

بسم تعالی



سیستم‌های عامل پیشرفته

تمرین سوم

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تمرینات عملی

سوال ۱.

برای حل این سوال ابتدا کد زیر را می‌نویسیم :

```
04
65 void create_file(char *buffer,int *file)
66 {
67     // Create the 10GB file
68     *file = open(FILENAME, O_WRONLY | O_CREAT, 0644);
69     if (*file < 0)
70     {
71         perror("Error creating file");
72         exit(1);
73     }
74
75     // Write 10GB of data
76
77     for (int i = 0; i < FILE_SIZE / BUFFER_SIZE; i++)
78     {
79         write(*file,buffer, BUFFER_SIZE);
80     }
81     printf("file created\n");
82     close(*file);
83 }
84
85 void read_file(char *buffer, int *file)
86 {
87     for (int j = 0; j < 10; j++)
88     {
89         if (use_cache)
90             *file = open(FILENAME, O_RDONLY);
91         else
92             *file = open(FILENAME, O_RDONLY | O_DIRECT);
93         if (*file < 0)
94         {
95             perror("Error opening file");
96             exit(1);
97         }
98
99         ssize_t bytes_read;
100         while ((bytes_read = read(*file,buffer, BUFFER_SIZE)) == BUFFER_SIZE)
101         {
102
103         }
104         if (bytes_read < 0)
105         {
106             perror("Error reading file");
107             exit(1);
108         }
109     }
110 }
111 }
```

سپس اسکریپت زیر را برای گرفتن نتایج می‌نویسیم :

```
10 gcc create_read.c -o create_read.o
11 gcc create_write.c -o create_write.o
12 sudo rm -rf '10gbfile.bin'
13 echo -e "----- TESTING READ -----\\n\\n\\n\\n"
14
15
16
17 echo -e "-----making the file----- \\n"
18 ./create_read.o
19
20 echo -e "-----test with cache - drop cache----- \\n"
21 time ./create_read.o
22 sleep 1
23
24 echo -e "-----test without cache - drop cache----- \\n"
25 sudo sync; echo 3 > /proc/sys/vm/drop_caches      You, 21 hours ago * added some fixes ...
26 time ./create_read.o --cache=false
27 sleep 1
28
29 echo -e "-----test with cache - no drop cache----- \\n"
30 time ./create_read.o
31 sleep 1
32
33 echo -e "-----test without cache - no drop cache----- \\n"
34 time ./create_read.o --cache=false
35 sleep 1
36
37 echo -e "-----removing the file-----\\n"
38
39
40 sudo rm -rf '10gbfile.bin'
41
42
43 echo -e "----- TESTING WRITE -----\\n\\n\\n\\n"
44
45 echo -e "-----test with cache - drop cache----- \\n"
46 time ./create_write.o
47 sleep 1
48
49 echo -e "-----test without cache - drop cache----- \\n"
50 sudo sync; echo 3 > /proc/sys/vm/drop_caches
51 time ./create_write.o --cache=false
52 sleep 1
53
54 echo -e "-----test with cache - no drop cache----- \\n"
55 time ./create_write.o
56 sleep 1
57
58 echo -e "-----test without cache - no drop cache----- \\n"
59 time ./create_write.o --cache=false
60 sleep 1
61
62
63 echo -e "----- TEST DONE :D ----- \\n"
```

حال نتایج کلی را مشاهده می‌کنیم.

```
----- TESTING READ -----  
  
-----making the file-----  
  
Cache is enabled.  
creating file  
file created  
-----test with cache - drop cache-----  
  
Cache is enabled.  
  
real    0m11.125s  
user    0m0.588s  
sys     0m10.536s  
-----test without cache - drop cache-----  
  
Cache is disabled.  
  
real    8m48.740s  
user    0m2.145s  
sys     0m49.192s  
-----test with cache - no drop cache-----  
  
Cache is enabled.  
  
real    0m18.293s  
user    0m0.714s  
sys     0m11.678s  
-----test without cache - no drop cache-----  
  
Cache is disabled.  
  
real    8m45.275s  
user    0m2.196s  
sys     0m47.125s  
-----removing the file-----
```

```
rm: cannot remove '/root/.local/share/Trash/files/': No such file or directory
----- TESTING WRITE -----
-----test with cache - drop cache-----
Cache is enabled.

real    3m16.356s
user    0m2.653s
sys     1m45.694s
rm: cannot remove '/root/.local/share/Trash/files/': No such file or directory
-----test without cache - drop cache-----
Cache is disabled.

real    8m35.808s
user    0m4.387s
sys     3m25.058s
rm: cannot remove '/root/.local/share/Trash/files/': No such file or directory
-----test with cache - no drop cache-----
Cache is enabled.

real    3m9.313s
user    0m2.654s
sys     1m43.829s
rm: cannot remove '/root/.local/share/Trash/files/': No such file or directory
-----test without cache - no drop cache-----
Cache is disabled.

real    8m31.991s
user    0m4.284s
sys     3m20.891s
rm: cannot remove '/root/.local/share/Trash/files/': No such file or directory
```

و خواسته‌ها را تک به تک بررسی می‌کنیم.

الف) خالی کردن کش قبل از برنامه دوم - حالت خواندن

```
-----test with cache - drop cache-----
Cache is enabled.

real    0m11.125s
user    0m0.588s
sys     0m10.536s
-----test without cache - drop cache-----

Cache is disabled.

real    8m48.740s
user    0m2.145s
sys     0m49.192s
```

ب) خالی نکردن کش قبل از برنامه دوم - حالت خواندن

```
-----test with cache - no drop cache-----  
Cache is enabled.  
  
real    0m18.293s  
user    0m0.714s  
sys     0m11.678s  
-----test without cache - no drop cache-----  
  
Cache is disabled.  
  
real    8m45.275s  
user    0m2.196s  
sys     0m47.125s
```

ج) بررسی حالت خواندن از فایل در حالات خالی کردن/نکردن کش

```
----- TESTING WRITE -----  
  
-----test with cache - drop cache-----  
Cache is enabled.  
  
real    3m16.356s  
user    0m2.653s  
sys     1m45.694s  
rm: cannot remove '/root/.local/share/Trash/files/': No such file or directory  
-----test without cache - drop cache-----  
  
Cache is disabled.  
  
real    8m35.808s  
user    0m4.387s  
sys     3m25.058s  
rm: cannot remove '/root/.local/share/Trash/files/': No such file or directory  
-----test with cache - no drop cache-----  
  
Cache is enabled.  
  
real    3m9.313s  
user    0m2.654s  
sys     1m43.829s  
rm: cannot remove '/root/.local/share/Trash/files/': No such file or directory  
-----test without cache - no drop cache-----  
  
Cache is disabled.  
  
real    8m31.991s  
user    0m4.284s  
sys     3m20.891s  
rm: cannot remove '/root/.local/share/Trash/files/': No such file or directory
```

نتیجه‌گیری‌های نهایی

همانطور که مشاهده می‌شود در حالت خواندن، در صورتی که کش داشته باشیم سرعت به شدت بالاتر از زمانی است که کش نداشته باشیم (۱۱ ثانیه در مقابل ۸:۵۰ دقیقه)

پس اولاً کش داشتن تاثیر به سزاوی در خواندن ما دارد و ثانیاً در زمانی که کش سیستم را قبل از تست خالی کنیم به صورت کلی در هر دو تست direct io و page cache نتیجه کمی بهتری خواهیم داشت که احتمالاً به دلیل عدم میس اضافه خوردن در کش است.

در حالت نوشتن نیز کش تاثیر به سزاوی در سرعت انجام عملیات دارد هر چند که در حالت نوشتن کش کننده از حالت خواندن با کش عمل می‌کند.

در حالت نوشتن، در اپ نکردن کش کمی بهتر عمل می‌کند.

تاثیر page cache بیشتر در خواندن مشاهده می‌شود.

سوال 2.

برای حل این سوال ابتدا کد زیر را می‌نویسیم:

```
95
96 void create_file(){
97     const char *dir_name = OUTPUT_DIRECTORY;
98     char *path;
99     int fd;
100    off_t offset;
101    char *buffer;
102    int name_length = MIN_NAME_LENGTH + rand() % (MAX_NAME_LENGTH - MIN_NAME_LENGTH + 1);
103
104    char name[name_length + 1];
105
106    // Seed the random number generator with the current time
107    uuid_t uuid;
108    char uuid_str[37];
109
110
111    uuid_generate(uuid);
112    uuid_unparse(uuid, uuid_str);
113
114
115    // print_uuid(uuid);
116    // Generate a random name consisting of NAME_LENGTH letters
117    for (int i = 0; i < name_length; i++) {
118        name[i] = 'a' + rand() % 26;
119    }
120    name[name_length] = '\0';
121    path = malloc(strlen(dir_name) + name_length + 2);
122    sprintf(path, "%s/%s", dir_name, name);
123
124
125    if (posix_memalign((void **)&buffer, BLOCK_SIZE, BUFFER_SIZE) != 0) {
126        perror("posix_memalign");
127        return;
128    }
129    memcpy(buffer, uuid_str, sizeof(uuid_str)-1);
130    if (use_cache)
131        fd = open(path, O_RDWR | O_TRUNC | O_CREAT, S_IRUSR | S_IWUSR);
132    else
133        fd = open(path, O_RDWR | O_TRUNC | O_CREAT | O_DIRECT, S_IRUSR | S_IWUSR);
134
135    if (fd == -1) {
136        printf("Error opening file\n");
137        return;
138    }
139
140    offset = lseek(fd, 0, SEEK_END);
141    if (offset == -1) {
142        printf("Error seeking to end of file\n");
143        close(fd);
144        return;
145    }
146    if (write(fd, buffer, BUFFER_SIZE) == -1) {
147        printf("Error writing metadata to file\n");
148        close(fd);
149        return;
150    }
151    // fsync(fd);
152    free(buffer); You, 4 hours ago + fix meta ...
153    close(fd);
154    if (verbose){
155        printf("File %s new uuid is : %s \n", name,uuid_str);
156        printf("Random name: %s\n", name);
157        printf("Metadata added successfully\n");
158    }
159
160 }
```

```

163 void read_metadata(const char *filename){
164     uuid_t uuid;
165     char uuid_str[37];
166     int fd;
167     off_t offset;
168     ssize_t nread;
169
170     char *boofor;
171     if (posix_memalign((void **)&boofor, BLOCK_SIZE, BUFFER_SIZE) != 0) {
172         perror("posix_memalign");
173         return;
174     }
175     // Open the file for reading
176
177     if (use_cache)
178         fd = open(filename, O_RDWR, S_IRUSR | S_IWUSR);
179     else
180         fd = open(filename, O_RDWR | O_DIRECT, S_IRUSR | S_IWUSR);
181     // printf("pointer : %p\n", &fd);
182     if (fd == -1) {
183         perror("open");
184         return;
185     }
186
187     offset = lseek(fd, 0, SEEK_END);
188     offset = lseek(fd, -BUFFER_SIZE, SEEK_CUR);
189     if (offset == -1) {
190         perror("lseek");
191         close(fd);
192         return;
193     }
194     nread = read(fd, boofor, BUFFER_SIZE);
195     if (nread == -1) {
196         perror("read");
197         close(fd);
198         return;
199     }
200     memcpy(uuid_str, boofor, sizeof(uuid_str)-1);
201     free(boofor);
202     // Print the UUID
203     if (verbose)
204         printf("UUID of file %s is %s\n", filename, uuid_str);
205
206     close(fd);
207 }
208

```

سپس اسکریپت زیر را برای گرفتن نتایج می‌نویسیم :

```
You, 4 hours ago | 1 author (You)
1 if [ -"$EUID" -ne 0 ]           You, 7 hours ago * right and change the metadata ...
2 then
3   echo "Please run this script as root"
4   exit
5 fi
6
7 echo -e "making sure you have uuid library...\n"
8
9 sudo apt install uuid-dev
10
11 gcc -g ./create_meta.c -o create_meta.o -luuid
12 sudo rm -rf ./outputs/*
13
14 echo -e "----- TEST WITHOUT BUFFER CACHE -----\\n\\n\\n"
15 ./create_meta.o --cache=false
16
17 sleep 1
18 sudo rm -rf ./outputs/*
19
20 sleep 1
21
22 echo -e "----- TEST WITH BUFFER CACHE -----\\n\\n\\n"
23 ./create_meta.o
24 sleep 1
25 sudo rm -rf ./outputs/*
```

حال نتایج کلی را مشاهده می‌کنیم.

```
----- TEST WITHOUT BUFFER CACHE -----  
  
Cache is disabled.  
use --verbose to see full details  
  
----- writing file metadata in output directory -----  
  
Done creating files and writing metadata  
Total time for 1000 writes (usec): 241046  
Average time for 1 write (usec): 241  
  
----- reading file metadata in output directory -----  
  
Done reading file metadata  
Total time for 1000 reads (usec): 165821  
Average time for 1 read (usec): 165  
----- TEST WITH BUFFER CACHE -----  
  
Cache is enabled.  
use --verbose to see full details  
  
----- writing file metadata in output directory -----  
  
Done creating files and writing metadata  
Total time for 1000 writes (usec): 53788  
Average time for 1 write (usec): 53  
  
----- reading file metadata in output directory -----  
  
Done reading file metadata  
Total time for 1000 reads (usec): 5200  
Average time for 1 read (usec): 5
```

الف) زمان لازم برای نوشتن فراداده - بدون Buffer Cache

```
Cache is disabled.  
use --verbose to see full details  
  
----- writing file metadata in output directory -----  
  
Done creating files and writing metadata  
Total time for 1000 writes (usec): 241046  
Average time for 1 write (usec): 241
```

ب) زمان لازم برای خواندن فراداده - بدون Buffer Cache

```
----- reading file metadatas in output directory -----  
  
Done reading file metadatas  
Total time for 1000 reads (usec): 165821  
Average time for 1 read (usec): 165
```

ج) زمان لازم برای نوشتن فراداده - با Buffer Cache

```
Cache is enabled.  
use --verbose to see full details  
  
----- writing file metadatas in output directory -----  
  
Done creating files and writing metadatas  
Total time for 1000 writes (usec): 53788  
Average time for 1 write (usec): 53
```

د) زمان لازم برای خواندن فراداده - با Buffer Cache

```
----- reading file metadatas in output directory -----  
  
Done reading file metadatas  
Total time for 1000 reads (usec): 5200  
Average time for 1 read (usec): 5
```

و) مقایسه

نتیجه‌گیری‌های نهایی

همانطور که مشاهده می‌کنیم، زمان لازم برای نوشتن بیشتر از زمان خواندن است که خوب انتظار این امر نیز می‌رفت.

در زمان استفاده از بافر کش، زمان کلی خواندن تقریباً ۳۳ برابر بهبود می‌یابد و همچنین زمان نوشتن نیز تقریباً ۵ برابر بهبود می‌یابد که نشان می‌دهد تاثیر بافر کش مانند page cache در خواندن به مراتب بیشتر از نوشتن است.

سوال 3.

مراحل نصب بحسب سایت :

Getting Started

1. First clone the Open CAS Linux project

```
git clone https://github.com/Open-CAS/open-cas-linux
```

2. Change current directory to project folder and update submodules

```
cd open-cas-linux  
git submodule update --init
```

3. Configure Open CAS Linux

```
./configure
```

4. Compile Open CAS Linux and install it

```
make  
make install
```

5. Verify the kernel modules were inserted by checking their versions

```
casadm -V
```

6. CAS should now be ready to start. For example, to use block device /dev/nvme0n1 as a caching device:

```
casadm -S -d /dev/disk/by-id/nvme-SSD
```

7. The output should return the cache instance number, use it to add a backend device. For example, to use block device /dev/sda1 as a backend device to cache instance 1:

```
casadm -A -d /dev/disk/by-id/wwn-0x1234567890b100d-part1 -i 1
```

8. Verify CAS instance is operational with:

```
casadm -L
```

```

bigwhoman@bigwhoman-pp /m/4/S/t/0/OS_Advanced> git clone https://github.com/Open-CAS/open-cas-linux
Cloning into 'open-cas-linux'...
remote: Enumerating objects: 13033, done.
remote: Counting objects: 100% (1113/1113), done.
remote: Compressing objects: 100% (614/614), done.
remote: Total 13033 (delta 597), reused 890 (delta 485), pack-reused 11920
Receiving objects: 100% (13033/13033), 3.12 MiB | 1023.00 KiB/s, done.
Resolving deltas: 100% (8567/8567), done.
bigwhoman@bigwhoman-pp /m/4/S/t/0/OS_Advanced> cd open-cas-linux/
bigwhoman@bigwhoman-pp /m/4/S/t/0/open-cas-linux (master)> git submodule update --init
Submodule 'ocf' (https://github.com/Open-CAS/ocf.git) registered for path 'ocf'
Cloning into '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/ocf'...
Submodule path 'ocf': checked out '15c2986b8d97fce3754884eb3dfad308b0df7ea7'
bigwhoman@bigwhoman-pp /m/4/S/t/0/open-cas-linux (master)> ./configure
Preparing configuration
Configuring OpenCAS

```

```

bigwhoman@bigwhoman-pp /m/4/S/t/0/open-cas-linux (master)> make
cd modules && make
make[1]: Entering directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules'
make[2]: Entering directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/ocf'
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_io_class.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_stats.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_composite_volume.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_cache.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_def.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_io.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_volume.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/cleaning/acp.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/cleaning/alru.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/promotion/nhit.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_types.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_cleaner.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_debug.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_core.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_ctx.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_metadata.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_queue.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_err.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_mngt.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_logger.h
  INSTALL /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules/include/ocf/ocf_cfg.h
make[3]: Entering directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/ocf'
make[3]: Nothing to be done for 'distcleandir'.

```

```

bigwhoman@bigwhoman-pp /m/4/S/t/0/open-cas-linux (master)> make install
cd modules && make install
make[1]: Entering directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules'
Installing Open-CAS modules
install: cannot create directory '/lib/modules/5.19.0-38-generic/extr': Permission denied
make[1]: *** [Makefile:59: install_files] Error 1
make[1]: Leaving directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules'
make: *** [Makefile:22: modules] Error 2
bigwhoman@bigwhoman-pp /m/4/S/t/0/open-cas-linux (master) [2]> sudo make install
[sudo] password for bigwhoman:
cd modules && make install
make[1]: Entering directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules'
Installing Open-CAS modules
make[1]: Leaving directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/modules'
cd casadm && make install
make[1]: Entering directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/casadm'
Installing casadm
make[1]: Leaving directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/casadm'
cd utils && make install
make[1]: Entering directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/utils'
Installing Open-CAS utils
make[1]: Leaving directory '/mnt/4b4aaacc-655d-4555-96d5-55b6788ec926/Sharif/term6/OS_Advanced/open-cas-linux/utils'
bigwhoman@bigwhoman-pp /m/4/S/t/0/open-cas-linux (master)> casadm -V

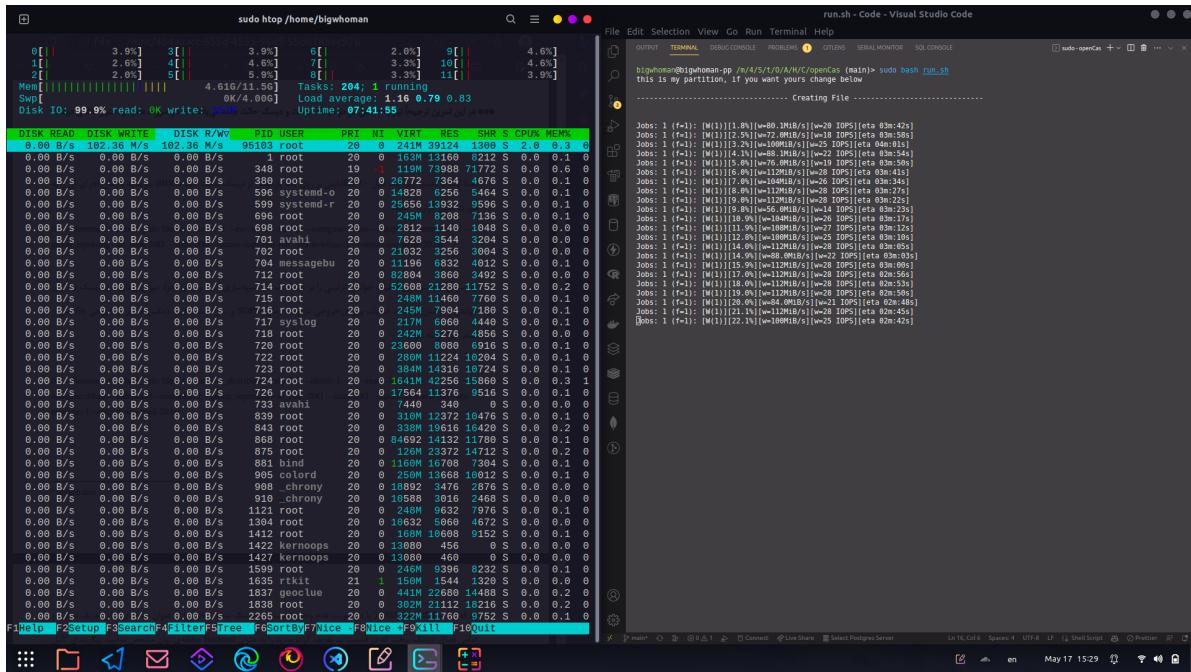
```

Name	Version
CAS Cache Kernel Module	22.12.0.0843.master
CAS CLI Utility	22.12.0.0843.master

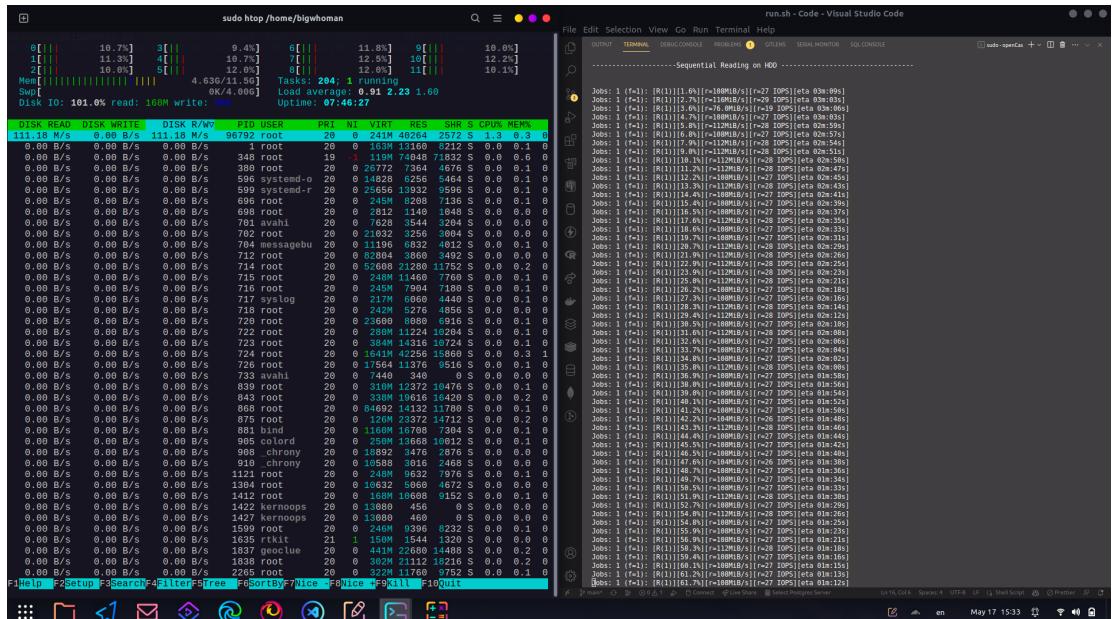
الف) ساخت فایل دیسک سخت

```
Jobs: 1 (f=1): [W(1)][99.5%][w=112MiB/s][w=28 IOPS][eta 0m:01s]
2.16user 2.65system 3:21.39elapsed 2%CPU (0avgtext+0avgdata 39124maxresident)
38832inputs+41943048outputs (973major+10537minor)pagefaults 0swaps
```

عکس حین اجرای دستور اول



ب) عملیات خواندن دیسک سخت



زمان اجرا

```
0.64user 2.83system 3:09.77elapsed 1%CPU (0avgtext+0avgdata 40276maxresident)k
41981560inputs+8outputs (977major+10547minor)pagefaults 0swaps
```

```
1 iops-test-job: (g=0): rw=read, bs=(R) 4096KiB-4096KiB, (W) 4096KiB-4096KiB, (T) 4096KiB-4096KiB, ioengine=libaio,iodepth=8
2 fio-3.28
3 Starting 1 process
4
5 iops-test-job: (groupid=0, jobs=1): err= 0: pid=99194: Wed May 17 15:45:11 2023
6   read: IOPS=27, BW=108MiB/s (113MB/s)(20.0GiB/189349msec)
7     slat (usec): min=65, max=124842, avg=9161.11, stdev=16091.27
8     clat (msec): min=48, max=2054, avg=286.60, stdev=54.05
9     lat (msec): min=68, max=2090, avg=295.76, stdev=53.63
10    clat percentiles (msec):
11      | 1.00th=[ 228], 5.00th=[ 253], 10.00th=[ 253], 20.00th=[ 264],
12      | 30.00th=[ 292], 40.00th=[ 292], 50.00th=[ 292], 60.00th=[ 292],
13      | 70.00th=[ 292], 80.00th=[ 292], 90.00th=[ 305], 95.00th=[ 309],
14      | 99.00th=[ 347], 99.50th=[ 363], 99.90th=[ 472], 99.95th=[ 222],
15      | 99.99th=[ 2056]
16   bw ( Kib/s): min=73728, max=122880, per=100.00%, avg=110866.75, stdev=5699.17, samples=378
17   iops : min= 18, max= 30, avg=27.05, stdev= 1.40, samples=378
18   lat (msec) : 50=0.02%, 100=0.02%, 250=1.17%, 500=98.69%, 750=0.02%
19   lat (msec) : 2000=0.02%, >=2000=0.06%
20   cpu : usr=0.07%, sys=1.02%, ctx=5163, majf=0, minf=8201
21   IO depths : 1=0.1%, 2=0.1%, 4=0.1%, 8=99.9%, 16=0.0%, 32=0.0%, >=64=0.0%
22     submit : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
23     complete : 0=0.0%, 4=100.0%, 8=0.1%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
24     issued rwt: total=5120,0,0 short=0,0,0 dropped=0,0,0
25     latency : target=0, window=0, percentile=100.00%, depth=8
26
27 Run status group 0 (all jobs):
28   READ: bw=108MiB/s (113MB/s), 108MiB/s-108MiB/s (113MB/s-113MB/s), io=20.0GiB (21.5GB), run=189349-189349msec
29
30 Disk stats (read/write):
31   sda: ios=40961/9, merge=59/5, ticks=11443294/4013, in_queue=11448212, util=100.00%
```

ج) تعریف حافظه نهان

استفاده از gparted برای ساخت یک پارتیشن 5 گیگ

/dev/nvme0n1p7	test		ext4	6.75 GiB	
New Partition #1	Cache		ext4	Cache	5.08 GiB

```
lrwxrwxrwx 1 root root 15 May 17 16:39 nvme-WDC_PC_SN520_SDAPNUW-256G-1202_20082F441812-part8 -> ../../nvme0n1p8
```

```
bigwhoman@bigwhoman-pp ~> sudo casadm -S -d /dev/disk/by-id/nvme-WDC_PC_SN520_SDAPNUW-256G-1202_20082F441812-part8 --force
[sudo] password for bigwhoman:
A filesystem existed on /dev/disk/by-id/nvme-WDC_PC_SN520_SDAPNUW-256G-1202_20082F441812-part8. Data may have been lost
Successfully added cache instance 1
```

```
bigwhoman@bigwhoman-pp ~> lsblk --output WWN,PARTLABEL,NAME,KNAME
WWN                                     PARTLABEL   NAME    KNAME
0x50014ee2bcfd4049                   block device /dev/sda1 as a backend device to cache instance 1:
0x50014ee2bcfd4049
0x50014ee2bcfd4049 casadm -A -d /dev/disk/by-id/wwn-0x1234567890b1000
0x50014ee2bcfd4049
0x50014ee2bcfd4049
0x50014ee2bcfd4049 ify CAS instance is operational with:
0x50014ee2bcfd4049
0x50014ee2bcfd4049 casadm -L
0x50014ee2bcfd4049

eui.e8238fa6bf530001001b444a440b4d81
eui.e8238fa6bf530001001b444a440b4d81  EFI system partition
eui.e8238fa6bf530001001b444a440b4d81  Microsoft reserved partition
eui.e8238fa6bf530001001b444a440b4d81  Basic data partition
eui.e8238fa6bf530001001b444a440b4d81  fast
eui.e8238fa6bf530001001b444a440b4d81
eui.e8238fa6bf530001001b444a440b4d81  Basic data partition
eui.e8238fa6bf530001001b444a440b4d81  test
eui.e8238fa6bf530001001b444a440b4d81  Cache
```

```
bigwhoman@bigwhoman-pp ~> sudo casadm -S -d /dev/disk/by-id/nvme-WDC PC SN520 SDAPNUW-256G-120  
2_20082F441812-part8 --force  
[sudo] password for bigwhoman:  
Sorry, try again.  
[sudo] password for bigwhoman:  
Successfully added cache instance 1  
bigwhoman@bigwhoman-pp ~> sudo casadm -A -d /dev/disk/by-id/wwn-0x50014ee2bcfd4049-part4 -i 1  
Successfully added core 1 to cache instance 1
```

```
bigwhoman@bigwhoman-pp ~ > lsblk
NAME      MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
sda        8:0    0 931.5G  0 disk
└─sda1     8:1    0 276.6G  0 part
└─sda2     8:2    0 297G   0 part
└─sda3     8:3    0 1K     0 part
└─sda4     8:4    0 140.7G  0 part
└─cas1-1  252:0  0 140.7G  0 disk
└─sda5     8:5    0 54.3G   0 part
└─sda6     8:6    0 117.2G  0 part /mnt/4b4aaacc-655d-4555-96d5-55b6788ec926
└─sda7     8:7    0 45.7G   0 part
nvme0n1   259:0  0 238.5G  0 disk
└─nvme0n1p1 259:1  0 100M   0 part /boot/efi
└─nvme0n1p2 259:2  0 16M    0 part
└─nvme0n1p3 259:3  0 83.9G  0 part
└─nvme0n1p4 259:4  0 138.2G 0 part /var/snap/firefox/common/host-hunspell
                               /
└─nvme0n1p5 259:5  0 498M   0 part
└─nvme0n1p6 259:6  0 4G     0 part
└─nvme0n1p7 259:7  0 6.7G   0 part
└─nvme0n1p8 259:8  0 5.1G   0 part
```

```
NAME    MAJ:MIN RM    SIZE RO TYPE MOUNTPOINTS
cas1-1  252:0    0  140.7G  0 disk /mnt/5ba9ddfc-07de-4eda-baef-39de9b4798a9
```

```
bigwhoman@bigwhoman-pp ~ [1]> sudo casadm -L----- Sequential Reading on HDD -----  
type      id      disk          status      write policy      device  
cache     1       /dev/nvme0n1p8  Running      wt              -  
L-core    1       /dev/sda4     Active      -                  /dev/cas1-1
```

د) تست جدید

سیاست write through

This screenshot shows a Linux terminal window with multiple tabs open, displaying system monitoring data and command-line history.

Terminal 1 (Top):

- Output of `sudo htop -h /usr` showing CPU usage, memory, and disk activity for various processes like `nginx`, `curl`, and `curl -O`.
- Memory usage table for `curl` and `curl -O`.
- Disk I/O statistics for `curl` and `curl -O`.

Terminal 2 (Bottom):

- Output of `run.sh - Code - Visual Studio Code` showing a list of jobs and their details.
- Output of `lsof -i` showing open file descriptors.
- Output of `lsof -i` showing listening ports.
- Output of `lsof -i` showing open TCP connections.
- Output of `lsof -i` showing open UDP connections.
- Output of `lsof -i` showing open shared memory segments.
- Output of `lsof -i` showing open pipes.
- Output of `lsof -i` showing open regular files.
- Output of `lsof -i` showing open character devices.
- Output of `lsof -i` showing open block devices.
- Output of `lsof -i` showing open symbolic links.
- Output of `lsof -i` showing open FIFOs.

Bottom Navigation:

- File, Edit, Selection, View, Go, Run, Terminal, Help menus.
- Output, Terminal, Debug Console, Problems, GitLens, Shared Monitor, SQL Console tabs.
- Search bar with filters: F2 Search, F4 Filter, F5 Tree, F6 Sort By, F7 Nice, F8 Nice, F9 Kill, F10 Quit.
- Help, P2 Setup, F3 Search, F4 Filter, F5 Tree, F6 Sort By, F7 Nice, F8 Nice, F9 Kill, F10 Quit buttons.
- Icons for main, search, connect, live share, select PostgreSQL server, and shell script.
- System status icons: battery, signal, volume, and network.
- Bottom status bar: Lo 17 Col 1 Spacers 11 UT-B L (shell Script) Prettier, May 17 17:54.

15.09user 24.01system 6:49.80elapsed 9%CPU (0avgtext+0avgdata 39920maxresident)k
42018144inputs+41943048outputs (997major+11561minor)pagefaults 0swaps

```

1 iops-test-job: (g=0): rw=read, bs=(R) 4096KiB-4096KiB, (W) 4096KiB-4096KiB, (T) 4096KiB-4096KiB, ioengine=libaio, iodepth=8
2 fio-3.28
3 Starting 1 process
4 iops-test-job: Laying out IO file (1 file / 20480MiB)
5
6 iops-test-job: (groupid=0, jobs=1): err= 0: pid=6080: Wed May 17 17:54:29 2023
7 read: IOPS=25, BW=103MiB/s (108MB/s)(20.86iB/199219msec)
8 slat (usec): min=94, max=3864, avg=430.60, stdev=188.65
9 clat (msec): min=78, max=633, avg=310.77, stdev=22.45
10 lat (msec): min=82, max=634, avg=311.20, stdev=22.43
11 clat percentiles (msec):
12 | 1.00th=[ 288], 5.00th=[ 288], 10.00th=[ 292], 20.00th=[ 296],
13 | 30.00th=[ 300], 40.00th=[ 305], 50.00th=[ 309], 60.00th=[ 313],
14 | 70.00th=[ 317], 80.00th=[ 321], 90.00th=[ 334], 95.00th=[ 342],
15 | 99.00th=[ 372], 99.50th=[ 384], 99.90th=[ 617], 99.95th=[ 625],
16 | 99.99th=[ 634]
17 bw ( Kib/s): min=65536, max=114917, per=100.00%, avg=105390.81, stdev=6649.48, samples=397
18 iops : min= 16, max= 28, avg=25.78, stdev= 1.63, samples=397
19 lat (msec) : 100=0.02%, 250=0.04%, 500=99.69%, 750=0.20%
20 cpu : usr=0.07%, sys=1.14%, ctx=5160, majf=0, minf=8200
21 IO depths : 1=0.1%, 2=0.1%, 4=0.1%, 8=99.9%, 16=0.0%, 32=0.0%, >64=0.0%
22 submit : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >64=0.0%
23 complete : 0=0.0%, 4=100.0%, 8=0.1%, 16=0.0%, 32=0.0%, 64=0.0%, >64=0.0%
24 issued rwt: total=5120, 0,0,0 short=0,0,0 dropped=0,0,0
25 latency : target=0, window=0, percentile=100.00%, depth=8
26
27 Run status group 0 (all jobs):
28 READ: bw=103MiB/s (108MB/s), 103MiB/s-103MiB/s (108MB/s-108MB/s), io=20.86iB (21.5GB), run=199219-199219msec
29
30 Disk stats (read/write):
31 casl=1: ios=20480/5, merge=0/0, ticks=6063536/1652, in_queue=6065188, util=100.00%, agrrios=40932/5, aggrmerge=0/1, aggrticks=12038172/1511, aggrin_queue=12040090, aggrutil=100.00%
32 sda: ios=40932/5, merge=0/1, ticks=12038172/1511, in_queue=12040090, util=100.00%
33
```

سیاست write back

```
bigwhoman@bigwhoman-pp ~> sudo casadm -S -c wb -d /dev/disk/by-id/n
6G-1202_20082F441812-part8 --force
Successfully added cache instance 1
bigwhoman@bigwhoman-pp ~> sudo casadm -A -d /dev/disk/by-id/wwn-0x5
Successfully added core 1 to cache instance 1
bigwhoman@bigwhoman-pp ~> sudo casadm -L
  type      id      disk      status      write policy      device
cache      1      /dev/nvme0n1p8    Running      wb              -
core       1      /dev/sda4      Active      -              /dev/cas1-1
```

```
iosps-test-job. (g=0). rw=(R) 4096KiB=4096KiB, (W) 4096KiB=4096KiB, (T) 4096KiB=4096KiB, ioengine=t饱满, iodepth=8
fio-3.28
Starting 1 process

iosps-test-job: (groupid=0, jobs=1): err= 0: pid=8643: Wed May 17 18:04:58 2023
  read: IOPS=25, BW=102MiB/s (107MB/s)(20.06iB/200180msec)
    slat (usec): min=96, max=316141, avg=719.95, stdev=7037.89
    clat (msec): min=51, max=2385, avg=311.96, stdev=70.74
    lat (msec): min=78, max=2385, avg=312.68, stdev=70.51
  clat percentiles (msec):
  | 1.00th=[ 180], 5.00th=[ 288], 10.00th=[ 292], 20.00th=[ 296],
  | 30.00th=[ 306], 40.00th=[ 305], 50.00th=[ 309], 60.00th=[ 313],
  | 70.00th=[ 317], 80.00th=[ 321], 90.00th=[ 334], 95.00th=[ 351],
  | 99.00th=[ 414], 99.50th=[ 477], 99.90th=[ 1318], 99.95th=[ 2366],
  | 99.99th=[ 2400]
  bw ( Kib/s): min=32833, max=114917, per=100.00%, avg=104781.45, stdev=7574.12, samples=400
  iops : min=     8, max=    28, avg=25.56, stdev= 1.85, samples=400
  lat (msec) : 100=0.12%, 250=1.17%, 500=98.28%, 750=0.31%, 2000=0.02%
  lat (msec) : >=2000=0.10%
  cpu : usr=0.05%, sys=1.46%, ctx=5111, majf=0, minf=8201
  IO depths : 1=0.1%, 2=0.1%, 4=0.1%, 8=99.9%, 16=0.0%, 32=0.0%, >=64=0.0%
    submit : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
    complete : 0=0.0%, 4=100.0%, 8=0.1%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
  issued rwt: total=5120, 0,0,0 short=0,0,0 dropped=0,0,0
  latency : target=0, window=0, percentile=100.00%, depth=8

Run status group 0 (all jobs):
  READ: bw=102MiB/s (107MB/s), 102MiB/s-102MiB/s (107MB/s-107MB/s), io=20.0GiB (21.5GB), run=200180-200180msec

Disk stats (read/write):
  casl-1: ios=20484/5, merge=0/0, ticks=6069916/4, in_queue=6069920, util=100.00%, aggrios=41021/7, aggrmerge=60/4, aggrticks=12014037/3328, aggrin_queue=12018044, aggrutil=99.87%
  sda: ios=41021/7, merge=60/4, ticks=12014037/3328, in_queue=12018044, util=99.87%
```

```
Jobs: 1 (f=1): [R(1)][99.5%][r=112MiB/s][r=28 IOPS][eta 00m:01s]
0.65user 3.87system 3:20.57elapsed 2%CPU (0avgtext+0avgdata 40120maxresident)k
41982976inputs+8outputs (985major+10539minor)pagefaults 0swaps
bigwhoman@bigwhoman-pp ~
```

سیاست write around

```
bigwhoman@bigwhoman-pp ~> sudo casadm -L
type      id   disk          status    write policy   device
cache     1    /dev/nvme0n1p8  Running    wa           -
Lcore     1    /dev/sda4     Active     -           /dev/cas1-1
```

```
1  iops-test-job: (g=0): rw=read, bs=(R) 4096KiB-4096KiB, (W) 4096KiB-4096KiB, (T) 4096KiB-4096KiB, ioengine=libaio, iodepth=8
2  fio-3.28
3  Starting 1 process
4
5  iops-test-job: (groupid=0, jobs=1): err= 0: pid=10901: Wed May 17 18:12:07 2023
6  read: IOPS=25, BW=102MiB/s (107MB/s)(28.06kB/201288msec)
7    slat (usec): min=94, max=327237, avg=712.04, stdev=7401.23
8    clat (msec): min=77, max=2177, avg=313.68, stdev=69.79
9    lat (msec): min=83, max=2354, avg=314.40, stdev=71.24
10   clat percentiles (msec):
11   | 1.00th=[ 125], 5.00th=[ 288], 10.00th=[ 292], 20.00th=[ 296],
12   | 30.00th=[ 300], 40.00th=[ 305], 50.00th=[ 309], 60.00th=[ 313],
13   | 70.00th=[ 317], 80.00th=[ 326], 90.00th=[ 338], 95.00th=[ 359],
14   | 99.00th=[ 466], 99.50th=[ 542], 99.90th=[ 1083], 99.95th=[ 2140],
15   | 99.99th=[ 2165]
16   bw ( KiB/s): min=49152, max=114917, per=100.00%, avg=104259.35, stdev=8468.08, samples=402
17   iops : min= 12, max= 28, avg=25.43, stdev= 2.07, samples=402
18   lat (msec) : 100=0.06%, 250=1.21%, 500=97.93%, 750=0.62%, 1000=0.06%
19   lat (msec) : 2000=0.02%, >=2000=0.10%
20   cpu : usr=0.66%, sys=1.39%, ctx=5108, majf=0, minf=8201
21   IO depths : 1=0.1%, 2=0.1%, 4=0.1%, 8=99.9%, 16=0.0%, 32=0.0%, >=64=0.0%
22   submit : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
23   complete : 0=0.0%, 4=100.0%, 8=0.1%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
24   issued rwt: total=5120,0,0,0 short=0,0,0 dropped=0,0,0
25   latency : target=0, window=0, percentile=100.00%, depth=8
26
27 Run status group 0 (all jobs):
28   READ: bw=102MiB/s (107MB/s), 102MiB/s-102MiB/s (107MB/s-107MB/s), io=20.0GiB (21.5GB), run=201288-201288msec
29
30 Disk stats (read/write):
31   | casl-1: ios=20484/5, merge=0/0, ticks=6101096/1860, in_queue=6102956, util=100.00%, aggrios=39756/24, agrmerge=691/24, aggrticks=11752474/10276, aggrin_queue=11766253, agrgrutil=100.00%
32   | sda: ios=39756/24, merge=691/24, ticks=11752474/10276, in_queue=11766253, util=100.00%
```

```
Jobs: 1 (f=1): [R(1)][99.0%][r=108MiB/s][r=27 IOPS][eta 00m:02s]
0.76user 3.67system 3:21.70elapsed 2%CPU (0avgtext+0avgdata 40260maxresident)k
41982984inputs+8outputs (979major+10544minor)pagefaults 0swaps
```

تحلیل‌ها

به صورت کلی در حالت sequential بدون استفاده io cache عملکرد تقریباً بهتری داریم چرا که در این حالت سرعت نوشتن بسیار بالا است و احتمالاً کش تعریف شده سریع پر می‌شود و مرتباً miss می‌خورد که می‌تواند علت نتایج بالا را توضیح دهد.

همچنین در بین ۳ سیاست مختلف کش کردن، به ترتیب سیاست write through، سپس write around و در نهایت سیاست write back عملکرد بهتری به نسبت یکدیگر دارند.

البته در حالت کلی عملکر هر سه به یکدیگر بسیار نزدیک است زیرا خواندن‌های ما به صورت sequential است.

د) تست برای - بدون کش random read

```
Jobs: 16 (f=16): [r(16)][0.2%][r=1277KiB/s][r=319 IOPS][eta 03d:00h:52m:18s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1441KiB/s][r=360 IOPS][eta 03d:00h:48m:13s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1341KiB/s][r=335 IOPS][eta 03d:00h:44m:41s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1216KiB/s][r=304 IOPS][eta 03d:00h:48m:35s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1210KiB/s][r=302 IOPS][eta 03d:00h:45m:34s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1342KiB/s][r=335 IOPS][eta 03d:00h:44m:03s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1182KiB/s][r=295 IOPS][eta 03d:00h:44m:02s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1278KiB/s][r=319 IOPS][eta 03d:00h:44m:59s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1246KiB/s][r=311 IOPS][eta 03d:00h:40m:35s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1342KiB/s][r=335 IOPS][eta 03d:00h:42m:59s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1378KiB/s][r=344 IOPS][eta 03d:00h:42m:28s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1402KiB/s][r=350 IOPS][eta 03d:00h:41m:01s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1246KiB/s][r=311 IOPS][eta 03d:00h:41m:57s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1314KiB/s][r=328 IOPS][eta 03d:00h:37m:38s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1274KiB/s][r=318 IOPS][eta 03d:00h:35m:43s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1310KiB/s][r=327 IOPS][eta 03d:00h:36m:40s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1374KiB/s][r=343 IOPS][eta 03d:00h:39m:59s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1278KiB/s][r=319 IOPS][eta 03d:00h:40m:55s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1250KiB/s][r=312 IOPS][eta 03d:00h:39m:29s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1242KiB/s][r=310 IOPS][eta 03d:00h:38m:31s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1246KiB/s][r=311 IOPS][eta 03d:00h:40m:24s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1406KiB/s][r=351 IOPS][eta 03d:00h:43m:41s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1278KiB/s][r=319 IOPS][eta 03d:00h:46m:29s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1310KiB/s][r=327 IOPS][eta 03d:00h:46m:55s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1374KiB/s][r=343 IOPS][eta 03d:00h:48m:46s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1406KiB/s][r=351 IOPS][eta 03d:00h:50m:37s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1342KiB/s][r=335 IOPS][eta 03d:00h:46m:50s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1246KiB/s][r=311 IOPS][eta 03d:00h:44m:29s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1374KiB/s][r=343 IOPS][eta 03d:00h:45m:51s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1214KiB/s][r=303 IOPS][eta 03d:00h:46m:17s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1246KiB/s][r=311 IOPS][eta 03d:00h:46m:16s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1374KiB/s][r=343 IOPS][eta 03d:00h:48m:33s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1250KiB/s][r=312 IOPS][eta 03d:00h:50m:22s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1374KiB/s][r=343 IOPS][eta 03d:00h:50m:47s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1306KiB/s][r=326 IOPS][eta 03d:00h:52m:08s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1278KiB/s][r=319 IOPS][eta 03d:00h:53m:56s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1250KiB/s][r=312 IOPS][eta 03d:00h:54m:20s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1242KiB/s][r=310 IOPS][eta 03d:00h:50m:53s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1438KiB/s][r=359 IOPS][eta 03d:00h:54m:15s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1278KiB/s][r=319 IOPS][eta 03d:00h:53m:18s]
Jobs: 16 (f=16): [r(16)][0.2%][r=1378KiB/s][r=344 IOPS][eta 03d:00h:53m:15s]
```

```
6.22user 8.53system 8:26.98elapsed 2%CPU (0avgtext+0avgdata 29688maxresident)k
1364520inputs+8outputs (1571major+4577minor)pagefaults 0swaps
```

```
1 iops-test-job: (g=0): rw=randread, bs=(R) 4096B-4096B, (W) 4096B-4096B, (T) 4096B-4096B, ioengine=libaio, iodepth=16
2 ...
3 fio-3.28
4 Starting 16 processes
5
6 fio: terminating on signal 2
7
8 iops-test-job: (groupid=0, jobs=16): err= 0: pid=13914: Wed May 17 18:30:58 2023
9   read: IOPS=326, BW=1308KiB/s (1339kB/s)(647MiB/506441ms)
10    slat (nsec): min=1314, max=473775k, avg=48786073.82, stdev=68099447.27
11    clat (usec): min=7, max=3217, avg=733.69, stdev=281.03
12    lat (msec): min=7, max=3299, avg=782.48, stdev=294.60
13    clat percentiles (msec):
14      | 1.00th=[ 153], 5.00th=[ 326], 10.00th=[ 409], 20.00th=[ 510],
15      | 30.00th=[ 584], 40.00th=[ 651], 50.00th=[ 709], 60.00th=[ 776],
16      | 70.00th=[ 852], 80.00th=[ 944], 90.00th=[ 1083], 95.00th=[ 1200],
17      | 99.00th=[ 1552], 99.50th=[ 1754], 99.90th=[ 2333], 99.95th=[ 2500],
18      | 99.99th=[ 2836]
19    bw ( KiB/s): min= 255, max= 5136, per=100.00%, avg=1308.35, stdev=31.77, samples=16164
20    iops : min= 63, max= 1284, avg=326.93, stdev= 7.94, samples=16164
21    lat (msec) : 10=0.01%, 20=0.03%, 50=0.15%, 100=0.30%, 250=2.05%
22    lat (msec) : 500=16.46%, 750=36.87%, 1000=29.31%, 2000=14.60%, >=2000=0.23%
23    cpu : usr=0.03%, sys=0.07%, ctx=77645, majf=0, minf=462
24    IO depths : 1=0.1%, 2=0.1%, 4=0.1%, 8=0.1%, 16=99.9%, 32=0.0%, >=64=0.0%
25    submit : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
26    complete : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.1%, 32=0.0%, 64=0.0%, >=64=0.0%
27    issued rwts: total=165543,0,0,0 short=0,0,0 dropped=0,0,0
28    latency : target=0, window=0, percentile=100.00%, depth=16
29
30 Run status group 0 (all jobs):
31   READ: bw=1308KiB/s (1339kB/s), 1308KiB/s-1308KiB/s (1339kB/s-1339kB/s), io=647MiB (678MB), run=506441-506441ms
32
33 Disk stats (read/write):
34   sda: ios=165562/7, merge=31/5, ticks=30733780/1443, in_queue=30735661, util=100.00%
```

د) تست برای - همراه کش

سیاست write through

```
bigwhoman@bigwhoman-pp ~> sudo casadm -L
type    id    disk          status   write policy   device
cache   1     /dev/nvme0n1p8  Running  wt           -
Lcore   1     /dev/sda4      Active    -           /dev/cas1-1
```

```
----- Random Reading -----
Jobs: 16 (f=16): [r(16)][0.0%][r=2056KiB/s][r=514 IOPS][eta 03d:12h:01m:10s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2040KiB/s][r=510 IOPS][eta 03d:08h:54m:26s]
Jobs: 16 (f=16): [r(16)][0.0%][r=1213KiB/s][r=303 IOPS][eta 03d:23h:16m:25s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2508KiB/s][r=627 IOPS][eta 04d:01h:48m:44s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2772KiB/s][r=693 IOPS][eta 04d:06h:02m:04s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2844KiB/s][r=711 IOPS][eta 04d:10h:57m:37s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2902KiB/s][r=725 IOPS][eta 04d:04h:39m:56s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2752KiB/s][r=688 IOPS][eta 03d:07h:05m:40s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2918KiB/s][r=729 IOPS][eta 03d:04h:51m:28s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2700KiB/s][r=675 IOPS][eta 03d:00h:59m:08s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2778KiB/s][r=694 IOPS][eta 02d:20h:46m:27s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2886KiB/s][r=721 IOPS][eta 02d:17h:35m:40s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2964KiB/s][r=741 IOPS][eta 02d:22h:42m:53s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3187KiB/s][r=796 IOPS][eta 02d:13h:17m:23s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3168KiB/s][r=792 IOPS][eta 02d:08h:51m:05s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3096KiB/s][r=774 IOPS][eta 02d:02h:31m:36s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3739KiB/s][r=934 IOPS][eta 02d:03h:00m:49s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3068KiB/s][r=767 IOPS][eta 02d:01h:47m:28s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3804KiB/s][r=951 IOPS][eta 01d:23h:02m:46s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3291KiB/s][r=822 IOPS][eta 01d:23h:47m:43s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3672KiB/s][r=918 IOPS][eta 02d:00h:18m:30s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3403KiB/s][r=850 IOPS][eta 01d:23h:36m:55s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3348KiB/s][r=837 IOPS][eta 02d:00h:25m:44s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3127KiB/s][r=781 IOPS][eta 01d:22h:21m:18s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3759KiB/s][r=939 IOPS][eta 01d:21h:38m:12s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3764KiB/s][r=941 IOPS][eta 01d:20h:39m:12s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3648KiB/s][r=912 IOPS][eta 01d:21h:40m:39s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3783KiB/s][r=945 IOPS][eta 01d:20h:48m:25s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3636KiB/s][r=909 IOPS][eta 01d:21h:28m:14s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3724KiB/s][r=931 IOPS][eta 01d:21h:38m:04s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3352KiB/s][r=838 IOPS][eta 01d:20h:50m:53s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3972KiB/s][r=993 IOPS][eta 01d:20h:43m:07s]
Jobs: 16 (f=16): [r(16)][0.0%][r=4116KiB/s][r=1029 IOPS][eta 01d:19h:50m:08s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3559KiB/s][r=889 IOPS][eta 01d:18h:16m:26s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3980KiB/s][r=995 IOPS][eta 01d:16h:37m:31s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3759KiB/s][r=939 IOPS][eta 01d:16h:32m:31s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3896KiB/s][r=974 IOPS][eta 01d:15h:41m:00s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4012KiB/s][r=1003 IOPS][eta 01d:14h:22m:57s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4197KiB/s][r=1049 IOPS][eta 01d:14h:32m:03s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4029KiB/s][r=1007 IOPS][eta 01d:13h:43m:34s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4007KiB/s][r=1001 IOPS][eta 01d:13h:41m:32s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4104KiB/s][r=1026 IOPS][eta 01d:12h:10m:58s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4199KiB/s][r=1049 IOPS][eta 01d:11h:49m:42s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4123KiB/s][r=1030 IOPS][eta 01d:12h:17m:32s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4415KiB/s][r=1103 IOPS][eta 01d:12h:29m:07s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4635KiB/s][r=1158 IOPS][eta 01d:12h:34m:20s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4179KiB/s][r=1044 IOPS][eta 01d:12h:37m:35s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4423KiB/s][r=1105 IOPS][eta 01d:12h:43m:50s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3996KiB/s][r=999 IOPS][eta 01d:12h:40m:08s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4695KiB/s][r=1173 IOPS][eta 01d:12h:28m:33s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3840KiB/s][r=960 IOPS][eta 01d:12h:43m:42s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4095KiB/s][r=1023 IOPS][eta 01d:12h:27m:18s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3888KiB/s][r=972 IOPS][eta 01d:12h:10m:55s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4063KiB/s][r=1015 IOPS][eta 01d:11h:49m:18s]
```

```

Jobs: 16 (f=16): [r(16)][0.5%][r=5608KiB/s][r=1402 IOPS][eta 22h:13m:12s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5913KiB/s][r=1478 IOPS][eta 22h:12m:52s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6172KiB/s][r=1543 IOPS][eta 22h:14m:58s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6434KiB/s][r=1608 IOPS][eta 22h:13m:48s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6372KiB/s][r=1593 IOPS][eta 22h:17m:44s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6016KiB/s][r=1504 IOPS][eta 22h:08m:30s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5493KiB/s][r=1373 IOPS][eta 22h:03m:13s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6846KiB/s][r=1711 IOPS][eta 21h:55m:52s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6042KiB/s][r=1510 IOPS][eta 21h:55m:38s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6128KiB/s][r=1532 IOPS][eta 22h:00m:12s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5876KiB/s][r=1469 IOPS][eta 21h:52m:51s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5961KiB/s][r=1490 IOPS][eta 21h:45m:55s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6432KiB/s][r=1608 IOPS][eta 21h:43m:10s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6042KiB/s][r=1510 IOPS][eta 21h:40m:25s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5848KiB/s][r=1462 IOPS][eta 21h:35m:03s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5573KiB/s][r=1393 IOPS][eta 21h:37m:34s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5933KiB/s][r=1483 IOPS][eta 21h:40m:14s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6206KiB/s][r=1551 IOPS][eta 21h:43m:48s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5721KiB/s][r=1430 IOPS][eta 21h:43m:56s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6280KiB/s][r=1570 IOPS][eta 21h:46m:56s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6354KiB/s][r=1588 IOPS][eta 21h:44m:43s]

```

```

Command exited with non-zero status 128KiB/s)[r=1079 IOPS][eta 18h:45m:41s]
16.74user 39.49system 10:21.96elapsed 9%CPU (0avgtext+0avgdata 29576maxresident)k
12611872inputs+8outputs (1570major+4558minor)pagefaults 0swaps

```

```

iops-test-job: (g=0): rw=randread, bs=(R) 4096B-4096B, (W) 4096B-4096B, (T) 4096B-4096B, ioengine=libaio, iodepth=16
...
fio-3.28
Starting 16 processes
fio: terminating on signal 2

iops-test-job: (groupid=0, jobs=16): err= 0: pid=23372: Wed May 17 18:46:59 2023
  read: IOPS=1384, BW=5540KiB/s (5673kB/s)(3362MB/621391msec)
    slat (usec): min=2, max=75244, avg=38.86, stdev=196.58
    clat (nsec): min=533, max=6104.6M, avg=184740899.95, stdev=665871021.41
    lat (usec): min=40, max=6104.6K, avg=184771.51, stdev=665869.95
  clat percentiles (usec):
    | 1.00th=[     72], 5.00th=[     77], 10.00th=[     79],
    | 20.00th=[    87], 30.00th=[    88], 40.00th=[    91],
    | 50.00th=[    99], 60.00th=[   139], 70.00th=[   155],
    | 80.00th=[  167], 90.00th=[ 283116], 95.00th=[109898],
    | 99.00th=[3472884], 99.50th=[3741320], 99.90th=[4244636],
    | 99.95th=[4395631], 99.99th=[4865393]
  bw ( KiB/s): min= 121, max=21017, per=100.00%, avg=6046.65, stdev=301.87, samples=18211
  iops : min= 25, max= 7752, avg=1510.86, stdev=75.43, samples=18211
  lat (nsec): 750±0.01%, 1000±0.01%
  lat (usec): 4±0.01%, 16±0.01%, 20±0.01%, 50±0.09%, 100±0.50%
  lat (usec): 250±31.62%, 500±0.22%, 750±0.02%, 1000±0.01%
  lat (msec): 2±0.02%, 4±0.03%, 16±0.01%, 20±0.02%, 50±0.33%
  lat (msec): 100±1.05%, 250±5.00%, 500±4.41%, 750±1.17%, 1000±0.34%
  lat (msec): 2000±0.32%, >2000±4.75%
  cpu : user=0.12%, sys=0.37%, ctxt=862708, majf=0, minf=474
  IO depths : 1=0.1%, 2=0.1%, 4=0.1%, 8=0.1%, 16=100.0%, 32=0.0%, >64=0.0%
    submit : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >64=0.0%
    complete : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.1%, 32=0.0%, 64=0.0%, >64=0.0%
  issued r/wts: total=860581,0,0, short=0,0,0, dropped=0,0,0
  latency : target=0, window=0, percentile=100.00%, depth=16

Run status group 0 (all jobs):
  READ: bw=5540KiB/s (5673kB/s), 5540KiB/s-5540KiB/s (5673kB/s-5673kB/s), io=3362MB (3525MB), run=621391-621391msec

Disk stats (read/write):
  casl-1: ios=860585/5, merge=0/0, ticks=158802736/4448, in_queue=158807184, util=100.00%, aggrios=149194/10, aggrmerge=59/6, aggrticks=38067666/2480, aggrin_queue=38071270, aggrutil=100.00%
  sda: ios=149194/10, merge=59/6, ticks=38067666/2480, in_queue=38071270, util=100.00%

```

سیاست write back

```
bigwhoman@bigwhoman-pp ~> sudo casadm -L
type    id   disk          status   write policy   device
cache   1    /dev/nvme0n1p8  Running   wb           -
Lcore   1    /dev/sda4      Active    -             /dev/cas1-1
bigwhoman@bigwhoman-pp ~> sudo mount /dev/cas1-1 /mnt/5ba9ddfc-07de-4eda-baef-3
```

```
----- Random Reading -----
Jobs: 16 (f=16): [r(16)][0.0%][r=1912KiB/s][r=478 IOPS][eta 03d:19h:01m:17s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2076KiB/s][r=519 IOPS][eta 04d:02h:24m:03s]
Jobs: 16 (f=16): [r(16)][0.0%][r=1672KiB/s][r=418 IOPS][eta 03d:19h:50m:25s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2704KiB/s][r=676 IOPS][eta 03d:08h:54m:22s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2580KiB/s][r=645 IOPS][eta 02d:19h:01m:33s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2642KiB/s][r=660 IOPS][eta 03d:03h:43m:36s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2808KiB/s][r=702 IOPS][eta 02d:22h:41m:33s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2628KiB/s][r=657 IOPS][eta 02d:16h:58m:37s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2954KiB/s][r=738 IOPS][eta 02d:18h:40m:16s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3099KiB/s][r=774 IOPS][eta 02d:22h:27m:46s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2944KiB/s][r=736 IOPS][eta 02d:07h:43m:39s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3044KiB/s][r=761 IOPS][eta 02d:06h:39m:39s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3251KiB/s][r=812 IOPS][eta 02d:03h:39m:48s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3175KiB/s][r=793 IOPS][eta 02d:01h:30m:16s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3515KiB/s][r=878 IOPS][eta 01d:22h:00m:46s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3151KiB/s][r=787 IOPS][eta 01d:23h:54m:24s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3852KiB/s][r=963 IOPS][eta 01d:23h:56m:30s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3092KiB/s][r=773 IOPS][eta 01d:21h:11m:43s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3380KiB/s][r=845 IOPS][eta 01d:22h:55m:46s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3495KiB/s][r=873 IOPS][eta 01d:21h:23m:45s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3692KiB/s][r=923 IOPS][eta 01d:21h:47m:55s]
Jobs: 16 (f=16): [r(16)][0.0%][r=4008KiB/s][r=1002 IOPS][eta 01d:19h:01m:06s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3403KiB/s][r=850 IOPS][eta 01d:16h:16m:28s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3163KiB/s][r=790 IOPS][eta 01d:16h:47m:15s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3668KiB/s][r=917 IOPS][eta 01d:16h:31m:42s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3344KiB/s][r=836 IOPS][eta 01d:17h:35m:43s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3656KiB/s][r=914 IOPS][eta 01d:17h:17m:40s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3831KiB/s][r=957 IOPS][eta 01d:17h:30m:39s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3351KiB/s][r=837 IOPS][eta 01d:16h:58m:42s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3724KiB/s][r=931 IOPS][eta 01d:16h:14m:08s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3636KiB/s][r=909 IOPS][eta 01d:13h:33m:15s]
Jobs: 16 (f=16): [r(16)][0.0%][r=4128KiB/s][r=1032 IOPS][eta 01d:13h:08m:01s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4208KiB/s][r=1052 IOPS][eta 01d:11h:34m:01s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3567KiB/s][r=891 IOPS][eta 01d:11h:48m:20s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4248KiB/s][r=1062 IOPS][eta 01d:12h:21m:48s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3627KiB/s][r=906 IOPS][eta 01d:12h:21m:04s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3776KiB/s][r=944 IOPS][eta 01d:12h:02m:22s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3887KiB/s][r=971 IOPS][eta 01d:12h:16m:53s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4200KiB/s][r=1050 IOPS][eta 01d:12h:21m:50s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4124KiB/s][r=1031 IOPS][eta 01d:11h:54m:34s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3680KiB/s][r=920 IOPS][eta 01d:11h:37m:24s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3971KiB/s][r=992 IOPS][eta 01d:10h:54m:56s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4380KiB/s][r=1095 IOPS][eta 01d:09h:29m:42s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4372KiB/s][r=1093 IOPS][eta 01d:08h:28m:06s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3979KiB/s][r=994 IOPS][eta 01d:07h:57m:47s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4324KiB/s][r=1081 IOPS][eta 01d:08h:17m:28s]
```

```

Jobs: 16 (f=16): [r(16)][0.9%][r=148KiB/s][r=1/87 IOPS][eta 18h:03m:48s]
Jobs: 16 (f=16): [r(16)][0.9%][r=7352KiB/s][r=1838 IOPS][eta 18h:06m:04s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6436KiB/s][r=1609 IOPS][eta 18h:05m:00s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6872KiB/s][r=1718 IOPS][eta 18h:08m:23s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6998KiB/s][r=1749 IOPS][eta 18h:06m:49s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6830KiB/s][r=1707 IOPS][eta 17h:58m:49s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6904KiB/s][r=1726 IOPS][eta 17h:51m:55s]
Jobs: 16 (f=16): [r(16)][0.9%][r=7176KiB/s][r=1794 IOPS][eta 17h:49m:44s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6888KiB/s][r=1722 IOPS][eta 17h:51m:17s]
Jobs: 16 (f=16): [r(16)][0.9%][r=7300KiB/s][r=1825 IOPS][eta 17h:48m:27s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6748KiB/s][r=1687 IOPS][eta 17h:48m:34s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6804KiB/s][r=1701 IOPS][eta 17h:42m:57s]
Jobs: 16 (f=16): [r(16)][0.9%][r=7827KiB/s][r=1956 IOPS][eta 17h:44m:26s]
Jobs: 16 (f=16): [r(16)][0.9%][r=7412KiB/s][r=1853 IOPS][eta 17h:43m:04s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6310KiB/s][r=1577 IOPS][eta 17h:42m:49s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6966KiB/s][r=1741 IOPS][eta 17h:42m:04s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6846KiB/s][r=1711 IOPS][eta 17h:41m:33s]
Jobs: 16 (f=16): [r(16)][0.9%][r=7323KiB/s][r=1830 IOPS][eta 17h:37m:08s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6548KiB/s][r=1637 IOPS][eta 17h:39m:50s]
Jobs: 16 (f=16): [r(16)][0.9%][r=7387KiB/s][r=1846 IOPS][eta 17h:41m:09s]
Jobs: 16 (f=16): [r(16)][0.9%][r=6702KiB/s][r=1675 IOPS][eta 17h:44m:12s]
Jobs: 16 (f=16): [r(16)][0.9%][r=7823KiB/s][r=1955 IOPS][eta 17h:42m:18s]
Jobs: 16 (f=16): [r(16)][1.0%][r=6724KiB/s][r=1681 IOPS][eta 17h:40m:20s]
Jobs: 16 (f=16): [r(16)][1.0%][r=7472KiB/s][r=1868 IOPS][eta 17h:43m:03s]
Jobs: 16 (f=16): [r(16)][1.0%][r=7492KiB/s][r=1873 IOPS][eta 17h:41m:46s]
Jobs: 16 (f=16): [r(16)][1.0%][r=7316KiB/s][r=1829 IOPS][eta 17h:42m:25s]

```

```

Command exited with non-zero status 128KiB/s)[r=362 IOPS][eta 17h:41m:45s]
17.00user 40.93system 10:19.88elapsed 9%CPU (0avgtext+0avgdata 29604maxresident)k
12643152inputs+8outputs (1569major+4574minor)pagefaults 0swaps

```

```

ips-test-job: (g=0): rw=randread, bs=(R) 4096B-4096B, (W) 4096B-4096B, (T) 4096B-4096B, ioengine=libaio, iodepth=16
...
fio-3.28
Starting 16 processes

fio: terminating on signal 2

ips-test-job: (groupid=0, jobs=16): err: 0: pid=34667: Wed May 17 19:00:00 2023
read: IOPS=1393, BW=5573KiB/s (5707kB/s)(3370MiB/619206msec)
  slat (usec): min=2, max=174964, avg=33.44, stdev=578.39
  clat (usec): min=2, max=6635.7k, avg=183612.33, stdev=668403.26
  lat (usec): min=39, max=6635.7k, avg=183646.30, stdev=668403.26
  clat percentiles (usec):
  | 1.00th=[    72], 5.00th=[    77], 10.00th=[    79],
  | 20.00th=[   87], 30.00th=[   89], 40.00th=[   91],
  | 50.00th=[ 100], 60.00th=[ 147], 70.00th=[ 155],
  | 80.00th=[ 167], 90.00th=[ 283116], 95.00th=[ 901776],
  | 99.00th=[3506439], 99.50th=[3808429], 99.90th=[4328522],
  | 99.95th=[4506058], 99.99th=[4999611]
bw ( KiB/s): min= 113, bw=28837, per=100.00%, avp=6136.63, stdev=389.33, samples=17987
iops : min= 17, max= 7207, avg=1532.75, stdev=77.32, samples=17987
lat (usec) : 4=<0.01%, 10=<0.01%, 20=<0.01%, 50=<0.07%, 100=<0.01%
lat (usec) : 250=<32.29%, 500=<0.20%, 750=<0.01%, 1000=<0.01%
lat (msec) : 2=<0.01%, 4=<0.01%, 10=<0.01%, 20=<0.02%, 50=<0.31%
lat (msec) : 100=<1.03%, 250=<5.04%, 500=<4.48%, 750=<1.23%, 1000=<0.35%
lat (msec) : 2000=<0.30%, >=2000=<4.61%
cpu : usr=<0.12%, sys=<0.38%, ctx=<865458, mafj=<0, minf=<486
IO depths : 1=<0.1%, 2=<0.1%, 4=<0.1%, 8=<0.1%, 16=<0.0%, 32=<0.0%, >=64=<0.0%
  submit : 0=<0.0%, 4=<100.0%, 8=<0.0%, 16=<0.0%, 32=<0.0%, 64=<0.0%, >=64=<0.0%
  complete : 0=<0.0%, 4=<100.0%, 8=<0.0%, 16=<0.1%, 32=<0.0%, 64=<0.0%, >=64=<0.0%
  issued rwt: total=<862675.0,0,0 short=<0.0,0.0 dropped=<0.0,0.0
  latency : target=<0, window=<0, percentile=<100.00%, depth=<16

Run status group 0 (all jobs):
  READ: bw=5573KiB/s (5707kB/s), 5573KiB/s-5573KiB/s (5707kB/s-5707kB/s), io=3370MiB (3534MB), run=619206-619206msec

Disk stats (read/write):
  casl-1: ios=<862679/5, merge=<0/0, ticks=<158197892/84, in_queue=<158197976, util=<100.00%, aggrios=<149513/6, aggrmerge=<62/5, aggrticks=<37918983/2130, aggrin_queue=<37921686, aggrutil=<100.00%
  sda: ios=<149513/6, merge=<62/5, ticks=<37918983/2130, in_queue=<37921686, util=<100.00%
```

سیاست write around

```
bigwhoman@bigwhoman-pp ~> sudo casadm -L
type      id   disk           status    write policy   device
cache     1    /dev/nvme0n1p8  Running    wa             -
Lcore     1    /dev/sda4     Active     -              /dev/cas1-1
```

```
----- Random Reading -----
Jobs: 16 (f=16): [r(16)][0.0%][r=1876KiB/s][r=469 IOPS][eta 04d:03h:17m:46s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2206KiB/s][r=551 IOPS][eta 04d:12h:40m:54s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2626KiB/s][r=656 IOPS][eta 04d:13h:36m:58s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2076KiB/s][r=519 IOPS][eta 04d:16h:01m:29s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2554KiB/s][r=638 IOPS][eta 04d:06h:02m:04s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2726KiB/s][r=681 IOPS][eta 03d:07h:52m:51s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2670KiB/s][r=667 IOPS][eta 03d:08h:18m:34s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2698KiB/s][r=674 IOPS][eta 03d:07h:05m:40s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2542KiB/s][r=635 IOPS][eta 03d:05h:17m:14s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2692KiB/s][r=673 IOPS][eta 03d:03h:53m:01s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2740KiB/s][r=685 IOPS][eta 03d:01h:46m:25s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3216KiB/s][r=804 IOPS][eta 02d:16h:05m:35s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2928KiB/s][r=732 IOPS][eta 02d:15h:31m:00s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3099KiB/s][r=774 IOPS][eta 02d:17h:04m:04s]
Jobs: 16 (f=16): [r(16)][0.0%][r=2952KiB/s][r=738 IOPS][eta 02d:18h:40m:41s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3355KiB/s][r=838 IOPS][eta 02d:11h:10m:39s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3232KiB/s][r=808 IOPS][eta 02d:02h:36m:30s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3807KiB/s][r=951 IOPS][eta 02d:00h:45m:16s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3171KiB/s][r=792 IOPS][eta 01d:21h:49m:51s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3852KiB/s][r=963 IOPS][eta 01d:23h:31m:43s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3676KiB/s][r=919 IOPS][eta 01d:22h:51m:42s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3512KiB/s][r=878 IOPS][eta 01d:22h:06m:25s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3672KiB/s][r=918 IOPS][eta 01d:20h:07m:08s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3660KiB/s][r=915 IOPS][eta 01d:20h:20m:16s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3748KiB/s][r=937 IOPS][eta 01d:17h:32m:57s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3687KiB/s][r=921 IOPS][eta 01d:15h:40m:12s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3451KiB/s][r=862 IOPS][eta 01d:14h:37m:26s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3591KiB/s][r=897 IOPS][eta 01d:15h:02m:55s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3427KiB/s][r=856 IOPS][eta 01d:14h:39m:13s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3404KiB/s][r=851 IOPS][eta 01d:14h:24m:27s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3987KiB/s][r=996 IOPS][eta 01d:14h:24m:14s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3680KiB/s][r=920 IOPS][eta 01d:13h:46m:17s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3588KiB/s][r=897 IOPS][eta 01d:13h:46m:45s]
Jobs: 16 (f=16): [r(16)][0.0%][r=3964KiB/s][r=991 IOPS][eta 01d:14h:06m:42s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4003KiB/s][r=1000 IOPS][eta 01d:13h:45m:02s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4427KiB/s][r=1106 IOPS][eta 01d:14h:00m:57s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3836KiB/s][r=959 IOPS][eta 01d:14h:22m:40s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4271KiB/s][r=1067 IOPS][eta 01d:14h:25m:09s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3740KiB/s][r=935 IOPS][eta 01d:14h:52m:25s]
Jobs: 16 (f=16): [r(16)][0.1%][r=3928KiB/s][r=982 IOPS][eta 01d:15h:09m:59s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4019KiB/s][r=1004 IOPS][eta 01d:15h:29m:04s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4075KiB/s][r=1018 IOPS][eta 01d:15h:38m:24s]
Jobs: 16 (f=16): [r(16)][0.1%][r=4343KiB/s][r=1085 IOPS][eta 01d:15h:51m:01s]
```

```

Jobs: 16 (f=16): [r(16)][0.5%][r=6662KiB/s][r=1665 IOPS][eta 21h:17m:59s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5837KiB/s][r=1459 IOPS][eta 21h:19m:55s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6144KiB/s][r=1536 IOPS][eta 21h:24m:06s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6230KiB/s][r=1557 IOPS][eta 21h:21m:56s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6386KiB/s][r=1596 IOPS][eta 21h:15m:07s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6162KiB/s][r=1540 IOPS][eta 21h:13m:14s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5916KiB/s][r=1479 IOPS][eta 21h:11m:00s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5721KiB/s][r=1430 IOPS][eta 21h:06m:33s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6382KiB/s][r=1595 IOPS][eta 21h:10m:52s]
Jobs: 16 (f=16): [r(16)][0.5%][r=5997KiB/s][r=1499 IOPS][eta 21h:09m:32s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6206KiB/s][r=1551 IOPS][eta 21h:08m:29s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6408KiB/s][r=1602 IOPS][eta 21h:05m:47s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6696KiB/s][r=1674 IOPS][eta 20h:58m:23s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6534KiB/s][r=1633 IOPS][eta 20h:59m:18s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6402KiB/s][r=1600 IOPS][eta 20h:55m:27s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6780KiB/s][r=1695 IOPS][eta 20h:55m:07s]
Jobs: 16 (f=16): [r(16)][0.5%][r=6204KiB/s][r=1551 IOPS][eta 20h:59m:07s]
Jobs: 16 (f=16): [r(16)][0.6%][r=5996KiB/s][r=1499 IOPS][eta 20h:56m:30s]
Jobs: 16 (f=16): [r(16)][0.6%][r=6244KiB/s][r=1561 IOPS][eta 21h:00m:43s]
Jobs: 16 (f=16): [r(16)][0.6%][r=6576KiB/s][r=1644 IOPS][eta 21h:01m:54s]
Jobs: 16 (f=16): [r(16)][0.6%][r=5576KiB/s][r=1394 IOPS][eta 21h:05m:11s]
Jobs: 16 (f=16): [r(16)][0.6%][r=7043KiB/s][r=1760 IOPS][eta 21h:04m:33s]
Jobs: 16 (f=16): [r(16)][0.6%][r=6030KiB/s][r=1507 IOPS][eta 21h:01m:15s]
Jobs: 16 (f=16): [r(16)][0.6%][r=6322KiB/s][r=1580 IOPS][eta 21h:01m:49s]
Jobs: 16 (f=16): [r(16)][0.6%][r=6454KiB/s][r=1613 IOPS][eta 21h:01m:18s]

```

```

Command exited with non-zero status 128KiB/s][r=1097 IOPS][eta 20h:58m:27s]
12.18user 27.09system 7:14.03elapsed 9%CPU (0avgtext+0avgdata 29580maxresident)k
7860008inputs+8outputs (1567major+4568minor)pagefaults 0swaps

```

```

1 iops-test-job: (g=0): rw=randread, bs=(R) 4096B-4096B, (W) 4096B-4096B, (T) 4096B-4096B, ioengine=libaio, iodepth=16
2 ...
3 fio-3.28
4 Starting 16 processes
5
6 fio: terminating on signal 2
7
8 iops-test-job: (groupid=0, jobs=16): err= 0: pid=45772: Wed May 17 19:09:34 2023
9 read: IOPS=1247, BW=4990KiB/s (5110kB/s)(2112MiB/433399msec)
10    slat (usec): min=2, max=<1191, avg=33.70, stdev=257.53
11    clat (nsec): min=1513, max=6102.0M, avg=205032311.47, stdev=664804826.01
12    lat (usec): min=40, max=6102.0k, avg=205066.64, stdev=664803.22
13    clat percentiles (usec):
14      | 1.00th=[   72], 5.00th=[   77], 10.00th=[   81],
15      | 20.00th=[   88], 30.00th=[   89], 40.00th=[   94],
16      | 50.00th=[  110], 60.00th=[  151], 70.00th=[  159],
17      | 80.00th=[  200], 90.00th=[ 354419], 95.00th=[2122318],
18      | 99.00th=[3238003], 99.50th=[3607102], 99.90th=[4395631],
19      | 99.95th=[4596958], 99.99th=[4999611]
20    bw ( KiB/s): min= 114, max=28125, per=100.00%, avg=5442.83, stdev=282.56, samples=12711
21    iops : min= 18, max= 7024, avg=1359.49, stdev=70.61, samples=12711
22    lat (usec) : 2=<0.1%, 4=<0.1%, 10=<0.1%, 20=<0.1%, 50=<0.07%
23    lat (usec) : 100=<45.40%, 250=<4.98%, 500=<0.32%, 750=<0.01%, 1000=<0.01%
24    lat (msec) : 2=<0.01%, 4=<0.01%, 10=<0.01%, 20=<0.02%, 50=<0.32%
25    lat (msec) : 100=<1.03%, 250=<5.10%, 500=<4.67%, 750=<1.28%, 1000=<0.39%
26    lat (msec) : 2000=<0.97%, >=2000=5.43%
27    cpu : usr=<0.12%, sys=<0.36%, ctx=542851, majf=0, minf=467
28    IO depths : 1=<0.1%, 2=<0.1%, 4=<0.1%, 8=<0.1%, 16=<0.0%, 32=<0.0%, >=64=<0.0%
29    submit : 0=<0.0%, 4=<0.0%, 8=<0.0%, 16=<0.0%, 32=<0.0%, 64=<0.0%, >=64=<0.0%
30    complete : 0=<0.0%, 4=<0.0%, 8=<0.0%, 16=<0.1%, 32=<0.0%, 64=<0.0%, >=64=<0.0%
31    issued rwt: total=<40710.0,0,0 short=<0.0,0.0 dropped=<0.0,0.0
32    latency : target=<0, window=<100.00%, percentile=<100.00%, depth=<16
33
34 Run status group 0 (all jobs):
35   READ: bw=4990KiB/s (5110kB/s), 4990KiB/s-4990KiB/s (5110kB/s-5110kB/s), io=2112MiB (2215MB), run=433399-433399msec
36
37 Disk stats (read/write):
38   casl-1: ios=540714/5, merge=0/0, ticks=110701280/5844, in_queue=110707124, util=100.00%, aggrios=103541/29, agrmerge=206/15, aggrticks=26449344/5446, aggrin_queue=26457809, aggrutil=100.00%
39   sda: ios=103541/29, merge=206/15, ticks=26449344/5446, in_queue=26457809, util=100.00%
40

```

تحلیل‌ها

در این حالت، به علت این که به صورت رندوم از یک فایل ۲۰ گیگ می‌خواهیم بخوانیم سیستم به شدت ضعیف عمل کرده و همانطور که دیده می‌شود سرعت ما از ۱۲۰ مگ بر ثانیه در حالت sequential به ۱.۵ مگابایت می‌رسد و متاسفانه اجرای تمامی این خواندن میسر نیست اما از یک فریم ۱۰ دقیقه‌ای از هر ۳ را بررسی می‌کنیم.

اولاً که حالت عادی و بدون کش کاملاً ضعیف عمل کرده و تقریباً با سرعت ثابت ۱.۳ مگابایت بر ثانیه و تعداد عملیات ۵۴۰ iops کار می‌کند و اتمام خواندن این فایل با این سیاست تقریباً ۳ روز کامل طول می‌کشد !!!!!

در این نقطه است که کش به کمک ما می‌آید، پس سه حالت مختلف کش را بررسی می‌کنیم.

در سیاست **write through**، سیستم با سرعت ۲ مگابایت بر ثانیه و ۵۰۰ iops شروع کرده و به صورت تدریجی در زمان زیاد می‌شود که به دلیل این است که داده‌های ما به مرور زمان در کش زیاد شده (اما به ۵ گیگ نمی‌رسند یا خیلی دیر می‌رسند) پس احتمال اینکه کش ما hit شود بسیار بالا است و در نهایت کار نیز سرعت به حدود ۶.۵ مگابایت بر ثانیه و ۱۵۰۰ iops می‌رسد که یعنی در همین حالت نیز نسبت به حالت بدون کش حدود ۳ برابر بهینه‌سازی داشته‌ایم و نهایتاً از ۳ روز کامل به ۲۱ ساعت می‌رسیم.

در سیاست **write back** سیستم با سرعت حدود ۲ مگابات بر ثانیه و ۵۰۰ iops مانند سیستم قبلی شروع کرده اما با شبیب نسبتاً زیادی سرعت آن بالا می‌رود و در در زمان کمی (حدوداً ۱۰ ثانیه) به سرعت ۴ مگابایت بر ثانیه و ۱۰۰۰ iops می‌رسد که یعنی به تعداد بیشتری hit در کش رسیده‌ایم.

همچنین در این حالت تا زمان نسبتاً کمی به سرعت ۶ مگابایت می‌رسیم و پس از آن سرعت رشد کمتر شده اما باز صعودی است و در نهایت به سرعت ۷.۵ مگابایت و ۱۷۰۰

iops می‌رسیم که یعنی خواندن این فایل ۱۷ ساعت طول می‌کشد که ۴ ساعت از حالت write through سریع‌تر است.

در سیاست **write around** نیز مانند سیاست دوم سریع به سرعت ۴ مگابایت بر ثانیه می‌رسیم اما اما پس از آن سرعت نرخ افزایشی بسیار کمی دارد و نهایتاً به سرعت ۶.۵ مگابایت بر ثانیه می‌رسیم که یعنی این حالت بسیار شبیه write through است.

درنهایت می‌توان دید استفاده کردن از کش در حالت random read و سرعت پایین بسیار به ما کمک می‌کند اما در سرعت‌های بالا و sequential read مخصوصاً در هنگام نوشتن بالا و فضای کش کوچک بعضاً می‌تواند به کاهش عملکرد نیز منجر شود و همچنین سیاست random read در هنگام write back، بهینه‌سازی نبستاً خوبی برای ما به ارمغان می‌آورد.