COEN241 HW1

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1. Configurations:

- QEMU - Installed a Ubuntu based VM, 10 GB disk space, 2 GB of memory and 8 CPU cores allocated to it.
- Docker - Installed Ubuntu on 2 GB of memory.

2. To enable the QEMU VM, I did the following:

a. Created an image with 10 Gigabytes allocated to it using the command **qemu-img.exe create ubuntu.img 10G -f qcow2**

b. Installed Ubuntu on it using the command **qemu-system-x86_64.exe -hda .\ubuntu.img -boot d -cdrom .\ubuntu-16.04.7-server-amd64.iso -m 2048 -boot strict=on**

c. Booted the VM on QEMU from the installed image using the command **qemu-system-x86_64.exe -hda .\ubuntu.img -boot d -m 2048 -boot strict=on**
This VM uses 2GB of memory.

3. To create a Docker container, I did the following:

a. Install Docker and pull the Ubuntu image with sysbench preinstalled using the command **docker pull csminpp/ubuntu-sysbench**

b. Launch the container using the command **docker run -d -p 80:80 csminpp/ubuntu-sysbench**
Rest of the work is done using the Docker CLI.

5. Experiment details:

For both QEMU and Docker, I ran the following tests:

a. cpu - ran it with cpu-max-prime set to 28000,30000 and 35000

b. fileio - ran it with file-io-mode set to **seqwr** (sequential write) , **seqrewr** (sequential rewrite) and **rndrw** (combined random read/write) for 3000 files, 64KB each.

6. **Scripts for automated running**:

CPU test script file:

```
for i in 1 2 3 4 5
do
sysbench --test=cpu --cpu-max-prime=28000 run >>res_cpu.txt
done
for i in 1 2 3 4 5
do
sysbench --test=cpu --cpu-max-prime=30000 run >>res_cpu.txt
done
for i in 1 2 3 4 5
do
sysbench --test=cpu --cpu-max-prime=35000 run >>res_cpu.txt
done
```

FILEIO test script file:

```
for i in 1 2 3 4 5
do
sysbench --test=fileio --file-test-mode=seqwr -file-block-size=64K --file-num=3000
--file-total-size=192000K --num-threads=4 --file-io-mode=sync --prepare >>res_fileio.txt
sysbench --test=fileio --file-test-mode=seqwr --file-block-size=64K --file-num=3000
--file-total-size=192000K --num-threads=4 --file-io-mode=sync --run >>res_fileio.txt
sysbench --test=fileio --file-test-mode=seqwr --file-block-size=64K --file-num=3000
--file-total-size=192000K --num-threads=4 --file-io-mode=sync --cleanup >>res_fileio.txt
done

for i in 1 2 3 4 5
do
sysbench --test=fileio --file-test-mode=seqrewr --file-block-size=64K --file-num=3000
--file-total-size=192000K --num-threads=4 --file-io-mode=sync --prepare >>res_fileio.txt
sysbench --test=fileio --file-test-mode=segrewr --file-block-size=64K --file-num=3000
--file-total-size=192000K --num-threads=4 --file-io-mode=sync --run >>res_fileio.txt
sysbench --test=fileio --file-test-mode=seqrewr --file-block-size=64K --file-num=3000
--file-total-size=192000K --num-threads=4 --file-io-mode=sync --cleanup >>res_fileio.txt
done

for i in 1 2 3 4 5
do
```

```
sysbench --test=fileio --file-test-mode=rndrw --file-block-size=64K --file-num=3000
-file-total-size=192000K --num-threads=4 --file-io-mode=sync --prepare >>res_fileio.txt
sysbench --test=fileio --file-test-mode=rndrw --file-block-size=64K --file-num=3000
--file-total-size=192000K --num-threads=4 --file-io-mode=sync --run >>res_fileio.txt
sysbench --test=fileio --file-test-mode=rndrw --file-block-size=64K --file-num=3000
--file-total-size=192000K --num-threads=4 --file-io-mode=sync --cleanup >>res_fileio.txt
done
```

7. **Results :**

1. **QEMU VM:**

CPU test:
The table below compares the time elapsed (in seconds) to the max-prime set in the CPU test.

cpu-max-prime	MIN	MAX	AVG
28000	279.9	290.5	283.3
30000	301.5	313.2	310.7
35000	342.6	363.3	357.8

FileIO:
The table below compares the time elapsed (in seconds) to the file test mode.

	MIN	MAX	AVG
seqwr	22.32	26.78	23.55
seqrewr	10.42	13.56	11.74
rndrw	101.44	116.37	104.93

2. DOCKER:

CPU test:
The table below compares the time elapsed (in seconds) to the max-prime set in the CPU test.

cpu-max-prime	MIN	MAX	AVG
28000	19.70	19.73	19.71
30000	21.68	21.75	21.70
35000	26.95	27.08	27.01

FileIO:
The table below compares the time elapsed (in seconds) to the file test mode.

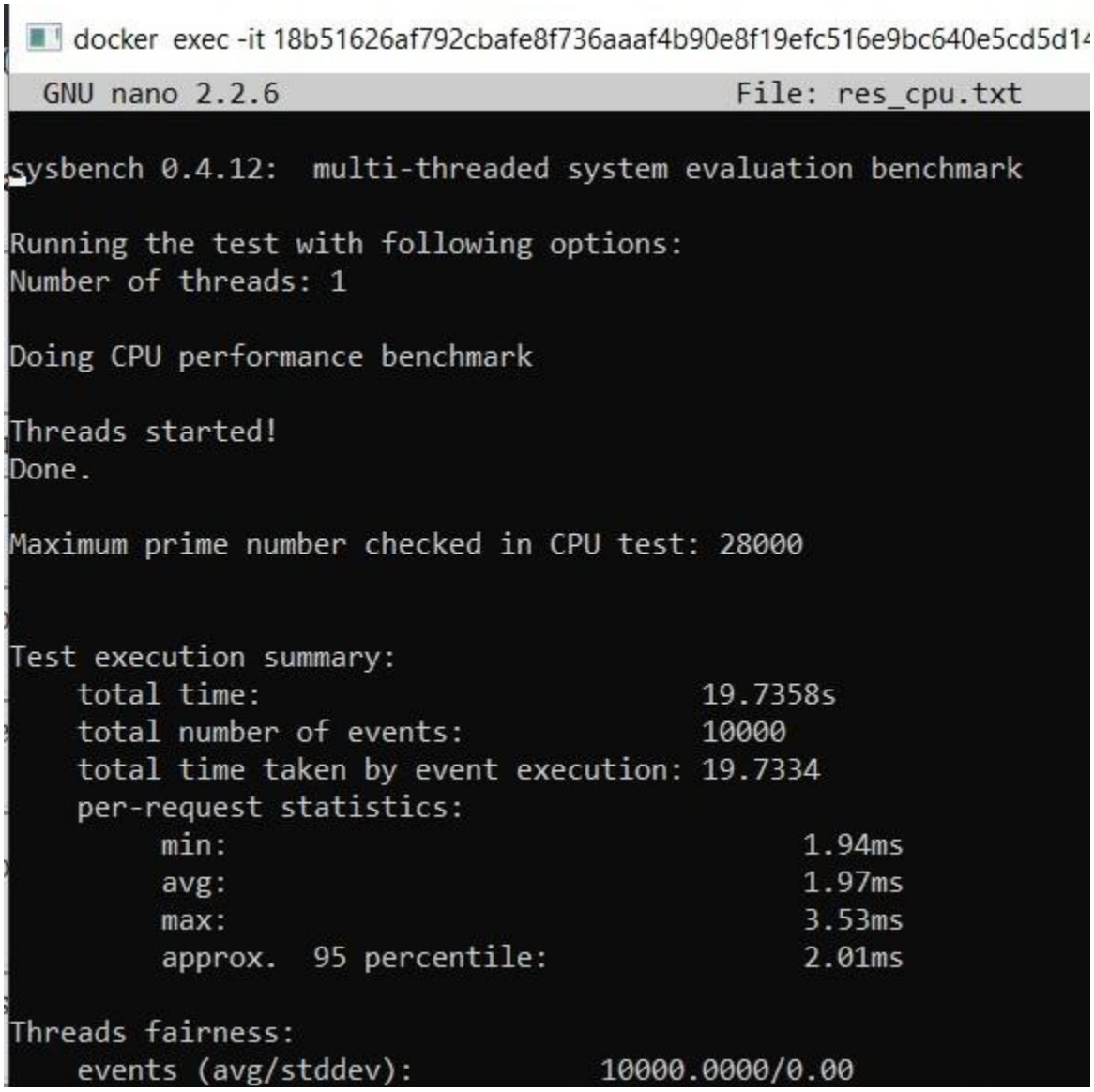
file-test-mode	MIN	MAX	AVG
seqwr	5.35	5.83	5.42
seqrewr	0.34	0.65	0.56
rndrw	23.89	30.75	27.23

Analysis:

As expected, we can see that QEMU VM takes much more time to run the same test(s) compared to a Docker container, as Docker containers are generally faster and less resource-intensive than virtual machines.

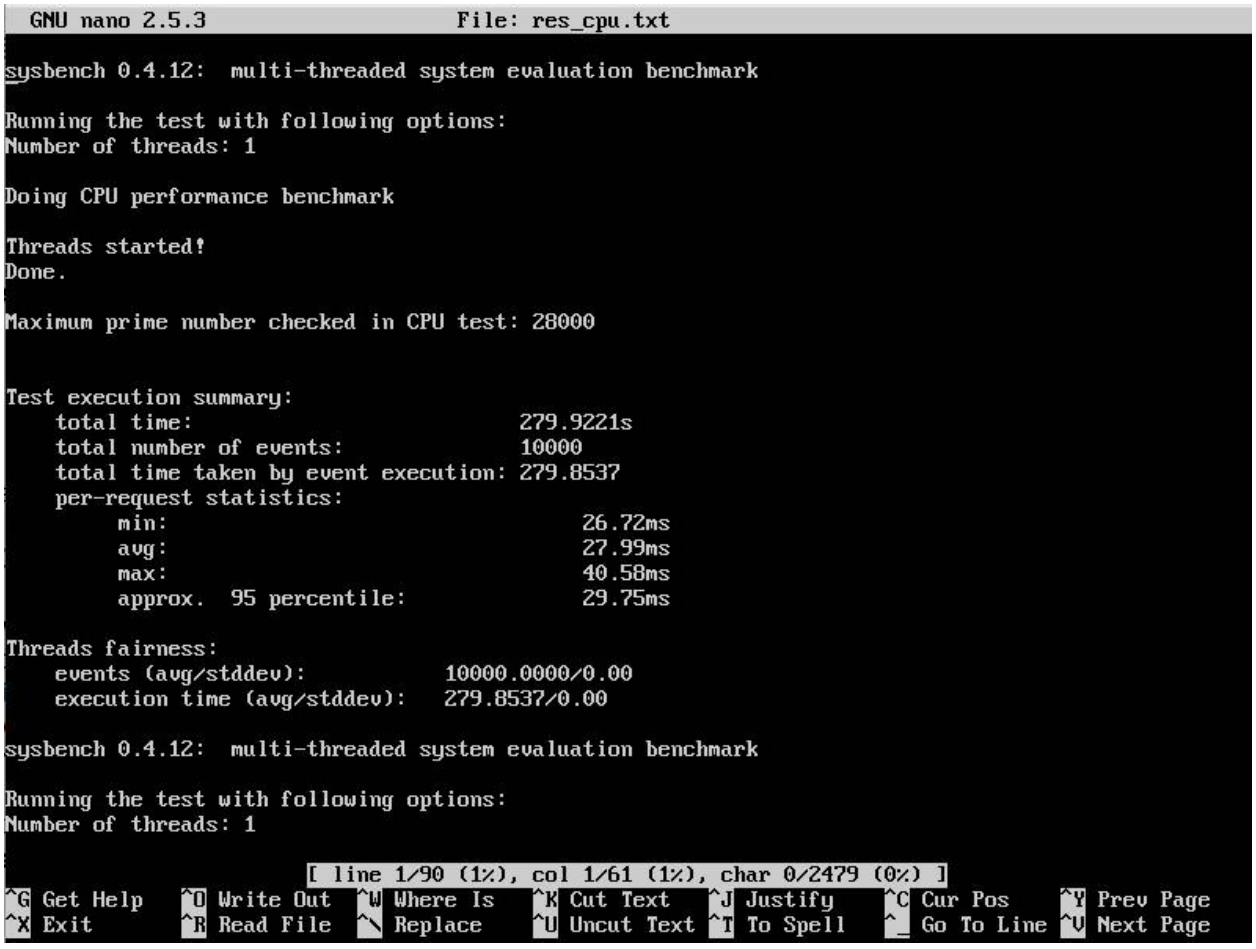
8. **Miscellaneous Screenshots**:

Docker:



```
  GNU nano 2.2.6                                                File: res_fileio.t

Number of threads: 4

Extra file open flags: 0
3000 files, 64Kb each
187.5Mb total file size
Block size 64Kb
Number of random requests for random IO: 10000
Read/Write ratio for combined random IO test: 1.50
Periodic FSYNC enabled, calling fsync() each 100 requests.
Calling fsync() at the end of test, Enabled.
Using synchronous I/O mode
Doing random r/w test
Threads started!
Done.

Operations performed:  6017 Read, 4013 Write, 300001 Other = 310031 Total
Read 376.06Mb  Written 250.81Mb  Total transferred 626.88Mb  (20.384Mb/sec)
  326.14 Requests/sec executed

Test execution summary:
    total time:                          30.7538s
    total number of events:              10030
    total time taken by event execution: 0.1779
    per-request statistics:
         min:                                  0.00ms
         avg:                                  0.02ms
         max:                                  0.62ms
         approx.  95 percentile:               0.03ms

Threads fairness:
    events (avg/stddev):           2507.5000/74.37
    execution time (avg/stddev):   0.0445/0.00

sysbench 0.4.12:  multi-threaded system evaluation benchmark

Removing test files...
sysbench 0.4.12:  multi-threaded system evaluation benchmark

3000 files, 64Kb each, 187Mb total
Creating files for the test...
sysbench 0.4.12:  multi-threaded system evaluation benchmark

Running the test with following options:
Number of threads: 4
```

QEMU VM:


GNU nano 2.5.3 File: res_cpu.txt
sysbench 0.4.12: multi-threaded system evaluation benchmark
Running the test with following options:
Number of threads: 1
Doing CPU performance benchmark
Threads started!
Done.
Maximum prime number checked in CPU test: 28000
Test execution summary:
total time: 279.9221s
total number of events: 10000
total time taken by event execution: 279.8537
per-request statistics:
min: 26.72ms
avg: 27.99ms
max: 40.58ms
approx. 95 percentile: 29.75ms
Threads fairness:
events (avg/stddev): 10000.0000/0.00
execution time (avg/stddev): 279.8537/0.00
sysbench 0.4.12: multi-threaded system evaluation benchmark
Running the test with following options:
Number of threads: 1
[line 1/90 (1%), col 1/61 (1%), char 0/2479 (0%)]
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos ^Y Prev Page
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line ^V Next Page