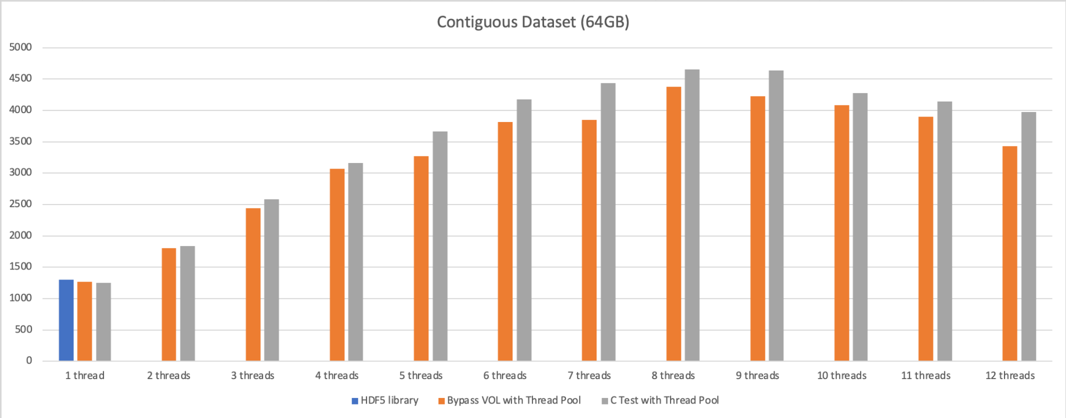
Single-threaded HDF5 application with Bypass VOL connector and internal thread pool

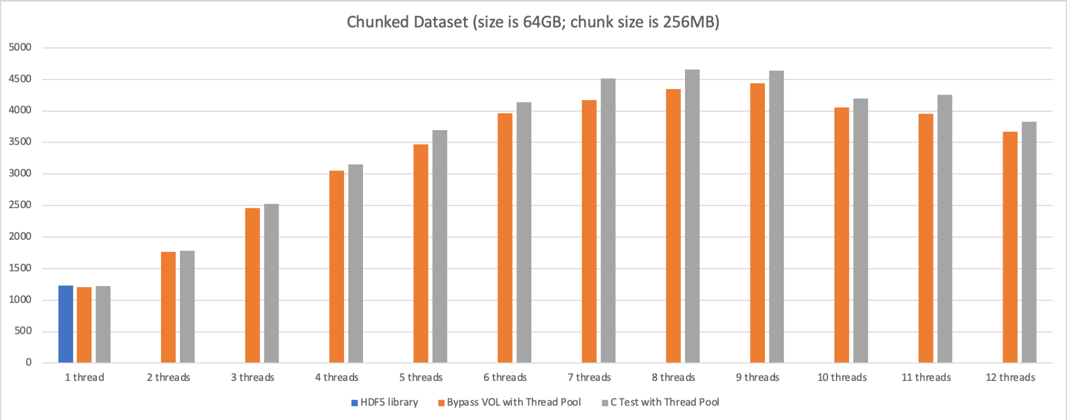
Reading 64GB contiguous and chunked dataset by 4MB hyperslabs.

1) Blue bar is a single-threaded HDF5 program.
2) Orange bar is the same HDF5 program; it uses Bypass VOL connector with the thread pool.
3) Grey bar is a C program that mimics the I/O pattern of the Bypass VOL connector. The pattern is stored in the text file as offset and length pairs. The C program also uses the thread pool.

2) and 3) use the thread pool of 1 to 12 threads (horizontal axis). Vertical axis is reading speed in MB/sec.



Dataset Size = 64GB on Linux												
	1 thread	2 threads	3 threads	4 threads	5 threads	6 threads	7 threads	8 threads	9 threads	10 threads	11 threads	12 threads
HDF5 library	1303											
Bypass VOL w	1268	1807	2442	3074	3276	3813	3852	4382	4226	4087	3902	3434
C Test with Th	1251	1838	2587	3160	3666	4178	4439	4652	4640	4281	4143	3980



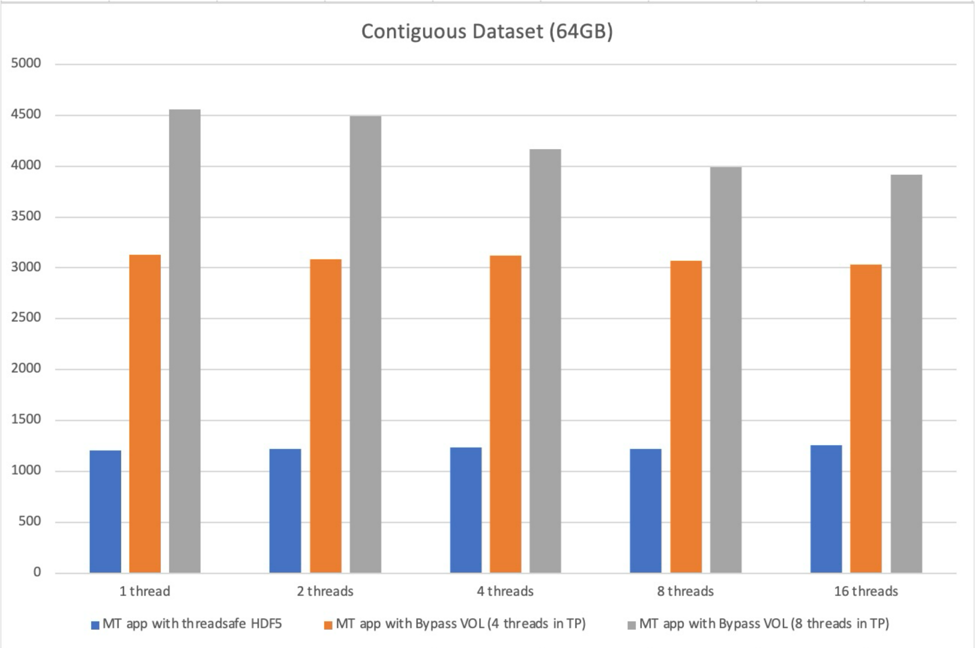
Dataset Size = 64GB on Linux												
	1 thread	2 threads	3 threads	4 threads	5 threads	6 threads	7 threads	8 threads	9 threads	10 threads	11 threads	12 threads
HDF5 library	1227											
Bypass VOL w	1206	1769	2457	3055	3472	3959	4173	4349	4442	4058	3955	3674
C Test with Th	1225	1784	2530	3151	3692	4141	4518	4653	4643	4195	4258	3833

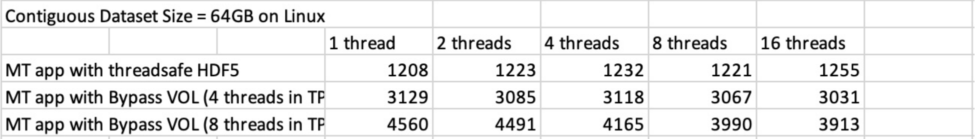
Multi-threaded HDF5 application with Bypass VOL connector and internal thread pool

Reading 64GB contiguous and chunked dataset by 4MB hyperslabs

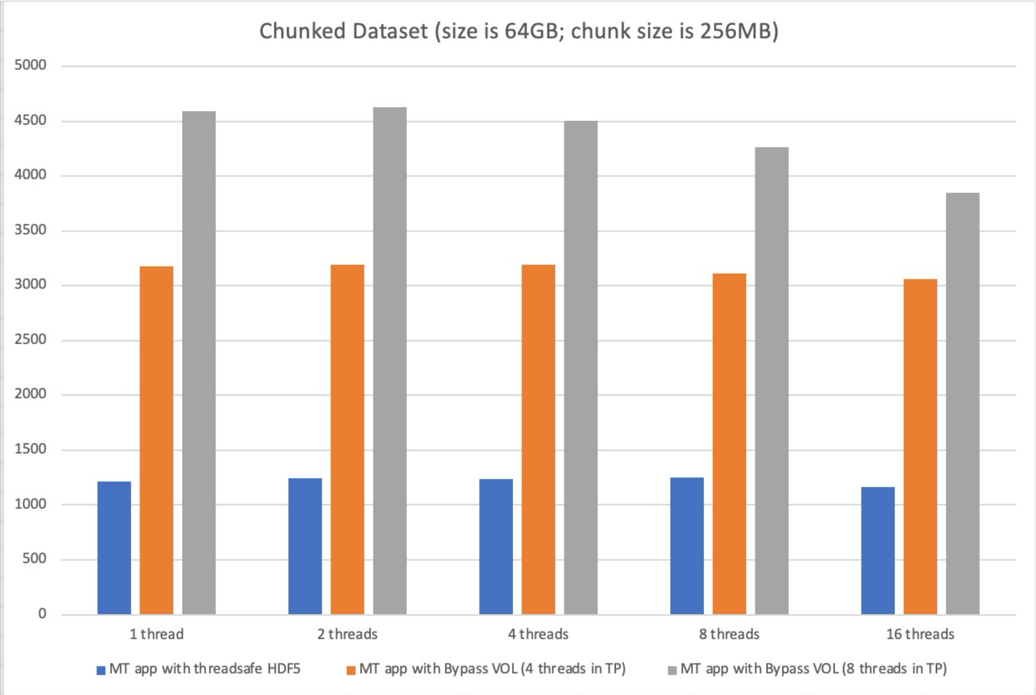
1) Blue bar is a multi-threaded HDF5 application with thread-safe HDF5.
2) Orange bar is the same HDF5 program with Bypass VOL connector; 4 threads are in the thread pool (TP).
3) Grey bar is the same HDF5 program with Bypass VOL connector; 8 threads are in the thread pool (TP).

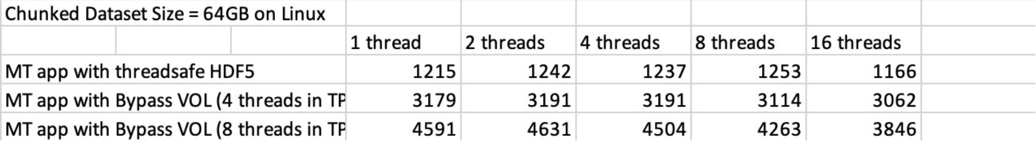
Horizontal axis is number of threads used by the HDF5 app. Vertical axis is reading speed in MB/sec.





Contiguous Dataset Size = 64GB on Linux					
	1 thread	2 threads	4 threads	8 threads	16 threads
MT app with threadsafe HDF5	1208	1223	1232	1221	1255
MT app with Bypass VOL (4 threads in TP	3129	3085	3118	3067	3031
MT app with Bypass VOL (8 threads in TP	4560	4491	4165	3990	3913





Chunked Dataset Size = 64GB on Linux					
	1 thread	2 threads	4 threads	8 threads	16 threads
MT app with threadsafe HDF5	1215	1242	1237	1253	1166
MT app with Bypass VOL (4 threads in TP	3179	3191	3191	3114	3062
MT app with Bypass VOL (8 threads in TP	4591	4631	4504	4263	3846

Summary

In both cases (single-threaded HDF5 application with the thread pool and multi-threaded HDF5 application with the thread pool) we see nice performance improvement (~ 3x to 4.5x speedup). We need to investigate performance drop in both cases when the number of total threads increases. We are currently working on a benchmark that doesn’t use thread pool.