Assessment Week 3

Application Selection for Performance Testing

Objective

The primary purpose of Week 3 was to select and test different applications that represent a range of workload types, including CPU-intensive, RAM-intensive, I/O-intensive, and Network-intensive operations. The aim was to evaluate the system's performance and stability under these workloads, using Linux Mint as the primary operating system.

System Information and Setup

Operating System: Linux Mint 22.2 (Zara)

Kernel Version: 5.15.0-160-generic (x86_64)

Network Configuration: Host-Only Adapter (connected to Ubuntu Server via Internal Network)

Connection: SSH communication between Linux Mint and Ubuntu Server established successfully

Applications Selected for Testing

Different types of workloads were simulated using the following tools:

Workload Type	Application / Tool	Purpose
CPU-Intensive	**stress-ng**	To test CPU performance and stability under high processing load
RAM-Intensive	**stress-ng**	To test memory handling and allocation
I/O-Intensive	**fio**	To test disk input/output performance
Network-Intensive	**iperf3**	To test network speed and stability between Mint and Ubuntu

Server Workload	**Apache2**	To simulate a web server environment

All tools were installed using:

sudo apt update
sudo apt install stress-ng iperf3 fio apache2 -y

Basic System Commands Used

1. **uname -a** Displays detailed information about the system kernel, including Linux version, machine architecture, and hostname. Used to confirm that Linux Mint is running correctly with the correct kernel.

2. **free -h** Shows memory (RAM) usage in a user-friendly format. Used to assess total, used, and free memory before and after tests.

3. **lsb_release -a** Shows distribution details such as the OS name (Linux Mint), version number, and codename “Zara." Helps verify the exact Linux distribution and release version.

4. **df -h** Shows disk space usage in a clear and easy-to-read format. Used to monitor available storage and confirm enough space for I/O operations testing.

5. **ip addr** Displays all network interfaces and IP addresses. Used to confirm host-only and internal network configuration between Mint and Ubuntu.

Performance Testing and Results

1. CPU-Intensive Test

Command:

stress-ng --cpu 4 --timeout 30s

This test ran four CPU stressors for 30 seconds. The CPU utilisation approached nearly 100%, confirming system stability and the effectiveness of multi-threaded processing.

2. RAM-Intensive Test

Command:

stress-ng --vm 2 --vm-bytes 512M --timeout 30s

Two virtual memory stress tests were performed, each lasting 30 seconds and using 512 MB of RAM. The tests finished without issues, confirming stable memory operation and the absence of crashes.

3. I/O-Intensive (Disk) Test

Command:

fio --name=readwrite --rw=rw --size=500M --numjobs=2 --runtime=60s --group_reporting

This command performed continuous read/write operations on a 500 MB file using two jobs. Average throughput reached **~177 MB/s**, showing efficient disk I/O performance.

4. Network-Intensive Test

Commands:

- On **Ubuntu Server**: iperf3 -s
- On **Linux Mint (Client)**: iperf3 -c 192.168.56.2

The test evaluated network throughput between Linux Mint and Ubuntu Server. Results indicated an average of 14.5 Gbits/sec, demonstrating outstanding virtual network performance and minimal latency.

5. Server Workload (Web Server) Test Commands:

sudo systemctl start apache2
sudo systemctl status apache2

The Apache2 web server was installed and started successfully. It stayed active and stable, demonstrating the system's capacity to manage web-related tasks.

Expected Resource Profiles

Test Type	Resource Focus	Observed Usage
CPU Test	Processor load	~100% utilization
RAM Test	Memory allocation	1 GB (2×512 MB)
Disk Test	Storage I/O	177 MB/s read/write
Network Test	Bandwidth	14.5 Gbits/sec
Web Server Test	CPU + Memory	Stable, low resource usage

Monitoring Strategy

During all tests, system resources were monitored using:

top
htop
free -h
df -h

These commands monitored CPU usage, RAM consumption, and disk activity in real time. The system remained responsive and stable throughout testing.

Conclusion

Week 3 effectively demonstrated Linux Mint's performance across various workload types. All tools — stress-ng, fio, iperf3, and apache2 — were installed and run via SSH connections between Mint and Ubuntu Server. Linux Mint proved easier to manage, more stable, and more efficient during testing than Ubuntu Server. This phase confirmed that the configured environment could sustain high workloads across CPU, memory, disk, and network layers without performance decline.

Application Selection Matrix

Workload Type	Application / Tool	Purpose	Justification for Selection
CPU-Intensive	stress-ng	Simulates heavy processor load by running multiple CPU stressors.	It is lightweight, easy to install, and widely used for testing CPU performance and system stability.
RAM-Intensive	stress-ng (VM mode)	Allocates and stresses memory to test system stability and RAM handling.	Simple syntax and integrates smoothly with CPU tests for combined performance evaluation.
I/O-Intensive	fio	Performs continuous read/write operations to	A powerful and flexible disk benchmarking tool that provides detailed I/O

		test disk throughput.	performance statistics.
Network-Intensive	iperf3	Measures data transfer rates between two connected machines.	Ideal for network performance testing, providing precise bandwidth and latency measurements.
Server / Web Workload	apache2	Simulates web server traffic and HTTP request handling.	Commonly used server software; useful for observing CPU and memory usage under real-world workloads.

Issues and Fixes

During Week 3 setup and testing, multiple technical issues emerged with network configuration and the installation of performance tools. Here is a summary of the key problems and how they were addressed.

1. Network Configuration Problems

Initially, Ubuntu Server was unable to connect to the internet, resulting in repeated "Temporary failure in name resolution" errors during software installation and updates.

Cause: The virtual machine was configured to use only a *Host-Only Adapter*, which restricts access to the internet.

Fix: A second adapter was added and configured as *Internal Network (intnet)*. After restarting the network services using:

sudo systemctl restart systemd-networkd
sudo systemctl restart systemd-resolved.

The server successfully obtained an IP address (10.0.2.x and 192.168.56.x) and could ping external sites such as 8.8.8.8 and google.com.

2. SSH Connection Failures

There were multiple failed attempts to connect Linux Mint to Ubuntu Server using SSH (**Permission denied (publickey,password)** errors).

Cause: The SSH service (sshd) was not correctly configured to allow password-based authentication.

Fix: The SSH configuration file was edited using sudo nano /etc/ssh/sshd_config, and the following line was updated: PasswordAuthentication yes. After restarting the SSH service with: sudo systemctl restart ssh, Linux Mint successfully connected to the Ubuntu Server using: ssh admin@192.168.56.2.

3. Adapter Setup and "Network Unreachable" Errors

At several points during testing, the message 'Network is unreachable' appeared.

Cause: The IP addresses of both VMs were not on the same subnet, or the virtual cable option was disabled.

Fix: Both adapters were set to **Host-Only Network (HostNetwork)** with **Virtual Cable Connected** enabled, and the correct adapter type (**Intel PRO/1000 T Server**) was chosen in VirtualBox settings. This allowed both VMs (Mint and Ubuntu) to communicate using IPs within the same subnet (192.168.56.x).

4. Package Installation Errors

When trying to install **stress-ng**, **iperf3**, and **fio**, several "failed to fetch" errors appeared due to unreachable repositories.

Fix: After fixing the DNS issue, the following commands were run to update the package lists and complete the installation:

```
sudo apt update
sudo apt install stress-ng iperf3 fio apache2 -y
```

All tools installed successfully afterwards.

5. Apache2 Hostname Warning

When starting the Apache web server, the system displayed:
apache2: Could not reliably determine the server's fully qualified domain name

Fix: The message was harmless, but for best practice, the /etc/hosts file was edited to include the server's hostname to avoid future warnings. The service was confirmed **active (running)** afterwards.

Reflection

This week's setup process demanded patience and involved several troubleshooting steps, particularly concerning VirtualBox networking and SSH configuration. Despite these difficulties, all issues were resolved through systematic testing, research, and repeated verification commands such as ip addr, ping, and systemctl status. By the end of Week 3, both virtual machines were fully functional and capable of running multi-layered performance tests over SSH, marking a significant technical milestone in the coursework.