분산시스템 과제 #6

박종현, 2025-05-09
공과대학 컴퓨터정보통신공학과

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[ch 3-9]

```
207_0035/
INFO  : Kill Command = /home/hduser/hadoop_test/hadoop-3.4.0/bin/mapred job  -kill job_1746737381207_0035
INFO  : Hadoop job information for Stage-2: number of mappers: 1; number of reducers: 1
INFO  : 2025-05-09 06:25:27,486 Stage-2 map = 0%,  reduce = 0%
INFO  : 2025-05-09 06:25:33,731 Stage-2 map = 100%,  reduce = 0%, Cumulative CPU 3.4 sec
INFO  : 2025-05-09 06:25:40,969 Stage-2 map = 100%,  reduce = 100%, Cumulative CPU 9.09 sec
INFO  : MapReduce Total cumulative CPU time: 9 seconds 90 msec
INFO  : Ended Job = job_1746737381207_0035
INFO  : MapReduce Jobs Launched:
INFO  : Stage-Stage-1: Map: 1  Reduce: 1   Cumulative CPU: 6.27 sec   HDFS Read: 16374 HDFS Write: 338 HDFS EC Read: 0 S
UCCESS
INFO  : Stage-Stage-2: Map: 1  Reduce: 1   Cumulative CPU: 9.09 sec   HDFS Read: 15207 HDFS Write: 310 HDFS EC Read: 0 S
UCCESS
INFO  : Total MapReduce CPU Time Spent: 15 seconds 360 msec
INFO  : Completed executing command(queryId=hduser_20250509062450_87ae73dc-4991-4581-9208-506478fb1a77); Time taken: 51.
002 seconds
+---------+--------+-------------------+------------+-------+--------+
|  name   | salary |      projects     | avg_salary | rank  | prank  |
+---------+--------+-------------------+------------+-------+--------+
| paul    | 2000   | ["proj1","proj2"] | 1300.0     | 1     | 0.0    |
| david   | 1500   | ["proj1"]         | 1300.0     | 2     | 0.25   |
| nina    | 1200   | ["proj2"]         | 1300.0     | 3     | 0.5    |
| peter   | 1000   | ["proj1"]         | 1300.0     | 4     | 0.75   |
| michael | 800    | ["proj1","proj2"] | 1300.0     | 5     | 1.0    |
+---------+--------+-------------------+------------+-------+--------+
5 rows selected (51.212 seconds)
0: jdbc:hive2://localhost:10000>
```

```
INFO  : Kill Command = /home/hduser/hadoop_test/hadoop-3.4.0/bin/mapred job  -kill job_1746737381207_0037
INFO  : Hadoop job information for Stage-2: number of mappers: 1; number of reducers: 1
INFO  : 2025-05-09 06:26:37,025 Stage-2 map = 0%,  reduce = 0%
INFO  : 2025-05-09 06:26:43,218 Stage-2 map = 100%,  reduce = 0%, Cumulative CPU 5.18 sec
INFO  : 2025-05-09 06:26:50,422 Stage-2 map = 100%,  reduce = 100%, Cumulative CPU 8.82 sec
INFO  : MapReduce Total cumulative CPU time: 8 seconds 820 msec
INFO  : Ended Job = job_1746737381207_0037
INFO  : MapReduce Jobs Launched:
INFO  : Stage-Stage-1: Map: 1  Reduce: 1   Cumulative CPU: 6.28 sec   HDFS Read: 17036 HDFS Write: 338 HDFS EC Read: 0 S
UCCESS
INFO  : Stage-Stage-2: Map: 1  Reduce: 1   Cumulative CPU: 8.82 sec   HDFS Read: 16033 HDFS Write: 338 HDFS EC Read: 0 S
UCCESS
INFO  : Total MapReduce CPU Time Spent: 15 seconds 100 msec
INFO  : Completed executing command(queryId=hduser_20250509062600_6df50979-05e5-4ecd-bd6f-8d4c4a2772f0); Time taken: 51.
079 seconds
+---------+--------+-------------------+------------+-------+---------------------+
|  name   | salary |      projects     | avg_salary | rank  |        prank        |
+---------+--------+-------------------+------------+-------+---------------------+
| paul    | 2000   | ["proj1","proj2"] | 1325.0     | 1     | 0.0                 |
| david   | 1500   | ["proj1"]         | 1325.0     | 2     | 0.3333333333333333  |
| peter   | 1000   | ["proj1"]         | 1325.0     | 3     | 0.6666666666666666  |
| michael | 800    | ["proj1","proj2"] | 1325.0     | 4     | 1.0                 |
| nina    | 1200   | ["proj2"]         | 1200.0     | 1     | 0.0                 |
+---------+--------+-------------------+------------+-------+---------------------+
5 rows selected (51.245 seconds)
0: jdbc:hive2://localhost:10000>
0: jdbc:hive2://localhost:10000>
```

```
|                isPivotResult: true               |
+--------------------------------------------------+
|                      Explain                     |
+--------------------------------------------------+
|           Statistics: Num rows: 1 Data size: 2108 Basic stats: COMPLETE Column stats: NONE |
|           Select Operator                        |
|             expressions: _col1 (type: string), _col2 (type: int), _col5 (type: array<string>), _col0 (type: double),
 rank_window_1 (type: int), percent_rank_window_2 (type: double) |
|             outputColumnNames: _col0, _col1, _col2, _col3, _col4, _col5 |
|             Statistics: Num rows: 1 Data size: 2108 Basic stats: COMPLETE Column stats: NONE |
|           File Output Operator                   |
|             compressed: false                    |
|             Statistics: Num rows: 1 Data size: 2108 Basic stats: COMPLETE Column stats: NONE |
|             table:                               |
|               input format: org.apache.hadoop.mapred.SequenceFileInputFormat |
|               output format: org.apache.hadoop.hive.ql.io.HiveSequenceFileOutputFormat |
|               serde: org.apache.hadoop.hive.serde2.lazy.LazySimpleSerDe |
|                                                  |
|   Stage: Stage-0                                 |
|     Fetch Operator                               |
|       limit: -1                                  |
|       Processor Tree:                            |
|         ListSink                                 |
|                                                  |
+--------------------------------------------------+
119 rows selected (0.216 seconds)
0: jdbc:hive2://localhost:10000>
```

[ch 3-11]

```
hduser@ubuntu:~$ jps
1363 HMaster
1735 JarBootstrapMain
1947 Jps
hduser@ubuntu:~$ ss -ltn
State    Recv-Q  Send-Q        Local Address:Port      Peer Address:Port   Process
LISTEN   0       4096          127.0.0.53%lo:53              0.0.0.0:*
LISTEN   0       4096           127.0.0.54:53              0.0.0.0:*
LISTEN   0       128                    *:16010                 *:*
LISTEN   0       128                    *:16030                 *:*
LISTEN   0       50        [::ffff:127.0.0.1]:2181               *:*
LISTEN   0       4096      [::ffff:127.0.1.1]:16020              *:*
LISTEN   0       4096      [::ffff:127.0.1.1]:16000              *:*
LISTEN   0       4096                   *:22                   *:*
hduser@ubuntu:~$
```

```
hduser@ubuntu:~/hbase_test/hbase-2.6.2/bin$ ./hbase shell
HBase Shell
Use "help" to get list of supported commands.
Use "exit" to quit this interactive shell.
For Reference, please visit: http://hbase.apache.org/2.0/book.html#shell
Version 2.6.2, r6b3b36b429cf9a9d74110de79eb3b327b29ebf17, Fri Feb 14 14:39:16 UT
C 2025
Took 0.0011 seconds
hbase:001:0> create 'test', 'cf1'
Created table test
Took 0.9918 seconds
=> Hbase::Table - test
hbase:002:0> create 'test1', 'cf1', 'cf2'
Created table test1
Took 0.6605 seconds
=> Hbase::Table - test1
hbase:003:0> list
TABLE
test
test1
2 row(s)
Took 0.0246 seconds
=> ["test", "test1"]
hbase:004:0>
```

```
●●●   ⌥⌘2           hduser@ubuntu: ~/hbase_test/hbase-2.6.2/bin
⬚ 17% _____  ▤ 14 GB _____  ▯ 76% _____
hbase:004:0> describe 'test'
Table test is ENABLED
test, {TABLE_ATTRIBUTES => {METADATA => {'hbase.store.file-tracker.impl' => 'DEF
AULT'}}}
COLUMN FAMILIES DESCRIPTION
{NAME => 'cf1', INDEX_BLOCK_ENCODING => 'NONE', VERSIONS => '1', KEEP_DELETED_CE
LLS => 'FALSE', DATA_BLOCK_ENCODING => 'NONE', TTL => 'FOREVER', MIN_VERSIONS =>
 '0', REPLICATION_SCOPE => '0', BLOOMFILTER => 'ROW', IN_MEMORY => 'false', COMP
RESSION => 'NONE', BLOCKCACHE => 'true', BLOCKSIZE => '65536 B (64KB)'}

1 row(s)
Quota is disabled
Took 0.1031 seconds
hbase:005:0> describe 'test1'
Table test1 is ENABLED
test1, {TABLE_ATTRIBUTES => {METADATA => {'hbase.store.file-tracker.impl' => 'DE
FAULT'}}}
COLUMN FAMILIES DESCRIPTION
{NAME => 'cf1', INDEX_BLOCK_ENCODING => 'NONE', VERSIONS => '1', KEEP_DELETED_CE
LLS => 'FALSE', DATA_BLOCK_ENCODING => 'NONE', TTL => 'FOREVER', MIN_VERSIONS =>
 '0', REPLICATION_SCOPE => '0', BLOOMFILTER => 'ROW', IN_MEMORY => 'false', COMP
RESSION => 'NONE', BLOCKCACHE => 'true', BLOCKSIZE => '65536 B (64KB)'}

{NAME => 'cf2', INDEX_BLOCK_ENCODING => 'NONE', VERSIONS => '1', KEEP_DELETED_CE
LLS => 'FALSE', DATA_BLOCK_ENCODING => 'NONE', TTL => 'FOREVER', MIN_VERSIONS =>
```

```
●●●   ⌥⌘2           hduser@ubuntu: ~/hbase_test/hbase-2.6.2/bin
⬚ 24% _____  ▤ 14 GB _____  ▯ 75% _____
 '0', REPLICATION_SCOPE => '0', BLOOMFILTER => 'ROW', IN_MEMORY => 'false', COMP
RESSION => 'NONE', BLOCKCACHE => 'true', BLOCKSIZE => '65536 B (64KB)'}

2 row(s)
Quota is disabled
Took 0.0331 seconds
hbase:006:0> put 'test', 'key1', 'cf1:a', 'value1'
Took 0.0603 seconds
hbase:007:0> put 'test', 'key2', 'cf1:a', 'value2'
Took 0.0097 seconds
hbase:008:0> put 'test', 'key2', 'cf1:a', 'value2'
Took 0.0049 seconds
hbase:009:0> put 'test', 'key4', 'cf1:c', 'value4'
Took 0.0076 seconds
hbase:010:0> scan 'test'
ROW                  COLUMN+CELL
 key1                column=cf1:a, timestamp=2025-05-15T07:35:59.138, value=val
                     ue1
 key2                column=cf1:a, timestamp=2025-05-15T07:36:05.394, value=val
                     ue2
 key4                column=cf1:c, timestamp=2025-05-15T07:36:08.459, value=val
                     ue4
3 row(s)
Took 0.0288 seconds
hbase:011:0> ▮
```

```
  ⚫⚫⚫  ⌥⌘2          hduser@ubuntu: ~/hbase_test/hbase-2.6.2/bin

  ▯ 22% ‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾  ▥ 14 GB ‾‾‾‾‾‾‾‾‾‾‾‾  ▯ 75% ‾‾‾‾‾‾‾‾‾‾
hbase:009:0> put 'test', 'key4', 'cf1:c', 'value4'
Took 0.0076 seconds
hbase:010:0> scan 'test'
ROW                    COLUMN+CELL
 key1                  column=cf1:a, timestamp=2025-05-15T07:35:59.138, value=val
                       ue1
 key2                  column=cf1:a, timestamp=2025-05-15T07:36:05.394, value=val
                       ue2
 key4                  column=cf1:c, timestamp=2025-05-15T07:36:08.459, value=val
                       ue4
3 row(s)
Took 0.0288 seconds
hbase:011:0> put 'test', 'key1', 'cf1:a', 'value5'
Took 0.0078 seconds
hbase:012:0> scan 'test'
ROW                    COLUMN+CELL
 key1                  column=cf1:a, timestamp=2025-05-15T07:36:20.605, value=val
                       ue5
 key2                  column=cf1:a, timestamp=2025-05-15T07:36:05.394, value=val
                       ue2
 key4                  column=cf1:c, timestamp=2025-05-15T07:36:08.459, value=val
                       ue4
3 row(s)
Took 0.0140 seconds
hbase:013:0> ▮
```

```
  ⚫⚫⚫  ⌥⌘2          hduser@ubuntu: ~/hbase_test/hbase-2.6.2/bin

  ▯ 21% ‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾  ▥ 14 GB ‾‾‾‾‾‾‾‾‾‾‾‾  ▯ 75% ‾‾‾‾‾‾‾‾‾‾
                       ue1
 key2                  column=cf1:a, timestamp=2025-05-15T07:36:05.394, value=val
                       ue2
 key4                  column=cf1:c, timestamp=2025-05-15T07:36:08.459, value=val
                       ue4
3 row(s)
Took 0.0288 seconds
hbase:011:0> put 'test', 'key1', 'cf1:a', 'value5'
Took 0.0078 seconds
hbase:012:0> scan 'test'
ROW                    COLUMN+CELL
 key1                  column=cf1:a, timestamp=2025-05-15T07:36:20.605, value=val
                       ue5
 key2                  column=cf1:a, timestamp=2025-05-15T07:36:05.394, value=val
                       ue2
 key4                  column=cf1:c, timestamp=2025-05-15T07:36:08.459, value=val
                       ue4
3 row(s)
Took 0.0140 seconds
hbase:013:0> disable 'test'
Took 0.3399 seconds
hbase:014:0> drop 'test'
Took 0.1331 seconds
hbase:015:0> exit
hduser@ubuntu:~/hbase_test/hbase-2.6.2/bin$ ▮
```

5

```
●●●    ⌥⌘2            hduser@ubuntu: ~/hbase_test/hbase-2.6.2/bin
▢ 21% ‿‿‿‿‿          ▤ 14 GB ▭▭▭▭▭▭         ▯ 75% ▭▭▭▭▭▭
3 row(s)
Took 0.0288 seconds
hbase:011:0> put 'test', 'key1', 'cf1:a', 'value5'
Took 0.0078 seconds
hbase:012:0> scan 'test'
ROW                     COLUMN+CELL
 key1                   column=cf1:a, timestamp=2025-05-15T07:36:20.605, value=val
                        ue5
 key2                   column=cf1:a, timestamp=2025-05-15T07:36:05.394, value=val
                        ue2
 key4                   column=cf1:c, timestamp=2025-05-15T07:36:08.459, value=val
                        ue4
3 row(s)
Took 0.0140 seconds
hbase:013:0> disable 'test'
Took 0.3399 seconds
hbase:014:0> drop 'test'
Took 0.1331 seconds
hbase:015:0> exit
hduser@ubuntu:~/hbase_test/hbase-2.6.2/bin$ sh stop-hbase.sh
stop-hbase.sh: 180: /home/hduser/hbase_test/hbase-2.6.2/bin/hbase-config.sh: Syn
tax error: "(" unexpected
hduser@ubuntu:~/hbase_test/hbase-2.6.2/bin$ ./stop-hbase.sh
stopping hbase..........
hduser@ubuntu:~/hbase_test/hbase-2.6.2/bin$ ▮
```

[ch 3-12]

```
●●●    ⌥⌘2            hduser@ubuntu: ~/hbase_test/hbase-2.6.2/bin
▢ 22% ‿‿‿‿‿          ▤ 14 GB ▭▭▭▭▭▭         ▯ 74% ▭▭▭▭▭▭
C 2025
Took 0.0012 seconds
hbase:001:0> create 'testdata', 'cf1', 'cf2'
Created table testdata
Took 1.0506 seconds
=> Hbase::Table - testdata
hbase:002:0> put 'testdata', 'rowA', 'cf1:A', 'val1'
Took 0.1207 seconds
hbase:003:0> put 'testdata', 'rowA', 'cf1:A', 'val1'
Took 0.0115 seconds
hbase:004:0> put 'testdata', 'rowC', 'cf2:C', 'val3'
Took 0.0044 seconds
hbase:005:0> put 'testdata', 'rowA', 'cf2:B', 'val4'
Took 0.0046 seconds
hbase:006:0> scan 'testdata'
ROW                     COLUMN+CELL
 rowA                   column=cf1:A, timestamp=2025-05-15T07:39:19.643, value=val
                        1
 rowA                   column=cf2:B, timestamp=2025-05-15T07:39:27.511, value=val
                        4
 rowC                   column=cf2:C, timestamp=2025-05-15T07:39:23.710, value=val
                        3
2 row(s)
Took 0.0241 seconds
hbase:007:0> ▮
```

```
⌥⌘2          hduser@ubuntu: ~/hbase_test/hbase-2.6.2/bin

 28%  ~~~~~~~~~~~~~       14 GB                        74%
hbase:012:0> put 'testdata', 'rowA', 'cf1:A', 'val5'
Took 0.0076 seconds
hbase:013:0> scan 'testdata'
ROW                      COLUMN+CELL
 rowA                    column=cf1:A, timestamp=2025-05-15T07:39:41.183, value=val
                         5
 rowA                    column=cf2:B, timestamp=2025-05-15T07:39:27.511, value=val
                         4
 rowC                    column=cf2:C, timestamp=2025-05-15T07:39:23.710, value=val
                         3
2 row(s)
Took 0.0178 seconds
hbase:014:0> delete 'testdata', 'rowA', 'cf1:a'
Took 0.0163 seconds
hbase:015:0> scan 'testdata'
ROW                      COLUMN+CELL
 rowA                    column=cf1:A, timestamp=2025-05-15T07:39:41.183, value=val
                         5
 rowA                    column=cf2:B, timestamp=2025-05-15T07:39:27.511, value=val
                         4
 rowC                    column=cf2:C, timestamp=2025-05-15T07:39:23.710, value=val
                         3
2 row(s)
Took 0.0169 seconds
hbase:016:0>
```

```
⌥⌘2          hduser@ubuntu: ~/hbase_test/hbase-2.6.2/bin

 26%  ~~~~~~~~~~~~~       14 GB                        74%
hbase:019:0>
hbase:020:0>
hbase:021:0> alter 'testdata', 'delete' => 'cf2'
Updating all regions with the new schema...
1/1 regions updated.
Done.
Took 1.7870 seconds
hbase:022:0> scan 'testdata'
ROW                      COLUMN+CELL
 rowA                    column=cf1:A, timestamp=2025-05-15T07:39:41.183, value=val
                         5
1 row(s)
Took 0.0160 seconds
hbase:023:0> alter 'testdata', 'cf2'
Updating all regions with the new schema...
1/1 regions updated.
Done.
Took 1.5975 seconds
hbase:024:0> scan 'testdata'
ROW                      COLUMN+CELL
 rowA                    column=cf1:A, timestamp=2025-05-15T07:39:41.183, value=val
                         5
1 row(s)
Took 0.0117 seconds
hbase:025:0>
```

```
●●●   ⌥⌘2          hduser@ubuntu: ~/hbase_test/hbase-2.6.2/bin

▢ 23% ⌁⌁⌁⌁⌁⌁⌁⌁⌁⌁     ▤ 14 GB ▬▬▬▬▬▬▬     ▯ 74% ▬▬▬▬▬▬▬
Done.
Took 1.5975 seconds
hbase:024:0> scan 'testdata'
ROW                      COLUMN+CELL
 rowA                    column=cf1:A, timestamp=2025-05-15T07:39:41.183, value=val
                         5
1 row(s)
Took 0.0117 seconds
hbase:025:0> put 'testdata', 'rowA', 'cf1:A', 'val5'
Took 0.0140 seconds
hbase:026:0> put 'testdata', 'rowC', 'cf2:C', 'val3'
Took 0.0073 seconds
hbase:027:0> put 'testdata', 'rowA', 'cf2:B', 'val4'
Took 0.0056 seconds
hbase:028:0> scan 'testdata'
ROW                      COLUMN+CELL
 rowA                    column=cf1:A, timestamp=2025-05-15T07:40:22.784, value=val
                         5
 rowA                    column=cf2:B, timestamp=2025-05-15T07:40:30.033, value=val
                         4
 rowC                    column=cf2:C, timestamp=2025-05-15T07:40:27.417, value=val
                         3
2 row(s)
Took 0.0172 seconds
hbase:029:0>
```

```
●●●   ⌥⌘2          hduser@ubuntu: ~/hbase_test/hbase-2.6.2/bin

▢ 30% ⌁⌁⌁⌁⌁⌁⌁⌁⌁⌁     ▤ 14 GB ▬▬▬▬▬▬▬     ▯ 74% ▬▬▬▬▬▬▬
ROW                      COLUMN+CELL
 rowA                    column=cf1:A, timestamp=2025-05-15T07:40:22.784, value=val
                         5
 rowA                    column=cf2:B, timestamp=2025-05-15T07:40:30.033, value=val
                         4
 rowC                    column=cf2:C, timestamp=2025-05-15T07:40:27.417, value=val
                         3
2 row(s)
Took 0.0172 seconds
hbase:029:0>
hbase:030:0>
hbase:031:0> deleteall 'testdata', 'rowA'
Took 0.0035 seconds
hbase:032:0> scan 'testdata'
ROW                      COLUMN+CELL
 rowC                    column=cf2:C, timestamp=2025-05-15T07:40:27.417, value=val
                         3
1 row(s)
Took 0.0092 seconds
hbase:033:0> truncate 'testdata'
Truncating 'testdata' table (it may take a while):
Disabling table...
Truncating table...
Took 1.0325 seconds
hbase:034:0>
```