2025 Winter RocksDB Study
2nd week

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How to analyze RocksDB

- Recommended Approaches
  - ✓1) Read and write researches
    - Documents, Lectures, Papers (Top-tier conference)
    - Conference: EuroSys, OSDI, FAST, ATC, VLDB, SIGMOD …
  - ✓2) Remarks and Code
    - VS code, Terminal …
  - ✓3) Code Tracing
    - GDB, Uftrace
  - ✓4) Draw figures
    - Structure, Class, Code flow with Draw.io and PPT
  - ✓5) Write a markdown document
    - Using github
  - ✓6) Draw a evaluation figures
    - Python, Excel
  - ✓7) Prepare 15-minute presentation

Key-Value Store 분석

(RocksDB 중점)

Dankook Univ. Embedded Lab.

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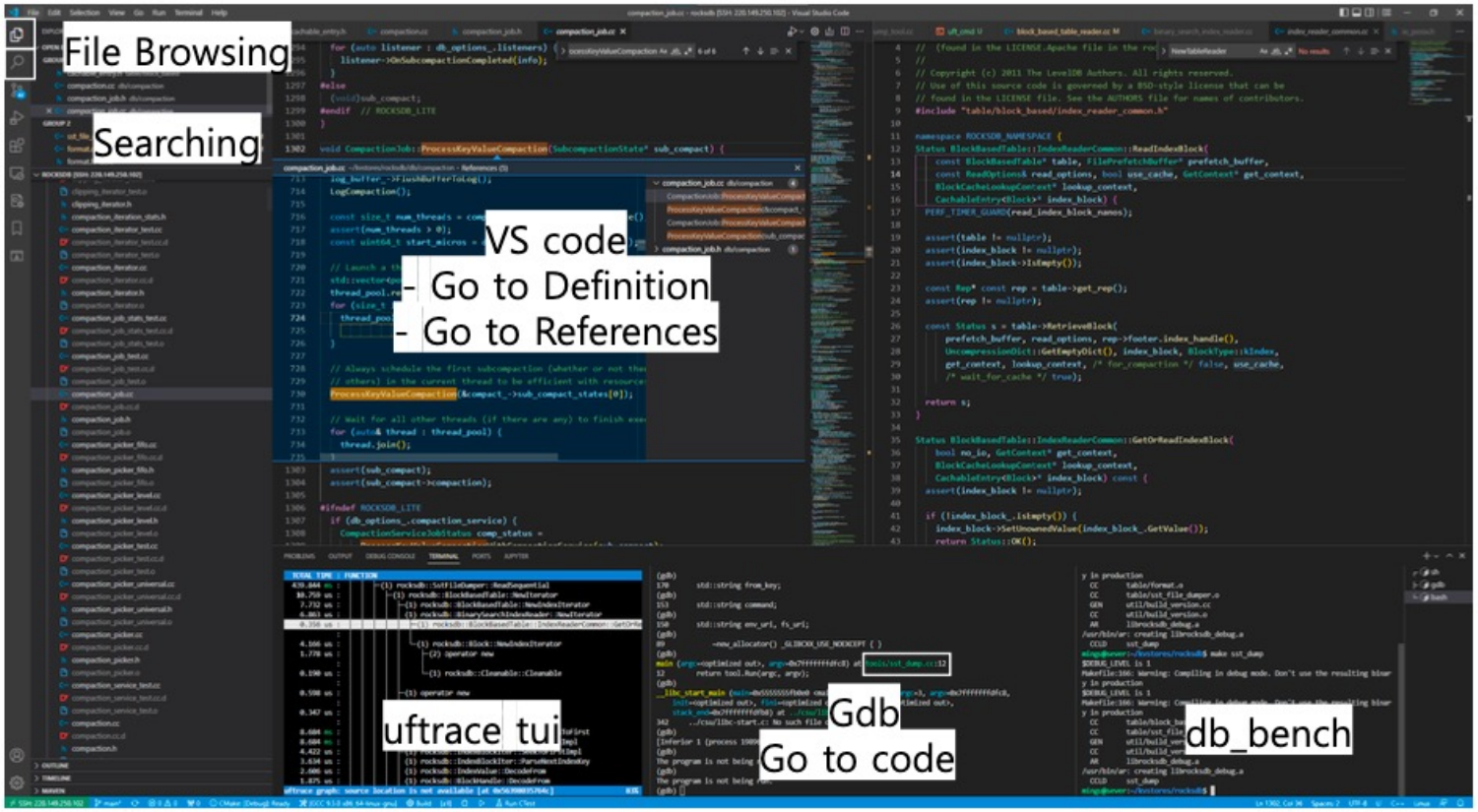
목차

Analyze Tool Example (by min-guk)

- VS code



Analyze Tool Example (by min-guk)

- GDB
  - ✓Run
    - $ gdb <program>
    - $ gdb –args <program> <arg1> <arg2> …
  - ✓Process
    - > r > run
    - > c > continue
    - > n > next
    - > s > step
    - > fin > finish

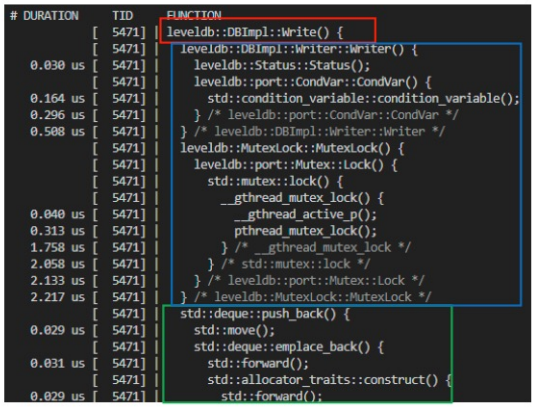
```
mingu@server:~/leveldb_release/build$ gdb --args ./db_bench --benchmarks="fillrandom"
GNU gdb (Ubuntu 9.2-0ubuntu1~20.04.1) 9.2
Copyright (C) 2020 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<http://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
    <http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./db_bench...                    Open file in Editor (Ctrl + Click)
(gdb) b db_impl.cc:894
Breakpoint 1 at 0x12213: file /home/mingu/leveldb_release/db/db_impl.cc, line 894.
(gdb) i b
Num     Type           Disp Enb Address            What
1       breakpoint     keep y   0x0000000000012213 in leveldb::DBImpl::DoCompactionWork(leveldb::DBImpl::CompactionState*)
at /home/mingu/leveldb_release/db/db_impl.cc:894
(gdb)
```

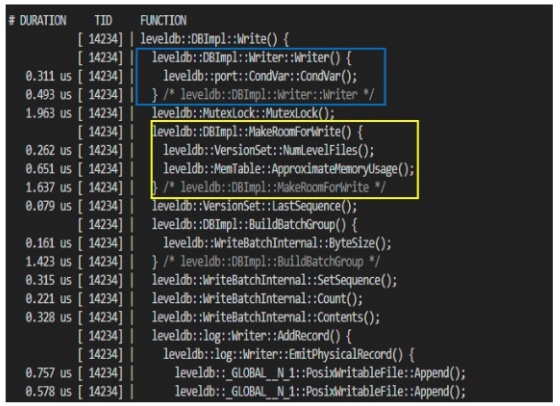
```
1013        input->Next();
(gdb) s
leveldb::(anonymous namespace)::MergingIterator::Next (this=
    0x555555590fee <leveldb::(anonymous namespace)::TwoLevelIterator::value() const+96>)
    at /home/mingu/leveldb_release/table/merger.cc:55
55        void Next() override {
(gdb) n
56          assert(Valid());
(gdb)
63          if (direction_ != kForward) {
(gdb)
77          current_->Next();
(gdb)
78          FindSmallest();
(gdb) s
leveldb::(anonymous namespace)::MergingIterator::FindSmallest (
    this=0x555555590f8c <leveldb::(anonymous namespace)::TwoLevelIterator::key() const+96>)
    at /home/mingu/leveldb_release/table/merger.cc:148
148     void MergingIterator::FindSmallest() {
(gdb)
```

Analyze Tool Example (by min-guk)

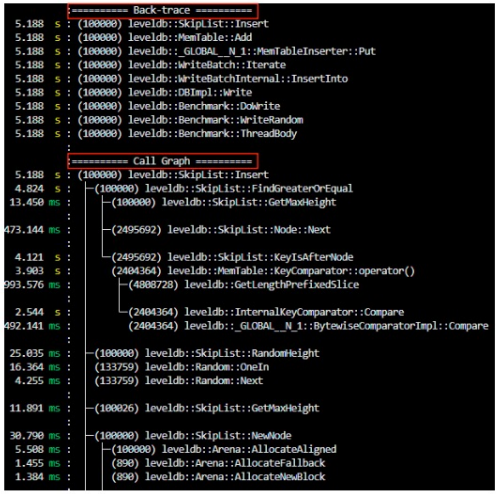
- Uftrace
  - ✓Record
    - Run a program and saves the trace data
  - ✓Replay
    - Show program execution in the trace data
  - ✓Graph/Tui
    - Show function call graph in the trace data
  - ✓Filter



No Filter



Filter



Research Topic (Recommended)

- Research Topic
  - ✓1) Write (flush, WAL and compaction)
    - GearDB (FAST'19), WOKV (ICCCBDA'18), Reducing WAF (ICDE'22)
  - ✓2) Read (bloom filter and cache)
    - ElasticBF (FAST'19), BloomStore (MSST'12), Rosetta (SIGMOD'20)
  - ✓3) Key-value store structure (Tiered Storage and PMem)
    - NoveLSM (FAST'18), MatrixKV (ATC'20), SpanDB (FAST'21), PRISM (ASPLOS'23)

- Advanced Research Topic
  - ✓1) Key-value separation
    - Wisckey (FAST'16), FenceKV (TPDS'22)
  - ✓2) In-memory index optimization
    - JellyFish (Middleware'20), ListDB (OSDI'22), S3 (VLDB'19)
  - ✓3) Learned Index
    - Bourbon (OSDI'20)

Future Schedule

- Study Schedule (4 weeks)

Week 3 (25.2.4)	• RocksDB Benchmark evaluation (Flush, Compaction, WAL, Bloom filter, Cache) • Analyze the reasons for performance degradation or improvement
Week 4 (25.2.11)	• Analyze the code relevant to the topic chosen by each team • Visualize the code using structure diagram and code flow
Week 5 (25.2.18)	• Document the results from the previous week's work (using Github wiki) • Propose optimization ideas based on the analysis
Week 6 (25.2.25)	• Organize and refine areas that were incomplete in the documentation process • Implement the proposed optimization ideas and present the experimental results

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Thank You
Q & A ?

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