Blog Post 5: The 4 Big Challenges in Building a Unified Disaster Map (And How We're Solving Them)

Integrating geospatial information technologies from satellites, drones, and sensors for a project like PANTHEON presents significant technical and organizational challenges. Ensuring the system is reliable, fast, and trustworthy is paramount, especially in high-stakes disaster contexts.

Here are four of the biggest challenges we address in our deliverable:

1. **The Challenge: Interoperability and Data Heterogeneity** Spatial data comes in a wide variety of formats (raster vs. vector), scales, and resolutions—from local UAV imagery to global satellite products. These disparate sources often lack a common interface, making seamless data exchange difficult.
    - **Our Solution:** We strictly enforce the adoption of **open standards** defined by the Open Geospatial Consortium (OGC). Protocols like WMS, WFS, and WCS enable harmonized data sharing across all of PANTHEON's internal software components and with external partner platforms.
2. **The Challenge: Scalability and Performance** A system handling high-volume satellite imagery, UAV footage, and real-time IoT streams can face performance bottlenecks. This is especially true during a disaster when user demand surges and low-latency is critical.
    - **Our Solution:** PANTHEON uses cloud-native architectures and **containerized services (e.g., via Docker)**. Our containerized GeoServer, PostGIS, and bespoke REST API backend allow for horizontal scaling, while additional tiling and caching strategies can be added to improve rendering speed for web clients.
3. **The Challenge: Data Quality and Validation** Geospatial data can suffer from errors in georeferencing, outdated information, or sensor noise. Poor data quality can severely undermine trust and lead to flawed decision-making.
    - **Our Solution:** We build data validation workflows directly into the ingestion pipeline. This includes specialized checks for coordinate system consistency and cross-referencing with authoritative sources (like OpenStreetMap). Our GeoServer instance also provides a "Layer Preview" capability for manual review.
4. **The Challenge: Security and Access Control** Spatial data infrastructures used for disaster management must protect sensitive information and ensure system availability. Risks include unauthorized access, data leaks, and manipulation of decision-critical inputs.
    - **Our Solution:** PANTHEON's security practices include **Role-Based Access Control** to define user privileges and Identity and Access Management (e.g., Keycloak) for secure data transmission and authentication.

In our final post, we'll look to the future and explore how emerging technologies like AI will make this platform even more powerful.