Week 6 Journal – Performance Evaluation and Analysis

Objective

The goal of this task was to evaluate system performance under different workloads, further analyse key performance metrics, identify bottlenecks, and apply optimisation techniques.
The main areas of focus were:

1. CPU usage
2. Memory usage
3. Disk I/O performance
4. Network performance
5. System latency
6. Service response times

Testing Scenarios

1. Baseline Performance Testing

Baseline testing was carried out to assess the system's standard performance before applying any stress or load. Commands such as:

top
htop
free -h
sudo hdparm -Tt /dev/sda

These commands were used to monitor CPU and memory usage, and check disk I/O speed.

Result:

- CPU usage was consistently below 2%.
- Around 1.5 GB of RAM was free during idle time.
- Disk read speed averaged around 750 MB/s. This confirmed that the system was stable and performing efficiently under normal conditions.

Application Load Testing

To test performance under pressure, the stress-ng tool was used to simulate heavy CPU usage. Commands:

sudo apt install stress-ng -y
sudo stress-ng --cpu 4 --timeout 60s

While running the stress test, htop was used to monitor CPU spikes and system load.

Result:

- CPU utilisation increased to nearly 100% on all cores.
- Memory usage also increased slightly, but no system crash or lag occurred. The system handled high loads successfully, showing strong stability.

Performance Analysis (Identifying Bottlenecks)

After conducting both baseline and stress testing, the system's behaviour was analysed to identify potential slowdowns. Tools used:

hdparm
ping 8.8.8.8
iperf3 -c 127.0.0.1

Result:

- Disk and memory were stable.
- Network latency was minimal (below 1ms).
- CPU was the only heavily used component during stress tests.

No serious bottlenecks were found, and the system was well-balanced.

Optimisation Testing

After performance evaluation, system improvements were implemented to enhance both performance and stability:

- Kernel network parameters were tuned in /etc/sysctl.conf:

- **net.ipv4.tcp_syncookies=1**
- **net.ipv4.conf.all.accept_redirects=0**
- **net.ipv4.conf.all.rp_filter=1**

- Firewall and intrusion detection were configured (ufw, fail2ban).
- Automatic updates were enabled to ensure consistent system patching.

Result: After optimisation, SSH response times improved, network behaviour was smoother, and overall latency decreased.

Performance Summary Table

Test Type	Tool / Command Used	Key Observations	Result
Baseline	top, htop, free -h, hdparm	Low CPU/memory usage, stable disk speed	Stable
Load	stress-ng	CPU maxed at 100%, no crash	Stable
Analysis	ping, iperf3, hdparm	Low latency, minimal disk delay	Efficient
Optimisation	sysctl.conf, ufw, fail2ban	Improved response times & stability	Optimised

System Latency Testing

Latency was measured using the time and dmesg commands:

time ls -lah
sudo dmesg | grep -i latency

Result: The average response time for simple commands was less than **0.005s**, and no kernel latency errors were reported.

Service Response Time Testing

Service responsiveness was measured for SSH and web connections:

time ssh localhost
curl -o /dev/null -s -w "%{time_total}\n" http://localhost

Result:

- SSH responded in ~0.18s.
- Localhost web response was ~0.02s. This shows excellent service responsiveness for a virtualised server.

Performance Analysis and Improvements

The system's performance remained steady throughout all tests. The implementation of kernel optimisations, firewall strengthening, and monitoring services resulted in enhanced responsiveness and security.

Two main improvements implemented:

1. Kernel-level TCP and routing enhancements.
2. Automated security and update configuration for performance reliability.

Conclusion

This week's performance evaluation confirmed that the server was both efficient and resilient. CPU and disk performed strongly, latency remained low, and all services responded quickly. After optimisation, the overall system performance and security posture significantly improved, achieving a balance between speed, stability, and security.