

# 1.Github Repo Link

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<https://github.com/Johnspeanut/cs6650Assignment2>

## 2. Description of Server Design

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### 2.1 Overview

The server uses Tomcat for executing http request and RabbitMQ for message container. As long as a post request is received, the server will validate the url path as first. If the path is valid, a message object will be constructed based on `LiftRide`. The server then pushes the message object to RabbitMQ queue, where the consumer will pull messages from it.

### 2.2 Server package

#### 2.2.1 `SkierServlet` class

This class extends `HttpServlet` and aims to process post requests from client side and push messages to RabbitMQ queue. Creating connections are heavy workloads. In my case, connections are created in `init()` method so that it does not bother to generate them when calling `doPost()` method. Also, the class includes `isUrlValid()`, `isValidSkierLiftUrl()` to validate the http request.

#### 2.2.2 `LiftRide`

This class is to encapsulate a lift ride record. It includes constructor, get methods, and set methods.

#### 2.2.3 `LiftRideRequest`

This class is to encapsulate a lift ride request record. It includes constructor, get methods, and set methods.

### 2.3 Consumer package

It only includes `Main` class. The message information is saved in a `ConcurrentHashMap`.

### 2.4 Client package

This package incorporates `Counter`, `LiftRideRequest`, `Main`, `Phase`, and `UpicHttpClient` classes. The package aims to send http request to Tomcat promptly.

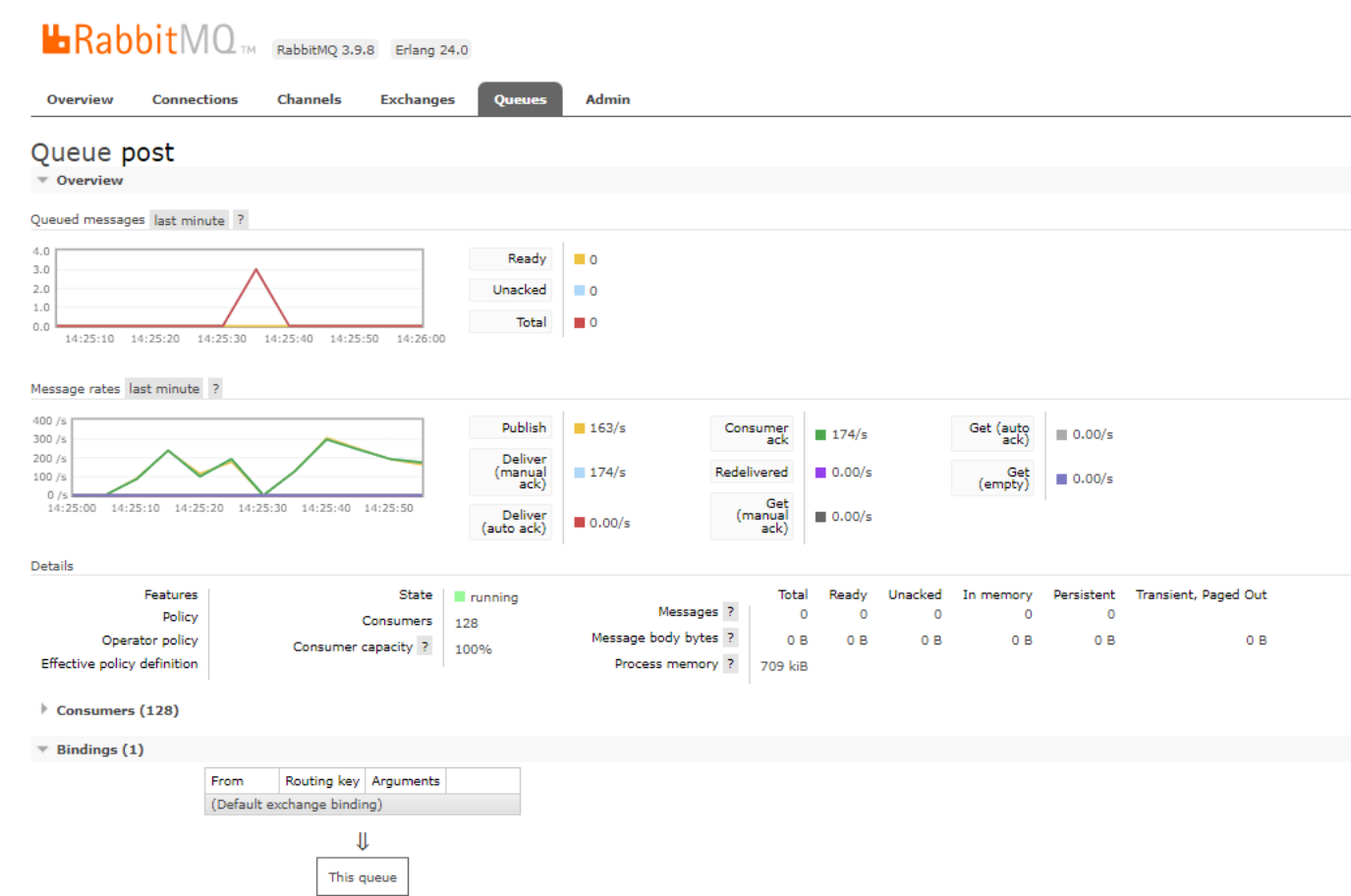
## 3. Test Runs

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### 3.1 64-Threads in client

- number of Tomcat servers: 1
- number of channels in each Tomcat server: 64
- number of threads in the consumer: 128

- basicQos for each channel in consumer: 10



The screenshot shows the RabbitMQ Queue post page for a queue named 'test'. The top navigation bar includes 'Overview', 'Connections', 'Channels', 'Exchanges', 'Queues', and 'Admin'. The 'Queue post' title is followed by a dropdown menu set to 'Overview'.

**Queued messages last minute**

A line graph shows the number of queued messages over time from 14:28:20 to 14:29:10. The y-axis ranges from 0.0 to 5.0. A red line shows a peak of 4 messages at 14:28:30.

**Message rates last minute**

A line graph shows message rates over time from 14:28:10 to 14:29:00. The y-axis ranges from 0/s to 600/s. A green line shows a peak rate of approximately 450/s at 14:28:30.

**Details**

Features	State	Messages	Total	Ready	Unacked	In memory	Persistent	Transient, Paged Out
Policy	running	128	0	0	0	0	0	
Operator policy	Consumers	128	0 B	0 B	0 B	0 B	0 B	0 B
Effective policy definition	Consumer capacity	100%	708 kiB					

**Consumers (128)**

**Bindings (1)**

A diagram shows a box labeled 'From' connected to a box labeled 'Routing key' and 'Arguments'. Below this is a box labeled '(Default exchange binding)'. An arrow points down to a box labeled 'This queue'.

The screenshot shows the RabbitMQ 3.9.8 web interface. The top navigation bar includes 'Overview', 'Connections', 'Channels', 'Exchanges', 'Queues' (selected), and 'Admin'. The main heading is 'Queue post'. Below it, the 'Overview' tab is active.

**Queued messages last minute**

A line graph shows the number of queued messages over the last minute. The y-axis ranges from 0.0 to 1.5. The x-axis shows time from 14:29:20 to 14:30:10. The graph shows a fluctuating red line, indicating message activity.

**Message rates last minute**

A line graph shows the message rates over the last minute. The y-axis ranges from 0/s to 400/s. The x-axis shows time from 14:29:10 to 14:30:00. The graph shows a green line that starts around 350/s, fluctuates, and then drops sharply to near 0/s by 14:30:00.

**Queue Status**

- Ready: 0
- Unacked: 0
- Total: 0

**Message Rates**

- Publish: 4.4/s
- Deliver (manual ack): 4.4/s
- Deliver (auto ack): 0.00/s
- Consumer ack: 4.4/s
- Redelivered: 0.00/s
- Get (manual ack): 0.00/s
- Get (auto ack): 0.00/s
- Get (empty): 0.00/s

**Details**

Features	State	Messages	Total	Ready	Unacked	In memory	Persistent	Transient, Paged Out
Policy	running	0	0	0	0	0	0	0 B
Operator policy	Consumers	128	0 B	0 B	0 B	0 B	0 B	0 B
Effective policy definition	Consumer capacity	100%	451 kiB					

**Consumers (128)**

**Bindings (1)**

From: Routing key Arguments  
(Default exchange binding)


↓

This queue

```
response:Success: /4/seasons/2021/days/100/skiers/89426723 LiftRide@69c21147
response:Success: /6/seasons/2021/days/100/skiers/89437250 LiftRide@1d315cb5
response:Success: /9/seasons/2021/days/100/skiers/89439987 LiftRide@18f83558
response:Success: /8/seasons/2021/days/100/skiers/89444011 LiftRide@30532ff1
response:Success: /1/seasons/2021/days/100/skiers/89451124 LiftRide@71a63da3
response:Success: /5/seasons/2021/days/100/skiers/89456763 LiftRide@11162dbe
response:Success: /8/seasons/2021/days/100/skiers/89463103 LiftRide@47ef124c
response:Success: /6/seasons/2021/days/100/skiers/89473786 LiftRide@2f2d7d7f
response:Success: /2/seasons/2021/days/100/skiers/89481050 LiftRide@7b39ff94
response:Success: /0/seasons/2021/days/100/skiers/89482605 LiftRide@2b57978e
response:Success: /2/seasons/2021/days/100/skiers/89491991 LiftRide@1b0615d3
response:Success: /9/seasons/2021/days/100/skiers/89493876 LiftRide@ee60c29
Number requests: 99126
Number of success: 99126
Number of failure: 0
Throughput in requests per second: Mean response time (milliseconds): 3
Wall time (second): 368
```

3.2 128-Threads in client

- number of Tomcat servers: 1
- number of channels in each Tomcat server: 64
- number of threads in the consumer: 128
- basicQos for each channel in consumer: 10




RabbitMQ 3.9.8 Erlang 24.0

OverviewConnectionsChannelsExchangesQueuesAdmin

Queue post

Overview

Queued messages last minute ?

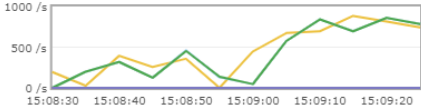


Ready0

Unacked0

Total0

Message rates last minute ?



Publish742/s

Deliver (manual ack)784/s

Deliver (auto ack)0.00/s

Consumer ack784/s

Redelivered0.00/s

Get (manual ack)0.00/s

Get (auto ack)0.00/s

Get (empty)0.00/s

Details

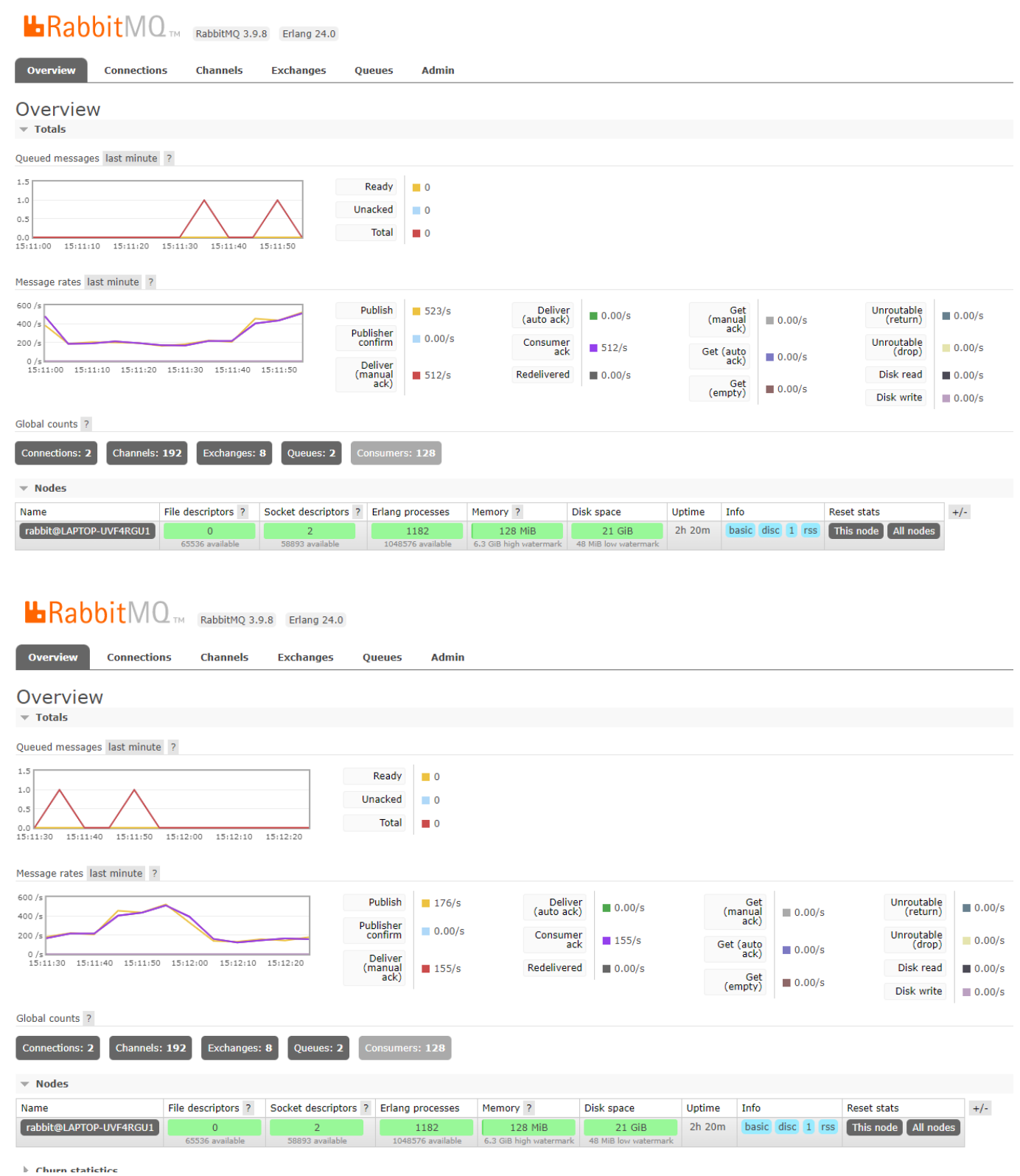
Features	State	running	Messages ?	Total	Ready	Unacked	In memory	Persistent	Transient, Paged Out
Policy	Consumers	128	Message body bytes ?	0	0	0	0	0	0
Operator policy	Consumer capacity ?	100%	Process memory ?	0 B	0 B	0 B	0 B	0 B	0 B
Effective policy definition				451 kiB					

Consumers (128)

Bindings (1)

From	Routing key	Arguments
(Default exchange binding)		

4 / 9



RabbitMQ

RabbitMQ 3.9.8

Erlang 24.0

Overview

Connections

Channels

Exchanges

Queues

Admin

Overview

Totals

Queued messages

last minute

Ready

Unacked

Total

0

0

0

Message rates

last minute

Publish

Publisher confirm

Deliver (manual ack)

176/s

0.00/s

155/s

Deliver (auto ack)

Consumer ack

Redelivered

0.00/s

155/s

0.00/s

Get (manual ack)

Get (auto ack)

Get (empty)

0.00/s

0.00/s

0.00/s

Unroutable (return)

Unroutable (drop)

Disk read

Disk write

0.00/s

0.00/s

0.00/s

0.00/s

Global counts

Connections: 2

Channels: 192

Exchanges: 8

Queues: 2

Consumers: 128

Nodes

Name	File descriptors	Socket descriptors	Erlang processes	Memory	Disk space	Uptime	Info	Reset stats	+/-
rabbit@LAPTOP-UVF4RGU1	0 65536 available	2 58893 available	1182 1048576 available	128 MiB 6.3 GiB high watermark	21 GiB 48 MiB low watermark	2h 20m	basic disc 1 rss	This node All nodes	

Churn statistics



### 3.3 256-Threads in client

- number of Tomcat servers: 1
- number of channels in each Tomcat server: 64
- number of threads in the consumer: 128
- basicQos for each channel in consumer: 10

RabbitMQ

RabbitMQ 3.9.8

Erlang 24.0

Overview

Connections

Channels

Exchanges

Queues

Admin

Overview

Totals

Queued messages

last minute

?

Ready

0

Unacked

1

Total

1

1.5

1.0

0.5

0.0

15:16:00

15:16:10

15:16:20

15:16:30

15:16:40

15:16:50

Message rates

last minute

?

Publish

461/s

Publisher confirm

0.00/s

Deliver (manual ack)

461/s

Deliver (auto ack)

0.00/s

Consumer ack

461/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

600 /s

400 /s

200 /s

0 /s

15:16:00

15:16:10

15:16:20

15:16:30

15:16:40

15:16:50

Global counts

?

Connections: 2

Channels: 192

Exchanges: 8

Queues: 2

Consumers: 128

Nodes

Name	File descriptors ?	Socket descriptors ?	Erlang processes	Memory ?	Disk space	Uptime	Info	Reset stats	+/-
rabbit@LAPTOP-UVF4RGU1	0 65536 available	2 58893 available	1182 1048576 available	124 MiB 6.3 GiB high watermark	21 GiB 48 MiB low watermark	2h 25m	basic disc 1 rss	This node All nodes	

RabbitMQ

RabbitMQ 3.9.8

Erlang 24.0

Overview

Connections

Channels

Exchanges

Queues

Admin

Overview

Totals

Queued messages

last minute

?

Ready

0

Unacked

3

Total

3

1.5

1.0

0.5

0.0

15:17:00

15:17:10

15:17:20

15:17:30

15:17:40

15:17:50

Message rates

last minute

?

Publish

687/s

Publisher confirm

0.00/s

Deliver (manual ack)

697/s

Deliver (auto ack)

0.00/s

Consumer ack

697/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

1000 /s

750 /s

500 /s

250 /s

0 /s

15:17:00

15:17:10

15:17:20

15:17:30

15:17:40

15:17:50

Global counts

?

Connections: 2

Channels: 192

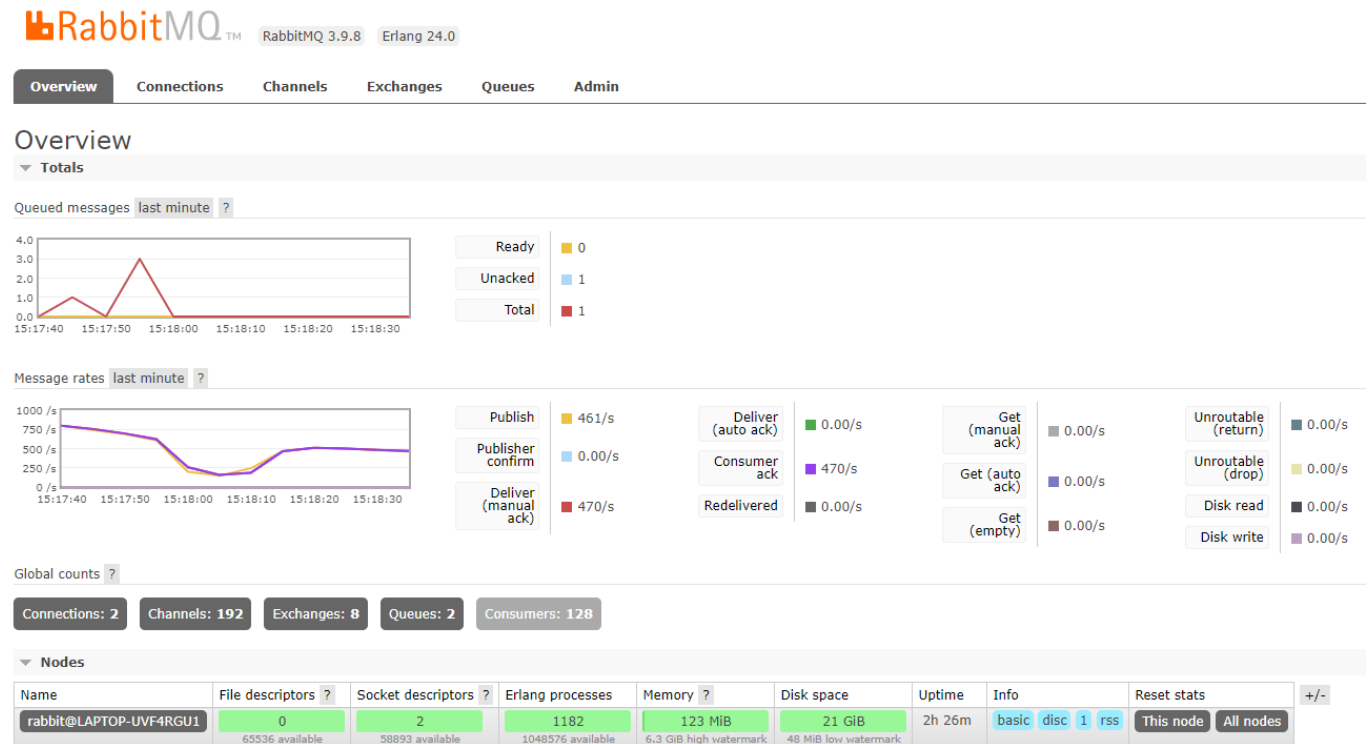
Exchanges: 8

Queues: 2

Consumers: 128

Nodes

Name	File descriptors ?	Socket descriptors ?	Erlang processes	Memory ?	Disk space	Uptime	Info	Reset stats	+/-
rabbit@LAPTOP-UVF4RGU1	0 65536 available	2 58893 available	1182 1048576 available	130 MiB 6.3 GiB high watermark	21 GiB 48 MiB low watermark	2h 26m	basic disc 1 rss	This node All nodes	



```

response:Success: /0/seasons/2021/days/100/skiers/22350339 LiftRide@59c82d9a
response:Success: /2/seasons/2021/days/100/skiers/22350693 LiftRide@65e7608c
response:Success: /0/seasons/2021/days/100/skiers/22352818 LiftRide@285e806e
response:Success: /9/seasons/2021/days/100/skiers/22354041 LiftRide@7d89940f
response:Success: /1/seasons/2021/days/100/skiers/22355727 LiftRide@1ded8398
response:Success: /9/seasons/2021/days/100/skiers/22358003 LiftRide@1e9187a4
response:Success: /8/seasons/2021/days/100/skiers/22359148 LiftRide@3c3705f5
response:Success: /7/seasons/2021/days/100/skiers/22361211 LiftRide@316d4434
response:Success: /5/seasons/2021/days/100/skiers/22361778 LiftRide@69718b57
response:Success: /5/seasons/2021/days/100/skiers/22363438 LiftRide@744da7ac
response:Success: /0/seasons/2021/days/100/skiers/22365096 LiftRide@578a7eb8
response:Success: /2/seasons/2021/days/100/skiers/22366784 LiftRide@3dfbba79
Number requests: 96939
Number of success: 96939
Number of failure: 0
Throughput in requests per second: Mean response time (milliseconds): 3
Wall time (second): 348

```

## 4. Bonus Points

### 4.1 512-threads in client test run

- number of Tomcat servers: 1
- number of channels in each Tomcat server: 64
- number of threads in the consumer: 256
- basicQos for each channel in consumer: 10

RabbitMQ

RabbitMQ 3.9.8

Erlang 24.0

Overview

Connections

Channels

Exchanges

Queues

Admin

Overview

Totals

Queued messages

last minute

?

1.0

0.0

15:24:50

15:25:00

15:25:10

15:25:20

15:25:30

15:25:40

Ready

0

Unacked

0

Total

0

Message rates

last minute

?

150 /s

0 /s

15:24:50

15:25:00

15:25:10

15:25:20

15:25:30

15:25:40

Publish

0.00/s

Publisher confirm

0.00/s

Deliver (manual ack)

0.00/s

Deliver (auto ack)

0.00/s

Consumer ack

0.00/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: 192

Exchanges: 8

Queues: 2

Consumers: 128

Nodes

Name	File descriptors ?	Socket descriptors ?	Erlang processes	Memory ?	Disk space	Uptime	Info	Reset stats	+/-
rabbit@LAPTOP-UVF4RGU1	0 65536 available	2 58893 available	1182 1048576 available	120 MiB 6.3 GiB high watermark	21 GiB 48 MiB low watermark	2h 33m	basic disc 1 rss	This node All nodes	

RabbitMQ

RabbitMQ 3.9.8

Erlang 24.0

Overview

Connections

Channels

Exchanges

Queues

Admin

Overview

Totals

Queued messages

last minute

?

1.5

0.0

15:25:40

15:25:50

15:26:00

15:26:10

15:26:20

15:26:30

Ready

0

Unacked

1

Total

1

Message rates

last minute

?

1.5 k/s

0.0 k/s

15:25:40

15:25:50

15:26:00

15:26:10

15:26:20

15:26:30

Publish

790/s

Publisher confirm

0.00/s

Deliver (manual ack)

791/s

Deliver (auto ack)

0.00/s

Consumer ack

791/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: 192

Exchanges: 8

Queues: 2

Consumers: 128

Nodes

Name	File descriptors ?	Socket descriptors ?	Erlang processes	Memory ?	Disk space	Uptime	Info	Reset stats	+/-
rabbit@LAPTOP-UVF4RGU1	0 65536 available	2 58893 available	1182 1048576 available	128 MiB 6.3 GiB high watermark	21 GiB 48 MiB low watermark	2h 34m	basic disc 1 rss	This node All nodes	



RabbitMQ

RabbitMQ 3.9.8

Erlang 24.0

Overview

Connections

Channels

Exchanges

Queues

Admin

Overview

Totals

Queued messages

last minute

?

Ready

0

Unacked

0

Total

0

15:26:50

15:27:00

15:27:10

15:27:20

15:27:30

15:27:40

Message rates

last minute

?

Publish

354/s

Publisher confirm

0.00/s

Deliver (manual ack)

354/s

15:26:50

15:27:00

15:27:10

15:27:20

15:27:30

15:27:40

Deliver (auto ack)

0.00/s

Consumer ack

354/s

Redelivered

0.00/s

15:26:50

15:27:00

15:27:10

15:27:20

15:27:30

15:27:40

Get (manual ack)

0.00/s

Get (auto ack)

0.00/s

Get (empty)

0.00/s

15:26:50

15:27:00

15:27:10

15:27:20

15:27:30

15:27:40

Unroutable (return)

0.00/s

Unroutable (drop)

0.00/s

Disk read

0.00/s

Disk write

0.00/s

15:26:50

15:27:00

15:27:10

15:27:20

15:27:30

15:27:40

Global counts

?

Connections: 2

Channels: 192

Exchanges: 8

Queues: 2

Consumers: 128

Nodes

Name	File descriptors ?	Socket descriptors ?	Erlang processes	Memory ?	Disk space	Uptime	Info	Reset stats	+/-
rabbit@LAPTOP-UVF4RGU1	0 65536 available	2 58893 available	1182 1048576 available	129 MiB 6.3 GiB high watermark	21 GiB 48 MiB low watermark	2h 35m	basic disc 1 rss	This node All nodes	

response:Success: /3/seasons/2021/days/100/skiers/22350007 LiftRide@271020c

response:Success: /8/seasons/2021/days/100/skiers/22351570 LiftRide@5db4f2ee

response:Success: /2/seasons/2021/days/100/skiers/22353268 LiftRide@4e440fa8

response:Success: /3/seasons/2021/days/100/skiers/22353920 LiftRide@7f7c7a98

response:Success: /9/seasons/2021/days/100/skiers/22356378 LiftRide@644e1f34

response:Success: /8/seasons/2021/days/100/skiers/22358285 LiftRide@2938e73a

response:Success: /8/seasons/2021/days/100/skiers/22358550 LiftRide@278d8b05

response:Success: /3/seasons/2021/days/100/skiers/22361320 LiftRide@18f6b154

response:Success: /6/seasons/2021/days/100/skiers/22361625 LiftRide@33c458b9

response:Success: /1/seasons/2021/days/100/skiers/22364070 LiftRide@3da51be1

response:Success: /3/seasons/2021/days/100/skiers/22365320 LiftRide@4946adc2

response:Success: /8/seasons/2021/days/100/skiers/22367080 LiftRide@4a8c92da

Number requests: 99576

Number of success: 99576

Number of failure: 0

Throughput in requests per second: Mean response time (milliseconds): 3

Wall time (second): 301