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**.

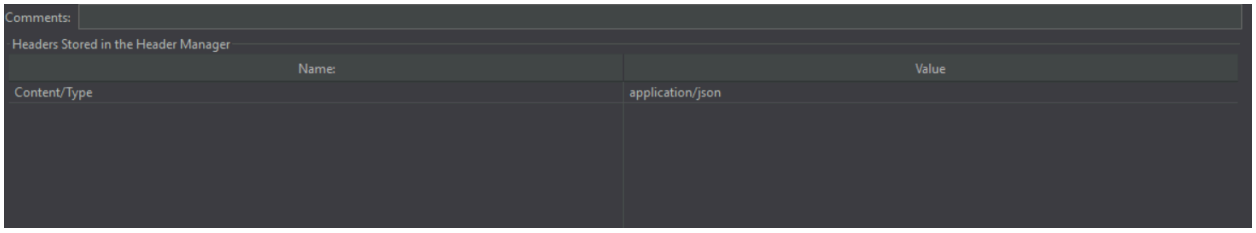
2. Methodology and Tools

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"
}
```



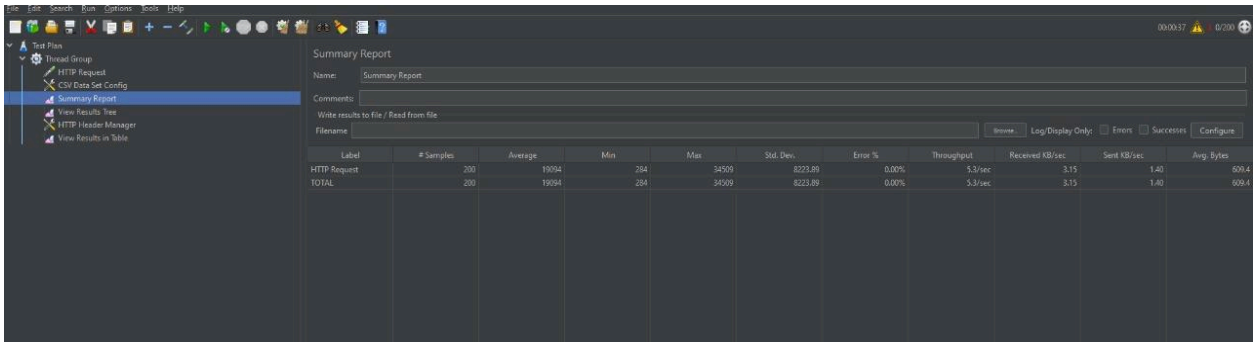
3. Test Scenarios and Detailed Results

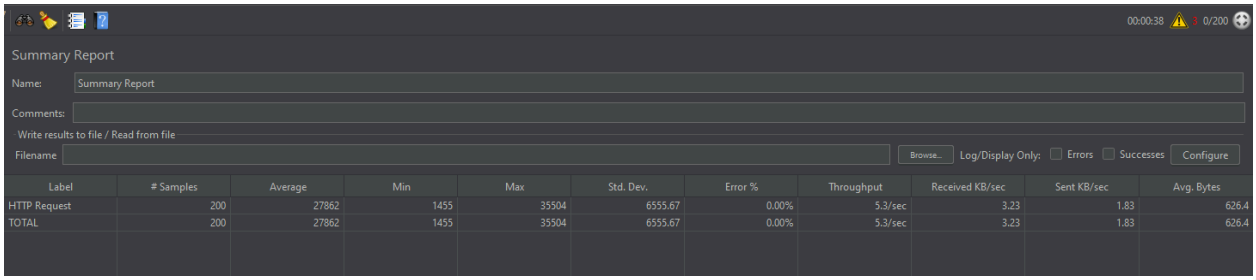
The performance tests were executed in phases, incrementally increasing the virtual user load to observe the system's behavior under stress.

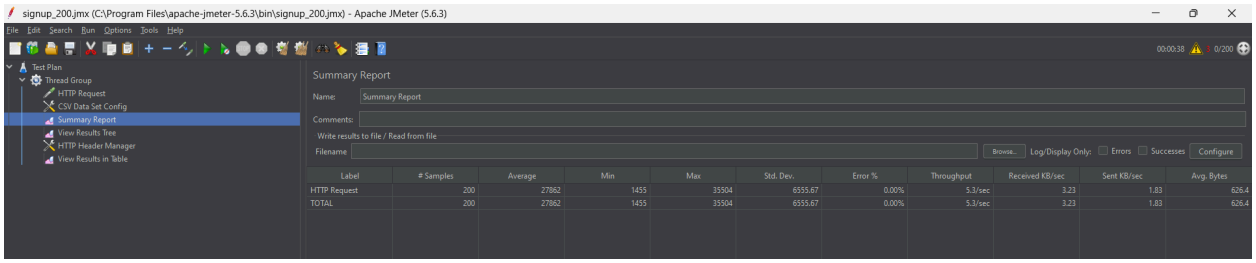
Scenario A: Baseline and Stability Check (200 Users)

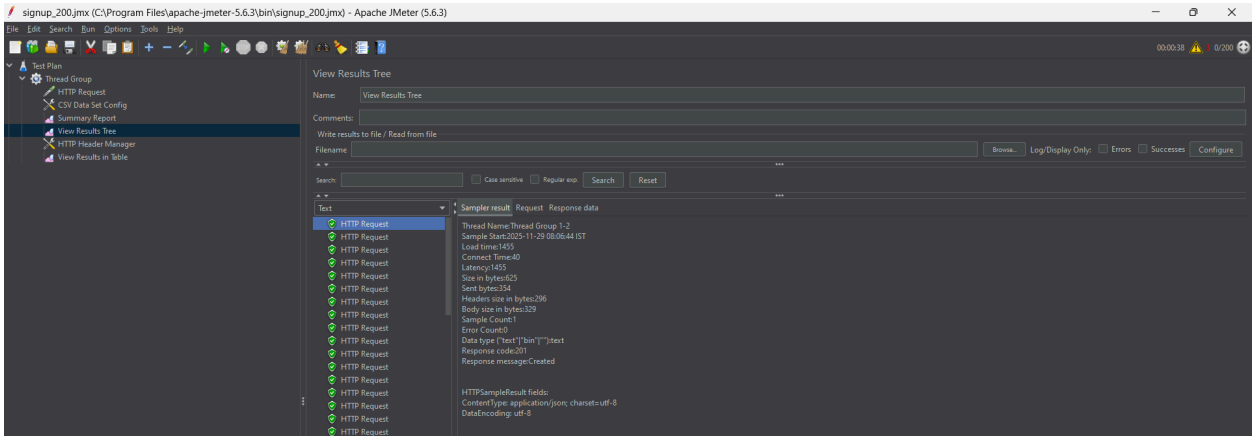
This scenario established a performance baseline under standard load.

User Flow	Virtual Users (Threads)	Error Rate	Status
Buyer Signup	200	0%	**PASS**
Buyer Login	200	0%	**PASS**









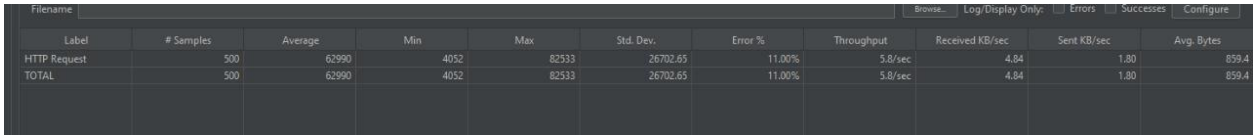
Analysis: The system demonstrated excellent stability and reliability for both signup and login processes with a baseline load of 200 concurrent users, achieving a perfect 0% error rate. This confirms the system meets the basic concurrency NFR.

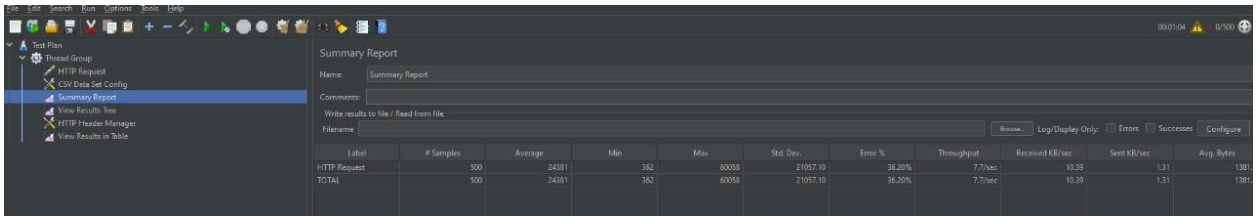
Scenario B: High Load Test and Bottleneck Identification (500 Logins)

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**





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:

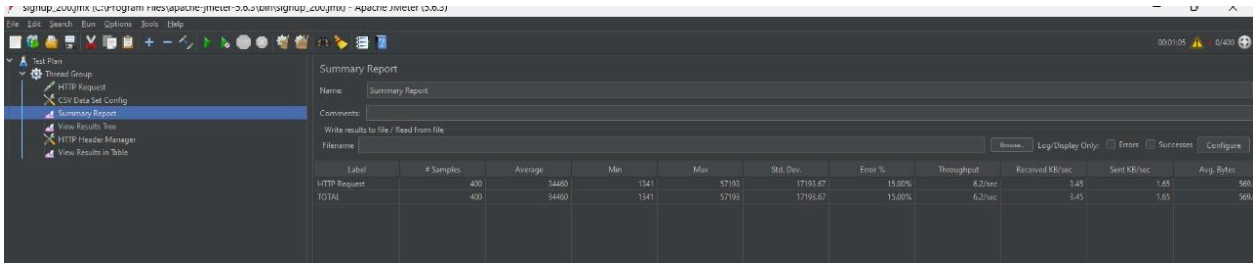
- **The server exhibited a high error rate immediately after starting, which then consistently decreased as the test progressed and the server ran for some time.**
- **Interpretation:** This is typical behavior for an application that requires a "warm-up" period, where resources are initialized, caches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

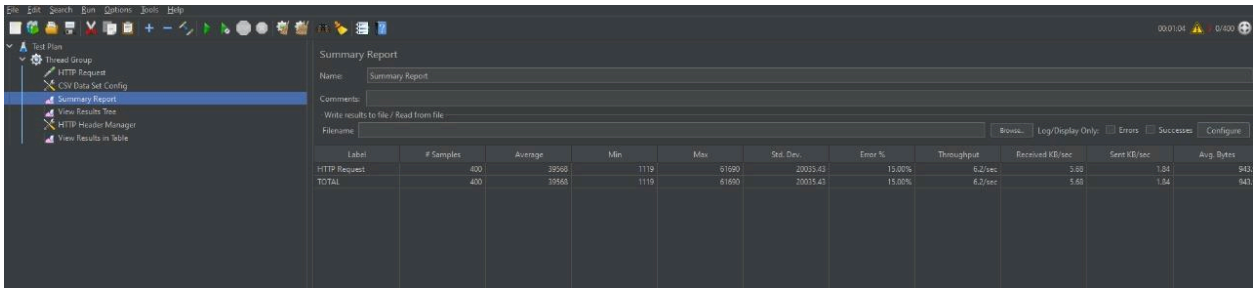
Scenario C: Sustained Medium Load Confirmation (400 Users)

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





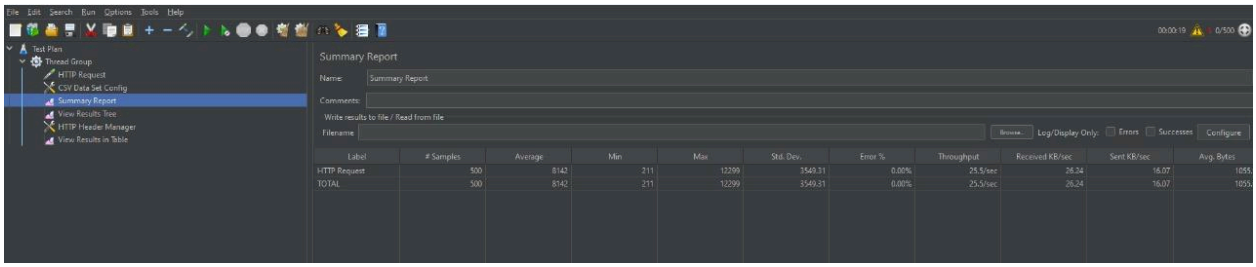
Analysis: With 400 concurrent users, the failure rate stabilized at **15% for both signup and login**. This confirms that the system's capacity threshold is somewhere below 400 concurrent users, and the bottlenecks identified in Scenario B persist at this load level. The system does **not** meet the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

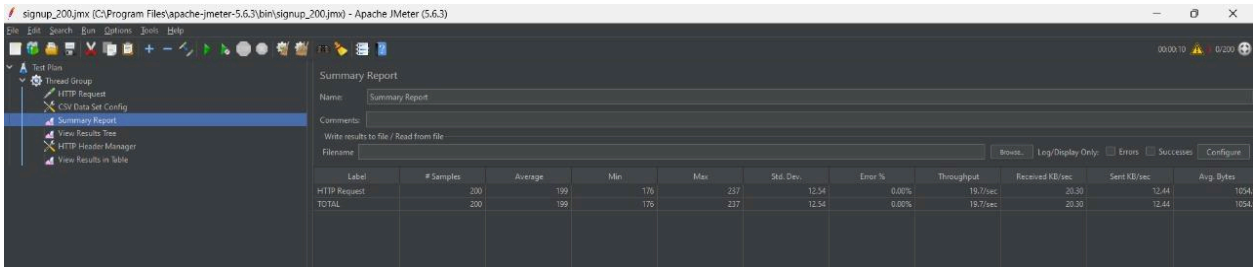
Scenario D: Core Business Functionality - Order Placement

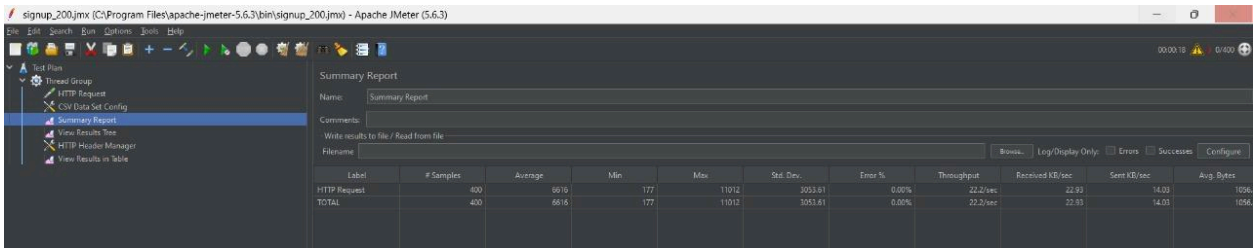
This critical scenario tested the reliability of the order processing pipeline.

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

Place Order	400	0%	**PASS**
Place Order	500	0%	**PASS**







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).