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Out[45]:

1 小结

- 测试5G大小的数据，hdfs默认使用20+个cpu核，fio默认使用8个左右cpu核。为排除此影响，将hdfs限制使用8个核，测试结果表明目前无影响，因只读取数据并未用来计算。
- hdfs读IO的磁盘块大小默认为64k，其随hdfs层hfs.blocksize配置大小增大而增大。经测试，增大hfs.blocksize并不能提高读IO速度。

1.1 140M->120M->100M->80M的速度差哪去了

- 140M为磁盘理论读IO; 120M为HDFS本地短路读IO; 100M为HDFS 5Node×1盘；80M为HDFS 5Node×3盘，大量文件读时的单盘IO
- 120M为HDFS本地短路读IO，20M~140M的差值不在于磁盘的非连续读，因其非连续读比例很低，因此非连续读对IO影响可以忽略。其时间是花在HDFS的计算上：从meta读取chunks的hashsum，从block中读取chunk的checksum，计算chunk的checksum并比对，无误后再从内存中查询并读取下一批chunks。其计算的具体时间待分析获取。虽其计算时间暂时估计不长，但因其有时隔，导致读IO不连续，从而产生了不同批次chunks读取之间的磁盘旋转延迟。（一个7200（转/每分钟）的硬盘，每旋转一周所需时间为 $60 \times 1000 \div 7200 = 8.33$ 毫秒，则平均旋转延迟时间为 $8.33 \div 2 = 4.17$ 毫秒（平均情况下，需要旋转半圈））。 $120 \sim 140 \times 2ms / (2ms + 0.4ms)$, 其中 $2ms \sim 1000ms / (120M / 256k \text{ 每次IO})$
- 100M为HDFS 5Node×1盘的读IO。HDFS写与读的Map task分布是不均匀，举个例子: 4node, 20file*2G, 2复本（为何会出现如此的不均匀待分析）。这样导致无法全部本地读。而跨节点读chunks，需要两次一去一回两次网络通信，一次读meta一次读data(测试集群ping时间0.1ms)。 $100 \sim 140 \times 2ms / (2ms + 0.4ms + 0.3ms)$ 。其中网络延迟用0.3ms计算有待验证，因网络IO从Java开始->linux 网络IO栈。

node1	node2	node3	node5	
write	8	2	10	0
read	3	8	0	9

* 80M为HDFS 5Node×3盘的读I0。相对于HDFS 5Node×1盘读I0。多盘情况下，HDFS对于同一个文件可能/ 应该会存储至同一DataNode的不同磁盘上(待分析确认)，从而使增加了磁盘的随机读取比例。具体80M如何严 格计算待分析。其中，测试使用的HDD，256K随机读磁盘只有32mbps的速度。

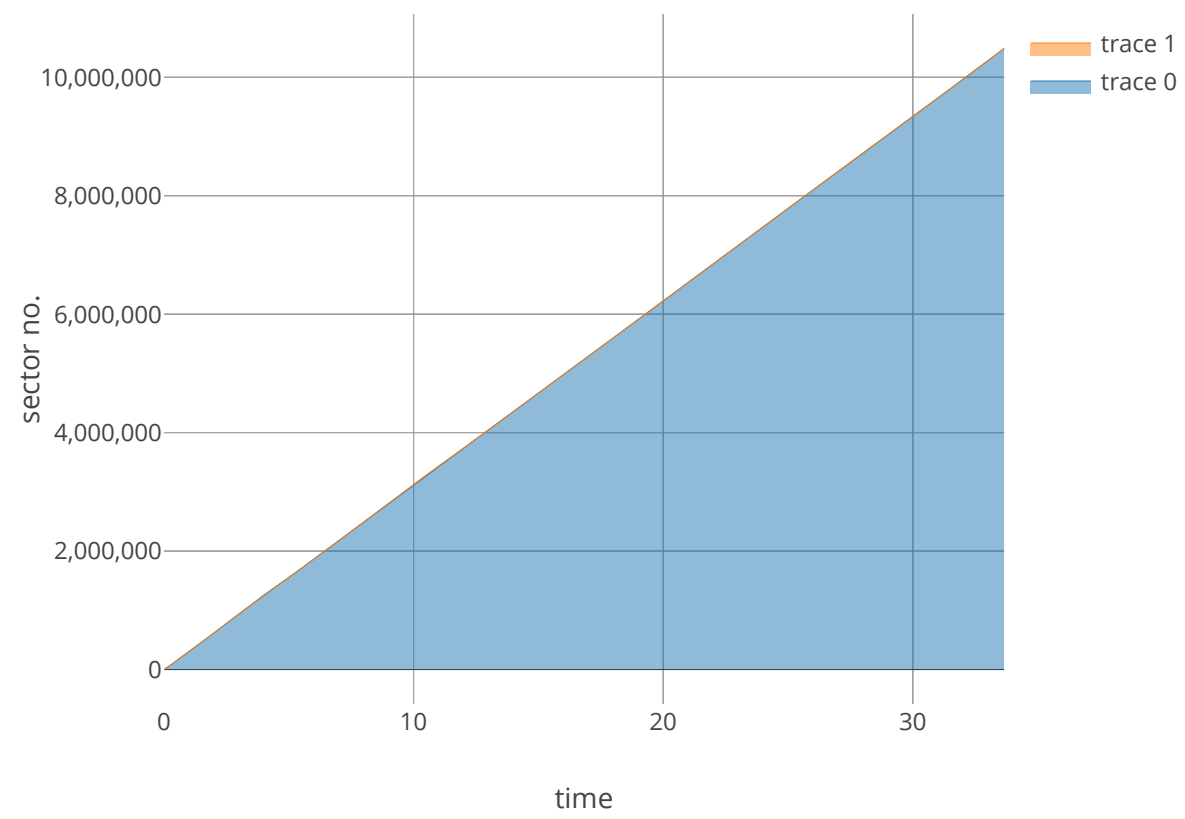
2 fio 128k

which are all presented in seconds.

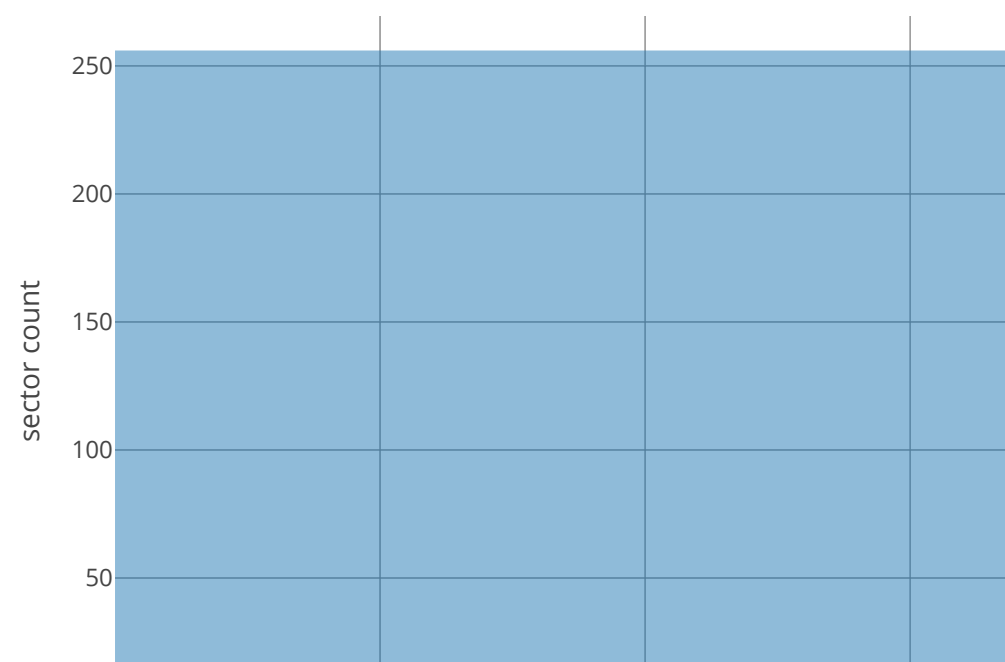
	ALL	MIN	AVG	MAX	N		
Q2Q	0.000346332	0.000821722	0.015571019		40959		
Q2G	0.000000542	0.000001737	0.000042552		40960		
G2I	0.000001077	0.000002466	0.000052575		40960		
I2D	0.000000530	0.000001497	0.000015243		40960		
D2C	0.000315126	0.000771652	0.015483064		40960		
Q2C	0.000321538	0.000777353	0.015508110		40960		
===== Device Overhead =====							
DEV	Q2G	G2I	Q2M	I2D	D2C		
(8, 16)	0.2235%	0.3173%	0.0000%	0.1926%	99.2666%		
Overall	0.2235%	0.3173%	0.0000%	0.1926%	99.2666%		
===== Device Merge Information =====							
DEV	#Q	#D	Ratio	BLKmin	BLKavg	BLKmax	Total
(8, 16)	40960	40960	1.0	256	256	256	10485760
===== Device Q2Q Seek Information =====							
DEV	NSEEKS	MEAN	MEDIAN	MODE			
(8, 16)	40960	1792.0	0	0(40959)			
Overall	NSEEKS	MEAN	MEDIAN	MODE			
Average	40960	1792.0	0	0(40959)			
===== Device D2D Seek Information =====							
DEV	NSEEKS	MEAN	MEDIAN	MODE			
(8, 16)	40960	1792.0	0	0(40959)			
Overall	NSEEKS	MEAN	MEDIAN	MODE			
Average	40960	1792.0	0	0(40959)			

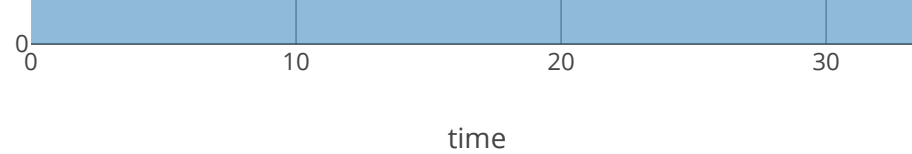
iops	mbps
1204	150

sector request



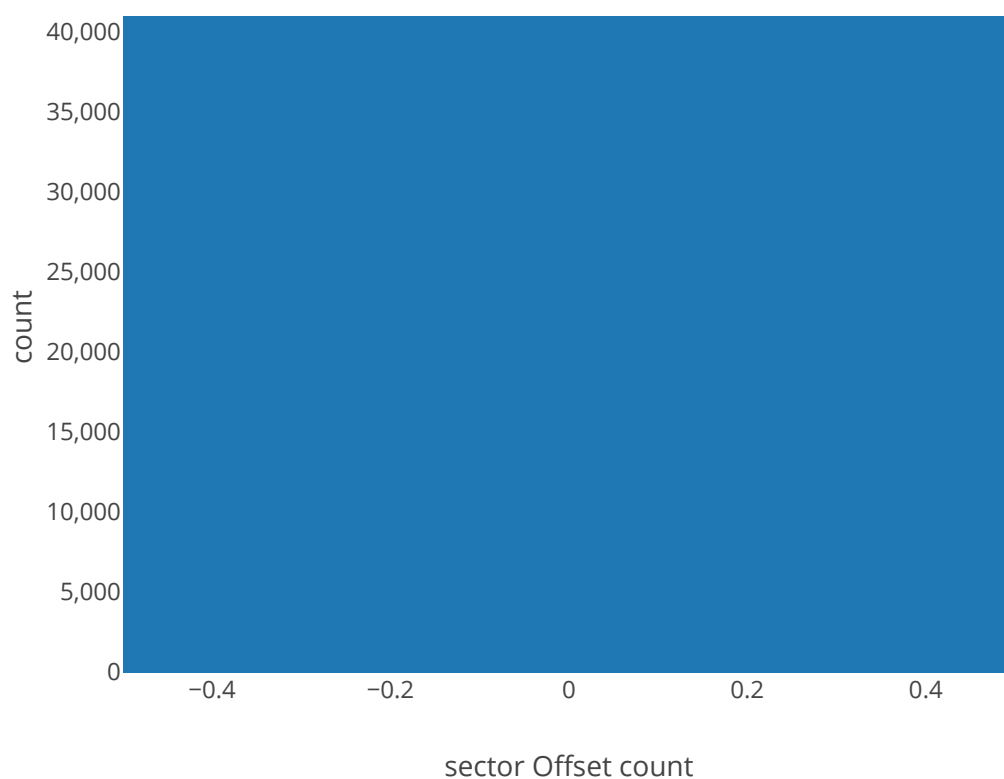
sector count





sector offset	occurrence
sum	40958
0	40958

sector Offset Cumulative



3 hdfs 128k without meta cached

情况复杂的地方

- hdfs测试时不事先缓存block的meta文件
- Linux文件系统经过多次读写

	ALL	MIN	AVG	MAX	N
Q2Q	0.000003077	0.001008152	0.032582540	37279	
Q2G	0.000000454	0.000000799	0.000029385	37279	
G2I	0.000000804	0.000001413	0.000024370	37279	
Q2M	0.000001259	0.000001259	0.000001259	1	
I2D	0.000000492	0.000001786	0.033691765	37279	
M2D	0.000017584	0.000017584	0.000017584	1	
D2C	0.000266326	0.002319013	0.138943938	37280	
Q2C	0.000269986	0.002323012	0.138947146	37280	

===== Device Overhead =====

DEV	Q2G	G2I	Q2M	I2D	D2C
(8, 16)	0.0344%	0.0608%	0.0000%	0.0769%	99.8279%
Overall	0.0344%	0.0608%	0.0000%	0.0769%	99.8279%

===== Device Merge Information =====

DEV	#Q	#D	Ratio	BLKmin	BLKavg	BLKmax	Total
(8, 16)	37280	37279	1.0	7	255	512	9523895

===== Device Q2Q Seek Information =====

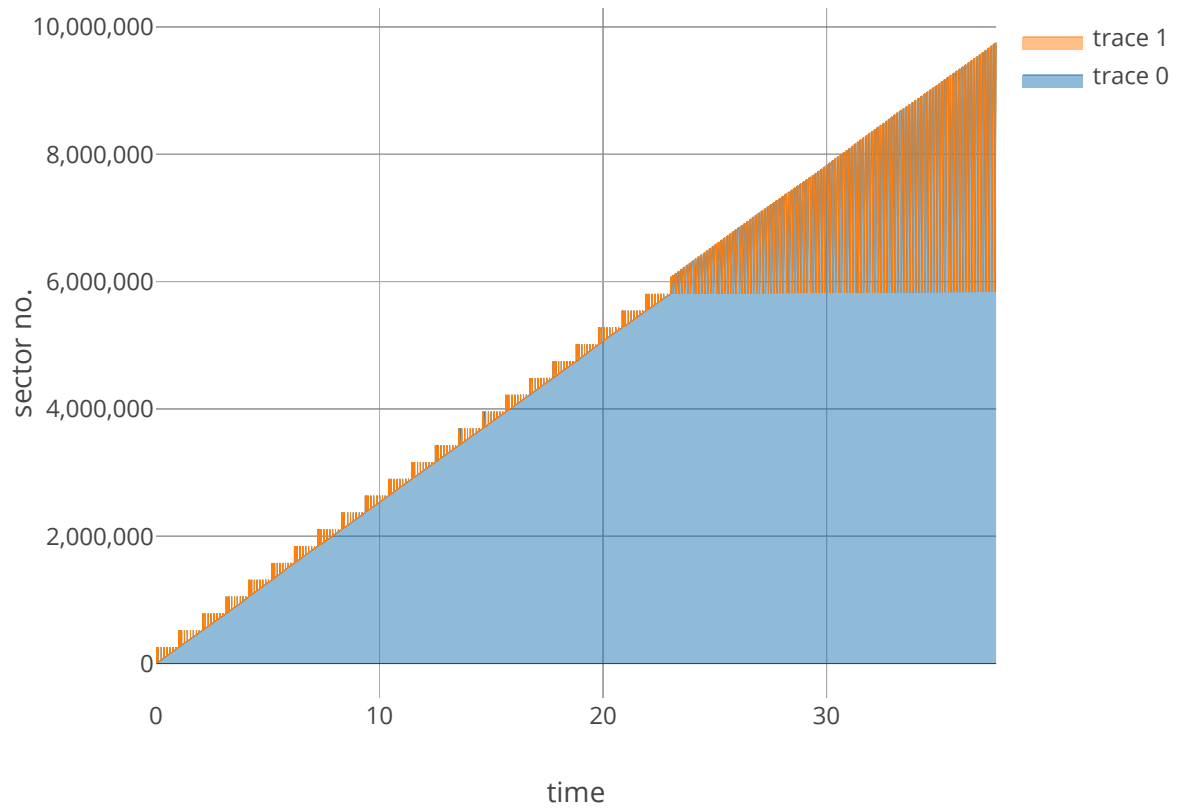
DEV	NSEEKS	MEAN	MEDIAN	MODE
(8, 16)	37280	72788.1	0	0(36478)
Overall	NSEEKS	MEAN	MEDIAN	MODE
Average	37280	72788.1	0	0(36478)

===== Device D2D Seek Information =====

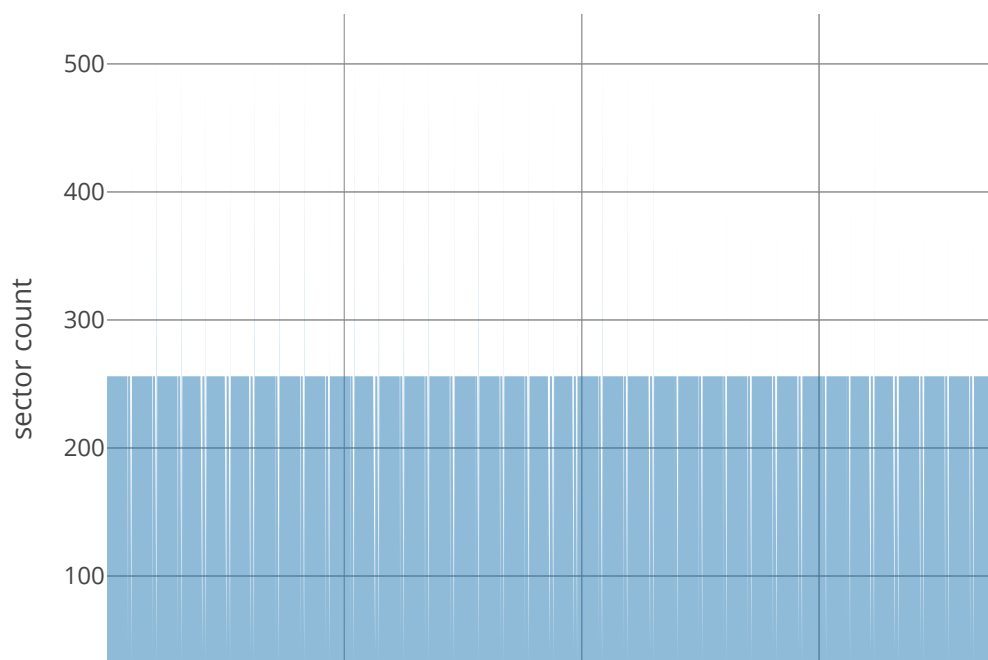
DEV	NSEEKS	MEAN	MEDIAN	MODE
(8, 16)	37279	73188.7	0	0(36476)
Overall	NSEEKS	MEAN	MEDIAN	MODE
Average	37279	73188.7	0	0(36476)

iops	mbps
981	122

sector request



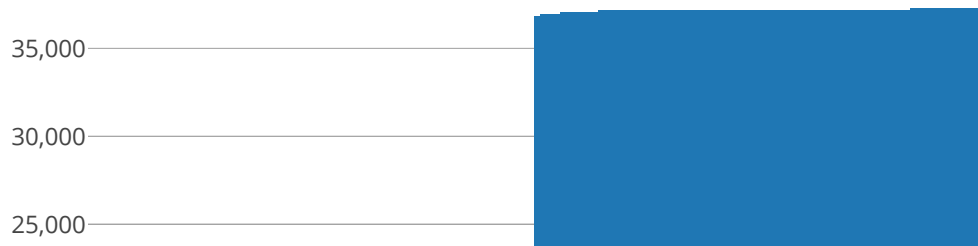
sector count

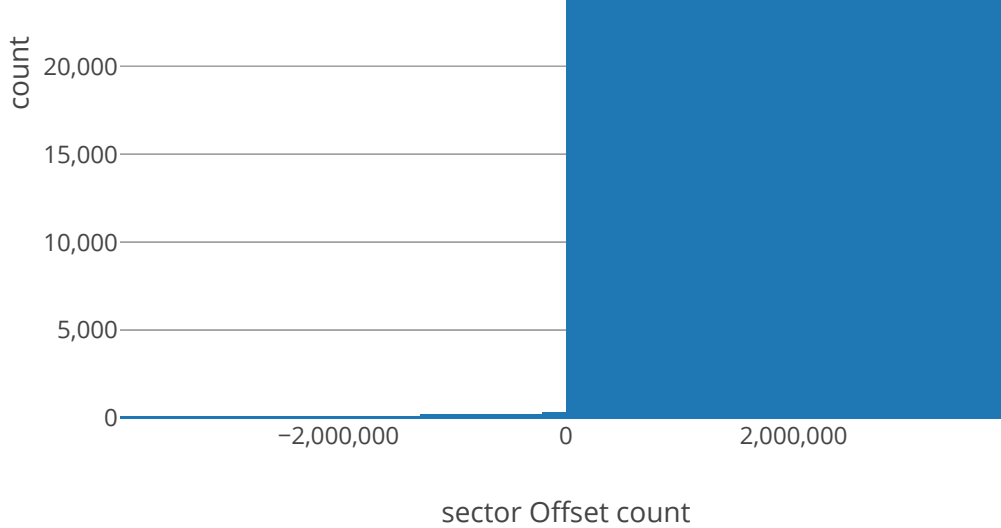




		sector offset	occurrence
		sum	37271
<div>-3914224, -3906160, -3904176, -3901904, -3865336, -3832824, -3800312, -3767800, -3735288, -3702776, -3670264, -3654136, -3646072, -3644088, -3641816, -3605248, -3572736, -3540224, -3507712, -3475200, -3442688, -3410176, -3394048, -3385984, -3384000, -3381728, -3345160, -3312648, -3280136, -3247624, -3215112, -3182600, -3150088, -3133960, -3125896, -3123912, -3121640, -3085072, -3052560, -3020048, -2987536, -2955024, -2922512, -2890000, -2873872, -2865808, -2863824, -2861552, -2824984, -2792472, -2759960, -2727448, -2694936, -2662424, -2629912, -2613784, -2605720, -2603736, -2601464, -2564896, -2532384, -2499872, -2467360, -2434848, -2402336, -2369824, -2353696, -2345632, -2343648, -2341376, -2304808, -2272296, -2239784, -2207272, -2174760, -2142248, -2109736, -2093608, -2085544, -2083560, -2081288, -2044720, -2012208, -1979696, -1947184, -1914672, -1882160, -1849648, -1833520, -1825456, -1823472, -1821200, -1784632, -1752120, -1719608, -1687096, -1654584, -1622072, -1589560, -1573432, -1565368, -1563384, -1561112, -1524544, -1492032, -1459520, -1427008, -1394496, -1361984, -1329472, -1313344, -1305280, -1303296, -1301024, -1264456, -1231944, -1199432, -1166920, -1134408, -1101896, -1069384, -1053256, -1045192, -1043208, -1040936, -1004368, -971856, -939344, -906832, -874320, -841808, -809296, -793168, -785104, -783120, -780848, -744280, -711768, -679256, -646744, -614232, -581720, -549208, -533080, -525016, -523032, -520760, -484192, -451680, -419168, -386656, -354144, -321632, -289120, -272992, -264928, -262944, 2056, 260640, 262880, 264800, 272736, 288864, 321376, 353888, 386400, 418912, 451424, 484152, 520728, 522968, 524888, 532824, 548952, 581464, 613976, 646488, 679000, 711512, 744240, 780816, 783056, 784976, 792912, 809040, 841552, 874064, 906576, 939088, 971600, 1004328, 1040904, 1043144, 1045064, 1053000, 1069128, 1101640, 1134152, 1166664, 1199176, 1231688, 1264416, 1300992, 1303232, 1305152, 1313088, 1329216, 1361728, 1394240, 1426752, 1459264, 1491776, 1524504, 1561080, 1563320, 1565240, 1573176, 1589304, 1621816, 1654328, 1686840, 1719352, 1751864, 1784592, 1821168, 1823408, 1825328, 1833264, 1849392, 1881904, 1914416, 1946928, 1979440, 2011952, 2044680, 2081256, 2083496, 2085416, 2093352, 2109480, 2141992, 2174504, 2207016, 2239528, 2272040, 2304768, 2341344, 2343584, 2345504, 2353440, 2369568, 2402080, 2434592, 2467104, 2499616, 2532128, 2564856, 2601432, 2603672, 2605592, 2613528, 2629656, 2662168, 2694680, 2727192, 2759704, 2792216, 2824944, 2861520, 2863760, 2865680, 2873616, 2889744, 2922256, 2954768, 2987280, 3019792, 3052304, 3085032, 3121608, 3123848, 3125768, 3133704, 3149832, 3182344, 3214856, 3247368, 3279880, 3312392, 3345120, 3381696, 3383936, 3385856, 3393792, 3409920, 3442432, 3474944, 3507456, 3539968, 3572480, 3605208, 3641784, 3644024, 3645944, 3653880, 3670008, 3702520, 3735032, 3767544, 3800056, 3832568, 3865296, 3901872, 3904112, 3906032, 3913968</div>			1
		-262176, -259936, -258016, 257888, 259872, 264200	21
<div>-250080, -233952, -201440, -168928, -136416, -103904, -71392, -38664, 38624, 71136, 103648, 136160, 168672, 201184, 233696, 249824</div>			22
		0	36477

sector Offset Cumulative



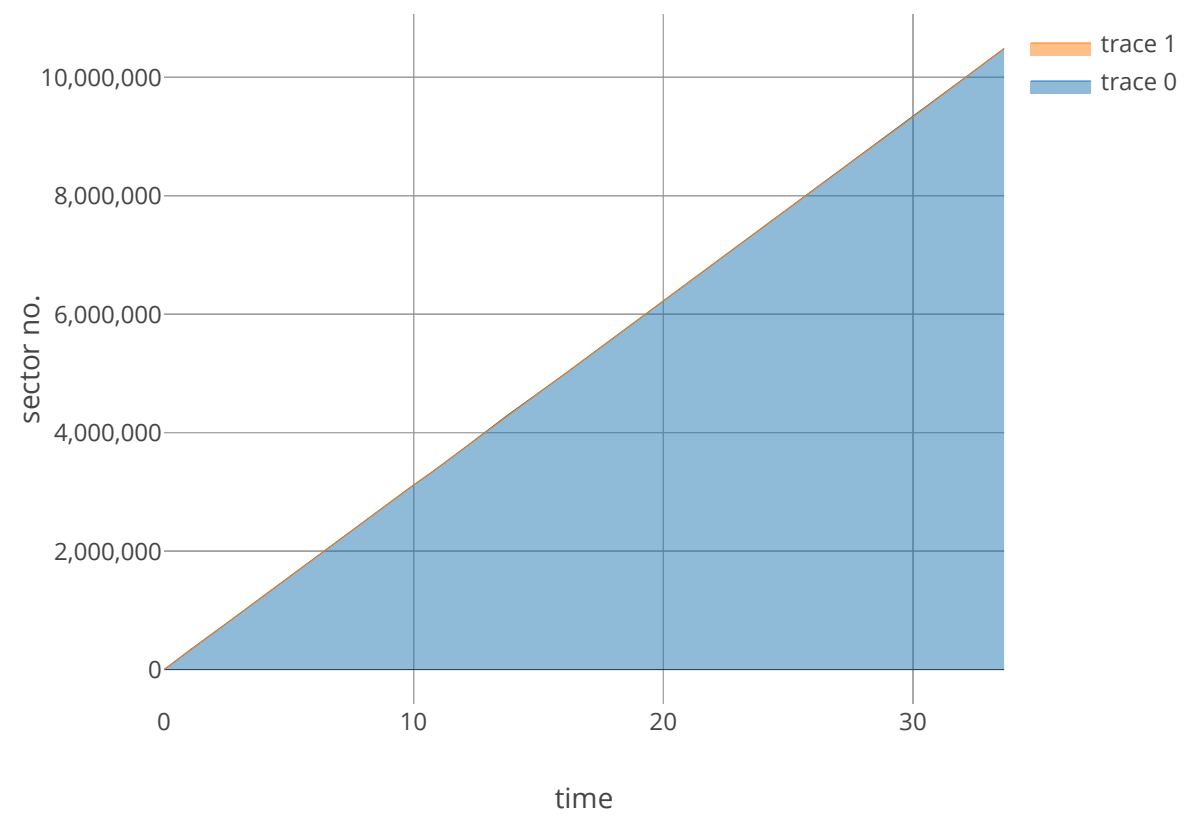


4 fio 256k

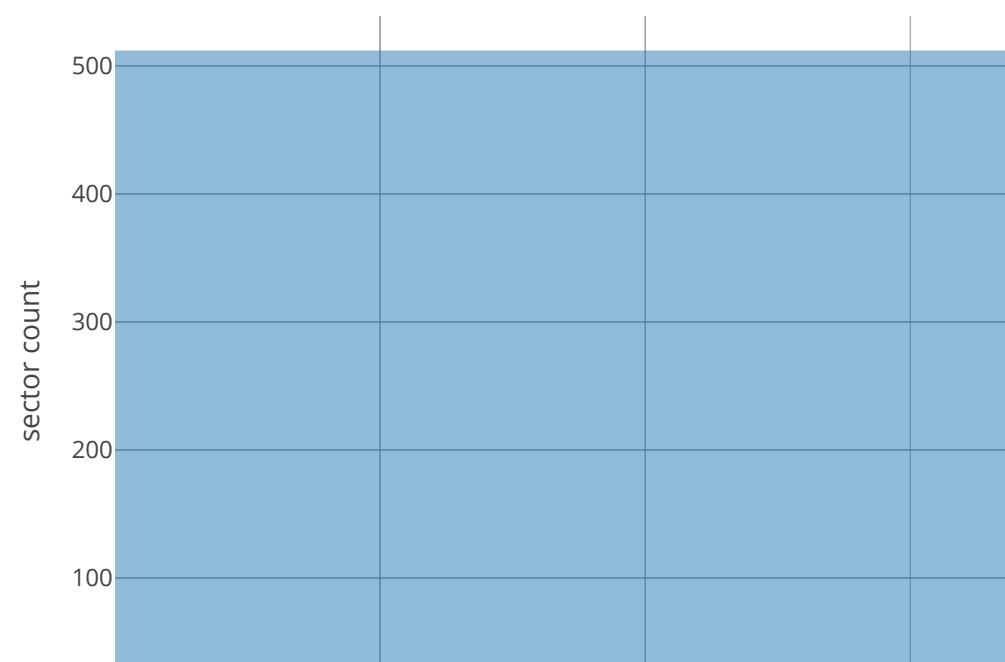
	ALL	MIN	AVG	MAX	N		
Q2Q	0.000712424	0.001642867	0.019586698		20481		
Q2G	0.000000684	0.000002185	0.000200479		20482		
G2I	0.000001747	0.000003693	0.000028984		20482		
I2D	0.000000510	0.000001827	0.001278471		20482		
D2C	0.000800196	0.001649716	1.518316182		20482		
Q2C	0.000807329	0.001657421	1.519598762		20482		
===== Device Overhead =====							
DEV	Q2G	G2I	Q2M	I2D	D2C		
(8, 16)	0.1318%	0.2228%	0.0000%	0.1103%	99.5351%		
Overall	0.1318%	0.2228%	0.0000%	0.1103%	99.5351%		
===== Device Merge Information =====							
DEV	#Q	#D	Ratio	BLKmin	BLKavg	BLKmax	Total
(8, 16)	20482	20482	1.0	1	511	512	10485763
===== Device Q2Q Seek Information =====							
DEV	NSEEKS	MEAN	MEDIAN	MODE			
(8, 16)	20482	95432.9	0	0(20477)			
Overall	NSEEKS	MEAN	MEDIAN	MODE			
Average	20482	95432.9	0	0(20477)			
===== Device D2D Seek Information =====							
DEV	NSEEKS	MEAN	MEDIAN	MODE			
(8, 16)	20482	95432.9	0	0(20477)			
Overall	NSEEKS	MEAN	MEDIAN	MODE			
Average	20482	95432.9	0	0(20477)			

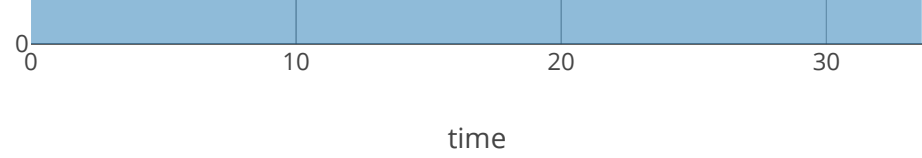
iops	mbps
602	150

sector request

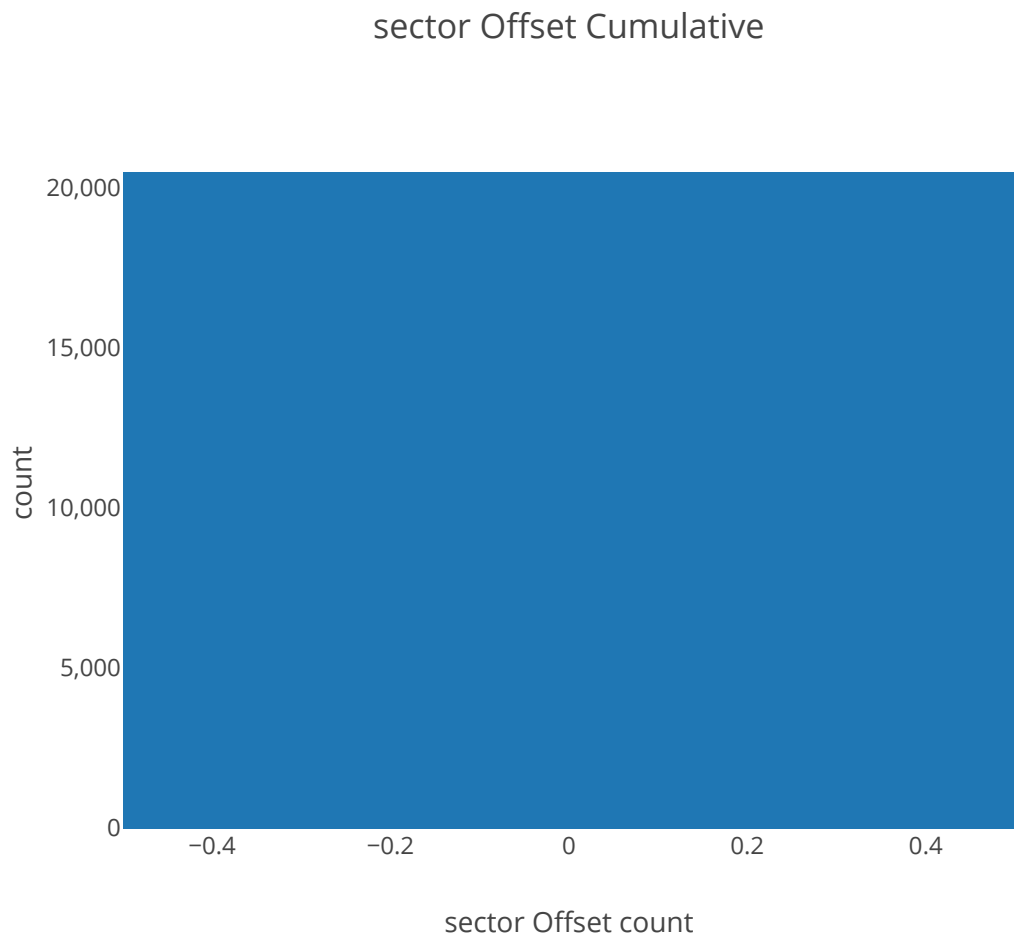


sector count





sector offset	occurrence
sum	20478
0	20478



5 hdfs 256k with meta cached

	ALL	MIN	AVG	MAX	N
Q2Q	0.000003571	0.002128149	2.892110594	19215	
Q2G	0.000000498	0.000001229	0.000018257	19213	
G2I	0.000000330	0.000002156	0.000026465	19213	
Q2M	0.000000324	0.000000805	0.000001503	3	
I2D	0.000000352	0.000001433	0.006060339	19213	
M2D	0.000016595	0.000017995	0.000020043	3	
D2C	0.000516258	0.004054541	1.506533534	19216	
Q2C	0.000522824	0.004059360	1.506534963	19216	

===== Device Overhead =====

DEV	Q2G	G2I	Q2M	I2D	D2C
(8, 16)	0.0303%	0.0531%	0.0000%	0.0353%	99.8813%
Overall	0.0303%	0.0531%	0.0000%	0.0353%	99.8813%

===== Device Merge Information =====

DEV	#Q	#D	Ratio	BLKmin	BLKavg	BLKmax	Total
(8, 16)	19216	19213	1.0	8	512	1024	9851000

===== Device Q2Q Seek Information =====

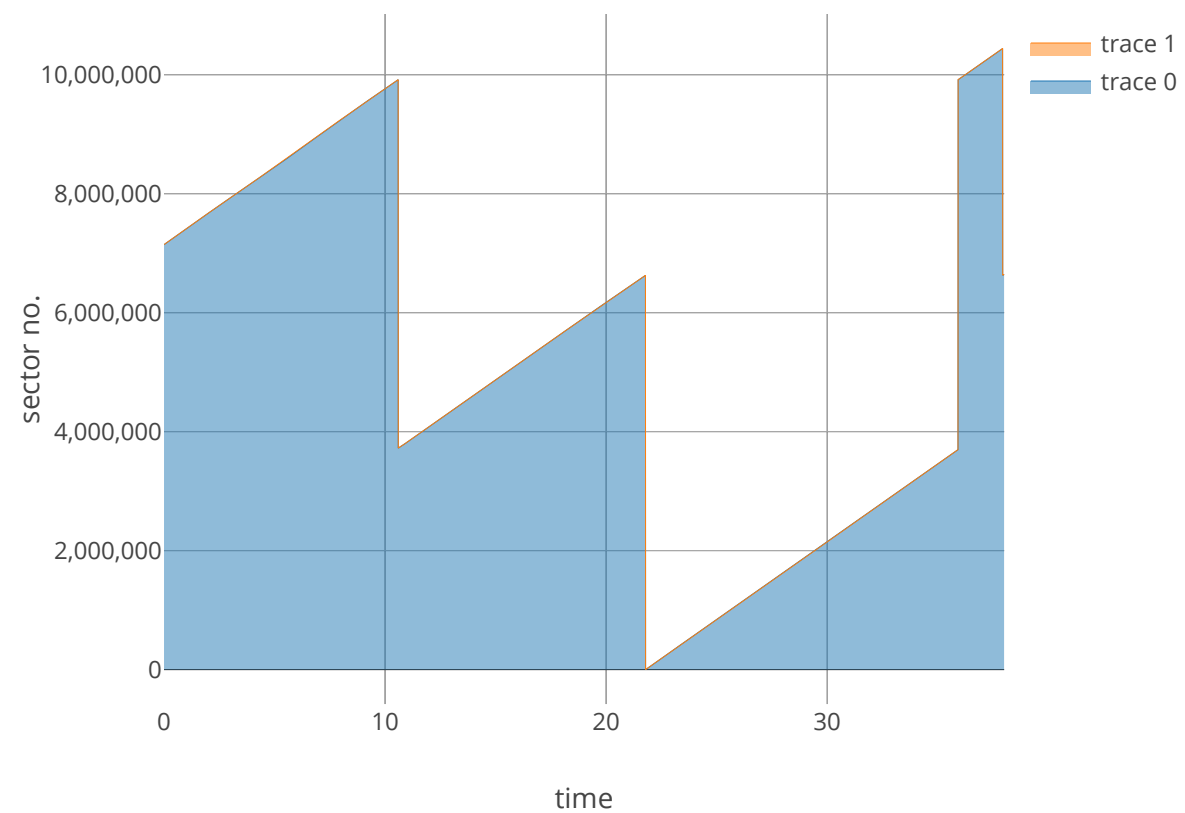
DEV	NSEEKS	MEAN	MEDIAN	MODE
(8, 16)	19216	105440.9	0	0(19162)
Overall	NSEEKS	MEAN	MEDIAN	MODE
Average	19216	105440.9	0	0(19162)

===== Device D2D Seek Information =====

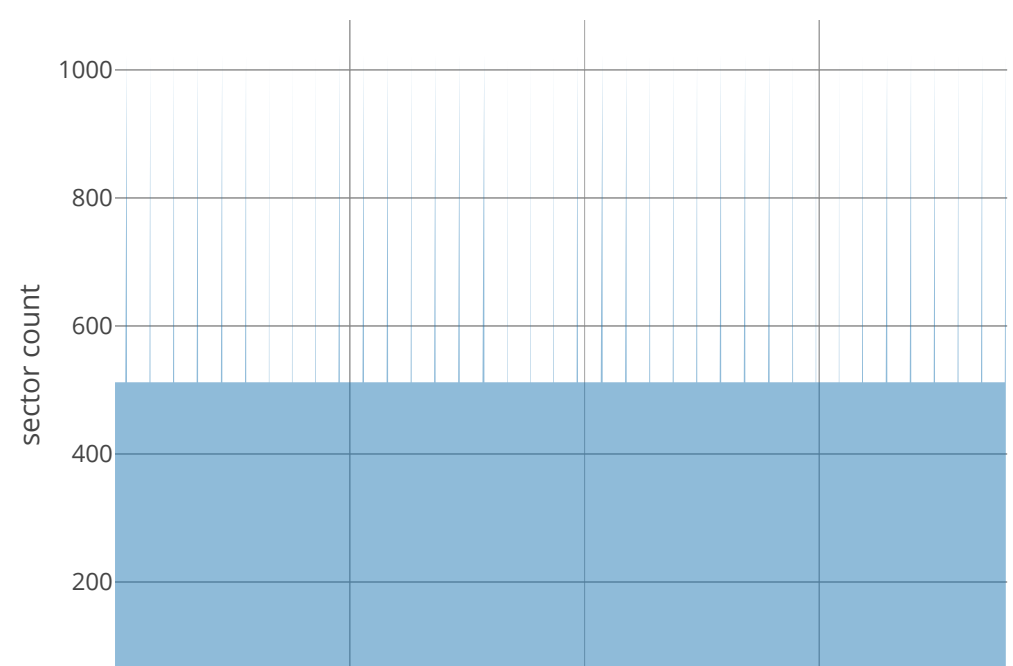
DEV	NSEEKS	MEAN	MEDIAN	MODE
(8, 16)	19213	105695.5	0	0(19159)
Overall	NSEEKS	MEAN	MEDIAN	MODE
Average	19213	105695.5	0	0(19159)

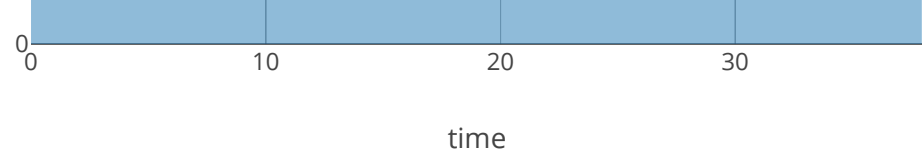
iops	mbps
480	120

sector request

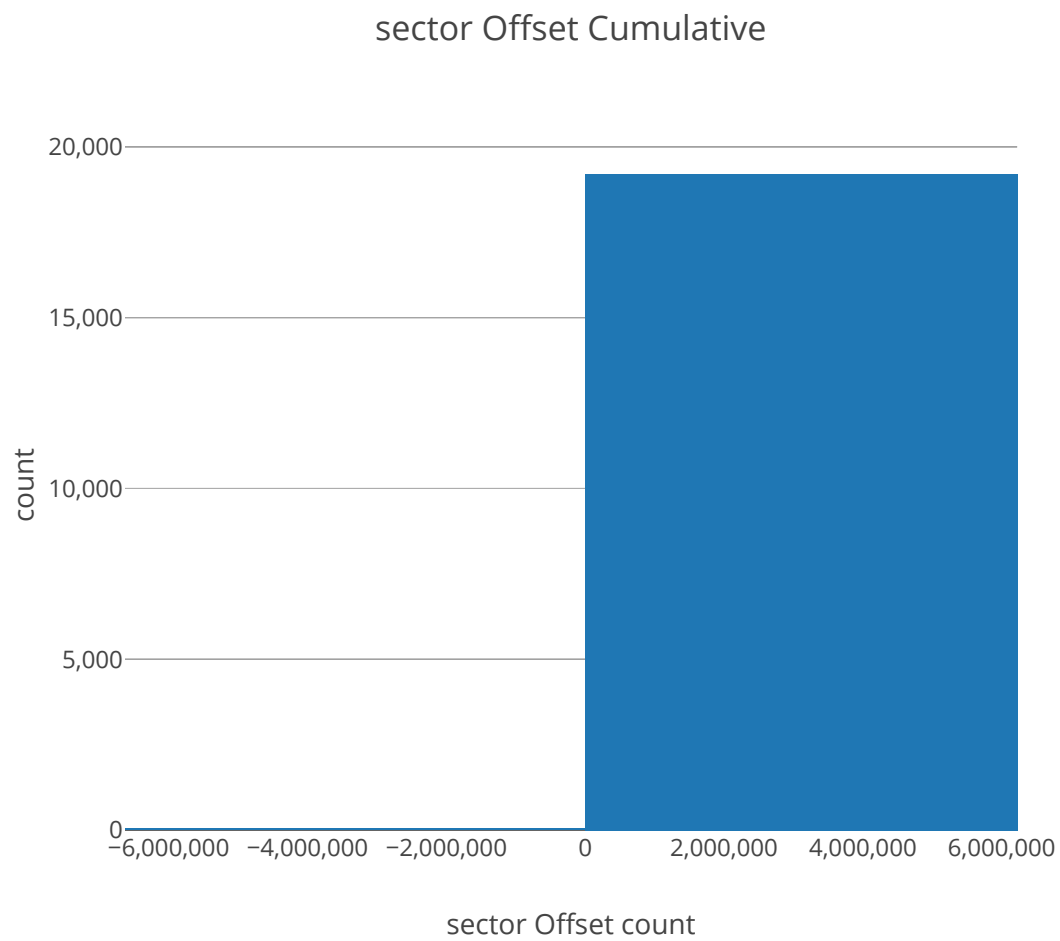


sector count





sector offset	occurrence
sum	19191
-6626792, -6193120, -3813264, 6219024	1
0	19154
2056	33



6 fio 512k

为何 Device D2D Seek Information MEAN 会变成0? 1024应该就是此磁盘最大IO?刚好不用等待?

	ALL	MIN	AVG	MAX	N
Q2Q	0.001282243	0.003280818	0.012768844		10239
Q2G	0.000000819	0.000002280	0.000026416		10240
G2I	0.000002394	0.000004240	0.000021110		10240
I2D	0.000000675	0.000001978	0.000014806		10240
D2C	0.001182734	0.003192608	0.012681449		10240
Q2C	0.001196733	0.003201106	0.012689434		10240

===== Device Overhead =====

DEV	Q2G	G2I	Q2M	I2D	D2C
(8, 16)	0.0712%	0.1325%	0.0000%	0.0618%	99.7345%
Overall	0.0712%	0.1325%	0.0000%	0.0618%	99.7345%

===== Device Merge Information =====

DEV	#Q	#D	Ratio	BLKmin	BLKavg	BLKmax	Total
(8, 16)	10240	10240	1.0	1024	1024	1024	10485760

===== Device Q2Q Seek Information =====

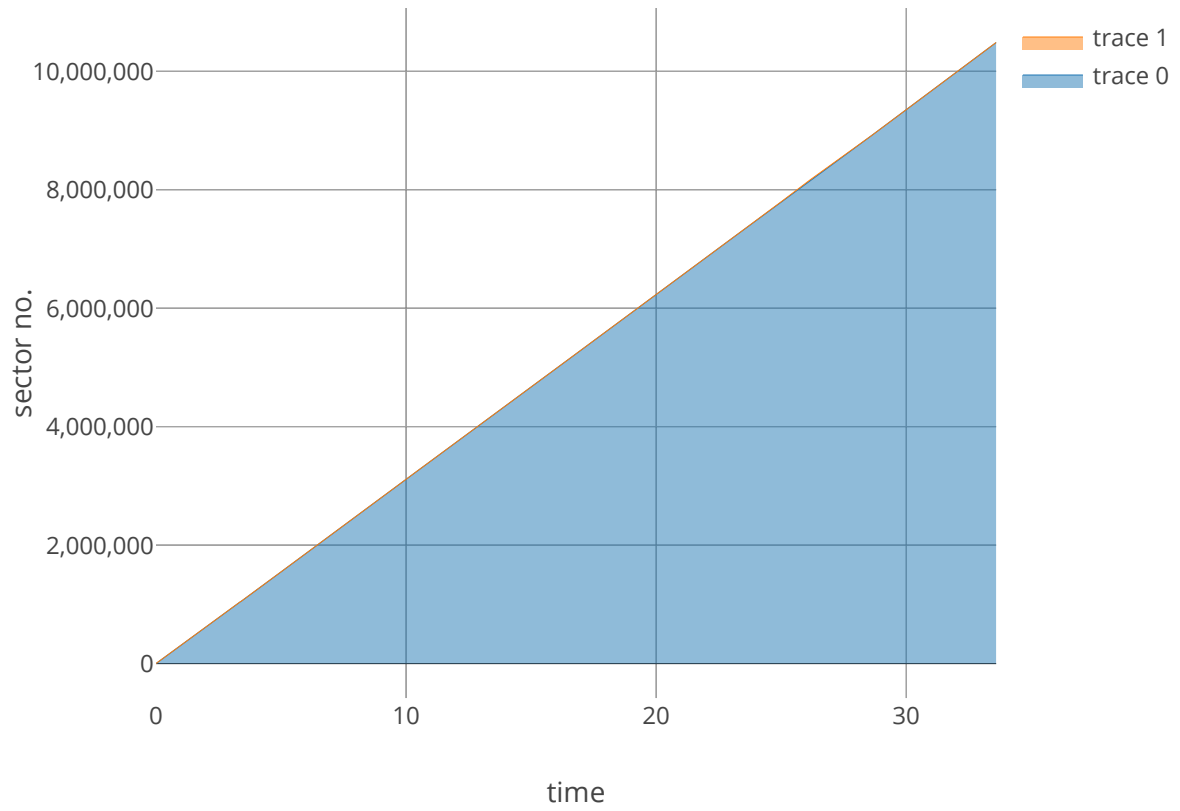
DEV	NSEEKS	MEAN	MEDIAN	MODE
(8, 16)	10240	0.0	0	0(10239)
Overall	NSEEKS	MEAN	MEDIAN	MODE
Average	10240	0.0	0	0(10239)

===== Device D2D Seek Information =====

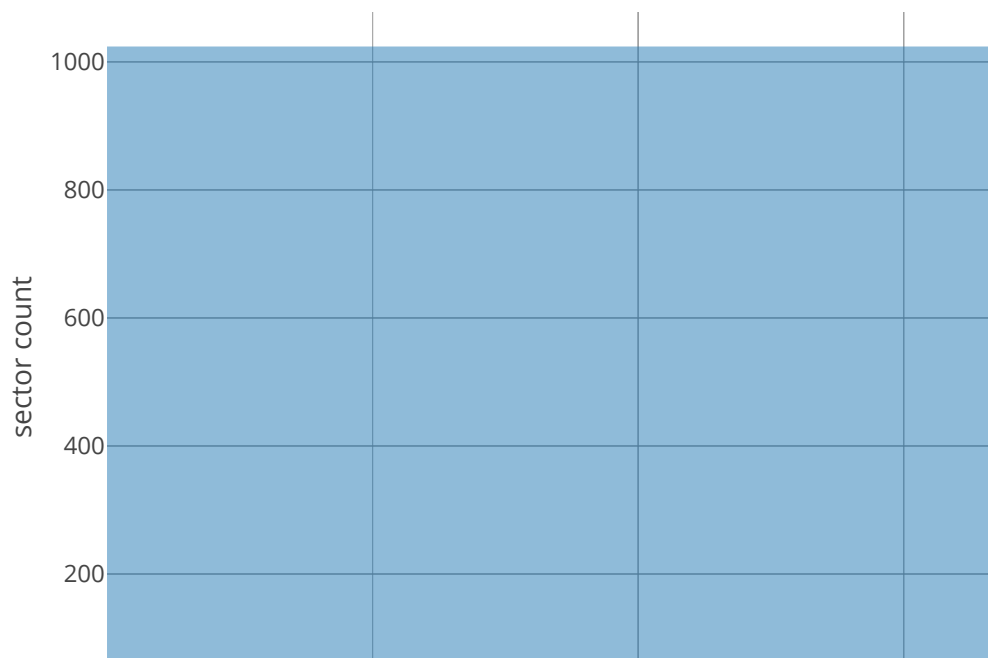
DEV	NSEEKS	MEAN	MEDIAN	MODE
(8, 16)	10240	0.0	0	0(10239)
Overall	NSEEKS	MEAN	MEDIAN	MODE
Average	10240	0.0	0	0(10239)

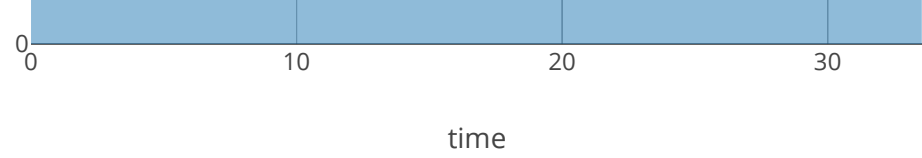
iops	mbps
301	150

sector request

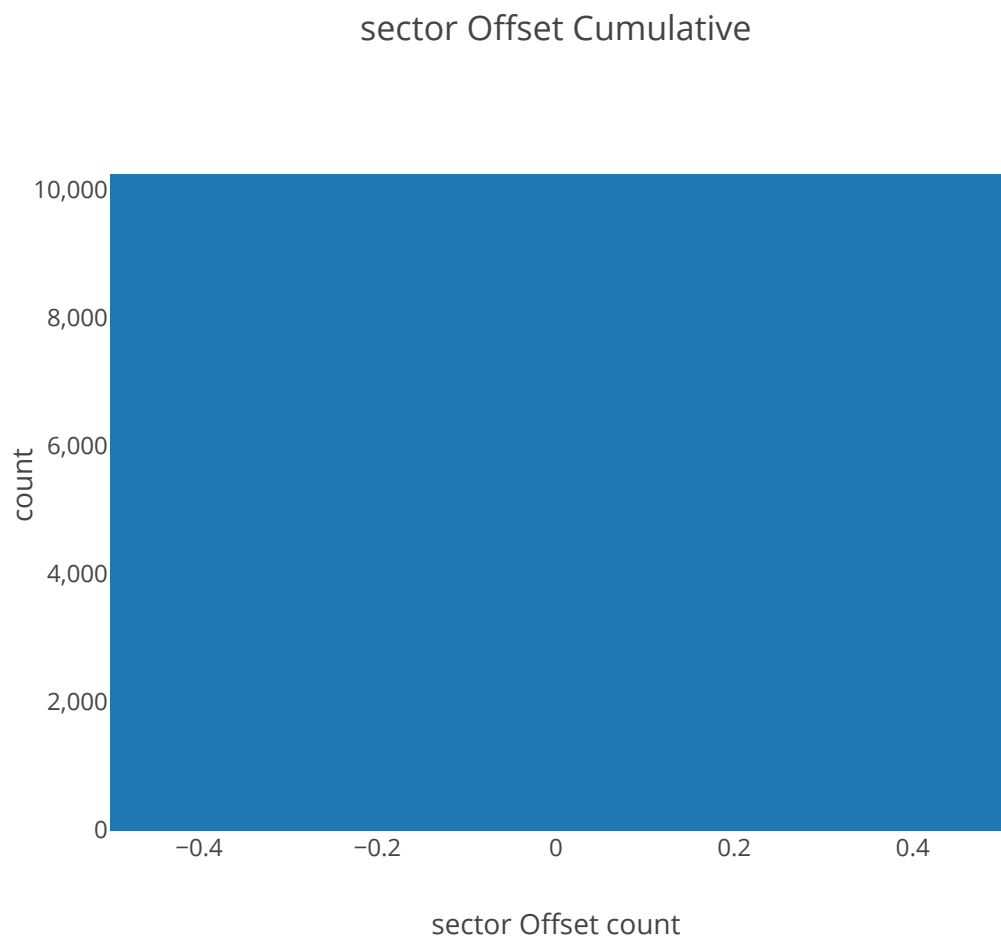


sector count





sector offset	occurrence
sum	10238
0	10238



7 hdfs 512k with meta cached

	ALL	MIN	AVG	MAX	N
Q2Q	0.000036918	0.003926955	0.079896994		9202
Q2G	0.000000466	0.000001302	0.000027054		9203
G2I	0.000000472	0.000109761	0.000277723		9203
I2D	0.000000691	0.000015493	0.018139622		9203
D2C	0.000978363	0.025177188	1.514897961		9203
Q2C	0.001210695	0.025303744	1.533041806		9203

===== Device Overhead =====

DEV	Q2G	G2I	Q2M	I2D	D2C
(8, 16)	0.0051%	0.4338%	0.0000%	0.0612%	99.4999%
Overall	0.0051%	0.4338%	0.0000%	0.0612%	99.4999%

===== Device Merge Information =====

DEV	#Q	#D	Ratio	BLKmin	BLKavg	BLKmax	Total
(8, 16)	9203	9203	1.0	8	1024	1024	9425322

===== Device Q2Q Seek Information =====

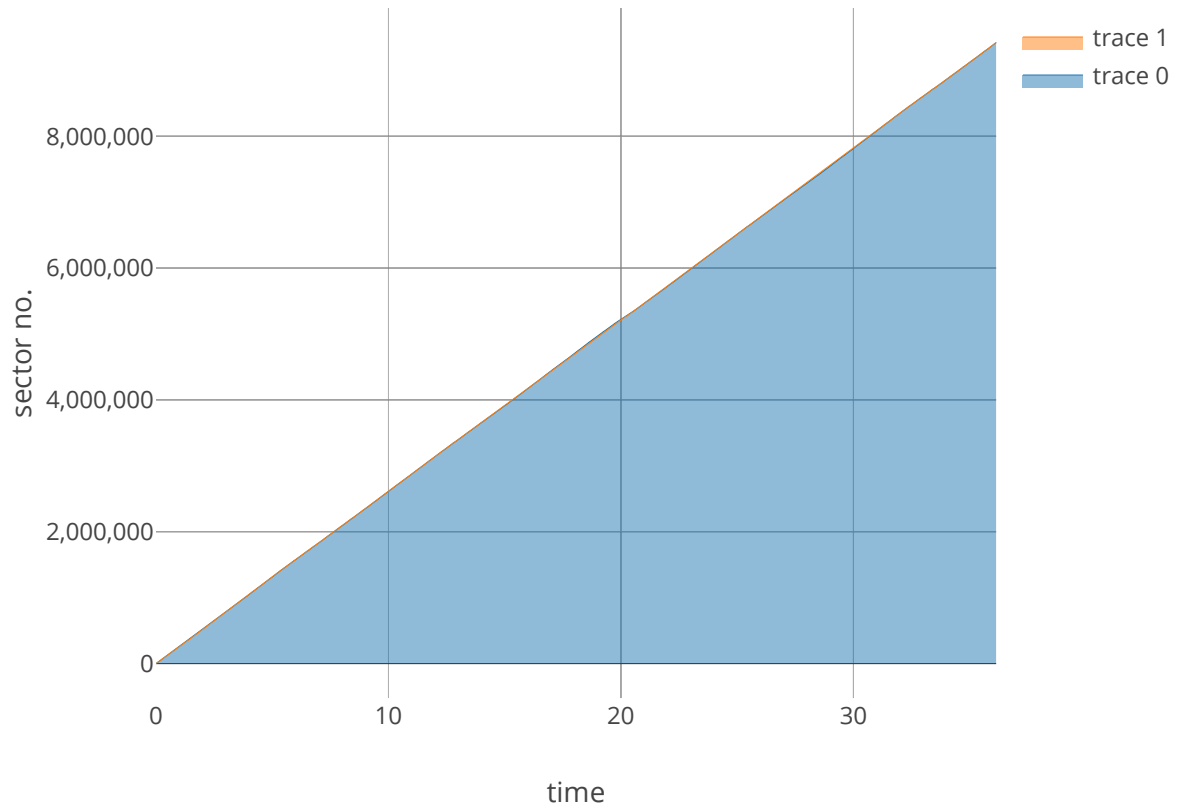
DEV	NSEEKS	MEAN	MEDIAN	MODE
(8, 16)	9203	111025.0	0	0(9197)
Overall	NSEEKS	MEAN	MEDIAN	MODE
Average	9203	111025.0	0	0(9197)

===== Device D2D Seek Information =====

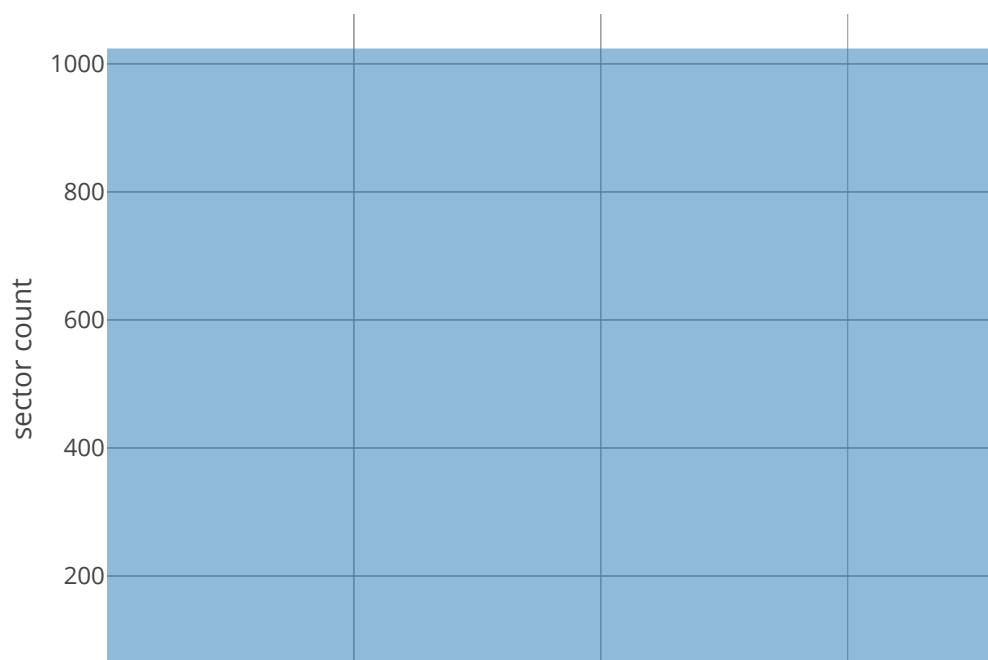
DEV	NSEEKS	MEAN	MEDIAN	MODE
(8, 16)	9203	111026.8	0	0(9197)
Overall	NSEEKS	MEAN	MEDIAN	MODE
Average	9203	111026.8	0	0(9197)

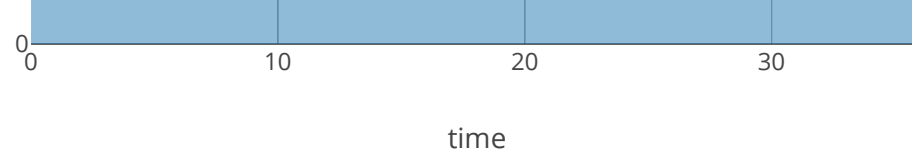
iops	mbps
248	124

sector request



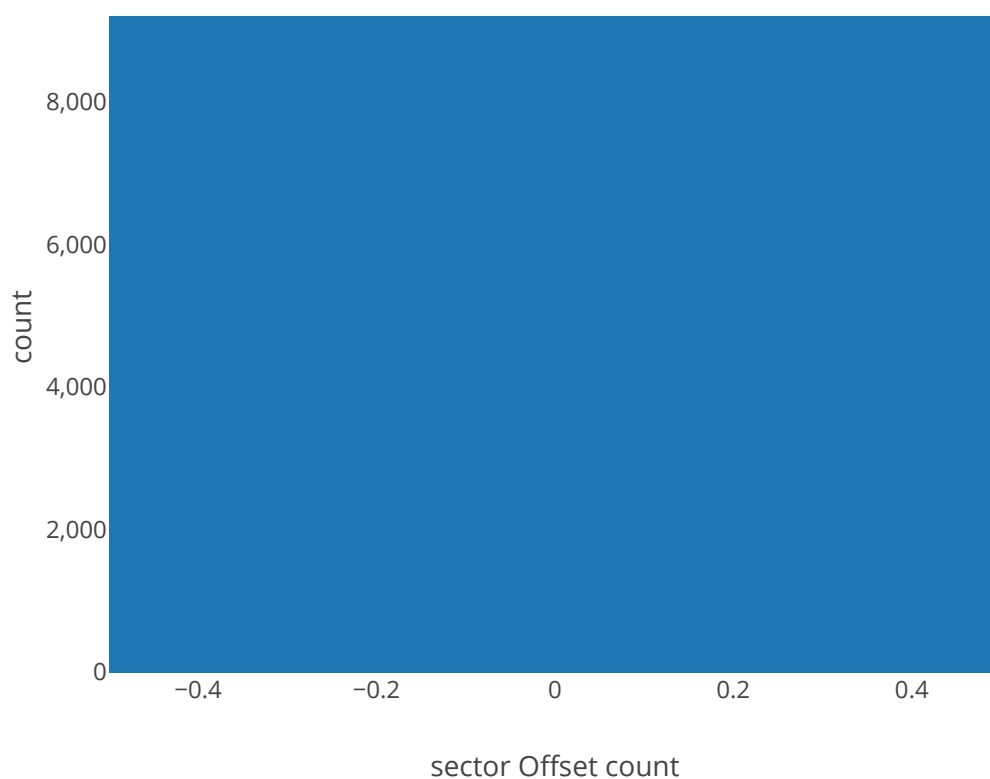
sector count





sector offset	occurrence
sum	9198
0	9198

sector Offset Cumulative



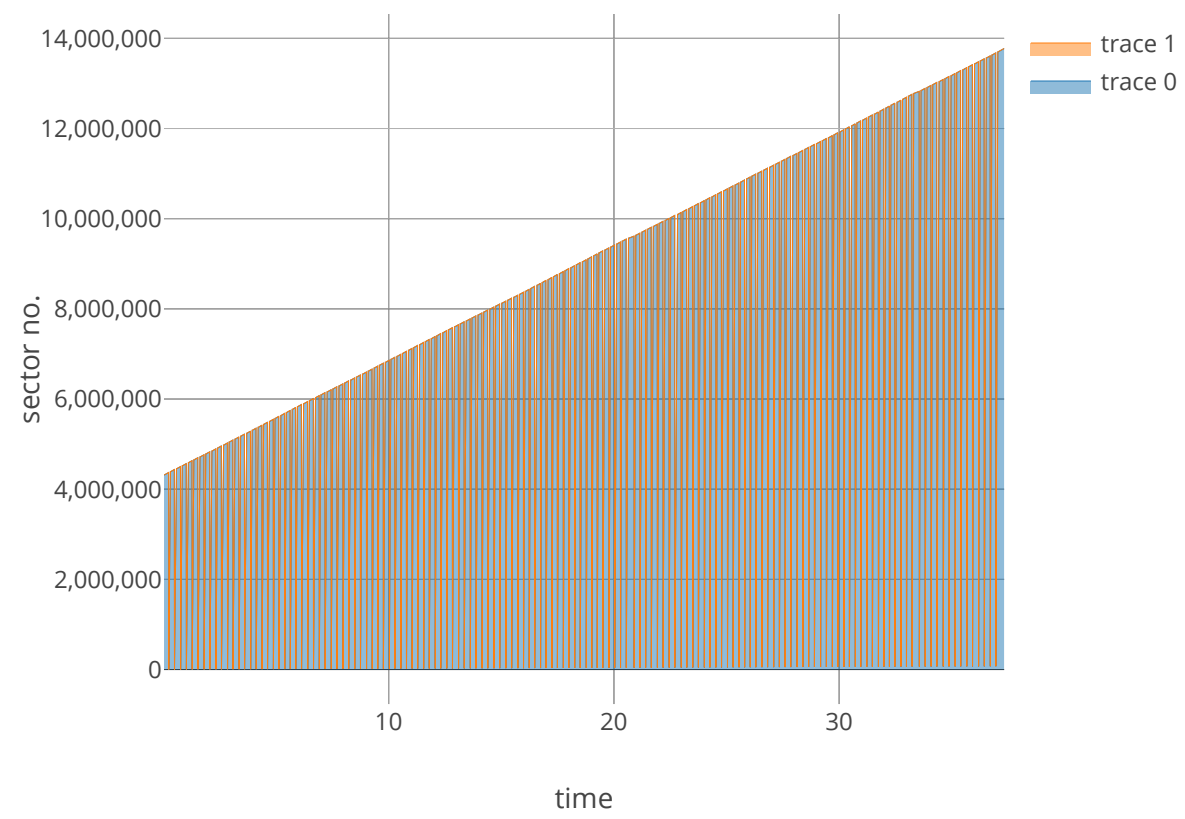
8 hdfs 512k without meta cached

sector request图说明，其起始不是从接近0开始，即是其meta与data之间的block在Linux文件系统层上的偏移大小，类似如下这样，这个偏差大小不是固定的：

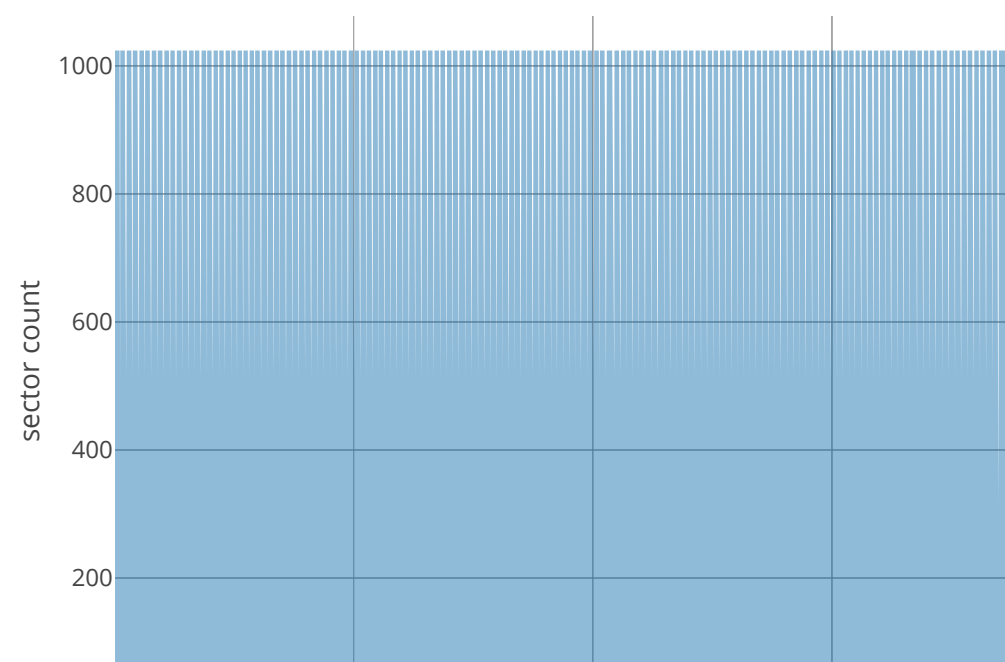
```
hdparm --fibmap blk_1073741968_1144.meta
blk_1073741968_1144.meta:
  filesystem blocksize 4096, begins at LBA 0; assuming 512 byte sectors.
  byte_offset  begin_LBA    end_LBA    sectors
                0  977802496  977882503    80008
[root@hadoop3 subdir0]# hdparm --fibmap blk_1073741968_1144
blk_1073741968_1144: No such file or directory
# hdparm --fibmap blk_1073741968
blk_1073741968:
  filesystem blocksize 4096, begins at LBA 0; assuming 512 byte sectors.
  byte_offset  begin_LBA    end_LBA    sectors
                0  981427576  991667575   10240000
```

iops	mbps
247	122

sector request



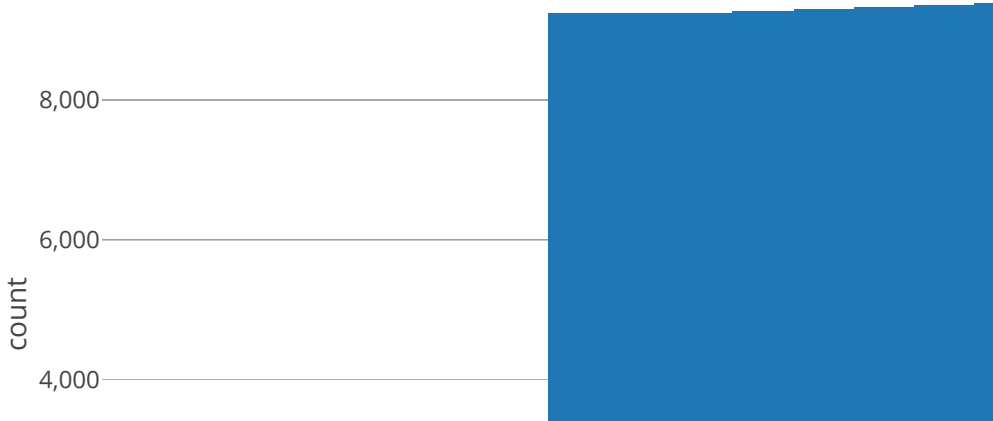
sector count

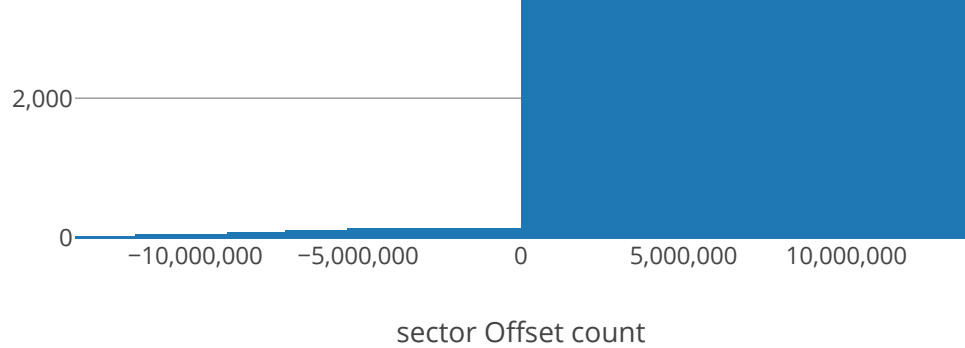




		sector offset	occurrence
		sum	9381
<div>-13603480, -13538456, -13473432, -13408408, -13343384, -13278360, -13213336, -13148312, -13083288, -13018264, -12953240, -12888216, -12823192, -12758168, -12693144, -12628120, -12563096, -12498072, -12433048, -12368024, -12303000, -12237976, -12172952, -12107928, -12042904, -11977880, -11912856, -11847832, -11782808, -11717784, -11652760, -11587736, -11522712, -11457688, -11392664, -11327640, -11262616, -11197592, -11132568, -11067544, -11002520, -10937496, -10872472, -10807448, -10742424, -10677400, -10612376, -10547352, -10482328, -10417304, -10352280, -10287256, -10222232, -10157208, -10092184, -10027160, -9962136, -9897112, -9832088, -9767064, -9702040, -9637016, -9571992, -9506968, -9441944, -9376920, -9311896, -9246872, -9181848, -9116824, -9051800, -8986776, -8921752, -8856728, -8791704, -8726680, -8661656, -8596632, -8531608, -8466584, -8401560, -8336536, -8271512, -8206488, -8141464, -8076440, -8011416, -7946392, -7881368, -7816344, -7751320, -7686296, -7621272, -7556248, -7491224, -7426200, -7361176, -7296152, -7231128, -7166104, -7101080, -7036056, -6971032, -6906008, -6840984, -6775960, -6710936, -6645912, -6580888, -6515864, -6450840, -6385816, -6320792, -6255768, -6190744, -6125720, -6060696, -5995672, -5930648, -5865624, -5800600, -5735576, -5670552, -5605528, -5540504, -5475480, -5410456, -5345432, -5280408, -5215384, -5150360, -5085336, -5020312, -4955288, -4890264, -4825240, -4760216, -4695192, -4630168, -4565144, -4500120, -4435096, -4370072, 4369560, 4434584, 4499608, 4564632, 4629656, 4694680, 4759704, 4824728, 4889752, 4954776, 5019800, 5084824, 5149848, 5214872, 5279896, 5344920, 5409944, 5474968, 5539992, 5605016, 5670040, 5735064, 5800088, 5865112, 5930136, 5995160, 6060184, 6125208, 6190232, 6255256, 6320280, 6385304, 6450328, 6515352, 6580376, 6645400, 6710424, 6775448, 6840472, 6905496, 6970520, 7035544, 7100568, 7165592, 7230616, 7295640, 7360664, 7425688, 7490712, 7555736, 7620760, 7685784, 7750808, 7815832, 7880856, 7945880, 8010904, 8075928, 8140952, 8205976, 8271000, 8336024, 8401048, 8466072, 8531096, 8596120, 8661144, 8726168, 8791192, 8856216, 8921240, 8986264, 9051288, 9116312, 9181336, 9246360, 9311384, 9376408, 9441432, 9506456, 9571480, 9636504, 9701528, 9766552, 9831576, 9896600, 9961624, 10026648, 10091672, 10156696, 10221720, 10286744, 10351768, 10416792, 10481816, 10546840, 10611864, 10676888, 10741912, 10806936, 10871960, 10936984, 11002008, 11067032, 11132056, 11197080, 11262104, 11327128, 11392152, 11457176, 11522200, 11587224, 11652248, 11717272, 11782296, 11847320, 11912344, 11977368, 12042392, 12107416, 12172440, 12237464, 12302488, 12367512, 12432536, 12497560, 12562584, 12627608, 12692632, 12757656, 12822680, 12887704, 12952728, 13017752, 13082776, 13147800, 13212824, 13277848, 13342872, 13407896, 13472920, 13537944, 13603168</div>			1
		0	9095

sector Offset Cumulative





9 fio 1024k

主要为验证fio 512k之后 seek time = 0。

	ALL	MIN	AVG	MAX	N
-----	-----	-----	-----	-----	-----
Q2Q	0.000032066	0.003279503	0.015242607		10239
Q2G	0.000000506	0.000001677	0.000017236		10240
G2I	0.000002716	0.000022179	0.000213716		10240
I2D	0.000000885	0.000007785	0.000039517		10240
D2C	0.001169797	0.004788006	0.015142566		10240
Q2C	0.001392663	0.004819647	0.015161123		10240

===== Device Overhead =====

DEV	Q2G	G2I	Q2M	I2D	D2C
(8, 16)	0.0348%	0.4602%	0.0000%	0.1615%	99.3435%
Overall	0.0348%	0.4602%	0.0000%	0.1615%	99.3435%

===== Device Merge Information =====

DEV	#Q	#D	Ratio	BLKmin	BLKavg	BLKmax	Total
(8, 16)	10240	10240	1.0	1024	1024	1024	10485760

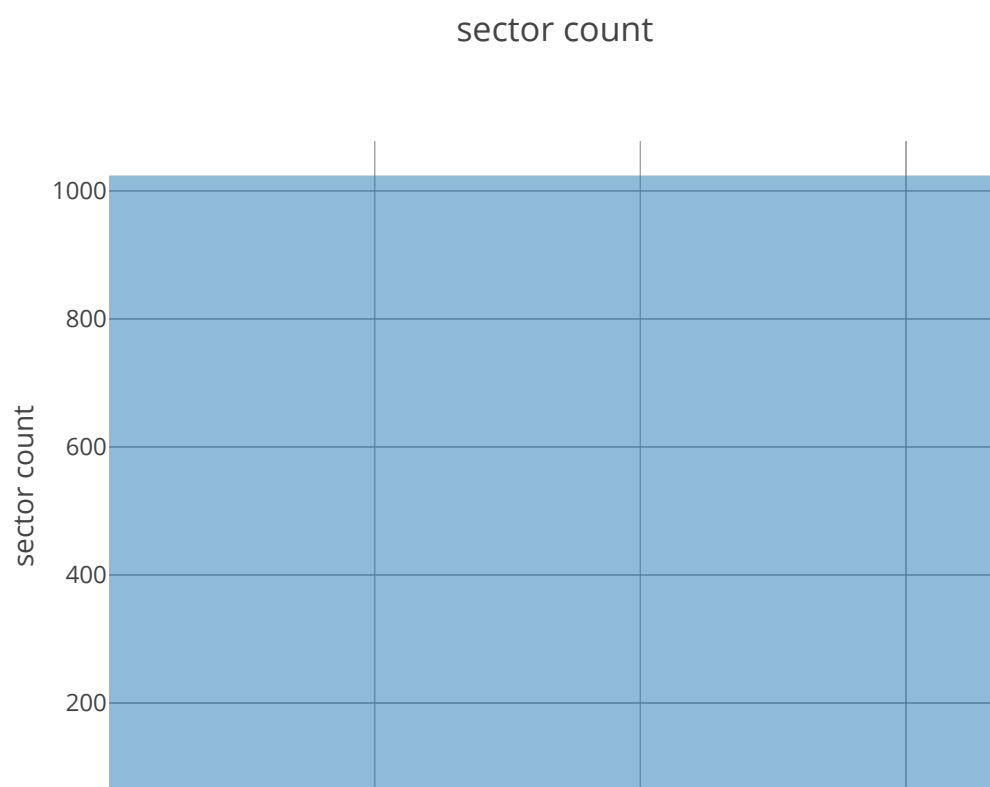
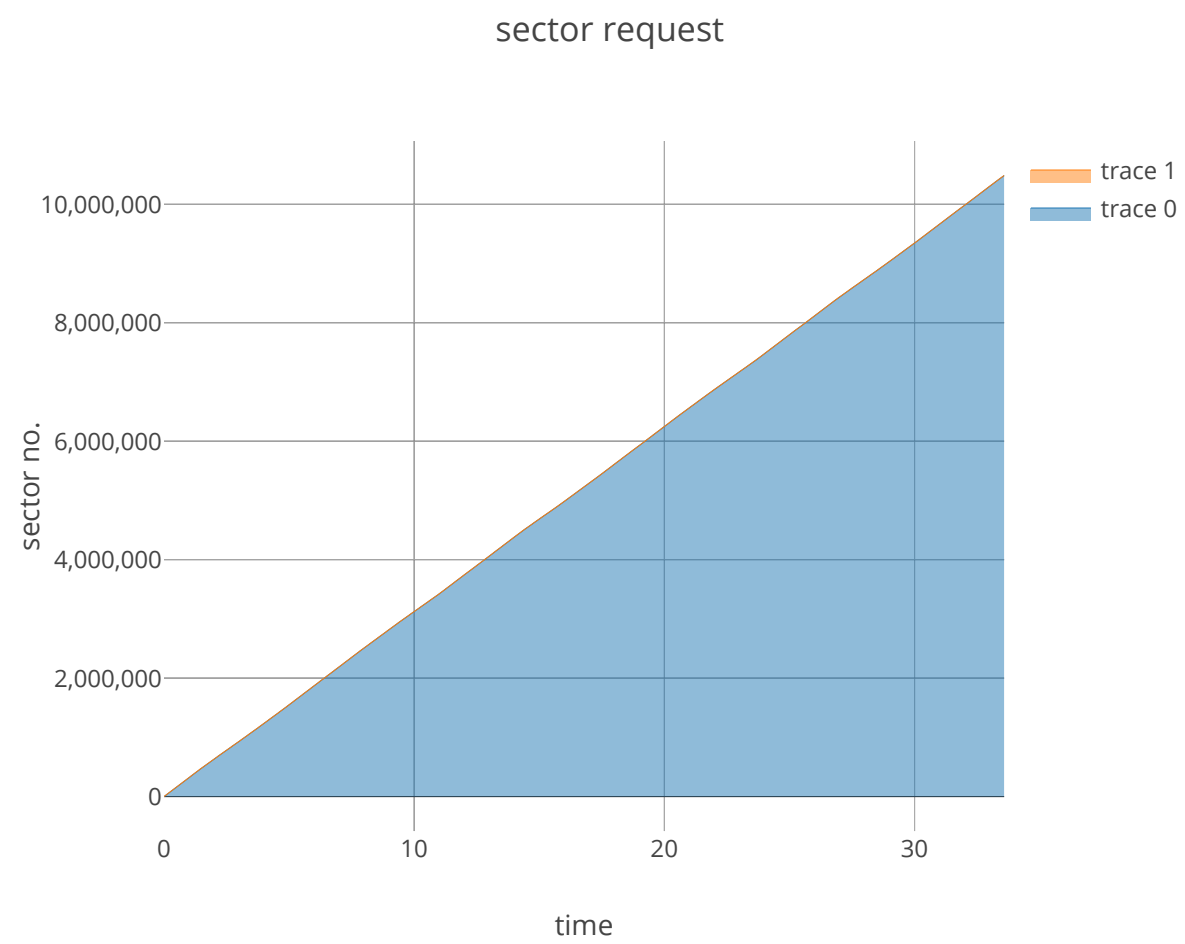
===== Device Q2Q Seek Information =====

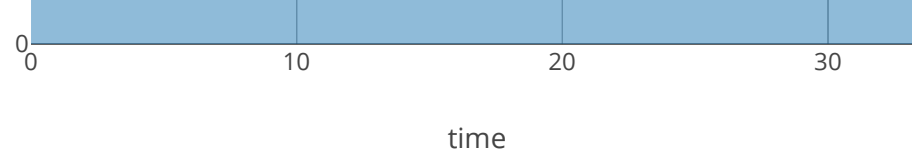
DEV	NSEEKS	MEAN	MEDIAN	MODE
(8, 16)	10240	0.0	0	0(10239)
Overall	NSEEKS	MEAN	MEDIAN	MODE
Average	10240	0.0	0	0(10239)

===== Device D2D Seek Information =====

DEV	NSEEEKS	MEAN	MEDIAN	MODE
-----	-----	-----	-----	-----
(8, 16)	10240	0.0	0	0(10239)
-----	-----	-----	-----	-----
Overall	NSEEEKS	MEAN	MEDIAN	MODE
Average	10240	0.0	0	0(10239)

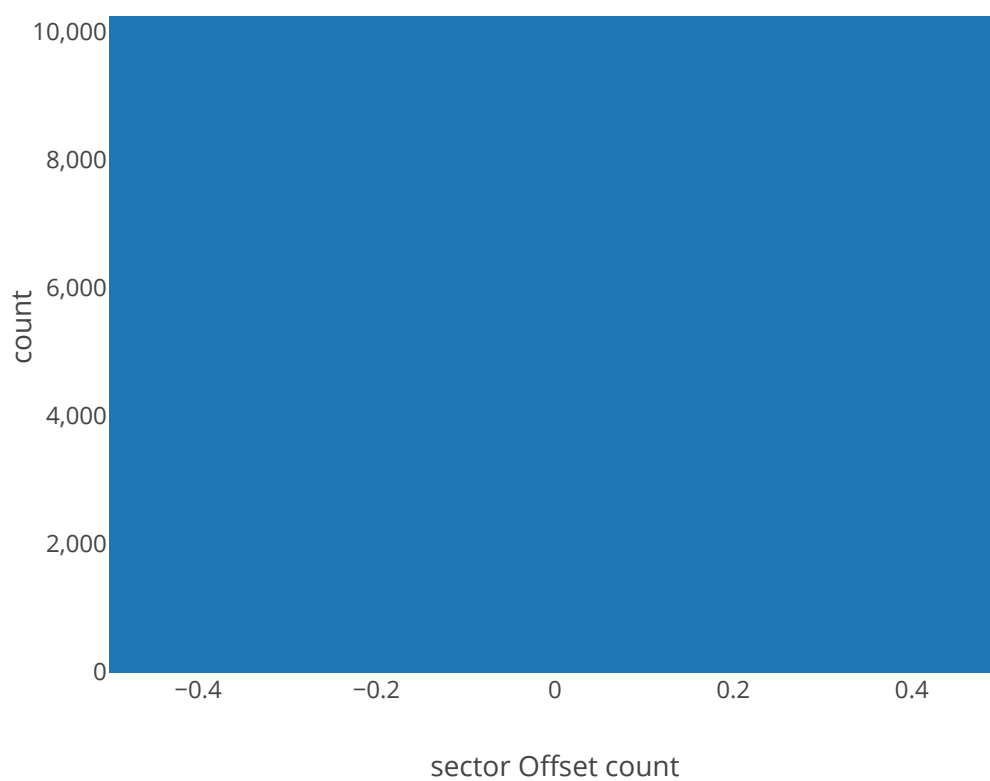
iops	mbps
301	150





sector offset	occurrence
sum	10238
0	10238

sector Offset Cumulative

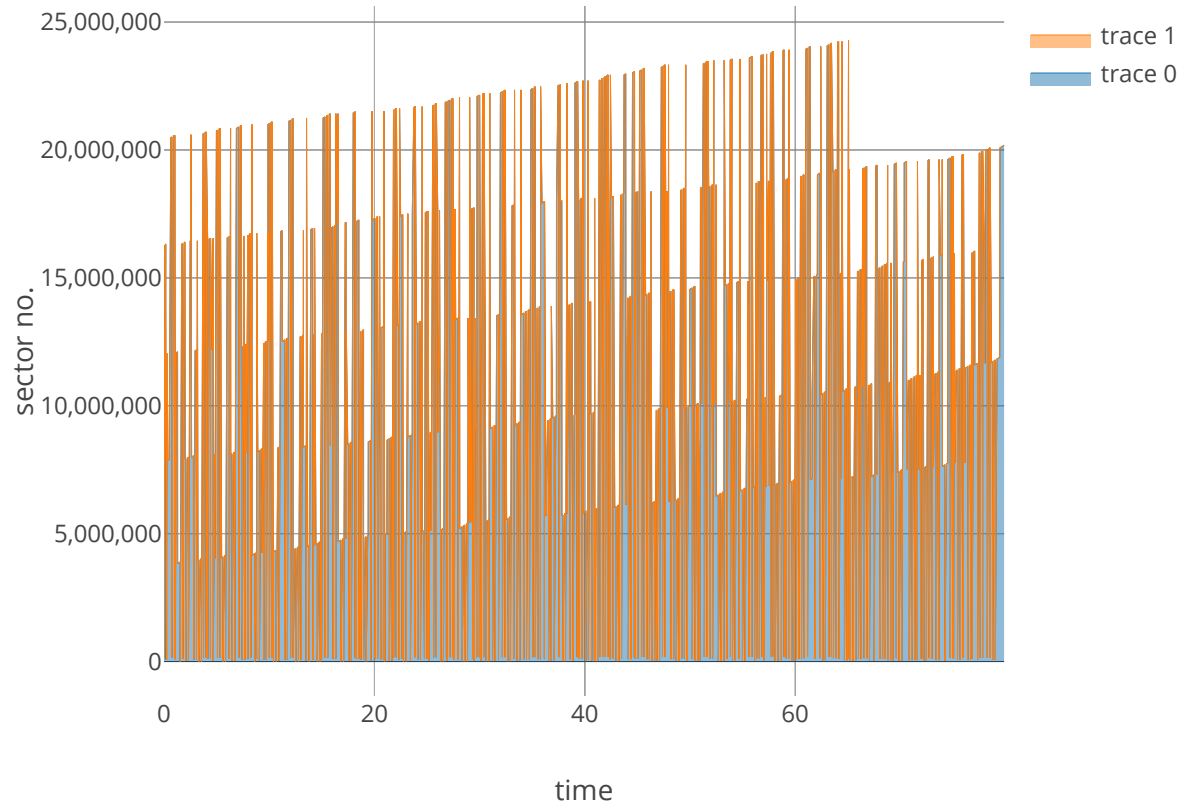


10 hdfs 256k without meta cached 5filex2G blocksize=5g

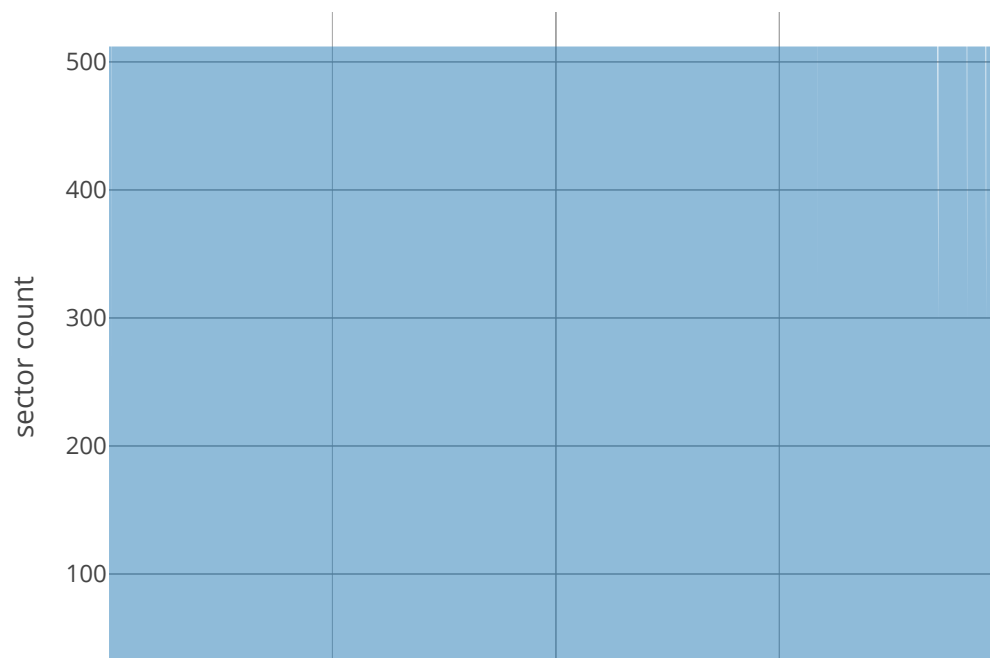
hdfs.blocksize = 5g, 如何是单文件读取是512k大小的io, 现在多文件同时读取, 其变成256k大小, 具体逻辑待分析。

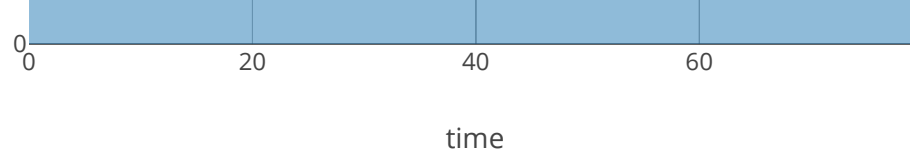
iops	mbps
488	121

sector request



sector count

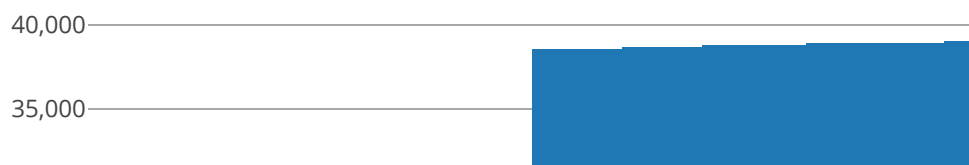


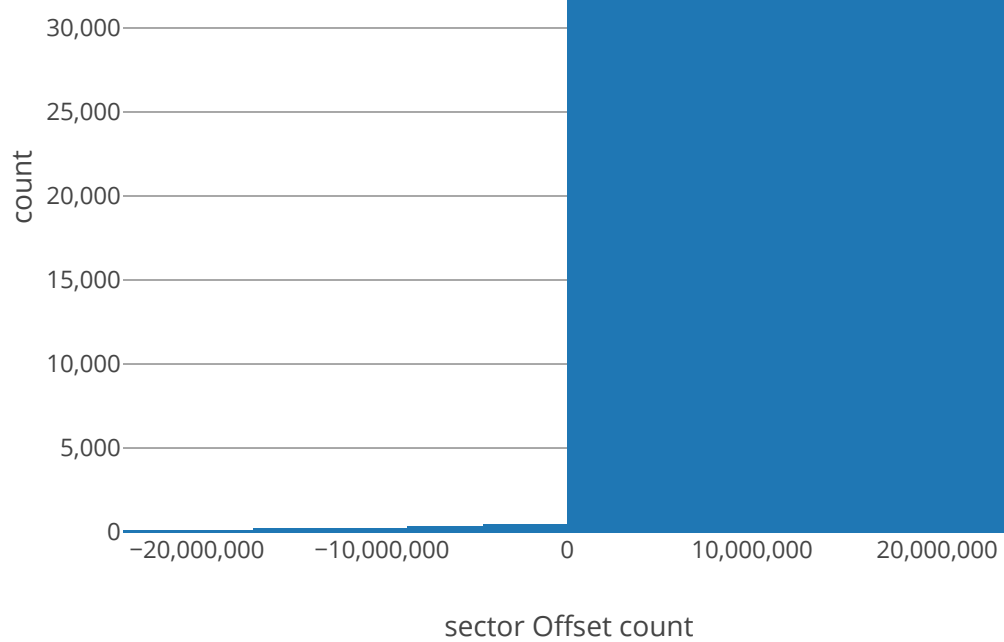


		sector offset	occurrence
		sum	39016
-23989336, -23924312, -23794264, -23729240, -23664216, -23599192, -23534168, -23469144, -23404120, -23339096, -23274072, -23209048, -23144024, -23079000, -23013976, -22948952, -22883928, -22818904, -22753880, -22688856, -22623832, -22558808, -22493784, -22428760, -22363736, -22298712, -22233688, -22168664, -22103640, -22038616, -21973592, -21908568, -21843544, -21778520, -21713496, -21648472, -21583448, -21518424, -21453400, -21388376, -21323352, -21258328, -21193304, -21128280, -21063256, -20998232, -20933208, -20868184, -20803160, -20738136, -20673112, -20608088, -20543064, -20478040, -20413016, -20347992, -19941648, -19876624, -19811600, -19746576, -19681552, -19616528, -19551504, -19486480, -19421456, -19356432, -19291408, -19226384, -19161360, -19096336, -19031312, -18966288, -18926680, -18901264, -18836240, -18771216, -18706192, -18641168, -18576144, -18511120, -18446096, -18381072, -18316048, -18251024, -18186000, -18120976, -18055952, -17990928, -17925904, -17860880, -17795856, -17730832, -17705968, -17665808, -17600784, -17535760, -17470736, -17405712, -17340688, -17275664, -17210640, -17145616, -17080592, -17072512, -17072000, -17015568, -17014656, -16987520, -16950544, -16940928, -16939904, -16913792, -16904064, -16885520, -16875392, -16854912, -16820496, -16818048, -16809856, -16755472, -16744320, -16690560, -16690448, -16625424, -16620416, -16560400, -16495376, -16430352, -16365328, -16300304, -16235280, -16170256, -15877656, -15812632, -15747608, -15682584, -15617560, -15552536, -15487512, -15422488, -15357464, -15292440, -15227416, -15162392, -15097368, -15032344, -14967320, -14902296, -14837272, -14772248, -14707224, -14642200, -14577176, -14512152, -14447128, -14382104, -14317080, -14252056, -14187032, -14122008, -14056984, -13991960, -13926936, -13861912, -13796888, -13731864, -13696896, -13666840, -13614464, -13601816, -13536792, -13471768, -13414784, -13406744, -13399424, -13341720, -13211672, -13173120, -13146648, -13081624, -13076864, -13044608, -13035392, -13016600, -13009792, -12951576, -12886552, -12840320, -12821528, -12756504, -12746624, -12691480, -12626456, -12561432, -12536704, -12519808, -12496408, -12431384, -12387200, -12366360, -12361600, -12359552, -12318592, -12316032, -12301336, -12236312, -12204928, -12197248, -12193664, -12177280, -12171288, -12126080, -12123520, -12118912, -12106264, -12086656, -12079488, -12069760, -12053376, -12041240, -11976216, -11943960, -11933056, -11927832, -11729008, -11663984, -11598960, -11533936, -11468912, -11403888, -11338864, -11273840, -11208816, -11143792, -11078768, -11013744, -10948720, -10883696, -10818672, -10753648, -10688624, -10623600, -10558576, -10493552, -10428528, -10363504, -10298480, -10233456, -10168432, -10103408, -10038384, -9973360, -9908336, -9843312, -9778288, -9713264, -9648240, -9583216, -9518192, -9453168, -9388144, -9323120, -9258096, -9193072, -9128048, -9117184, -9089024, -9063024, -8932976, -8919704, -8912896, -8867952, -8827392, -8802928, -8786944, -8783360, -8737904, -8730496, -8723328, -8697344, -8684544, -8680320, -8672880, -8672128, -8664576, -8643968, -8621440, -8607856, -8582016, -8563712, -8562688, -8554368, -8544640, -8543232, -8542832, -8537088, -8536448, -8523648, -8519680, -8518656, -8518144, -8490880, -8482816, -8477808, -8454016, -8448896, -8417664, -8413184, -8412784, -8352640, -8347760, -8298880, -8291712, -8288640, -8282736, -8279424, -8261504, -8227712, -8217712, -8197504, -8187264, -8185216, -8166784, -8152688, -8143744, -8098688, -8087664, -8040320, -8028032, -8022640, -8015232, -8011648, -7957616, -7892592, -7665016, -7599992, -7534968, -7469944, -7404920, -7339896, -7274872, -7209848, -7144824, -7079800, -7014776, -6949752, -6884728, -6819704, -6754680, -6689656, -6624632, -6559608, -6494584, -6429560, -6364536, -6299512, -6234488, -6169464, -6104440, -6039416, -5974392, -5909368, -5844344, -5779320, -5714296, -5649272, -5584248, -5519224, -5454200, -5389176, -5324152, -5259128, -5194104, -5129080, -5064056, 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3849216, 3861504, 3862528, 3880960, 3893112, 3908096, 3958136,			1

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sector Offset Cumulative



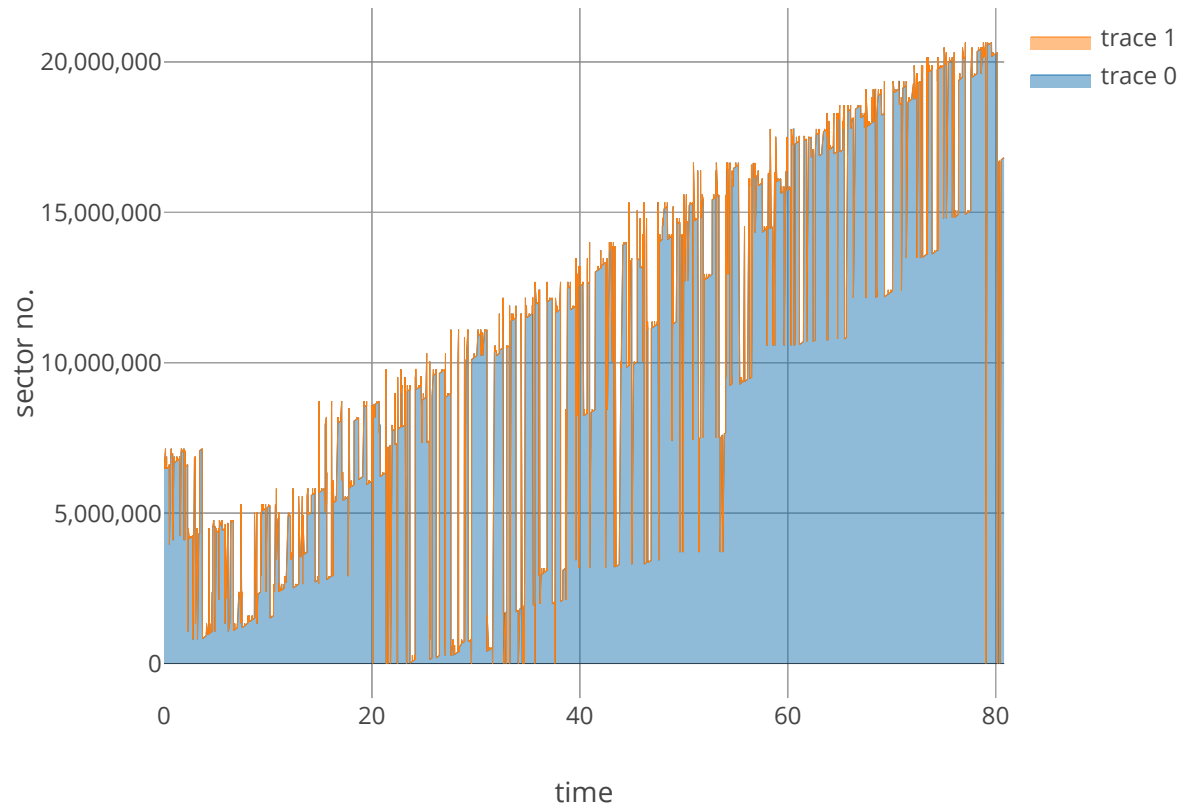


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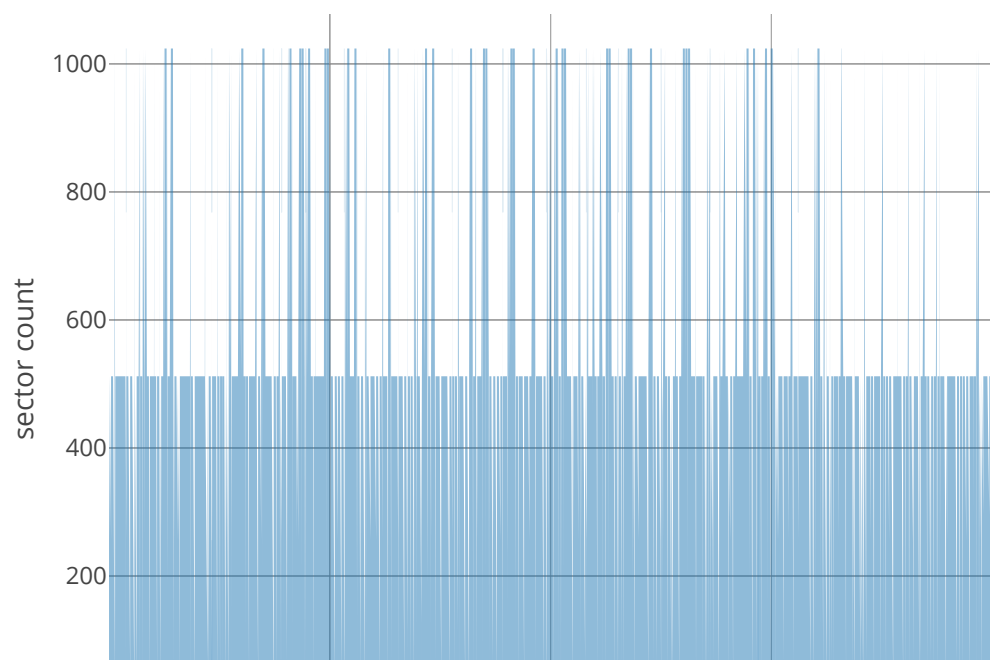
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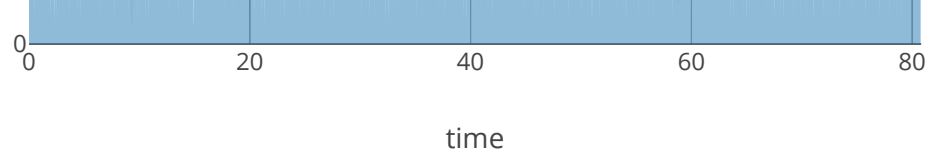
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sector request



sector count

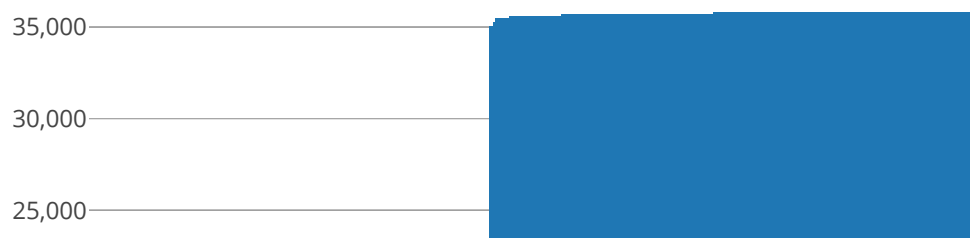


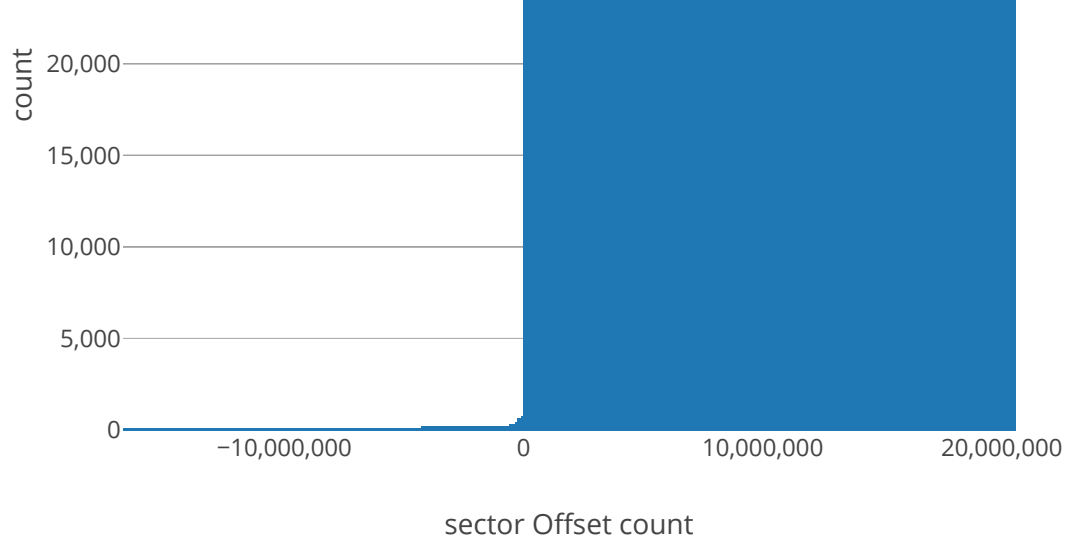


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-233952	43
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sector Offset Cumulative

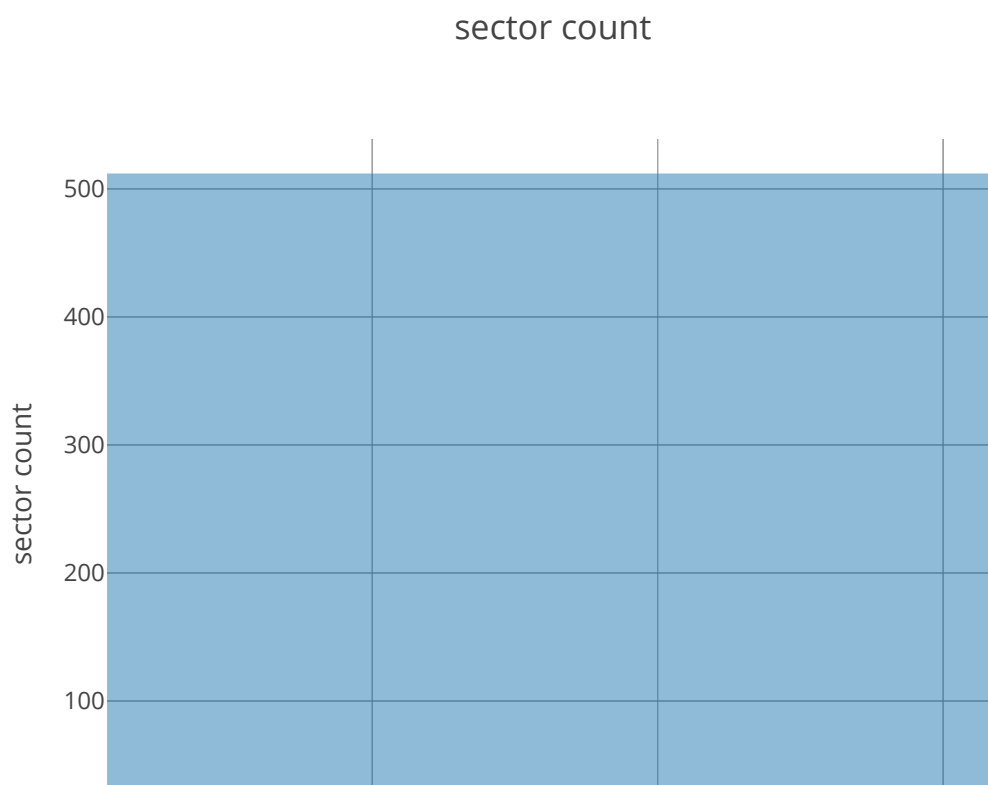
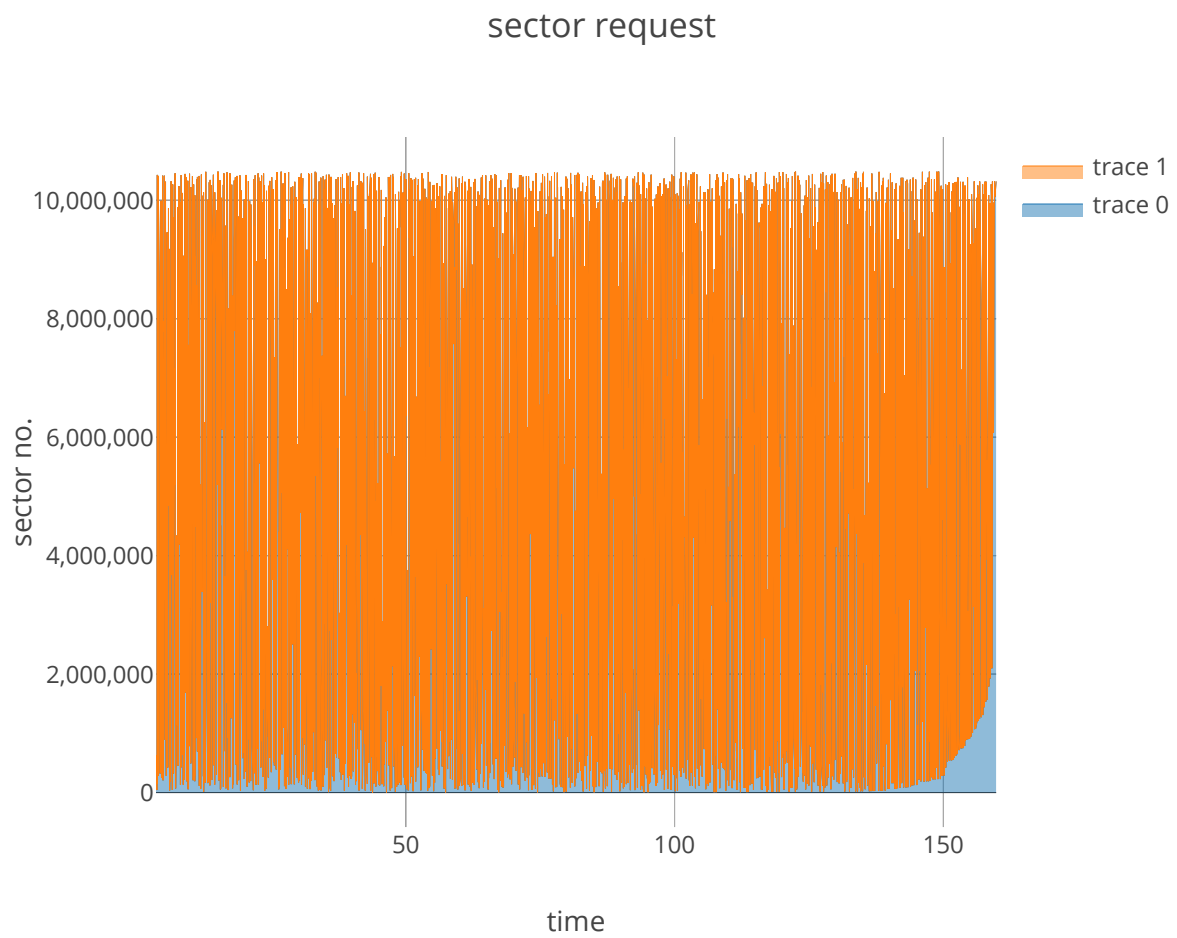




12 fio 256k random read

观察随机读的IO模型长什么样

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time

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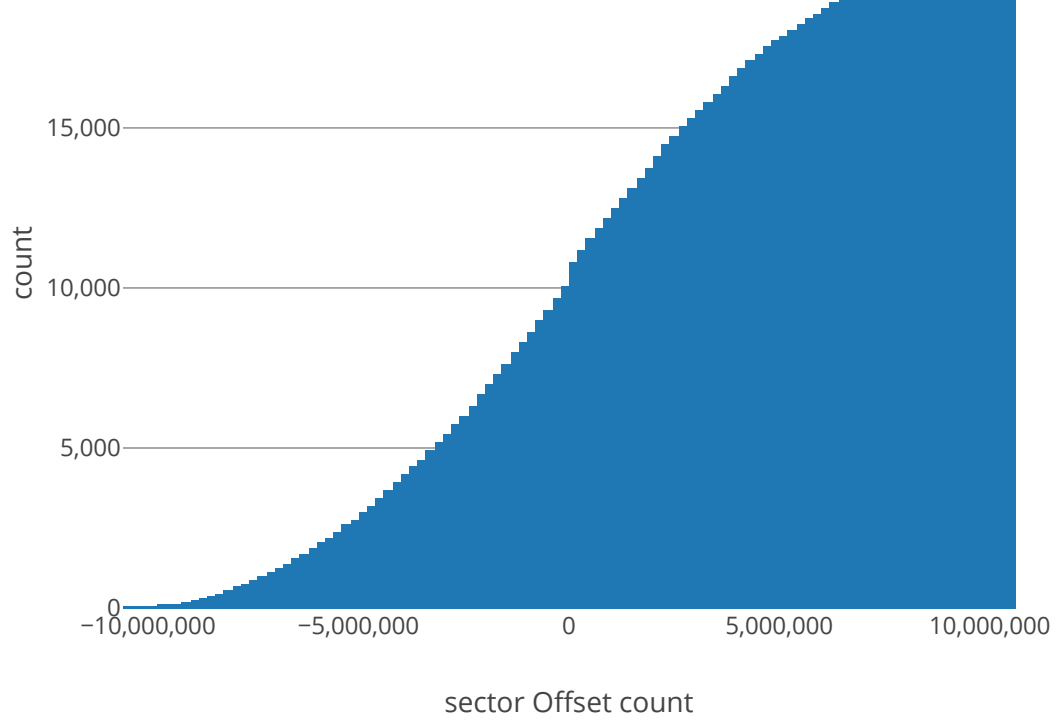
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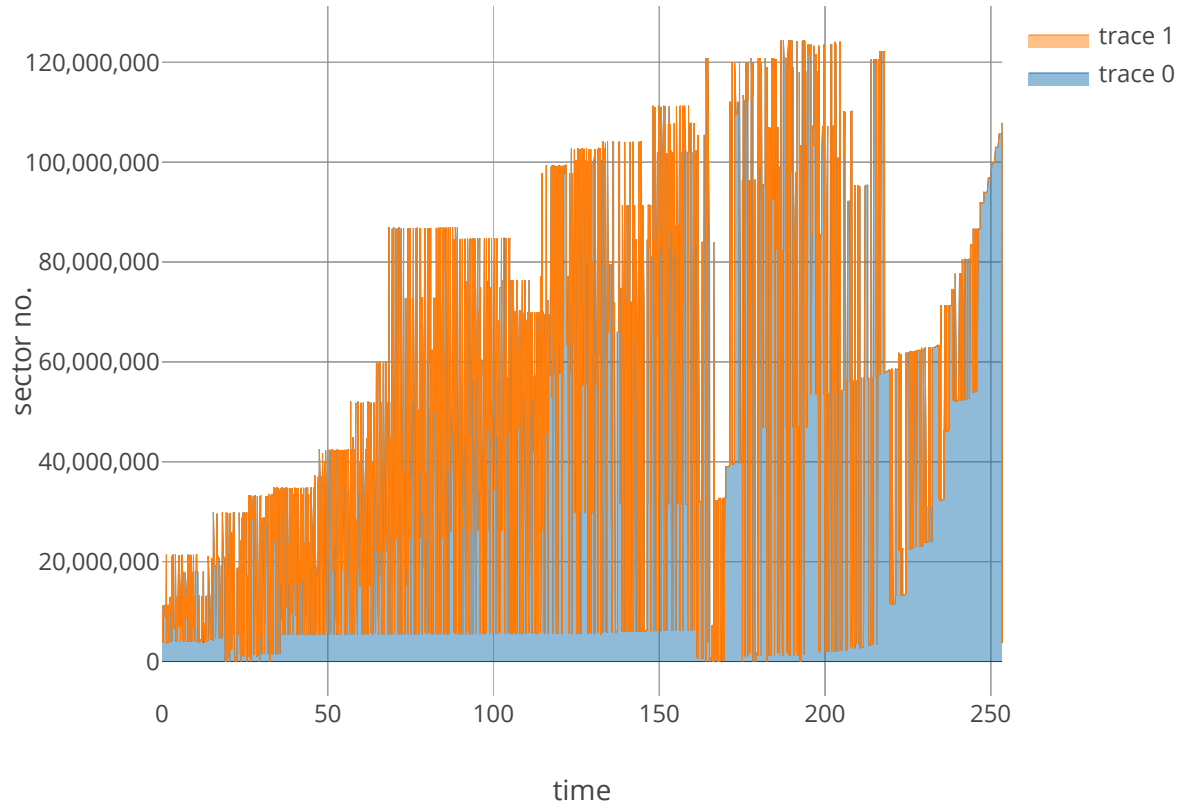


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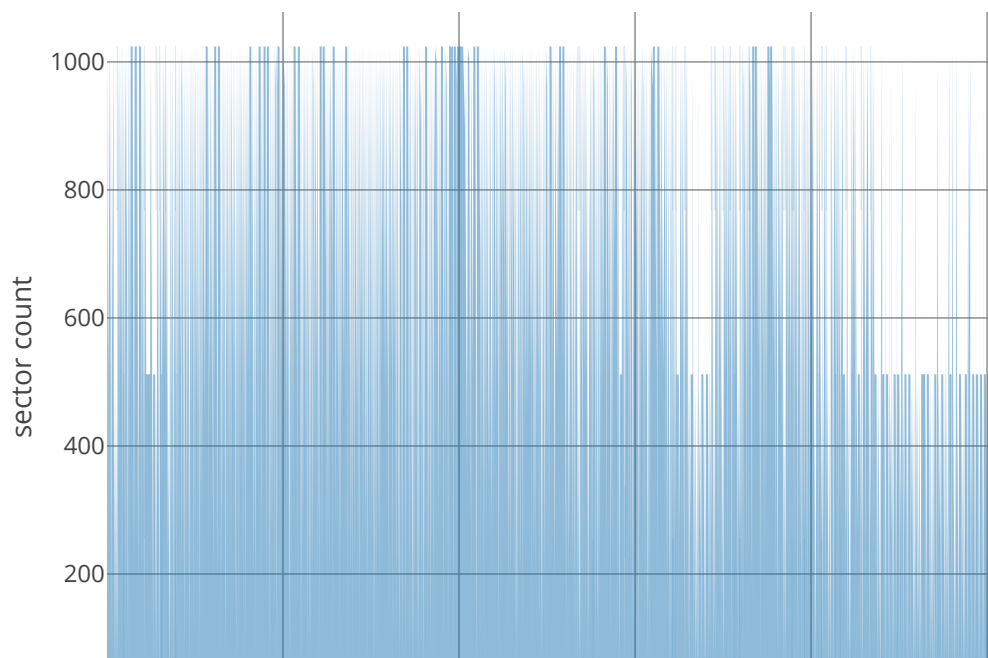
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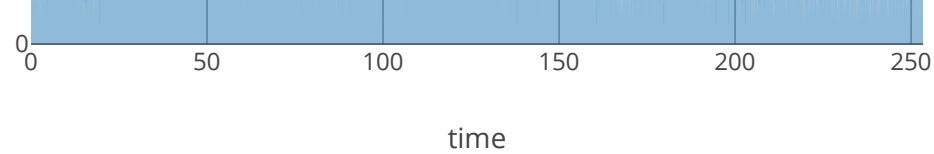
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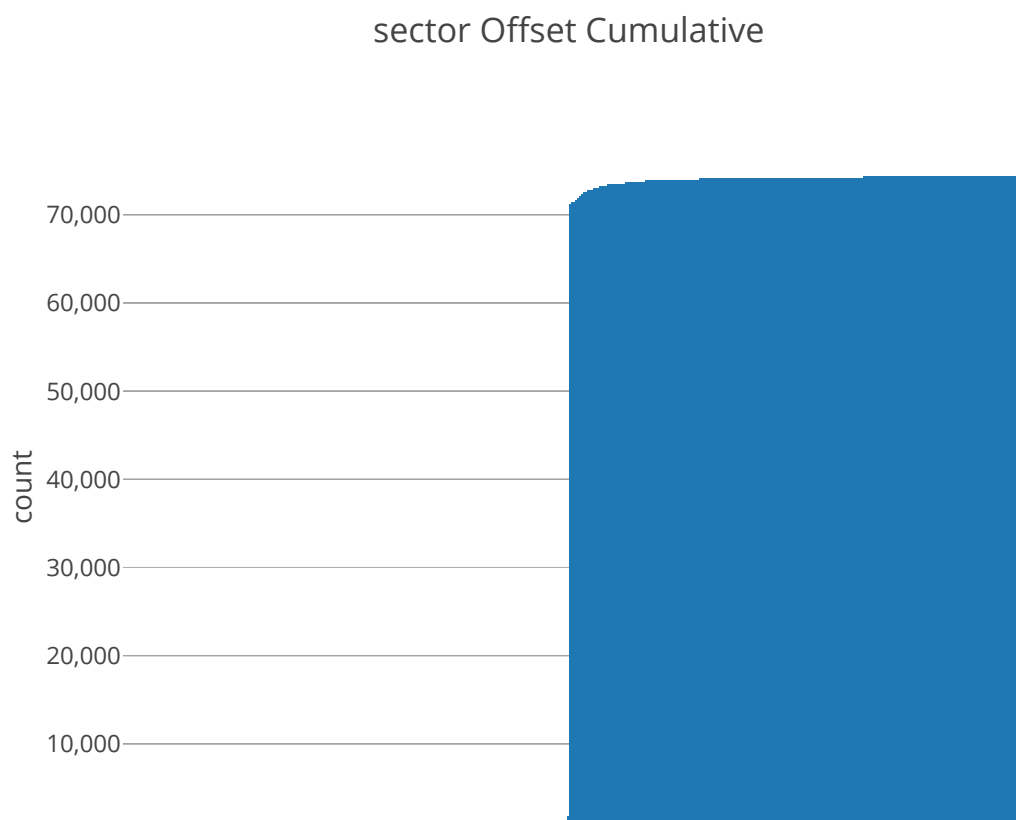
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