# Gabriel Floreslovo CSCE 438 - Distributed Systems Section 500

# MP2.1: A Scalable Tiny SNS

#### Features:

- Coordinator that assigns newly connected clients to an available server cluster
- Clients do not know implementation; only connect to coordinator once

### **Architecture:**

- Coordinator
  - Serves both SNS servers and SNS clients
  - <u>Servers</u>
    - Server opens gRPC channel as a client of the coordinator
    - Server begins sending "Heartbeats" to tell the coordinator that it is still "alive" or active
    - Coordinator stores metadata of all servers on all clusters as a "routing table"
      - This table is updated on every heartbeat (updating current metadata) or when a new server joins the SNS (adding new entry to table)
    - Coordinator periodically checks for "dead" or inactive servers by seeing if their last heartbeat was more than 10 seconds ago
      - Marks a dead server as having missed a heartbeat

#### Clients

- Client opens gRPC channel as client of the coordinator
- Client requests server from the coordinator
- Coordinator assigns client a server, client connects and begins to interact with SNS as normal

## Implementation:

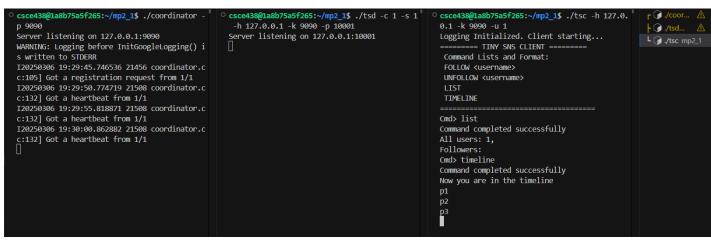
- Server
  - Initialize a server info struct for communication with coordinator in accordance with coordinator service protobuf definition
  - Create stub on coordinator channel
  - Create a heartbeat handler for a thread that will send heartbeat every 5 seconds with thread::sleep\_for and chrono::seconds
    - In thread, use stub to send heartbeats to coordinator as rpc's
    - First heartbeat should be a "registration" heartbeat to create the data for this server on the coordinator's end
- Client
  - Create stub on coordinator channel
  - Use stub to request a server

Use returned server info to create normal server channel and corresponding stub

#### Coordinator

- Hold metadata table as vector of vectors: [clusterid][serverid]
- Assign clients to clusters by (clientid 1) mod 3 + 1
- Use mutex when writing/reading server metadata so as to not create race condition between threads
- Periodically checks to see if any servers are dead by looping through metadata files in a separate thread

# Test 1:



## Test 2:

```
csce438@1a8b75a5f265:~/mp2 1$ ./coordinator -
                                                  csce438@1a8b75a5f265:~/mp2 1$ ./tsd -c 1 -s 1
                                                                                                    ® csce438@1a8b75a5f265:~/mp2 1$ ./tsc -h 127.0.
                                                   -h 127.0.0.1 -k 9090 -p 10001
                                                                                                     0.1 -k 9090 -u 1
                                                                                                     Logging Initialized. Client starting...connec
Server listening on 127.0.0.1:9090
                                                   Server listening on 127.0.0.1:10001
                                                                                                                                                      L ./tsc mp2_1
WARNING: Logging before InitGoogleLogging() i
                                                                                                     tion failed: -1
                                                                                                   @ csce438@1a8b75a5f265:~/mp2_1$ ./tsc -h 127.0.
s written to STDERR
                                                  csce438@1a8b75a5f265:~/mp2_1$ ./tsd -c 1 -s 1
                                                                                                     0.1 -k 9090 -u 1
I20250306 19:31:44.151580 22858 coordinator.c
                                                   -h 127.0.0.1 -k 9090 -p 10001
c:105] Got a registration request from 1/1
                                                   Server listening on 127.0.0.1:10001
                                                                                                     Logging Initialized. Client starting...connec
I20250306 19:31:49.162156 22858 coordinator.c
                                                                                                     tion failed: -1
c:132] Got a heartbeat from 1/1
                                                                                                    ocsce438@1a8b75a5f265:~/mp2_1$./tsc-h 127.0.
I20250306 19:32:02.209405 22845 coordinator.c
                                                                                                     0.1 -k 9090 -u 1
c:229] missed heartbeat from server
                                                                                                     Logging Initialized. Client starting...
I20250306 19:32:08.013160 23031 coordinator.c
                                                                                                               TINY SNS CLIENT
                                                                                                      Command Lists and Format:
c:105] Got a registration request from 1/1
I20250306 19:32:13.036494 23031 coordinator.c
                                                                                                      FOLLOW <username>
c:132] Got a heartbeat from 1/1
                                                                                                      UNFOLLOW <username>
120250306 19:32:18.061538 23031 coordinator.c
c:132] Got a heartbeat from 1/1
                                                                                                      TIMELINE
I20250306 19:32:20.379426 22845 coordinator.c
c:229] missed heartbeat from server 1
                                                                                                     Cmd> list
I20250306 19:32:23.091826 23031 coordinator.c
                                                                                                     Command completed successfully
c:132] Got a heartbeat from 1/1
                                                                                                     All users: 1,
I20250306 19:32:28.136282 23031 coordinator.c
                                                                                                     Followers:
c:132] Got a heartbeat from 1/1
                                                                                                     Cmd> timeline
                                                                                                     Command completed successfully
120250306 19:32:32.459282 22845 coordinator.c
c:229] missed heartbeat from server 1
                                                                                                     Now you are in the timeline
I20250306 19:32:33.180524 23031 coordinator.c
c:132] Got a heartbeat from 1/1
I20250306 19:32:35.489305 22845 coordinator.c
c:229] missed heartbeat from server 1
```

# Test 3:

ocsce438@1a8b75a5f265:~/mp2_1\$ ./c	o csce438@1a8b75a5f265:~/mp2_1\$ ./t sd -c 1 -s 1 -h 127.0.0.1 -k 9090	<pre>® csce438@1a8b75a5f265:~/mp2_1\$ ./t sd -c 2 -s 2 -h 127.0.0.1 -k 9090</pre>	o csce438@1a8b75a5f265:~/mp2_1\$ ./t	Cmd> list Invalid Input No Arguments Giv	-
Server listening on 127.0.0.1:909	-p 10001	-p 10002	Logging Initialized. Client start	en	- (a ./tsd mp2_1
0	Server listening on 127.0.0.1:100	Server listening on 127.0.0.1:100	ing	Cmd> list	
WARNING: Logging before InitGoogl	01	02	======= TINY SNS CLIENT ======	grpc failed: failed to connect to	- () ./tsc mp2_1
eLogging() is written to STDERR		^C -	==	all addresses; last error: UNKNO	L
120250306 20:29:21.434345 22993 c		csce438@1a8b75a5f265:~/mp2_1\$ ./t	Command Lists and Format:	WN: ipv4:127.0.0.1:10002: Failed	
oordinator.cc:105] Got a registra		sd -c 2 -s 2 -h 127.0.0.1 -k 9090	FOLLOW <username></username>	to connect to remote host: Connec	
tion request from 1/1		-p 10002	UNFOLLOW <username></username>	tion refused	
120250306 20:29:23.269562 23049 c		Server listening on 127.0.0.1:100	LIST	Cmd> timeline	
oordinator.cc:105] Got a registra		02	TIMELINE	grpc failed: failed to connect to	
tion request from 2/2		Ĭ.	111111111111111111111111111111111111111	all addresses; last error: UNKNO	
120250306 20:29:26.450839 23049 c			====	WN: ipv4:127.0.0.1:10002: Failed	
oordinator.cc:132] Got a heartbea			Cmd> list	to connect to remote host: Connec	
t from 1/1			Command completed successfully	tion refused	
I20250306 20:29:28.293609 22993 c			All users: 1.	Cmd> ^C	
oordinator.cc:132] Got a heartbea			Followers:	ocsce438@1a8b75a5f265:~/mp2 1\$ ./t	
t from 2/2			Cmd> timeline	sc -h 127.0.0.1 -k 9090 -u 2	
120250306 20:29:31.471063 23049 c			Command completed successfully	Logging Initialized. Client start	
oordinator.cc:132] Got a heartbea			Now you are in the timeline	ing	
t from 1/1				====== TINY SNS CLIENT ======	
I20250306 20:29:33.338685 23049 c					
oordinator.cc:132] Got a heartbea				Command Lists and Format:	
t from 2/2				FOLLOW <username></username>	1
I20250306 20:29:36.516672 22993 c				UNFOLLOW <username></username>	
oordinator.cc:132] Got a heartbea				LIST	
t from 1/1				TIMELINE	
I20250306 20:29:41.562317 22993 c					
oordinator.cc:132] Got a heartbea					
t from 1/1				Cmd> list	
I20250306 20:29:46.593528 22993 c				Command completed successfully	
oordinator.cc:132] Got a heartbea				All users: 2,	
t from 1/1				Followers:	
120250306 20:29:46.683683 22980 c				Cmd> timeline	
oordinator.cc:229] missed heartbe				Command completed successfully	
at from server 2				Now you are in the timeline	
I20250306 20:29:51.613929 22993 c					