CONFERENCE OMAINTEC 2026 EXHIBITION FM

The 23rd International Asset Facility and Maintenance Management Conference

FROM PHYSICAL TO VIRTUAL: TRANSFORMING FACILITIES MANAGEMENT USING DIGITAL TWIN TECHNOLOGY

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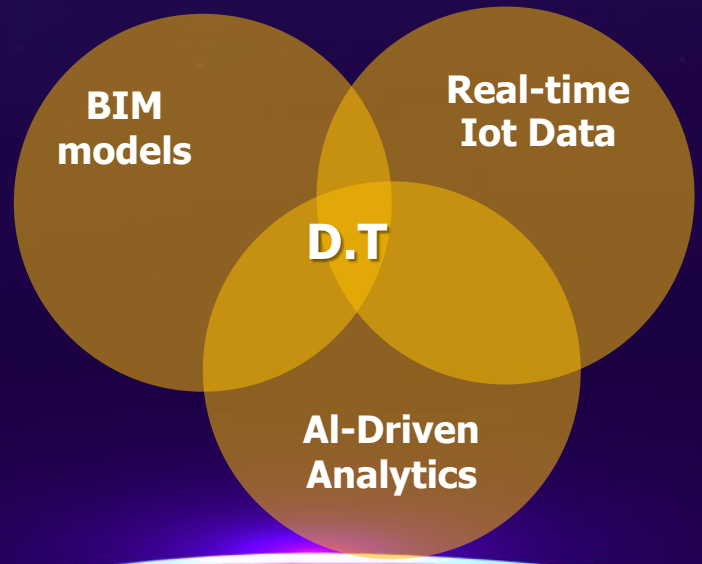
FROM PHYSICAL TO VIRTUAL: TRANSFORMING FACILITIES MANAGEMENT USING DIGITAL TWIN TECHNOLOGY

The Core Concept: A Digital Twin is a dynamic, virtual representation of a physical asset, system, or process. It is more than just a 3D BIM model; it's a living model that is continuously updated with real-time data from IoT sensors, building management systems (BMS), and other sources. This creates a bidirectional flow of information, allowing facilities managers to not only monitor but also simulate, analyse, and optimize building performance throughout its entire lifecycle.

Methodology: Integration of real-time IoT data, BIM models, and AI-driven analytics.



Key Outcomes:

- Proactive, Predictive Maintenance
- Energy Optimization & Sustainability
- Enhanced Space Utilization

The Challenge: Traditional FM Paradigms

Reactive Maintenance

Actions taken only upon failure or complaint. Results in unplanned downtime and reduced asset lifespan.

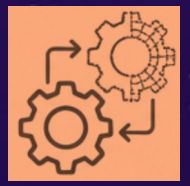
Data Silos

Critical data locked in disparate systems (CMMS, BAS, CAD), creating operational "blind spots."

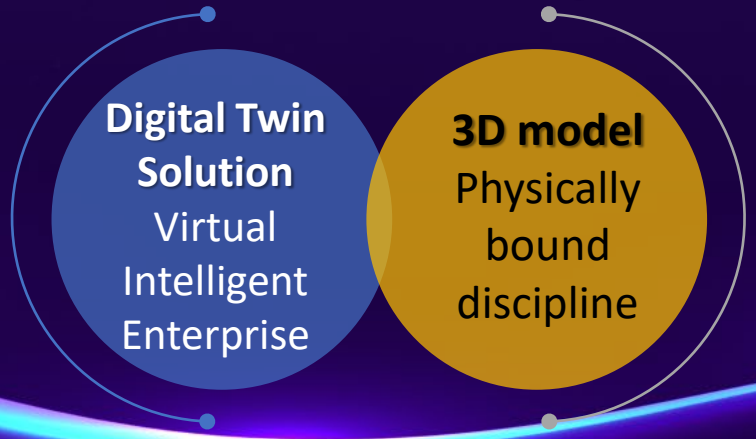
Manual Processes

Reliance on paper logs, manual inspections, and fragmented communication leads to inefficiency.

What is Digital Twin Solution? → Dynamic virtual representation of a physical asset → **UTILIZES** → 1- Simulation, 2- Machine Learning, 3- Reasoning → **TO** → PREDICT FUTURE PERFORMANCE



Therefore, the *Digital Twin* is not merely a static *3D model*; it is a *Cyber-Physical System (CPS)* that evolves in real-time, moving FM from a physically-bound discipline to a virtual, intelligent one



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3-Layer Framework Architecture

Physical Layer

The "**Sensor-Instrumented Asset**." Includes architectural elements and engineering systems instrumented with IoT sensors

Sensor-Instrumented Asset

Data Layer

The "**Central Nervous System**." Ingests, aggregates, and harmonizes data from sensors, BIM, and CMMS into a data lake.

Central Nervous System

Virtual Layer

The "**Cognitive Core**." Powered by AI to run simulations, predict failures, and provide visualization dashboards.

Cognitive Core

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The Digital Twin is a synergy of three enabling technologies

IoT Nervous System

Provides the continuous stream of real-time data from the physical world (Temp, Vibration, and Occupancy).

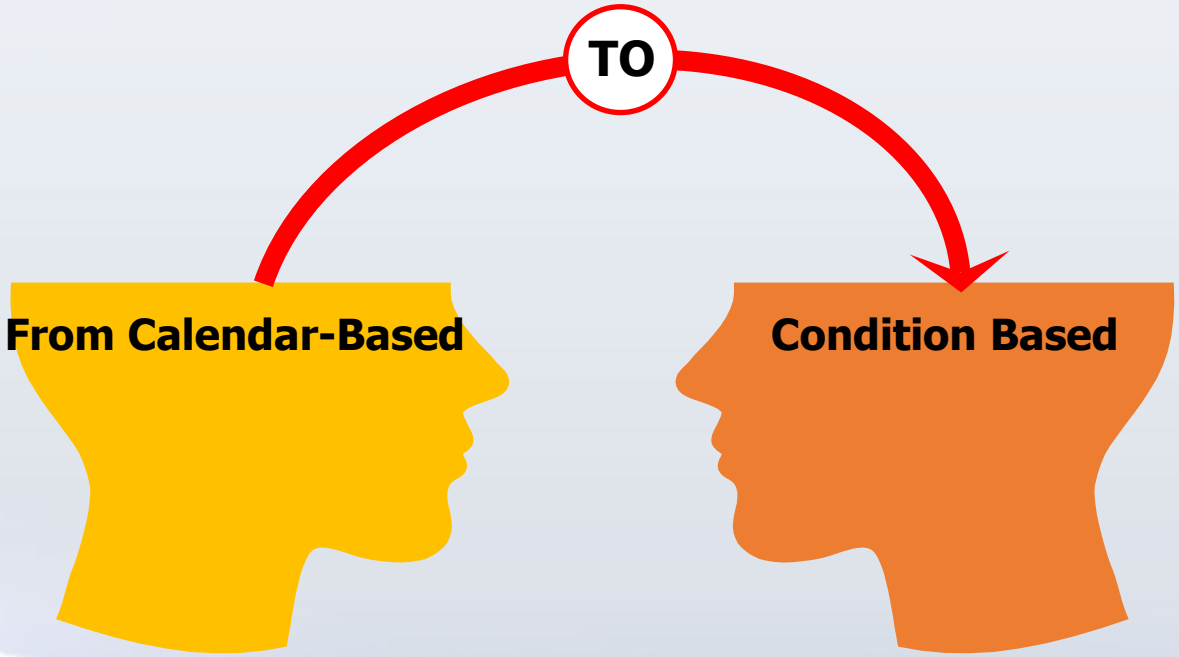
BIM (Skeleton)

Provides the 3D geometry and semantic database (Asset specs, spatial relationships, warranty info).

AI (Brain)

Processes integrated data to identify patterns, anomalies, and correlations invisible to humans.

Predictive & Prescriptive Maintenance



Instead of maintaining equipment according to a fixed schedule (preventive maintenance), the Twin device utilizes sensor data (vibration, Thermography) to determine its actual condition.

The Prescriptive Advantage:

Predict: "Bearing failure likely in 48 hours."

Prescribe: "Replace Part #XYZ"

Act: Automatically checks inventory and schedules technician.

Energy Performance & Optimization: The Digital Proving Ground

The Feedback Loop

The optimization process is a continuous cyber-physical feedback loop enabled by the digital twin's layers:

Baseline

BIM model calibrated with real-time IoT data

Simulation

Test "What-if" scenarios (e.g., Dynamic Setbacks, Optimal Start/Stop).

Deployment

Push optimized set-points to BAS

Result: Deep energy retrofits via operational changes alone (10-25% savings).

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Dynamic Analytics

Using People Counters and WiFi probes to create heat maps of actual usage.

- Identify underutilized assets.
- Optimize cleaning schedules based on usage.
- Right-size meeting rooms.

Occupant Comfort

Monitoring IAQ, Thermal, and Visual comfort against ASHRAE standards.

- Automated Action: Increase ventilation if CO2 rises.
- Proactive Resolution: Flag comfort drifts before complaints occur.

Summary of Digital Twin implementations across different sectors:

Building Type	% Reduction in Maintenance Costs	% Energy Savings	Improvement in Space Utilization	Key Comfort Metric Improvement
Commercial Office	25%	15%	20% (Desk Sharing Ratio)	15% reduction in comfort tickets
University Campus	18%	22%	30% (Classroom Usage Efficiency)	IAQ maintained > 95% of time
Hospital	30%	12%	N/A	Patient room temp. variance ±0.5°C

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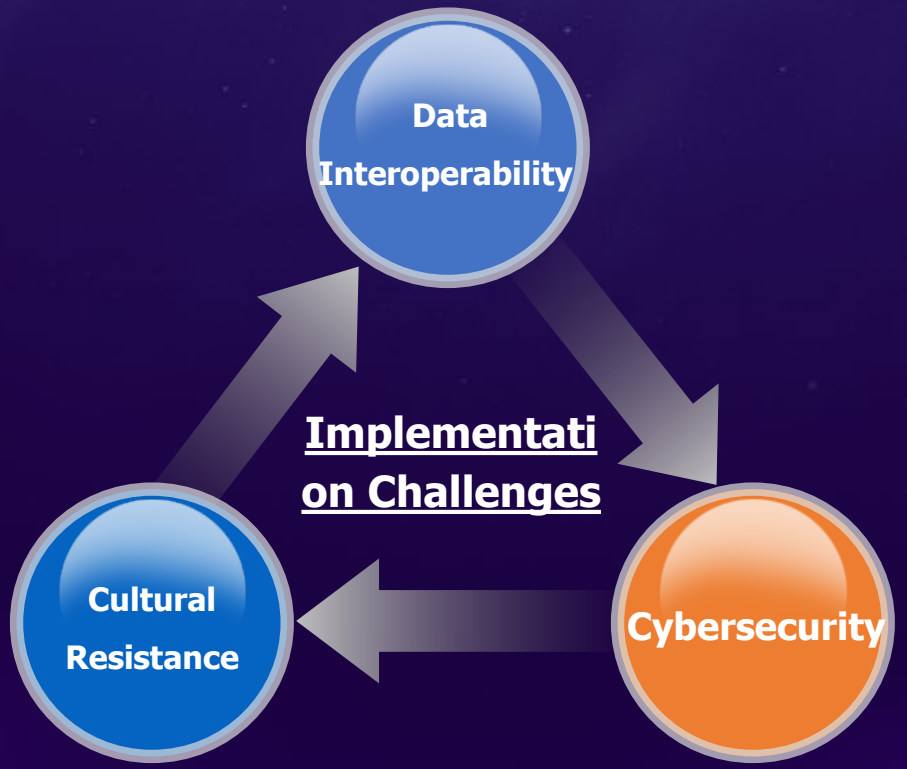
The "Tower of Babel" problem. Systems (IoT, BIM, CMMS) speak different languages. Requires open standards like IFC.



Moving from "If it isn't broke, don't fix it" to data-driven trust. Requires strong change management.

Connecting OT to IT expands the attack surface. Risks include operational disruption and privacy breaches.

Conclusion

Digital Twin Technology is The Indispensable Central Nervous System of The Future Intelligent Building.

The Imperative:

1. **Prioritize Data Strategy: Break down silos.**
2. **Start Phased: Focus on high-value use cases first.**
3. **Empower People: Foster a culture of data literacy.**

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