Github URL

https://github.com/Shengnany/BSDS_Data_Persistance

Description

Description of your database designs and deployment topologies on AWS

1. For data persistence, I used redis in both step 1 and step 2. I installed redis on a new instance. I also set up the password for my database: 6650.
2. My AWS EC2 instances:
    a. Tomcat web server
    b. Consumer (Skier Microservice consuming from Rabbitmq writing to Redis)
    c. Consumer (Resort Microservice consuming from Rabbitmq writing to Redis)
    d. Rabbitmq message broker
    e. Redis database
3. Data model: The data model I implemented was based on the access pattern. The key was formed from primary key values of the table by a separator ("_"). For example,
   “How many rides on lift N happened on day N?” [#lift rides on N/day N]

```
k = RESORT+liftId+SEP+dayId+SEP+RIDES_TOTAl; // key is stored for day N and lift N
if(!jedis.exists(k)) {
  jedis.set(k, v); // if not contains v = 1
}
else{
  jedis.incr(k); // if contains, value increment  by 1
}
```

Mitigation strategy

Protecting against load peaks

Imagine you have a server which can handle a certain number of requests per minute. Suddenly, the number of requests increases significantly - maybe because a connected partner system is going mad or due to a denial of service attack. An EventCountCircuitBreaker can be configured to stop the application from processing requests when a sudden peak load is detected and to start request processing again when things calm down. The following code fragment shows a typical example of such a scenario. Here the EventCountCircuitBreaker allows up to 1000 requests per minute before it interferes. When the load goes down again to 800 requests per second it switches back to state closed:

I used a circuit breaker in both server and client to introduce throttling. On the server side, the event is represented as the number of writes to the queue. When the number of requests increases significantly (maybe due to the slow speed of the rabbitmq system writing to the database), then the event breaker will open. Here my EventCountCircuitBreaker allows up to 4000 requests per seconds before it interferes. When the load goes down again to 2000 requests per second it switches back. On the client side, the event breaker is imposed on the number of posts sent each interval.

Before introducing the mitigation strategy, the program always throws me Exception of connection error and fails after it has retired five times. But after introducing the circuit breaker, even at the peak load period, there were only a few API EXception errors and only tried one time before success. The circuit breaker here has controlled the overall requests speed. The throughput has been steady around 1k req/sec.

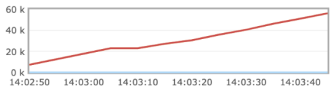
One Instance for running 128 threads for skier service::

RMQ management window:

Overview

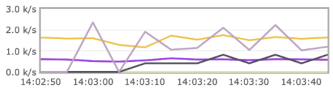
Totals

Queued messages last minute ?



Ready	61,216
Unacked	7
Total	61,223

Message rates last minute ?



Publish	1,640/s	Deliver (auto ack)	0.00/s	Get (manual ack)	0.00/s	Unroutable (return)	0.00/s
Publisher confirm	0.00/s	Consumer ack	582/s	Get (auto ack)	0.00/s	Unroutable (drop)	0.00/s
Deliver (manual ack)	582/s	Redelivered	0.00/s	Get (empty)	0.00/s	Disk read	819/s
						Disk write	1,199/s

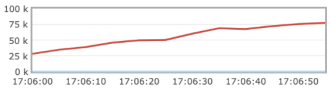
```
Please Enter numThreads, numSkiers, numLifts, numRuns, seperated by a white space
128 20000 40 20
Please Enter IP and port, seperated by a white space
54.213.49.251 8080
numThreads | numSkiers | numLifts | numRuns:
[128, 20000, 40, 20]
Total threads: 173
=====================================
starting phase1...
There are 32 concurrent threads...
In this phase: 32 threads, 2500 requests per thread, 7 waitThreads before next phase could start
Time passed in this phase: 128931 ms
=====================================
=====================================
starting phase2...
There are 153 concurrent threads (including those from phase1) at start...
In this phase: 128 threads, 1250 requests per thread, 26 waitThreads before next phase could start
Time passed in this phase: 101193 ms
=====================================
=====================================
starting phase3...
There are 115 remaining threads...
In this phase: 13 threads, 2 requests per thread, 0 waitThreads before next phase could start
Time passed in this phase: 6 ms
=====================================
numThreads: 128, numSkiers: 20000, numLifts: 40, numRuns: 20
After all phases:
Number of successful posts: 240026
Number of unsuccessful posts: 0
Wall time: 233seconds
Throughput: 1030 requests/sec
Terminating program...

Process finished with exit code 0
```

Overview

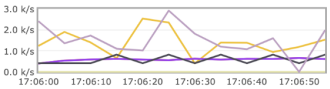
Totals

Queued messages last minute ?



Ready	80,074
Unacked	7
Total	80,081

Message rates last minute ?



Publish	1,531/s	Deliver (auto ack)	0.00/s	Get (manual ack)	0.00/s	Unroutable (return)	0.00/s
Publisher confirm	0.00/s	Consumer ack	611/s	Get (auto ack)	0.00/s	Unroutable (drop)	0.00/s
Deliver (manual ack)	611/s	Redelivered		Get (empty)	0.00/s	Disk read	819/s
						Disk write	1,990/s

Click to toggle line

```
Please Enter numThreads, numSkiers, numLifts, numRuns, seperated by a white space
256 20000 40 20
Please Enter IP and port, seperated by a white space
54.213.49.251 8080
numThreads | numSkiers | numLifts | numRuns:
[256, 20000, 40, 20]
Total threads: 346
=======================================
starting phase1...
There are 64 concurrent threads...
In this phase: 64 threads, 1250 requests per thread, 13 waitThreads before next phase could start
Time passed in this phase: 48891 ms
=======================================
=======================================
starting phase2...
There are 307 concurrent threads (including those from phase1) at start...
In this phase: 256 threads, 625 requests per thread, 52 waitThreads before next phase could start
WriteNewLiftRide error...Retry at most five times
WriteNewLiftRide error...Retry at most five times
Server response with: 0
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
WriteNewLiftRide error...Retry at most five times
Server response with: 0
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
```

```
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
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Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
numThreads: 256, numSkiers: 20000, numLifts: 40, numRuns: 20
After all phases:
Number of successful posts: 240052
Number of unsuccessful posts: 0
Wall time: 161seconds
Throughput: 1491 requests/sec
Terminating program...
```
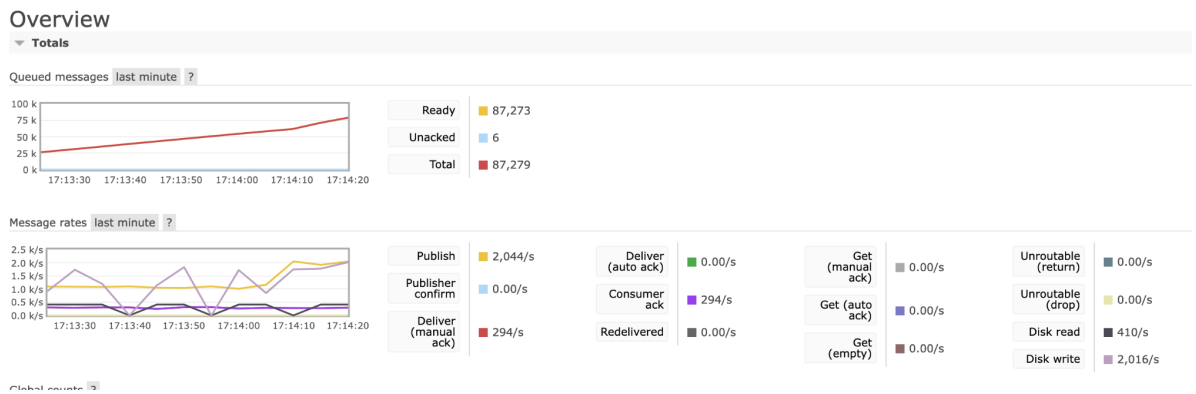
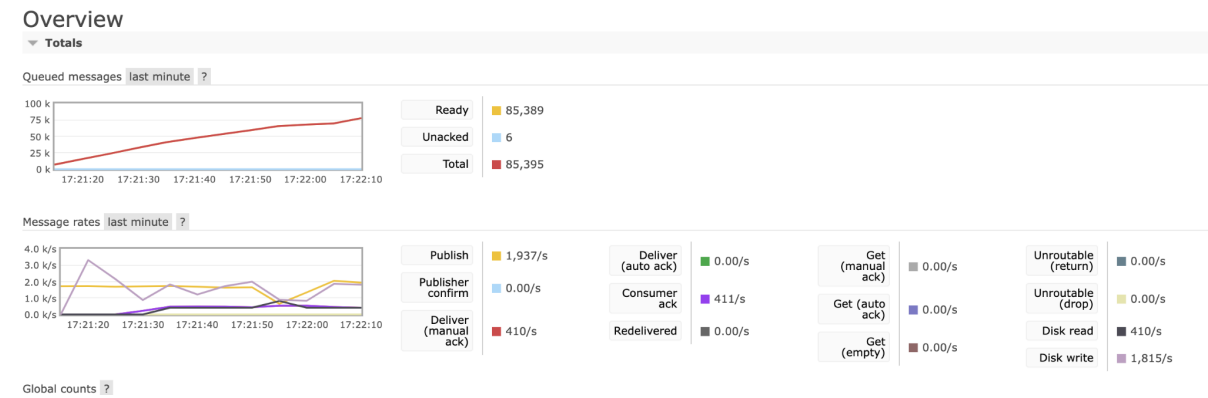

One Instance for running 128 and 256 threads for resort service:



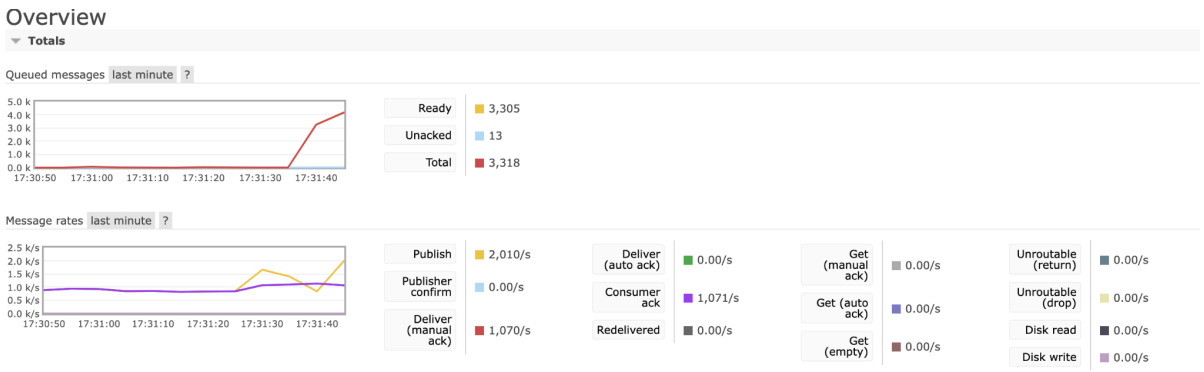
```
/Users/shengnanyou/Downloads/jdk-11.0.13.jdk/Contents/Home/bin/java ...
Please Enter numThreads, numSkiers, numLifts, numRuns, seperated by a white space
128 20000 40 20
Please Enter IP and port, seperated by a white space
54.213.49.251 8080
numThreads | numSkiers | numLifts | numRuns:
[128, 20000, 40, 20]
Total threads: 173
=======================================
starting phase1...
There are 32 concurrent threads...
In this phase: 32 threads, 2500 requests per thread, 7 waitThreads before next phase could start
Time passed in this phase: 76287 ms
=======================================
=======================================
starting phase2...
There are 153 concurrent threads (including those from phase1) at start...
In this phase: 128 threads, 1250 requests per thread, 26 waitThreads before next phase could start
Time passed in this phase: 82054 ms
=======================================
=======================================
starting phase3...
There are 115 remaining threads...
In this phase: 13 threads, 2 requests per thread, 0 waitThreads before next phase could start
Time passed in this phase: 11 ms
=======================================
numThreads: 128, numSkiers: 20000, numLifts: 40, numRuns: 20
After all phases:
Number of successful posts: 240026
Number of unsuccessful posts: 0
Wall time: 166seconds
Throughput: 1445 requests/sec
Terminating program...
```

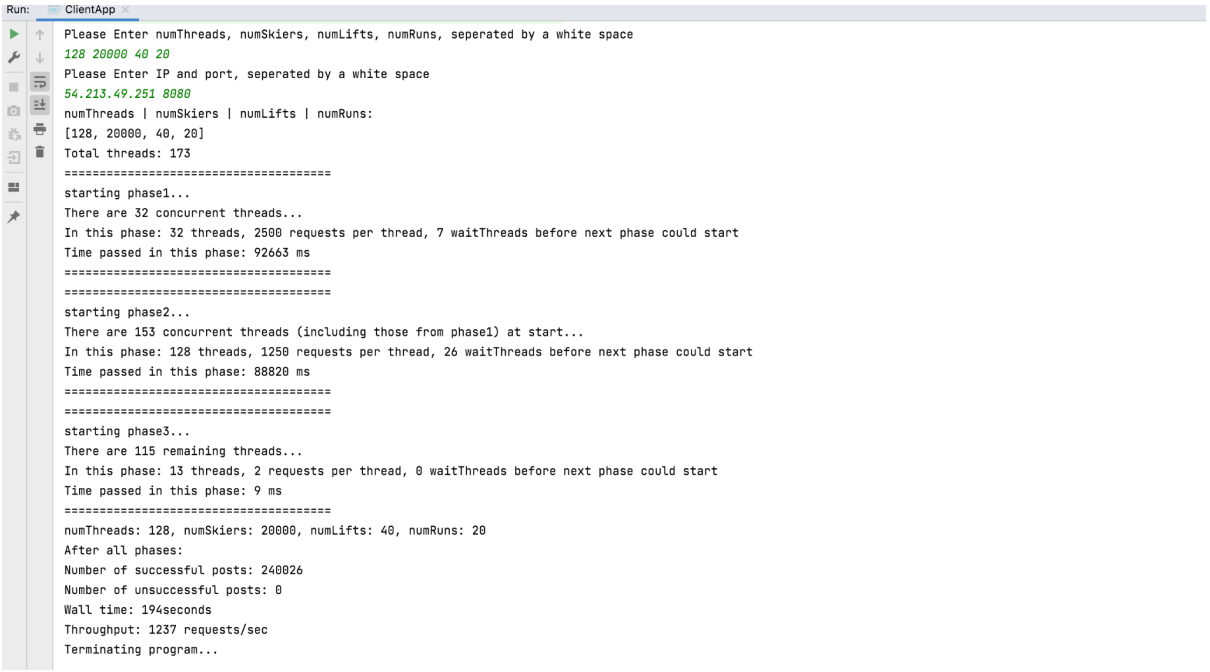


```
/Users/shengnanyou/Downloads/jdk-11.0.13.jdk/Contents/Home/bin/java ...
Please Enter numThreads, numSkiers, numLifts, numRuns, seperated by a white space
256 20000 40 20
Please Enter IP and port, seperated by a white space
54.213.49.251 8080
numThreads | numSkiers | numLifts | numRuns:
[256, 20000, 40, 20]
Total threads: 346
=====================================
starting phase1...
There are 64 concurrent threads...
In this phase: 64 threads, 1250 requests per thread, 13 waitThreads before next phase could start
Time passed in this phase: 47956 ms
=====================================
=====================================
starting phase2...
There are 307 concurrent threads (including those from phase1) at start...
In this phase: 256 threads, 625 requests per thread, 52 waitThreads before next phase could start
WriteNewLiftRide error...Retry at most five times
WriteNewLiftRide error...Retry at most five times
WriteNewLiftRide error...Retry at most five times
Server response with: 0
Server response with: 0
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
```

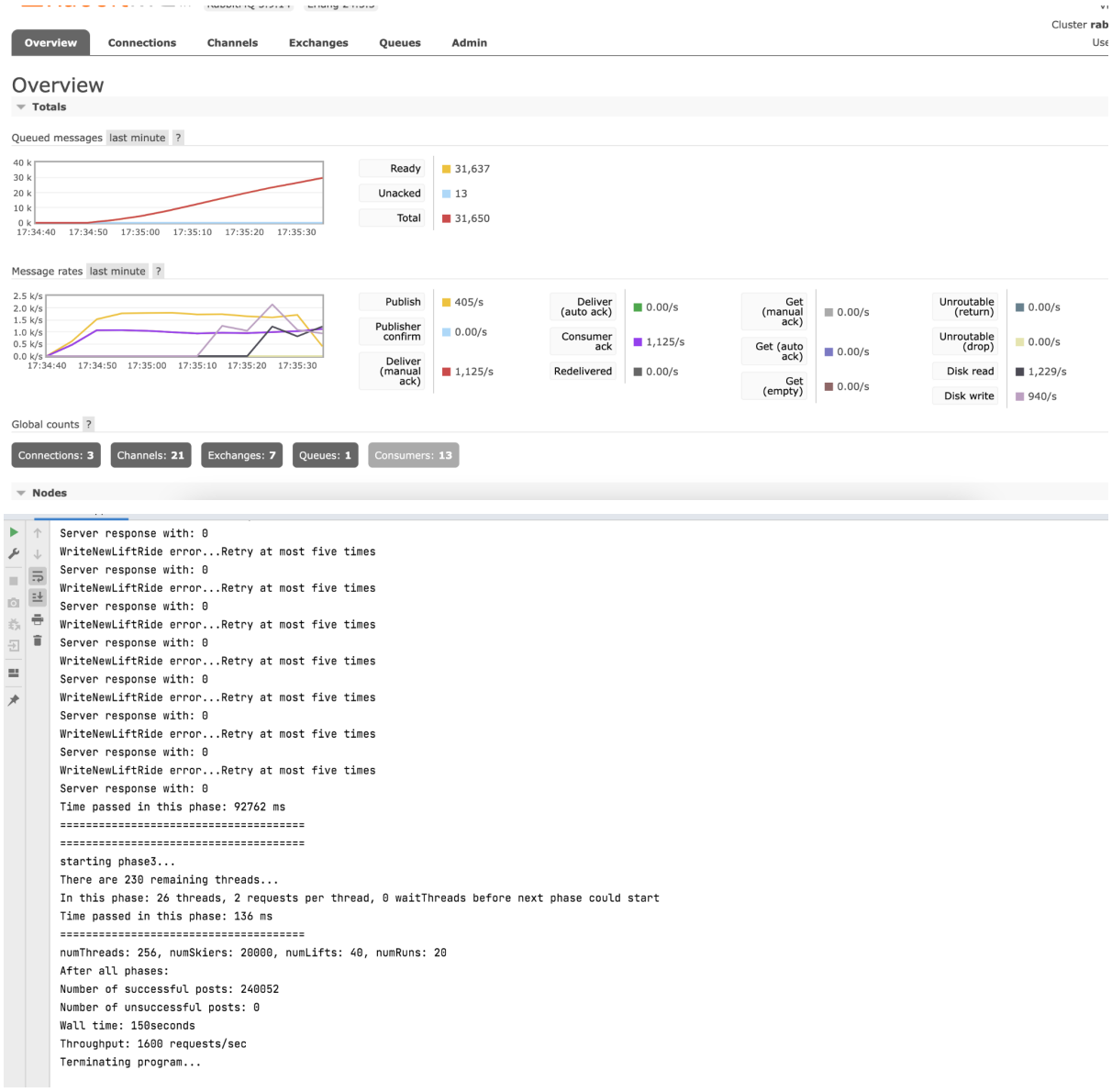
```
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
Time passed in this phase: 82727 ms
=====================================
=====================================
starting phase3...
There are 229 remaining threads...
In this phase: 26 threads, 2 requests per thread, 0 waitThreads before next phase could start
Time passed in this phase: 18 ms
=====================================
numThreads: 256, numSkiers: 20000, numLifts: 40, numRuns: 20
After all phases:
Number of successful posts: 240052
Number of unsuccessful posts: 0
Wall time: 138seconds
Throughput: 1739 requests/sec
Terminating program...

Process finished with exit code 0
```

One Instance for running 128 threads for both service:

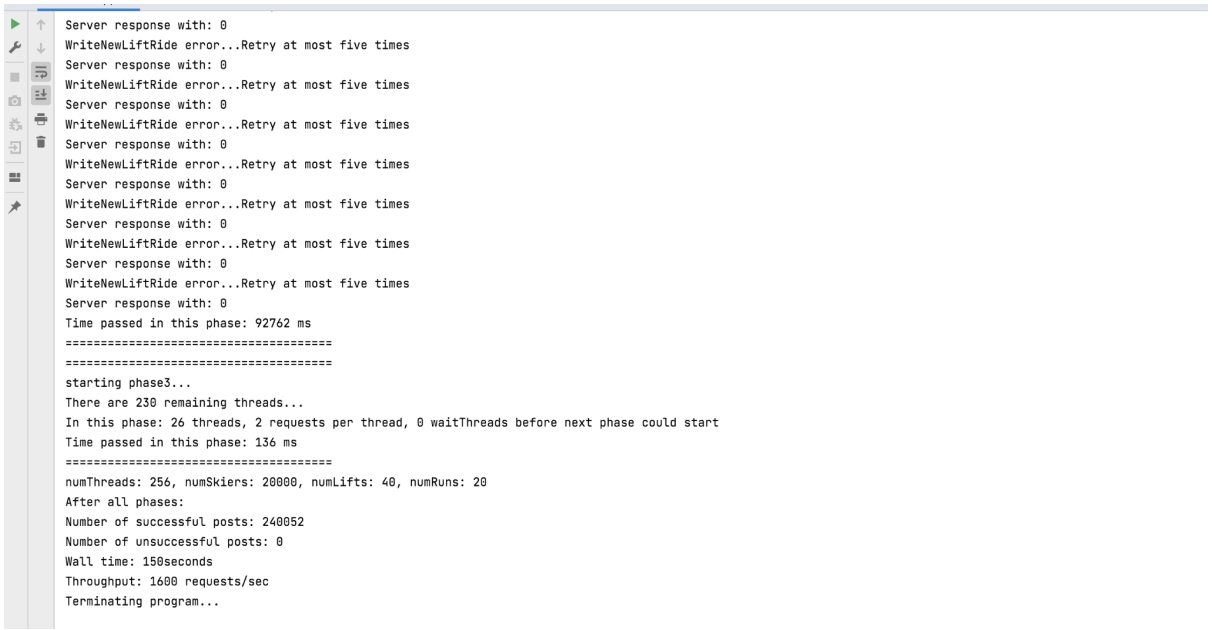




One Instance for running 256 threads for both service:




```
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
Time passed in this phase: 92762 ms
=======================================
=======================================
starting phase3...
There are 230 remaining threads...
In this phase: 26 threads, 2 requests per thread, 0 waitThreads before next phase could start
Time passed in this phase: 136 ms
=======================================
numThreads: 256, numSkiers: 20000, numLifts: 40, numRuns: 20
After all phases:
Number of successful posts: 240052
Number of unsuccessful posts: 0
Wall time: 150seconds
Throughput: 1600 requests/sec
Terminating program...
```



```
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
WriteNewLiftRide error...Retry at most five times
Server response with: 0
Time passed in this phase: 92762 ms
=====================================
=====================================
starting phase3...
There are 230 remaining threads...
In this phase: 26 threads, 2 requests per thread, 0 waitThreads before next phase could start
Time passed in this phase: 136 ms
=====================================
numThreads: 256, numSkiers: 20000, numLifts: 40, numRuns: 20
After all phases:
Number of successful posts: 240052
Number of unsuccessful posts: 0
Wall time: 150seconds
Throughput: 1600 requests/sec
Terminating program...
```