URL: https://github.com/YeZhang125/cs6650-assignment1.git

Client Architecture Overview

Key Components and Structure

The client implementation comprises the following essential classes:

1. MultiThreadedLiftRideClient.java

- **Purpose:** Acts as the program's main entry point, orchestrating the load testing process.
- **Functions:**
    - Configures parameters such as server URL, number of threads, and requests per thread.
    - Utilizes `ExecutorService` to manage concurrent execution.
    - Monitors thread completion and delegates task execution to `HTTPClientThread`.

2. HTTPClientThread.java

- **Purpose:** Handles HTTP request execution and logs responses from simulated clients.
- **Functions:**
    - Sends HTTP POST requests via `HttpClient`.
    - Logs request details, including timestamp, type, latency, response code, and throughput, to a CSV file.
    - Implements retry logic for failed requests.
    - Calculates and stores response times for further evaluation.

3. EventProducer.java

- **Purpose:** Generates randomized event data for HTTP POST requests, simulating skier lift events.
- **Functions:**
    - Produces synthetic data representing ski resort activities with randomized attributes (e.g., resort ID, season ID, skier ID).
    - Ensures varied request simulation to enhance realism in load testing.

4. LatencyComputationForClient2.java

- **Purpose:** Processes collected latency data post-test to derive performance metrics.
- **Functions:**
    - Reads logged data from CSV files.

    - Computes statistics such as mean, median, minimum, maximum, and p99 latencies.
    - Determines system throughput.

Project Structure and Class Interactions

Modules:

- **client1:** Houses the primary classes (`MultiThreadedLiftRideClient`, `HTTPClientThread`, `EventProducer`, `LatencyComputationForClient2`).
- **server:** Contains the servlet responsible for request handling.

Class Interactions:

- `MultiThreadedLiftRideClient` initiates and supervises multiple `HTTPClientThread` instances.
- Each `HTTPClientThread` collaborates with `EventProducer` to generate request data.
- After execution, `LatencyComputationForClient2` evaluates and reports system performance.

Throughput Performance Estimation Using Little's Law

Throughput Calculation:

Throughput is measured by analyzing the total test duration and the number of completed requests.

Given:

- **Total Requests** = 200,000
- **Request time per request** = 0.1 sec
- **Number of threads** = 500

Steps:

1. **Time to process all requests**:
   Since we have 500 threads running in parallel, each thread can handle requests simultaneously. The total time to process all 200,000 requests would be:
   Total time=Total Requests / Threads × Request time per request = Total time =200,000 / 500 × 0.1 = 400 × 0.1 = 40 seconds

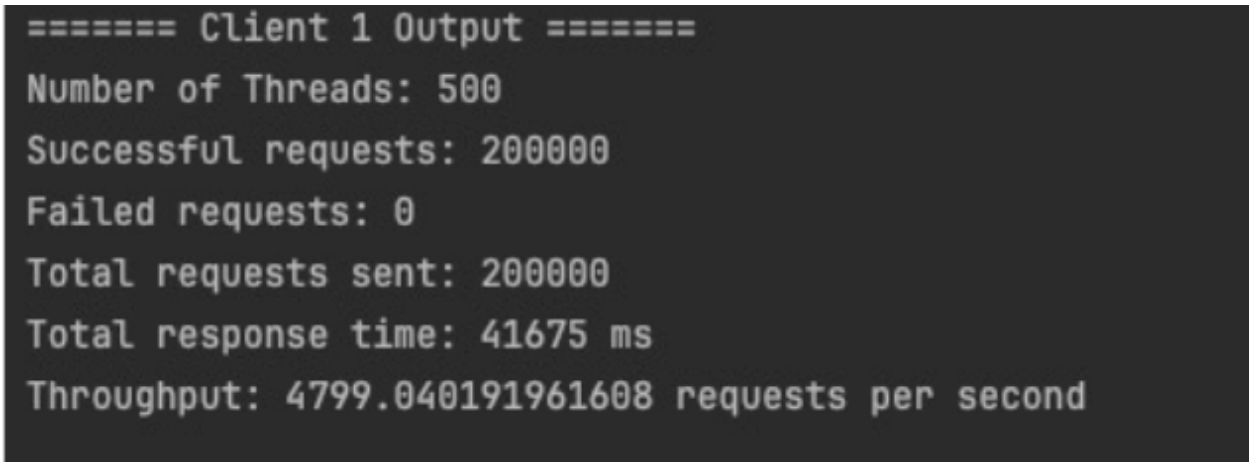
2. **Throughput using Little's Law**:
   We can now calculate the throughput. Throughput is the number of requests handled per second. In this case, it's simply:
   Throughput=Total Requests / TotalTime = 200,000 / 40 =5,000 requests/sec

The esitmated throughput is **5,000 requests per second**, as it takes 40 seconds to process all 200,000 requests with 500 threads, where each request takes 0.1 second.

This metric provides insight into the system's capacity and performance under different load conditions.

Screenshots

Client 1



Client 2

```
======= Client 1 Output =======
Number of Threads: 500
Successful requests: 200000
Failed requests: 0
Total requests sent: 200000
Total response time: 41675 ms
Throughput: 4799.040191961608 requests per second

======= Client 2 Output =======
Response Time Metrics:
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Average: 99.720575 ms
Median: 96 ms
Minimum: 21 ms
Maximum: 2061 ms
99th Percentile: 371 ms

Throughput Metrics:
-------------------
Per-thread: 10.02802079711233 requests/sec
Estimated Total (500 threads): 5014.010398556165 requests/sec

Process finished with exit code 0
```

EC2 Instance

http://44.243.12.46:8080/assignment1_war/skiers/10/seasons/2025/days/1/skiers/4

Save

POST http://44.243.12.46:8080/assignment1_war/skiers/10/seasons/2025/days/1/skiers/4 Send

Params Authorization Headers (8) Body Scripts Settings Cookies

none form-data x-www-form-urlencoded raw binary GraphQL JSON Beautify

```
{
  "time": 217,
  "liftID": 21
}
```

Body Cookies Headers (5) Test Results 201 Created 46 ms 222 B

JSON Preview Visualize

```
{
    "message": "Skier processed successfully"
}
```