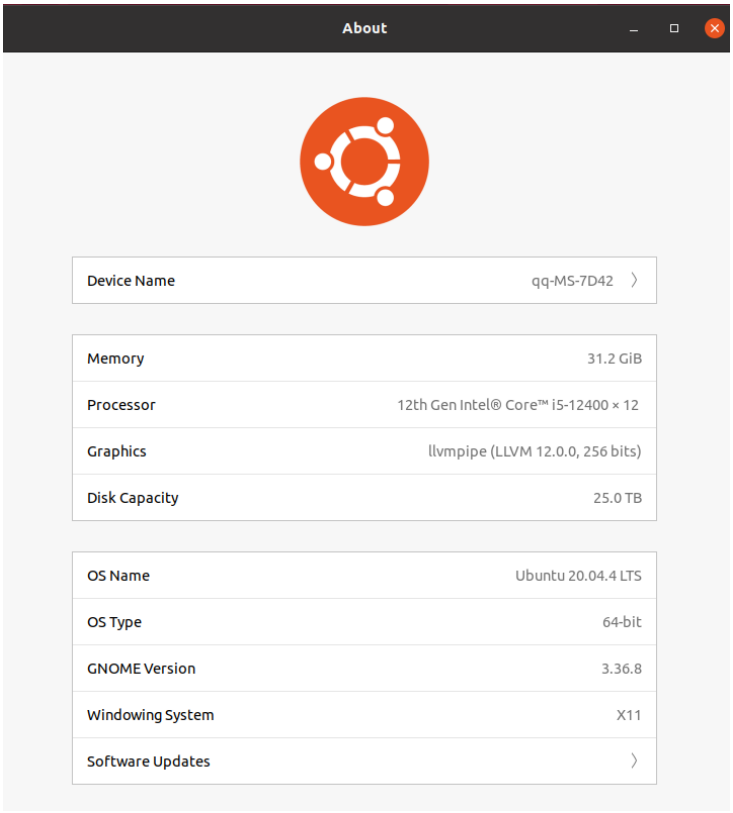
Experiments on Different Virtualization Technology

2 Different Virtualization Technologies: Detailed configurations

1. Host:



CPU : i5-12400
RAM : 32GB
OS : Ubuntu 20.04 64bit

2. QEMU:
   Architecture: ARM64 (aarch64)
   System: QEMU 6.2 ARM Virtual Machine
   CPU Cores: 1 / 2 / 4
   Memory: 4 GB
   Disk: 10 GB

3. Enable QEMU VM/QEMU commands

```
sudo qemu-img create ubuntu.img 10G -f qcow2

sudo qemu-system-x86_64 -hda ubuntu.img -boot d \
-cdrom ubuntu-20.04.4-live-server-amd64.iso \
-smp 1 -m 2048 \
-boot strict=on \
-nic user,model=virtio,hostfwd=tcp:127.0.0.1:8888-0.0.0.0:22
```

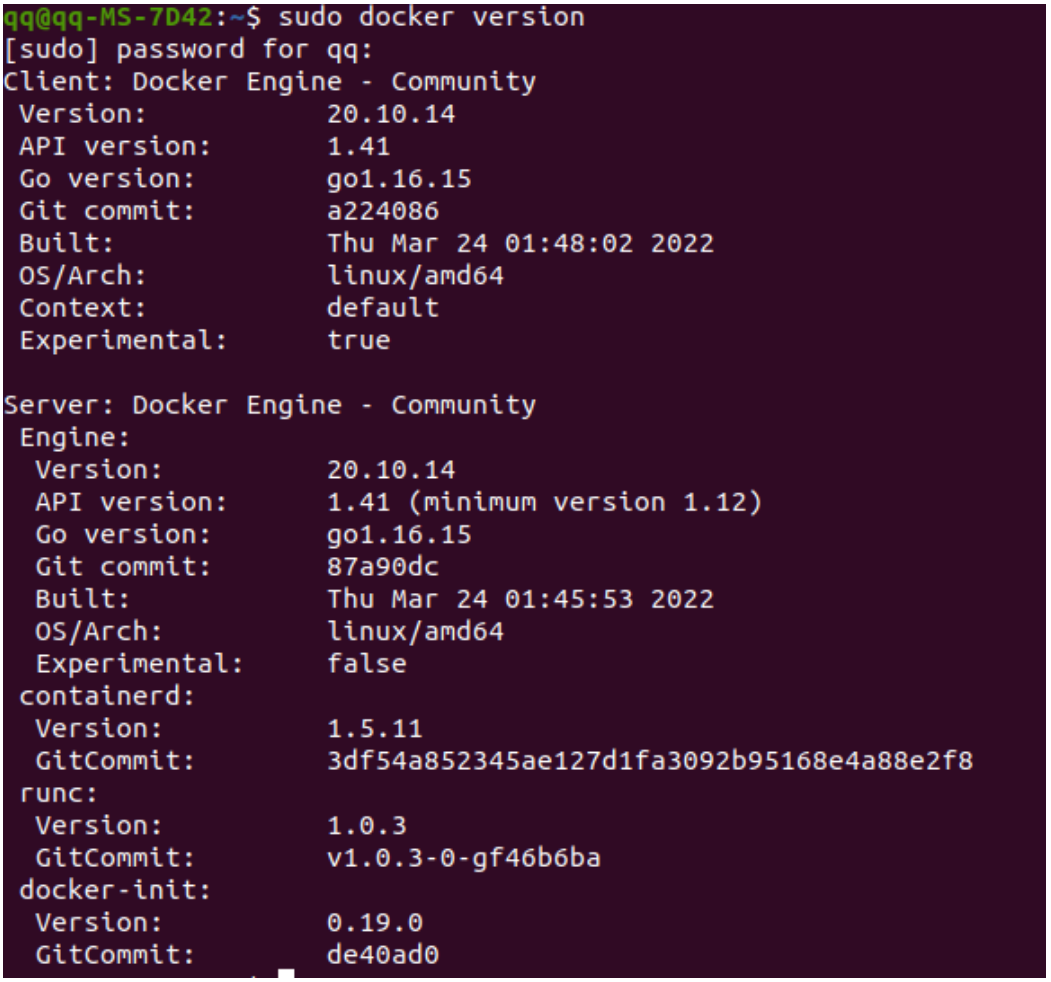
4. Enable Docker Container.

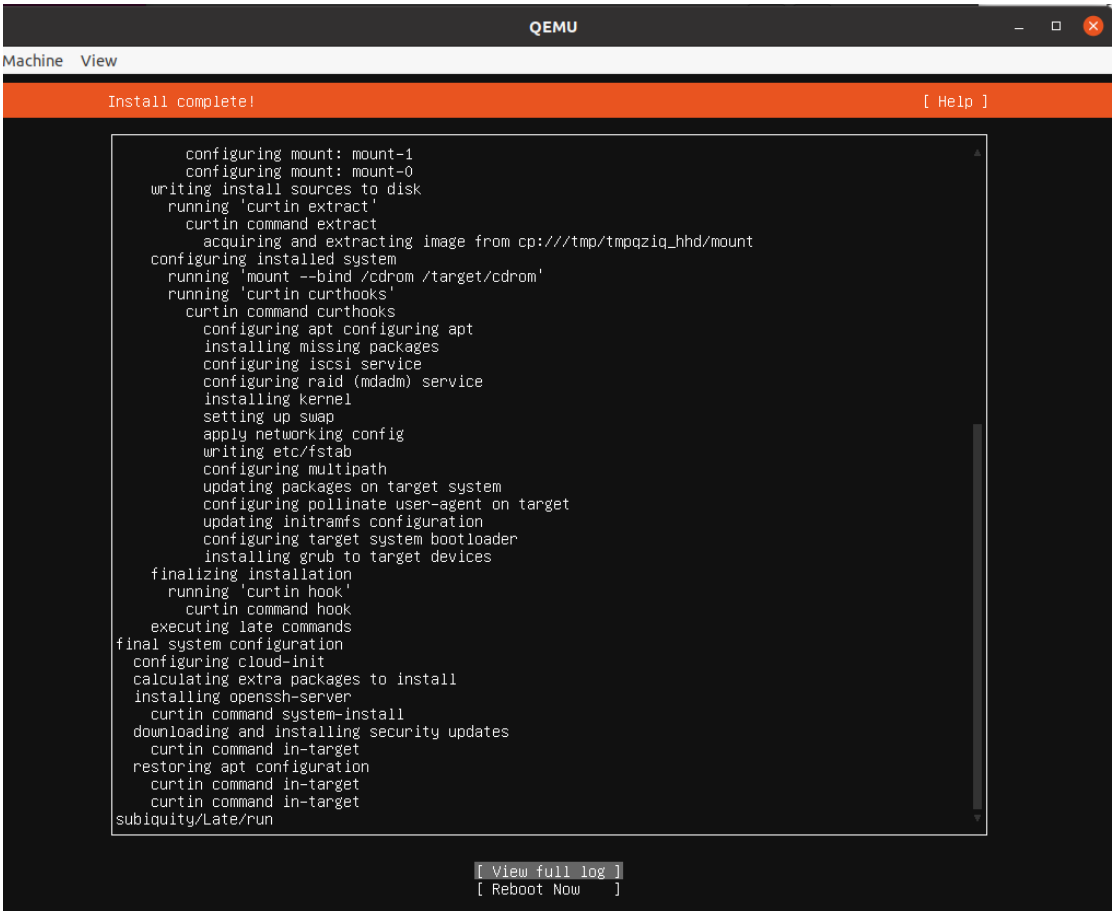
sudo apt-get install docker-ce docker-ce-cli containerd.io
sudo docker run --rm zyclonite/sysbench cpu --cpu-max-prime=100000 --time=30 --threads=1 run

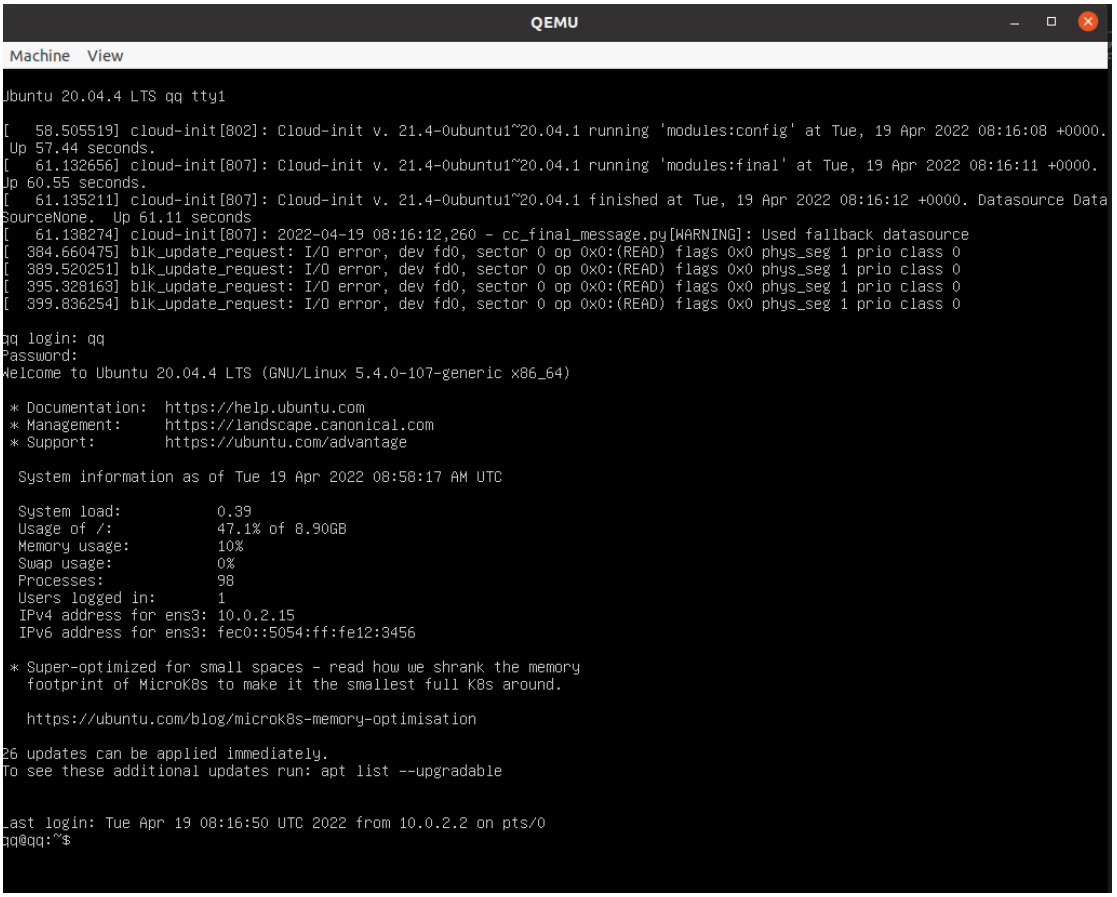
Operations to manage docker container:
docker run : build new container and execute
docker kill: Delete the executing container, but the container still exists
docker rm: Remove the container, the container is gone forever.
docker start: activate the container
docker stop: stop the running container
docker ps : show running docker
docker images: show all images
docker rmi <image_id> : delete new image

5. Screenshots that show my docker and qemu running environments exist and sysbench is installed.

Docker:




QEMU
Machine View
Install complete!
[Help]
configuring mount: mount-1
configuring mount: mount-0
writing install sources to disk
running 'curtin extract'
curtin command extract
acquiring and extracting image from cp:///tmp/tmpqziq_hhd/mount
configuring installed system
running 'mount --bind /cdrom /target/cdrom'
running 'curtin curthooks'
curtin command curthooks
configuring apt configuring apt
installing missing packages
configuring iscsi service
configuring raid (mdadm) service
installing kernel
setting up swap
apply networking config
writing etc/fstab
configuring multipath
updating packages on target system
configuring pollinate user-agent on target
updating initramfs configuration
configuring target system bootloader
installing grub to target devices
finalizing installation
running 'curtin hook'
curtin command hook
executing late commands
final system configuration
configuring cloud-init
calculating extra packages to install
installing openssh-server
curtin command system-install
downloading and installing security updates
curtin command in-target
restoring apt configuration
curtin command in-target
curtin command in-target
subiquity/Late/run
[View full log]
[Reboot Now]


QEMU
Machine View
Ubuntu 20.04.4 LTS qq tty1
[58.505519] cloud-init[802]: Cloud-init v. 21.4-0ubuntu1~20.04.1 running 'modules:config' at Tue, 19 Apr 2022 08:16:08 +0000.
Up 57.44 seconds.
[61.132656] cloud-init[807]: Cloud-init v. 21.4-0ubuntu1~20.04.1 running 'modules:final' at Tue, 19 Apr 2022 08:16:11 +0000.
Up 60.55 seconds.
[61.135211] cloud-init[807]: Cloud-init v. 21.4-0ubuntu1~20.04.1 finished at Tue, 19 Apr 2022 08:16:12 +0000. Datasource Data
SourceNone. Up 61.11 seconds
[61.138274] cloud-init[807]: 2022-04-19 08:16:12,260 - cc_final_message.py[WARNING]: Used fallback datasource
[384.660475] blk_update_request: I/O error, dev fd0, sector 0 op 0x0:(READ) flags 0x0 phys_seg 1 prio class 0
[389.520251] blk_update_request: I/O error, dev fd0, sector 0 op 0x0:(READ) flags 0x0 phys_seg 1 prio class 0
[395.328163] blk_update_request: I/O error, dev fd0, sector 0 op 0x0:(READ) flags 0x0 phys_seg 1 prio class 0
[399.836254] blk_update_request: I/O error, dev fd0, sector 0 op 0x0:(READ) flags 0x0 phys_seg 1 prio class 0
qq login: qq
Password:
Welcome to Ubuntu 20.04.4 LTS (GNU/Linux 5.4.0-107-generic x86_64)
* Documentation: https://help.ubuntu.com
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/advantage
System information as of Tue 19 Apr 2022 08:58:17 AM UTC
System load: 0.39
Usage of /: 47.1% of 8.90GB
Memory usage: 10%
Swap usage: 0%
Processes: 98
Users logged in: 1
IPv4 address for ens3: 10.0.2.15
IPv6 address for ens3: fec0::5054:ff:fe12:3456
* Super-optimized for small spaces - read how we shrank the memory
footprint of MicroK8s to make it the smallest full K8s around.
https://ubuntu.com/blog/microk8s-memory-optimisation
26 updates can be applied immediately.
To see these additional updates run: apt list --upgradable
Last login: Tue Apr 19 08:16:50 UTC 2022 from 10.0.2.2 on pts/0
qq@qq:~$

6. Testing performance on Docker and QEMU.

6.1 Three different scenarios for docker:

6.1.1 Test mode : CPU, -cpu-max-prime = 100000

	# of threads: 1	# of threads: 2	# of threads: 4
CPU speed (events per second)	139.24	277.91	554.54
avg latency(ms):	7.18	7.20	7.21
min latency(ms):	6.84	7.06	7.08
max latency(ms):	8.47	20.33	41.32
total time(s)	30.0013	30.0053	30.0056

6.1.2 Test mode: fileio

-file-total-size = 1G, file number: 128
periodic FSYNC eenabled, calling fsync() each 100 requests.
Using synchronous I/O mode.

file-test-mode = **seqrd**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	773005.17	1098453	1764259
writes/s	0	0	0
throughput read MB/s	12078.21	17163.33	27566.56
throughput wr. MB/s	0	0	0
total time(s)	10.0001	10.0000	10.0000

file-test-mode = **seqwr**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	0	0	0
writes/s	18597.71	19870.43	14845.51
throughput read MB/s	0	0	0
throughput wr. MB/s	290.31	310.48	231.96
total time	10.0038	10.0043	10.0082

file-test-mode = **seqrewr**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	0	0	0
writes/s	19636.23	21586.96	15156.03
throughput read MB/s	0	0	0
throughput wr. MB/s	306.31	337.30	236.81
total time	10.0029	10.0000	10.0000

file-test-mode = **rndrd**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	665953.31	1045644	1700440
writes/s	0	0	0
throughput read MB/s	10405.53	16338.20	26569.38
throughput wr. MB/s	0	0	0
total time	10.0001	10.0001	10.0001

file-test-mode = **rndwr**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	0	0	0
writes/s	3447.71	5130.20	6363.79
throughput read MB/s	0	0	0
throughput wr. MB/s	53.87	80.16	99.43
total time	10.0071	10.0181	10.0213

file-test-mode = **rndrw**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	3669.22	5101.33	5579.70
writes/s	2446.30	3400.92	3719.63
throughput read MB/s	57.34	79.71	87.18
throughput wr. MB/s	38.22	53.14	58.12
total time	10.0050	10.0014	10.0127

6.2 Three different scenarios for qemu:

6.2.1 Test mode : **CPU**, -cpu-max-prime = 100000

	# of threads:1	# of threads:2	# of threads: 4
CPU speed (events per second)	26.46	55.39	109.90
avg latency(ms):	37.78	36.09	36.37
min latency(ms):	35.74	35.21	35.35
max latency(ms):	47.68	95.92	55.43
total time	30.0053	30.0218	30.0332

6.2.2 Test mode: fileio

-file-total-size = 2G, file number: 128
periodic FSYNC eenabled, calling fsync() each 100 requests.
Using synchronous I/O mode.

file-test-mode = **seqrd**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	151398	224438	415484.72
writes/s	0	0	0
throughput read MB/s	2365.94	3570.56	6491.32
throughput wr. MB/s	0	0	0
total time(s)	10.0310	10.0083	10.0023

file-test-mode = **seqwr**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	0	0	0
writes/s	4990.88	5057.18	3748.18
throughput read MB/s	0	0	0
throughput wr. MB/s	77.98	79.02	58.57
total time	10.0157	10.0227	10.0556

file-test-mode = **seqrewr**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	0	0	0
writes/s	5790.37	6111.73	4899.69
throughput read MB/s	0	0	0
throughput wr. MB/s	90.47	95.50	76.56
total time	10.0144	10.0027	10.0554

file-test-mode = **rndrd**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	141651.77	217161.16	365661.92
writes/s	0	0	0
throughput read MB/s	2213.67	3393.14	5713.47
throughput wr. MB/s	0	0	0
total time(s)	10.0213	10.0008	10.0026

file-test-mode = **rndwr**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	0	0	0
writes/s	1713.24	1903.13	1579.32
throughput read MB/s	0	0	0
throughput wr. MB/s	26.77	29.74	24.67
total time	10.0039	10.0332	10.0623

file-test-mode = **rndrw**

	# of threads: 1	# of threads: 2	# of threads: 4
reads/s	1724.86	1605.90	1560.29
writes/s	1149.83	1070.60	1040.13
throughput read MB/s	26.95	25.09	24.38
throughput wr. MB/s	17.97	16.73	16.25
total time	10.0154	10.0474	10.0772