Performance Analysis RockDB 분석

컴퓨터소프트웨어학부 김현정 박정호

CONTENTS

 Perf

 사용한 옵션, 시행착오, 분석 결과

 To Do

 해결해야 할 문제, 질문

Perf

시행착오 사용한 옵션 분석 결과

시행착오 – 실험 방식

- 1. 100초, 300초, 600초 실행 후 전체 실행에 대한 performance sampling
 - 너무 실험시간이 길어서 세 실험 모두 5개의 level을 다 사용하고 있었고, 따라서 각 실행의 결과가 거의 같 았다. (이전의 latency 측정 실험 기준으로 대략 30초 이내로 모든 레벨을 사용하게 되었다.)
- 2. 25, 50, 75, 100초 실행 후 전체 실행에 대한 performance sampling
 - 전체 실행에 대해서 샘플링한 것으로 인해 유의미한 performance pattern 이 가려졌고, 이로 인해 각 함수의 CPU Cycle 비율의 차이가 거의 없었다.
- 3. 100초 실행 중, 초반 10초, 후반 10초의 performance sampling
 - 특정 구간의 performance pattern 을 볼 수 있으리라 기대했으나, 구간의 길이가 너무 길어서 이 역시 두 결과 간의 CPU Cycle 비율 차이가 거의 없었다.

사용한 옵션

- 1. 초반 측정 sudo perf record -g sleep 2 sudo perf record -g sleep 10
- 2. 후반 90~100초 측정 sudo perf record -g -d 90000 sleep 10
- 3. 특정 symbol filter sudo perf report -symbol-filter=[symbol_name]

이후 실험 결과는 총 100초 실행 중 초반 2초, 후반 2초 간의 performance pattern 을 측정한 기록이다.

0초~2초 --no-children

```
9.19% read bottleneck libc-2.27.so
                                                            random r
       read bottleneck libc-2.27.so
                                                           random
4.77% read bottleneck read bottleneck breakdown test
                                                          main
4.21% rocksdb:low0
                                                          copy user enhanced fast string
                        [kernel.kallsyms]
1.93% rocksdb:low0
                        libc-2.27.so
                                                            memmove avx unaligned erms
1.81% read bottleneck libc-2.27.so
 1.70% rocksdb:low0
                       libc-2.27.so
                                                            memset avx2 erms
1.69% read bottleneck [kernel.kallsyms]
                                                          copy user enhanced fast string
1.45% read bottleneck read bottleneck breakdown test
1.36% rocksdb:low0
                       libsnappy.so.1.1.7
                                                          snappy::internal::CompressFragment
                                                          rocksdb::crc32c::crc32c 3way
1.16% rocksdb:low0
                       read bottleneck breakdown test
1.09% read bottleneck libc-2.27.so
                                                          cfree@GLIBC 2.2.5
1.08% rocksdb:low0
                       libc-2.27.so
                                                          cfree@GLIBC 2.2.5
                                                          do syscall 64
0.85% read bottleneck [kernel.kallsyms]
                                                           memmove avx unaligned erms
0.84% read bottleneck libc-2.27.so
0.81% read bottleneck [vdso]
                                                            vdso clock gettime
0.76% read bottleneck read bottleneck breakdown test
                                                          rocksdb::IndexBlockIter::SeekImpl
0.72% rocksdb:low0
                       [kernel.kallsvms]
                                                       [k] do svscall 64
0.72% rocksdb:low0
                       read bottleneck breakdown test
                                                          rocksdb::CompactionIterator::NextFromInput
0.66% read bottleneck read bottleneck breakdown test
                                                          rocksdb::MemTable::KeyComparator::operator()
0.61% read bottleneck libc-2.27.so
                                                          malloc
0.61% read bottleneck read bottleneck breakdown test
                                                          rocksdb::crc32c::crc32c 3way
0.60% rocksdb:low0
                        libc-2.27.so
0.53% read bottleneck read bottleneck breakdown test
                                                          rocksdb::(anonymous namespace)::BytewiseComparatorImpl::Compare
0.51% read bottleneck libc-2.27.so
                                                            memcmp avx2 movbe
0.48% rocksdb:low0
                       read bottleneck breakdown test
                                                          rocksdb::MergingIterator::Next
                                                          rocksdb::MemTable::KeyComparator::operator()
0.47% read bottleneck read bottleneck breakdown test
0.43% rocksdb:low0
                       [kernel.kallsyms]
                                                            block commit write.isra.34
0.43% rocksdb:low0
                                                           int malloc
                       libc-2.27.so
0.42% rocksdb:low0
                                                          radix tree next chunk
                       [kernel.kallsvms]
0.42% read bottleneck read bottleneck breakdown test
                                                          rocksdb::BlockIter<rocksdb::IndexValue>::CompareCurrentKey
0.40% read bottleneck libc-2.27.so
                                                           int malloc
0.39% read bottleneck [kernel.kallsyms]
                                                           radix tree lookup
                                                          std:: cxx11::basic string<char, std::char traits<char>, std::allocator<char>
0.38% rocksdb:low0
                        libstdc++.so.6.0.25
0.38% read bottleneck [kernel.kallsyms]
                                                          find get entry
0.36% rocksdb:low0
                       read bottleneck breakdown test
                                                          rocksdb::BlockBasedTableIterator::status
0.35% read bottleneck [kernel.kallsyms]
                                                           entry trampoline start
0.34% rocksdb:low0
                       read bottleneck breakdown test
                                                          rocksdb::LRUHandleTable::FindPointer
```

0초~2초_1 --children

Children	Self	Command	Shared Object	Svii	ıbol
26.13%	4.77%		read bottleneck breakdown test	[.]	main
18.31%	0.00%	rocksdb:low0	read bottleneck breakdown test	1.1	rocksdb::DBImpl::BackgroundCallCompaction
17.72%	0.00%	rocksdb:low0	libstdc++.so.6.0.25	i.i	: · ·
17.72%	0.00%	rocksdb:low0	read bottleneck breakdown test	j.j	rocksdb::ThreadPoolImpl::Impl::BGThreadWrapper
17.72%	0.00%	rocksdb:low0	read bottleneck breakdown test	$[\cdot]$	rocksdb::DBImpl::BGWorkCompaction
17.72%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	rocksdb::ThreadPoolImpl::Impl::BGThread
16.81%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	rocksdb::DBImpl::BackgroundCompaction
16.78% 16.60%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	
16.60%	0.29%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	rocksdb::CompactionJob::ProcessKeyValueCompaction
15.07%		rocksdb:low0	[kernel.kallsyms]	[k]	
14.99%		rocksdb:low0	[kernel.kallsyms]	[k]	
11.93%	0.00%	read_bottleneck	[unknown]	[.]	
11.82%	0.02%	read_bottleneck		[.]	
11.80%	0.03%	read_bottleneck		[.]	,
11.77%	0.02%	read_bottleneck	read_bottleneck_breakdown_test	[.]	rocksdb::TransactionBaseImpl::Get
11.74%	0.01%	read_bottleneck	read_bottleneck_breakdown_test	[.]	
11.72%	0.04%	read_bottleneck	read_bottleneck_breakdown_test	[.]	
11.55%	0.01%		read_bottleneck_breakdown_test	[.]	rocksdb::DBImpl::Get
11.55%	0.00%	read_bottleneck	read_bottleneck_breakdown_test	[.]	
11.47%	0.09%	read_bottleneck	read_bottleneck_breakdown_test	[.]	rocksdb::DBImpl::GetImpl
9.83%		read_bottleneck	read_bottleneck_breakdown_test	[.]	
9.54% 9.46%		read_bottleneck	[unknown]	[.]	
9.46%		read_bottleneck		[.]	
9.21%		read_bottleneck		[.]	
9.13%	0.09%		read_bottleneck_breakdown_test	[.]	rocksdb::CompactionIterator::Next
9.00%	0.20%	read_bottleneck	read_bottleneck_breakdown_test	[.]	
8.64%	0.33%	read_bottleneck	read_bottleneck_breakdown_test	$[\cdot]$	rocksdb::BlockBasedTable::Get
8.32% 8.20%	0.10%	read_bottleneck	[kernel.kallsyms]	[k]	
8.20%		read_bottleneck	[kernel.kallsyms]	[k]	/ -
7.89%	7.78%	read_bottleneck	libc-2.27.so	[.]	
7.77%	0.00%	rocksdb:low0	libpthread-2.27.so	[.]	
7.77%	0.00%	rocksdb:low0	[kernel.kallsyms]	[k]	· -
7.76%	0.00%	rocksdb:low0	[kernel.kallsyms]	[k]	
7.76%	0.00%	rocksdb:low0	[kernel.kallsyms]	[k]	·
7.76% 7.76%	0.00%	rocksdb:low0	[kernel.kallsyms]	[k]	
7.76%		rocksdb:low0	[kernel.kallsyms]	[k]	
7.76%		rocksdb:low0	[kernel.kallsyms]	[k]	
7.68%	0.05%	rocksdb:low0	[kernel.kallsyms]	[k]	generic_perform_write

0초~2초_2 --children

```
[kernel.kallsyms]
          0.05% rocksdb:low0
                                                                  [k] generic perform write
                                                                    rocksdb::MergingIterator::Next
          0.48% rocksdb:low0
                                 read bottleneck breakdown test
          0.07% read bottleneck read bottleneck breakdown test
                                                                     rocksdb::PessimisticTransaction::Commit
                                 read bottleneck breakdown test
          0.20% rocksdb:low0
                                                                     rocksdb::BlockBasedTableIterator::NextAndGetResult
          0.04% read bottleneck read bottleneck breakdown test
                                                                     rocksdb::WriteCommittedTxn::CommitWithoutPrepareInternal
          0.10% rocksdb:low0
                                 read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTableIterator::Next
          0.26% read bottleneck read bottleneck breakdown test
                                                                     rocksdb::DBImpl::WriteImpl
         0.16% rocksdb:low0
                                 read bottleneck breakdown test
                                                                    rocksdb::(anonymous namespace)::LevelIterator::NextAndGetResult
                                 read bottleneck breakdown test [.] rocksdb::BlockBasedTableIterator::FindBlockForward
5.55%
         0.13% rocksdb:low0
         0.08% rocksdb:low0
                                 libpthread-2.27.so
                                                                      libc pread64
         0.13% read bottleneck read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTable::NewDataBlockIterator<rocksdb::DataBlockIter>
4.98%
         0.04% rocksdb:low0
                                 read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTableIterator::InitDataBlock
          0.04% read bottleneck read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTable::RetrieveBlock<rocksdb::Block>
4.69%
         0.25% rocksdb:low0
                                 read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTableBuilder::Add
4.63%
                                 read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTable::NewDataBlockIterator<rocksdb::DataBlockIter>
4.62%
         0.15% rocksdb:low0
                                                                     rocksdb::BlockBasedTable::MaybeReadBlockAndLoadToCache<rocksdb::Block>
4.60%
         0.16% read bottleneck read bottleneck breakdown test
         0.06% read bottleneck libpthread-2.27.so
                                                                      libc pread64
4.53%
         0.05% read bottleneck libpthread-2.27.so
                                                                      libc write
          4.21% rocksdb:low0
                                                                     copy user enhanced fast string
                                 [kernel.kallsyms]
         0.10% rocksdb:low0
                                 read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTable::RetrieveBlock<rocksdb::Block>
                                                                    sys write
         0.05% read bottleneck
                                 [kernel.kallsyms]
         0.04% rocksdb:low0
                                                                     sys pread64
                                  [kernel.kallsyms]
 3.57%
         0.04% read bottleneck
                                  [kernel.kallsyms]
                                                                    sys pread64
 .48%
         0.05% read bottleneck
                                  [kernel.kallsyms
                                                                     vfs write
         0.04% rocksdb:low0
                                  [kernel.kallsyms]
                                                                    vfs read
         0.04% read bottleneck
                                  [kernel.kallsyms]
                                                                  [k] vfs read
 .30%
                                                                      vfs write
         0.00% read bottleneck
                                  [kernel.kallsvms]
                                  [kernel.kallsyms
         0.03% read bottleneck
                                                                     new sync write
         0.04% read bottleneck
                                  [kernel.kallsyms]
                                                                    ext4 file write iter
         0.00% rocksdb:low0
                                  [kernel.kallsyms]
                                                                      vfs read
          0.03% rocksdb:low0
                                  [kernel.kallsyms]
                                                                     new sync read
          0.02% read bottleneck
                                  [kernel.kallsyms
                                                                      generic file write iter
```

90초~100초 --no-children

		,		_	
4.88% read bottleneck read bot					
4.80% read bottleneck chreakdown_test [.] main				- : :	
4.9% rocksdb:lowb libc-2.27.so [k] copy_user_enhanced_fast_string nemmore_avx_unaligned_erms [k] copy_user_enhanced_fast_string nemmore_avx_unaligned_erms [k] copy_user_enhanced_fast_string nemset_avx2_erms [k] copy_user_enhanced_fast_string [k]					
1.92% rocksdb:low0 libc-2.27.so [,] memmove_avx_unaligned_emms [,] rand bottleneck libc-2.27.so [,] rand libc-2.27.so libc-2.27.so [,] rand libc-2.27.so libc-2.27.so [,] rand libc-2.27.so					
1.62% read bottleneck libc-2.27.so 1.68% read bottleneck kernel.kallsyms read bottleneck libsappy.so.1.1.7 1.77% rocksdb:low0 libc-2.27.so 1.69% read bottleneck libc-2.27.so 1.69% read bottleneck libc-2.27.so 1.69% read bottleneck libc-2.27.so 1.69% read bottleneck libc-2.27.so 1.75% read bottleneck				ĺκΊ	
1.68% rocksdb:low0 libc-2.27.50 [,] memset avx2 erms k copy user_enhanced fast_string [, rand@plt .] rand@plt .				أ٠j	
1.06% read_bottleneck kernel.kallsyms k copy_user_enhanced_fast_string		_			
1.47% read bottleneck breakdown test [.] rand@plt [.] snappy:internal::CompressFragment [.] rand@plt [.] snappy:internal::CompressFragment [.] rocksdb:low0 libsnappy.so.1.1.7 rocksdb::crc32c:::crc32c_3way [.] cfree@cLIBC 2.2.5 [.] rocksdb::indexBlockIter::SeekImpl [.] rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::CompactionIterator::NextFromInput [.] rocksdb::CompactionIterator::NextFromInput [.] rocksdb::CompactionIterator::NextFromInput [.] rocksdb::CompactionIterator::NextFromInput [.] rocksdb::crc32c::crc32c::crc32c::crc32c::way [.] rocksdb::crc32c::crc32c::way [.] rocksdb::crc32c::crc32c::crc32c::way [.] rocksdb::crc32c::crc					
1.31% rocksdb:low0 libsnappy.so.1.1.7 [.] snappy::internal::CompressFragment 1.17% rocksdb:low0 libc-2.27.so 1.97% read bottleneck 0.88% read bottleneck 0.75% read bottleneck 0					
1.17% rocksdb:low0 read_bottleneck breakdown_test [.] rocksdb::crc32c::crc32c_3way 1.04% rocksdb:low0 libc-2.27.so [.] cfree@GLIBC_2.2.5 0.80% read_bottleneck 0.78% read_bottleneck 0.79% rocksdb:low0 0.68% rocksdb:low0 0.68% rocksdb:low0 0.68% rocksdb:low0 0.68% read_bottleneck 0.79% read_bottleneck					CI
1.04% rocksdb:low0 libc_2.27.so [.] cfree@GLIBC_2.2.5 0.97% read bottleneck libc_2.27.so [.] cfree@GLIBC_2.2.5 0.80% read bottleneck libc_2.27.so [.] cfree@GLIBC_2.2.5 0.78% read bottleneck libc_2.27.so [.] cfree@GLIBC_2.2.5 0.78% read bottleneck libc_2.27.so [.] memmove axy unaligned erms 0.75% read bottleneck libc_2.27.so [.] memmove axy unaligned erms 0.76% rocksdb:low0 libc_2.27.so [.] memmove axy unaligned erms 0.68% rocksdb:low0 libc_2.27.so [.] rocksdb::IndexBlockIter::SeekImpl 0.68% rocksdb:low0 libc_2.27.so [.] rocksdb::IndexBlockIter::NextFromInput 0.68% read bottleneck libc_2.27.so [.] rocksdb::MemTable::KeyComparator::operator() 0.55% read bottleneck libc_2.27.so [.] malloc 0.55% read bottleneck libc_2.27.so [.] malloc 0.55% read bottleneck libc_2.27.so [.] malloc 0.56% read bottleneck libc_2.27.so [.] malloc 0.56% read bottleneck libc_2.27.so [.] malloc 0.48% rocksdb:low0 libc_2.27.so [.] memmove axy2 movbe 0.48% rocksdb:low0 read bottleneck breakdown test [.] rocksdb::Memmable::KeyComparator::operator() 0.48% rocksdb:low0 read bottleneck breakdown test [.] rocksdb::BlockBasedTableIterator::status [.] rocksdb::BlockBuilder::Add rocksdb::CompareCurrentKey read bottleneck read bottleneck read bottleneck read bottl				ŀ٠İ	
1.				ŀ٠İ	
0.80% read_bottleneck (kernel.kallsyms] (k) do_syscall_64 (.]vdso_clock_gettime (.]wdso_clock_gettime (.] _				أ٠أ	
0.78% read bottleneck vdso		_		[:]	
0.75% read_bottleneck libc-2.27.so [.]memmove_avx_unaligned_erms [.] rocksdb::IndexBlockIter::SeekImpl read_bottleneck breakdown_test [.] rocksdb::IndexBlockIter::SeekImpl do_syscall_64 coksdb::low0 rocksdb::low0 libc-2.77.so [.] malloc read_bottleneck breakdown_test [.] rocksdb::CompactionIterator::NextFromInput malloc rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::CompactionIterator::NextFromInput malloc rocksdb::CompactionIterator::NextFromInput malloc rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::CompactionIterator::NextFromInput malloc rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::CompactionIterator::NextFromInput malloc rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::CompactionIterator::NextFromInput malloc rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::CompactionIterator::NextFromInput malloc rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::CompactionIterator::NextFromInput malloc rocksdb::IndexBlockIter::SeekImpl [.] rocksdb::IndexBlockIter::SeekIm				F	
0.75% read_bottleneck read_b					
0.74% rocksdb:low0 [kernel.kallsyms] [k] do_syscall_64 rocksdb:low0 rocksdb:low0 libc-2.27.so libc-2.27.so libc-2.27.so read_bottleneck_breakdown_test rocksdb::MemTable::KeyComparator::operator() rocksdb::MemTable::KeyComparator::operator() rocksdb::demTable::KeyComparator::operator() rocksdb::demTable::KeyComparator::operator() rocksdb::demTable::KeyComparator::operator() rocksdb::demTable::KeyComparator::operator() rocksdb::demTable::KeyComparator::operator() rocksdb::demTable::KeyComparator::operator() rocksdb::demTable::KeyComparator::operator() rocksdb::demTable::KeyComparator::Next rocksdb::demTable::KeyComparator::Mext rocksdb::demT				- : :	
cocksdb:low0 read_bottleneck_breakdown_test cocksdb:low0 libc-2.27.so cocksdb:low0 read_bottleneck read_bottleneck read_bottleneck read_bottleneck read_bottleneck read_bottleneck read_bottleneck read_bottleneck libc-2.27.so cocksdb:					
cocksdb:low0 libc-2.27.so [.] malloc libc-2.27.so libstd++.so.6.0.25 libstd++.so.6.0.25 libstd++.so.6.0.25 lstd::csyComparator::operator() std::ckapt-raits 0.46% rocksdb:low0 libstd++.so.6.0.25 lstd::cxy11::basic_string <char, br="" std::char_traits<=""> 0.43% rocksdb:low0 libc-2.27.so libc-2.27.</char,>				ĺκΊ	
read_bottleneck read_bottleneck_breakdown_test read_bottleneck				أ٠أ	
read_bottleneck read_bottlen				أ٠أ	
1.55% read_bottleneck 1.5 2.27.so [.] malloc 1.55% rocksdb:low0 read_bottleneck 1.5 rocksdb::MergingIterator::Next 1.	0.64%	read_pottleneck	read_bottleneck_breakdown_test	أ٠أ	
<pre>0.55% rocksdb:low0 read_bottleneck breakdown_test 0.54% read_bottleneck read_bottleneck breakdown_test 0.56% read_bottleneck read_bottleneck breakdown_test 0.56% read_bottleneck libc-2.27.so [.]memcmp_avx2_movbe 0.49% rocksdb:low0 [kernel.kallsyms] [k] radix_tree_next_chunk 0.48% read_bottleneck read_bottleneck breakdown_test 0.46% rocksdb:low0 [kernel.kallsyms] [k] rocksdb::MemTable::KeyComparator::operator() 0.46% rocksdb:low0 [kernel.kallsyms] [k]block_commit_write.isra.34 0.46% rocksdb:low0 read_bottleneck_breakdown_test 0.43% rocksdb:low0 read_bottleneck_breakdown_test 0.41% read_bottleneck libc-2.27.so [.] _int_malloc 0.43% rocksdb:low0 read_bottleneck_breakdown_test 0.44% rocksdb:low0 read_bottleneck_breakdown_test 0.46% rocksdb:low0 read_bottleneck_breakdown_test 0.4</pre>					
<pre>0.54% read_bottleneck read_bottleneck breakdown test [.] rocksdb::(anonymous namespace)::BytewiseComparatorImpl::Compare 0.50% read_bottleneck libc-2.27.so [.]memcmp_avx2_movbe 0.49% rocksdb:low0</pre>					
0.50% read_bottleneck libc-2.27.so [.] _memcmp_avx2_movbe 0.49% rocksdb:low0 [kernel.kallsyms] [k] radix_tree_next_chunk 0.48% read_bottleneck read_bottleneck_breakdown_test [.] rocksdb::MemTable::KeyComparator::operator() 0.46% rocksdb:low0 libstdc++.so.6.0.25 [.] std::_cxx11::basic_string <char, std::char_traits<char="">, std::allocator<char>>: 0.46% rocksdb:low0 [kernel.kallsyms] [k] _block_commit_write.isra.34 0.46% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBasedTableIterator::status 0.41% read_bottleneck libc-2.27.so [.] _int_malloc 0.40% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBuilder::Add 0.40% read_bottleneck read_bottleneck_breakdown_test [.] rocksdb::BlockBuilder::Add 0.40% read_bottleneck [kernel.kallsyms] [k] _radix_tree_lookup</char></char,>					
<pre>0.49% rocksdb:low0 [kernel.kallsyms] [k] radix tree_next_chunk 0.48% read_bottleneck read_bottleneck breakdown_test [.] rocksdb::MemTable::KeyComparator::operator() 0.46% rocksdb:low0 libstdc++.so.6.0.25 [.] std::_cxx11::basic_string<char, std::char_traits<char="">, std::allocator<char>>: 0.46% rocksdb:low0 [kernel.kallsyms] [k] _block_commit_write.isra.34 0.46% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBasedTableIterator::status 0.41% read_bottleneck libc-2.27.so [.] _int_malloc 0.40% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBuilder::Add 0.40% read_bottleneck read_bottleneck_breakdown_test [.] rocksdb::BlockBuilder::Add 0.40% read_bottleneck [kernel.kallsyms] [k] _radix_tree_lookup</char></char,></pre>					
<pre>0.48% read_bottleneck read_bottleneck_breakdown_test [.] rocksdb::MemTable::KeyComparator::operator() 0.46% rocksdb:low0</pre>					
<pre>0.46% rocksdb:low0 libstdc++.so.6.0.25 [.] std::_cxx11::basic_string<char, std::char_traits<char="">, std::allocator<char>>: 0.46% rocksdb:low0 [kernel.kallsyms] [k] _block_commit_write.isra.34 0.46% rocksdb:low0 libc-2.27.so [.] int_malloc 0.43% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBasedTableIterator::status 0.41% read_bottleneck libc-2.27.so [.] int_malloc 0.40% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBuilder::Add 0.40% read_bottleneck read_bottleneck_breakdown_test [.] rocksdb::BlockBuilder::Add 0.40% read_bottleneck [kernel.kallsyms] [k]radix_tree_lookup</char></char,></pre>				ĹĸĬ	
<pre>0.46% rocksdb:low0 [kernel.kallsyms] [k] _block_commit_write.isra.34 0.46% rocksdb:low0 libc-2.27.so [.] int_malloc 0.43% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBasedTableIterator::status 0.41% read_bottleneck libc-2.27.so [.] int_malloc 0.40% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBuilder::Add 0.40% read_bottleneck read_bottleneck_breakdown_test [.] rocksdb::BlockIter<rocksdb::indexvalue>::CompareCurrentKey 0.38% read_bottleneck [kernel.kallsyms] [k]radix_tree_lookup</rocksdb::indexvalue></pre>				١٠,١	
<pre>0.46% rocksdb:low0 libc-2.27.so [.] int_malloc 0.43% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBasedTableIterator::status 0.41% read_bottleneck libc-2.27.so [.] int_malloc 0.40% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBuilder::Add 0.40% read_bottleneck read_bottleneck_breakdown_test [.] rocksdb::BlockIter<rocksdb::indexvalue>::CompareCurrentKey 0.38% read_bottleneck [kernel.kallsyms] [k]radix_tree_lookup</rocksdb::indexvalue></pre>					
<pre>0.43% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBasedTableIterator::status 0.41% read_bottleneck libc-2.27.so</pre>					DIOCK_COMMILE_WITTEISFd.54
<pre>0.41% read_bottleneck libc-2.27.so</pre>					
0.40% rocksdb:low0 read_bottleneck_breakdown_test [.] rocksdb::BlockBuilder::Add 0.40% read_bottleneck_read_bottleneck_breakdown_test [.] rocksdb::BlockIter <rocksdb::indexvalue>::CompareCurrentKey 0.38% read_bottleneck [kernel.kallsyms] [k]radix_tree_lookup</rocksdb::indexvalue>					
0.40% read_bottleneck read_bottleneck_breakdown_test [.] rocksdb::BlockIter <rocksdb::indexvalue>::CompareCurrentKey 0.38% read_bottleneck [kernel.kallsyms] [k]radix_tree_lookup</rocksdb::indexvalue>					
0.38% read_bottleneck [kernel.kallsyms] [k]radix_tree_lookup					
					, , , , , , , , , , , , , , , , , , , ,
6.36% Feau_bottleheck [kernel-kalisyllis] [k] Tillu_get_ently					
	0.58/6	i eau_bottieneck	[Kei Her-Karrsyllis]	[[,]	TING BECTENITY

90초~100초_1 --children

Children	c-10		Channel Object	C	L-1
	Self	Command	Shared Object	Sym	
25.14% 19.62%	4.80% 0.00%	read_bottleneck	read_bottleneck_breakdown_test		<pre>main rocksdb::DBImpl::BackgroundCallCompaction</pre>
	0.00%	rocksdb:low0	read_bottleneck_breakdown_test libstdc++.so.6.0.25	[.]	! !-!6
18.82%			1100101111	ļ٠ļ	
18.82%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	اً ٠ اِ	
18.82%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	
18.82%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	
18.08%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[·]	1 0 1
18.05%		rocksdb:low0	read_bottleneck_breakdown_test	[·]	
17.86%		rocksdb:low0	read_bottleneck_breakdown_test	[.]	
15.48%		rocksdb:low0	[kernel.kallsyms]	[k]	
15.40%	0.74%		[kernel.kallsyms]	[k]	- / -
11.49%		read_bottleneck	[unknown]	ĺ٠ĺ	0x46e51060000000000
11.38%	0.02%	read_bottleneck	read_bottleneck_breakdown_test	[·]	·
11.36% 11.33%	0.02%	read_bottleneck	read_bottleneck_breakdown_test	ĺ٠ĺ	
11.33%	0.02%	read_bottleneck	read_bottleneck_breakdown_test	[.]	
11.30%	0.01%	read_bottleneck	read_bottleneck_breakdown_test	[·]	
11.29%	0.07%		read_bottleneck_breakdown_test	[.]	
11.11%	0.01%	read_bottleneck			rocksdb::DBImpl::Get
11.10%	0.01%		read_bottleneck_breakdown_test		rocksdb::DBImpl::Get
11.02%	0.09%		read_bottleneck_breakdown_test	[٠]	
9.89%			read_bottleneck_breakdown_test	[.]	
9.89% 9.40% 9.02%		read_bottleneck		[.]	
9.02%		read_bottleneck	[unknown]	[.]	
8.90% 8.90%	8.88%	read_bottleneck	libc-2.27.so	[.]	
8.90%	0.06%			[.]	
8.61%	0.17%	read_bottleneck	read_bottleneck_breakdown_test	[.]	rocksdb::TableCache::Get
8.26%	0.29%		read_bottleneck_breakdown_test	[.]	
8.17%	0.55%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	
7.93%	0.10%	read_bottleneck	[kernel.kallsyms]	[k]	
7.91%	0.00%	rocksdb:low0	libpthread-2.27.so	[.]	
7.91%	0.00%	rocksdb:low0	[kernel.kallsyms]	[k]	<i>,</i> –
7.91%		rocksdb:low0	[kernel.kallsyms]	[k]	-
7.91%	0.00%	rocksdb:low0	[kernel.kallsyms]	[k]	
7.91%	0.00%	rocksdb:low0	[kernel.kallsyms]	[k]	
7.90%	0.00%	rocksdb:low0	[kernel.kallsyms]	[k]	ext4_file_write_iter
7.90%		rocksdb:low0	[kernel.kallsyms]	[k]	generic_file_write_iter
7.82%	0.80%	read_bottleneck	[kernel.kallsyms]	[k]	do_syscall_64
			33 6		

90초~100초_2 --children

7.82%	0.80%	read_bottleneck	[kernel.kallsyms]		do_syscall_64
7.82%	0.05%	rocksdb:low0	[kernel.kallsyms]		generic_perform_write
7.75%	7.66%	read_bottleneck			random
6.96% 6.86%					rocksdb::PessimisticTransaction::Commit
6.86%	0.23%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	rocksdb::BlockBasedTableIterator::NextAndGetResult
6.57%	0.10%	rocksdb:low0		[.]	rocksdb::BlockBasedTableIterator::Next
6.52%	0.15%	rocksdb:low0		[.]	rocksdb::(anonymous namespace)::LevelIterator::NextAndGetResult
6.15%	0.17%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	rocksdb::BlockBasedTableIterator::FindBlockForward
5.88%		read_bottleneck	read_bottleneck_breakdown_test	[.]	rocksdb::WriteCommittedTxn::CommitWithoutPrepareInternal
5.88% 5.65% 5.28%		read_bottleneck	read_bottleneck_breakdown_test	[.]	·
5.28%	0.08%	rocksdb:low0	libpthread-2.27.so	[.]	libc_pread64
5.16%	0.08%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	rocksdb::BlockBasedTableIterator::InitDataBlock
5.10%	0.28%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	rocksdb::BlockBasedTableBuilder::Add
5.01%	0.23%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	rocksdb::BlockBasedTable::NewDataBlockIterator <rocksdb::datablockiter></rocksdb::datablockiter>
4.77%	0.12%	read_bottleneck	read_bottleneck_breakdown_test	[.]	rocksdb::BlockBasedTable::NewDataBlockIterator <rocksdb::datablockiter></rocksdb::datablockiter>
4.49%	0.04%	read_bottleneck	read_bottleneck_breakdown_test	[.]	rocksdb::BlockBasedTable::RetrieveBlock <rocksdb::block></rocksdb::block>
4.40%	4.40%	rocksdb:low0	[kernel.kallsyms]	[k]	copy_user_enhanced_fast_string
4.40%	0.18%	read_bottleneck	read_bottleneck_breakdown_test	[.]	rocksdb::BlockBasedTable::MaybeReadBlockAndLoadToCache <rocksdb::block></rocksdb::block>
4.35%	0.05%	read_bottleneck	libpthread-2.27.so	[.]	libc_pread64
4.09%	0.03%	read_bottleneck	libpthread-2.27.so	[.]	_libc_write
3.87%	0.13%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	rocksdb::BlockBasedTable::RetrieveBlock <rocksdb::block></rocksdb::block>
3.82%	0.07%	rocksdb:low0	[kernel.kallsyms]	[k]	sys_pread64
3.60%	0.04%	rocksdb:low0	[kernel.kallsyms]	[k]	vfs_read
3.45%	0.04%	read_bottleneck	[kernel.kallsyms]	[k]	sys_write
3.34%	0.04%	read_bottleneck	[kernel.kallsyms]	[k]	sys_pread64
3.34%	0.00%	rocksdb:low0	[kernel.kallsyms]	[k]	vfs_read
3.33%	0.04%	rocksdb:low0	[kernel.kallsyms]		new_sync_read
3.29%	0.04%	read_bottleneck	[kernel.kallsyms]		vfs_write
3.29%	0.03%	rocksdb:low0	[kernel.kallsyms]		ext4_file_read_iter
3.23%	0.23%	rocksdb:low0	[kernel.kallsyms]	[k]	generic_file_read_iter
3.16%	0.03%	read_bottleneck	[kernel.kallsyms]	[k]	vfs_read
		· · ·	11 (

90초~92초_1 --no-children

Overhead	Command	Shared Object	Sym	bol
9.13%	read bottleneck		[.]	random r
7.82%	read bottleneck	libc-2.27.so	[.]	random
4.86%	read_bottleneck	read_bottleneck_breakdown_test	[.]	main
4.52%	rocksdb:low0	[kernel.kallsyms]	[k]	
1.95%	rocksdb:low0	libc-2.27.so	[.]	memmove_avx_unaligned_erms_
1.84%	read_bottleneck	libc-2.27.so	[.]	rand
1.66%	rocksdb:low0	libc-2.27.so	[.]	memset_avx2_erms
1.66%		[kernel.kallsyms]		copy_user_enhanced_fast_string
1.48%		read_bottleneck_breakdown_test	[.]	rand@plt
1.38%	rocksdb:low0	libsnappy.so.1.1.7	[.]	
1.24%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	
1.07%	rocksdb:low0	libc-2.27.so	[.]	cfree@GLIBC_2.2.5
0.99%	read_bottleneck		[.]	
0.85%	read_bottleneck	[kernel.kallsyms]	[k]	do_syscall_64
0.80%	read_bottleneck		[.]	vdso_clock_gettime
0.79%		read_bottleneck_breakdown_test	[.]	
0.77%	read_bottleneck		[.]	memmove_avx_unaligned_erms
0.75%	rocksdb:low0	[kernel.kallsyms]		do_syscall_64
	rocksdb:low0			rocksdb::CompactionIterator::NextFromInput
		read_bottleneck_breakdown_test		rocksdb::MemTable::KeyComparator::operator()
	rocksdb:low0	libc-2.27.so		malloc
0.59%	read_bottleneck			malloc
0.56%				rocksdb::crc32c::crc32c_3way
0.55%		read_bottleneck_breakdown_test	$[\cdot]$	
0.51%	rocksdb:low0	read_bottleneck_breakdown_test	[.]	rocksdb::MergingIterator::Next
	read_bottleneck		[.]	memcmp_avx2_movbe
		read_bottleneck_breakdown_test	$[\cdot]$	
	rocksdb:low0 rocksdb:low0	[kernel.kallsyms] libc-2.27.so	[k]	block_commit_write.isra.34 int_malloc
		read bottleneck breakdown test	$[\cdot]$	
	read_bottleneck		ŀļ	int malloc
	read_bottleneck	[kernel.kallsyms]	[.] [k]	radix tree lookup
	rocksdb:low0	libstdc++.so.6.0.25	[]	radix_tree_lookup std::cxx11::basic_string <char, std::char_traits<char="">, std::allocator<char> >::_M_replace</char></char,>
	rocksdb:low0	[kernel.kallsyms]	[1]	radix tree next chunk
	rocksdb:low0	read bottleneck breakdown test	[]	rocksdb::LRUHandleTable::FindPointer
	read bottleneck		[k]	find get entry
	rocksdb:low0	read bottleneck breakdown test	וֹ.'וֹ	,
0.37%	100030011000		[.]	- OCKSUD TID LOCKDUS CUTUO LECTUCO TESCUCUS

90초~92초_2 --no-children

```
0.34% read bottleneck read bottleneck breakdown test
                                                           rocksdb::BlockFetcher::ReadBlockContents
0.33% rocksdb:low0
                       read bottleneck breakdown test
                                                           rocksdb::BlockBuilder::Add
0.32% read bottleneck [kernel.kallsyms]
                                                             entry trampoline start
0.32% rocksdb:low0
                       read bottleneck breakdown test
                                                          rocksdb::CompactionJob::ProcessKeyValueCompaction
0.31% read bottleneck
                       [kernel.kallsyms]
                                                           syscall return via sysret
                                                           rocksdb::BlockBasedTable::Get
0.31% read bottleneck read bottleneck breakdown test
0.30% rocksdb:low0
                       [kernel.kallsyms]
                                                          crc32c pcl intel update
0.30% read bottleneck read bottleneck breakdown test
                                                           rocksdb::Status::operator=
0.30% rocksdb:low0
                        [kernel.kallsyms]
                                                             entry trampoline start
                                                          get page from freelist
0.30% rocksdb:low0
                        [kernel.kallsyms]
0.28% rocksdb:low0
                        [kernel.kallsyms]
                                                           find get entry
0.27% read bottleneck
                                                             vdso gettimeofday
                       [vdso]
0.26% rocksdb:low0
                       read bottleneck breakdown test
                                                           rocksdb::BlockBasedTableBuilder::Add
0.26% rocksdb:low0
                       read bottleneck breakdown test
                                                           rocksdb::BlockFetcher::ReadBlockContents
0.26% rocksdb:high0
                       libc-2.27.so
                                                             memmove avx unaligned erms
0.26% read bottleneck read bottleneck breakdown test
                                                          rocksdb::InlineSkipList<rocksdb::MemTableRep::KeyComparator const&>::RecomputeSpliceLevels
0.26% rocksdb:low0
                        [vdso]
                                                             vdso gettimeofday
0.25% rocksdb:low0
                        [kernel.kallsyms]
                                                          syscall return via sysret
0.25% read bottleneck read bottleneck breakdown test
                                                           rocksdb::DBImpl::WriteImpl
0.24% read bottleneck read bottleneck breakdown test
                                                           rocksdb::HistogramBucketMapper::IndexForValue
0.24% rocksdb:low0
                       read bottleneck breakdown test
                                                          rocksdb::HistogramBucketMapper::IndexForValue
                                                          rocksdb::Env::Default
0.24% read bottleneck read bottleneck breakdown test
0.24% rocksdb:low0
                       libstdc++.so.6.0.25
                                                           std:: cxx11::basic string<char, std::char traits<char>, std::allocator<char> >:: M append
0.24% read bottleneck read bottleneck breakdown test
                                                          rocksdb::Version::Get
0.23% read bottleneck libc-2.27.so
                                                             clock gettime
0.23% read bottleneck read bottleneck breakdown test
                                                           rocksdb::(anonymous namespace)::PosixEnv::NowNanos
0.22% rocksdb:low0
                       [kernel.kallsyms]
                                                           generic file read iter
                                                           rocksdb::LRUHandleTable::FindPointer
0.22% read bottleneck read bottleneck breakdown test
0.22% rocksdb:low0
                       read bottleneck breakdown test
                                                           rocksdb::RandomAccessFileReader::Read
0.21% read bottleneck libpthread-2.27.so
                                                            pthread mutex lock
0.21% rocksdb:low0
                       [kernel.kallsyms]
                                                          release pages
0.21% rocksdb:low0
                       read bottleneck breakdown test
                                                           rocksdb::BlockBasedTableIterator::NextAndGetResult
0.20% rocksdb:low0
                        [kernel.kallsyms]
                                                            radix tree lookup
```

90초~92초_1 --children

Children	Self	Command	Shared Object	Symbol
25.53%	4.86%		read_bottleneck_breakdown_test	[.] main
18.83%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[.] rocksdb::DBImpl::BackgroundCallCompaction
18.11%	0.00%	rocksdb:low0	libstdc++.so.6.0.25	[.] 0x00000000000bd6df
18.11%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[.] rocksdb::ThreadPoolImpl::Impl::BGThreadWrapper
18.11%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[.] rocksdb::ThreadPoolImpl::Impl::BGThread
18.11%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[.] rocksdb::DBImpl::BGWorkCompaction
17.26%	0.00%	rocksdb:low0	read_bottleneck_breakdown_test	[.] rocksdb::DBImpl::BackgroundCompaction
17.23%		rocksdb:low0	read_bottleneck_breakdown_test	[.] rocksdb::CompactionJob::Run
17.03%	0.32%	rocksdb:low0	read_bottleneck_breakdown_test	[.] rocksdb::CompactionJob::ProcessKeyValueCompaction
15.62%	0.07%	rocksdb:low0	[kernel.kallsyms]	[k] entry_SYSCALL_64_after_hwframe
15.54%	0.75%	rocksdb:low0	[kernel.kallsyms]	[k] do_syscall_64
11.73%	0.00%	read_bottleneck	[unknown]	[.] 0x81bcc06000000000
11.60%	0.02%	read_bottleneck		[.] rocksdb::TransactionBaseImpl::Get
11.58%	0.03%		read_bottleneck_breakdown_test	[.] rocksdb::TransactionBaseImpl::Get
11.55%	0.03%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::TransactionBaseImpl::Get
11.52%	0.01%	read_bottleneck		[.] rocksdb::WriteBatchWithIndex::GetFromBatchAndDB
11.50%	0.06%	read_bottleneck		[.] rocksdb::WriteBatchWithIndex::GetFromBatchAndDB
11.34%	0.01%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::DBImpl::Get
11.32%	0.01%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::DBImpl::Get
11.25%	0.09%		read_bottleneck_breakdown_test	[.] rocksdb::DBImpl::GetImpl
9.69%	0.24%		read_bottleneck_breakdown_test	[.] rocksdb::Version::Get
9.46%	0.08%	rocksdb:low0	read_bottleneck_breakdown_test	[.] rocksdb::CompactionIterator::Next
9.15%	9.13%	read_bottleneck		[.]random_r
9.11%	0.00%	read_bottleneck	[unknown]	[.] 0x5541c6894d5641cf
8.96%	0.06%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::PessimisticTransactionDB::Put
8.87%	0.16%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::TableCache::Get
8.56% 8.06%	0.31%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::BlockBasedTable::Get
8.06%	0.09%	read_bottleneck	[kernel.kallsyms]	[k] entry_SYSCALL_64_after_hwframe
8.01%	0.00%	rocksdb:low0	libpthread-2.27.so	[.]libc_write
8.01%	0.00%	rocksdb:low@	[kernel.kallsyms]	[k] sys_write
8.00%	0.00%	rocksdb:low@	[kernel.kallsyms]	[k] vfs_write
8.00%	0.00%	rocksdb:low@	[kernel.kallsyms]	[k]vfs_write
8.00%	0.00%	rocksdb:low@	[kernel.kallsyms]	[k] new_sync_write
8.00%	0.00%	rocksdb:low@	[kernel.kallsyms]	[k] ext4_file_write_iter
8.00%		rocksdb:low0	[kernel.kallsyms]	[k]generic_file_write_iter
8.00% 8.00% 8.00% 7.96% 7.92%	0.85%	read_bottleneck	[kernel.kallsyms]	[k] do_syscall_64
7.92%	7.82%	read_bottleneck	libc-2.27.so	[.]random

90초~92초_2 --children

```
0.05% rocksdb:low0
                                  [kernel.kallsvms]
                                                                  [k] generic perform write
         0.51% rocksdb:low0
                                 read bottleneck breakdown test
                                                                     rocksdb::MergingIterator::Next
                                                                     rocksdb::PessimisticTransaction::Commit
         0.06% read bottleneck read bottleneck breakdown test
         0.21% rocksdb:low0
                                 read_bottleneck_breakdown_test
                                                                     rocksdb::BlockBasedTableIterator::NextAndGetResult
                                 read bottleneck breakdown test
         0.11% rocksdb:low0
                                                                     rocksdb::BlockBasedTableIterator::Next
         0.13% rocksdb:low0
                                 read bottleneck breakdown test
                                                                     rocksdb::(anonymous namespace)::LevelIterator::NextAndGetResult
         0.15% rocksdb:low0
                                 read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTableIterator::FindBlockForward
         0.04% read bottleneck read bottleneck breakdown test
                                                                     rocksdb::WriteCommittedTxn::CommitWithoutPrepareInternal
         0.25% read bottleneck read bottleneck breakdown test
                                                                     rocksdb::DBImpl::WriteImpl
         0.08% rocksdb:low0
                                 libpthread-2.27.so
                                                                      libc pread64
         0.05% rocksdb:low0
                                 read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTableIterator::InitDataBlock
4.91%
                                 read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTable::NewDataBlockIterator<rocksdb::DataBlockIter>
         0.17% rocksdb:low0
4.88%
         0.11% read bottleneck read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTable::NewDataBlockIterator<rocksdb::DataBlockIter>
4.64%
         0.26% rocksdb:low0
                                 read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTableBuilder::Add
4.62%
         0.05% read bottleneck read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTable::RetrieveBlock<rocksdb::Block>
                rocksdb:low0
                                  [kernel.kallsyms]
                                                                     copy user enhanced fast string
                                                                     rocksdb::BlockBasedTable::MaybeReadBlockAndLoadToCache<rocksdb::Block>
4.52%
         0.19% read bottleneck read bottleneck breakdown test
4.47%
                read bottleneck libpthread-2.27.so
                                                                      libc pread64
4.08%
                read bottleneck libpthread-2.27.so
                                                                     libc write
3.94%
         0.11% rocksdb:low0
                                 read bottleneck breakdown test
                                                                     rocksdb::BlockBasedTable::RetrieveBlock<rocksdb::Block>
         0.06% rocksdb:low0
                                  [kernel.kallsyms]
                                                                     sys pread64
         0.04% rocksdb:low0
                                                                     vfs read
                                  [kernel.kallsyms]
3.45%
         0.04% read bottleneck
                                  [kernel.kallsvms]
                                                                     sys write
               read bottleneck
3.43%
                                  [kernel.kallsyms]
                                                                     sys pread64
3.34%
         0.00% rocksdb:low0
                                  [kernel.kallsyms]
                                                                      vfs read
3.33%
         0.03% rocksdb:low0
                                  [kernel.kallsyms]
                                                                     new sync read
3.30%
                                  [kernel.kallsvms
                                                                     ext4 file read iter
         0.03% rocksdb:low0
3.30%
         0.03% read bottleneck
                                  [kernel.kallsyms]
                                                                     vfs write
         0.22% rocksdb:low0
                                  [kernel.kallsyms]
                                                                     generic file read iter
                                                                  [k] vfs read
3.25%
         0.04% read bottleneck
                                  [kernel.kallsyms]
         0.00% read bottleneck
                                  [kernel.kallsyms]
                                                                      vfs write
.15%
                                 [kernel.kallsvms
3.15%
         0.01% read bottleneck
                                                                  [k] new svnc write
```

Symbol 분석

Children	Selt	Command	Shared Object	Symbol Symbol
9.97%			read_bottleneck_breakdown_test	
0.33%	0.01%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::MemTableListVersion::Get
0.33%	0.02%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::MemTableListVersion::GetFromList
Children	Salf	Command	Shared Object	Symbol
				,
9.99%	0.24%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::Version::Get
0.31%	0.00%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::MemTableListVersion::Get
0.31%	0.01%	read_bottleneck	read_bottleneck_breakdown_test	[.] rocksdb::MemTableListVersion::GetFromList
0.00%	0.00%	rocksdb:high0	read_bottleneck_breakdown_test	[.] rocksdb::Version::GetTableProperties
0.00%	0.00%	rocksdb:low0	read bottleneck breakdown test	[.] rocksdb::MemTableListVersion::GetEarliestSequenceNum

Symbol 분석

```
Children
                                    Shared Object
              Self Command
                                                                    Symbol
            0.80% read_bottleneck read_bottleneck_breakdown_test [.] rocksdb::IndexBlockIter::SeekImpl
   1.78%
           --0.98%--rocksdb::IndexBlockIter::SeekImpl
                     --0.62%--rocksdb::BlockIter<rocksdb::IndexValue>::CompareCurrentKey
           --0.80%--0x409d106000000000
                    main
                    rocksdb::TransactionBaseImpl::Get
                    rocksdb::TransactionBaseImpl::Get
                    rocksdb::TransactionBaseImpl::Get
                    rocksdb::WriteBatchWithIndex::GetFromBatchAndDB
                    rocksdb::WriteBatchWithIndex::GetFromBatchAndDB
                    rocksdb::DBImpl::Get
                    rocksdb::DBImpl::Get
                    rocksdb::DBImpl::GetImpl
                    rocksdb::Version::Get
                    rocksdb::TableCache::Get
                    rocksdb::BlockBasedTable::Get
                      --0.79%--rocksdb::BlockIter<rocksdb::IndexValue>::Seek
                               rocksdb::IndexBlockIter::SeekImpl
```

분석 결과

- 1. 초반 N초와 후반 N초의 기록 간의 차이는 compaction의 유무 이외에는 크게 발견되지 않았다.
 - 총 실행의 CPU Cycle에서 차지하는 비율이 각 함수마다 크게 달라지지 않았고, 비율의 순위도 크게 변동 되지 않았다.
- GET 함수의 내용 중 가장 높은 비율을 차지하는 부분은 SST File에서 탐색하는 부분이었으며, 이는 SST File 에서 탐색하면서 참조하는 Data Block의 수가 많기 때문인 것으로 추측된다.
 - 또한, Data Block을 탐색하면서 sequence number는 사용하지 않고, user key만을 사용하는 것으로 파악되었다. Sequence number는 key value를 찾은 후 이를 validate하는 과정에서 사용되고 있었다.

To Do

해결해야 할 문제

질문

해결해야 할 문제 및 질문

- 여러 방식으로 실험을 했음에도 유의미한 차이가 나타나지 않았는데 저희가 놓친 부분이 있나요?
 혹시 CPU Cycle 비율이 아닌 다른 척도를 확인해야 하나요?
- 2. 지금의 저희의 가설으로는 sequence number 를 더 활용해서 데이터 블록을 탐색하는 횟수를 줄이는 것이 성능 개선의 방법일 것이라고 생각합니다. 혹시 이런 방향성이 맞을까요?

THANK YOU!

감사합니다!