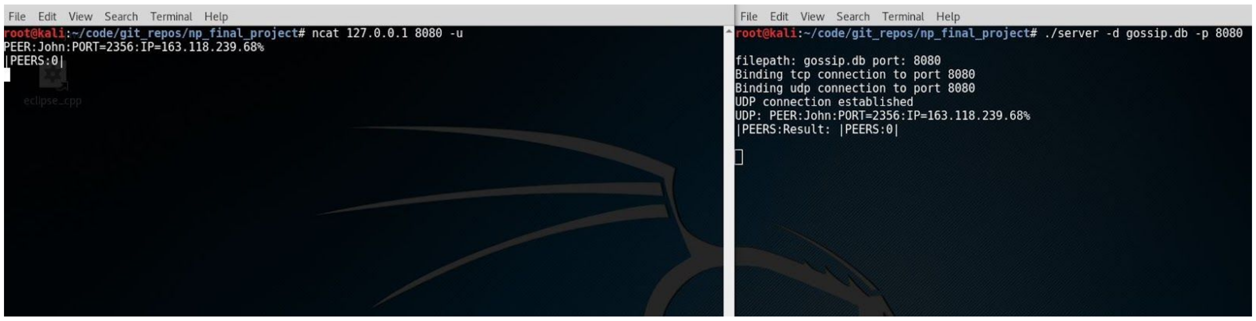
- Picture of Database:



	PEER	PORT	IP
1	John	2356	163.118.239.68

```
Query OK
Row(s) returned: 1
```

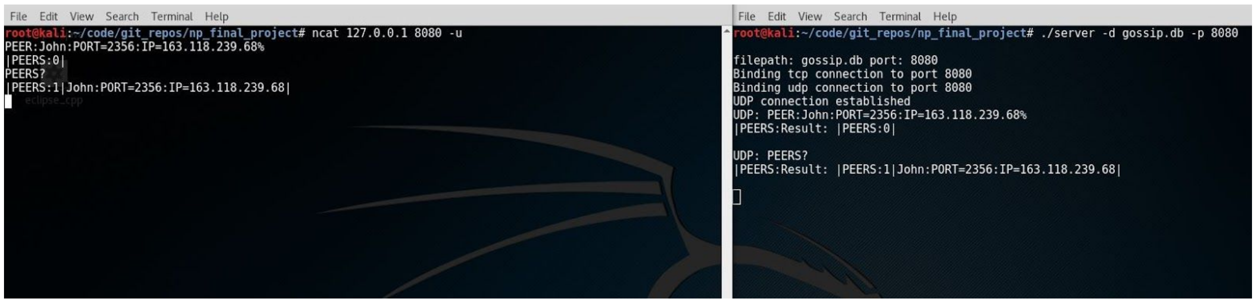
- Adding a Peer:


File Edit View Search Terminal Help
File Edit View Search Terminal Help

```
root@kali:~/code/git_repos/np_final_project# ncat 127.0.0.1 8080 -u
PEER:John:PORT=2356:IP=163.118.239.68%
|PEERS:0|
```

```
root@kali:~/code/git_repos/np_final_project# ./server -d gossip.db -p 8080

filepath: gossip.db port: 8080
Binding tcp connection to port 8080
Binding udp connection to port 8080
UDP connection established
UDP: PEER:John:PORT=2356:IP=163.118.239.68%
|PEERS:Result: |PEERS:0|
```

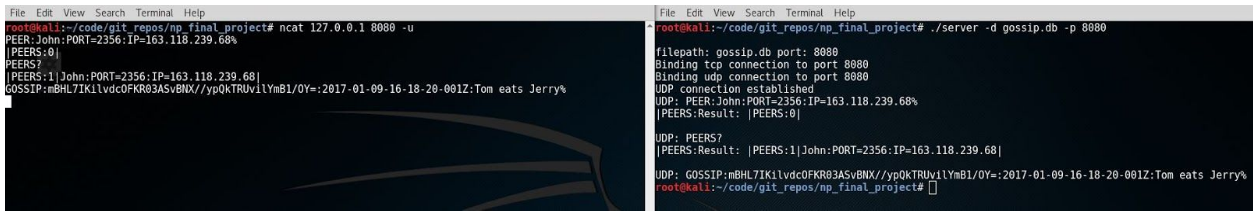
- Checking the Peers with the PEERS? Command:


File Edit View Search Terminal Help
File Edit View Search Terminal Help

```
root@kali:~/code/git_repos/np_final_project# ncat 127.0.0.1 8080 -u
PEER:John:PORT=2356:IP=163.118.239.68%
|PEERS:0|
PEERS?
|PEERS:1|John:PORT=2356:IP=163.118.239.68|
```

```
root@kali:~/code/git_repos/np_final_project# ./server -d gossip.db -p 8080

filepath: gossip.db port: 8080
Binding tcp connection to port 8080
Binding udp connection to port 8080
UDP connection established
UDP: PEER:John:PORT=2356:IP=163.118.239.68%
|PEERS:Result: |PEERS:0|

UDP: PEERS?
|PEERS:Result: |PEERS:1|John:PORT=2356:IP=163.118.239.68|
```

- Sending a Gossip Message:


File Edit View Search Terminal Help
File Edit View Search Terminal Help

```
root@kali:~/code/git_repos/np_final_project# ncat 127.0.0.1 8080 -u
PEER:John:PORT=2356:IP=163.118.239.68%
|PEERS:0|
PEERS?
|PEERS:1|John:PORT=2356:IP=163.118.239.68|
GOSSIP:mBHL7IKilvdcOFKR03ASvBNX//ypQkTRUvilYmB1/OY=:2017-01-09-16-18-20-001Z:Tom eats Jerry%
```

```
root@kali:~/code/git_repos/np_final_project# ./server -d gossip.db -p 8080

filepath: gossip.db port: 8080
Binding tcp connection to port 8080
Binding udp connection to port 8080
UDP connection established
UDP: PEER:John:PORT=2356:IP=163.118.239.68%
|PEERS:Result: |PEERS:0|

UDP: PEERS?
|PEERS:Result: |PEERS:1|John:PORT=2356:IP=163.118.239.68|

UDP: GOSSIP:mBHL7IKilvdcOFKR03ASvBNX//ypQkTRUvilYmB1/OY=:2017-01-09-16-18-20-001Z:Tom eats Jerry%
root@kali:~/code/git_repos/np_final_project#
```

6. Conclusion

In conclusion, the gossip server was created under the specifications provided in the class.

7. References

http://www.masterraghu.com/subjects/np/introduction/unix_network_programming_v1.3/ch08lev1sec15.html (File descriptor select)

http://stackoverflow.com/questions/6715736/using-select-for-non-blocking-sockets (non-blocking sockets for broadcasting)

http://ntrg.cs.tcd.ie/undergrad/4ba2/multicast/antony/example.html (for broadcasting)

http://beej.us/guide/bgnet/output/html/singlepage/bgnet.html (general networking)