CS6650 Assignment2 Report

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Git Repo: https://github.com/zhxunynn/CS6650Assignments/tree/main/Assignment3

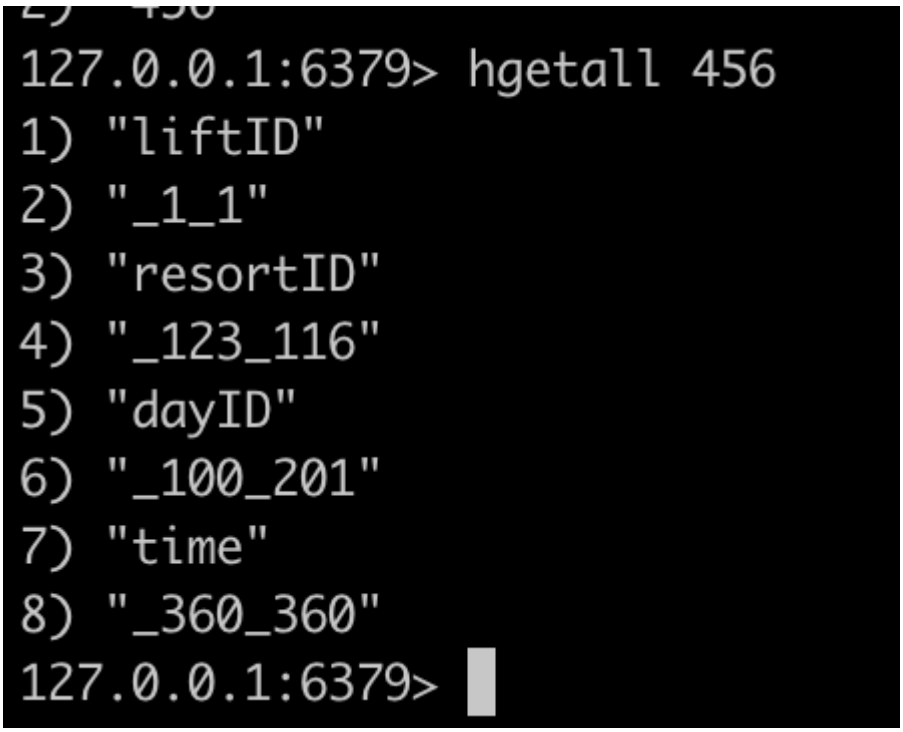
Database Design

In order to satisfy the requests, I used skierID as primary key, so that we can easily retrieve the details for skier N.

The value for each key consists of: `dayID="_".join(days)`, `liftID="_".join(lift)` and `resortID="_".join(resorts)`.

I also used "day{$dayID$}" as another primary key, and the value consists of resortID and skierID.

Here's a screenshot of the database structure:



Based on the above design, we can respond to the requests by:

- "For skier N, how many days have they skied this season?"
  - `redis-cli --raw hgetall skierID | awk 'NR == DAY_LINE_ID' | awk -F "_" '{for(i=2;i<=NF;i+=2) print $i}' | sort -u | wc -l`

- "For skier N, what are the vertical totals for each ski day?" (calculate vertical as liftID*10)
    - `redis-cli --raw hgetall skierID | awk 'NR == LIFTID_LINE_ID' | awk -F "_" '{for(i=2;i<=NF;i+=2) print $i*10}' | paste -sd+ - | bc`
- "For skier N, show me the lifts they rode on each ski day"
    - `redis-cli --raw hget skierID dayID`
- "How many unique skiers visited resort X on day N?"
    - `redis-cli --raw hget "dayN" | awk '{print $1}' | grep '^X_' | cut -d'_' -f2 | sort -u | wc -l`
    - If we stick to use skierID as key, we have to do the query like:

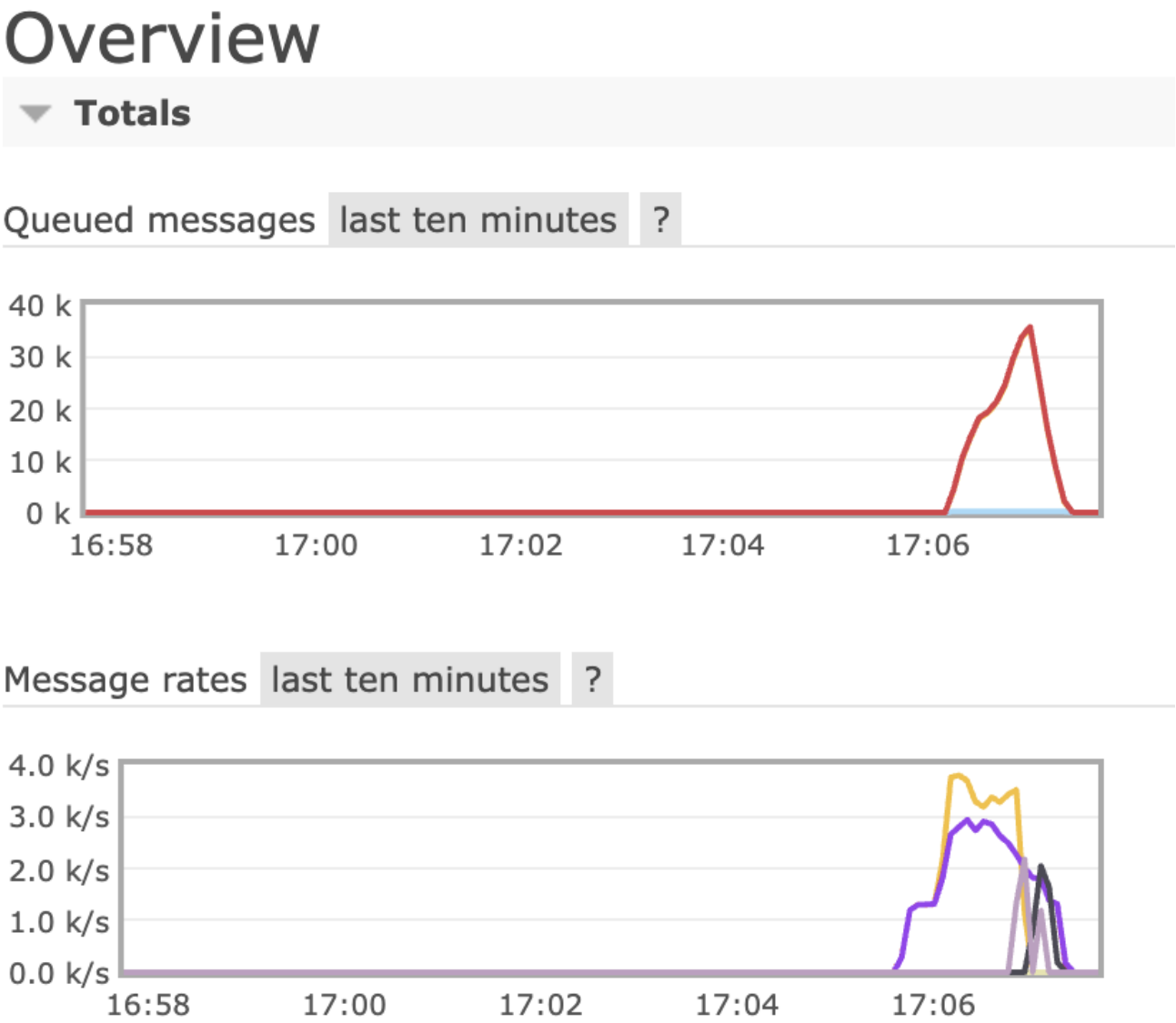
```
redis-cli --raw keys skierID | awk '{print $1}' | while read -r skier_id; do \
skier_value=$(redis-cli hget "$skier_id" "liftID") && \
resort_id=$(echo "$skier_value" | cut -d'|' -f1) && \
day_id=$(echo "$skier_value" | cut -d'|' -f3) && \
if [ "$resort_id" = "X" ] && [ "$day_id" = "N" ]; then \
  echo "$skier_id"; \
fi; \
done | wc -l
```

Results Analysis

Without Improvement

Before we take any changes, the result below is **based on the `t2.micro` instance type:**


1 usage
un
HW3ClientAWS
/Users/xunyan/Library/Java/JavaVirtualMachines/openjdk-21.0.2/Contents/Home/bin/java ...
Mar 29, 2024 5:05:41 PM ClientMain main
INFO: Both client and server are ready!
Mar 29, 2024 5:05:41 PM ClientMain main
INFO: Ready to run phases!
Mar 29, 2024 5:05:41 PM ClientMain doPhase
INFO: Startup is ready to start!
Mar 29, 2024 5:05:41 PM ClientMain doPhase
INFO: Startup phase is going to execute 32 threads with 1000 requests each.
Mar 29, 2024 5:06:06 PM ClientMain doPhase
INFO: Startup has already terminated 1 thread(s).
Mar 29, 2024 5:06:06 PM ClientMain doPhase
INFO: Catchup is ready to start!
Mar 29, 2024 5:06:06 PM ClientMain doPhase
INFO: Catchup phase is going to execute 96 threads with 1750 requests each.
Mar 29, 2024 5:06:55 PM ClientMain doPhase
INFO: Catchup has already terminated 96 thread(s).
==========Results==========
Successful Requests: 200000
Failed Requests: 0
Total run time: 74014 (ms)
Total Throughput in requests per second: 2702.1914772880805
==========
Process finished with exit code 0



As we can notice, the queued messages remain a very high amount. In order to handle this, I tried to increase the capacity of instance but unfortunatelly I don't have money, so throttling is the only option for me.

With Improvement

In summary, I took the following actions:

- Introduced Exponential Backoffs in Client:

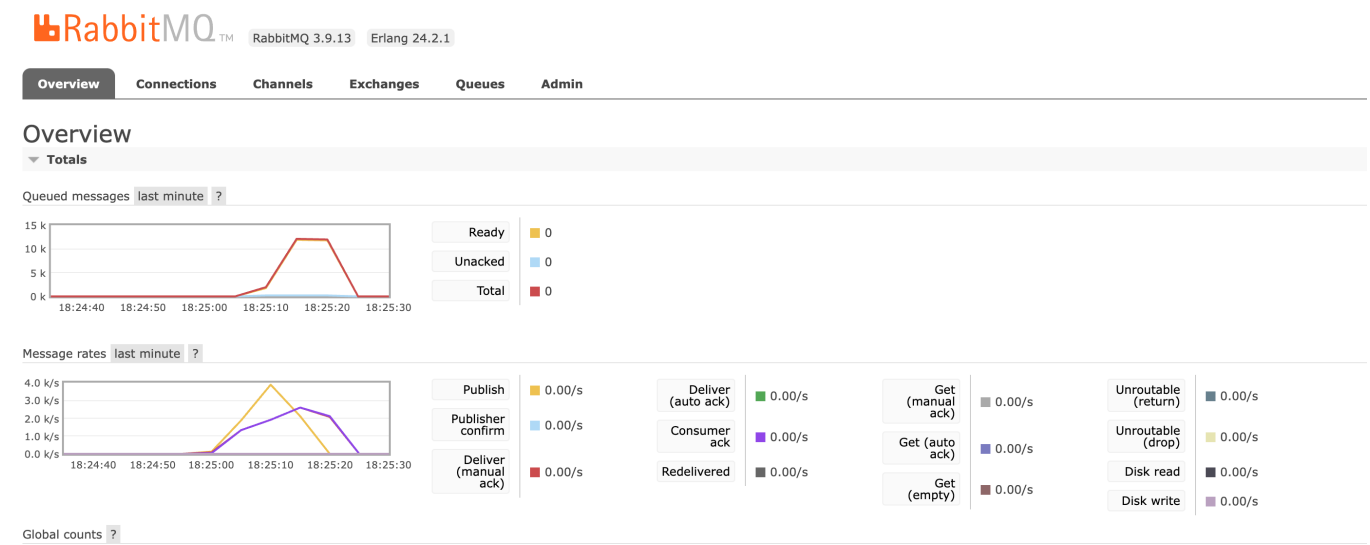
ProcessThread.java × SkierServlet.java pom.xml (Server) pom.xml (Consu

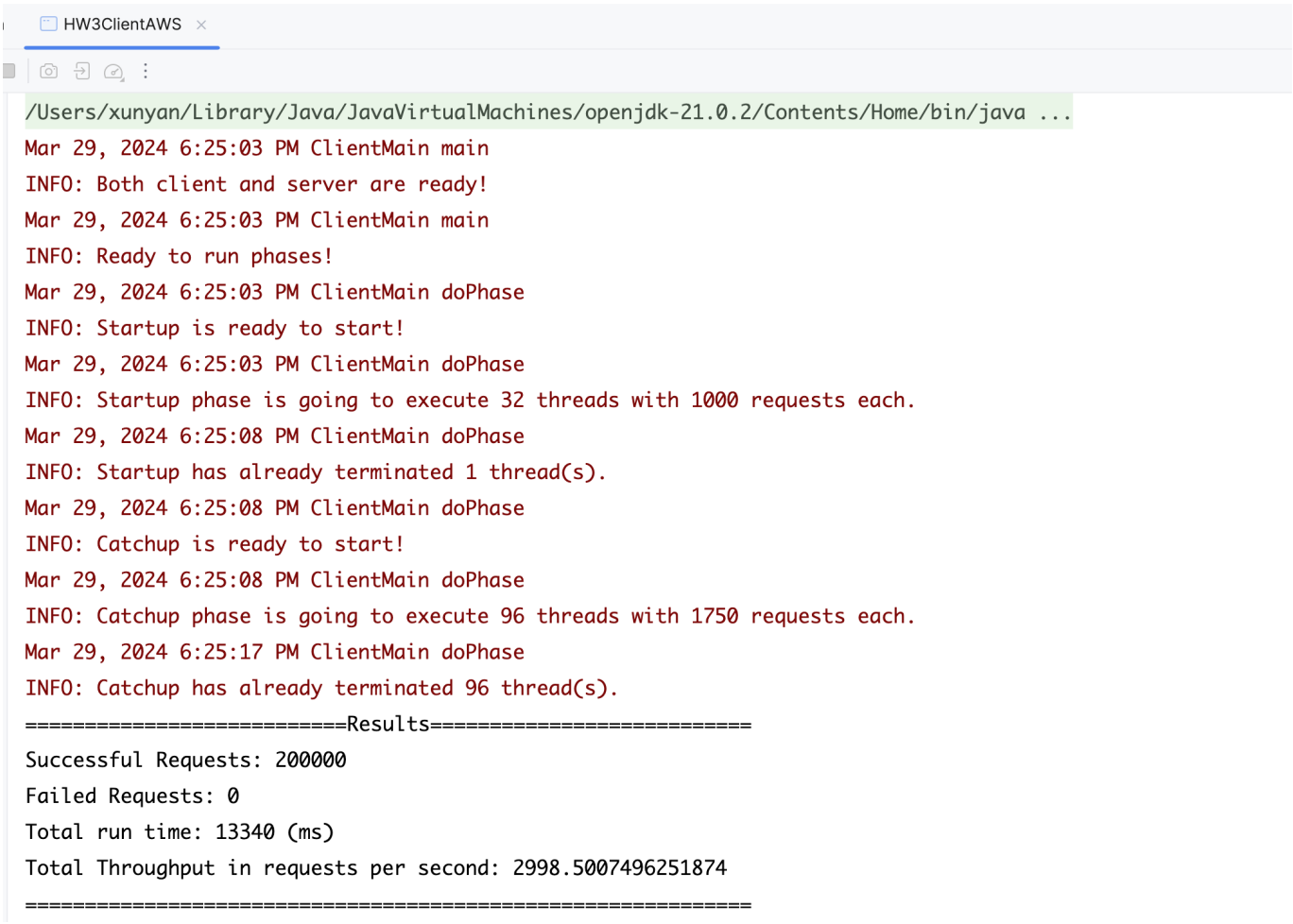
```
                new LiftRide().liftID(liftID).time(time),
                resortID,
                seasonID: "2024",
                dayID: "1",
                skierID
            );
            break;
        } catch (ApiException e) {
            triedCount++;
            try {
                Thread.sleep((long) Math.pow(5, triedCount));
            } catch (InterruptedException ex) {
                ex.printStackTrace();
            }
```

- Adopting Resilience4j CircuitBreaker in Server

```
<dependency>
    <groupId>io.github.resilience4j</groupId>
    <artifactId>resilience4j-circuitbreaker</artifactId>
    <version>2.2.0</version>
</dependency>
```

And the result became:





As we can see, the chart has dramatically improved. Previously we have ~40k queued messages, but after introducing expotential backoffs & the throttling, we can notice the queued message decreased to ~10k, which is 25% of previous queued messages, and the throughput even increased to ~3000.