

MiniProject 1 – Containers and VMs

REPORT:

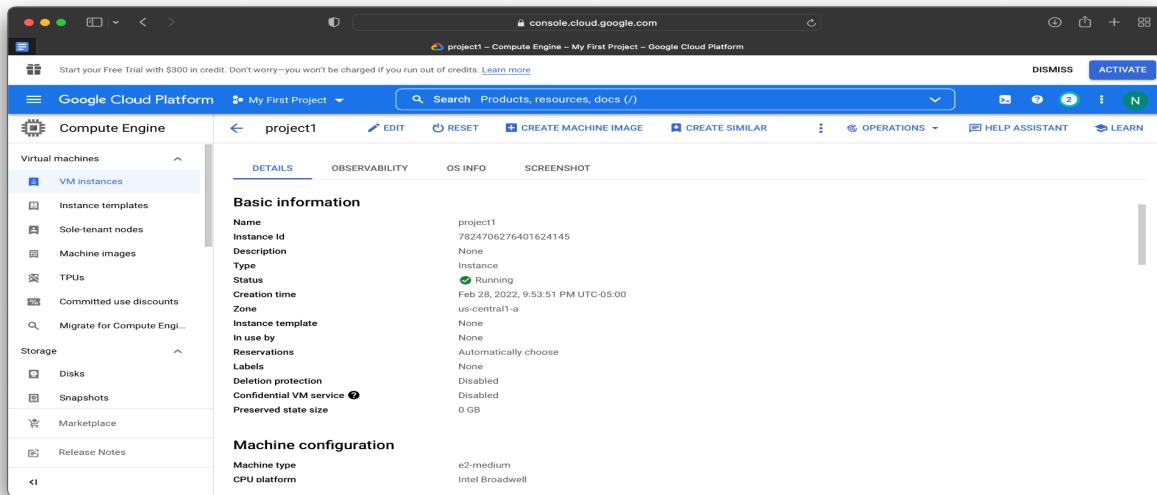
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1. VM Instance Created:

VM Instance is created using specified version of OS that is Ubuntu Bionic Beaver(18.04) with 30GB of Disk space.



The screenshot shows the Google Cloud Platform Compute Engine interface. The left sidebar is collapsed, showing 'Virtual machines' with 'VM instances' selected. The main content area displays the details of a VM instance named 'project1'. The 'DETAILS' tab is active, showing the following information:

Basic information	
Name	project1
Instance Id	7824706276401624145
Description	None
Type	Instance
Status	Running
Creation time	Feb 28, 2022, 9:53:51 PM UTC-05:00
Zone	us-central1-a
Instance template	None
In use by	None
Reservations	Automatically choose
Labels	None
Deletion protection	Disabled
Confidential VM service	Disabled
Preserved state size	0 GB

Machine configuration

Machine type	e2-medium
CPU platform	Intel Broadwell

Figure 1: Basic Information about the VM instance.

The screenshot shows the Google Cloud Platform Compute Engine interface for a VM instance named 'project1'. The 'DETAILS' tab is selected. Key configuration details include:

- Machine configuration:**
 - Machine type: e2-medium
 - CPU platform: Intel Broadwell
 - vCPUs to core ratio: —
 - Display device: Enabled
 - GPUs: None
- Networking:**
 - Public DNS PTR Record: None
 - Total egress bandwidth tier: —
 - NIC type: —
- Firewalls:**
 - HTTP traffic: Off
 - HTTPS traffic: Off

Figure 1: Machine Configuration of the VM instance.

The screenshot shows the Google Cloud Platform Compute Engine interface for a VM instance named 'project1'. The 'DETAILS' tab is selected. Key configuration details include:

- Network tags:** None
- Network interfaces:**

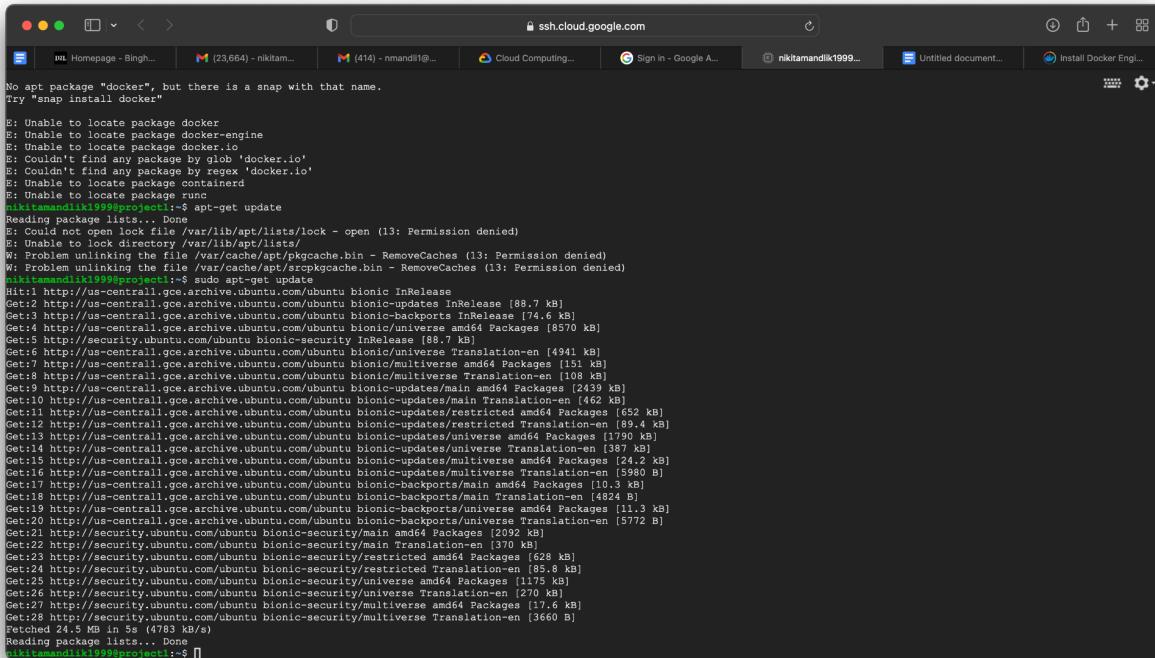
Name	Network	Subnetwork	Primary internal IP	Alias IP ranges	External IP	Network tier	IP forwarding
nic0	default	default	10.128.0.3		104.197.142.249 (Ephemeral)	Premium	Off
- Storage:**
 - Boot disk:**

Name	Image	Interface type	Size (GB)	Device name	Type	Encryption	Mode	When deleting instance
project1	ubuntu-1804-bionic-v20220213	SCSI	30	instance-2	Balanced persistent disk	Google-managed	Boot, read/write	Delete disk
 - Local disks:** None

Figure 3: Network Interfaces and details for the VM Instance.

2. Docker Basics:

The docker is installed in the VM Instance. Basic commands for the understanding of docker basics.



```
No apt package "docker", but there is a snap with that name.
Try "snap install docker"
E: Unable to locate package docker
E: Unable to locate package docker-engine
E: Couldn't find any package by glob 'docker.io'
E: Couldn't find any package by regex 'docker.io'
E: Unable to locate package containerd
E: Unable to locate package runc
nikitamandlik1999project1:~$ apt-get update
Reading package lists... Done
Err:1 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic InRelease
  Could not open lock file /var/lib/apt/lists/lock - open (13: Permission denied)
W: Unable to lock directory /var/lib/apt/lists/
W: Problem unlinking the file /var/cache/apt/pkgscache.bin - RemoveCaches (13: Permission denied)
W: Problem unlinking the file /var/cache/apt/srcpkgscache.bin - RemoveCaches (13: Permission denied)
nikitamandlik1999project1:~$ sudo apt-get update
Hit:1 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic InRelease
Get:2 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates InRelease [89.7 kB]
Get:3 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-backports InRelease [74.6 kB]
Get:4 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic/universe amd64 Packages [8570 kB]
Get:5 http://security.ubuntu.com/ubuntu bionic/bionic-security InRelease [88.7 kB]
Get:6 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic/universe Translation-en [4941 kB]
Get:7 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic/multiverse amd64 Packages [151 kB]
Get:8 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic/multiverse Translation-en [108 kB]
Get:9 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates/main amd64 Packages [1462 kB]
Get:10 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates/main Translation-en [462 kB]
Get:11 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates/restricted amd64 Packages [652 kB]
Get:12 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates/restricted Translation-en [89.4 kB]
Get:13 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates/universe amd64 Packages [1790 kB]
Get:14 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates/universe Translation-en [387 kB]
Get:15 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates/multiverse amd64 Packages [24.2 kB]
Get:16 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates/multiverse Translation-en [5980 B]
Get:17 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-security/main amd64 Packages [110 kB]
Get:18 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-backports/main Translation-en [4824 B]
Get:19 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-backports/universe amd64 Packages [11.3 kB]
Get:20 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-backports/universe Translation-en [5772 B]
Get:21 http://security.ubuntu.com/ubuntu bionic-security/main amd64 Packages [2092 kB]
Get:22 http://security.ubuntu.com/ubuntu bionic-security/main Translation-en [370 kB]
Get:23 http://security.ubuntu.com/ubuntu bionic-security/restricted amd64 Packages [626 kB]
Get:24 http://security.ubuntu.com/ubuntu bionic-security/restricted Translation-en [65.8 kB]
Get:25 http://security.ubuntu.com/ubuntu bionic-security/universe amd64 Packages [1175 kB]
Get:26 http://security.ubuntu.com/ubuntu bionic-security/universe Translation-en [270 kB]
Get:27 http://security.ubuntu.com/ubuntu bionic-security/multiverse amd64 Packages [17.6 kB]
Get:28 http://security.ubuntu.com/ubuntu bionic-security/multiverse Translation-en [3660 B]
Fetched 24.5 MB in 5s (4783 kB/s)
Reading package lists... Done
nikitamandlik1999project1:~$
```

Figure 4: “docker-v” Command to show the version of Docker Installation.

```

niki@mandlik1999:~/project1:$ docker pull alpine
Using default tag: latest
Got permission denied while trying to connect to the Docker daemon socket at unix:///var/run/docker.sock: Post "http://$2Fvar%2Frun%2Fdocker.sock/v1.24/images/create?fromImage=alpine&staplayer": dial unix /var/run/docker.sock: connect: permission denied
niki@mandlik1999:~/project1:$ sudo docker pull alpine
Using default tag: latest
latest: Pulling from library/alpine
Digest: sha256:21a3d8ea0032a8057914f36584b5288d2e5ecc984380bc0118285c70fa8c9300
Status: Downloaded newer image for alpine:latest
docker.io/library/alpine:latest
niki@mandlik1999:~/project1:$ sudo docker run alpine ls -l
total 56
drwxr-xr-x 2 root root 4096 Nov 24 09:20 bin
drwxr-xr-x 5 root root 340 Mar 1 03:26 dev
drwxr-xr-x 1 root root 4096 Mar 1 03:26 etc
drwxr-xr-x 2 root root 4096 Nov 24 09:20 home
drwxr-xr-x 7 root root 4096 Nov 24 09:20 lib
drwxr-xr-x 5 root root 4096 Nov 24 09:20 media
drwxr-xr-x 2 root root 4096 Nov 24 09:20 mnt
drwxr-xr-x 2 root root 4096 Nov 24 09:20 opt
drwxr-xr-x 184 root root 0 Mar 1 03:26 proc
drwxr-xr-x 2 root root 4096 Nov 24 09:20 root
drwxr-xr-x 2 root root 4096 Nov 24 09:20 run
drwxr-xr-x 2 root root 4096 Nov 24 09:20 sbin
drwxr-xr-x 2 root root 4096 Nov 24 09:20 srv
dr-xr-xr-x 13 root root 0 Mar 1 03:26 sys
drwxrwxrwx 2 root root 4096 Nov 24 09:20 tmp
drwxr-xr-x 7 root root 4096 Nov 24 09:20 usr
drwxr-xr-x 12 root root 4096 Nov 24 09:20 var
niki@mandlik1999:~/project1:$

```

Figure 5: Docker “alpine” as first container.

```

niki@mandlik1999:~/project1:$ sudo docker run alpine echo "hello from alpine"
hello from alpine
niki@mandlik1999:~/project1:$ sudo docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
niki@mandlik1999:~/project1:$ sudo docker ps -a
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
63c7956992b alpine ""/bin/sh" 40 seconds ago Exited (0) 40 seconds ago
540e1430beal alpine "echo 'hello from al... About a minute ago Exited (0) About a minute ago
77143f19325 alpine "ls -l" 2 minutes ago Exited (0) 2 minutes ago
niki@mandlik1999:~/project1:$ sudo docker run -it alpine /bin/sh
/ # ls
bin dev etc home lib media mnt opt proc root run sbin srv sys tmp usr var
/ # uname -a
Linux ff7f2d59fd76 5.4.0-1064-gcp #68~18.04.1-Ubuntu SMP Sun Feb 6 07:26:13 UTC 2022 x86_64 Linux
/ #

```

Figure 6: Commands associated with Docker Apline Container.

3. QEMU Installation:

```
Setting up libupowerd-plugins-good@:0-amd64 (1.14.5-0ubuntu1-18.04.2) ...
Setting up dconf-settings-backend-amd64 (0.26.0-2ubuntu3) ...
Setting up gsettings-desktop-schemas (3.28.0-1ubuntu1) ...
Setting up libv4l1-0-amd64 (1.14.2-1) ...
Setting up libgbp-pixbuf2.0-0-amd64 (2.36.11-2) ...
Setting up libgbg-pixbuf2.0-bin (2.36.11-2) ...
Setting up libibridl (12.2.13-0ubuntu0.18.04.10) ...
Setting up qemu-block-extra:amd64 (1:2.11+dfsg-1ubuntu7.39) ...
Setting up qemu-utils (1:2.11+dfsg-1ubuntu7.39) ...
Setting up libbsbm1 (1.1.0-1ubuntu1.1-0.28-0ubuntu0.18.04.2) ...
Setting up fontconfig (2.12.6-0ubuntu2) ...
Regenerating fonts cache... done.
Setting up qemu-system-common (1:2.11+dfsg-1ubuntu7.39) ...
Created symlink /etc/systemd/system/multi-user.target.wants/qemu-kvm.service → /lib/systemd/system/qemu-kvm.service.
Setting up libcairo2:amd64 (1.15.10-0ubuntu0.1) ...
Setting up libcairo-gobject:amd64 (1.15.10-0ubuntu0.1) ...
Setting up libpango-1.0-0-amd64 (1.40.14-1ubuntu0.1) ...
Setting up libtheora0:amd64 (1.1.1+dfsg.1-14) ...
Setting up libshout3:amd64 (2.4.1-2build1) ...
Setting up gstreamer1.0-plugins-base:amd64 (1.14.5-0ubuntu1-18.04.3) ...
Setting up libdsdl1.2debian:amd64 (1.2.15+dfsg0-1ubuntu0.1) ...
Setting up qemu-system-a390x (1:2.11+dfsg-1ubuntu7.39) ...
Setting up libpangofft2-0.0.0-amd64 (1.40.14-1ubuntu0.1) ...
Setting up libpangoft2-0.0-amd64 (1:2.38.0-0ubuntu1.1-0.1) ...
Setting up libqmi-system-sparc (1.2.11+dfsg-1ubuntu7.39) ...
Setting up qemu-system-misc (1:2.11+dfsg-1ubuntu7.39) ...
Setting up qemu-system-arm (1:2.11+dfsg-1ubuntu7.39) ...
Setting up qemu-system-nmips (1:2.11+dfsg-1ubuntu7.39) ...
Setting up qemu-system-ppc (1:2.11+dfsg-1ubuntu7.39) ...
Setting up libpangocaliro-1.0-0:amd64 (1.40.14-1ubuntu0.1) ...
Setting up qemu-system (1:2.11+dfsg-1ubuntu7.39) ...
Setting up gstreamer1.0-x:amd64 (1.14.5-0ubuntu1-18.04.3) ...
Setting up qemu (1:2.11+dfsg-1ubuntu7.39) ...
Processing triggers for libc-bin (2.27-3ubuntu1.4) ...
Processing triggers for system (237-3ubuntu10.53) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for unattended-upgrades (0.85.1-0ubuntu1) ...
Processing triggers for install-info (6.5.0.0.dfsg.1-2) ...
Processing triggers for liblibleb-0.0:amd64 (2.56.4-0ubuntu0.18.04.9) ...
Setting up libgl-pool-networking:amd64 (2.62.1-1ubuntu0.1) ...
Setting up libcomp2.4-1:amd64 (2.62.1-1ubuntu0.1) ...
Processing triggers for libc-bin (2.27-3ubuntu1.4) ...
Processing triggers for gstreamer1.0-plugins-good:amd64 (1.14.5-0ubuntu1-18.04.2) ...
nikitamandalik1999project1:~ wget http://mirror.pnl.gov/releases/18.04/ubuntu-18.04.6-live-server-amd64.iso
--2022-03-01 03:44:15-- http://mirror.pnl.gov/releases/18.04/ubuntu-18.04.6-live-server-amd64.iso
Resolving mirror.pnl.gov (mirror.pnl.gov)... 192.101.102.2
Connecting to mirror.pnl.gov (mirror.pnl.gov)|192.101.102.2|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 1016070144 (969M) [application/octet-stream]
Saving to: 'ubuntu-18.04.6-live-server-amd64.iso'

ubuntu-18.04.6-live-server-amd64.iso          100%[=====] 969.00M 45.3MB/s   in 30s

nikitamandalik1999project1:~ sudo qemu-img create ubuntu.img 10G
Formatting 'ubuntu.img', fmt='raw' size=10737418240
nikitamandalik1999project1:~ █
```

Figure 7: To check that QEMU is Installed

The following commands are performed for QEMU installation

- \$sudo apt-get update
 - \$sudo apt-get install qemu
 - \$wget http://mirror.pnl.gov/releases/18.04/ubuntu-18.04.6-live-server-amd64.iso
 - \$sudo qemu-img create ubuntu.img 10G

To enable the QEMU VM following commands are used-

- \$sudo apt-get update
- \$sudo apt-get install gnome-core
- \$sudo apt-get install gnome-panel
- \$sudo apt-get install vnc4server
- \$vncserver

firewall setting

vncserver via gcp terminal

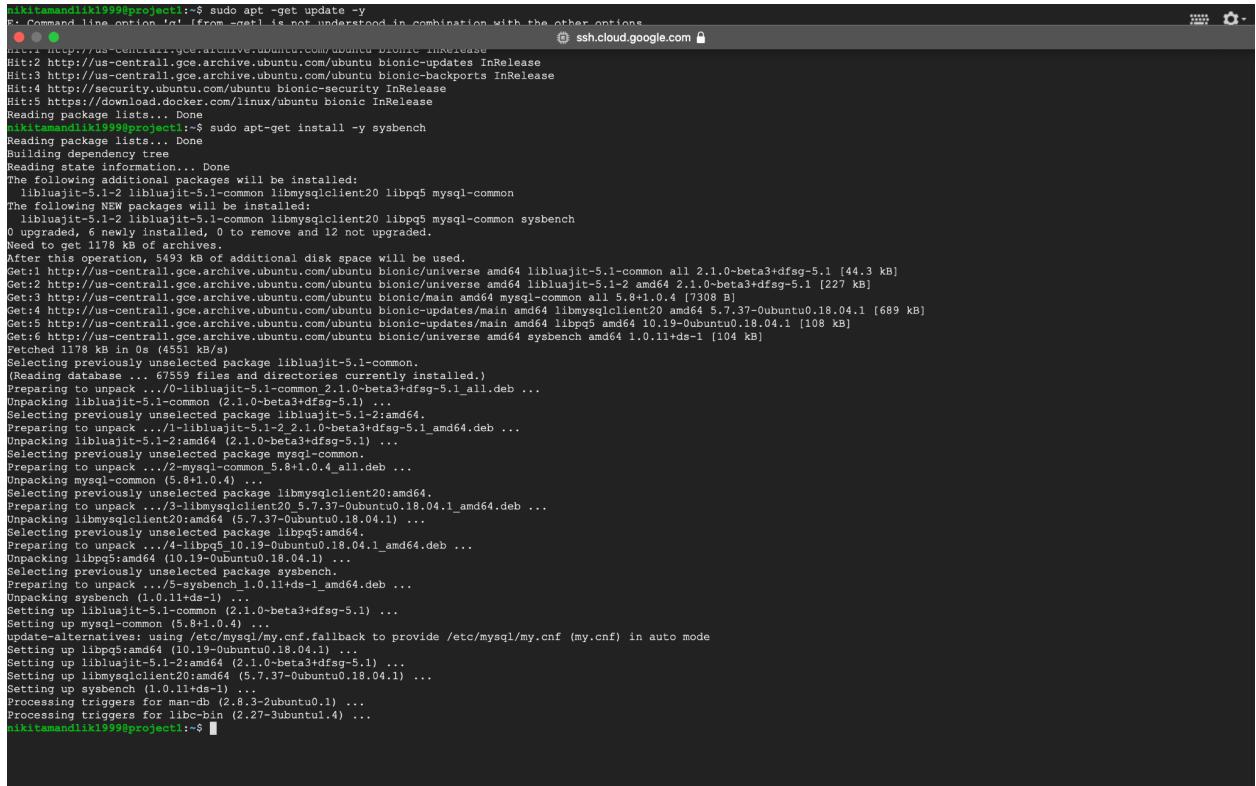
vnc app: ip address and gcp instance ip with :5901

The guest OS execution which emulates the entire hardware, therefore it is not connected with the hardware. The system call is not going through the hypervisor and the host OS the call gets executed. The increase in the interconnection time causes the delay.

Time taken to install the QEMU: approximately 3hr 30 min.

4. Sysbench Installation:

Sysbench fileio commands are run inside docker :



```
nikitamandlik1999@project1:~$ sudo apt -get update -y
E: Command line option 'a' (from -get) is not understood in combination with the other options
nikitamandlik1999@project1:~$ ssh.cloud.google.com
nikitamandlik1999@project1:~$ sudo apt-get install -y sysbench
Reading package lists... Done
Building dependency tree
Reading state information...
The following additional packages will be installed:
  libluajit-5.1-2 libluajit-5.1-common libmysqlclient20 libpq5 mysql-common
The following NEW packages will be installed:
  libluajit-5.1-2 libluajit-5.1-common libmysqlclient20 libpq5 mysql-common sysbench
0 upgraded, 6 newly installed, 0 to remove, 12 not upgraded.
Need to get 1178 kB of archives.
After this operation, 5493 kB of additional disk space will be used.
Get: 1 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic/universe amd64 libluajit-5.1-common all 2.1.0-beta3+dfsg-5.1 [44.3 kB]
Get: 2 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic/universe amd64 libluajit-5.1-2 amd64 2.1.0-beta3+dfsg-5.1 [227 kB]
Get: 3 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic/main amd64 mysql-common all 5.8.1-0.4 [7308 B]
Get: 4 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates/main amd64 libmysqlclient20 amd64 5.7.37-Ubuntu0.18.04.1 [689 kB]
Get: 5 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic-updates/main amd64 libpq5 amd64 10.19-Ubuntu0.18.04.1 [108 kB]
Get: 6 http://us-central1.gce.archive.ubuntu.com/ubuntu bionic/universe amd64 sysbench amd64 1.0.11+ds-1 [104 kB]
Fetched 1178 kB in 0s (4551 kB/s)
Selecting previously unselected package libluajit-5.1-common.
(Reading database ... 67559 files and directories currently installed.)
Preparing to unpack .../libluajit-5.1-common_2.1.0-beta3+dfsg-5.1_all.deb ...
Unpacking libluajit-5.1-common (2.1.0-beta3+dfsg-5.1) ...
Selecting previously unselected package libluajit-5.1-2:amd64.
Preparing to unpack .../libluajit-5.1-2:amd64 (2.1.0-beta3+dfsg-5.1) ...
Unpacking libluajit-5.1-2:amd64 (2.1.0-beta3+dfsg-5.1) ...
Selecting previously unselected package mysql-common.
Preparing to unpack .../mysql-common_5.8+1.0.4_all.deb ...
Unpacking mysql-common (5.8+1.0.4) ...
Selecting previously unselected package libmysqlclient20:amd64.
Preparing to unpack .../libmysqlclient20_5.7.37-Ubuntu0.18.04.1_amd64.deb ...
Unpacking libmysqlclient20:amd64 (5.7.37-Ubuntu0.18.04.1) ...
Selecting previously unselected package libpq5:amd64.
Preparing to unpack .../libpq5_10.19-Ubuntu0.18.04.1_amd64.deb ...
Unpacking libpq5:amd64 (10.19-Ubuntu0.18.04.1) ...
Selecting previously unselected package sysbench.
Preparing to unpack .../sysbench_1.0.11+ds-1_amd64.deb ...
Unpacking sysbench (1.0.11+ds-1) ...
Setting up libluajit-5.1-common (2.1.0-beta3+dfsg-5.1) ...
Setting up mysql-common (5.8+1.0.4) ...
update-alternatives: using /etc/mysql/my.cnf.fallback to provide /etc/mysql/my.cnf (my.cnf) in auto mode
Setting up libpq5:amd64 (10.19-Ubuntu0.18.04.1) ...
Setting up libluajit-5.1-2:amd64 (2.1.0-beta3+dfsg-5.1) ...
Setting up libmysqlclient20:amd64 (5.7.37-Ubuntu0.18.04.1) ...
Setting up sysbench (1.0.11+ds-1) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for libc-bin (2.27-3ubuntu1.4) ...
nikitamandlik1999@project1:~$
```

Figure 8: Sysbench Installation status.

```

nixit@mandlik1999:~/project1:$ sudo docker pull csminpp/ubuntu-sysbench
Using default tag: latest
latest: Pulling from csminpp/ubuntu-sysbench
Image is up to date for csminpp/ubuntu-sysbench:latest
Digest: sha256:90fd06985472eec3aa99b665618c23f074debd326fcc87a5fb59d2be1f9d497435
Status: Downloaded newer image for csminpp/ubuntu-sysbench:latest
docker.io/csminpp/ubuntu-sysbench:latest
nixit@mandlik1999:~/project1:$ sudo docker run -it --runtime=runc csminpp/ubuntu-sysbench /bin/bash
root@78926e52f7c1:/# sysbench --test=fileio --file-total-size=1G prepare
sysbench 0.4.12: multi-threaded system evaluation benchmark

128 files, 8192Kb each, 1024Mb total
Creating files for the test...
root@78926e52f7c1:/# ls
bin run test_file.104 test_file.115 test_file.126 test_file.22 test_file.33 test_file.44 test_file.55 test_file.66 test_file.77 test_file.88 test_file.99
boot sbin test_file.105 test_file.116 test_file.127 test_file.23 test_file.34 test_file.45 test_file.56 test_file.67 test_file.78 test_file.89 var
dev srv test_file.106 test_file.117 test_file.13 test_file.24 test_file.35 test_file.46 test_file.57 test_file.68 test_file.79 test_file.9 user
etc sys test_file.107 test_file.118 test_file.14 test_file.25 test_file.36 test_file.47 test_file.58 test_file.69 test_file.8 test_file.90 var
home sysbench test_file.108 test_file.119 test_file.15 test_file.26 test_file.37 test_file.48 test_file.59 test_file.7 test_file.80 test_file.91
lib test_file.0 test_file.109 test_file.12 test_file.16 test_file.27 test_file.38 test_file.49 test_file.6 test_file.70 test_file.81 test_file.92
lib64 test_file.1 test_file.110 test_file.121 test_file.18 test_file.29 test_file.39 test_file.4 test_file.50 test_file.61 test_file.72 test_file.83 test_file.94
media test_file.10 lib test_file.111 test_file.122 test_file.19 test_file.3 test_file.40 test_file.51 test_file.62 test_file.73 test_file.84 test_file.95
mnt test_file.100 test_file.112 test_file.123 test_file.2 test_file.30 test_file.41 test_file.52 test_file.63 test_file.74 test_file.85 test_file.96
opt test_file.101 test_file.113 test_file.124 test_file.20 test_file.31 test_file.42 test_file.53 test_file.64 test_file.75 test_file.86 test_file.97
proc test_file.102 test_file.114 test_file.125 test_file.21 test_file.32 test_file.43 test_file.54 test_file.65 test_file.76 test_file.87 test_file.98
root test_file.103
root@78926e52f7c1:/#

```

```

Time limit exceeded, exiting...
done.

Operations performed: 104400 Read, 69600 Write, 222687 Other = 396687 Total
Read 1.593Gb Written 1.062Gb Total transferred 2.655Gb (45.312Mb/sec)
2899.98 Requests/sec executed

Test execution summary:
total time: 60.0004s
total number of events: 174000
total time taken by event execution: 1.5563
per-request statistics:
min: 0.00ms
avg: 0.01ms
max: 0.63ms
approx. 95 percentile: 0.01ms

Threads fairness:
events (avg/stddev): 174000.0000/0.00
execution time (avg/stddev): 1.5563/0.00
root@78926e52f7c1:/# sysbench --test=fileio --file-total-size=1G --file-test-mode=rndrw --max-time=60 --max-requests=0 run
sysbench 0.4.12: multi-threaded system evaluation benchmark

Running the test with following options:
Number of threads: 1

Extra file open flags: 0
128 requests each
1Gb total file size
Block size 16Kb
Number of random requests for random IO: 0
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!
Time limit exceeded, exiting...
Done.

Operations performed: 105720 Read, 70480 Write, 225463 Other = 401663 Total
Read 1.613Gb Written 1.075Gb Total transferred 2.6886Gb (45.885Mb/sec)
2936.65 Requests/sec executed

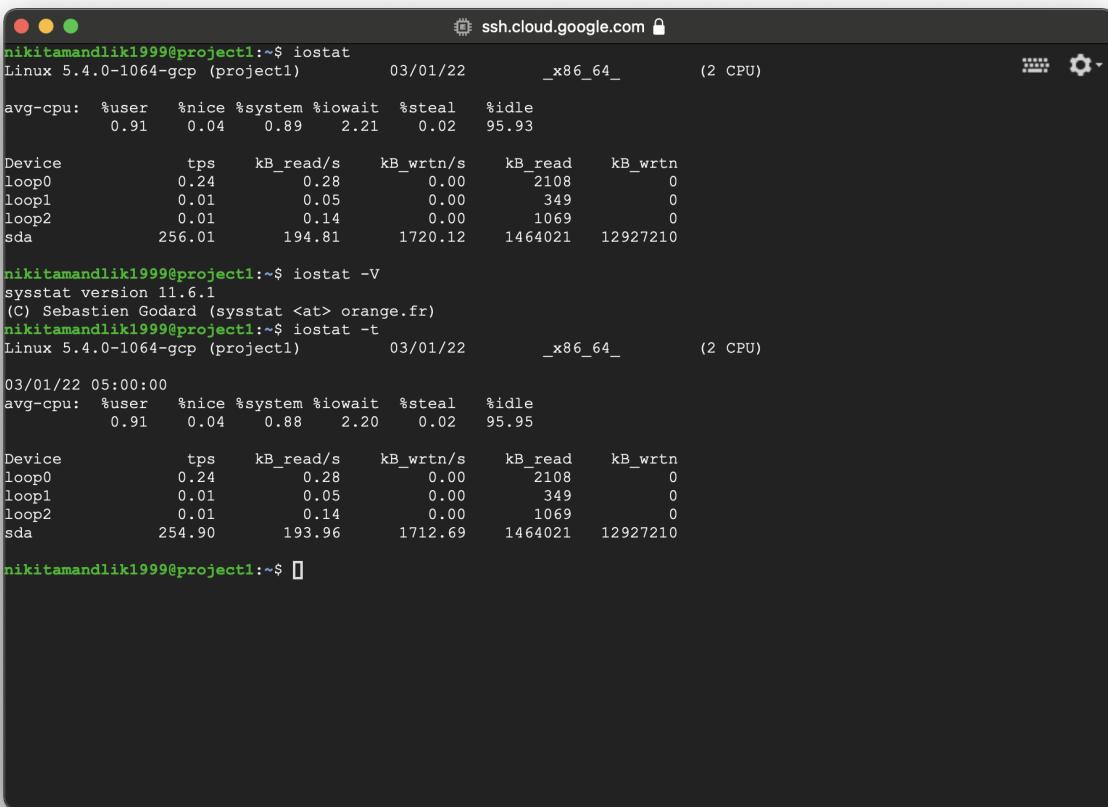
Test execution summary:
total time: 60.00003s
total number of events: 176200
total time taken by event execution: 1.5380
per-request statistics:
min: 0.00ms
avg: 0.01ms
max: 0.70ms
approx. 95 percentile: 0.01ms

Threads fairness:
events (avg/stddev): 176200.0000/0.00
execution time (avg/stddev): 1.5380/0.00
root@78926e52f7c1:/#

```

```
root@78926e52f7c1:/# sysbench --test=fileio --file-total-size=1G --file-test-mode=rndrw cleanup
syebench 0.4.12: multi-threaded system evaluation benchmark
Removing test files...
root@78926e52f7c1:/# ls
bin boot dev etc home lib lib64 media mnt opt proc root run sbin srv sys sysbench tmp usr var
root@78926e52f7c1:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
overlay        29G   4.1G   25G  15% /
tmpfs          64M     0  64M  0% /dev
tmpfs          2.0G   0  2.0G  0% /sys/fs/cgroup
shm            64M     0  64M  0% /dev/shm
/dev/dal        29G   4.1G   25G  15% /etc/hosts
tmpfs          2.0G   0  2.0G  0% /proc/acpi
tmpfs          2.0G   0  2.0G  0% /proc/scsi
tmpfs          2.0G   0  2.0G  0% /sys/firmware
root@78926e52f7c1:/#
```

5. lstat installation:



```
nikitamandlik1999@project1:~$ iostat
Linux 5.4.0-1064-gcp (project1)        03/01/22      _x86_64_      (2 CPU)

avg-cpu: %user   %nice  %system %iowait  %steal   %idle
          0.91    0.04    0.89    2.21    0.02   95.93

Device      tps    kB_read/s    kB_wrtn/s    kB_read    kB_wrtn
loop0       0.24      0.28      0.00     2108       0
loop1       0.01      0.05      0.00      349       0
loop2       0.01      0.14      0.00     1069       0
sda        256.01    194.81    1720.12   1464021  12927210

nikitamandlik1999@project1:~$ iostat -V
sysstat version 11.6.1
(C) Sebastien Godard (sysstat <at> orange.fr)
nikitamandlik1999@project1:~$ iostat -t
Linux 5.4.0-1064-gcp (project1)        03/01/22      _x86_64_      (2 CPU)

03/01/22 05:00:00
avg-cpu: %user   %nice  %system %iowait  %steal   %idle
          0.91    0.04    0.88    2.20    0.02   95.95

Device      tps    kB_read/s    kB_wrtn/s    kB_read    kB_wrtn
loop0       0.24      0.28      0.00     2108       0
loop1       0.01      0.05      0.00      349       0
loop2       0.01      0.14      0.00     1069       0
sda        254.90    193.96    1712.69   1464021  12927210

nikitamandlik1999@project1:~$ [
```

Figure 9: lstat Basic Operations

```
ssh.cloud.google.com 🔒
Device      tps    kB_read/s   kB_wrtn/s   kB_read   kB_wrtn
loop0       0.24      0.28        0.00     2108       0
loop1       0.01      0.05        0.00      349       0
loop2       0.01      0.14        0.00     1069       0
sda        254.90    193.96     1712.69   1464021  12927210

nikitamandlik1999@project1:~$ iostat -d 5 3
Linux 5.4.0-1064-gcp (project1)           03/01/22      _x86_64_      (2 CPU)

Device      tps    kB_read/s   kB_wrtn/s   kB_read   kB_wrtn
loop0       0.23      0.27        0.00     2108       0
loop1       0.01      0.04        0.00      349       0
loop2       0.01      0.14        0.00     1069       0
sda        245.57    186.86     1649.97   1464065  12927526

Device      tps    kB_read/s   kB_wrtn/s   kB_read   kB_wrtn
loop0       0.00      0.00        0.00       0       0
loop1       0.00      0.00        0.00       0       0
loop2       0.00      0.00        0.00       0       0
sda        0.00      0.00        0.00       0       0

Device      tps    kB_read/s   kB_wrtn/s   kB_read   kB_wrtn
loop0       0.00      0.00        0.00       0       0
loop1       0.00      0.00        0.00       0       0
loop2       0.00      0.00        0.00       0       0
sda        0.00      0.00        0.00       0       0

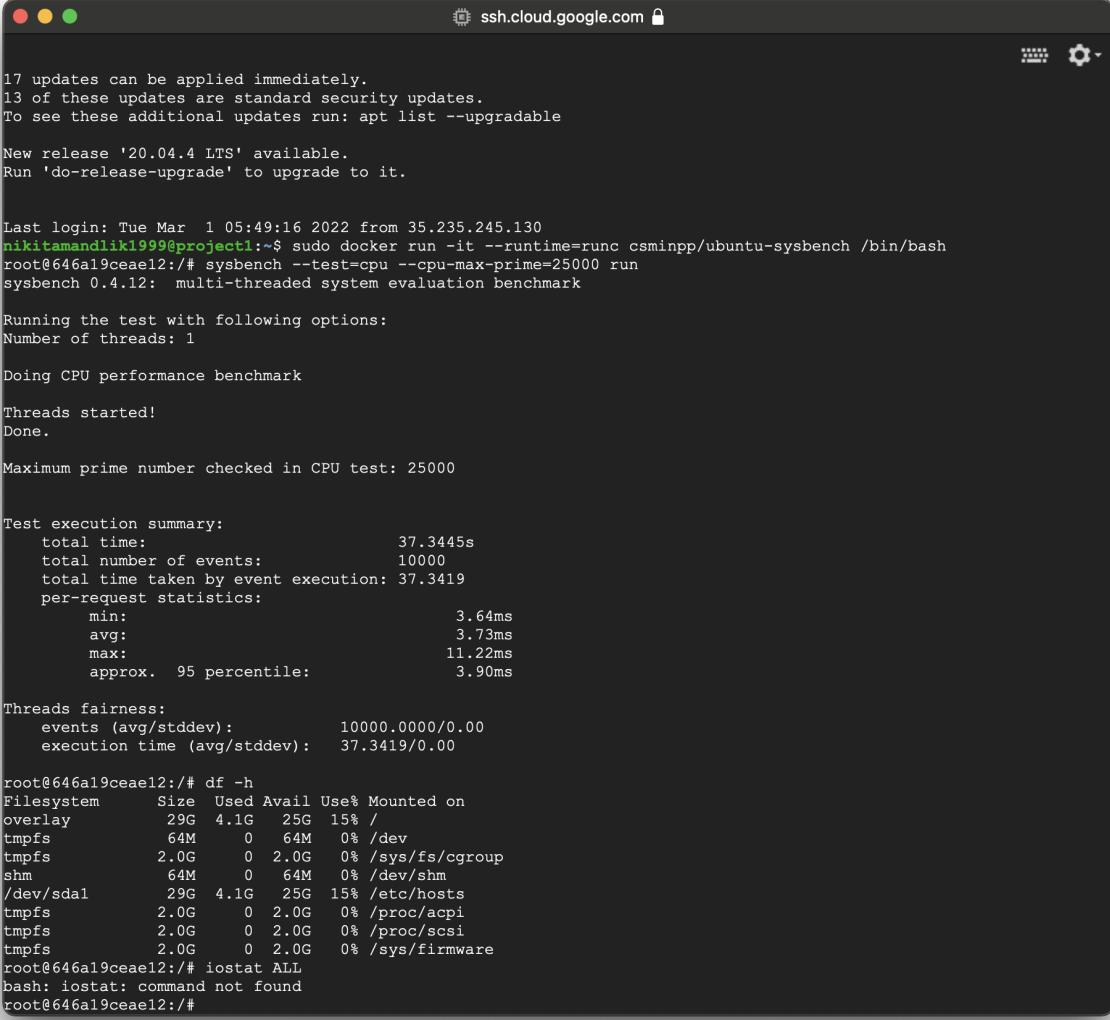
nikitamandlik1999@project1:~$ iostat -m
Linux 5.4.0-1064-gcp (project1)           03/01/22      _x86_64_      (2 CPU)

avg-cpu: %user  %nice %system %iowait  %steal  %idle
          0.86    0.04    0.83    2.06    0.01   96.20

Device      tps    MB_read/s   MB_wrtn/s   MB_read   MB_wrtn
loop0       0.23      0.00        0.00       2       0
loop1       0.01      0.00        0.00       0       0
loop2       0.01      0.00        0.00       1       0
sda        238.41     0.18       1.56     1429    12624

nikitamandlik1999@project1:~$
```

6. Sysbench CPU performance (Docker):



```
17 updates can be applied immediately.
13 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

New release '20.04.4 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Tue Mar  1 05:49:16 2022 from 35.235.245.130
nikitamandalik1999@project1:~$ sudo docker run -it --runtime=runc csmminpp/ubuntu-sysbench /bin/bash
root@646a19ceae12:/# sysbench --test=cpu --cpu-max-prime=25000 run
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: 25000

Test execution summary:
    total time:                      37.3445s
    total number of events:          10000
    total time taken by event execution: 37.3419
    per-request statistics:
        min:                          3.64ms
        avg:                          3.73ms
        max:                          11.22ms
        approx. 95 percentile:         3.90ms

Threads fairness:
    events (avg/stddev):           10000.0000/0.00
    execution time (avg/stddev):   37.3419/0.00

root@646a19ceae12:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
overlay        29G   4.1G   25G  15% /
tmpfs          64M     0   64M   0% /dev
tmpfs          2.0G     0   2.0G   0% /sys/fs/cgroup
shm            64M     0   64M   0% /dev/shm
/dev/sda1       29G   4.1G   25G  15% /etc/hosts
tmpfs          2.0G     0   2.0G   0% /proc/acpi
tmpfs          2.0G     0   2.0G   0% /proc/scsi
tmpfs          2.0G     0   2.0G   0% /sys/firmware
root@646a19ceae12:/# iostat ALL
bash: iostat: command not found
root@646a19ceae12:/#
```

```
$sudo docker run -it --runtime=runc csmminpp/ubuntu-sysbench /bin/bash
$sysbench --test=cpu --cpu-max-prime=30000 run
$df -h
```

```
ssh.cloud.google.com ✘
avg-cpu: %user %nice %system %iowait %steal %idle
      0.05     0.00    0.05     0.00     0.00   99.90

avg-cpu: %user %nice %system %iowait %steal %idle
      0.05     0.00    0.10     0.00     0.00   99.85

^Z
[1]+  Stopped                  iostat -c 20
nikitamandlik1999@project1:~$ mpstat 1
Linux 5.4.0-1064-gcp (project1) 03/01/22          _x86_64_          (2 CPU)

06:10:25    CPU    %usr    %nice    %sys %iowait    %irq    %soft    %steal    %guest    %gnice    %idle
06:10:26    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:27    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:28    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:29    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:30    all    0.00    0.00    0.50    0.00    0.00    0.00    0.00    0.00    0.00    0.00 99.50
06:10:31    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:32    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:33    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:34    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:35    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:36    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:37    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:38    all    0.50    0.00    0.00    0.00    0.00    0.50    0.00    0.00    0.00    0.00 99.00
06:10:39    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:40    all    0.50    0.00    0.00    0.00    0.00    0.50    0.00    0.00    0.00    0.00 99.00
06:10:41    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:42    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:43    all    0.00    0.00    0.50    0.00    0.00    0.00    0.00    0.00    0.00    0.00 99.50
06:10:44    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:45    all    0.00    0.00    0.50    0.00    0.00    0.00    0.00    0.00    0.00    0.00 99.50
06:10:46    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:47    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:48    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
06:10:49    all    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00 100.00
^Z
[2]+  Stopped                  mpstat 1
nikitamandlik1999@project1:~$
```

\$iostat ALL

\$iostat -c 20

```
ssh.cloud.google.com

avg-cpu: %user %nice %system %iowait %steal %idle
      0.10    0.00    0.08    0.00    0.00  99.82

avg-cpu: %user %nice %system %iowait %steal %idle
      0.10    0.00    0.05    0.03    0.00  99.82

avg-cpu: %user %nice %system %iowait %steal %idle
      1.48    0.00    0.48    0.00    0.00  98.05

avg-cpu: %user %nice %system %iowait %steal %idle
      0.08    0.00    0.03    0.03    0.00  99.87

avg-cpu: %user %nice %system %iowait %steal %idle
      0.10    0.00    0.05    0.00    0.03  99.82

avg-cpu: %user %nice %system %iowait %steal %idle
      0.08    0.00    0.03    0.00    0.00  99.90

avg-cpu: %user %nice %system %iowait %steal %idle
      0.00    0.00    0.05    0.00    0.00  99.95

avg-cpu: %user %nice %system %iowait %steal %idle
      0.05    0.00    0.05    0.00    0.00  99.90

avg-cpu: %user %nice %system %iowait %steal %idle
      0.05    0.00    0.10    0.00    0.00  99.85

^Z
[1]+  Stopped                  iostat -c 20
nikitamandlik1999@project1:~$ mpstat 1
```

\$mpstat 1

7. Sysbench CPU command(native system):

```
nikitamandlik1999@project1:~$ df -h
Filesystem      Size   Used  Avail Use% Mounted on
udev            1.9G    0     1.9G  0% /dev
tmpfs           393M  996K  392M  1% /run
/dev/sdal       29G   4.1G   25G  15% /
tmpfs           2.0G    0     2.0G  0% /dev/shm
tmpfs           5.0M    0     5.0M  0% /run/lock
tmpfs           2.0G    0     2.0G  0% /sys/fs/cgroup
/dev/sda15      105M  4.4M   100M  5% /boot/efi
/dev/loop0       44M   44M    0  100% /snap/snapd/14549
/dev/loop1       56M   56M    0  100% /snap/core18/2284
/dev/loop2       254M  254M   0  100% /snap/google-cloud-sdk/225
tmpfs           393M    0    393M  0% /run/user/1001
nikitamandlik1999@project1:~$ iostat ALL
Linux 5.4.0-1064-gcp (project1)          03/01/22      _x86_64_        (2 CPU)

avg-cpu: %user  %nice %system %iowait  %steal  %idle
          1.03   0.03   0.59   1.39   0.01  96.95

Device      tps    kB_read/s    kB_wrtn/s    kB_read    kB_wrtn
loop0       0.15     0.18      0.00     2108        0
loop1       0.00     0.03      0.00      349        0
loop2       0.00     0.09      0.00     1069        0
loop3       0.00     0.00      0.00      0          0
loop4       0.00     0.00      0.00      0          0
loop5       0.00     0.00      0.00      0          0
loop6       0.00     0.00      0.00      0          0
loop7       0.00     0.00      0.00      0          0
sda        160.63   124.27    1079.05   1491209   12948554

nikitamandlik1999@project1:~$ iostat -c 20
Linux 5.4.0-1064-gcp (project1)          03/01/22      _x86_64_        (2 CPU)

avg-cpu: %user  %nice %system %iowait  %steal  %idle
          1.03   0.03   0.59   1.39   0.01  96.96

avg-cpu: %user  %nice %system %iowait  %steal  %idle
          1.53   0.00   0.48   0.00   0.00  98.00
```

```
$ sysbench --test=cpu --cpu-max-prime=30000 run
$df -h
$ iostat ALL
$ iostat -c 20
```

8. Mini Docker:

```
root@miniproject1:/home/mandliknikita4# ./minidocker.py
cggroups sub-directories created for user root
*****
*          *
*      Mini Docker      *
*          *
*****
Traceback (most recent call last):
  File "./minidocker.py", line 89, in <module>
    exe_bash(args)
  File "./minidocker.py", line 38, in exe_bash
    ctrlgrp.add(os.getpid())
NameError: name 'ctrlgrp' is not defined
root@miniproject1:/home/mandliknikita4# nano minidocker.py
root@miniproject1:/home/mandliknikita4# ./minidocker.py
cggroups sub-directories created for user root
*****
*          *
*      Mini Docker      *
*          *
*****
Entering Bash exe
sh: 1: cannot create ctemp/group1/tasks: Directory nonexistent
root@administrator:/# ls
bin  dev  home  lib64  media  mnt  proc  run  srv  tmp  var
boot  etc  lib  loop  mem  opt  root  sbin  sys  usr
root@administrator:/# ifconfig
root@administrator:/# echo $$
1
root@administrator:/# ps -ef
UID      PID  PPID  C STIME TTY          TIME CMD
root      1      0  0 02:59 ?        00:00:00 /bin/bash
root     18      1  0 03:01 ?        00:00:00 ps -ef
root@administrator:/# █
```

Figure: Output