PAE
MODELS TO MEANING
SkyCentrics
ONUMA SYSTEM
Stephen Lothrop
PAE
Tristan de Frondeville
SkyCentrics
Kimon Onuma
ONUMA
SEMANTIC BUILDINGS
RDF Knowledge Graphs
Open Building Stack
cloudBIM
C4SB FOUNDATION

C4SB FOUNDATION

2022-2024

2025

2026

2525 SPECIFICATION FRAMEWORK

SEMANTIC BUILDINGS

DIGITAL BUILDING PROFILE

BCC BACnet CLOUD COLLECTIVE

TxO

LonMark

Asset Leadership Standard

BCS Cyber Security

Digital Twin Labs

IBB

cloudBIM

OPEN FDD Spec

Agentic AI Foundation

ECOPORT GEBs

Open Building Stack

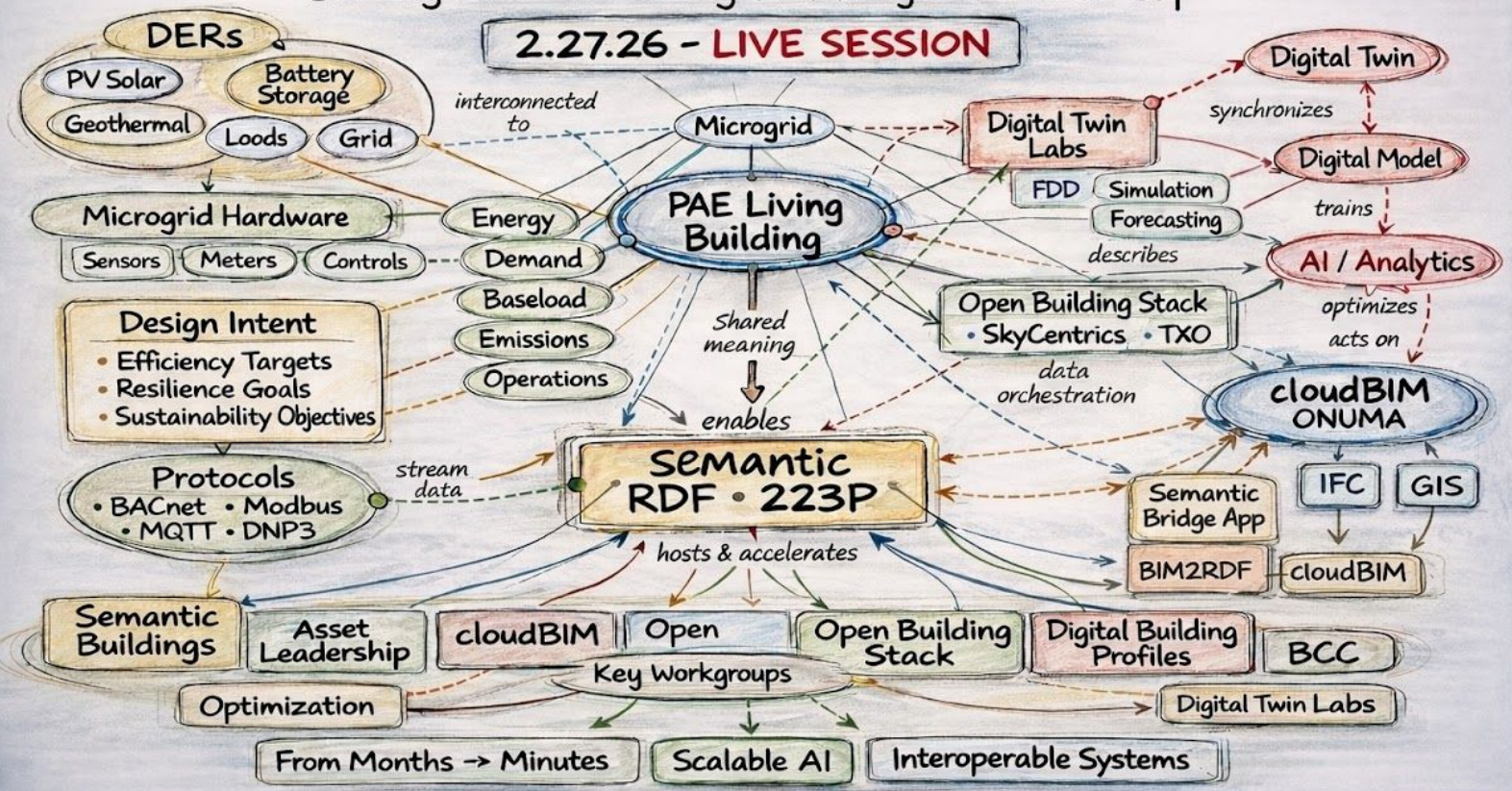
Project Arete

THE LINUX FOUNDATION

MODELS TO MEANING

Building-Aware AI: Closing the Microgrid Semantic Gap

2.27.26 – LIVE SESSION



Coalstion for Smarter Buildings

Net Zero Energy

58k
Square Feet

Net Zero Water

20
Energy Use Intensity

PAE Living Building

PORTLAND, OR | **OPENED IN 2021**

Developer-led Living Buildings are a possibility

WHAT WE LEARNED

EUI

To maintain tenant flexibility 20-25 EUI is ideal in Portland

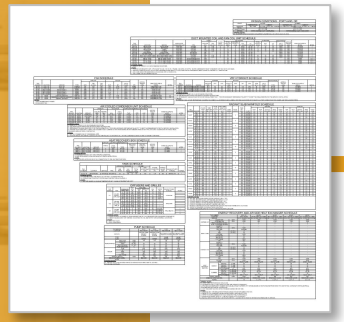
Vacuum flush and composting toilets provides better control

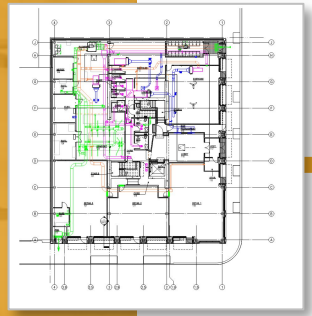
60% of our PV-generation is on an array donated to an affordable housing development

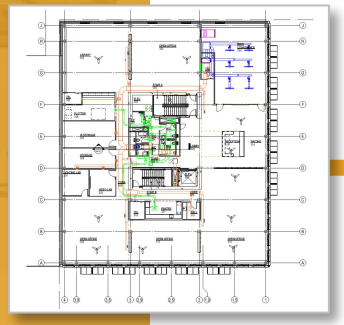
Microgrids, batteries, resilience, and the grid

After Construction

Plans are put away “somewhere safe.” Figuring out how things are connected means opening a document and cross-referencing others. No way to see the connections from the collection.

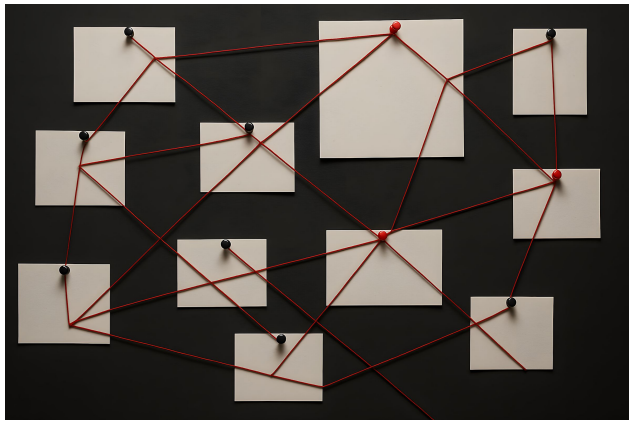




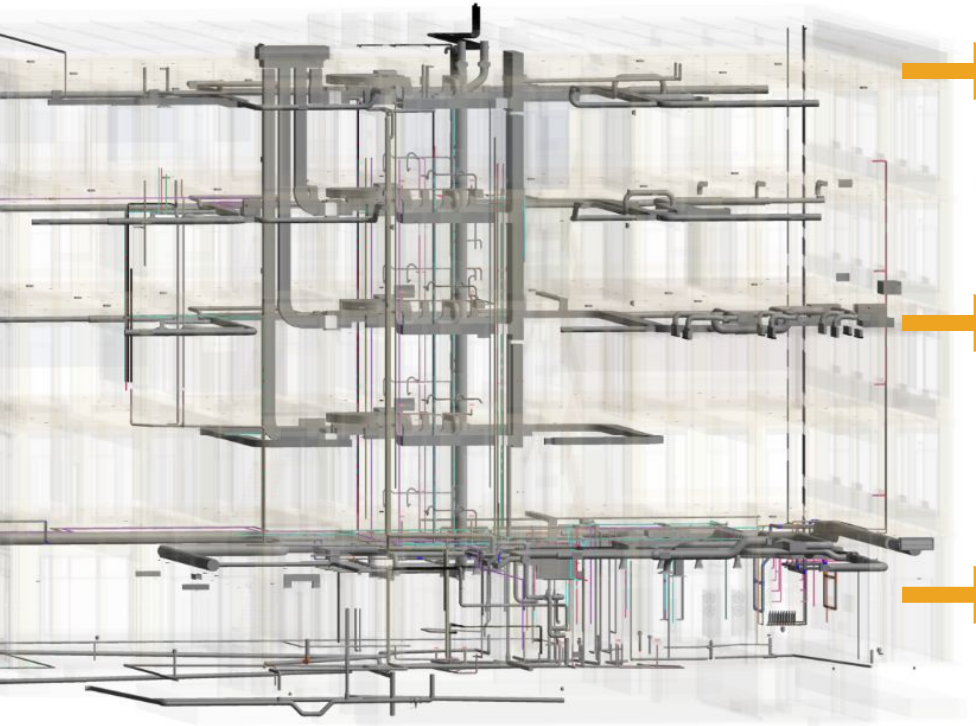


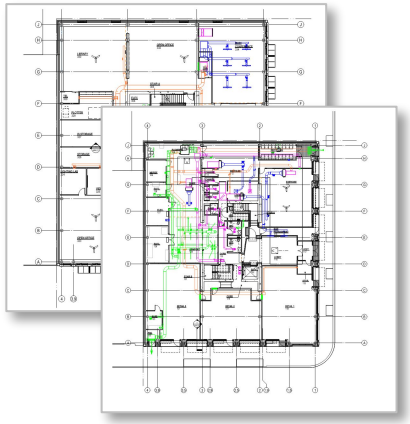
Relationships are not built into documents

We create the meaning, connections, and relationships of data when we read it and cross-reference it. Computers don’t have a way to infer meaning. They need to be told explicitly.

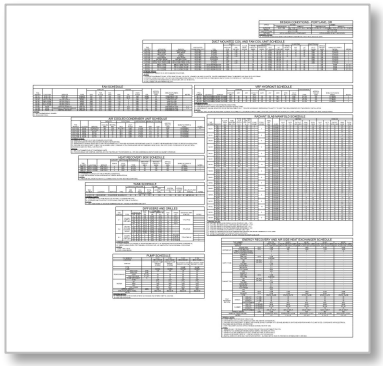


What do we do with the BIM?





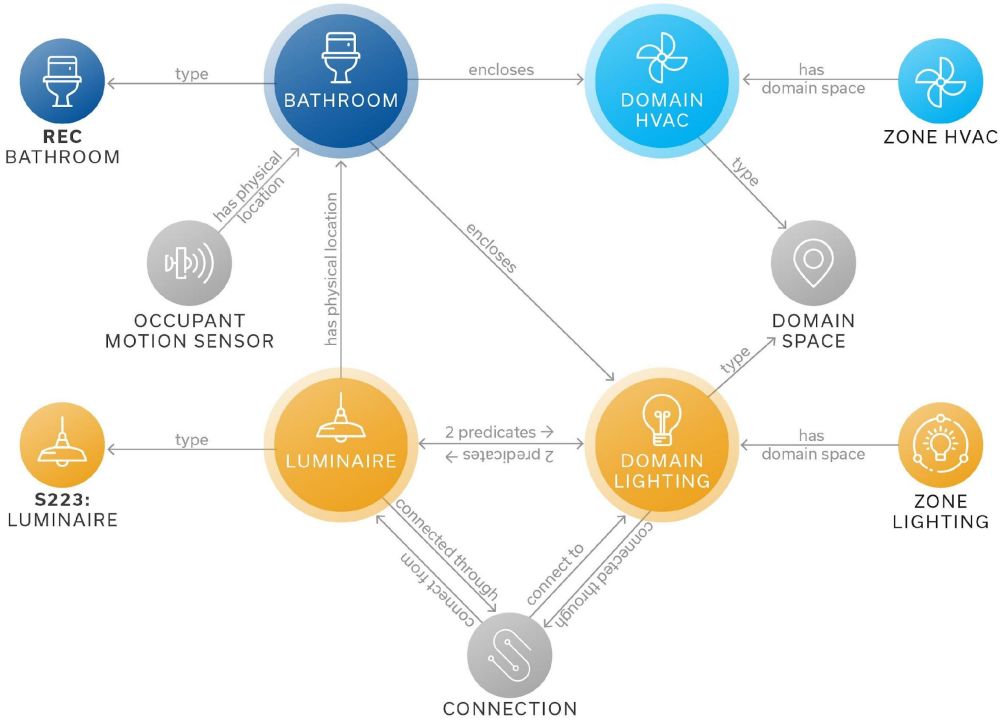
Slice the building into 2D slices to put on PDFs



Create more schedules

There are multiple ways to build a semantic model. RDF semantic models can use multiple ontologies simultaneously.

There is no need to choose just one

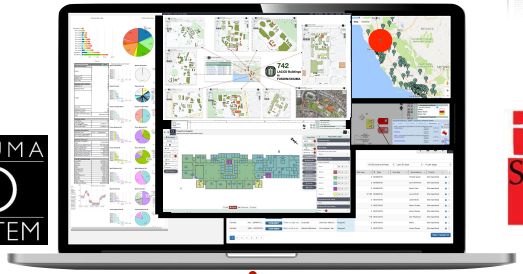


REC: Real Estate Core
https://dev.realestatecore.io/ontology/Space/Architecture/Room/Bathroom

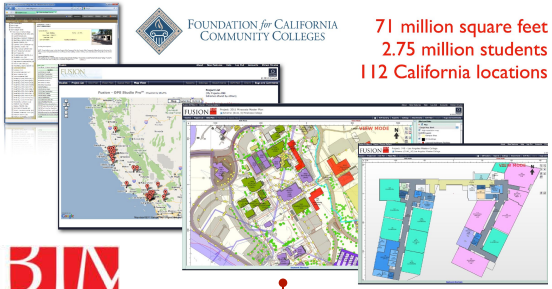
s223: ASHRAE 223
https://explore.open223.info/s223/Luminaire.html

ONUMA
SYSTEM
ZAiMAP
cloudBIM
Kimon Onuma, FAIA
ONUMA, Inc.
CLOUD BIM
ARCHITECT
INTENT TO LIFECYCLE
HANDOVER TO

35 Years of Building Informed Environments



ONUMA SYSTEM



FOUNDATION for CALIFORNIA COMMUNITY COLLEGES

71 million square feet
2.75 million students
112 California locations

BIM STORM

ZAi

Owner's Data

Architects, Engineers Geodesigners, Analysts

BIM GIS FM Project

U.S. DEPARTMENT OF HOMELAND SECURITY

LOS ANGELES COMMUNITY COLLEGE DISTRICT

NFMT2025 National Facilities Management & Technology March 25-27, 2025 • Baltimore

1990 | 1994 | 2000 | 2003 | 2008 | 2011 | 2014 | 2016 | 2017 | 2021 | 2023 | 2024-25

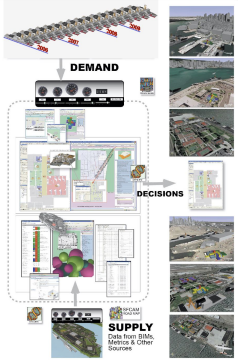
Yokosuka US Navy Base BIM

1994

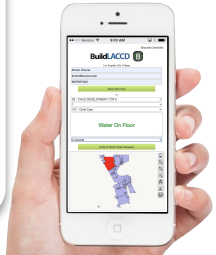
US Coast Guard

Assets

2003



BIM genie



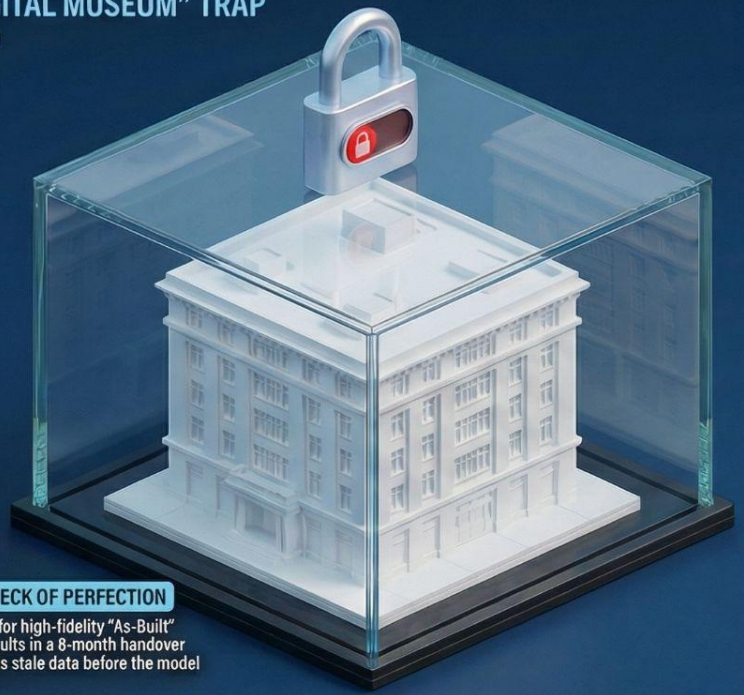
DEPARTMENT OF STATE UNITED STATES OF AMERICA

BRAINS & BYTES BIM STORM

ONUMA SYSTEM ZAiMAP

CONNECTION BEFORE PERFECTION: THE MINIMUM VIABLE TWIN

THE "DIGITAL MUSEUM" TRAP
(THE TRAP)



THE BOTTLENECK OF PERFECTION
Waiting months for high-fidelity "As-Built" Ravit models results in a 8-month handover cycle that creates stale data before the model is even opened.

THE REALITY OF PROPRIETARY SILOS
Geometry is often locked in proprietary software, making it impossible to use for daily operations or cross-system integration.

> **A perfect map with no traffic data is useless.**
> Without live connectivity, a high-detail model is merely a static asset with no operational utility.

THE "MINIMUM VIABLE TWIN"
(THE SOLUTION)

START WITH WHAT YOU HAVE
Leverage existing "dirty" data, PDPs, Matterport scans, and simple massing to establish location and scale in under an hour.

CONNECTIVITY OVER COMPLEXITY
Use Web Service APIs (JSON/REST) to bridge the gop between static assets and live operations immediately.

MEANING VIA SEMANTICS
Contaxt and meaning emerge when simple assets are aligned to standards like ASMRAE 222P, allowing humans and AI to act en data.

CASE STUDY: NORTHGATE MARKET #39

LIVE CLOUDBIM ENVIRONMENT

FROM ZERO TO LIVE IN DAYS
Northgate integrated 140+ assets into a CloudBIM environment using live web APIs without waiting for perfect BIM standards.

DIRECT SYSTEM KNOWLEDGE WINS
Immediate value was achieved by identifying web service APIs instantly, gaining access to 50% of building data in minutes.

THE WINNING SEQUENCE
Operations first → Context second → Live integration third. Layer detail only as it becomes necessary for operations.

THE BOTTOM LINE

"DON'T WAIT FOR THE WALLS TO BE PERFECT TO TURN ON THE LIGHTS."

CONTEXT > GEOMETRY: Meaningful operational intelligence is found in the connection between live flows and spatial context, not in geometric precision.

Velocity and access are the true drivers at digital transformation in the built environment.

A Platform is Infrastructure, Not an App

ASHRAE 2026 Seminar 42: From Models to Meaning: Bridging BIM, HVAC, and Operations with Ontologies

Definition: A platform is a shared infrastructure that makes building and portfolio data usable over time.

Clarification:

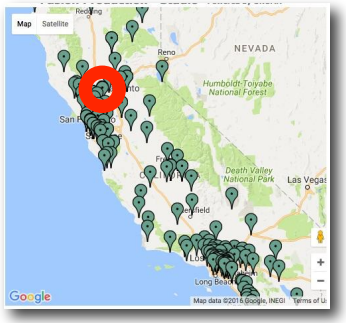
- ✓ It is **NOT** a BAS (Building Automation System).
- ✓ It is **NOT** a single building.
- ✓ It is **NOT** an app.

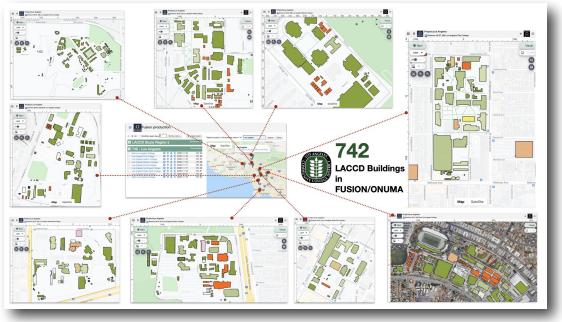
Role: Tools, devices, and software are just "containers." The platform is what **keeps the data trustworthy, connected, and valuable** for many users (occupants, technicians, future teams).

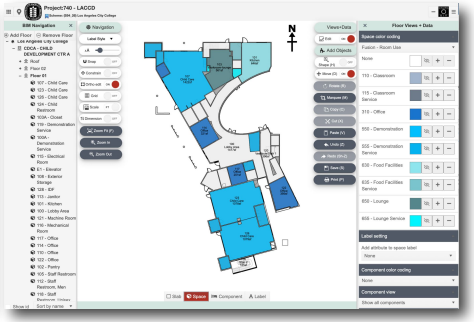
California Community Colleges have the Data

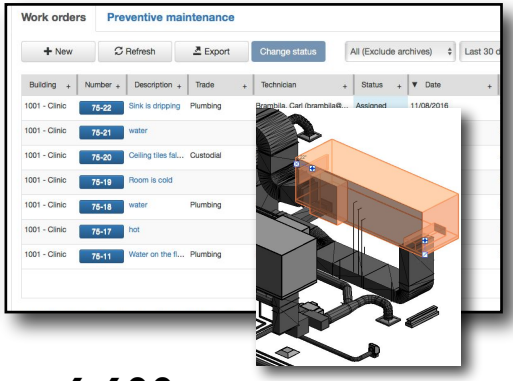
Data translated into graphic floor plans

Largest College District in the US









72 CCC Districts
~5,000 Buildings
~90M SF

2011~2025 >

LACCD GIS
9 Campuses
~18M SF

2021~2025 >

742 Building BIMs
30,599 Spaces
+75K Work Orders

2021~2025 >

6,600
Tagged Assets
In BIM

2024~2025 >

From BIM to Meaning: What a Semantic Model Does for Digital Twins and AI

BIM:
Isolated Parts & Data

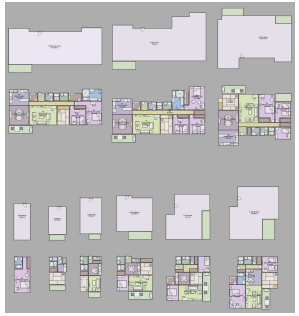
RDF: The Semantic Model
(Meaning & Connections)

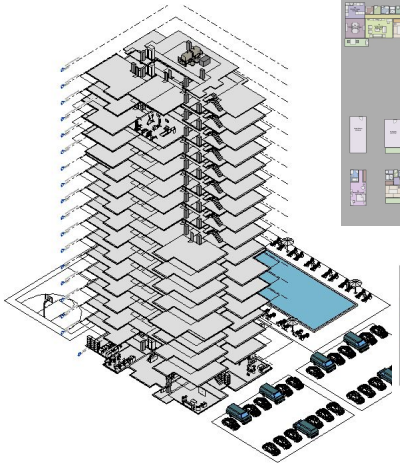
Digital Twin & AI:
Intelligent, Interconnected System

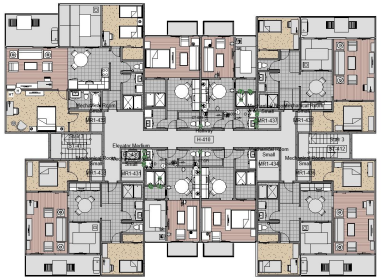
RDF is like a single-line diagram or an Excel table, it doesn't just list parts, it **shows the connections between them** so machines and people can read the same logic.

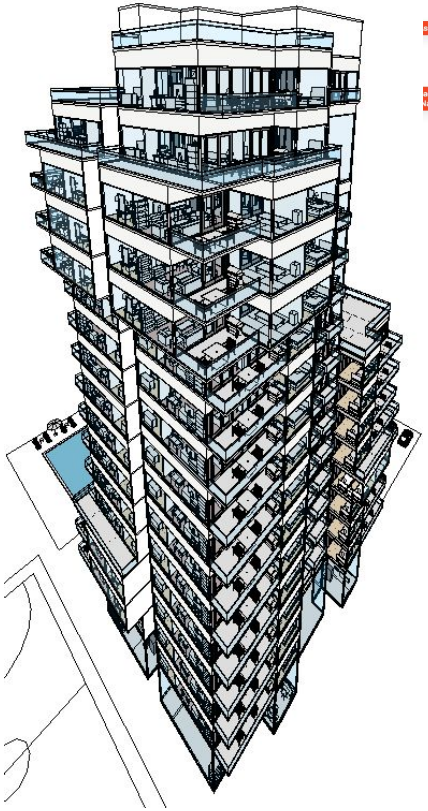
ZAIMAP
ONUMA
SYSTEM

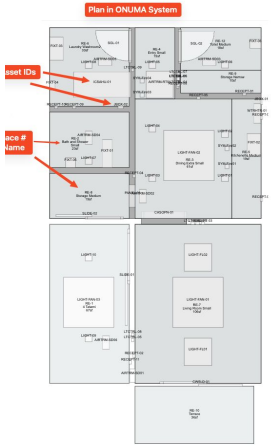
From BIM to Meaning:

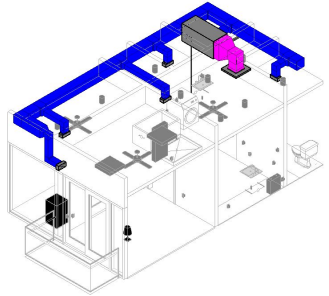


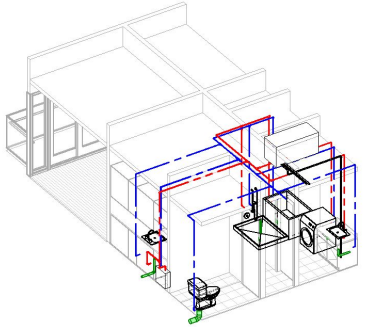


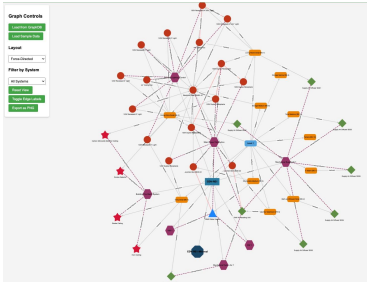












Monolith vs Microgrid: The Digital Twin Parallel

Hollywood BIM = Centralized Power Plant

- Massive
- Centralized
- High Maintenance
- Single Point of Failure
- Hard to Adapt

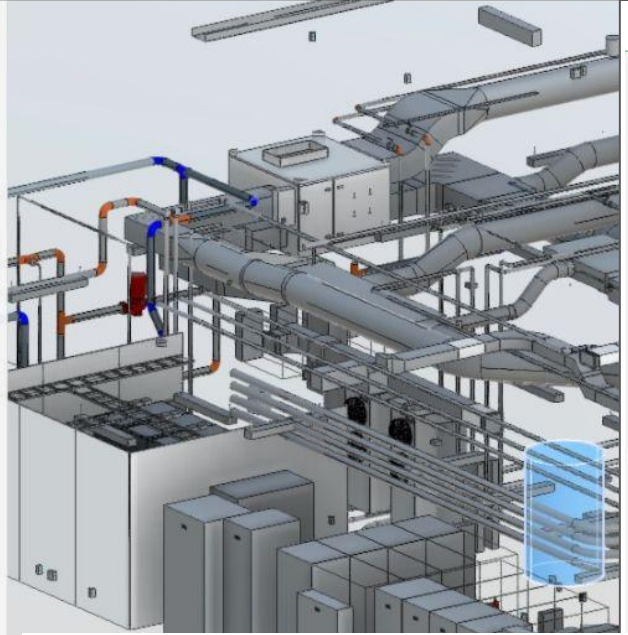
"It's impressive — but brittle."

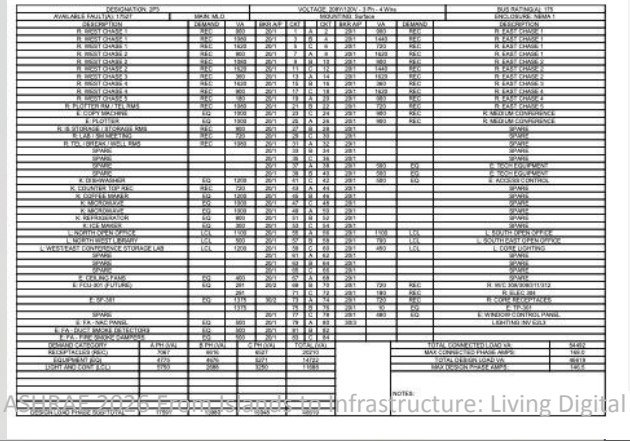
Cloud BIM = Microgrid

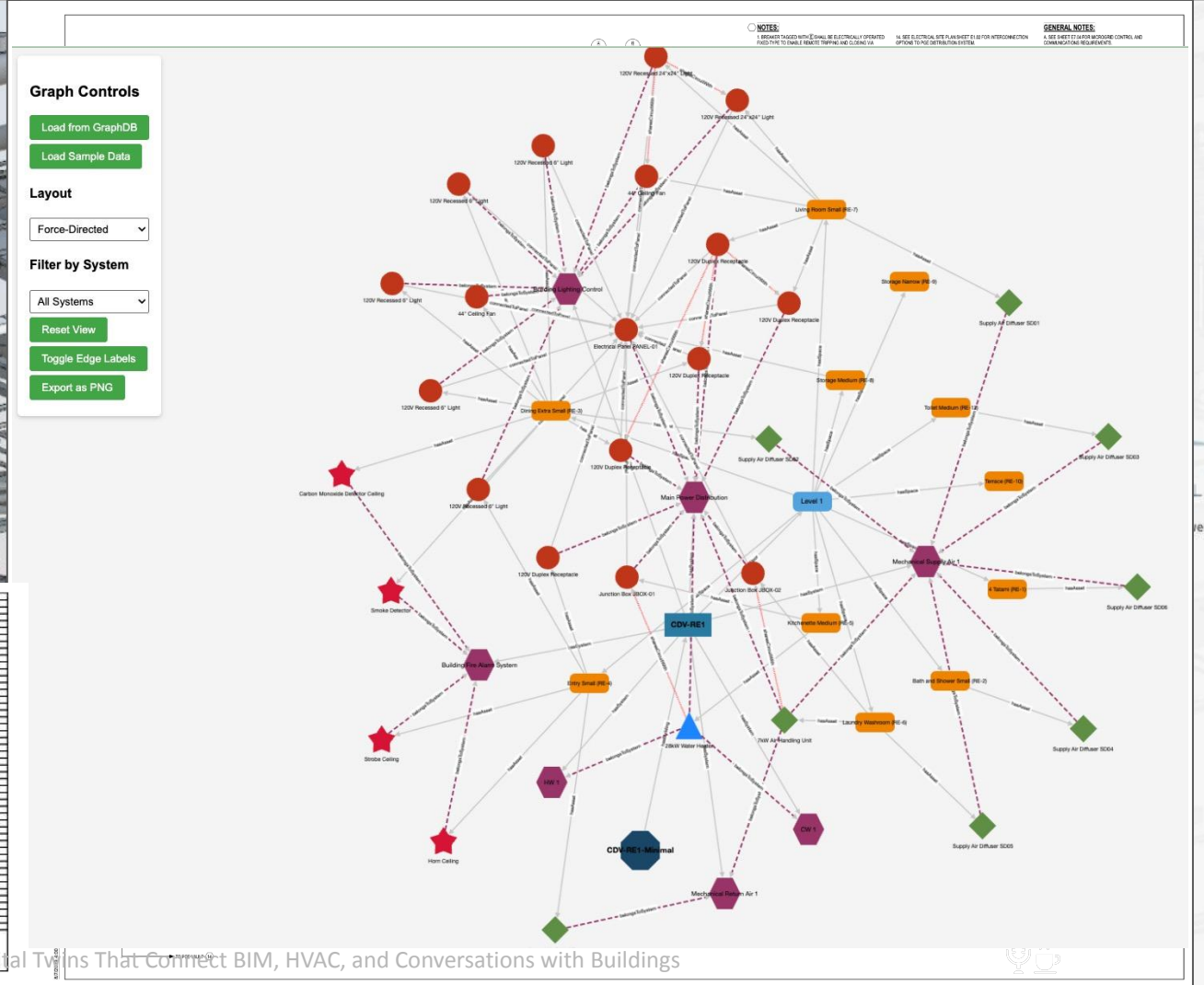
- Distributed
- Modular
- Resilient
- API-connected
- Real-Time adaptable.

- Distributed. Modular. Adaptable.
- Designed for real-time conditions.

Operational resilience requires **distributed intelligence** — not monolithic models.





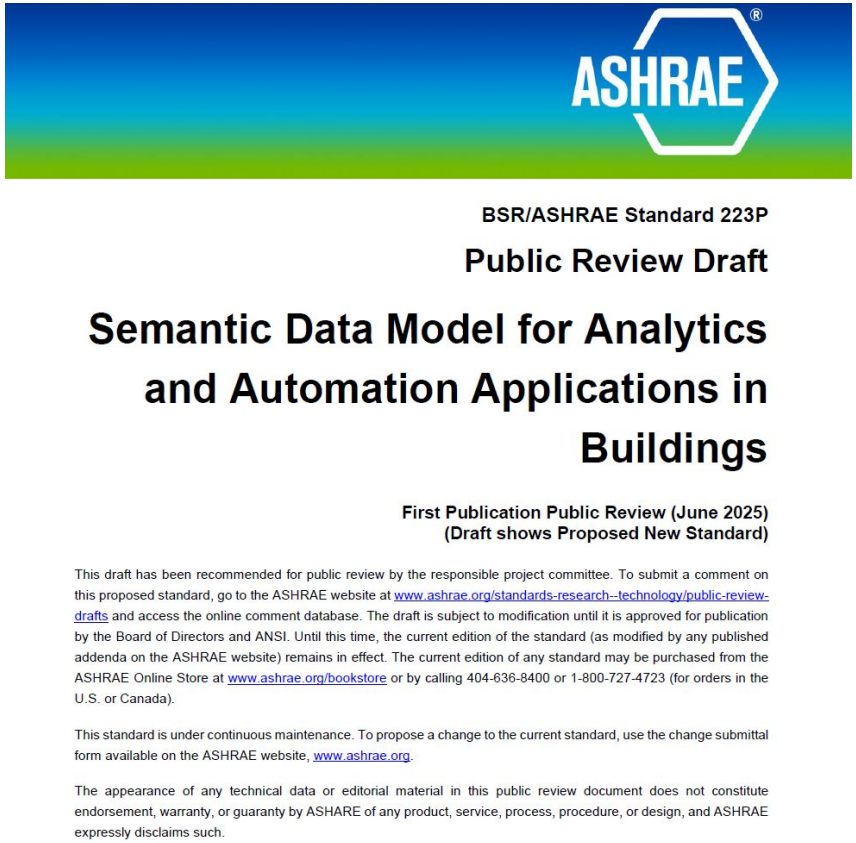


ASHRAE 2025 Epoch Slapper Infrastructure: Living Digital Twins That Connect BIM, HVAC, and Conversations with Buildings

ASHRAE Standard 223P

Title: Semantic Data Model for Analytics and Automation Applications in Buildings

Purpose: The purpose of this standard is to formally define knowledge concepts and a methodology to apply them to create interoperable, **machine-readable semantic models** for representing building system information for analytics, automation, and control.



BSR/ASHRAE Standard 223P

Public Review Draft

Semantic Data Model for Analytics and Automation Applications in Buildings

First Publication Public Review (June 2025)
(Draft shows Proposed New Standard)

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at www.ashrae.org/standards-research--technology/public-review-drafts and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at www.ashrae.org/bookstore or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

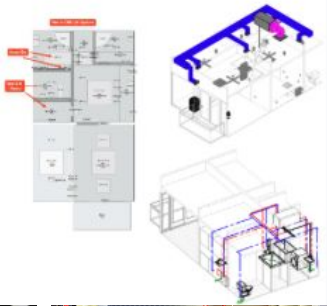
This standard is under continuous maintenance. To propose a change to the current standard, use the change submittal form available on the ASHRAE website, www.ashrae.org.

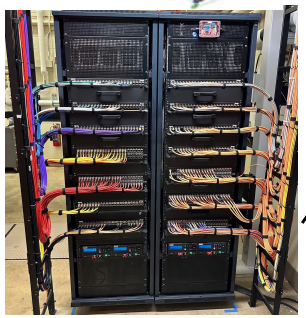
The appearance of any technical data or editorial material in this public review document does not constitute endorsement, warranty, or guaranty by ASHARE of any product, service, process, procedure, or design, and ASHRAE expressly disclaims such.

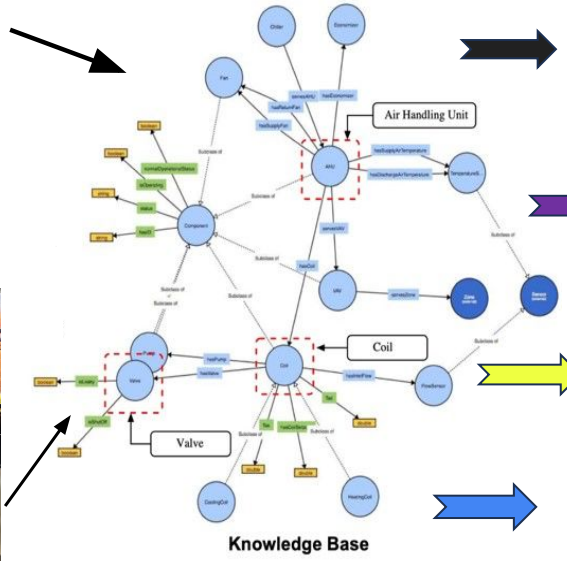
Slide Credit: Parastoo Delgoshaei : National Institute of Standards and Technolgoy (NIST)

Big Picture

- Semantic Graphs:
  - Offer context to data acquired from various sources such as sensors, physical, and information models
  - Enable applications to understand relationships and connections across data silos.







Building Digital Twin

Advanced Control

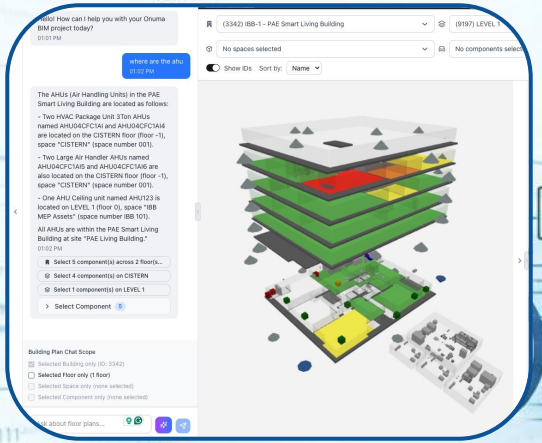
Fault Detection & Diagnostic

Auto Commissioning

Slide Credit: Parastoo Delgoshaei : National Institute of Standards and Technolgoy (NIST)

4 - A Reference Implementation for Semantic Maintenance

A live connection between operational cloudBIM and a Semantic Model Using ASHRAE 223.



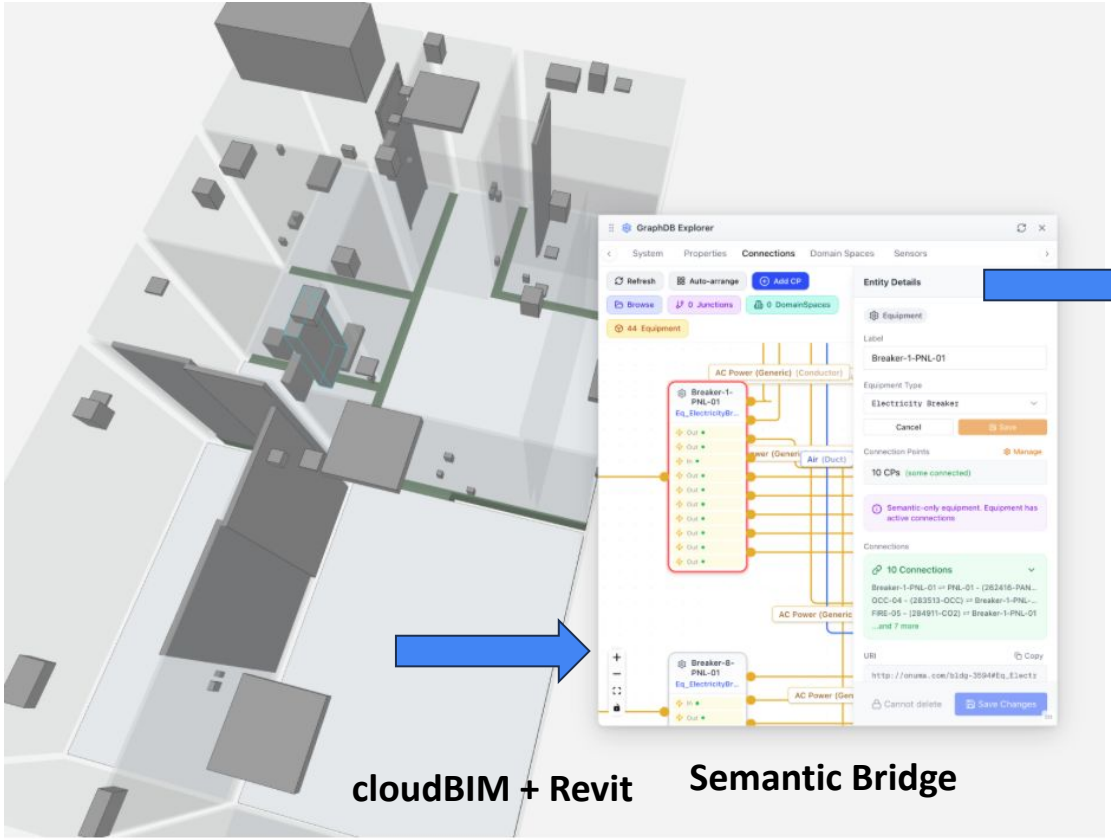
OPERATIONAL
cloudBIM

Semantic Bridge App
Two Way between BIM & RDF

SEMANTIC
MODEL (RDF)

ZAIMAP
ONUMA
SYSTEM

A Potential Workflow to Create Semantic Graphs



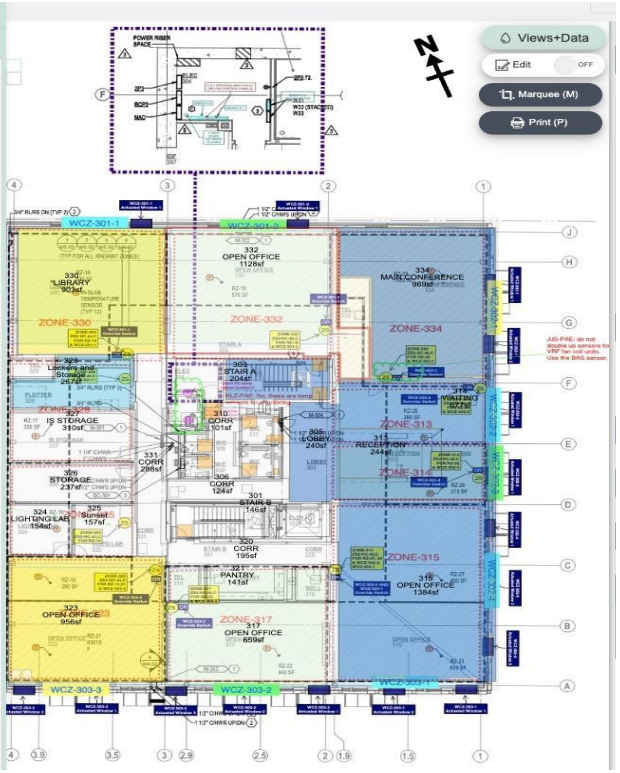
cloudBIM + Revit

Semantic Bridge

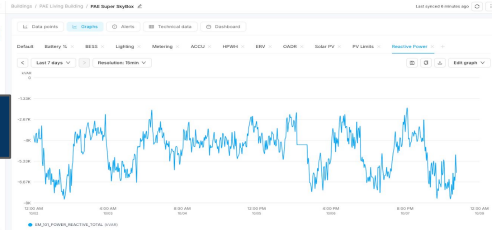
ASHRAE223P graph (partial)

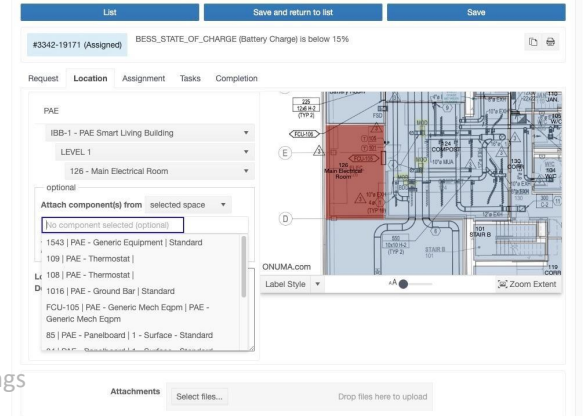
Slide Credit: Parastoo Delgoshaei : National Institute of Standards and Technolgoy (NIST)

PAE Living Building and ONUMA Digital Twin



SkyCentrics





Search element

Search all

- PAE Living Building
  - IBB-1 - PAE Smart Living Building
    - T.O. PENTHOUSE
    - + Roof
    - + LEVEL 5
    - + LEVEL 4
    - + LEVEL 3
    - + LEVEL 2
    - LEVEL 1A
    - – LEVEL 1
      - 127 - Battery Room
      - 112 - BICYCLES
      - 1[illegible] - CHANGE
      - 109 - CHANGE
      - 124 - COMPOST
      - 119 - CORR
      - 130 - CORR
      - 123 - ELEC
      - 128 - ELEC.
      - 102 - ELEV.
      - 114 - EXERCISE
      - 115 - EXIT PASSAGEWAY
      - F 101 - Facil BAS Assets
      - 122 - FDC
      - IBB 101 - IBB BAS Assets
      - IBB 101 - IBB MEP Assets
      - 110 - JAN.
      - 116 - LOBBY
      - 113 - LOCKERS
      - 126 - Main Electrical Room
      - 129 - MDF/EF The Cage
      - 125 - PLUMBING
      - 120 - RECYCLING
      - 118 - RETAIL 1
      - 121 - RETAIL 2

Navigation

Label Style

Scale FT

Zoom Fit (F)

Zoom In

Zoom Out

Cycle Selection (Y)

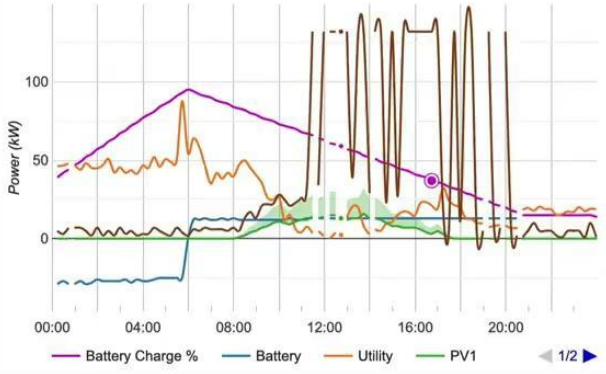
PAE

PAE Smart Living Building (IBB-1)

Energy Monitoring: Battery, Utility, PV1, PV2 (24-hour view)

Previous Day | Oct 30, 2025 | Next Day

Energy Sources - Thursday, October 30, 2025



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Building Information			
04-Initial Occupancy Year	[04-Initial Occupancy Year]	**72-Building Age**	[72-Building Age]
07-Gross Area	[07-Gross Area]	**08-E and G Status**	[08-E and G Status]
11-Floors	9 Floors	**13-Historic**	[13-Historic]
14-Link 1	Link 1	**15-Utilities and Energy Link**	15-Utilities and Energy Link
18R-Projects	[18R-Projects]	**19R-Number of**	[19R-Count the

Views+Dat

Edit

Marquee (M)

Print (P)

Revert | Save | Close | Enter Building

Simple Conversations with Complex Data

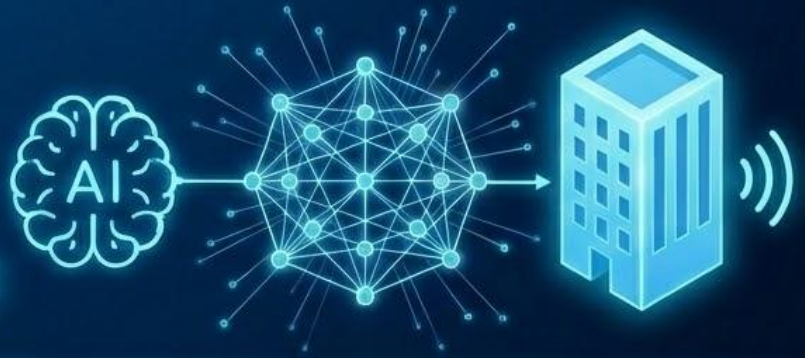
(ONUMA System: To reduce human and AI Hallucinations)

If we can call up an Uber on our apps, we should be able to do the same with buildings

THIS IS THE GROUNDING LAYER AI HAS BEEN MISSING

AI Is Hallucinating Because Our Buildings Are Mute.

- AI researchers lack real building data
- Synthetic data fills the gap poorly
- Buildings already generate reality
- Semantics make that reality legible
- Maintenance keeps it trustworthy



> “You can’t have a smart building with dumb data. Semantics is the language AI speaks.”

ZAiMAP
ONUMA
SYSTEM

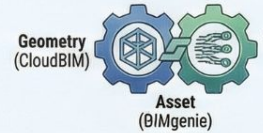
AI doesn’t need smarter models, it needs buildings that can speak.

Operational Proof: The Ice Cream Case Workflow

MILESTONE ACHIEVED: The Digital Twin Handshake

Milestone: BIM object selection shows live time-series telemetry.

The Handshake: Geometry ↔ Asset ↔ Telemetry.

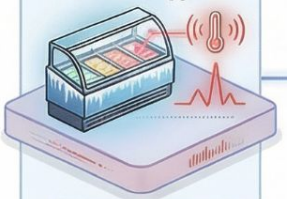


This connection ensures that 30 spatial data, unique asset identifiers, and real-time sensor streams are synchronized as a single source of truth.

"Each system does what it does best." Sensing, decisioning, contextualizing, and executing are distributed across specialized platforms father than one monoiithic silo.

OPERATIONAL WORKFLOW: THE ICE CREAM CASE SCENARIO

1. DETECTION: Sensor Trigger



An ice cream case sensor defects a temperature rise or anomaly in the physical store.

2. INTELLIGENCE: Alert Validation

rules evaluate the conamion to validate the alert and sould false alarms (e.g., standard defrest systex).

3. TRANSPORT: Web Service APIs

Validated signals are transmitted via open Web Service APIs (JSON/REST) in the cloud environment.

4. CONTEXT: ONUMA CloudBIM

The system provides sparial context, identifying the esect location ('DT Dairy Cooler') and its relationship to the building.

5. ACTION: BiMgenie Work Order

An automated work order is triggered in BIMgenie, prequpulated with asset details, location, and the specific condition.

6. RESOLUTION: Technician Dispatch

A technician is dispetched immediately to the correct case, resolving the issue before product loss accers.

NEXT-PHASE INTELLIGENCE: ZAIMAP AI (PROTOTYPE/EARLY STAGE)

ZAIMAP: "Conversations with the Building"

[Early Stage / Prototype] AI initiates contextual queries like "Find the gateway, which room is it iil?"

Status: Read-Oriented: Currently in the "Next Phase" of development, the AI uses CloudBIM structures to establish situational awareness.

Future Maturity: As mappings mature, these will evolve into operational commands and predictive maintenance conversations.

OPERATIONAL OUTCOMES & VALUE

PREVENT PRODUCT LOSS

Immediate detection and dispatch prevent the loss of temperature-sensitive inventory.

FASTER RESPONSE & LESS SEARCH TIME

Eliminates the "30% of a technician's day" typically wasted searching for rooms, assets, and data.

UPTIME OPTIMIZATION

Proactive workflows ensure critical systems remain operational with minimal menual discovery required.

Convergent Paths to the Living Digital Twin: Why Meaning Matters More Than Geometry

30% of Technician Time is Wasted.
Searching for rooms, assets, data in proprietary dashboards.

The $100k+ "Handover Gap."
Massive costs to recompile data, 6-19 month delay before operational.

The Universal Challenge: "Spaghetti Data"

Data is Plentiful, but Fragmented and Unusable.

Smarter islands in a rising sea of data; raw connections, chaotic, no standard language.

PAE Path: Deep Design

Deep Design.
Structured, heavy BIM for energy & structural integrity.

High- fidelity BIM models

Structural schematics

"Progress comes from connection, not perfection."

Energy modeling

Years of Planning

Years of Planning

ONE Destination: The Unified Digital Twin

Geometry, identity, and relationships converge for operational intelligence.

Market Path: Agile Deployment

Agile Deployment.
Rapid, API-driven for real-time sensors & immediate asset management.

"Start with what you have."

Sensor streams

Real-time sensor data streams

48 HOURS

Bootstrap a twin.

The Destination: Meaning Over Geometry.

Data Alone is Noise; Context Creates Meaning.

A system of systems that knows what it is looking at and is connected to the building's present reality.

Success is measured by ability to act—triggering a work order automatically when a sensor detects a temperature spike.

The Living Operational Backbone.

Moving from a "Digital Dead End" (static files) to an open, semantic cloud that evolves throughout the building's lifecycle.

ZAIMAP
ONUMA
SYSTEM

NotebookLM

Platform Solutions Resources Open Source Enterprise Pricing

Search or jump

C4SB Foundation

The C4SB Foundation is a coalition dedicated to fostering the implementation of interoperable smart information systems i

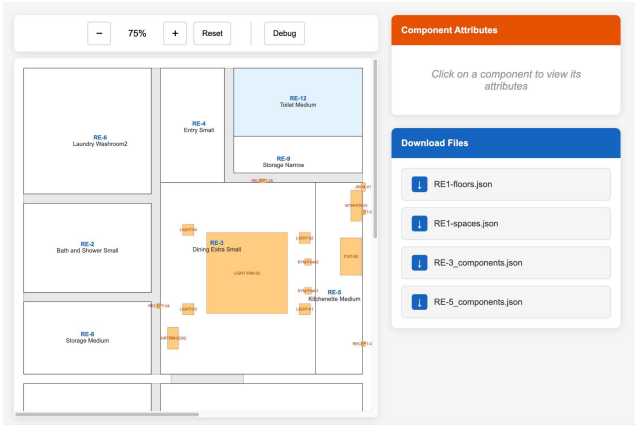
10 followers · United States of America · https://c4sb.org · company/c4sb · @C4SB_org

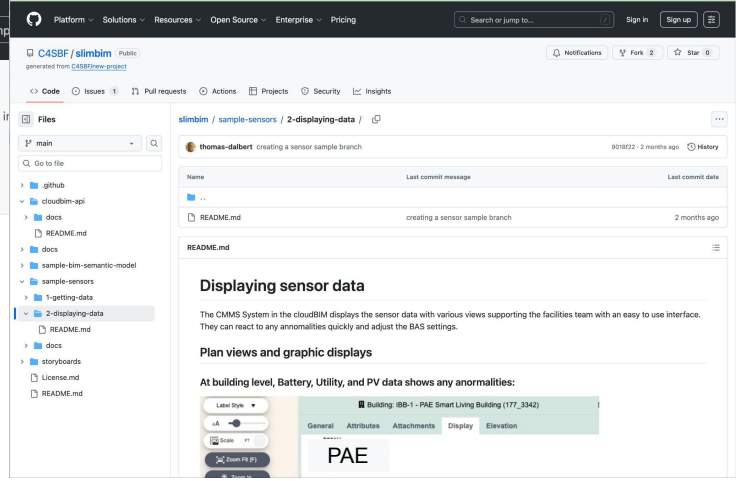
Overview · Repositories 14 · Projects · Packages · People

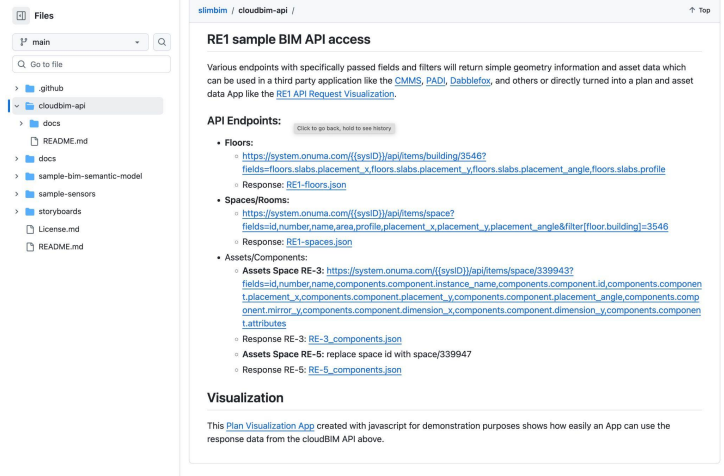
README.md

The Coalition for Smarter Buildings (C4SB), now part of the Linux Foundation as C4SBF, serves as an open-source initiative dedicated to revolutionizing building automation and IoT interoperability. It provides foundational reference models, standardized schemas, and open APIs designed to enable seamless data exchange across a diverse ecosystem of sensors, controls, software platforms, and vendor systems.

By fostering a collaborative community of manufacturers, software providers, integrators, and end-users. C4SBF accelerates the development and adoption of plug-and-play building technology, helping unlock smarter, more efficient, and future-proof building environments.







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buildingsmart.us

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(NIBS)

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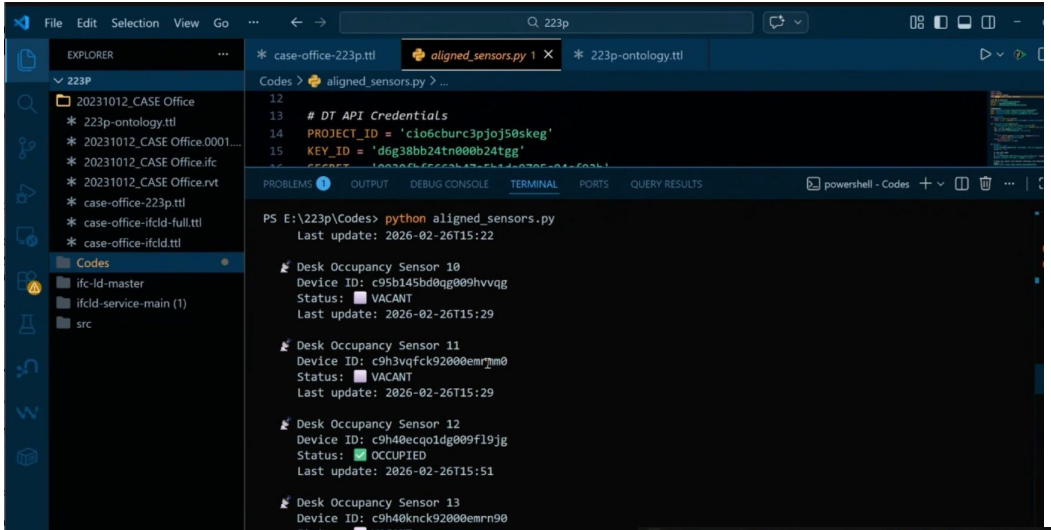
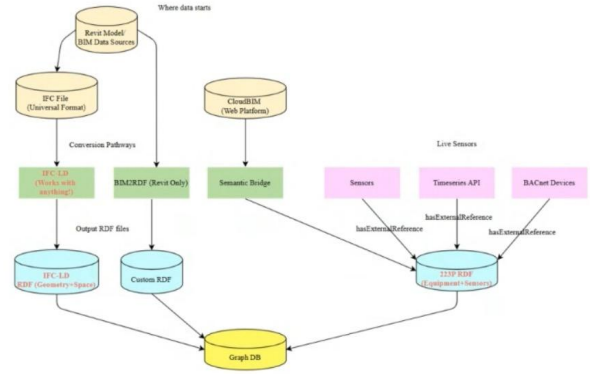
Luke Faulkner
Co-Chair
(BIMForum & AISC)

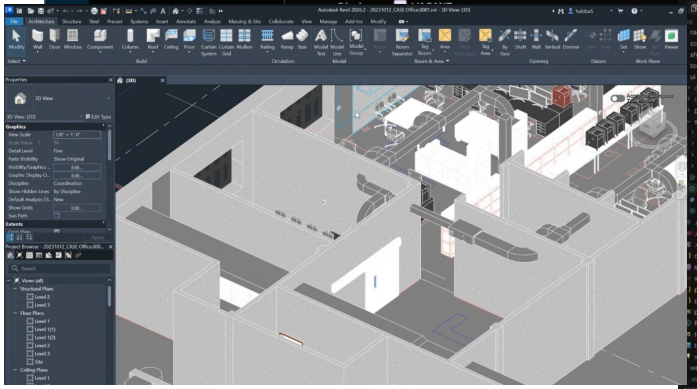
Roger Grant
Co-Chair
(NIBS)

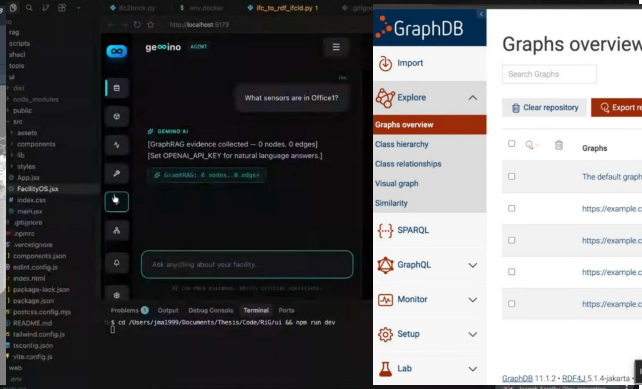
Dennis Shelden of Rensselaer Polytechnic Institute (RPI) & Researchers: Joseph Aerathu of Georgia Tech, Ahosan Habib of RPI

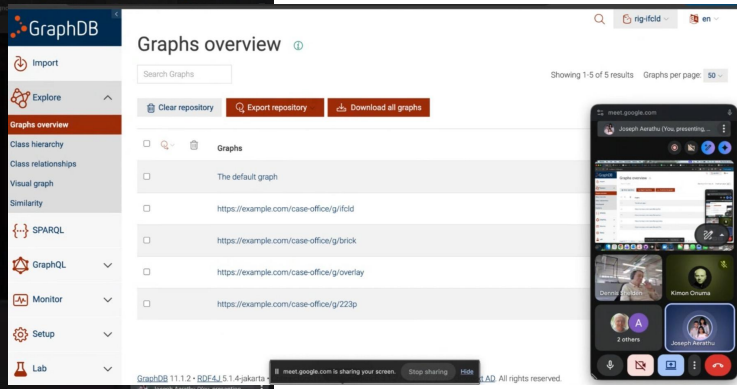




IFC-LD as a Complementary Pathway for BIM-to-Semantic Web Integration







Friday, March 13th, 2026
8:00 am - 4:00 pm
4450 W Adams Blvd, Los Angeles, CA 90016

TAP + Professional Practice Committees

AIA Los Angeles
TAP + Professional Practice Committees

TAP + Professional Practice Committees
AIA Los Angeles

Keynote Speaker

Kimon Onuma, FAIA

Onuma, Inc.

Presentation

THE ARCHITECTURE OF INTELLIGENCE: MEASURING WHAT MATTERS (AND TURNING BUILDINGS INTO LIVING SYSTEMS)

AI: Architectural Intelligence

Fri March 13th | 8am - 4pm
4450 W Adams Blvd, Los Angeles, CA 90016

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Stephen Lothrop
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