Drive successful BIM to FM practice – from a large facility owner's perspective

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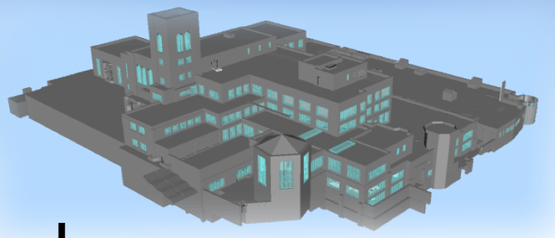
Solution Architect
Autodesk

Class Summary

PRINCETON UNIVERSITY



Many facility owners require intelligent models as deliverables for capital projects. However, simply asking for models or COBie, or mandating industry-standard Building Information Modeling (BIM) execution plans, may not fit the specific requirements and workflows within an owner's organization. In this session, you will learn best practices from Princeton University with more than a decade's experiences of driving successful BIM projects.

Class Summary

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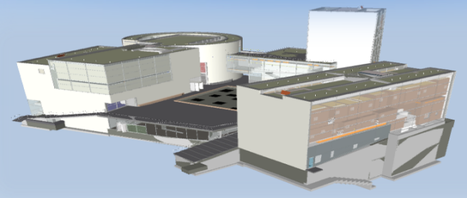
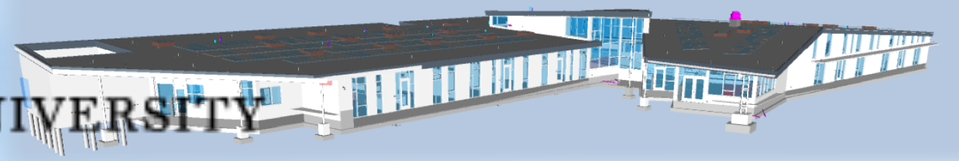


We will share with you how Princeton has standardized the workflows to obtain an integrated deliverable that combines BIM models with as-built documents and data. Princeton will explain how defining the facilities management (FM) deliverable as a prime objective very early in the construction phase empowers architects, engineers, and contactors to increase the quality of their services, while providing excellent FM deliverables.

Class Summary

PRINCETON UNIVERSITY



You will also discover innovative technologies of integrating Princeton's existing FM applications with Autodesk, Inc., technology to extend BIM to FM teams.

This session features BIM 360 Glue and BIM 360 Field.

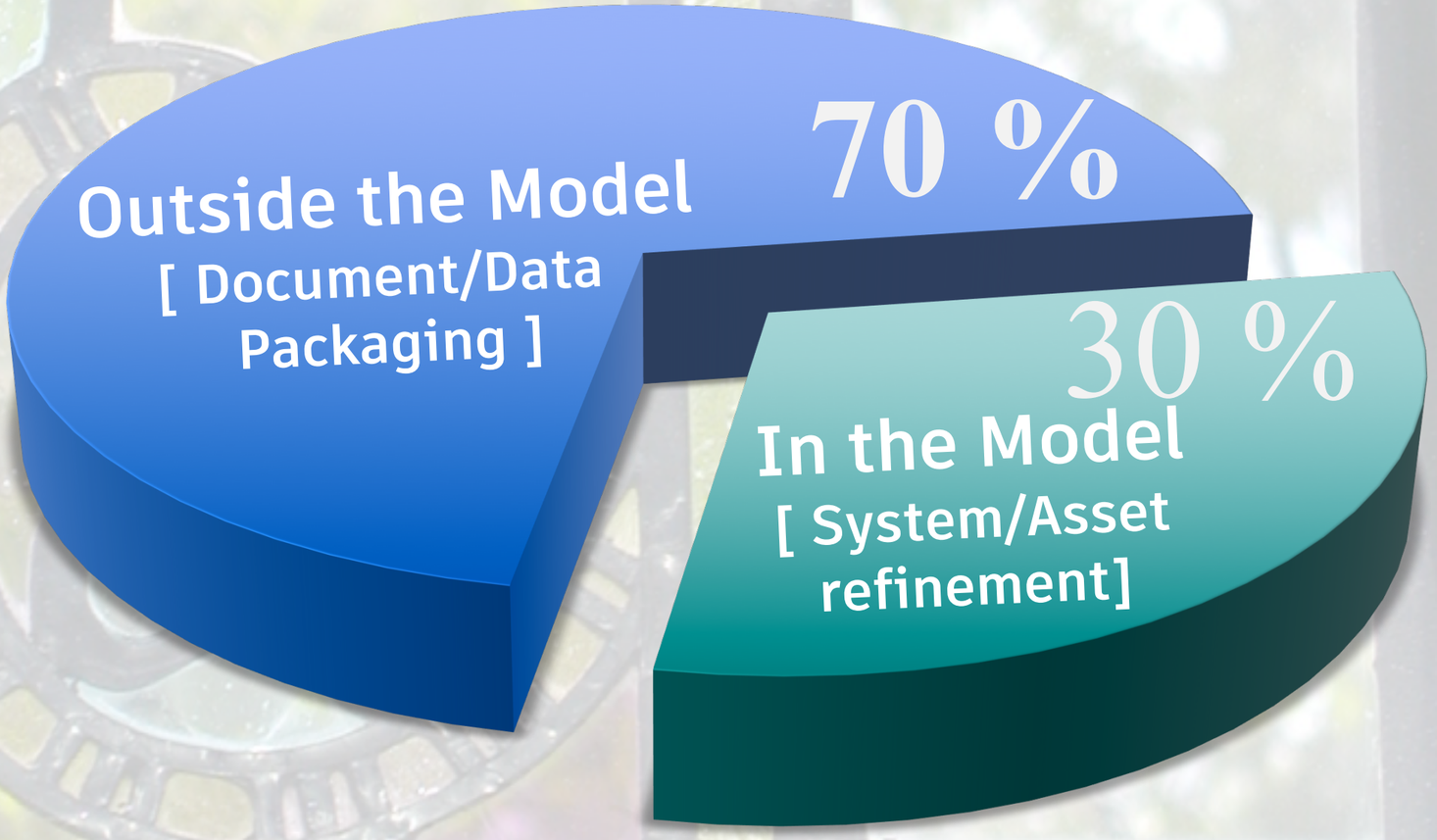
Key learning objectives

At the end of this class, you will be able to:

- Understand important steps towards developing your ‘custom’ BIM standards.
- Set the stage for your BIM teams, and drive your team through an efficient, productive process.
- Integrate FM document collection workflows that seamlessly integrate with project execution workflows.
- Deploy a software solution that fully integrates BIM360Field, Glue and your FM library, creating a high value FM deliverable.

BIM to FM at Princeton

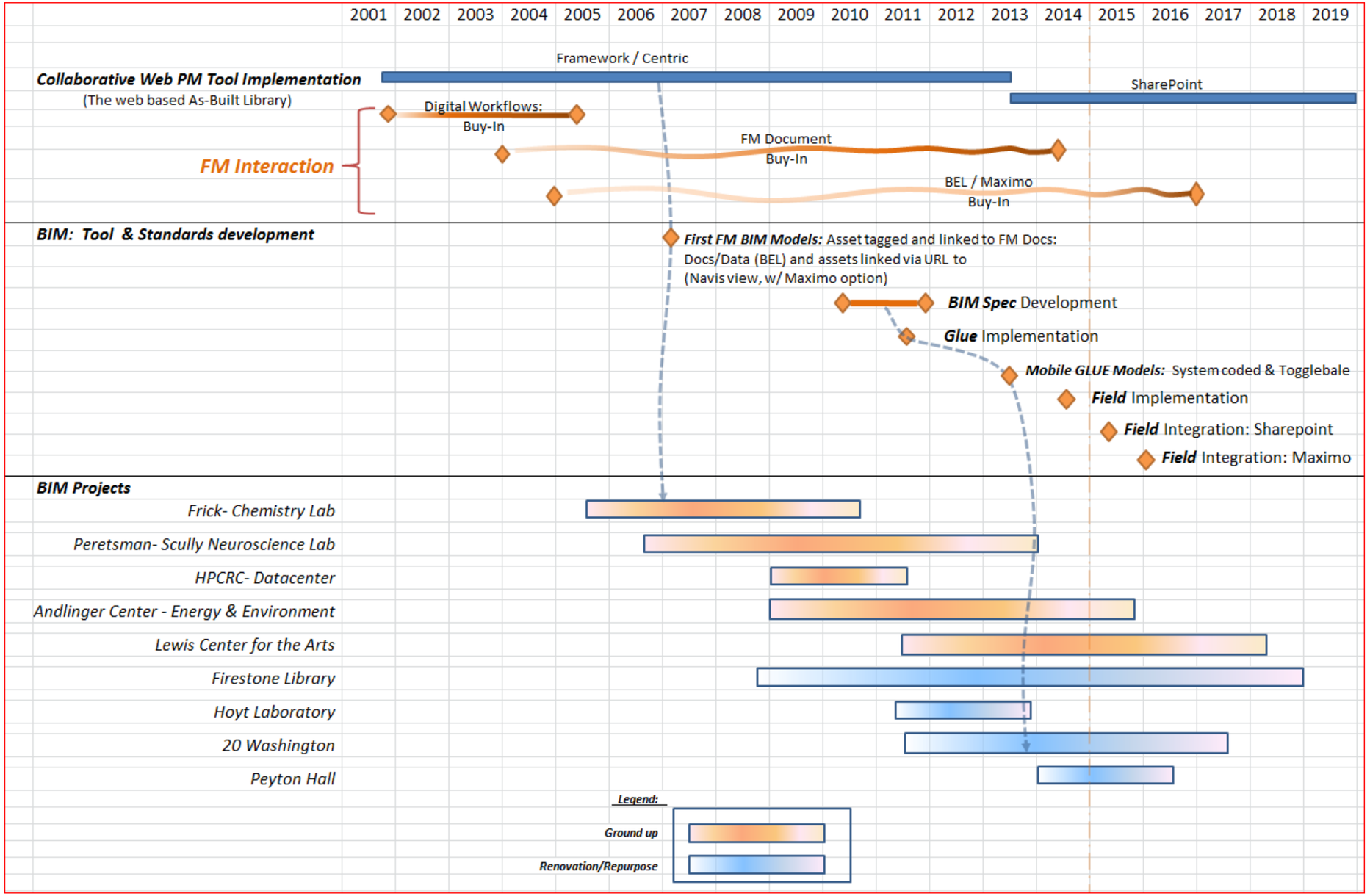
- Focus over Time



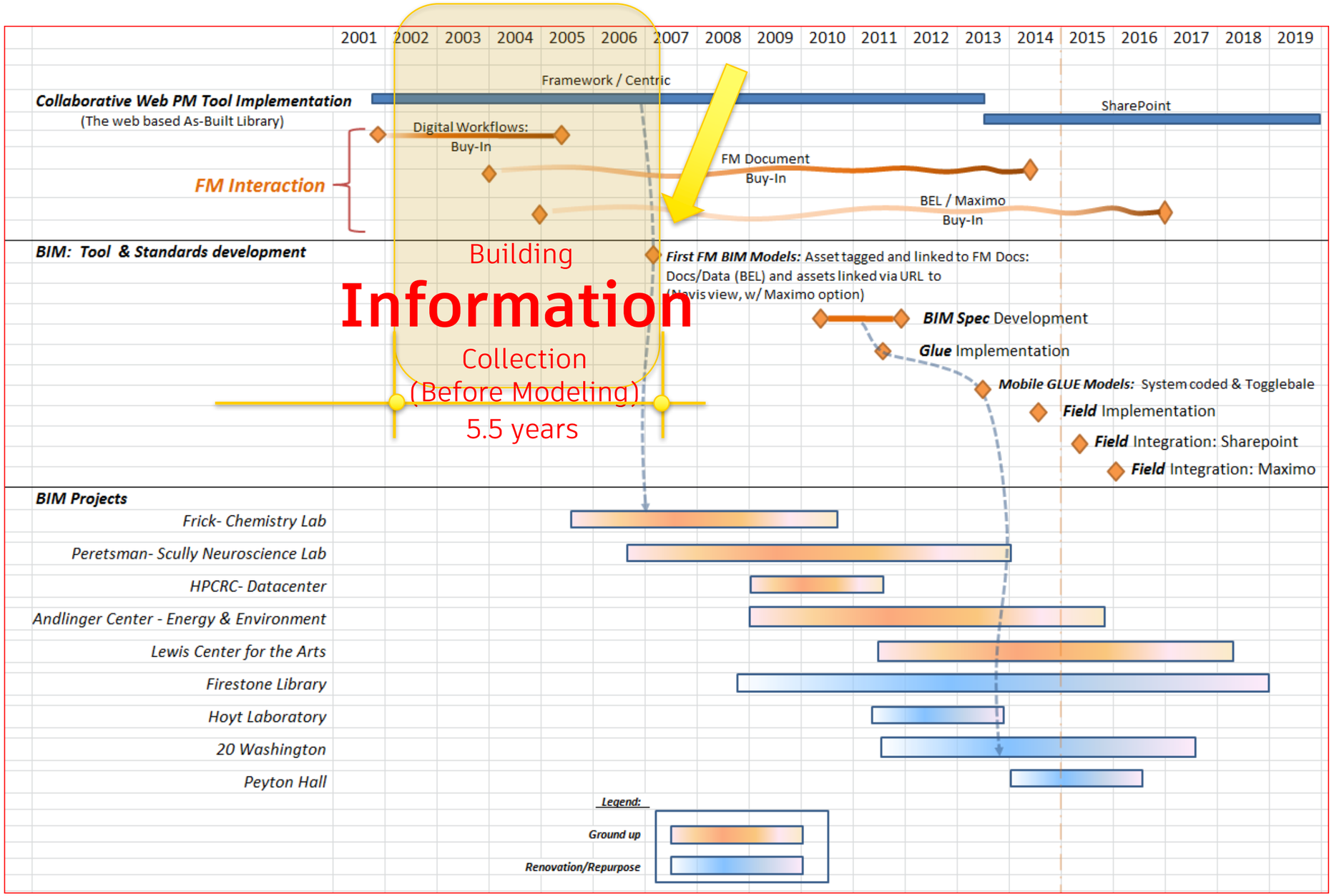
BIM to FM at Princeton

- Approach

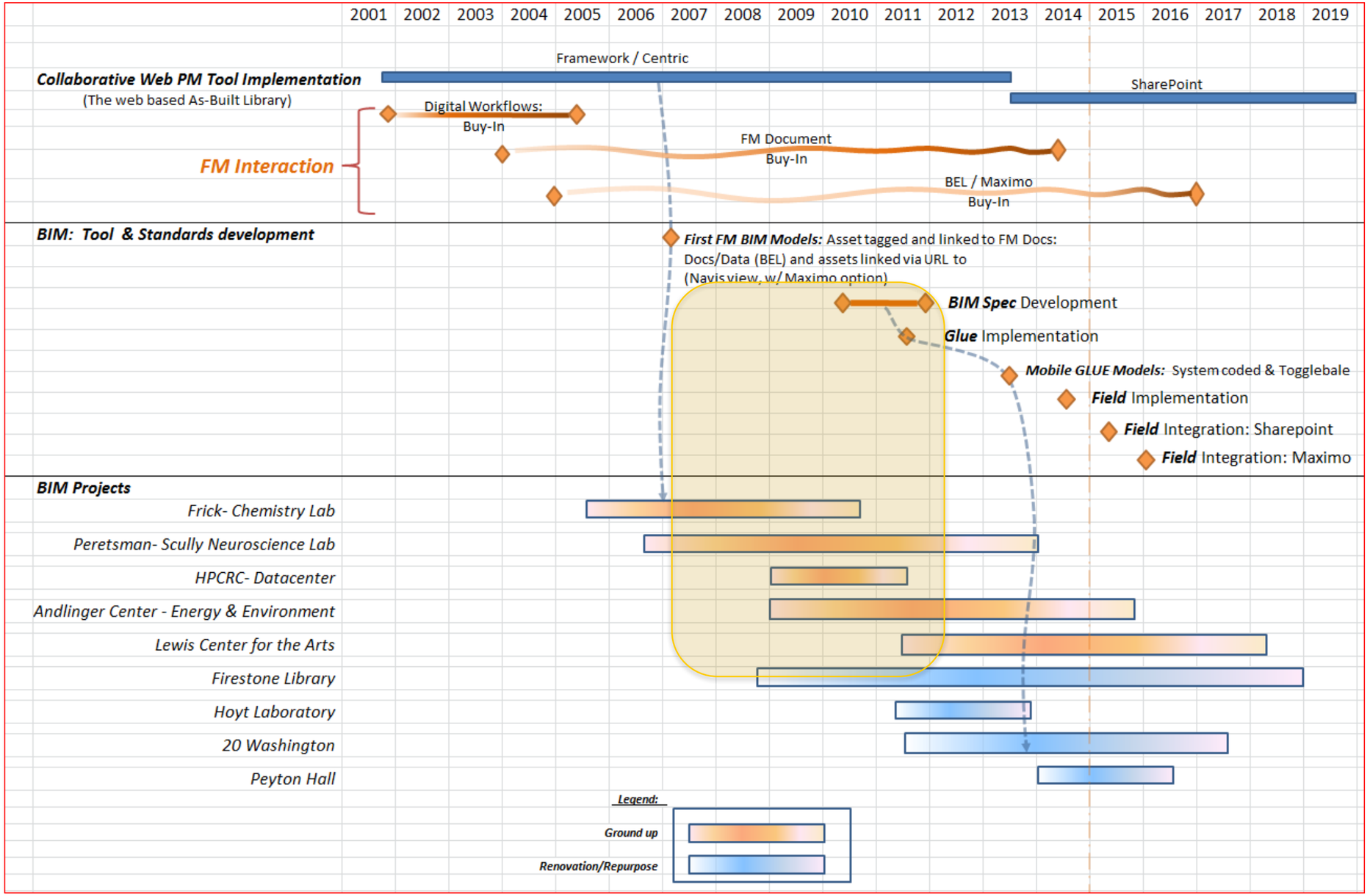
1. Keep model ‘intelligence-light’
2. No Revit Mandate



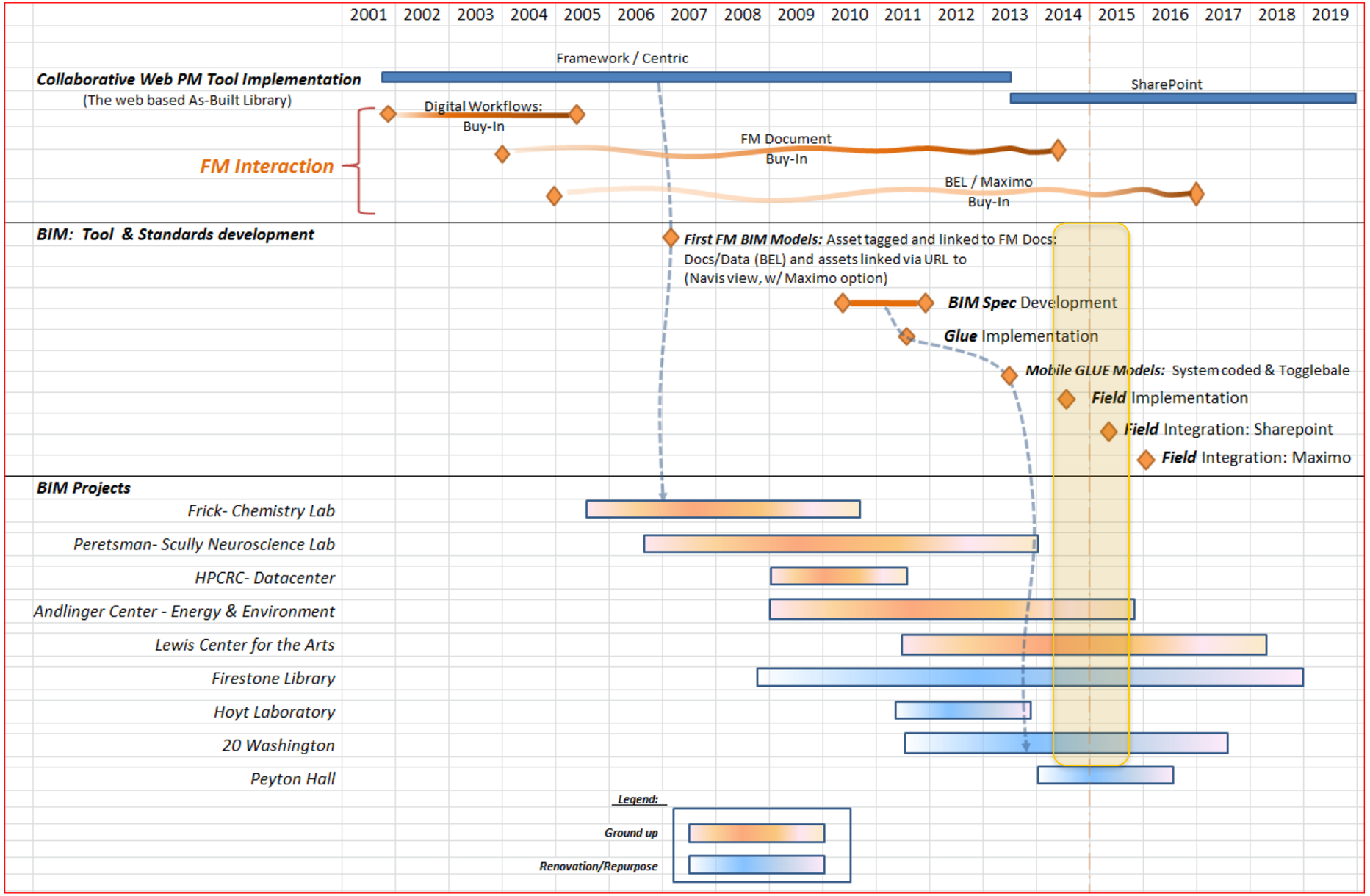
BIM to FM Development TimeLine



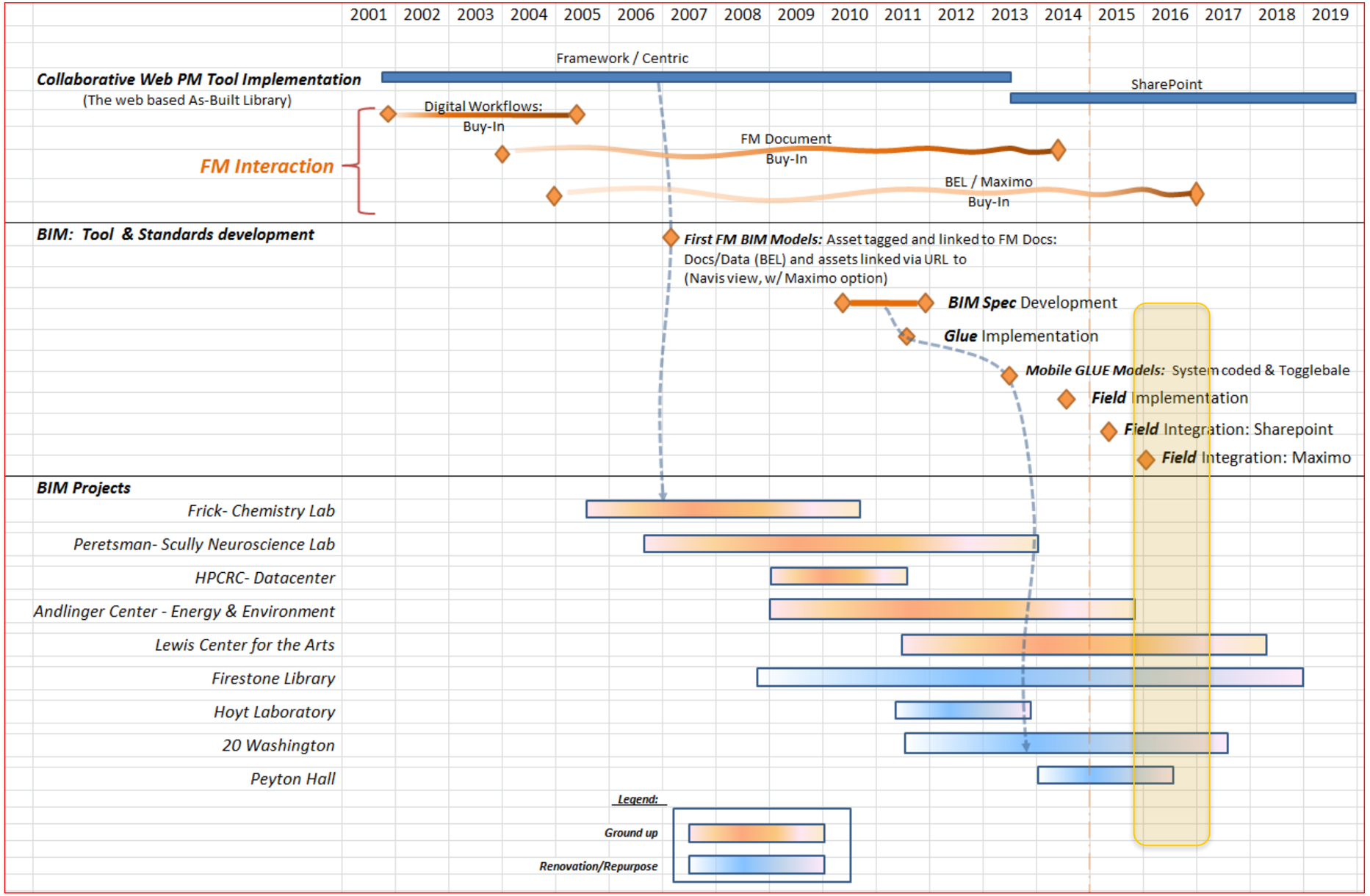
Digital FM Library existed pre-BIM



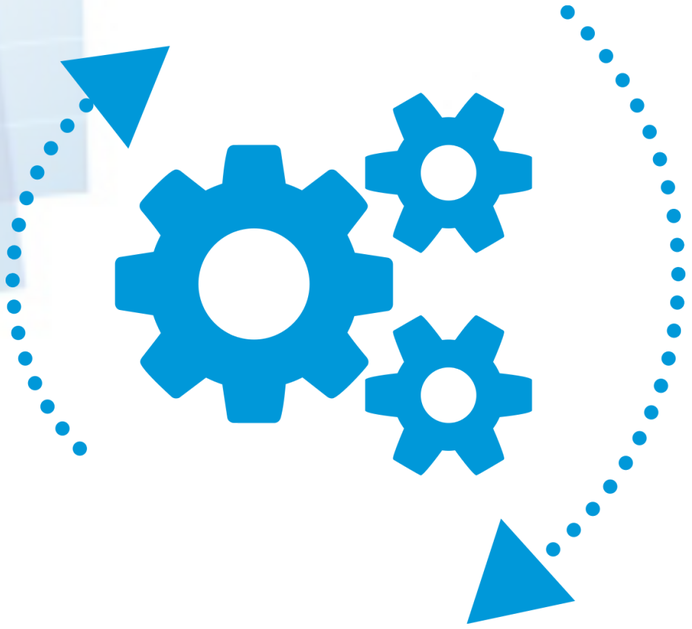
BIM Spec evolution- Experience based



Field Integration w/ FM Docs/Data



BIM to CMMS Integration - Patience



1. Owner Driven Processes

- Developing BIM / BIM to FM requirements.
- BIM Deployment: Creating a strong team environment.

2. Technology

- An integrated BIM to FM solution.

Developing you BIM Requirements Key Steps

1. Needs Assessment (FM focused)
2. Supply Stream evaluation
3. Impact Analysis
4. Value Judgment
5. BIM Spec development
6. Deploy, Maintain(h)

Developing you BIM Requirements

Needs Assessment

- Documents
  - Format
  - Quick Reference
  - Cx Documentation
- Assets
  - Attributes
- UI / Device
  - Desktop/Handhelds (type, OS?)
- System isolation
  - (2D & 3D)
  - Level of Detail
- Location based query
  - Asset Location
  - Asset Area Served
- CMMS Integration?

Developing you BIM Requirements

Needs Assessment

- Documents
  - Format
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  - Asset Location
  - Asset Area Served
- CMMS Integration?
  - Very Wary…..

Developing you BIM Requirements Key Steps

1. Needs Assessment (FM focused)
2. Supply Stream evaluation
3. Impact Analysis
4. Value Judgment
5. BIM Spec development
6. Deploy, Maintain(h)

Developing you BIM Requirements

Supply Stream analysis

1. Needs Assessment (FM focused)
2. Supply Stream evaluation (AE & Contractor)
   - What are current processes and business needs.
   - Software, technical expertise and workflows.
3. Impact Analysis
4. Value Judgment
5. BIM Spec development
6. Deploy, Maintain(h)

Developing you BIM Requirements
Key Steps

1. Conduct needs assessment (FM focused)
2. Evaluate supply stream
3. Impact analysis
4. Value judgment
5. Develop custom standards
6. Deploy, monitor, update (h)

Developing you BIM Requirements

Impact Analysis- AE Team

- Culture Change
  - Model Sharing
  - Design validation
- Authoring Software Choices
- Staff Workflow
  - Design Coordination – Lead Designers to BIM Drafters
  - Change Management (BIM updating)
  - Record Design BIM deliverables
- (LOD) Conventions
  - Modeling for FM

Developing you BIM Requirements

Impact Analysis- Contractor

- Culture Change
- Technical Proficiency/Staff
- Authoring Software Choices
- Fabrication Dependencies
- Native Model Intelligence
- Level of Detail (LOD) Conventions
- Work Required to Tag Modeled Assets
- Work to Upload Asset Attributes

Owner Driven BIM Implementation – Key Steps

Developing BIM / BIM to FM requirements

1. Conduct needs assessment (FM focused)
2. Evaluate supply stream
3. Impact analysis
4. Value judgment
5. Develop custom standards
6. Deploy, monitor, update (h)

Owner Driven BIM Implementation – Key Steps

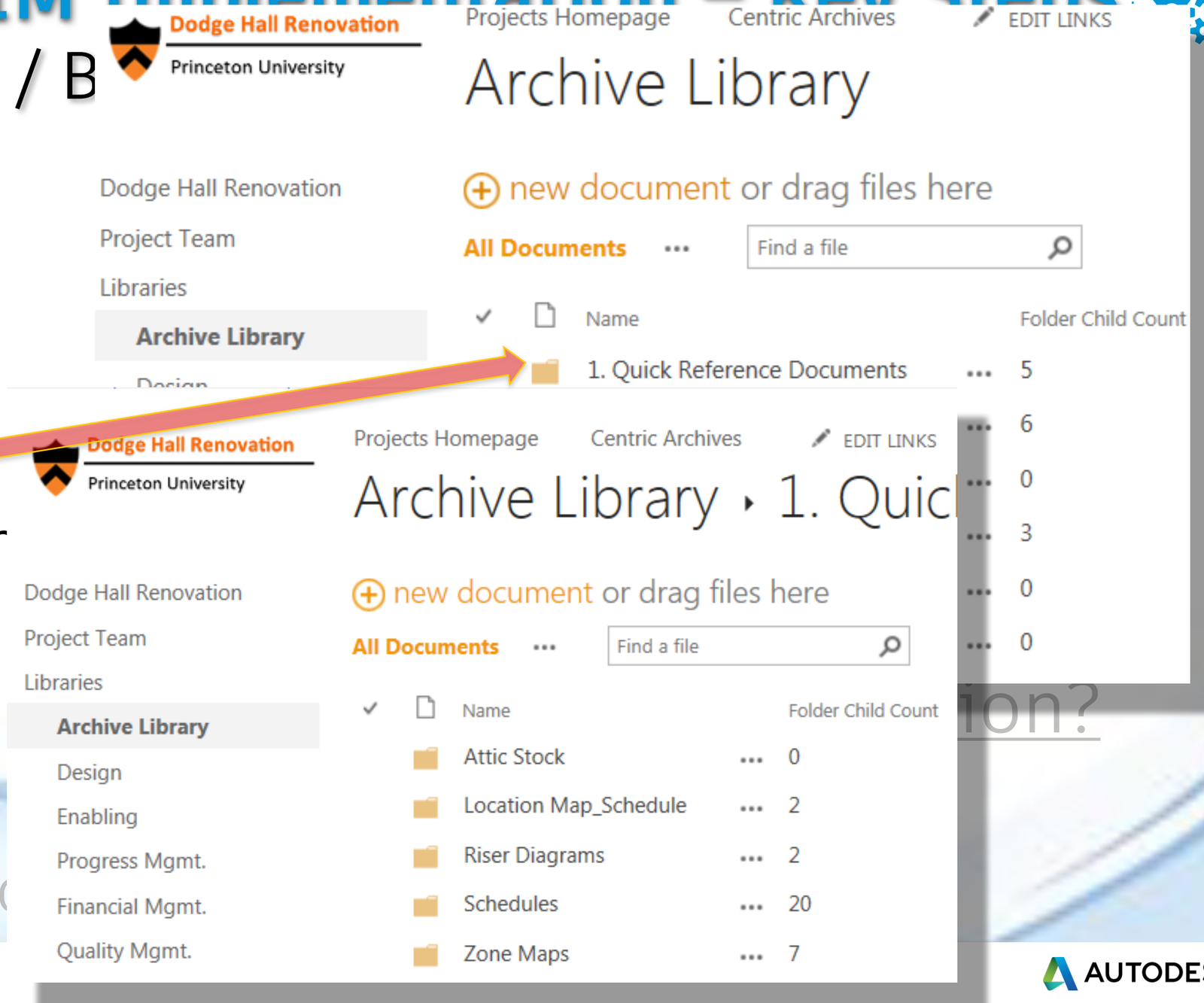
Developing BIM / BIM to FM requirements

1. Conduct needs assessment (FM focused)
2. Evaluate supply stream
3. Impact analysis
4. Value judgment (Where to invest the effort)
5. Develop custom standards
6. Deploy, monitor, update (h)

Owner Driven BIM Implementation – Key Steps

Developing BIM / B

- Documents
  - Format
  - As-Builts
  - Quick Reference
  - Cx Documentation
- Assets
  - Attributes
- UI / Device
  - Desktop/Handheld



Owner Driven BIM Implementation – Key Steps

Developing BIM / BIM to FM requirements – Value

- Documents
  - Format
  - As-Builts
  - Quick Reference
  - Cx Documentation
- Assets
  - Attributes
- UI / Device
  - Desktop/Handhelds (type, OS?)
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  - (2D & 3D)
  - Level of Detail
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  - Asset Location
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- CMMS Integration?

Owner Driven BIM Implementation – Key Steps

Developing BIM / BIM to FM requirements – Value

- Documents
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  - Cx Documentation
- Assets
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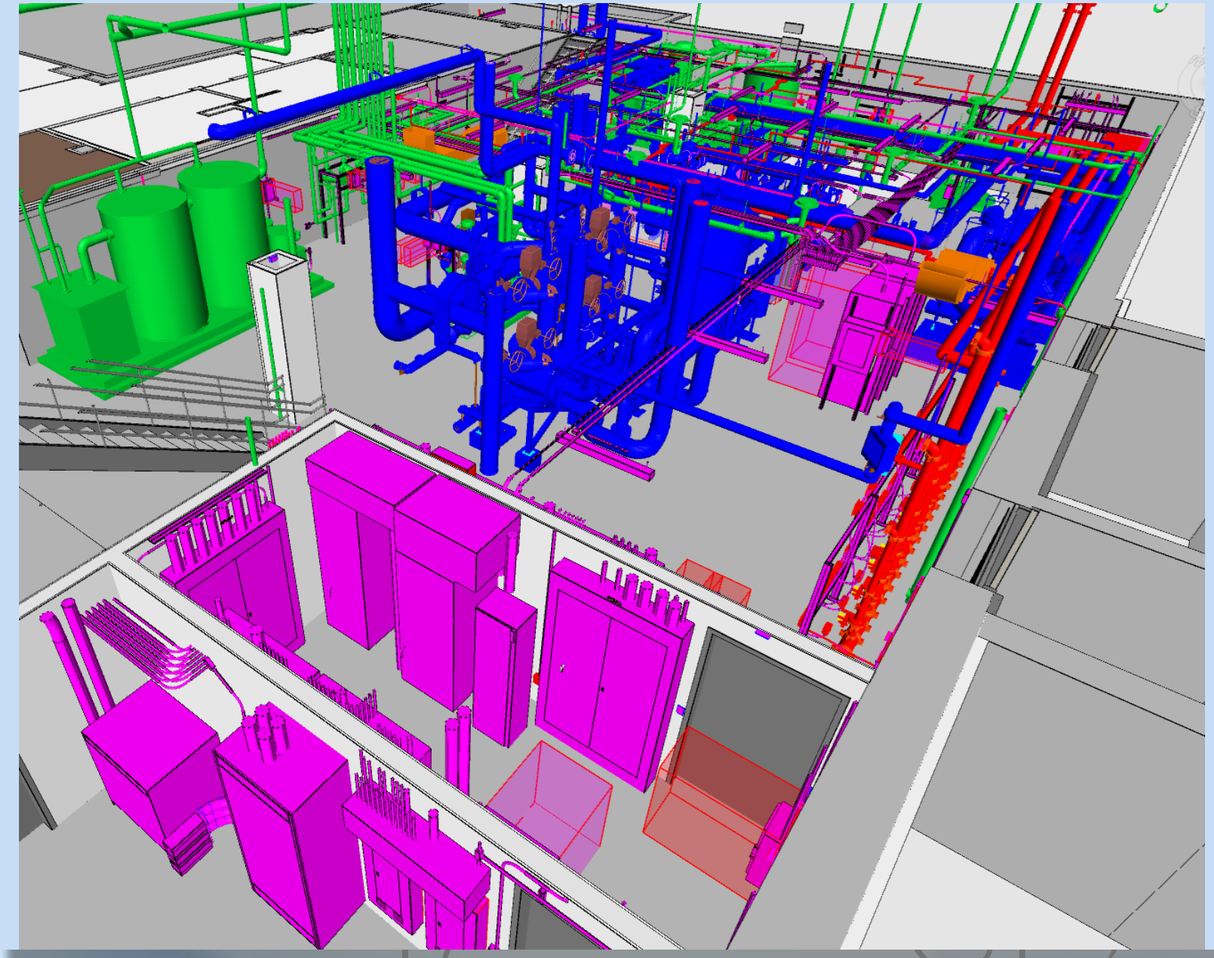
Owner Driven BIM Implementation – Key Steps

Developing BIM / BIM to FM requirements – Value

First mention of “Model stuff”



- System isolation
  - (2D & 3D)
  - Level of Detail
- Location based query
  - Asset Location
  - **Asset Area Served**
- CMMS Integration?

Owner Driven BIM Implementation – Key Steps

1. Conduct needs assessment (FM focused)
2. Evaluate supply stream
3. Impact analysis
4. Value judgment
5. Develop custom standards
6. Deploy, monitor, update (**h**)

Owner Driven BIM Implementation – Key Steps

Now you know what you want,

You've established the BIM to FM requirements,

You've assembled your project team.

DEPLOYMENT!

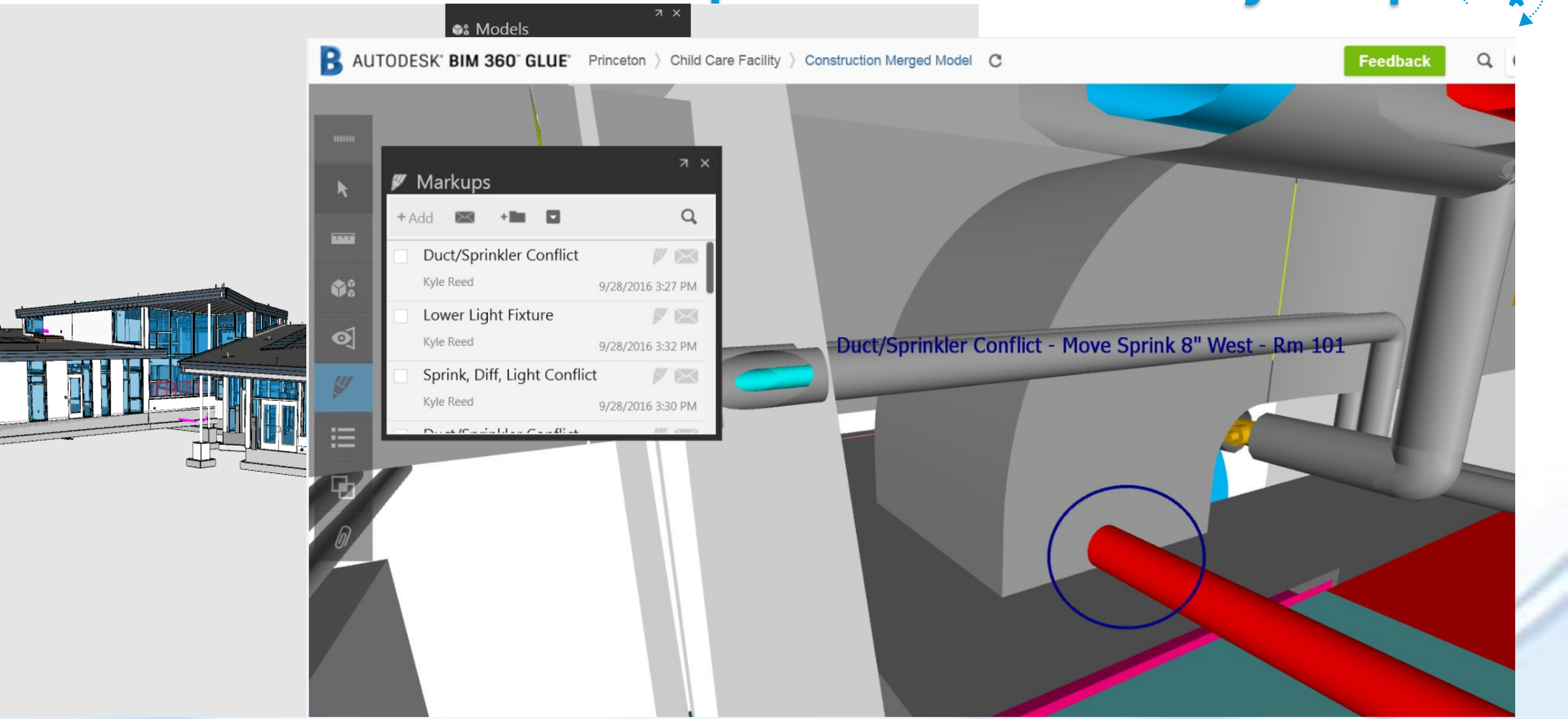
Where is the Owner's influence most helpful?

Owner Driven BIM Implementation – Key Steps

DEPLOYMENT!

1. Strong Owner presence/lead through design validation: AE, Contractor & FM participation.
2. Require the Contractor to utilize models in procurement phase: Bidding 'Open House – BIM demo'
3. Engage FM to participate throughout construction coordination phase.
4. Monitor the completeness of the BIM to FM deliverable.
5. Highlight the importance of the BIM to FM deliverable on turnover to FM.

Owner Driven BIM Implementation – Key Steps



Owner Driven BIM Implementation – Key Steps

DEPLOYMENT!

1. Strong Owner presence/lead through design validation: AE, Contractor & FM participation.
2. Require the Contractor ‘markets’ the models at “Bidding Open House – BIM demo”, and Owner co-presents.
3. Engage FM to participate throughout construction coordination phase.
4. Monitor the completeness of the BIM to FM deliverable.
5. Highlight the importance of the BIM to FM deliverable on turnover to FM.

Owner Driven BIM Implementation – Key Steps

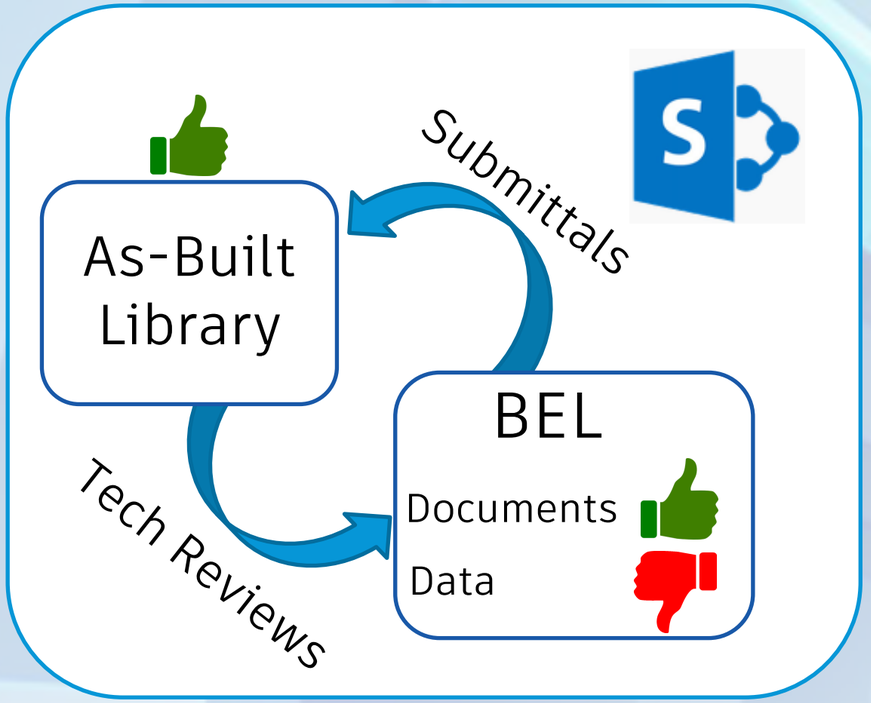
To do these, its all about ….

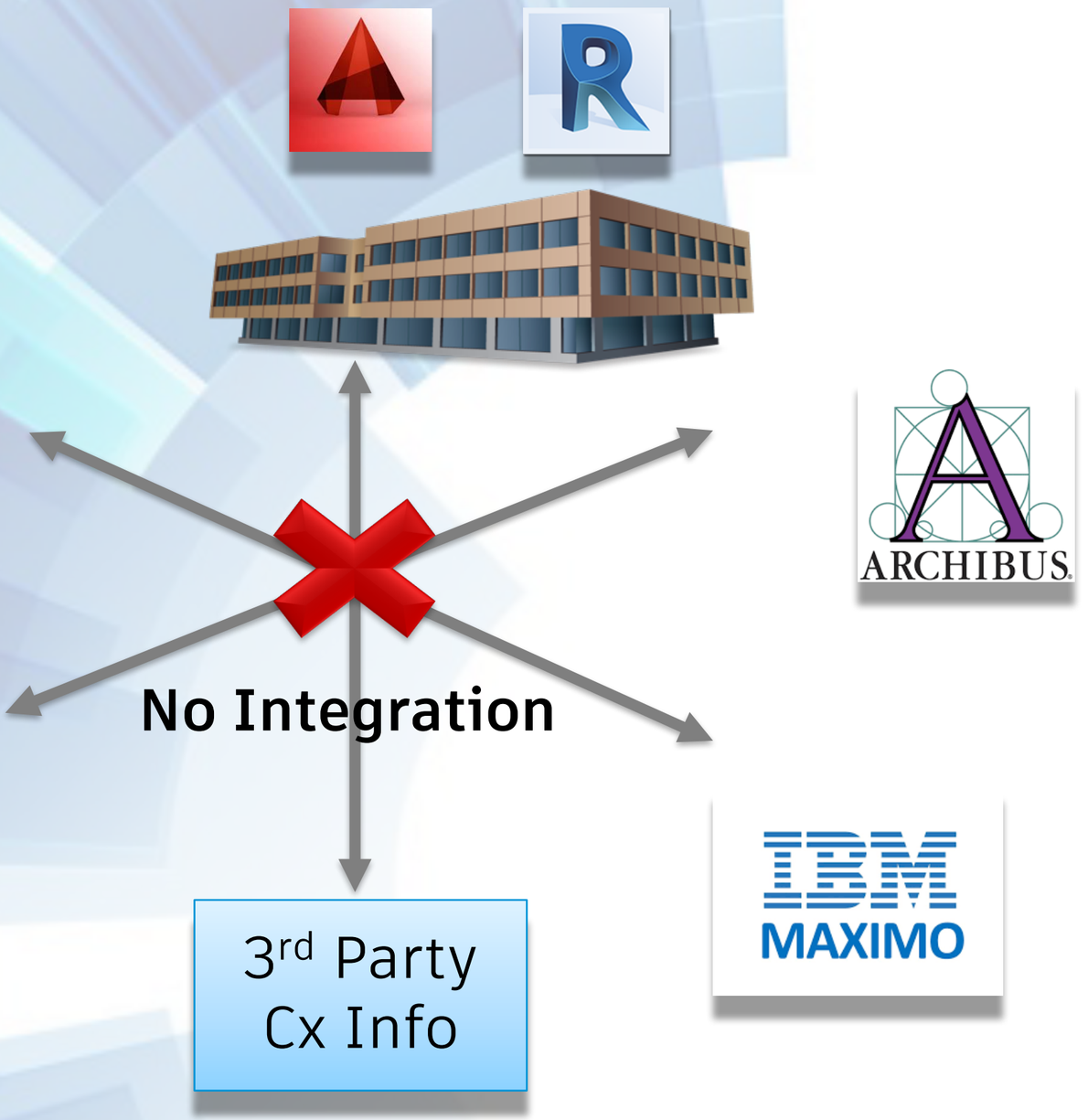
- *Packaging*
- *Presentation*
- *(enter Technology…)*

3. Engage FM to participate throughout construction coordination phase.
4. Monitor the completeness of the BIM to FM deliverable.
5. Highlight the importance of the BIM to FM deliverable on turnover to FM.

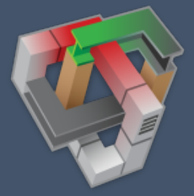
Technology

The Challenge





AUTODESK® BIM 360™



VDC / BIM Management

Production Planning

Layout & Verification

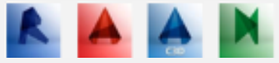
Field Management

Building Operations

Project Control - Doc Management, RFIs, Submittals

Construction Enterprise Integration & Insight

AUTODESK FORGE



SkySync

Leica

TOPCON

Microsoft HoloLens

Ecosystem Integration

SharePoint

COINS

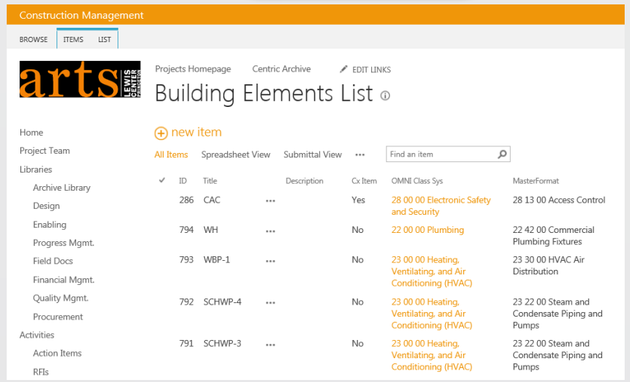
CMiC

COSENTIAL

salesforce

IBM maximo

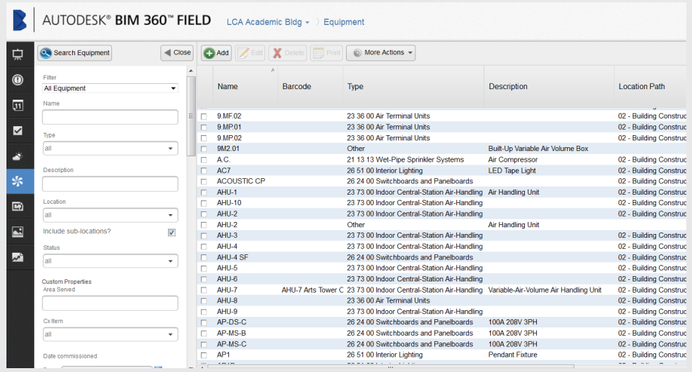
FM:Systems



- Document Library
- PM Workflows
  - Submittals
  - Tech Reviews
  - RFIs
  - Sub Award
  - Change Mgmt
  - Rx

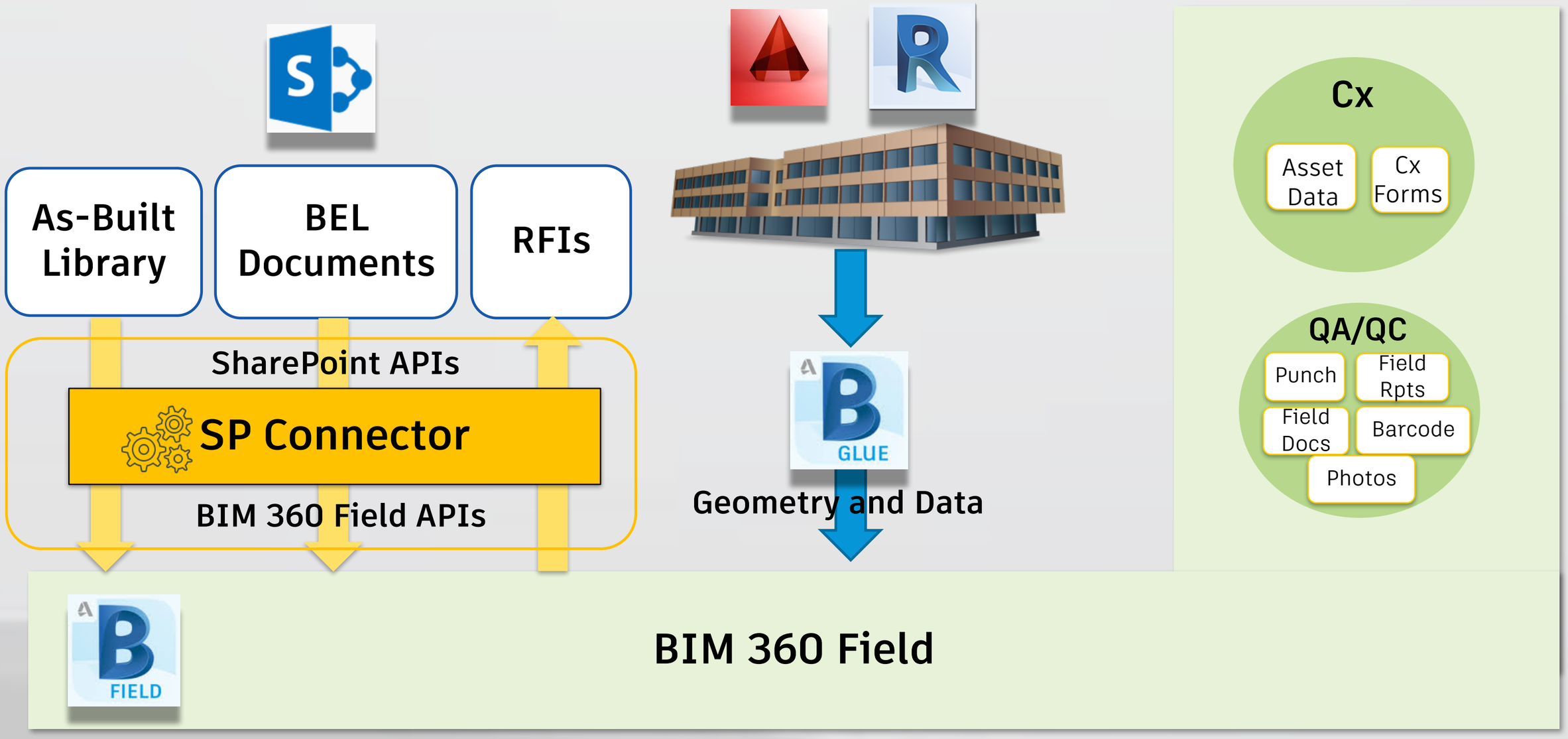
Model Viewer

- Design validation
- Coordination validation
- FM Accessibility verification
- Asset isolation
- System isolation
- Field markups

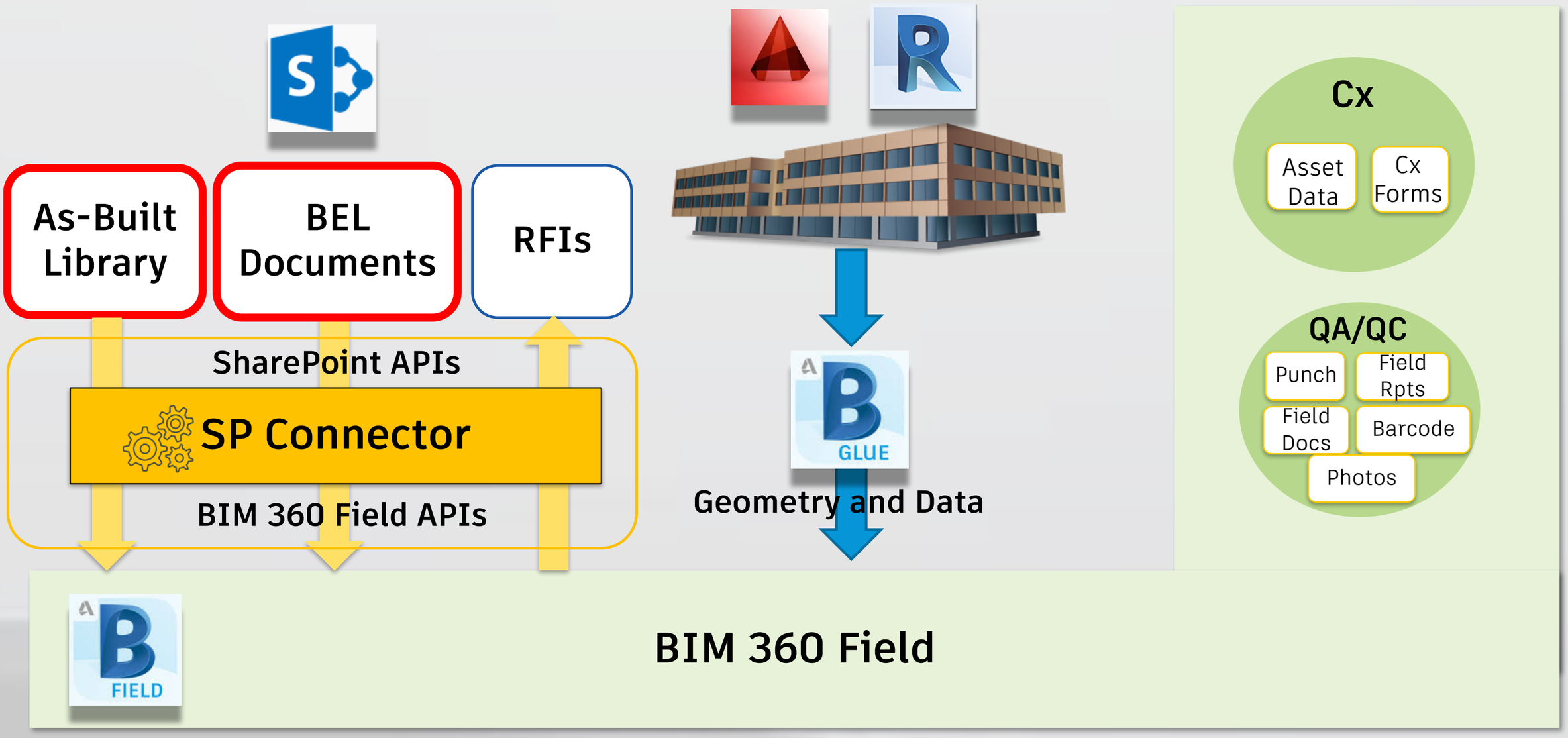


- Asset data collection
- Cx platform
  - Issue tracking
  - Punchlist
  - QA/QC
  - Field Observations
  - Barcode integration
  - Photo markup

The Integration

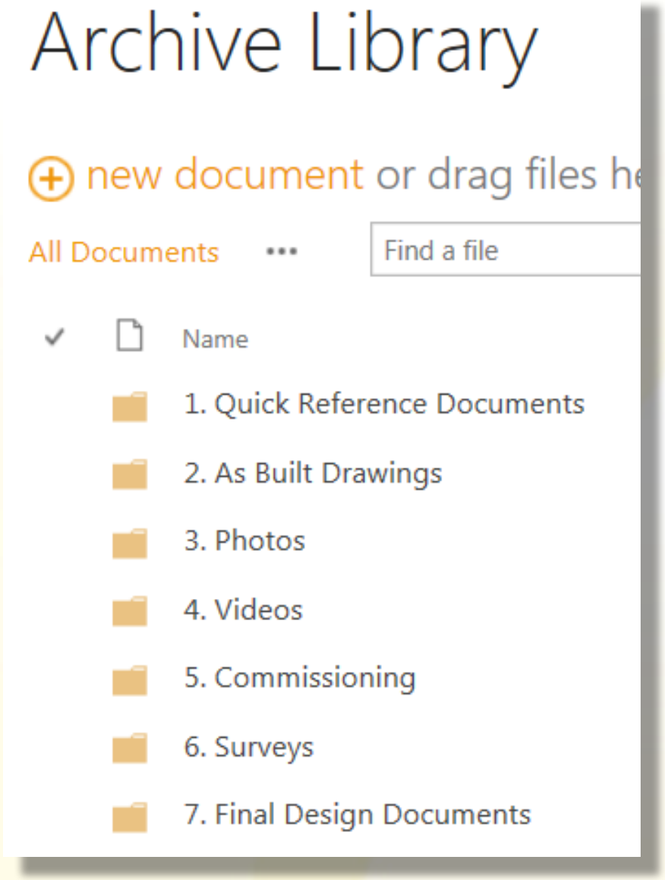


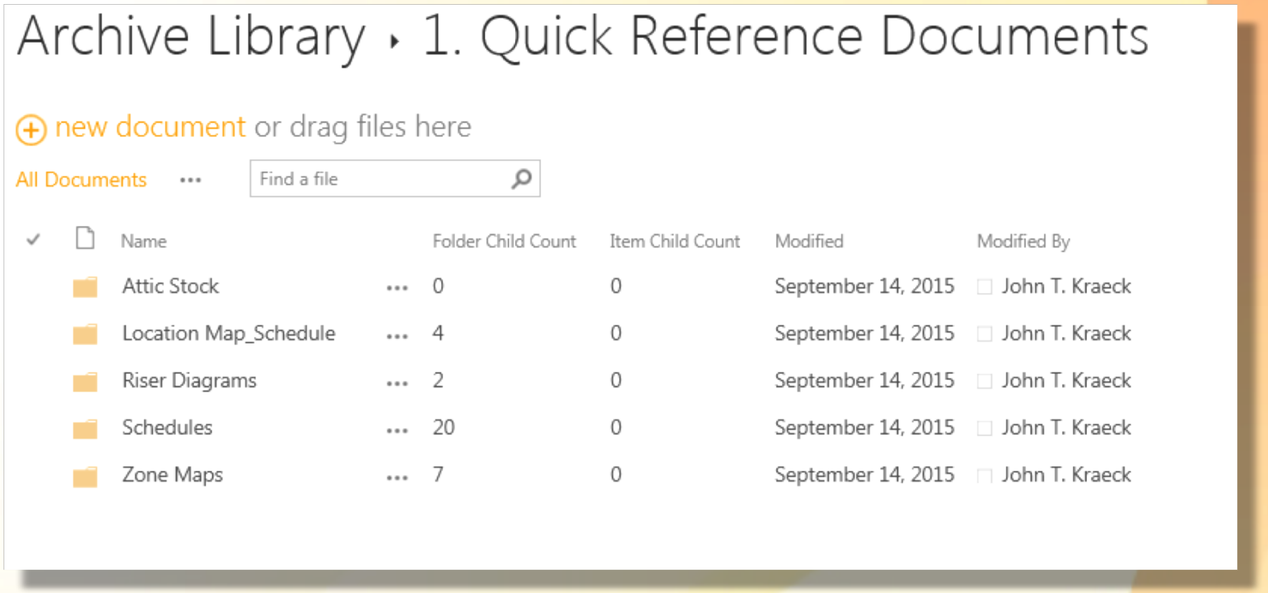
The Integration



SharePoint

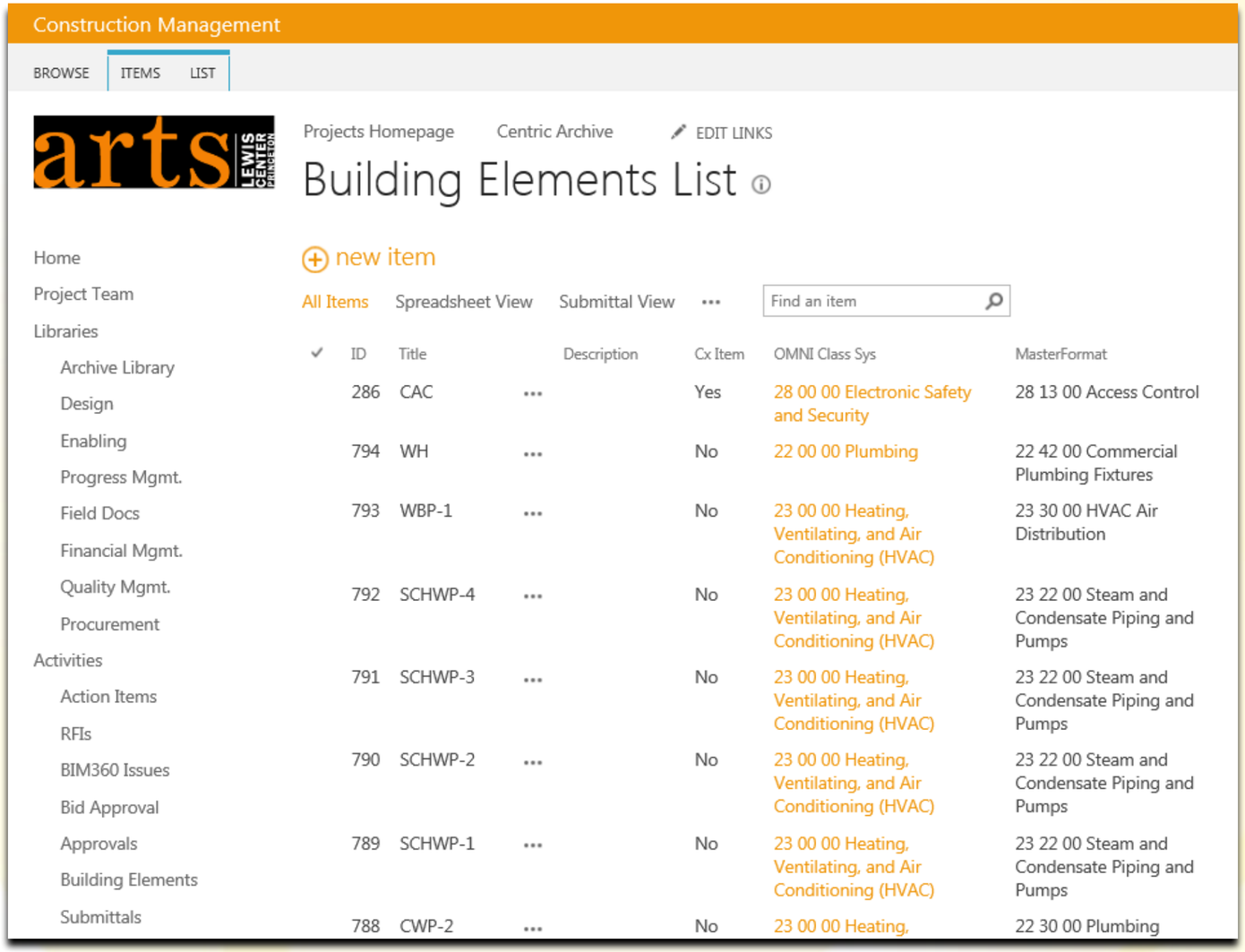
Document archive library (As-Built Library)





SharePoint

Building Elements List (BEL)



BEL: A collection of maintainable elements (assets or systems)

- Each record contains bundled as-built documents.

- The linking is part of natural submittal workflow.

New Submittal: 22 67 00 00 PCWP-11 O&M Manuals

Contractor creates submittal

Tag	Descr	MasterFormat Tier 1	
PCWP-11	PCWP-11 O&M Manuals	22-XX-XX-XX	

New Submittal: 22 67 00 00 PCWP-11 O&M Manuals

Tag	Descr	MasterFormat Tier 1	
PCWP-11	PCWP-11 O&M Manuals	22-XX-XX-XX	

Building Elements List (BEL)

Tag	Descr	MasterFormat Tier 1	MasterFormat Tier 2	Linked Documents
AHU-1	Lab wing AHU	23 00 00 00	23 74 00 00	Submittal-255 O&M Manual Warranty
HX-5	Heat Exchanger	23 00 00 00	23 57 00 00	Submittal-254 O&M Manual Warranty
LT-7	Light Type 7	26 00 00 00	26 51 00 00	Submittal-257 O&M Manual ( )
PCWP-11	PCHW secondary pump	22 00 00 00	22 67 00 00	Submittal-355 ( ) ( )
CT-4	Current Transformer Type 4	26 00 00 00	26 26 00 00	Submittal-210 O&M Manual Warranty
SP-3	Sump Pump Type 3	22 00 00 00	22 35 00 00	Submittal-385 O&M Manual Warranty

Based on submittal's MasterFormat value…

BEL List is queried for system matches

New Submittal: 22 67 00 00 PCWP-11 O&M Manuals

Tag	Descr	MasterFormat Tier 1	
PCWP-11	PCWP-11 O&M Manuals	22-XX-XX-XX	

Building Elements List (BEL)

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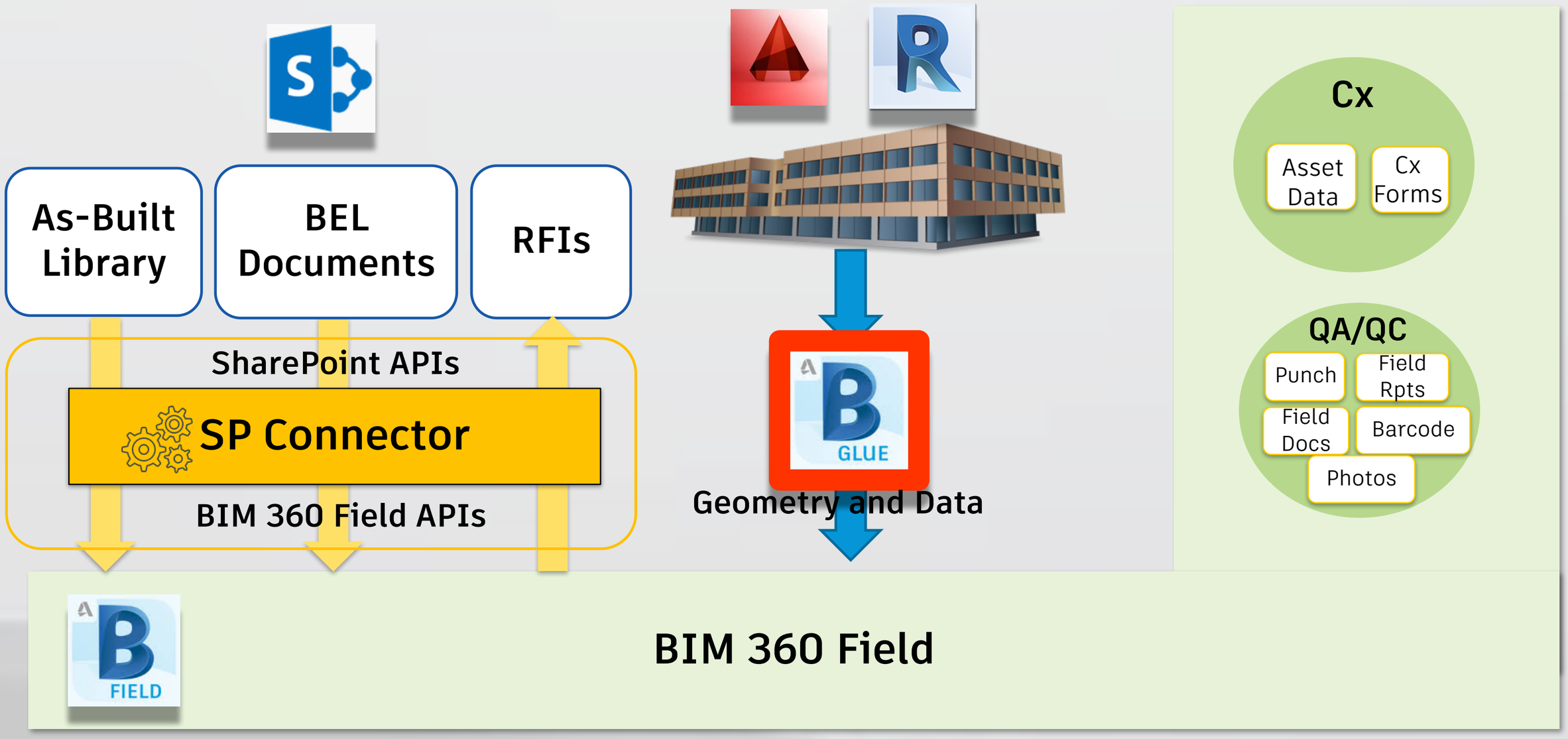
PCWP-11	PCHW secondary pump	22 00 00 00	22 67 00 00	Submittal-355 ( ) ( )
CT-4	Current Transformer Type 4	26 00 00 00	26 26 00 00	Submittal-210 O&M Manual Warranty
SP-3	Sump Pump Type 3	22 00 00 00	22 35 00 00	Submittal-385 O&M Manual Warranty

User bundles appropriate submittal link(s).

The Integration

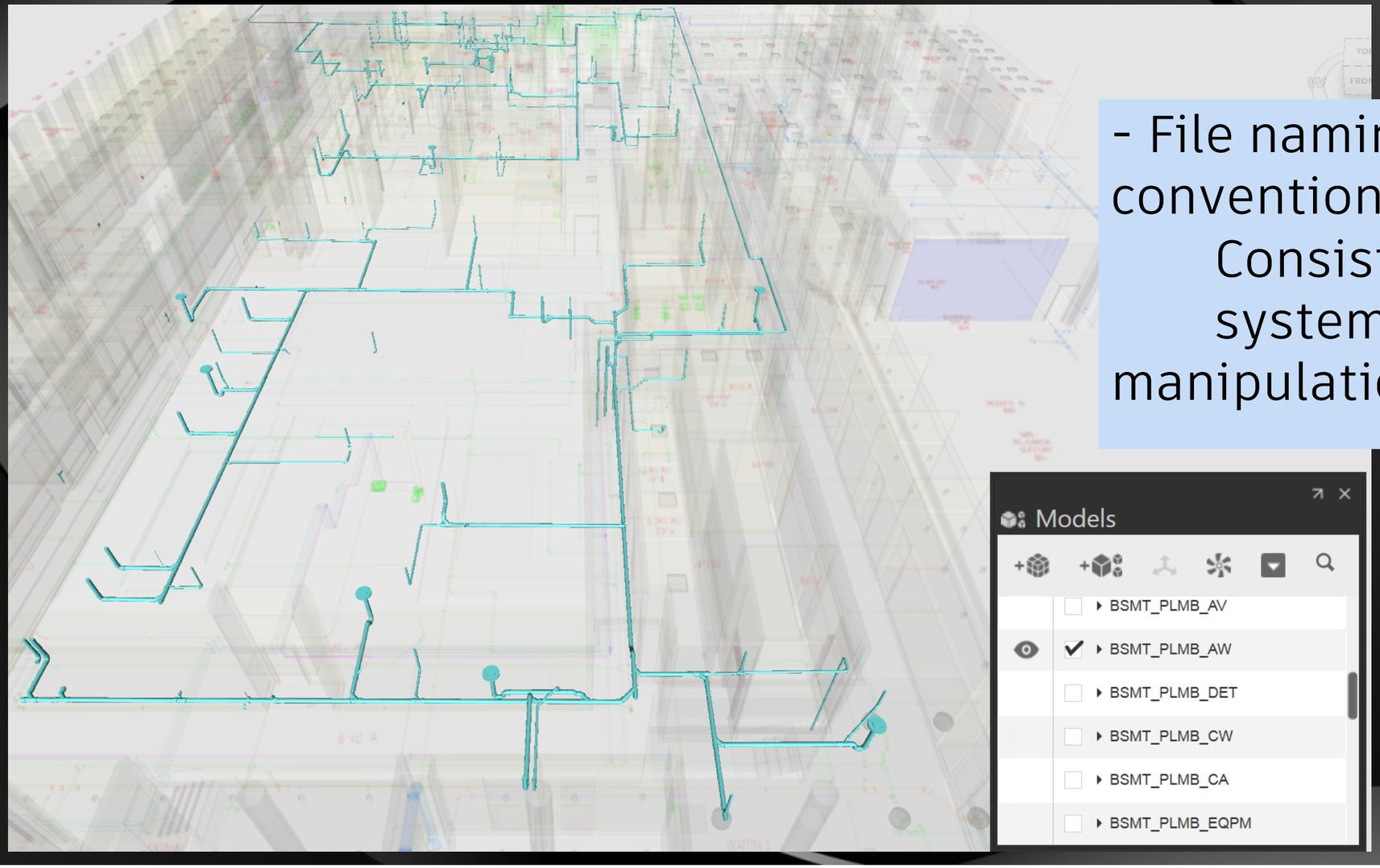


BIM 360 Glue

Model Viewer

BIM 360 Glue

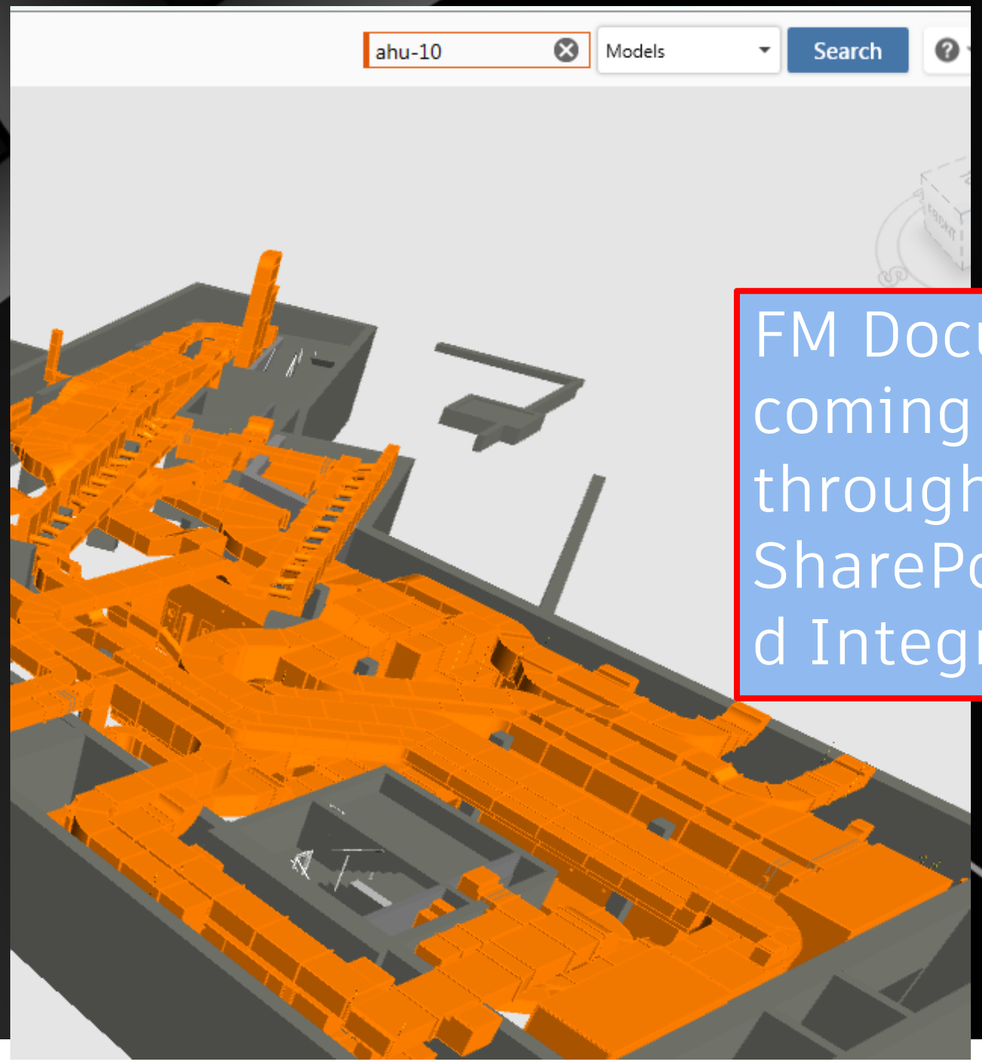
System Isolation and Model Access in the Field



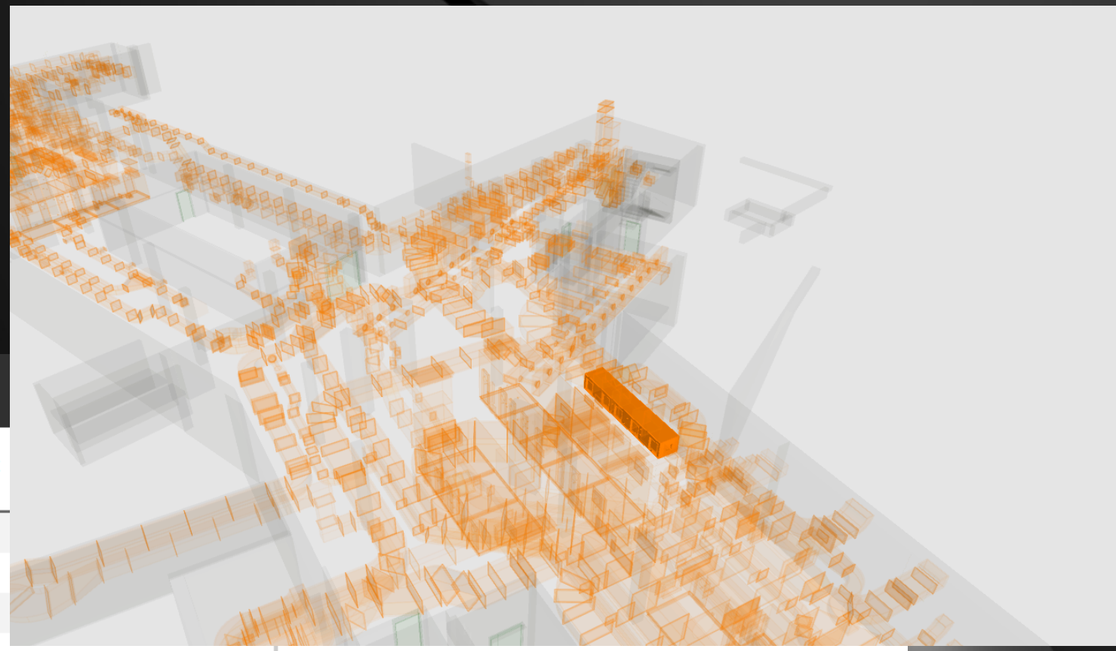
- File naming convention:
  - Consistent, easy system manipulation.

BIM 360 Glue

Search Asset and Information



FM Documents coming through via SharePoint/Field Integration

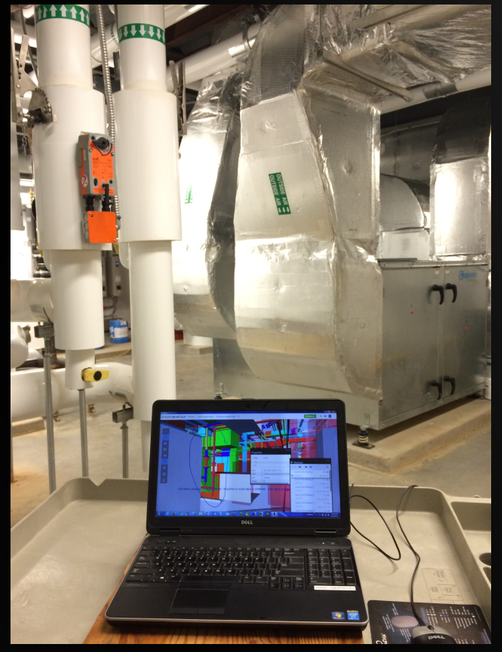


Parent

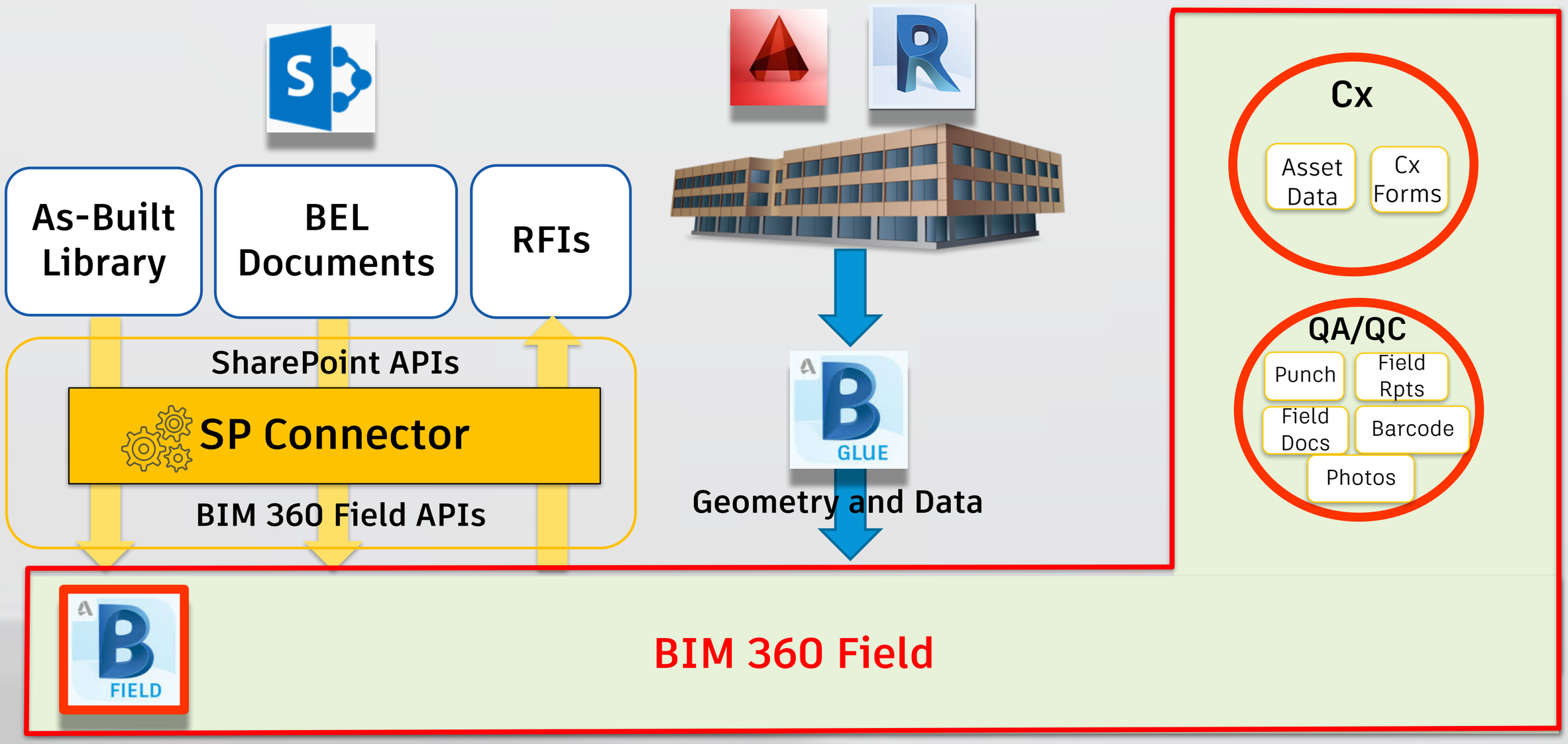
Name	AHU-10
Location	02 - Building Construction>Sub Basement
Serial number	
Description	
237313-0003-0_Haakon_Air_Handling_Units_-_Steam_Coils_RESPONSE.pdf	https://bim360field.autodesk.com/public_link/a2b2fde0cdf815e5bbe04c1e106c0dca0
237313-0003-0_Haakon_Air_Handling_Units_-_Steam_Coils.pdf	https://bim360field.autodesk.com/public_link/afab9d12ba65aa6a98cd40d1ec8447ce9
HTS-Haakon_Coil_Substitition_request.pdf	https://bim360field.autodesk.com/public_link/aad08c7251e162c5abed444c1e3b9ab32
237313-0001-0_Haakon_Air_Handling_Units-RESPONSE.pdf	https://bim360field.autodesk.com/public_link/a84aa173d946af6cb37140ee0e729a9fe

BIM 360 Glue

Model Verification and Access in the Field

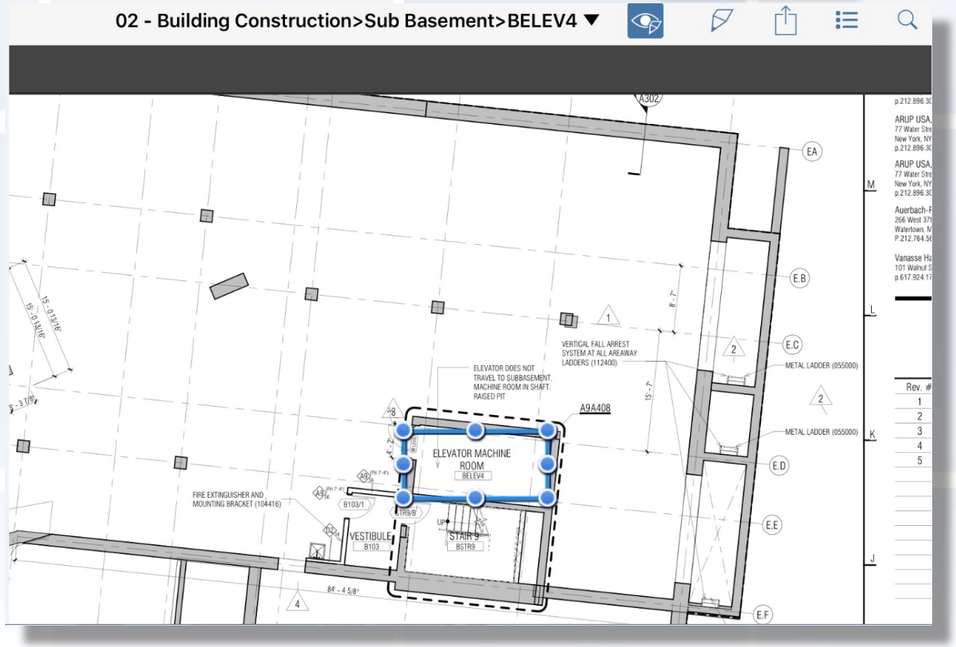


The Integration



BIM 360 Field

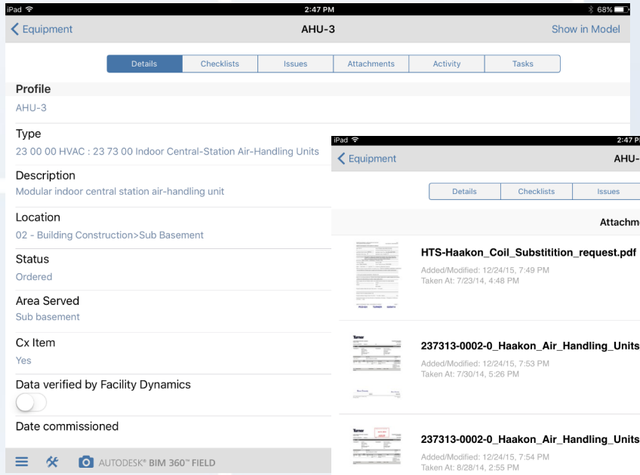
QA/QC

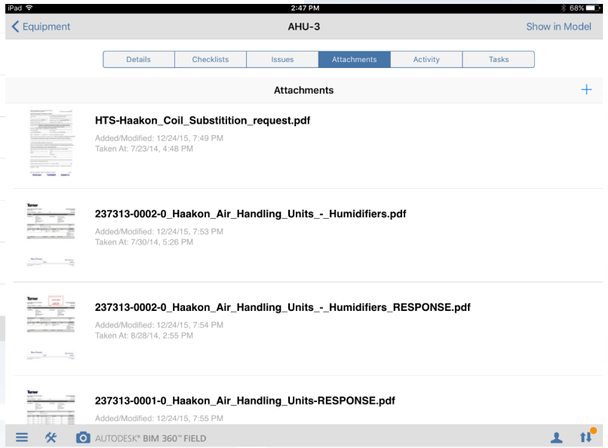


- **Bar Code enabled location data**
  - **Punch list**
  - **Field Observation**
  - **QA/QC**
  - **BELs tied to this**

BIM 360 Field

QA/QC

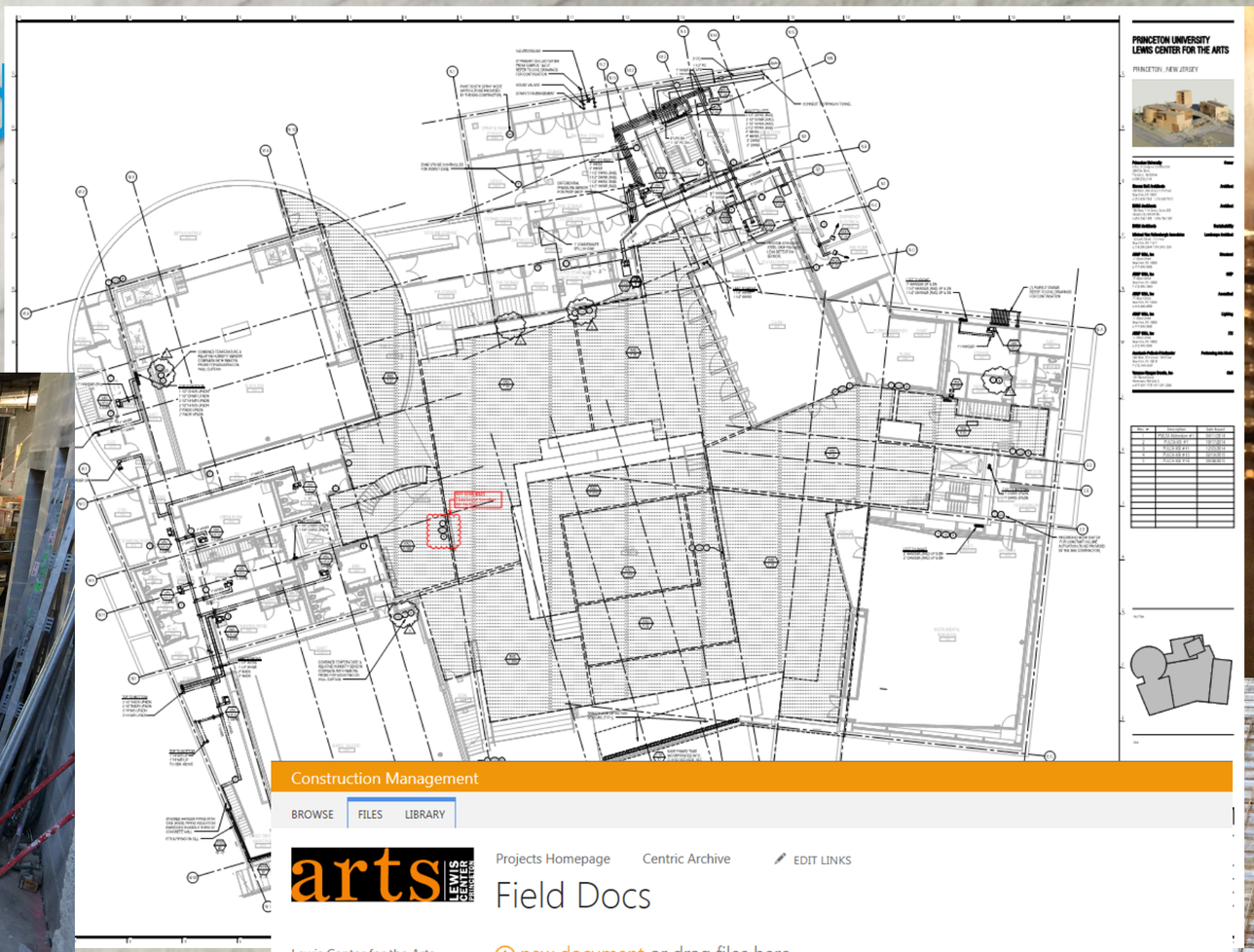


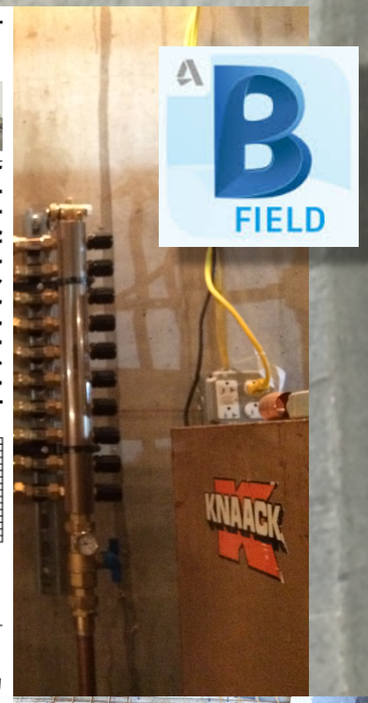


- **Bar code enabled asset/BEL data**
  - **QA/QC**
  - **Commissioning**
  - **As Built documents**
  - **CMMS Attributes**

BIM 360 Field

QA/QC





Construction Management

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Lewis Center for the Arts, Academic Building
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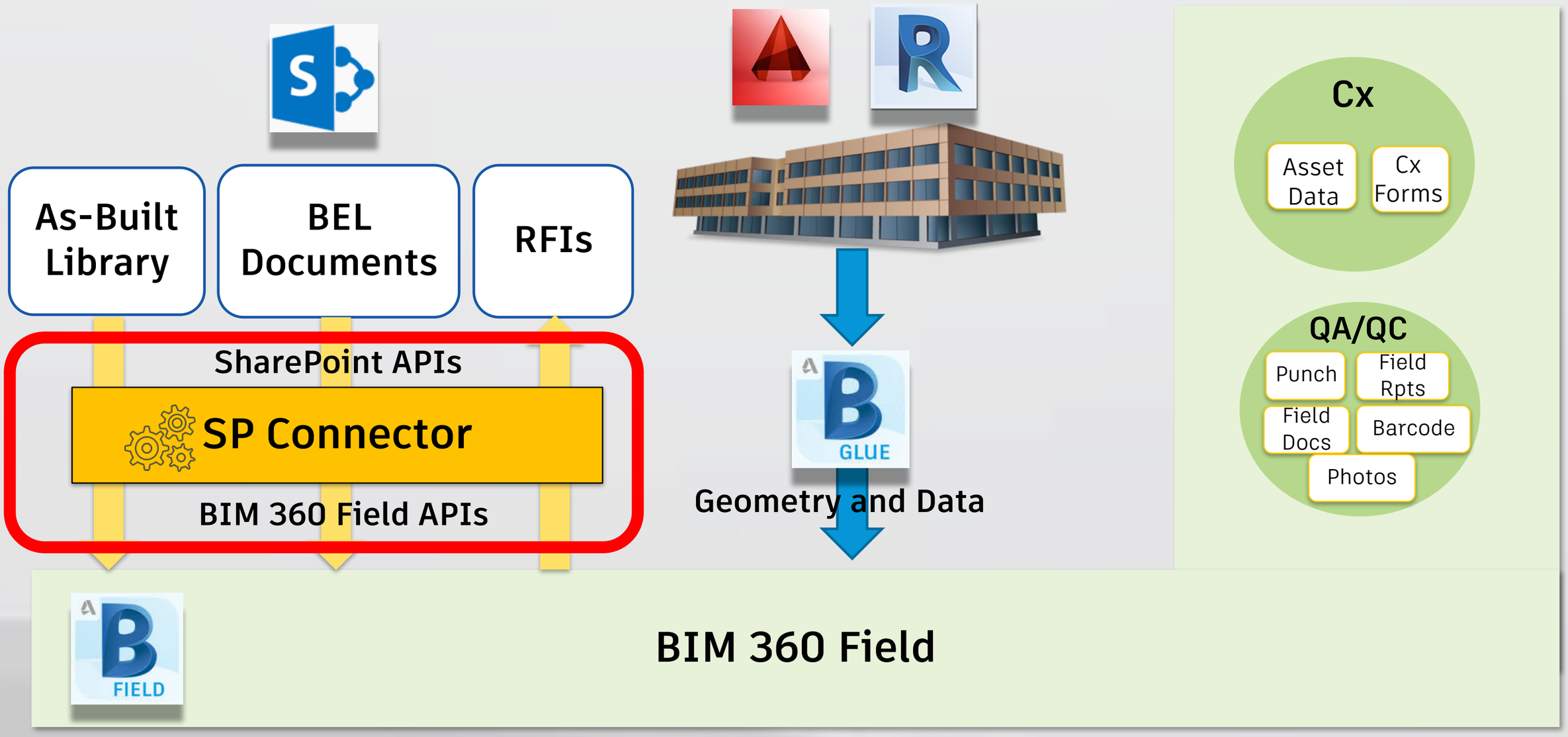
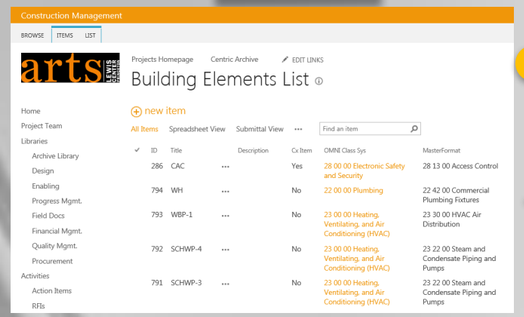
Name	Folder Child Count	Modified	Modified By
1. Drawing PDFs	21	July 28, 2015	Barbara J. Murphy
2. Sketches	0	July 21, 2015	Barbara J. Murphy
3. Floor Plans	0	July 28, 2015	Barbara J. Murphy
SPECS	6	October 29, 2015	Enoque Panzo
160418_Field Report_MVVA	0	April 21	Ryan Camp
2016.08.05_Field Report-002	0	August 5	Ryan Camp

- **Most recent dwg changes always available – note red markup on plan**

The Integration



SP Connector Solution Overview



- Submittals
- BEL documents

SP APIs

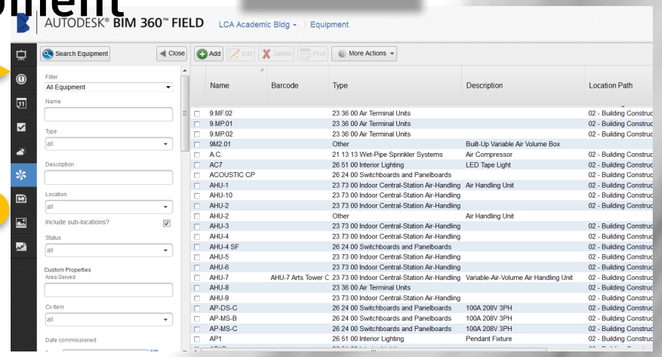
- RFIs

SP Connector

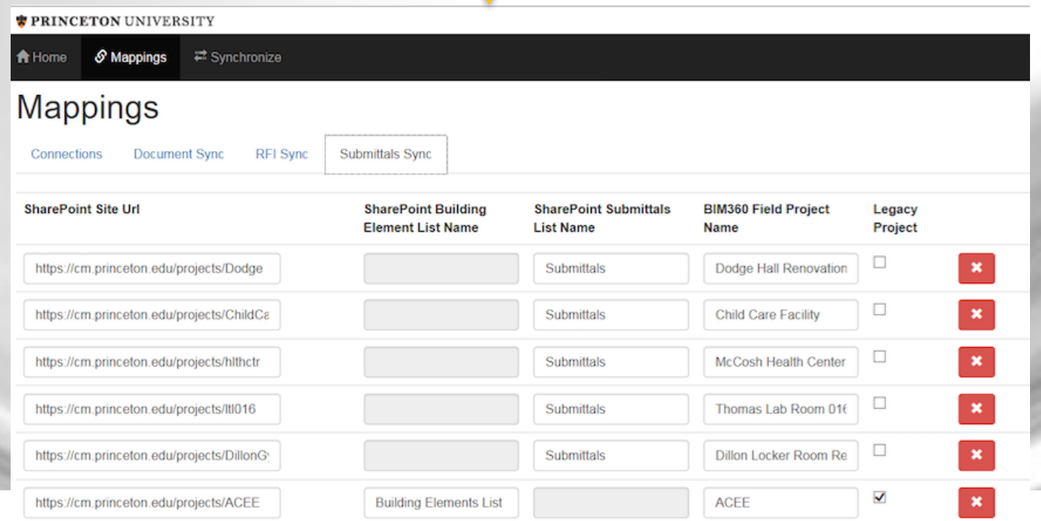
- Library
- Attach to Equipment

Field APIs

- Issues of RFI type

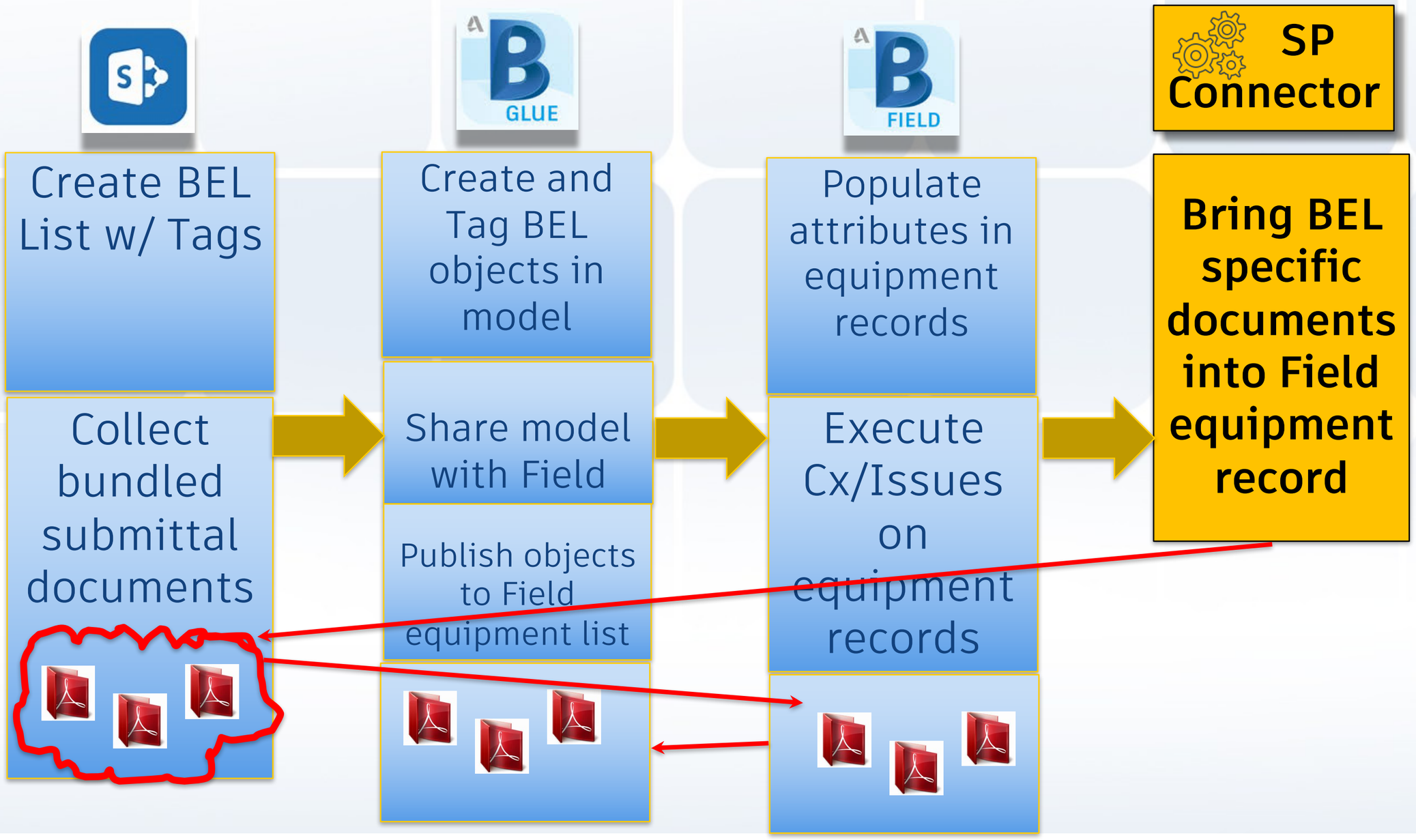


SharePoint Site URL



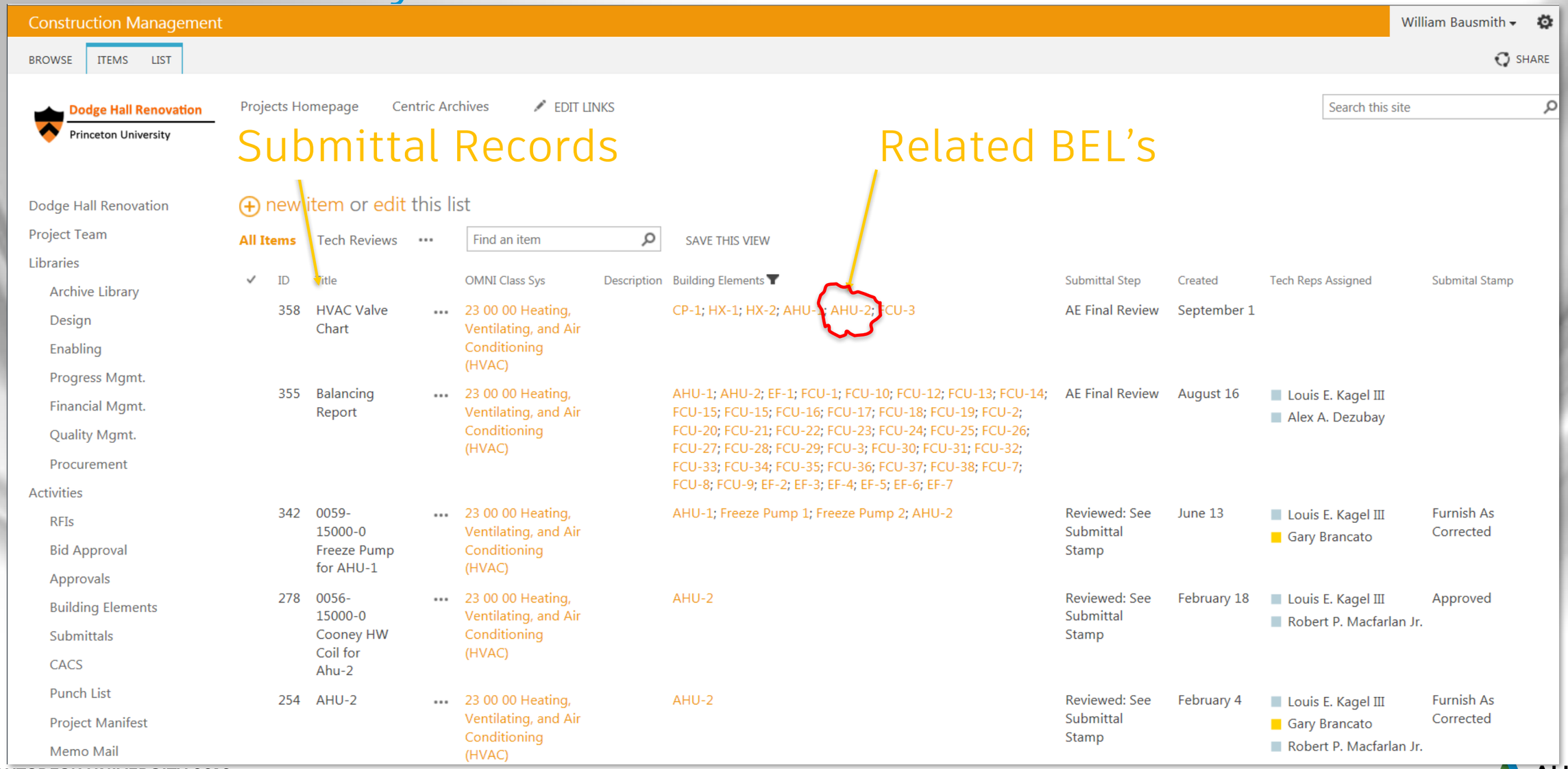
BIM 360 Field Project Name

BIM to FM: Integration workflow



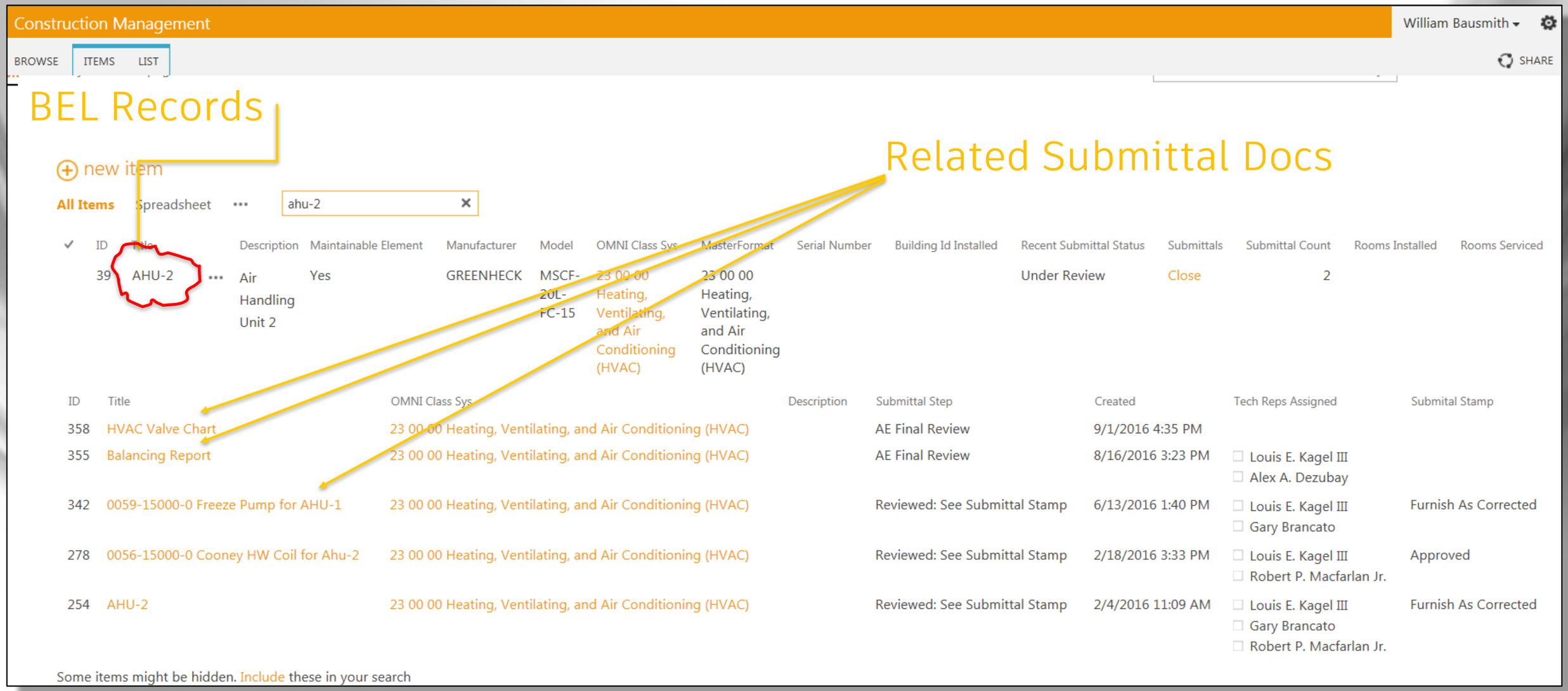
SP Connector

Submittals Sync – Submittals in SharePoint



SP Connector

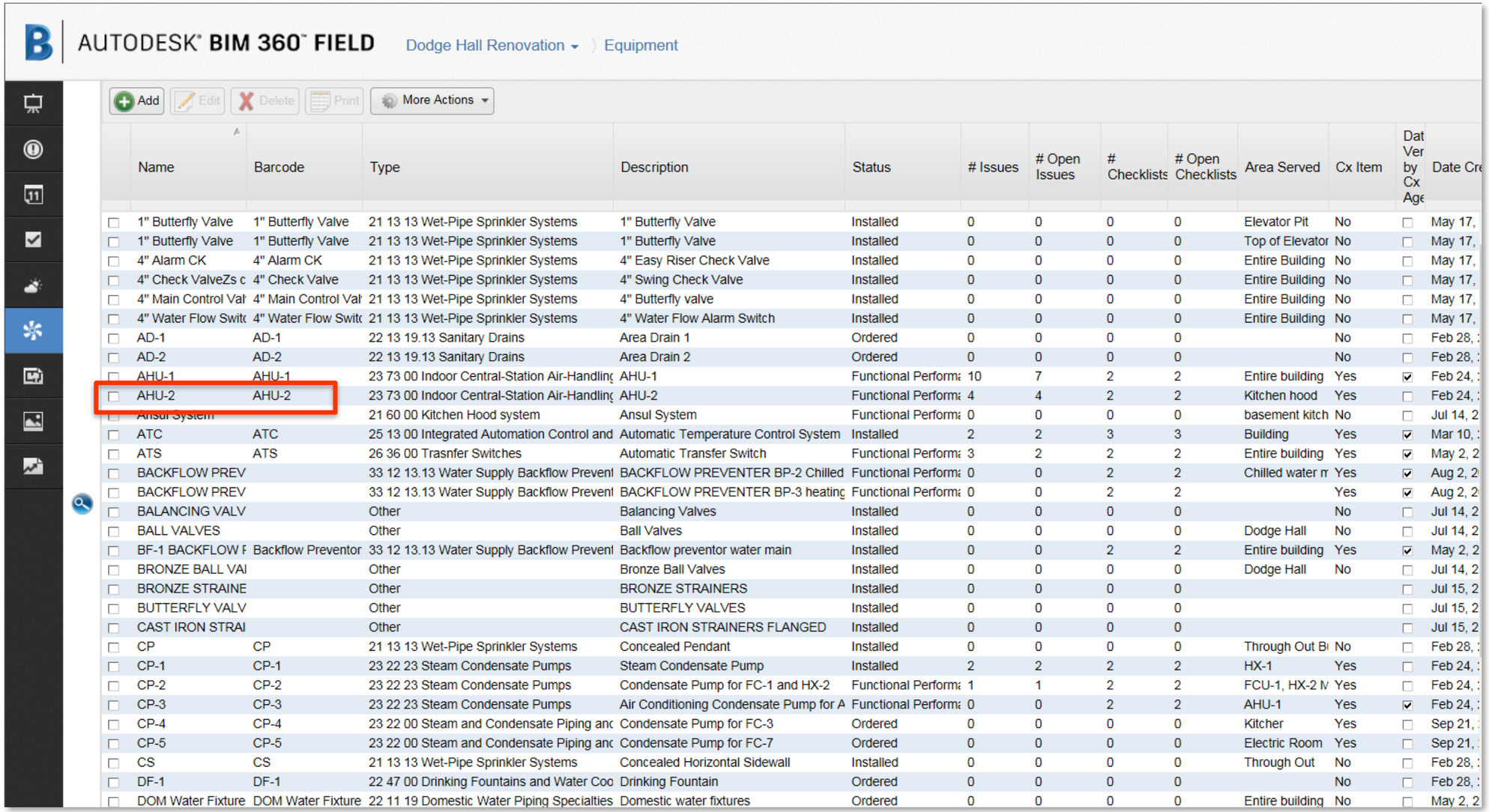
Submittals Sync – BEL records, bundling Submittals (as-builts)



SP Connector

Documents Sync

BEL list in Field

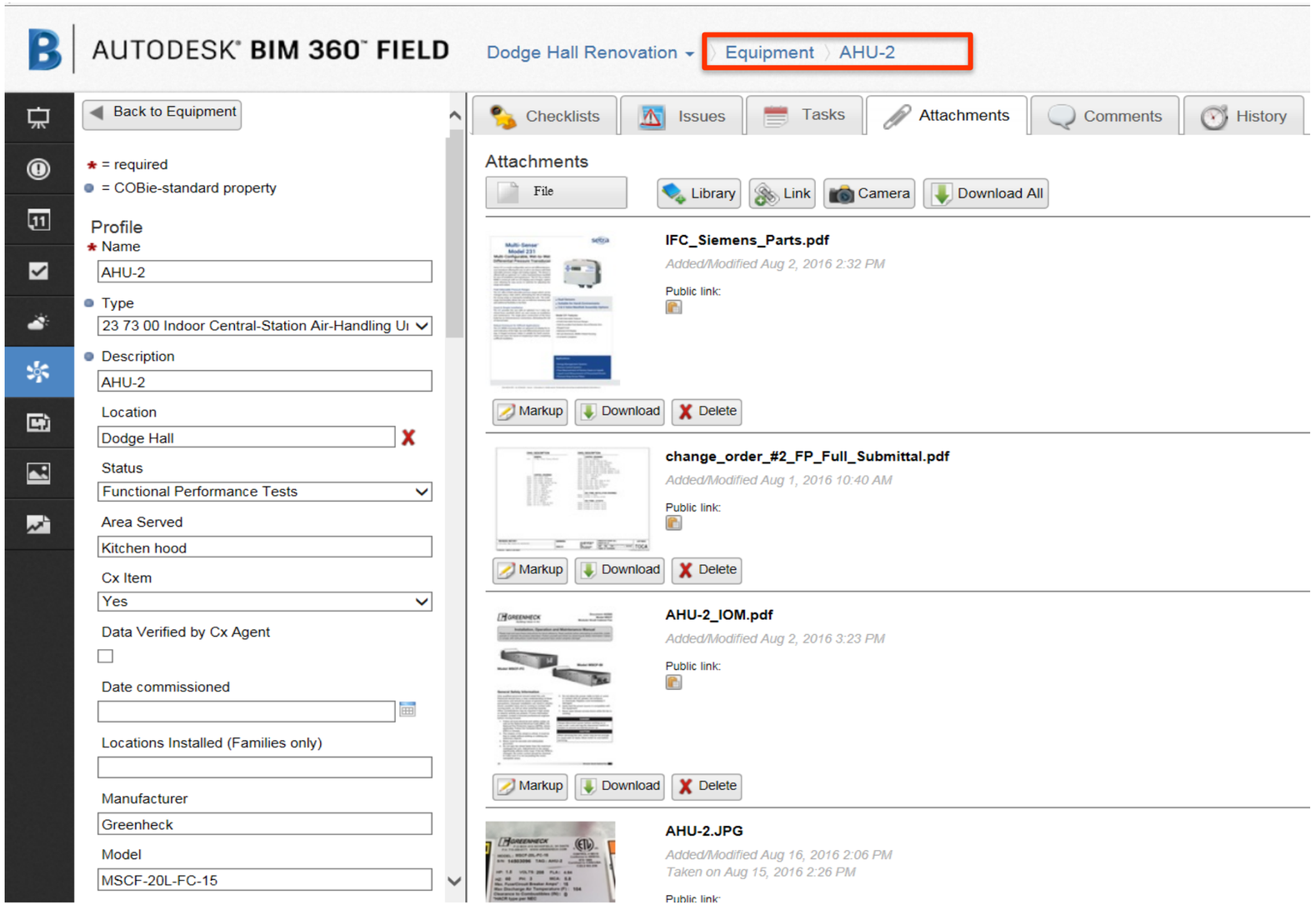


Name	Barcode	Type	Description	Status	# Issues	# Open Issues	# Checklists	# Open Checklists	Area Served	Cx Item	Dat Ver by Cx Age	Date Cre
1" Butterfly Valve	1" Butterfly Valve	21 13 13 Wet-Pipe Sprinkler Systems	1" Butterfly Valve	Installed	0	0	0	0	Elevator Pit	No		May 17,
1" Butterfly Valve	1" Butterfly Valve	21 13 13 Wet-Pipe Sprinkler Systems	1" Butterfly Valve	Installed	0	0	0	0	Top of Elevator	No		May 17,
4" Alarm CK	4" Alarm CK	21 13 13 Wet-Pipe Sprinkler Systems	4" Easy Riser Check Valve	Installed	0	0	0	0	Entire Building	No		May 17,
4" Check ValveZs c	4" Check Valve	21 13 13 Wet-Pipe Sprinkler Systems	4" Swing Check Valve	Installed	0	0	0	0	Entire Building	No		May 17,
4" Main Control Val	4" Main Control Val	21 13 13 Wet-Pipe Sprinkler Systems	4" Butterfly valve	Installed	0	0	0	0	Entire Building	No		May 17,
4" Water Flow Switc	4" Water Flow Switc	21 13 13 Wet-Pipe Sprinkler Systems	4" Water Flow Alarm Switch	Installed	0	0	0	0	Entire Building	No		May 17,
AD-1	AD-1	22 13 19.13 Sanitary Drains	Area Drain 1	Ordered	0	0	0	0		No		Feb 28,
AD-2	AD-2	22 13 19.13 Sanitary Drains	Area Drain 2	Ordered	0	0	0	0		No		Feb 28,
AHU-1	AHU-1	23 73 00 Indoor Central-Station Air-Handling	AHU-1	Functional Performa	10	7	2	2	Entire building	Yes	☑	Feb 24,
AHU-2	AHU-2	23 73 00 Indoor Central-Station Air-Handling	AHU-2	Functional Performa	4	4	2	2	Kitchen hood	Yes		Feb 24,
Ansul System		21 60 00 Kitchen Hood system	Ansul System	Functional Performa	0	0	0	0	basement kitch	No		Jul 14, 2
ATC	ATC	25 13 00 Integrated Automation Control and	Automatic Temperature Control System	Installed	2	2	3	3	Building	Yes	☑	Mar 10,
ATS	ATS	26 36 00 Trasnfer Switches	Automatic Transfer Switch	Functional Performa	3	2	2	2	Entire building	Yes	☑	May 2, 2
BACKFLOW PREV		33 12 13.13 Water Supply Backflow Prevent	BACKFLOW PREVENTER BP-2 Chilled	Functional Performa	0	0	2	2	Chilled water r	Yes	☑	Aug 2, 2
BACKFLOW PREV		33 12 13.13 Water Supply Backflow Prevent	BACKFLOW PREVENTER BP-3 heating	Functional Performa	0	0	2	2		Yes	☑	Aug 2, 2
BALANCING VALV		Other	Balancing Valves	Installed	0	0	0	0		No		Jul 14, 2
BALL VALVES		Other	Ball Valves	Installed	0	0	0	0	Dodge Hall	No		Jul 14, 2
BF-1 BACKFLOW F	Backflow Preventor	33 12 13.13 Water Supply Backflow Prevent	Backflow preventor water main	Installed	0	0	2	2	Entire building	Yes	☑	May 2, 2
BRONZE BALL VAI		Other	Bronze Ball Valves	Installed	0	0	0	0	Dodge Hall	No		Jul 14, 2
BRONZE STRAINE		Other	BRONZE STRAINERS	Installed	0	0	0	0				Jul 15, 2
BUTTERFLY VALV		Other	BUTTERFLY VALVES	Installed	0	0	0	0				Jul 15, 2
CAST IRON STRAI		Other	CAST IRON STRAINERS FLANGED	Installed	0	0	0	0				Jul 15, 2
CP	CP	21 13 13 Wet-Pipe Sprinkler Systems	Concealed Pendant	Installed	0	0	0	0	Through Out Bi	No		Feb 28,
CP-1	CP-1	23 22 23 Steam Condensate Pumps	Steam Condensate Pump	Installed	2	2	2	2	HX-1	Yes		Feb 24,
CP-2	CP-2	23 22 23 Steam Condensate Pumps	Condensate Pump for FC-1 and HX-2	Functional Performa	1	1	2	2	FCU-1, HX-2 M	Yes		Feb 24,
CP-3	CP-3	23 22 23 Steam Condensate Pumps	Air Conditioning Condensate Pump for A	Functional Performa	0	0	2	2	AHU-1	Yes	☑	Feb 24,
CP-4	CP-4	23 22 00 Steam and Condensate Piping and	Condensate Pump for FC-3	Ordered	0	0	0	0	Kitcher	Yes		Sep 21,
CP-5	CP-5	23 22 00 Steam and Condensate Piping and	Condensate Pump for FC-7	Ordered	0	0	0	0	Electric Room	Yes		Sep 21,
CS	CS	21 13 13 Wet-Pipe Sprinkler Systems	Concealed Horizontal Sidewall	Installed	0	0	0	0	Through Out	No		Feb 28,
DF-1	DF-1	22 47 00 Drinking Fountains and Water Coo	Drinking Fountain	Ordered	0	0	0	0		No		Feb 28,
DOM Water Fixture	DOM Water Fixture	22 11 19 Domestic Water Piping Specialties	Domestic water fixtures	Ordered	0	0	0	0	Entire building	No		May 2, 2

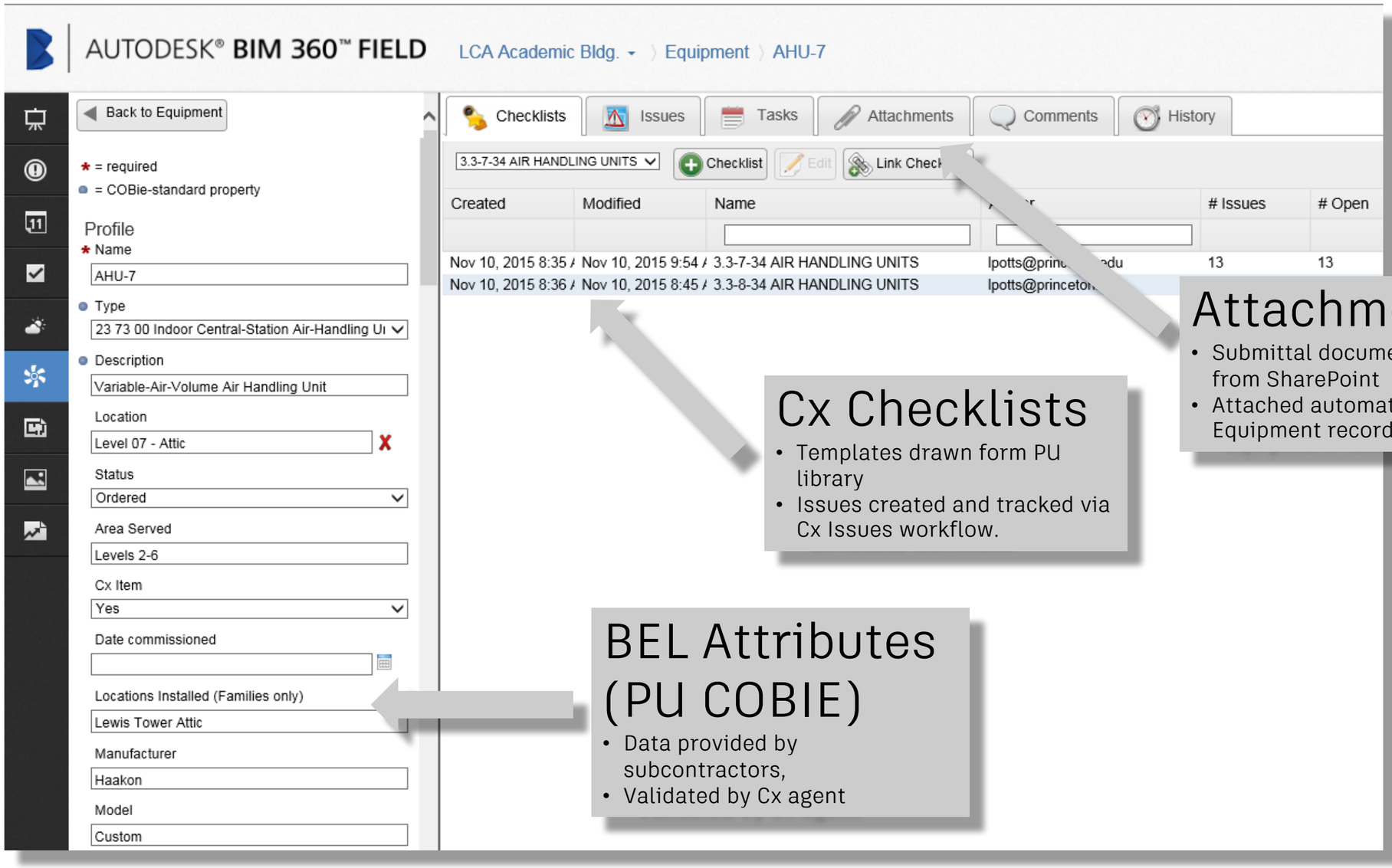
SP Connector

Documents Sync

BEL Documents in Field

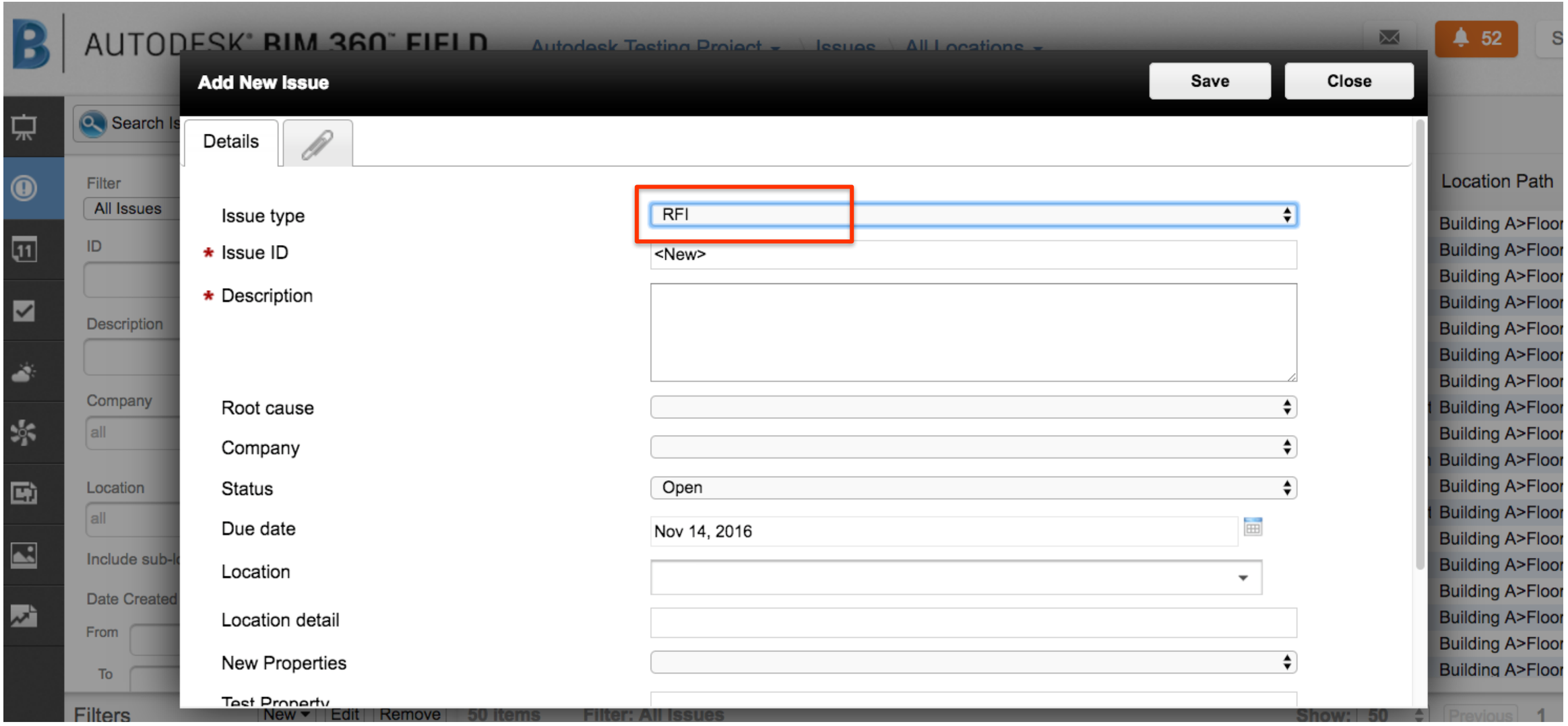


Asset Information is integrated



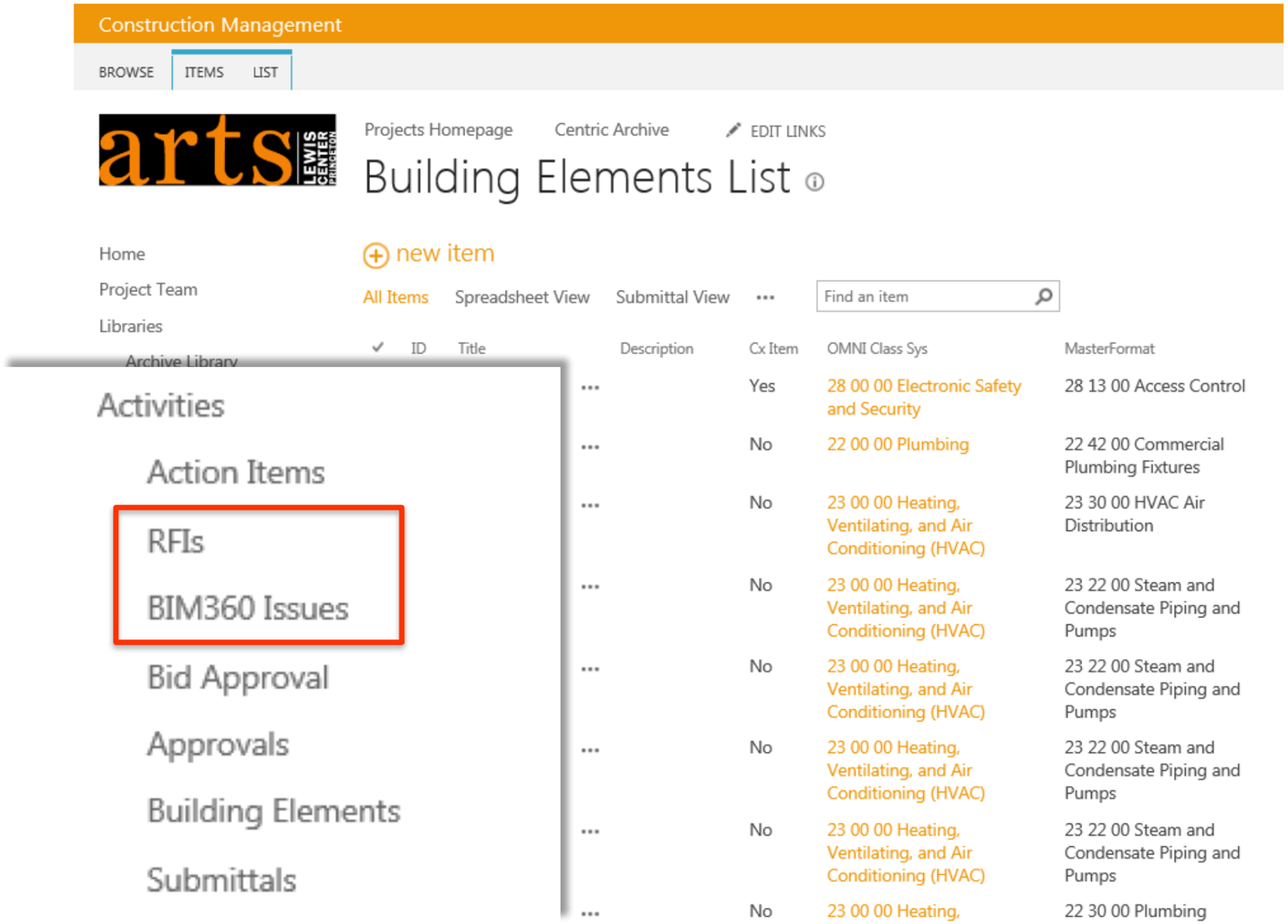
SP Connector

RFIs Sync



SP Connector

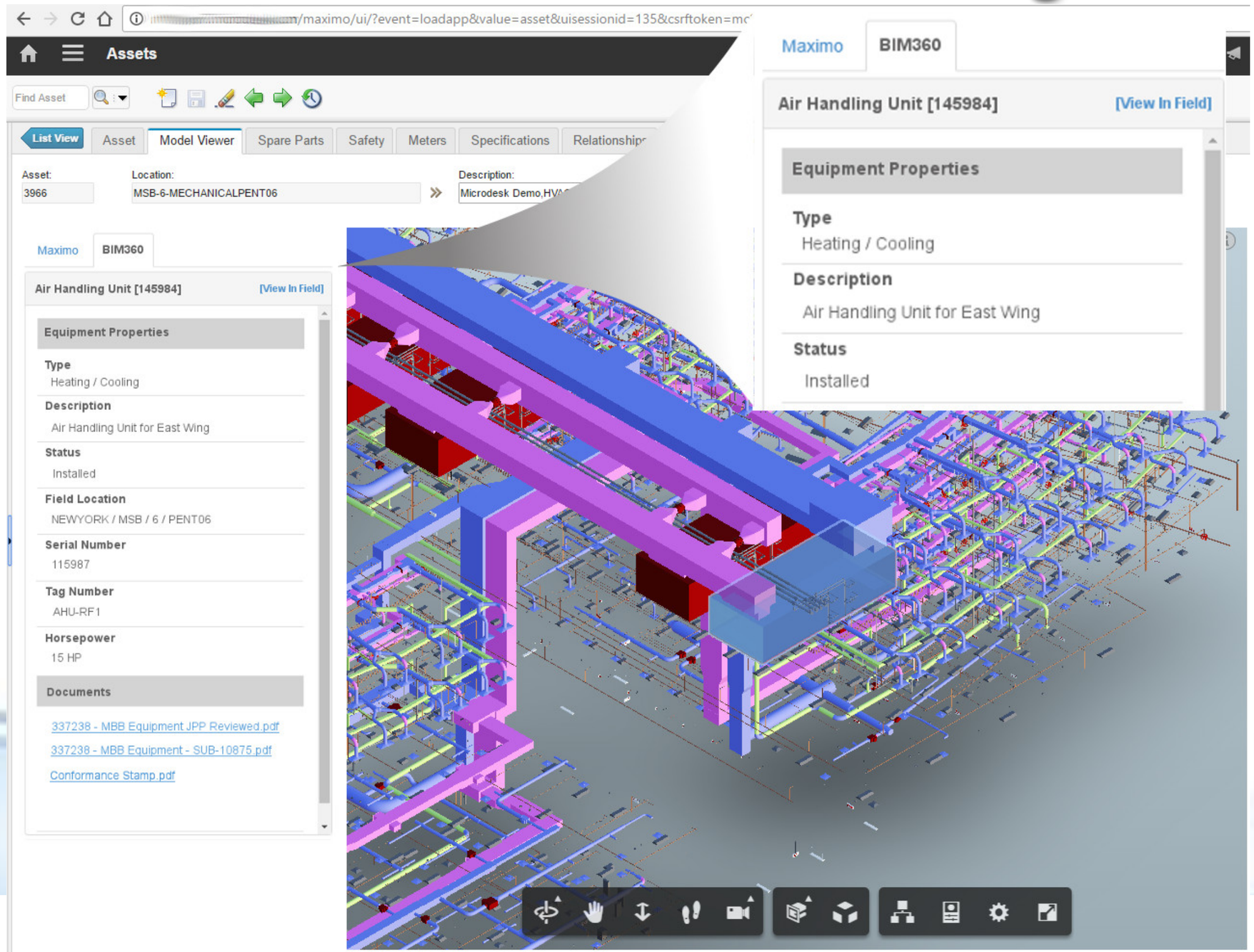
RFIs Sync



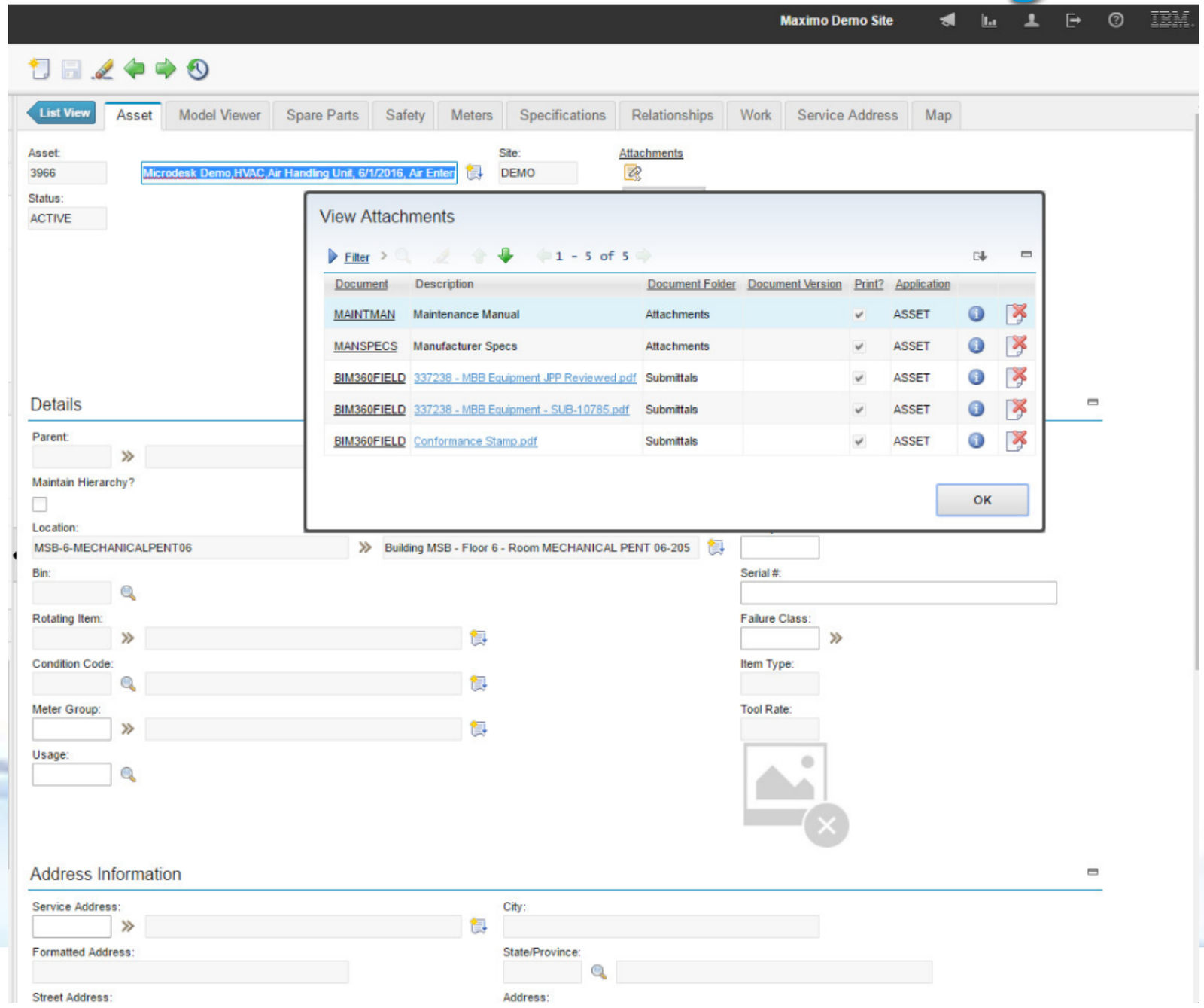
Next Step

BIM 360 – Maximo Integration Vision

Owner Driven BIM- CMMS Integration



Owner Driven BIM- CMMS Integration



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