

TimescaleDB

```
- Create a hypertable with automatic columnstore CREATE TABLE sensor_data
( time TIMESTAMPTZ NOT NULL, sensor_id TEXT NOT NULL, temperature
DOUBLE PRECISION, humidity DOUBLE PRECISION, pressure DOUBLE
PRECISION ) WITH ( tsdb.hypertable ); - create index CREATE INDEX
idx_sensor_id_time ON sensor_data(sensor_id, time DESC);
```

```
'tsdb.hypertable' - Converts this into a TimescaleDB hypertable
```

See more:

```
- [About hypertables](https://docs.tigerdata.com/use-timescale/latest/hypertables/)
- [API reference](https://docs.tigerdata.com/api/latest/hypertable/)
- [About columnstore](https://docs.tigerdata.com/use-timescale/latest/compression/about-comp)
- [Enable columnstore manually](https://docs.tigerdata.com/use-timescale/latest/compression)
- [API reference](https://docs.tigerdata.com/api/latest/compression/)
```

Step 4: Insert Sample Data

Let's add some sample sensor readings:

```
```sql
-- Enable timing to see time to execute queries
\timing on

-- Insert sample data for multiple sensors
-- SET timescaledb.enable_direct_compress_insert = on to insert data directly to the columnstore
SET timescaledb.enable_direct_compress_insert = on;
INSERT INTO sensor_data (time, sensor_id, temperature, humidity, pressure)
SELECT
 time,
 'sensor_' || ((random() * 9)::int + 1),
 20 + (random() * 15),
 40 + (random() * 30),
 1000 + (random() * 50)
FROM generate_series(
 NOW() - INTERVAL '90 days',
 NOW(),
 INTERVAL '1 seconds'
) AS time;

-- Once data is inserted into the columnstore we optimize the order and structure
-- this compacts and orders the data in the chunks for optimal query performance and compression
DO $$
```

```

DECLARE ch TEXT;
BEGIN
 FOR ch IN SELECT show_chunks('sensor_data') LOOP
 CALL convert_to_columnstore(ch, recompress := true);
 END LOOP;
END $$;

```

This generates ~7,776,001 readings across 10 sensors over the past 90 days.

Verify the data was inserted:

```
SELECT COUNT(*) FROM sensor_data;
```

### Step 5: Run Your First Analytical Queries

Now let's run some analytical queries that showcase TimescaleDB's performance:

```

-- Enable query timing to see performance
\timing on

```

*-- Query 1: Average readings per sensor over the last 7 days*

```

SELECT
 sensor_id,
 COUNT(*) as readings,
 ROUND(AVG(temperature)::numeric, 2) as avg_temp,
 ROUND(AVG(humidity)::numeric, 2) as avg_humidity,
 ROUND(AVG(pressure)::numeric, 2) as avg_pressure
FROM sensor_data
WHERE time > NOW() - INTERVAL '7 days'
GROUP BY sensor_id
ORDER BY sensor_id;

```

*-- Query 2: Hourly averages using time\_bucket*

*-- Time buckets enable you to aggregate data in hypertables by time interval and calculate statistics*

```

SELECT
 time_bucket('1 hour', time) AS hour,
 sensor_id,
 ROUND(AVG(temperature)::numeric, 2) as avg_temp,
 ROUND(AVG(humidity)::numeric, 2) as avg_humidity
FROM sensor_data
WHERE time > NOW() - INTERVAL '24 hours'
GROUP BY hour, sensor_id
ORDER BY hour DESC, sensor_id
LIMIT 20;

```

*-- Query 3: Daily statistics across all sensors*

```

SELECT
 time_bucket('1 day', time) AS day,

```

```

COUNT(*) as total_readings,
ROUND(AVG(temperature)::numeric, 2) as avg_temp,
ROUND(MIN(temperature)::numeric, 2) as min_temp,
ROUND(MAX(temperature)::numeric, 2) as max_temp
FROM sensor_data
GROUP BY day
ORDER BY day DESC
LIMIT 10;

```

```

-- Query 4: Latest reading for each sensor
-- Highlights the value of Skipscan executing in under 100ms without skipscan it takes over
SELECT DISTINCT ON (sensor_id)
 sensor_id,
 time,
 ROUND(temperature::numeric, 2) as temperature,
 ROUND(humidity::numeric, 2) as humidity,
 ROUND(pressure::numeric, 2) as pressure
FROM sensor_data
ORDER BY sensor_id, time DESC;

```

Notice how fast these analytical queries run, even with aggregations across millions of rows. This is the power of TimescaleDB's columnstore.

## What's Happening Behind the Scenes?

TimescaleDB automatically: - **Partitions your data** into time-based chunks for efficient querying - **Write directly to columnstore** using columnar storage (90%+ compression typical) and faster vectorized queries - **Optimizes queries** by only scanning relevant time ranges and columns - **Enables time\_bucket()** - a powerful function for time-series aggregation

See more:

- Query data
- Write data
- About time buckets
- API reference
- All TimescaleDB features

## Next Steps

Now that you've got the basics, explore more:

## Create Continuous Aggregates

Continuous aggregates make real-time analytics run faster on very large datasets. They continuously and incrementally refresh a query in the background, so that when you run such query, only the data that has changed needs to be

computed, not the entire dataset. This is what makes them different from regular PostgreSQL materialized views, which cannot be incrementally materialized and have to be rebuilt from scratch every time you want to refresh them.

Let's create a continuous aggregate for hourly sensor statistics:

### Step 1: Create the Continuous Aggregate

```
CREATE MATERIALIZED VIEW sensor_data_hourly
WITH (timescaledb.continuous) AS
SELECT
 time_bucket('1 hour', time) AS hour,
 sensor_id,
 AVG(temperature) AS avg_temp,
 AVG(humidity) AS avg_humidity,
 AVG(pressure) AS avg_pressure,
 MIN(temperature) AS min_temp,
 MAX(temperature) AS max_temp,
 COUNT(*) AS reading_count
FROM sensor_data
GROUP BY hour, sensor_id;
```

This creates a materialized view that pre-aggregates your sensor data into hourly buckets. The view is automatically populated with existing data.

**Step 2: Add a Refresh Policy** To keep the continuous aggregate up-to-date as new data arrives, add a refresh policy:

```
SELECT add_continuous_aggregate_policy(
 'sensor_data_hourly',
 start_offset => INTERVAL '3 hours',
 end_offset => INTERVAL '1 hour',
 schedule_interval => INTERVAL '1 hour'
);
```

This policy: - Refreshes the continuous aggregate every hour - Processes data from 3 hours ago up to 1 hour ago (leaving the most recent hour for real-time queries) - Only processes new or changed data incrementally

**Step 3: Query the Continuous Aggregate** Now you can query the pre-aggregated data for much faster results:

```
-- Get hourly averages for the last 24 hours
SELECT
 hour,
 sensor_id,
 ROUND(avg_temp::numeric, 2) AS avg_temp,
 ROUND(avg_humidity::numeric, 2) AS avg_humidity,
```

```

 reading_count
FROM sensor_data_hourly
WHERE hour > NOW() - INTERVAL '24 hours'
ORDER BY hour DESC, sensor_id
LIMIT 50;

```

### Benefits of Continuous Aggregates

- **Faster queries:** Pre-aggregated data means queries run in milliseconds instead of seconds
- **Incremental refresh:** Only new/changed data is processed, not the entire dataset
- **Automatic updates:** The refresh policy keeps your aggregates current without manual intervention
- **Real-time option:** You can enable real-time aggregation to combine materialized and raw data

**Try It Yourself** Compare the performance difference:

```

-- Query the raw hypertable (slower on large datasets)
\timing on
SELECT
 time_bucket('1 hour', time) AS hour,
 AVG(temperature) AS avg_temp
FROM sensor_data
WHERE time > NOW() - INTERVAL '60 days'
GROUP BY hour
ORDER BY hour DESC
LIMIT 24;

-- Query the continuous aggregate (much faster)
SELECT
 hour,
 avg_temp
FROM sensor_data_hourly
WHERE hour > NOW() - INTERVAL '60 days'
ORDER BY hour DESC
LIMIT 24;

```

Notice how the continuous aggregate query is significantly faster, especially as your dataset grows!

See more:

- [About continuous aggregates](#)
- [API reference](#)
- [TimescaleDB Documentation](#)
- [Time-series Best Practices](#)

- Continuous Aggregates

## Examples

Learn TimescaleDB with complete, standalone examples using real-world datasets. Each example includes sample data and analytical queries.

- **NYC Taxi Data** - Transportation and location-based analytics
- **Financial Market Data** - Trading and market data analysis
- **Application Events** - Event logging with UUIDv7

Or try some of our workshops - **AI Workshop: EV Charging Station Analysis** - Integrate PostgreSQL with AI capabilities for managing and analyzing EV charging station data - **Time-Series Workshop: Financial Data Analysis** - Work with cryptocurrency tick data, create candlestick charts

Documentation associated with Apache licensed “community edition” of TimescaleDB provided for convenience and built from Apache licensed source code available [here](#).