Assignment 3

CS6650 Fall 2022
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Github Repository URL:
https://github.com/elioxiaolan/Assignment03

Database Design:

For data design, my original plan was to set the skier ID and resort ID as the HashMap values, and HashMap value contain the resort ID, season ID, day ID, skier ID, time, lift ID, and vertical. However, the difficulty with this schema was that I would need to create several HashMap in Redis, which was expensive and inefficient for querying data from the database.

A better solution I came up with was to use simple keys with the values being a set of strings, and the strings elements in the set are serialized JSON strings. One benefit of this database design is that we do not have to know the exact design of how the keys and values are formed, which makes the queries ad hoc, and thus this design is more scalable than other alternatives. The JSON structures of values also reduce the cost of queries.

AWS EC2 Specifications:

Server: I used a t2.micro EC2 instance to distribute requests.

Consumer: I used three different sizes of EC2 instance, the first one was t2.micro, the second was t2.medium instance, and the last t3.medium.

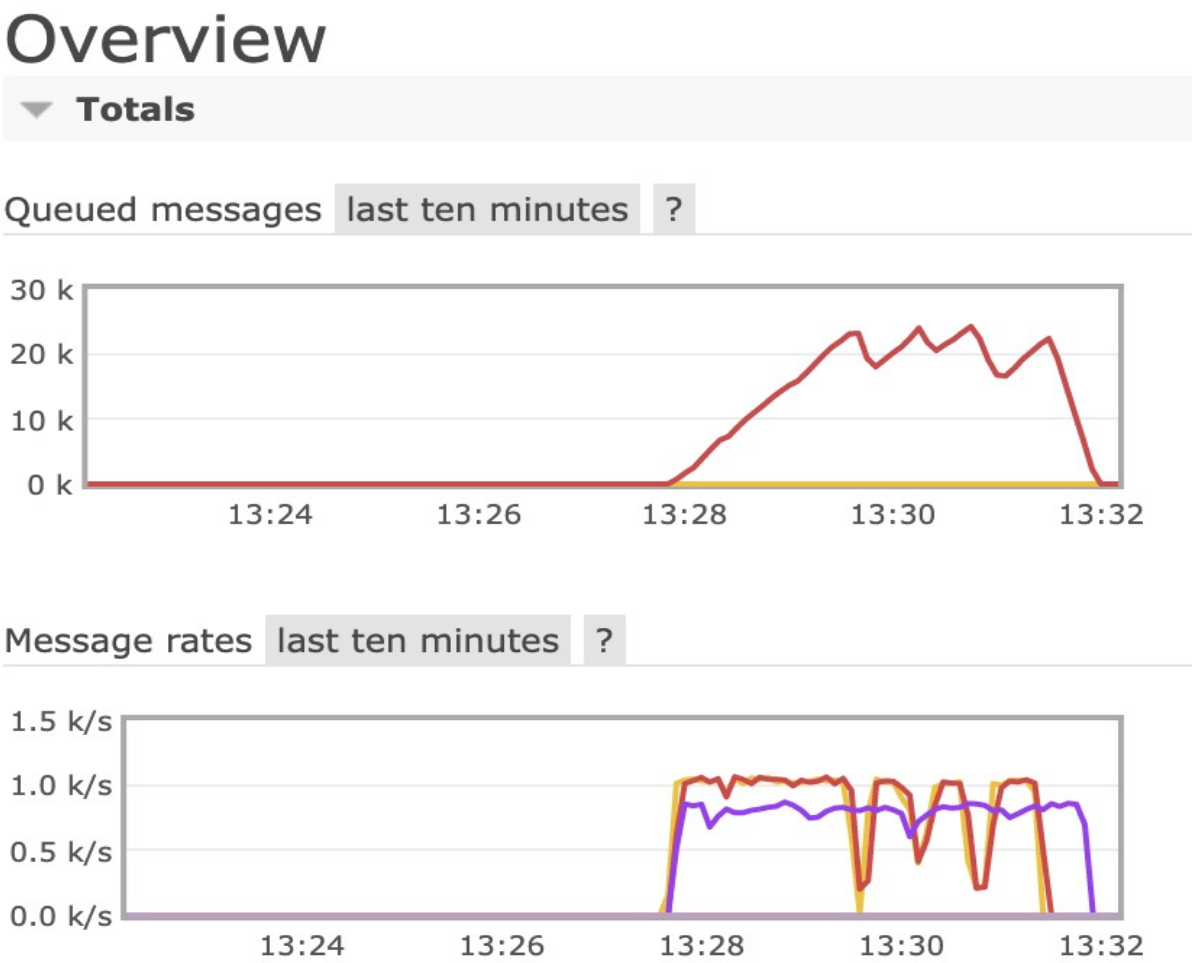
RabbitMQ: I used a t2.micro EC2 instance.

Redis: I used a t2.micro EC2 instance.

RabbitMQ Results:

At first, I used a t2.micro EC2 instance for my Consumer, and I set the number of thread as 32 for Client, the number of thread as 128 for Consumer. As a result, there are many messages in the Queue during the whole process, the results are as followed (I used Consumer_Resort as my Consumer):

32 Threads for Client and 128 Threads for Consumer (t2.micro):

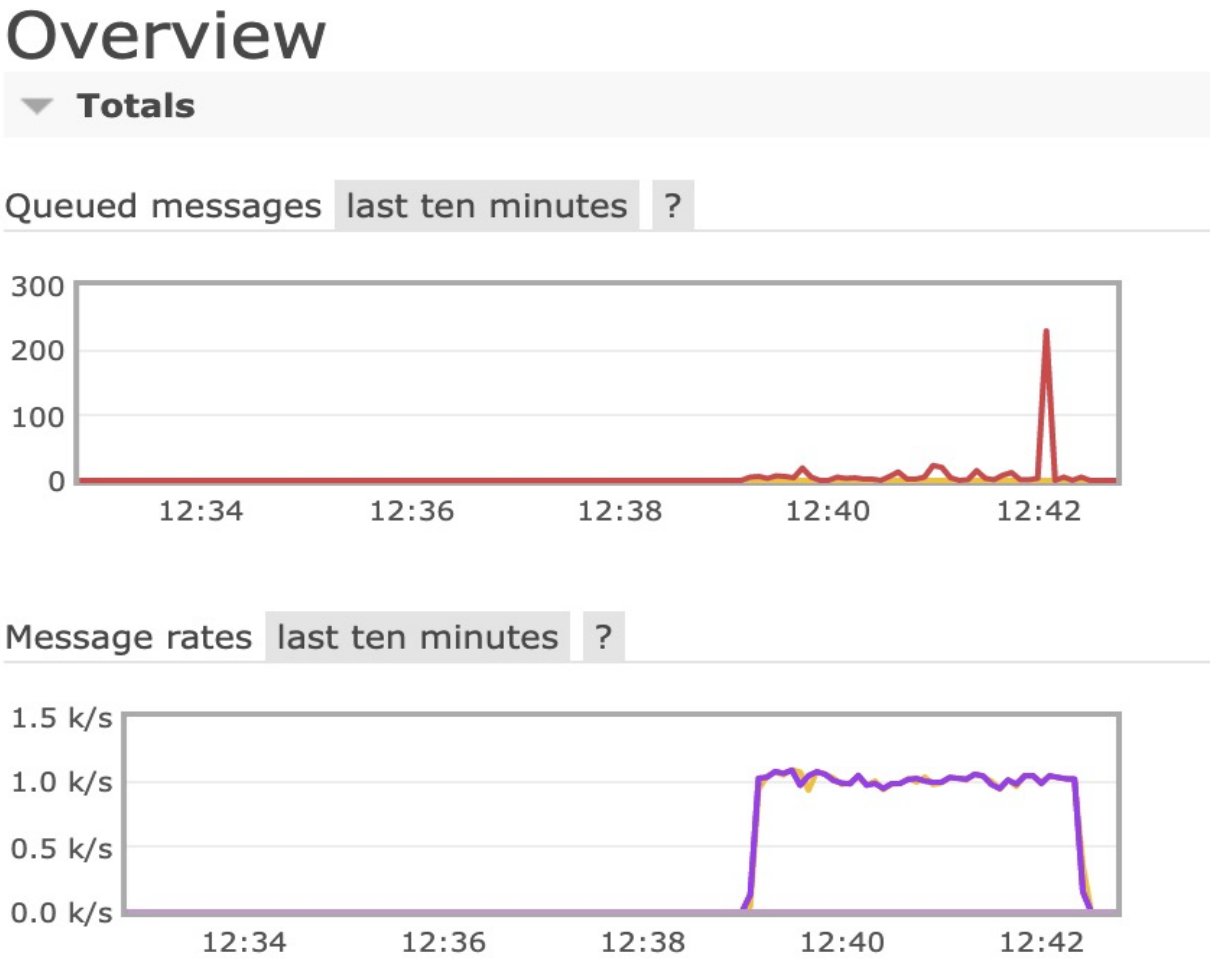



```
************************************************************
Number of successful requests: 200000
Number of failed requests: 0
Total wall time: 222310
The mean response time: 35.32599497884513
The median response time: 29.0
Throughput: 900 requests/second
The p99 (99th percentile) response time: 68.0
The max response time: 6053.0
The min response time: 17.0
```

It seems that my Consumer can't process the messages and store them in my remote Redis server fast enough, so I considered increasing the size of my Consumer instance and then increasing the number of threads I spawn.

I employed a new size of EC2 instance as my Consumer EC2 instance, and change the number of threads from 128 to 256 in Consumer, the test results are as followed:

32 Threads for Client and 128 Threads for Consumer (t2.medium):



```
************************************************************
Number of successful requests: 200000
Number of failed requests: 0
Total wall time: 198286
The mean response time: 31.480363716389245
The median response time: 29.0
Throughput: 1010 requests/second
The p99 (99th percentile) response time: 160.0
The max response time: 712.0
The min response time: 16.0
```

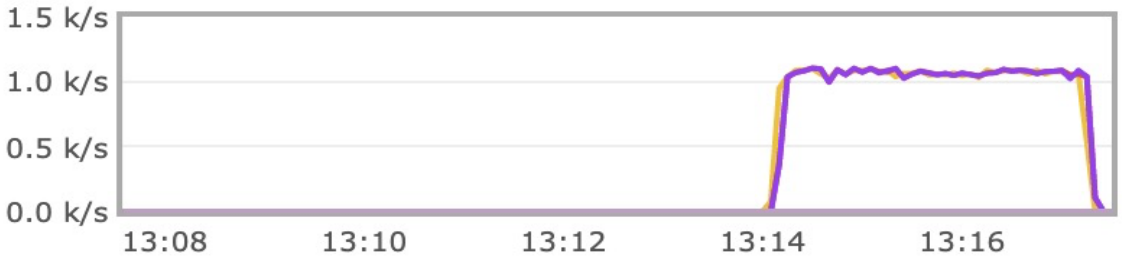
32 Threads for Client and 256 Threads for Consumer (t2.medium):

Overview

Totals

Queued messages last ten minutes ?

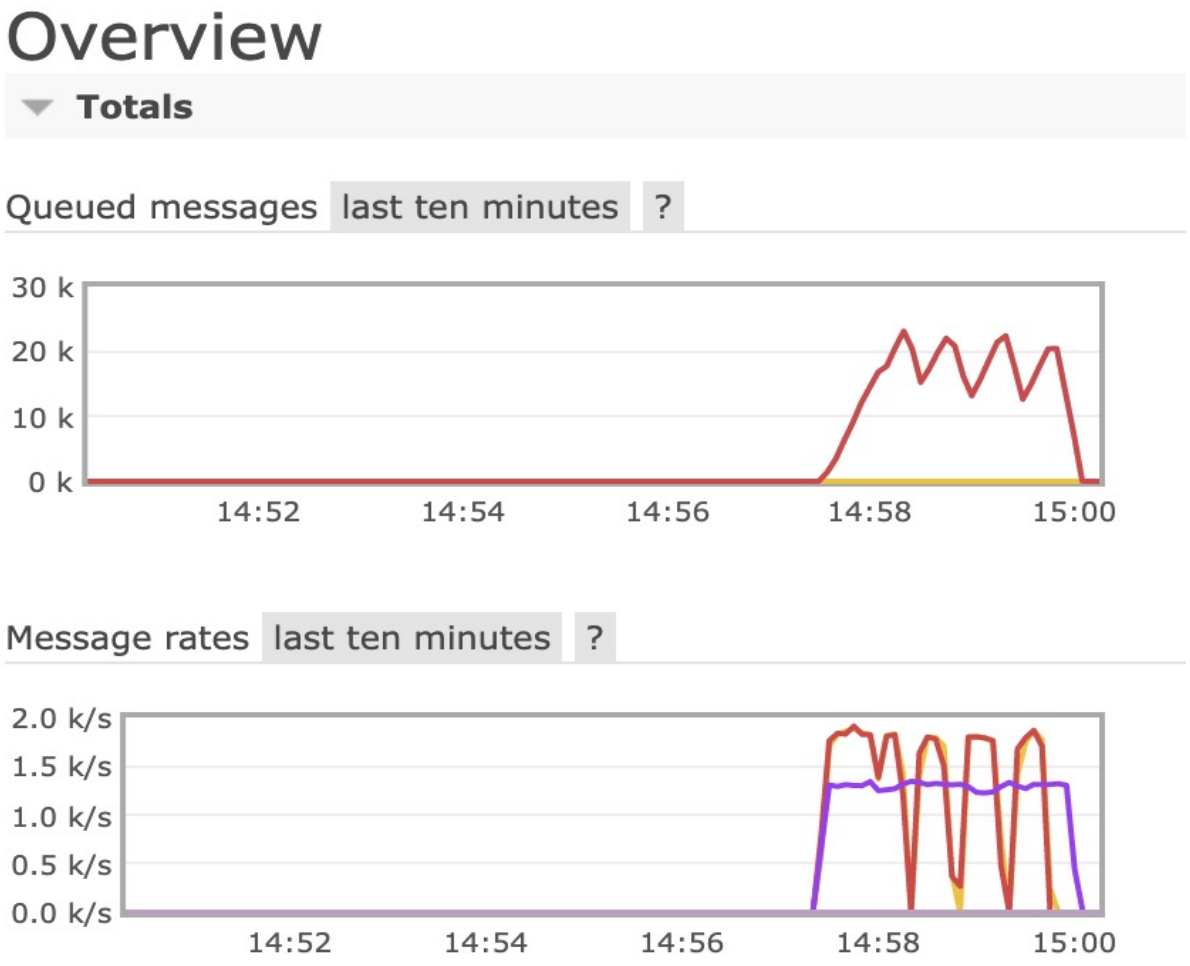
Message rates last ten minutes ?




```
************************************************************
Number of successful requests: 200000
Number of failed requests: 0
Total wall time: 189542
The mean response time: 30.134111574588122
The median response time: 29.0
Throughput: 1058 requests/second
The p99 (99th percentile) response time: 56.0
The max response time: 712.0
The min response time: 17.0
```

From the results we can conclude that a larger size of EC2 instance can increase the process rate of Consumer but has no effect on the throughput.

The next step I did was to employed a larger EC2 instance for the Consumer, so I used a t3.medium instance for the Consumer, and the number of threads of Consumer remain the same as previous, but I change the number of threads of Client, and I see an increase in throughput with an increase in the number of messages in the queue:



```
************************************************************
Number of successful requests: 200000
Number of failed requests: 0
Total wall time: 140049
The mean response time: 44.26606105778129
The median response time: 33.0
Throughput: 1428 requests/second
The p99 (99th percentile) response time: 115.0
The max response time: 7045.0
The min response time: 18.0
```

The increase in throughput can’t offset the increase in the number of messages in queue, which means there are some room of optimization for Consumer part.