

How to test:

1. Clean the build environment: Run make clean.
2. Compile the project: Run make.
3. Run the tests:
 - Test 1: Run ./test1.
 - Test 2: Run ./test2.
 - Test 3: Run ./test3.

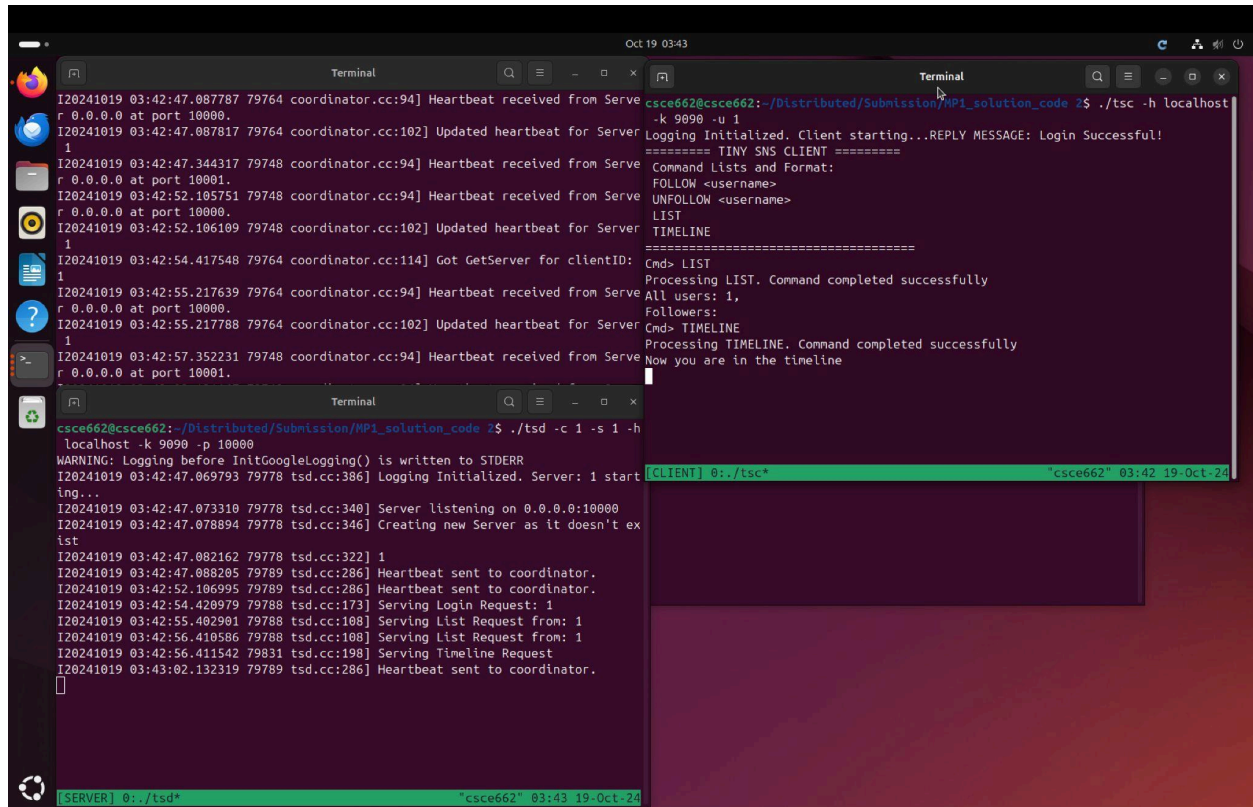
Code changes for test:

I have included three scripts - testcase1.cc, testcase2.cc, testcase3.cc with detailed comments before starting and killing the coordinator, server, and client, along with the necessary commands. I used tmux to manage terminals.

The `Makefile` has been updated to handle the compilation and cleaning of test1, test2, and test3.

Screenshots:

(Attached in zip too) : Test screenshots in order.



```
Oct 19 03:43

Terminal
I20241019 03:42:47.087787 79764 coordinator.cc:94] Heartbeat received from Server
r 0.0.0.0 at port 10000.
I20241019 03:42:47.087817 79764 coordinator.cc:102] Updated heartbeat for Server
1
I20241019 03:42:47.344317 79748 coordinator.cc:94] Heartbeat received from Server
r 0.0.0.0 at port 10001.
I20241019 03:42:52.105751 79748 coordinator.cc:94] Heartbeat received from Server
r 0.0.0.0 at port 10000.
I20241019 03:42:52.106109 79748 coordinator.cc:102] Updated heartbeat for Server
1
I20241019 03:42:54.417548 79764 coordinator.cc:114] Got GetServer for clientID:
1
I20241019 03:42:55.217639 79764 coordinator.cc:94] Heartbeat received from Server
r 0.0.0.0 at port 10000.
I20241019 03:42:55.217788 79764 coordinator.cc:102] Updated heartbeat for Server
1
I20241019 03:42:57.352231 79748 coordinator.cc:94] Heartbeat received from Server
r 0.0.0.0 at port 10001.

Terminal
csce662@csce662:~/Distributed/Submission/MP1_solution_code % ./tsc -h localhost
-k 9090 -u 1
Logging Initialized. Client starting...REPLY MESSAGE: Login Successful!
===== TINY SNS CLIENT =====
Command Lists and Format:
FOLLOW <username>
UNFOLLOW <username>
LIST
TIMELINE
=====
Cmd> LIST
Processing LIST. Command completed successfully
All users: 1,
Followers:
Cmd> TIMELINE
Processing TIMELINE. Command completed successfully
Now you are in the timeline

Terminal
csce662@csce662:~/Distributed/Submission/MP1_solution_code % ./tsd -c 1 -s 1 -h
localhost -k 9090 -p 10000
WARNING: Logging before InitGoogleLogging() is written to STDERR
I20241019 03:42:47.069793 79778 tsd.cc:386] Logging Initialized. Server: 1 start
ing...
I20241019 03:42:47.073310 79778 tsd.cc:340] Server listening on 0.0.0.0:10000
I20241019 03:42:47.078894 79778 tsd.cc:346] Creating new Server as it doesn't ex
ist
I20241019 03:42:47.082162 79778 tsd.cc:322] 1
I20241019 03:42:47.088205 79789 tsd.cc:286] Heartbeat sent to coordinator.
I20241019 03:42:52.106995 79789 tsd.cc:286] Heartbeat sent to coordinator.
I20241019 03:42:54.420979 79788 tsd.cc:173] Serving Login Request: 1
I20241019 03:42:55.402901 79788 tsd.cc:108] Serving List Request from: 1
I20241019 03:42:56.410586 79788 tsd.cc:108] Serving List Request from: 1
I20241019 03:42:56.411542 79831 tsd.cc:198] Serving Timeline Request
I20241019 03:43:02.132319 79789 tsd.cc:286] Heartbeat sent to coordinator.

[SERVER] 0:./tsd* "csce662" 03:43 19-Oct-24

[CLIENT] 0:./tsc* "csce662" 03:42 19-Oct-24
```

```
Oct 19 03:44
Terminal
I20241019 03:44:24.891333 80145 coordinator.cc:94] Heartbeat received from Server 1
I20241019 03:44:24.891358 80145 coordinator.cc:102] Updated heartbeat for Server 1
I20241019 03:44:25.335187 80145 coordinator.cc:94] Heartbeat received from Server 1
I20241019 03:44:25.335281 80145 coordinator.cc:102] Updated heartbeat for Server 1
I20241019 03:44:27.472467 80145 coordinator.cc:94] Heartbeat received from Server 1
I20241019 03:44:29.894258 80145 coordinator.cc:114] Got GetServer for clientID: 1
I20241019 03:44:29.903807 80106 coordinator.cc:94] Heartbeat received from Server 1
I20241019 03:44:29.903117 80106 coordinator.cc:102] Updated heartbeat for Server 1
I20241019 03:44:35.342896 80106 coordinator.cc:94] Heartbeat received from Server 1
I20241019 03:44:35.343030 80106 coordinator.cc:102] Updated heartbeat for Server 1
I20241019 03:44:37.490633 80106 coordinator.cc:94] Heartbeat received from Server 1
I20241019 03:44:37.490633 80106 coordinator.cc:102] Updated heartbeat for Server 1
I20241019 03:44:10.657202 80134 tsd.cc:340] Server listening on 0.0.0.0:10000
I20241019 03:44:10.663384 80134 tsd.cc:346] Creating new Server as it doesn't exist
I20241019 03:44:10.668493 80134 tsd.cc:322] 1
I20241019 03:44:10.672004 80146 tsd.cc:286] Heartbeat sent to coordinator.
^C
csc662@csc662:~/Distributed/Submission/MP1_solution_code_2$ ./tsd -c 1 -s 1 -h localhost -k 9090 -p 10000
WARNING: Logging before InitGoogleLogging() is written to STDERR
I20241019 03:44:24.868957 80202 tsd.cc:386] Logging Initialized. Server: 1 starting...
I20241019 03:44:24.873075 80202 tsd.cc:340] Server listening on 0.0.0.0:10000
I20241019 03:44:24.883802 80202 tsd.cc:387] Server exists
I20241019 03:44:24.895814 80213 tsd.cc:286] Heartbeat sent to coordinator.
I20241019 03:44:29.897405 80212 tsd.cc:173] Serving Login Request: 1
I20241019 03:44:29.903570 80213 tsd.cc:286] Heartbeat sent to coordinator.
I20241019 03:44:30.890183 80228 tsd.cc:108] Serving List Request from: 1
I20241019 03:44:31.902467 80228 tsd.cc:108] Serving List Request from: 1
I20241019 03:44:31.905274 80212 tsd.cc:198] Serving Timeline Request

[COORDINATOR] csc662 03:44 19-Oct-24
[SERVER] 0:./tsd* csc662 03:44 19-Oct-24

csc662@csc662:~/Distributed/Submission/MP1_solution_code_2$ ./tsc -h localhost -k 9090 -u 1
Logging Initialized. Client starting...REPLY MESSAGE: you have already joinedconnection failed: -1
csc662@csc662:~/Distributed/Submission/MP1_solution_code_2$ ./tsc -h localhost -k 9090 -u 1
Logging Initialized. Client starting...REPLY MESSAGE: you have already joinedconnection failed: -1
csc662@csc662:~/Distributed/Submission/MP1_solution_code_2$ ./tsc -h localhost -k 9090 -u 1
Logging Initialized. Client starting...REPLY MESSAGE: Login Successful!
===== TINY SNS CLIENT =====
Command Lists and Format:
FOLLOW <username>
UNFOLLOW <username>
LIST
TIMELINE
=====
Cmd> LIST
Processing LIST. Command completed successfully
All users: 1,
Followers:
Cmd> TIMELINE
Processing TIMELINE. Command completed successfully
Now you are in the timeline

[CLIENT] 0:./tsc* csc662 03:44 19-Oct-24
```

```
Oct 19 03:46
Terminal
I20241019 03:45:51.318440 80349 coordinator.cc:94] Heartbeat received from Server 2
I20241019 03:45:55.662887 80349 coordinator.cc:102] Updated heartbeat for Server 2
I20241019 03:45:55.663028 80349 coordinator.cc:94] Heartbeat received from Server 1
I20241019 03:46:01.340035 80349 coordinator.cc:102] Updated heartbeat for Server 1
I20241019 03:46:01.340207 80349 coordinator.cc:94] Heartbeat received from Server 2
I20241019 03:46:05.668638 80308 coordinator.cc:102] Updated heartbeat for Server 2
I20241019 03:46:05.668737 80308 coordinator.cc:94] Heartbeat received from Server 1
I20241019 03:46:11.352635 80308 coordinator.cc:102] Updated heartbeat for Server 1
I20241019 03:46:11.352874 80308 coordinator.cc:94] Heartbeat received from Server 2
I20241019 03:45:23.215601 80348 tsd.cc:198] Serving Timeline Request
I20241019 03:45:25.617404 80350 tsd.cc:286] Heartbeat sent to coordinator.
I20241019 03:45:35.630251 80350 tsd.cc:286] Heartbeat sent to coordinator.
I20241019 03:45:45.650449 80350 tsd.cc:286] Heartbeat sent to coordinator.
I20241019 03:45:55.664427 80350 tsd.cc:286] Heartbeat sent to coordinator.
I20241019 03:46:05.669142 80350 tsd.cc:286] Heartbeat sent to coordinator.
I20241019 03:46:15.693593 80350 tsd.cc:286] Heartbeat sent to coordinator.

[COORDINATOR] csc662 03:46 19-Oct-24
[SERVER1] csc662 03:46 19-Oct-24
[SERVER2] tsc662 03:46 19-Oct-24

csc662@csc662:~/Distributed/Submission/MP1_solution_code_2$ ./tsc -h localhost -k 9090 -u 2
Logging Initialized. Client starting...REPLY MESSAGE: Login Successful!
===== TINY SNS CLIENT =====
Command Lists and Format:
FOLLOW <username>
UNFOLLOW <username>
LIST
TIMELINE
=====
Cmd> LIST
Processing LIST. Command completed successfully
All users: 2,
Followers:
Cmd> TIMELINE
Processing TIMELINE. Command completed successfully
Now you are in the timeline

[CLIENT1] csc662 03:46 19-Oct-24
[CLIENT2] 0:./tsc* csc662 03:46 19-Oct-24

csc662@csc662:~/Distributed/Submission/MP1_solution_code_2$ ./tsc -h localhost -k 9090 -u 2
Logging Initialized. Client starting...REPLY MESSAGE: Login Successful!
===== TINY SNS CLIENT =====
Command Lists and Format:
FOLLOW <username>
UNFOLLOW <username>
LIST
TIMELINE
=====
Cmd> LIST
Processing LIST. Command completed successfully
All users: 2,
Followers:
Cmd> TIMELINE
Processing TIMELINE. Command completed successfully
Now you are in the timeline

[CLIENT2] 0:./tsc* csc662 03:46 19-Oct-24
```

Files Modified

- **tsc.cc:**
 - Updated the main function to accept new command-line options (-h, -k, -u).
 - The connectTo() function now calls the Coordinator Stub's GetServer() function to fetch server information (hostname and port) instead of using the SNS service stub.
 - The RPC call to the SNS service is made using this retrieved information.
 - Since the Timeline doesn't call the server on initialization, the Follow function is used to ping the server.
- **tsd.cc:**
 - Modified the main function to accept new command-line options (-c, -s, -h, -k, -p).
 - The RunServer function sets the server information and checks with the Coordinator Stub using the exists function.
 - If the server is not registered with the coordinator, it registers itself using the Create function.
 - A heartbeat thread (sendHeartbeat) is started to call the Coordinator Stub's heartbeat function every 5 seconds after registration.
- **coordinator.cc:**
 - The GetServer function now locates a server in the cluster based on the formula $(clientId - 1 \bmod 3) + 1$, returning the corresponding hostname and port for client connections.
 - The HeartBeat function updates the server status every 5 seconds.
 - The exists function checks if the server is present in the clusters array, while the Create function adds a new server to the cluster.
- **coordinator.proto:**
 - Added clusterId to the Server Info for improved management.
 - Updated the exists and create functions to utilize serverInfo for simplicity.
- **Makefile:**
 - Updated to manage the compilation and cleaning of test1, test2, and test3.