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**FACULTY OF COMPUTER AND MATHEMATICAL SCIENCES**

**BACHELOR OF COMPUTER SCIENCE (HONS) COMPUTER NETWORKS  
(CDCS255)  
NETWORK PROGRAMMING (ITT440)**

**INDIVIDUAL ASSIGNMENT**

**TITLE: COMPREHENSIVE WEB APPLICATION PERFORMANCE TESTING &  
ANALYSIS**

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## 1. INTRODUCTION

Performance testing is conducted to evaluate the stability, scalability, and responsiveness of a website or application under various load conditions. For this assignment, Apache JMeter is used to test the response performance of the web application *test.k6.io*. Three types of tests were executed: **Load Test**, **Stress Test**, and **Spike Test**, each to analyse how the server behaves under different levels of concurrent traffic.

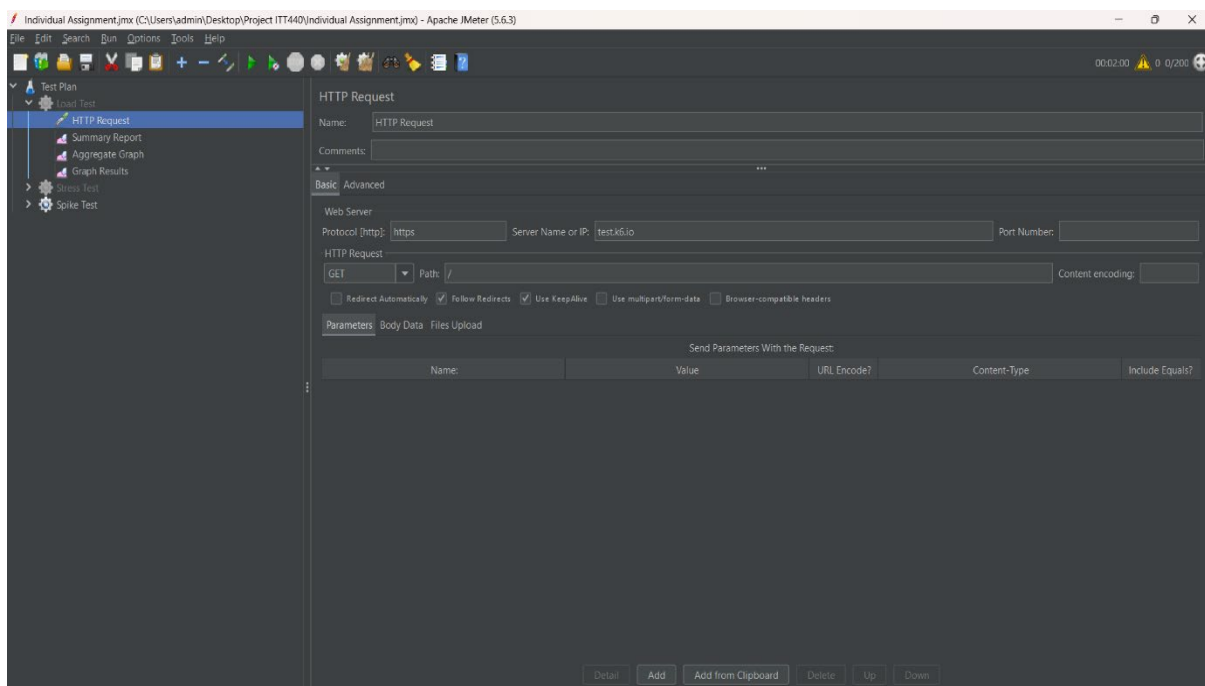
## 2. OBJECTIVES

The objective of this performance testing is:

- To evaluate the application performance under normal and increasing user load.
- To determine the breaking point or degradation point of the server.
- To observe application behaviour during sudden traffic spikes.
- To compare performance metrics obtained from Load, Stress, and Spike tests.

## 3. TOOLS & ENVIRONMENT SETUP

- Tool: Apache JMeter 5.6.3
- Protocol: HTTPS
- Server: test.k6.io
- Request Method: GET
- Test Duration: 2 minutes for each test
- Listeners Used: Summary Report, Aggregate Graph, Graph Result



❖ Figure 1: JMeter HTTP Request configuration

## 4. TEST SCENARIOS

Test Type	Users	Ramp-up	Duration	Purpose
Load Test	50 users	20s	120s	Observe normal traffic behaviour
Stress Test	200 users	10s	120s	Test system performance under heavy load
Spike Test	200 users	0s (instant)	120s	Measure reaction to sudden traffic surge

## 5. TEST EXECUTION & RESULTS

### ➤ Load Test Result (50 Users)

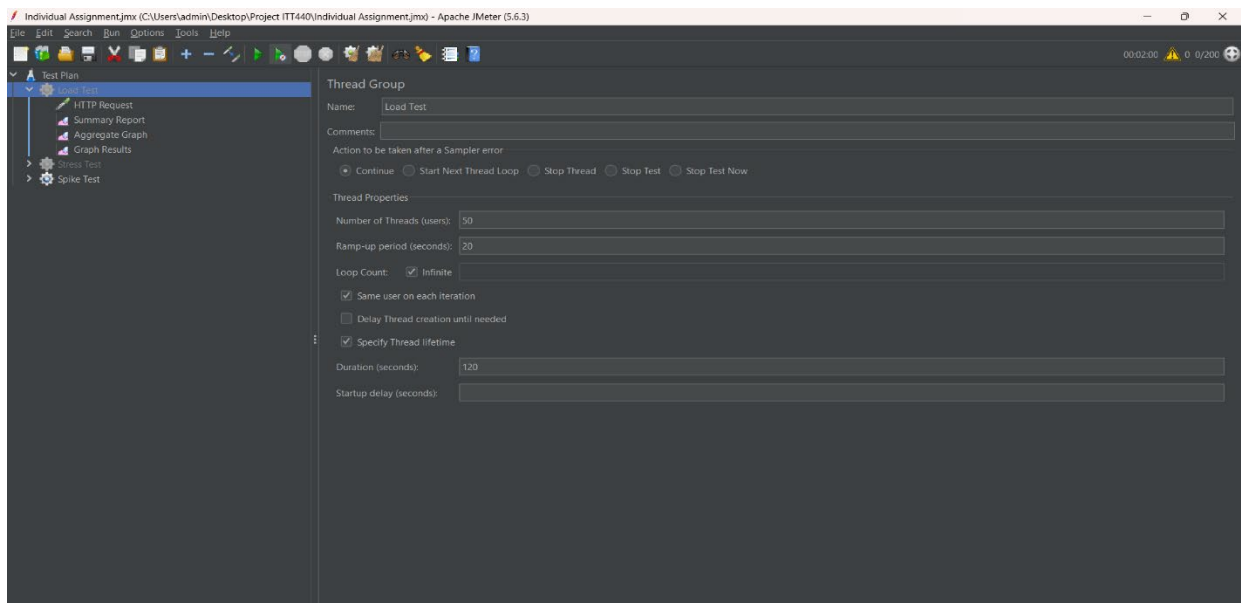
Purpose: To simulate normal expected traffic and observe stability.

Summary Output:

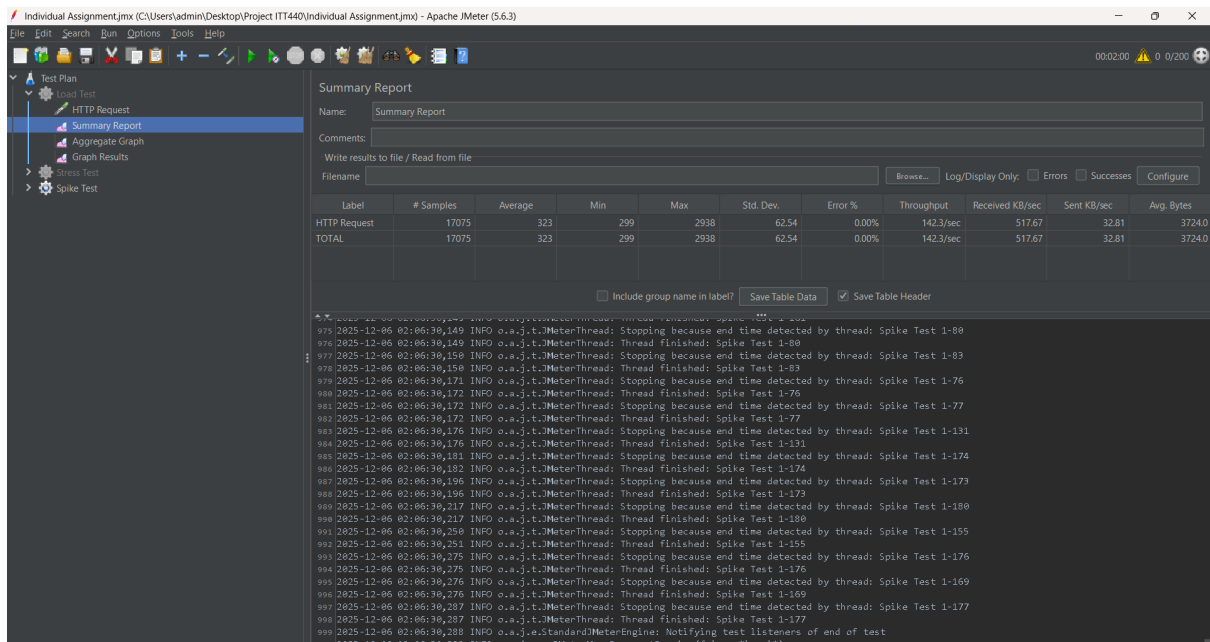
- Total samples: 17075
- Average Response Time: 323 ms
- Min: 299 ms
- Max: 2938 ms
- Throughput: 142 req/sec
- Error Rate: 0%

Interpretation:

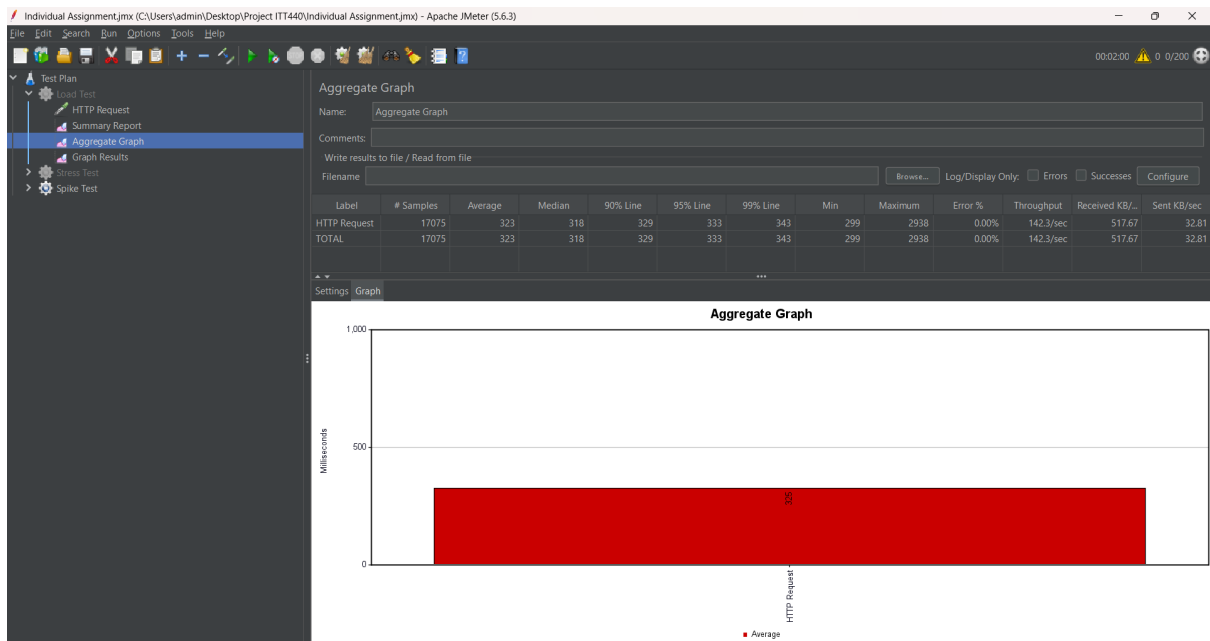
- ✓ Server handles normal user load smoothly.
- ✓ Response time consistent and stable.
- ✓ No failure detected.



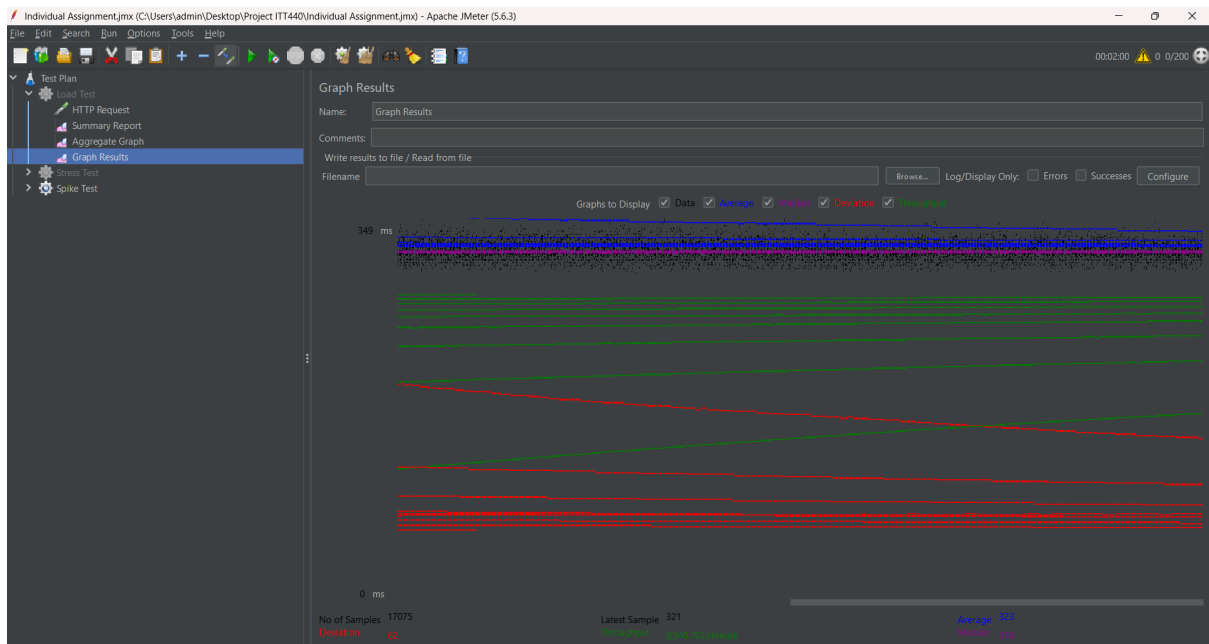
❖ Figure 2: Load Test Thread Group



❖ Figure 3: Summary Report



❖ Figure 4: Aggregate Graph



❖ *Figure 5: Graph Result*

### ➤ **Stress Test Result (200 Users)**

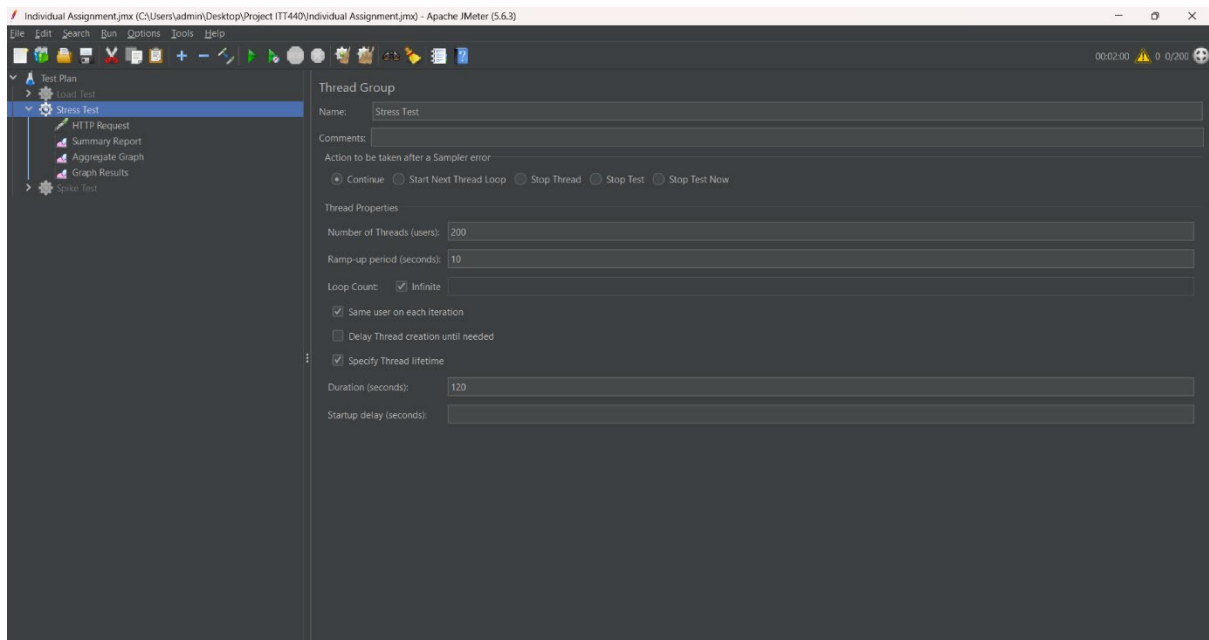
Purpose: To test performance at high load and find system tolerance limit.

Summary Output:

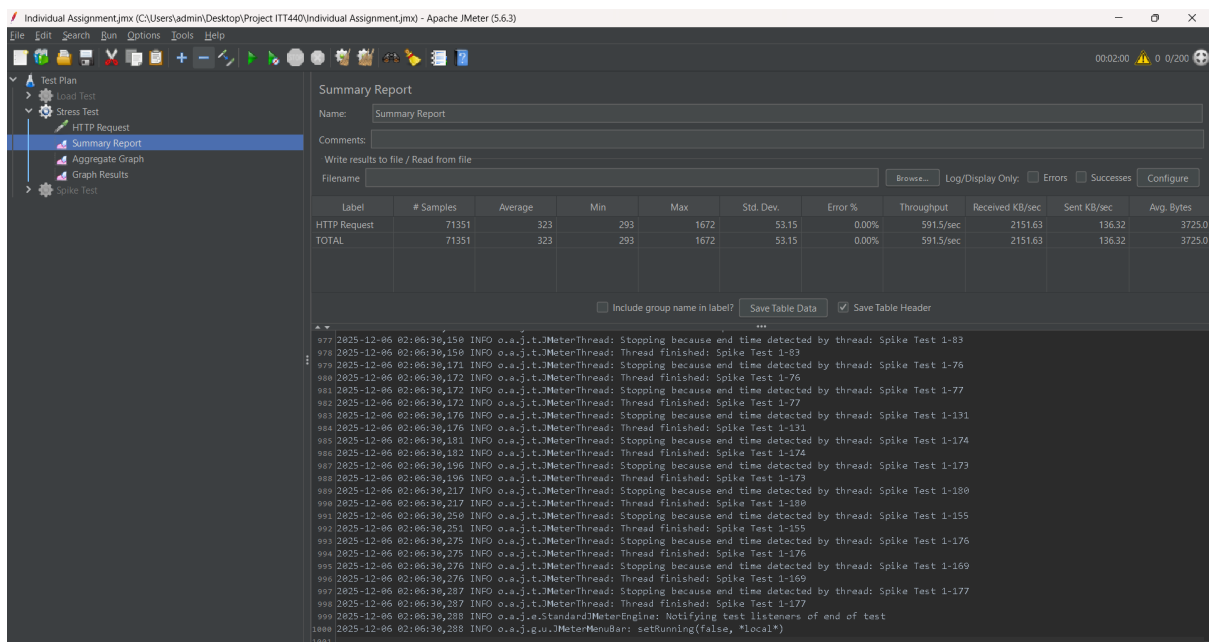
- Total Samples: 71,351
- Average Response Time: 323 ms
- Min: 293 ms
- Mas: 1672 ms
- Throughput: 591 req/sec
- Error Rate: 0%

Interpretation:

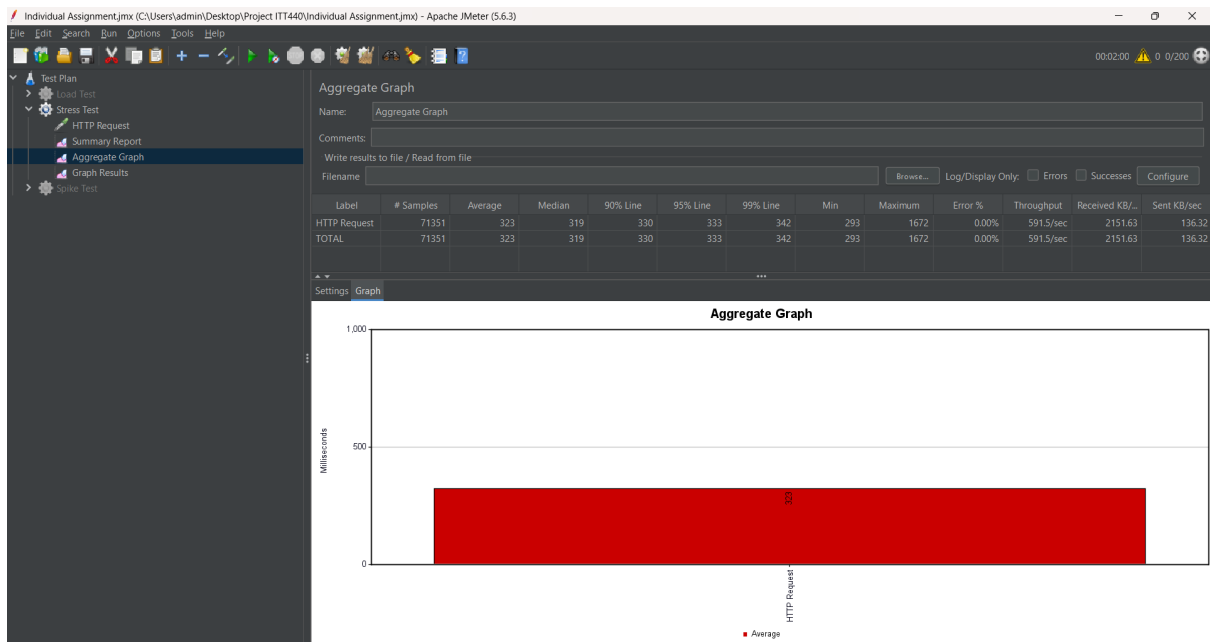
- ✓ Website still can handle 200 users.
- ✓ Response time slightly increased but acceptable.
- ✓ No major performance degradation.



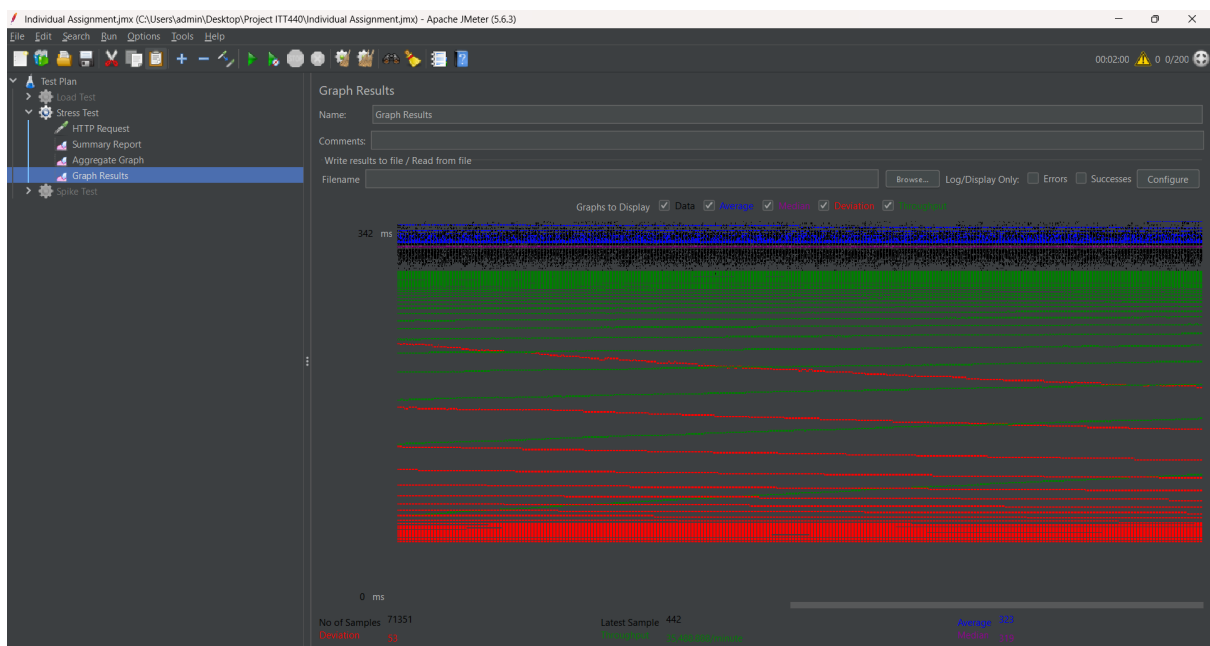
❖ Figure 6: Stress Test Thread Group



❖ Figure 7: Summary Report



❖ Figure 8: Aggregate Graph



❖ Figure 9: Graph Result



### ➤ Spike Test Result

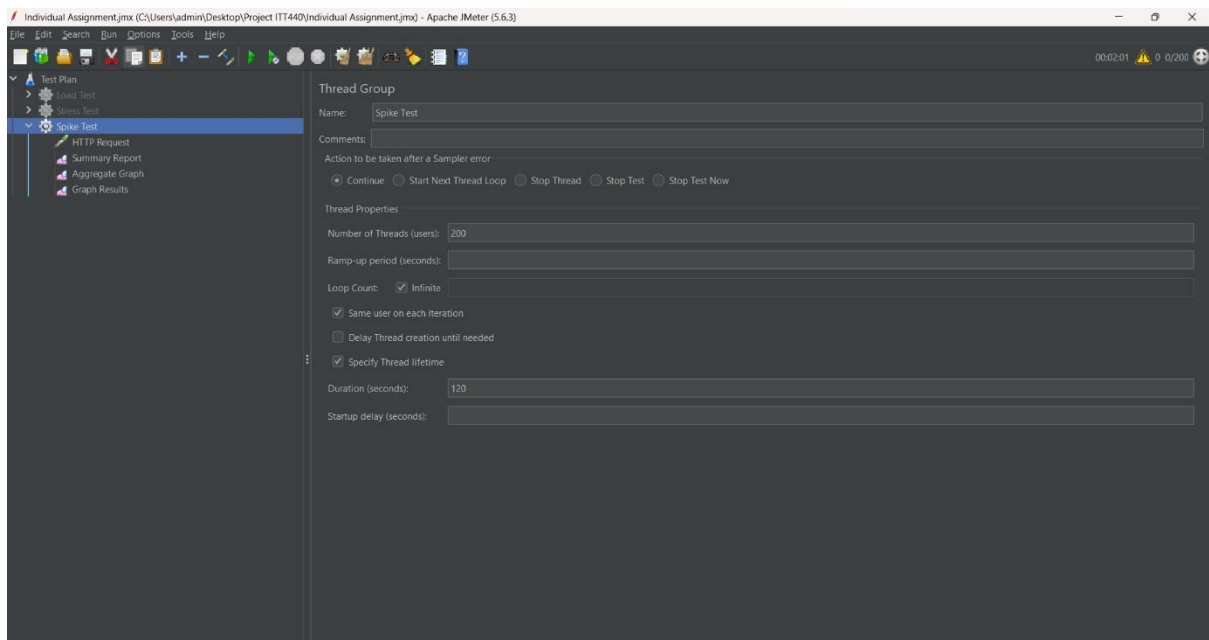
Purpose: To simulate sudden massive incoming user instantly.

Summary Output:

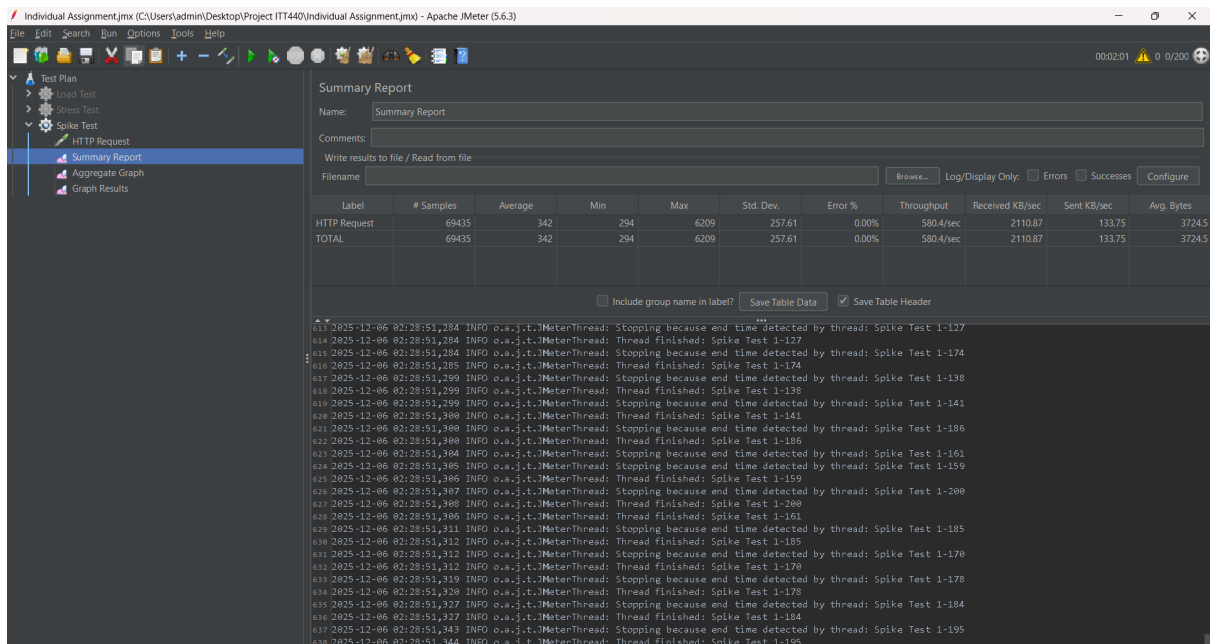
- Total Samples: 69,435
- Average Response Time: 342 ms
- Min: 294 ms
- Max 6209 ms
- Throughput: 580 req/sec
- Error Rate: 0%

Interpretation:

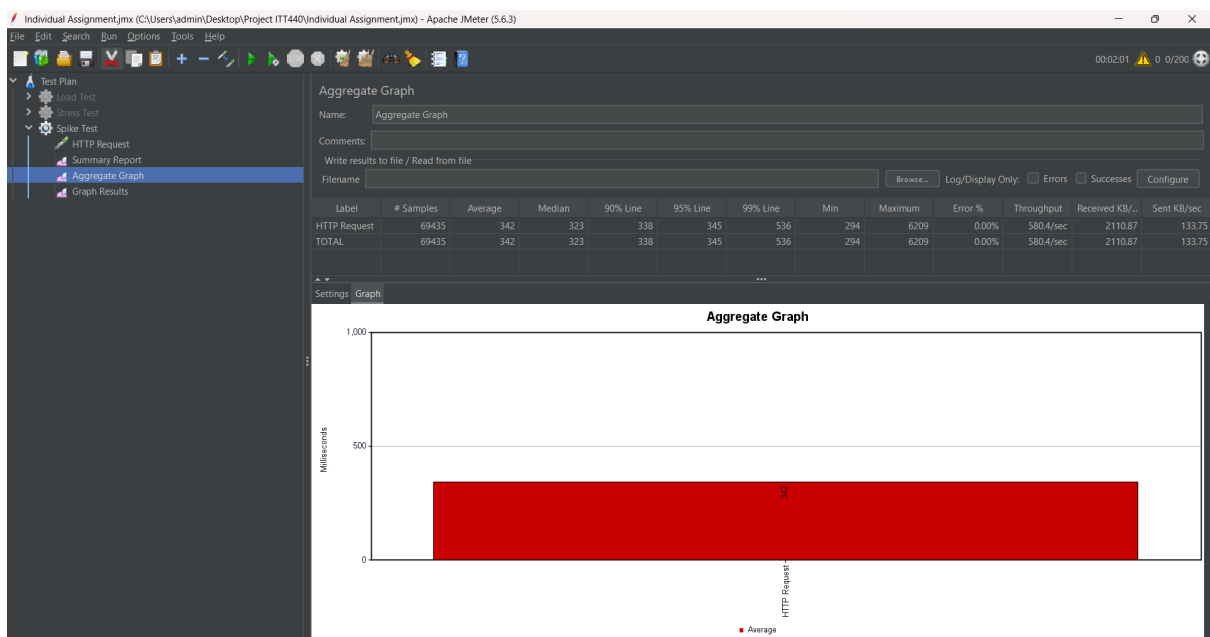
- ⚠ Sudden spike caused temporary latency.
- ✓ Server recovered & continued responding.
- ✓ Good resilience but slower at peak loads.



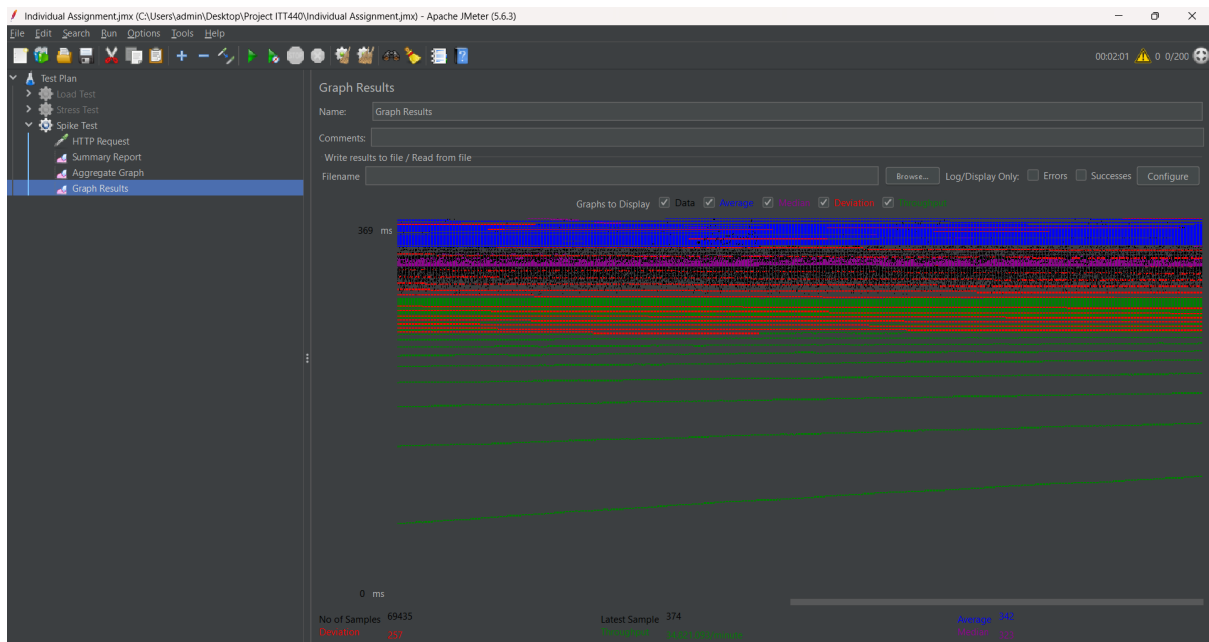
❖ Figure 10: Spike Test Thread Group



❖ Figure 11: Summary Report



❖ Figure 12: Aggregate Graph



❖ Figure 13: Graph Result

## 6. OVERALL COMPARISON SUMMARY

Test Type	Avg Response Time	Max Response	Throughput	Stability
Load Test	323 ms	2938 ms	142 req/sec	Stable
Stress Test	323 ms	1672 ms	591 req/sec	Stable
Spike Test	342 ms	6209 ms	580 req/sec	Stable with latency increase

### Key Finding:

- The system is stable under normal and heavy load
- Spike test showed highest response time, indicating strain during sudden traffic
- No errors were recorded in all scenarios and server very reliable.

## 7. CONCLUSION

Based on all three tests, the website *test.k6.io* performs well under normal and stress conditions with consistent response times and zero errors. During the spike scenario, response time increased significantly but the server remained functional without failure.

Overall, the web application demonstrates good scalability, reliability, and handling capacity, suitable for medium-high traffic volumes.

## 8. RECOMMENDATION

To improve performance under unexpected peak loads:

- Implement caching to reduce response time.
- Consider load balancing for better scalability.
- Use auto-scaling servers to handle sudden spikes.
- Monitor server health for optimization.