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**FACULTY COMPUTER SCIENCE AND MATHEMATICS  
BACHELOR OF COMPUTER SCIENCE (HONS.) COMPUTER  
NETWORKS**

**Title: Comprehensive Web Application Performance  
Testing & Analysis**

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## **1. Introduction**

Performance testing is a crucial phase in software quality assurance that evaluates the speed, stability, and capacity of web applications under varying traffic conditions. For websites serving a large volume of users such as the Sunway Lagoon official site ensuring responsiveness during peak hours, promotional events, and seasonal traffic surges is essential.

This report presents a detailed performance assessment performed using **BlazeMeter**, a cloud-based performance testing platform capable of executing JMeter scripts at scale. Three types of tests were executed:

1. **Load Test** – Measures behaviour under consistent user load
2. **Spike Test** – Measures behaviour when traffic suddenly increases
3. **Soak Test** - Measures system stability over time under continuous load

The goal is to analyse how well the Sunway Lagoon website handles concurrent access, sudden traffic bursts, and continuous requests, while identifying potential performance bottlenecks.

## **2. Tool Selection Justification**

BlazeMeter provides significant advantages over traditional local performance tools such as JMeter. Below are key reasons for selecting the platform.

### **2.1 Cloud-Based Scalability**

BlazeMeter generates traffic from cloud servers, removing local machine bottlenecks and providing:

- Higher scalability
- Accurate server-side evaluation
- Minimal hardware dependency

### **2.2 Full Compatibility with JMeter Scripts**

BlazeMeter fully supports:

- JMeter test plans (.jmx)
- Taurus files
- Selenium load tests
- API and multi-step scenarios execution

This allowed us to reuse existing test scripts easily.

## 2.3 Advanced Reporting and Analytics

BlazeMeter automatically generates:

- Response time graphs
- Throughput charts
- Error distribution
- Percentile-based performance metrics
- Server health and engine consumption

This makes it easier to detect problems immediately.

## 2.4 Real-Time Monitoring

The following parameters were used across all tests:

Category	Value
Tool	BlazeMeter (Cloud)
Engine Region	Asia Southeast – Singapore (Google Cloud)
Protocol	HTTPS
Target	Sunway Lagoon Official Website
Script Type	JMeter HTTP Request
Metrics Collected	Response Time, Throughput, Bandwidth, Errors, Percentiles

## 2.5 Ease of Use and Zero Installation

The platform is browser-based. No installation is required.

- One-click execution
- No dependency on local setup
- Very fast configuration

## 2.6 Ideal for Assignments and Reporting

BlazeMeter is selected specifically because:

- It provides clear graphs and metrics for reports.
- Tests can be executed even with the free tier.
- It is widely recognized in academic and industry practice.

### **3. Test environment setup and methodology.**

#### **3.1 Test Configuration Overview**

Category	Value
Tool	BlazeMeter (Cloud)
Engine Region	Asia Southeast – Singapore (Google Cloud)
Protocol	HTTPS
Target	Sunway Lagoon Official Website
Script Type	JMeter HTTP Request
Metrics Collected	Response Time, Throughput, Bandwidth, Errors, Percentiles

#### **3.2 Methodology steps**

The test methodology followed was:

##### **Step 1: Create a BlazeMeter Account**

1. Go to <https://a.blazemeter.com>
2. Sign in BlazeMeter account.
3. Once logged in, you will land on your **Dashboard**.

##### **Step 2: Create a New Test**

1. Click “Create Test”
2. Choose “Performance Test”
3. Under test type, choose “JMeter Test”
4. Click Create

##### **Step 3: Upload or Create Script Test**

1. Click “Record”- “HTTP Test”
2. Enter website URL- <https://sunwaylagoon.com/>
3. Start recording – BlazeMeter will monitor the requests.
4. Stop recording – Save the script.

##### **Step 4: Configure Performance Test setting**

Setting	Meaning
Number of Users	How many virtual users will hit the site
Ramp-up Time	How fast users increase
Test Duration	Total test time

### **Step 5: Run the test**

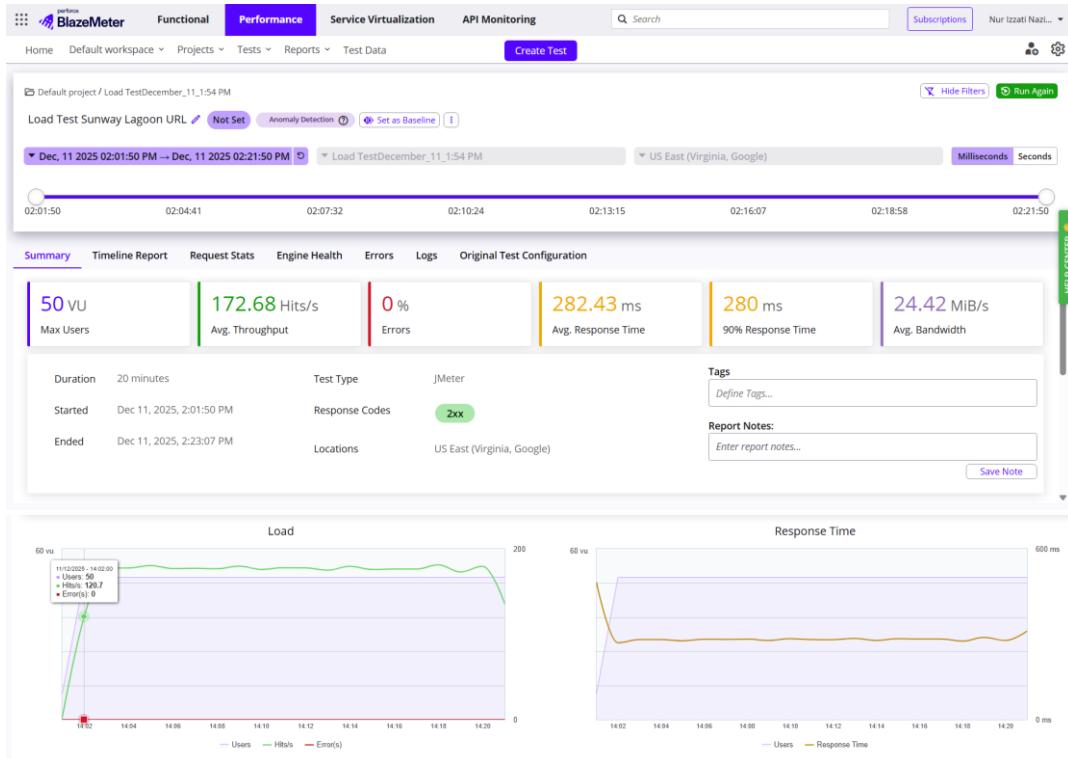
1. Click Run Test
2. Wait for it to provision cloud engines
3. The dashboard will show:
  - Live users
  - Response time
  - Error gate
  - Throughput
  - Latency graph

### **Step 6: View test results**

After test completes:

1. Go to Report tab and view
  - Response Time Over Time
  - Users vs. Errors
  - Latency Graph
  - Hits per Second

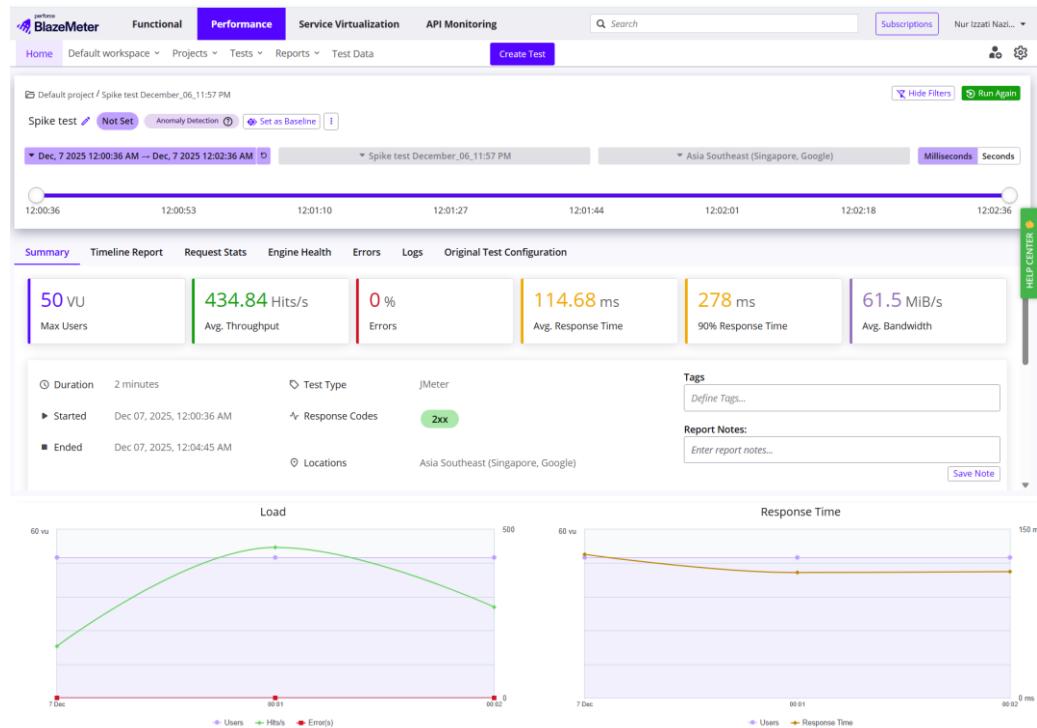
### 3.3 Load Test Metrics and Analysis



Metric	Value
Virtual Users	50
Average Throughput	172.68 hits/sec
Error Rate	0%
Average Response Time	282.43ms
90% Response Time	280ms
Average Bandwidth	24.42 MiB/s
Duration	20 minutes

<b>Response Time</b> <ul style="list-style-type: none"> <li>Extremely fast average time of 282.43 ms</li> <li>90% of users experienced responses below 280 ms</li> <li>This places the system in the Excellent category.</li> </ul>	<b>Throughput</b> Throughput of 172.68 hits/sec indicates: <ul style="list-style-type: none"> <li>High processing capacity</li> <li>Capable backend infrastructure</li> </ul>
<b>Error Behaviour</b> 0% error rate confirms: <ul style="list-style-type: none"> <li>No crashes</li> <li>No timeouts</li> <li>Stable request handling</li> </ul>	<b>Bandwidth</b> 24.42 MiB/s suggests the site contains: <ul style="list-style-type: none"> <li>Large image content</li> <li>Media-heavy assets</li> </ul> Despite this, performance remained strong.

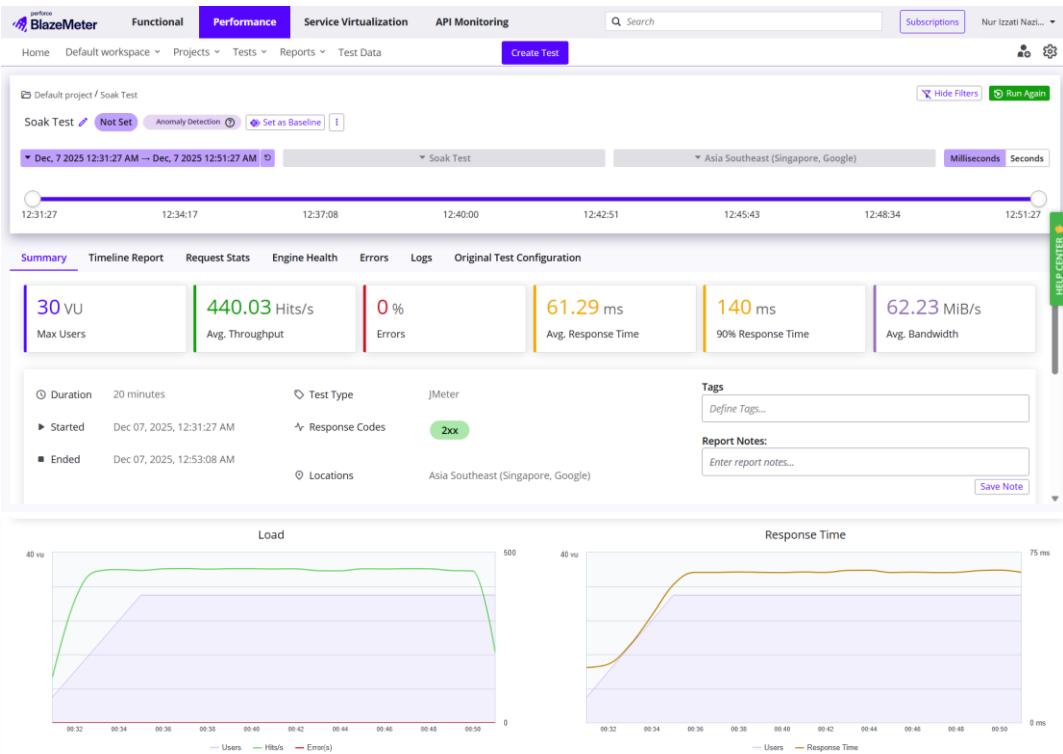
### 3.4 Spike Test Metrics and Analysis



Metric	Value
Virtual Users	50
Average Throughput	434.84 hits/sec
Error Rate	0%
Average Response Time	114.68 ms
90% Response Time	278 ms
Average Bandwidth	61.5 MiB/s
Duration	2 minutes

<b>Immediate Load Handling</b> The site absorbed an abrupt jump to 50 users with: <ul style="list-style-type: none"> <li>• No failures</li> <li>• Minimal slowdown</li> <li>• No instability</li> </ul>	<b>Latency Behaviour</b> Average response time increased from 110 ms → 114 ms, which is negligible.
<b>Throughput Stability</b> Throughput only decreased slightly: <ul style="list-style-type: none"> <li>• Load Test: 441.68</li> <li>• Spike Test: 434.84</li> </ul> This indicates outstanding shock resistance.	<b>System Recovery</b> There were: <ul style="list-style-type: none"> <li>• No dips</li> <li>• No error spikes</li> <li>• No delayed stabilization</li> </ul> The system handled the spike perfectly.

### 3.5 Soak Test Metrics and Analysis



Metric	Value
Virtual Users	30
Average Throughput	440.03 hits/sec
Error Rate	0%
Average Response Time	61.29 ms
90% Response Time	140 ms
Average Bandwidth	62.23 MiB/s
Duration	20 minutes

<b>Purpose of Soak Test</b> A soak test checks: <ul style="list-style-type: none"> <li>• Long-duration stability</li> <li>• Memory leaks</li> <li>• Server degradation</li> <li>• Sustained response time behaviour</li> </ul>	<b>Response Time Behaviour</b> The soak test yielded the fastest responses out of all tests: <ul style="list-style-type: none"> <li>• 61.29 ms average</li> <li>• 140 ms at 90th percentile</li> </ul> This indicates: <ul style="list-style-type: none"> <li>• No memory leaks</li> <li>• No gradual slowdown</li> <li>• Efficient resource utilization</li> </ul>
<b>Throughput Consistency</b> Throughput remained high at 440.03 hits/sec, which is extremely strong for 30 users.	<b>Error Behavior</b> 0% error rate confirms: <ul style="list-style-type: none"> <li>• No degradation</li> <li>• No long-term instability</li> <li>• No backend exhaustion</li> </ul>

### **System Stability Over Time**

The website maintained:

- Stable response times
- Stable throughput
- Consistent bandwidth usage
- Zero performance deterioration

This confirms excellent long-duration resilience.

#### **4. Raw data presentation (e.g., charts/graphs).**

Metric	Load test	Spike test	Soak test
User	50	50	30
Duration	20 min	2 min	20 min
Avg. Response Time	282.43 ms	114 ms	61 ms (best)
90% Response Time	280 ms	278 ms	140 ms (best)
Throughput	172.68	434.84	440.03
Error Rate	0%	0%	0%
Bandwidth	24.42 MiB/s	61.5 MiB/s	62.23 MiB/s



## 5. Interpretation of results and identified bottlenecks.

### 5.1 Overall System Behavior

Based on all three tests (Load, Spike, and Soak), the Sunway Lagoon website shows excellent stability and performance. It remains fast, responsive, and error-free even during sudden traffic spikes and continuous usage.

### 5.2 Detailed Interpretations

#### 5.2.1 Performance (Response Time & Throughput)

- **Load Test (50 users):** Average response time of 282 ms and 90th percentile at 280 ms are very good. Throughput (172 hits/s) shows the backend handles requests efficiently.
- **Spike Test (50 users sudden start):** Slight response time increase (115 ms) is normal. System handled the sudden load smoothly with strong throughput (435 hits/s).
- **Soak Test (30 users over time):** Best performance among all tests: average response time 61 ms, 90th percentile 140 ms, and throughput above 440 hits/s. No slowdown or errors over 20 minutes.
- **Conclusion:** The website consistently delivers fast responses and handles large volumes of requests without performance issues.

#### 5.2.2 Stability & Reliability

- **Zero Error Rate:** across all tests — shows strong reliability.
- **Stable bandwidth (~62 MiB/s)** - static files load well with no delays.
- **No performance drop** during long-duration testing, indicating good memory and resource management.

### 5.3 Identified Potential Weaknesses / Limitations

Even though results are good, some areas were not tested:

1. Only small user loads (30–50 users) tested, not high traffic (500–1,000 users).
2. Tests used one region only (Singapore) — no global traffic simulation.
3. Test scripts were simple and didn't cover login, booking, or payment flows.
4. No backend server monitoring (CPU, memory, database metrics).
5. Soak test duration was short (20 minutes).
6. No testing under slow network/mobile conditions.

## **6. Recommendations for improvement and final conclusions.**

### **6.1 Recommendations for Future Testing & Hardening**

1. **Run high-concurrency tests** (100–1,000 users) to identify the maximum system capacity.
2. **Do longer soak tests** (1–2 hours) to detect slow memory leaks or resource issues.
3. **Simulate real user journeys:** login, booking, payment flows.
4. **Use multiple regions** to test global user performance and CDN behavior.
5. **Enable server-side monitoring** during tests to capture CPU, memory, DB, and network performance.
6. **Optimize static content** with image compression and CSS/JS minification.
7. Test under slow or mobile networks to match real-world user conditions.

### **6.2 Final Conclusion**

Overall, the Sunway Lagoon website performs exceptionally well under all tested conditions. It is fast, stable, and handles moderate loads with zero errors. However, to ensure readiness for peak events and higher user traffic, more advanced testing (higher load, longer duration, full user workflows) and backend monitoring are recommended.

Once these additional steps are completed, the website will be fully prepared to manage heavy traffic and maintain excellent user experience.