1. Introduction

Week 3 focused on selecting applications to simulate different workload types and preparing a monitoring strategy to evaluate server performance. The goal is to understand how the server behaves under CPU, memory, I/O, and network load.

2. Application Selection

Workload Type	Application	Purpose
CPU-intensive	`stress`	Generate high CPU load for testing
Memory-intensive	`stress`	Allocate RAM to simulate memory-heavy applications
I/O-intensive	`fio`	Perform disk read/write tests
Network-intensive	`iperf3`	Measure network throughput
Server application	`nginx`	Web server for monitoring typical service performance

3. Performance Monitoring Plan

The server will be monitored via the following commands:

Command Explanation :

- `top` → Displays active processes and CPU/memory usage in real-time

- `htop` → Interactive process viewer with visual resource graphs

- `iostat -xz 1` → Shows extended disk I/O statistics every 1 second

- `iperf3 -s` → Starts network performance test server on the server machine

- `iperf3 -c 192.168.56.101` → Runs client to measure bandwidth to a specific server or workstatio

4. Expected Resource Profiles

Application	Expected CPU	Expected RAM	Expected I/O	Network
stress CPU	High	Low	Low	Low
stress RAM	Moderate	High	Low	Low
fio	Low	Low	High	Low
iperf3	Low	Low	Low	High
nginx	Moderate	Moderate	Moderate	Moderate

5. Monitoring Strategy

1. Run each application individually and monitor server metrics via `top`, `htop`, `iostat`, and `iperf3`.

2. Record baseline performance for each application.

3. Collect quantitative data for CPU, memory, disk, and network usage.

4. Compare results to identify bottlenecks and areas for optimisation in later weeks.

```
liveuser@localhost-live:~$ sudo dnf install stress-ng
Updating and loading repositories:
Repositories loaded.
Package            Arch     Version             Repository      Size
Installing:
 stress-ng         x86_64 0.19.06-1.fc43        updates       19.0 MiB
Installing dependencies:
 Judy              x86_64 1.0.5-39.fc43          fedora       364.6 KiB
top - 00:18:32 up 24 min,  2 users,  load average: 0.30, 0.23, 0.28
Tasks: 253 total,   1 running, 252 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.5 us,  0.6 sy,  0.0 ni, 96.1 id,  0.0 wa,  2.2 hi,  0.6 si,  0.0 st
MiB Mem :   8566.2 total,   2230.1 free,   2007.6 used,   4992.4 buff/cache
MiB Swap:   8192.0 total,   8192.0 free,      0.0 used.   6558.6 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
   2022 liveuser  20   0 5297144 410176 175940 S   4.6   4.7   0:56.48 gnome-shell
   3384 liveuser  20   0 1983340 281692 150096 S   4.6   3.2   0:20.96 ptyxis
     73 root      20   0       0      0      0 I   0.3   0.0   0:02.71 kworker/u16:3-events_unbound
   1167 dbus      20   0    8868   6908   2940 S   0.3   0.1   0:02.13 dbus-broker
   1211 root      20   0  516732   4344   3908 S   0.3   0.0   0:01.13 VBoxService
   2547 liveuser  20   0  620072  11992  10284 S   0.3   0.1   0:00.51 goa-identity-se
   3917 root      20   0       0      0      0 I   0.3   0.0   0:00.03 kworker/0:1-events
   4084 liveuser  20   0  235416   6012   3808 R   0.3   0.1   0:00.28 top
      1 root      20   0   42156  22136  11712 S   0.0   0.3   0:09.33 systemd
      2 root      20   0       0      0      0 S   0.0   0.0   0:00.05 kthreadd
      3 root      20   0       0      0      0 S   0.0   0.0   0:00.00 pool_workqueue_release
      4 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-rcu_gp
      5 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-sync_wq
      6 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-kvfree_rcu_reclaim
      7 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-slub_flushwq
      8 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-netns
     10 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/0:0H-events_highpri
     13 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworker/R-mm_percpu_wq
     15 root      20   0       0      0      0 S   0.0   0.0   0:00.67 ksoftirqd/0
     16 root      20   0       0      0      0 I   0.0   0.0   0:00.76 rcu_preempt
```

```
vboxuser@ubuntu:~$ sudo apt install stress-ng
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
stress-ng is already the newest version (0.17.06-1build1).
The following package was automatically installed and is no longer required:
  libllvm19
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 8 not upgraded.
vboxuser@ubuntu:~$ htop
top - 00:20:37 up 26 min,  1 user,  load average: 0.10, 0.14, 0.14
Tasks: 213 total,   2 running, 211 sleeping,   0 stopped,   0 zombie
%Cpu(s):  7.8 us,  6.5 sy,  0.0 ni, 84.7 id,  0.2 wa,  0.0 hi,  0.9 si,  0.0 st
MiB Mem :   5688.8 total,   3699.2 free,   1031.2 used,   1222.7 buff/cache
MiB Swap:      0.0 total,      0.0 free,      0.0 used.   4657.6 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
   2071 vboxuser  20   0 4766276 383400 145108 S  76.0   6.6   1:17.48 gnome-shell

   2890 vboxuser  20   0  556328  53328  41664 R  15.8   0.9   0:08.32 gnome-terminal-

   3403 vboxuser  20   0 2875488  61032  46964 S   4.8   1.0   0:01.94 gjs

    678 root      20   0       0      0      0 I   2.1   0.0   0:02.44 kworker/u16:9-events_unbound

   2187 vboxuser  20   0  388668  12192   7020 S   2.1   0.2   0:03.26 ibus-daemon
```

```
vboxuser@ubuntu:~$ stress-ng --cpu 4 --timeout 20s
stress-ng: info:  [3955] setting to a 20 secs run per stressor
stress-ng: info:  [3955] dispatching hogs: 4 cpu
stress-ng: info:  [3955] skipped: 0
stress-ng: info:  [3955] passed: 4: cpu (4)
stress-ng: info:  [3955] failed: 0
stress-ng: info:  [3955] metrics untrustworthy: 0
stress-ng: info:  [3955] successful run completed in 4 mins, 33.40 secs
```

```
vboxuser@ubuntu:~$ stress-ng --vm 2 --vm-bytes 75% --timeout 20s
stress-ng: info:  [4039] setting to a 20 secs run per stressor
stress-ng: info:  [4039] dispatching hogs: 2 vm
```

```
liveuser@localhost-live:~$ stress-ng --vm 2 --vm-bytes 75% --timeout
20s
stress-ng: info:  [4609] setting to a 20 secs run per stressor
stress-ng: info:  [4609] dispatching hogs: 2 vm
stress-ng: info:  [4610] vm: using 835.65M per stressor instance (tot
al 1.63G of 2.18G available memory)
```

```
liveuser@localhost-live:~$ iperf3 --version
iperf 3.19.1 (cJSON 1.7.15)
Linux localhost-live 6.17.1-380.fc43.x86_64 #1 SMP PREEMPT_DYNAMIC Mon Oct  6 15:37:21 UTC 2025 x86_64
Optional features available: CPU affinity setting, IPv6 flow label, SCTP, TCP congestion algorithm setting, sendfile / zerocopy, socket pacing, authentication, bind to device, support IPv4 don't fragment, POSIX t
hreads
```

```
liveuser@localhost-live:~$ iperf3 -c 192.168.56.101
Connecting to host 192.168.56.101, port 5201
[  5] local 192.168.56.102 port 32886 connected to 192.168.56.101 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  5]   0.00-1.00   sec  57.6 MBytes   483 Mbits/sec   34    549 KBytes
[  5]   1.00-2.00   sec  81.6 MBytes   684 Mbits/sec  135    328 KBytes
[  5]   2.00-3.00   sec  65.9 MBytes   553 Mbits/sec   90    331 KBytes
[  5]   3.00-4.00   sec  86.9 MBytes   730 Mbits/sec  135    208 KBytes
[  5]   4.00-5.00   sec  81.9 MBytes   687 Mbits/sec  135    221 KBytes
[  5]   5.00-6.00   sec  82.6 MBytes   693 Mbits/sec  120    206 KBytes
[  5]   6.00-7.00   sec   109 MBytes   914 Mbits/sec   45    392 KBytes
[  5]   7.00-8.00   sec  89.5 MBytes   750 Mbits/sec  135    239 KBytes
[  5]   8.00-9.00   sec  56.4 MBytes   473 Mbits/sec   90    242 KBytes
[  5]   9.00-10.01  sec  57.2 MBytes   478 Mbits/sec   55    211 KBytes
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  5]   0.00-10.01  sec   769 MBytes   644 Mbits/sec  974            sender
[  5]   0.00-10.01  sec   765 MBytes   641 Mbits/sec                 receiver

iperf Done.
```

```
T R:    0.00B      W:    0.00B    |C R:    0.00B      W:    0.00B
TID       PRIO USER      DISK READ    DISK WRITE  GRAPH▽COMMAND [T](09:3
    1    be/4 root        0.00 B/s     0.00 B/s      systemd              ▲
    2    be/4 root        0.00 B/s     0.00 B/s      kthreadd
    3    be/4 root        0.00 B/s     0.00 B/s      pool_workqueue
    4    be/0 root        0.00 B/s     0.00 B/s      kworker/R-rcu_
    5    be/0 root        0.00 B/s     0.00 B/s      kworker/R-sync
    6    be/0 root        0.00 B/s     0.00 B/s      kworker/R-kvfr
    7    be/0 root        0.00 B/s     0.00 B/s      kworker/R-slub
    8    be/0 root        0.00 B/s     0.00 B/s      kworker/R-netn
   10    be/0 root        0.00 B/s     0.00 B/s      kworker/0:0H-k
   12    be/4 root        0.00 B/s     0.00 B/s      kworker/u16:0-
   13    be/0 root        0.00 B/s     0.00 B/s      kworker/R-mm_p
   15    be/4 root        0.00 B/s     0.00 B/s      ksoftirqd/0
   16    be/4 root        0.00 B/s     0.00 B/s      rcu_preempt          ▼
```

Moniter disk activity on fedora

```
liveuser@localhost-live:~$ iostat -x a
Linux 6.17.1-300.fc43.x86_64 (localhost-live)    12/09/2025    _x86_
64_     (4 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           0.89    0.03    8.95    0.60    0.00   89.54

Device             r/s     rkB/s   rrqm/s  %rrqm r_await rareq-sz
w/s      wkB/s   wrqm/s  %wrqm w_await wareq-sz    d/s     dkB/s    dr
qm/s  %drqm d_await dareq-sz    f/s f_await  aqu-sz  %util
```