

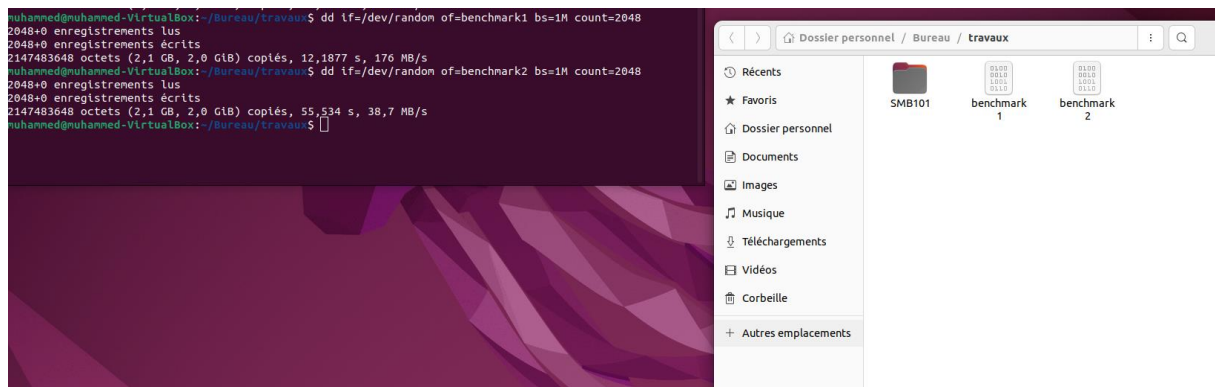
I Limiter la vitesse d'accès disque

1. Réalisation du benchmark disque

Afin de réaliser deux tests consécutifs générant deux fichiers de 2Go, j'exécute les commandes suivantes :

- `dd if=/dev/random of=benchmark1 bs=1M count=2048`
- `dd if=/dev/random of=benchmark2 bs=1M count=2048`

Mon premier fichier généré se nommera benchmark1 et le deuxième benchmark2.

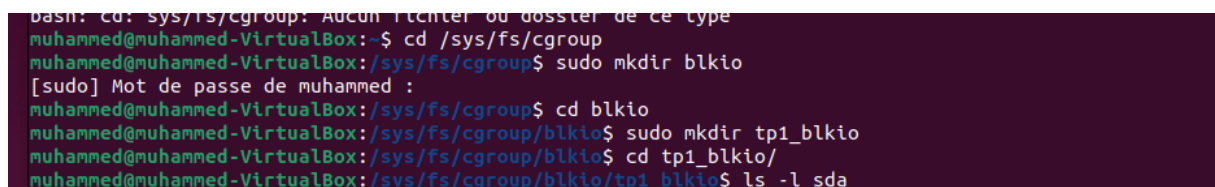


On remarque à la fin des exécutions les taux de transfert :

- 176 mb/s pour le premier fichier
- 38,7 mb/s pour le deuxième fichier

2. La mise en place du cgroup sur le sous-système adéquat

Voici les commandes que j'ai exécuté afin de mettre en place un cgroup nommé « `tp1_blkio` » portant sur le sous-système « `blkio` » à l'aide des commandes de base d'un terminal.



La commande que j'exécute afin d'avoir le numéro majeur et mineur est « ls -l sda ».

```
muhammed@muhammed-VirtualBox:/$ cd /dev
muhammed@muhammed-VirtualBox:/dev$ ls -l sda
brw-rw---- 1 root disk 8, 0 mai 21 18:37 sda
muhammed@muhammed-VirtualBox:/dev$
```

On remarque que le numéro majeur est 8, et 0 pour le numéro mineur.

Afin de limiter la vitesse de lecture à 5mo/s, j'exécute la commande « sudo mount -t cgroup -o blkio none /sys/fs/cgroup/blkio ».

Puis j'exécute la commande « sudo echo "8:0 5242880" | sudo tee /sys/fs/cgroup/blkio/tp1_blkio/blkio.throttle.read_bps_device ».

```
muhammed@muhammed-VirtualBox:/$ sudo echo "8:0 5242880" | sudo tee /sys/fs/cgroup/blkio/tp1_blkio/blkio.thro
ttle.read_bps_device
[sudo] Mot de passe de muhammed :
Désolé, essayez de nouveau.
[sudo] Mot de passe de muhammed :
Désolé, essayez de nouveau.
[sudo] Mot de passe de muhammed :
8:0 5242880
muhammed@muhammed-VirtualBox:/$
```

3. Le constat de l'exécution de la contrainte mise en place

J'ouvre iotop dans un terminal et j'exécute la commande « sudo cgexec -g blkio:tp1_blkio dd if=/dev/zero of=/dev/null bs=1M count=4000 ».

Voici ce que cela affiche :

The image contains two terminal screenshots. The left screenshot shows the iotop command output, which is a table with columns: TID, PRIO, USER, DISK READ, DISK WRITE, SWAPIN, IO>, and COMMAND. The 'DISK READ' column for all processes is 0.00 B/s, and the 'DISK WRITE' column for all processes is 0.00 B/s. The 'COMMAND' column shows various system processes like 'init splash', '[kthreadd]', '[rcu_gp]', '[slub_flushwq]', '[netns]', '[kworker/0:0H-events_highpri]', '[mm_percpu_wq]', '[rcu_tasks_kthread]', '[rcu_tasks_trace_kthread]', '[ksoftirqd/0]', '[rcu_preempt]', '[migration/0]', '[idle_inject/0]', '[cpuhp/0]', '[cpuhp/1]', '[idle_inject/1]', '[migration/1]', '[ksoftirqd/1]', '[kworker/1:0H]', '[cpuhp/2]', '[idle_inject/2]', '[migration/2]', '[ksoftirqd/2]', '[kworker/2:0H-kblockd]', '[cpuhp/3]', '[idle_inject/3]', '[migration/3]', '[ksoftirqd/3]', and '[kworker/3:0H-events_highpri]'. The right screenshot shows the execution of the command 'sudo cgexec -g blkio:tp1_blkio dd if=/dev/zero of=/dev/null bs=1M count=4000'. The output shows the progress of the data transfer, with the first part showing '2097152000 octets (21 GB, 20 GiB) copiés, 6,03092 s, 3,5 GB/s' and the second part showing '2097152000 octets (21 GB, 20 GiB) copiés, 5,23666 s, 4,0 GB/s'.

```
muhammed@muhammed-VirtualBox: /
Total DISK READ: 0.00 B/s | Total DISK WRITE: 382.16 M/s
Current DISK READ: 0.00 B/s | Current DISK WRITE: 351.52 M/s
TID PRIO USER DISK READ DISK WRITE SWAPIN IO> COMMAND
4430 be/4 root 0.00 B/s 382.16 M/s ?unavailable? dd if=/dev/zero of=/tmp/null bs=1M count=4000
1 be/4 root 0.00 B/s 0.00 B/s ?unavailable? init splash
2 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [kthreadd]
3 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [rcu_gp]
4 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [rcu_par_gp]
5 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [slub_flushwq]
6 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [netns]
8 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [kworker/0:0H-events_highpri]
10 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [mm_percpu_wq]
11 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [rcu_tasks_kthread]
12 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [rcu_tasks_trace_kthread]
13 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [rcu_tasks_trace_kthread]
14 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [ksoftirqd/0]
15 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [rcu_preempt]
16 rt/4 root 0.00 B/s 0.00 B/s ?unavailable? [migration/0]
17 rt/4 root 0.00 B/s 0.00 B/s ?unavailable? [idle_inject/0]
19 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [cpuhp/0]
20 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [cpuhp/1]
21 rt/4 root 0.00 B/s 0.00 B/s ?unavailable? [idle_inject/1]
22 rt/4 root 0.00 B/s 0.00 B/s ?unavailable? [migration/1]
23 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [ksoftirqd/1]
25 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [kworker/1:0H]
26 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [cpuhp/2]
27 rt/4 root 0.00 B/s 0.00 B/s ?unavailable? [idle_inject/2]
28 rt/4 root 0.00 B/s 0.00 B/s ?unavailable? [migration/2]
29 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [ksoftirqd/2]
31 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [kworker/2:0H-kblockd]
32 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [cpuhp/3]
33 rt/4 root 0.00 B/s 0.00 B/s ?unavailable? [idle_inject/3]
34 rt/4 root 0.00 B/s 0.00 B/s ?unavailable? [migration/3]
35 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [ksoftirqd/3]
37 be/4 root 0.00 B/s 0.00 B/s ?unavailable? [kworker/3:0H-events_highpri]
keys: any: refresh q: quit i: ionice a: active p: proc b: accum
sort: r: asc left: SWAPIN right: COMMAND home: TID end: COMMAND
CONFIG_TASK_DELAY_ACCT not enabled in kernel, cannot determine SWAPIN and IO %

muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio
20000+0 enregistrements écrits
2097152000 octets (21 GB, 20 GiB) copiés, 6,03092 s, 3,5 GB/s
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo cgexec -g blkio:tp1_blkio dd if=/dev/zero
of=/dev/null bs=1M count=20000
20000+0 enregistrements lus
20000+0 enregistrements écrits
2097152000 octets (21 GB, 20 GiB) copiés, 5,23666 s, 4,0 GB/s
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo cgexec -g blkio:tp1_blkio dd if=/dev/zero
of=/dev/null bs=1M count=10000
10000+0 enregistrements lus
10000+0 enregistrements écrits
10485760000 octets (10 GB, 9,8 GiB) copiés, 2,70047 s, 3,9 GB/s
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo cgexec -g blkio:tp1_blkio dd if=/dev/zero
of=/dev/null bs=1M count=100000
^C78727+0 enregistrements lus
78727+0 enregistrements écrits
82551242752 octets (83 GB, 77 GiB) copiés, 13,1636 s, 6,3 GB/s
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo cgexec -g blkio:tp1_blkio dd if=/dev/zero
of=/dev/null bs=1M count=100000
100000+0 enregistrements lus
100000+0 enregistrements écrits
10485760000 octets (10 GB, 9,8 GiB) copiés, 13,5101 s, 7,8 GB/s
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo cgexec -g blkio:tp1_blkio dd if=/dev/zero
of=/dev/null bs=1M count=2000
2000+0 enregistrements lus
2000+0 enregistrements écrits
2097152000 octets (2,1 GB, 2,0 GiB) copiés, 21,8552 s, 96,0 MB/s
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo cgexec -g blkio:tp1_blkio dd if=/dev/zero
of=/dev/null bs=1M count=4000
```

Ce que je constate est que la colonne Read dans iotop ne dépasse jamais la vitesse de lecture qui était limitée à 5 Mo/s. Donc cela montre que la contrainte est bien respectée lors de l'exécution des tests de benchmark disque avec dd.

Lorsque j'exécute la commande dd avec 2 terminaux distinctes, on remarque les 2 processus dans iotop s'exécuter avec une répartition équitable des ressources I/O, et la contrainte de limitation de la vitesse de lecture est toujours respecter.

The screenshot displays a virtual machine environment with three terminal windows. The leftmost window shows the output of the 'iotop' command, which monitors disk I/O in real-time. It lists various system processes, including 'dd', 'init splash', '[kthread]', '[rcu_gp]', '[rcu_par_gp]', '[slub_flushwq]', '[netns]', '[kworker/0:0H-events_highpri]', '[mm_percpu_wq]', '[rcu_tasks_kthread]', '[rcu_tasks_rude_kthread]', '[rcu_tasks_trace_kthread]', '[ksftirqd/0]', '[rcu_preempt]', '[rcu_preempt]', '[migration/0]', '[idle_inject/0]', '[cpuhp/0]', '[cpuhp/1]', '[idle_inject/1]', '[migration/1]', '[ksftirqd/1]', '[kworker/1:0H]', '[cpuhp/2]', '[idle_inject/2]', '[migration/2]', '[ksftirqd/2]', '[kworker/2:0H-kblockd]', '[cpuhp/3]', '[idle_inject/3]', '[migration/3]', and '[ksftirqd/3]'. The middle window shows the output of the 'dd' command, which is used to create a file. The rightmost window shows the output of the 'nano' command, which is used to edit a file.

```
muhammed@muhammed-VirtualBox: /  
Total DISK READ: 0.00 B/s | Total DISK WRITE: 49.89 M/s  
Current DISK READ: 0.00 B/s | Current DISK WRITE: 366.14 M/s  
TID  PRIO  USER     DISK READ  DISK WRITE  SWAPIN      IO>   COMMAND  
4461 be/4 root      0.00 B/s   23.90 M/s ?unavailable? dd if=/dev/zero of=/tmp/null bs=1M count=4000  
4464 be/4 root      0.00 B/s   25.99 M/s ?unavailable? dd if=/dev/zero of=/tmp/null bs=1M count=4000  
1 be/4 root      0.00 B/s   0.00 B/s ?unavailable? init splash  
2 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [kthread]  
3 be/0 root      0.00 B/s   0.00 B/s ?unavailable? [rcu_gp]  
4 be/0 root      0.00 B/s   0.00 B/s ?unavailable? [rcu_par_gp]  
5 be/0 root      0.00 B/s   0.00 B/s ?unavailable? [slub_flushwq]  
6 be/0 root      0.00 B/s   0.00 B/s ?unavailable? [netns]  
8 be/0 root      0.00 B/s   0.00 B/s ?unavailable? [kworker/0:0H-events_highpri]  
10 be/0 root      0.00 B/s   0.00 B/s ?unavailable? [mm_percpu_wq]  
11 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [rcu_tasks_kthread]  
12 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [rcu_tasks_rude_kthread]  
13 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [rcu_tasks_trace_kthread]  
14 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [ksftirqd/0]  
15 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [rcu_preempt]  
16 rt/4 root      0.00 B/s   0.00 B/s ?unavailable? [migration/0]  
17 rt/4 root      0.00 B/s   0.00 B/s ?unavailable? [idle_inject/0]  
19 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [cpuhp/0]  
20 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [cpuhp/1]  
21 rt/4 root      0.00 B/s   0.00 B/s ?unavailable? [idle_inject/1]  
22 rt/4 root      0.00 B/s   0.00 B/s ?unavailable? [migration/1]  
23 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [ksftirqd/1]  
25 be/0 root      0.00 B/s   0.00 B/s ?unavailable? [kworker/1:0H]  
26 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [cpuhp/2]  
27 rt/4 root      0.00 B/s   0.00 B/s ?unavailable? [idle_inject/2]  
28 rt/4 root      0.00 B/s   0.00 B/s ?unavailable? [migration/2]  
29 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [ksftirqd/2]  
31 be/0 root      0.00 B/s   0.00 B/s ?unavailable? [kworker/2:0H-kblockd]  
32 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [cpuhp/3]  
33 rt/4 root      0.00 B/s   0.00 B/s ?unavailable? [idle_inject/3]  
34 rt/4 root      0.00 B/s   0.00 B/s ?unavailable? [migration/3]  
35 be/4 root      0.00 B/s   0.00 B/s ?unavailable? [ksftirqd/3]  
keys: any: refresh q: quit i: toggle g: active p: proc a: accum  
sort: r: asc left: SWAPIN right: COMMAND home: TID end: COMMAND  
CONFIG_TASK_DELAY_ACCT not enabled in kernel, cannot determine SWAPIN and IO %  
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio  
4000+0 enregistrements lus  
4000+0 enregistrements écrits  
4194304000 octets (4,2 GB, 3,9 GiB) copiés, 27,182 s, 154 MB/s  
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo cgexec -g blkio:tp1_blkio dd  
if=/dev/zero of=/tmp/null bs=1M count=4000  
p[sudo] Mot de passe de muhammed :  
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio  
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo nano  
[sudo] Mot de passe de muhammed :  
Désolé, essayez de nouveau.  
[sudo] Mot de passe de muhammed :  
sudo: 1 saisie de mot de passe incorrecte  
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo nano blkio.throttle.write_  
blkio.throttle.write_bps_device blkio.throttle.write_tops_device  
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo nano blkio.throttle.write_bp  
s_device  
[sudo] Mot de passe de muhammed :  
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo nano blkio.throttle.write_bp  
s_device  
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$  
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo nano blkio.throttle.write_bp  
s_device  
muhammed@muhammed-VirtualBox: /sys/fs/cgroup/blkio/tp1_blkio$ sudo cgexec -g blkio:tp1_blkio dd  
if=/dev/zero of=/tmp/null bs=1M count=4000  
[sudo] Mot de passe de muhammed :
```

II Partager la mémoire

1. La réalisation d'un programme allouant un certain montant de mémoire.