

PostgreSQL Plan at Execution Time

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Why this Talk?

Execution Plan remains a puzzle for many
Don't know what to do

SQL Execution

1. Lex and Parse
2. Rewrite
3. Paths
4. Plans
5. Execute

Case 1

```
CREATE TABLE COMPANY (  
    COMPANY_ID SMALLINT,  
    COMPANY_NAME VARCHAR(200),  
    COMPANY_TYPE SMALLINT  
);
```

```
EXPLAIN ANALYZE SELECT count(*) FROM COMPANY WHERE COMPANY_TYPE=1;
```

```
EXPLAIN ANALYZE SELECT count(*) FROM COMPANY WHERE COMPANY_TYPE=2;
```

It's not free of cost!

Cost We Pay

Planning time: 5.285 ms

Execution time: 5.112 ms

Planning time: 150.562 ms

Execution time: 5.663 ms

Prepare it in Advance

```
PREPARE preplan(int) AS SELECT count(*) FROM company WHERE company_type=$1;
```

```
EXPLAIN ANALYZE execute preplan(1);
```

```
EXPLAIN ANALYZE execute preplan(2);
```

??

What's Happening

~~Lex and Parse~~
~~Rewrite~~
~~Paths~~
Plans
Execute

Repeat

```
PREPARE preplan(int) AS SELECT count(*) FROM company WHERE company_type=$1;
```

```
EXPLAIN ANALYZE execute preplan(1);
```

```
EXPLAIN ANALYZE execute preplan(2);
```

??

What's Happening

~~Lex and Parse~~

~~Rewrite~~

~~Paths~~

~~Plans~~

Execute

Repeated Execution which ends up in same execution plan

“It occurs only after five or more executions produce plans whose estimated cost average (including planning overhead) is more expensive than the generic plan cost estimate”

Repeat

```
PREPARE preplan(int) AS SELECT count(*) FROM company WHERE company_type=$1;
```

```
EXPLAIN ANALYZE execute preplan(2);
```

```
EXPLAIN ANALYZE execute preplan(1);
```

??

What's Happening

“Using EXECUTE values which are rare in columns with many duplicates can generate **custom plans** that are **so much cheaper than the generic plan, even after adding planning overhead, that the generic plan might never be used**”

Plan Cache Manager

Cache at session level

Generic plan ← No replan

Custom plans ← Needs replanning

Cache invalidation

Upcoming PostgreSQL 12: Complete control

`src/backend/utils/cache/plancache.c`

Skipping Steps - Demo

The fastest way to do something is not to do everything

- Plan
- Dynamic



Runtime Partition Pruning - PostgreSQL 11

(never executed)

QUERY PLAN

```
-----  
Append (actual rows=0 loops=1)  
  InitPlan 1 (returns $0)  
    -> Result (actual rows=1 loops=1)  
      -> Seq Scan on ab_a2_b1 (actual rows=0 loops=1)  
          Filter: ((a >= 2) AND (a <= 2) AND (b < $0))  
      -> Seq Scan on ab_a2_b2 (actual rows=0 loops=1)  
          Filter: ((a >= 2) AND (a <= 2) AND (b < $0))  
      -> Seq Scan on ab_a2_b3 (never executed)  
          Filter: ((a >= 2) AND (a <= 2) AND (b < $0))  
(9 rows)
```


Partition Pruning - PostgreSQL 12

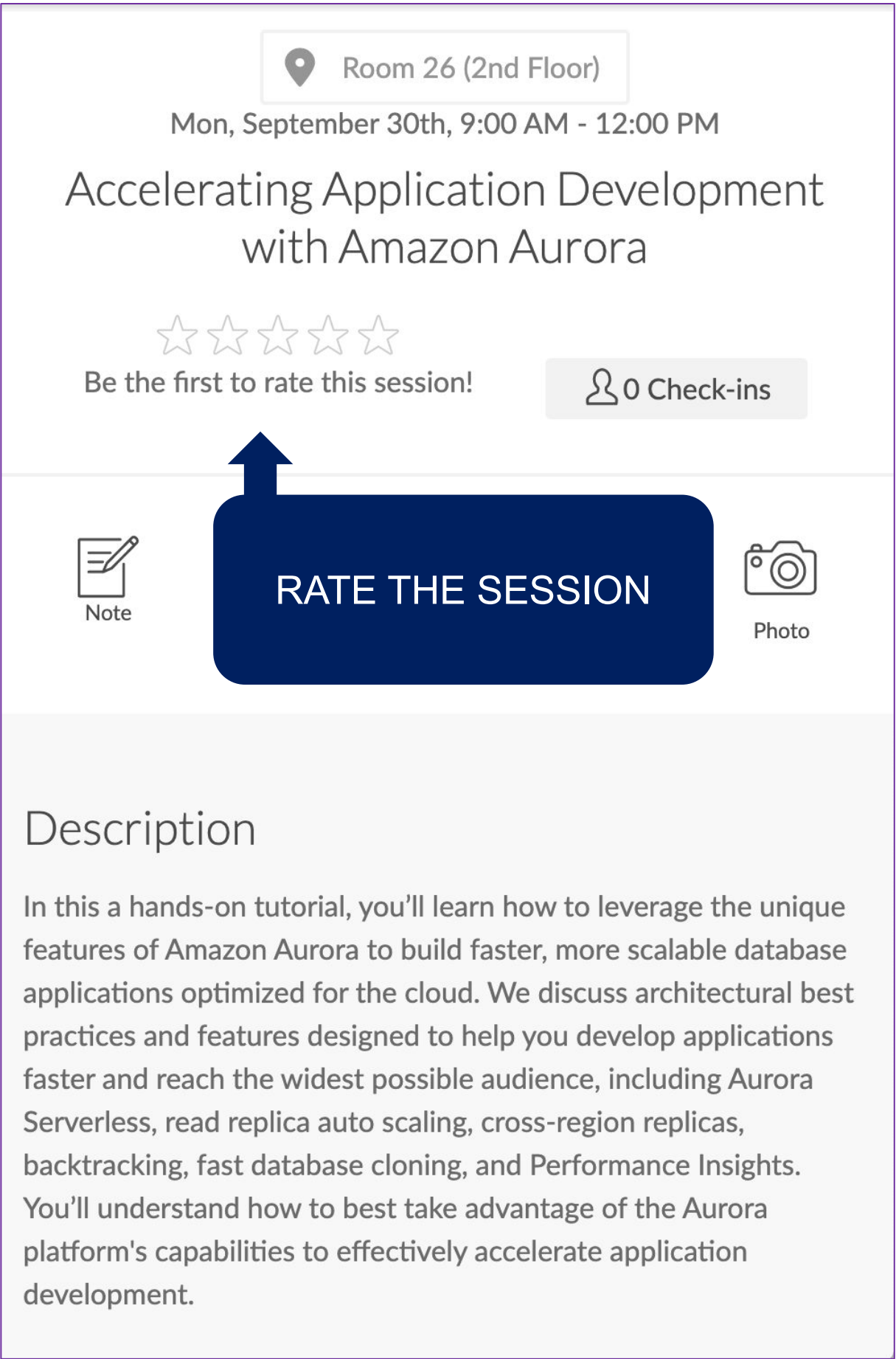
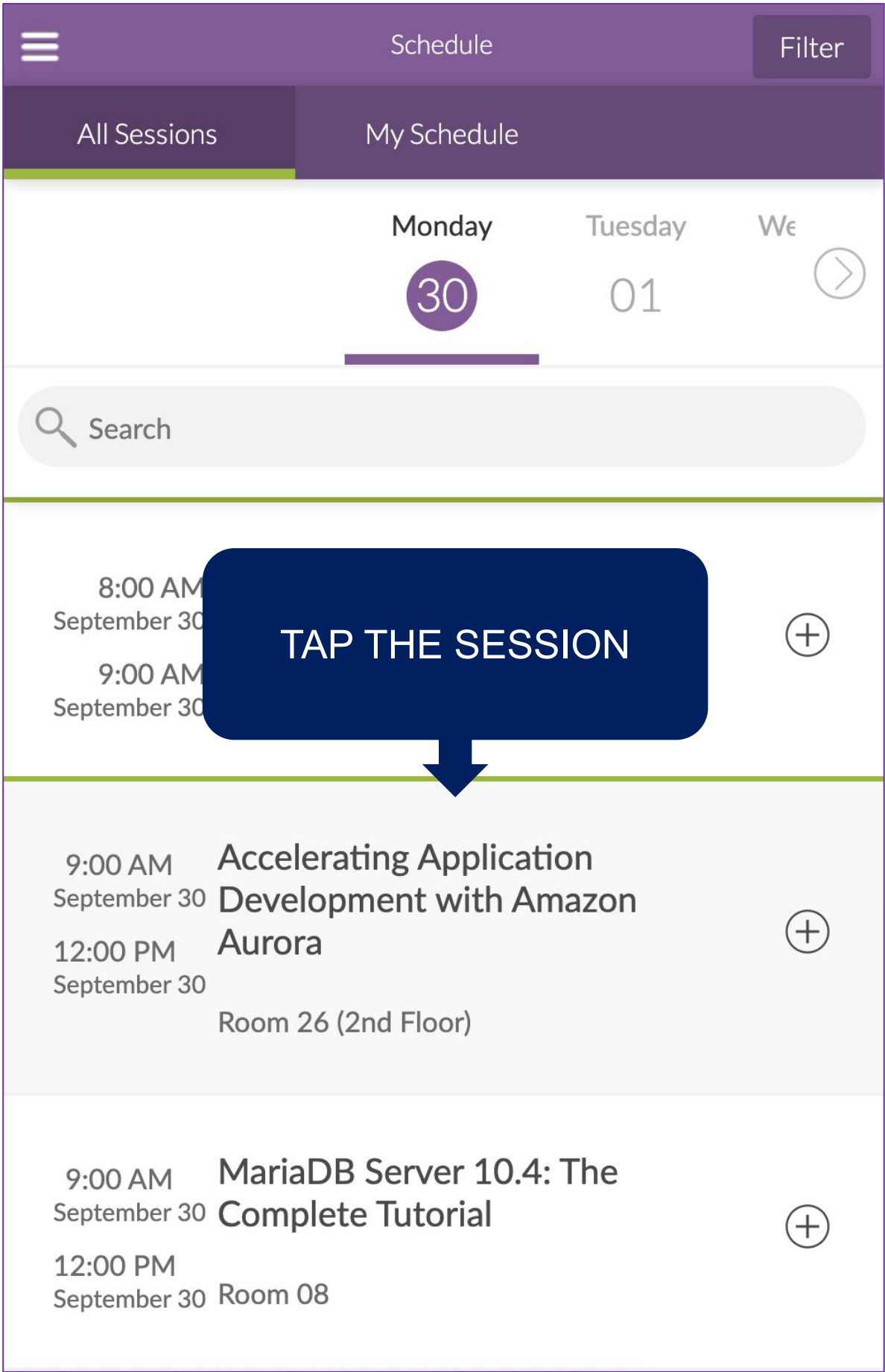
PostgreSQL 11

```
Aggregate (cost=25.98..25.99 rows=1 width=8) (actual time=0.010..0.011 rows=1 loops=1)
-> Append (cost=16.45..25.97 rows=6 width=0) (actual time=0.007..0.007 rows=0 loops=1)
    -> Bitmap Heap Scan on trading_p2019_02 (cost=16.45..25.94 rows=6 width=0) (actual
        Recheck Cond: ((trade_ts >= '2019-02-02 00:00:00'::timestamp without time zone)
    -> Bitmap Index Scan on trading_p2019_02_pkey (cost=0.00..16.45 rows=6 width=0)
        Index Cond: ((trade_ts >= '2019-02-02 00:00:00'::timestamp without time zone)
Planning Time: 50.683 ms
Execution Time: 0.096 ms
(8 rows)
```

PostgreSQL 12

```
Aggregate (cost=25.95..25.96 rows=1 width=8) (actual time=0.022..0.023 rows=1 loops=1)
-> Bitmap Heap Scan on trading_p2019_02 (cost=16.45..25.94 rows=6 width=0) (actual
    Recheck Cond: ((trade_ts >= '2019-02-02 00:00:00'::timestamp without time zone)
-> Bitmap Index Scan on trading_p2019_02_pkey (cost=0.00..16.45 rows=6 width=0)
    Index Cond: ((trade_ts >= '2019-02-02 00:00:00'::timestamp without time zone)
Planning Time: 0.317 ms
Execution Time: 0.096 ms
(7 rows)
```


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Thank You

