Blog Post 3: The Anatomy of a Digital Twin: Data Acquisition from Satellite, Aerial, and In-Situ Sources

The fidelity and utility of a Smart City Digital Twin are entirely contingent upon the quality and breadth of its data. To construct a living, real-time replica of a city, the PANTHEON SCDT relies on a multi-layered data aggregation framework, a "central nervous system" of advanced monitoring technologies.

This framework operates across three distinct levels:

1. **From Space (Macro-Scale Monitoring):** The project utilizes data from Earth Observation (EO) programs like **Copernicus**. These satellites provide the large-scale context, offering invaluable geospatial information to monitor the spread of wildfires, map the extent of floodplains, or detect subtle ground deformations that could signal seismic risk.
2. **From the Air (High-Resolution Mapping):** For a more detailed perspective, **Unmanned Aerial Vehicles (UAVs)** are deployed. These platforms can rapidly survey a specific area to generate ultra-high-resolution 2D and 3D maps. This is critical for assessing damage to specific infrastructure, such as buildings or bridges, post-event.
3. **On the Ground (In-Situ Granular Data):** At the most granular level, the **Internet of Things (IoT)** provides ground-truth data. The PANTHEON system integrates a network of low-cost, terrestrial sensors, including:
   - **Micro-climate weather stations** reporting real-time, localized temperature, wind, and humidity—all critical variables for fire propagation models.
   - **Traffic and mobility sensors** to understand transportation network congestion.
   - **Infrastructure sensors** monitoring the health and status of critical power grids, water systems, and communication networks.

This immense volume of "Big Data" is harvested, aggregated, and processed, forming the lifeblood of the Digital Twin and enabling its analytical functions.

Next: We examine the "analytical engine" that processes this data: the project's Artificial Intelligence.