Couchbase

Architecture and Administration Basics

N1QL & FTS Labs

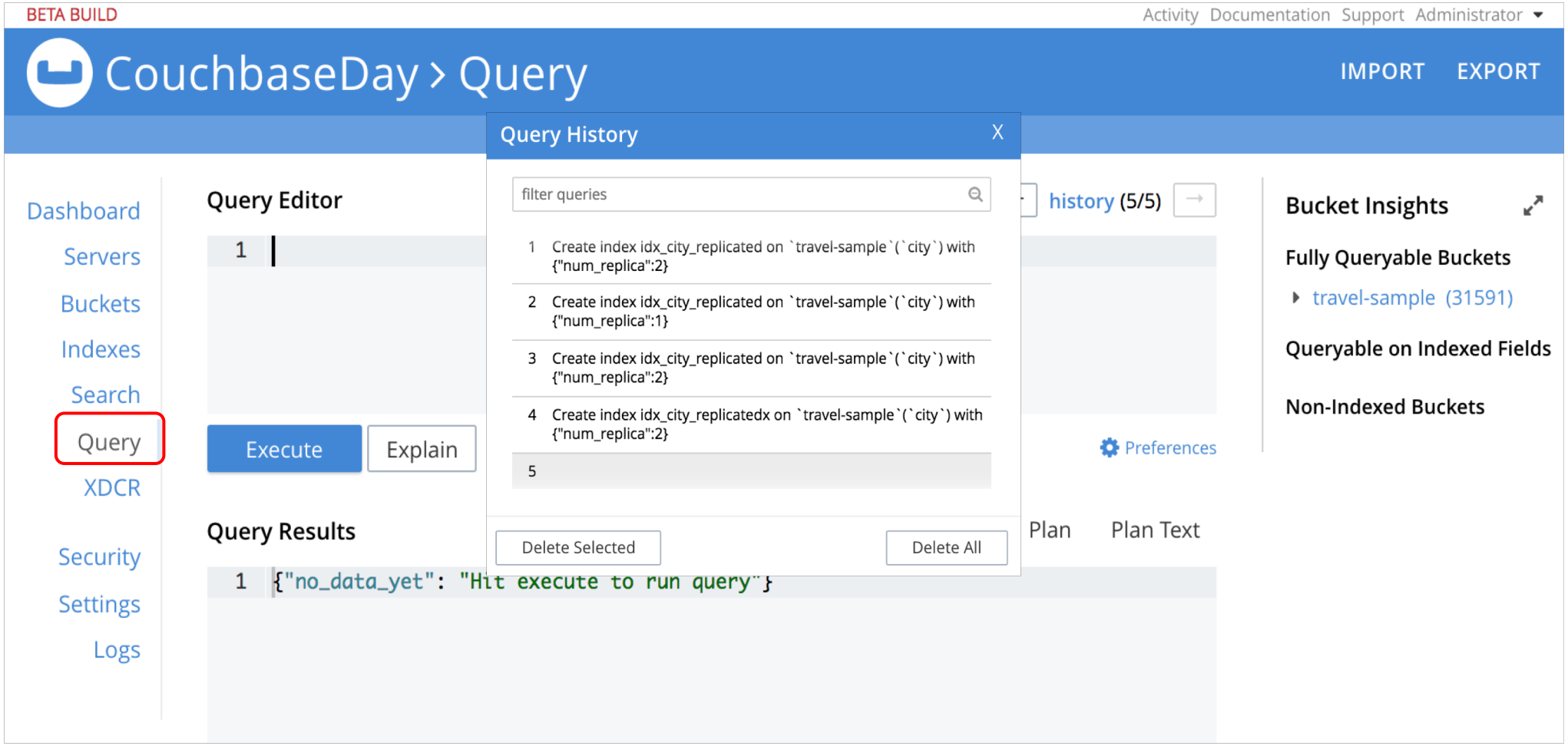
1

Lab 1-N1QL Basics

Lab Objectives

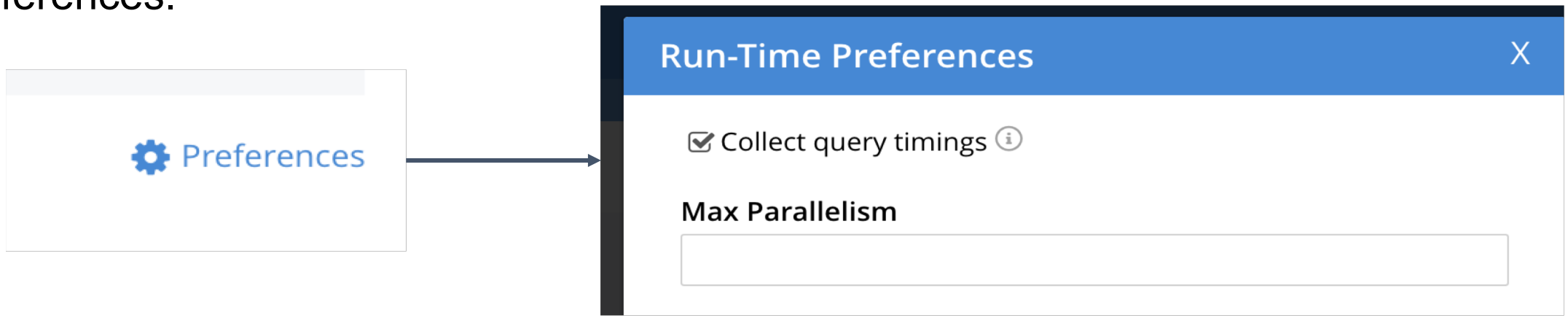
- Identify key parts of the query bench
- Query execution from the terminal
- Understand query performance and explain plans
- Review impact of indexes on query performance
- Exploring various N1QL SELECT features

Query Workbench



Exercise – Run-Time preferences

1. Open the Run-Time Preferences window, select “Collect Query Timings” and save your preferences.

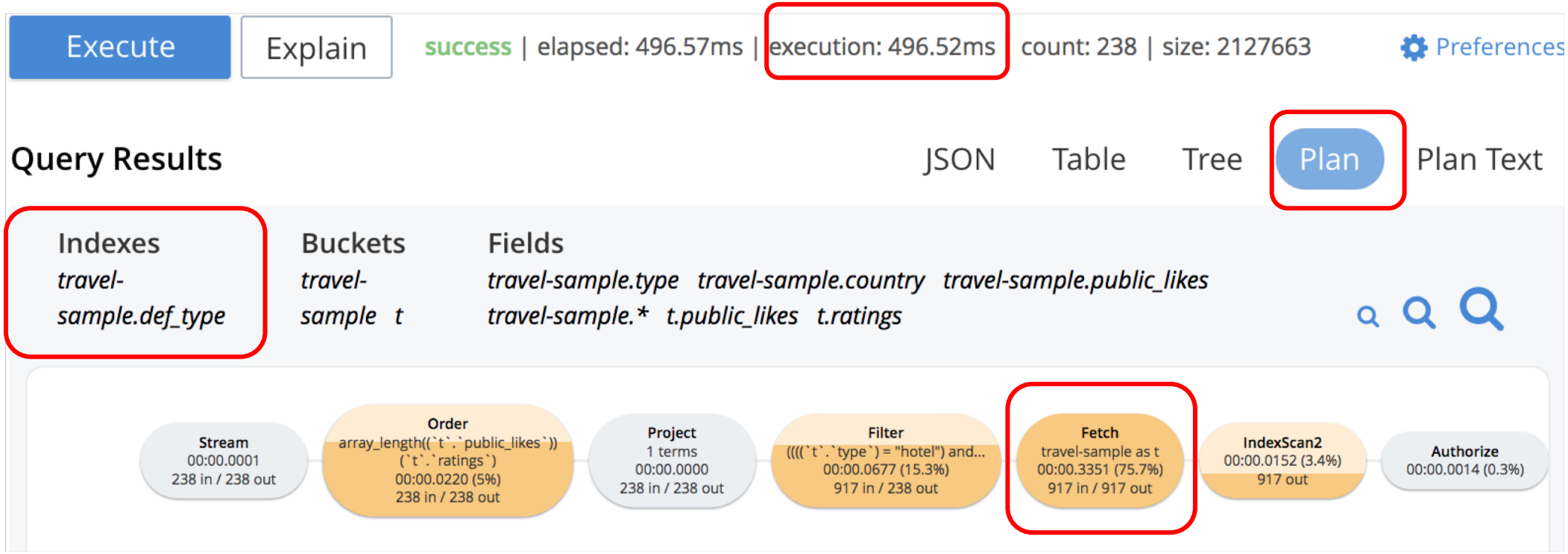


1. Open the query workbench and execute the following statement:

```
SELECT *
FROM `travel-sample` t
WHERE type = "hotel"
AND country = "United Kingdom"
AND ARRAY_LENGTH(public_likes) > 3
ORDER BY ARRAY_LENGTH(public_likes), ratings DESC
```

Exercise – Query visual plan

1. Navigate to visual query plan
2. What is the execution time ?
3. What indexes are used ?
4. Where does the query spend most of the time ?



N1QL – Simple SELECT

- Run a basic query

```
SELECT * FROM `travel-sample` WHERE name = 'Atifly'
```

- Find out what is the key of the returned object (use META().id)
- Write a query that returns the same object using USE KEYS
- Observe the difference in query execution time


```
[
    {
        "travel-sample": {
            "callsign": "atifly",
            "country": "United States",
            "iata": "A1",
            "icao": "A1F",
            "id": 10226,
            "name": "Atifly",
            "type": "airline"
        }
]
```

Impact of Indexes for Query Execution

- Try running the original query again:

```
SELECT * FROM `travel-sample` WHERE name = 'Atifly';

EXPLAIN SELECT * FROM `travel-sample` WHERE name = 'Atifly';
```

- Now, lets create an index on the name field:

```
CREATE INDEX idx_airline_name ON `travel-sample`(name);
```

- Now rerun the query:

```
SELECT * FROM `travel-sample` WHERE name = 'Atifly';

EXPLAIN SELECT * FROM `travel-sample` WHERE name = 'Atifly';
```

- Did the indexed field reduced the query time by an order of magnitude?

N1QL – JOIN

- Run a query with a JOIN

```
SELECT air.name, route.sourceairport,
       route.destinationairport
FROM `travel-sample` AS route
     JOIN `travel-sample` AS air
     ON KEYS route.airlineid
LIMIT 2;
```

- **Optional:** Try out changing to `LEFT JOIN`. Why may you get empty objects? Now try adding filter on `WHERE route.type = "route"`


```
[
    {
      "destinationairport": "ATL",
      "name": "Air France",
      "sourceairport": "XNA"
    },
    {
      "destinationairport": "CDG",
      "name": "Air France",
      "sourceairport": "VIE"
    }
]
```

N1QL - Children in the Tree

- Run a basic query with nested Arrays

```
SELECT *
FROM `travel-sample` AS route
WHERE ANY child IN route.schedule SATISFIES
child.flight = 'AF443' END LIMIT 2;
```

- Try to create the following array index and check how it improves query performance

```
CREATE INDEX idx_route_flights ON `travel-
sample` (DISTINCT ARRAY child.flight FOR
child IN schedule END);
```

- **Optional:** Modify the query to select routes that contain flights after 23:00:00 and create a suitable index


```
[
    {
      "route": {
        "airline": "AF",
        "airlineid": "airline_137",
        "destinationairport": "MRS",
        "distance": 2881.617376098415,
        "equipment": "320",
        "id": 10000,
        "schedule": [
          {
            "day": 0,
            "flight": "AF443",
            "utc": "20:59:00"
          },
        .....
```

N1QL Queries over the Terminal

- SSH into server running the query service (using PuTTY or Mac Terminal):
  - **`ssh root@192.168.61.101`**
  - **`couchbase123!`**
- Start the Couchbase query shell and try to run a query
  - **`/opt/couchbase/bin/cbq --user Administrator --password password`**
  - **`SELECT * FROM `travel-sample` WHERE name = 'Atifly';`**

N1QL Query Service Over REST

- The Query Service (port 8093) responds to GET requests
- Try this from a terminal:
  - `curl -v http://192.168.61.101:8093/query/service -d 'statement=SELECT name FROM system:keyspaces&creds=[{"user": "Administrator", "pass": "password"}]'`
- The Query service always returns timing statistics for how long it took to retrieve the information, and to send it to you.
- For a more detailed look at what the query service is doing try passing the same query, with “explain”:
  - `curl -v http://192.168.61.101:8093/query/service -d 'statement=EXPLAIN SELECT name FROM system:keyspaces&creds=[{"user": "Administrator", "pass": "password"}]'`

2 | Lab 2: Index Optimization

Lab Objectives

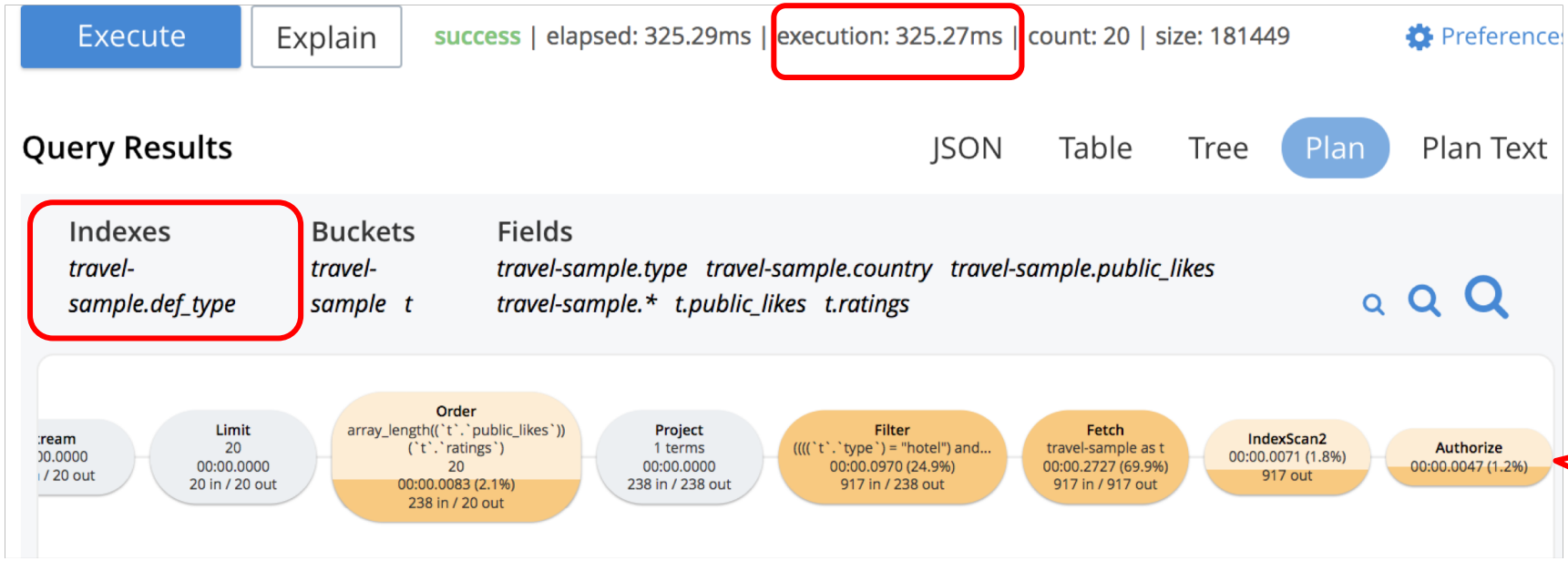
- Exploring different types of indexes – composite, partial and covering – and their effect on performance
- Observe pagination pushdown into index

Initial Query Performance

Open the query workbench and execute the following statement:

```
SELECT * FROM `travel-sample` t
WHERE type = "hotel" AND country = "United Kingdom" AND ARRAY_LENGTH(public_likes) > 3
ORDER BY ARRAY_LENGTH(public_likes), ratings DESC
OFFSET 0
LIMIT 20;
```

What is the execution time? What indexes are used?



The index returns 917 results before the filtering

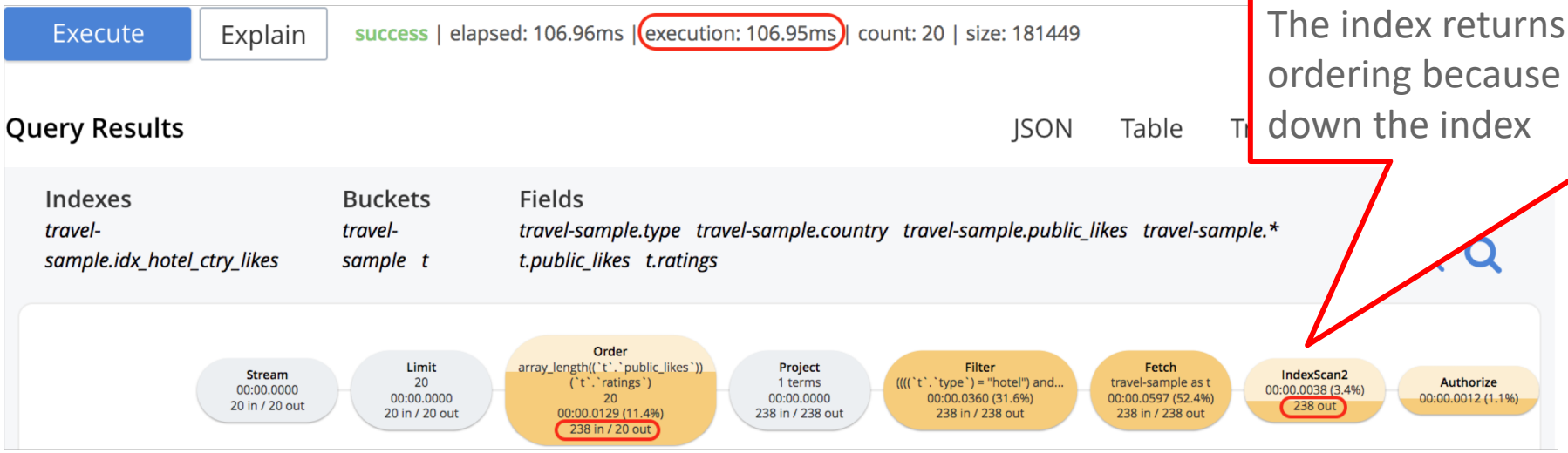
Using a More Suitable Composite Index

Open the query workbench and execute the following statements (one at a time)

```
CREATE INDEX idx_hotel_ctry_likes
ON `travel-sample`(country, ARRAY_LENGTH(public_likes))
WHERE type = "hotel";

SELECT * FROM `travel-sample` t WHERE type = "hotel" AND country = "United Kingdom" AND
ARRAY_LENGTH(public_likes) > 3
ORDER BY ARRAY_LENGTH(public_likes), ratings DESC
OFFSET 0
LIMIT 20;
```

Why is the execution time better? Can it be improved?



The index returns 238 results before the ordering because the DESC order is not pushed down the index

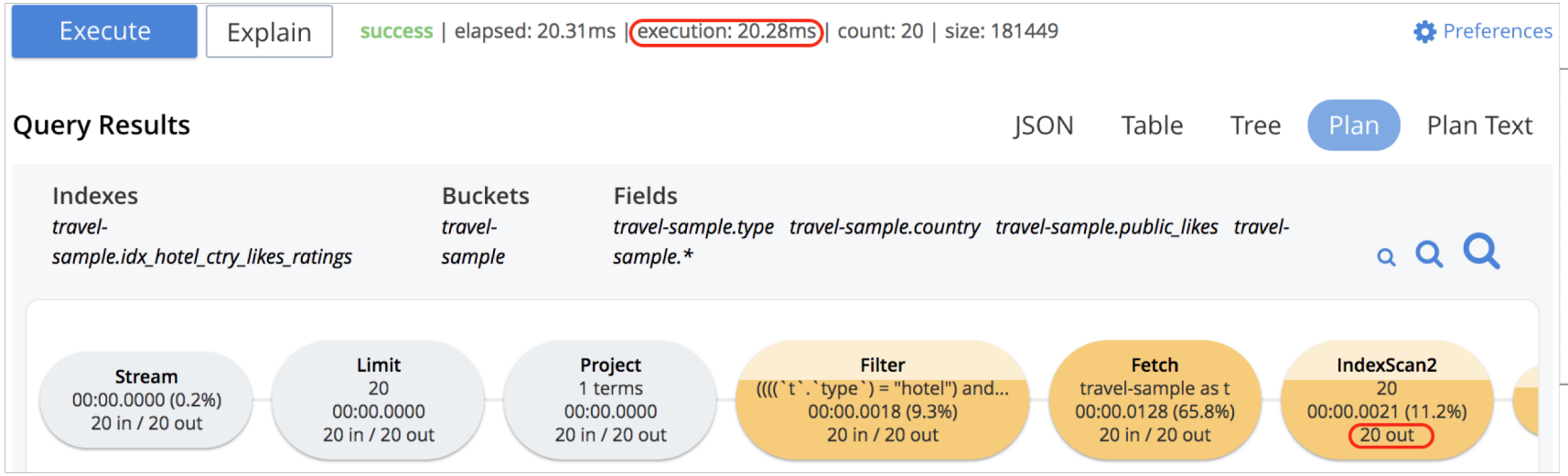
Using a Partial Index

Open the query workbench and execute the following statement (one at a time):

```
DROP INDEX `travel-sample`.idx_hotel_ctry_likes;

CREATE INDEX idx_hotel_ctry_likes_ratings
ON `travel-sample`(country, ARRAY_LENGTH(public_likes), ratings DESC)
WHERE type = "hotel";
```

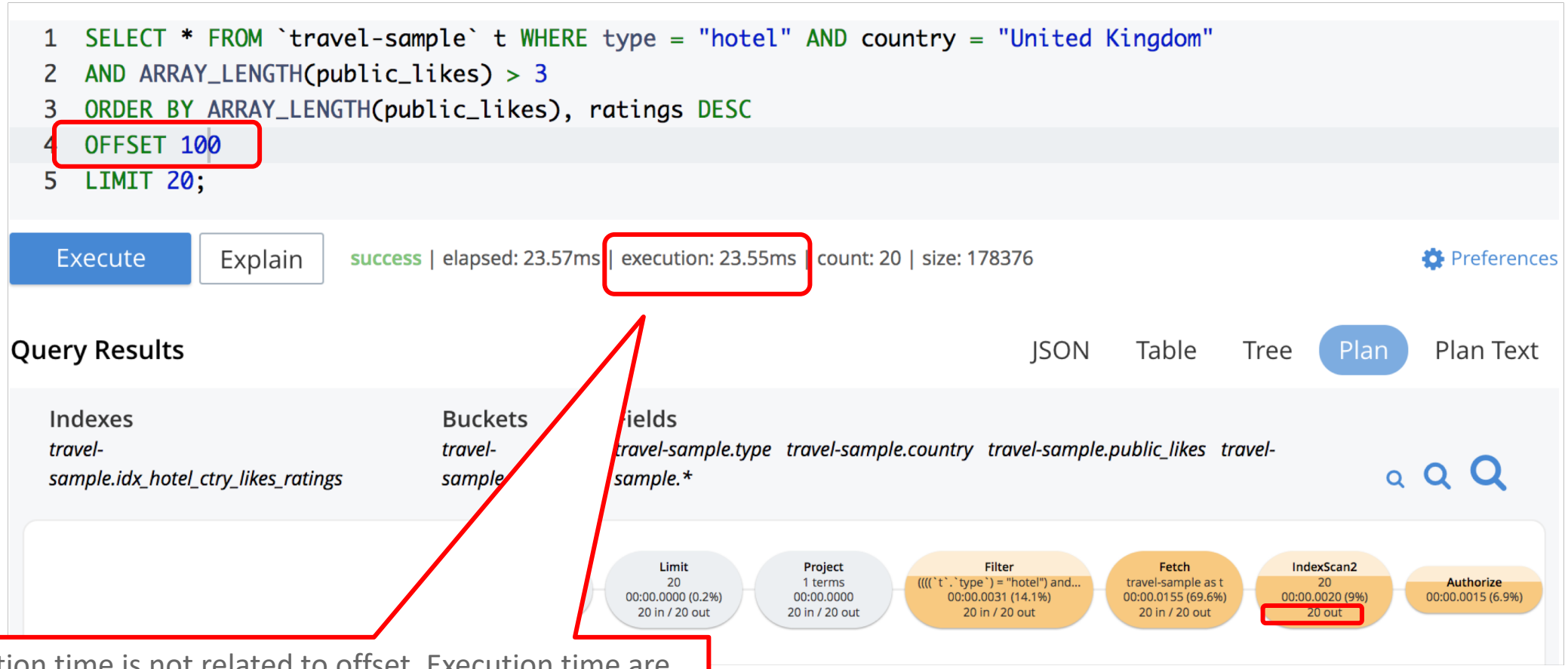
Rerun the previous query again. Why is the query execution time better?



Limit has been pushed down the index.

Offset & Limit Push Down to Index Scan

Rerun the previous query with different offsets (40, 100, 200) and compare the results.



Execution time is not related to offset. Execution time are the same (offset=0 or offset=100) and independent from the offset value because the offset has been pushed down.

Using a Covering Index

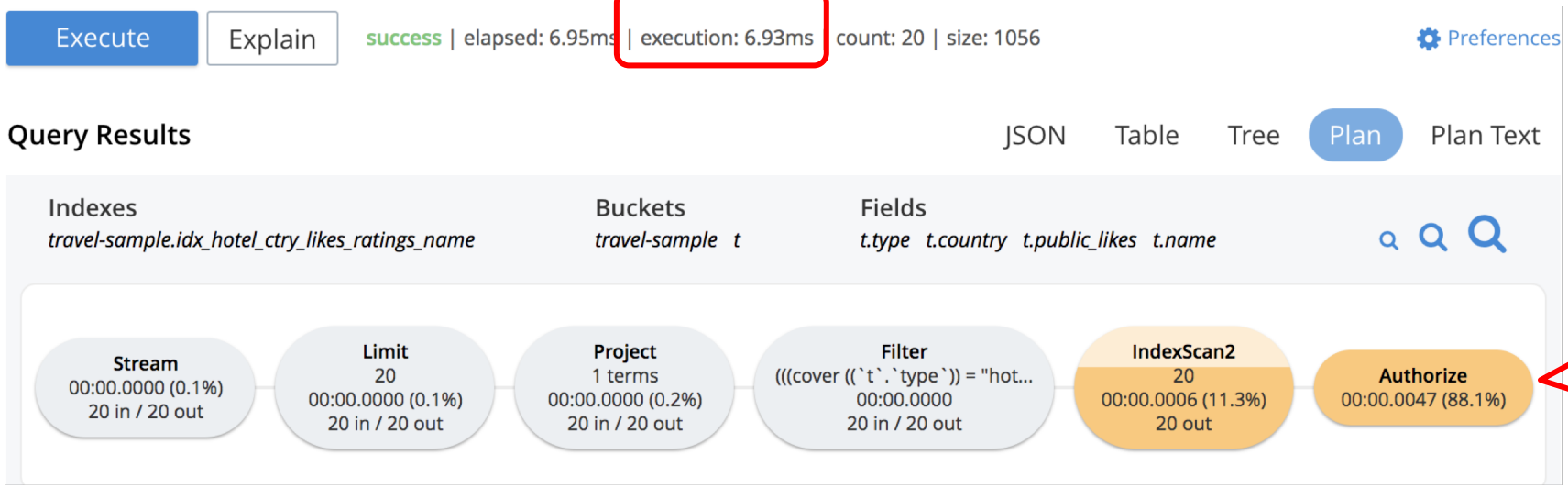
Execute the following statements (one at a time)

```
DROP INDEX `travel-sample`.idx_hotel_ctry_likes_ratings;

CREATE INDEX `idx_hotel_ctry_likes_ratings_name`
ON `travel-sample`(`country`,array_length(`public_likes`),`ratings` DESC, name)
WHERE (`type` = "hotel");

SELECT name FROM `travel-sample` t WHERE type = "hotel" AND country = "United Kingdom"
AND ARRAY_LENGTH(public_likes) > 3
ORDER BY ARRAY_LENGTH(public_likes), ratings DESC
OFFSET 0 LIMIT 20;
```

Why is the query so much faster now?



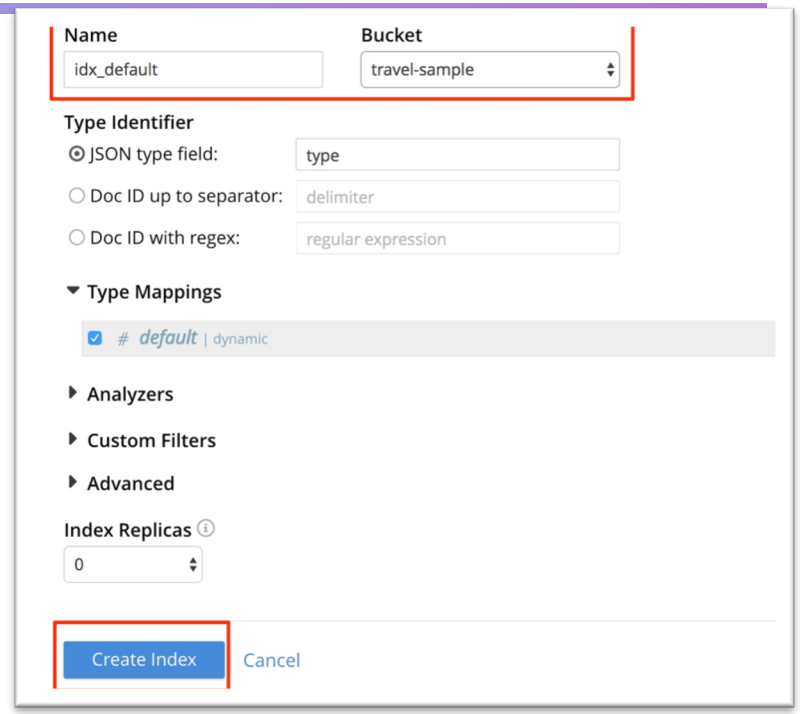
No fetching data because covering index

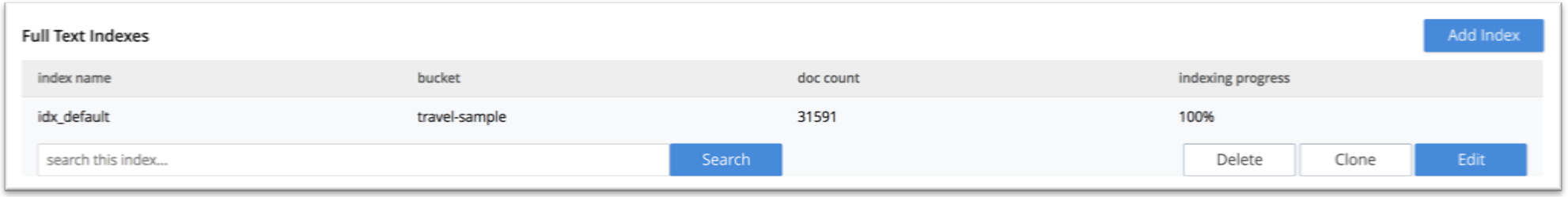
3 | Lab 3: FTS Basics

FTS: Create a default Index

Let's build the default Index on `travel-sample` bucket.

- Build a new default Index
  - Give index name "idx_default"
  - Select bucket "travel-sample"
  - Create Index
- Observe time to create default index. (~60s)
- Check the size on disk of the default index. (~ 915Mb)
- Search default index & review search results

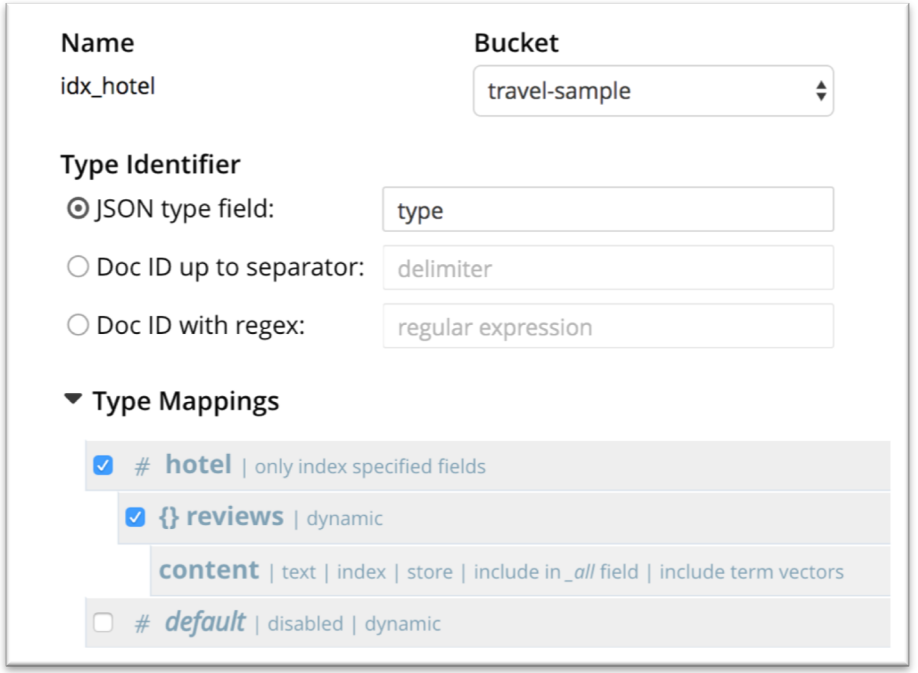




Note: Default index are not recommended in a production environment

FTS: Create a custom Index on type = hotel

Let's build a new Index on `travel-sample` bucket.



- Build a new Index
  - Give index name "idx_hotel"
  - Select bucket "travel-sample"
  - Add a Type mapping = hotel (only index specified fields)
  - Disable the default mapping.
  - Add a child mapping on reviews (array)
  - Add a field mapping on content
    (only index specified fields and store)
- Observe time to create default index. (~5s)
- Check the size on disk of the default index. (~ 79Mb)
- Search "friendly" in the UI with the hotel index & review search results

Bonus: Run the same search with the REST API. (you can find the curl command in the UI)