fio - ?????????? ???????? ???????? ??????????

Тут неплохой список тестов: https://docs.oracle.com/en-us/iaas/Content/Block/References/samplefiocommandslinux.htm

Команды:

```
#IOPS

fio --filename=/file --size=5GB --direct=1 --rw=randrw --bs=4k \
--ioengine=libaio --iodepth=256 --runtime=120 --numjobs=4 --time_based \
--group_reporting --name=iops-test-job --eta-newline=1

# B/W
fio --filename=/file --size=5GB --direct=1 --rw=randrw --bs=64k \
--ioengine=libaio --iodepth=64 --runtime=120 --numjobs=4 --time_based \
--group_reporting --name=throughput-test-job --eta-newline=1

# Latency
fio --filename=/file --size=5GB --direct=1 --rw=randrw --bs=4k \
--ioengine=libaio --iodepth=1 --numjobs=1 --time_based --group_reporting \
--name=rwlatency-test-job --runtime=120 --eta-newline=1
```

Вот пример random r/w iops на десктопном Toshiba HDD:

```
iops-test-job: (groupid=0, jobs=4): err= 0: pid=251421: Wed Jul 17 10:37:16 2024
  read: IOPS=76, BW=307KiB/s (314kB/s)(36.1MiB/120567msec)
    slat (usec): min=3, max=1056.9k, avg=25388.41, stdev=70969.08
    clat (msec): min=285, max=10659, avg=6440.46, stdev=987.92
     lat (msec): min=500, max=10763, avg=6465.85, stdev=990.85
    clat percentiles (msec):
     |  1.00th=[ 1653],  5.00th=[ 5671], 10.00th=[ 6007], 20.00th=[ 6141],
```

```
     | 30.00th=[ 6275], 40.00th=[ 6342], 50.00th=[ 6477], 60.00th=[ 6544],
     | 70.00th=[ 6678], 80.00th=[ 6812], 90.00th=[ 7148], 95.00th=[ 7819],
     | 99.00th=[ 8926], 99.50th=[ 9060], 99.90th=[ 9866], 99.95th=[10268],
     | 99.99th=[10671]
   bw (  KiB/s): min=   40, max=  608, per=100.00%, avg=307.70, stdev=26.41, samples=907
   iops        : min=   10, max=  152, avg=76.92, stdev= 6.60, samples=907
  write: IOPS=79, BW=319KiB/s (326kB/s)(37.5MiB/120567msec); 0 zone resets
    slat (usec): min=3, max=975286, avg=25577.27, stdev=70511.46
    clat (msec): min=469, max=9979, avg=6323.55, stdev=931.04
     lat (msec): min=500, max=9979, avg=6349.13, stdev=933.87
    clat percentiles (msec):
     |  1.00th=[ 1569],  5.00th=[ 5604], 10.00th=[ 5940], 20.00th=[ 6074],
     | 30.00th=[ 6208], 40.00th=[ 6275], 50.00th=[ 6342], 60.00th=[ 6409],
     | 70.00th=[ 6544], 80.00th=[ 6611], 90.00th=[ 6879], 95.00th=[ 7684],
     | 99.00th=[ 8658], 99.50th=[ 8792], 99.90th=[ 9194], 99.95th=[ 9597],
     | 99.99th=[10000]
   bw (  KiB/s): min=   64, max=  632, per=100.00%, avg=320.56, stdev=26.98, samples=909
   iops        : min=   16, max=  158, avg=80.14, stdev= 6.74, samples=909
  lat (msec)   : 500=0.02%, 750=0.25%, 1000=0.26%, 2000=0.76%, >=2000=98.71%
  cpu          : usr=0.03%, sys=0.04%, ctx=11061, majf=0, minf=43
  IO depths    : 1=0.1%, 2=0.1%, 4=0.1%, 8=0.2%, 16=0.3%, 32=0.7%, >=64=98.7%
     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=0.0%, 32=0.0%, 64=0.0%, >=64=0.1%
     issued rwts: total=9243,9607,0,0 short=0,0,0,0 dropped=0,0,0,0
     latency   : target=0, window=0, percentile=100.00%, depth=256

Run status group 0 (all jobs):
   READ: bw=307KiB/s (314kB/s), 307KiB/s-307KiB/s (314kB/s-314kB/s), io=36.1MiB (37.9MB),
run=120567-120567msec
  WRITE: bw=319KiB/s (326kB/s), 319KiB/s-319KiB/s (326kB/s-326kB/s), io=37.5MiB (39.3MB),
run=120567-120567msec

Disk stats (read/write):
  sda: ios=9257/9607, merge=0/0, ticks=4143068/3114506, in_queue=7257575, util=99.37%
```

Блоками по 512 картина еще унылее.

На 8к вцелом плюс-минус то же

```
iops-test-job: (groupid=0, jobs=4): err= 0: pid=251505: Wed Jul 17 10:42:18 2024
  read: IOPS=77, BW=620KiB/s (635kB/s)(73.0MiB/120481msec)
    slat (usec): min=3, max=387273, avg=25978.96, stdev=69175.81
    clat (msec): min=320, max=8886, avg=6372.20, stdev=876.49
     lat (msec): min=486, max=8886, avg=6398.18, stdev=878.93
    clat percentiles (msec):
     |  1.00th=[ 1552],  5.00th=[ 5738], 10.00th=[ 6007], 20.00th=[ 6208],
     | 30.00th=[ 6275], 40.00th=[ 6409], 50.00th=[ 6477], 60.00th=[ 6544],
     | 70.00th=[ 6678], 80.00th=[ 6812], 90.00th=[ 7013], 95.00th=[ 7215],
     | 99.00th=[ 7684], 99.50th=[ 7819], 99.90th=[ 8288], 99.95th=[ 8423],
     | 99.99th=[ 8926]
   bw (  KiB/s): min=  176, max= 1344, per=99.33%, avg=616.50, stdev=53.06, samples=915
   iops        : min=   22, max=  168, avg=77.06, stdev= 6.63, samples=915
  write: IOPS=80, BW=644KiB/s (660kB/s)(75.8MiB/120481msec); 0 zone resets
    slat (usec): min=3, max=417654, avg=24495.72, stdev=67714.31
    clat (msec): min=305, max=7858, avg=6266.56, stdev=797.47
     lat (msec): min=486, max=7903, avg=6291.05, stdev=799.85
    clat percentiles (msec):
     |  1.00th=[ 1670],  5.00th=[ 5738], 10.00th=[ 5940], 20.00th=[ 6141],
     | 30.00th=[ 6208], 40.00th=[ 6275], 50.00th=[ 6409], 60.00th=[ 6477],
     | 70.00th=[ 6544], 80.00th=[ 6611], 90.00th=[ 6745], 95.00th=[ 6879],
     | 99.00th=[ 7215], 99.50th=[ 7416], 99.90th=[ 7752], 99.95th=[ 7752],
     | 99.99th=[ 7886]
   bw (  KiB/s): min=   96, max= 1264, per=99.48%, avg=641.88, stdev=54.29, samples=918
   iops        : min=   12, max=  158, avg=80.24, stdev= 6.79, samples=918
  lat (msec)   : 500=0.06%, 750=0.25%, 1000=0.17%, 2000=0.88%, >=2000=98.63%
  cpu          : usr=0.03%, sys=0.04%, ctx=11609, majf=0, minf=44
  IO depths    : 1=0.1%, 2=0.1%, 4=0.1%, 8=0.2%, 16=0.3%, 32=0.7%, >=64=98.7%
     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=0.0%, 32=0.0%, 64=0.0%, >=64=0.1%
     issued rwts: total=9340,9704,0,0 short=0,0,0,0 dropped=0,0,0,0
     latency   : target=0, window=0, percentile=100.00%, depth=256

Run status group 0 (all jobs):
   READ: bw=620KiB/s (635kB/s), 620KiB/s-620KiB/s (635kB/s-635kB/s), io=73.0MiB (76.5MB),
run=120481-120481msec
```

```
  WRITE: bw=644KiB/s (660kB/s), 644KiB/s-644KiB/s (660kB/s-660kB/s), io=75.8MiB (79.5MB),
run=120481-120481msec

Disk stats (read/write):
  sda: ios=9328/9704, merge=0/0, ticks=4175537/3088888, in_queue=7264425, util=99.67%
```

Иопсы те же, но скорость выросла.

WD RED на 5400 оборотов. Несмотря на то что он на 5400, скорость выше чем у 7200 Toshiba HDD

```
iops-test-job: (groupid=0, jobs=4): err= 0: pid=251543: Wed Jul 17 10:46:32 2024
  read: IOPS=86, BW=348KiB/s (356kB/s)(41.1MiB/120812msec)
    slat (usec): min=2, max=652947, avg=22065.33, stdev=65152.95
    clat (msec): min=411, max=8507, avg=5712.90, stdev=758.82
     lat (msec): min=699, max=8507, avg=5734.97, stdev=760.79
    clat percentiles (msec):
     |  1.00th=[ 2106],  5.00th=[ 4799], 10.00th=[ 5134], 20.00th=[ 5336],
     | 30.00th=[ 5537], 40.00th=[ 5604], 50.00th=[ 5738], 60.00th=[ 5873],
     | 70.00th=[ 6007], 80.00th=[ 6208], 90.00th=[ 6477], 95.00th=[ 6678],
     | 99.00th=[ 7215], 99.50th=[ 7416], 99.90th=[ 7819], 99.95th=[ 7886],
     | 99.99th=[ 8154]
   bw (  KiB/s): min=   56, max=  784, per=100.00%, avg=350.09, stdev=32.50, samples=915
   iops        : min=   14, max=  196, avg=87.52, stdev= 8.12, samples=915
  write: IOPS=90, BW=362KiB/s (371kB/s)(42.7MiB/120812msec); 0 zone resets
    slat (usec): min=2, max=612526, avg=22706.93, stdev=65998.81
    clat (msec): min=542, max=7598, avg=5518.32, stdev=699.72
     lat (msec): min=699, max=7598, avg=5541.03, stdev=702.26
    clat percentiles (msec):
     |  1.00th=[ 1989],  5.00th=[ 4665], 10.00th=[ 5000], 20.00th=[ 5201],
     | 30.00th=[ 5336], 40.00th=[ 5470], 50.00th=[ 5604], 60.00th=[ 5671],
     | 70.00th=[ 5805], 80.00th=[ 5940], 90.00th=[ 6141], 95.00th=[ 6342],
     | 99.00th=[ 6678], 99.50th=[ 6812], 99.90th=[ 7215], 99.95th=[ 7282],
     | 99.99th=[ 7483]
   bw (  KiB/s): min=   56, max=  848, per=100.00%, avg=364.32, stdev=33.56, samples=914
   iops        : min=   14, max=  212, avg=91.08, stdev= 8.39, samples=914
```

```
  lat (msec)   : 500=0.01%, 750=0.05%, 1000=0.08%, 2000=0.85%, >=2000=99.01%
  cpu          : usr=0.04%, sys=0.04%, ctx=13052, majf=0, minf=47
  IO depths    : 1=0.1%, 2=0.1%, 4=0.1%, 8=0.1%, 16=0.3%, 32=0.6%, >=64=98.8%
     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=0.0%, 32=0.0%, 64=0.0%, >=64=0.1%
     issued rwts: total=10509,10929,0,0 short=0,0,0,0 dropped=0,0,0,0
     latency   : target=0, window=0, percentile=100.00%, depth=256

Run status group 0 (all jobs):
   READ: bw=348KiB/s (356kB/s), 348KiB/s-348KiB/s (356kB/s-356kB/s), io=41.1MiB (43.0MB),
run=120812-120812msec
  WRITE: bw=362KiB/s (371kB/s), 362KiB/s-362KiB/s (371kB/s-371kB/s), io=42.7MiB (44.8MB),
run=120812-120812msec

Disk stats (read/write):
  sdc: ios=10532/10929, merge=0/0, ticks=4648821/2648107, in_queue=7296927, util=99.67%
```

Seagate Barracuda 7200.14

```
iops-test-job: (groupid=0, jobs=4): err= 0: pid=251590: Wed Jul 17 10:49:41 2024
  read: IOPS=27, BW=111KiB/s (114kB/s)(13.1MiB/120986msec)
    slat (usec): min=3, max=1103.8k, avg=72458.05, stdev=194381.62
    clat (msec): min=488, max=20448, avg=17135.15, stdev=3593.05
     lat (msec): min=1045, max=20537, avg=17207.61, stdev=3594.34
    clat percentiles (msec):
     |  1.00th=[ 2333],  5.00th=[ 7215], 10.00th=[13758], 20.00th=[17113],
     | 30.00th=[17113], 40.00th=[17113], 50.00th=[17113], 60.00th=[17113],
     | 70.00th=[17113], 80.00th=[17113], 90.00th=[17113], 95.00th=[17113],
     | 99.00th=[17113], 99.50th=[17113], 99.90th=[17113], 99.95th=[17113],
     | 99.99th=[17113]
   bw (  KiB/s): min=   32, max=  336, per=100.00%, avg=131.32, stdev=12.72, samples=697
   iops        : min=    8, max=   84, avg=32.83, stdev= 3.18, samples=697
  write: IOPS=29, BW=116KiB/s (119kB/s)(13.7MiB/120986msec); 0 zone resets
    slat (usec): min=3, max=1236.0k, avg=67783.98, stdev=189096.67
    clat (msec): min=471, max=22212, avg=16727.15, stdev=3523.66
     lat (msec): min=1045, max=22508, avg=16794.94, stdev=3528.58
```

```
    clat percentiles (msec):
     |  1.00th=[ 2265],  5.00th=[ 7215], 10.00th=[13221], 20.00th=[16979],
     | 30.00th=[17113], 40.00th=[17113], 50.00th=[17113], 60.00th=[17113],
     | 70.00th=[17113], 80.00th=[17113], 90.00th=[17113], 95.00th=[17113],
     | 99.00th=[17113], 99.50th=[17113], 99.90th=[17113], 99.95th=[17113],
     | 99.99th=[17113]
   bw (  KiB/s): min=   32, max=  368, per=100.00%, avg=135.84, stdev=13.41, samples=704
   iops        : min=    8, max=   92, avg=33.96, stdev= 3.35, samples=704
  lat (msec)   : 500=0.03%, 1000=0.03%, 2000=0.82%, >=2000=99.13%
  cpu          : usr=0.02%, sys=0.02%, ctx=3369, majf=0, minf=44
  IO depths    : 1=0.1%, 2=0.1%, 4=0.2%, 8=0.5%, 16=0.9%, 32=1.9%, >=64=96.3%
     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=99.9%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.1%
     issued rwts: total=3358,3509,0,0 short=0,0,0,0 dropped=0,0,0,0
     latency   : target=0, window=0, percentile=100.00%, depth=256

Run status group 0 (all jobs):
   READ: bw=111KiB/s (114kB/s), 111KiB/s-111KiB/s (114kB/s-114kB/s), io=13.1MiB (13.8MB),
run=120986-120986msec
  WRITE: bw=116KiB/s (119kB/s), 116KiB/s-116KiB/s (119kB/s-119kB/s), io=13.7MiB (14.4MB),
run=120986-120986msec

Disk stats (read/write):
  sdd: ios=3373/3509, merge=0/0, ticks=4327686/2960324, in_queue=7288009, util=99.87%
```

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