Advanced Databases

Cassandra CA

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Programme Code: TU856

1. Setting up the cluster and keyspace
   We have a cluster with two nodes.

```
|/ State=Normal/Leaving/Joining/Moving
--  Address     Load        Tokens  Owns (effective)  Host ID                               Rack
UN  172.17.0.3  215.92 KiB  16      100.0%            b589c151-9fd0-4074-a4be-9943cab8a432  rack1
UN  172.17.0.2  203.95 KiB  16      100.0%            4f96e4e6-ad9f-46b2-bb0c-ddcbe701f16f  rack1
```

   Both nodes are up and functioning normally. Very little load on either only about 200 Kib and each has a unique host ID should It be needed
   We have made a keyspace with a simple strategy that has 2 copies for backup and restore purposes.

2. Porting the data to Cassandra

```
|/ State=Normal/Leaving/Joining/Moving
--  Address     Load        Tokens  Owns (effective)  Host ID                               Rack
UN  172.17.0.3  215.92 KiB  16      100.0%            b589c151-9fd0-4074-a4be-9943cab8a432  rack1
UN  172.17.0.2  203.95 KiB  16      100.0%            4f96e4e6-ad9f-46b2-bb0c-ddcbe701f16f  rack1
```

```
Table: factresults
SSTable count: 1
Old SSTable count: 0
Space used (live): 5412
Space used (total): 5412
Space used by snapshots (total): 0
Off heap memory used (total): 40
SSTable Compression Ratio: 0.6835820895522388
Number of partitions (estimate): 7
Memtable cell count: 0
Memtable data size: 0
Memtable off heap memory used: 0
Memtable switch count: 1
Local read count: 7
Local read latency: NaN ms
Local write count: 28
Local write latency: NaN ms
Pending flushes: 0
Percent repaired: 0.0
Bytes repaired: 0.000KiB
Bytes unrepaired: 0.327KiB
Bytes pending repair: 0.000KiB
Bloom filter false positives: 0
Bloom filter false ratio: 0.00000
Bloom filter space used: 24
Bloom filter off heap memory used: 16
Index summary off heap memory used: 16
Compression metadata off heap memory used: 8
Compacted partition minimum bytes: 43
Compacted partition maximum bytes: 50
Compacted partition mean bytes: 50
Average live cells per slice (last five minutes): NaN
Maximum live cells per slice (last five minutes): 0
Average tombstones per slice (last five minutes): NaN
Maximum tombstones per slice (last five minutes): 0
Dropped Mutations: 0
Droppable tombstone ratio: 0.00000
```

Data shows that there are 7 partitions and the read/write count. Also shoes the space used by the tables.

3. Golf data
    a. Basic query on golf data

```
cqlsh:advanceddb> select * from factresults;

 player_sk | p_name | p_sname  | prize | year
-----------+--------+----------+-------+------
         5 |   John | McDonald |  2000 | 2014
        10 | Martha |     Ross |  8000 | 2014
         1 |  Tiger |    Woods | 16000 | 2014
         8 |   Paul |      Bin | 12000 | 2014
         2 |   Jane |    Smith |  9000 | 2014
         6 |  Mario |   Baggio |  6000 | 2014
         9 |  Peter |    Flynn |  9400 | 2014

(7 rows)

Tracing session: e1f38940-7ccc-11ed-b772-a790186e6aaa

 activity | timestamp | source | source_elapsed | client
----------------------------------------------------------------------------------------------------------------
 Execute CQL3 query | 2022-12-15 23:04:52.442000 | 172.17.0.2 | 0 | 127.0.0.1
 Parsing select * from factresults; [Native-Transport-Requests-1] | 2022-12-15 23:04:52.446000 | 172.17.0.2 | 3788 | 127.0.0.1
 Preparing statement [Native-Transport-Requests-1] | 2022-12-15 23:04:52.446001 | 172.17.0.2 | 4093 | 127.0.0.1
 Computing ranges to query [Native-Transport-Requests-1] | 2022-12-15 23:04:52.446002 | 172.17.0.2 | 4500 | 127.0.0.1
 Submitting range requests on 33 ranges with a concurrency of 14 (7.2 rows per range expected) [Native-Transport-Requests-1] | 2022-12-15 23:04:52.447000 | 172.17.0.2 | 4900 | 127.0.0.1
 Submitted 1 concurrent range requests [Native-Transport-Requests-1] | 2022-12-15 23:04:52.448000 | 172.17.0.2 | 5957 | 127.0.0.1
 Executing seq scan across 1 sstables for (min(-9223372036854775808), min(-9223372036854775808)] [ReadStage-3] | 2022-12-15 23:04:52.448001 | 172.17.0.2 | 6198 | 127.0.0.1
 Read 7 live rows and 0 tombstone cells [ReadStage-3] | 2022-12-15 23:04:52.449000 | 172.17.0.2 | 7129 | 127.0.0.1
 Request complete | 2022-12-15 23:04:52.450091 | 172.17.0.2 | 8091 | 127.0.0.1
```

Getting the whole tables took 8091 ms

b. Query of non-primary index (without index)

```
cqlsh:advanceddb> select * from factresults where prize=8000;

 player_sk | p_name | p_sname | prize | year
-----------+--------+---------+-------+------
        10 | Martha |    Ross |  8000 | 2014

(1 rows)

Tracing session: e8491670-7ccc-11ed-b772-a790186e6aaa

 activity | timestamp | source | source_elapsed | client
----------------------------------------------------------------------------------------------------------------
 Execute CQL3 query | 2022-12-15 23:05:03.063000 | 172.17.0.2 | 0 | 127.0.0.1
 Parsing select * from factresults where prize=8000; [Native-Transport-Requests-1] | 2022-12-15 23:05:03.063001 | 172.17.0.2 | 206 | 127.0.0.1
 Preparing statement [Native-Transport-Requests-1] | 2022-12-15 23:05:03.063002 | 172.17.0.2 | 326 | 127.0.0.1
 Index mean cardinalities are prize_amount:1. Scanning with prize_amount. [Native-Transport-Requests-1] | 2022-12-15 23:05:03.064000 | 172.17.0.2 | 1251 | 127.0.0.1
 Computing ranges to query [Native-Transport-Requests-1] | 2022-12-15 23:05:03.064001 | 172.17.0.2 | 1451 | 127.0.0.1
 Submitting range requests on 33 ranges with a concurrency of 33 (0.028125 rows per range expected) [Native-Transport-Requests-1] | 2022-12-15 23:05:03.065000 | 172.17.0.2 | 1789 | 127.0.0.1
 Enqueuing request to Full(/172.17.0.3:7000,(8933257125127335943,-9094809265671526113]) [Native-Transport-Requests-1] | 2022-12-15 23:05:03.066000 | 172.17.0.2 | 3039 | 127.0.0.1
 Submitted 1 concurrent range requests [Native-Transport-Requests-1] | 2022-12-15 23:05:03.071000 | 172.17.0.2 | 8508 | 127.0.0.1
 Sending RANGE_REQ message to /172.17.0.3:7000 message size 151 bytes [Messaging-EventLoop-3-2] | 2022-12-15 23:05:03.072000 | 172.17.0.2 | 8732 | 127.0.0.1
 RANGE_REQ message received from /172.17.0.2:7000 [Messaging-EventLoop-3-5] | 2022-12-15 23:05:03.078000 | 172.17.0.3 | 367 | 127.0.0.1
 Executing read on advanceddb.factresults using index prize_amount [ReadStage-2] | 2022-12-15 23:05:03.085000 | 172.17.0.3 | 7620 | 127.0.0.1
 Executing single-partition query on factresults.prize_amount [ReadStage-2] | 2022-12-15 23:05:03.085001 | 172.17.0.3 | 8022 | 127.0.0.1
 Acquiring sstable references [ReadStage-2] | 2022-12-15 23:05:03.085002 | 172.17.0.3 | 8151 | 127.0.0.1
 Skipped 0/1 non-slice-intersecting sstables, included 0 due to tombstones [ReadStage-2] | 2022-12-15 23:05:03.086000 | 172.17.0.3 | 8396 | 127.0.0.1
 Partition index with 0 entries found for sstable 1 [ReadStage-2] | 2022-12-15 23:05:03.086001 | 172.17.0.3 | 8792 | 127.0.0.1
 Executing single-partition query on factresults [ReadStage-2] | 2022-12-15 23:05:03.088000 | 172.17.0.3 | 10741 | 127.0.0.1
 Acquiring sstable references [ReadStage-2] | 2022-12-15 23:05:03.088001 | 172.17.0.3 | 10901 | 127.0.0.1
 Merging memtable contents [ReadStage-2] | 2022-12-15 23:05:03.088002 | 172.17.0.3 | 10987 | 127.0.0.1
 Key cache hit for sstable 1 [ReadStage-2] | 2022-12-15 23:05:03.088003 | 172.17.0.3 | 11157 | 127.0.0.1
 Read 1 live rows and 0 tombstone cells [ReadStage-2] | 2022-12-15 23:05:03.092000 | 172.17.0.3 | 15038 | 127.0.0.1
 Merged data from memtables and 1 sstables [ReadStage-2] | 2022-12-15 23:05:03.092001 | 172.17.0.3 | 15177 | 127.0.0.1
 Enqueuing response to /172.17.0.2:7000 [ReadStage-2] | 2022-12-15 23:05:03.093000 | 172.17.0.3 | 15267 | 127.0.0.1
 Sending RANGE_RSP message to cassandra/172.17.0.2:7000 message size 85 bytes [Messaging-EventLoop-3-1] | 2022-12-15 23:05:03.093001 | 172.17.0.3 | 15634 | 127.0.0.1
 RANGE_RSP message received from /172.17.0.3:7000 [Messaging-EventLoop-3-5] | 2022-12-15 23:05:03.094000 | 172.17.0.2 | 31503 | 127.0.0.1
 Processing response from /172.17.0.3:7000 [RequestResponseStage-3] | 2022-12-15 23:05:03.095000 | 172.17.0.2 | 32149 | 127.0.0.1
 Request complete | 2022-12-15 23:05:03.095780 | 172.17.0.2 | 32780 | 127.0.0.1
```

Much longer to execute, 32780 ms. Checks all 33 ranges rather then just the prize column.

c. Adding a secondary index to golf data

```
cqlsh:advanceddb> select * from factresults where prize=8000 ALLOW FILTERING;

 player_sk | p_name | p_sname | prize | year
-----------+--------+---------+-------+------
        10 | Martha |    Ross |  8000 | 2014

(1 rows)

Tracing session: ecd184c0-7ccc-11ed-b772-a790186e6aaa

 activity | timestamp | source | source_elapsed | client
----------------------------------------------------------------------------------------------------------------
 Execute CQL3 query | 2022-12-15 23:05:10.668000 | 172.17.0.2 | 0 | 127.0.0.1
 Parsing select * from factresults where prize=8000 ALLOW FILTERING; [Native-Transport-Requests-1] | 2022-12-15 23:05:10.668001 | 172.17.0.2 | 203 | 127.0.0.1
 Preparing statement [Native-Transport-Requests-1] | 2022-12-15 23:05:10.668002 | 172.17.0.2 | 352 | 127.0.0.1
 Index mean cardinalities are prize_amount:1. Scanning with prize_amount. [Native-Transport-Requests-1] | 2022-12-15 23:05:10.669000 | 172.17.0.2 | 617 | 127.0.0.1
 Computing ranges to query [Native-Transport-Requests-1] | 2022-12-15 23:05:10.669001 | 172.17.0.2 | 718 | 127.0.0.1
 Submitting range requests on 33 ranges with a concurrency of 33 (0.028125 rows per range expected) [Native-Transport-Requests-1] | 2022-12-15 23:05:10.669002 | 172.17.0.2 | 956 | 127.0.0.1
 Enqueuing request to Full(/172.17.0.3:7000,(8933257125127335943,-9094809265671526113]) [Native-Transport-Requests-1] | 2022-12-15 23:05:10.670000 | 172.17.0.2 | 1884 | 127.0.0.1
 Submitted 1 concurrent range requests [Native-Transport-Requests-1] | 2022-12-15 23:05:10.670001 | 172.17.0.2 | 2272 | 127.0.0.1
 RANGE_REQ message received from /172.17.0.2:7000 [Messaging-EventLoop-3-5] | 2022-12-15 23:05:10.671000 | 172.17.0.3 | 81 | 127.0.0.1
 Sending RANGE_REQ message to /172.17.0.3:7000 message size 151 bytes [Messaging-EventLoop-3-2] | 2022-12-15 23:05:10.671000 | 172.17.0.2 | 2456 | 127.0.0.1
 Executing read on advanceddb.factresults using index prize_amount [ReadStage-1] | 2022-12-15 23:05:10.672000 | 172.17.0.3 | 566 | 127.0.0.1
 Executing single-partition query on factresults.prize_amount [ReadStage-1] | 2022-12-15 23:05:10.672001 | 172.17.0.3 | 809 | 127.0.0.1
 Acquiring sstable references [ReadStage-1] | 2022-12-15 23:05:10.672002 | 172.17.0.3 | 1025 | 127.0.0.1
 Skipped 0/1 non-slice-intersecting sstables, included 0 due to tombstones [ReadStage-1] | 2022-12-15 23:05:10.673000 | 172.17.0.3 | 1288 | 127.0.0.1
 Key cache hit for sstable 1 [ReadStage-1] | 2022-12-15 23:05:10.673001 | 172.17.0.3 | 1481 | 127.0.0.1
 Executing single-partition query on factresults [ReadStage-1] | 2022-12-15 23:05:10.673002 | 172.17.0.3 | 1905 | 127.0.0.1
 Acquiring sstable references [ReadStage-1] | 2022-12-15 23:05:10.673003 | 172.17.0.3 | 2021 | 127.0.0.1
 Merging memtable contents [ReadStage-1] | 2022-12-15 23:05:10.673004 | 172.17.0.3 | 2112 | 127.0.0.1
 Key cache hit for sstable 1 [ReadStage-1] | 2022-12-15 23:05:10.674000 | 172.17.0.3 | 2287 | 127.0.0.1
 Read 1 live rows and 0 tombstone cells [ReadStage-1] | 2022-12-15 23:05:10.674001 | 172.17.0.3 | 2660 | 127.0.0.1
 Merged data from memtables and 1 sstables [ReadStage-1] | 2022-12-15 23:05:10.674002 | 172.17.0.3 | 2825 | 127.0.0.1
 Enqueuing response to /172.17.0.2:7000 [ReadStage-1] | 2022-12-15 23:05:10.674003 | 172.17.0.3 | 2996 | 127.0.0.1
 Sending RANGE_RSP message to cassandra/172.17.0.2:7000 message size 85 bytes [Messaging-EventLoop-3-1] | 2022-12-15 23:05:10.675000 | 172.17.0.3 | 3377 | 127.0.0.1
 RANGE_RSP message received from /172.17.0.3:7000 [Messaging-EventLoop-3-5] | 2022-12-15 23:05:10.676000 | 172.17.0.2 | 8192 | 127.0.0.1
 Processing response from /172.17.0.3:7000 [RequestResponseStage-2] | 2022-12-15 23:05:10.677000 | 172.17.0.2 | 8651 | 127.0.0.1
 Request complete | 2022-12-15 23:05:10.678457 | 172.17.0.2 | 10457 | 127.0.0.1
```

Much faster then before the index was added only 10457 ms.

```
Table (index): factresults.prize_amount
SSTable count: 1
Old SSTable count: 0
Space used (live): 5416
Space used (total): 5416
Space used by snapshots (total): 0
Off heap memory used (total): 40
SSTable Compression Ratio: 0.6737804878048781
Number of partitions (estimate): 7
Memtable cell count: 0
Memtable data size: 0
Memtable off heap memory used: 0
Memtable switch count: 1
Local read count: 0
Local read latency: NaN ms
Local write count: 7
Local write latency: NaN ms
Pending flushes: 0
Percent repaired: 0.0
Bytes repaired: 0.000KiB
Bytes unrepaired: 0.320KiB
Bytes pending repair: 0.000KiB
Bloom filter false positives: 0
Bloom filter false ratio: 0.00000
Bloom filter space used: 24
Bloom filter off heap memory used: 16
Index summary off heap memory used: 16
Compression metadata off heap memory used: 8
Compacted partition minimum bytes: 43
Compacted partition maximum bytes: 50
Compacted partition mean bytes: 50
Average live cells per slice (last five minutes): NaN
Maximum live cells per slice (last five minutes): 0
Average tombstones per slice (last five minutes): NaN
Maximum tombstones per slice (last five minutes): 0
Dropped Mutations: 0
Droppable tombstone ratio: 0.00000
```

Table index now shows in stablestats. Takes up 5416 bytes so more space is needed for each index the database has.

d. Adding an SASI index to golf data to facilitate pattern matching

```
cqlsh:advanceddb> tracing on;
Now Tracing is enabled
cqlsh:advanceddb> SELECT * FROM factresults WHERE p_name like 'M%';

 player_sk | p_name | p_sname | prize | year
-----------+--------+---------+-------+------
        10 | Martha |    Ross |  8000 | 2014
         6 |  Mario |  Baggio |  6000 | 2014

(2 rows)

Tracing session: f23a4750-7cd4-11ed-9559-4da1364bff5b

 activity                                                                                                                 | timestamp                  | source     | source_elapsed | client
--------------------------------------------------------------------------------------------------------------------------+----------------------------+------------+----------------+-----------
                                                                                                       Execute CQL3 query | 2022-12-16 00:02:35.718000 | 172.17.0.2 |              0 | 127.0.0.1
                                  Parsing SELECT * FROM factresults WHERE p_name like 'M%'; [Native-Transport-Requests-1] | 2022-12-16 00:02:35.721000 | 172.17.0.2 |           2903 | 127.0.0.1
                                                                        Preparing statement [Native-Transport-Requests-1] | 2022-12-16 00:02:35.722000 | 172.17.0.2 |           3818 | 127.0.0.1
                  Index mean cardinalities are sasi_p_name:-9223372036854775808. Scanning with sasi_p_name. [Native-Transport-Requests-1] | 2022-12-16 00:02:35.723000 | 172.17.0.2 |           5298 | 127.0.0.1
                                                                    Computing ranges to query [Native-Transport-Requests-1] | 2022-12-16 00:02:35.724000 | 172.17.0.2 |           5666 | 127.0.0.1
 Submitting range requests on 33 ranges with a concurrency of 1 (-2.59407332E17 rows per range expected) [Native-Transport-Requests-1] | 2022-12-16 00:02:35.724001 | 172.17.0.2 |           6041 | 127.0.0.1
             Enqueuing request to Full(/172.17.0.3:7000,(8933257125127335943,-9094809265671526113]) [Native-Transport-Requests-1] | 2022-12-16 00:02:35.729000 | 172.17.0.2 |          10455 | 127.0.0.1
                                                     Submitted 1 concurrent range requests [Native-Transport-Requests-1] | 2022-12-16 00:02:35.735000 | 172.17.0.2 |          16436 | 127.0.0.1
                                 Sending RANGE_REQ message to /172.17.0.3:7000 message size 148 bytes [Messaging-EventLoop-3-2] | 2022-12-16 00:02:35.735001 | 172.17.0.2 |          16543 | 127.0.0.1
                                                 RANGE_REQ message received from /172.17.0.2:7000 [Messaging-EventLoop-3-5] | 2022-12-16 00:02:35.743000 | 172.17.0.3 |            336 | 127.0.0.1
                                              Executing read on advanceddb.factresults using index sasi_p_name [ReadStage-1] | 2022-12-16 00:02:35.747000 | 172.17.0.3 |           4201 | 127.0.0.1
                                                                Executing single-partition query on factresults [ReadStage-1] | 2022-12-16 00:02:35.777000 | 172.17.0.3 |          33957 | 127.0.0.1
                                                                                Acquiring sstable references [ReadStage-1] | 2022-12-16 00:02:35.777001 | 172.17.0.3 |          34284 | 127.0.0.1
                                       Skipped 0/1 non-slice-intersecting sstables, included 0 due to tombstones [ReadStage-1] | 2022-12-16 00:02:35.777002 | 172.17.0.3 |          34497 | 127.0.0.1
                                                                                 Key cache hit for sstable 1 [ReadStage-1] | 2022-12-16 00:02:35.778000 | 172.17.0.3 |          34661 | 127.0.0.1
                                                                   Merged data from memtables and 1 sstables [ReadStage-1] | 2022-12-16 00:02:35.779000 | 172.17.0.3 |          36000 | 127.0.0.1
                                                                Executing single-partition query on factresults [ReadStage-1] | 2022-12-16 00:02:35.780000 | 172.17.0.3 |          36718 | 127.0.0.1
                                                                                Acquiring sstable references [ReadStage-1] | 2022-12-16 00:02:35.780001 | 172.17.0.3 |          37031 | 127.0.0.1
                                       Skipped 0/1 non-slice-intersecting sstables, included 0 due to tombstones [ReadStage-1] | 2022-12-16 00:02:35.780002 | 172.17.0.3 |          37313 | 127.0.0.1
                                                                                 Key cache hit for sstable 1 [ReadStage-1] | 2022-12-16 00:02:35.781000 | 172.17.0.3 |          37538 | 127.0.0.1
                                                                   Merged data from memtables and 1 sstables [ReadStage-1] | 2022-12-16 00:02:35.781001 | 172.17.0.3 |          37971 | 127.0.0.1
                                                                     Read 2 live rows and 0 tombstone cells [ReadStage-1] | 2022-12-16 00:02:35.781002 | 172.17.0.3 |          38339 | 127.0.0.1
                                                                     Enqueuing response to /172.17.0.2:7000 [ReadStage-1] | 2022-12-16 00:02:35.783000 | 172.17.0.3 |          39625 | 127.0.0.1
                         Sending RANGE_RSP message to cassandra/172.17.0.2:7000 message size 128 bytes [Messaging-EventLoop-3-1] | 2022-12-16 00:02:35.783001 | 172.17.0.3 |          40373 | 127.0.0.1
                                                 RANGE_RSP message received from /172.17.0.3:7000 [Messaging-EventLoop-3-8] | 2022-12-16 00:02:35.784000 | 172.17.0.2 |          66241 | 127.0.0.1
                                                     Processing response from /172.17.0.3:7000 [RequestResponseStage-2] | 2022-12-16 00:02:35.785000 | 172.17.0.2 |          66717 | 127.0.0.1
                                                                                                         Request complete | 2022-12-16 00:02:35.785585 | 172.17.0.2 |          67585 | 127.0.0.1
```

This has allowed us to fins everyone with a name starting with M which would otherwise have been very difficult. It does however take significant amounts of time compared to other searches at 67585ms.

This method does not create a new table index like the normal manual indexing does. This saves on space but still allows like searches.

4. Data including collection data type

```
cqlsh:advanceddb> insert into jobhist(empid, jobsheld) values (3, {'first job':'Manager Dept X', 'Current job':'General Manager'});
cqlsh:advanceddb> CREATE INDEX jobs_idx ON jobhist (jobsheld);
cqlsh:advanceddb> select * from jobhist where jobsheld CONTAINS 'Cashier' ALLOW FILTERING;

 empid | jobsheld
-------+-----------------------------------------------------
     1 | {'Current job': 'Supervisor', 'first job': 'Cashier'}

(1 rows)
cqlsh:advanceddb> tracing on
Now Tracing is enabled
cqlsh:advanceddb> select * from jobhist where jobsheld CONTAINS 'Cashier' ALLOW FILTERING;

 empid | jobsheld
-------+-----------------------------------------------------
     1 | {'Current job': 'Supervisor', 'first job': 'Cashier'}

(1 rows)

Tracing session: 537801e0-7cd7-11ed-95a0-03aab981e901

 activity                                                                                                                   | timestamp                  | source     | source_elapsed | client
----------------------------------------------------------------------------------------------------------------------------+----------------------------+------------+----------------+-----------
                                                                                                         Execute CQL3 query | 2022-12-16 00:19:37.854000 | 172.17.0.3 |              0 | 127.0.0.1
                Parsing select * from jobhist where jobsheld CONTAINS 'Cashier' ALLOW FILTERING; [Native-Transport-Requests-1] | 2022-12-16 00:19:37.855000 | 172.17.0.3 |           1011 | 127.0.0.1
                                                                          Preparing statement [Native-Transport-Requests-1] | 2022-12-16 00:19:37.856000 | 172.17.0.3 |           1407 | 127.0.0.1
                                  Index mean cardinalities are jobs_idx:1. Scanning with jobs_idx. [Native-Transport-Requests-1] | 2022-12-16 00:19:37.857000 | 172.17.0.3 |           2738 | 127.0.0.1
                                                                    Computing ranges to query [Native-Transport-Requests-1] | 2022-12-16 00:19:37.857001 | 172.17.0.3 |           3127 | 127.0.0.1
 Submitting range requests on 33 ranges with a concurrency of 33 (0.028125 rows per range expected) [Native-Transport-Requests-1] | 2022-12-16 00:19:37.858000 | 172.17.0.3 |           3764 | 127.0.0.1
                                                         Submitted 1 concurrent range requests [Native-Transport-Requests-1] | 2022-12-16 00:19:37.862000 | 172.17.0.3 |           7680 | 127.0.0.1
                                                 Executing read on advanceddb.jobhist using index jobs_idx [ReadStage-2] | 2022-12-16 00:19:37.866000 | 172.17.0.3 |          11983 | 127.0.0.1
                                                     Executing single-partition query on jobhist.jobs_idx [ReadStage-2] | 2022-12-16 00:19:37.866001 | 172.17.0.3 |          12267 | 127.0.0.1
                                                                       Acquiring sstable references [ReadStage-2] | 2022-12-16 00:19:37.867000 | 172.17.0.3 |          12378 | 127.0.0.1
                                  Skipped 0/1 non-slice-intersecting sstables, included 0 due to tombstones [ReadStage-2] | 2022-12-16 00:19:37.867001 | 172.17.0.3 |          12547 | 127.0.0.1
                                                   Partition index with 0 entries found for sstable 1 [ReadStage-2] | 2022-12-16 00:19:37.867002 | 172.17.0.3 |          12880 | 127.0.0.1
                                                          Executing single-partition query on jobhist [ReadStage-2] | 2022-12-16 00:19:37.870000 | 172.17.0.3 |          15317 | 127.0.0.1
                                                                       Acquiring sstable references [ReadStage-2] | 2022-12-16 00:19:37.870001 | 172.17.0.3 |          15571 | 127.0.0.1
                                                                        Key cache hit for sstable 1 [ReadStage-2] | 2022-12-16 00:19:37.870002 | 172.17.0.3 |          15834 | 127.0.0.1
                                  Skipped 0/1 non-slice-intersecting sstables, included 0 due to tombstones [ReadStage-2] | 2022-12-16 00:19:37.870003 | 172.17.0.3 |          16014 | 127.0.0.1
                                                            Merged data from memtables and 1 sstables [ReadStage-2] | 2022-12-16 00:19:37.871000 | 172.17.0.3 |          16522 | 127.0.0.1
                                                              Read 1 live rows and 0 tombstone cells [ReadStage-2] | 2022-12-16 00:19:37.872000 | 172.17.0.3 |          17855 | 127.0.0.1
                                                            Merged data from memtables and 1 sstables [ReadStage-2] | 2022-12-16 00:19:37.872001 | 172.17.0.3 |          18104 | 127.0.0.1
                                                                                                       Request complete | 2022-12-16 00:19:37.873148 | 172.17.0.3 |          19148 | 127.0.0.1
```

This allows us to search more effectively with only 19148ms for the full result.

```
Table (index): jobhist.jobs_idx
SSTable count: 1
Old SSTable count: 0
Space used (live): 5390
Space used (total): 5390
Space used by snapshots (total): 0
Off heap memory used (total): 35
SSTable Compression Ratio: 0.6194029850746269
Number of partitions (estimate): 4
Memtable cell count: 0
Memtable data size: 0
Memtable off heap memory used: 0
Memtable switch count: 1
Local read count: 0
Local read latency: NaN ms
Local write count: 6
Local write latency: NaN ms
Pending flushes: 0
Percent repaired: 0.0
Bytes repaired: 0.000KiB
Bytes unrepaired: 0.262KiB
Bytes pending repair: 0.000KiB
Bloom filter false positives: 0
Bloom filter false ratio: 0.00000
Bloom filter space used: 16
Bloom filter off heap memory used: 8
Index summary off heap memory used: 19
Compression metadata off heap memory used: 8
Compacted partition minimum bytes: 43
Compacted partition maximum bytes: 86
Compacted partition mean bytes: 71
Average live cells per slice (last five minutes): NaN
Maximum live cells per slice (last five minutes): 0
Average tombstones per slice (last five minutes): NaN
Maximum tombstones per slice (last five minutes): 0
Dropped Mutations: 0
Droppable tombstone ratio: 0.00000
```

This method also add a new index table which takes up more space. For a small table like this the index takes up almost as much space as it though it does improve performance.