



Seeking breakthrough outcomes in projects and Facility whole life management



Lake Constance 5D Conference | October 28-29, 2013

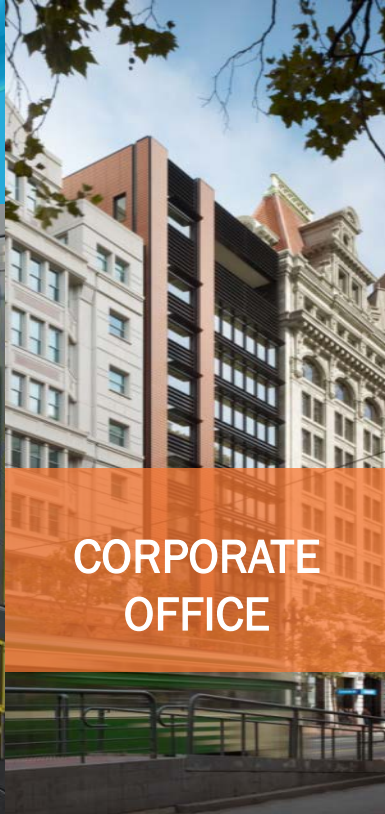


DPR Core Market Sectors

**ADVANCED
TECHNOLOGY**



**HIGHER
EDUCATION**



**CORPORATE
OFFICE**



LIFE SCIENCES



HEALTHCARE



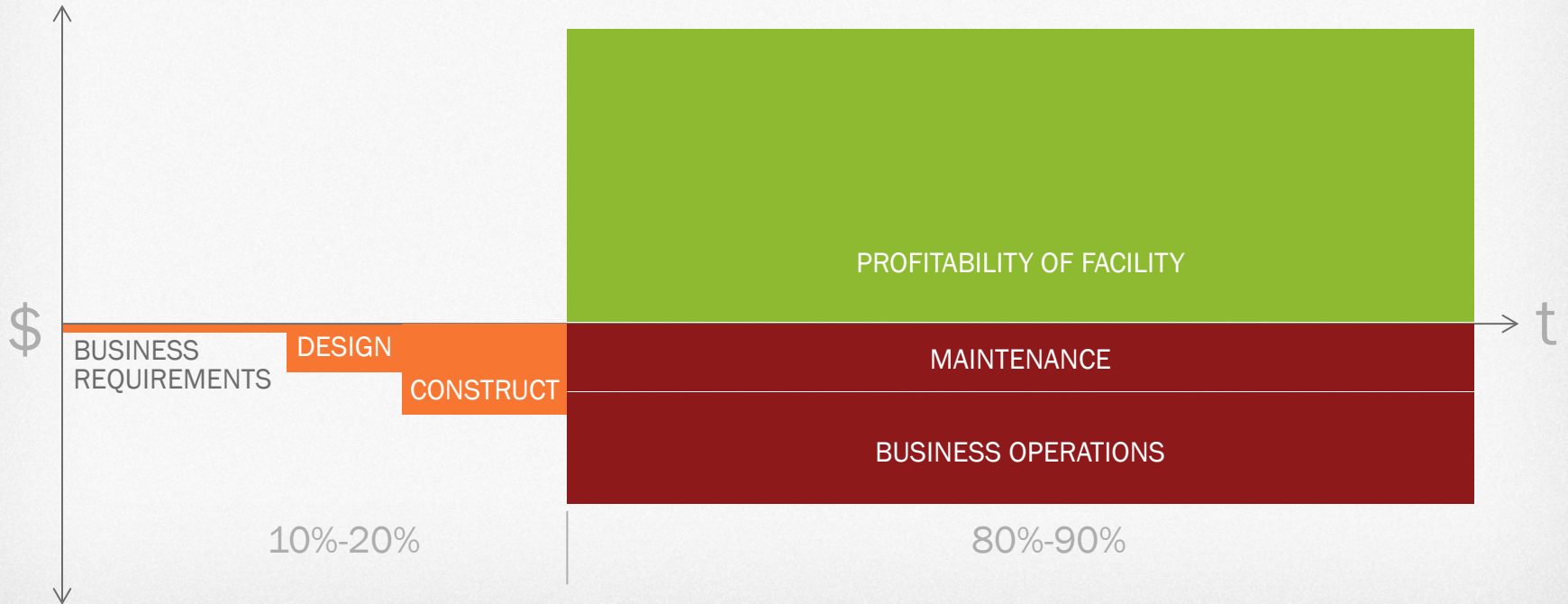
DPR at a Glance



- 17 offices
- 1,100 professional employees
- 1,250 craft employees

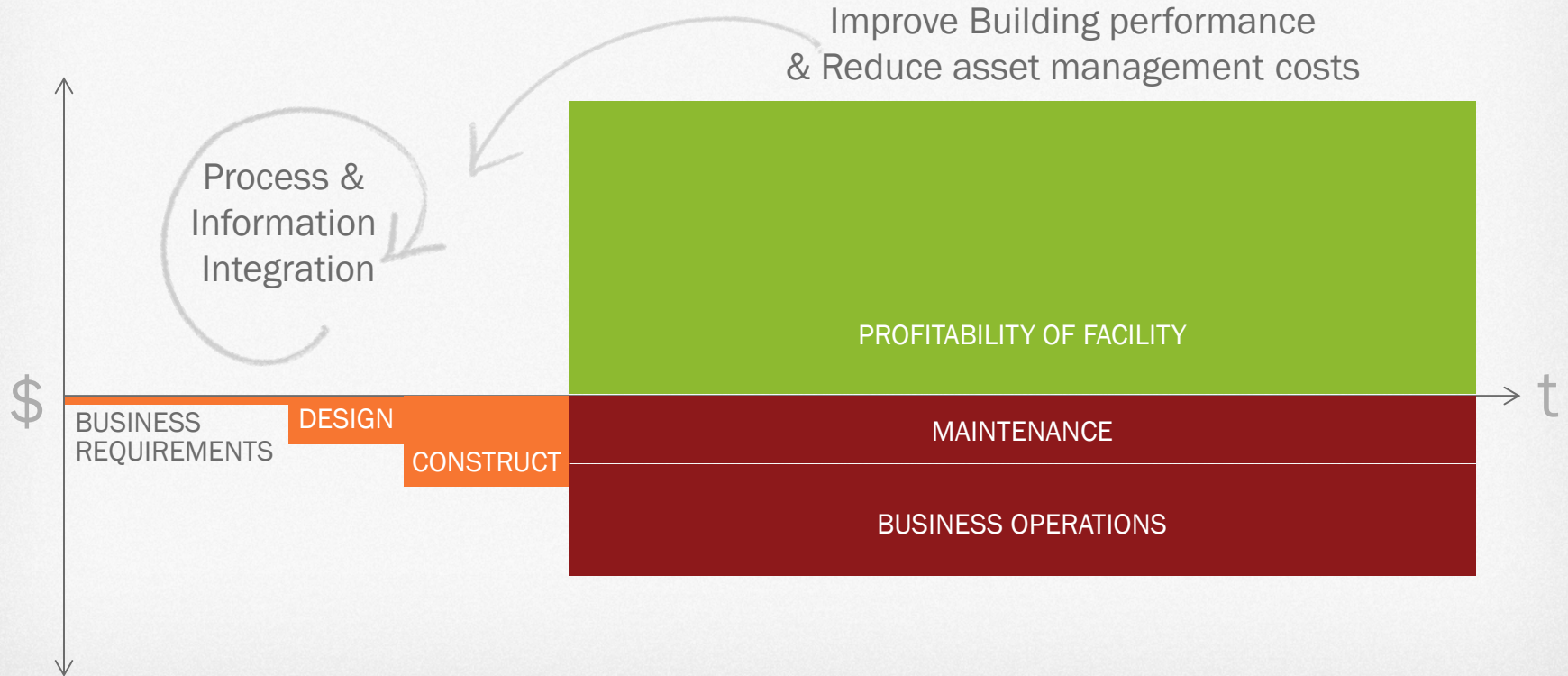


TOTAL COST OF OWNERSHIP



DPR CONSULTING

Make value flow upstream & downstream of construction





UCSF Medical Center

- Ranked among the nation's top 10 hospitals by *U.S. News & World Report*.
- 1,000 physicians, 660 beds (Parnassus and Mount Zion hospitals) and clinics with more than 75 adult and nearly 50 pediatric specialties.
- The medical center is a pioneer in turning ground-breaking discoveries into life-saving treatments.
- All UCSF professional schools are ranked among the Top 10 in the United States by *U.S. News & World Report*.

UCSF Primary Locations

Add layer Saved

UCSF Primary Locations

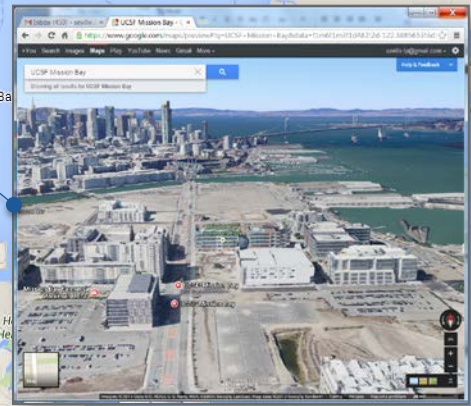
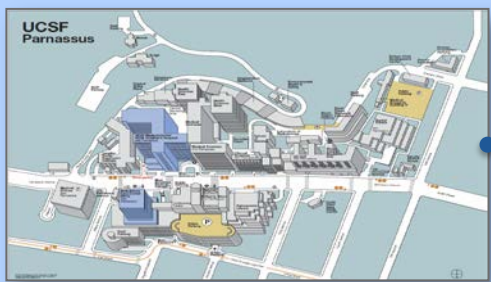
Style Data Labels

name

Styled by name

- UCSF Parnassus - UCSF Parnassus
- UCSF/Mission Bay - UCSF/Mission B
- Ucsf-Mount Zion - Ucsf-Mount Zion

Base map





UCSF Medical Center



UCSF and DPR have partnered to deliver a new Medical Center in the San Francisco Bay Area. Opening in 2015, the UCSF Benioff Children's Hospital at Mission Bay will provide Children's, Women's Specialty and Cancer related services

PROJECT DESCRIPTION

- Project budget \$1.52B
- 935,000 GSF + 60,000 SF roof gardens
- 4 year construction phase
 - Start: December 2010
 - Substantial Completion: June 2014
- Sustainability: LEED Gold, over 60,000 SF of roof gardens

PROJECT DESCRIPTION

- Serving all pediatric specialties, adult surgical oncology, and women's birthing program
- 289 beds
- 20 ORs and 8 procedure/interventional rooms
- 17 imaging rooms



Hospital



Outpatient
Building

Hospital



Energy Center



Outpatient Building

Hospital













CUSTOMER VALUE IN CONSTRUCTION

The Dragon of Uncertainty

CLEAR GOALS



CERTAIN SPACE PROGRAM



CLEAN DESIGN



STABLE CONSTRUCTION



SUCCESS!



DELIVERING CONSTRUCTION VALUE TO DPR CUSTOMERS

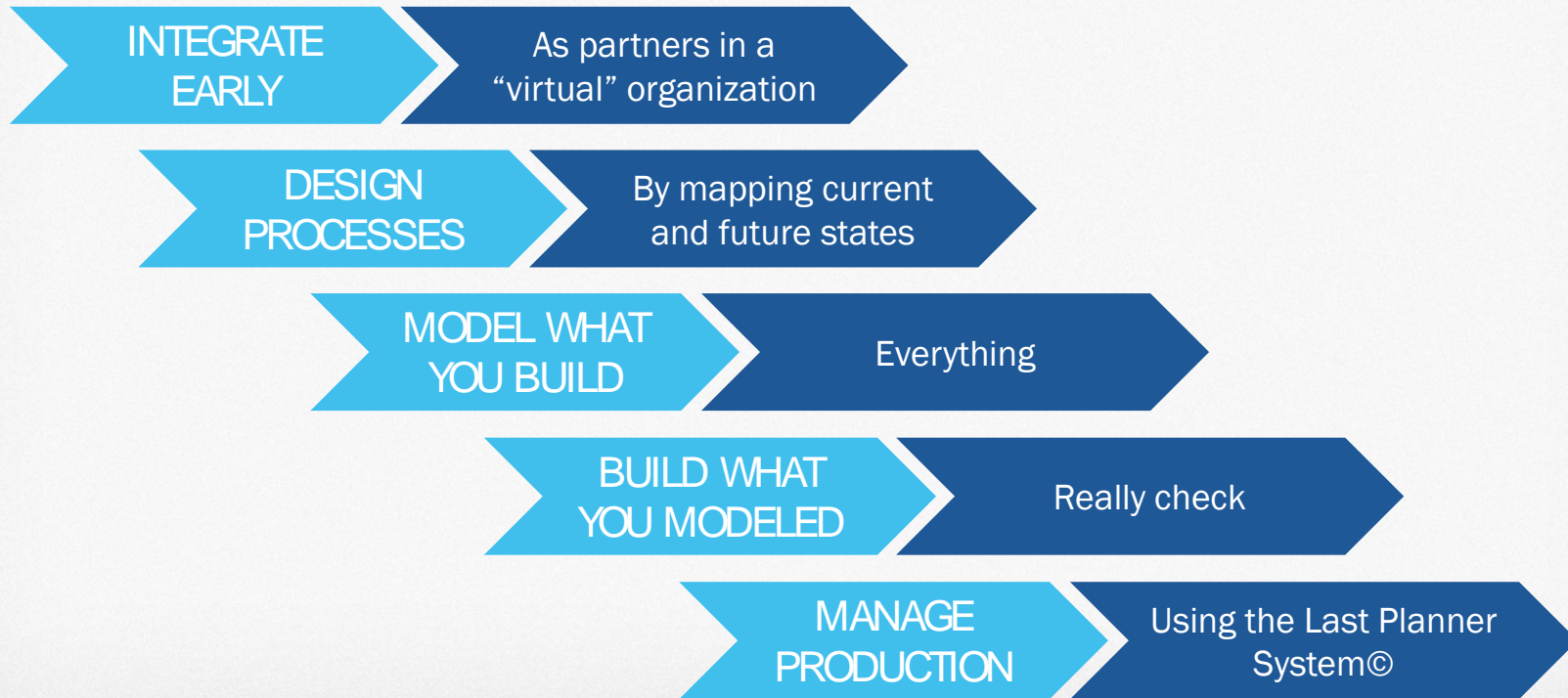
- ✓ The “Right” Building
- ✓ Predictable Outcomes
- ✓ Consequences of Decisions Made Clear Quickly
- ✓ Value for Money
- ✓ Fast Delivery
- ✓ Lowest Operating Costs
- ✓ Sustainability
- ✓ Zero Rework
- ✓ No Injuries

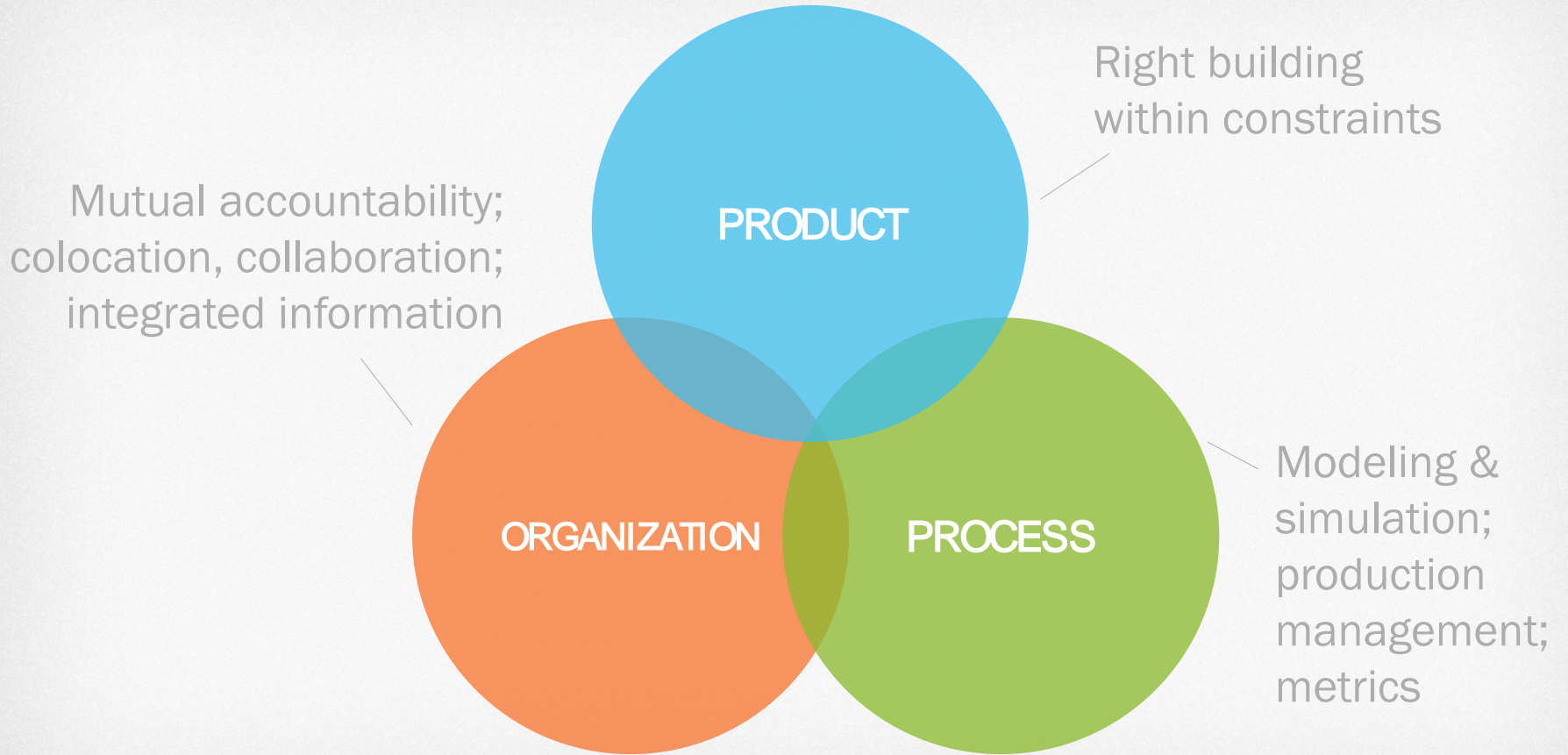


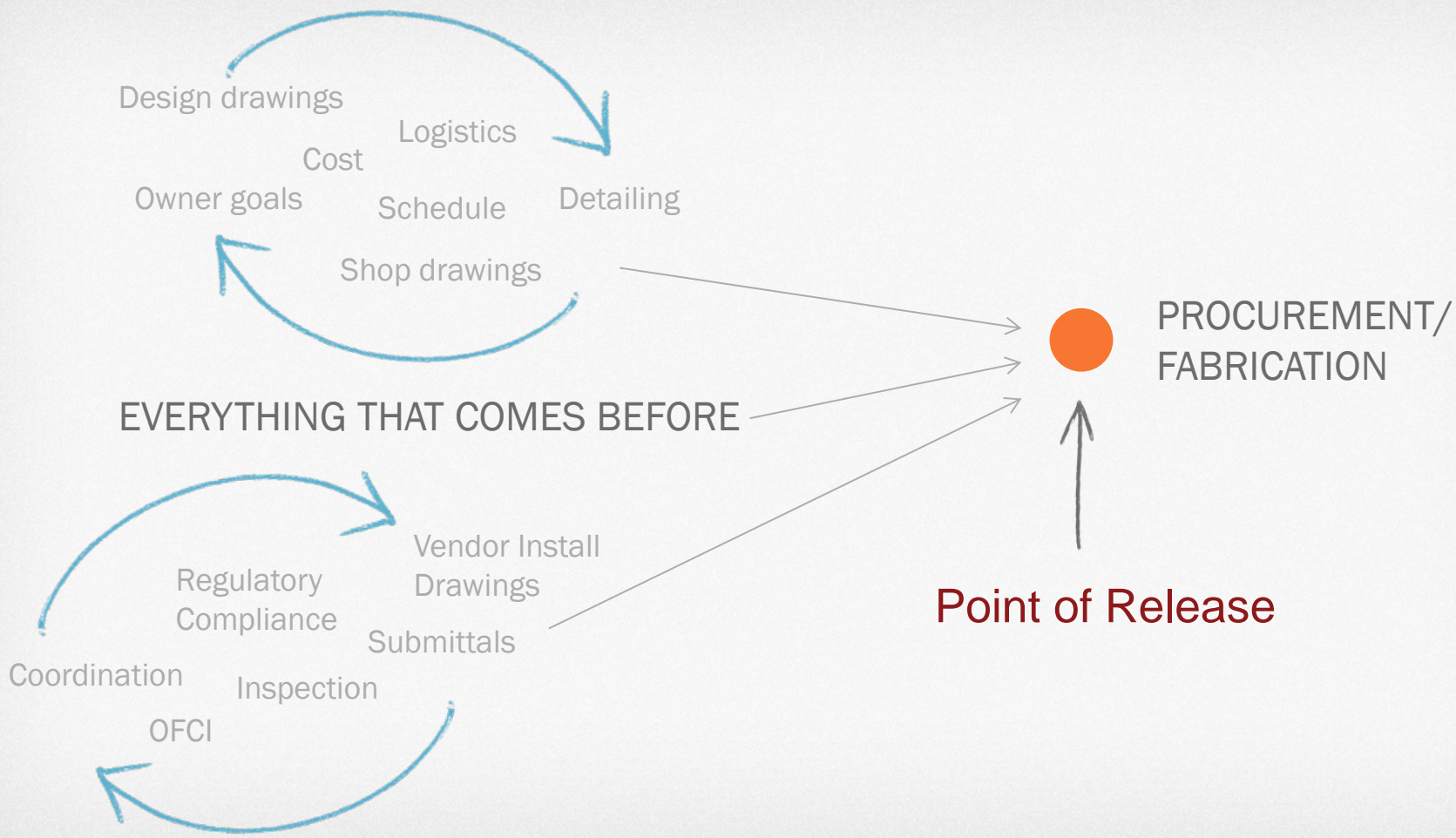


FIRST PRINCIPLES

What must be done



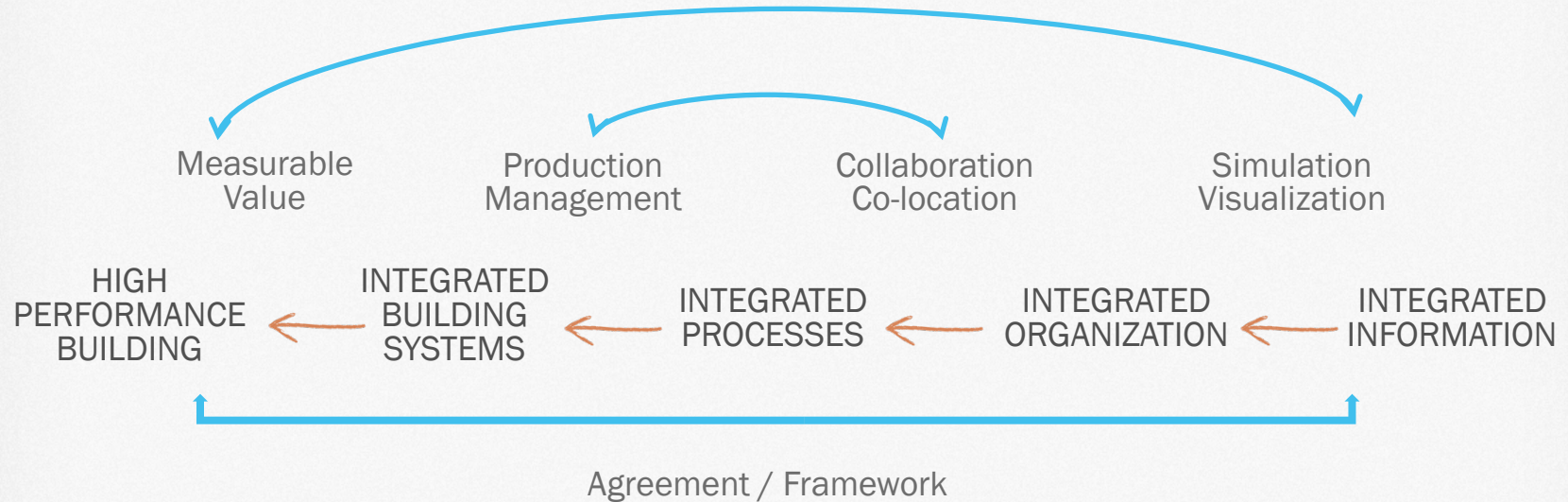




A DIFFERENT APPROACH

INTEGRATED PROJECT DELIVERY

A simple framework

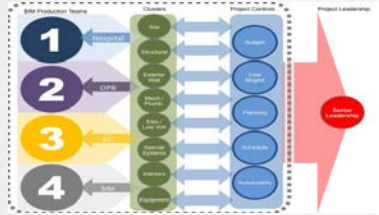


Martin Fischer, Atul Khanzode, Dean Reed, and Howard Ashcraft (2012)

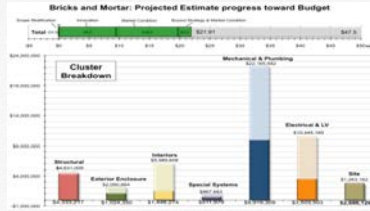
INTEGRATION TIMELINE

- Design started August 2007 without builders
- Integrated contract not possible
- DPR joins team August 2008
- Design Assist subs join as integrated partners under GMP contracts
- Virtual Design & Construction workshop March 2009
- Team co-located June 2009

THE INTEGRATION PLAN



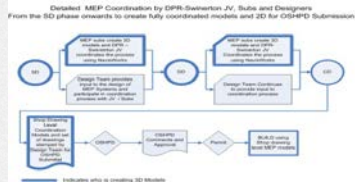
Virtual Company



Target Costing



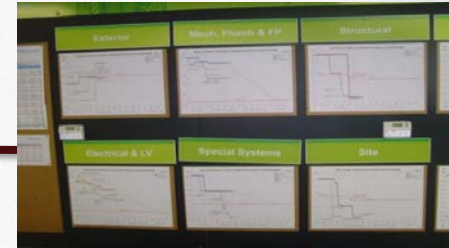
Virtual Handoffs



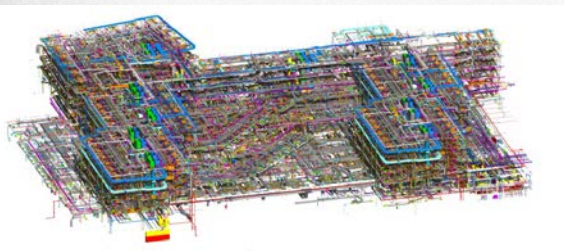
Virtual Building Process



UCSF Medical Center at Mission Bay



Process Metrics



Virtual Building Tools



Collaborative Planning Workshop



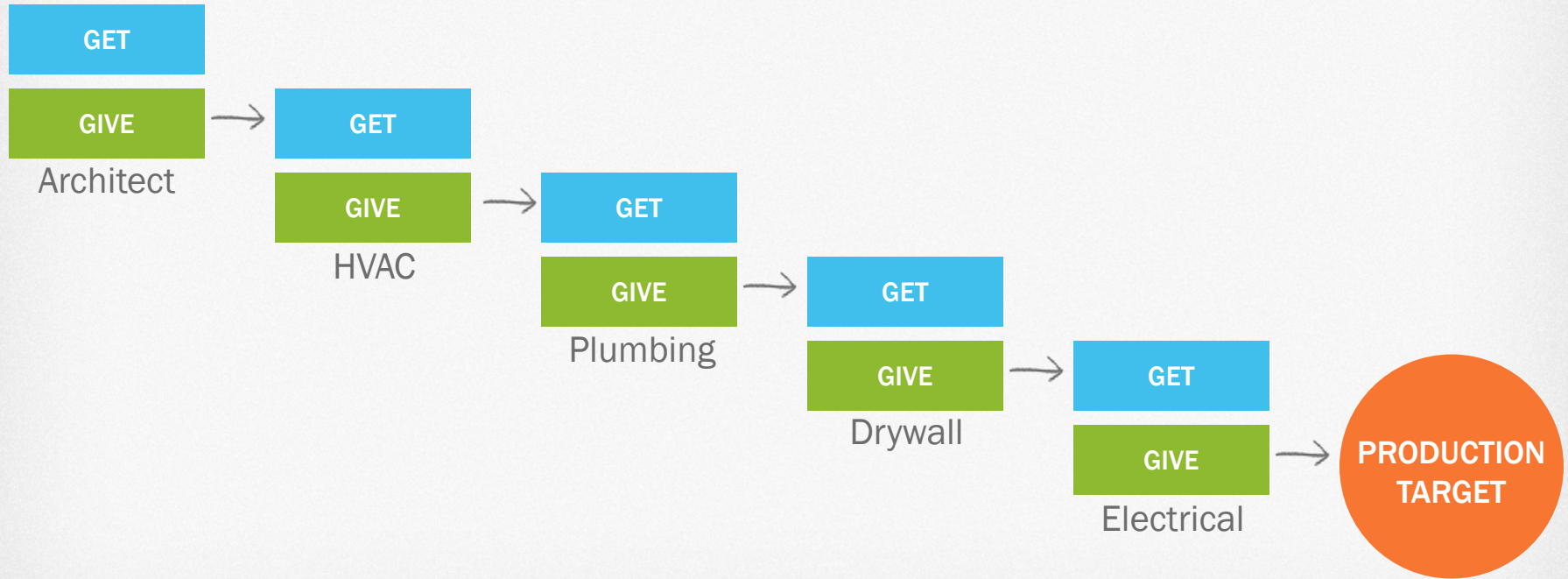
Integrated Center for Design and Construction

DESIGNING WORK PROCESSES



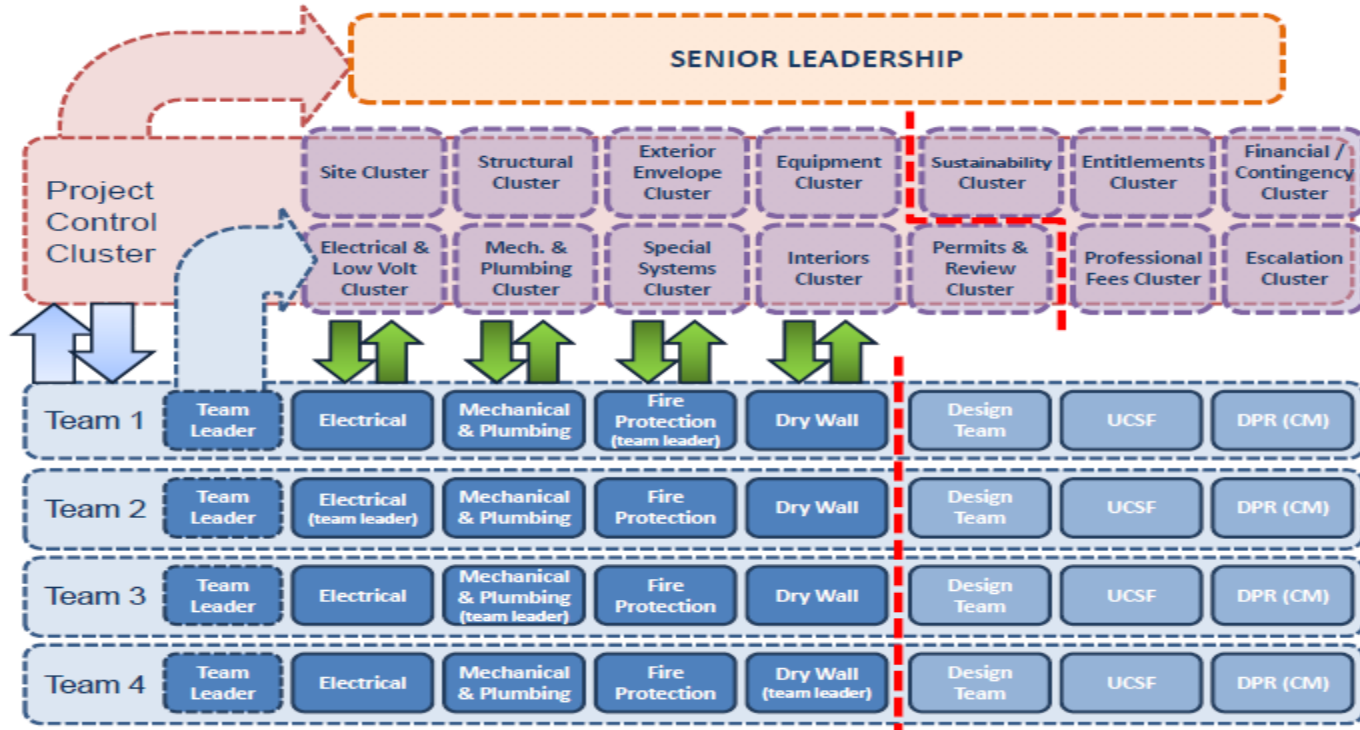
NETWORKS OF COMMITMENTS

Customers vs. suppliers



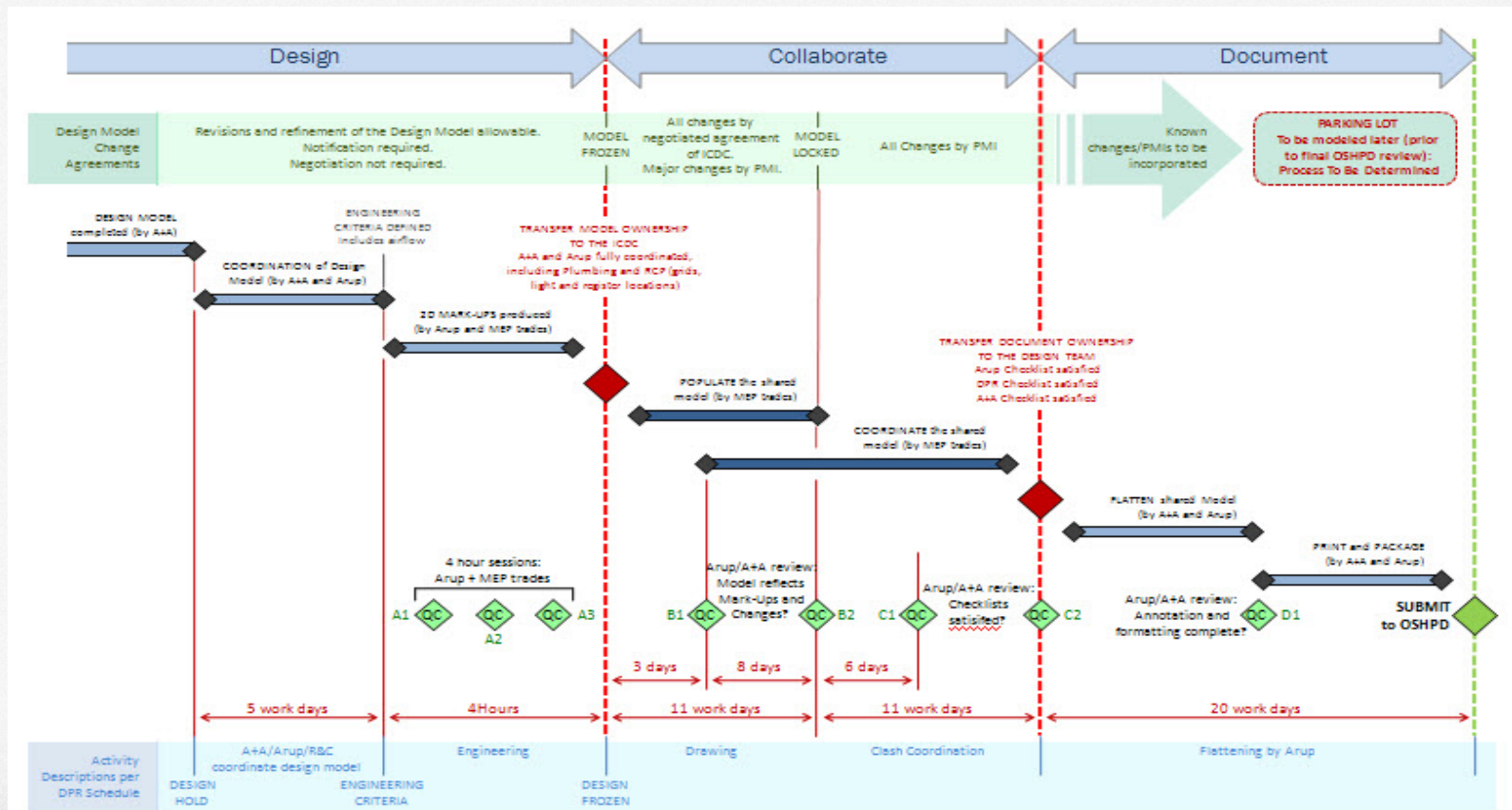


BIG ROOM PROCESS FLOW



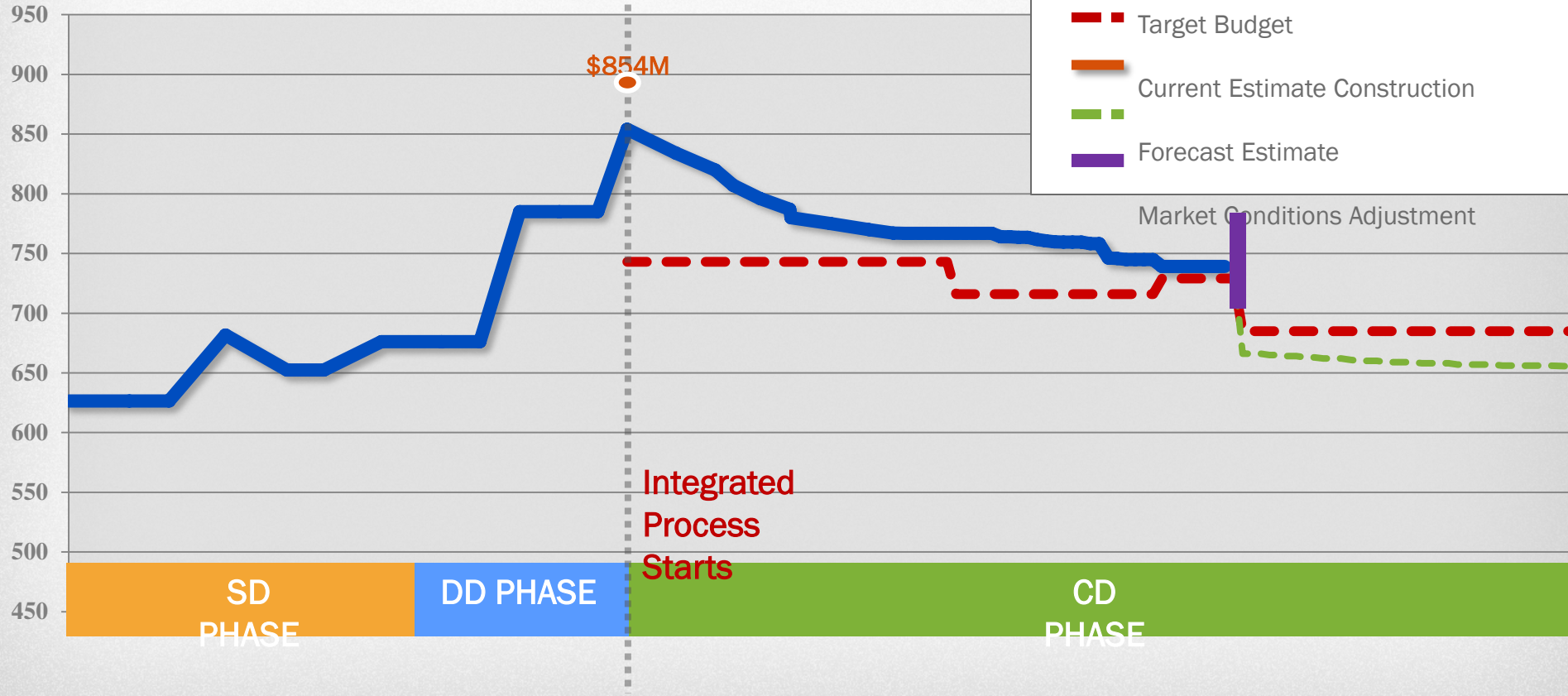
BIG ROOM: PROCESS FLOW DIAGRAM

PLANNING MODEL COORDINATION



CONSTRUCTION COSTS

Progress Towards Budget



MODELED WHAT WOULD BE BUILT

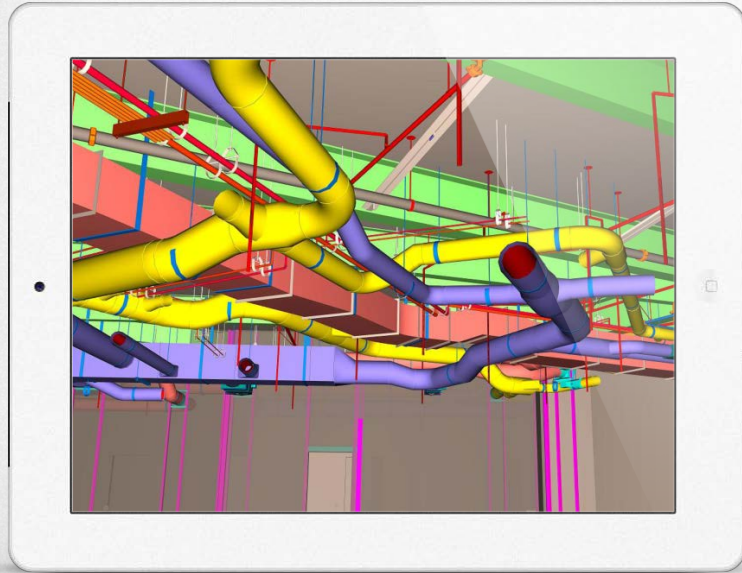
SHARED UNDERSTANDING

Does this guy understand
my constraints?



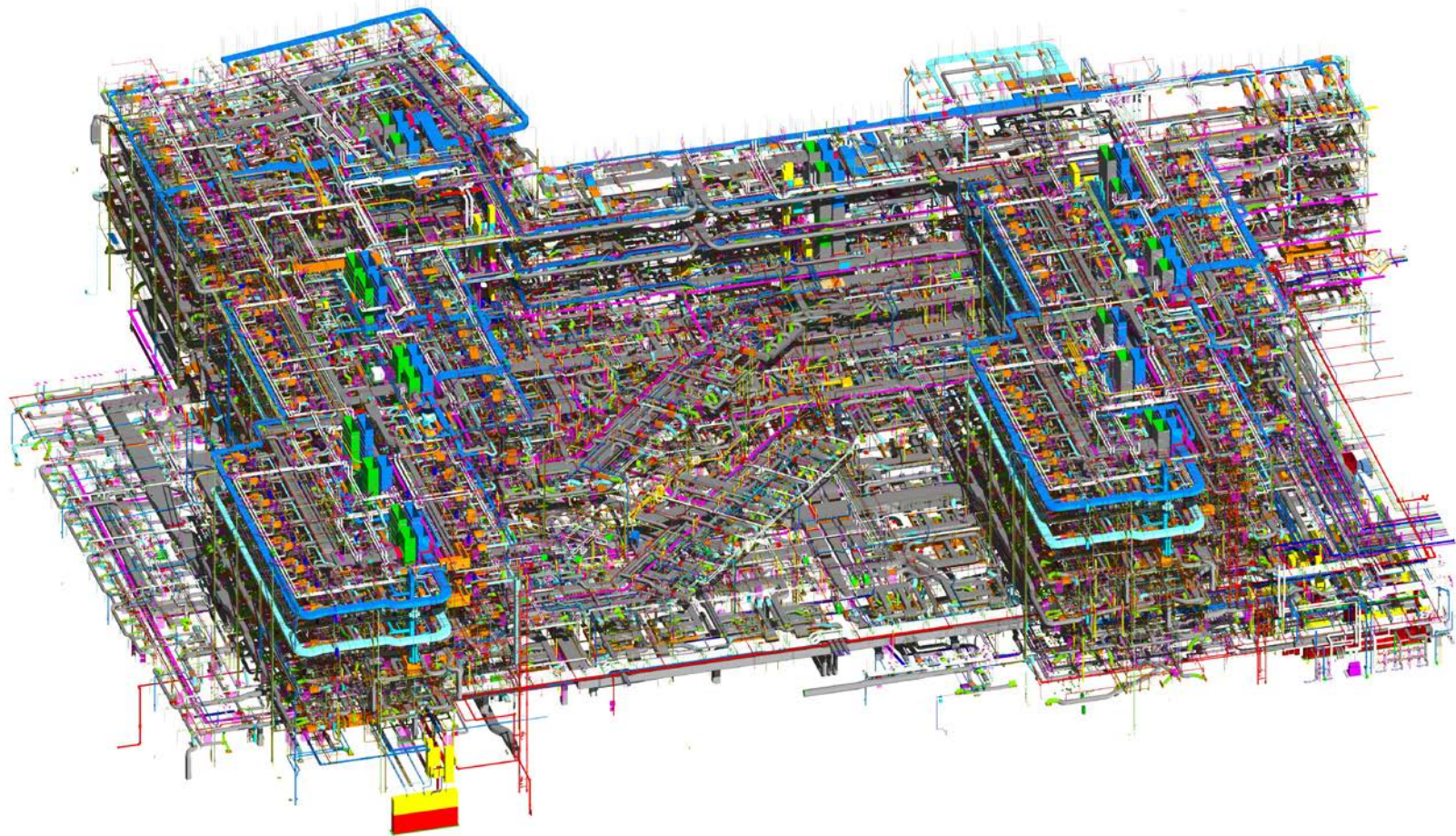
PRODUCT MODELS

Model what you build, build what you modeled



BIM USES

- 1 Visualization
- 2 Target value design
- 3 Design/fabrication coordination
- 4 Model-based estimating
- 5 Model-based production



CLASH RESOLUTION

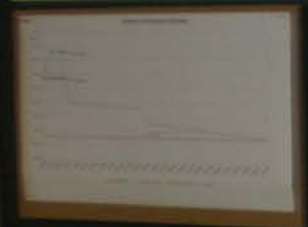
UCSF Mission Bay



Cost Target Budget Track



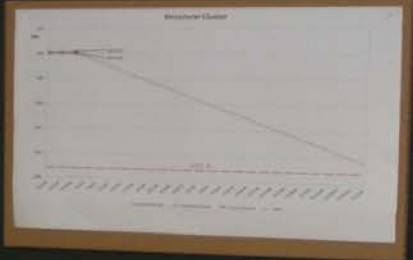
Exterior



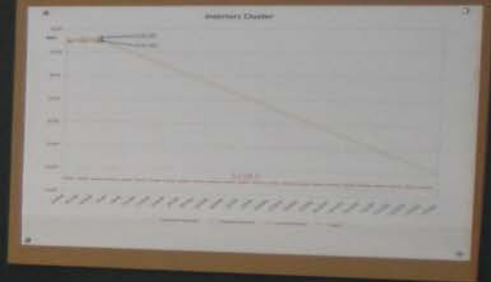
Mech, Plumb & FP



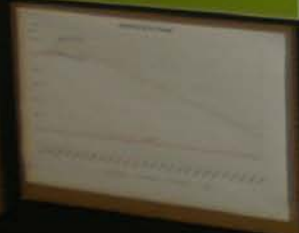
Structural



Interiors



Electrical & LV



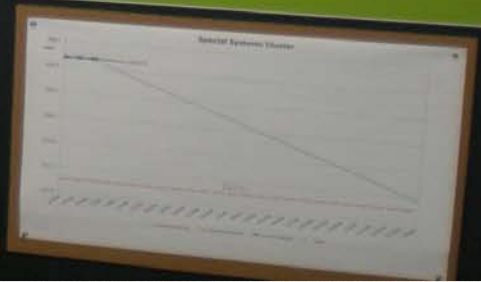
Equipment



Site



Special Systems



WHOLE LIFE VALUE

WHOLE LIFE VALUE

MEASURABLE TCO GOALS



MODEL SYSTEMS
COLLECT SERVICE DATA



MONITOR SYSTEM PERFORMANCE
ASSESS SYSTEM CONDITION



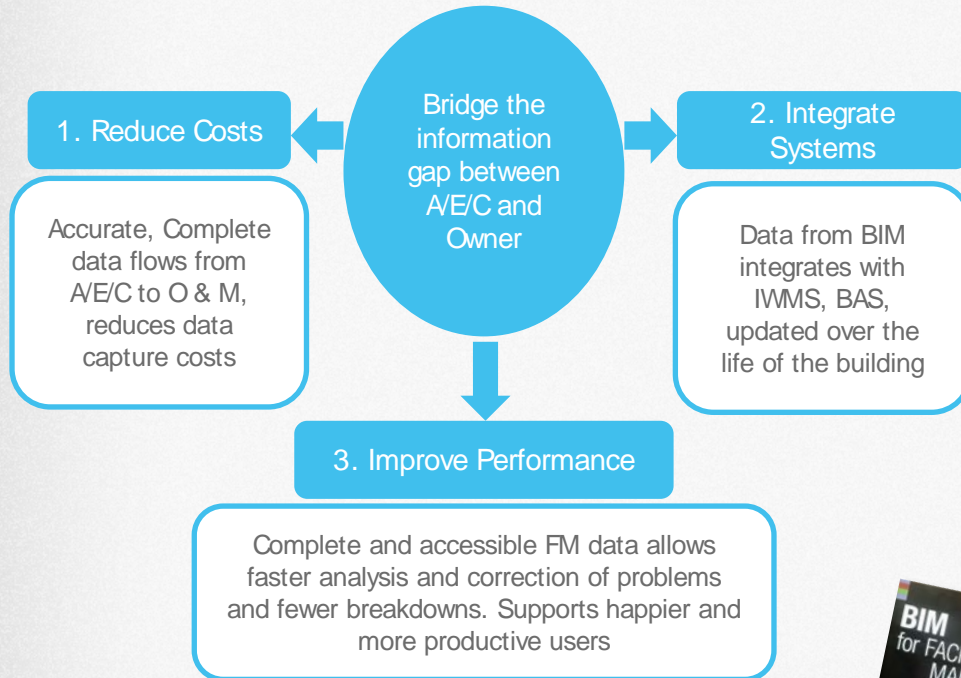
IMPROVE DECISIONS



IMPROVE PERFORMANCE,
EXTEND SYSTEM LIFE



BENEFITS OF BIM FOR TOTAL COST OF OWNERSHIP



GOALS

- Reduce energy spend
- Defer re-capitalization



INTEGRATED INFORMATION ROI

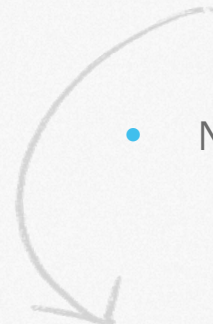
2009 IFMA survey of Maintenance Data

INPUTS

- 400,000 SF office, 346,000 SF rentable
- 25 yr. useful life
- 6% interest on invested funds
- \$100K initial cost
- \$31,250 ongoing cost (1 FTE @ 25%)
- \$41,000 initial savings
avoid 1 FTE, 4 months to collect maintenance data
- \$68,680 ongoing annual savings
 - Better access to accurate information
0.5 hr., 1600 work orders/yr., \$50/hr. burdened labor -> **\$0.10/GSF**
 - 3% utility savings
- **NPV = \$420k, ROI 64%,
net investment payback 1.56 yr.**

BACKGROUND

- Costs of inadequate interoperability (NIST GCR 04-867, 2004)
 - O&M is 80% of life cycle cost
 - **\$0.24 per SF**, from lack of integrated information
- NPV assumptions are conservative

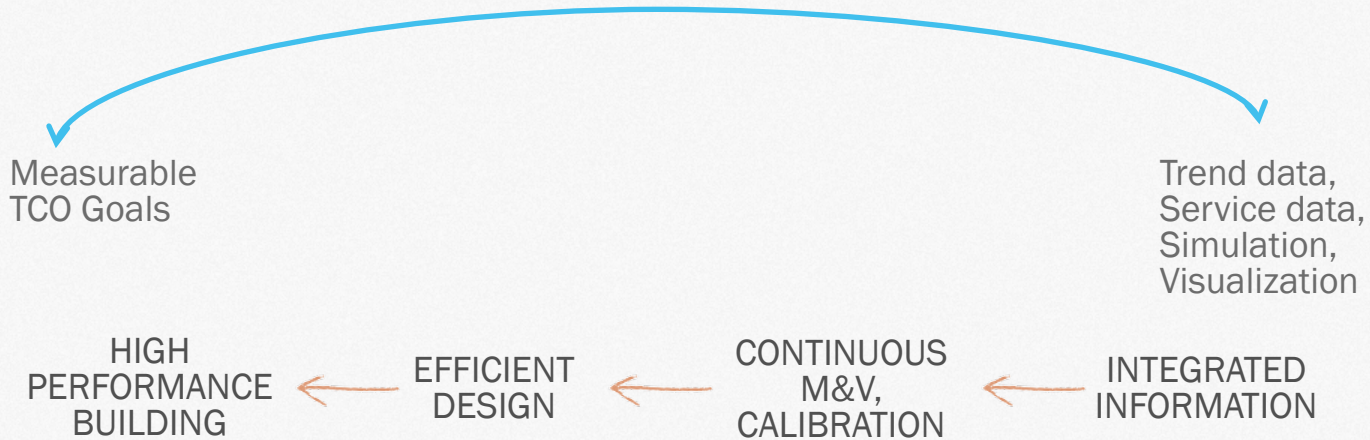


BIM for Facility Managers © 2013 by John Wiley and Sons
Paul Teicholz, Editor



HIGH PERFORMANCE

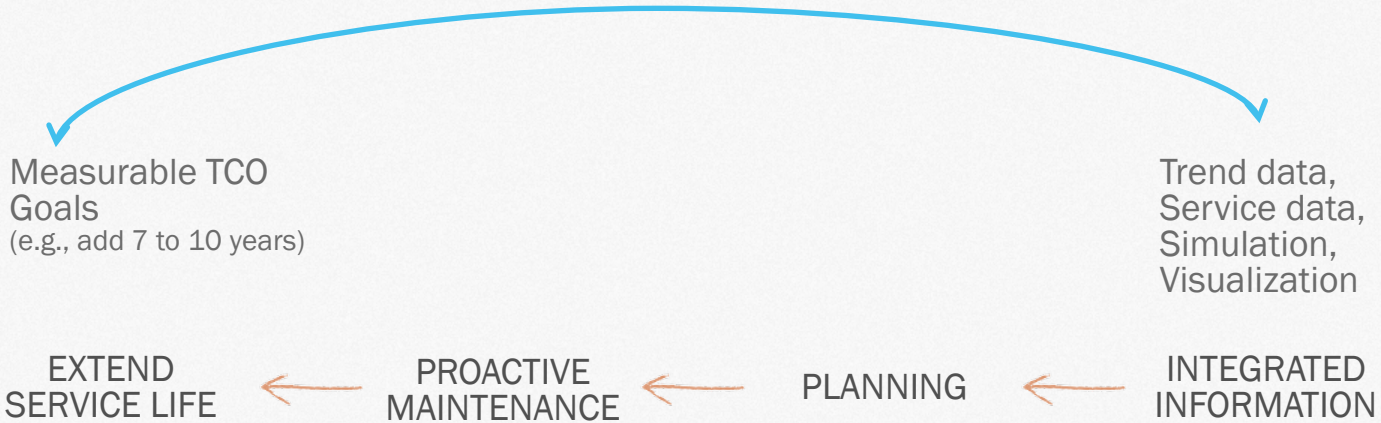
Through life cycle



Adapted from VDC Framework diagram by
Martin Fisher, 2012

EXTEND SERVICE LIFE

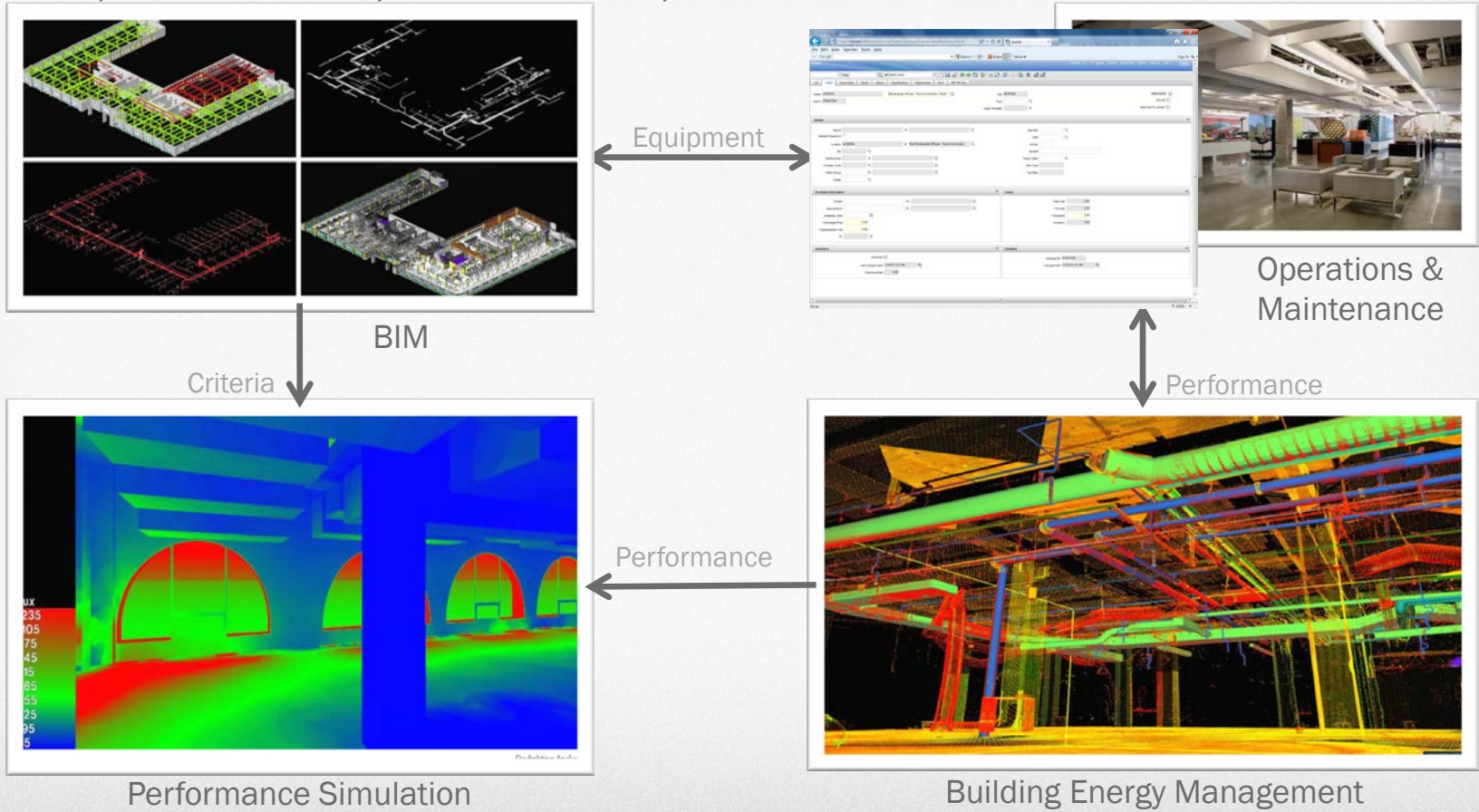
Through life cycle

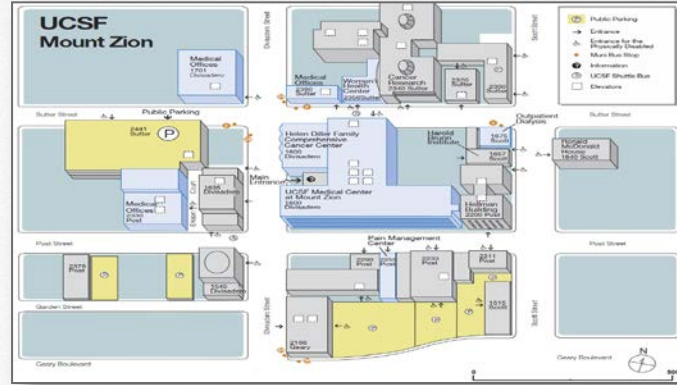
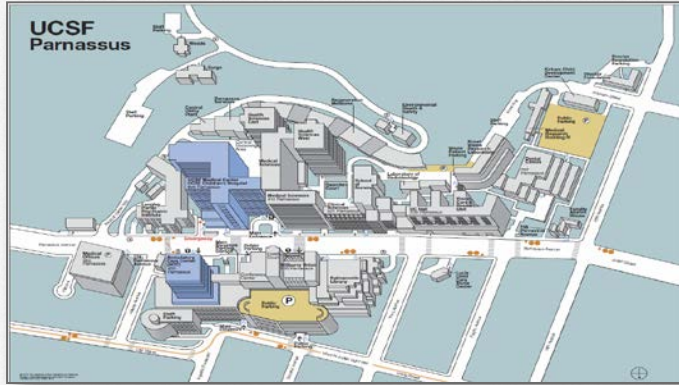


Adapted from VDC Framework diagram by
Martin Fisher, 2012

CONTINUOUS MEASUREMENT & VERIFICATION

Model, simulate, measure, act



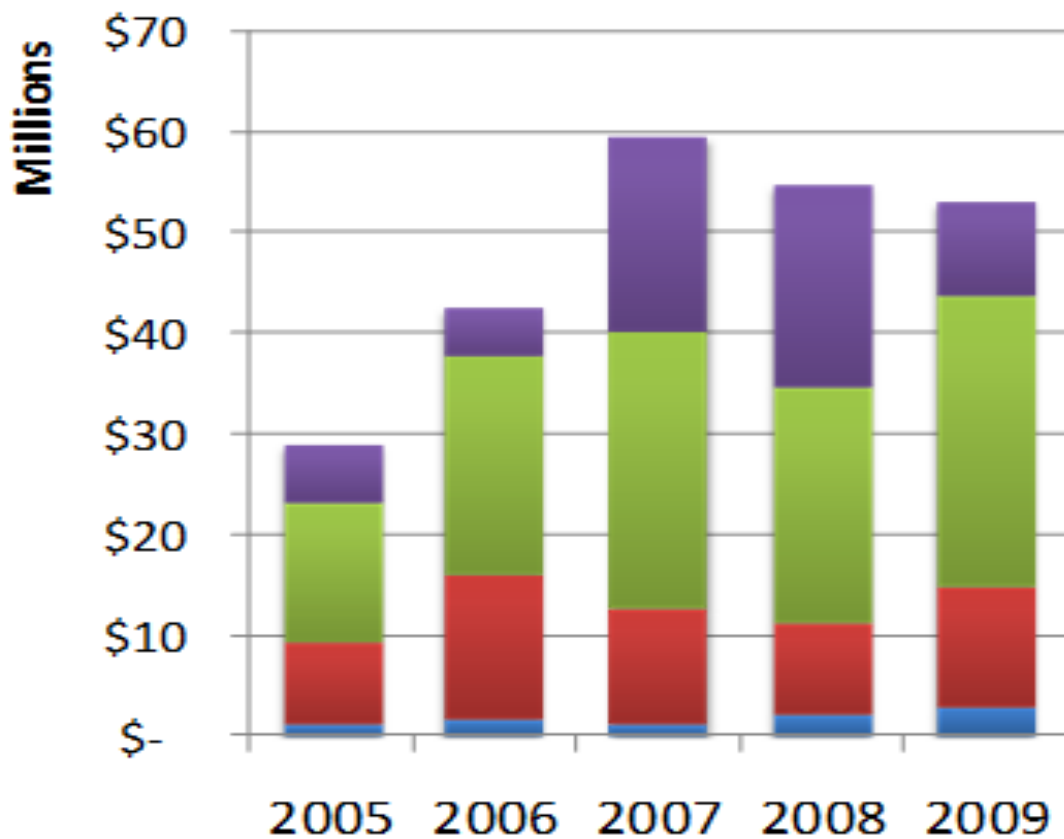


Parnassus and Mount Zion Campuses

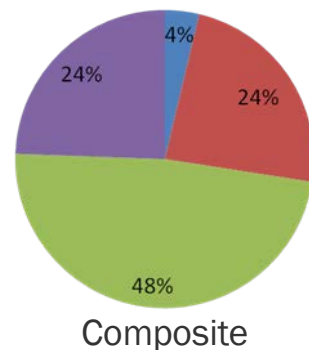
UCSF FACILITIES AND SERVICES PERSPECTIVE

UCSF MC historical 5-year spending

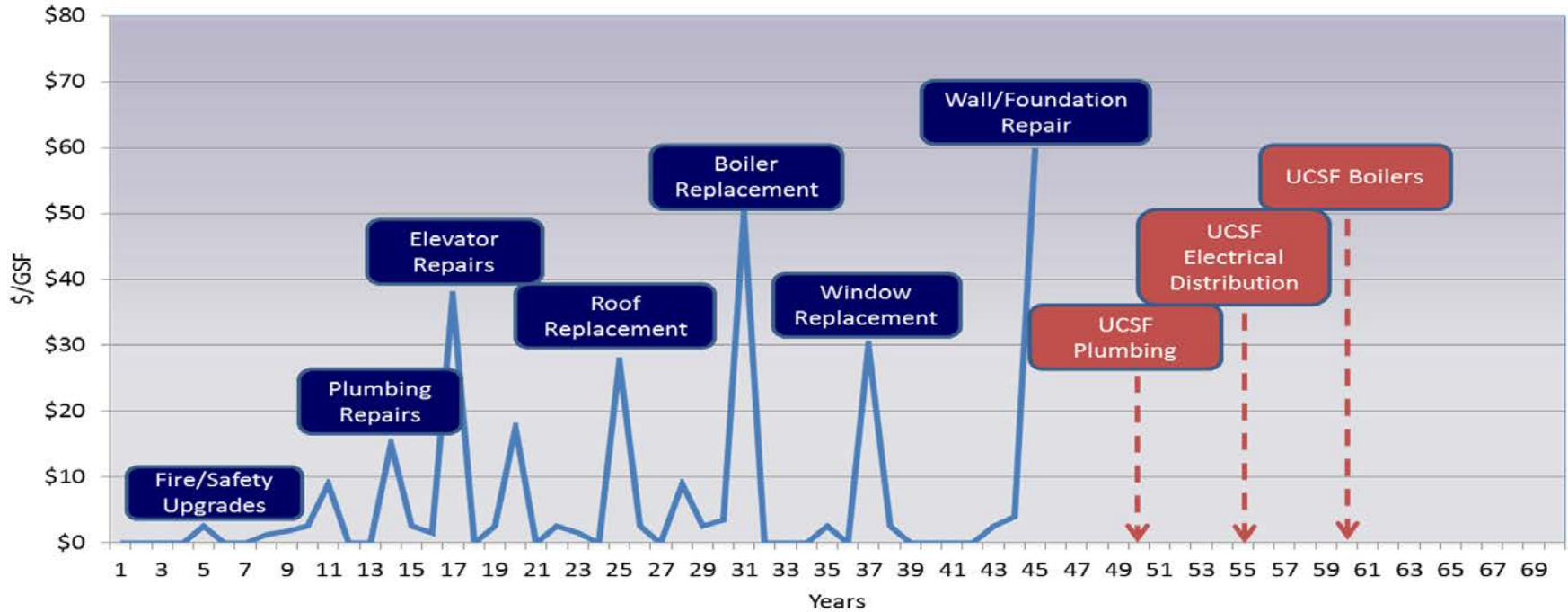
UCSF Medical Center | 2009



- Safety/Code
- Space Renewal
- Building systems/infrastructure
- Envelope



AGING INFRASTRUCTURE



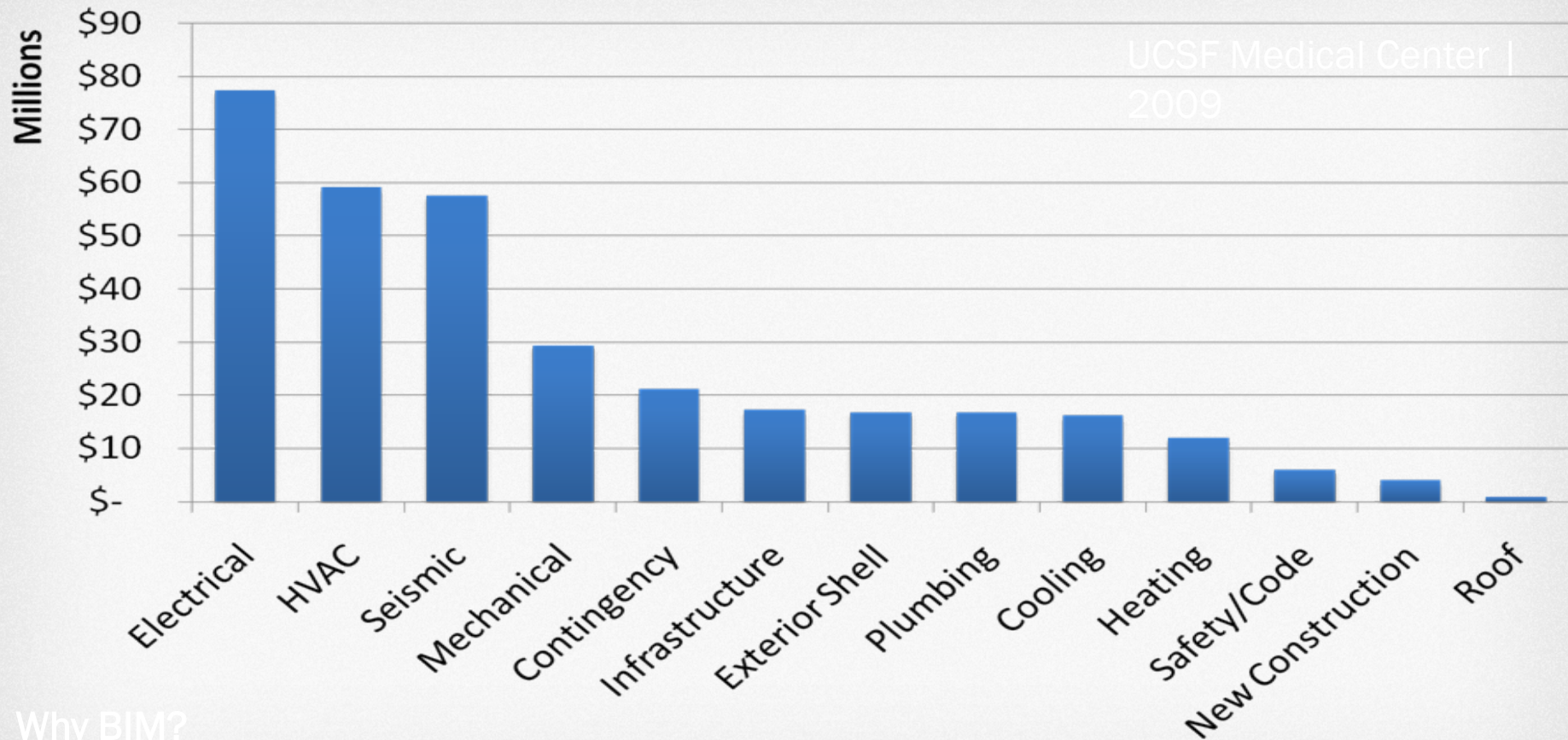
Many system components >25 yrs old

— Annual Life Cycle Cash Flow

UCSF Medical Center | 2009



Total prospective 10-year need - \$334M



Why BIM?
Opportunities!

EXAMPLE OPPORTUNITIES TO REDUCE O&M COSTS

PM-only Work Order Data from MMS - April through September 2012 - Rate assumption \$76/hr

	Work Orders	\$	Time (H)	Opportunity	Potential BIM Solution	Potential Barriers
Steam Traps	185/115*	\$9,285	122	time \$	heat sensor	technology exists
Smoke Damper	241	\$80,245	1055	time reduction	_2D/3D location on mobile device _field recording	
Air Flow Measurements	166	\$8,788	115	time \$	air flow sensor	technology cost to implement
Humidity Readings	543	\$9,134	120	time \$	humidity sensor	
Tube System	74	\$3,446	45	time reduction	adjustment to existing BAS	

IMPROVEMENT OPPORTUNITIES

“The first step with any related project is having...relevant information about the system.”

Alvin Cantor, UCSF

- Future projects WILL take place
- Facilities maintenance – Preventive, Ad-hoc
 - \$11.66 per square foot (2012 budget)
 - \$44M per year (3 year average – facility improvements)
- Emergencies – quick access to information
- Reporting for authorities having jurisdiction (AHJ)
- IT
- Space Management – utilization, planning, chargeback

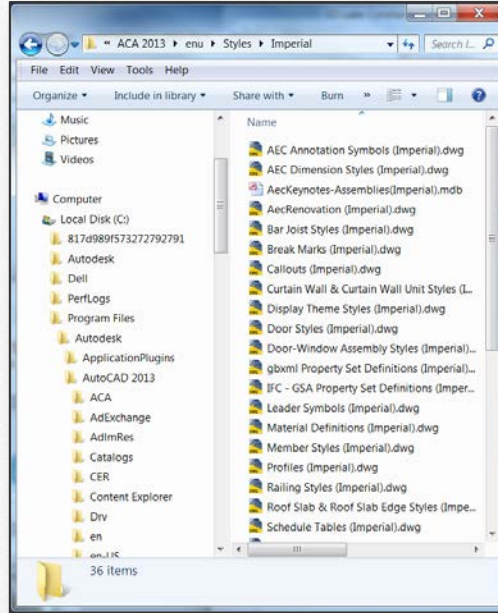
**BRIDGING CAPITAL PROJECT AND FACILITIES
SERVICES INTERESTS AT MISSION BAY**

OWNER'S INFORMATION MANAGEMENT CHALLENGE

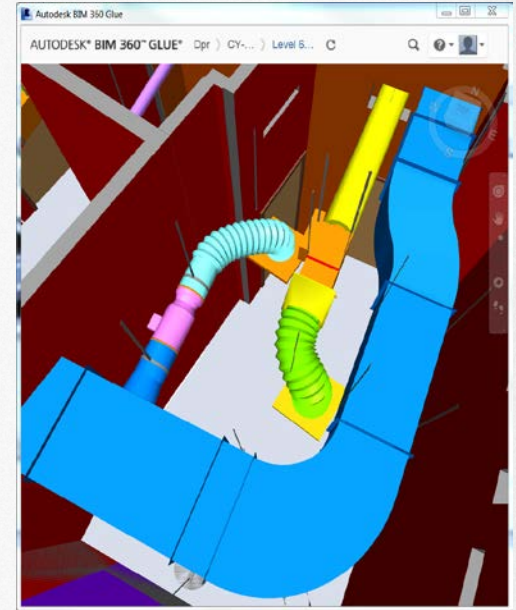
Increasing value, and complexity



Paper



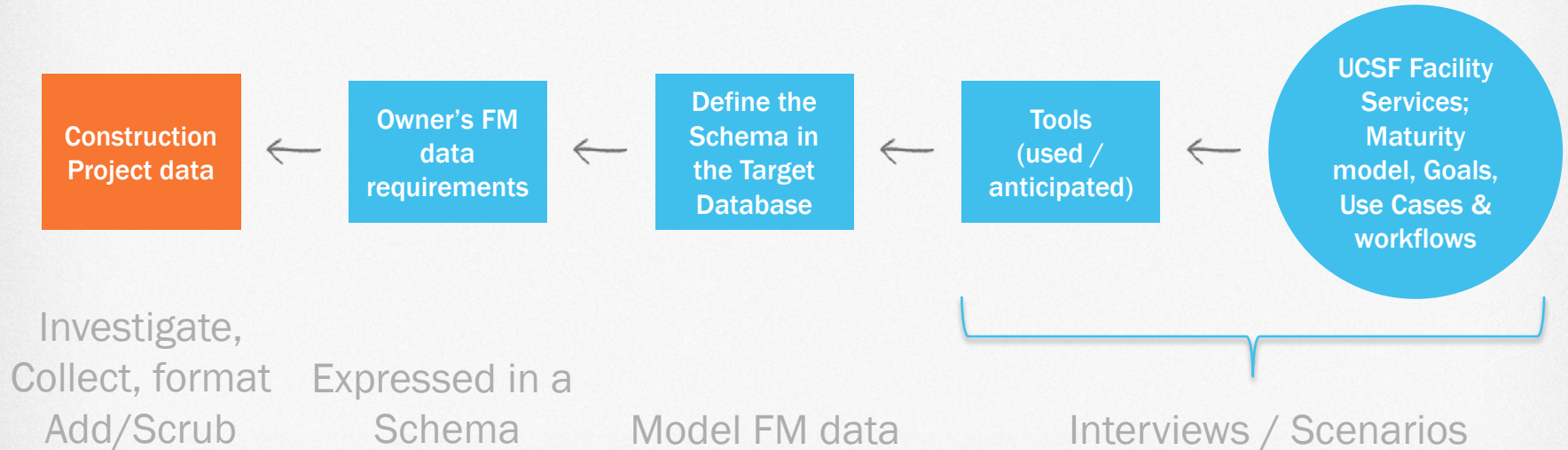
Digital Files



Elements with data

ASSESSMENT

Pull project data for Facilities Management





UCSF BIM FOR FM GOALS

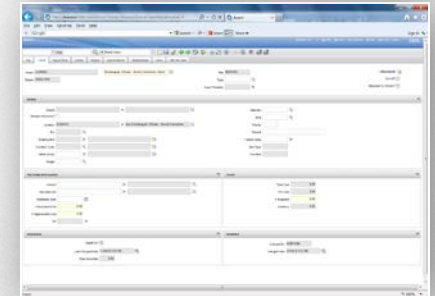
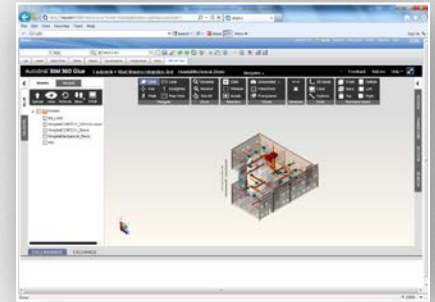
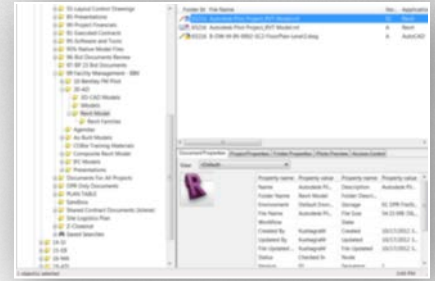
- 
- ✓ Improve strategic planning and decision making with better data
 - ✓ Reduce uncertainty around capital spending
 - ✓ Transfer building knowledge/info/process
 - ✓ Information and collaboration across Facilities & Support Services and other UCSF departments

UCSF BIM FOR FM OBJECTIVES

- Know what's in the facility: inventory MEPF elements
- Integrate information
 - Operational, performance data from project should flow to UCSF Systems
- Fast access to accurate information
 - 'See' behind the paint: 3D visualization, locate MEPF elements by room and distribution circuit

SCENARIOS

- Manage files in a document control system
- Generate FM views from construction BIM
- View, navigate, filter, and query 3D model
- Manage Spaces
- Support work order management
- Simulate, monitor, and optimize performance



SOFTWARE ROLES

A Suite of products is required

	Role	Tools that fulfill roles
1	Maintain/edit construction as-built models	CAD and BIM tools;
2	Document control: manage model and document file versions	Bentley Projectwise,
3	2D Drawing Navigation and Viewing	PlanGrid, FastTac, BlueBeam, MySmartPlans, Google Maps Platform
4	Merge source 3D models for cross discipline views, clash detection, filtered views for FM	Navisworks, BIM 360 Glue; Veo M6, Bentley i-model, ecoDomus, etc.
5	Scripting for model merge and filtered views	Gap – View configuration manager
6	Validate and scrub data	ecoDomus, Assemble Systems
7	Publish data to Integrated Workplace Management Systems: CAFM, CMMS	COBie spreadsheet; IBM Maximo
8	Link documents to model elements	Navisworks, BIM 360 Glue; Veo M6, Bentley i-model, ecoDomus, etc.
9	Present 3D model views to internal and external groups, with simple, easy-to-use apps	Navisworks, BIM 360 Glue; Veo M6, Bentley i-model, ecoDomus, etc.
10	Manage changes to source BIM models and interfaces to enterprise systems	Gap – tools do not support versions, synchronization

Current conditions

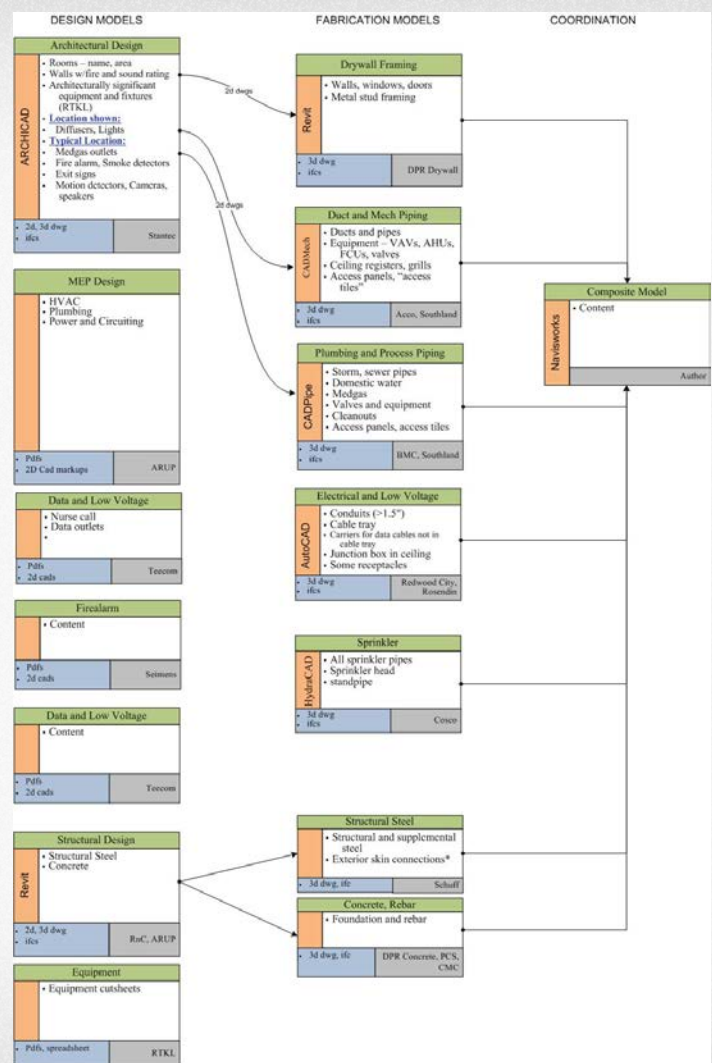
DOCUMENT WORKFLOWS

UCSF MISSION BAY

Project models

MULTIPLE SYSTEMS

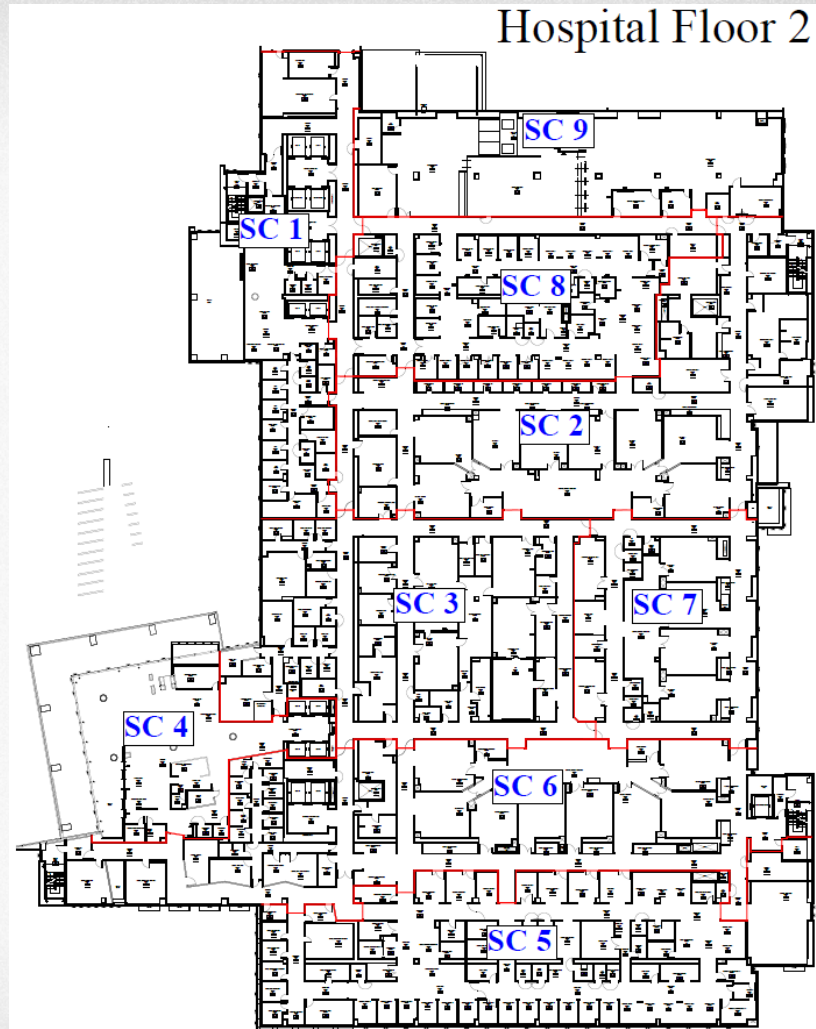
- Architectural – ArchiCAD
- Structural – Revit, Tekla
- MEP,
 - M: CAD Duct,
 - E: CAD MEP
 - P: CAD Pipe



UCSF MISSION BAY

Chunking Project models

- Architectural – ArchiCAD
- Structural – Revit, Tekla
- MEP,
 - M: CAD Duct,
 - E: CAD MEP
 - P: CAD Pipe





SEPARATE WORKFLOWS FOR MODELS AND DOCUMENTS

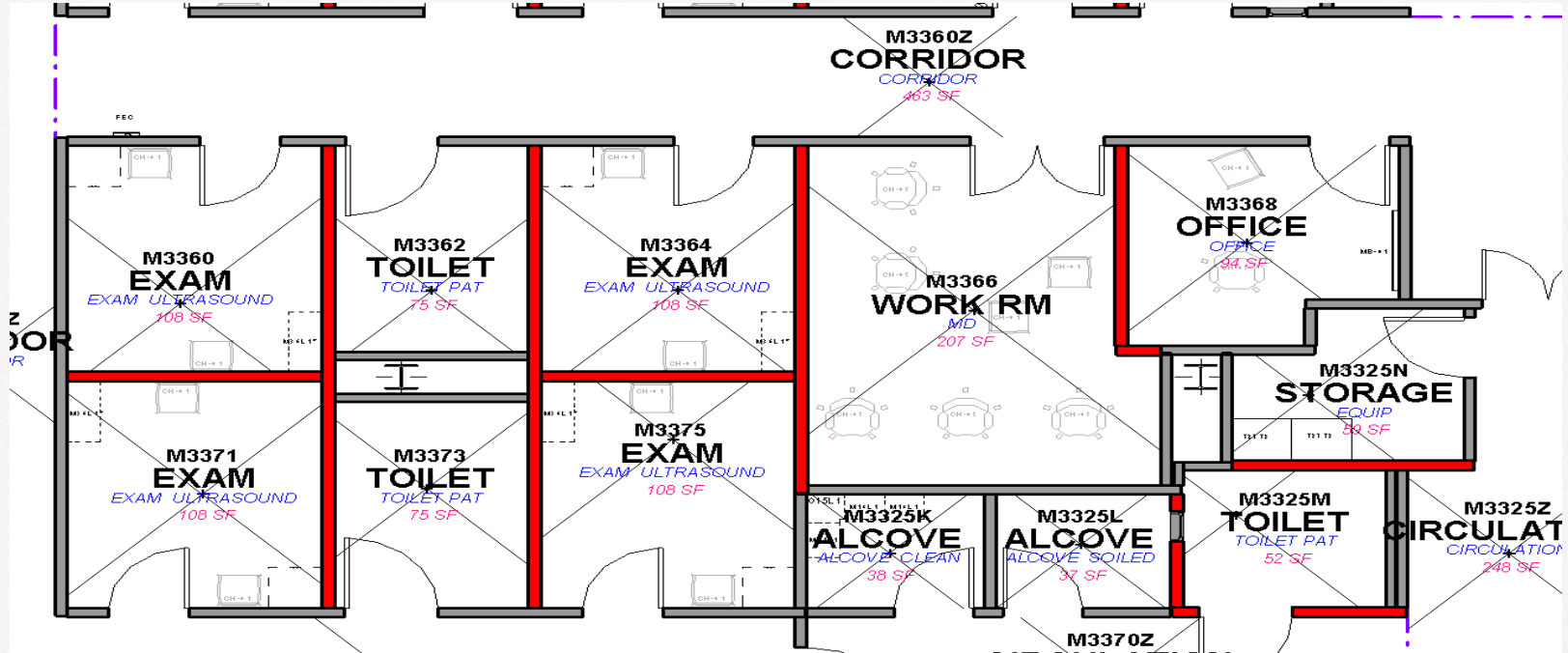
- Architectural – ArchiCAD
- Structural – Revit, Tekla
- MEP,
 - M: CAD Duct,
 - E: CAD MEP
 - P: CAD Pipe

Current conditions

PROJECT DATA

UCSF MISSION BAY

Space management data is the low hanging fruit



Create Rooms in Revit. Add Space Planning Data – Room Category, Room Desc., Area

UCSF MISSION BAY

Spaces published to COBie

							COBie2-Space	
Name	CreatedBy	CreatedOn	Room Category	FloorName	Description	ExtSystem		
M3248	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P6	Autodesk Revit Architecture 2012	Autodesk.Revit	
M3246	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P7	Autodesk Revit Architecture 2012	Autodesk.Revit	
M3244	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P8	Autodesk Revit Architecture 2012	Autodesk.Revit	
M3242	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P9	Autodesk Revit Architecture 2012	Autodesk.Revit	
M3240	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P10	Autodesk Revit Architecture 2012	Autodesk.Revit	
M3238	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P11	Autodesk Revit Architecture 2012	Autodesk.Revit	
M3236	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P12	Autodesk Revit Architecture 2012	Autodesk.Revit	
M3243	durgas@vconstruct.in	9/13/2013 5:14:26 PM	TYPE	Level 3	UTILITY ISLAND	Autodesk Revit Architecture 2012	Autodesk.Revit	
M3250	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P5	A	/it	
M3243	durgas@vconstruct.in	9/13/2013 5:14:26 PM	TYPE	Level 3	UTILITY ISLAND	A	/it	
M3258	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P1	A	/it	
M3256	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P2	A	/it	
M3254	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P3	A	/it	
M3252	durgas@vconstruct.in	9/13/2013 5:14:26 PM	INFUSION RM	Level 3	INFUSION BAY P4	A	/it	
M3261	durgas@vconstruct.in	9/13/2013 5:14:26 PM	ALCOVE	Level 3	NOURISHMENT	A	/it	
M3259	durgas@vconstruct.in	9/13/2013 5:14:26 PM	CORRIDOR	Level 3	CORRIDOR	A	/it	
M3265	durgas@vconstruct.in	9/13/2013 5:14:26 PM	CLEAN UTILITY	Level 3	CLEAN UTILITY MEDS	A	/it	
M3239	durgas@vconstruct.in	9/13/2013 5:14:26 PM	CHARTING	Level 3	CHARTING	A	/it	
M3235	durgas@vconstruct.in	9/13/2013 5:14:26 PM	SOILED UTIL	Level 3	SOILED UTILITY	A	/it	
M3237	durgas@vconstruct.in	9/13/2013 5:14:26 PM	TOILET	Level 3	TOILET STAFF	A	/it	
M3222	durgas@vconstruct.in	9/13/2013 5:14:26 PM	TOILET	Level 3	TOILET PAT	A	/it	
M3226	durgas@vconstruct.in	9/13/2013 5:14:26 PM	TREATMENT	Level 3	TREATMENT ROOM	A	/it	
M3249	durgas@vconstruct.in	9/13/2013 5:14:26 PM	CORRIDOR	Level 3	CORRIDOR	A	/it	
M3232	durgas@vconstruct.in	9/13/2013 5:14:26 PM	PVT INFUSION	Level 3	PVT INFUSION	A	/it	
M3230	durgas@vconstruct.in	9/13/2013 5:14:26 PM	PVT INFUSION	Level 3	PVT INFUSION	A	/it	

Scheduled fields (in order):

- Number
- COBieCreatedBy
- COBieCreatedOn
- Room Category
- Level
- Name
- RevitExtSystem
- RevitExtObject
- RevitExternalIDName
- COBieRoomTag
- Unbounded Height
- Area

Publish Data in COBie Format for use in Maximo Implementation.

THE UCSF OPS LIST

“Information we’d like to see in a perfect world”

PRODUCT CATEGORIES

- 5 architectural
- 18 Electrical
- 92 Medical, Mechanical, Plumbing

INFORMATION WE'D LIKE TO SEE IN A PERFECT WORLD...											
	FACILITIES 5% ITEM DESCRIPTION	Infrastructure System	Process	Downstream Service Area	Upstream Isolation	Regulatory Requirement	BIM (3D)	2D	DENSITY	# OF ATTRIBUTES	Warranty
2	AIR COMPRESSOR	MECH					!				
3	AIR CONDITION/WINDOW	MECH					!				
4	AIR CONDITIONING UNIT	MECH					!				
6	AIR HANDLING UNIT	MECH					✓		●		
7	AREA DRAIN INTERIOR	PLMB					✓		●		
8	AREA DRAINS, EXTERIOR OF BLDGS	PLMB					!		●		
9	BACKFLOW PREVENTION DEVICES	PLMB					!		●		
11	BOILER	MECH					✓		●		
12	BOOSTER FAN	MECH					!				
14	BRANCH HEAT PUMP	MECH					!		●		
15	CARBON DIOXIDE SYSTEM	PLMB					✓				
18	ABSORPTION CHILLER UNITS	MECH					!		●		
21	CHILL WATER COILS	MECH					!		●		
22	CHILL WATER PUMP	MECH					!		●		
23	CHILL WATER SYSTEM	MECH					!				
24	CHILLER ABSORPTION	MECH					!		●		
25	CHILLER CENTRIFUGAL	MECH					!		●		
27	COMPRESSOR	MECH					✓		●		
28	CONDENSATE RETURN BOOSTER PUMP	MECH					✓		●		
30	CONDENSATE RETURN LIFT PUMP	MECH					✓		●		

DATA COLLECTION

COMMON DATA

Identity and classification

The screenshot shows a software interface with a tree view on the left and a list view on the right. The tree view is expanded to 'Product', which contains sub-items like 'DryCirculation', 'AirFilter', 'AirHandlingUnit', etc. The list view shows properties for 'Product', including 'barcode', 'location', 'manufacturer', 'masterformat2004Number', 'masterformat2004Title', 'mfrSerialNumber', 'modelName', 'notes', 'ownerEquipmentReferenceNumber', 'tag', 'uniformatNumber', and 'uniformatTitle'. A red callout box labeled '1st priority' points to 'location', and another red callout box labeled '1st priority' points to 'tag'. A blue circle highlights the entire list view area.

PRODUCT DATA

Describe items for condition assessment

The screenshot shows a software interface with a tree view on the left and a list view on the right. The tree view is expanded to 'Product', which contains sub-items like 'DryCirculation', 'AirFilter', 'AirHandlingUnit', etc. The list view shows properties for 'AirHandlingUnit', including 'areaServed', 'branchPipeSize', 'centralSystemServing', 'cFMMaximum', 'cFMMinimum', 'inletSize', 'maximumPressureDrop', 'minimumOutsideWeight', 'operationWeight', 'other', 'reheatCoil', 'returnFan', and 'supplyFan'. A blue circle highlights the entire list view area.

- Determine the data the organization will manage
- Express the data in a schema (e.g., COBie)
- Map between project and enterprise systems

ASSET PROPERTIES, DEFENDING CHAMPIONS

PENN STATE

DPR-MISSION BAY

Penn State Asset Attribute List V3.0.xls [Compatibility Mode] - Microsoft Excel

AS53

Asset Information organized according to PSU UNIFORMAT II Standard

Asset	Parameter	Attribute	Responsibilities per Phase		
			Design	Construction	Commissioning
537 Water Heater	Equipment ID		Record	Validate	Validate
	Maximo Barcode #	#	-	Record	Validate
	Location	Room # (bldg#-room ex. 0000000-000X)	Record	Validate	Validate
	Installation Date	Date (MM,DD,YYYY)	-	Record	Validate
	Warranty Date	Date (MM,DD,YYYY)	-	Record	Validate
	Manufacturer		-	Record	Validate
	Model #		-	Record	Validate
545 Source Breaker Number(s)	#		-	Record	Validate
	Source Power Panel Name	Panel Name	-	Record	Validate
548 Furnace	Equipment ID		Record	Validate	Validate
	Maximo Barcode #	#	Record	Validate	Validate
	Location	Room # (bldg#-room ex. 0000000-000X)	Record	Validate	Validate
	Fuel Type	Natural Gas, Oil, Propane	Record	Validate	Validate
	Heat Input Maximum	BTU/HR	Record	Record	Validate
	Installation Date	Date (MM,DD,YYYY)	-	Record	Validate
	Warranty Date	Date (MM,DD,YYYY)	-	Record	Validate
555 Manufacturer			-	Record	Validate
	Model #		-	Record	Validate
557 Source Breaker Number(s)	#		-	Record	Validate
	Source Power Panel Name	Panel Name	-	Record	Validate
560 VAV	Equipment ID		Record	Validate	Validate
	Subclassification (Select)	Fan Powered, Standard,	Record	Validate	Validate
	Maximo Barcode #	#	-	Record	Validate
	Location	Room # (bldg#-room ex. 0000000-000X)	Record	Validate	Validate
	Installation Date	Date (MM,DD,YYYY)	-	Record	Validate
	Warranty Date	Date (MM,DD,YYYY)	-	Record	Validate
	Manufacturer		-	Record	Validate
567 information	Model #		-	Record	Validate
	Source Breaker Number(s)	#	-	Record	Validate
569 requirements	Source Power Panel Name	Panel Name	-	Record	Validate
	Space Served	Room # (bldg#-room ex. 0000000-000X)	Record	Validate	Validate
572 Sensor	Equipment ID		Record	Validate	Validate
	Subclassification (Select)	Gas, Fire Eye, pH, Humidity, Temperature	Record	Validate	Validate
	Maximo Barcode #	#	-	Record	Validate
	Location	Room # (bldg#-room ex. 0000000-000X)	Record	Validate	Validate

MyCpse UML - Asset Object Schema (2013-04-29WholeModel.ums) - MyCpse Enterprise Workbench

OutputDiffuser.csv - Microsoft Excel

mfSerialNumber

Asset Type	Attribute	Data Type	
Product	barcode	int	
	location	location	
	manufacturer	string	
	masterformat2004Number	string	
	masterformat2004Title	string	
	mfSerialNumber	string	
	modelName	string	
	notes	string	
	ownerEquipmentReferenceNumber	string	
	tag	string	
	uniformNumber	string	
	uniformTitle	string	
	DryCirculation	configuration	string
		service	string
type		string	
Diffuser	zone	string	
	borderType	string	
Diffuser	elevation	double	
	inletNeckDimensions	int	
	maximumDesignAirFlow	int	
	maximumStaticPressure	double	
	maximumThrow	double	
	minimumDesignAirFlow	double	
	minimumThrow	double	
	mounting	string	
	noiseCriteria	string	
	nominalDimensions	string	
	throwPattern	string	

ASSET PROPERTIES, DEFENDING CHAMPIONS

Penn State/DPR-Mission Bay

COMPARISON

- Penn State: 37 product types
- DPR/Mission Bay: 68 product types
- Use what we can, +- 38 new product categories

DPR Asset Attribute List V1.0.xls [Compatibility Mode] - Microsoft Excel						
E16						
A	B	C	D	E	F	
1	DPR/USC List 68					
2	Wet Circulation (9)	Dry Circulation (23)	Gas (23)	Plumbing Fixtures (2)	Electrical (11)	Other ?
3	ShutOffValveMWC	TerminalAirValveWithSoun	FlowSwitch	HotWaterGenerator	Lamp	
4	Pipe	ReHeatCoil	HoseBib	Sink	LightingFixture	
5	CleanOut	FlexDuct	MedicalGasPanel		ElectricalPanel	
6	Drain	RectangularDuct	MedicalGasValveBox		Receptacle	
7	HouseTrap	RoundDuct	Meter		MotionSensor	
8	ShutOffValvePWC	LinearDiffuser	PressureGauge		PullBox	
9	ValveBox	CeilingDiffuser	Thermometer		ControlRelay	
10	Vent	WallDiffuser	Motor		Conduit	
11	Pump	RadiantPanel			EquipmentConnection	
12		RadiantFloor			JunctionBox	
13		Damper			Switch	
14		MotorizedDamper				
15		FireSmokeDamper				
16		AirHandlingUnit				
17		ComputerRmACUnit				
18		Fan				
19		InDuctHumidifier				
28	Penn State					
29	Valve	Heater		Water Fountain	Panelboards	Elevator
30	Pump	Air Conditioner			Transformer	Hoist
31	Steam Trap	Chiller			Fixture	
32	Boiler	Walk-in Cooler			Fixture	
33	Pump	Cooling Tower			Contactor	
34	Water Heater	Dehumidifier			Access	
35		Pump			Control	
36		Fan			Panel	Manhole
37		Collector			Generator	Manhole
38		Compressor			Switch	
39		Dryer - Air			Uninterruptable Power Supply	
40		Blower				
41		Fan				
42		Heat Exchanger				
43		VAV				

SOURCES FOR ATTRIBUTE DATA

Schedules, specs, Submittals, Commission & test reports, etc.

Data UCSF seeks

		ATTRIBUTE	ATTRIBUTE_VALUE	SOURCE
CeilingDiffuser	Class	uniformatNumber		
		uniformatTitle		
		masterformat2004Number		
		masterformat2004Title		
		ownerEquipmentReferenceNumber		
		tag	SAG	
		manufacturer	TITUS	B-M0.16
		modelName	PCS	B-M0.17
		mfrSerialNumber		
		location	B060805	MODEL
		barcode		
		notes		
		service	SALP	
		type		
		configuration		
		zone		
		mounting	RAPID	B-M0.17
		nominalDimensions	12" X 12"	MODEL
		inletNeckDimensions	14" ϕ	MODEL
		maximumStaticPressure		0.1
		throwPattern	4-WAY	B-M0.17
		maximumDesignAirFlow		410
		minimumDesignAirFlow		
		maximumThrow		
minimumThrow				
noiseCriteria				
borderType				
elevation	9'			
eqptID				




Identification
 System
 Product

Example Sources

SUPPLY AIR OUTLET SCHEDULE								
ITEM	MANUFACTURER & MODEL NO.	TYPE	NECK SIZE IN. X IN.	OVERALL DIMENSION IN. X IN.	MAX. S.P. IN. WC	MAX. N.C.	NOTES	SERVICE
SAG	TITUS PCS	PERFORATED SUPPLY AIR GRILLE	SEE PLAN	SEE PLAN	0.1	25	4, 7	

Schedule

Drawing legend

	SQUARE OR RECTANGULAR CEILING DIFFUSER (SUPPLY) (DESIGNATION)-(TYPE) _____ SIZE (CFM)
	AIR FLOW PATTERN - 3 WAY INDICATED
	EXHAUST AIR INLET

Drawing Notes

- ④ 4-WAY BLOW UNLESS NOTED OTHERWISE.
- ⑤ SHALL HAVE INTEGRAL VOLUME DAMPER ACCESSIBLE FROM THE FACE PLATE OF THE DIFFUSER.
- ⑥ (NOT USED)
- ⑦ RAPID-MOUNT FRAME AT GYPSUM BOARD CEILING, SEE PLAN FOR LOCATIONS.

ASSESSMENT SUMMARY

Background

UCSF wants to manage CAD as-built models to support future projects, and pull 3D CAD geometry, data, and project documents for facilities management

Goals

- Lower total cost of ownership;
- Reduce costs of information loss and duplicate data entry;

Current Conditions

- Detailed BIMs for design and construction;
- Project nearing closeout;
- Team thinking through As-built delivery
- Documentation is paper and digital

Analysis

- Project Content
 - Multiple CAD Platforms
 - Model chunking
 - Content not optimized for operations.
 - Client's O&M requirements not incorporated in buy out processes
- Bentley Facilities and BIM 360 Glue Pilot
 - Bentley: complicated workflows; limited MEP data from ACAD products;
 - BIM 360 Glue: simple workflows; Browser 3D; 1st generation product w/gaps

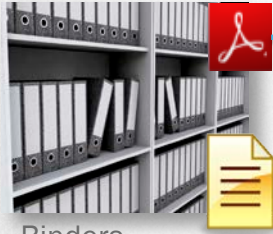
Proposed counter measures

- \$450K content dev; awarded first 2 of 10 work packages

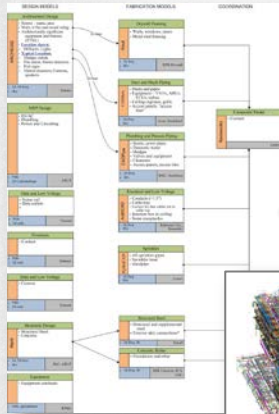
Desired state

BRIDGE PROJECT AND ASSET SYSTEMS

MAKING PROJECT DATA FLOW TO OWNER



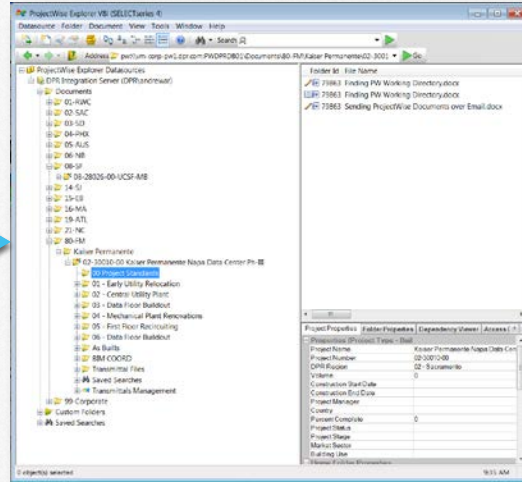
Binders



CAD/BIM files

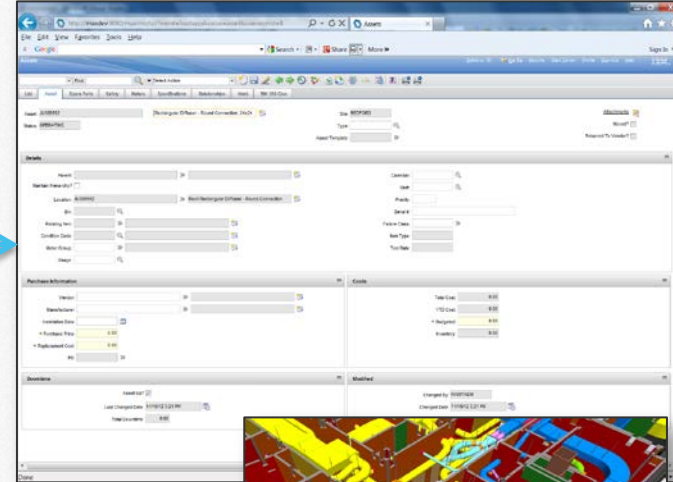


Coordinated Models

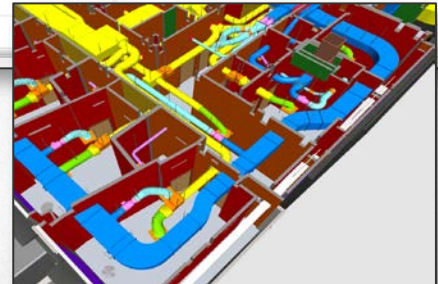


Projectwise Document Control

Asset
Data



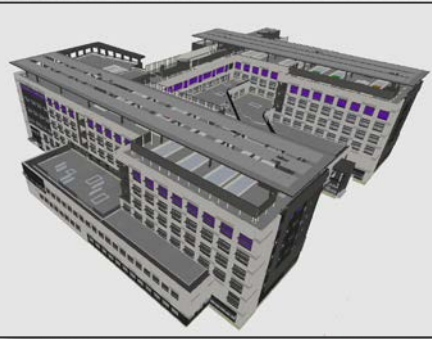
Maximo
Work order



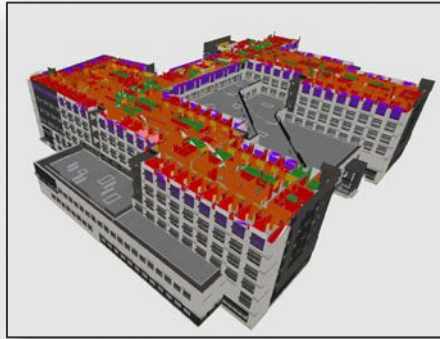
Visualize, query properties and find documents

INTEGRATED INFORMATION

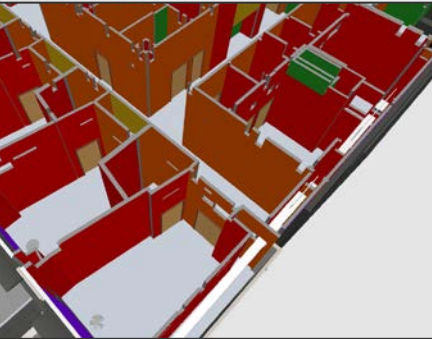
Fast and Accurate Access, through easy to use tools and Work Order System



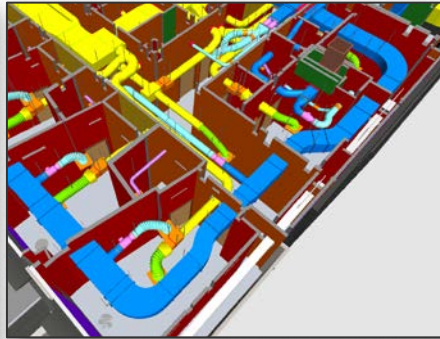
1. Hospital



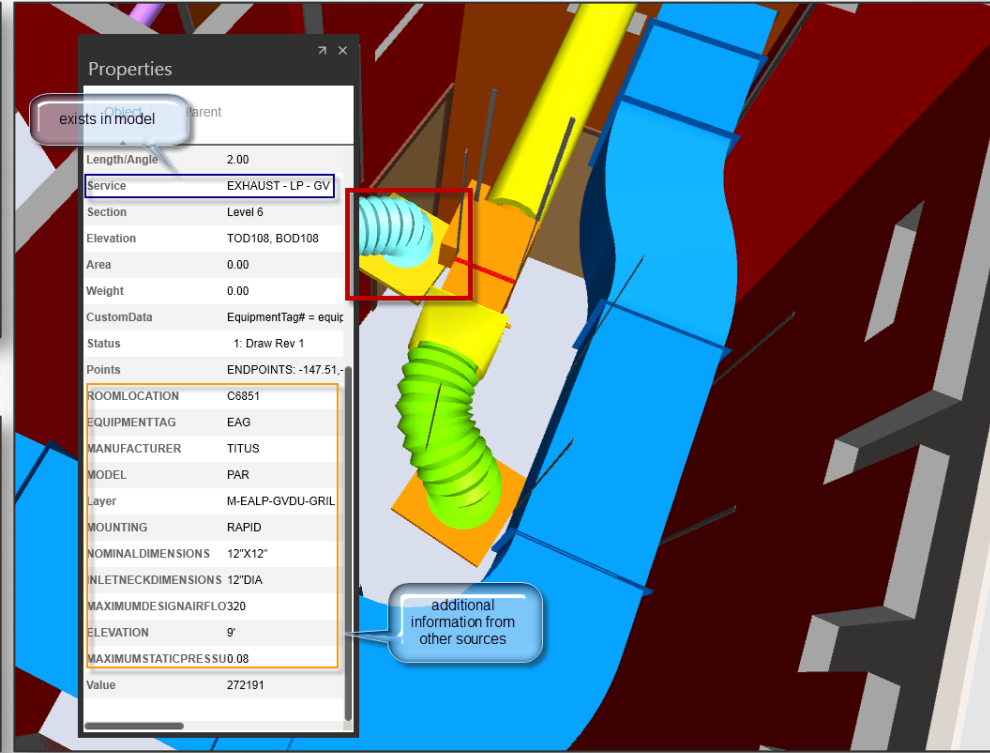
2. 6th floor



3. Room



4. Mechanical



5. Diffuser data

Properties	
Object	exists in model
Parent	
Length/Angle	2.00
Service	EXHAUST - LP - GV
Section	Level 6
Elevation	TOD108, BOD108
Area	0.00
Weight	0.00
CustomData	EquipmentTag# = equip
Status	1: Draw Rev 1
Points	ENDPOINTS: -147.51,-
ROOMLOCATION	C6851
EQUIPMENTTAG	EAG
MANUFACTURER	TITUS
MODEL	PAR
Layer	M-EALP-GVDU-GRIL
MOUNTING	RAPID
NOMINALDIMENSIONS	12"X12"
INLETNECKDIMENSIONS	12"DIA
MAXIMUMDESIGNAIRFLOW	320
ELEVATION	9'
MAXIMUMSTATICPRESSURE	0.08
Value	272191

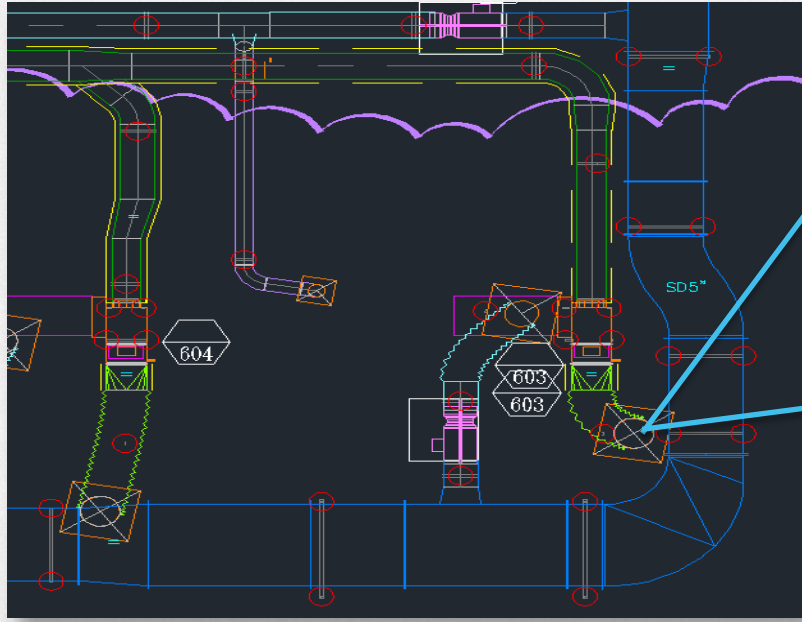
ADDING DATA

CADmep+	
Item Number	CD
Description	CD
End Size(s)	24x24, Vav collar 14,
Length/Angle	2"
Service	SUPPLY - LP - GV
Section	Level 6
Elevation	TOD9'-0", BOD9'-0"
Area	0"
Weight	0"
Notes	
CustomData	EquipmentTag# = equip,...
Status	1: Draw Rev 1
Points	ENDPOINTS: -108.47,-950...

Existing BIM Data

PROPERTY SETS	
UCSF FM Common	
EQUIPMENTTAG	SAG
MANUFACTURER	TITUS
MASTERFORMATTITLE	
MODEL	PCS
ROOMLOCATION	C6851
SERIALNO	
UCSFEQPTTAG	
UCSF FM Diffusers	
ELEVATION	9'
INLETNECKDIMENSIO...	14" DIA
MAXIMUMDESIGNAIR...	410
MAXIMUMSTATICPRE...	0.1
MOUNTING	RAPID
NOMINALDIMENSIONS	12"X12"
THROWPATTERN	4-WAY
UCSF FM HVAC System	
Layer	M-SALP-GVDU-GRIL
SERVICE	SUPPLY - LP - GV

Additional BIM Data



Source BIM file

- Identification
- System
- Product

PUBLISH TO COBIE

WP 2 PILOT EQUIP COBIE Draft.xlsx - Microsoft Excel

	A	B	C	D	E	F	G	H	I
1	Name	CreatedBy	CreatedOn	Category	SheetName	RowName	Value	Unit	ExtSystem
2	uniformatNumber	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		n/a	
3	uniformatTitle	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		n/a	
4	masterformat2004Number	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		n/a	
5	masterformat2004Title	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		n/a	
6	ownerEquipmentReferenceNumber	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01		n/a	
7	tag	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01	SAG	n/a	
8	manufacturer	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD	TITUS	n/a	
9	modelName	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD	PCS	n/a	
10	mfrSerialNumber	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		n/a	
11	location	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01	B06085	n/a	
12	barcode	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01		n/a	
13	notes	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01		n/a	
14	service	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01	SALP	n/a	
15	type	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD	PERFORATED	n/a	
16	configuration	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01		n/a	
17	zone	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01		n/a	
18	mounting	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD	RAPID	n/a	
19	nominalDimensions	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD	12" X 12"	in x in	
20	inletNeckDimensions	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01	14" φ	inches	
21	maximumStaticPressure	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		0.1 inches in WC (water Column)	
22	throwPattern	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01	4-WAY	n/a	
23	maximumDesignAirFlow	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01		410 cubicfeet/minute	
24	minimumDesignAirFlow	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01		cubicfeet/minute	
25	maximumThrow	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		feet?	
26	minimumThrow	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		feet?	
27	noiseCriteria	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		dB	
28	borderType	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		n/a	
29	elevation	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Component	CD-01	9'	feet	
30									
31	uniformatNumber	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		n/a	
32	uniformatTitle	Alvin.Cantor@ucsfmedctr.org	2013-08-22T13:30:11	Approved	Type	CD		n/a	

Ready

ACCURATE & FAST INFORMATION ACCESS

The screenshot displays a web-based interface for a Building Information Modeling (BIM) application. The browser address bar shows the URL: <http://maxdev3080/maximo/uf/event=loadapp&value=asset&sessionid=8>. The interface includes a top navigation bar with tabs for "List", "Asset", "Spare Parts", "Safety", "Meters", and "Specifications". A search bar and "Select Action" dropdown are also present. The main content area shows a 3D model of a building's HVAC system, specifically "Level 6 Walls + HVAC". The model features various colored components: blue for walls, red for structural elements, and yellow, green, and cyan for ductwork and piping. A "Models" panel on the left lists various equipment types, including "M-SALP-GVDU" and "M-SALP-GVDU-GRIL". A "Properties" panel on the right displays detailed information for the selected object, including its parent, area, weight, status, and various technical specifications.

Object	Parent
Area	0.00
Weight	0.00
CustomData	Equipment Tag = equip
Status	1. Draw Rev 1
Points	ENDPOINTS -108 47-
ROOMLOCATION	C6851
EQUIPMENTTAG	SAG
MANUFACTURER	TITUS
MODEL	PCS
Layer	M-SALP-GVDU-GRIL
MOUNTING	RAPID
NOMINALDIMENSIONS	12"x12"
INLETNECKDIMENSIONS	14"DIA
THROWPATTERN	4-WAY
MAXIMUMDESIGNAIRFLOW	410
ELEVATION	9'
MAXIMUMSTATICPRESSURE	1
Value	272192

Lessons Learned

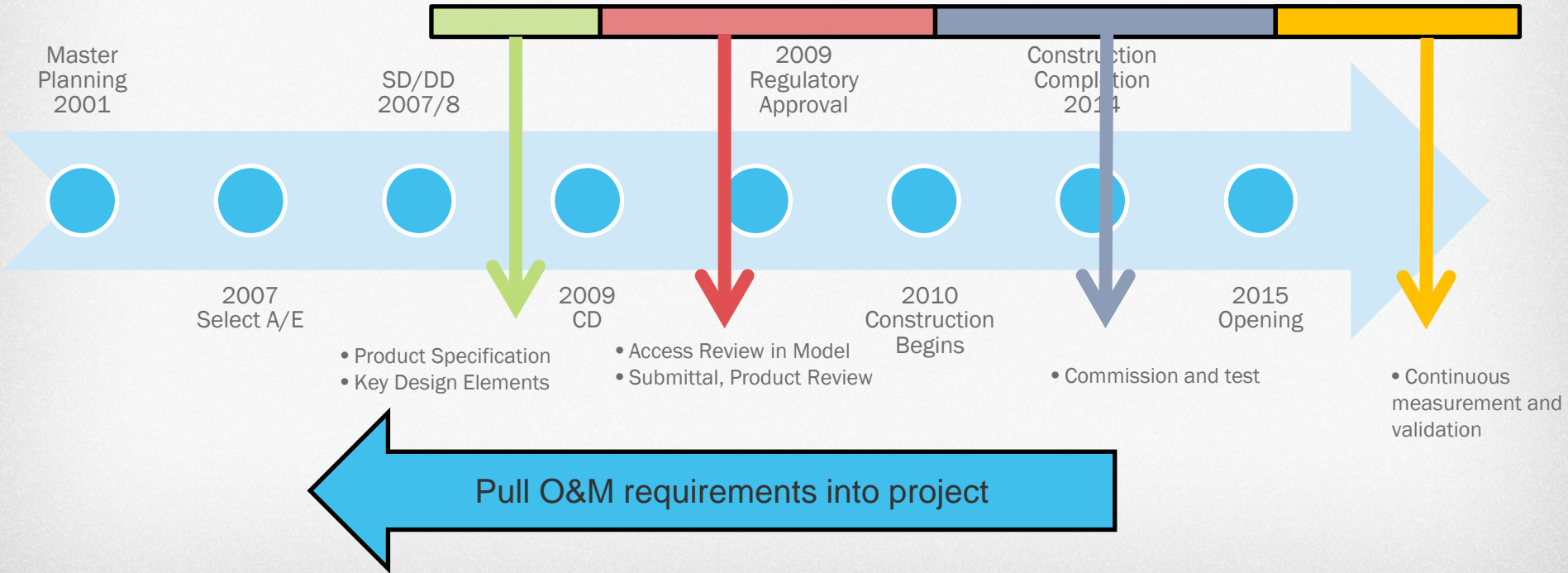
THE DATA NEEDS TO BE MANAGED

EXTEND VDC PRINCIPLES TO FACILITY MANAGEMENT

Make value flow from project to operations

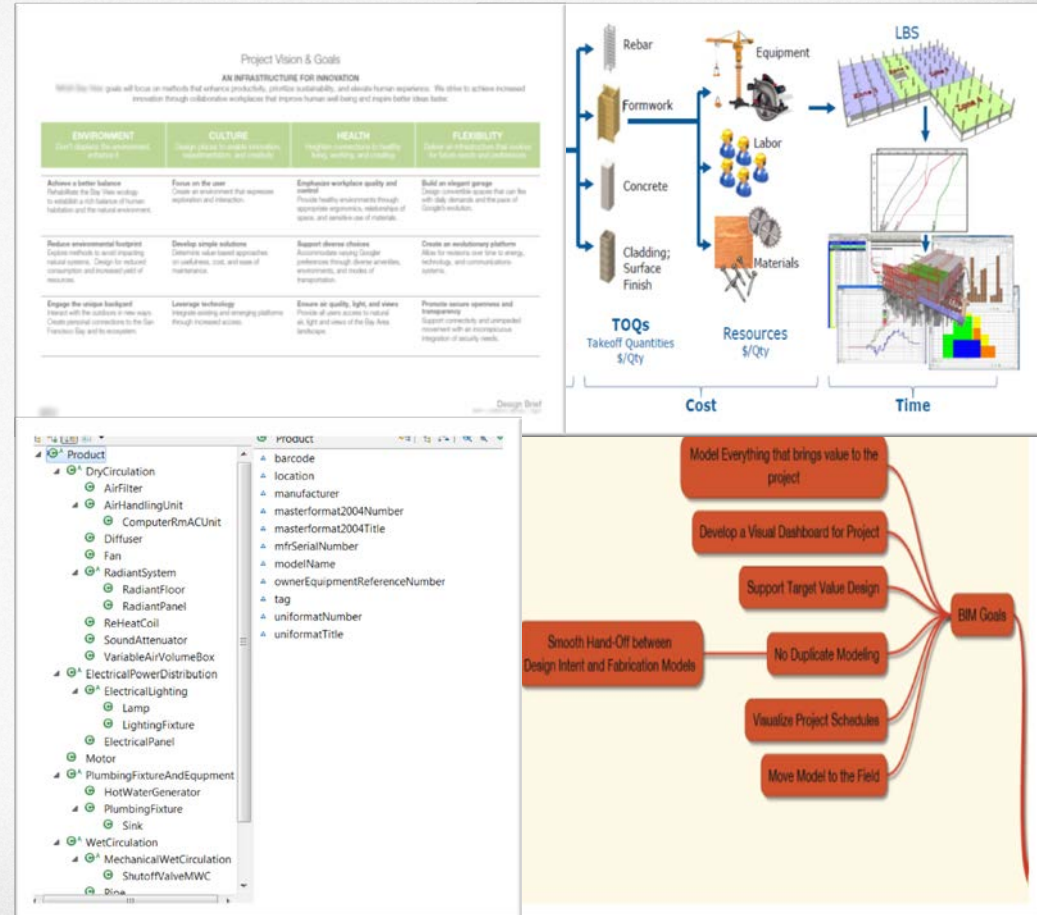
- Pull facility management requirements into project buyout processes and work products;
- Transition from digital files to object data;
- Coordinate design, construction, and operations;
- Support knowledge transfer:
 - Commissioning starts with pre-construction;
 - Designers/builders should stay involved;
 - Continuous measurement and verification;
- New Service opportunity

EARLY OWNER INVOLVEMENT



ASSESSMENT

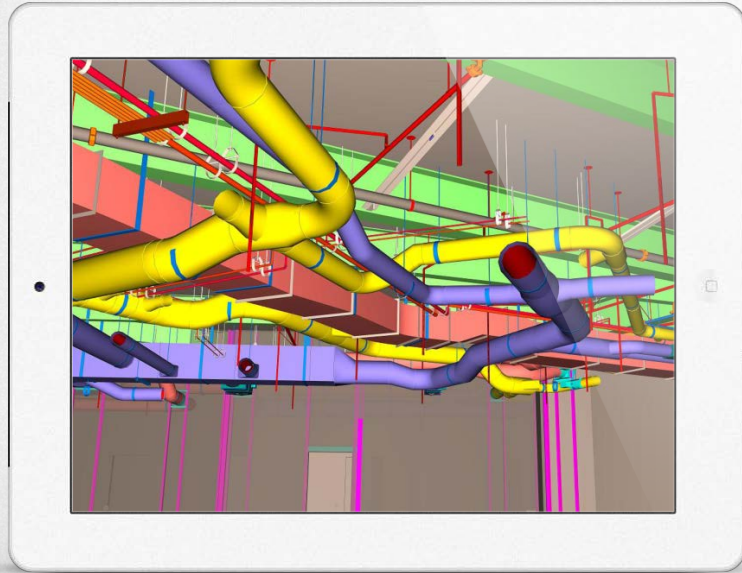
- Capacity
- Business processes and requirements
- Measurable KPIs
- Data requirements & workflows
- Pilots
- Standards
- Roadmap





PRODUCT MODELS FOR O&M

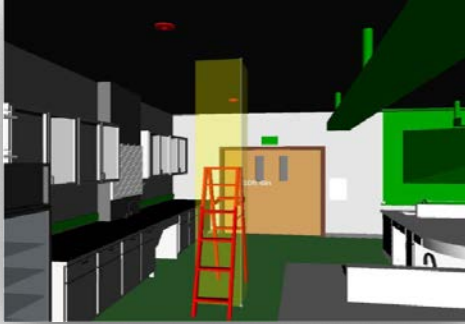
Model what you manage, manage what you model



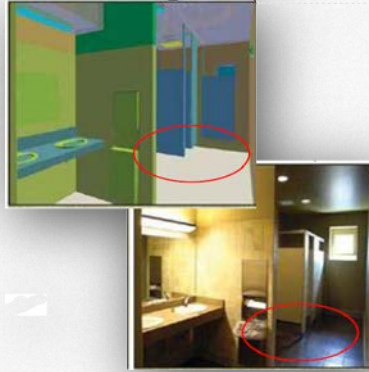
BIM USES FOR WHOLE LIFE MANAGEMENT

- 1 Physical criteria for design & performance simulation
- 2 Visual O&M design review
- 3 Inventory equipment
- 4 3D user interface to locate systems & equip, find product information
- 5 Basis of design for building changes

O & M REVIEW



Verify Access



Catch design errors



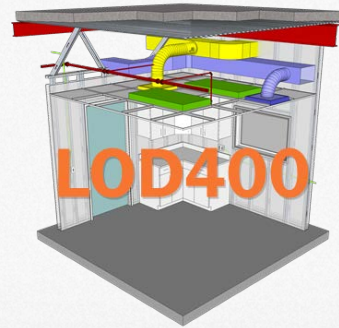
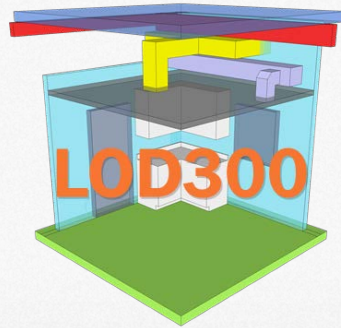
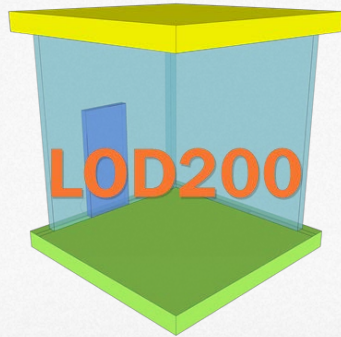
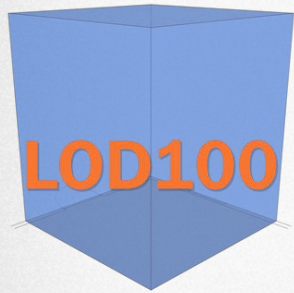
Verify Safety

LEVEL OF DEVELOPMENT PROTOCOL

A.K.A. : Model Progression Specification (MPS)

AIA E202 BIM Protocol Exhibit

Minimum Modeling Matrix (M3)



CONTENT PLAN

Include Modeling Guidelines

BIM ELEMENT

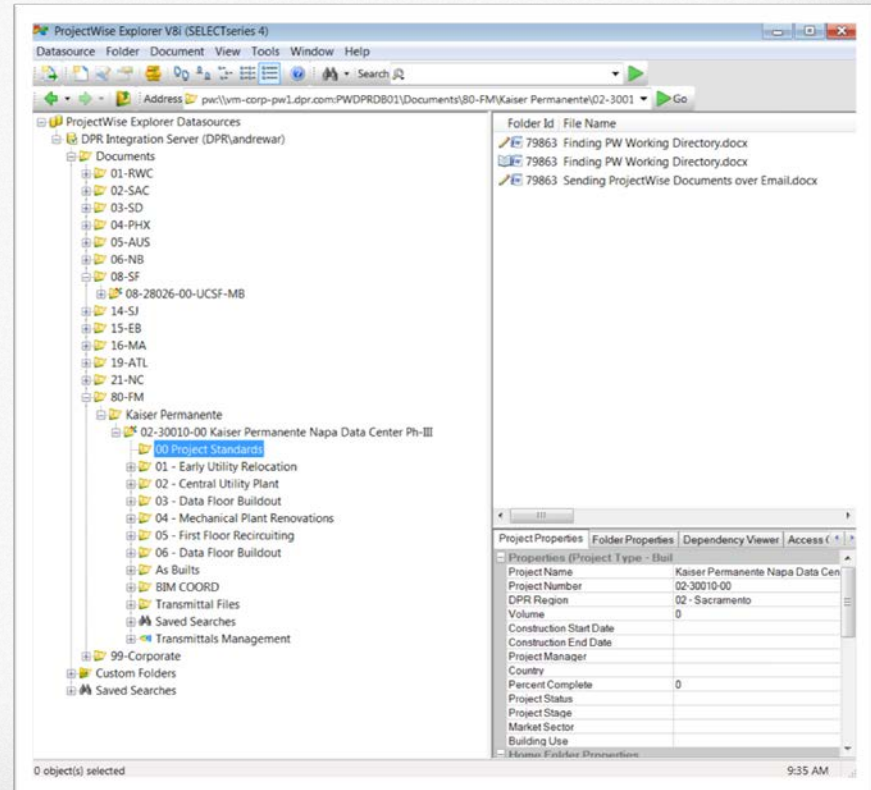
- Inventory elements owner wants to manage
- Names
- Property sets
- Model and data views/interfaces

Assembly Code	Category	Family	Type
D3040100	Mechanical Equipment	D3060-Titus_DESV-HWC_RH-12in	D3060-VAV-DESV-HWC-RH-12in
D3050	Mechanical Equipment	D3050-AHU	D3050-AHU-23000CFM
D3060	Ducts		D3060-Rectangular Duct-Radius Elbows / Taps
	Parking	Parking Array	G2020 - 9' x 18' - 24' Drive Isle
	Roofs	Basic Roof	18" Roof
	Ducts		Taps
	Ducts		Mitered Elbows / Tees
	Duct Fittings	Rectangular to Round Transition - Angle	45 Degree
	Duct Fittings	Rectangular Transition - Angle	45 Degree
	Ducts		Radius Elbows / Taps
	Ducts		D3060-RoundDucts-Tap
	Duct Fittings	Rectangular Elbow - Radius	1.5 W
	Duct Fittings	Rectangular to Round Transition - Angle	30 Degree
	Pipes		D3050-MCHWS
	Pipes		D3050-MCHWR
	Pipe Fittings	Pipe Elbow - Long Radius	Standard
	Pipe Fittings	Transition - Welded - Generic	Standard
	Pipes		D3050-HWS
	Pipes		D3050-HWR
	Ducts		Tees
	Duct Fittings	Round Endcap	Standard
	Air Terminals	Sup Ceiling Diffuser - Round	24"x24" - 10"ø
	Flex Ducts		Flex - Round
	Duct Fittings	Round Transition - Angle	45 Degree
	Duct Fittings	Round Takeoff	Standard
	Duct Fittings	Round Elbow	1.5 D
	Duct Fittings	Round Transition - Angle	30 Degree
	Duct Fittings	Round Tapered Wye - DTL	Standard
	Duct Fittings	Rectangular Elbow - Mitered	Standard
	Duct Fittings	Rectangular Transition - Angle	60 Degree
	Roofs	Basic Roof	18" Roof
	Curtain Systems		3x14
	Curtain Panels	B2010 Exterior 4 Part Curtain Wall Panel	B2010 Exterior 4 Part Curtain Wall Panel
	Curtain Wall Mullions	Rectangular Mullion	1.5" x 2.5" rectangular
	Curtain Panels	System Panel	Glazed
			Pendant

MANAGE FILES

Single source of truth about facility

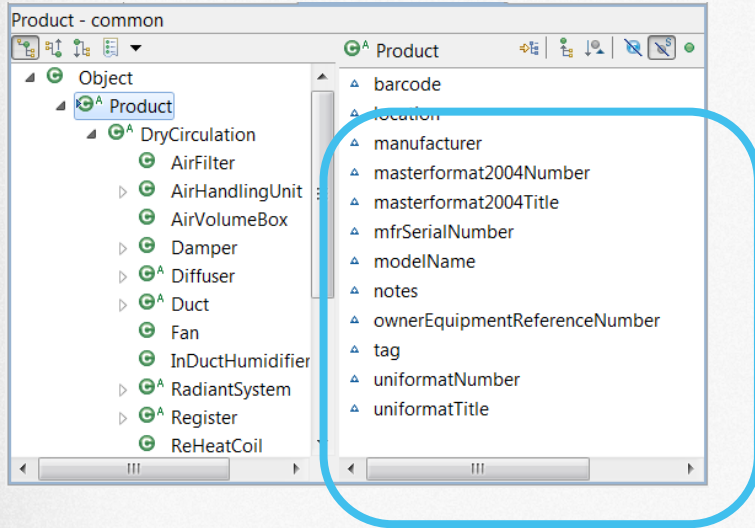
- Secure repository
- File check-out, versioning
- Workflows for sharing
- Security
- Continuous service



DATA COLLECTION

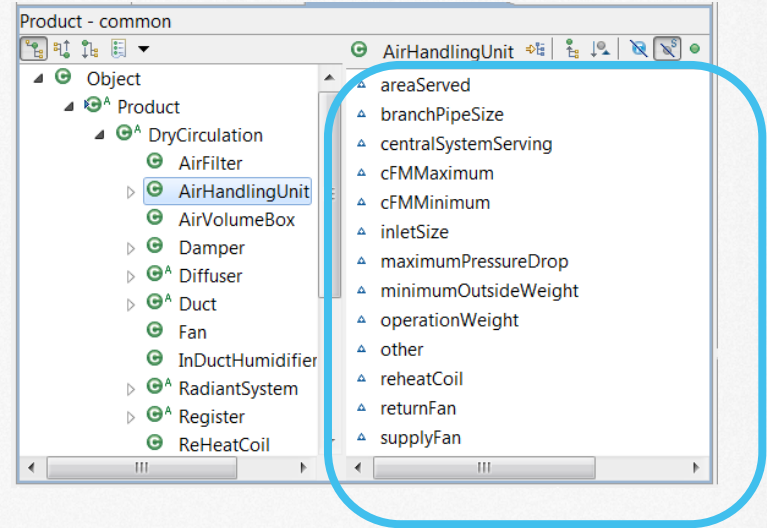
COMMON DATA

Identity and classification

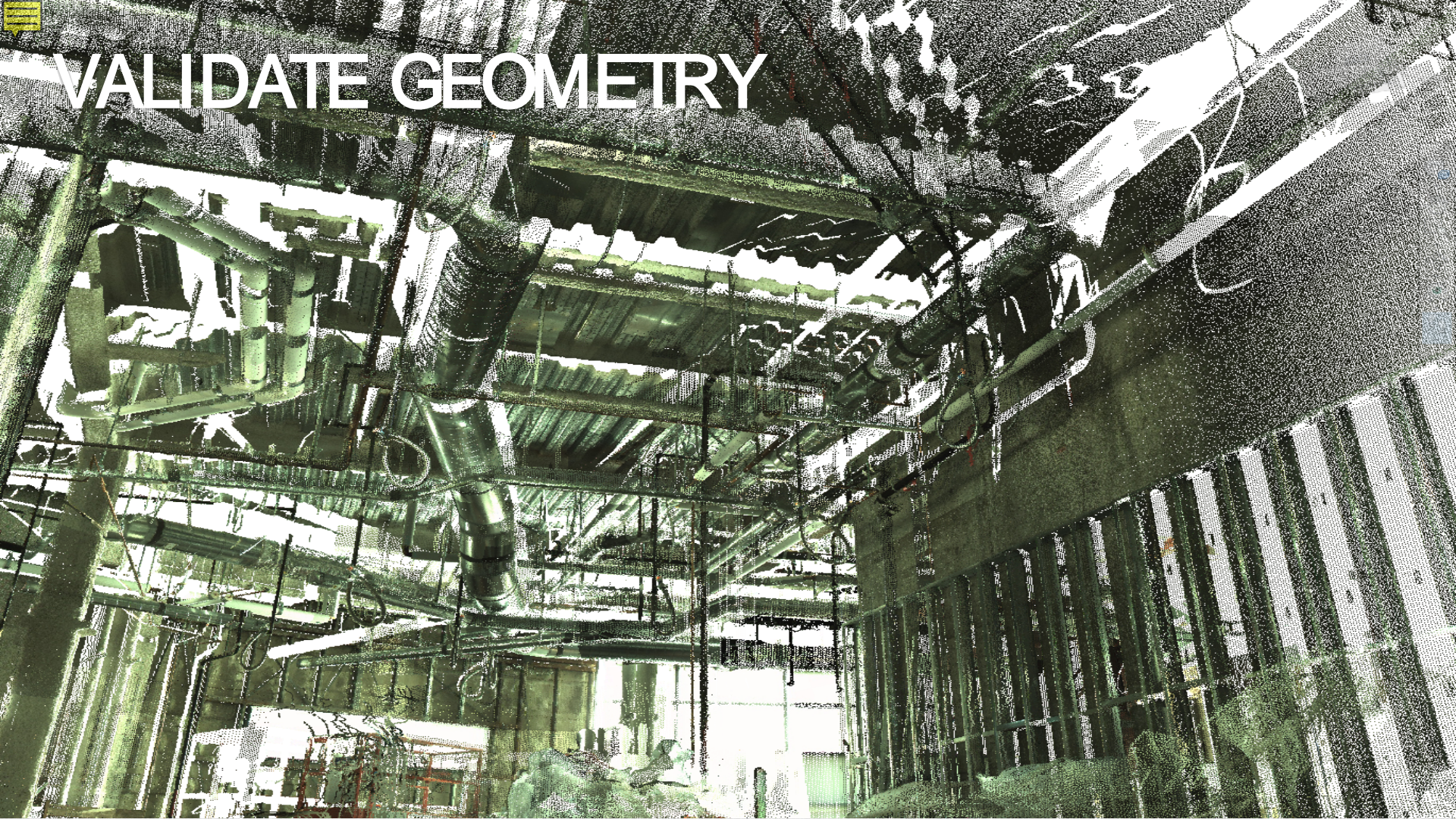


PRODUCT DATA

Describe items for condition assessment



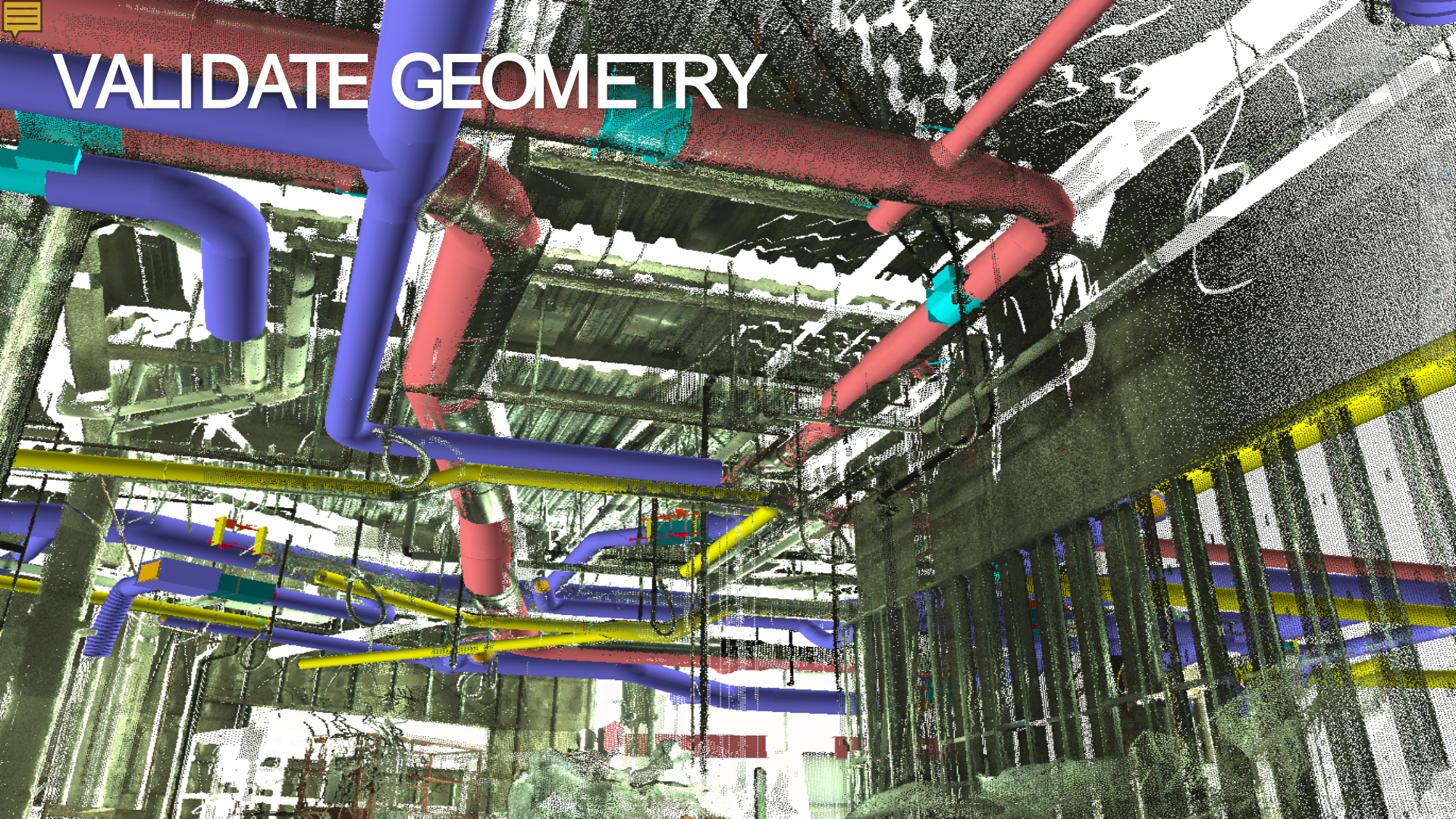
- Determine the data the organization will manage
- Express the data in a schema (e.g., COBie)
- Map between project and enterprise systems



VALIDATE GEOMETRY



VALIDATE GEOMETRY



VALIDATE ASSET DATA

http://newpm.ecodomus.com/App/Reports/MissingAttributes.aspx

File Edit View Favorites Tools Help

PM - EcoDomus TeamPulse - Manage Pro... BASECAMP DEV EcoDomus EcoDomus GSA Concourse Suite Commu...

Missing Attributes

COBie QC

Documents Checklist

Component Report

BIM Server

Activities

Project Setup

Integration

Category: Type Facility: SCHOOL OF CINEMATIC AR1

OmniClass	Name	Required Attributes
23-17 11 00:Doors	CAS GILL 2 DOOR SM: basic	TypeName,InstanceDescription,USCEquipmentNumber,UniFormatNumber,Mate
23-17 11 00:Doors	Door Glass S_GA MT MT NG: Door 3-0x7-0x1_PT-15	TypeName,InstanceDescription,USCEquipmentNumber,UniFormatNumber,Mate
23-17 11 00:Doors	Door Wood D_FL WD HM NG:Door 4-4x8-10x1_3/4_STC-35	TypeName,InstanceDescription,USCEquipmentNumber,UniFormatNumber,Mate
23-19 31 17 13:Lavatory Units	LAV	Revisions,UniFormatNumber,InstanceName,USCEquipmentNumber,InstanceDes
23-19 31 17 13:Lavatory Units	LAV	Revisions,UniFormatNumber,InstanceName,USCEquipmentNumber,InstanceDes
23-27 17 00:Pumps	CRP BELL & GOSSETT 65CC DUPLEX	USCEMSId,USCEquipmentNumber,UniFormatNumber,InstanceDescription,Insta
23-27 17 00:Pumps	Fire Pump	OmniClassNumber,USCEMSId,USCEquipmentNumber,UniFormatNumber,Instan
23-27 17 00:Pumps	HWP	USCEMSId,USCEquipmentNumber,UniFormatNumber,InstanceDescription,Insta
23-27 17 00:Pumps	Sump pit	USCEMSId,USCEquipmentNumber,UniFormatNumber,InstanceDescription,Insta
23-27 17 00:Pumps	Sump Pump - Vertical Discharge:Sump Pumps SP-1.2	USCEMSId,USCEquipmentNumber,InstanceDescription,InstanceName,OmniClas

Page size: 10

Missing Attributes to be Resolved

Add missing attributes to model

lavascrypt:WebForm_DoPostBackWithOptions(new WebForm_PostBackOptions("ctl00\$ContentPlaceHolder1\$g_missing_attribute_reports\$ctl00\$ctl16\$linkEntityName", "", false, "", "#", false, true))

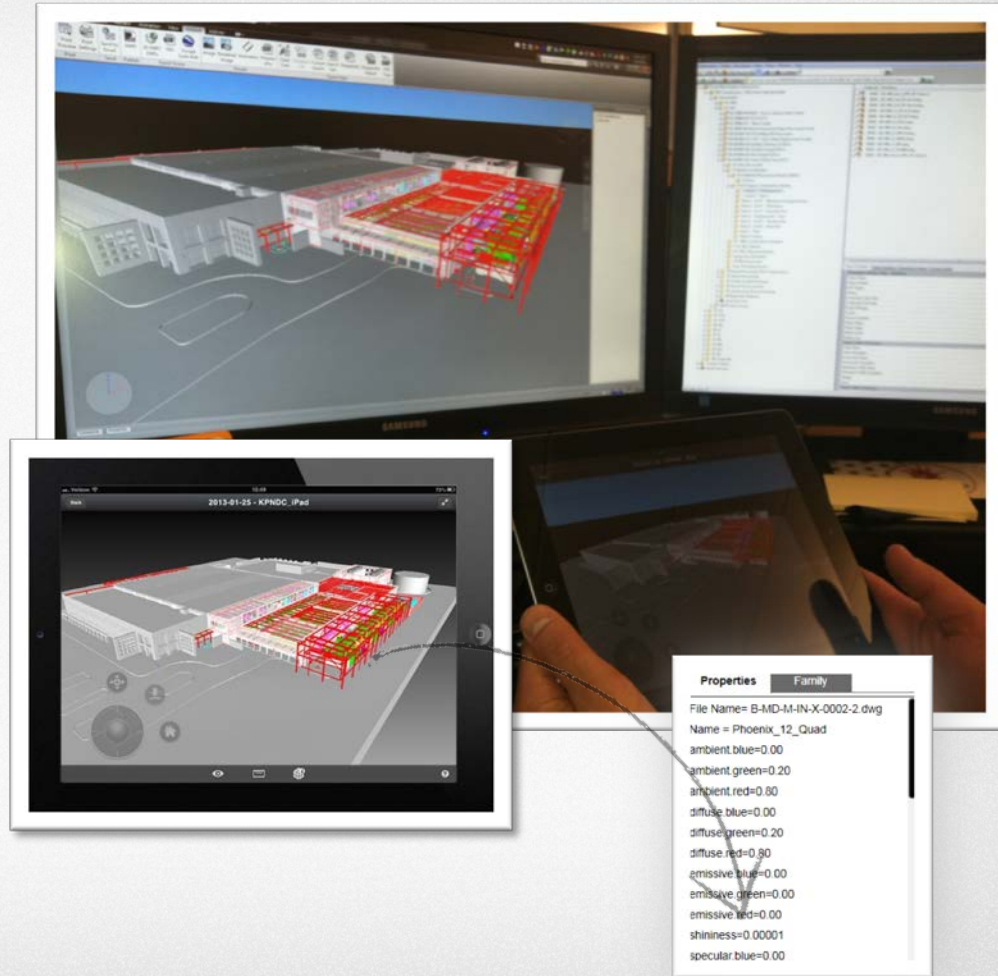
120%

Image courtesy of ecoDomus

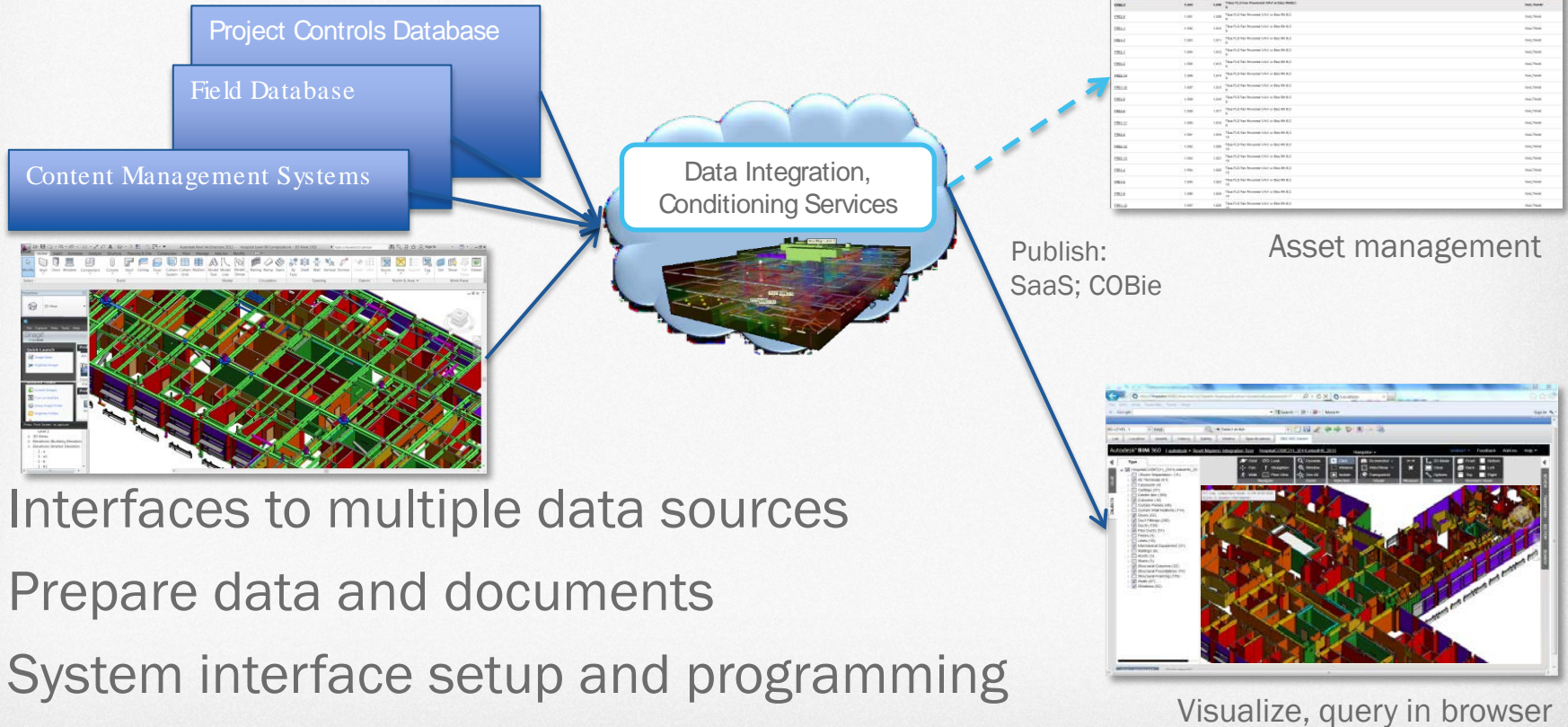
FRIENDLY TOOLS

to find information

- Desktop and other devices
- See equipment
- Inspect properties
- Find documents



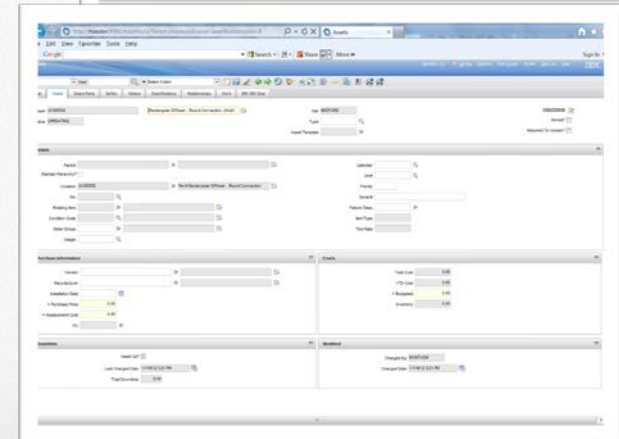
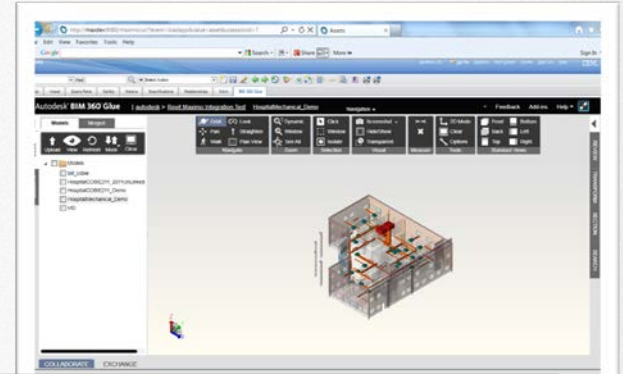
SYSTEM INTEGRATION



MAINTENANCE WORK ORDERS

Eliminate redundant data entry

- BIM provides inventory of products and systems for the maintenance management system (CMMS/EAM)
- O&M staff use 3D Viewer to inspect assets from CMMS



VALUES

Facility whole life management

Client Value

Reduce Total Cost of Ownership

Improve O&M planning: extend system(s) service life;
improve building performance

Content flows into Enterprise Systems

Content Mgmt./Extraction/Validation

Document
View/Share/Collaborate

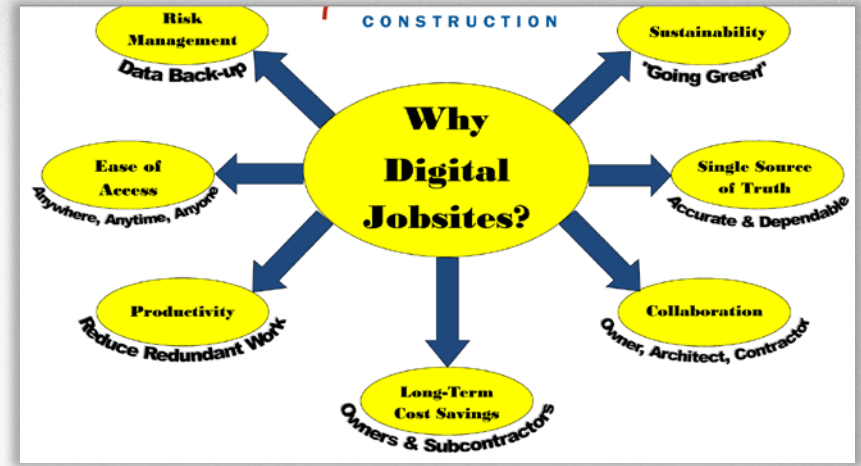
Document
Management

Processes and Enterprise Services

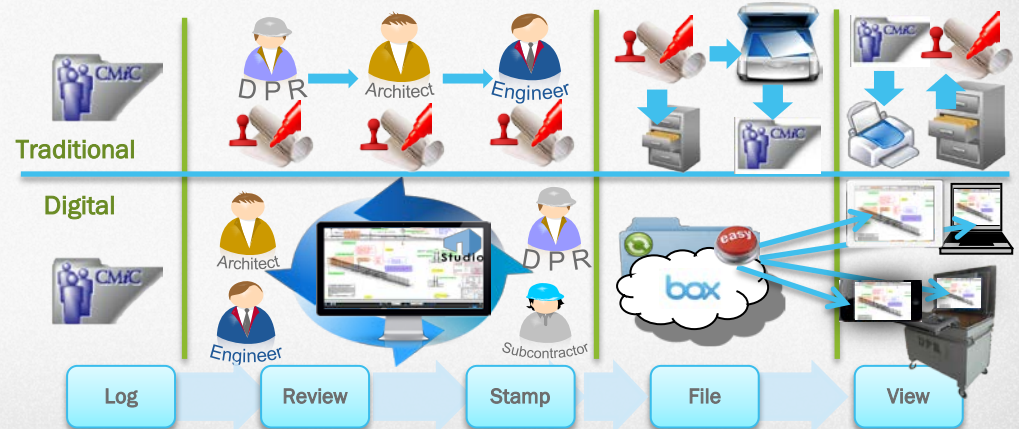
IMPACT ON PROJECT DELIVERY

DIGITAL JOB SITES

- Best practices
- Map document workflows
- Standards
- Enabling technology



Submittal Workflow
Example



DIGITAL RECORDS MANAGEMENT

Enterprise services

Five pillars

	Capture Structured and unstructured electronic and physical content	Management Classification and security of records and data attached to those records (metadata)	Preservation Identification and disciplined archival of records	Retrieval timely retrieval of relevant records for legal as well as statutory requirements	Destruction The regular elimination of records that have no current or longterm value to the business
What (Goal)	Identify and digitize paper records; Increase % of content that is "born digital" ;Keep content digital	Enhance information security, improve information management	Ensure documents created today are usable tomorrow	Efficient retrievability to avoid legal and regulatory Penalties	Efficient use of digital space
Why	Ensure Security and Compliance				
How	<ol style="list-style-type: none">1. Convert "paper" documents into digital files with OCR Scanners2. Request electronic signatures			<ol style="list-style-type: none">1. Create technology "Data Maps" for projects.2. Ensure that technology selected offers ways to retrieve data while maintaining metadata	

DPR Consulting

IPD Education

- Workshops IPD/Lean AEC
- Planning
- Project assessment
- Design management
- Embed experts

Building Whole Life Services

- BIM for FM assessment
- IPD/BIM Guidelines
- BIM validation
- System integration
- Managed Services

THANK YOU!

andrewar@dpr.com