

Disk Benchmarking

Design Decisions:

Strong Scaling

- Strong scaling is performed by having the problem size in our case 10GB (text file) fixed and varying the number of threads(1, 2, 4 ,8) to process with varying block size of 8B, 8KB, 8MB and 80MB
- Parameter space involved in the benchmarking are
 - Sequential Read+write
 - Sequential Read
 - Random Read

Compiler Optimization

- We have utilized - O2 optimization

In order to avoid disk data to be cached and worked out of memory, 3.5 Gb of memory map is created in side the program before the execution of disk specific test.

IOzone bench mark is being used as the prebuilt disk bench mark for comparison

Performance Results

Results corresponding to different parameter space , threads and disk block is laid out in the form of data table and result comparison graph below. The description of each result is also mentioned with the graph.

8B Execution – Latency (milli sec)

	Sequential Read+Write	Sequential Read	Random Read
Threads - 1	0.000464	0.000206	0.000208
Threads - 2	0.000224	0.000093	0.000291
Threads - 4	0.000194	0.000092	0.000251
Threads - 8	0.000171	0.000087	0.000262

8KB Execution – Throughput (MB/sec)

	Sequential Read+Write	Sequential Read	Random Read
Threads - 1	56.888889	243.809524	262.563902
Threads - 2	56.888889	445.217391	319.999512
Threads - 4	120.470588	10240	10239.968750
Threads - 8	1024.000000	10240	5119.968750

8MB Execution – Throughput (MB/sec)

	Sequential Read+Write	Sequential Read	Random Read
Threads - 1	85.3	262.564103	393.538462
Threads - 2	213.3	365.714286	639
Threads - 4	262.5	10240	10208
Threads - 8	1280	10240	10176

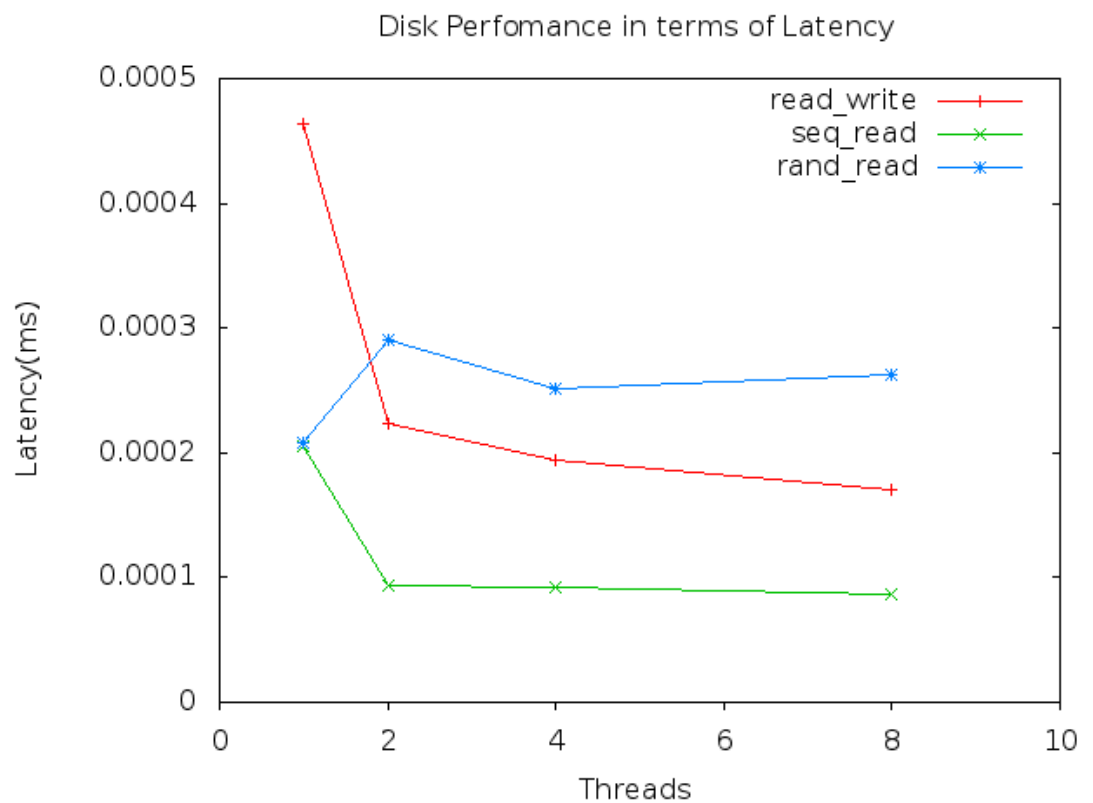
80MB Execution – Throughput (MB/sec)

	Sequential Read+Write	Sequential Read	Random Read
Threads - 1	48.301887	117.701149	282.2
Threads - 2	155.151515	330.322581	630
Threads - 4	512.000000	10240	4960
Threads - 8	930.9	10240	9600

Performance Graphs

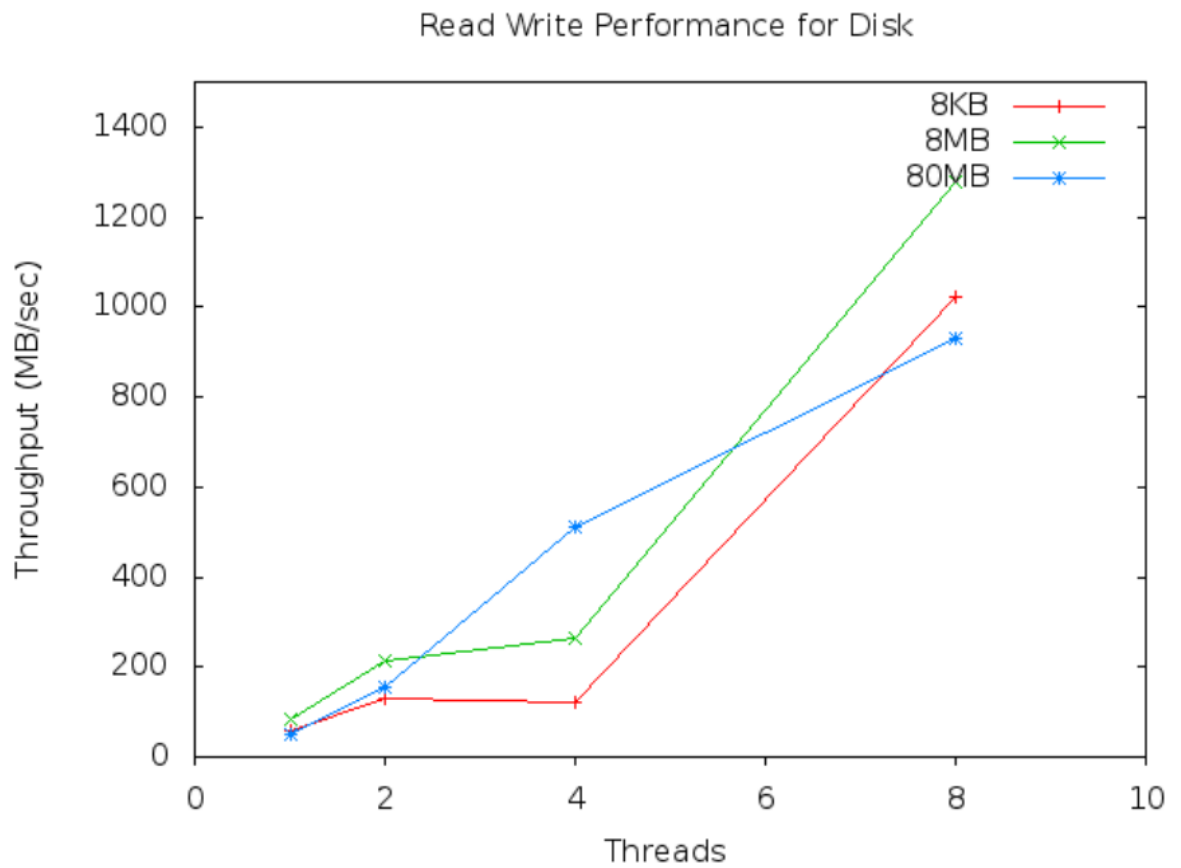
1. 8 Byte disk block usage for measuring latency

- Latency measured at a block size of 8B is observed to vary to a greater extent for all operations (read_write, seq_read, rand_read) as the number of thread increased from 1 to 2
- It is observed that read_write tends to drop with a great degree as concurrency increased from 1 to 2 number of threads
- It is observed in all the operations that varying the number of threads has little effect after a concurrency factor of 4



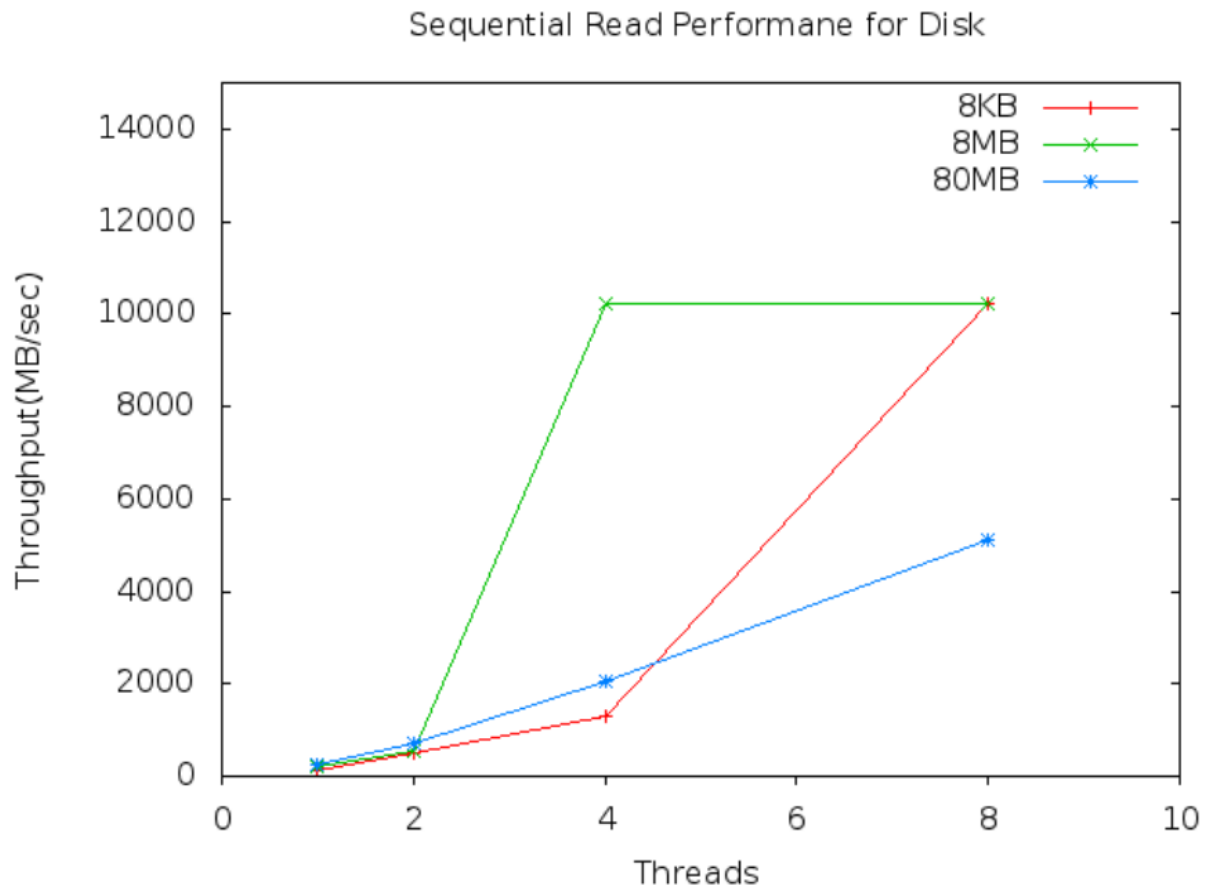
2. Throughput measured for read and write operations over varied number of block sizes and concurrency

- Amount of data processed greatly increases when a block size of 8MB is used with varying concurrency
- We can observe that the throughput for all of the disk block size tends to increase up to concurrency value of 4 after which the changes in throughput varies with change in block size



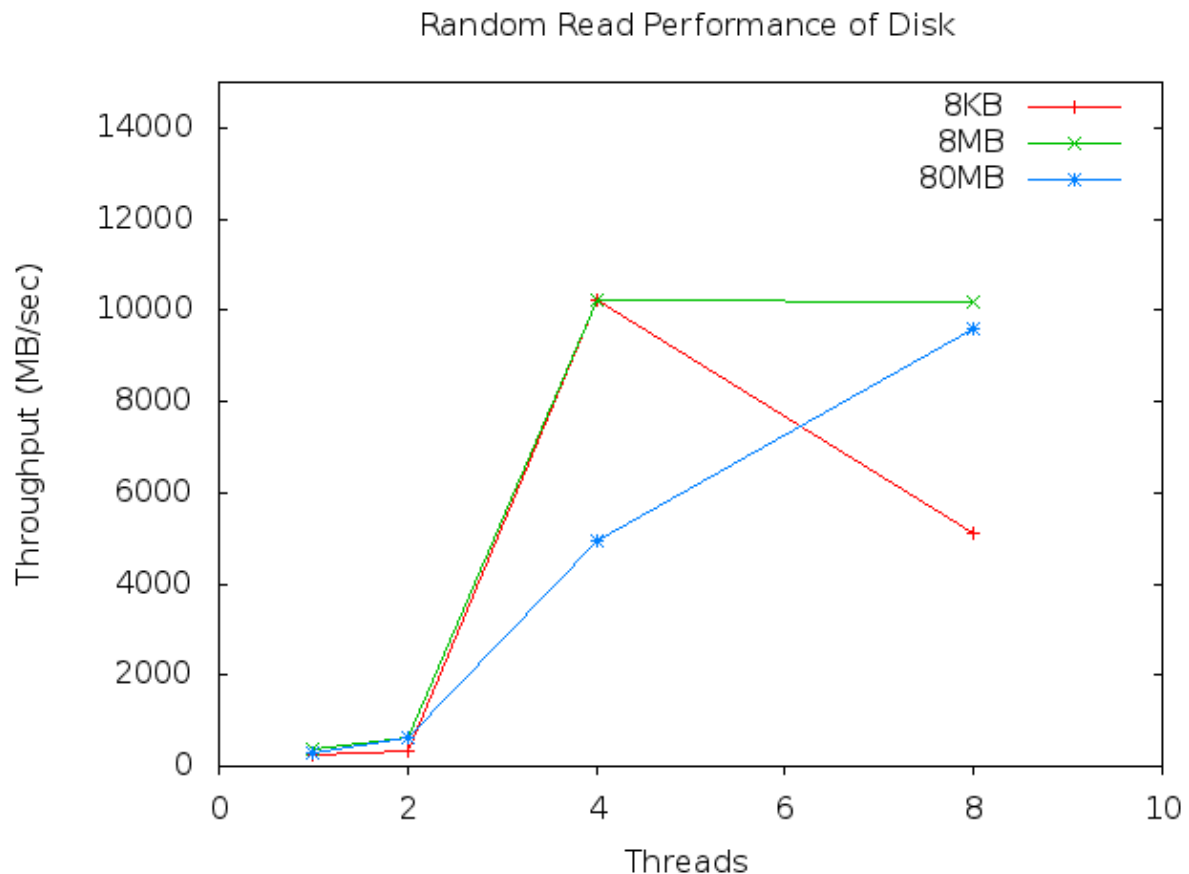
3. Throughput measured for sequential read operations over varied number of block sizes and concurrency

- In case of sequential read operation, it is observed varying concurrency is having a positive effect on throughput for all the disk block sizes
- Observed that the 8MB block tends to have grown rapidly after 2 threads



4. Throughput measured for random read operation with varying block sizes and concurrency

- Random read throughput tends to vary drastically with varying block sizes after concurrency increases more than 4
- It is observed for 8MB disk block random reads throughput peaks as concurrency increase



Result Analysis:

From the above graphs we can conclude that having 4 threads resulted in optimal performance over varied number of block sizes (8B, 8KB, 8MB, 80MB) and with varied disk operations (read+write, sequential read, random read) and it is observed. As it is seen, as concurrency increased the throughput increased indicating that the hardisk maybe a HDD

Iozone Disk Bechmark Report

Iozone benchmark execution is performed over sequential read, random read and sequential write with a maximum file size of 5242880 kilobytes 4 concurrent threads and record length of 8KB

Operation	IOZone(Mb/s)	Observation(Mb/s)	Efficiency
Sequential Read	76022.13	10240	13.46
Random Read	1368.88	10239.96	748
Sequential Write	38759.93	1024	2.64

Iozone: Performance Test of File I/O

Version \$Revision: 3.471 \$

Compiled for 64 bit mode.

Build: linux

Contributors:William Norcott, Don Capps, Isom Crawford, Kirby Collins

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Run began: Mon Oct 9 06:19:41 2017

File size set to 5242880 kB

Record Size 8 kB

Command line used: ./iozone -s5g -r8 -i 0 -i 1 -i2 -t 4 -b output.xls

Output is in kBytes/sec

Time Resolution = 0.000001 seconds.

Processor cache size set to 1024 kBytes.

Processor cache line size set to 32 bytes.

File stride size set to 17 * record size.

Throughput test with 4 processes

Each process writes a 5242880 kByte file in 8 kByte records

Children see throughput for 4 initial writers = 38759.93 kB/sec

Parent sees throughput for 4 initial writers = 37945.84 kB/sec

Min throughput per process	=	9482.71 kB/sec
Max throughput per process	=	9904.18 kB/sec
Avg throughput per process	=	9689.98 kB/sec
Min xfer	=	5020048.00 kB

Children see throughput for 4 rewriters	=	80576.62 kB/sec
Parent sees throughput for 4 rewriters	=	78302.85 kB/sec
Min throughput per process	=	19664.77 kB/sec
Max throughput per process	=	21042.63 kB/sec
Avg throughput per process	=	20144.15 kB/sec
Min xfer	=	4899400.00 kB

Children see throughput for 4 readers	=	76022.13 kB/sec
Parent sees throughput for 4 readers	=	75954.01 kB/sec
Min throughput per process	=	18824.54 kB/sec
Max throughput per process	=	19142.29 kB/sec
Avg throughput per process	=	19005.53 kB/sec
Min xfer	=	5156512.00 kB

Children see throughput for 4 re-readers	=	79150.52 kB/sec
Parent sees throughput for 4 re-readers	=	79137.70 kB/sec
Min throughput per process	=	19673.21 kB/sec
Max throughput per process	=	19926.19 kB/sec
Avg throughput per process	=	19787.63 kB/sec
Min xfer	=	5178000.00 kB

Children see throughput for 4 random readers	=	1368.88 kB/sec
Parent sees throughput for 4 random readers	=	1368.87 kB/sec
Min throughput per process	=	330.41 kB/sec
Max throughput per process	=	350.96 kB/sec

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7         Max throughput per process          = 6506.05 kB/sec
1         Avg throughput per process          = 342.22 kB/sec
2         Min xfer                            = 4935912.00 kB
3
4         Children see throughput for 4 random writers = 26024.20 kB/sec
5         Parent sees throughput for 4 random writers = 24633.18 kB/sec
6         Min throughput per process          = 6081.37 kB/sec
7         Max throughput per process          = 6752.66 kB/sec
8         Avg throughput per process          = 6506.05 kB/sec
9         Min xfer                            = 4722072.00 kB
10
11
12
13     "Throughput report Y-axis is type of test X-axis is number of processes"
14     "Record size = 8 kBytes "
15     "Output is in kBytes/sec"
16
17     " Initial write " 38759.93
18
19     " Rewrite " 80576.62
20
21     " Read " 76022.13
22
23     " Re-read " 79150.52
24
25     " Random read " 1368.88
26
27     " Random write " 26024.20
28
29
30     iozone test complete.

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