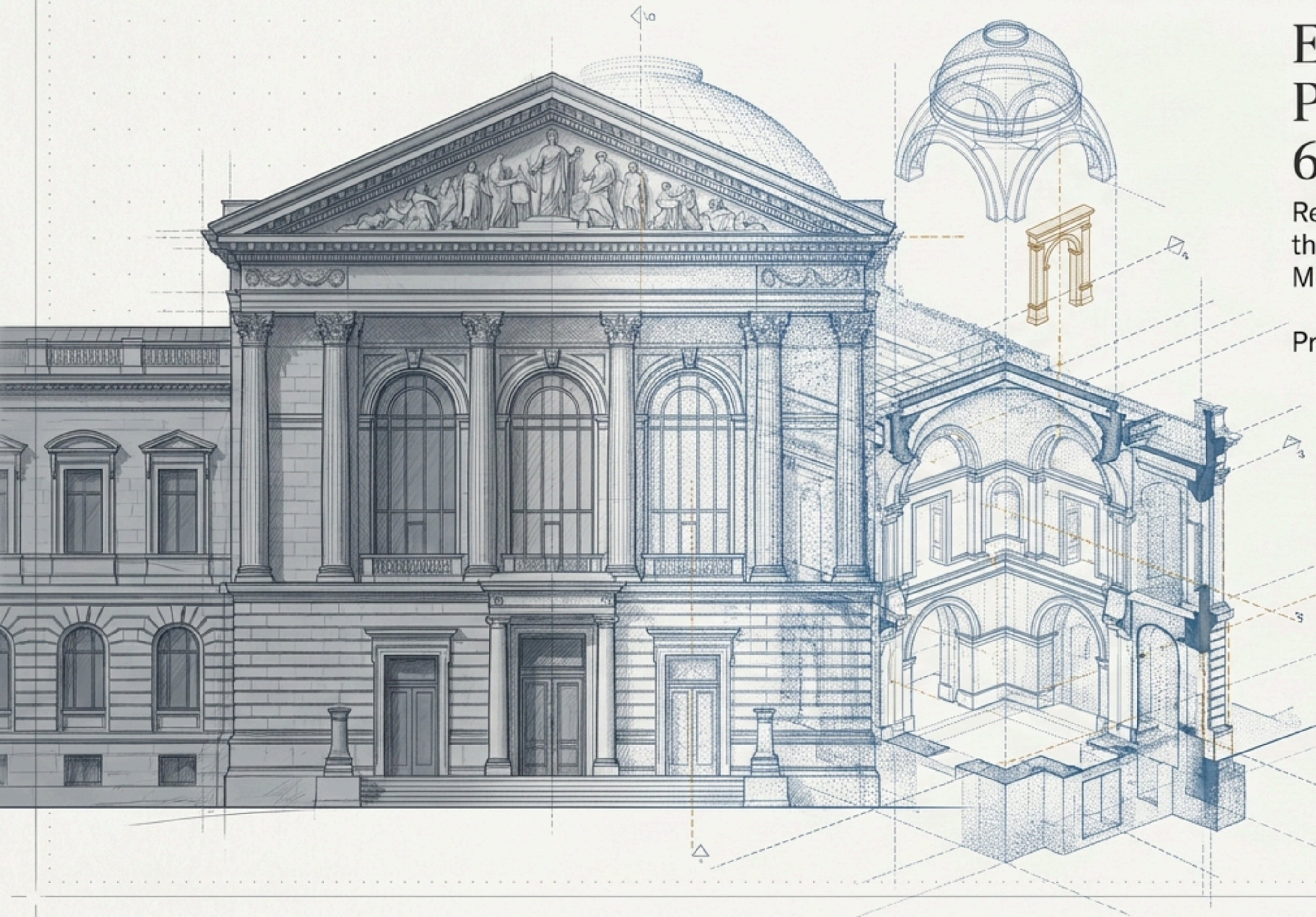


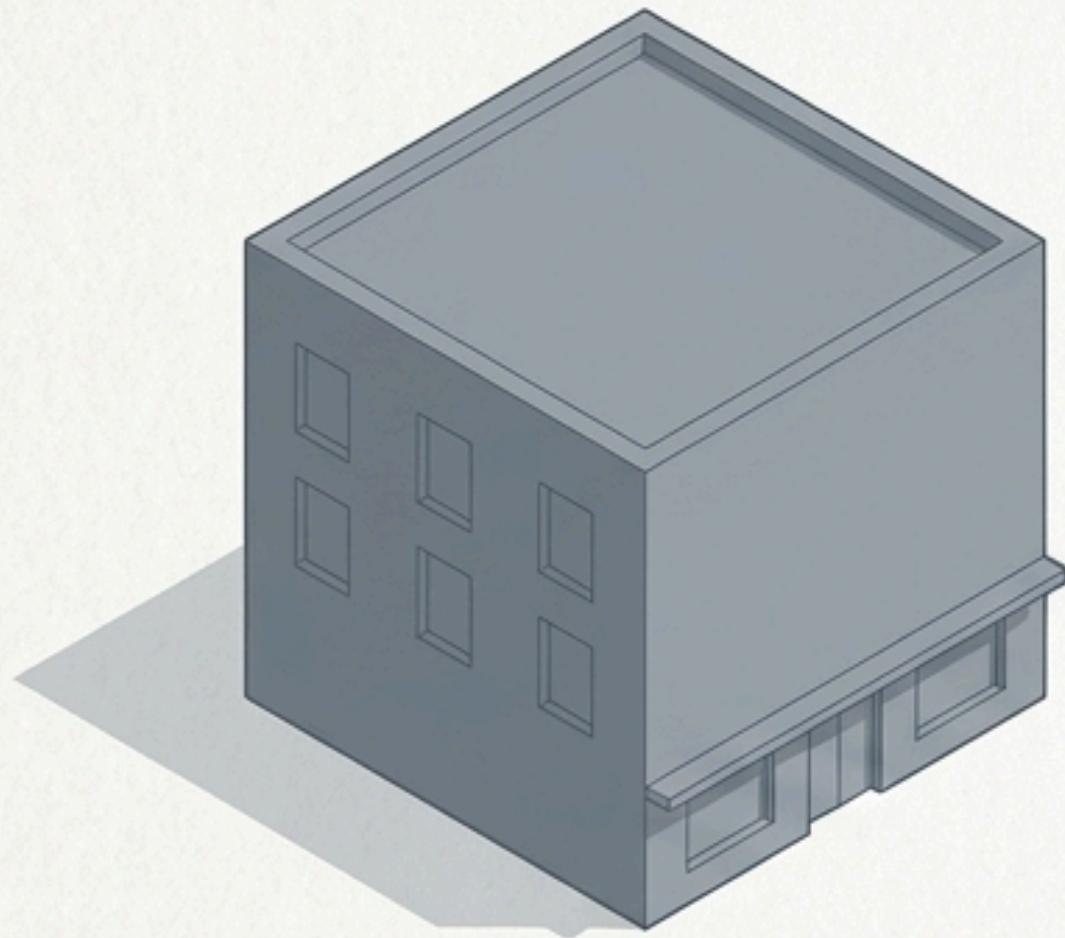
Engineering Preservation: The 6D Museum

Redefining Cultural Infrastructure through Building Information Modeling and Digital Twins.

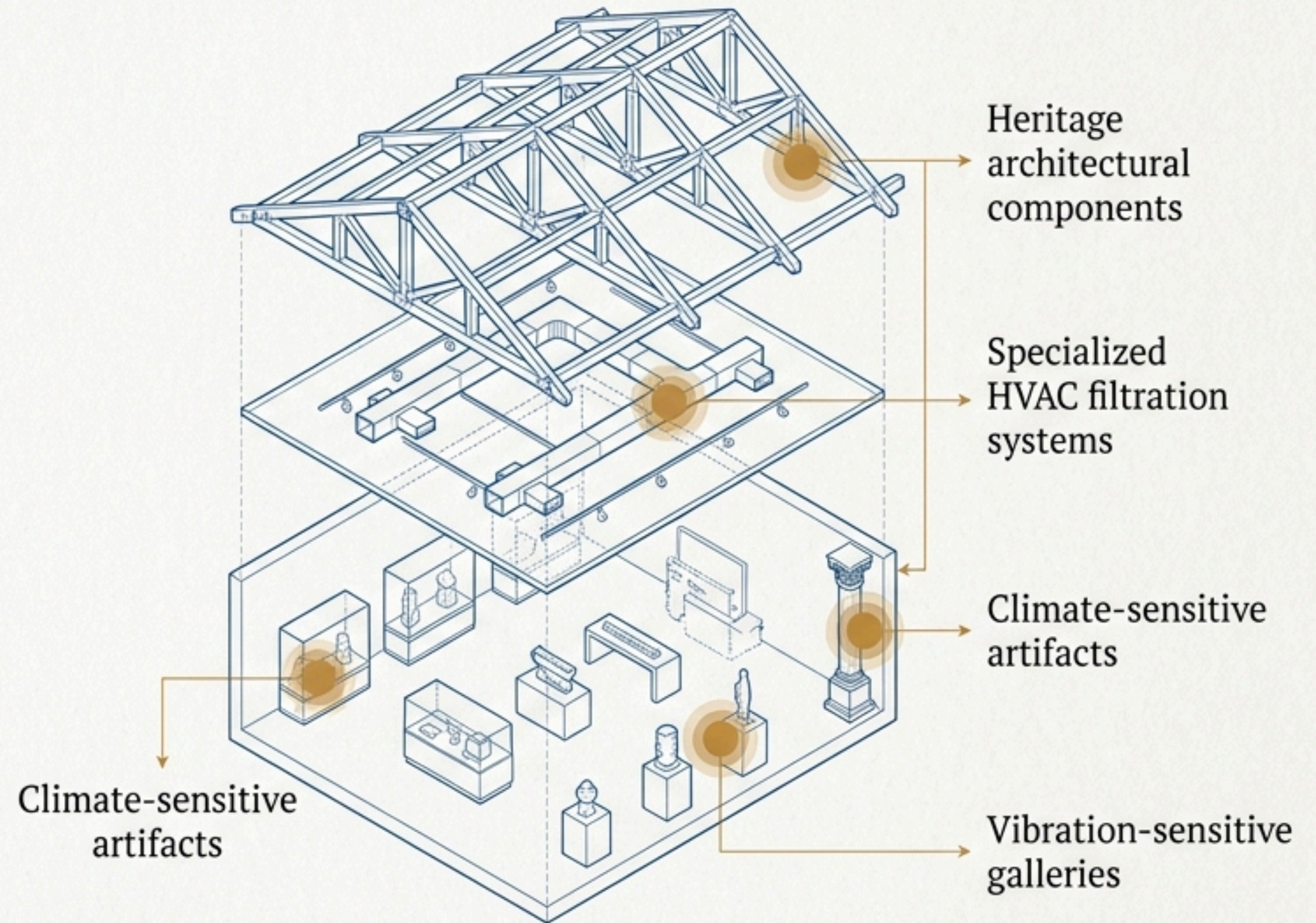
Presented by Roots BIM LLC



Museums Are Highly Sensitive Operational Environments



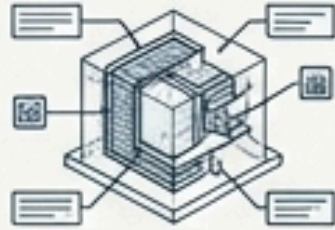
Conventional Buildings allow for operational tolerance.



A small operational failure inside a museum can lead to irreversible cultural loss.

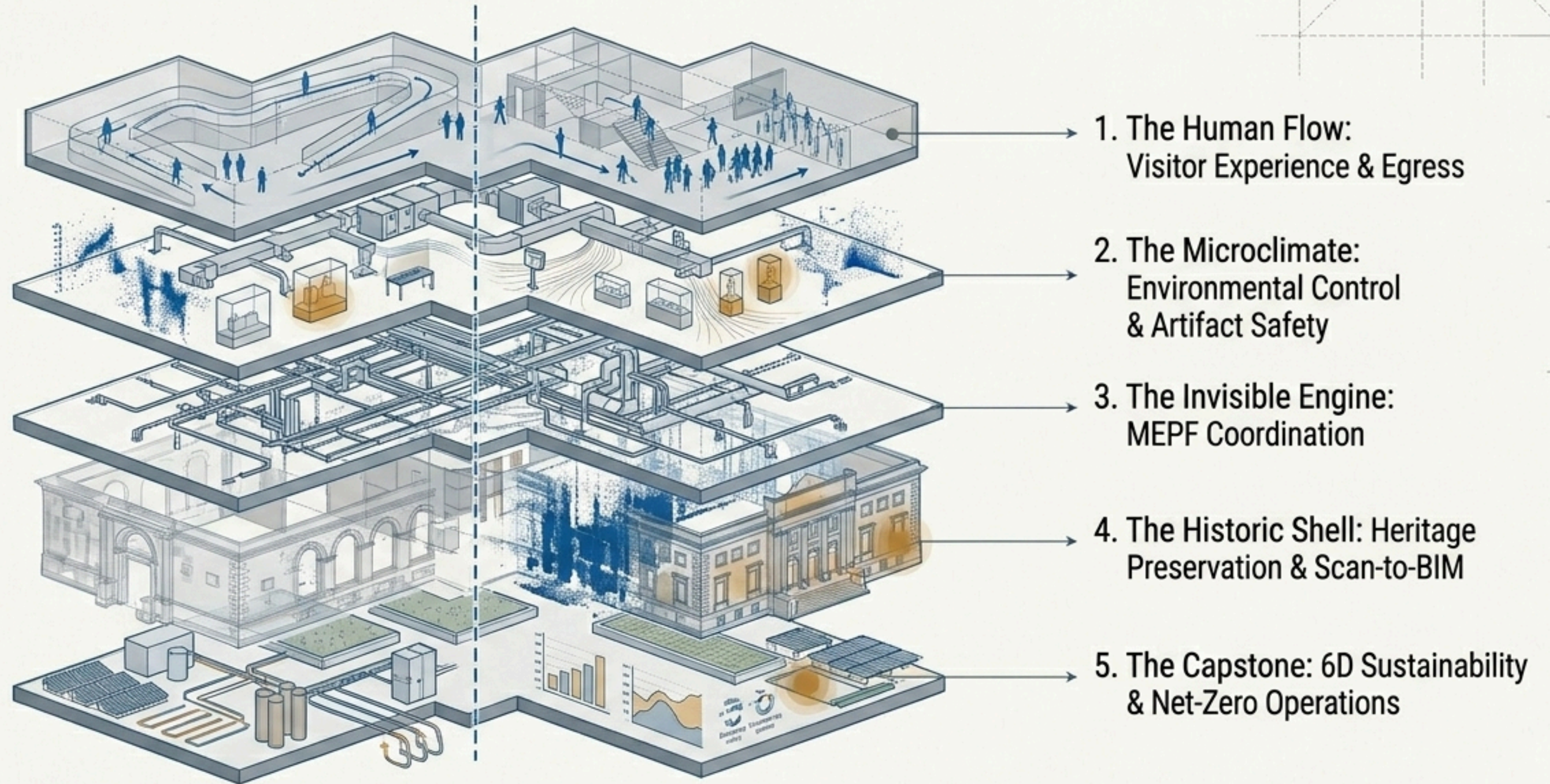
The Digital Backbone: From Fragmented Geometry to Centralized Intelligence

Reactive vs. Predictive Preservation

	Traditional CAD & FM		Intelligent BIM Ecosystem	
Documentation		Fragmented Drawings		 Centralized Intelligence Platform
Geometry		Lines and Shapes Only		 Embedded Engineering & Operational Data
Environment		Manual Inspection		 Sensor-based Digital Twins & Airflow Simulation
Maintenance		Reactive Fixes		 Predictive Lifecycle Information

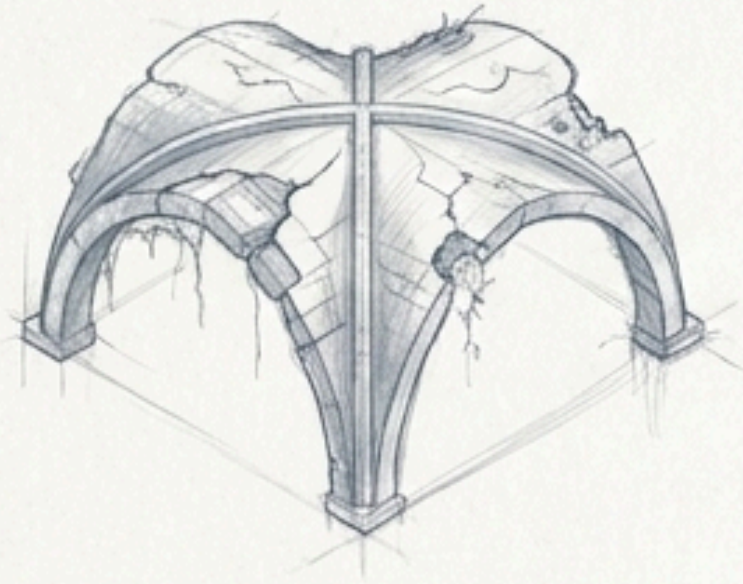
BIM creates an intelligent digital twin where every component—from fire protection to conservation room specs—contains embedded, actionable data.

Peeling Back the Layers of a Cultural Asset

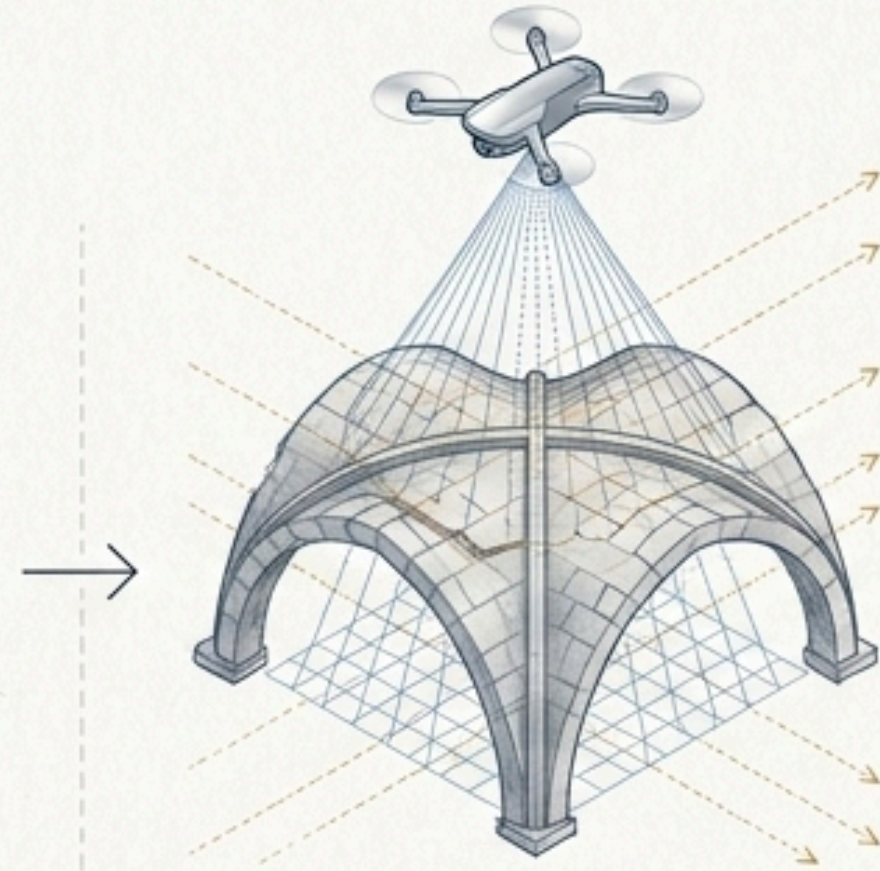


[Architecture, conservation science, and MEP engineering must function in complete synchronization.]

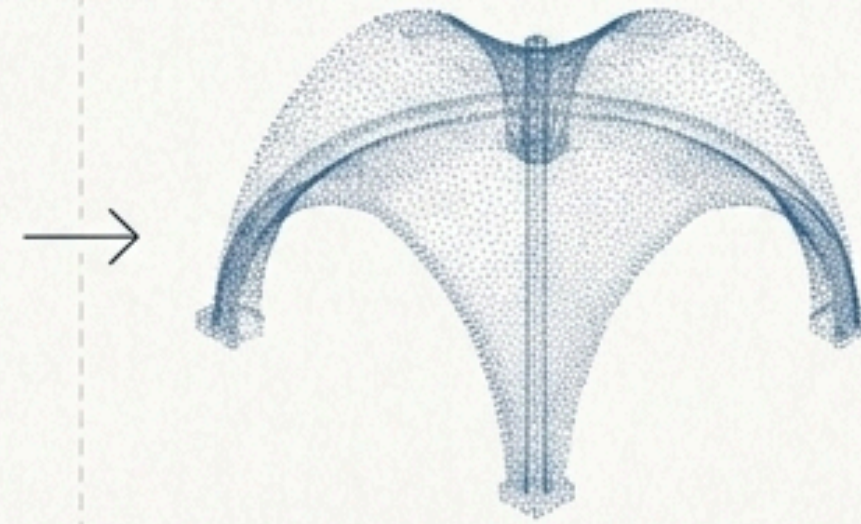
The Historic Shell: Digitizing the Undocumented



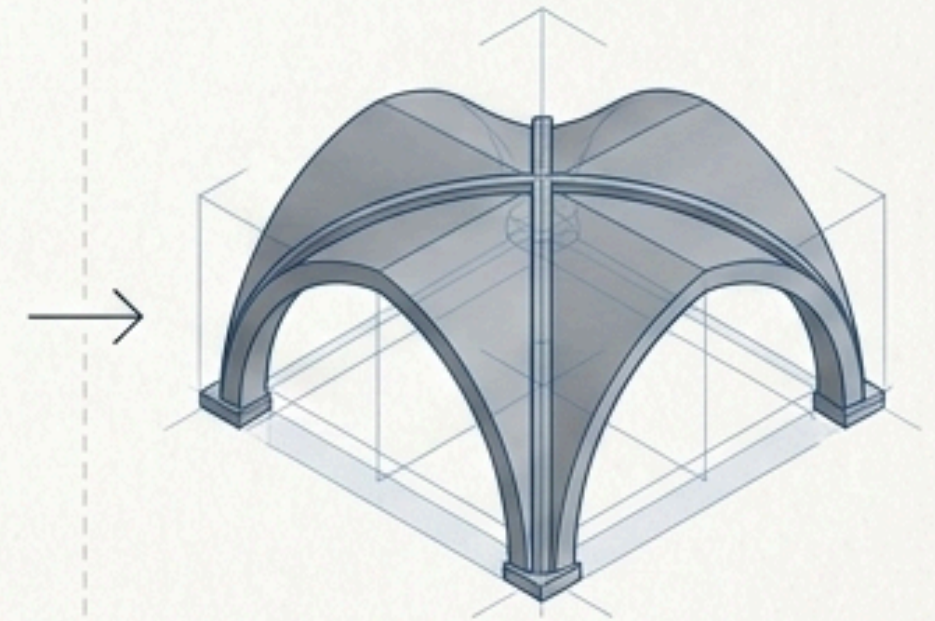
Capture: LiDAR scanning & UAV photogrammetry reconstruct existing conditions with millimeter-level precision.



Process: Complex vaulted ceilings and asymmetrical geometries are converted into point clouds.



Model: Transforming raw data into intelligent parametric HBIM models.

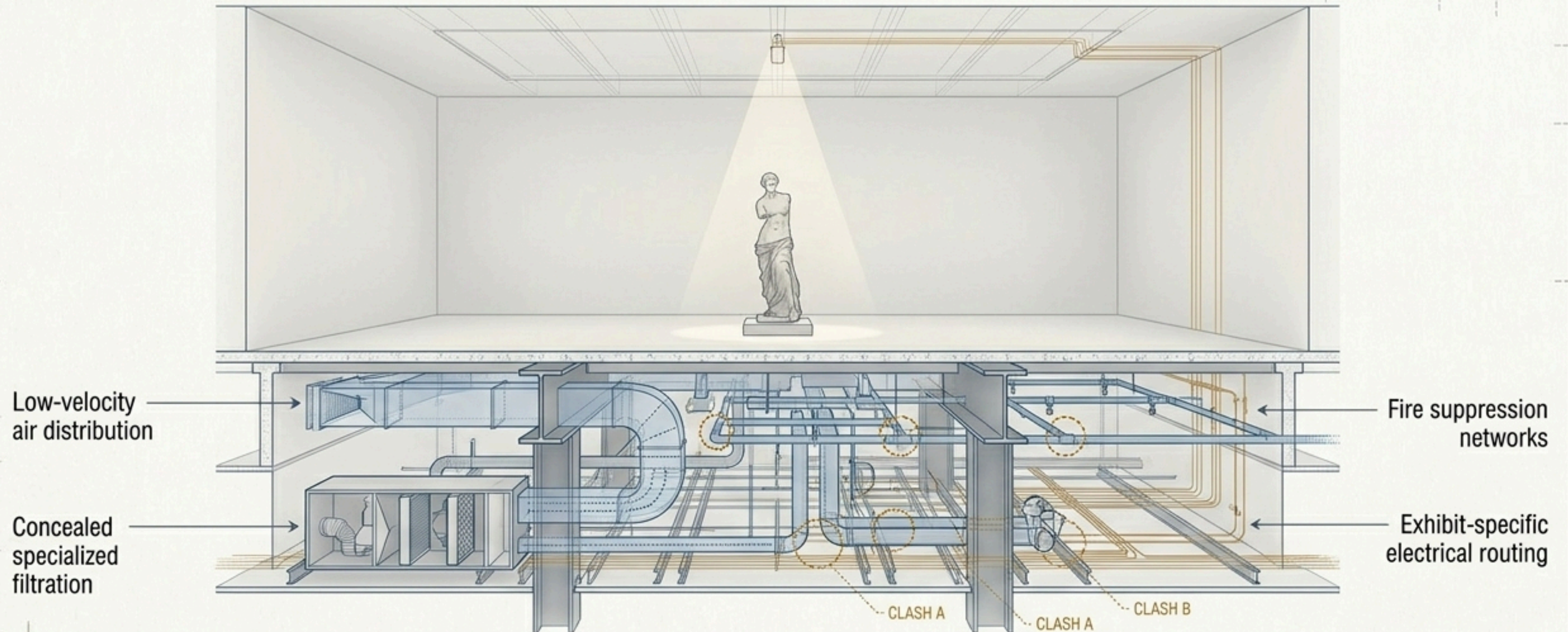


Outcomes: Structural assessment | Restoration planning | Clash-free retrofitting | Conservation sequencing

Achieving mission-critical documentation without physically disturbing fragile heritage elements.

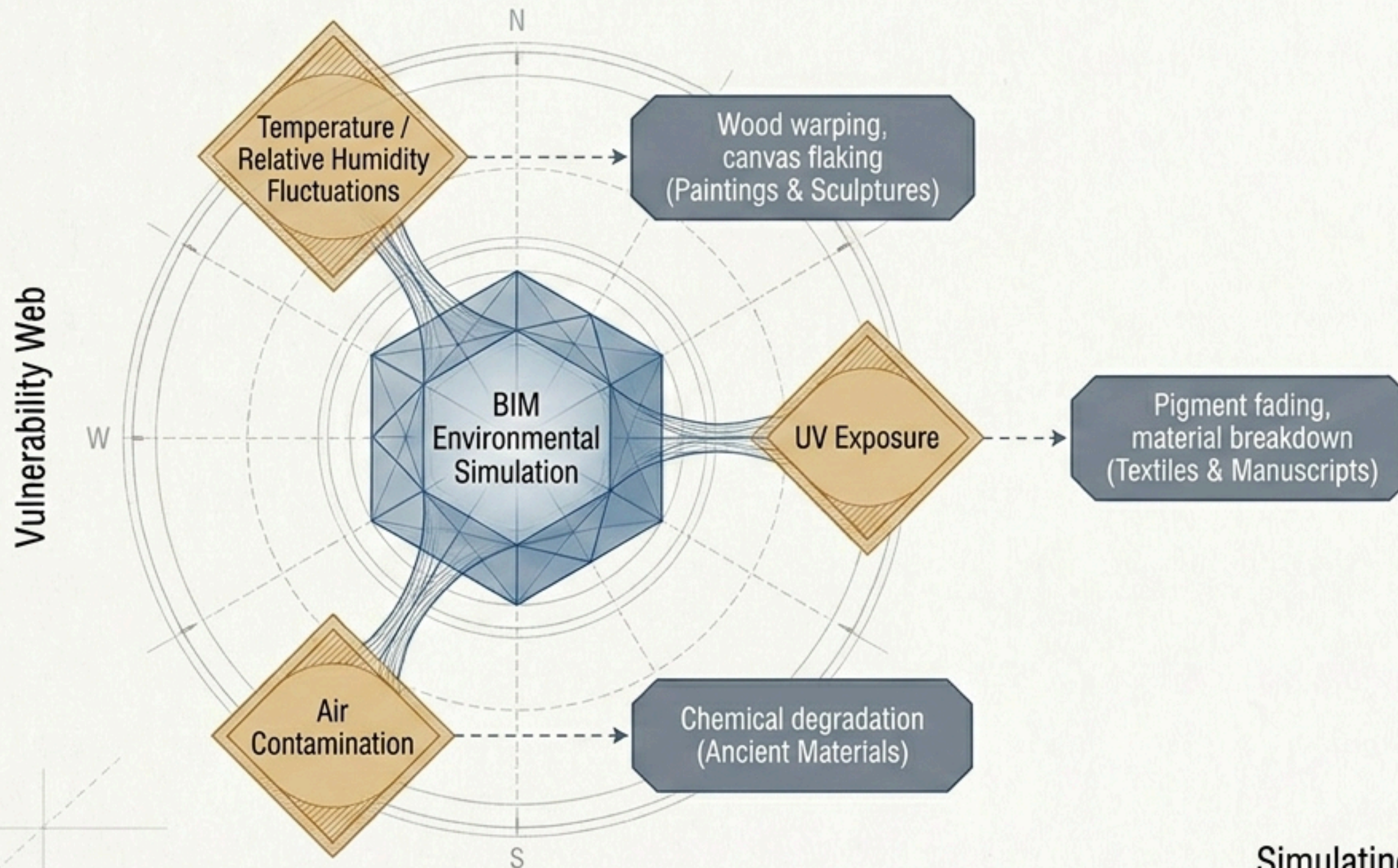
The Invisible Engine: Precision MEP Coordination

Museum systems must perform at extremely high precision while remaining completely invisible.

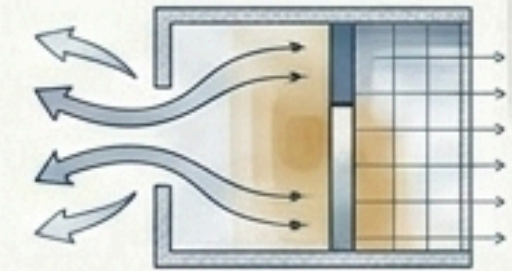


The BIM Advantage: Coordinated workflows avoid conflicts between structural members, conservation ceilings, and duct systems—minimizing costly field modifications and protecting artifacts.

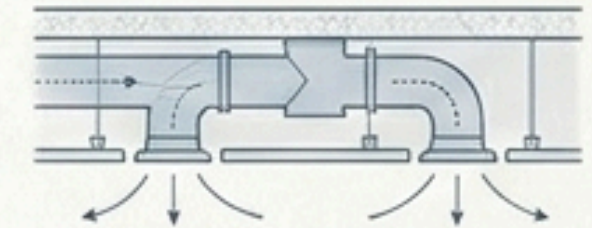
The Microclimate: Engineering Preservation-Grade Environments



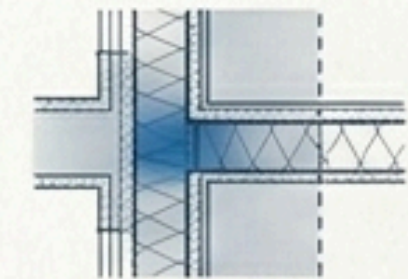
BIM Solutions:



- Computational airflow analysis & energy simulation.



- Optimized duct routing & accurate diffuser placement.



- Reduced thermal bridging & stable HVAC zoning.

Simulating and optimizing environmental behavior before construction or renovation begins.

The Human Flow: Simulating the Visitor Experience

Modern museums are highly experiential.
BIM ensures they are culturally immersive
and operationally efficient.



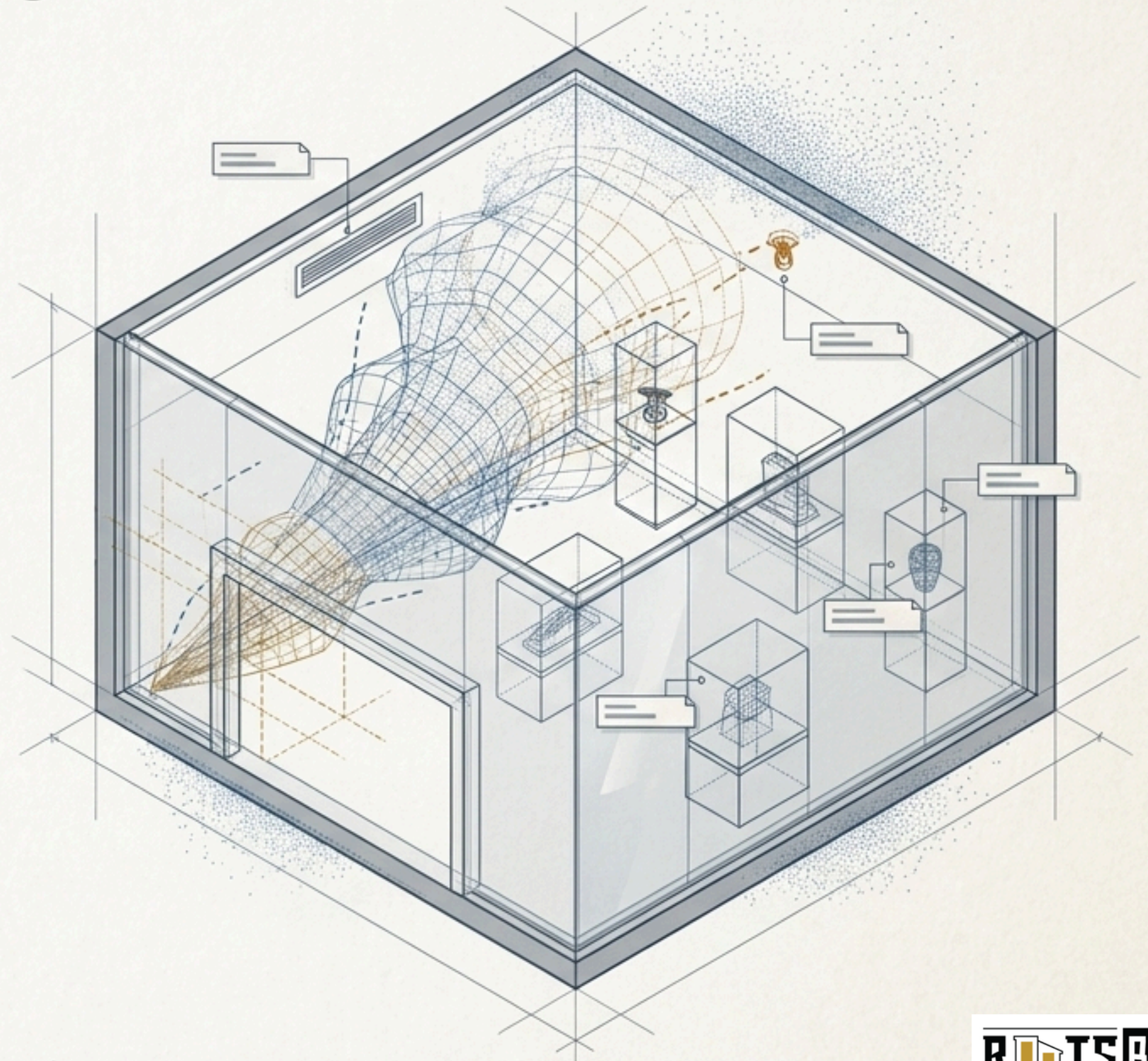
Risk Management: Moving from Inspection to Intelligent Control

Unique Museum Risks

- Fire hazards near irreplaceable artifacts.
- Water leakage risks.
- Security vulnerabilities.

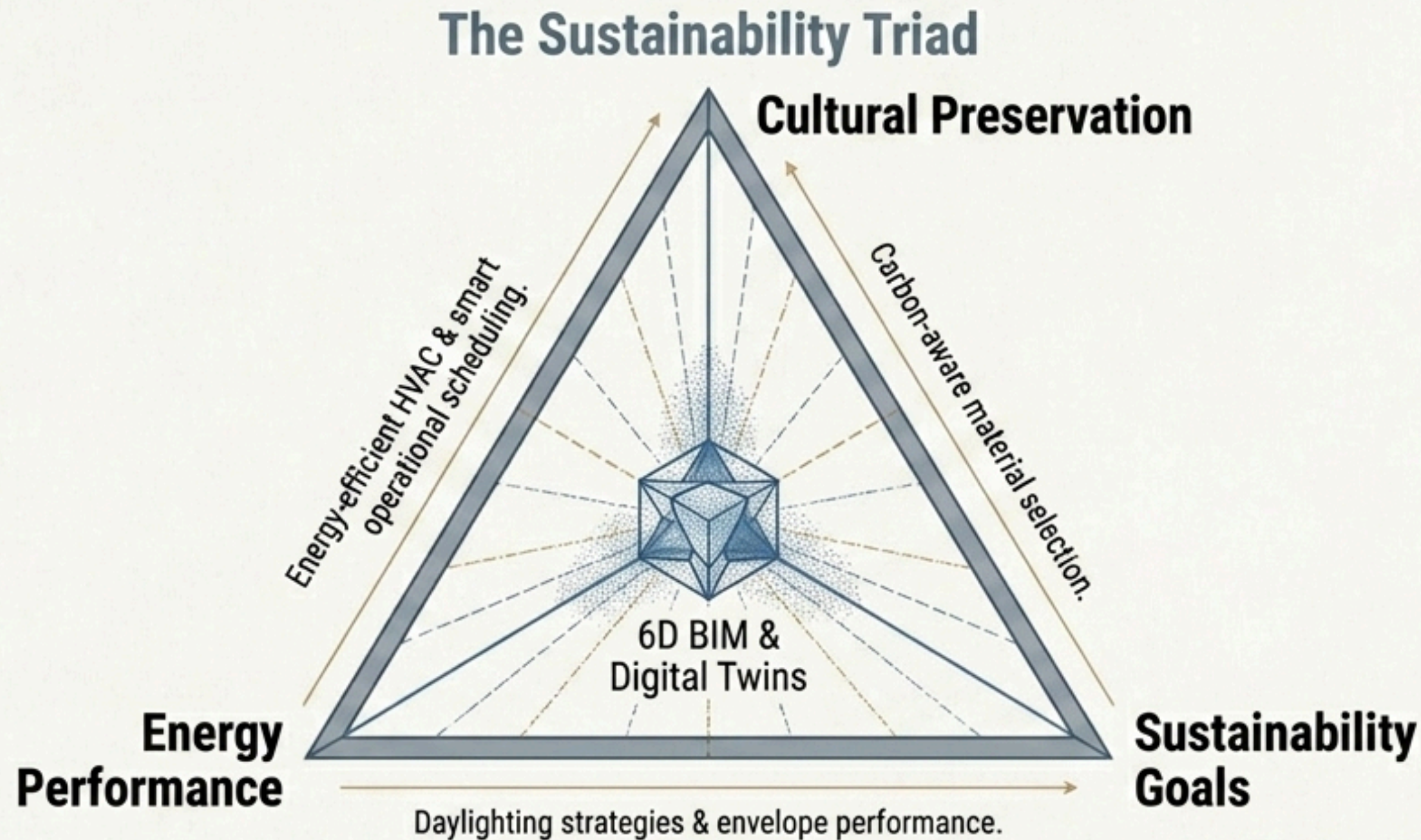
BIM Mitigations

- Emergency Response Visualization: Dynamic fire & smoke simulation.
- Asset Tagging & Sensor Integration: Real-time lifecycle monitoring.
- Maintenance Tracking: Predicting environmental system failures before they occur.



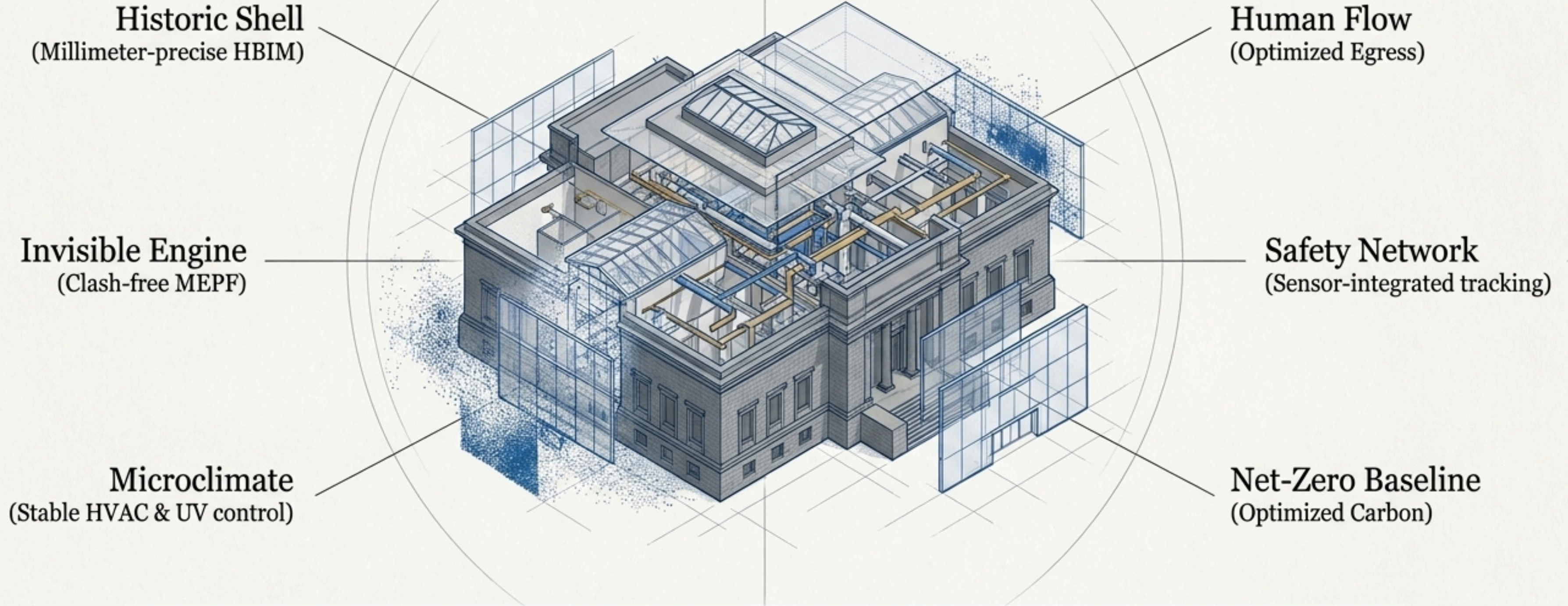
Net-Zero Infrastructure: The Balancing Act

Museums are inherently energy-intensive. 6D BIM reduces operational carbon while strictly maintaining preservation-grade environmental standards.



Engineering a sustainable future without compromising the microclimate of the past.

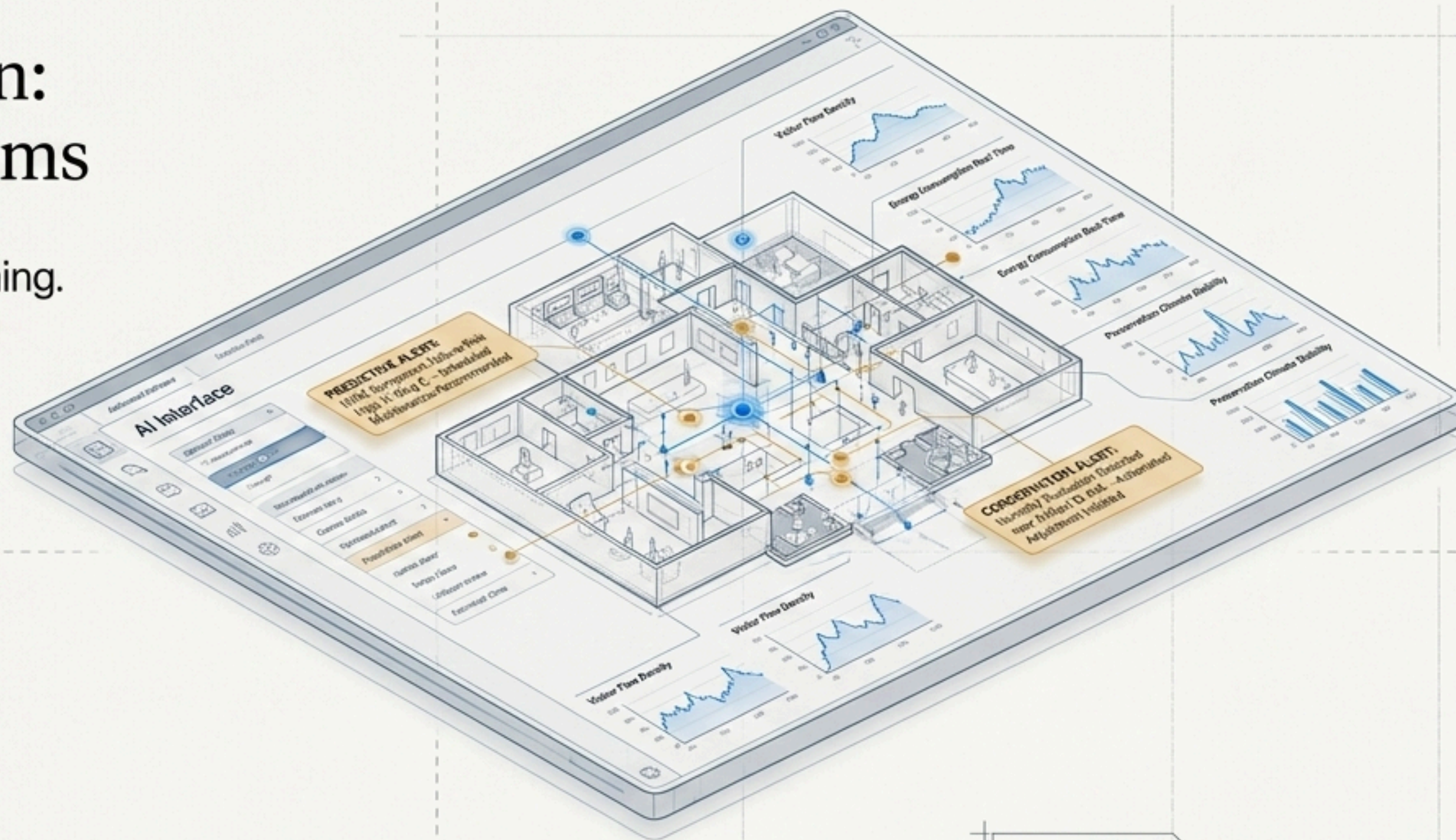
The 6D Digital Twin Ecosystem: Complete Synchronization



Architecture, engineering, and conservation are no longer isolated disciplines.
BIM unifies them into a single, predictive intelligence platform.

The Next Evolution: AI + BIM Ecosystems

The digital twin is just the beginning.
Future-ready infrastructures are
integrating next-generation
capabilities.



Future Node

AI-driven predictive
maintenance.

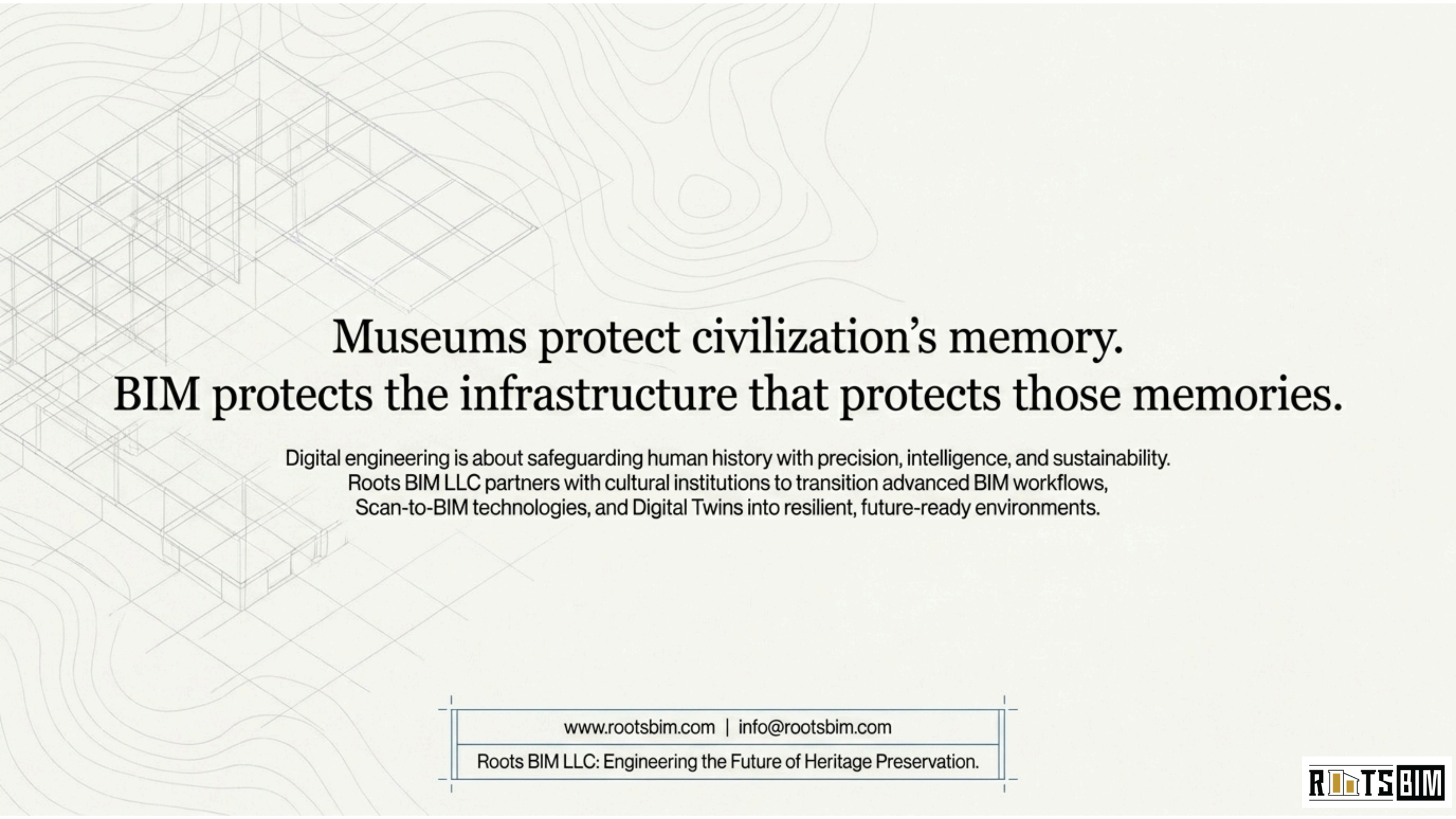
Real-time environmental
analytics & Semantic
BIM databases.

Robotics-assisted
conservation tracking.

Augmented Reality visitor
guidance & Digital Twin
operations centers.

Takeaway

Museums will evolve into intelligent
cultural infrastructures where
engineering precision supports
historical preservation at every scale.



Museums protect civilization's memory. BIM protects the infrastructure that protects those memories.

Digital engineering is about safeguarding human history with precision, intelligence, and sustainability.
Roots BIM LLC partners with cultural institutions to transition advanced BIM workflows,
Scan-to-BIM technologies, and Digital Twins into resilient, future-ready environments.

www.rootsbim.com | info@rootsbim.com

Roots BIM LLC: Engineering the Future of Heritage Preservation.

