

## Test Cases

- 1) 3 cgroups with different weight in same ioband device(ioband1) : Buffered IO
- 2) 3 cgroups with different weight in same ioband device(ioband1) : Direct IO
- 3) 3 cgroups with different weight in each ioband device(ioband1, 2, 3) : Buffered IO
- 4) 3 cgroups with different weight in each ioband device(ioband1, 2, 3) : Direct IO

## The process for the testing

```
[root@localhost test]# dmsetup targets | grep ioband
ioband                v1.7.0
```

### setting for test case 1) and 2)

#### 1. Create the Ioband device

```
echo "0 $(blockdev --getsize /dev/sdb1) ioband /dev/sdb1 1 0 0 none weight 0 :80" | dmsetup
create ioband1
```

#### 2. Create the 3 cgroups

```
mkdir /home/cgroup/bio
mount -t cgroup -o bio none /home/cgroup/bio
mkdir /home/cgroup/bio/bgroup1
mkdir /home/cgroup/bio/bgroup2
mkdir /home/cgroup/bio/bgroup3
```

#### 3. Assign the weight to each cgroup

```
dmsetup message ioband1 0 type cgroup
dmsetup message ioband1 0 attach 1
dmsetup message ioband1 0 attach 2
dmsetup message ioband1 0 attach 3
dmsetup message ioband1 0 weight 1:10
dmsetup message ioband1 0 weight 2:30
dmsetup message ioband1 0 weight 3:60
```

#### 4. Allocate the process to the proper cgroup

```
In the terminal for bgroup1 testing
echo $$ > /home/cgroup/bio/bgroup1/tasks
```

In the terminal for bgroup2 testing  
echo \$\$ > /home/cgroup/bio/bgroup2/tasks

In the terminal for bgroup3 testing  
echo \$\$ > /home/cgroup/bio/bgroup3/tasks

### **5. Generate the IO requests to the device**

In each terminal, execute the command :  
./tiotest -R -d /dev/sdb1 -f 300

## **setting for test case 3) and 4)**

### **1. Create the Ioband device**

```
echo "0 $(blockdev --getsize /dev/sdb1) ioband /dev/sdb1 1 0 0 none weight 0 :30" | dmsetup  
create ioband1  
echo "0 $(blockdev --getsize /dev/sdb2) ioband /dev/sdb2 2 0 0 none weight 0 :30" | dmsetup  
create ioband2  
echo "0 $(blockdev --getsize /dev/sdb3) ioband /dev/sdb3 3 0 0 none weight 0 :30" | dmsetup  
create ioband3
```

### **2. Create the 3 cgroups**

```
mkdir /home/cgroup/bio  
mount -t cgroup -o bio none /home/cgroup/bio  
mkdir /home/cgroup/bio/bgroup1  
mkdir /home/cgroup/bio/bgroup2  
mkdir /home/cgroup/bio/bgroup3
```

### **3. Assign the weight to each cgroup**

```
dmsetup message ioband1 0 type cgroup  
dmsetup message ioband2 0 type cgroup  
dmsetup message ioband3 0 type cgroup  
dmsetup message ioband1 0 attach 1  
dmsetup message ioband2 0 attach 2  
dmsetup message ioband3 0 attach 3  
dmsetup message ioband1 0 weight 1:10  
dmsetup message ioband2 0 weight 2:30  
dmsetup message ioband3 0 weight 3:60
```

### **4. Allocate the process to the proper cgroup**

In the terminal for bgroup1 testing

```
echo $$ > /home/cgroup/bio/bgroup1/tasks
```

In the terminal for bgroup2 testing

```
echo $$ > /home/cgroup/bio/bgroup2/tasks
```

In the terminal for bgroup3 testing

```
echo $$ > /home/cgroup/bio/bgroup3/tasks
```

### **5. Generate the IO requests to the device**

In the terminal for bgroup1, execute the commands : .

```
/tiotest -R -d /dev/sdb1 -f 300
```

In the terminal for bgroup2, execute the commands : .

```
/tiotest -R -d /dev/sdb2 -f 300
```

In the terminal for bgroup3, execute the commands : .

```
/tiotest -R -d /dev/sdb3 -f 300
```

# Test Results

## 3-cgroups in Ioband1 (buffered IO)

### Cgroup1 (weight : 10) in ioband1

```
[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb1 -f 500
```

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 2000 MBs	86.2 s	23.212 MB/s	0.7 %	19.6 %
Random Write 16 MBs	8.9 s	1.764 MB/s	0.0 %	3.0 %
Read 2000 MBs	33.4 s	59.876 MB/s	1.0 %	18.5 %
Random Read 16 MBs	62.9 s	0.249 MB/s	0.0 %	0.6 %

Tiotest latency results:

Item	Average latency	Maximum latency	% >2 sec	% >10 sec
Write	0.631 ms	3510.497 ms	0.00352	0.00000
Random Write	0.036 ms	42.322 ms	0.00000	0.00000
Read	0.183 ms	2139.320 ms	0.00020	0.00000
Random Read	41.393 ms	1145.085 ms	0.00000	0.00000
Total	0.564 ms	3510.497 ms	0.00184	0.00000

### Cgroup2 (weight : 30) in ioband1

```
[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb1 -f 500
```

Tiotest results for 4 concurrent io threads

Item	Time	Rate	Usr CPU	Sys CPU
Write 2000 MBs	85.9 s	23.287 MB/s	0.7 %	19.5 %
Random Write 16 MBs	8.8 s	1.768 MB/s	0.0 %	2.1 %

Read 2000 MBs	33.4 s	59.954 MB/s	1.3 %	19.3 %
Random Read 16 MBs	62.6 s	0.249 MB/s	0.0 %	0.9 %

Tiotest latency results:

Item	Average latency	Maximum latency	% >2 sec	% >10 sec
Write	0.642 ms	4108.431 ms	0.00430	0.00000
Random Write	0.239 ms	345.584 ms	0.00000	0.00000
Read	0.183 ms	2139.674 ms	0.00020	0.00000
Random Read	41.322 ms	1192.475 ms	0.00000	0.00000
Total	0.570 ms	4108.431 ms	0.00223	0.00000

### **Cgroup3 (weight : 60) in ioband1**

[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb1 -f 500

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 2000 MBs	85.6 s	23.363 MB/s	0.6 %	19.1 %
Random Write 16 MBs	8.8 s	1.777 MB/s	0.0 %	1.9 %
Read 2000 MBs	33.4 s	59.905 MB/s	1.4 %	19.0 %
Random Read 16 MBs	62.5 s	0.250 MB/s	0.0 %	1.0 %

Tiotest latency results:

Item	Average latency	Maximum latency	% >2 sec	% >10 sec
Write	0.638 ms	3521.069 ms	0.00430	0.00000
Random Write	0.035 ms	32.103 ms	0.00000	0.00000
Read	0.183 ms	2140.087 ms	0.00020	0.00000
Random Read	42.655 ms	1131.777 ms	0.00000	0.00000
Total	0.573 ms	3521.069 ms	0.00223	0.00000

### 3 cgroups in Ioband1 (Direct IO)

#### Cgroup1 (weight : 10) in ioband1

```
[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb1 -f 300
```

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 1200 MBs	158.7 s	7.562 MB/s	0.5 %	42.7 %
Random Write 16 MBs	37.6 s	0.415 MB/s	0.1 %	2.7 %
Read 1200 MBs	31.6 s	38.002 MB/s	1.1 %	24.9 %
Random Read 16 MBs	37.6 s	0.416 MB/s	0.0 %	1.4 %

Tiotest latency results:

Item	Average latency	Maximum latency	% >2 sec	% >10 sec
Write	2.040 ms	1100.418 ms	0.00000	0.00000
Random Write	36.940 ms	1191.799 ms	0.00000	0.00000
Read	0.383 ms	1220.109 ms	0.00000	0.00000
Random Read	31.596 ms	1251.501 ms	0.00000	0.00000
Total	1.636 ms	1251.501 ms	0.00000	0.00000

#### Cgroup2 (weight : 30) in ioband1

```
[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb1 -f 300
```

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 1200 MBs	161.9 s	7.410 MB/s	0.6 %	41.4 %
Random Write 16 MBs	42.7 s	0.366 MB/s	0.1 %	1.6 %
Read	23.0 s	52.181 MB/s	1.5 %	26.5 %

1200 MBs				
Random Read 16 MBs	38.8 s	0.403 MB/s	0.0 %	1.0 %

Tiotest latency results:

Item	Average latency	Maximum latency	% >2 sec	% >10 sec
Write	2.091 ms	1100.622 ms	0.00000	0.00000
Random Write	40.535 ms	1220.029 ms	0.00000	0.00000
Read	0.270 ms	376.784 ms	0.00000	0.00000
Random Read	31.979 ms	1240.180 ms	0.00000	0.00000
Total	1.632 ms	1240.180 ms	0.00000	0.00000

### Cgroup3 (weight : 60) in ioband1

```
[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb1 -f 300
```

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 1200 MBs	161.0 s	7.452 MB/s	0.6 %	42.4 %
Random Write 16 MBs	42.4 s	0.369 MB/s	0.0 %	1.9 %
Read 1200 MBs	23.8 s	50.380 MB/s	1.3 %	21.9 %
Random Read 16 MBs	38.8 s	0.403 MB/s	0.0 %	1.2 %

Tiotest latency results:

Item	Average latency	Maximum latency	% >2 sec	% >10 sec
Write	2.059 ms	1152.353 ms	0.00000	0.00000
Random Write	40.350 ms	1226.239 ms	0.00000	0.00000
Read	0.282 ms	501.691 ms	0.00000	0.00000
Random Read	31.819 ms	1247.065 ms	0.00000	0.00000
Total	1.619 ms	1247.065 ms	0.00000	0.00000

### 3 cgroups in each ioband (Buffered IO)

#### Cgroup1 (weight : 10) in ioband1

```
[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb1 -f 300
```

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 1200 MBs	80.1 s	14.982 MB/s	0.5 %	19.0 %
Random Write 16 MBs	13.4 s	1.163 MB/s	0.0 %	1.3 %
Read 1200 MBs	22.0 s	54.442 MB/s	2.2 %	65.8 %
Random Read 16 MBs	15.3 s	1.024 MB/s	0.1 %	4.0 %

Tiotest latency results:

Item	Average latency	Maximum latency	% >2 sec	% >10 sec
Write	0.981 ms	2694.729 ms	0.00293	0.00000
Random Write	1.359 ms	4029.854 ms	0.02500	0.00000
Read	0.278 ms	501.927 ms	0.00000	0.00000
Random Read	14.838 ms	441.326 ms	0.00000	0.00000
Total	0.725 ms	4029.854 ms	0.00161	0.00000

#### Cgroup2 (weight : 30) in ioband2

```
[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb2 -f 300
```

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 1200 MBs	78.2 s	15.342 MB/s	0.3 %	14.3 %
Random Write 16 MBs	56.6 s	0.276 MB/s	0.0 %	0.4 %
Read 1200 MBs	25.4 s	47.235 MB/s	1.7 %	29.1 %
Random Read 16 MBs	11.6 s	1.349 MB/s	0.0 %	3.2 %

Tiotest latency results:



Item	Average latency	Maximum latency	% >2 sec	% >10 sec
Write	0.900 ms	2408.693 ms	0.00260	0.00000
Random Write	6.879 ms	13228.764 ms	0.05000	0.05000
Read	0.326 ms	514.466 ms	0.00000	0.00000
Random Read	10.955 ms	536.346 ms	0.00000	0.00000
Total	0.720 ms	13228.764 ms	0.00161	0.00032

### Cgroup3 (weight : 60) in ioband3

[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb3 -f 300

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 1200 MBs	121.1 s	9.910 MB/s	0.4 %	13.9 %
Random Write 16 MBs	53.6 s	0.292 MB/s	0.0 %	0.6 %
Read 1200 MBs	27.2 s	44.119 MB/s	1.8 %	52.5 %
Random Read 16 MBs	14.1 s	1.108 MB/s	0.0 %	5.0 %

Tiotest latency results:

Item	Average latency	Maximum latency	% >2 sec	% >10 sec
Write	1.169 ms	29472.366 ms	0.00358	0.00065
Random Write	0.029 ms	10.061 ms	0.00000	0.00000
Read	0.351 ms	370.426 ms	0.00000	0.00000
Random Read	13.604 ms	370.924 ms	0.00000	0.00000
Total	0.838 ms	29472.366 ms	0.00177	0.00032

### 3 cgroups in each ioband (Direct IO)

#### Cgroup1 (weight : 10) in ioband1

[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb1 -f 300

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 1200 MBs	165.2 s	7.264 MB/s	0.6 %	42.9 %
Random Write 16 MBs	54.4 s	0.287 MB/s	0.0 %	1.4 %
Read 1200 MBs	63.0 s	19.040 MB/s	0.6 %	21.7 %
Random Read 16 MBs	85.9 s	0.182 MB/s	0.0 %	1.3 %

Tiotest latency results:

Item	Average latency	Maximum latency	% > 2 sec	% >10 sec
Write	2.137 ms	1100.518 ms	0.00000	0.00000
Random Write	49.299 ms	1201.320 ms	0.00000	0.00000
Read	0.809 ms	1303.757 ms	0.00000	0.00000
Random Read	85.744 ms	1323.506 ms	0.00000	0.00000
Total	2.322 ms	1323.506 ms	0.00000	0.00000

## Cgroup2 (weight : 30) in ioband2

```
[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb2 -f 300
```

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 1200 MBs	165.1 s	7.270 MB/s	0.5 %	43.6 %
Random Write 16 MBs	51.2 s	0.305 MB/s	0.0 %	1.3 %
Read 1200 MBs	66.5 s	18.036 MB/s	0.8 %	9.7 %
Random Read 16 MBs	79.7 s	0.196 MB/s	0.0 %	1.1 %

Tiotest latency results:

Item	Average latency	Maximum latency	% > 2 sec	% >10 sec
Write	2.145 ms	1100.446 ms	0.00000	0.00000
Random Write	49.714 ms	1207.058 ms	0.00000	0.00000

Read	0.865 ms	1307.850 ms	0.00000	0.00000
Random Read	79.075 ms	1294.266 ms	0.00000	0.00000
Total	2.313 ms	1307.850 ms	0.00000	0.00000

### Cgroup3 (weight : 60) ioband3

[root@localhost tiobench-0.3.3]# ./tiotest -R -d /dev/sdb3 -f 300

Tiotest results for 4 concurrent io threads:

Item	Time	Rate	Usr CPU	Sys CPU
Write 1200 MBs	165.9 s	7.235 MB/s	0.6 %	43.5 %
Random Write 16 MBs	61.5 s	0.254 MB/s	0.0 %	1.6 %
Read 1200 MBs	82.9 s	14.476 MB/s	0.4 %	17.5 %
Random Read 16 MBs	58.6 s	0.267 MB/s	0.0 %	0.7 %

Tiotest latency results:

Item	Average latency	Maximum latency	% >2 sec	% >10 sec
Write	2.147 ms	1100.500 ms	0.00000	0.00000
Random Write	57.557 ms	1242.063 ms	0.00000	0.00000
Read	1.062 ms	1303.949 ms	0.00000	0.00000
Random Read	56.682 ms	1314.354 ms	0.00000	0.00000
Total	2.318 ms	1314.354 ms	0.00000	0.00000