CitCom^AI   Ville de Differdange   LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY | LIST
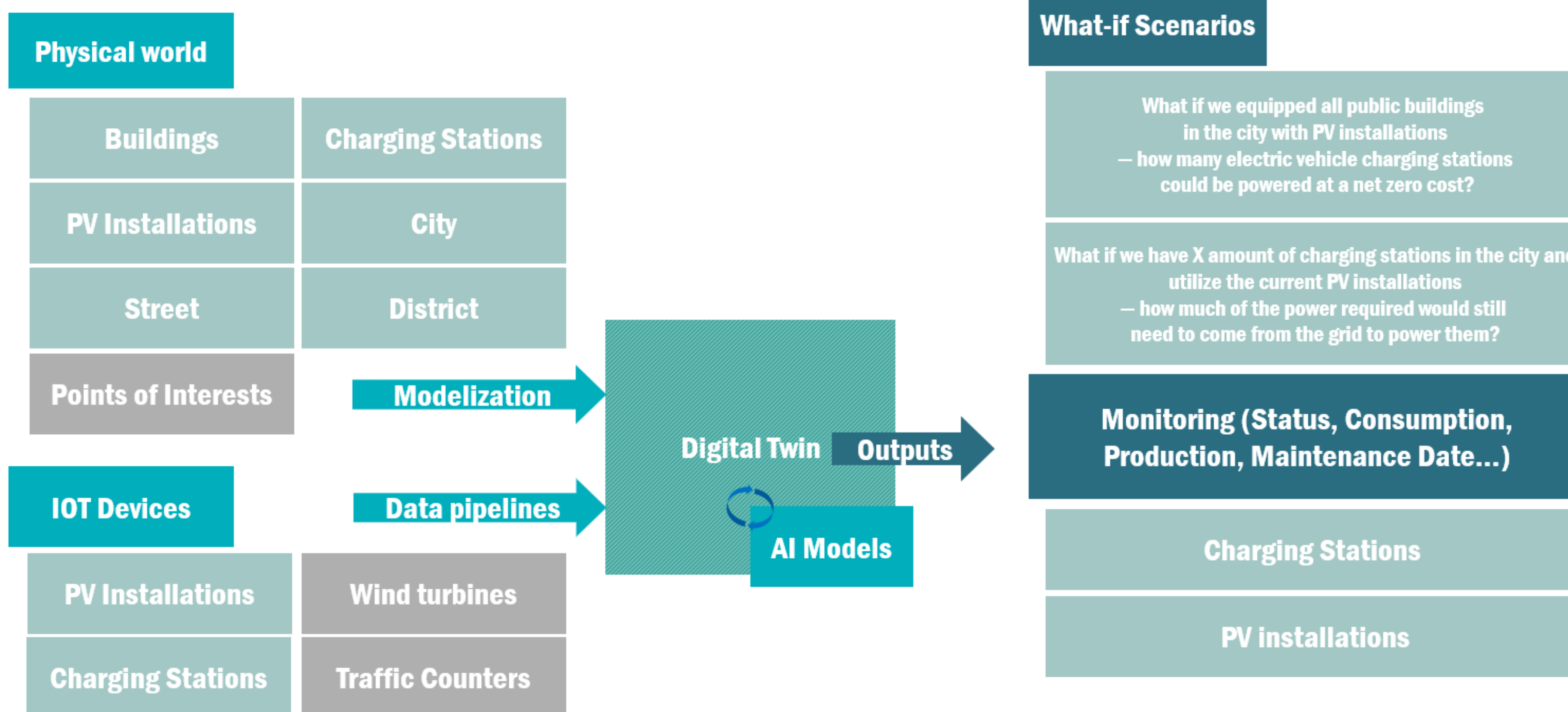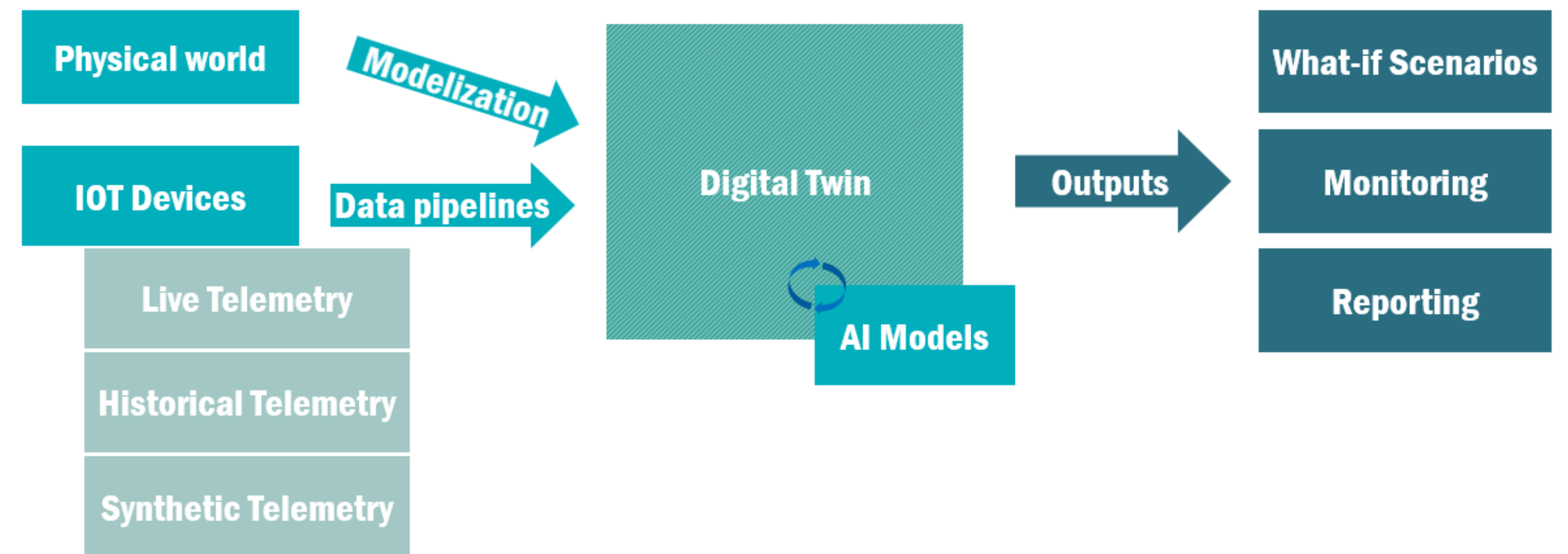
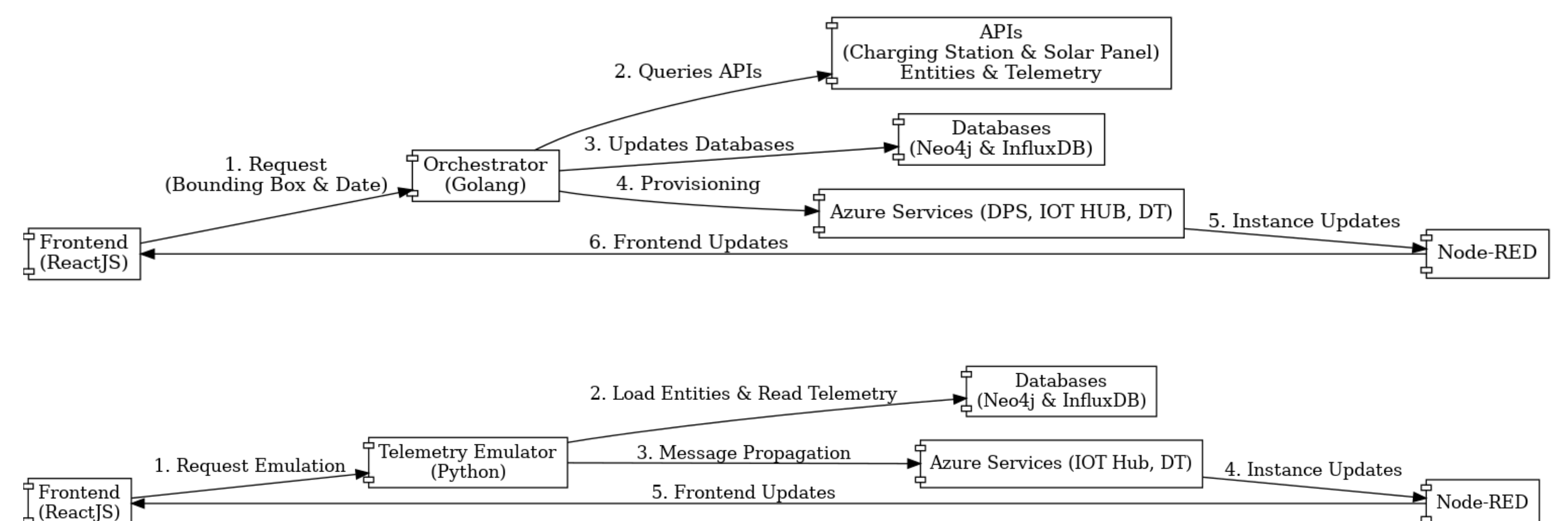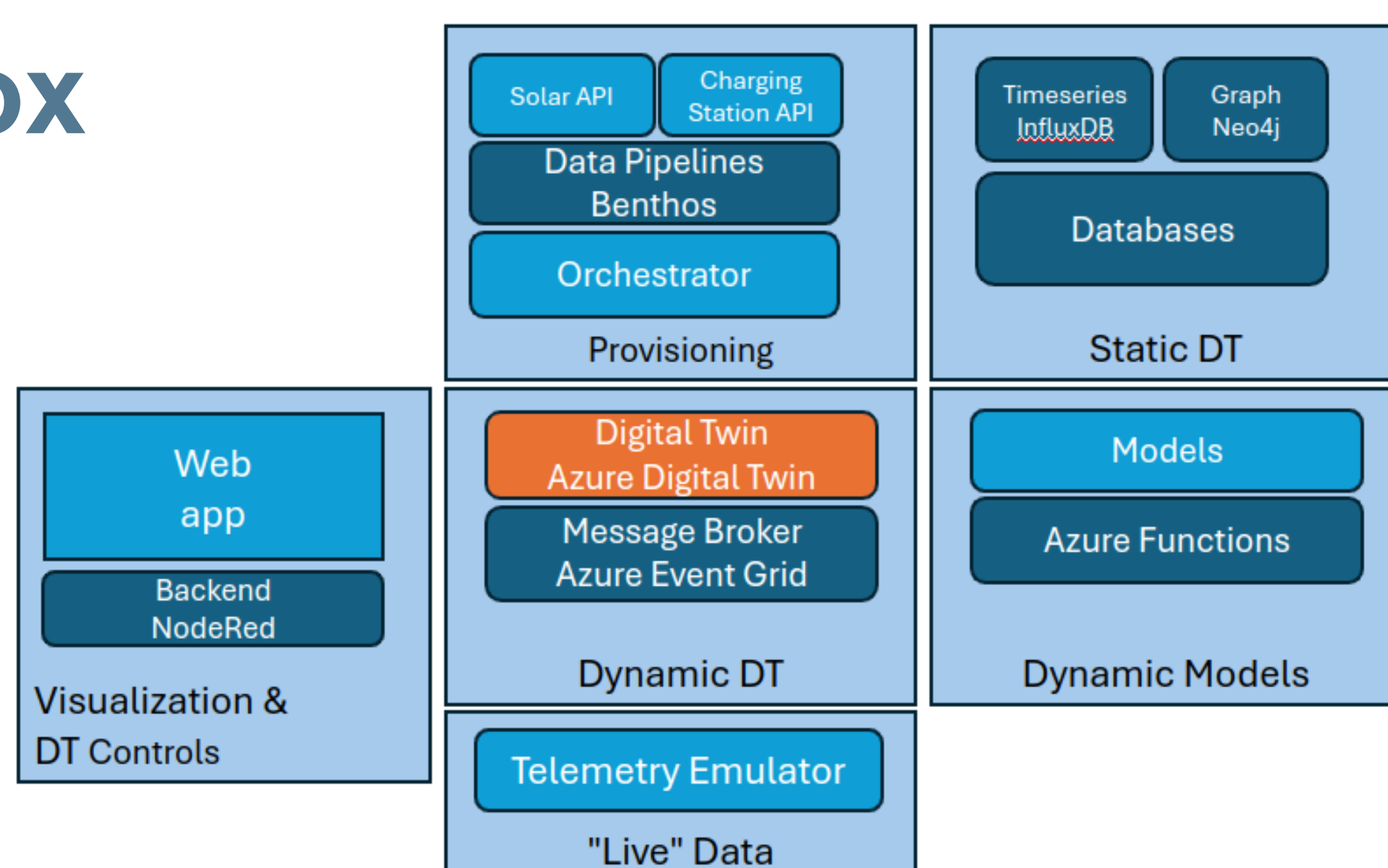# LOCAL DIGITAL TWINS FOR ELECTROMOBILITY

Context

The deployment of electromobility in urban areas is crucial for sustainable development.

Local Digital Twins (LDTs) are emerging as the most suitable tools to facilitate informed decision-making for city planners.

Physical world — Modelization → Digital Twin → Outputs → What-if Scenarios

IOT Devices — Data pipelines →
- Live Telemetry
- Historical Telemetry
- Synthetic Telemetry

Digital Twin — AI Models

- Monitoring
- Reporting

Physical world
- Buildings
- Charging Stations
- PV Installations
- City
- Street
- District
- Points of Interests

Modelization →

IOT Devices
- PV Installations
- Wind turbines
- Charging Stations
- Traffic Counters

Data pipelines → Digital Twin — AI Models → Outputs

What-if Scenarios

What if we equipped all public buildings in the city with PV installations — how many electric vehicle charging stations could be powered at a net zero cost?

What if we have X amount of charging stations in the city and utilize the current PV installations — how much of the power required would still need to come from the grid to power them?

Monitoring (Status, Consumption, Production, Maintenance Date...)

Charging Stations

PV installations

Case-study

Our project explores the transformative impact of LDTs on electromobility.

In a concrete pilot experimentation in the City of Differdange in South Luxembourg, CitCom.ai contributes to testing and experimenting AI and Digital Twins for urban sustainability and technological advancement.

Toolbox

Provisioning: Solar API, Charging Station API, Data Pipelines Benthos, Orchestrator

Static DT: Timeseries InfluxDB, Graph Neo4j, Databases

Visualization & DT Controls: Web app, Backend NodeRed

Dynamic DT: Digital Twin Azure Digital Twin, Message Broker Azure Event Grid

Dynamic Models: Models, Azure Functions

"Live" Data: Telemetry Emulator

Frontend (ReactJS) — 1. Request (Bounding Box & Date) → Orchestrator (Golang) — 2. Queries APIs → APIs (Charging Station & Solar Panel) Entities & Telemetry; 3. Updates Databases → Databases (Neo4j & InfluxDB); 4. Provisioning → Azure Services (DPS, IOT HUB, DT) — 5. Instance Updates → Node-RED; 6. Frontend Updates

Frontend (ReactJS) — 1. Request Emulation → Telemetry Emulator (Python) — 2. Load Entities & Read Telemetry → Databases (Neo4j & InfluxDB); 3. Message Propagation → Azure Services (IOT Hub, DT) — 4. Instance Updates → Node-RED; 5. Frontend Updates

Data

- Charging Stations Entities & Telemetry
- Solar Panels Entities & Telemetry
- Building Entities (lidar Cadastral survey of Luxembourg)
- Electric Consumption and Production of the public building of the city

Models

- Charging Station Power Consumption Model
- Solar Power Production Model

Visualization

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