Assignment 3 – CS6650

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1. URL for Github Repo: https://github.com/tyuchn/cs6650-hw3-ytian
2. Database Design and deployment topology
    a. Database Design

```
CREATE SCHEMA SkierApplication;
use SkierApplication;

create table LiftRides(
  id INT NOT NULL AUTO_INCREMENT,
  skierId INT NOT NULL,
  dayId INT NOT NULL,
  time INT NOT NULL,
  liftId INT NOT NULL,
  PRIMARY KEY ( id )
);

create table Resorts(
  id INT NOT NULL AUTO_INCREMENT,
  dayId INT NOT NULL,
  year INT NOT NULL,
  time INT NOT NULL,
  resortId INT NOT NULL,
  skierId INT NOT NULL,
  liftId INT NOT NULL,
  PRIMARY KEY ( id ),
);
```

LiftRides table is used to store the skier and lift ride information for specific season. To consume message from message queue ASAP, each request will be stored as a single entry in the DB. As a result, the LiftRides table has the fields of skier id, id, time, lift id, the primary key is automatically assigned by MySQL. To enable the queries like “For skier N, XXX”, we need to group the rows by skier Id while executing SQL queries.

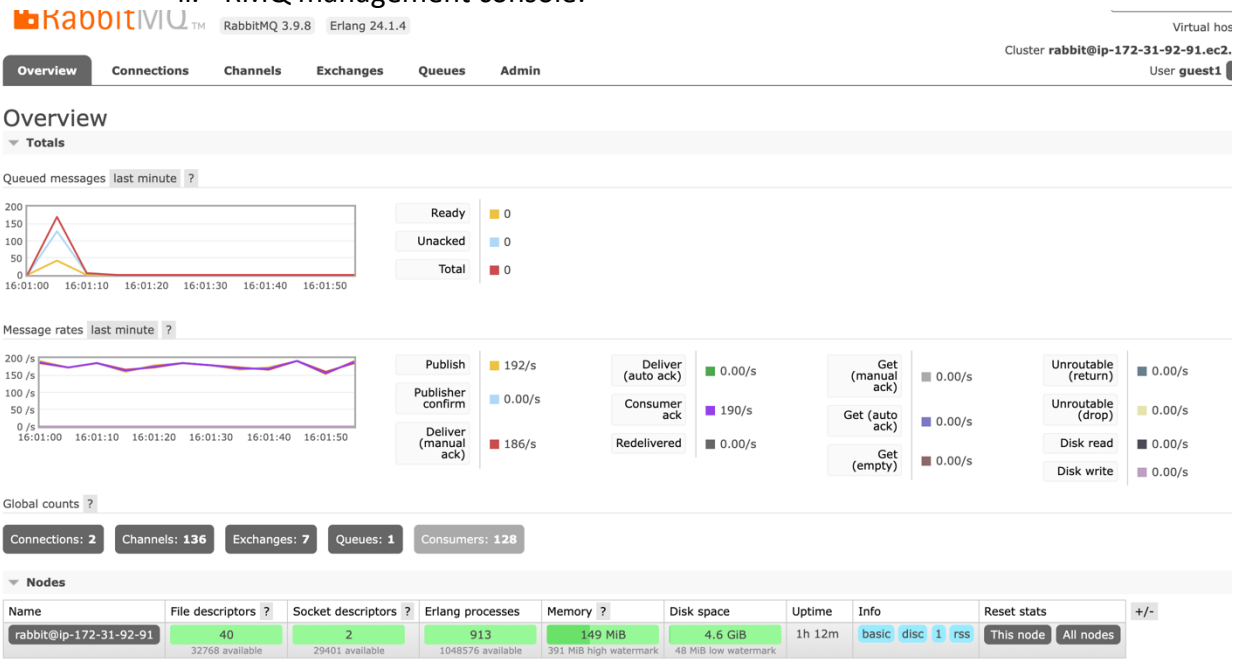
Vice versa, Resort table is used to store data pertinent to the ski resort. It has the fields of dayId, year, time, resortId, skierId and liftId. The primary key is also automatically incremented for each record. To enable queries like “For day N, XXX”, we can select on the specific day and do some “group by” operations.

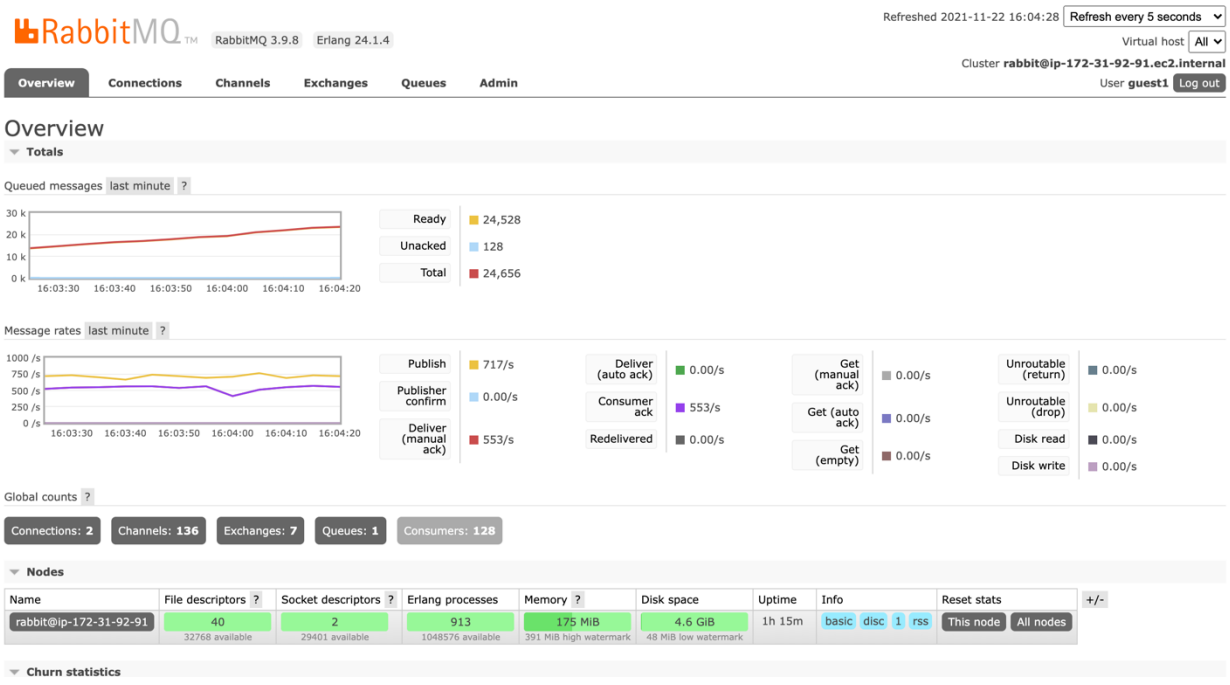
    b. Deployment topology
    I created an MySQL instance on RDS, the attribute is db.t2.micro with 1 vCPU and 1 GB RAM at the beginning. The JDBC connection was established on consumer microservices.

3. Test Results – original setup

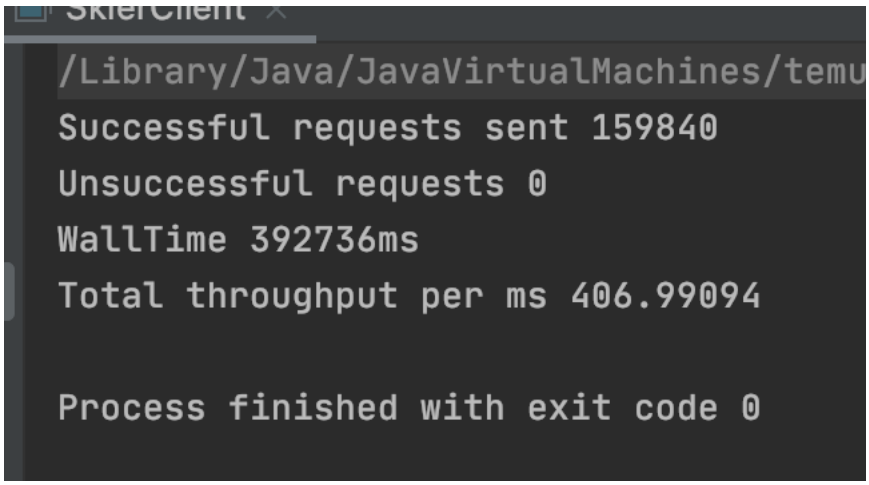
At the first step, both the consumer and db instance are t2.micro, the running result showed as below

a. Step1 – 128 threads
   i. Commands lines:
      -numThreads 128 -numSkiers 100000 -address 54.82.5.13:8080
   ii. RMQ management console:





iii. Result:

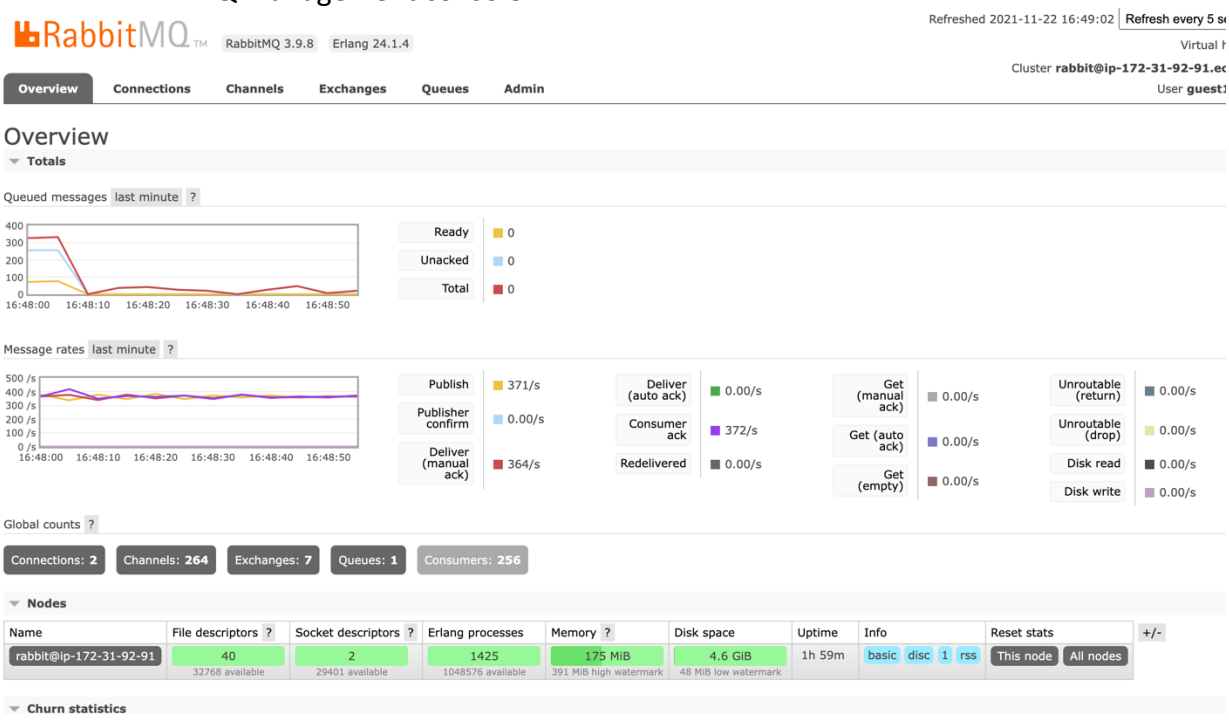


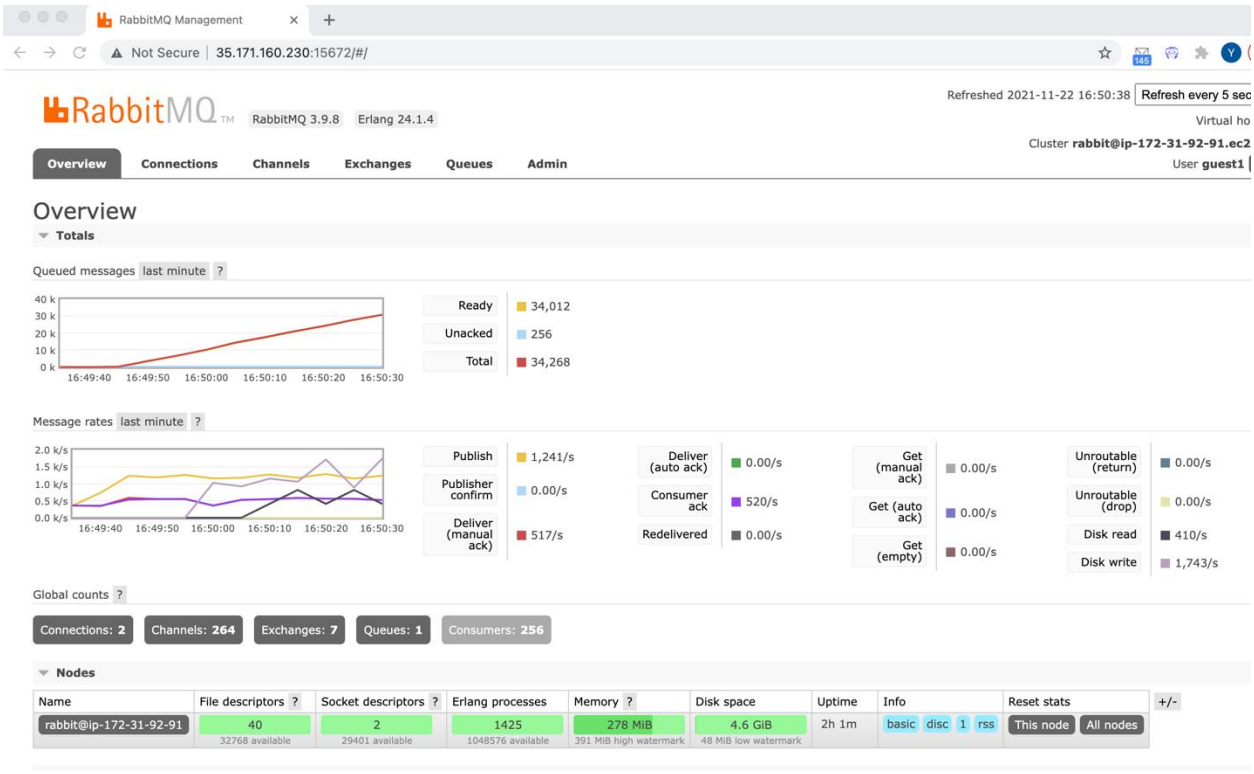
b. Step1 – 256 threads

i. Commands lines:

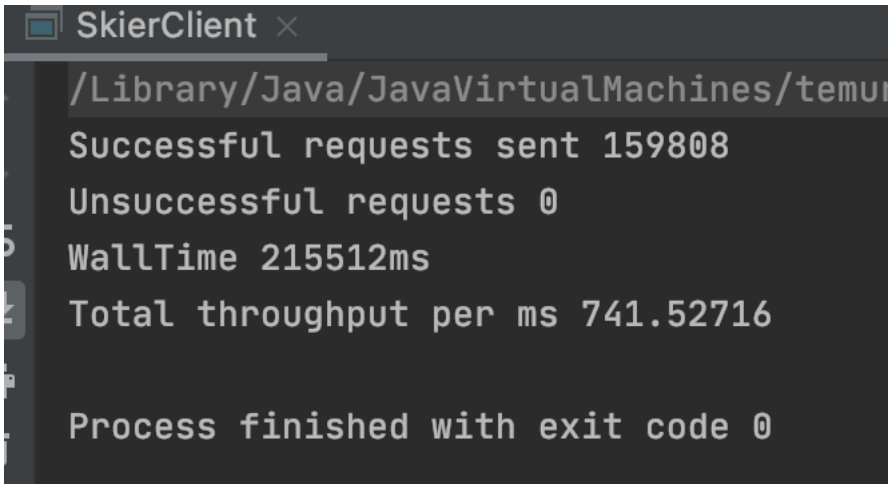
-numThreads 256 -numSkiers 100000 -address 54.82.5.13:8080

ii. RMQ management console:





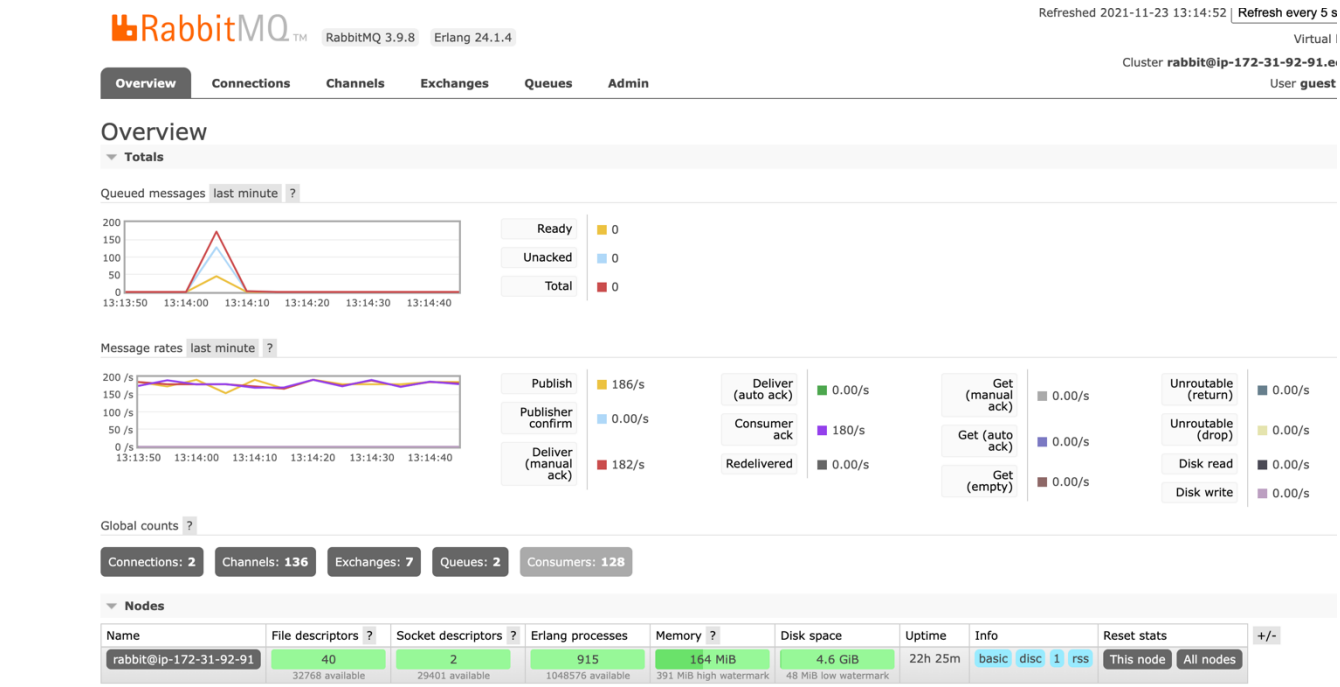
iii. Result:

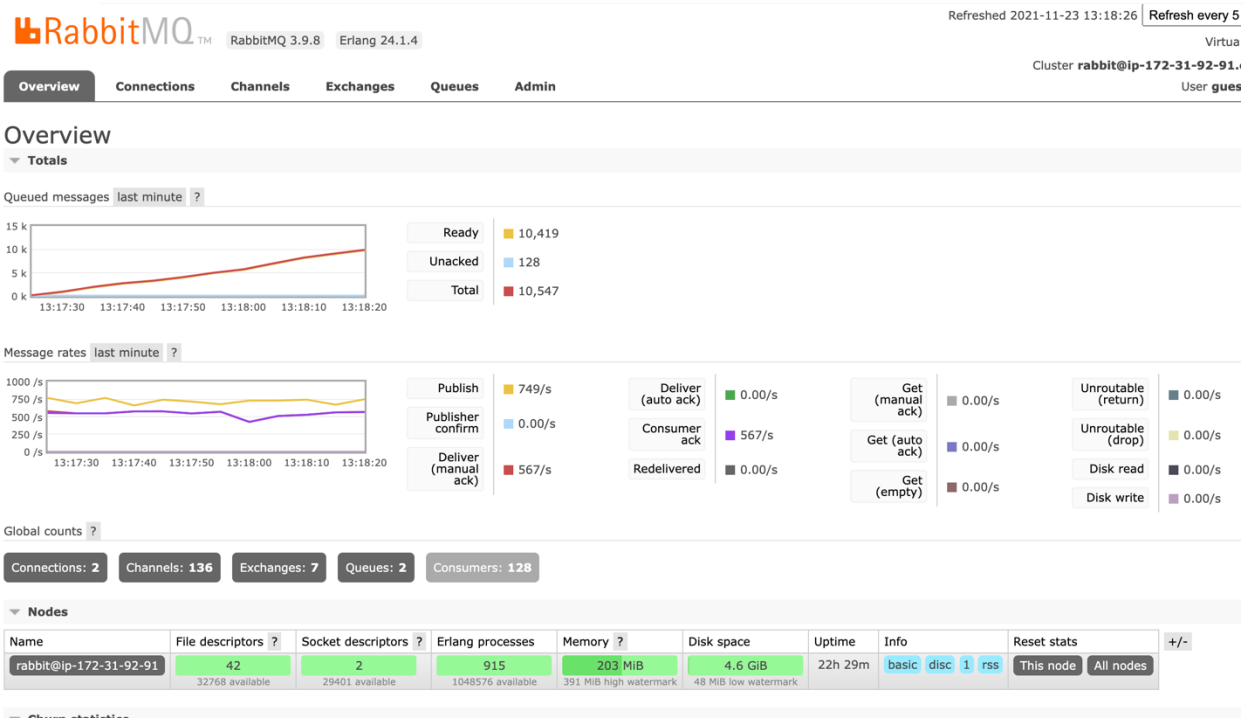


c. Step2 – 128 threads

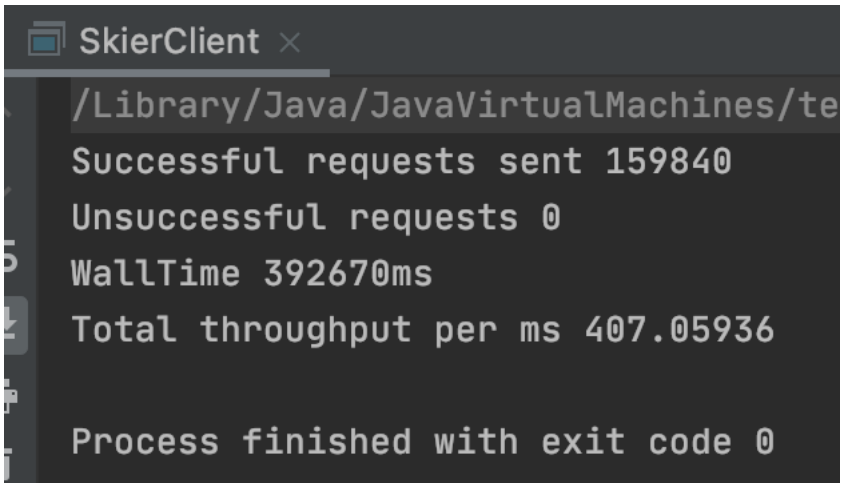
i. Commands lines:
-numThreads 128 -numSkiers 100000 -address 54.82.5.13:8080

ii. RMQ management console:

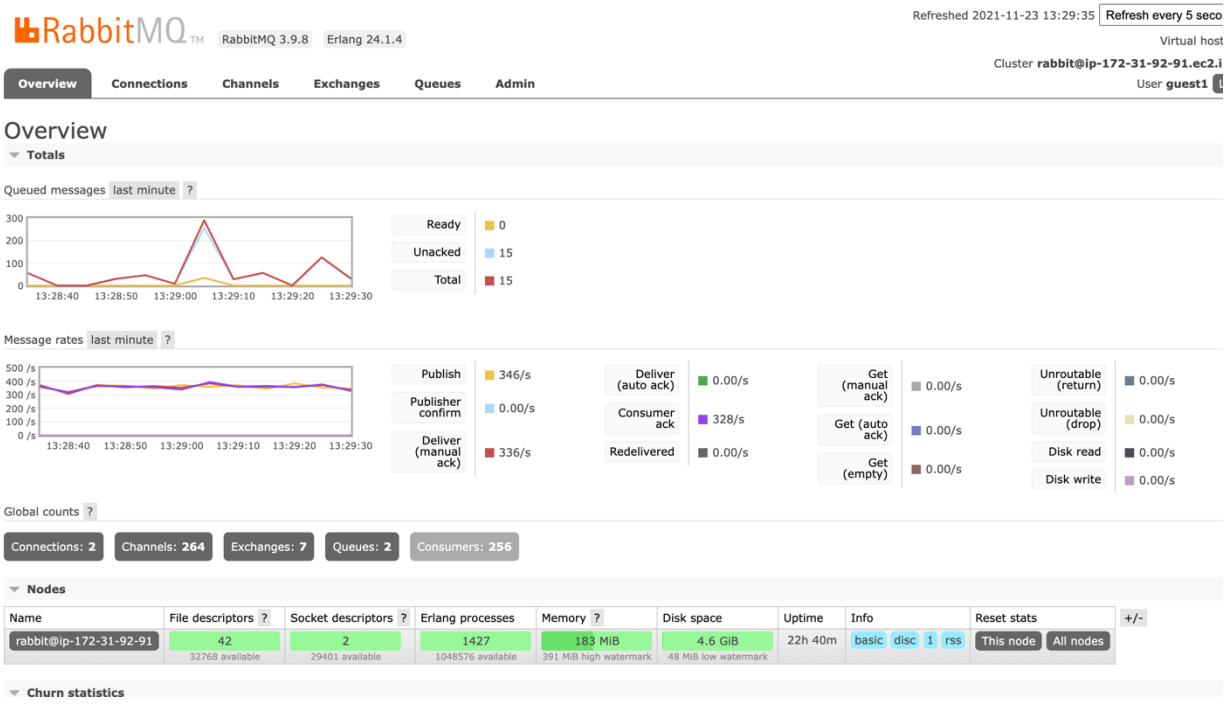

RabbitMQ
RabbitMQ 3.9.8
Erlang 24.1.4
Refreshed 2021-11-23 13:14:52
Refresh every 5 s
Overview
Connections
Channels
Exchanges
Queues
Admin
User guest
Overview
Totals
Queued messages last minute
Ready 0
Unacked 0
Total 0
Message rates last minute
Publish 186/s
Publisher confirm 0.00/s
Deliver (manual ack) 182/s
Deliver (auto ack) 0.00/s
Consumer ack 180/s
Redelivered 0.00/s
Get (manual ack) 0.00/s
Get (auto ack) 0.00/s
Get (empty) 0.00/s
Unroutable (return) 0.00/s
Unroutable (drop) 0.00/s
Disk read 0.00/s
Disk write 0.00/s
Global counts
Connections: 2
Channels: 136
Exchanges: 7
Queues: 2
Consumers: 128
Nodes
Name
File descriptors
Socket descriptors
Erlang processes
Memory
Disk space
Uptime
Info
Reset stats
rabbit@ip-172-31-92-91
40
2
915
164 MiB
4.6 GiB
22h 25m
This node
All nodes

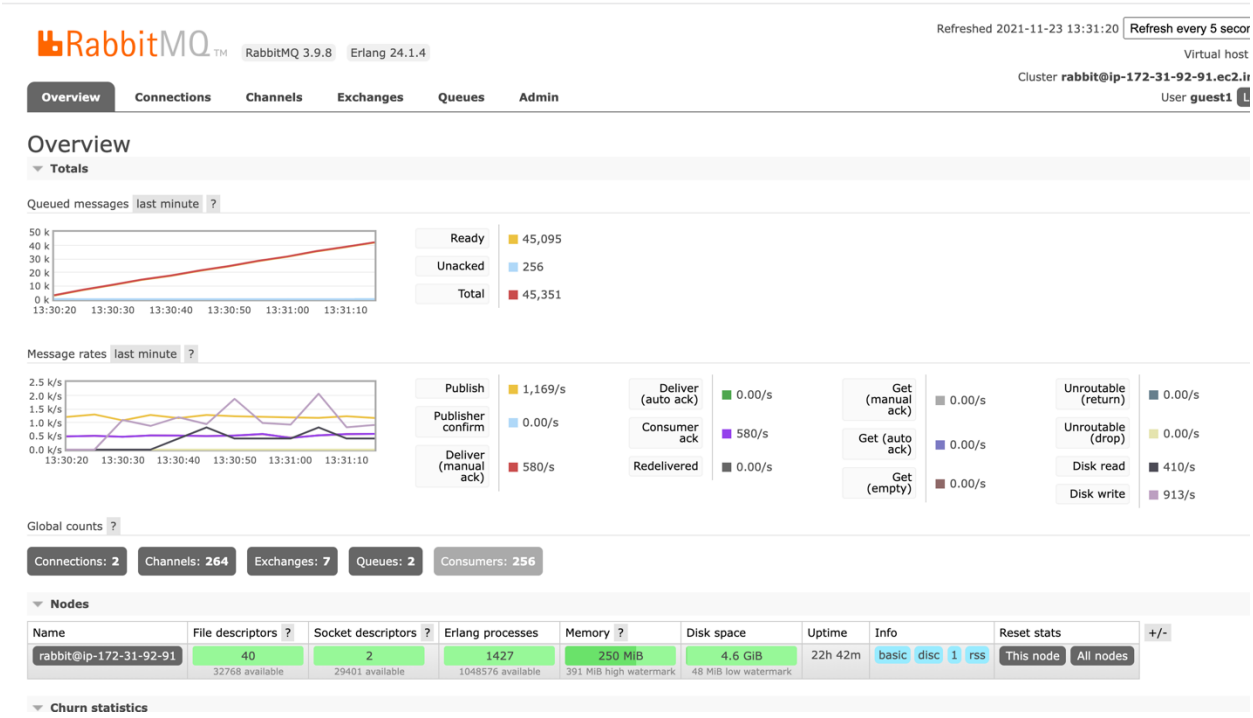

RabbitMQ
RabbitMQ 3.9.8
Erlang 24.1.4
Refreshed 2021-11-23 13:18:26
Refresh every 5
Overview
Connections
Channels
Exchanges
Queues
Admin
Overview
Totals
Queued messages last minute
Ready 10,419
Unacked 128
Total 10,547
Message rates last minute
Publish 749/s
Publisher confirm 0.00/s
Deliver (manual ack) 567/s
Deliver (auto ack) 0.00/s
Consumer ack 567/s
Redelivered 0.00/s
Get (manual ack) 0.00/s
Get (auto ack) 0.00/s
Get (empty) 0.00/s
Unroutable (return) 0.00/s
Unroutable (drop) 0.00/s
Disk read 0.00/s
Disk write 0.00/s
Global counts
Connections: 2
Channels: 136
Exchanges: 7
Queues: 2
Consumers: 128
Nodes
Name
File descriptors
Socket descriptors
Erlang processes
Memory
Disk space
Uptime
Info
Reset stats
rabbit@ip-172-31-92-91
42
2
915
203 MiB
4.6 GiB
22h 29m
This node
All nodes

iii. Result:

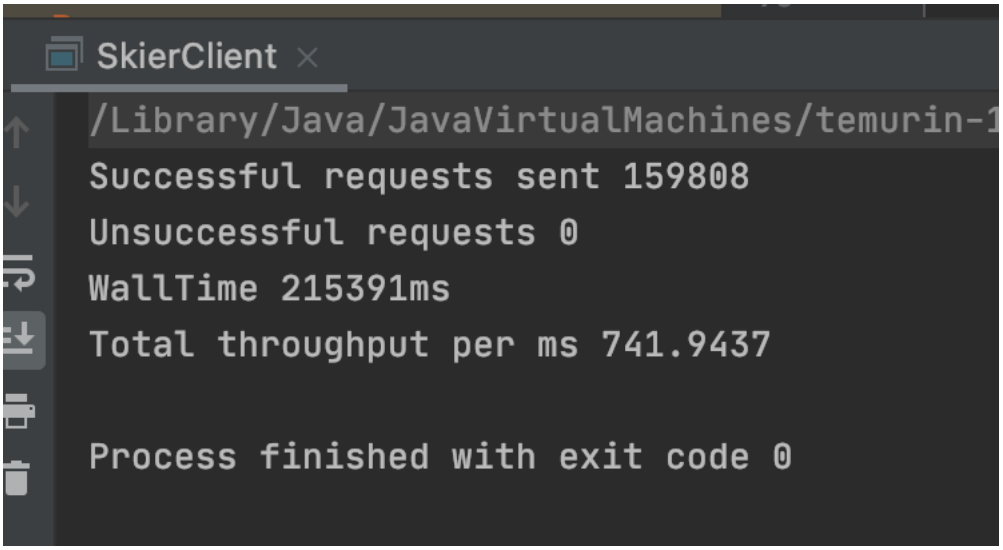


d. Step2 – 256 threads
   i. Commands lines:
   -numThreads 256 -numSkiers 100000 -address 54.82.5.13:8080
   ii. RMQ management console:

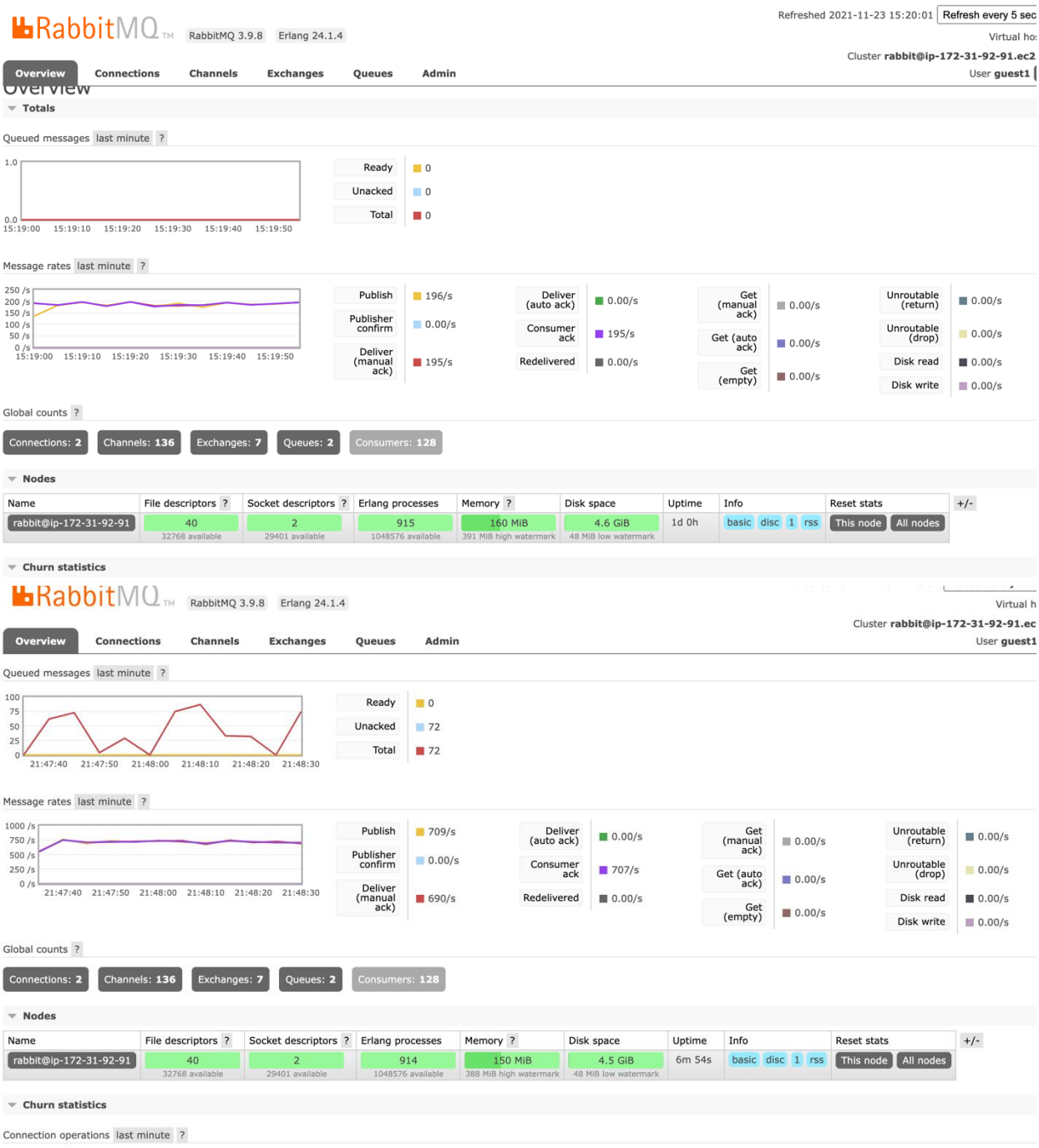




iii. Result:



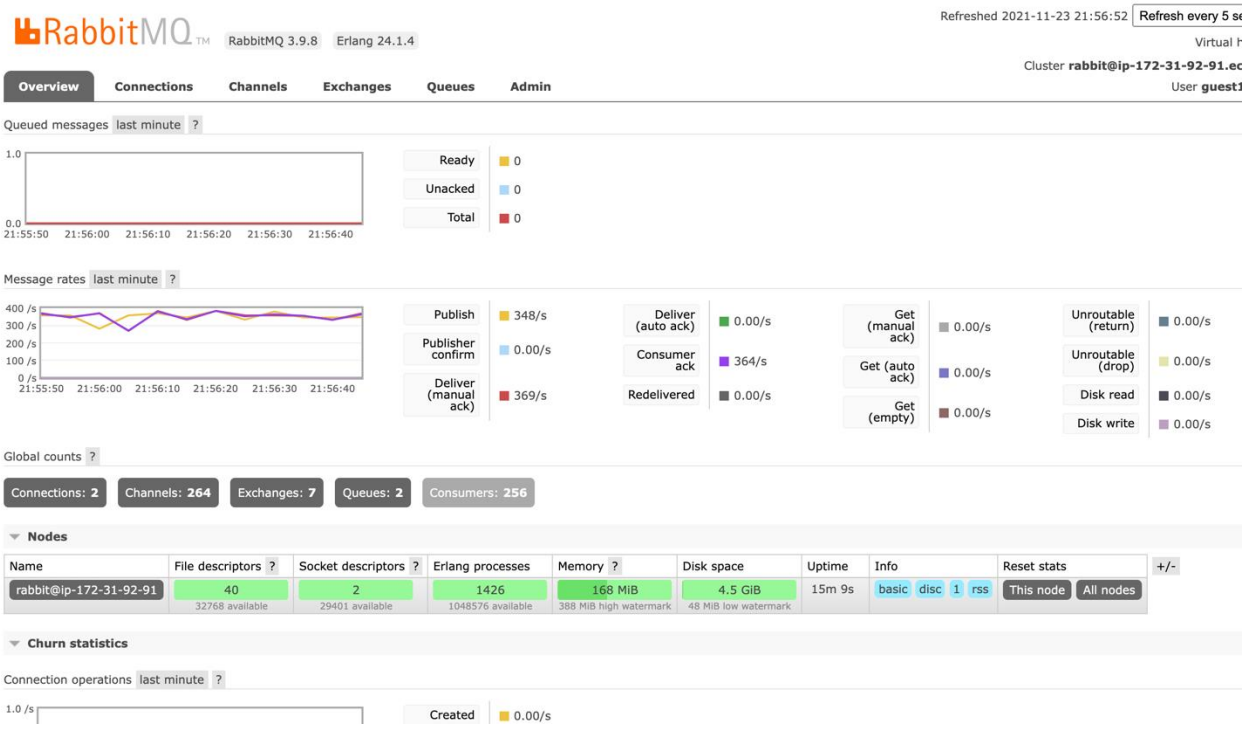
4. Test Results – after increasing capacity
   At this step, both the consumer and db instance are increased from t2.micro to t2.large
   a. Step1 – 128 threads
      i. Commands lines:
      -numThreads 128 -numSkiers 100000 -address 54.82.5.13:8080
      ii. RMQ management console:

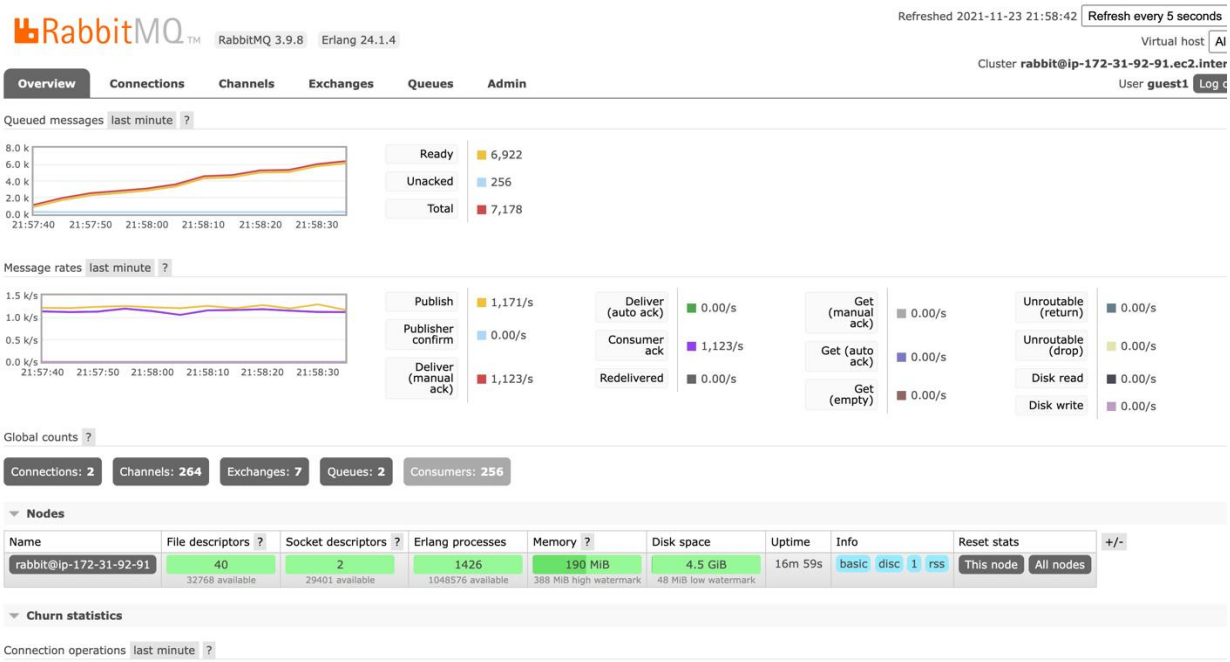

RabbitMQ
RabbitMQ 3.9.8
Erlang 24.1.4
Refreshed 2021-11-23 15:20:01
Refresh every 5 sec
Cluster rabbit@ip-172-31-92-91.ec2
User guest1
Overview
Connections
Channels
Exchanges
Queues
Admin
Totals
Queued messages last minute
Ready 0
Unacked 0
Total 0
Message rates last minute
Publish 196/s
Publisher confirm 0.00/s
Deliver (manual ack) 195/s
Deliver (auto ack) 0.00/s
Consumer ack 195/s
Redelivered 0.00/s
Get (manual ack) 0.00/s
Get (auto ack) 0.00/s
Get (empty) 0.00/s
Unroutable (return) 0.00/s
Unroutable (drop) 0.00/s
Disk read 0.00/s
Disk write 0.00/s
Global counts
Connections: 2
Channels: 136
Exchanges: 7
Queues: 2
Consumers: 128
Nodes
Name
File descriptors
Socket descriptors
Erlang processes
Memory
Disk space
Uptime
Info
Reset stats
rabbit@ip-172-31-92-91
40
32768 available
2
29401 available
915
1048576 available
160 MiB
391 MiB high watermark
4.6 GiB
48 MiB low watermark
1d 0h
basic disc 1 rss
This node
All nodes
Churn statistics
RabbitMQ
RabbitMQ 3.9.8
Erlang 24.1.4
Cluster rabbit@ip-172-31-92-91.ec
User guest1
Overview
Connections
Channels
Exchanges
Queues
Admin
Queued messages last minute
Ready 0
Unacked 72
Total 72
Message rates last minute
Publish 709/s
Publisher confirm 0.00/s
Deliver (manual ack) 690/s
Deliver (auto ack) 0.00/s
Consumer ack 707/s
Redelivered 0.00/s
Get (manual ack) 0.00/s
Get (auto ack) 0.00/s
Get (empty) 0.00/s
Unroutable (return) 0.00/s
Unroutable (drop) 0.00/s
Disk read 0.00/s
Disk write 0.00/s
Global counts
Connections: 2
Channels: 136
Exchanges: 7
Queues: 2
Consumers: 128
Nodes
Name
File descriptors
Socket descriptors
Erlang processes
Memory
Disk space
Uptime
Info
Reset stats
rabbit@ip-172-31-92-91
40
32768 available
2
29401 available
914
1048576 available
150 MiB
388 MiB high watermark
4.5 GiB
48 MiB low watermark
6m 54s
basic disc 1 rss
This node
All nodes
Churn statistics
Connection operations last minute

iii. Result:

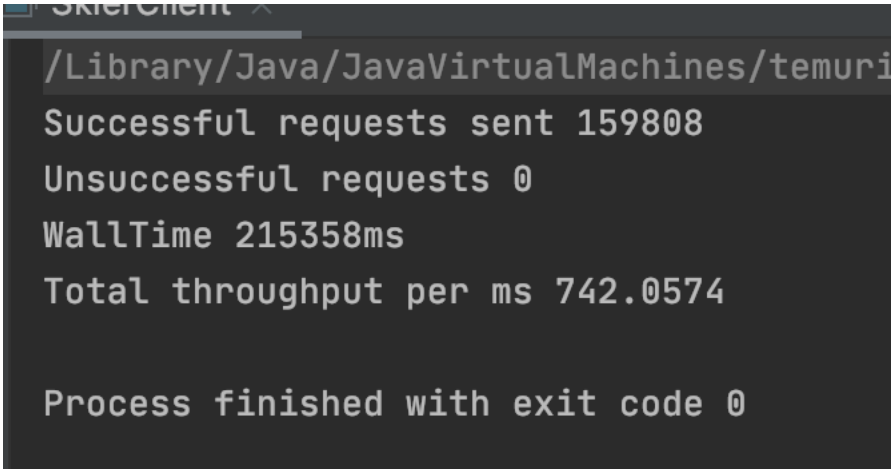
```
/Library/Java/JavaVirtualMachines/temu
Successful requests sent 159840
Unsuccessful requests 0
WallTime 390395ms
Total throughput per ms 409.4315

Process finished with exit code 0
```

b. Step1 – 256 threads
   i. Commands lines:
   -numThreads 256 -numSkiers 100000 -address 54.82.5.13:8080
   ii. RMQ management console:





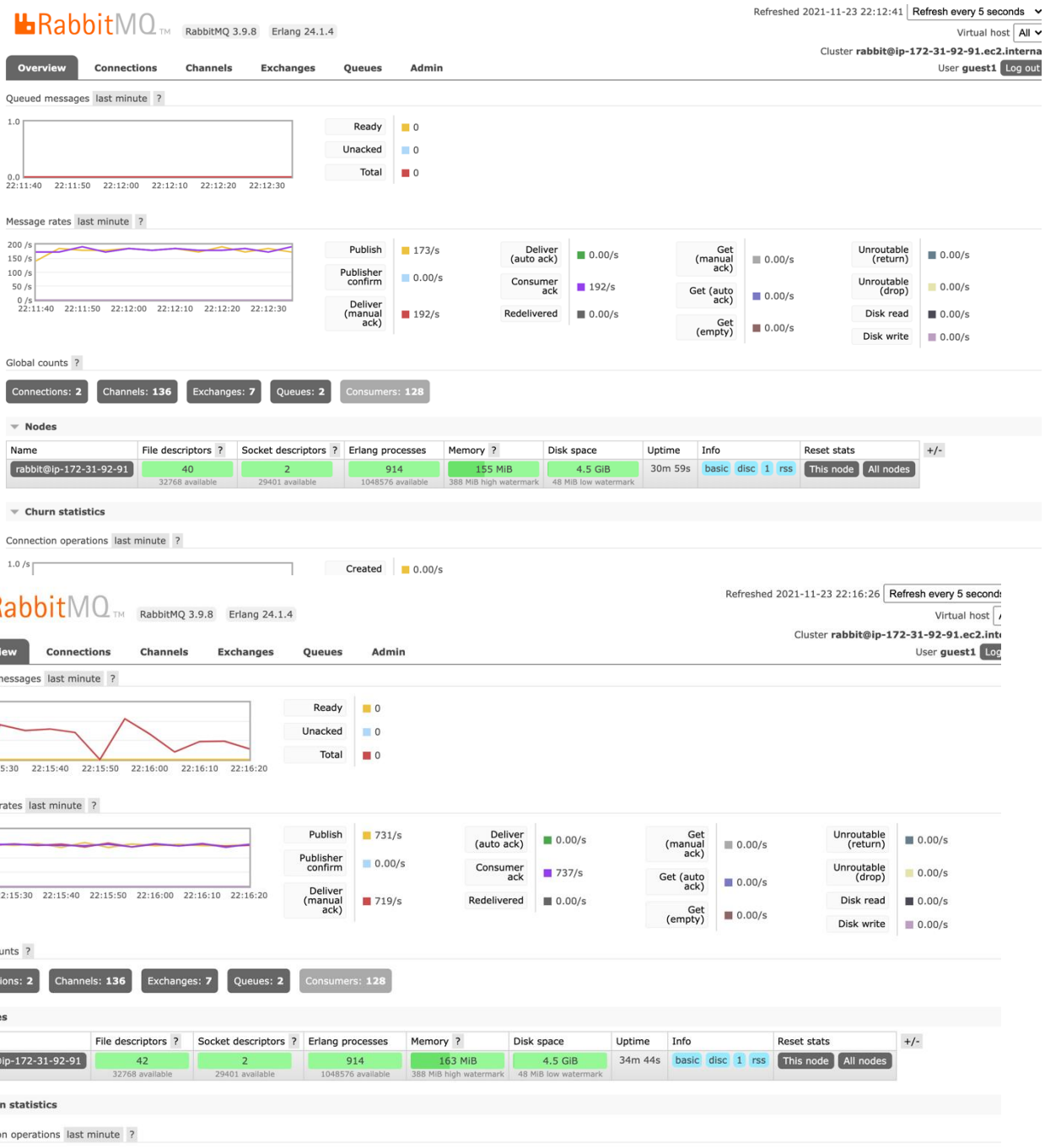
iii. Result:



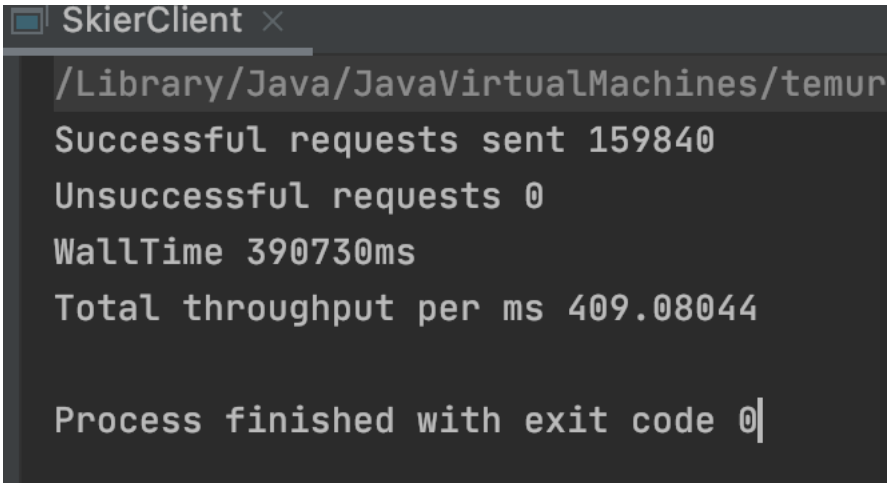
c. Step2 – 128 threads

i. Commands lines:
-numThreads 128 -numSkiers 100000 -address 54.82.5.13:8080

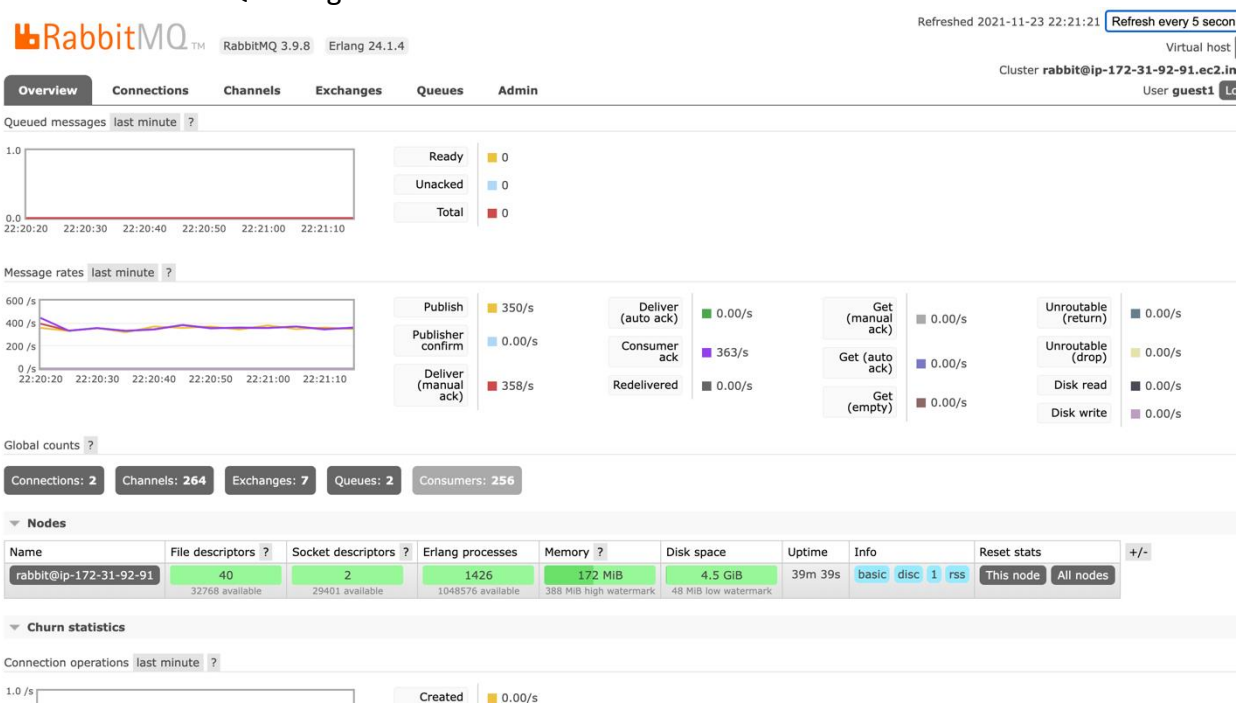
ii. RMQ management console:

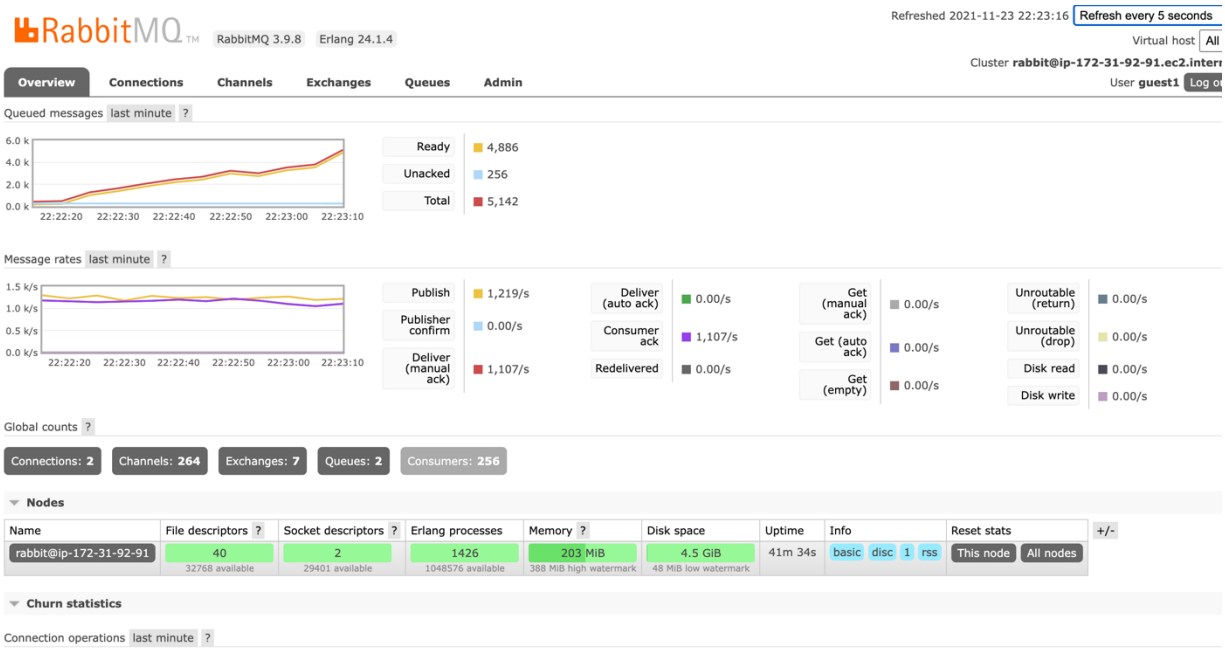

RabbitMQ
RabbitMQ 3.9.8
Erlang 24.1.4
Refreshed 2021-11-23 22:12:41
Refresh every 5 seconds
Virtual host
All
Cluster rabbit@ip-172-31-92-91.ec2.interna
User guest1
Log out
Overview
Connections
Channels
Exchanges
Queues
Admin
Queued messages last minute
Ready 0
Unacked 0
Total 0
Message rates last minute
Publish 173/s
Publisher confirm 0.00/s
Deliver (manual ack) 192/s
Deliver (auto ack) 0.00/s
Consumer ack 192/s
Redelivered 0.00/s
Get (manual ack) 0.00/s
Get (auto ack) 0.00/s
Get (empty) 0.00/s
Unroutable (return) 0.00/s
Unroutable (drop) 0.00/s
Disk read 0.00/s
Disk write 0.00/s
Global counts
Connections: 2
Channels: 136
Exchanges: 7
Queues: 2
Consumers: 128
Nodes
Name
File descriptors
Socket descriptors
Erlang processes
Memory
Disk space
Uptime
Info
Reset stats
rabbit@ip-172-31-92-91
40
32768 available
2
29401 available
914
1048576 available
155 MiB
388 MiB high watermark
4.5 GiB
48 MiB low watermark
30m 59s
basic disc 1 rss
This node
All nodes
Churn statistics
Connection operations last minute
Created 0.00/s
RabbitMQ
RabbitMQ 3.9.8
Erlang 24.1.4
Refreshed 2021-11-23 22:16:26
Refresh every 5 seconds
Virtual host
Cluster rabbit@ip-172-31-92-91.ec2.int
User guest1
Overview
Connections
Channels
Exchanges
Queues
Admin
Queued messages last minute
Ready 0
Unacked 0
Total 0
Message rates last minute
Publish 731/s
Publisher confirm 0.00/s
Deliver (manual ack) 719/s
Deliver (auto ack) 0.00/s
Consumer ack 737/s
Redelivered 0.00/s
Get (manual ack) 0.00/s
Get (auto ack) 0.00/s
Get (empty) 0.00/s
Unroutable (return) 0.00/s
Unroutable (drop) 0.00/s
Disk read 0.00/s
Disk write 0.00/s
Global counts
Connections: 2
Channels: 136
Exchanges: 7
Queues: 2
Consumers: 128
Nodes
Name
File descriptors
Socket descriptors
Erlang processes
Memory
Disk space
Uptime
Info
Reset stats
rabbit@ip-172-31-92-91
42
32768 available
2
29401 available
914
1048576 available
163 MiB
388 MiB high watermark
4.5 GiB
48 MiB low watermark
34m 44s
basic disc 1 rss
This node
All nodes
Churn statistics
Connection operations last minute

iii. Result:

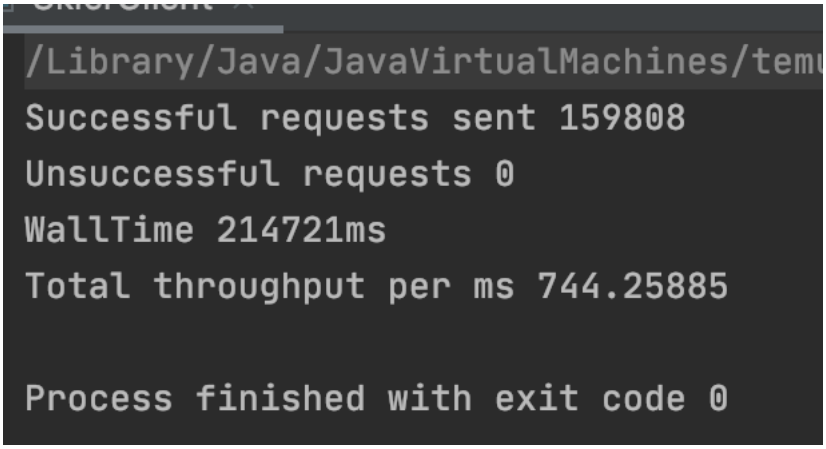


d. Step2 – 256 threads
   i. Commands lines:
   -numThreads 256 -numSkiers 100000 -address 54.82.5.13:8080
   ii. RMQ management console:





iii. Result:



5. Result Analysis

At the beginning, for both 128 threads and 256 threads in Step 1&2, we can see significant (tens of thousand) backlog in the message queue, which was caused by the DB bottleneck with no double. In order to eliminate it, I chose to increase the capacity of both the DB and consumer. After increase the size from t2.micro to t2.large, we can see the result for 128 thread, peek of the backlog is less than 100, while for 256 threads, peek of backlog is less than 7k. Because we enhanced the capacity of our RAM and add more memory to the instance, we have higher I/O speed. As a result, the decrement of backlogs is significant, the bottleneck was mitigated significantly. So, we can say our solution is successful.