Ski Resort Client Documentation

Zhiwei Zhou - CS6650 Assignment 2

GitHub Repository: https://github.com/zz39/SkiResort-CS6650

Configuration

Server Setup Instructions

1. Deploy `Assignment2.war` to your Tomcat-enabled EC2 instance
2. Deploy `Consumer-1.0-SNAPSHOT.jar` to the same EC2 instance
3. Configure your EC2 security groups to allow traffic on:
    - Port 8080 (Tomcat)
    - Port 15672 (RabbitMQ management)
    - Port 5672 (RabbitMQ messaging)
4. Start the Tomcat server
5. Verify deployment by accessing `http://{server-public-ip}:8080/Assignment2/`
6. Test API endpoints to ensure proper functionality

System Architecture

Server Implementation (Servlet)

Servlet Package

- `HttpServlet`: Extended by the `SkierServlet` class to handle HTTP requests and responses (Java Servlet API)

RabbitMQ Client Package

- `ConnectionFactory`: Creates connections to the RabbitMQ server
- `Connection`: Represents an active connection to RabbitMQ
- `Channel`: Represents a communication channel within a connection
- `Queue`: Represents a message queue in RabbitMQ

Processing Flow

Channel Pool Management

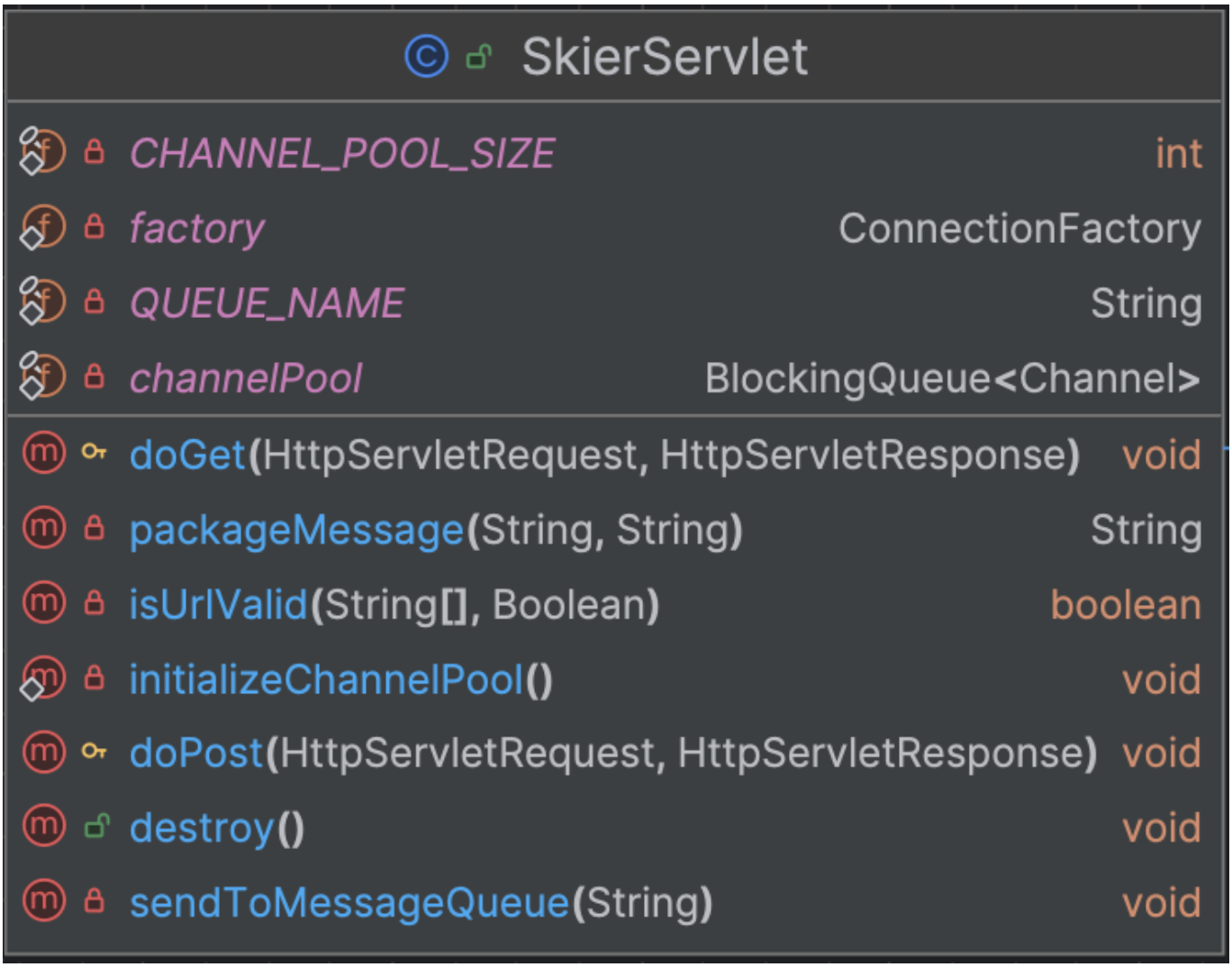
- Static initialization block (`static { initializeChannelPool(); }`) creates a fixed pool of channels
- Channels are stored in the `channelPool` queue for efficient reuse

HTTP Request Processing

- The servlet overrides `doGet` and `doPost` methods
- URL path validation occurs in both methods
- Invalid URLs return a 404 (Not Found) status code

Message Handling

- In `doPost`, valid requests have their body read and packaged into JSON
- The skier ID is included in the message
- `sendToMessageQueue` method handles transmission to RabbitMQ:
    1. Polls a channel from the pool
    2. Publishes the message to the queue
    3. Returns the channel to the pool



Consumer Implementation

Primary Classes

LiftRideConsumer

- Establishes RabbitMQ server connection
- Manages the channel pool
- Provides utilities for message data extraction

ConsumerThread

- Implements `Runnable` interface
- Each instance runs in a dedicated thread

- Responsible for consuming messages from the queue

Processing Flow

System Initialization

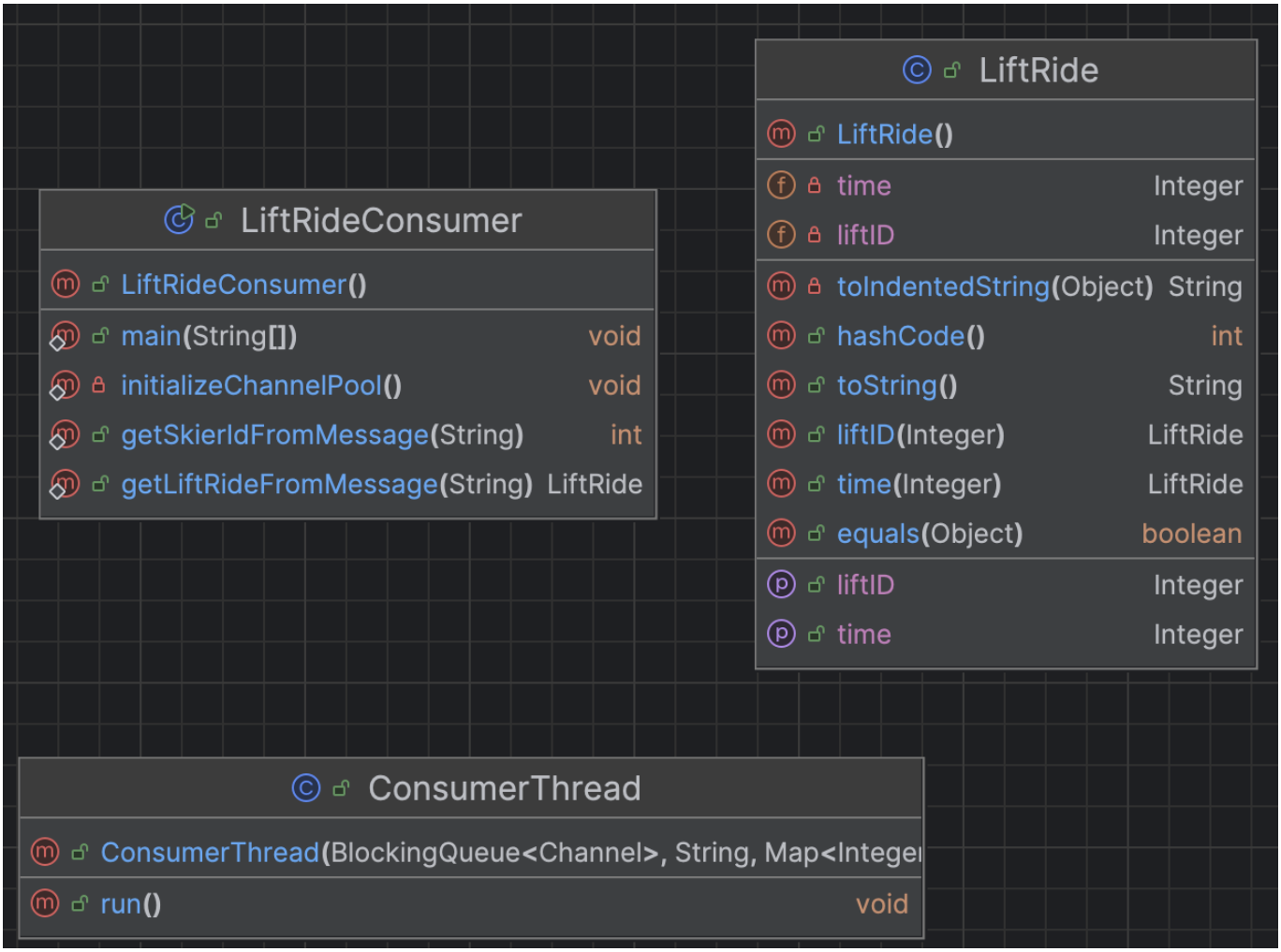
- `LiftRideConsumer` initializes the channel pool
- Launches `NUM_OF_THREAD` concurrent `ConsumerThread` instances
- Each thread consumes messages from the designated queue

Message Processing

- Each `ConsumerThread`:
    1. Polls a channel from the shared pool
    2. Consumes messages from the RabbitMQ queue
    3. Parses incoming messages to extract skier ID and LiftRide data
    4. Updates the `skierLiftRides` map with new lift ride information

Concurrency Handling

- Uses `ConcurrentHashMap` for thread-safe data updates
- Implements `BlockingQueue` for the channel pool to ensure thread-safe operations



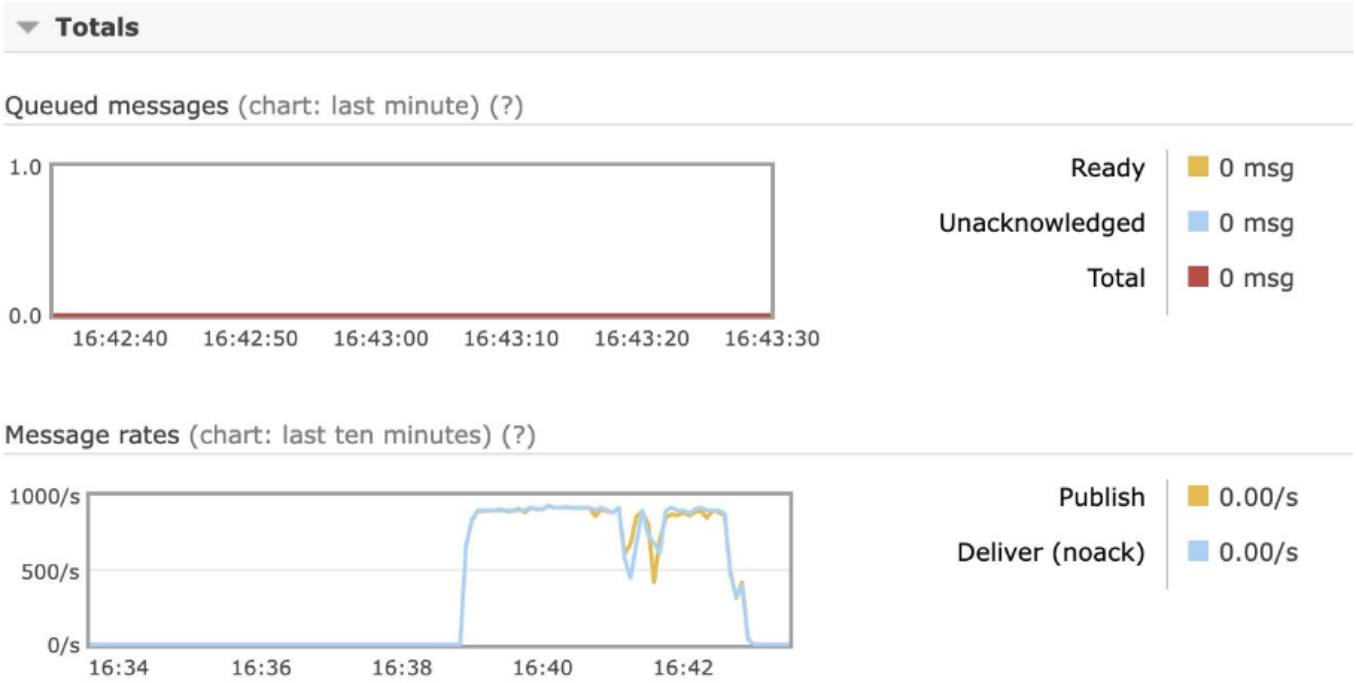
Message Flow:

Sending Messages: A client sends an HTTP POST request to the servlet with the skier data in the request body. The servlet packages the data into a JSON message and sends it to the RabbitMQ queue using one of the pooled channels.

Receiving Messages: the LiftRideConsumer class consumes messages from the SkierQueue using multiple ConsumerThread instances. Each thread extracts the skier ID and lift ride information from the JSON message and updates the skierLiftRides map with this data. The map is a ConcurrentHashMap to ensure thread-safe.

Result for single EC2 instance:

- Queue length: 0
- Throughput: 826 requests/second
- Number of producer channels: 120
- Number of consumer channels: 120

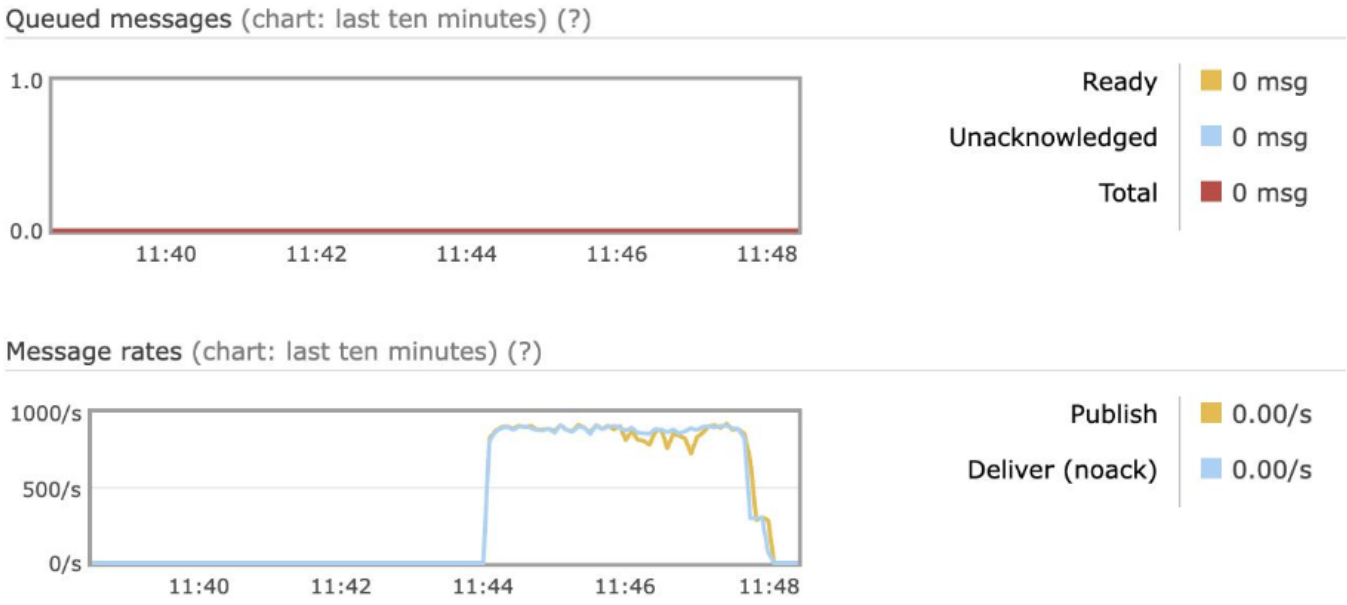



```
Successful requests: 200000
Failed requests: 0
Total time: 242026 ms
Throughput: 826.3574987811227 requests/second
```

Result for ELB EC2 instance:

- Queue length: 0
- Throughput: 826 requests/second
- Number of producer channels: 120
- Number of consumer channels: 120

- Number of Load Balancers on EC2: 3




```
Successful requests: 200000
Failed requests: 0
Total time: 224947 ms
Throughput: 889.0983209378209 requests/second
```