

IT314 Software Engineering

Non - Functional Testing
GROUP 29 - Market Connect
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Non-Functional Requirements (NFR) Testing Report Summary

1. Introduction and Objective

This document summarizes the results of the performance testing phase, which focused on validating critical Non-Functional Requirements (NFRs) related to system **Scalability, Stability, and Reliability** under various user load conditions.

The primary objective was to determine the system's capacity limits, identify potential bottlenecks, and confirm transaction integrity for core user flows, namely **Buyer Signup, Buyer Login, and Order Placement**.

2. Methodology and Tools

The testing was conducted as a **Load Test**, simulating concurrent virtual users executing key business processes against the application.

- **Test Tool: Apache JMeter** was used to script the user workflows, generate the required load, and record key metrics (Latency, Throughput, and Error Rate).

User Flow: The tests focused on the "Buyer" role, using the following payload structure for authentication requests:

```
{
  "name": "${name}",
  "email": "${email}",
  "password": "${password}",
  "confirmPassword": "${confirmPassword}",
  "mobNo": "${mobNo}",
  "role": "Buyer"
}
```

Configure the CSV Data Source

Filename: C:/Users/Dushy/OneDrive/Desktop/csv/user.csv Browse...

File encoding:

Variable Names (comma-delimited): name,email,password,confirmPassword,mobNo,role

Ignore first line (only used if Variable Names is not empty): True

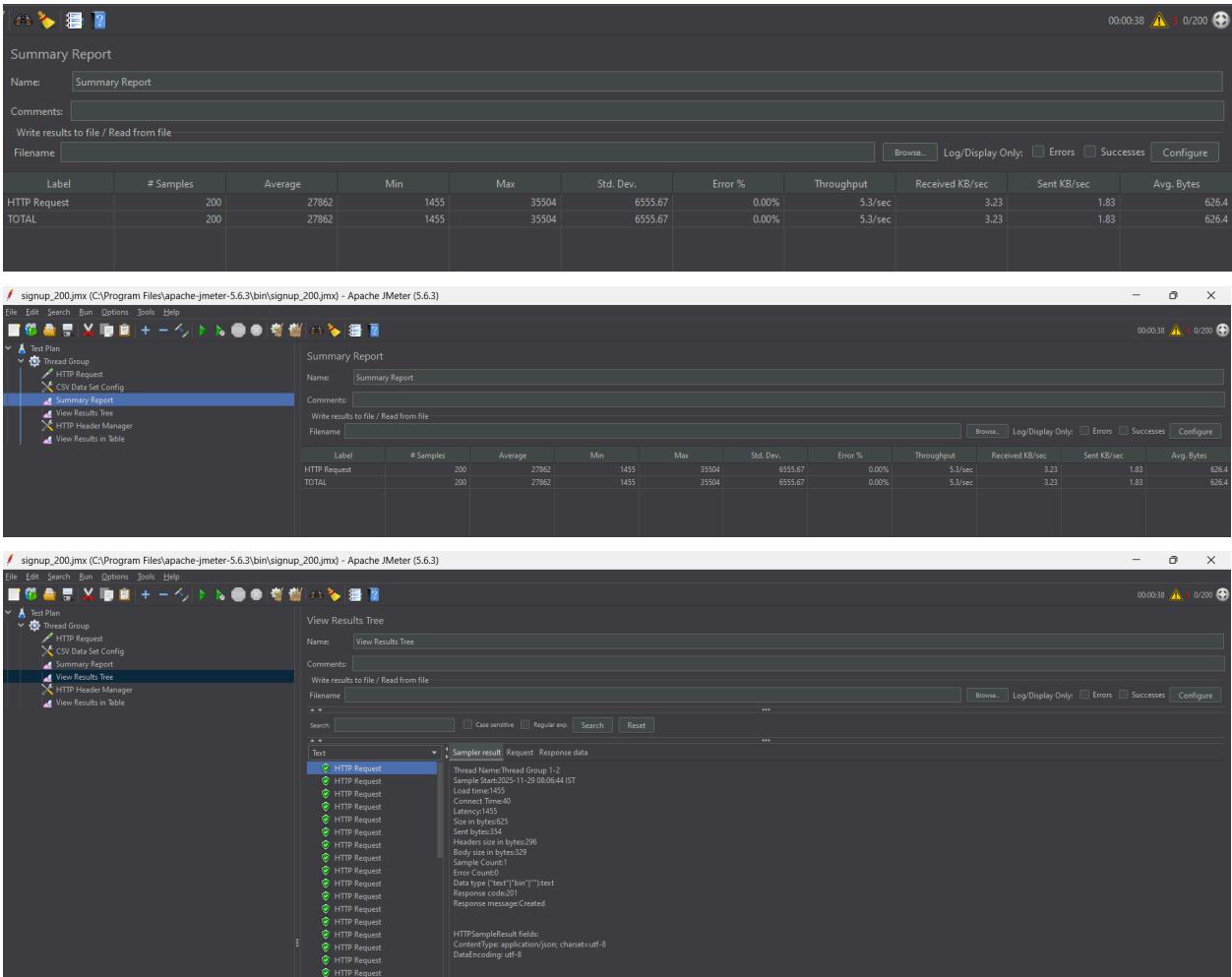
Delimiter (use '\t' for tab): ,

Allow quoted data?: False

Recycle on EOF?: True

Stop thread on EOF?: False

Sharing mode: All threads



Analysis: The system demonstrated excellent stability and reliability for both signup and login processes with a baseline load of 200 concurrent users, achieving a perfect 0% error rate. This confirms the system meets the basic concurrency NFR.

Scenario B: High Load Test and Bottleneck Identification (500 Logins)

The load was significantly increased to probe system limits.

User Flow	Virtual Users (Threads)	Error Rate	Status
Buyer Signup	500	Not specified (assumed low/0%)	PASS

Buyer Login 500 11% **FAIL**

Filename: <input type="text"/>											<input type="button" value="Browse..."/>	<input type="button" value="Log/Display Only..."/>	<input type="button" value="Errors"/>	<input type="button" value="Successes"/>	<input type="button" value="Configure"/>
Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes					
HTTP Request	500	62990	4052	82533	26702.65	11.00%	5.8/sec	4.04	1.80	859.4					
TOTAL	500	62990	4052	82533	26702.65	11.00%	5.8/sec	4.04	1.80	859.4					

Summary Report															
Name: Summary Report															
Comments:															
Write results to file / Read from file															
Filename: <input type="text"/>											<input type="button" value="Browse..."/>	<input type="button" value="Log/Display Only..."/>	<input type="button" value="Errors"/>	<input type="button" value="Successes"/>	<input type="button" value="Configure"/>
Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes					
HTTP Request	500	24281	362	80058	21057.10	36.20%	7.2/sec	10.39	1.31	1381					
TOTAL	500	24281	362	80058	21057.10	36.20%	7.2/sec	10.39	1.31	1381					

Error Detail:

- **11% of Login Transactions Failed.**
- The primary cause was attributed to a **Connection Issue**, specifically recorded as "445 added" (likely indicating 445 individual connection failures/timeouts within the 11% error group). This strongly suggests a system-level bottleneck, likely related to database connection pooling, network throughput limits, or insufficient resource allocation on the application server.

Initial Server Observation: A critical behavioral finding was observed during initial server startup/ramp-up:

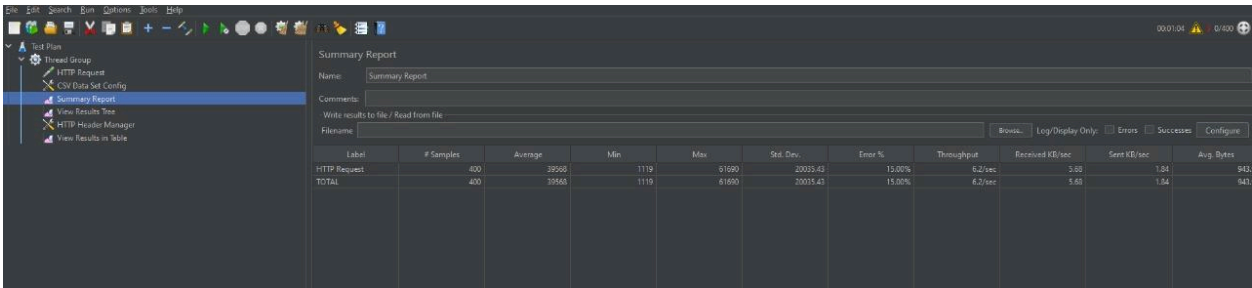
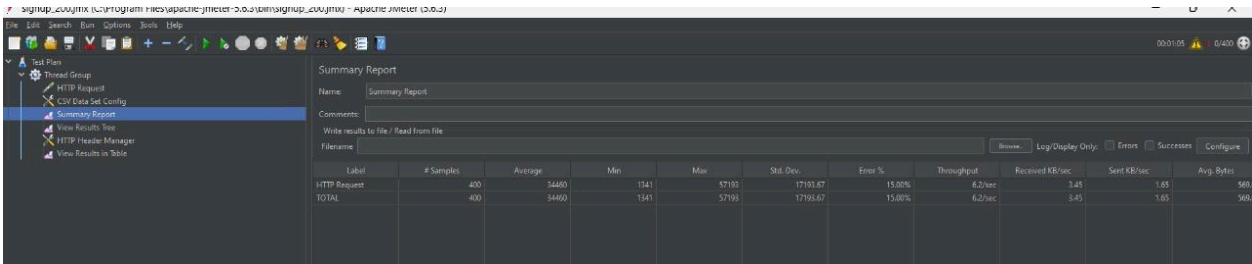
- **The server exhibited a high error rate immediately after starting, which then consistently decreased as the test progressed and the server ran for some time.**
- **Interpretation:** This is typical behavior for an application that requires a "warm-up" period, where resources are initialized, caches are populated, or connection pools are established. While the system stabilized, this points to a potential cold-start latency NFR violation.

Scenario C: Sustained Medium Load Confirmation (400 Users)

This scenario confirmed the presence of transaction errors at a slightly reduced load compared to Scenario B.

User Flow Virtual Users (Threads) Error Rate Status

Buyer Signup	400	15%	FAIL	Confirmed
Buyer Login	400	15%	FAIL	Confirmed



Analysis: With 400 concurrent users, the failure rate stabilized at **15% for both signup and login**. This confirms that the system’s capacity threshold is somewhere below 400 concurrent users, and the bottlenecks identified in Scenario B persist at this load level. The system does **not** meet the NFR for concurrent user stability above 200 users.

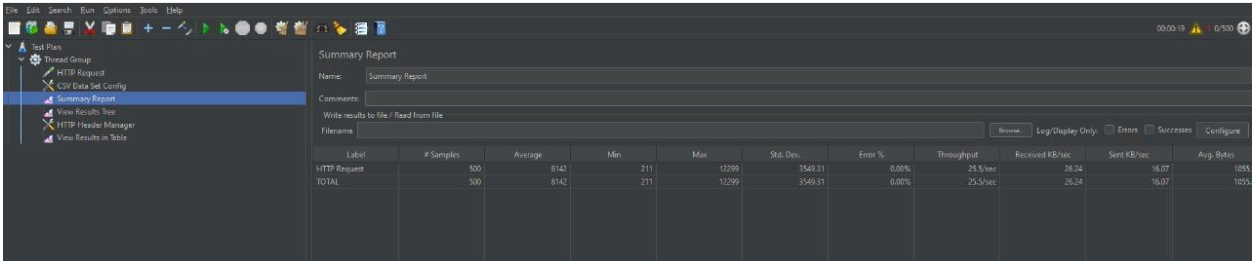
Scenario D: Core Business Functionality - Order Placement

This critical scenario tested the reliability of the order processing pipeline.

User Flow	Virtual Orders (Threads)	Error Rate	Status
Place Order	200	0%	PASS

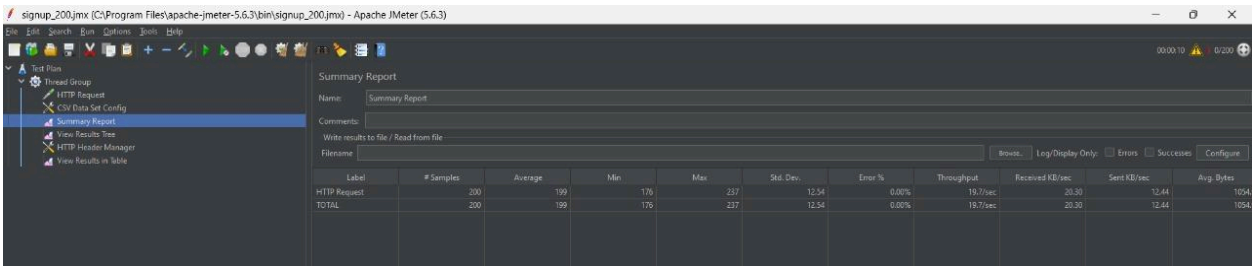
Place Order 400 0% **PASS**

Place Order 500 0% **PASS**



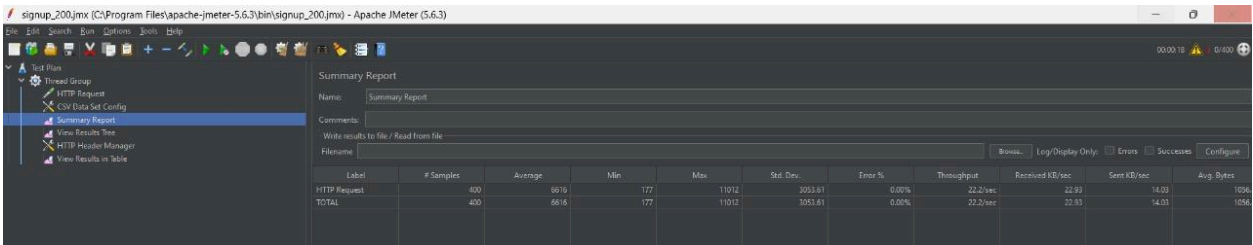
The screenshot shows the Apache JMeter Summary Report for a test plan named 'Summary Report'. The report displays performance metrics for 500 samples. The 'Label' column lists 'HTTP Request' and 'TOTAL'. The '# Samples' column shows 500 for both. The 'Average' column shows 8142 for 'HTTP Request' and 8142 for 'TOTAL'. The 'Min' column shows 211 for both. The 'Max' column shows 12299 for both. The 'Std. Dev.' column shows 1549.31 for both. The 'Error %' column shows 0.00% for both. The 'Throughput' column shows 25.5/sec for both. The 'Received KB/sec' column shows 26.24 for both. The 'Sent KB/sec' column shows 16.07 for both. The 'Avg. Bytes' column shows 1054 for both.

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
HTTP Request	500	8142	211	12299	1549.31	0.00%	25.5/sec	26.24	16.07	1054
TOTAL	500	8142	211	12299	1549.31	0.00%	25.5/sec	26.24	16.07	1054



The screenshot shows the Apache JMeter Summary Report for a test plan named 'Summary Report'. The report displays performance metrics for 200 samples. The 'Label' column lists 'HTTP Request' and 'TOTAL'. The '# Samples' column shows 200 for both. The 'Average' column shows 199 for 'HTTP Request' and 199 for 'TOTAL'. The 'Min' column shows 176 for both. The 'Max' column shows 237 for both. The 'Std. Dev.' column shows 12.54 for both. The 'Error %' column shows 0.00% for both. The 'Throughput' column shows 19.7/sec for both. The 'Received KB/sec' column shows 20.30 for both. The 'Sent KB/sec' column shows 12.44 for both. The 'Avg. Bytes' column shows 1054 for both.

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
HTTP Request	200	199	176	237	12.54	0.00%	19.7/sec	20.30	12.44	1054
TOTAL	200	199	176	237	12.54	0.00%	19.7/sec	20.30	12.44	1054



The screenshot shows the Apache JMeter Summary Report for a test plan named 'Summary Report'. The report displays performance metrics for 400 samples. The 'Label' column lists 'HTTP Request' and 'TOTAL'. The '# Samples' column shows 400 for both. The 'Average' column shows 9616 for 'HTTP Request' and 9616 for 'TOTAL'. The 'Min' column shows 177 for both. The 'Max' column shows 11012 for both. The 'Std. Dev.' column shows 1053.61 for both. The 'Error %' column shows 0.00% for both. The 'Throughput' column shows 22.2/sec for both. The 'Received KB/sec' column shows 22.93 for both. The 'Sent KB/sec' column shows 14.03 for both. The 'Avg. Bytes' column shows 1054 for both.

Label	# Samples	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB/sec	Sent KB/sec	Avg. Bytes
HTTP Request	400	9616	177	11012	1053.61	0.00%	22.2/sec	22.93	14.03	1054
TOTAL	400	9616	177	11012	1053.61	0.00%	22.2/sec	22.93	14.03	1054

Analysis: The order placement functionality demonstrated exceptional robustness. Even with up to 500 concurrent order placements, the error rate remained at **0%**. This suggests that while the authentication services (Signup/Login) are highly sensitive to load, the core transactional service for processing orders is well-optimized and capable of handling significantly higher concurrency.

4. Key Findings and Recommendations

Key Findings

1. **Capacity Limit Identified:** The system handles 200 concurrent users reliably (0% error) but fails catastrophically at 400 and 500 concurrent users (15% and 11% error rates, respectively) for authentication services.
2. **Authentication Bottleneck:** The primary failure mode for Signup/Login is related to **connection issues/timeouts**, indicating a resource bottleneck (DB connection pool exhaustion, thread limits, or network configuration).
3. **Order Service Reliability:** The core Order Placement service is highly reliable and scalable, maintaining 0% error up to 500 concurrent orders.
4. **System Warm-Up Required:** The initial high error rate at server startup indicates a necessary resource initialization or cache loading period, impacting the true Time to Service Readiness NFR.

Recommendations

Area	Recommendation	Rationale
Authentication Service	Immediate action is required to tune the database connection pool size and application server thread configurations.	Address the 11-15% persistent error rates caused by connection issues at medium-to-high loads.
System Reliability	Implement a Pre-warming Strategy (e.g., scheduled tasks to hit key endpoints) after deployment/startup.	Mitigate the high initial error rates observed during server start-up and ensure immediate service readiness.
Future Testing	Conduct stress testing to find the absolute breaking point and identify the maximum throughput limit of the Order Placement service.	Leverage the high reliability observed in the Order service (0% error @ 500 orders).