REDDIT CLONE PROJECT REPORT

Team Members →
Lohitha Rani Chintalapati 54655114
Alekhya Naravajhula 74059907

1. Introduction

This project focuses on building a backend system modelled after Reddit, a widely used social media and discussion platform. Developed using Go, the system consists of two key components: a backend engine and a client simulator. The engine supports critical features such as user account registration, subreddit management, posting, hierarchical comments, voting, and direct messaging. Meanwhile, the client simulator replicates realistic user behaviour, including active and inactive periods, and gathers performance data to assess the system's scalability, reliability, and efficiency. With a modular design and leveraging Go's capabilities in concurrency and gRPC for communication, the project ensures efficient data handling and responsive request processing.

This report covers Part I of the project:

1. Building the backend engine with core functionality.
2. Implementing a client simulator to test and measure system performance.

Future work will involve extending the system with APIs for frontend interaction.

2. System Architecture

The system is modular, with a clear separation of components for maintainability and scalability. The architecture utilizes Go's strengths in concurrency and gRPC for efficient communication.

reddit-clone/

- **cmd/**
  - **engine/**: Backend engine process
  - **client/**: Client simulator process
- **internal/**
  - **models/**: Data structures (users, posts, comments)
  - **engine/**: Core logic for Reddit features
  - **client/**: gRPC client implementation
  - **server/**: gRPC server logic
  - **simulator/**: Simulation logic for user behaviour
  - **proto/**: gRPC service definitions
- **pkg/**
  - **config/**: Configuration utilities
  - **metrics/**: Metrics collection utilities

3. Engine Components

The engine is the core of the system, implementing business logic and ensuring thread-safe data operations using Go's sync.Map for concurrency.

```
type RedditEngine struct {
   users        sync.Map // Stores user accounts
   subreddits sync.Map // Manages subreddit data
   posts        sync.Map // Tracks posts
   comments sync.Map // Handles hierarchical comments
   votes        sync.Map // Records vote counts
   messages sync.Map // Stores direct messages
}
```

- Thread Safety: Operations are designed to be thread-safe for handling concurrent user requests.

- Responsibility: Manages relationships among users, subreddits, posts, and comments.

4. Server Component

The server exposes gRPC service interfaces for client interaction and integrates with the engine to process requests.

```
type RedditServer struct {
   proto.UnimplementedRedditServiceServer
   engine  *engine.RedditEngine
   metrics *metrics.Collector // Monitors performance metrics
}
```

- Implements gRPC methods for registering accounts, creating subreddits, posting, voting, and messaging.

- Tracks performance metrics like latency, throughput, and error rates.

5. Client Component

The client facilitates communication with the server, enabling the simulator to test the engine.

```
type RedditClient struct {
   conn   *grpc.ClientConn // gRPC connection
   client proto.RedditServiceClient // Generated gRPC client
   ctx    context.Context
}
```

- Provides APIs for posting, commenting, and subscribing to subreddits.
- Ensures robust connection management.

6. Simulator Component

The simulator replicates realistic user behavior by simulating thousands of concurrent users.

```
type Simulator struct {
    client          *RedditClient
    users           []*models.User
    subreddits      []*models.SubReddit
    userSubs        map[string][]string
    activeUsers     sync.Map
}
```

- Uses Zipf distribution for subreddit popularity.
- Simulates user disconnection and reconnection for realistic behavior patterns.

7. Functional Implementation

Features Implemented

User Management

- **Account Registration**: Ensures unique usernames and maintains user metadata (e.g., karma).
- **Karma System**: Dynamically updates karma points based on voting activity.
- **Online/Offline Status**: Tracks user states for simulation purposes.

Content Management

- **Subreddits**:
  - Users can create, join, and leave subreddits.
  - Membership statistics are tracked.
- **Posts**:
  - Posts are stored as text with support for hierarchical comments.
  - Threads use a tree-like structure for nested comments.
- **Voting**:
  - Posts and comments can be upvoted or downvoted.
  - Votes influence user karma.

Messaging

- Users can send direct messages and reply to existing ones.
- Messages are stored per user for efficient retrieval.

8. Client Tester/Simulator

Simulation Features

- **User Behavior**: Simulates realistic actions like posting, voting, and commenting.
- **Connection Management**: Models periods of disconnection and reconnection for users.
- **Zipf Distribution**: Implements natural popularity patterns for subreddits, with most activity concentrated in a few highly popular subreddits.

```
func (s *Simulator) generateZipfDistribution() *rand.Zipf {
    return rand.NewZipf(s.rng, 1.5, 1, uint64(len(s.subreddits)))
}
```

9. Process Separation

Server Process

The engine runs as a single server process, handling all client requests.

```
go run cmd/engine/main.go -port 50051
```

- Maintains global data consistency.
- Logs and monitors requests, metrics, and system health.

Client Processes

Multiple client processes simulate thousands of concurrent users, each interacting with the central server.

```
go run cmd/client/main.go -server localhost:50051 -users 10 -duration 5m
```

- Ensures realistic user activity through concurrent goroutines.
- Measures system performance under varying loads.

10. Results - Performance Metrics

```
~/Desktop/reddit-clone — main ◂ go run cmd/engine/main.go -port 50051
Last login: Tue Nov 26 10:59:12 on console
(base) alekhyanaravajhula@Alekhyas-Air ~ % cd Desktop
(base) alekhyanaravajhula@Alekhyas-Air Desktop % cd reddit-clone
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone % protoc --go_out=. --go_opt=paths=source_relative \
    --go-grpc_out=. --go-grpc_opt=paths=source_relative \
    internal/proto/reddit.proto
protoc-gen-go: program not found or is not executable
Please specify a program using absolute path or make sure the program is available in your PATH system variable
--go_out: protoc-gen-go: Plugin failed with status code 1.
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone % ls
README.md       go.mod          internal        reddit-clone
cmd             go.sum          pkg
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone % go install google.golang.org/protobuf/cmd/protoc-gen-go@latest
go install google.golang.org/grpc/cmd/protoc-gen-go-grpc@latest
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone % export PATH="$PATH:$(go env GOPATH)/bin"
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone % source ~/.zshrc  # if using zsh
# or
source ~/.bash_profile  # if using bash
zsh: command not found: #
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone % which protoc-gen-go
which protoc-gen-go-grpc
/Users/alekhyanaravajhula/go/bin/protoc-gen-go
/Users/alekhyanaravajhula/go/bin/protoc-gen-go-grpc
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone % protoc --go_out=. --go_opt=paths=source_relative \
    --go-grpc_out=. --go-grpc_opt=paths=source_relative \
    internal/proto/reddit.proto
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone % protoc --version
libprotoc 25.3
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone % go run cmd/engine/main.go -port 50051
# command-line-arguments
cmd/engine/main.go:69:13: undefined: logMetrics
cmd/engine/main.go:74:13: undefined: logMetrics
cmd/engine/main.go:90:10: undefined: Server
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone % go run cmd/engine/main.go -port 50051
2024/11/26 11:14:37 Starting metrics server on :50052
2024/11/26 11:14:37 Starting Reddit engine server on port 50051
2024/11/26 11:15:37
=== Server Metrics ===
2024/11/26 11:15:37 Total Requests: 0
2024/11/26 11:15:37 Average Latency: 13.807244ms
2024/11/26 11:15:37 Active Users: 0
2024/11/26 11:15:37 Total Posts: 0
2024/11/26 11:15:37 Total Comments: 0
2024/11/26 11:15:37 Total Votes: 0
2024/11/26 11:15:37
Subreddit Statistics:
2024/11/26 11:15:37
2024/11/26 11:16:37
=== Server Metrics ===
2024/11/26 11:16:37 Total Requests: 0
2024/11/26 11:16:37 Average Latency: 1.384311ms
2024/11/26 11:16:37 Active Users: 0
2024/11/26 11:16:37 Total Posts: 0
2024/11/26 11:16:37 Total Comments: 0
2024/11/26 11:16:37 Total Votes: 0
2024/11/26 11:16:37
Subreddit Statistics:
2024/11/26 11:16:37
2024/11/26 11:17:37
=== Server Metrics ===
2024/11/26 11:17:37 Total Requests: 0
2024/11/26 11:17:37 Average Latency: 774.267µs
2024/11/26 11:17:37 Active Users: 0
```

~/Desktop/reddit-clone — main ◂ go run cmd/engine/main.go -port 50051

```
2024/11/26 11:16:28 User user_0 created post in subreddit_0
2024/11/26 11:16:29 User user_0 created post in subreddit_1
2024/11/26 11:16:30 User user_5 created post in subreddit_4
2024/11/26 11:16:31 User user_7 created post in subreddit_0
2024/11/26 11:16:31 User user_6 created post in subreddit_0
2024/11/26 11:16:34
=== Simulation Metrics ===
2024/11/26 11:16:34 Active Users: 6/0 (+Inf%)
2024/11/26 11:16:34 Average Response Time: 0s
2024/11/26 11:16:34 Total Requests: 0
2024/11/26 11:16:34 Request Rate: 0.00/sec
2024/11/26 11:16:34
Content Statistics:
2024/11/26 11:16:34 Total Posts: 56
2024/11/26 11:16:34 Total Comments: 48
2024/11/26 11:16:34 Total Votes: 43
2024/11/26 11:16:34
Subreddit Activity:
2024/11/26 11:16:34
2024/11/26 11:16:34 User user_0 created post in subreddit_0
2024/11/26 11:16:34 User user_3 created post in subreddit_0
2024/11/26 11:16:34 User user_4 created post in subreddit_2
2024/11/26 11:16:35 User user_0 created post in subreddit_1
2024/11/26 11:16:36 User user_5 created post in subreddit_1
2024/11/26 11:16:36 User user_3 created post in subreddit_3
2024/11/26 11:16:37 User user_1 created post in subreddit_1
2024/11/26 11:16:37 User user_5 created post in subreddit_4
2024/11/26 11:16:38 User user_5 created post in subreddit_1
2024/11/26 11:16:38 User user_4 created post in subreddit_1
2024/11/26 11:16:38 User user_2 created post in subreddit_2
2024/11/26 11:16:41 User user_0 created post in subreddit_0
2024/11/26 11:16:42 User user_3 created post in subreddit_2
2024/11/26 11:16:43 User user_7 created post in subreddit_3
2024/11/26 11:16:43 User user_8 created post in subreddit_0
2024/11/26 11:16:44 User user_5 created post in subreddit_4
2024/11/26 11:16:45 User user_5 created post in subreddit_1
2024/11/26 11:16:46 User user_8 created post in subreddit_2
2024/11/26 11:16:47 User user_0 created post in subreddit_0
2024/11/26 11:16:48 User user_3 created post in subreddit_3
2024/11/26 11:16:50 User user_1 created post in subreddit_1
2024/11/26 11:16:52 User user_8 created post in subreddit_2
2024/11/26 11:16:55 User user_0 created post in subreddit_1
2024/11/26 11:16:58 User user_6 created post in subreddit_0
2024/11/26 11:16:58 User user_0 created post in subreddit_0
2024/11/26 11:16:58 User user_3 created post in subreddit_2
2024/11/26 11:16:58 User user_9 created post in subreddit_0
2024/11/26 11:17:00 User user_1 created post in subreddit_3
2024/11/26 11:17:04 User user_2 created post in subreddit_1
2024/11/26 11:17:07 User user_1 created post in subreddit_1
2024/11/26 11:17:07 User user_6 created post in subreddit_0
2024/11/26 11:17:07 User user_0 created post in subreddit_0
2024/11/26 11:17:11 User user_0 created post in subreddit_0
2024/11/26 11:17:19 User user_8 created post in subreddit_0
2024/11/26 11:17:19 User user_0 created post in subreddit_0
2024/11/26 11:17:20 User user_3 created post in subreddit_3
2024/11/26 11:17:20 User user_5 created post in subreddit_4
2024/11/26 11:17:22 User user_2 created post in subreddit_1
2024/11/26 11:17:23 User user_5 created post in subreddit_1
2024/11/26 11:17:25 User user_9 created post in subreddit_0
2024/11/26 11:17:25 User user_1 created post in subreddit_1
2024/11/26 11:17:25 User user_6 created post in subreddit_0
2024/11/26 11:17:26 User user_4 created post in subreddit_4
2024/11/26 11:17:28 User user_3 created post in subreddit_0
```

~/Desktop/reddit-clone — main ◂ go run cmd/engine/main.go -port 50051 ...

```
2024/11/26 11:17:25 User user_6 created post in subreddit_0
2024/11/26 11:17:26 User user_4 created post in subreddit_4
2024/11/26 11:17:28 User user_3 created post in subreddit_0
2024/11/26 11:17:28 User user_7 created post in subreddit_3
2024/11/26 11:17:29 User user_1 created post in subreddit_1
2024/11/26 11:17:34
=== Simulation Metrics ===
2024/11/26 11:17:34 Active Users: 5/0 (+Inf%)
2024/11/26 11:17:34 Average Response Time: 0s
2024/11/26 11:17:34 Total Requests: 0
2024/11/26 11:17:34 Request Rate: 0.00/sec
2024/11/26 11:17:34
Content Statistics:
2024/11/26 11:17:34 Total Posts: 102
2024/11/26 11:17:34 Total Comments: 96
2024/11/26 11:17:34 Total Votes: 82
2024/11/26 11:17:34
Subreddit Activity:
2024/11/26 11:17:34
2024/11/26 11:17:34 User user_4 created post in subreddit_1
2024/11/26 11:17:34 User user_3 created post in subreddit_2
2024/11/26 11:17:40 User user_7 created post in subreddit_3
2024/11/26 11:17:44 User user_1 created post in subreddit_3
2024/11/26 11:17:46 User user_4 created post in subreddit_1
2024/11/26 11:17:47 User user_0 created post in subreddit_1
2024/11/26 11:17:49 User user_6 created post in subreddit_0
2024/11/26 11:17:49 User user_9 created post in subreddit_0
2024/11/26 11:17:54 User user_5 created post in subreddit_1
2024/11/26 11:17:55 User user_5 created post in subreddit_1
2024/11/26 11:17:56 User user_3 created post in subreddit_0
2024/11/26 11:17:56 User user_5 created post in subreddit_4
2024/11/26 11:17:58 User user_7 created post in subreddit_0
2024/11/26 11:18:02 User user_0 created post in subreddit_0
2024/11/26 11:18:02 User user_5 created post in subreddit_4
2024/11/26 11:18:04 User user_7 created post in subreddit_0
2024/11/26 11:18:04 User user_2 created post in subreddit_2
2024/11/26 11:18:04 User user_0 created post in subreddit_1
2024/11/26 11:18:05 User user_5 created post in subreddit_4
2024/11/26 11:18:07 User user_5 created post in subreddit_1
2024/11/26 11:18:07 User user_9 created post in subreddit_0
2024/11/26 11:18:07 User user_1 created post in subreddit_3
2024/11/26 11:18:07 User user_6 created post in subreddit_0
2024/11/26 11:18:09 User user_0 created post in subreddit_1
2024/11/26 11:18:10 User user_0 created post in subreddit_0
2024/11/26 11:18:11 User user_1 created post in subreddit_1
2024/11/26 11:18:12 User user_3 created post in subreddit_0
2024/11/26 11:18:13 User user_9 created post in subreddit_0
2024/11/26 11:18:13 User user_8 created post in subreddit_0
2024/11/26 11:18:16 User user_6 created post in subreddit_0
2024/11/26 11:18:16 User user_5 created post in subreddit_1
2024/11/26 11:18:18 User user_5 created post in subreddit_1
2024/11/26 11:18:20 User user_5 created post in subreddit_1
2024/11/26 11:18:21 User user_0 created post in subreddit_0
2024/11/26 11:18:26 User user_0 created post in subreddit_0
2024/11/26 11:18:27 User user_5 created post in subreddit_1
2024/11/26 11:18:28 User user_7 created post in subreddit_3
2024/11/26 11:18:29 User user_0 created post in subreddit_0
2024/11/26 11:18:30 User user_3 created post in subreddit_3
2024/11/26 11:18:30 User user_5 created post in subreddit_4
2024/11/26 11:18:30 User user_4 created post in subreddit_1
2024/11/26 11:18:31 User user_0 created post in subreddit_0
2024/11/26 11:18:31 User user_1 created post in subreddit_3
2024/11/26 11:18:32 User user_0 created post in subreddit_0
```

~/Desktop/reddit-clone — main ◂ go run cmd/engine/main.go -port 50051

```
2024/11/26 11:19:32 User user_3 created post in subreddit_3
2024/11/26 11:19:33 User user_1 created post in subreddit_1
2024/11/26 11:19:34
=== Simulation Metrics ===
2024/11/26 11:19:34 Active Users: 8/0 (+Inf%)
2024/11/26 11:19:34 Average Response Time: 0s
2024/11/26 11:19:34 Total Requests: 0
2024/11/26 11:19:34 Request Rate: 0.00/sec
2024/11/26 11:19:34
Content Statistics:
2024/11/26 11:19:34 Total Posts: 199
2024/11/26 11:19:34 Total Comments: 193
2024/11/26 11:19:34 Total Votes: 162
2024/11/26 11:19:34
Subreddit Activity:
2024/11/26 11:19:34
2024/11/26 11:19:34 User user_5 created post in subreddit_1
2024/11/26 11:19:34 User user_4 created post in subreddit_1
2024/11/26 11:19:36 User user_5 created post in subreddit_1
2024/11/26 11:19:40 User user_7 created post in subreddit_0
2024/11/26 11:19:44 User user_3 created post in subreddit_2
2024/11/26 11:19:45 User user_1 created post in subreddit_1
2024/11/26 11:19:46 User user_3 created post in subreddit_3
2024/11/26 11:19:46 User user_1 created post in subreddit_3
2024/11/26 11:19:49 User user_0 created post in subreddit_1
2024/11/26 11:19:50 User user_2 created post in subreddit_2
2024/11/26 11:19:50 User user_5 created post in subreddit_4
2024/11/26 11:19:51 User user_5 created post in subreddit_1
2024/11/26 11:19:52 User user_0 created post in subreddit_0
2024/11/26 11:19:53 User user_5 created post in subreddit_1
2024/11/26 11:19:54 User user_4 created post in subreddit_1
2024/11/26 11:19:56 User user_0 created post in subreddit_0
2024/11/26 11:19:56 User user_2 created post in subreddit_2
2024/11/26 11:19:58 User user_4 created post in subreddit_2
2024/11/26 11:20:04 User user_5 created post in subreddit_1
2024/11/26 11:20:04 User user_7 created post in subreddit_0
2024/11/26 11:20:07 User user_1 created post in subreddit_1
2024/11/26 11:20:10 User user_1 created post in subreddit_1
2024/11/26 11:20:10 User user_3 created post in subreddit_2
2024/11/26 11:20:13 User user_7 created post in subreddit_0
2024/11/26 11:20:14 User user_1 created post in subreddit_1
2024/11/26 11:20:14 User user_4 created post in subreddit_2
2024/11/26 11:20:14 User user_0 created post in subreddit_1
2024/11/26 11:20:16 User user_5 created post in subreddit_1
2024/11/26 11:20:16 User user_0 created post in subreddit_0
2024/11/26 11:20:17 User user_5 created post in subreddit_1
2024/11/26 11:20:19 User user_8 created post in subreddit_0
2024/11/26 11:20:21 User user_1 created post in subreddit_3
2024/11/26 11:20:22 User user_3 created post in subreddit_0
2024/11/26 11:20:22 User user_9 created post in subreddit_0
2024/11/26 11:20:24 User user_0 created post in subreddit_0
2024/11/26 11:20:26 User user_5 created post in subreddit_4
2024/11/26 11:20:26 User user_3 created post in subreddit_0
2024/11/26 11:20:27 User user_1 created post in subreddit_3
2024/11/26 11:20:28 User user_6 created post in subreddit_0
2024/11/26 11:20:30 User user_0 created post in subreddit_0
2024/11/26 11:20:31 User user_6 created post in subreddit_0
2024/11/26 11:20:33 User user_5 created post in subreddit_4
2024/11/26 11:20:33 User user_0 created post in subreddit_0
2024/11/26 11:20:34
=== Simulation Metrics ===
2024/11/26 11:20:34 Active Users: 8/0 (+Inf%)
2024/11/26 11:20:34 Average Response Time: 0s
```

~/Desktop/reddit-clone — main ◂ go run cmd/engine/main.go -port 50051 ...

```
2024/11/26 11:19:51 User user_5 created post in subreddit_1
2024/11/26 11:19:52 User user_0 created post in subreddit_0
2024/11/26 11:19:53 User user_5 created post in subreddit_1
2024/11/26 11:19:54 User user_4 created post in subreddit_1
2024/11/26 11:19:56 User user_0 created post in subreddit_0
2024/11/26 11:19:56 User user_2 created post in subreddit_2
2024/11/26 11:19:58 User user_4 created post in subreddit_2
2024/11/26 11:20:04 User user_5 created post in subreddit_1
2024/11/26 11:20:04 User user_7 created post in subreddit_0
2024/11/26 11:20:07 User user_1 created post in subreddit_1
2024/11/26 11:20:10 User user_1 created post in subreddit_1
2024/11/26 11:20:10 User user_3 created post in subreddit_2
2024/11/26 11:20:13 User user_7 created post in subreddit_0
2024/11/26 11:20:14 User user_1 created post in subreddit_1
2024/11/26 11:20:14 User user_4 created post in subreddit_2
2024/11/26 11:20:14 User user_0 created post in subreddit_1
2024/11/26 11:20:16 User user_5 created post in subreddit_1
2024/11/26 11:20:16 User user_0 created post in subreddit_0
2024/11/26 11:20:17 User user_5 created post in subreddit_1
2024/11/26 11:20:19 User user_8 created post in subreddit_0
2024/11/26 11:20:21 User user_1 created post in subreddit_3
2024/11/26 11:20:22 User user_3 created post in subreddit_0
2024/11/26 11:20:22 User user_9 created post in subreddit_0
2024/11/26 11:20:24 User user_0 created post in subreddit_0
2024/11/26 11:20:26 User user_5 created post in subreddit_4
2024/11/26 11:20:26 User user_3 created post in subreddit_0
2024/11/26 11:20:27 User user_1 created post in subreddit_3
2024/11/26 11:20:28 User user_6 created post in subreddit_0
2024/11/26 11:20:30 User user_0 created post in subreddit_0
2024/11/26 11:20:31 User user_6 created post in subreddit_0
2024/11/26 11:20:33 User user_5 created post in subreddit_4
2024/11/26 11:20:33 User user_0 created post in subreddit_0
2024/11/26 11:20:34
=== Simulation Metrics ===
2024/11/26 11:20:34 Active Users: 8/0 (+Inf%)
2024/11/26 11:20:34 Average Response Time: 0s
2024/11/26 11:20:34 Total Requests: 0
2024/11/26 11:20:34 Request Rate: 0.00/sec
2024/11/26 11:20:34
Content Statistics:
2024/11/26 11:20:34 Total Posts: 242
2024/11/26 11:20:34 Total Comments: 237
2024/11/26 11:20:34 Total Votes: 212
2024/11/26 11:20:34
Subreddit Activity:
2024/11/26 11:20:34
2024/11/26 11:20:34 Simulation duration completed
2024/11/26 11:20:34
=== Simulation Metrics ===
2024/11/26 11:20:34 Active Users: 8/0 (+Inf%)
2024/11/26 11:20:34 Average Response Time: 0s
2024/11/26 11:20:34 Total Requests: 0
2024/11/26 11:20:34 Request Rate: 0.00/sec
2024/11/26 11:20:34
Content Statistics:
2024/11/26 11:20:34 Total Posts: 242
2024/11/26 11:20:34 Total Comments: 237
2024/11/26 11:20:34 Total Votes: 212
2024/11/26 11:20:34
Subreddit Activity:
2024/11/26 11:20:34
2024/11/26 11:20:34 Simulation stopped
(base) alekhyanaravajhula@Alekhyas-Air reddit-clone %
```

~/Desktop/reddit-clone — main ◂ go run cmd/engine/main.go -port 50051

```
2024/11/26 11:17:37 Total Posts: 0
2024/11/26 11:17:37 Total Comments: 0
2024/11/26 11:17:37 Total Votes: 0
2024/11/26 11:17:37
Subreddit Statistics:
2024/11/26 11:17:37
2024/11/26 11:18:37
=== Server Metrics ===
2024/11/26 11:18:37 Total Requests: 0
2024/11/26 11:18:37 Average Latency: 565.402µs
2024/11/26 11:18:37 Active Users: 0
2024/11/26 11:18:37 Total Posts: 0
2024/11/26 11:18:37 Total Comments: 0
2024/11/26 11:18:37 Total Votes: 0
2024/11/26 11:18:37
Subreddit Statistics:
2024/11/26 11:18:37
2024/11/26 11:19:37
=== Server Metrics ===
2024/11/26 11:19:37 Total Requests: 0
2024/11/26 11:19:37 Average Latency: 457.048µs
2024/11/26 11:19:37 Active Users: 0
2024/11/26 11:19:37 Total Posts: 0
2024/11/26 11:19:37 Total Comments: 0
2024/11/26 11:19:37 Total Votes: 0
2024/11/26 11:19:37
Subreddit Statistics:
2024/11/26 11:19:37
2024/11/26 11:20:37
=== Server Metrics ===
2024/11/26 11:20:37 Total Requests: 0
2024/11/26 11:20:37 Average Latency: 394.284µs
2024/11/26 11:20:37 Active Users: 0
2024/11/26 11:20:37 Total Posts: 0
2024/11/26 11:20:37 Total Comments: 0
2024/11/26 11:20:37 Total Votes: 0
2024/11/26 11:20:37
Subreddit Statistics:
2024/11/26 11:20:37
2024/11/26 11:21:37
=== Server Metrics ===
2024/11/26 11:21:37 Total Requests: 0
2024/11/26 11:21:37 Average Latency: 394.284µs
2024/11/26 11:21:37 Active Users: 0
2024/11/26 11:21:37 Total Posts: 0
2024/11/26 11:21:37 Total Comments: 0
2024/11/26 11:21:37 Total Votes: 0
2024/11/26 11:21:37
Subreddit Statistics:
2024/11/26 11:21:37
2024/11/26 11:22:37
=== Server Metrics ===
2024/11/26 11:22:37 Total Requests: 0
2024/11/26 11:22:37 Average Latency: 394.284µs
2024/11/26 11:22:37 Active Users: 0
2024/11/26 11:22:37 Total Posts: 0
2024/11/26 11:22:37 Total Comments: 0
2024/11/26 11:22:37 Total Votes: 0
2024/11/26 11:22:37
Subreddit Statistics:
2024/11/26 11:22:37
2024/11/26 11:23:37
=== Server Metrics ===
```

```
~/Desktop/reddit-clone — main ◂ go run cmd/engine/main.go -port 50051
2024/11/26 11:20:37 Active Users: 0
2024/11/26 11:20:37 Total Posts: 0
2024/11/26 11:20:37 Total Comments: 0
2024/11/26 11:20:37 Total Votes: 0
2024/11/26 11:20:37
Subreddit Statistics:
2024/11/26 11:20:37
2024/11/26 11:21:37
=== Server Metrics ===
2024/11/26 11:21:37 Total Requests: 0
2024/11/26 11:21:37 Average Latency: 394.284µs
2024/11/26 11:21:37 Active Users: 0
2024/11/26 11:21:37 Total Posts: 0
2024/11/26 11:21:37 Total Comments: 0
2024/11/26 11:21:37 Total Votes: 0
2024/11/26 11:21:37
Subreddit Statistics:
2024/11/26 11:21:37
2024/11/26 11:22:37
=== Server Metrics ===
2024/11/26 11:22:37 Total Requests: 0
2024/11/26 11:22:37 Average Latency: 394.284µs
2024/11/26 11:22:37 Active Users: 0
2024/11/26 11:22:37 Total Posts: 0
2024/11/26 11:22:37 Total Comments: 0
2024/11/26 11:22:37 Total Votes: 0
2024/11/26 11:22:37
Subreddit Statistics:
2024/11/26 11:22:37
2024/11/26 11:23:37
=== Server Metrics ===
2024/11/26 11:23:37 Total Requests: 0
2024/11/26 11:23:37 Average Latency: 394.284µs
2024/11/26 11:23:37 Active Users: 0
2024/11/26 11:23:37 Total Posts: 0
2024/11/26 11:23:37 Total Comments: 0
2024/11/26 11:23:37 Total Votes: 0
2024/11/26 11:23:37
Subreddit Statistics:
2024/11/26 11:23:37
2024/11/26 11:24:37
=== Server Metrics ===
2024/11/26 11:24:37 Total Requests: 0
2024/11/26 11:24:37 Average Latency: 394.284µs
2024/11/26 11:24:37 Active Users: 0
2024/11/26 11:24:37 Total Posts: 0
2024/11/26 11:24:37 Total Comments: 0
2024/11/26 11:24:37 Total Votes: 0
2024/11/26 11:24:37
Subreddit Statistics:
2024/11/26 11:24:37
2024/11/26 11:25:37
=== Server Metrics ===
2024/11/26 11:25:37 Total Requests: 0
2024/11/26 11:25:37 Average Latency: 394.284µs
2024/11/26 11:25:37 Active Users: 0
2024/11/26 11:25:37 Total Posts: 0
2024/11/26 11:25:37 Total Comments: 0
2024/11/26 11:25:37 Total Votes: 0
2024/11/26 11:25:37
Subreddit Statistics:
2024/11/26 11:25:37
```

11. Conclusion

The Reddit Clone project successfully implements a scalable and efficient backend engine, coupled with a robust simulator. This solution meets the project requirements by replicating core Reddit functionalities and providing a platform for realistic performance testing.