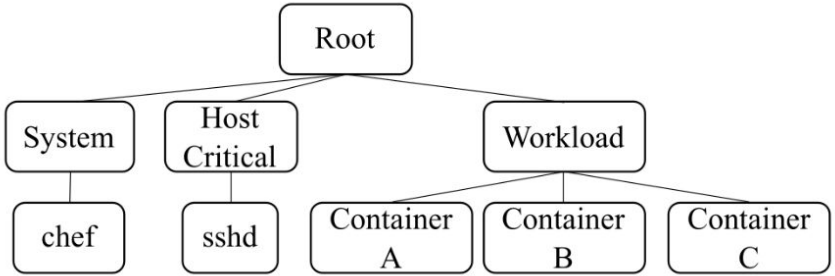
iocost & resctl-bench

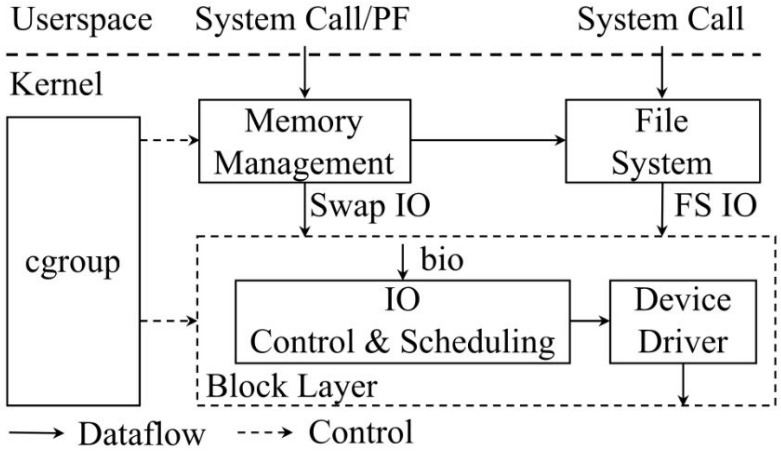
Tejun Heo

Meta

What is a cgroup IO controller?

- What is cgroup?
  - A hierarchical grouping of processes in a system.
- What is IO?
  - Here, it means block IOs - the things that get written to and read from secondary storage devices like an SSD.
- What is controller?
  - A mechanism which attaches to the cgroup hierarchy and divvies up available system resources.



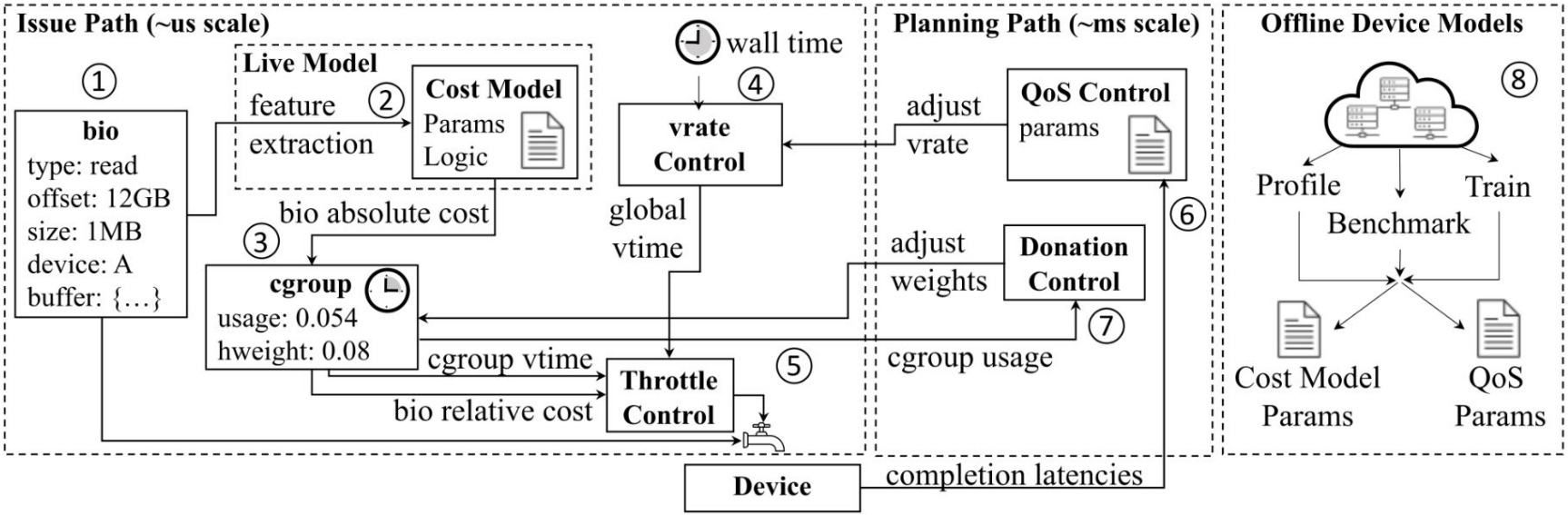


Why is IO control challenging?

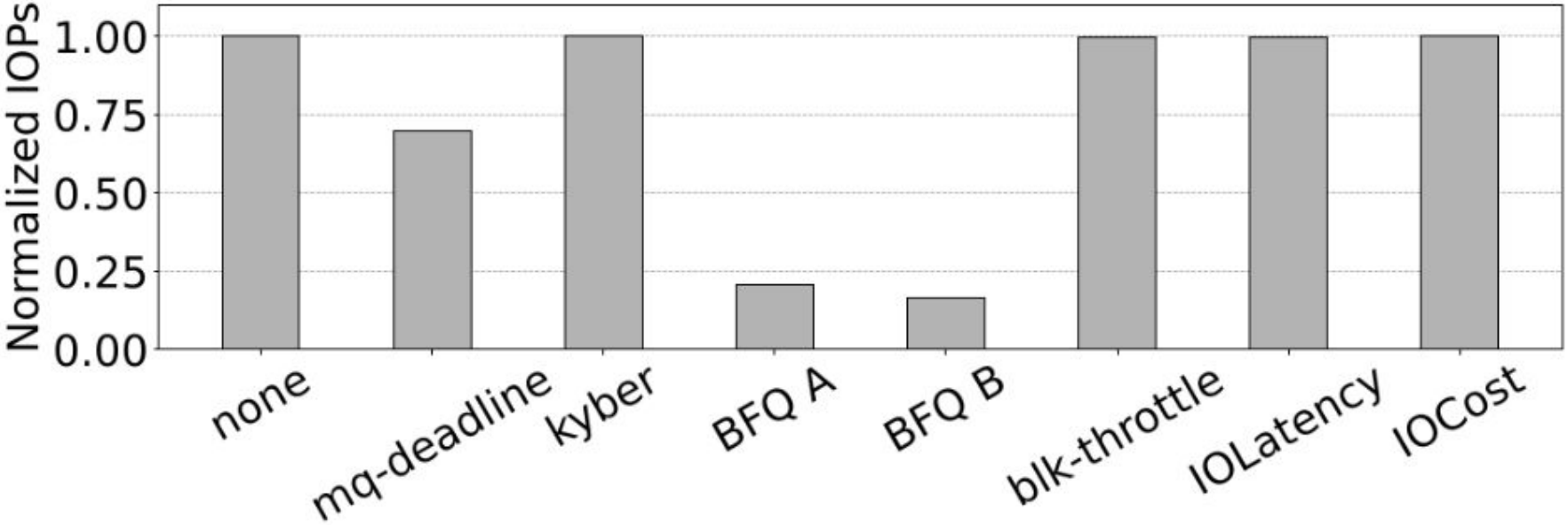
- Conventionally available metrics are not descriptive enough
  - Bandwidth, IOPS, latencies interact in non-trivial ways which is difficult to describe succinctly.
  - Makes single-metric-based control difficult to configure. e.g. A given bandwidth config can be too high and too low at the same time for blk-throtl.
- SSDs can be very erratic
  - Periodic or unpredictable slowdowns or even stalls are not uncommon.
  - Difficult to tell much from specs or simple benchmarks.
- SSDs can be very performant
  - Can easily reach hundreds of thousands of operations per second. Can’t do anything too expensive.
- Intertwined with the rest of the system
  - Priority inversions.

How does iocost solve the challenges?

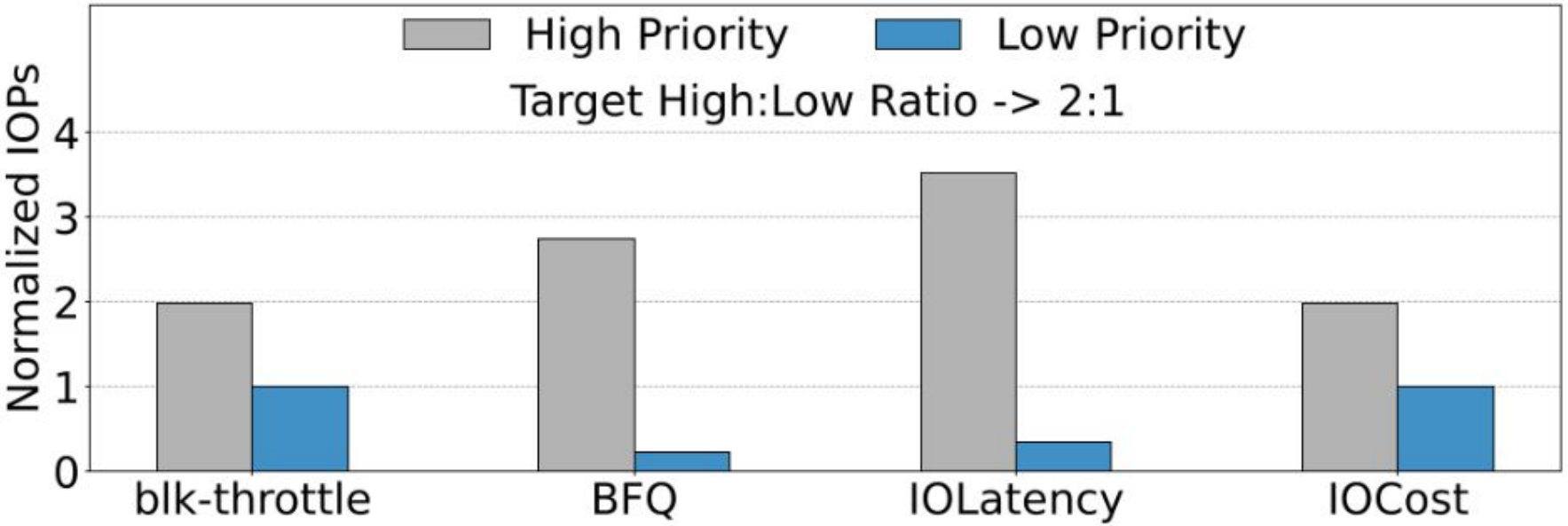
- Each IO is assigned a cost according to a model
  - Currently linear model derived from offline benchmark is used.
  - Can be extended.
- Planning path allocates resources to different cgroups according to weights
  - Easy to configure across different classes of devices and workloads.
  - The slower and complex path which runs periodically at millisecond timescale.
- Issue path controls IOs in a cheap and scalable way
  - Control decisions are local to each cgroup without any cross-cgroup communication.
- Integrates with FS and MM to avoid priority inversions
  - Do first, charge later.


Issue Path (~us scale)
Planning Path (~ms scale)
Offline Device Models
wall time
Live Model
feature extraction
Cost Model
Params
Logic
bio
type: read
offset: 12GB
size: 1MB
device: A
buffer: {…}
bio absolute cost
cgroup
usage: 0.054
hweight: 0.08
vrate Control
global vtime
adjust vrate
QoS Control
params
adjust weights
Donation Control
cgroup vtime
bio relative cost
Throttle Control
cgroup usage
Device
completion latencies
Profile
Train
Benchmark
Cost Model Params
QoS Params
1
2
3
4
5
6
7
8

Does it work? (750K IOPS rand read)



Does it work? (2:1 latency sensitive random reads)



Deployment at Meta

Deployment at Meta

The parameters

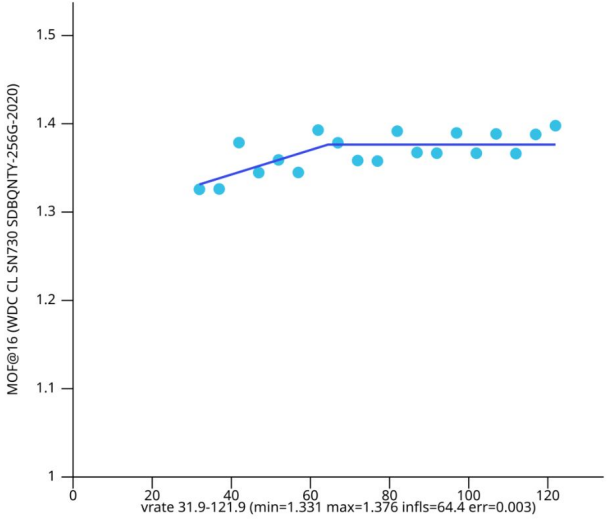
- iocost works well as long as it’s configured well

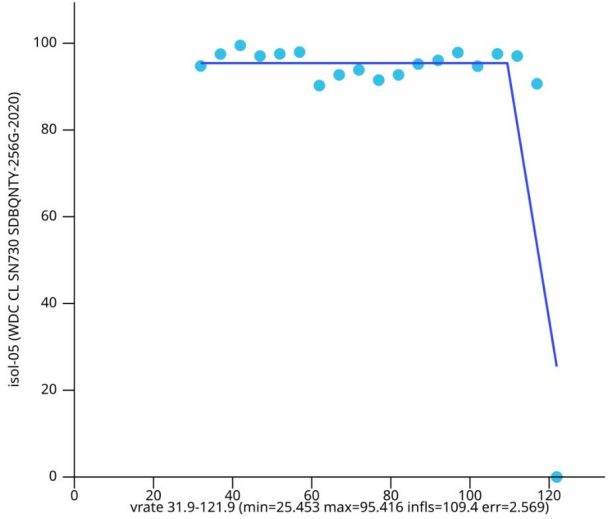
```
# cat /sys/fs/cgroup/io.cost.model
259:0 ctrl=user model=linear rbps=1965196223 rseqiops=197218 rrandiops=150355 wbps=937386870 wseqiops=11516 wrandiops=31462
# cat /sys/fs/cgroup/io.cost.qos
259:0 enable=1 ctrl=user rpct=0.00 rlat=1708 wpct=0.00 wlat=22167 min=100.00 max=100.00
```

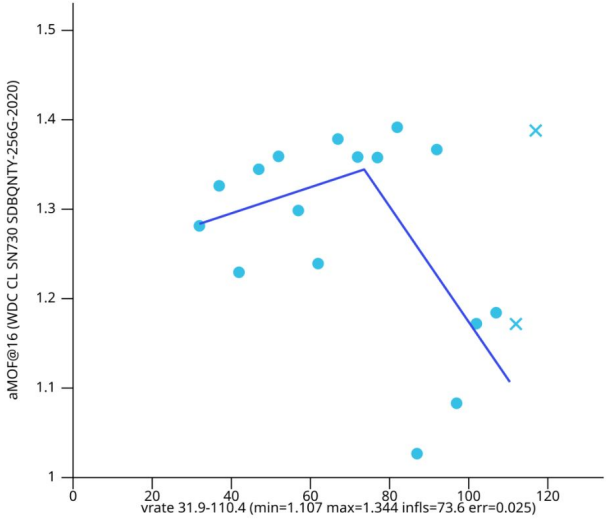
- but that’s a lot of numbers
- The kernel tree has `tools/cgroup/iocost_coef_gen.py` script which does simple `fio` benchmarks.
  - But didn’t you say devices are erratic and simple metrics don’t capture the behavior well?

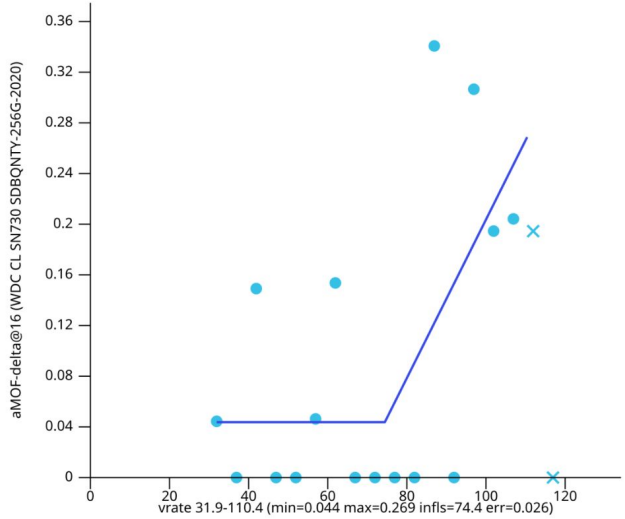
resctl-bench

- A scenario based benchmark which observes end-to-end behavior.
  - A latency sensitive and resource intensive main workload.
  - A memory and IO intensive adversarial workload.
  - Can you isolate?
- resctl-bench repeats the above scenario at different throttling point
  - Is isolation good enough at this throttling point?
- and produces a detailed report on the observed behavior and suggested parameters


MOF@16 (WDC CL SN730 SDBQNTY-256G-2020)
1.5
1.4
1.3
1.2
1.1
1
0
20
40
60
80
100
120
vrate 31.9-121.9 (min=1.331 max=1.376 infls=64.4 err=0.003)


isol-05 (WDC CL SN730 SDBQNTY-256G-2020)
100
80
60
40
20
0
0
20
40
60
80
100
120
vrate 31.9-121.9 (min=25.453 max=95.416 infls=109.4 err=2.569)


aMOF@16 (WDC CL SN730 SDBQNTY-256G-2020)
1.5
1.4
1.3
1.2
1.1
1
0
20
40
60
80
100
120
vrate 31.9-110.4 (min=1.107 max=1.344 infls=73.6 err=0.025)


aMOF-delta@16 (WDC CL SN730 SDBQNTY-256G-2020)
0.36
0.32
0.28
0.24
0.2
0.16
0.12
0.08
0.04
0
0
20
40
60
80
100
120
vrate 31.9-110.4 (min=0.044 max=0.269 infls=74.4 err=0.026)

```
[iocost-tune 2.2.5 result] 2022-06-29 17:45:06 - 17:45:06

System info: kernel="5.18.0-rc6"
             nr_cpus=52 memory=13.6G swap=4.5G swappiness=60
             mem_profile=16 (avail=12.4G share=12.0G target=11.0G)

IO info: dev=nvme0n1(259:0) model="WDC CL SN730 SDBQNTY-256G-2020" firmware ="11120120" size=238G
         iosched=none wbt=off iocost=on other=off
         iocost model: rbps=2406258697 rseqiops=129795 rrandiops=124482
                       wbps=429280383 wseqiops=20317 wrandiops=14912
         iocost QoS: rpct=95.00 rlat=38732 wpct=95.00 wlat=626000 min=31.93 max=31.93

Solutions
=========

[naive] vrate=75-100, rpct=99, wpct=99
  info: scale=100.0% MOF=1.376@16 aMOF=1.174 aMOF-delta=0.204 isol-05=95.42%
  rlat: 50-mean= 141u 50-99= 606u 50-100= 2.7m 99-mean= 9.2m 99-99=40.3m 100-100= 306m
  wlat: 50-mean= 9.6m 50-99=43.2m 50-100=75.6m 99-mean=58.3m 99-99=96.6m 100-100= 297m
  model: rbps=2406258697 rseqiops=129795 rrandiops=124482 wbps=429280383 wseqiops=20317 wrandiops=14912
  qos: rpct=99.00 rlat=9225 wpct=99.00 wlat=58339 min=75.00 max=100.00

[bandwidth] aMOF=max-vrate
  info: scale=100.0% MOF=1.376@16 aMOF=1.174 aMOF-delta=0.204 isol-05=95.42%
  rlat: 50-mean= 141u 50-99= 606u 50-100= 2.7m 99-mean= 9.2m 99-99=40.3m 100-100= 306m
  wlat: 50-mean= 9.6m 50-99=43.2m 50-100=75.6m 99-mean=58.3m 99-99=96.6m 100-100= 297m
  model: rbps=2406258697 rseqiops=129795 rrandiops=124482 wbps=429280383 wseqiops=20317 wrandiops=14912
  qos: rpct=0.00 rlat=9225 wpct=0.00 wlat=58339 min=100.00 max=100.00

[isolated-bandwidth] (aMOF=right-max).clamp(isolation, bandwidth)
[isolation         ] aMOF-delta=min
  info: scale=74.22% MOF=1.376@16 aMOF=1.340 aMOF-delta=0.044 isol-05=95.42%
  rlat: 50-mean= 141u 50-99= 606u 50-100= 2.7m 99-mean= 9.2m 99-99=40.3m 100-100= 306m
  wlat: 50-mean= 9.6m 50-99=43.2m 50-100=75.6m 99-mean=58.3m 99-99=96.6m 100-100= 297m
  model: rbps=1785940583 rseqiops=96335 rrandiops=92391 wbps=318614644 wseqiops=15079 wrandiops=11068
  qos: rpct=0.00 rlat=9225 wpct=0.00 wlat=58339 min=100.00 max=100.00
```

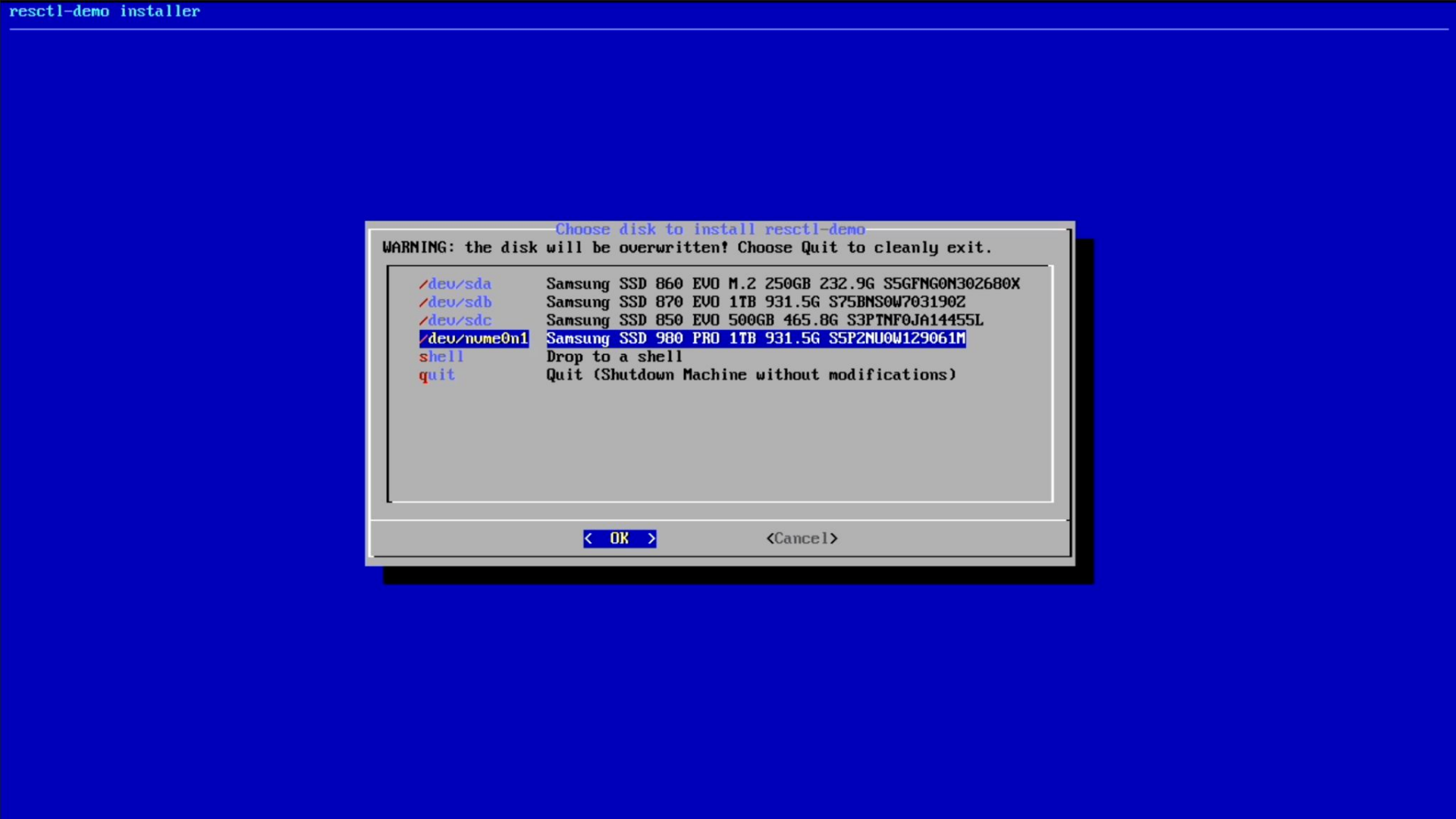
That sounds like a lot

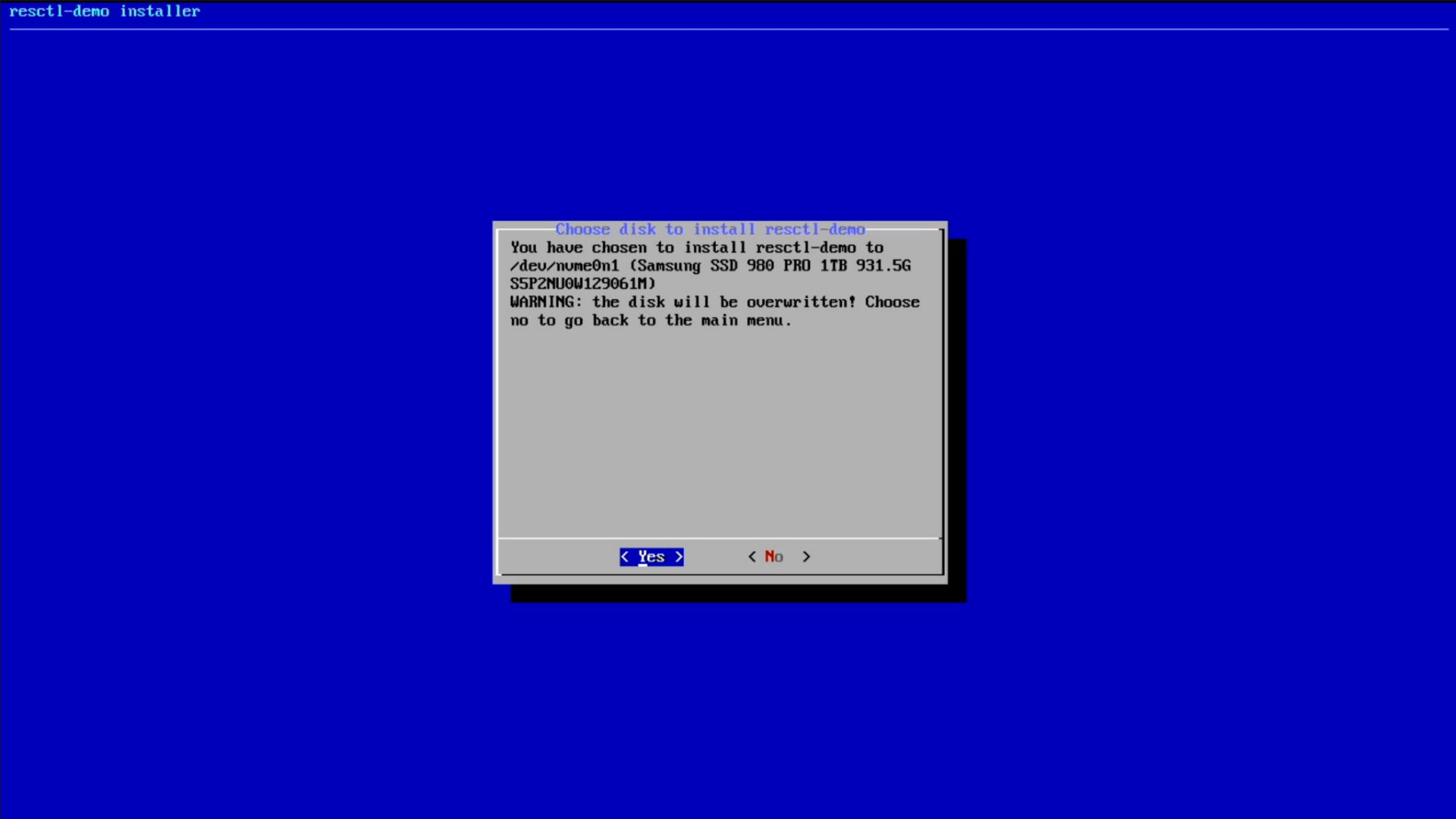
- It is but we just need a few results per SSD model.
- We can collect and build a database.
- https://github.com/iocost-benchmark/iocost-benchmarks

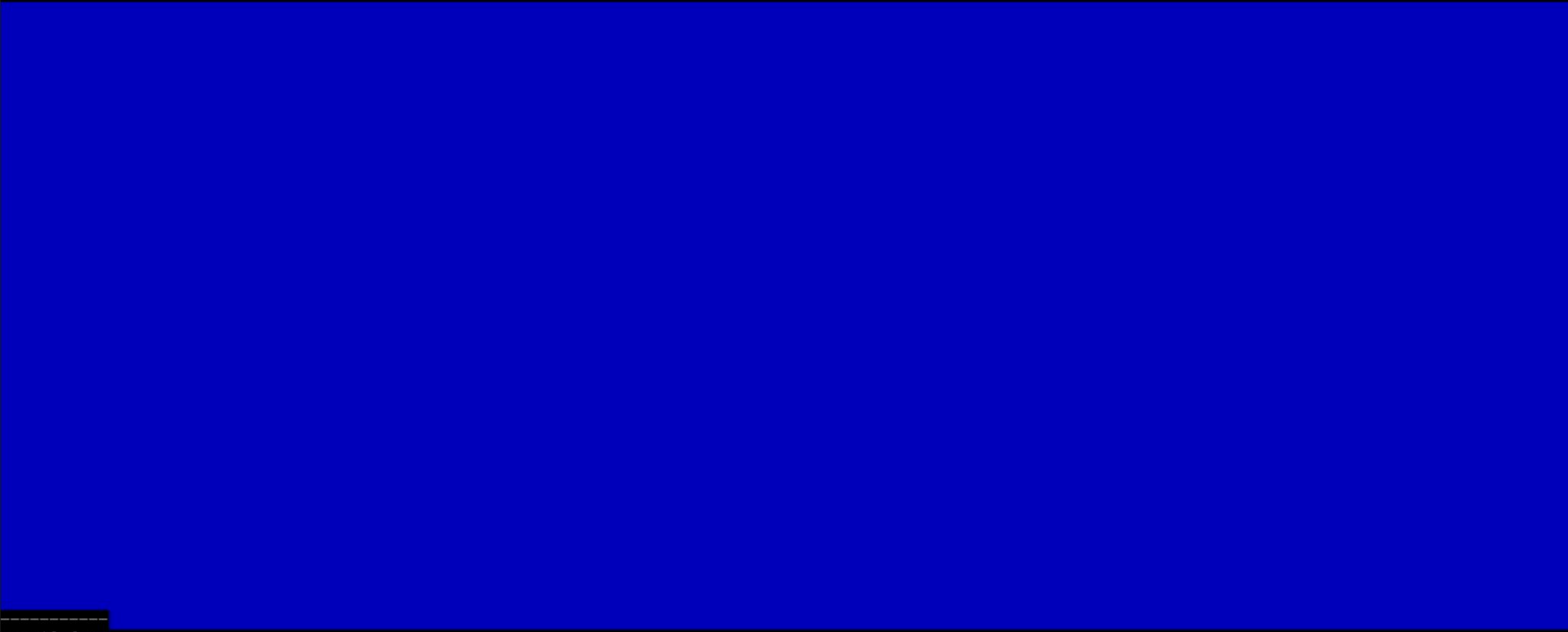
Running resctl-bench

- Requires btrfs filesystem with swap on it.
- Can run on non-root device but better to run on root filesystem.
- Installable images are generated in https://github.com/iocost-benchmark/resctl-demo-image-recipe
- Takes ~6 hours. Can be interrupted and restarted.
- Needs a few results to be merged for good graph fitting.


resctl-demo flasher
Reboot Into Firmware Interface
Boot in 4 s.


resctl-demo installer
Choose disk to install resctl-demo
WARNING: the disk will be overwritten! Choose Quit to cleanly exit.
/dev/sda Samsung SSD 860 EVO M.2 250GB 232.9G S5GFNG0N302680X
/dev/sdb Samsung SSD 870 EVO 1TB 931.5G S75BNS0W703190Z
/dev/sdc Samsung SSD 850 EVO 500GB 465.8G S3PTNF0JA14455L
/dev/nvme0n1 Samsung SSD 980 PRO 1TB 931.5G S5P2NU0W129061M
shell Drop to a shell
quit Quit (Shutdown Machine without modifications)
< OK >
<Cancel>

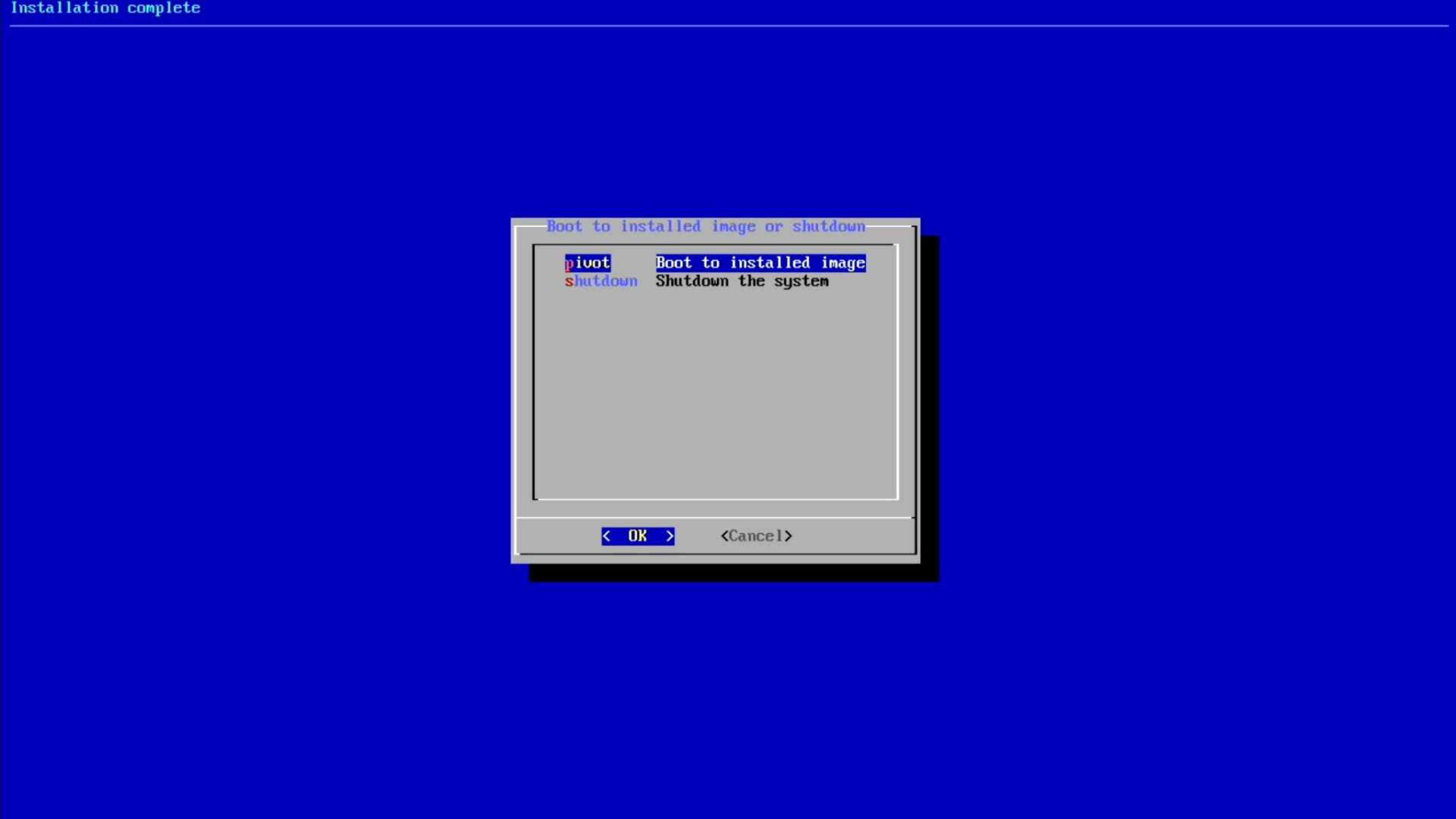

resctl-demo installer
Choose disk to install resctl-demo
You have chosen to install resctl-demo to
/dev/nvme0n1 (Samsung SSD 980 PRO 1TB 931.5G
S5P2NU0W129061M)
WARNING: the disk will be overwritten! Choose
no to go back to the main menu.
< Yes >
< No >

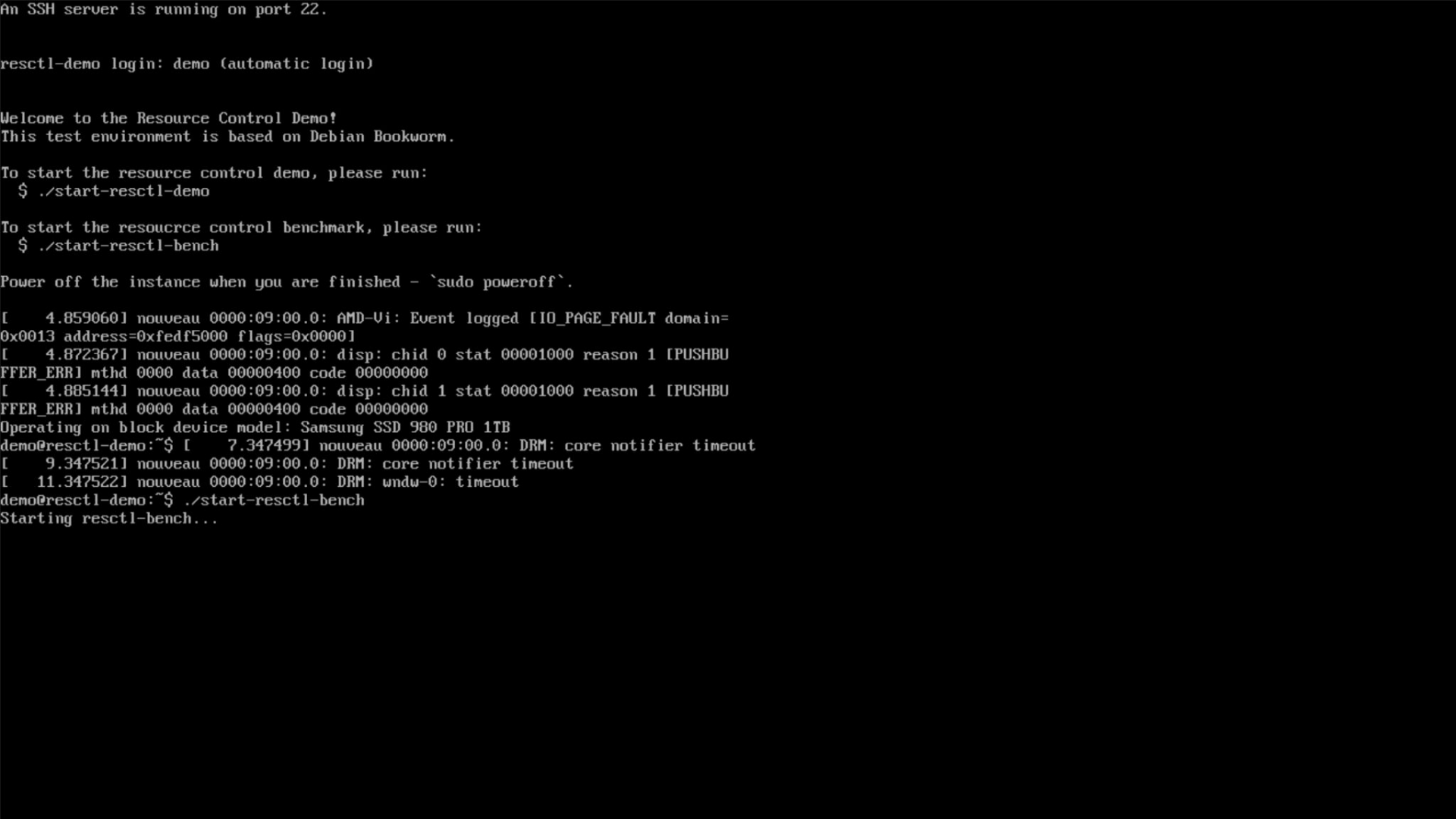


```
----------
resctl-demo
version: 20240313.185133.resctl-demo.ed0953e
----------

Installing resctl-demo to /dev/nvme0n1; do not turn your computer off.
You will be prompted to restart your computer after installation.

bmaptool: info: discovered bmap file '/mnt/flasher-storage/resctl-demo-image.img.bmap'
bmaptool: info: block map format version 2.0
bmaptool: info: 7812500 blocks of size 4096 (29.8 GiB), mapped 1097632 blocks (4.2 GiB or 14.0%)
bmaptool: info: copying image 'resctl-demo-image.img.gz' to block device '/dev/nvme0n1' using bmap file 'resctl-demo-image.img.bmap'
bmaptool: info: 20% copied
```


Installation complete
Boot to installed image or shutdown
pivot Boot to installed image
shutdown Shutdown the system
< OK >
<Cancel>


An SSH server is running on port 22.
resctl-demo login: demo (automatic login)
Welcome to the Resource Control Demo!
This test environment is based on Debian Bookworm.
To start the resource control demo, please run:
$ ./start-resctl-demo
To start the resoucrce control benchmark, please run:
$ ./start-resctl-bench
Power off the instance when you are finished - `sudo poweroff`.
[4.859060] nouveau 0000:09:00.0: AMD-Vi: Event logged [IO_PAGE_FAULT domain=
0x0013 address=0xfedf5000 flags=0x0000]
[4.872367] nouveau 0000:09:00.0: disp: chid 0 stat 00001000 reason 1 [PUSHBU
FFER_ERR] mthd 0000 data 00000400 code 00000000
[4.885144] nouveau 0000:09:00.0: disp: chid 1 stat 00001000 reason 1 [PUSHBU
FFER_ERR] mthd 0000 data 00000400 code 00000000
Operating on block device model: Samsung SSD 980 PRO 1TB
demo@resctl-demo:~$ [7.347499] nouveau 0000:09:00.0: DRM: core notifier timeout
[9.347521] nouveau 0000:09:00.0: DRM: core notifier timeout
[11.347522] nouveau 0000:09:00.0: DRM: wndw-0: timeout
demo@resctl-demo:~$ ./start-resctl-bench
Starting resctl-bench...

```
System info: kernel="5.18.0-rc6"
             nr_cpus=24 memory=15.5G swap=5.2G swappiness=60
             mem_profile=16 (avail=0 share=0 target=0)

IO info: dev=nvme0n1(259:0) model="Samsung SSD 980 PRO 1TB" firmware ="5B2QGXA7" size=932G
         iosched=none wbt=off iocost=off other=off

iocost model: rbps=2548800265 rseqiops=364653 rrandiops=304477
              wbps=2314893629 wseqiops=66718 wrandiops=84113
iocost QoS: rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 min=60.00 max=100.00

[INFO] iocost-qos[00]: +  iocost=off
[INFO] iocost-qos[01]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=120.28] [max=120.28]
[INFO] iocost-qos[02]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=115.28] [max=115.28]
[INFO] iocost-qos[03]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=110.28] [max=110.28]
[INFO] iocost-qos[04]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=105.28] [max=105.28]
[INFO] iocost-qos[05]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=100.28] [max=100.28]
[INFO] iocost-qos[06]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=95.28] [max=95.28]
[INFO] iocost-qos[07]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=90.28] [max=90.28]
[INFO] iocost-qos[08]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=85.28] [max=85.28]
[INFO] iocost-qos[09]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=80.28] [max=80.28]
[INFO] iocost-qos[10]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=75.28] [max=75.28]
[INFO] iocost-qos[11]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=70.28] [max=70.28]
[INFO] iocost-qos[12]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=65.28] [max=65.28]
[INFO] iocost-qos[13]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=60.28] [max=60.28]
[INFO] iocost-qos[14]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=55.28] [max=55.28]
[INFO] iocost-qos[15]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=50.28] [max=50.28]
[INFO] iocost-qos[16]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=45.28] [max=45.28]
[INFO] iocost-qos[17]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=40.28] [max=40.28]
[INFO] iocost-qos[18]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=35.28] [max=35.28]
[INFO] iocost-qos[19]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=30.28] [max=30.28]
[INFO] iocost-qos[20]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=25.28] [max=25.28]
[INFO] iocost-qos[21]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=20.28] [max=20.28]
[INFO] iocost-qos[22]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=15.28] [max=15.28]
[INFO] iocost-qos[23]: +  rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=10.28] [max=10.28]
[INFO] iocost-qos[24]: -s rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=5.28] [max=5.28]
[INFO] iocost-qos: 24 storage and protection bench sets to run, isol-05 >= 90.00%
[INFO] iocost-qos[00]: Running storage benchmark with QoS parameters:
[INFO] iocost-qos[00]: iocost=off
[INFO] base: Measuring available memory...
[INFO] Populating /var/lib/resctl-demo/scratch/hashd-A/testfiles with 497 32M files (15.52G)
[00:02:39] [mem-bisect] Estimating available memory... 14.5G
  rd-hashd-bench [INFO] [0/5] lat: 74.5 rps:1699.2 slope: -1.86% error_slope: -0.17% u
```

```
[INFO] base:   hash_size=1.2M rps_max=2000 mem_actual=18.8G chunk_pages=25 fake_cpu_load
[INFO] base: mem-profile 16G (mem_avail 14.5G, mem_share 12.0G, mem_target 11.0G)
[INFO] base: workload_mem_low=9.0G ballon_size=2.5G
[INFO] base: Applying hashd parameters
[INFO] base:   hash_size=1.2M rps_max=2000 mem_actual=18.8G chunk_pages=25 fake_cpu_load
[INFO] protection: Stabilizing hashd at 100.0% for Probing 18.8G (1/10)
[INFO] protection: Holding for 15.0s to measure the baseline
[INFO] protection: Starting memory hog
[INFO] protection: Probing 18.8G (1/10) failed after 0.17% (hashd failed while waiting, hashd-A Failed)
[INFO] base: mem-profile 16G (mem_avail 14.5G, mem_share 12.0G, mem_target 11.0G)
[INFO] base: workload_mem_low=9.0G ballon_size=2.5G
[INFO] base: Applying hashd parameters
[INFO] base:   hash_size=1.2M rps_max=2000 mem_actual=17.9G chunk_pages=25 fake_cpu_load
[INFO] protection: Stabilizing hashd at 100.0% for Probing 17.9G (2/10)
[INFO] protection: Holding for 15.0s to measure the baseline
[INFO] protection: Starting memory hog
[INFO] protection: Probing 17.9G (2/10) failed after 0.17% (hashd failed while waiting, hashd-A Failed)
[INFO] base: mem-profile 16G (mem_avail 14.5G, mem_share 12.0G, mem_target 11.0G)
[INFO] base: workload_mem_low=9.0G ballon_size=2.5G
[INFO] base: Applying hashd parameters
[INFO] base:   hash_size=1.2M rps_max=2000 mem_actual=17.0G chunk_pages=25 fake_cpu_load
[INFO] protection: Stabilizing hashd at 100.0% for Probing 17.0G (3/10)
[INFO] protection: Holding for 15.0s to measure the baseline
[INFO] protection: Starting memory hog
[INFO] protection: Probing 17.0G (3/10) failed after 0.17% (hashd failed while waiting, hashd-A Failed)
[INFO] base: mem-profile 16G (mem_avail 14.5G, mem_share 12.0G, mem_target 11.0G)
[INFO] base: workload_mem_low=9.0G ballon_size=2.5G
[INFO] base: Applying hashd parameters
[INFO] base:   hash_size=1.2M rps_max=2000 mem_actual=16.0G chunk_pages=25 fake_cpu_load
[INFO] protection: Stabilizing hashd at 100.0% for Probing 16.0G (4/10)
[INFO] protection: Holding for 15.0s to measure the baseline
[INFO] protection: Starting memory hog
[INFO] protection: Memory hog terminated after 6.0s, Probing 16.0G (4/10) finished
[INFO] protection: Probing 16.0G (4/10) succeeded, isol-05=92.50% >= 90.00%
[INFO] iocost-qos[01]: Running storage benchmark with QoS parameters:
[INFO] iocost-qos[01]: rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 [min=120.28] [max=120.28]
[INFO] base: Applying iocost parameters
[INFO] base:   model: rbps=2548800265 rseqiops=364653 rrandiops=304477 wbps=2314893629 wseqiops=66718 wrandiops=84113
[INFO] base:   qos: rpct=95.00 rlat=18776 wpct=95.00 wlat=71959 min=120.28 max=120.28
[INFO] base: mem-profile 16G (mem_avail 14.5G, mem_share 12.0G, mem_target 11.0G)
[INFO] base: workload_mem_low=9.0G ballon_size=2.5G
[INFO] storage: Measuring supportable memory footprint and IO latencies (1/1)
[00:02:58] [mem-bisect] mem: 21.6G/10.9G( -0.7%) rw: 682M/ 203M p50/90/99:  155u/ 975u/ 995u
  rd-hashd-bench [INFO] [0/5] lat: 72.1 rps:1550.5 slope: +0.01% error_slope: +0.39%
```

6 hours later

```
  wlat: 50-mean= 458u 50-99= 934u 50-100= 1.3m 99-mean= 3.6m 99-99=33.4m 100-100=43.0m
  model: rbps=2548800265 rseqiops=364653 rrandiops=304477 wbps=2314893629 wseqiops=66718 wrandiops=84113
  qos: rpct=99.00 rlat=1380 wpct=0.00 wlat=0 min=72.16 max=100.00

[rlat-99-q2] rlat-99=0.5-0.75
  info: scale=72.16% MOF=1.653@16 aMOF=1.523 aMOF-delta=0.122 isol-05=98.14%
  rlat: 50-mean= 107u 50-99= 301u 50-100= 937u 99-mean= 1.1m 99-99= 2.9m 100-100=38.5m
  wlat: 50-mean= 458u 50-99= 934u 50-100= 1.3m 99-mean= 3.4m 99-99=33.4m 100-100=43.0m
  model: rbps=1839086831 rseqiops=263115 rrandiops=219695 wbps=1670311498 wseqiops=48140 wrandiops=60692
  qos: rpct=99.00 rlat=1113 wpct=0.00 wlat=0 min=71.42 max=100.00

[rlat-99-q3] rlat-99=0.25-0.5
  info: scale=51.53% MOF=1.558@16 aMOF=1.523 aMOF-delta=0.047 isol-05=98.91%
  rlat: 50-mean=85.8u 50-99= 301u 50-100= 833u 99-mean= 847u 99-99= 2.2m 100-100=38.5m
  wlat: 50-mean= 458u 50-99= 934u 50-100= 1.3m 99-mean= 2.4m 99-99=33.4m 100-100=43.0m
  model: rbps=1313396777 rseqiops=187906 rrandiops=156897 wbps=1192864687 wseqiops=34380 wrandiops=43343
  qos: rpct=99.00 rlat=847 wpct=0.00 wlat=0 min=59.97 max=100.00

[rlat-99-q4] rlat-99=0-0.25
  info: scale=30.90% MOF=1.463@16 aMOF=1.501 aMOF-delta=0.016 isol-05=98.91%
  rlat: 50-mean=66.8u 50-99= 301u 50-100= 493u 99-mean= 580u 99-99= 1.5m 100-100=24.8m
  wlat: 50-mean= 438u 50-99= 934u 50-100= 1.3m 99-mean= 1.5m 99-99=14.5m 100-100=36.6m
  model: rbps=787706722 rseqiops=112696 rrandiops=94099 wbps=715417876 wseqiops=20619 wrandiops=25995
  qos: rpct=99.00 rlat=580 wpct=0.00 wlat=0 min=33.26 max=100.00

Remarks
=======

* bandwidth: Isolatable memory size is 13.08% < supportable, sizing may be difficult.
* isolated-bandwidth: Isolatable memory size is 9.18% < supportable, sizing may be difficult.

tar: Removing leading `/' from member names
resctl-bench finshed successfully!
Results saved to USB stick as Samsung_SSD_980_PRO_1TB/resctl-bench-result_2024_03_15-04_01_20
cp: error copying 'resctl-benchmark.tar.gz' to '/mnt/results/logs/resctl-benchmark.tar.gz': No space left on device
[24208.423710] INFO: task umount:96451 blocked for more than 122 seconds.
[24208.430870]       Tainted: G            E     5.18.0-rc6 #1
[24208.437014] "echo 0 > /proc/sys/kernel/hung_task_timeout_secs" disables this message.
[24331.303663] INFO: task umount:96451 blocked for more than 245 seconds.
[24331.310805]       Tainted: G            E     5.18.0-rc6 #1
[24331.316966] "echo 0 > /proc/sys/kernel/hung_task_timeout_secs" disables this message.
[24454.183632] INFO: task umount:96451 blocked for more than 368 seconds.
[24454.190826]       Tainted: G            E     5.18.0-rc6 #1
[24454.196992] "echo 0 > /proc/sys/kernel/hung_task_timeout_secs" disables this message.
demo@resctl-demo:~$
```

Files

- Recent
- Starred
- Home
- Documents
- Downloads
- Music
- Pictures
- Videos
- Trash
- flasher-storage
- htejun@gmail.com
- results
- 192.168.0.7
- Other Locations

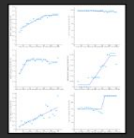
results / Samsung_SSD_980_PRO_1TB

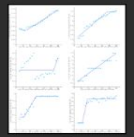
Name

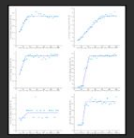
- resctl-bench-result_2024_03_15-04_01_20.json.gz
- resctl-bench-result_2024_03_15-04_01_20.pdf
- resctl-bench-result_2024_03_15-04_01_20.txt

1 of 4 — resctl-bench-result_2024_03_15-04_01_20.pdf — 96.7%


1


2


3


4

```
  info: scale=100.0% MOF=1.702@16 aMOF=1.478 aMOF-delta=0.223 isol-05=96.65%
  rlat: 50-mean= 135u 50-99= 301u 50-100= 937u 99-mean= 1.4m 99-99= 3.8m 100-100=38.5m
  wlat: 50-mean= 458u 50-99= 934u 50-100= 1.3m 99-mean= 3.6m 99-99=33.4m 100-100=43.0m
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  qos: rpct=99.00 rlat=1113 wpct=0.00 wlat=0 min=71.42 max=100.00

[rlat-99-q3] rlat-99=0.25-0.5
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  qos: rpct=99.00 rlat=847 wpct=0.00 wlat=0 min=59.97 max=100.00

[rlat-99-q4] rlat-99=0-0.25
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  rlat: 50-mean=66.8u 50-99= 301u 50-100= 493u 99-mean= 580u 99-99= 1.5m 100-100=24.8m
  wlat: 50-mean= 438u 50-99= 934u 50-100= 1.3m 99-mean= 1.5m 99-99=14.5m 100-100=36.6m
  model: rbps=787706722 rseqiops=112696 rrandiops=94099 wbps=715417876 wseqiops=20619 wrandiops=25995
  qos: rpct=99.00 rlat=580 wpct=0.00 wlat=0 min=33.26 max=100.00

Remarks
=======

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```

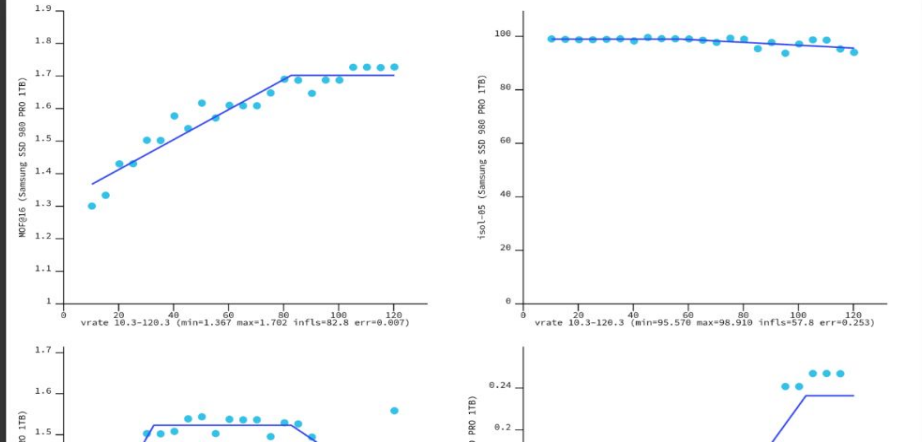

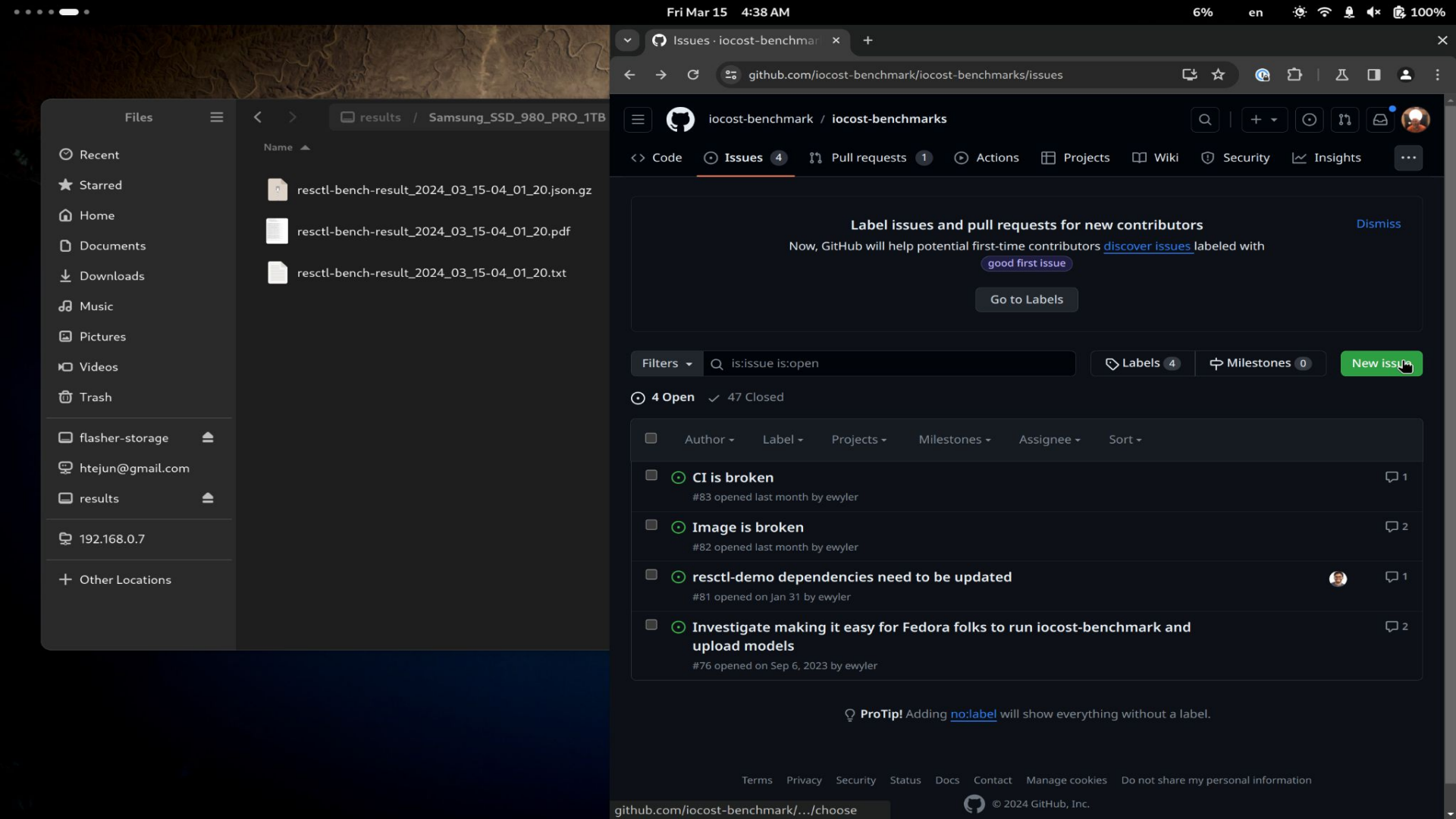
Fri Mar 15 4:38 AM
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Files
Recent
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Videos
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flasher-storage
htejun@gmail.com
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192.168.0.7
Other Locations
results / Samsung_SSD_980_PRO_1TB
Name
resctl-bench-result_2024_03_15-04_01_20.json.gz
resctl-bench-result_2024_03_15-04_01_20.pdf
resctl-bench-result_2024_03_15-04_01_20.txt
Issues · iocost-benchmar
github.com/iocost-benchmark/iocost-benchmarks/issues
iocost-benchmark / iocost-benchmarks
Code
Issues 4
Pull requests 1
Actions
Projects
Wiki
Security
Insights
Label issues and pull requests for new contributors
Dismiss
Now, GitHub will help potential first-time contributors discover issues labeled with
good first issue
Go to Labels
Filters
is:issue is:open
Labels 4
Milestones 0
New issue
4 Open
47 Closed
Author
Label
Projects
Milestones
Assignee
Sort
CI is broken
#83 opened last month by ewyler
1
Image is broken
#82 opened last month by ewyler
2
resctl-demo dependencies need to be updated
#81 opened on Jan 31 by ewyler
1
Investigate making it easy for Fedora folks to run iocost-benchmark and upload models
#76 opened on Sep 6, 2023 by ewyler
2
ProTip! Adding no:label will show everything without a label.
Terms
Privacy
Security
Status
Docs
Contact
Manage cookies
Do not share my personal information
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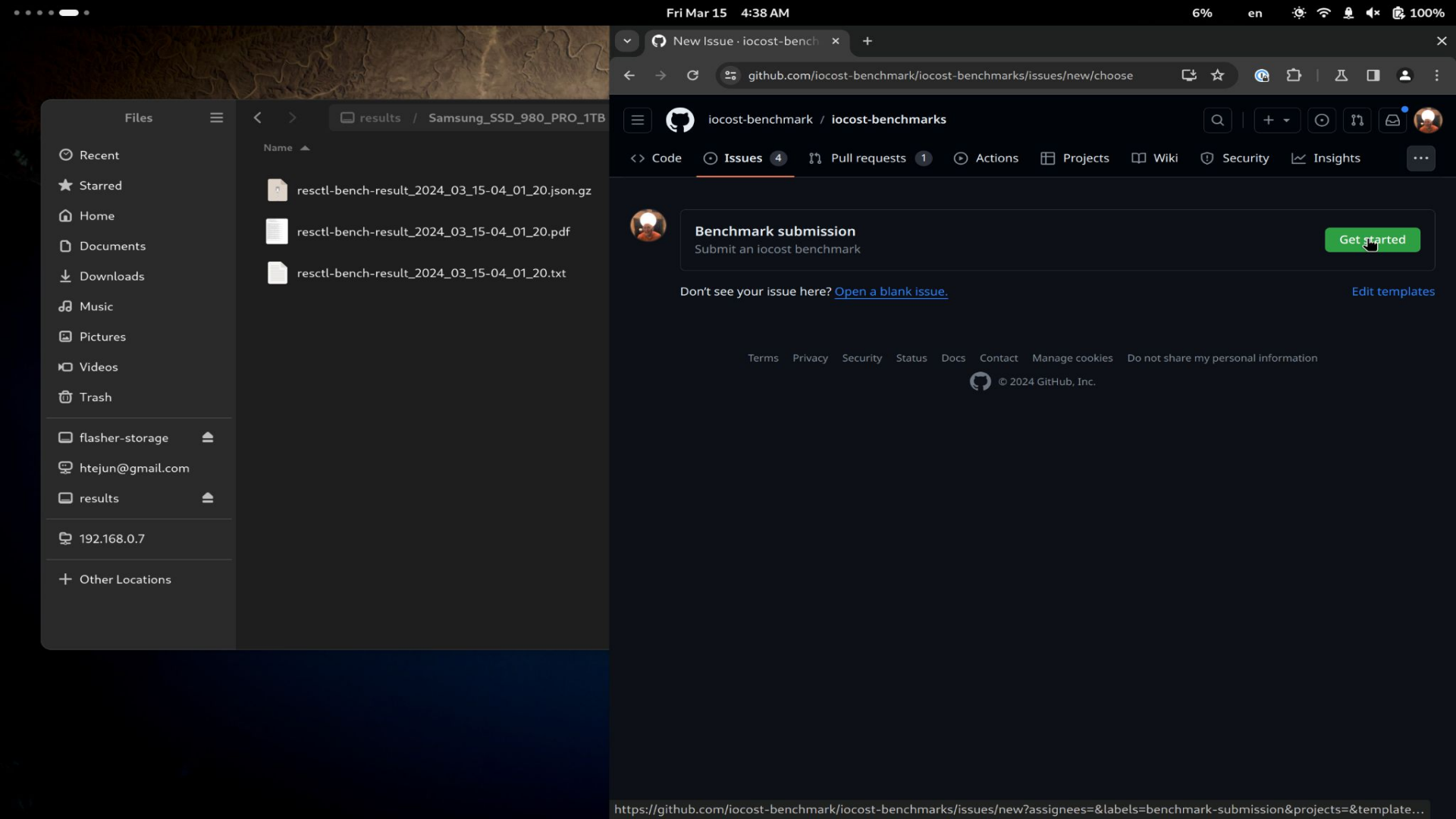
github.com/iocost-benchmark/.../choose


Fri Mar 15 4:38 AM
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Files
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resctl-bench-result_2024_03_15-04_01_20.txt
New Issue · iocost-bench
github.com/iocost-benchmark/iocost-benchmarks/issues/new/choose
iocost-benchmark / iocost-benchmarks
Code
Issues 4
Pull requests 1
Actions
Projects
Wiki
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Insights
Benchmark submission
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Get started
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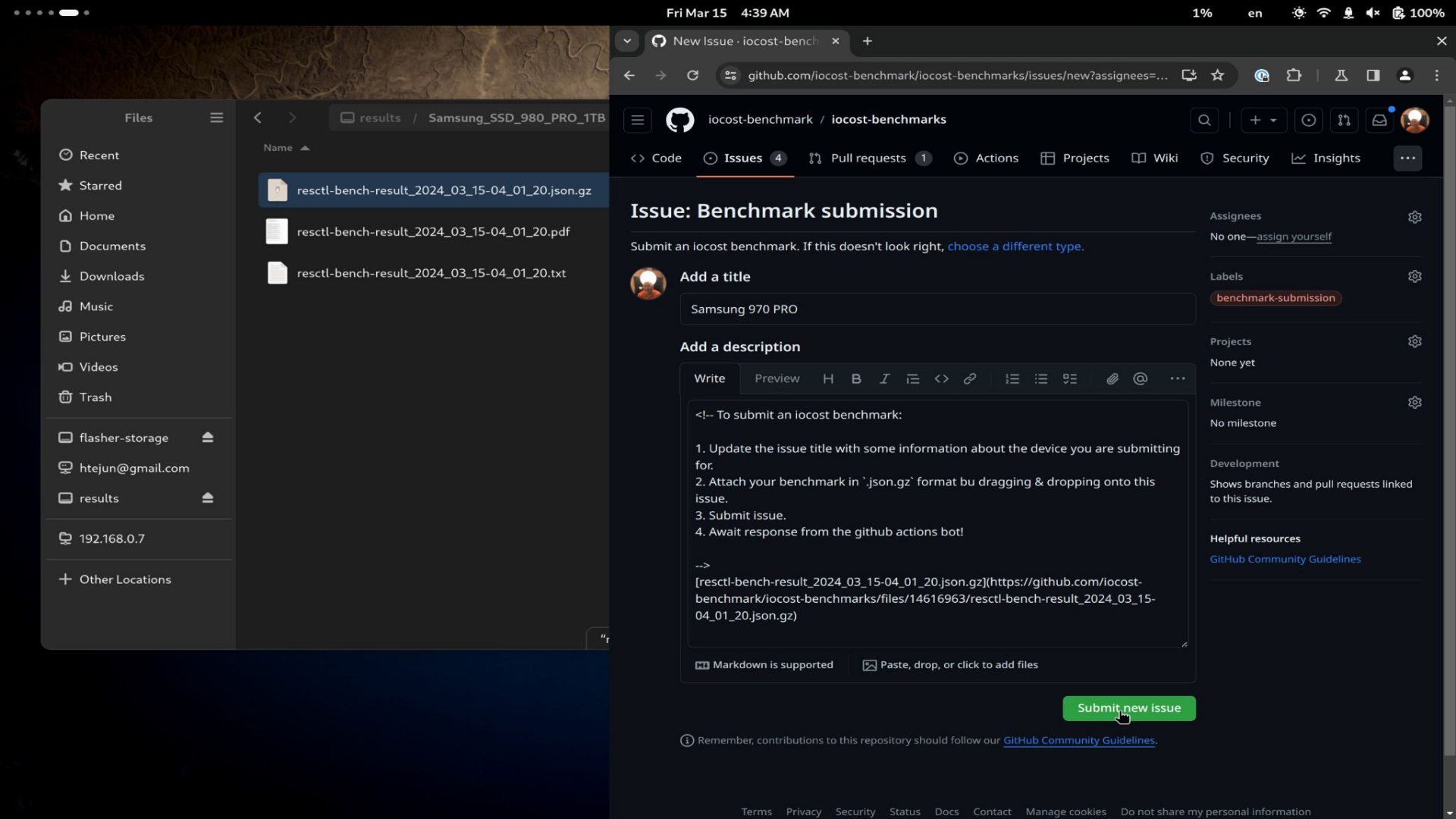
https://github.com/iocost-benchmark/iocost-benchmarks/issues/new?assignees=&labels=benchmark-submission&projects=&template...


Fri Mar 15 4:39 AM
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Files
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Downloads
Music
Pictures
Videos
Trash
flasher-storage
htejun@gmail.com
results
192.168.0.7
Other Locations
results / Samsung_SSD_980_PRO_1TB
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resctl-bench-result_2024_03_15-04_01_20.pdf
resctl-bench-result_2024_03_15-04_01_20.txt
New Issue · iocost-bench
github.com/iocost-benchmark/iocost-benchmarks/issues/new?assignees=...
iocost-benchmark / iocost-benchmarks
Code
Issues 4
Pull requests 1
Actions
Projects
Wiki
Security
Insights
Issue: Benchmark submission
Submit an iocost benchmark. If this doesn't look right, choose a different type.
Add a title
Samsung 970 PRO
Add a description
Write
Preview
<!-- To submit an iocost benchmark:
1. Update the issue title with some information about the device you are submitting for.
2. Attach your benchmark in `.json.gz` format bu dragging & dropping onto this issue.
3. Submit issue.
4. Await response from the github actions bot!
-->
[resctl-bench-result_2024_03_15-04_01_20.json.gz](https://github.com/iocost-benchmark/iocost-benchmarks/files/14616963/resctl-bench-result_2024_03_15-04_01_20.json.gz)
Markdown is supported
Paste, drop, or click to add files
Submit new issue
Remember, contributions to this repository should follow our GitHub Community Guidelines.
Assignees
No one—assign yourself
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benchmark-submission
Projects
None yet
Milestone
No milestone
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Open htejun opened this issue 5 minutes ago · 1 comment · May be fixed by #85

htejun commented 5 minutes ago — Member

resctl-bench-result_2024_03_15-04_01_20.json.gz

htejun added the benchmark-submission label 5 minutes ago

github-actions bot pushed a commit that referenced this issue 4 minutes ago

`Automated update from issue 84` 95bb73c

github-actions bot mentioned this issue 4 minutes ago

Automated update from issue 84 #85 Open

github-actions bot commented 4 minutes ago

You can find the PDFs for the new merges here: https://github.com/iocost-benchmark/iocost-benchmarks/actions/runs/8297951627

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No one—assign yourself

Labels
benchmark-submission

Projects
None yet

Milestone
No milestone

Development
Successfully merging a pull request may close this issue.
Automated update from issue 84
iocost-benchmark/iocost-benchmarks

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Unsubscribe
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1 participant

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Links

- iocost paper
  - https://www.cs.cmu.edu/~dskarlat/publications/iocost_asplos22.pdf
- resctl-demo and resctl-bench
  - https://github.com/facebookexperimental/resctl-demo
- resctl-bench result repository
  - https://github.com/iocost-benchmark/iocost-benchmarks


Meta