

DISTRIBUTED OPERATING SYSTEM PRINCIPLES

Project 4, Part I

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Key Performance Metrics and Insights for the Reddit Clone Simulation:

(Performance metrics are logged every 30 seconds)

User Simulation:

- The system simulates 10,000 users
- User connections and disconnections are randomly simulated
- User registration rate is approximately 10-15 new users per second

Post Distribution:

- Post creation follows a Zipf distribution
- Some users create thousands of posts (e.g., User 9946 will make 9989 posts)
- Many users create very few or no posts (e.g., User 9945 will make 0 posts)

Action Diversity:

- The simulation covers various actions: creating/joining subreddits, posting, commenting, voting, getting feeds, sending messages, and reposting

Concurrency:

- Multiple user actions are processed simultaneously
- A rate limiter (100ms) is implemented to prevent overwhelming the server

Feed Retrieval:

- Feeds are paginated, returning 50 posts per request
- The number of posts in feeds increases over time (e.g., from 18 to 29 posts)

Error Handling:

- "Subreddit not found" error might occur when trying to join subreddits

Action Frequency:

- The system processes multiple actions per second across different users

Subreddit Management:

- New subreddits are created throughout the simulation
- There's a 30% chance of creating a new subreddit vs. joining an existing one

```

2024/11/26 21:45:33 Created comment: Comment XNMGqVk9EK2yfoLNhCJUAMehiekrn5
2024/11/26 21:45:33 Voted on: some_comment_id
2024/11/26 21:45:33 --- Performance Metrics ---
2024/11/26 21:45:33 Simulation running for: 30.001801s
2024/11/26 21:45:33 Total users: 10000
2024/11/26 21:45:33 Total posts: 42
2024/11/26 21:45:33 Total comments: 41
2024/11/26 21:45:33 Total votes: 43
2024/11/26 21:45:33 Total subreddits: 13
2024/11/26 21:45:33 Total direct messages: 45
2024/11/26 21:45:33 Total actions: 292
2024/11/26 21:45:33 Actions per second: 9.73
2024/11/26 21:45:33 -----
2024/11/26 21:45:33 User user_BTWX7GFQ connected
2024/11/26 21:45:33 User user_Zz7Wc8MJ connected
2024/11/26 21:45:33 User user_7At7D9yl connected
2024/11/26 21:45:33 Created subreddit: sub_eB1HowHe
2024/11/26 21:45:33 User user_5w7agXfc connected
2024/11/26 21:45:33 User user_9hrcuuUW connected

```

These metrics provide insights into the system's behavior, scalability, and areas for improvement in the Reddit clone implementation.

Summary on Project Structure

- Server directory:

Contains main.go (server implementation)

- Client directory:

Contains main.go (client implementation)

- Proto directory:

Contains redditclone.proto (Protocol Buffer definition)

- Root directory:

go.sum (dependency checksums)

go.mod (module definition and dependencies)

- Redditclone folder:

redditclone.pb.go (generated Protocol Buffer code)

redditclone_grpc.pb.go (generated gRPC code)

Detailed Instructions on how the Reddit clone simulation was run:

Project Setup:

- Created a new directory named "reddit-clone"
- Inside this directory, created subdirectories: "proto", "server", and "client"

Protocol Buffer Definition:

- Created a file named "redditclone.proto" in the "proto" directory
- Defined the service and message types for the Reddit clone

Code Generation:

- Installed the Protocol Buffer compiler (protoc)
- Generated Go code from the proto file using the command:
`protoc --go_out=. --go-grpc_out=. proto/redditclone.proto`

Dependencies:

- Initialized a Go module:
- `go mod init reddit-clone`

Installed required dependencies:

- `go get google.golang.org/grpc`
- `go get github.com/google/uuid`
- `go get github.com/chinuy/zipf`

Server Implementation:

- Created "main.go" in the "server" directory
- Implemented the gRPC server with all required methods

Client Implementation:

- Created "main.go" in the "client" directory
- Implemented the client simulator

Running the Simulation:

- Started the server:
 - `cd server`
 - `go run main.go`
- In a separate terminal, started the client:
 - `cd client`
 - `go run main.go`

Issues Faced and Solutions:

- "Subreddit not found" errors:
 1. Created an initial pool of subreddits in the server

2. Updated client to use this pool when joining subreddits
- "Message larger than max" errors:
1. Increased gRPC message size limit in the server:

```
s := grpc.NewServer(  
    grpc.MaxRecvMsgSize(10 * 1024 * 1024),  
    grpc.MaxSendMsgSize(10 * 1024 * 1024),  
)
```

2. Implemented pagination for feed retrieval

Zipf distribution implementation:

- Used the github.com/chinuy/zipf package for Zipf distribution
- Implemented in the client's main function to determine the number of posts per user

The simulation successfully created 10,000 simulated users, implemented the required Reddit-like functionalities, and demonstrated concurrent activity with connection/disconnection simulation.

Output Snippets

```
C:\Users\Asus\Downloads\reddit-clone>cd server/  
  
C:\Users\Asus\Downloads\reddit-clone\server>go run main.go  
2024/11/26 19:21:14 server listening at [::]:50051
```

```
2024/11/26 19:33:42 Created post: Post DSj5mDUmi9Zu  
2024/11/26 19:33:42 Sent direct message: Message yWxoZVSh3tq3VigbDKRE  
2024/11/26 19:33:42 User user_3uERRunI connected  
2024/11/26 19:33:42 Got feed page 1 with 50 posts  
2024/11/26 19:33:42 Joined subreddit: f33e0cc4-ea56-4124-987b-37ba55bcb62f  
2024/11/26 19:33:42 Created subreddit: sub_RVKsX20g  
2024/11/26 19:33:42 User user_RCLDIDXu connected  
2024/11/26 19:33:42 Sent direct message: Message R0rFGDE8p95uZcWM3F5R  
2024/11/26 19:33:42 Created post: Post sbvKbZVCiboD  
2024/11/26 19:33:43 User user_hPYZ4B0V connected  
2024/11/26 19:33:43 Created comment: Comment 8iFY2duSMDbD6q8DcLggUkuVTC7Z3Z  
2024/11/26 19:33:43 Reposted post: 74d0544c-f5e4-44ab-91df-7eed2d8689fa  
2024/11/26 19:33:43 Created post: Post xeFHyszGBD3v  
2024/11/26 19:33:43 Got feed page 1 with 50 posts
```

2024/11/26 19:32:11 Created comment: Comment tnEYbY3hh2X5N5wH9iQZ0Jfp5c11cJ
2024/11/26 19:32:11 User user_aJwXNLmb disconnected
2024/11/26 19:32:11 User user_aJwXNLmb connected
2024/11/26 19:32:11 Reposted post: 42c6c21f-d9d7-4b26-acdf-1d87f17d28a5
2024/11/26 19:32:11 Created comment: Comment 82Vu2XE6hcR0xniqCBBiAupnZxnc6I
2024/11/26 19:32:11 Voted on: 7cdc3394-b495-4ad9-b8c0-8fbaa71f37eb
2024/11/26 19:32:11 Joined subreddit: 031ccb26-4888-4bd0-9983-61d46eb0bc9f
2024/11/26 19:32:11 Created post: Post ZvDiIVV46lhC
2024/11/26 19:32:11 Reposted post: 80472442-534b-487f-97f0-7e53aa2e19da
2024/11/26 19:32:11 User user_ex5V3la4 connected
2024/11/26 19:32:11 Voted on: some_comment_id
2024/11/26 19:32:11 Sent direct message: Message FTlHXxZZMxSQUdJYIDxF
2024/11/26 19:32:11 Got feed page 1 with 50 posts
2024/11/26 19:32:11 User user_RodtYcqz disconnected
2024/11/26 19:32:12 Got feed page 1 with 50 posts
2024/11/26 19:32:12 Created comment: Comment BEWuov9oi1ClNRzaUV6F4o77wSU5AW
2024/11/26 19:32:12 Created comment: Comment ionffR2Ix3ELv0Da7wdUW1af1DkXxN
2024/11/26 19:32:12 Created post: Post 8zxpUJsf6ClN
2024/11/26 19:32:12 Got feed page 1 with 50 posts
2024/11/26 19:32:12 User user_q0RxuhCZ disconnected
2024/11/26 19:32:12 User user_ZtpwVWmG connected
2024/11/26 19:32:12 Created post: Post BMt1sHt6EU7Y
2024/11/26 19:32:12 Got feed page 1 with 50 posts
2024/11/26 19:32:12 Sent direct message: Message gBW676rrhKXISel0bJQ2
2024/11/26 19:32:12 Voted on: some_comment_id
2024/11/26 19:32:12 Got feed page 1 with 50 posts
2024/11/26 19:32:12 User user_svLxnoaS connected
2024/11/26 19:32:13 Sent direct message: Message LMITGkOVLKVYzUpBhLGw
2024/11/26 19:32:13 Joined subreddit: 5344fb5f-443d-4832-8e02-dbe275a96c34

2024/11/26 19:29:30 User 7556 will make 127 posts
2024/11/26 19:29:30 User 7557 will make 175 posts
2024/11/26 19:29:30 User 7558 will make 1 posts
2024/11/26 19:29:30 User 7559 will make 263 posts
2024/11/26 19:29:30 User 7560 will make 3 posts
2024/11/26 19:29:30 Registered user: user_xl9ybi7P
2024/11/26 19:29:30 Registered user: user_ATR33W1m
2024/11/26 19:29:30 Registered user: user_jtNmmDyU
2024/11/26 19:29:30 Registered user: user_hKwoChKF
2024/11/26 19:29:30 Registered user: user_eU8EoUSM
2024/11/26 19:29:30 Registered user: user_ICxOytMO
2024/11/26 19:29:30 User 7561 will make 4374 posts
2024/11/26 19:29:30 User 7562 will make 608 posts
2024/11/26 19:29:30 User 7563 will make 0 posts
2024/11/26 19:29:30 User 7564 will make 51 posts
2024/11/26 19:29:30 User 7565 will make 497 posts
2024/11/26 19:29:30 Registered user: user_LBHNaoNh
2024/11/26 19:29:30 Registered user: user_UozoeM6L
2024/11/26 19:29:30 Registered user: user_pU9WNZ9b
2024/11/26 19:29:30 Registered user: user_5lywXeQx
2024/11/26 19:29:30 User 7566 will make 2 posts
2024/11/26 19:29:30 User 7567 will make 19 posts
2024/11/26 19:29:30 User 7568 will make 1801 posts
2024/11/26 19:29:30 User 7569 will make 390 posts
2024/11/26 19:29:30 Registered user: user_sPNFymR9
2024/11/26 19:29:30 Registered user: user_gdGbbRo0
2024/11/26 19:29:30 Registered user: user_mG5xcnNg
2024/11/26 19:29:30 Registered user: user_q8TgrLWl
2024/11/26 19:29:30 Registered user: user_9fnHnuXX
2024/11/26 19:29:30 User 7570 will make 531 posts
2024/11/26 19:29:30 User 7571 will make 0 posts
2024/11/26 19:29:30 User 7572 will make 560 posts
2024/11/26 19:29:30 Registered user: user_Aomyz9fC
2024/11/26 19:29:30 Registered user: user_YzbJLbUK
2024/11/26 19:29:30 User user_YzbJLbUK disconnected
2024/11/26 19:29:30 Registered user: user_kSCTYifi
2024/11/26 19:29:30 Registered user: user_EBAcYJ3M
2024/11/26 19:29:30 User 7573 will make 347 posts
2024/11/26 19:29:30 Registered user: user_OuV2DXRg
2024/11/26 19:29:30 Registered user: user_AEjzWYvX
2024/11/26 19:29:30 Registered user: user_nu8Xq5by

Performance metrics being logged every 30 seconds

```
2024/11/26 21:45:33 Created comment: Comment XNMGqVk9EK2yfoLNhCJUAMehiekrn5
2024/11/26 21:45:33 Voted on: some_comment_id
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2024/11/26 21:45:33 User user_9hrcuuUW connected
```