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PostgreSQL Ecosystem

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PostgreSQL Extension?

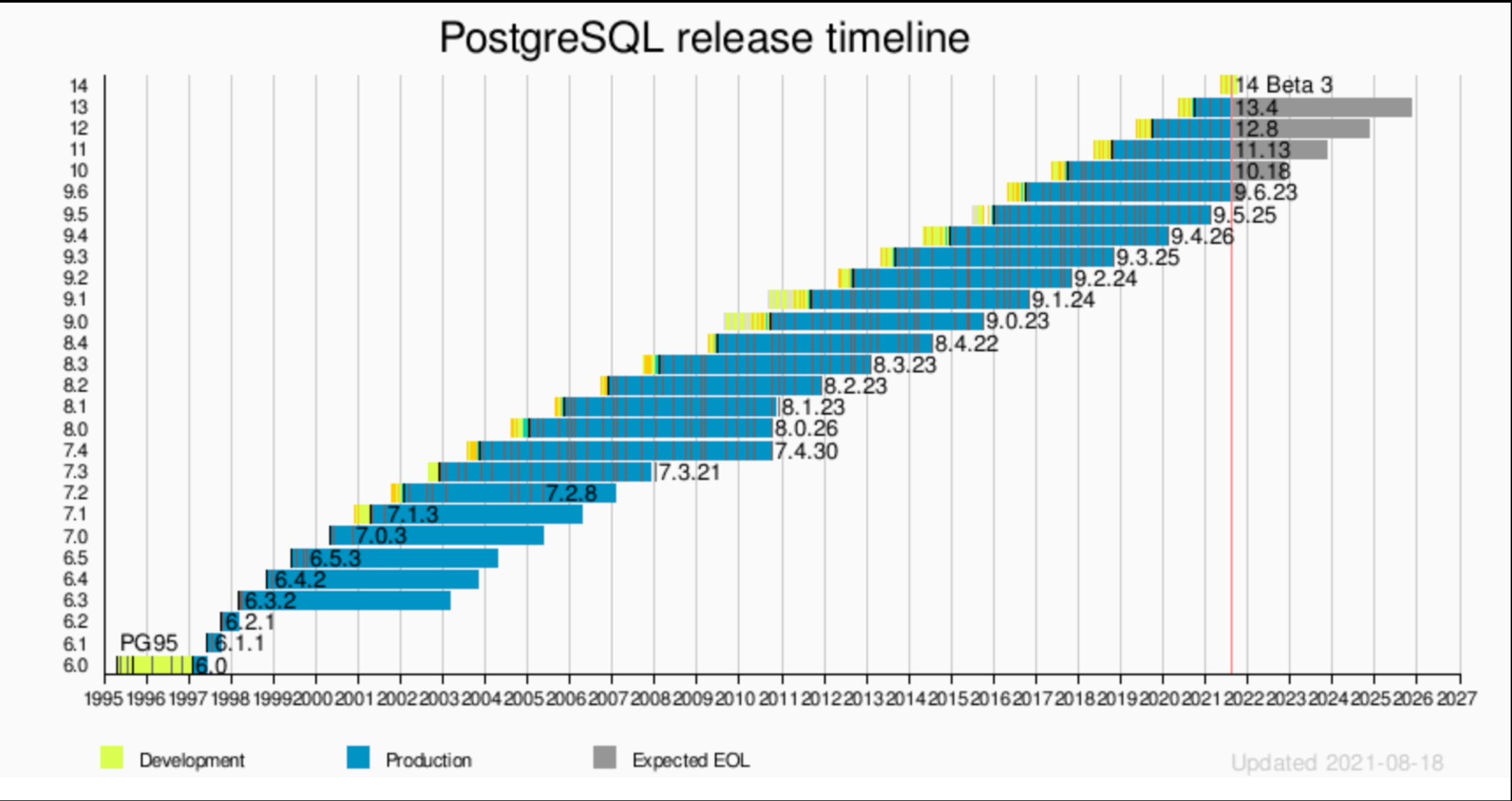
Basic Extensions

Citus

TimescaleDB

PostgreSQL

- The World's Most Advanced Open Source Relational Database
- <https://www.postgresql.org/>



The top 5 open source systems, August 2021

Rank	System	Score	Overall Rank
1.	MySQL	1238	2.
2.	PostgreSQL	577	4.
3.	MongoDB	497	5.
4.	Redis	170	6.
5.	Elasticsearch	157	8.

Extension

- PostgreSQL에서 제공하지 않는 추가 기능을 하나의 패키지로 제공
- Extension 구문으로 확장 기능의 설치/변경/업데이트 수행
- <https://pgxn.org>

```
-- 사용가능한 extension list
select * from pg_available_extensions;

-- extension 설치
CREATE EXTENSION tablefunc;

-- extension 삭제
DROP EXTENSION tablefunc;
```

Basic Extensions – FDW

- Foreign Data Wrapper
- 오라클의 dblink와 같은 기능
- postgres_fdw, oracle_fdw, msql_fdw, redis_fdw, file_fdw ...

```
-- fdw 테이블 생성
CREATE FOREIGN TABLE foreign_table (
    id integer NOT NULL,
    data text
)
SERVER foreign_server
OPTIONS (schema_name 'some_schema', table_name 'some_table');

-- 원격 데이터 조회
select * from foreign_table
```

Basic Extensions – Orafce

- Oracle's compatibility functions and packages
- Oracle to PostgreSQL migration 필수 extension

Basic Extensions – Pg_stat_statements

- 실행된 모든 SQL의 통계 수집

userid	dbid	queryid	substr	plans	total_plan_time	min_plan_time	max_plan_time	mean_plan_time	stddev_plan_time	calls	total_exec_time	m
local_blks_read	local_blks_dirtied	local_blks_written	temp_blks_read	temp_blks_written	blk_read_time	blk_write_time	wal_records	wal_fpi	wal_bytes			
16391	14174	-7499807972956520069	SELECT \$1	0	0	0	0	0	0	3	0.030122	
0	0	0	0	0	0	0	0	0	0	0		
16391	14174	6757379678631684054	SELECT SUM(blks_read	0	0	0	0	0	0	3	0.962883	
0	0	0	0	0	0	0	0	0	0	0		
16391	14174	2498311431433025341	SELECT SUM(seq_scan)	0	0	0	0	0	0	3	2.943776	
0	0	0	0	0	0	0	0	0	0	0		
16391	16384	-2998394077819368086	SELECT SUM(CASE relk	0	0	0	0	0	0	3	13.449399	
0	0	0	0	0	0	0	0	0	0	0		
(4 rows)												

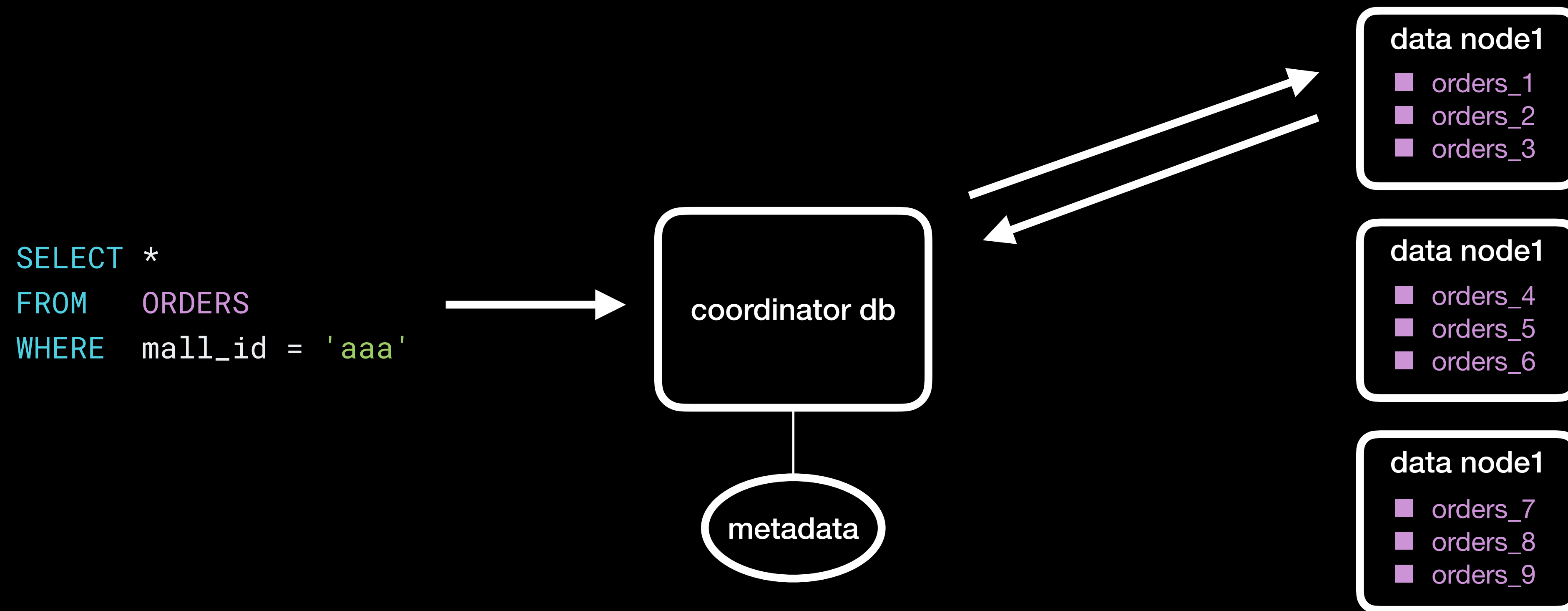
Basic Extensions – Auto_explain

- 실행된 쿼리의 실행계획을 로그파일에 기록

```
Query Text: select count(outboxmess0_.id) as col_0_0_ from outbox_message outboxmess0_ where outboxmess0_.occurred>$1 and outboxmess0_.env=$2 and (outboxmess0_.processed is null)
Aggregate (cost=4.95..4.96 rows=1 width=8)
-> Append (cost=0.70..4.94 rows=4 width=8)
-> Index Scan using outbox_message_idx3_p202108 on outbox_message_p202108 outboxmess0_ (cost=0.70..1.44 rows=1 width=8)
    Index Cond: (((env)::text = 'prod'::text) AND (processed IS NULL))
    Filter: (occurred > '2021-08-19 00:00:29.501053'::timestamp without time zone)
-> Index Scan using outbox_message_p202109_env_processed_id_idx on outbox_message_p202109 outboxmess0__1 (cost=0.14..1.16 rows=1 width=8)
    Index Cond: (((env)::text = 'prod'::text) AND (processed IS NULL))
    Filter: (occurred > '2021-08-19 00:00:29.501053'::timestamp without time zone)
-> Index Scan using outbox_message_p202110_env_processed_id_idx on outbox_message_p202110 outboxmess0__2 (cost=0.14..1.16 rows=1 width=8)
    Index Cond: (((env)::text = 'prod'::text) AND (processed IS NULL))
    Filter: (occurred > '2021-08-19 00:00:29.501053'::timestamp without time zone)
-> Index Scan using outbox_message_p202111_env_processed_id_idx on outbox_message_p202111 outboxmess0__3 (cost=0.14..1.16 rows=1 width=8)
    Index Cond: (((env)::text = 'prod'::text) AND (processed IS NULL))
    Filter: (occurred > '2021-08-19 00:00:29.501053'::timestamp without time zone)
```

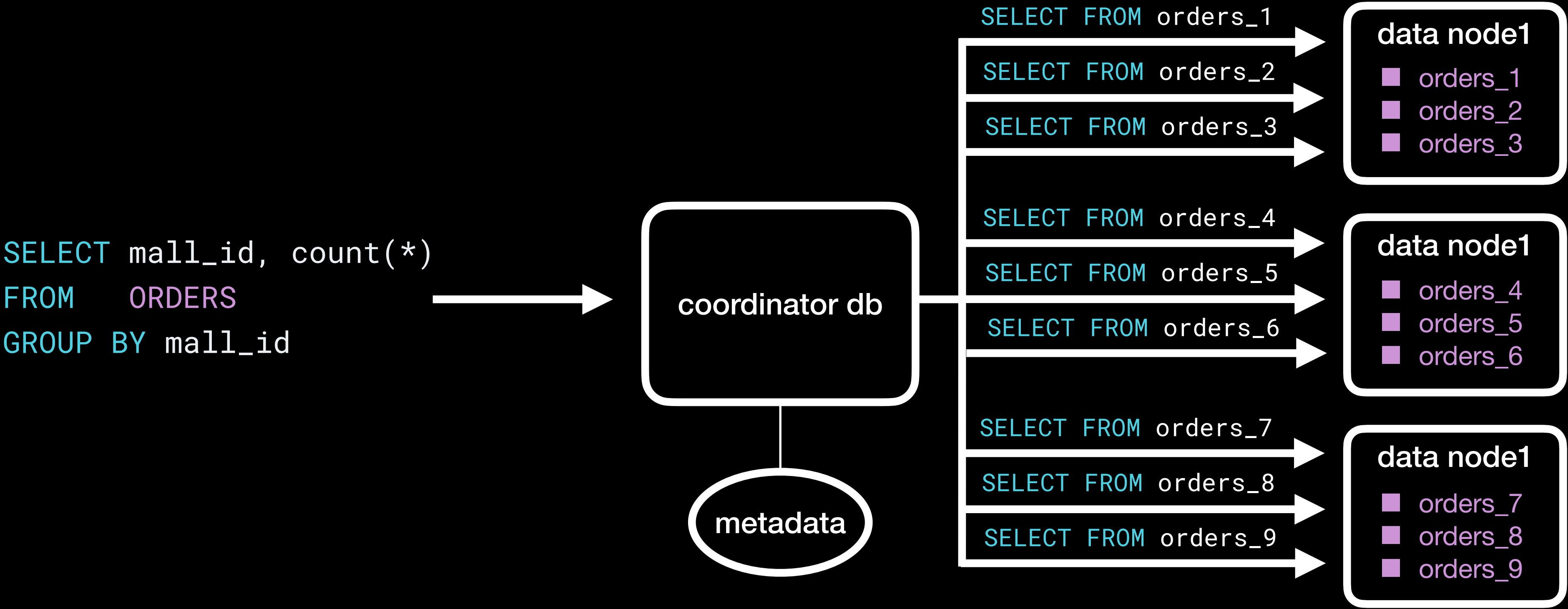
Citus

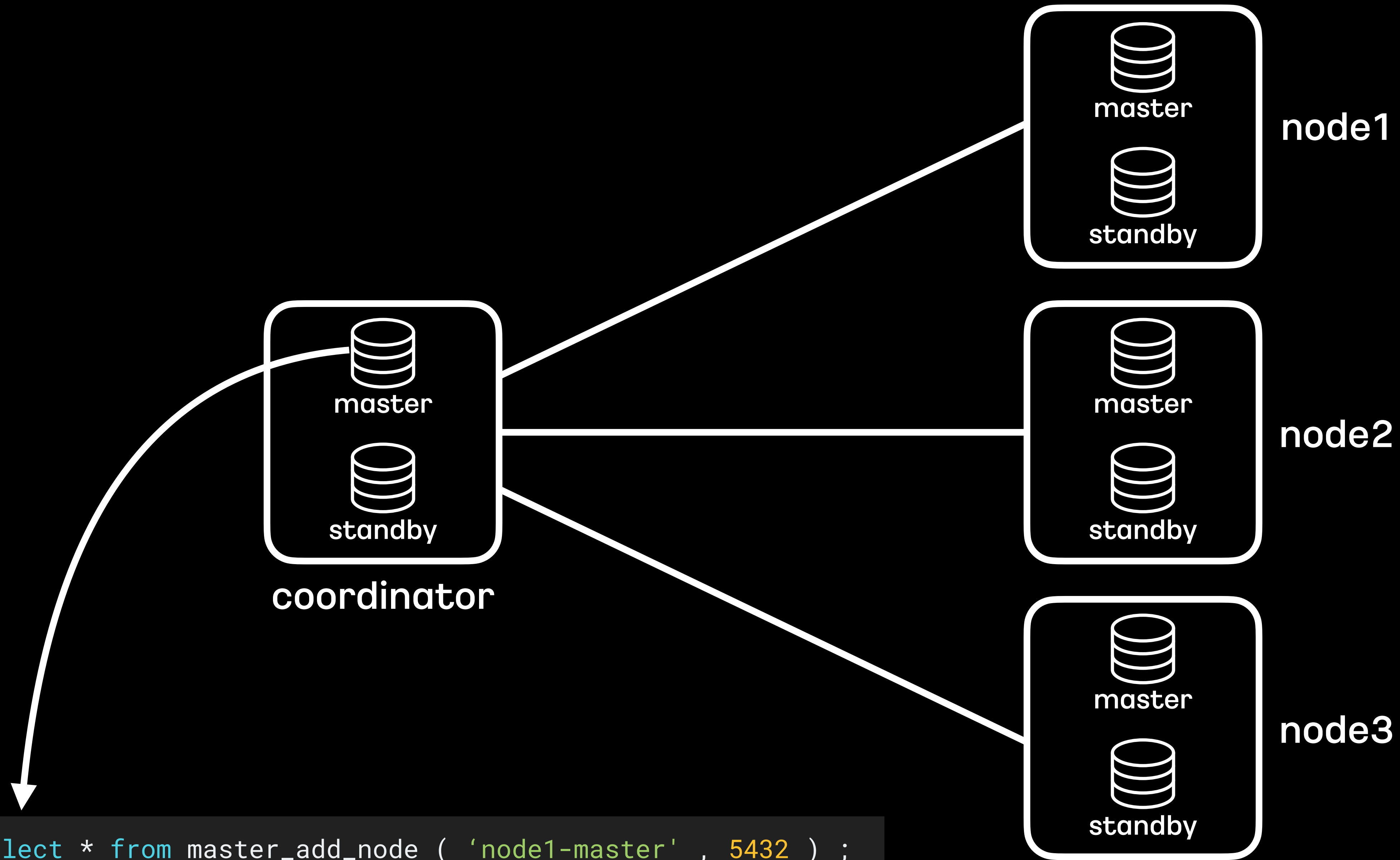
PostgreSQL을 분산 데이터베이스로 만들어주는 extension



Citus

PostgreSQL을 분산 데이터베이스로 만들어주는 extension





```
select * from master_add_node ( 'node1-master' , 5432 ) ;  
select * from master_add_node ( 'node2-master' , 5432 ) ;  
select * from master_add_node ( 'node3-master' , 5432 ) ;
```

Distributed Table

- 데이터를 분할하여 각 노드에 분산 저장
- citus.shard_count (default 32) 설정 으로 샤드 개수를 지정

```
CREATE TABLE orders (  
    order_id bigint not null,  
    mall_id varchar(30) not null,  
    ...  
);  
  
SELECT create_distributed_table('orders', 'mall_id');
```

Referenced Table

- 분할하지 않고 각 노드에 전체 데이터를 저장
- 조인에 자주 참여하는 작은 테이블이 후보

```
CREATE TABLE order_states (  
  code bigint not null,  
  state_name varchar(30) not null,  
  ...  
);  
  
SELECT create_reference_table('order_states');
```

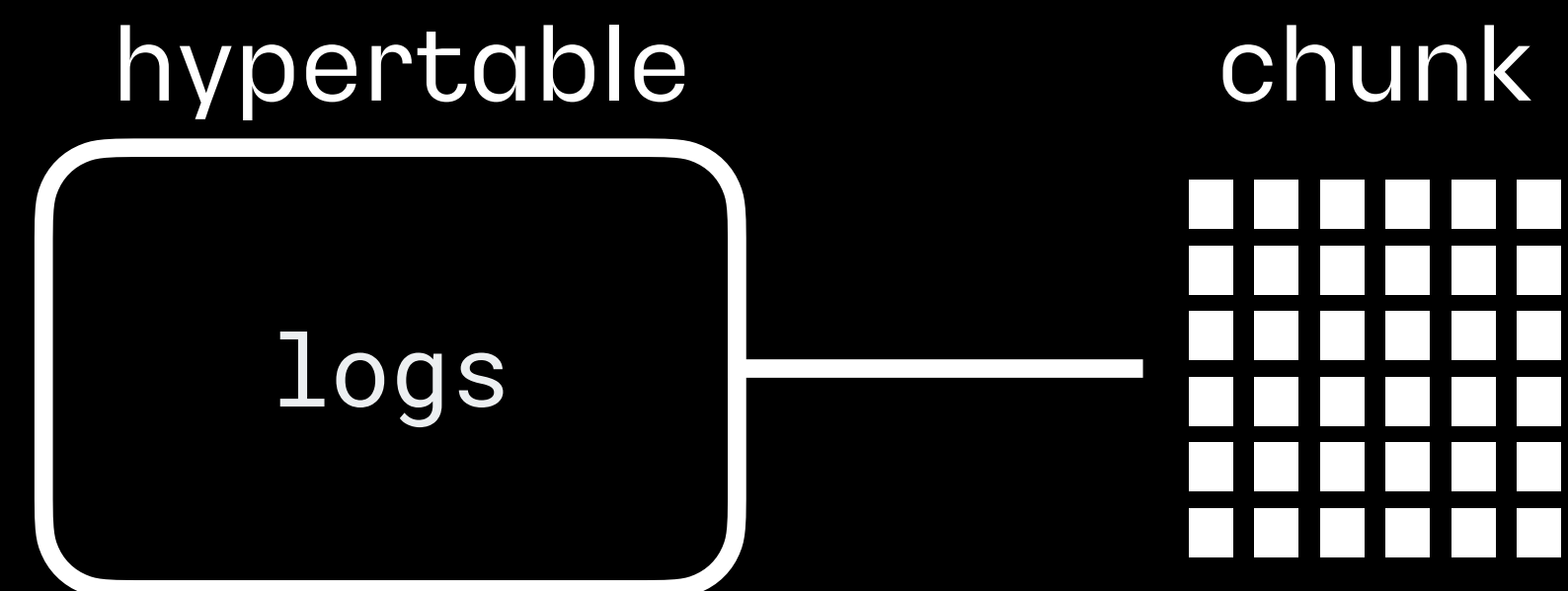
Local Table

- coordinator DB에 저장되는 일반 PostgreSQL테이블
- 조인에 참여 하지 않는 작은 테이블이 후보

TimescaleDB

- PostgreSQL Extension으로 개발된 시계열 데이터베이스
- Hypertable 객체를 통한 chunk단위 데이터 관리

```
CREATE TABLE logs (  
  time      TIMESTAMPT      NOT NULL,  
  host_name TEXT            NOT NULL,  
  cpu_avg   DOUBLE PRECISION NULL,  
  mem_used  DOUBLE PRECISION NULL  
);  
  
SELECT create_hypertable('logs', 'time');
```



TimescaleDB의 특징

PostgreSQL 호환성

Scale-out

데이터 보관기간 자동화

압축

TimescaleDB의 특징

- SQL을 포함한 PostgreSQL의 모든 기능 상속
- 시계열 데이터와 관계형 데이터를 하나의 database로 운영 가능

TimescaleDB의 특징

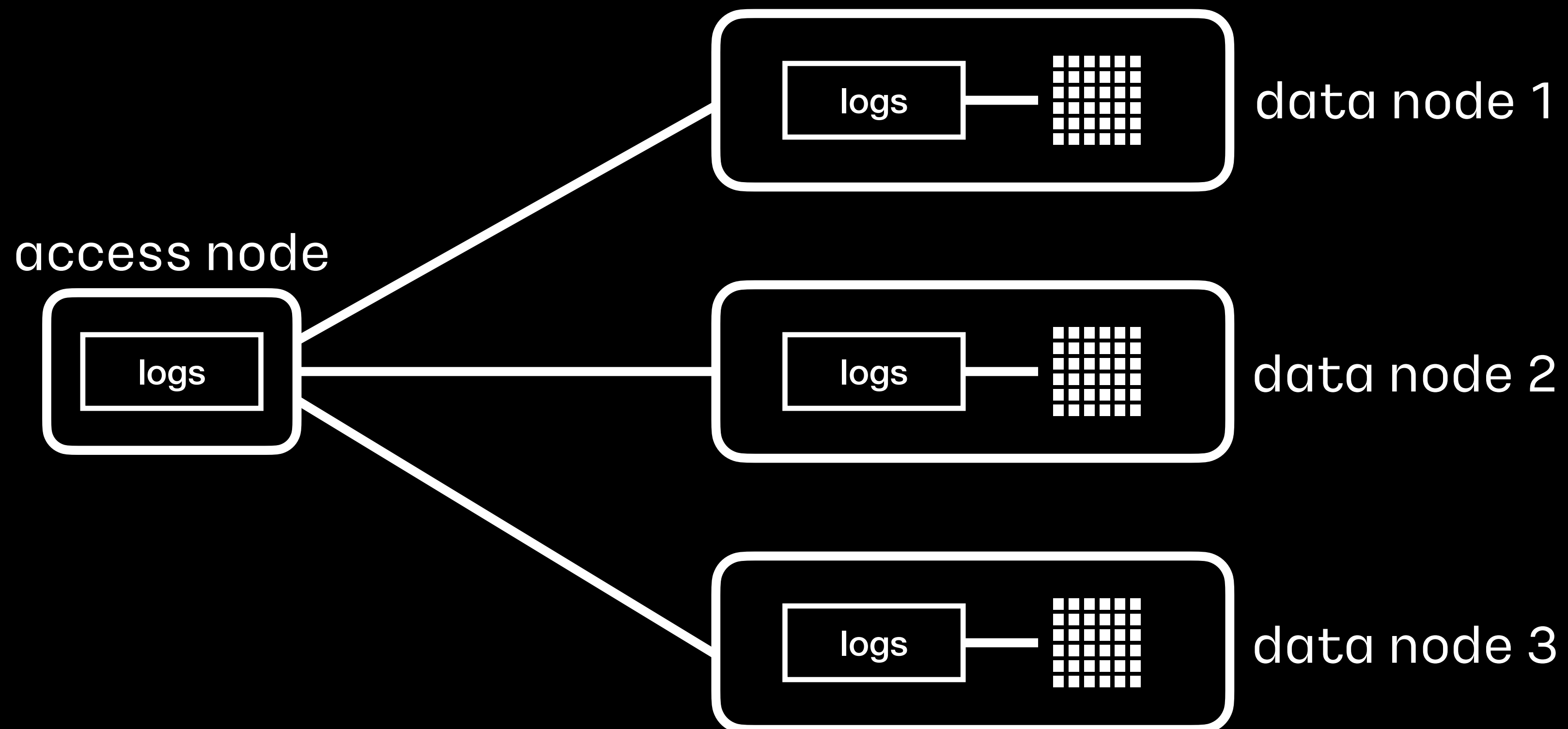
PostgreSQL Extension

Scale-out

데이터 보관기간 자동화

압축

```
CREATE TABLE logs (  
  time      TIMESTAMPT      NOT NULL,  
  host_name TEXT            NOT NULL,  
  cpu_avg   DOUBLE PRECISION NULL,  
  mem_used  DOUBLE PRECISION NULL  
);  
  
SELECT create_distributed_hypertable('logs', 'time', 'host_name');
```



TimescaleDB의 특징

PostgreSQL Extension

Scale-out

데이터 보관기간 자동화

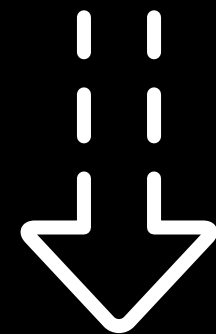
압축

-- 파티션 추가

```
CREATE TABLE logs_20210901 PARTITION OF logs  
FOR VALUES FROM ('2021-09-01') TO ('2021-09-02');
```

-- 보관기간이 지난 파티션 삭제

```
ALTER TABLE logs DETACH PARTITION logs_20110901;
```



-- 1일 단위로 chunk 분할

```
SELECT create_hypertable('conditions', 'time', chunk_time_interval => INTERVAL '1 day');
```

-- 보관기간 정책 설정

```
SELECT add_retention_policy('weather_metrics', INTERVAL '10 years');
```

TimescaleDB의 특징

PostgreSQL Extension

Scale-out

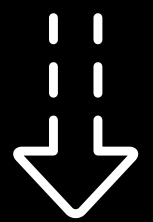
데이터 보관기간 자동화

압축

```
-- 압축 활성화
ALTER TABLE logs SET (
  timescaledb.compress,
  timescaledb.compress_segmentby = 'host_name'
);

-- 압축정책 설정
SELECT add_compression_policy('logs', INTERVAL '7 days');
```

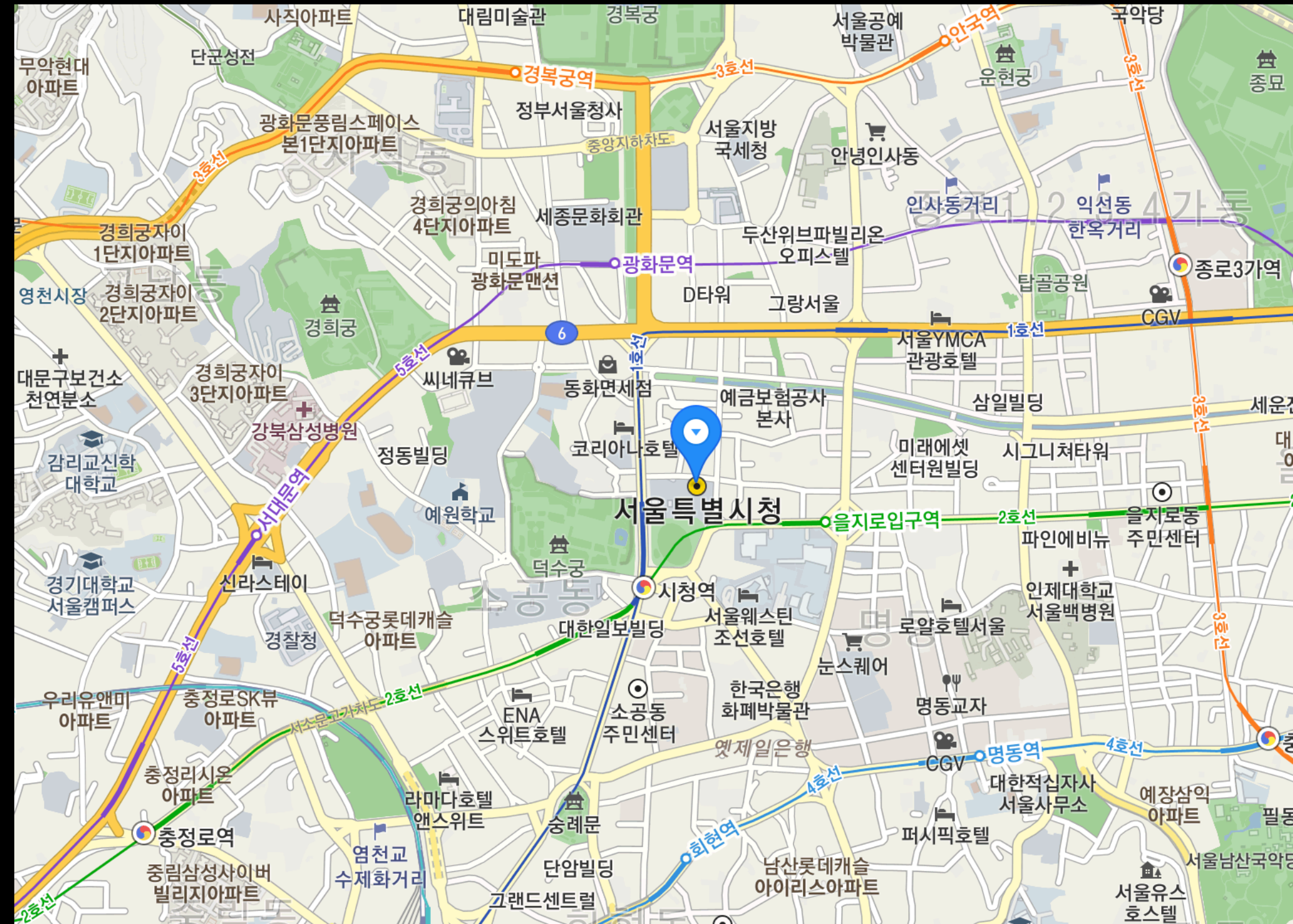
time	host_name	cpu_avg	mem_used
01:02	A	10	38
01:02	B	50	102
01:01	A	9	42
01:01	B	45	134



time	host_name	cpu_avg	mem_used
[01:01, 01:02]	A	[10, 9]	[38, 42]
[01:01, 01:02]	B	[50, 45]	[102, 134]

Postgis

- spatial database extension
- 카카오지도, 로드뷰, 카카오버스



E.O.D