Case2 – COUNT Query Bottleneck in Pagination

Verification Evidence PDF

Test Conditions (Fixed)

case2_get_posts.yml

```yaml
config:
  target: "http://localhost:8008"
  phases:
    - duration: 120        # 2분
      arrivalRate: 4      # 초당 4명 시작(RPS를 올리기 위한 진입 부하)
  defaults:
    headers:
      Content-Type: "application/json"

scenarios:
  - name: "Case2 - GET /api/posts paging"
    flow:
      - get:
          url: "/api/posts?page=0&size=20&sort=id,desc"
          expect:
            - statusCode: 200
```

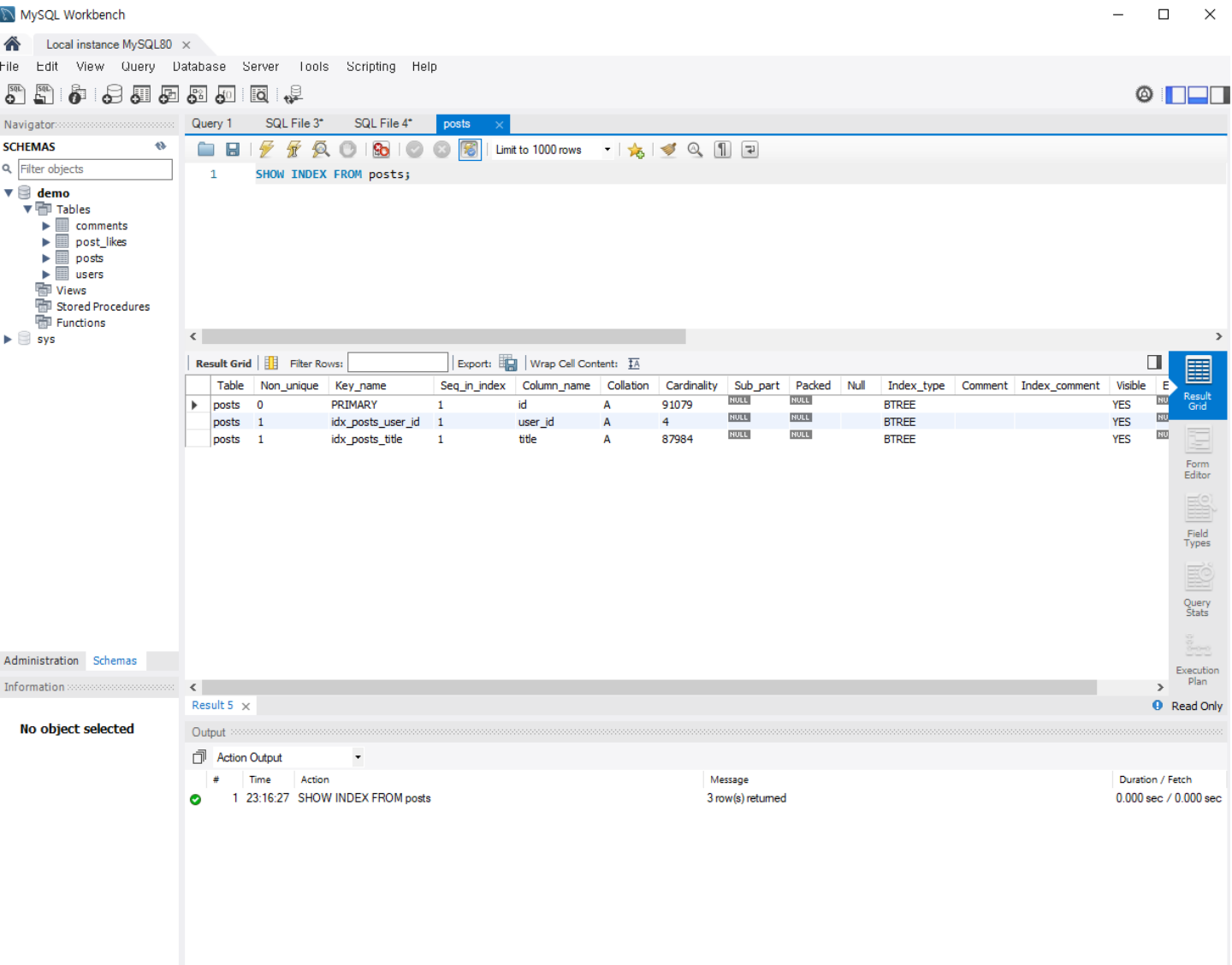
Artillery Test Scenario: case2_get_posts.yml

Query Definition

```
// 7) [case4-1] 목록 조회 전용 DTO ( N+1  제거 목적 )
@Query(  1개 사용 위치  cw01483-ly
        value =
                "select new com.example.demo.domain.post.dto.PostListResponseDto(" +
                        " p.id, " +
                        " p.displayNumber, " +
                        " p.title, " +
                        " p.content, " +
                        " p.views, " +
                        " a.nickname, " +
                        " p.createdAt, " +
                        " p.updatedAt, " +
                        " coalesce(count(pl.id), 0L) " +
                        ") "+
                "from Post p " +
                "join p.author a " +
                "left join com.example.demo.domain.post.entity.PostLike pl on pl.post = p " +
                "group by " +
                        " p.id, p.displayNumber, p.title, p.content, p.views, " +
                        "a.nickname, p.createdAt, p.updatedAt " +
                "order by p.id desc",
        countQuery = "select count(distinct p.id) " +
                "from Post p left join com.example.demo.domain.post.entity.PostLike pl on pl.post = p"
)
Page<PostListResponseDto> findPostListWithLikeCount(Pageable pageable);
```

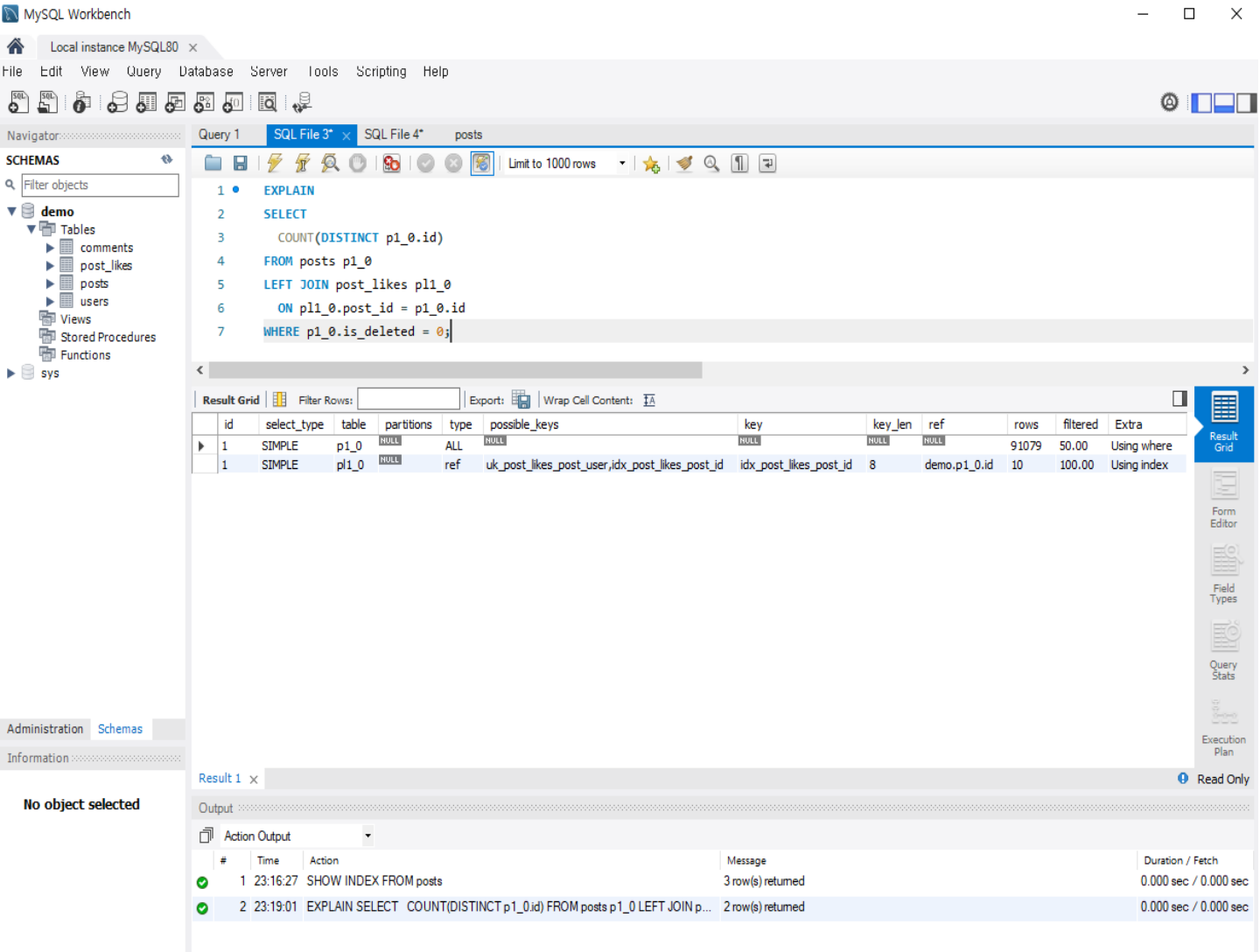
Paging Query and Associated COUNT Query
used in Spring Data Pageable Retrieval

Database Index State (Before)



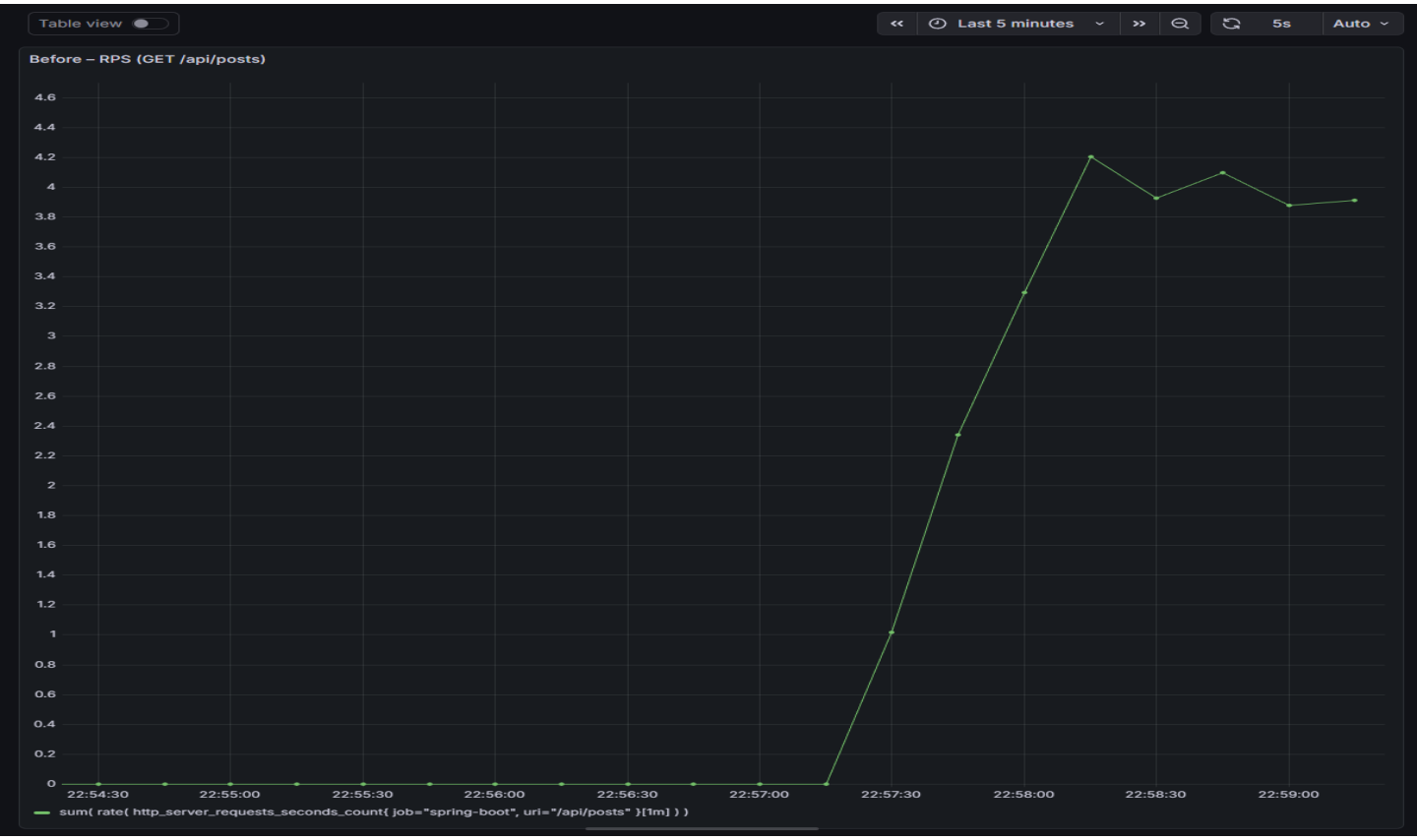
Index configuration of posts table before index creation

Execution Plan (Before)



Execution plan of COUNT query before index creation

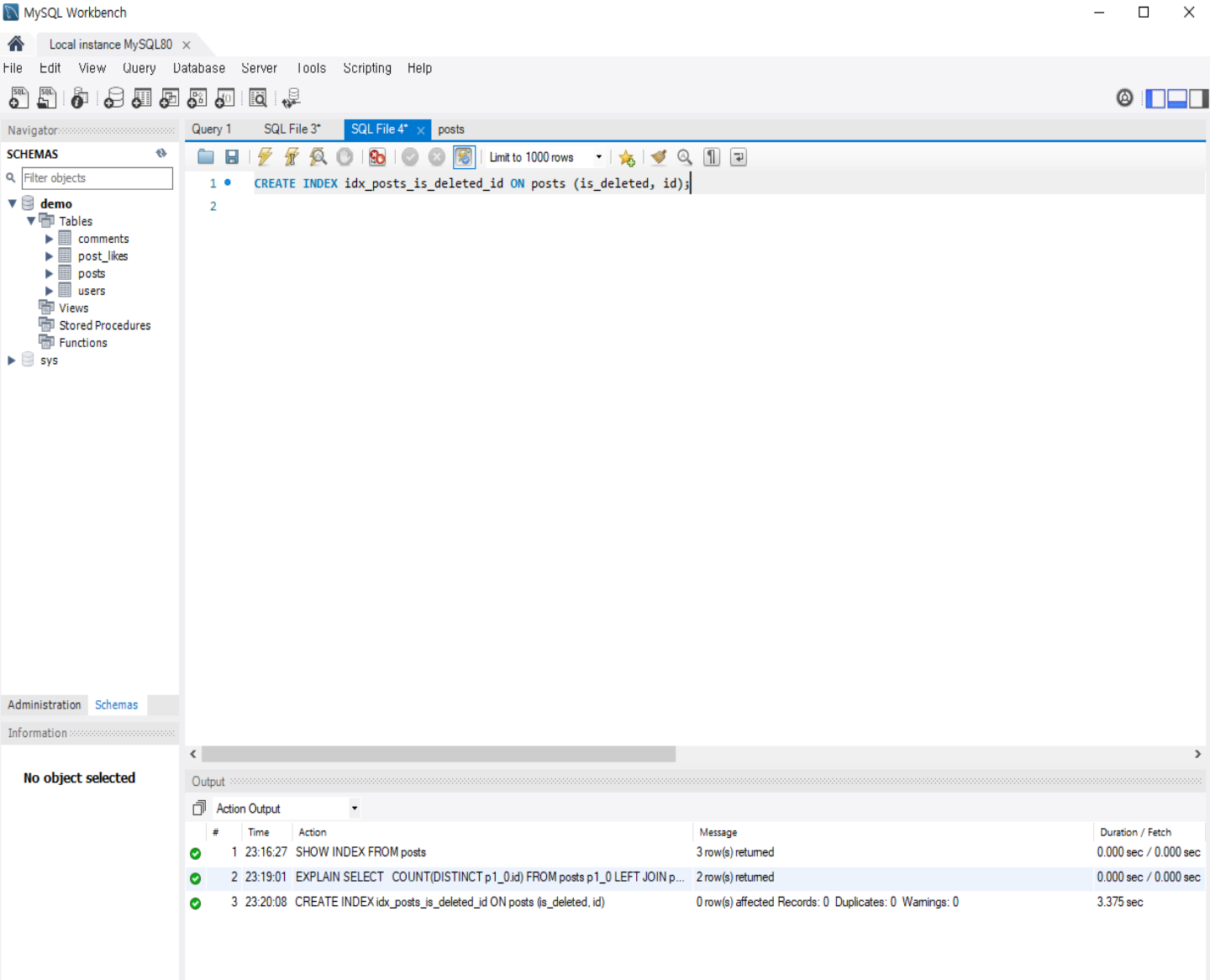
Performance Metrics (RPS) — Before



RPS During Load Test Execution (Before)

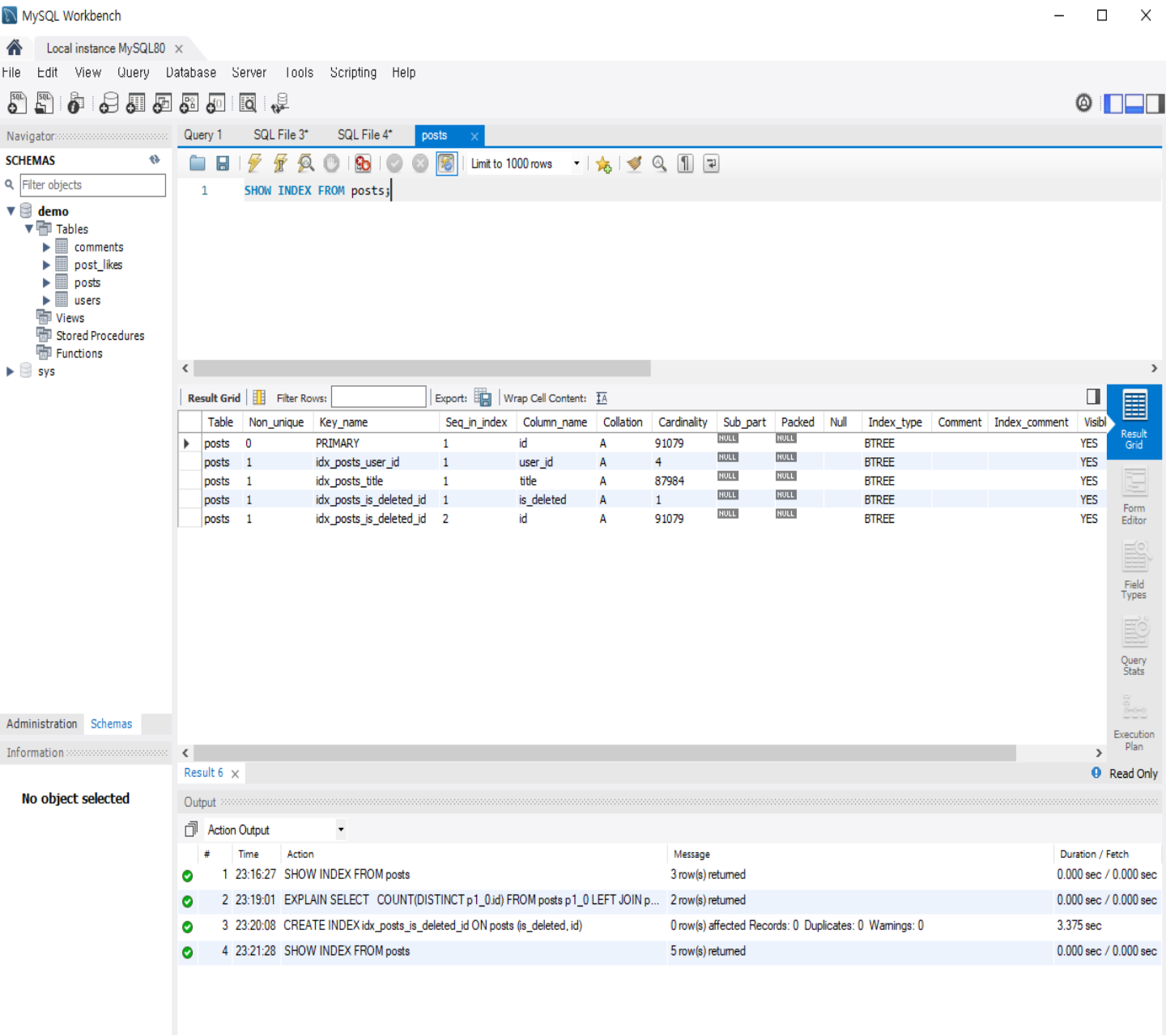
RPS After Test Completion (Before)

Index Creation (Composite Index on posts)



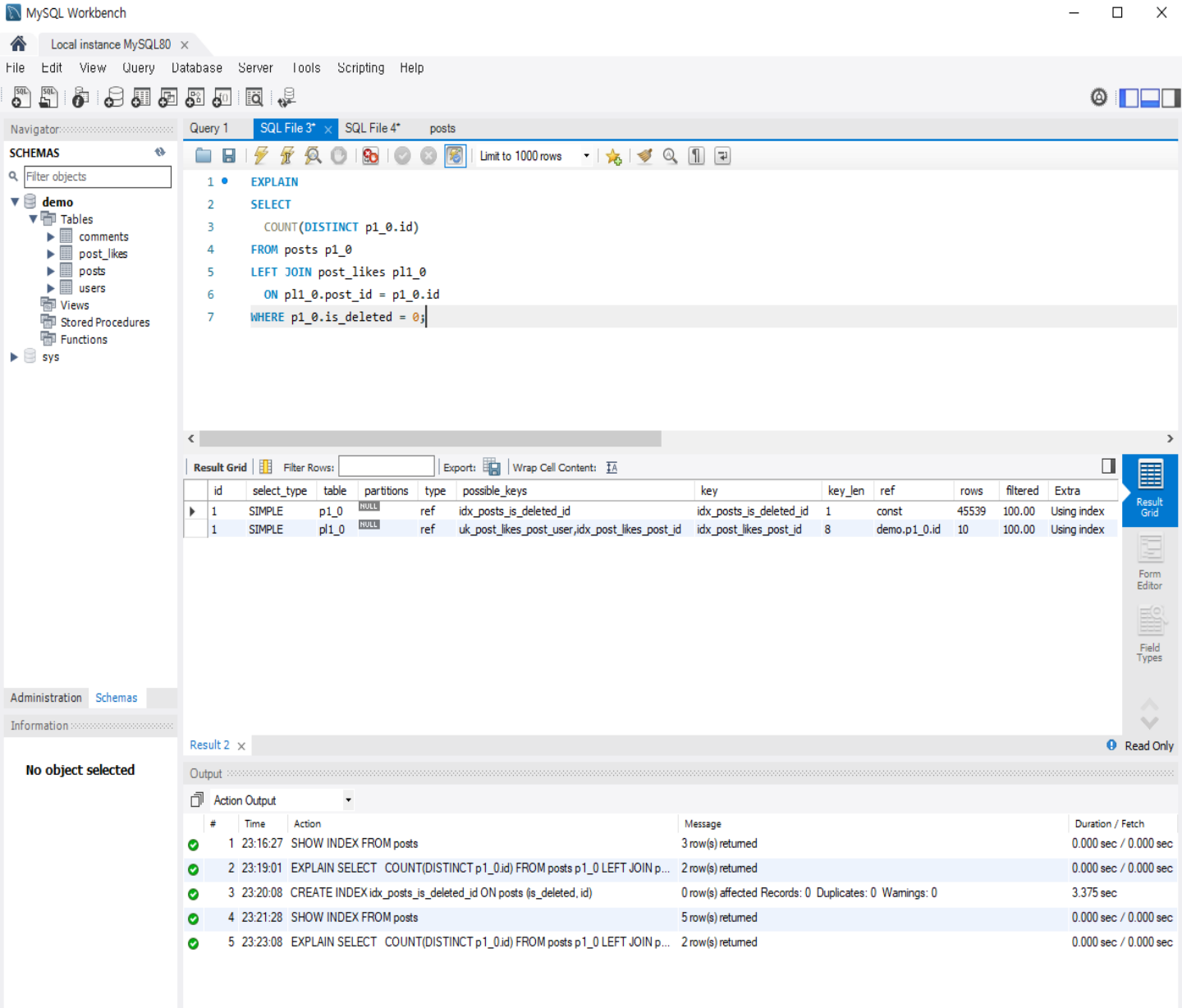
Creation of Composite Index (is_deleted, id) on posts Table

Database Index State (After)



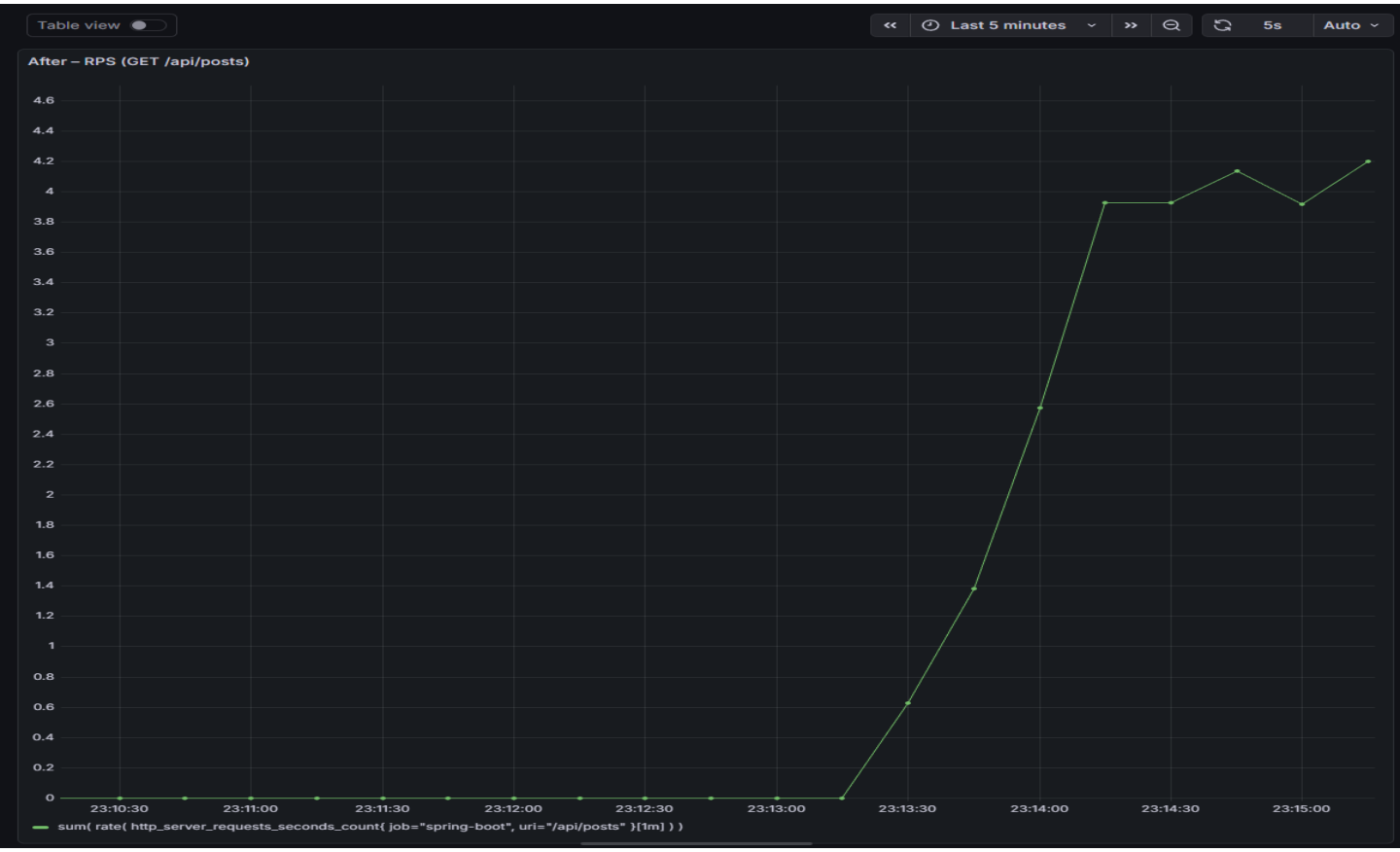
Index configuration of posts table after index creation

Execution Plan (After)



Execution plan of COUNT query after index creation

Performance Metrics (RPS) — After



RPS During Load Test Execution (After)

RPS After Test Completion (After)

SQL Execution Log (Before / After)

```
Hibernate:
    select
        p1_0.id,
        p1_0.display_number,
        p1_0.title,
        p1_0.content,
        p1_0.views,
        a1_0.nickname,
        p1_0.created_at,
        p1_0.updated_at,
        coalesce(count(pl1_0.id), 0)
    from
        posts p1_0
    join
        users a1_0
            on a1_0.id=p1_0.user_id
            and (a1_0.is_deleted = 0)
    left join
        post_likes pl1_0
            on pl1_0.post_id=p1_0.id
    where
        (
            p1_0.is_deleted = 0
        )
    group by
        p1_0.id,
        p1_0.display_number,
        p1_0.title,
        p1_0.content,
        p1_0.views,
        a1_0.nickname,
        p1_0.created_at,
        p1_0.updated_at
    order by
        p1_0.id desc
    limit
        ?
2026-01-02T21:37:24.091+09:00 TRACE 22812 --- [nio-8008-exec-2] org.hibernate.orm.jdbc.bind              : binding parameter (1:INTEGER) <- [20]
2026-01-02T21:37:24.891+09:00 DEBUG 22812 --- [nio-8008-exec-2] org.hibernate.SQL                        :
    select
        count(distinct p1_0.id)
    from
        posts p1_0
    left join
        post_likes pl1_0
            on pl1_0.post_id=p1_0.id
    where
        (
            p1_0.is_deleted = 0
        )
Hibernate:
    select
        count(distinct p1_0.id)
    from
        posts p1_0
```

COUNT query execution log before index creation

```
Hibernate:
    select
        p1_0.id,
        p1_0.display_number,
        p1_0.title,
        p1_0.content,
        p1_0.views,
        a1_0.nickname,
        p1_0.created_at,
        p1_0.updated_at,
        coalesce(count(pl1_0.id), 0)
    from
        posts p1_0
    join
        users a1_0
            on a1_0.id=p1_0.user_id
            and (a1_0.is_deleted = 0)
    left join
        post_likes pl1_0
            on pl1_0.post_id=p1_0.id
    where
        (
            p1_0.is_deleted = 0
        )
    group by
        p1_0.id,
        p1_0.display_number,
        p1_0.title,
        p1_0.content,
        p1_0.views,
        a1_0.nickname,
        p1_0.created_at,
        p1_0.updated_at
    order by
        p1_0.id desc
    limit
        ?
2026-01-04T21:31:11.347+09:00 TRACE 26916 --- [nio-8008-exec-5] org.hibernate.orm.jdbc.bind              : binding parameter (1:INTEGER) <- [20]
2026-01-04T21:31:12.188+09:00 DEBUG 26916 --- [nio-8008-exec-5] org.hibernate.SQL                        :
    select
        count(distinct p1_0.id)
    from
        posts p1_0
    left join
        post_likes pl1_0
            on pl1_0.post_id=p1_0.id
    where
        (
            p1_0.is_deleted = 0
        )
Hibernate:
    select
        count(distinct p1_0.id)
    from
        posts p1_0
```

COUNT query execution log after index creation

Artillery Result Comparison

Artillery Result Comparison

Metric	Before (No Index)	After (is_deleted, id Index)	Improvement (%)
HTTP 200 Responses	480	480	0.00%
Requests	480	480	0.00%
Errors	0	0	0.00%
Min Response Time (ms)	1040.0	1019.0	+2.02%
Mean Response Time (ms)	1246.4	1179.8	+5.34%
Median Response Time (ms)	1224.4	1153.1	+5.82%
p95 Response Time (ms)	1436.8	1380.5	+3.92%
p99 Response Time (ms)	1556.5	1525.7	+1.98%
Max Response Time (ms)	1615.0	1606.0	+0.56%

Table: Artillery latency summary (http.response_time)

```
All VUs finished. Total time: 2 minutes, 2 seconds

----------------------------------
Summary report @ 04:30:01(+0900)
----------------------------------

http.codes.200: ..................................................... 480
http.downloaded_bytes: .............................................. 2463360
http.request_rate: .................................................. 4/sec
http.requests: ...................................................... 480
http.response_time:
  min: .............................................................. 1040
  max: .............................................................. 1615
  mean: ............................................................. 1246.4
  median: ........................................................... 1224.4
  p95: .............................................................. 1436.8
  p99: .............................................................. 1556.5
http.response_time.2xx:
  min: .............................................................. 1040
  max: .............................................................. 1615
  mean: ............................................................. 1246.4
  median: ........................................................... 1224.4
  p95: .............................................................. 1436.8
  p99: .............................................................. 1556.5
http.responses: ..................................................... 480
vusers.completed: ................................................... 480
vusers.created: ..................................................... 480
vusers.created_by_name.Case2 - GET /api/posts paging: ................ 480
vusers.failed: ...................................................... 0
vusers.session_length:
  min: .............................................................. 1043.2
  max: .............................................................. 1617.7
  mean: ............................................................. 1253.2
  median: ........................................................... 1224.4
  p95: .............................................................. 1465.9
  p99: .............................................................. 1556.5
```

Artillery summary before index creation

```
All VUs finished. Total time: 2 minutes, 2 seconds

----------------------------------
Summary report @ 04:37:28(+0900)
----------------------------------

http.codes.200: ..................................................... 480
http.downloaded_bytes: .............................................. 2463360
http.request_rate: .................................................. 4/sec
http.requests: ...................................................... 480
http.response_time:
  min: .............................................................. 1019
  max: .............................................................. 1606
  mean: ............................................................. 1179.8
  median: ........................................................... 1153.1
  p95: .............................................................. 1380.5
  p99: .............................................................. 1525.7
http.response_time.2xx:
  min: .............................................................. 1019
  max: .............................................................. 1606
  mean: ............................................................. 1179.8
  median: ........................................................... 1153.1
  p95: .............................................................. 1380.5
  p99: .............................................................. 1525.7
http.responses: ..................................................... 480
vusers.completed: ................................................... 480
vusers.created: ..................................................... 480
vusers.created_by_name.Case2 - GET /api/posts paging: ................ 480
vusers.failed: ...................................................... 0
vusers.session_length:
  min: .............................................................. 1022
  max: .............................................................. 1633
  mean: ............................................................. 1185
  median: ........................................................... 1153.1
  p95: .............................................................. 1380.5
  p99: .............................................................. 1525.7
```

Artillery summary after index creation

- **Result:**
  No significant, user-visible performance change.

- **Observation:**
  COUNT query remains the primary bottleneck.

- **Validation:**
  SQL Log / EXPLAIN / Artillery / Grafana

Status: Limited Impact, Bottleneck Confirmed