

BIG DATA MADRID • TECH TALK #4

From Sensor to Dashboard, *a \$10 chip to a live dashboard.*

A real-time IoT pipeline built end to end with the same patterns as a production data stack, only smaller, cheaper and visible from the sensor to the screen.

THE PROBLEM

Production data stacks hide their plumbing: brokers, time-series stores and push channels sit behind managed services and dashboards.

The cheapest way to feel a real streaming pipeline is to build one you can hold: a sensor node, a broker and a database on one Raspberry Pi, with no cloud bill.

FOR

Data engineers, and anyone curious about streaming pipelines

STACK

Raspberry Pi Pico W

MicroPython

MQTT • EMQX

TimescaleDB

FastAPI

WebSocket

WHAT THE TALK COVERS

01 Five hops

Pico W with a DHT22 sensor → EMQX (MQTT) → TimescaleDB → FastAPI over WebSocket → the browser. About 150 lines of Python for the whole stack.

04 Push, not poll

PostgreSQL LISTEN/NOTIFY plus a WebSocket: the database is both the source of truth and the fan-out point, with zero polling.

02 MQTT vs Kafka

A Kafka producer needs hundreds of megabytes of RAM; an MQTT client runs in kilobytes. Neither is better: the right protocol lives at the right layer.

05 The seams

Where this scales: swap the sensor for Kafka producers, TimescaleDB for ClickHouse, NOTIFY for Debezium-style change data capture. Same shape.

03 A real time-series store

TimescaleDB hypertables on PostgreSQL: time-partitioned automatically, durable and replayable.

KEY TAKEAWAYS

- Same patterns, different physics: everything here is something data engineers already know, at a different scale.
- The MQTT topic is your schema: device, metric and sensor in one string.
- PostgreSQL LISTEN/NOTIFY is a zero-cost pub/sub bus for live interfaces.
- Protocol choice is a constraints choice: memory, network and durability decide it.

Watch the demo

www.youtube.com/watch?v=51kgUUPyI-WY

Read the write-up

jalcocert.github.io/JAlcocerT/plaints-102-and-iot

The code

github.com/JAlcocerT/RPi/tree/main/Z_MicroControllers

Want this in *your stack*?

A 30-minute decision call turns this pattern into a plan for your team.

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