Facilities of the future:

Developing & Integrating Facility Digital Twins using Forge

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DPR CONSTRUCTION

vconstruct

Digital Building Components

EIG Electrical Systems

Design/Engineering/Construction

VueOps

Owner Operations

Learning Objectives

1. What is the definition of a Facility Digital Twin?
2. What are the challenges in getting there?
3. How the Autodesk Forge platform supports the vision?
4. How can you get started?

Agenda

- Better Outcomes for Facility Operations & Maintenance
- Digital Twins: Why, What, How, and the Challenges
- VueOps Case Studies: How do you get there?
- VueOps’ Journey towards the Facility Digital Twin

Facility Digital Twins

Digital twin refers to a digital replica of potential and actual physical assets (physical twin), processes, people, places, systems and devices that can be used for various purposes.

The digital representation provides both the elements and the dynamics of how an Internet of things device operates and lives throughout its life cycle

Wikipedia

CapEx

Improve ROI by extending equipment service life

OpEx

Reduce operations & maintenance costs through faster response times

CapEx

OpEx

CapEx

OpEx

Challenges

Maintenance and Operations

- Fewer and fewer maintenance staff to cover more and more square footage
- Increased pressure to fix emergencies faster
- Back log of PM’s and lack visibility into state of many tasks
- Either don’t have systems or have systems that people don’t use (consistently)
- Time = 20% Proactive – 80% Reactive
- Huge unbudgeted burden to bring on a new building/project and align it with existing systems and processes

Challenges

Transition from Capital to Operations

- Existing Systems Need to Be Updated with Information Provided At Construction Turn Over
  - No Integration Plan or Clear Technical Set of Requirements
  - Document and Service Work Management
- Interest in Using a Construction Model Post Construction
  - Use cases evolving and unproven
  - Different Tools, Incomplete Attributes, Not All Users Native Model Files
- Limited Budgets for Improving Models or Integration
- Building changes after handover

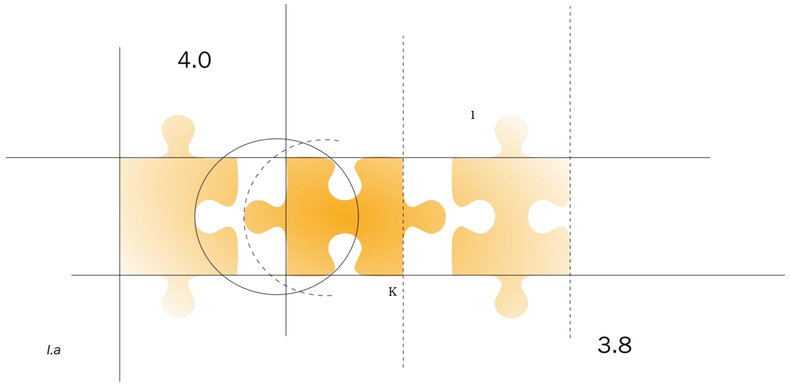
Imagine if you could...

- Digital Twin for Integrated Information
- Web Portal with Building Assets & Data
- BIM for Facility Management
- Manage Warranty & Ticketing

VueOps Case Studies

VueOps

Preparing the Digital Twin



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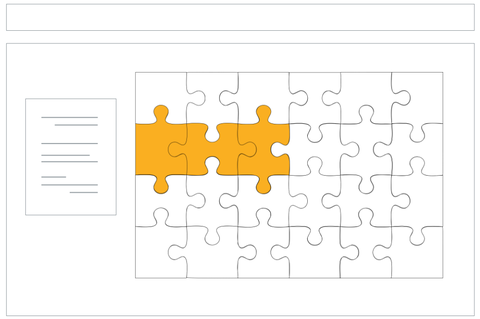


VueOps **method**
to ***prepare*** information
for operations

VueOps **platform**
to ***access*** information
for operations

Method

Preparing the Digital Twin

Clarify needs

`Lumens, voltage`

Specify what information you need for each asset you want to track

Prepare information

`Manufacturer, model`

Ensure the correct equipment is procured, installed, and tested

Integration platform

`O & M manual`

Gather the relevant information and setup the source of truth

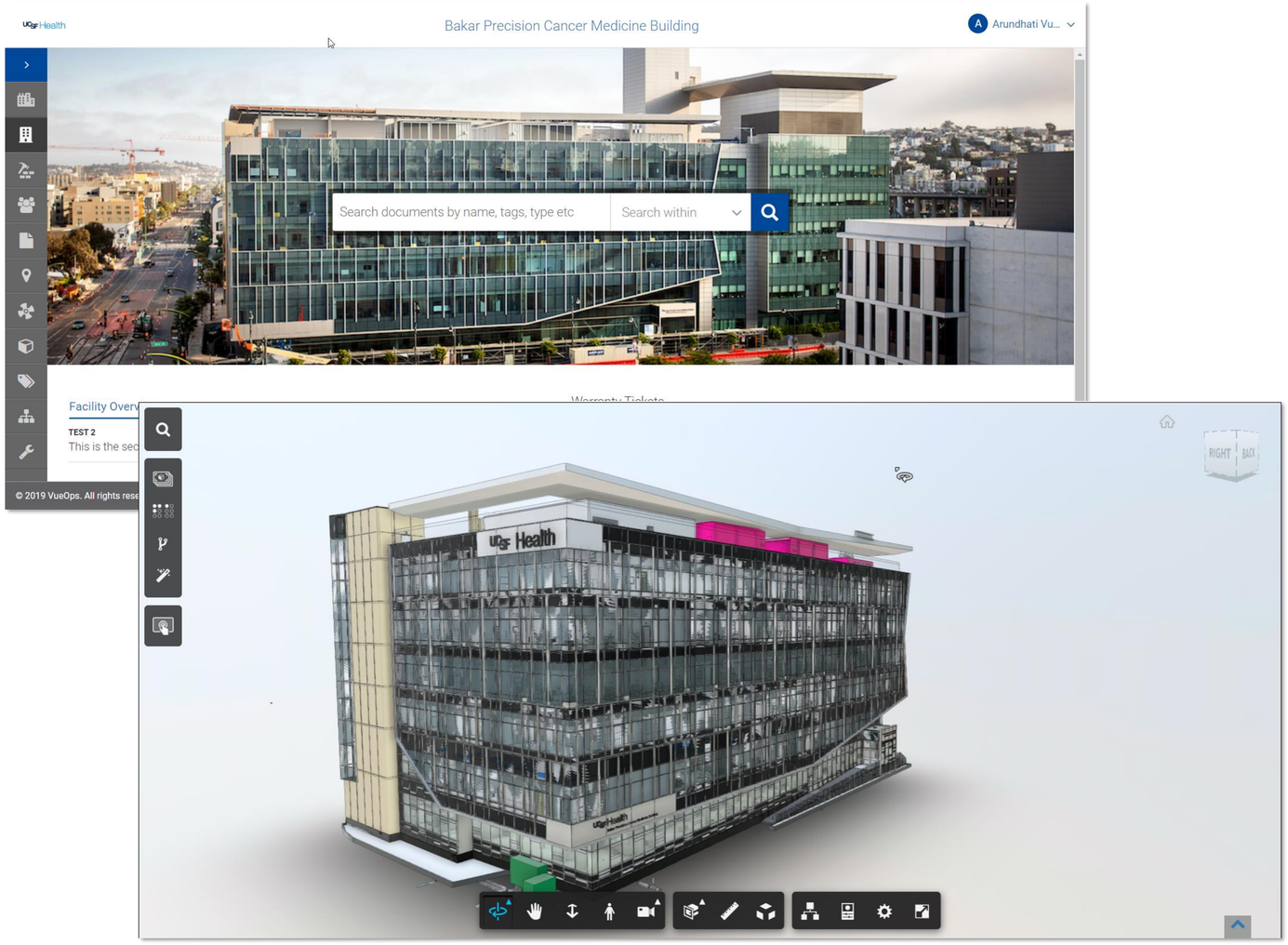
Coordinate changes

`stock number`

Update information as changes are made in the physical space

Customer Engagement: Early Start

UCSF Precision Cancer Medicine Building, San Francisco



18	180K	$275m
Months of incremental data collection and verification	Square feet	Project cost

189	5,265	262
Asset types	Total assets	Attribute types

UCSF Health RUDOLPH AND SLETTEN VueOps™

Customer Engagement: Early Start

UCSF Precision Cancer Medicine Building, San Francisco

AUTODESK REVIT

RF

Autodesk COBie Extension for Revit

360 FIELD

UCSF COBie Validation Tool

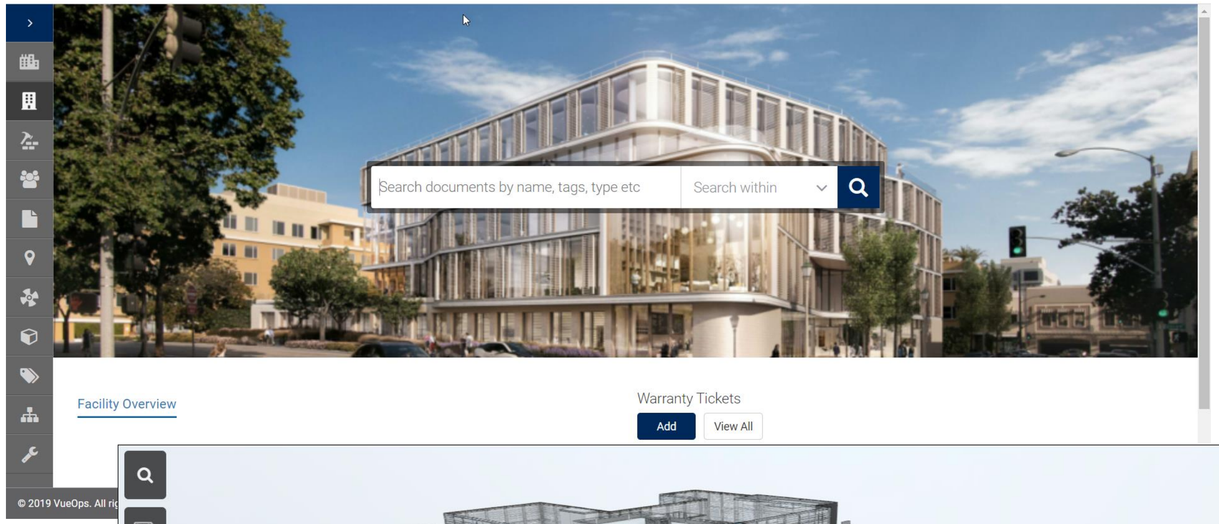
VueOps™

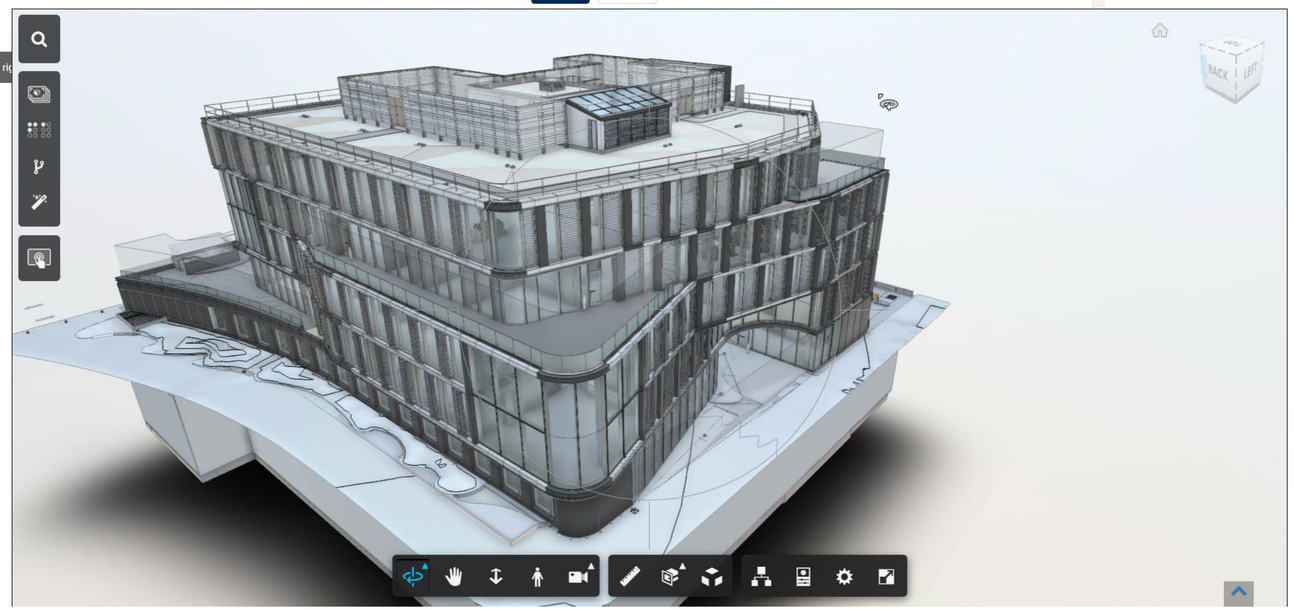
Decisions

- Where to collect the data – in the model or outside the model?
- Record model or As-Built model?
- Who models and who collects the data: Design Engineer or Contractor?
- I don’t want someone else’s data in my models!
- When should we collect the data?
- Build what you model or Model what you build?
- What is the final format for the data?
- What happens post-construction?

Customer Engagement: Late Start

Lifesciences Real Estate Developer, Southern California





4	390K	$137m
Months of one-time data collection at the end of project	Square feet	Project cost

54	5,851	10
Asset types	Total assets	Attribute types

Confidential client

DPR CONSTRUCTION

VueOps™

Customer Engagement: Late Start

Lifesciences Real Estate Developer, Southern California

AUTODESK REVIT

AUTODESK AUTOCAD

AUTODESK® NAVISWORKS®

iConstruct™ FOR AUTODESK™ NAVISWORKS™

VueOps™

Decisions

- What data is available in the models?
- Where can we find the missing data – approved submittals, procurement logs, record set
- Is the data true?
- Scope gaps – Who will model the gaps?

Defining better data requirements

ASSET LIST: Help a project team understands what assets an owner cares about managing

ATTRIBUTES: What data does the owner care for?

What assets are in the project?

Are they modeled?

Who is responsible for authoring the products and data?

Is the asset uniquely represented?

VueOps

D10 Conveying | D20 Plumbing | D30 HVAC | D40 Fire Prote... | D50 Electrical | E10 Equipment | B30 Exterior H... | C10 Interior Co...

1. Data Requirement
- Maximo Asset
- Visualization Only

In Project? [Yes/...
- NO
- YES

3. Is Product Mod...
- (blank)
- YES
- TBD
- NO

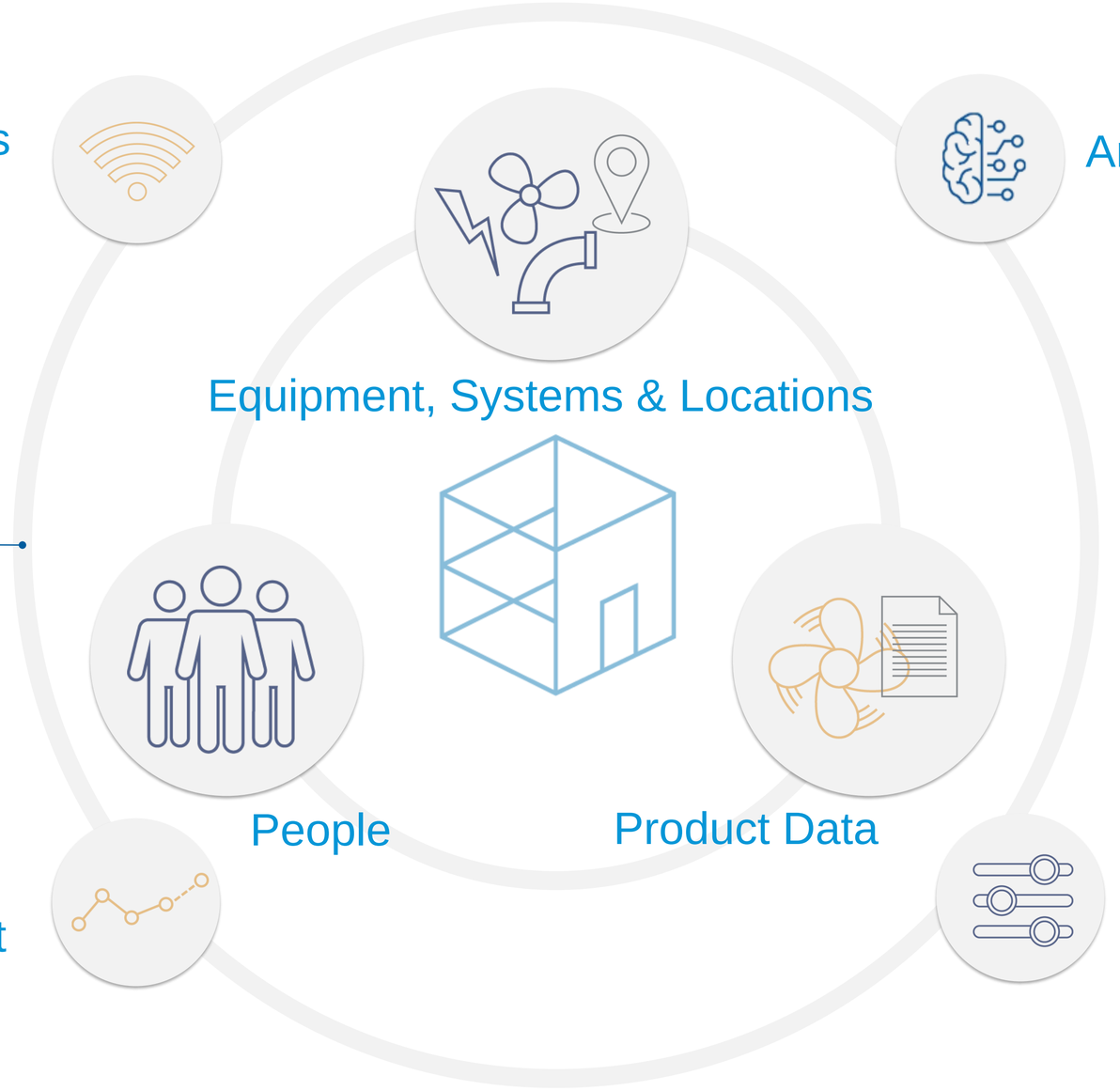
4. Which Trade M...
- PCMB-E.rvt
- PCMB-EQ.rvt
- PCMB-FP.dwg
- PCMB-M.rvt
- (blank)

5. Is Product Tag...
- NO
- YES
- (blank)

Product Class [OmniClass Level 2 Number: Nam	OmniClass [OmniClass Le 3/4 Number	Product [OmniClass Level 3/4 Name]	Attribute Sets	Tag Abbreviat
23-33 11 00: Commercial Boilers	23-33 11 00	Commercial Boilers	(blank)	BLR
	23-33 11 13	Condensing Boilers	(blank)	BLR
	23-33 11 17	Flexible Tube Boilers	(blank)	BLR
	23-33 11 21	Water Tube Boilers	(blank)	BLR
	23-33 11 22	Electric Boilers	(blank)	BLR
23-33 15 00: HVAC Heating Units	23-33 15 21	Hydronic HVAC Heaters	(blank)	HHWC
23-33 21 00: Chillers	23-33 21 13 11	Central Package Unit Chillers	A_COMMONIA_MOTORIA_CHILLER	CH
		Centrifugal Chillers	A_COMMONIA_MOTORIA_CHILLER	CH
	23-33 21 13 13	Reciprocating Chillers	A_COMMONIA_MOTORIA_CHILLER	CH
	23-33 21 13 17	Rotary Chillers	A_COMMONIA_MOTORIA_CHILLER	CH
	23-33 21 13 19	Rotary Screw Chillers	A_COMMONIA_MOTORIA_CHILLER	CH
	23-33 21 13 21	Screw Chillers	A_COMMONIA_MOTORIA_CHILLER	CH
	23-33 21 13 23	Scroll Chillers	A_COMMONIA_MOTORIA_CHILLER	CH
23-33 23 00: Cooling Towers	23-33 23 11	Mechanical Draft Cooling Towers	A_COMMONIA_MOTORIA_COOLING-TOWER	CT
	23-33 23 13	Natural Draft Cooling Towers	(blank)	CT
23-33 29 00: HVAC Dampers	23-33 29 19	Dampers	A_COMMON	DMPR
	23-33 29 23	Fire Dampers	A_NOSERIAL	FDMPR
	23-33 29 25	Smoke Dampers	A_COMMON	SDMPR
23-33 31 00: Air Circulators	23-33 31 19	Booster Fan		
		Fans	A_COMMONIA_MOTORIA_FAN	FN
	23-33 31 21	Power Ventilators (Cooling)	A_COMMONIA_MOTORIA_HVAC POWER VENTI	VENT
23-33 37 00: Refrigerant Condensing	23-33 37 00	Refrigerant Condensing Units	(blank)	(blank)
23-33 39 00: Air Conditioning Equipment				
23-33 43 00: HVAC Condenser Units				
23-27 17 00: Pumps	23-27 17 00	Fuel-oil pump	(blank)	CP
		Boiler feedw ater pump	(blank)	(blank)
		Drainage pump	(blank)	(blank)
		Sanitary sew age pump	(blank)	SP
		Steam condensate pump	A_COMMONIA_MOTORIA_STEAM CONDENSATE	CP
		Storage tank pump	(blank)	HWTP
		Stormw ater drainage pump	(blank)	SD
		Fire pump	A_COMMON	FP
23-27 23 00: Heat Exchangers	23-27 23 00	Heat Exchangers (plumbing)	A_COMMONIA_HEAT-EXCHANGER2	HEX
23-23 23 00: Loading Dock Equipmer	23-23 23 00	Loading Dock Equipment	(blank)	(blank)
23-27 21 00: Compressors	23-27 21 00	Air Compressors	A_COMMONIA_MOTORIA_COMPRESSOR	COMP

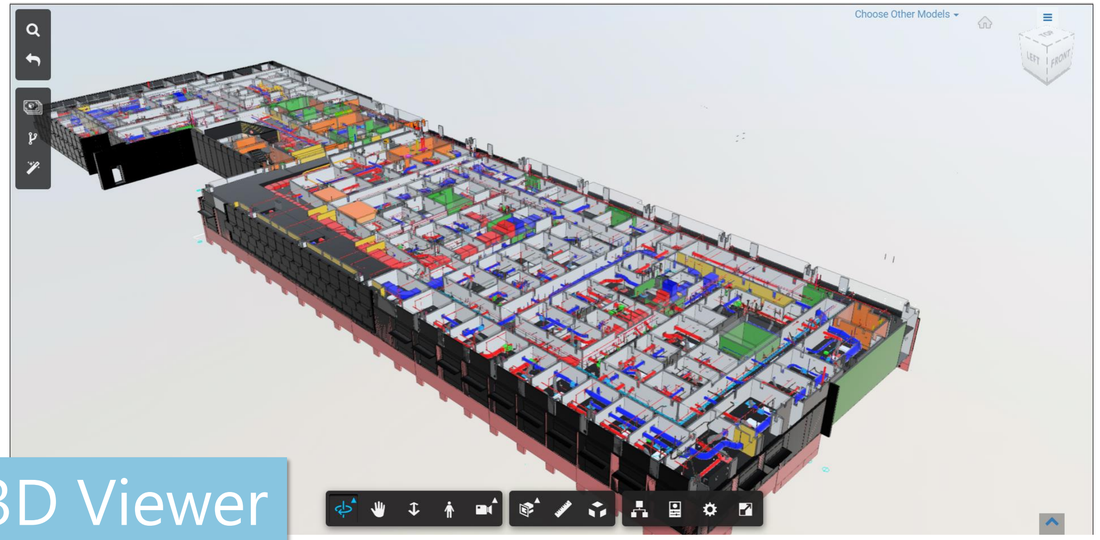
VueOps' Journey towards the Integrated Digital Twin

Integrated Platform for Data and Visualization

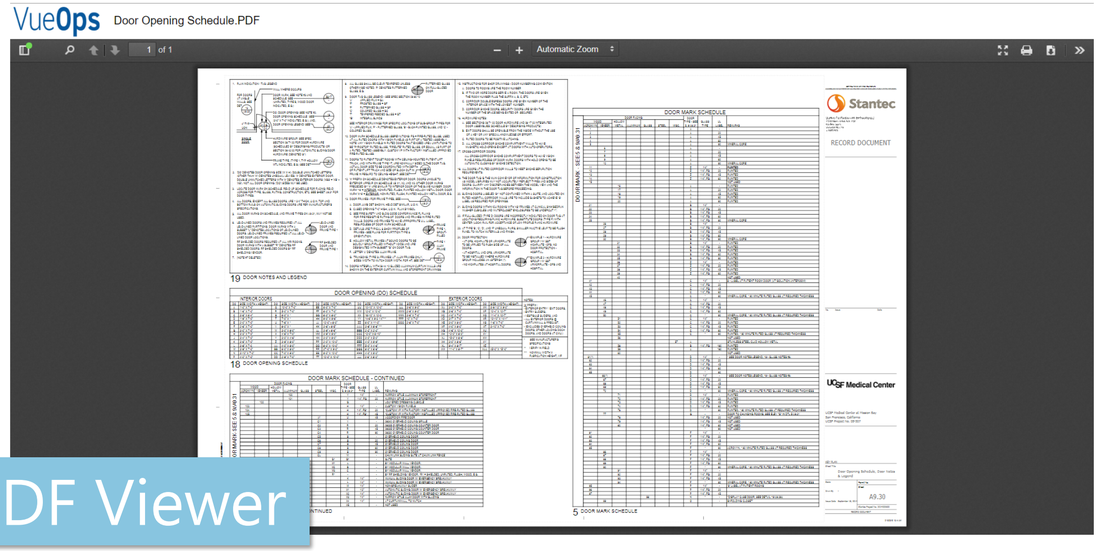


Multiple viewers

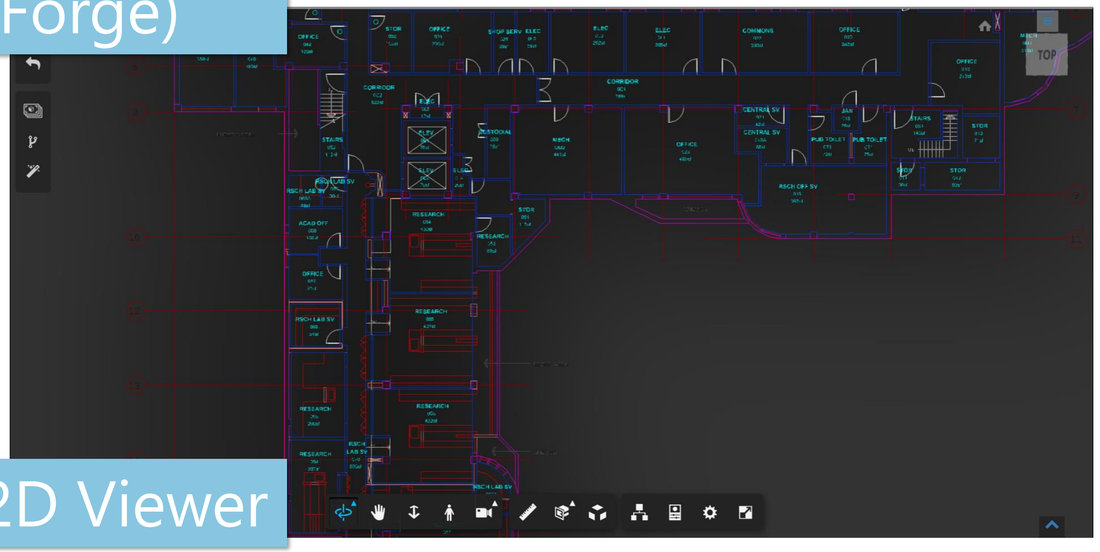
Improve access efficiency



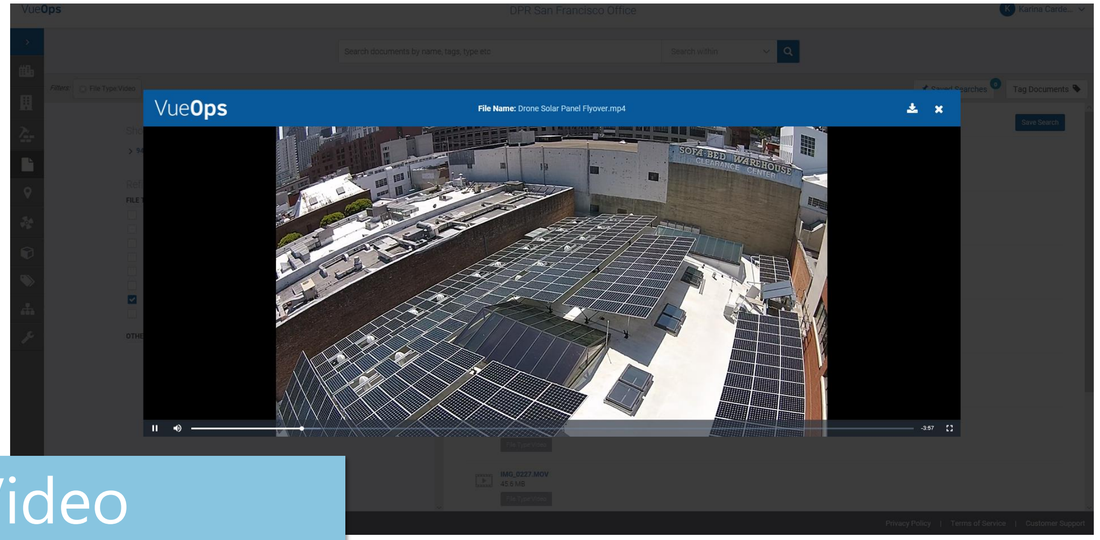
3D Viewer (Forge)



PDF Viewer



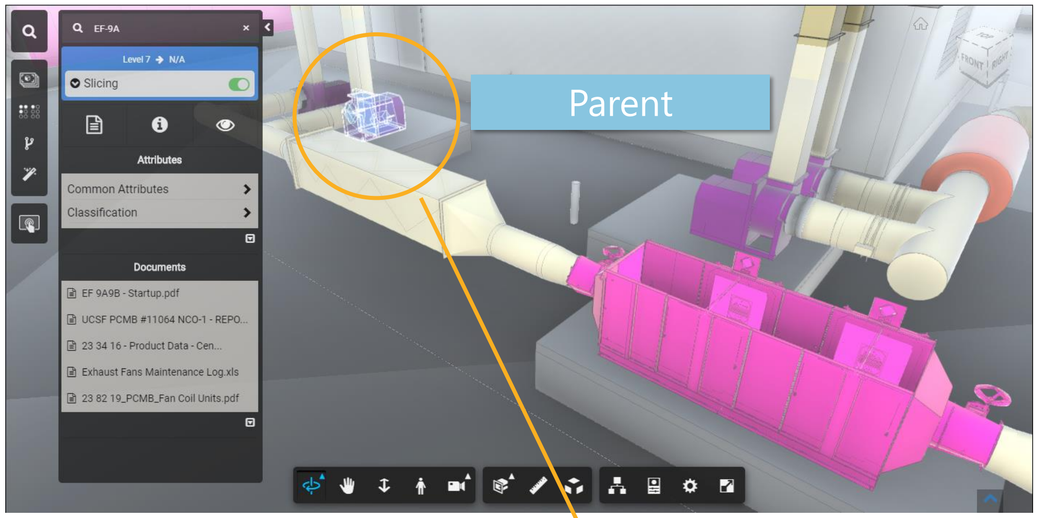
2D Viewer

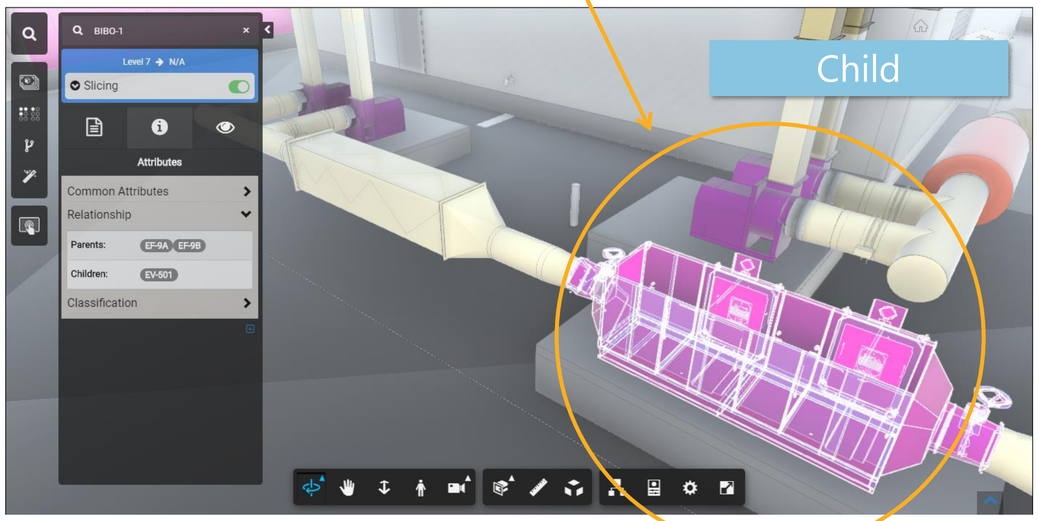


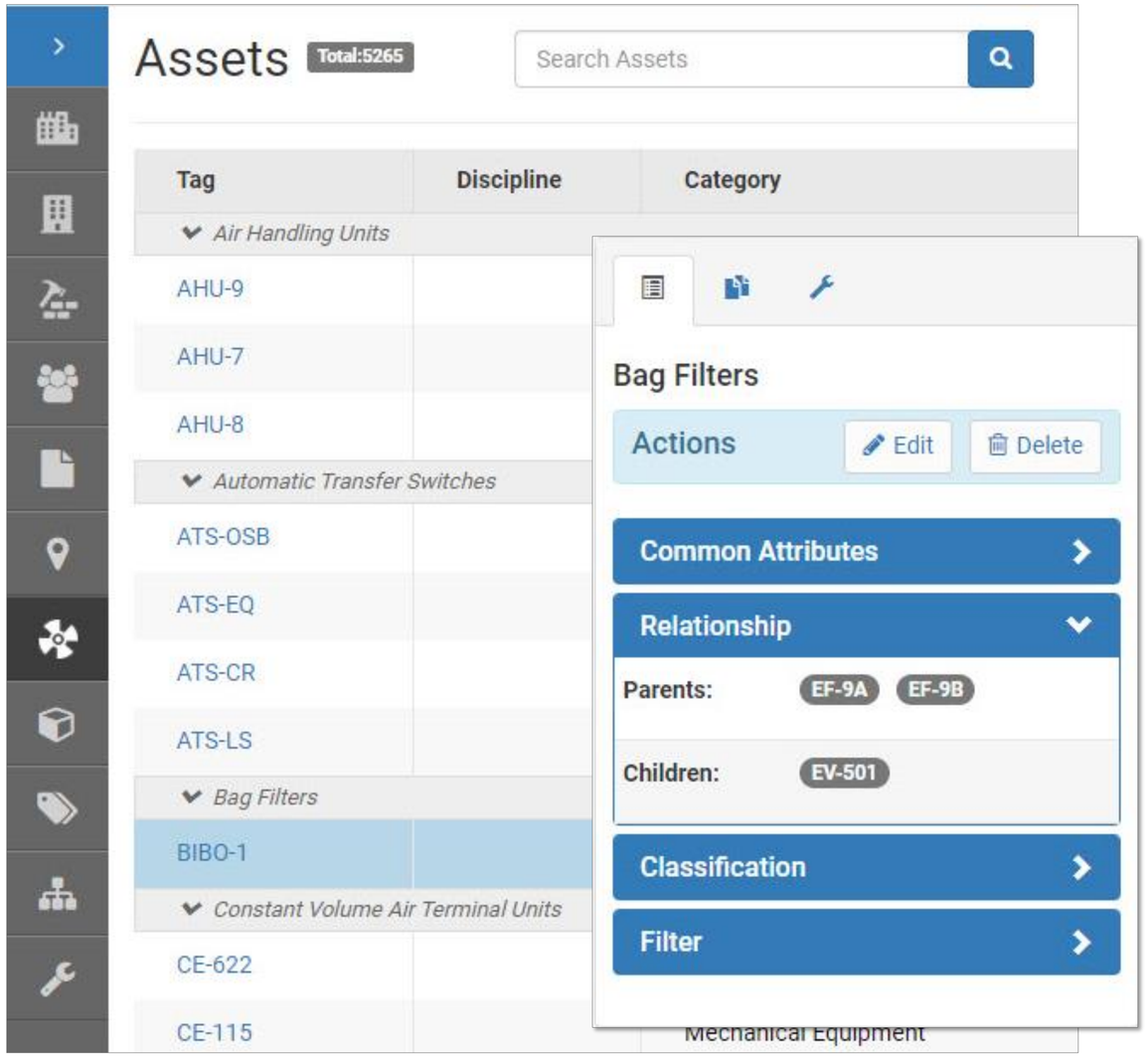
Video

Seeing upstream and downstream impacts

Help in minimizing disruptions

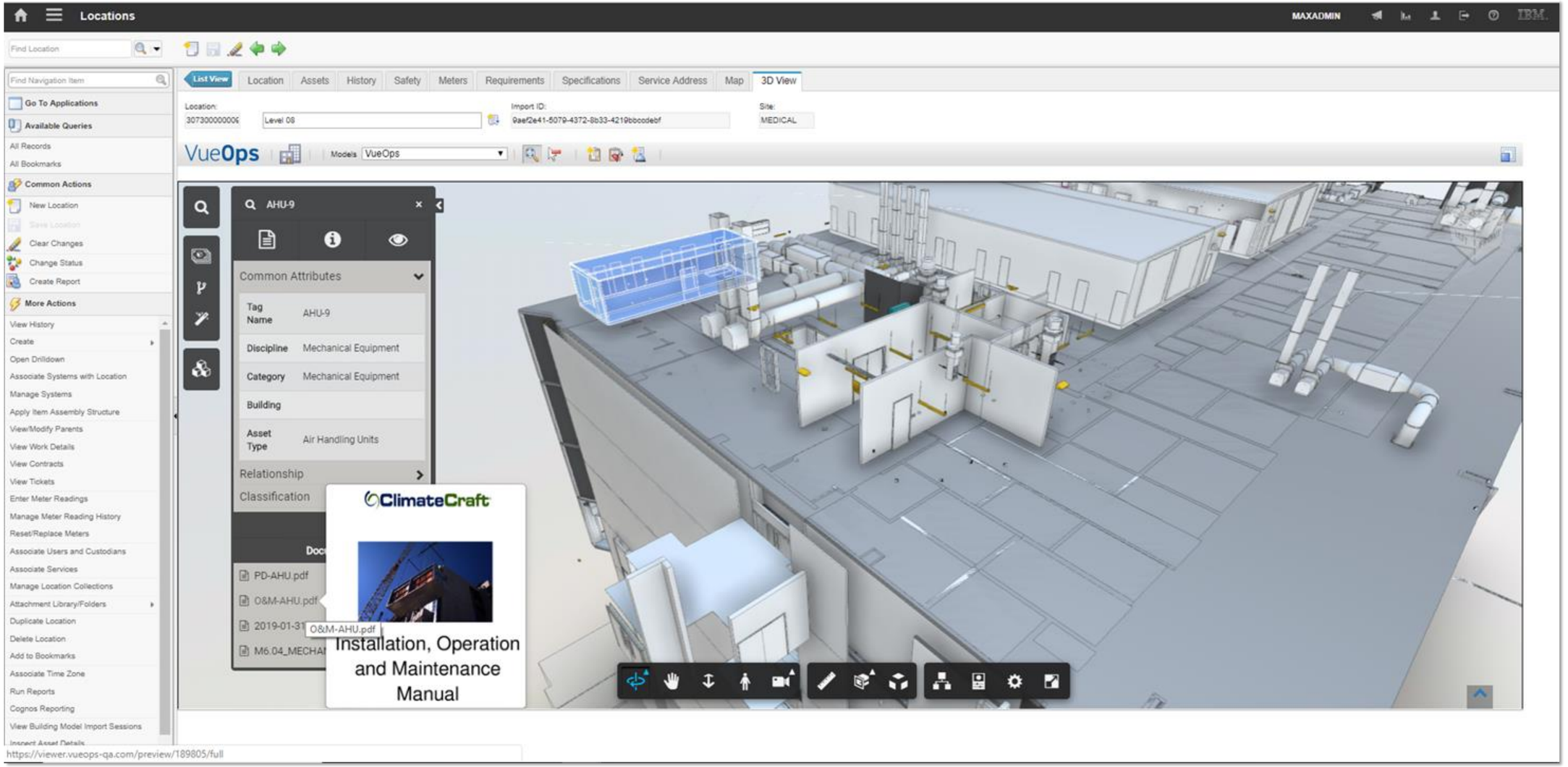






VueOps in IBM Maximo™

VueOps Viewer complete functionality in Maximo



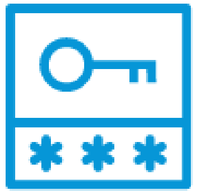
IBM Registered Business Partner

VueOps' use of Forge APIs

Viewer

Model Derivative

Data Management



Authentication

Webhooks

BIM 360

Quickly access warranty data

Gather service metrics and other critical insights

Virtual investigation of systems and assets in their locations

Provide value of BIM beyond construction

VueOps™

View information as an enterprise, building or project

Collect, organize, and display design & construction artifacts

Sustained relationships with clients

Increased maintenance productivity

How can you get started?

- Communicate the why
- Get in at the right time
- Keep the threshold low enough so you can cross it
- Build a roadmap
- Define success
- Find the right partners
- Learn and improve

VueOps™

Know your building inside out

www.vueops.com

AUTODESK®

Make anything™