

Efficient Ways to Visualize and Analyze Data in BIM360 Project with Power BI

Xiaodong Liang

Principal Developer Advocate | @coldwood



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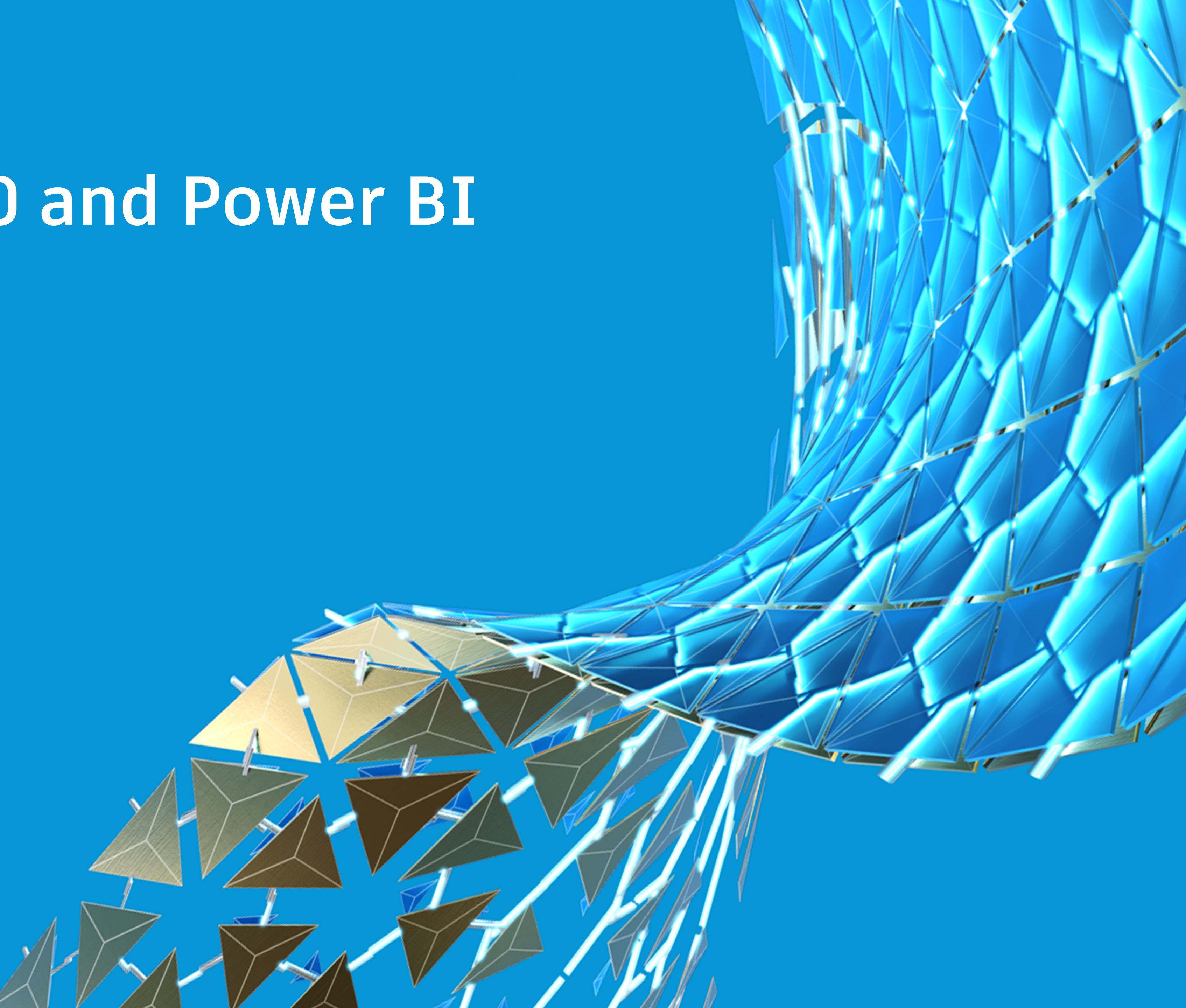
Principal Developer Advocate

Joined Autodesk in 2007 as a developer advocate. Starting with desktop products' APIs, Xiaodong is now engaging in Autodesk Forge and AEC solutions, including BIM360 and Revit etc. He is one of the contributors of Forge blog and ADN DevBlog, researching integrations by Forge and web & cloud technology . Xiaodong is based in China, yet mingling with the global community of Autodesk and programming. He is also the ambassador of Intel IoT technology

Agenda

- About BIM 360 and Power BI
- Power BI Templates for Construction
- Power BI Partner Card
- BIM 360 Forge API & Data Extraction
- Power BI Visual of Forge Viewer
- Power BI Embedded in Web App with Forge Viewer

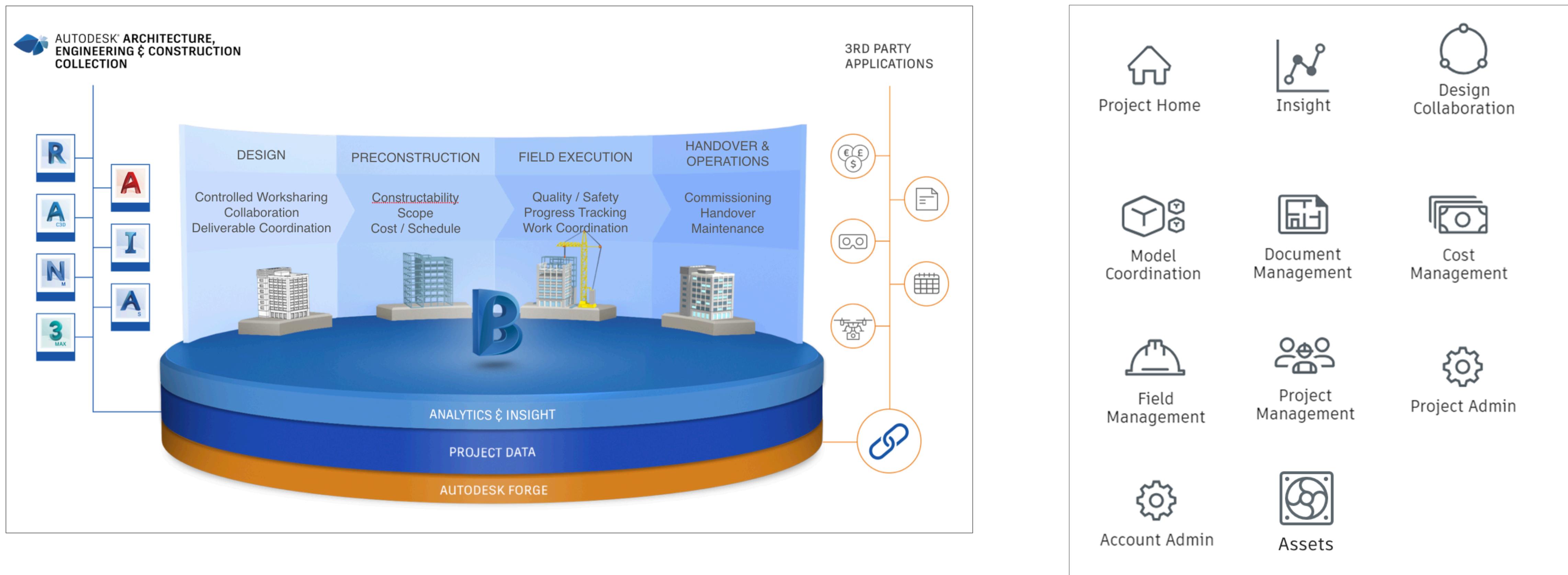
About BIM 360 and Power BI



BIM360



Unified platform connecting your project teams and data in real-time, from design through construction, supporting informed decision-making and leading to more predictable and profitable outcomes.



AUTODESK BIM 360 | Autodesk Forge Partner Development

Account Admin

- PROJECTS
- MEMBERS
- COMPANIES
- ROLES
- ANALYTICS
- SETTINGS
- APPS

Project Directory
The Project Directory lists all projects in your account.

112 Current Projects | View Archived

Name	Members	Companies	Project Status	Last Sign In
00 Design Files	0	1	Active	
Accelerator Shanghai	2	3	Active	May 8, 2020
AC J Liska	1	1	Active	Oct 26, 2018
AC J Liska Training	4	1	Active	Dec 9, 2019
AC Mori	1	1	Active	
ADN AEC WG	3	1	Active	Sep 4, 2020
AG New Project	2	2	Active	Aug 25, 2020
BIM 360 Cost Sample Project (Zhong)	2	4	Active	May 7, 2020
CLI-Test-Tool-Fldr-3	1	2	Active	
Cost Test Sample by Zhong	1	2	Active	Apr 28, 2020
DA for Civil 3D	2	2	Active	Jul 1, 2020

Filters

STATUS

- Active
- Inactive

Feedback

{3D}_rac_basic_sample_project.vt | V1 | Set not assigned

FORGE

16 Documents

- S001 - Title Sheet
- S101 - Framing Plans
- S201 - Upper House...
- S202 - Wall Section
- S203 - Central Pile...
- S204 - Footing Detail
- S205 - Column Sch...
- S206 - Elevations
- {3D}_rac_basic_sa...
- {3D}_rst_basic_sa...

TOP **LEFT** **FRONT**

Design Collaboration

Hope Engine
LandLAB
MA Engineers
Michael Wall
Architects

March
April

02/26/2018 04/17/2018

2 months

Architects

7 Sets 87 Sheets 8 3D views Project Model

Sets

- +A 100 series (55)
- +A 250 Sections (3)
- +A200 series (25)
- +Furniture - Working Views (4)
- Level 0 Floor Plan
- Level 1 Floor Plan
- Level 2 Floor Plan (Levels 3-5 Sim.)
- Level 6 Floor Plan
- +Presentation (2)
- AXO_SE
- AXO_SW
- +Qualcomm 50% CDs - Furniture Plans (8)
- +Set (2)

3D views

Project Model

AUTODESK BIM 360 | United Construction > Qualcomm Pacific Center

Design Collaboration

Hope Engine
LandLAB
MA Engineers
Michael Wall
Architects

March
April

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2 months

Architects

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- +Set (2)

3D views

Project Model

Account Management

- Projects
- Companies
- Users
- Roles
- Apps
- etc

Documents Management

- Folder
- Version
- Model Visualization
- 3D model/2D drawing
- Phases, rooms, levels...
- PDF, markup, hyperlink
- Review
- etc

Design Collaboration

- Real-time Revit cloud worksharing and collaboration workflows for Civil 3D and Plant 3D
- Connect design teams to improve project outcomes
- Improve productivity, reduce rework, and accelerate project delivery

Field Management

- Issue

- General data, assignee, status, type, sub-type, due-date, documents, pushpin...

- Checklist

- sections, item, fields, answers..

The screenshot shows the Autodesk BIM 360 Field Management interface. A modal window is open for an issue titled '#180' with the ID 'Incorrect lighting fixture'. The modal includes tabs for DETAILS, ATTACHMENTS, and ACTIVITY. The DETAILS tab displays information such as Assigned to (Andy Thelwell), Type (Quality), Due Date (Nov 5, 2018), Sub-type (Quality), Location (Level 3 > ... > su level 2), Owner (Krystian Macek), and Location Details (Unspecified). The root cause is listed as 'Design Change'. The background shows a list of other issues.

Project Management

- RFI

- General data, transitions, assignee, status, due-date, documents, pushpin...

- Submittals

- Meetings

The screenshot shows the Autodesk BIM 360 Project Management interface. A modal window is open for an RFI titled '#45' with the ID 'Verify above ceiling elements with room dimension change'. The modal includes tabs for DETAILS, ATTACHMENTS, and ACTIVITY. The DETAILS tab displays a question about room dimension changes and a suggested answer about ensuring MEP changes are reflected. The status is marked as 'CLOSED'. The background shows a list of other RFIs.

Asset Management

- General data

- Categories

- Details, linked Issues, Checklists...

- Status

The screenshot shows the Autodesk BIM 360 Asset Management interface. A modal window is open for an asset titled 'AHU-998'. The modal includes tabs for DETAILS, ISSUES, CHECKLISTS, and ATTACHMENTS. The DETAILS tab displays asset details such as Asset ID (AHU-998), Category (Air Handling Units (AHU's) > Air Cooled Chiller), Description (Performance Climate Changer Air Handler Floor 2), Barcode (Unspecified), Location (Unspecified), Serial number (Unspecified), Submittal (Unspecified), Purchase order (Unspecified), Purchase date (Unspecified), Installation date (Unspecified), Warranty start date (Unspecified), Warranty end date (Unspecified), and Expected life (years) (Unspecified). The background shows an asset tree and a list of other assets.

Clashes X

Group By {3D}_Hospital_L2_HVAC.rvt

433 OBJECTS WITH CLASHES

- Rectangular Duct [710399] 4 clashes with 1 other model
- Basic Wall [197837]
- Basic Wall [197807]
- Basic Wall [197808]
- Basic Wall [197814]
- Rectangular Duct [710449]

Not an issue Issue 4 clashes

Clash detection interface showing a large green 'X' over the 3D model, indicating a collision between a rectangular duct and a wall. The interface includes a sidebar for grouping and filtering clashes.

AUTODESK BIM 360 | United Construction > Pacific Center Campus

Cost Management

BUDGET CONTRACT COST ITEM PCO RFQ RCO OCO SCO

Budget Trend

Original Revised Projected

	MEP	Envelope package	Concrete Substructur...	Solar Protection	Site Management Sta...
Original	~17.5M	~11.5M	~10.5M	~5.5M	~5.5M
Revised	~17.5M	~11.5M	~10.5M	~5.5M	~5.5M
Projected	~17.5M	~11.5M	~10.5M	~5.5M	~5.5M

Cost Trend

Original Forecast

	MEP	Envelope package	Concrete Substructur...	Solar Protection	Site Management Sta...
Original	~18M	~12.5M	~10.5M	~5.5M	~5.5M
Forecast	~18M	~12.5M	~10.5M	~5.5M	~5.5M

Export

General Budget

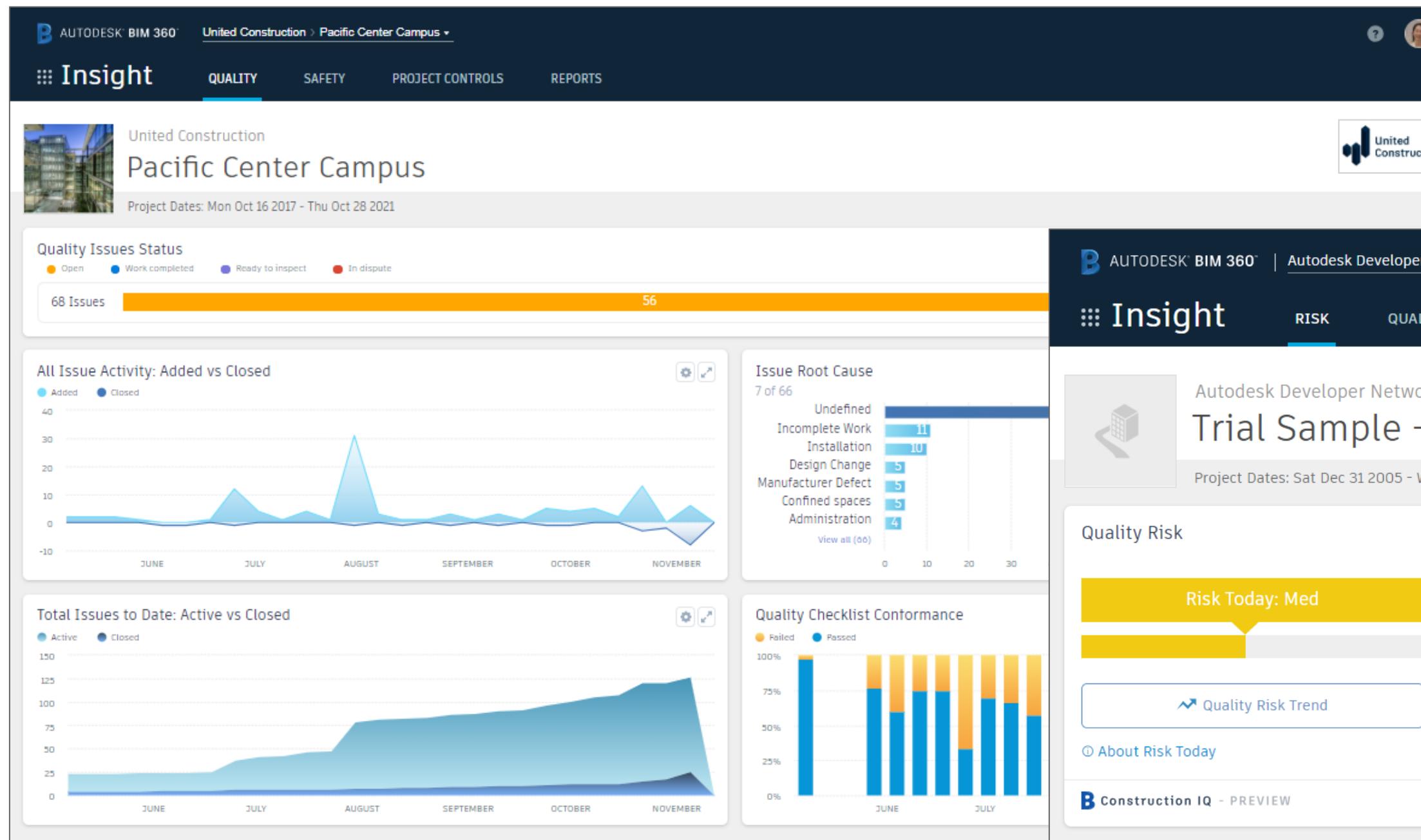
Contract Code	Contract Name	Supplier	Type	Original Budget	Internal Adjs	Approved Owner Changes	Revised Budget	Pending Owner Changes	Projected Budget	Comm
1011	Site Management S...	Internal	102,454,5...	0.00	1,053,652.56	103,508,1...	1,995.63	103,510,1...	102,15	
1012	Post Construction S...	Internal	5,590,416...	0.00	0.00	5,590,416...	0.00	5,590,416...	5,59	
1111	Accommodation	Internal	21,449.14	0.00	0.00	21,449.14	0.00	21,449.14	21,44	
1112	Site Accommodation	Internal	473,622.72	0.00	0.00	473,622.72	0.00	473,622.72	473,62	

Model Coordination

- Coordination Space
- Model Collections
- Clash Results
 - Matrix View, Breakdown View
- Clash Issue

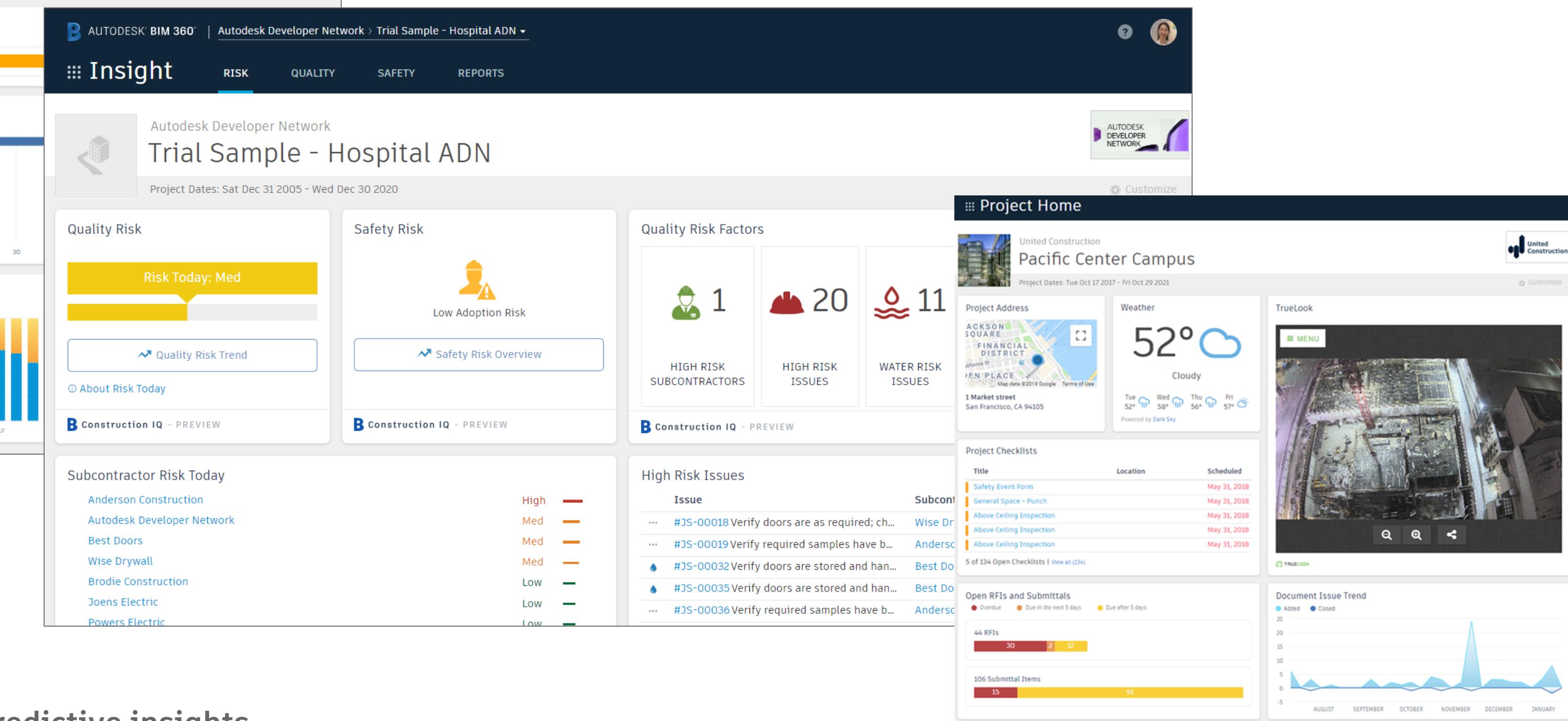
Cost Management

- Budget
- Change Order
- supplier contracts
- Budget impacts
- RCO, OCO, SCO etc..



Insights

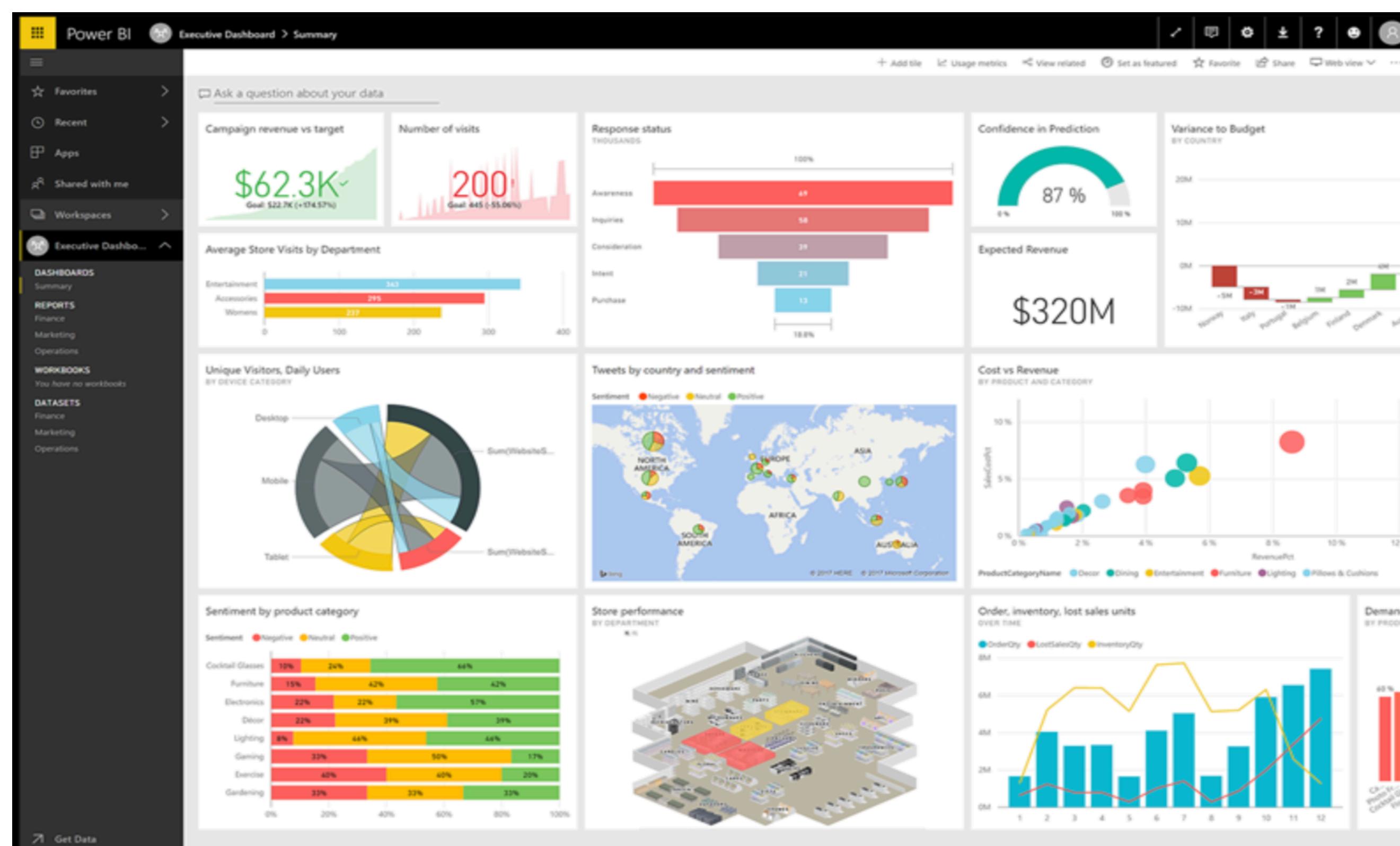
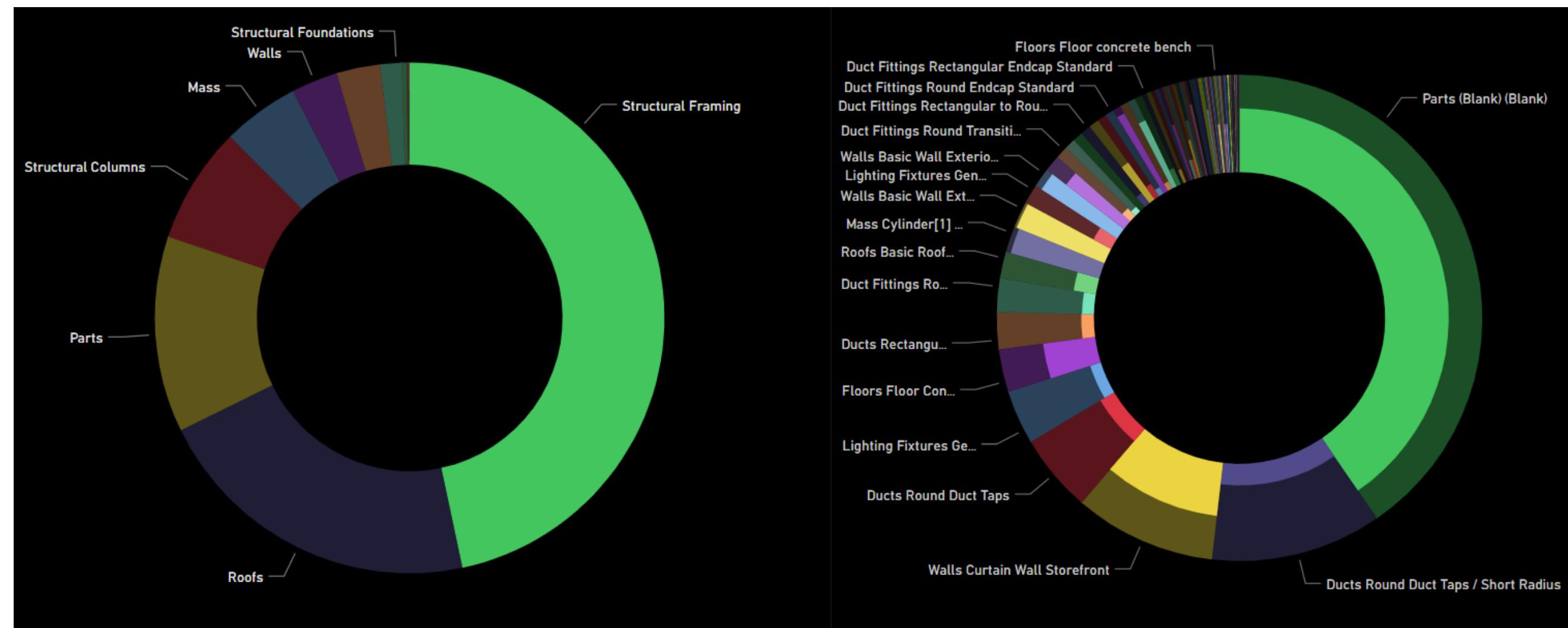
- Unified project-level data, analytics, and predictive insights.
- Review project data by intelligent cards
- Overview of metrics related to the current high-risk issues in project.
- Overview of metrics related to design review and model coordination processes.
- Overview of metrics related to the issues, RFIs, and submittals associated with project.
- Overview of cost and budget trends, such as the original vs projected budget for different aspects of the project.
- Overview of metrics related to the quality of the project.
- Support custom cards



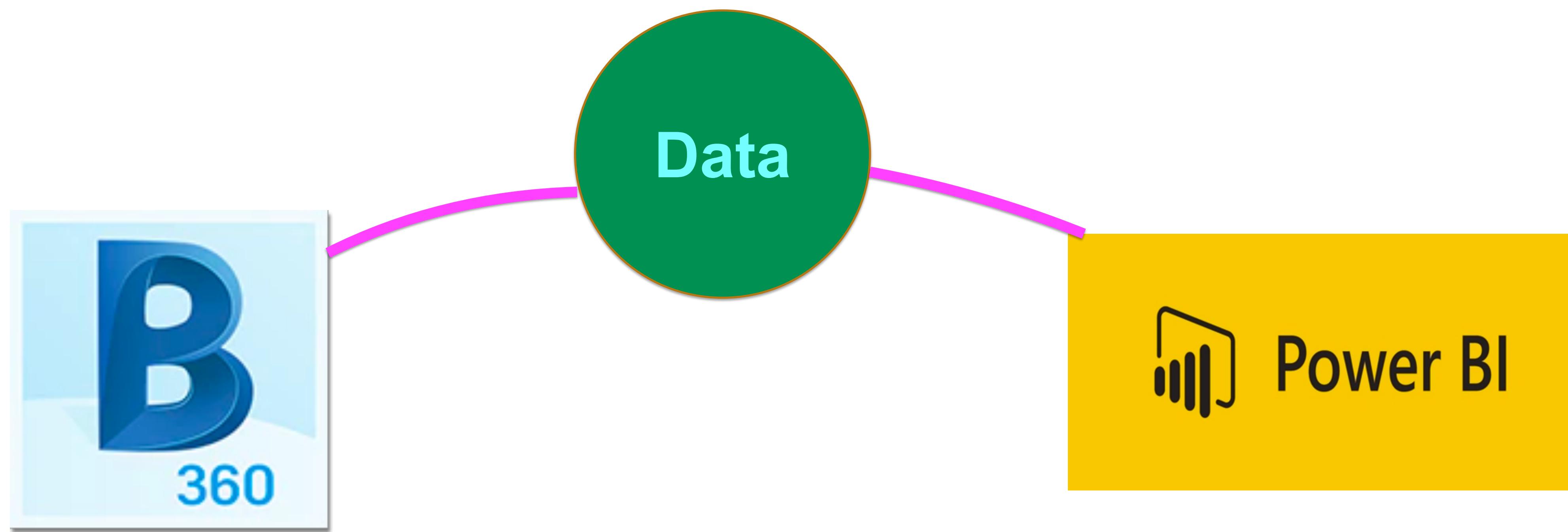
Power BI



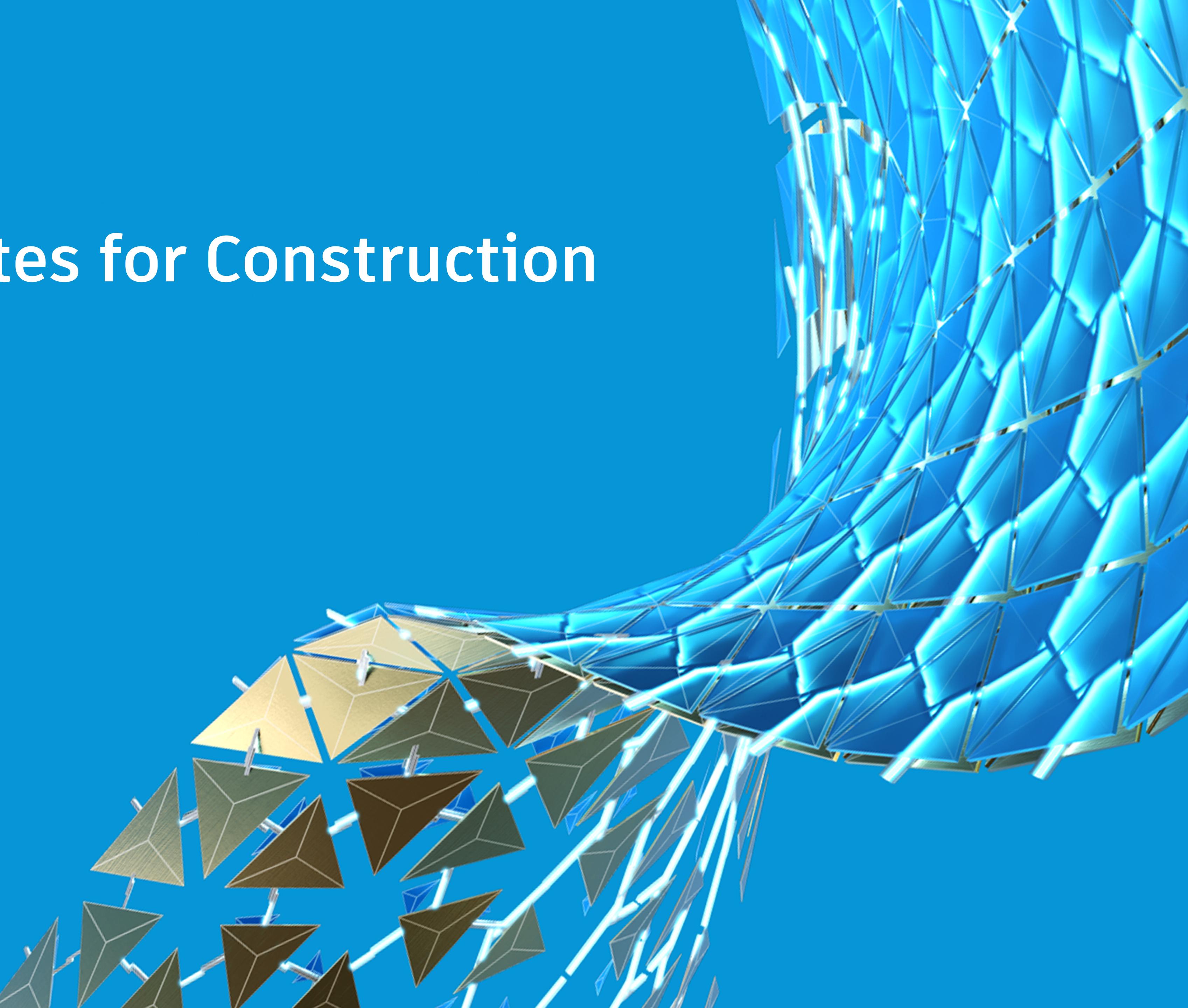
- Data analysis intelligently
- Rich types of visuals: general dashboards types, and huge number of custom visuals in AppSource
- Data modeling directly and interactively
- Generating, refreshing, data associating, data sorting, data mining automatically.
- Data searching and classifying efficiently
- Desktop version and web version
- Import data by file, database, data stream (IoT), scripts, custom data etc..
- Support custom visual
- Nice web services, embedded container, easy integration.



Key is Data

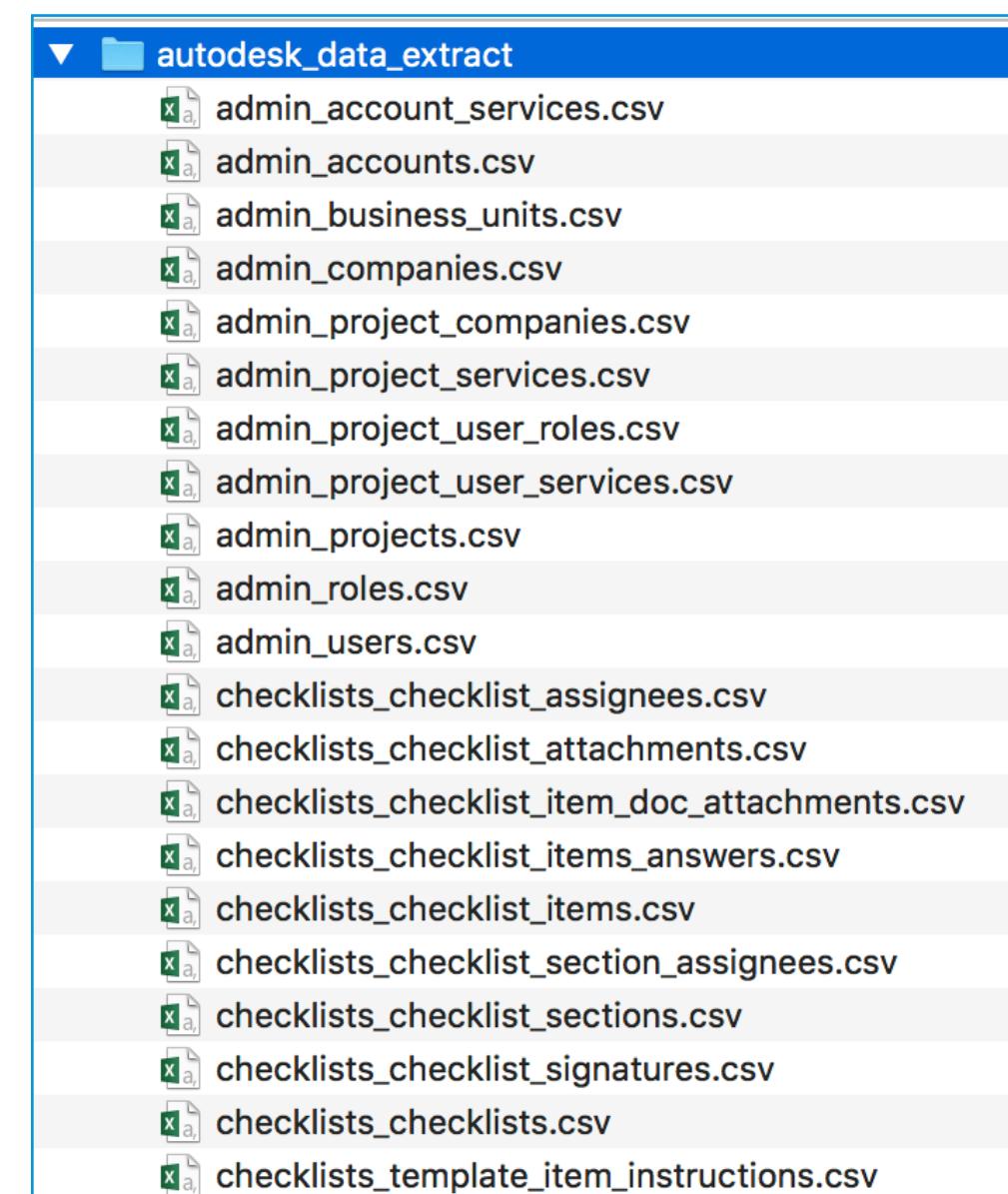
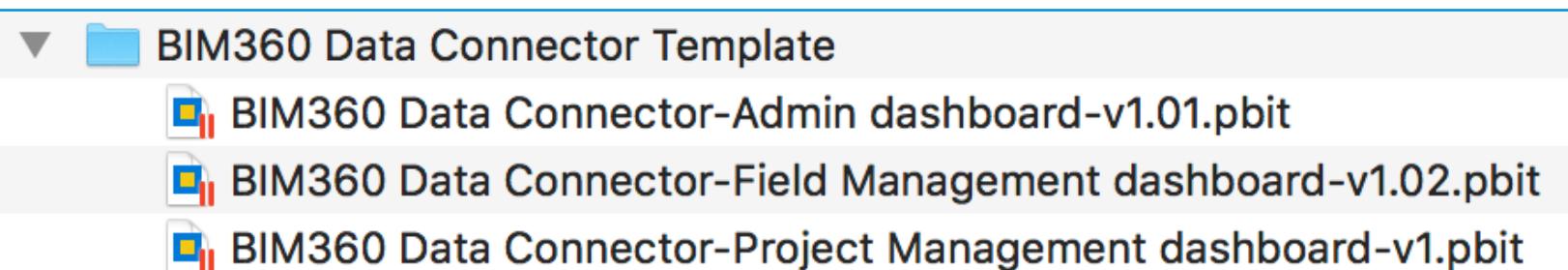


Power BI Templates for Construction



Data Connector

- Extract the account-level data
- Admin data
 - Activated services, Business units, Companies ,Projects, Users ,Roles
- Project data
 - Checklists, Cost, Daily logs, Issues, Locations, Submittals, RFIs
- Provide some Power BI reports templates
 - Admin dashboard
 - Project dashboard
 - RFI dashboard



AUTODESK® BIM 360™ | Autodesk Forge Partner Development ▾

Insight **RISK** **DESIGN** **QUALITY** **SAFETY** **DATA**

Data Connector Preview Run

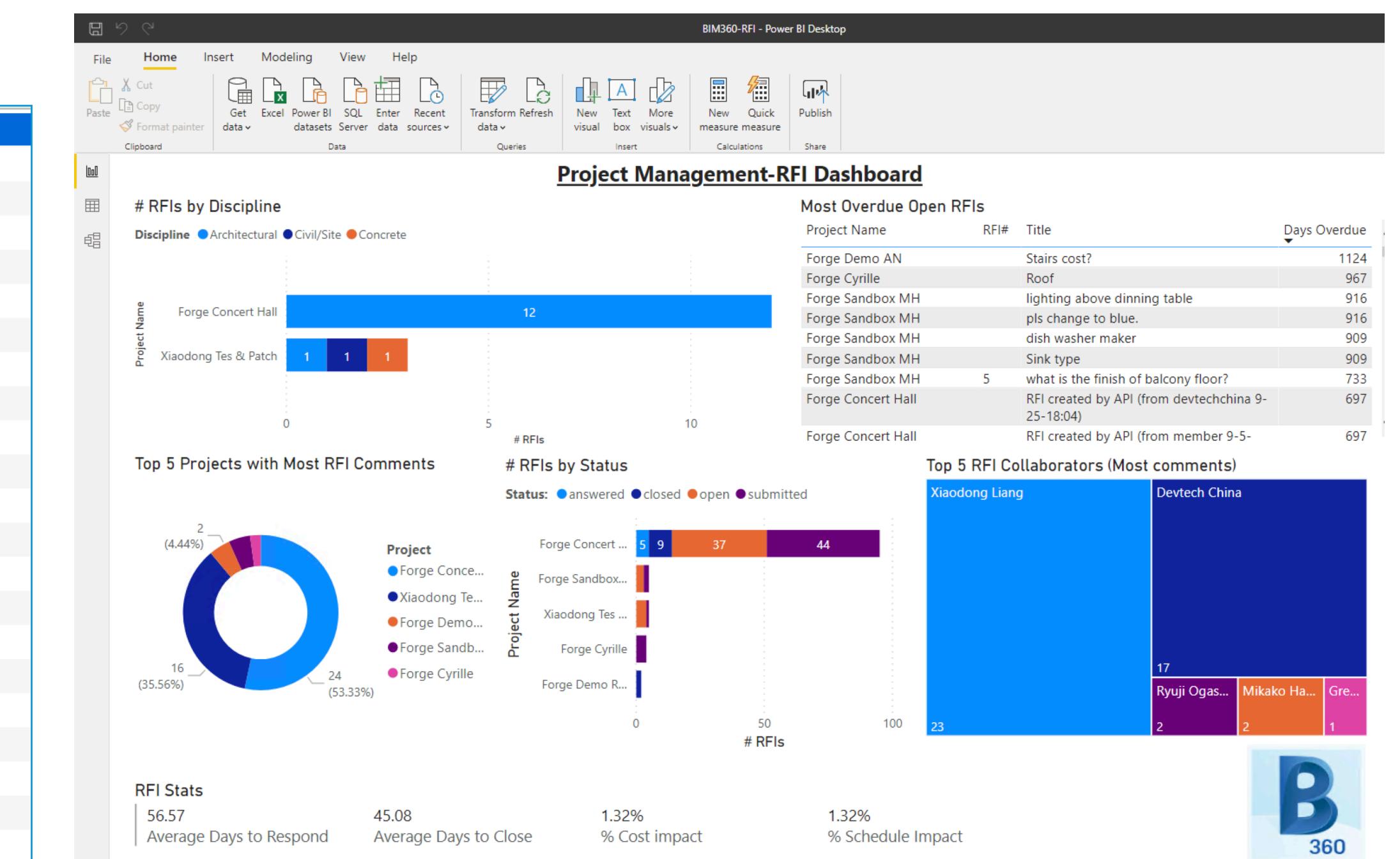
The data connector will automatically extract data from: Account projects, Companies, Users, Roles, and Business Units as well as Project Users, Project Companies (including archived projects), Project Roles, Issues, Checklists, Daily Logs, Locations, Submittals and Cost.

Generated files are only available for **30 days** after creation

AVAILABLE EXTRACTIONS

Created

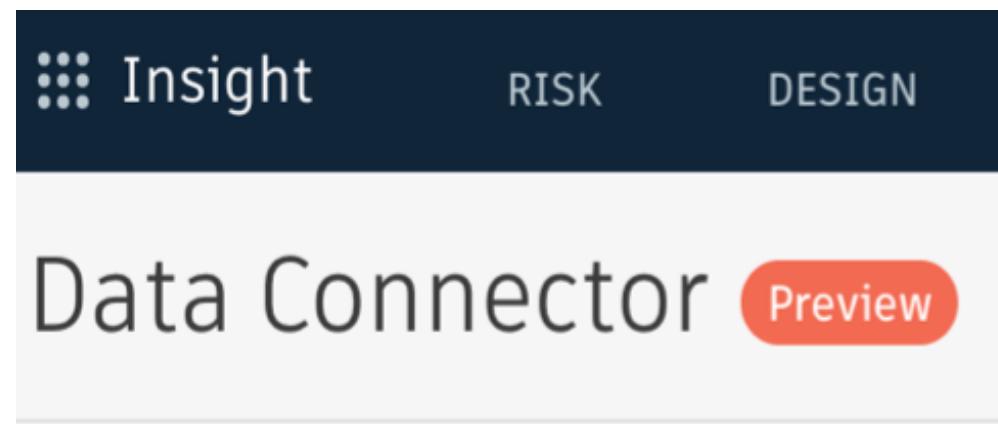
Aug 27, 2020 2:43 PM



Possible Data Sources for Report without Coding

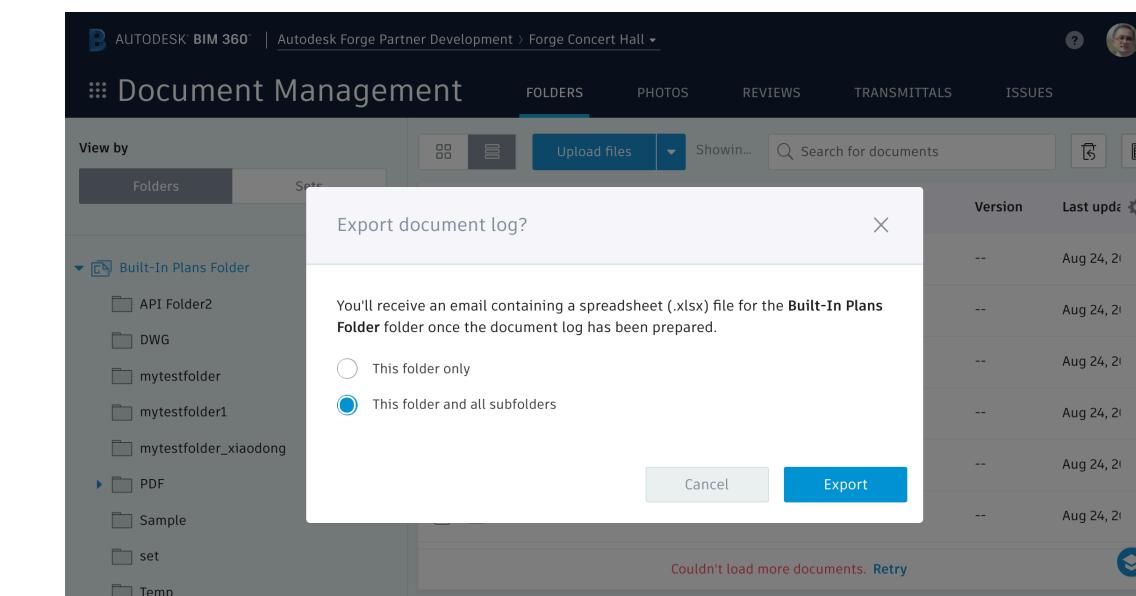
EXPORT BY BIM360 DATA CONNECTOR

- Most admin data and field management data
- Some data might not be available



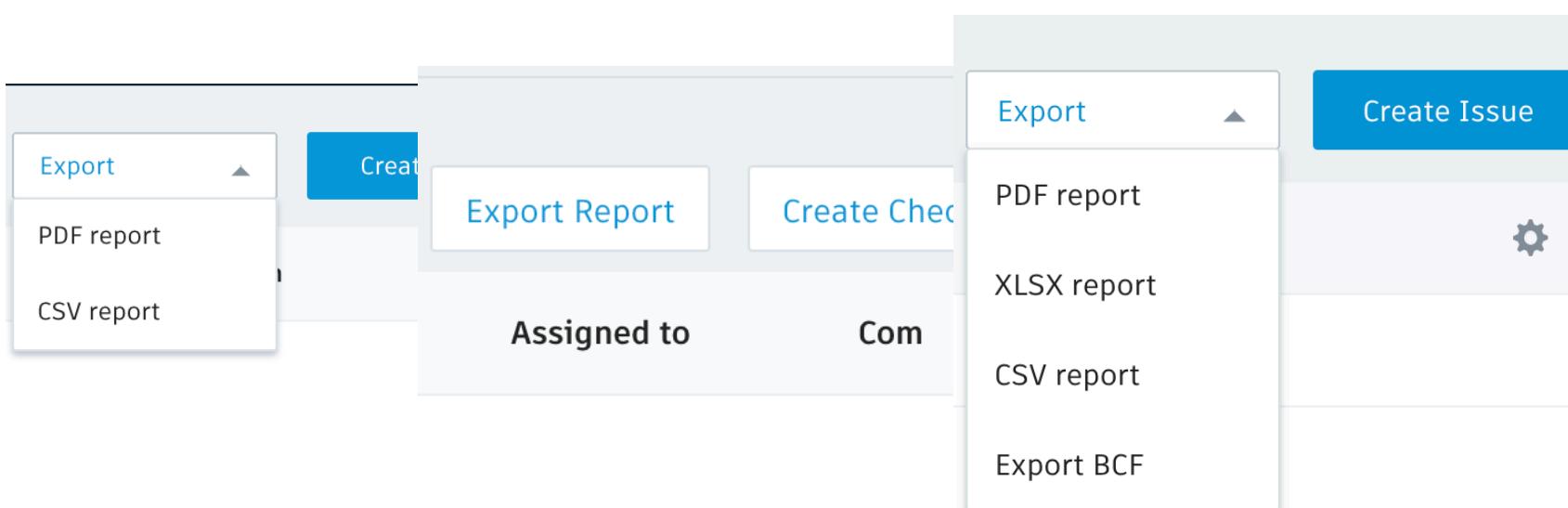
DOCUMENT LOGS

- General data of documents
- Documents in one folder and subfolder only



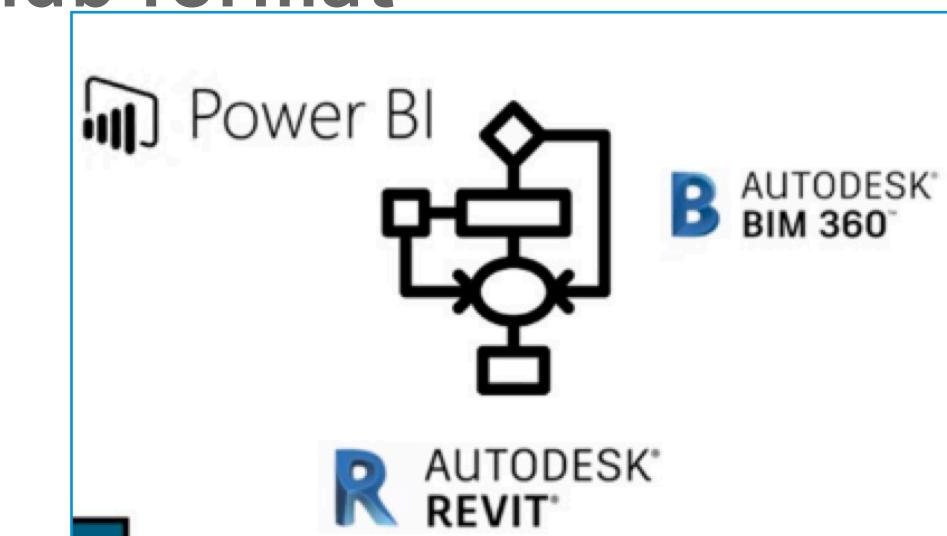
ISSUE/RFI/CHECKLIST REPORT

- Easy to dump data of these entities
- Data of one project only
- Some data might not be available

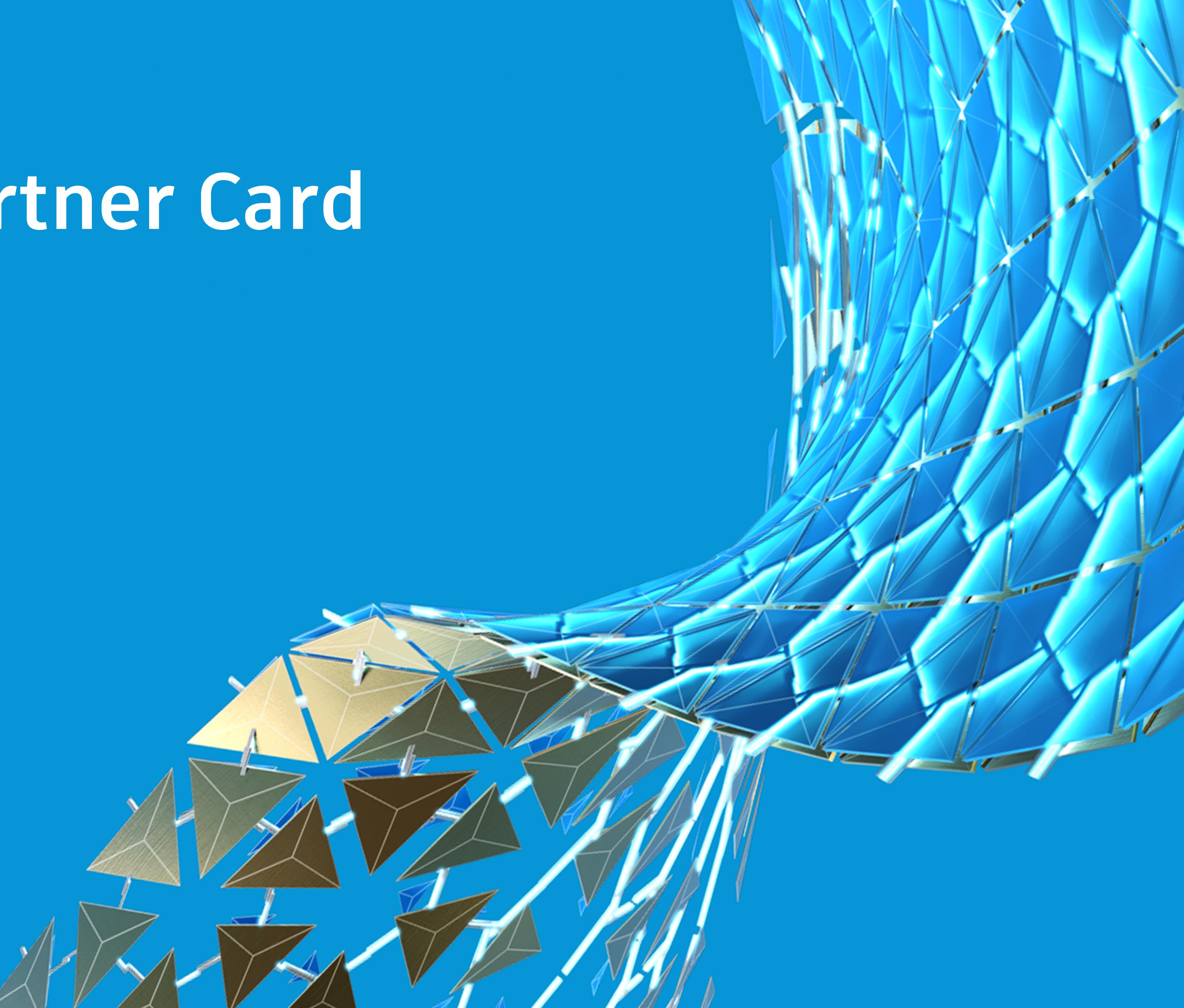


REVIT DATABASE LINK

- Depend on Revit
- One model metadata only
- In mdb format



Power BI Partner Card



Partner Card

- iFrame configuration
 - URL provided by the partner company when you subscribe or purchase the application
 - Or, URL can be accessed by 3rd party
 - Power BI, Domo,AOMS,Clarity...

The screenshot shows the Autodesk BIM 360 Insight interface. At the top, there's a navigation bar with the Autodesk BIM 360 logo, the current project 'Forge Concert Hall', and a dropdown menu. Below the navigation is a dark header bar with the word 'Insight' and tabs for RISK, DESIGN, PROJECT CONTROLS, COST, and SCHEDULE.

The main area is titled 'Customize Dashboard' and contains several cards:

- Quality Risk**: Shows 'Risk Today: Low' with a green bar chart.
- Safety Risk Today**: Shows 'Low Adoption Risk' with a yellow warning icon.
- Subcontractor Risk Today**: Lists subcontractors like Anderson Plumbing, Autodesk, Daqri, Autodesk Construction, and Autodesk Forge Partner Development, each with a low risk rating.

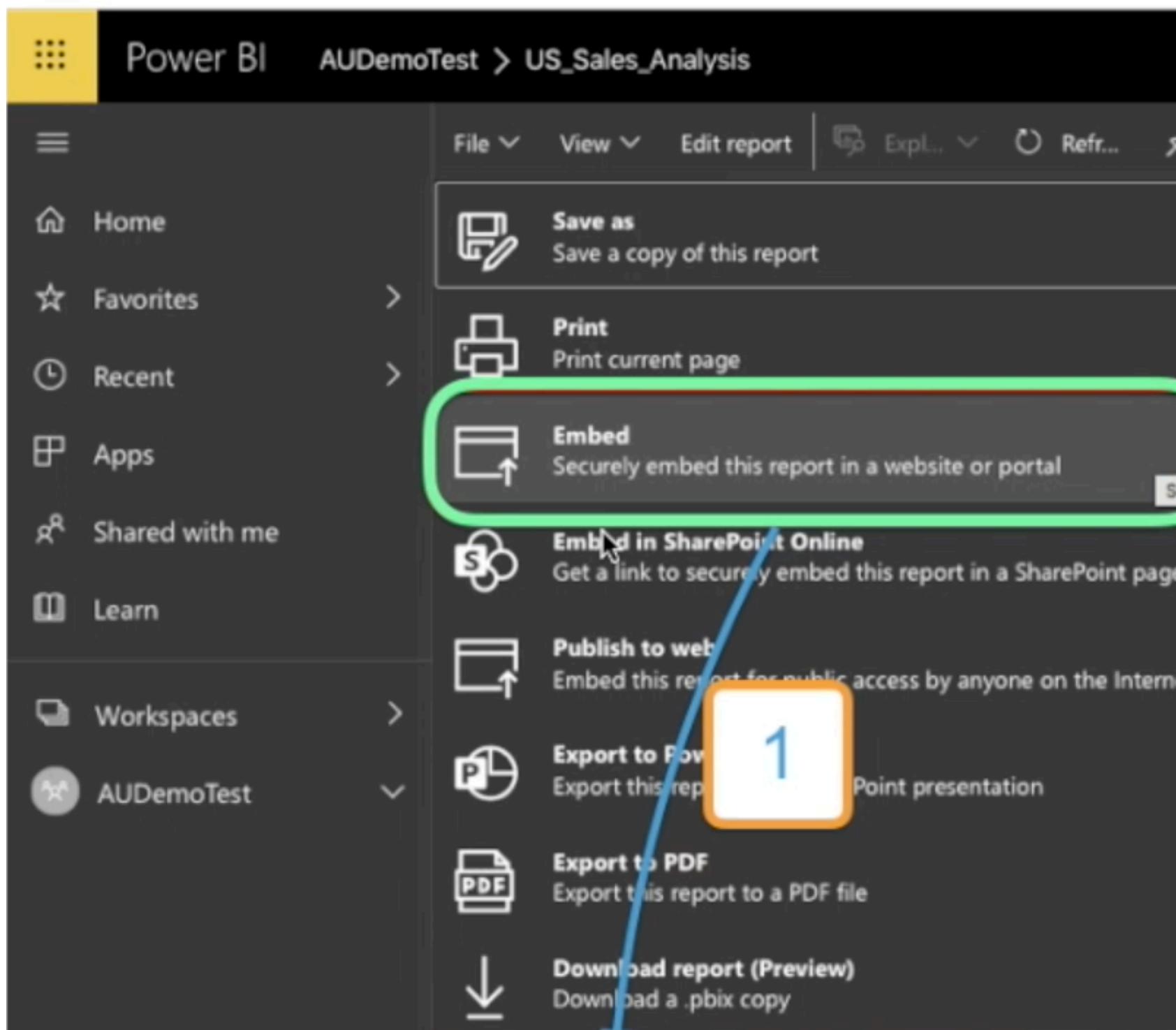
A central sidebar is titled 'Card Library' and contains a search bar and filters. The filters include categories like Construction IQ, Companies, Issues, Project Controls, Design, Reviews, RFIs, Submittals, Quality, Safety, Cost, Schedule, Partner Cards, and Planning. Below the filters is a grid of cards from various partners:

- PIX4D
- Power BI
- PPC SNAPSHOT
- PROJECT ADDRESS
- onTarget
- Pype

A modal window titled 'Configure Card' is open in the bottom right corner. It has fields for 'Card Title' (set to 'Project Schedule') and 'Partner URL'. There are 'Cancel' and 'Save' buttons at the bottom. The background of the modal is semi-transparent, showing the 'Project Schedule' and 'High Risk Quality Issues' sections of the dashboard.

Power BI Card

Embed with BIM 360 Insights



Secure embed code

Here's a link you can use to embed this content.

<https://app.powerbi.com/reportEmbed?reportId=781492ef-74d8-4249-97f6-bf749c994659>

HTML you can paste into a website

```
<iframe width="1140" height="541.25" src="https://app.powerbi.com/reportEmbed?report
```

Close

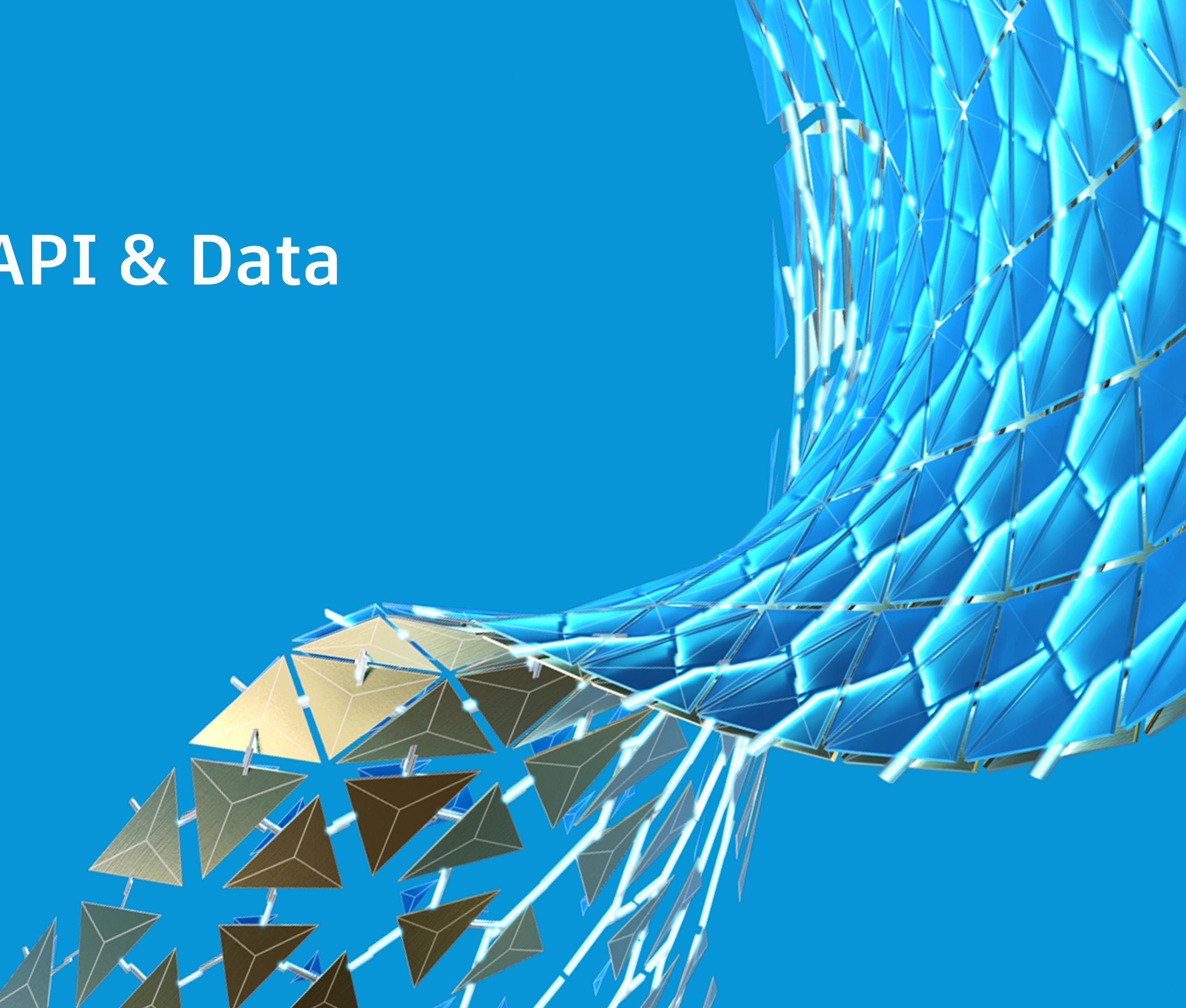
The screenshot shows the Autodesk BIM 360 Insights dashboard. At the top, it says "AUTODESK BIM 360 | Autodesk Forge Partner Development > Forge Concert Hall". The navigation tabs include RISK, DESIGN, PROJECT CONTROLS, COST, SCHEDULE, QUALITY, SAFETY, and REPORTS. Below that is a section titled "Customize Dashboard" with the sub-instruction "Organize the order and add new cards to your dashboard". A large Power BI card is embedded in the center of the dashboard, showing various data visualizations related to RFIs and project management. A pink oval surrounds the Power BI card, and a blue arrow points from the "Secure embed code" section of the previous screenshot to the "Secure embed code" section of this screenshot. Another blue arrow points from the "Embed" option in the Power BI menu to the Power BI card on the dashboard.

DEMO

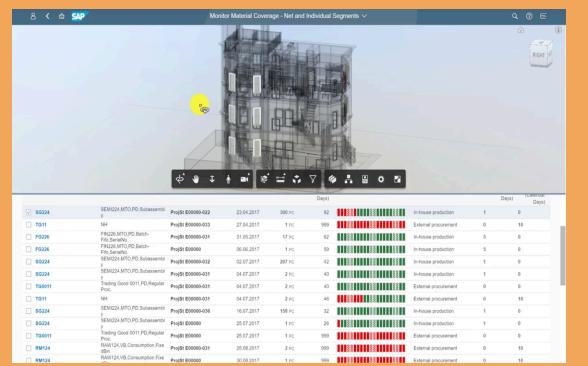
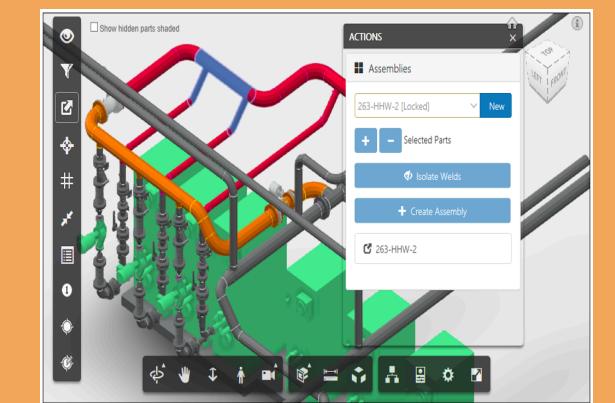
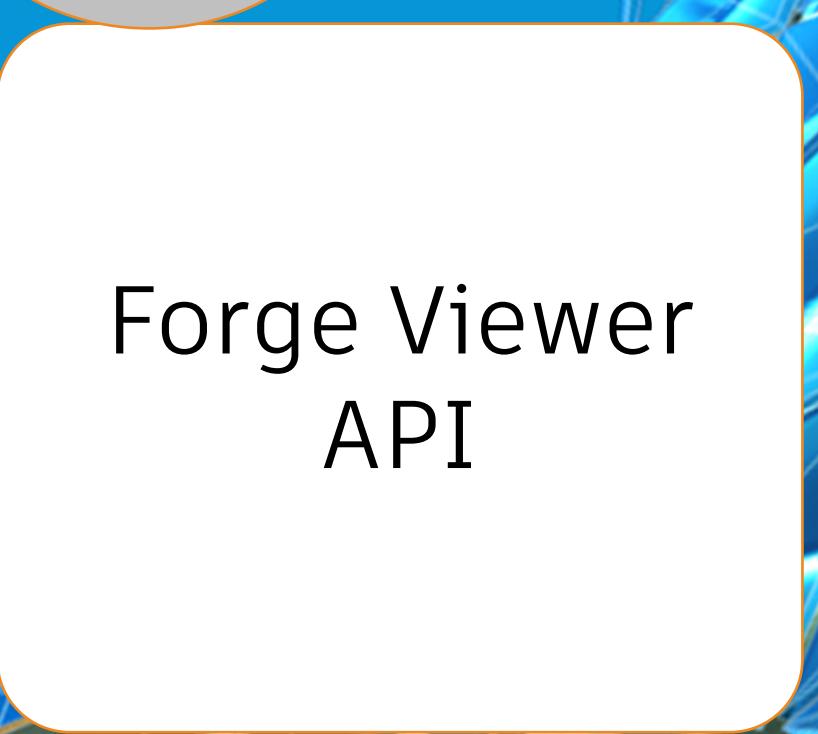
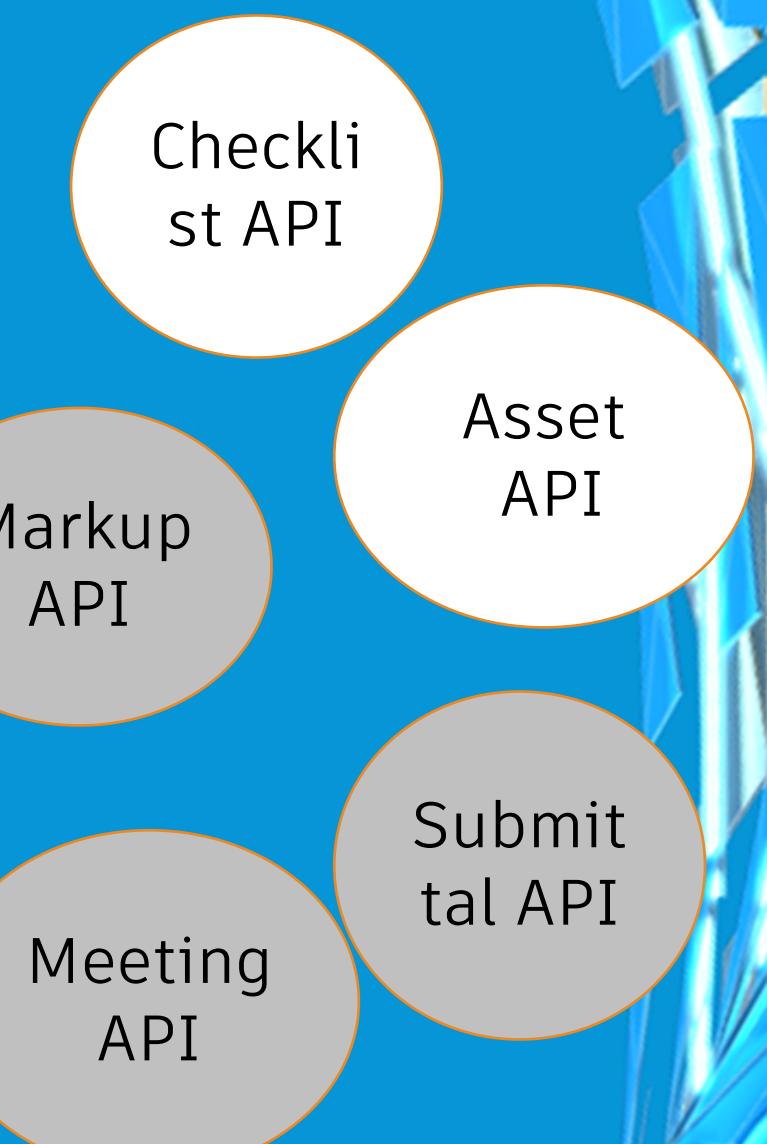
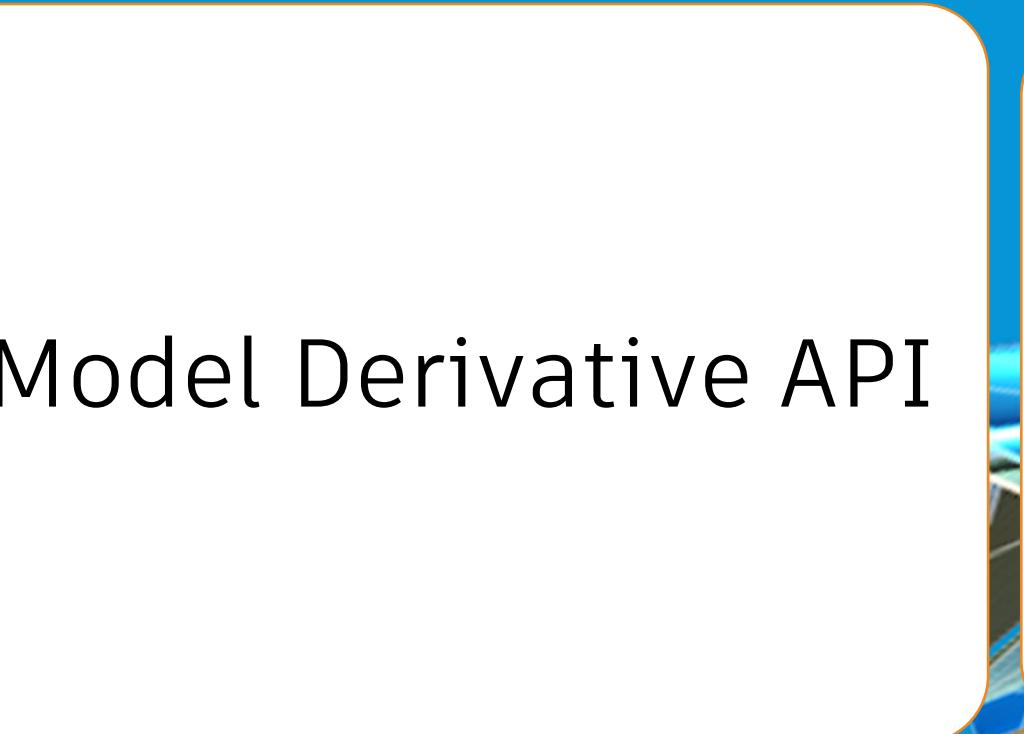
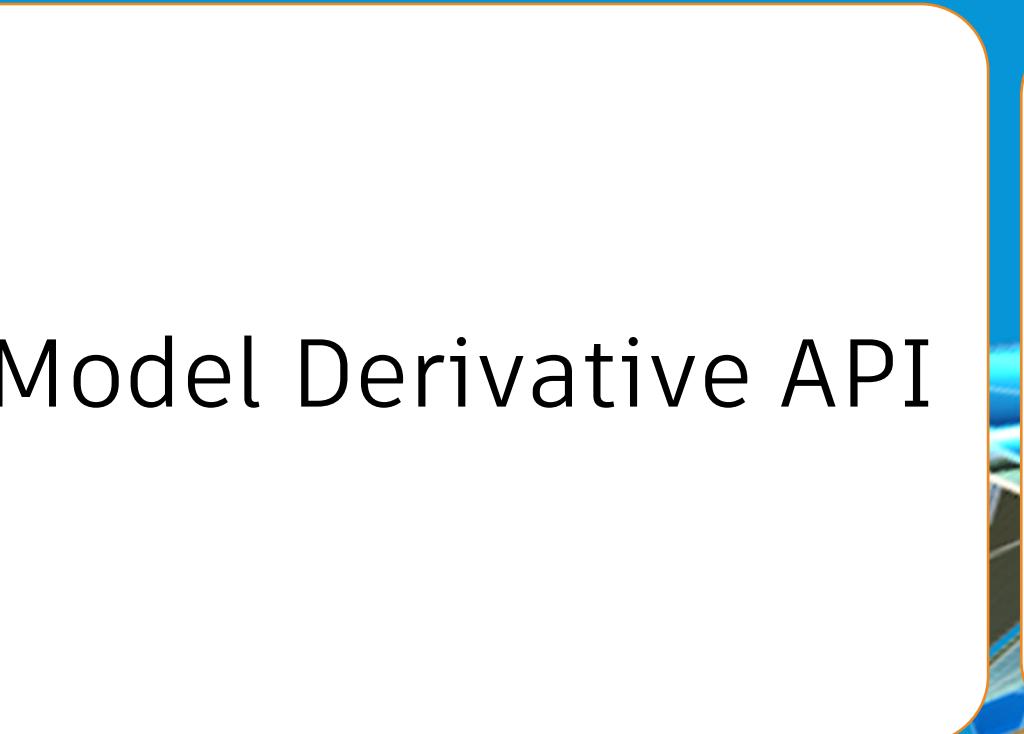
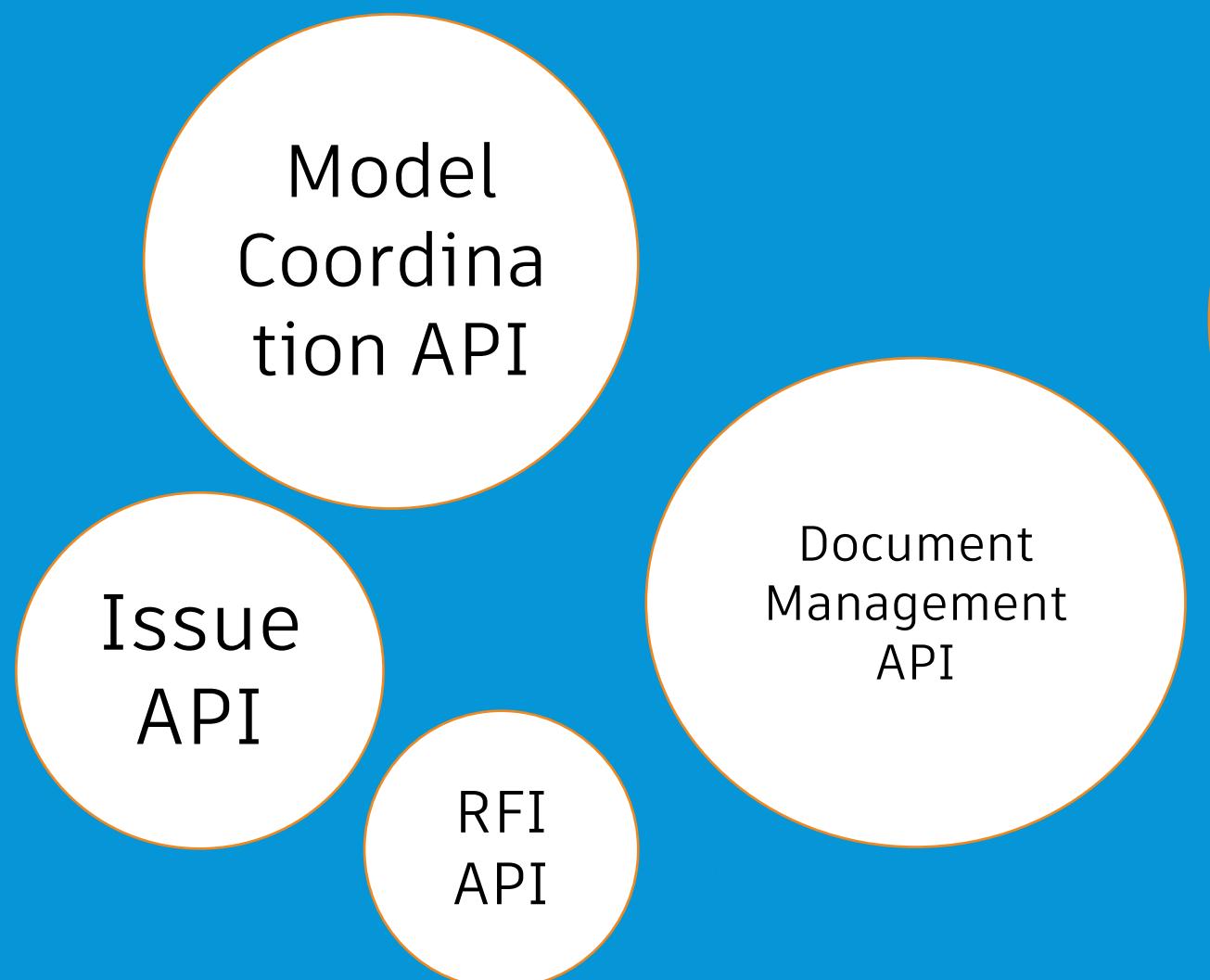
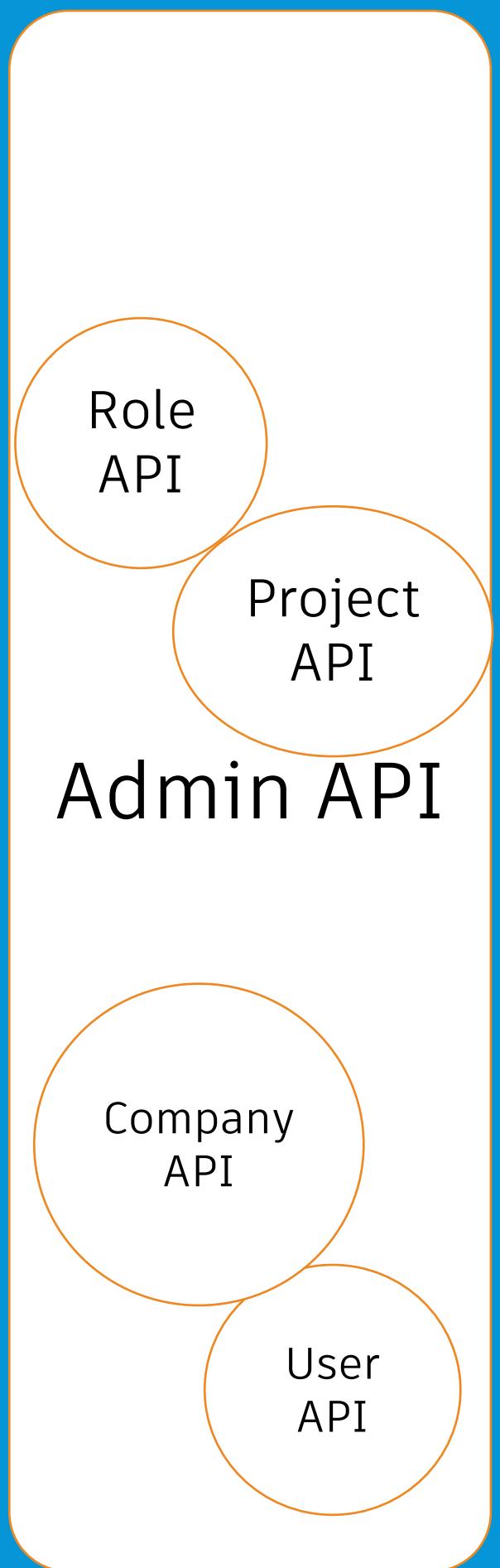
Power BI Templates for Construction

Power BI Partner Card

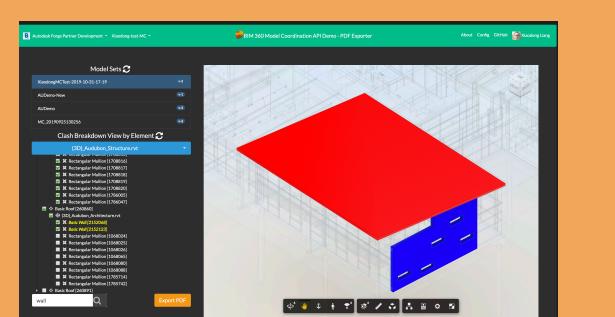
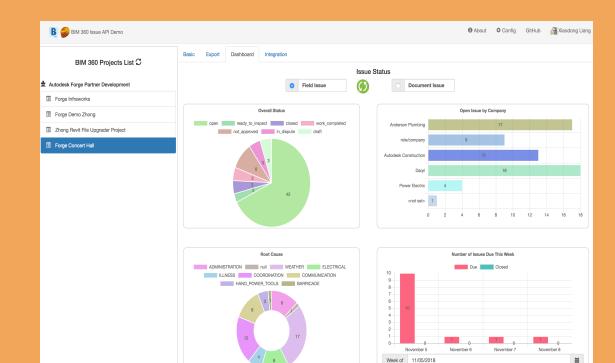
BIM 360 Forge API & Data Extraction



BIM 360



3rd Party Application



Authentication
Authorization

Webhook

Others

BIM 360 Fundamental Data Environment

Basic Steps to Start

STEP 1

CREATE FORGE APP

- Register Forge account
- Create Forge app
- Client ID
- Client Secret
- Callback URL

STEP 2

INTEGRATE APP WITH BIM360

- Approve the app to access BIM360 data (Admin/Docs)
- Or invite the app to access

STEP 3

CALL BIM360 WEB SERVICES

- Follow web service help to build the calling (by code or by tool)
- Input authentication token (2-legged) or authorization token (3 legged token)
- Set necessary scopes: data:read, or account:read
- Input query parameters

STEP 4

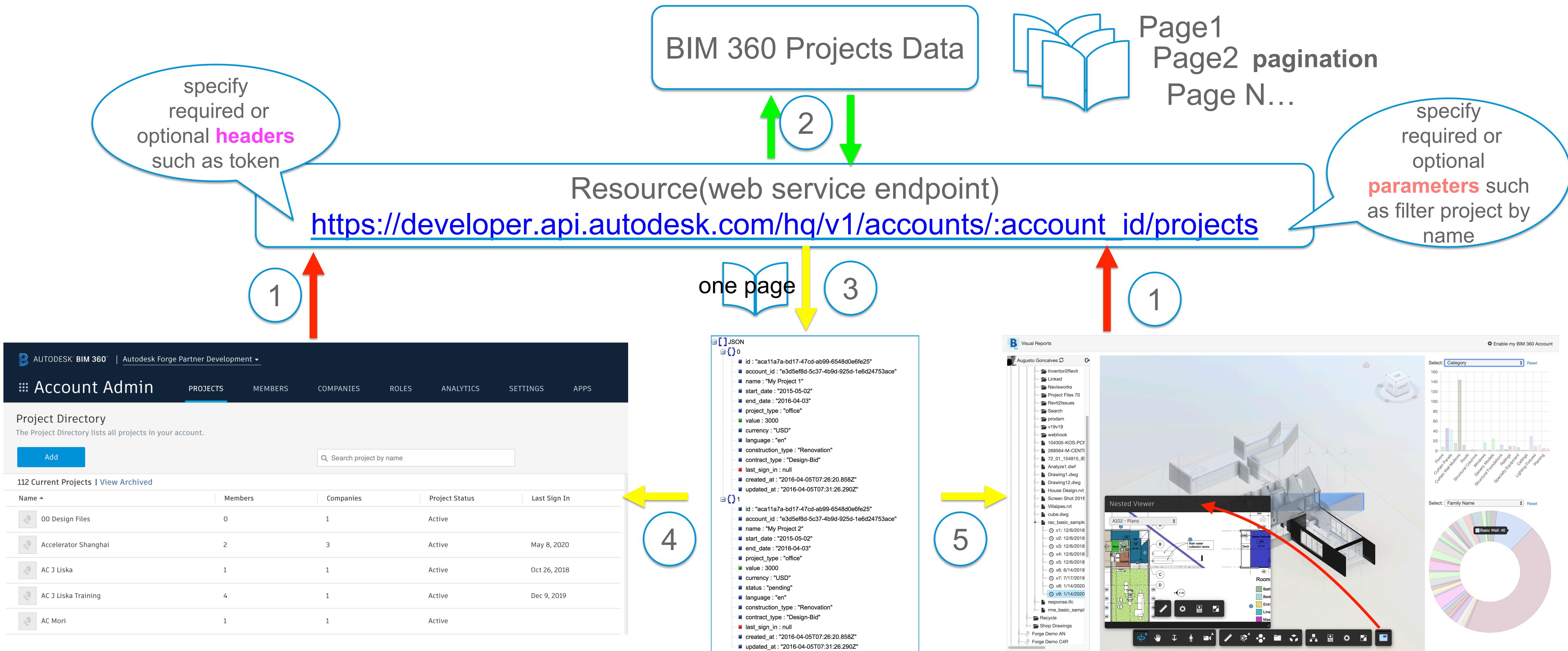
USE RESPONSE DATA

- Json format
- Key-value pair or array
- Inject to web app or analysis

```
JSON
[{"id": "aca11a7a-bd17-47cd-ab99-6548d0e6fe25", "account_id": "e3d5ef8d-5c37-4b9d-925d-1e6d24753ace", "name": "My Project 1", "start_date": "2015-05-02", "end_date": "2016-04-03", "project_type": "office", "value": 3000, "currency": "USD", "language": "en", "construction_type": "Renovation", "contract_type": "Design-Bid", "last_sign_in": null, "created_at": "2016-04-05T07:26:20.858Z", "updated_at": "2016-04-05T07:31:26.290Z"}, {"id": "aca11a7a-bd17-47cd-ab99-6548d0e6fe25", "account_id": "e3d5ef8d-5c37-4b9d-925d-1e6d24753ace", "name": "My Project 2", "start_date": "2015-05-02", "end_date": "2016-04-03", "project_type": "office", "value": 3000, "currency": "USD", "status": "pending", "language": "en", "construction_type": "Renovation", "contract_type": "Design-Bid", "last_sign_in": null, "created_at": "2016-04-05T07:26:20.858Z", "updated_at": "2016-04-05T07:31:26.290Z"}]
```

BIM 360 Forge API is RESTful

Quoted from wikipedia: Representational state transfer (REST) is a software architectural style that defines a set of constraints to be used for creating Web services.



Extract Data by RESTful Tool

Get data without coding or with a little coding

- Easy for test endpoints
- Support 2 legged token and 3 legged token workflow
- Support post and pre scripts
- Support batch running
- Limitations:
 - Some manual interferences are required
 - Loop for dumping all records with coding
 - Default response format is Json. Need to convert to flat format separately
 - No way to auto-export all records to local file

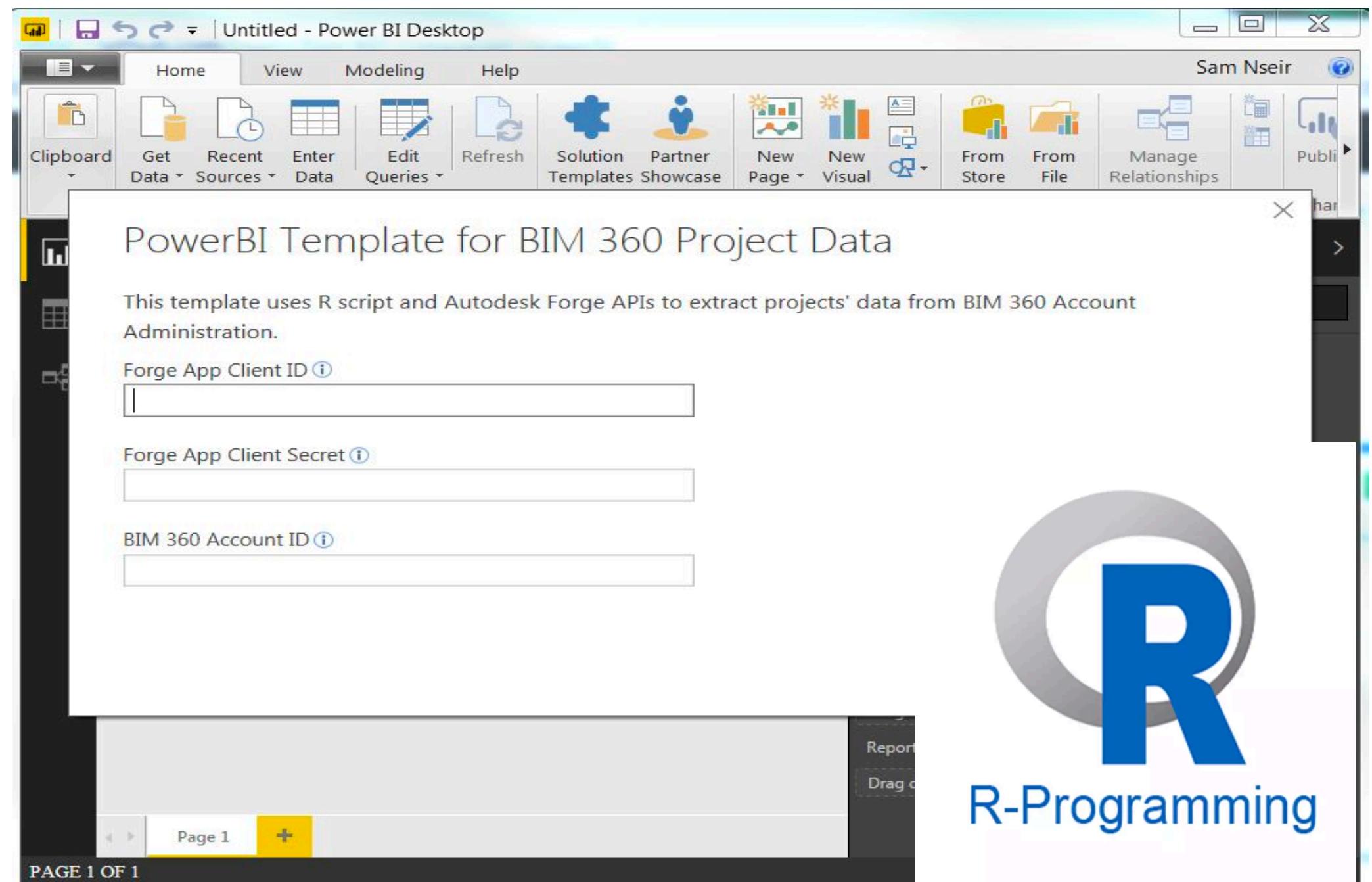
The screenshot shows the Postman application interface. On the left, there's a sidebar with a search bar and tabs for 'History', 'Collections', and 'APIs'. A 'New Collection' button is visible. Below these are several collections: 'Extract BIM360 Data' (selected), 'Authentication - 2 Legged Token- (data of Admin, Documents)', 'Forge DA - AutoCAD - v2 -Japan', 'Forge Design Automation V3 -Japan', 'Forge Workshop US', 'API Custom Attributes', 'AutoCAD DA v3', 'AutoCAD DA v3 Copy', 'BIM 360 Checklist API Test', 'BIM 360 Docs API - EMEA', and 'BIM 360 Docs API Stg'. The 'Extract BIM360 Data' collection has 4 requests. The main workspace shows a 'GET Projects' request under the 'Extract BIM360 Data' collection. The 'Headers' tab is selected, showing a single header 'Authorization' with the value 'Bearer {{access_token}}'. The 'Body' tab displays a JSON response for a project, which is partially shown below:

```
1 [  
2 {  
3   "id": "b7a13196-6f69-430b-ad54-114dfb4e46d8",  
4   "account_id": "a4f95080-84fe-4281-8d0a-bd8c885695e0",  
5   "name": "Forge Demo AG",  
6   "start_date": "2016-10-13",  
7   "end_date": "2019-10-31",  
8   "value": 1300000.0,  
9   "currency": "USD",  
10  "status": "active",  
11  "job_number": "1001-254-9900",  
12  "address_line_1": "1 market st",  
13  "address_line_2": "",  
14  "city": "San Francisco",  
15  "state_or_province": "California",  
16  "postal_code": "",  
17  "country": "United States",  
18  "business_unit_id": "e942fb46-7cbb-4291-b89c-67d9ae735ec9",  
19  "created_at": "2016-10-13T04:36:14.809Z",  
20  "updated_at": "2020-08-25T21:51:36.656Z",  
21  "project_type": "Demonstration Project",  
22  "timezone": "America/Sao_Paulo",  
23  "language": "en",  
24  "construction_type": "New Construction",
```

DEMO

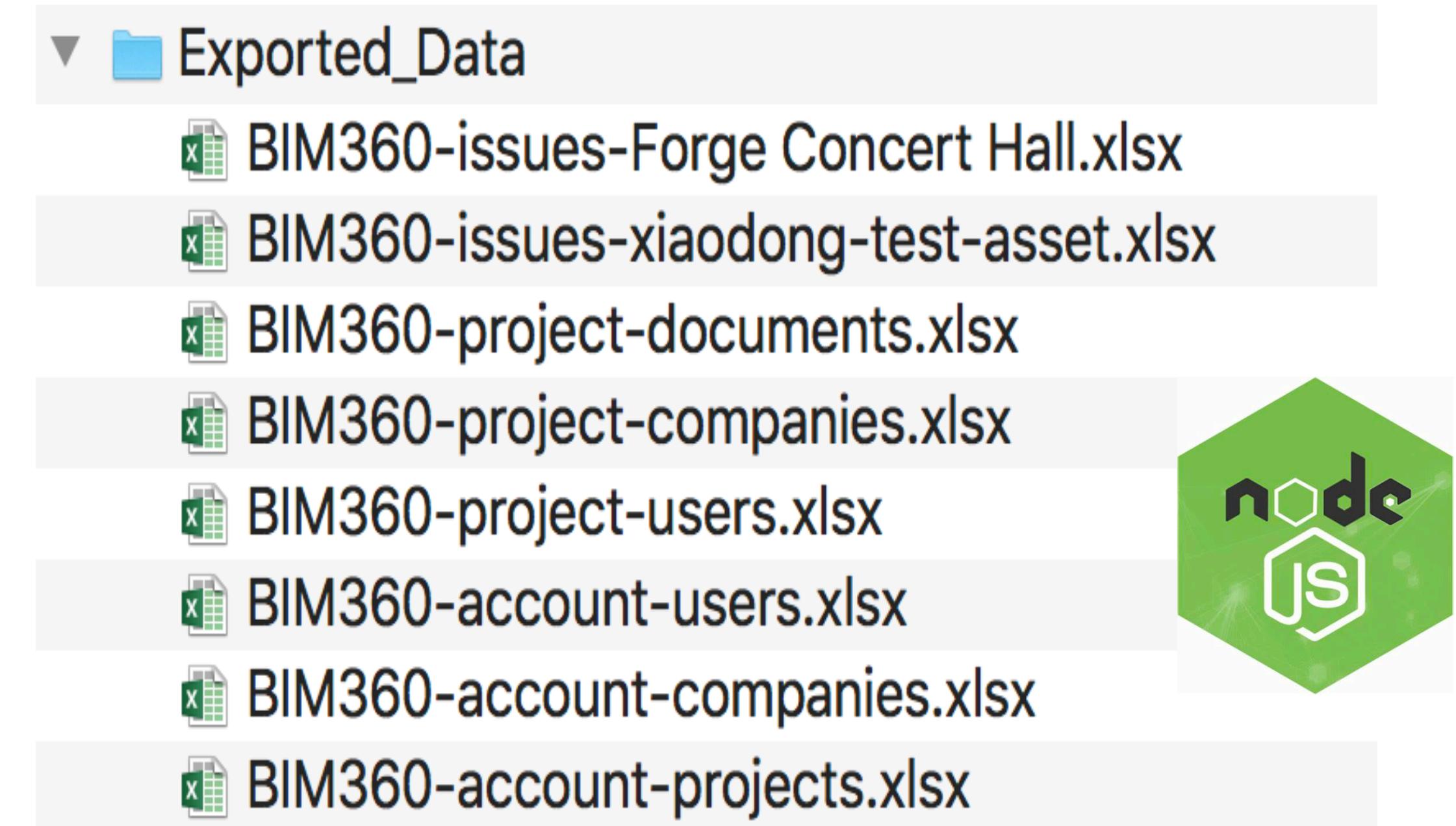
Extract BIM360 Data by Postman

Extract Data by Script



Less coding with R Scripts - Sam

- Import BIM360 admin, or document data to Power BI report
- Import BIM 360 feature data to Power BI report
- Easy to use (copy paste the demo code)
- One time execution, hard to debug and troubleshooting
- Tricky to work with 3 legged token
- Not suitable to dump pagination



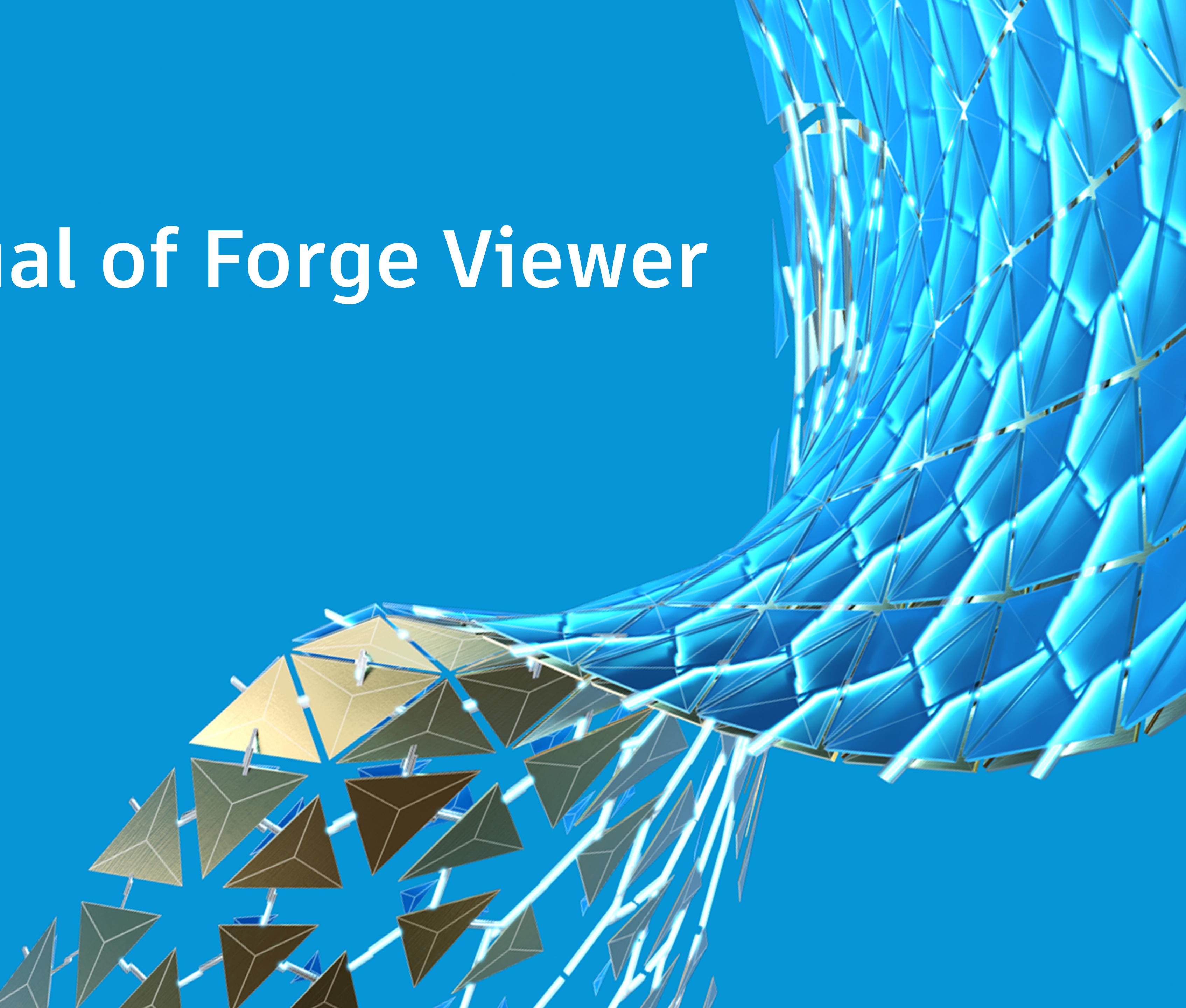
Less coding with Node.js utility - Xiaodong

- Support export BIM360 admin data to excel without coding
- Support export BIM360 document data to excel without coding
- Support export BIM360 feature data to excel without coding
- Extensible to add more custom exporting by less coding
- Support both 2legged token and 3legged token workflow
- Easy to handle pagination
- Easy to debug and troubleshooting

DEMO

Extract BIM360 Data by Node.js Tool

Power BI Visual of Forge Viewer



forge-pbit - Power BI

Not Secure | <https://app.powerbi.com/groups/f5497d12-a930-4f69-91fc-559165296d61/reports/7e242b56-0bed-4fa9-97fc-19a9efdf7a92/ReportSection>

forge-pbit | Data updated 8/10/2020

Power BI AUDemoTest

File View Reading view Mobile layout Ask a questi... Explor... Text b... Shape... Button... Visual interactio... Refre... Duplicate this pa... Sa... Pin a live Pa... Share to Tea... ...

Home Favorites Recent Apps Shared with me Learn Workspaces AUDemoTest

dbid material

dbid

2221 Glass
2222 Glass
2224 Glass
2226 Glass
2230 Glass
2232 Glass
2234 Glass
2452 Glass
2559 Glass
2561 Glass
2562 Glass
2577 Glass
2581 Glass
2583 Glass
2589 Glass
2591 Glass
2593 Glass
2597 Glass
2599 Glass
2601 Glass
2602 Glass
2603 Glass
2604 Glass
2605 Glass
2606 Glass
2607 Glass
2646 Glass
2660 Glass
2663 Glass
2667 Glass
2668 Glass
2701 Glass
2714 Glass
2716 Glass
2717 Glass
2729 Glass
2737 Glass
2739 Glass
2741 Glass
2743 Glass
2833 Glass
2835 Glass
2836 Glass
2848 Glass
2852 Glass
2853 Glass
2880 Glass
2882 Glass
2883 Glass
2902 Glass
2904 Glass
2905 Glass
2917 Glass
2921 Glass
2922 Glass
2949 Glass

Count of material by material

0.16K (3.43%)
1.19K (25.68%)
3.28K (70.66%)

material

- Metal - Aluminium, Black-Anodized
- Glass
- Stone - Granite
- Plastic - Dark Maroon, Smooth
- Concrete - Cast-in-Place Concrete
- <By Category>
- Site - Tarmacadam

Filters

Search

Filters on this visual

- Count of material is (All)
- material is (All)

Add data fields here

Filters on this page

Add data fields here

Filters on all pages

Add data fields here

Visualizations

Search

powerbi_forge

- Σ dbid
- material

Legend

material

Details

Add data fields here

Values

Count of material

Tooltips

Add data fields here

Drill through

Cross-report

Off

Keep all filters

On

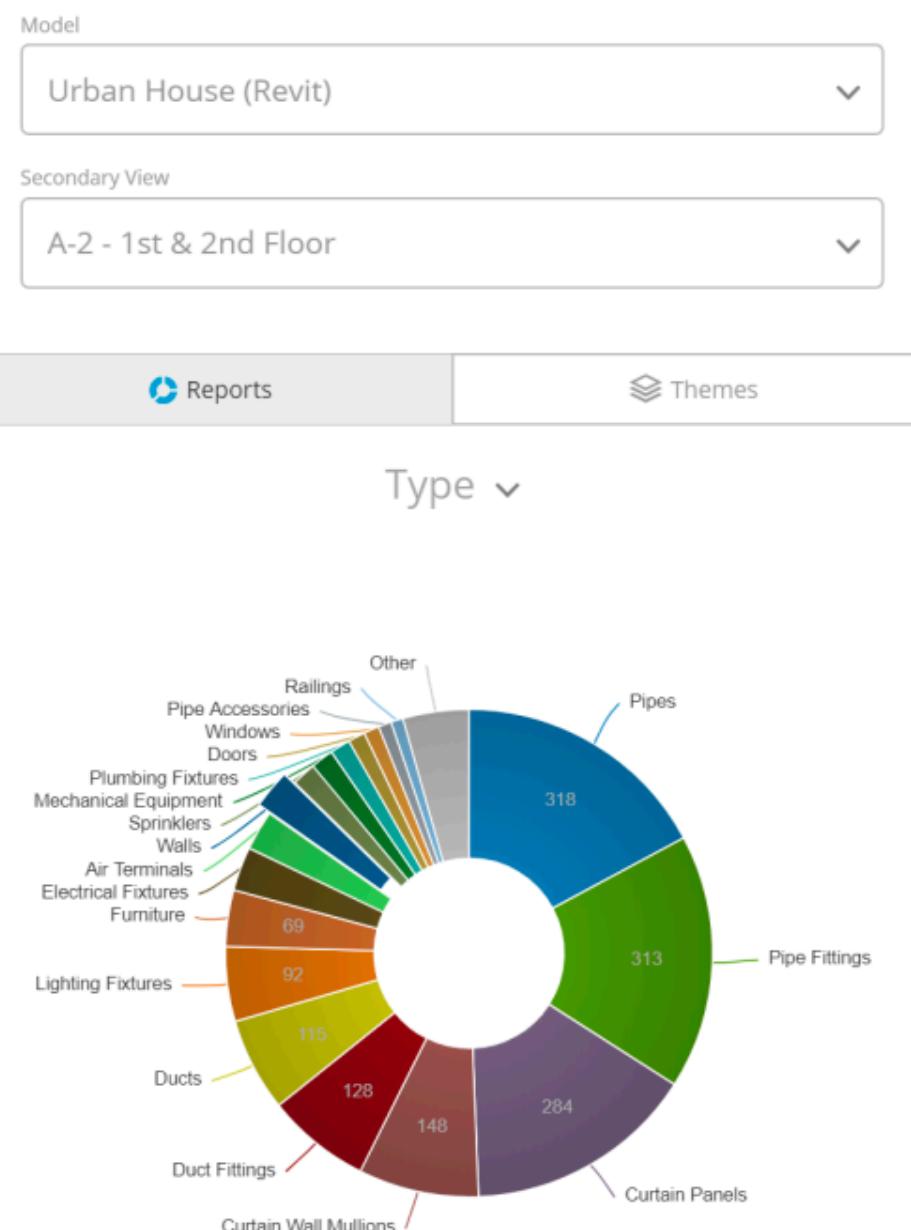
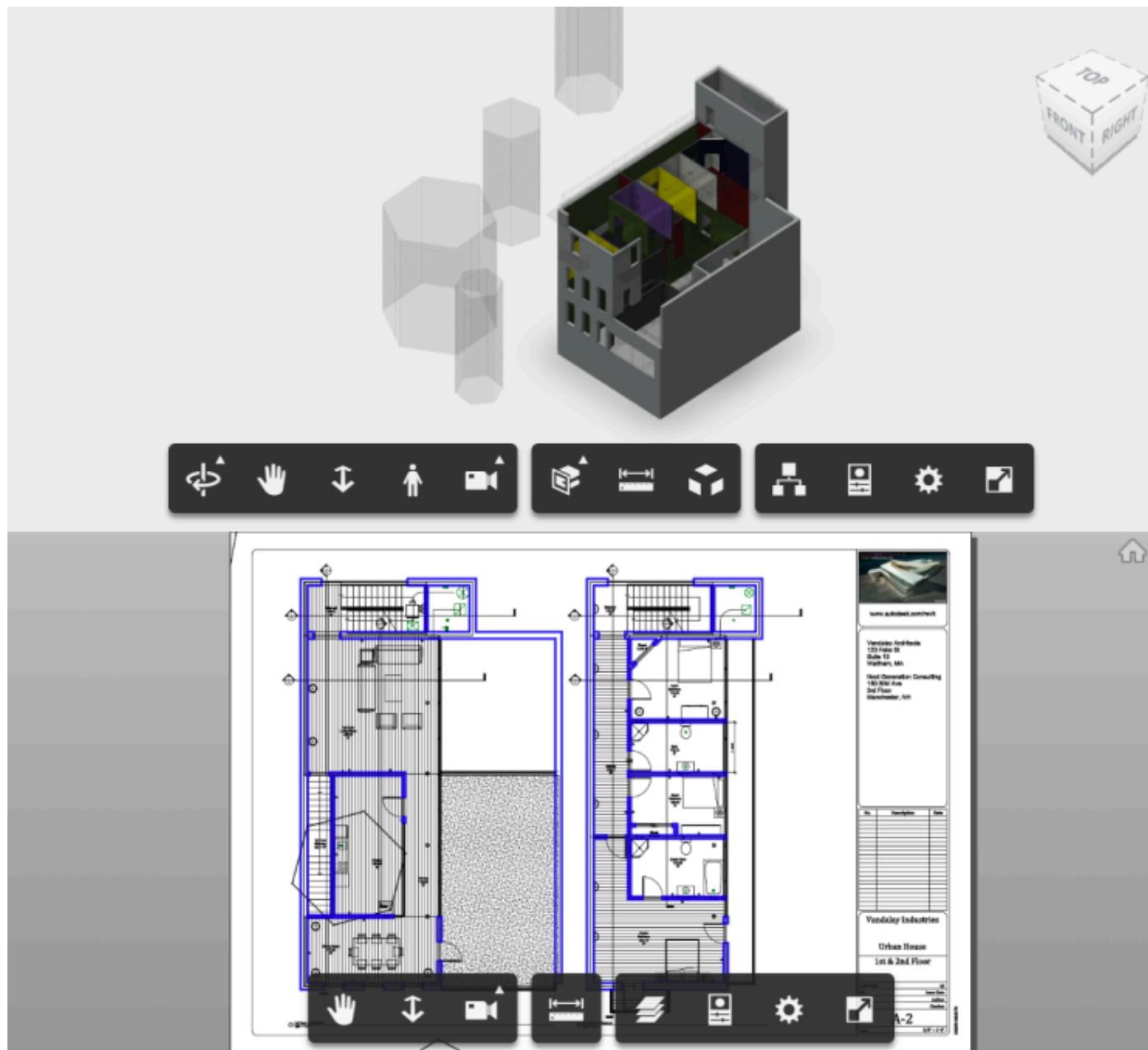
Add drill-through fields here

The report displays a 3D wireframe model of a modern building complex. Below it is a pie chart titled 'Count of material by material' showing the distribution of materials. The largest segment is Glass at 70.66%, followed by Metal - Aluminium, Black-Anodized at 25.68%, and Stone - Granite at 3.43%. A legend lists various materials with their corresponding colors. On the left, a search bar shows 'dbid material'. The right side features a 'Filters' pane with sections for this visual, page, and all pages, each with an 'Add data fields here' button. A 'Visualizations' pane on the far right shows a list of available charts and a 'powerbi_forge' section with a selected 'material' field. A 'Fields' pane on the far right also shows the 'material' field. Drill-through options are available for cross-reports.

Visuals

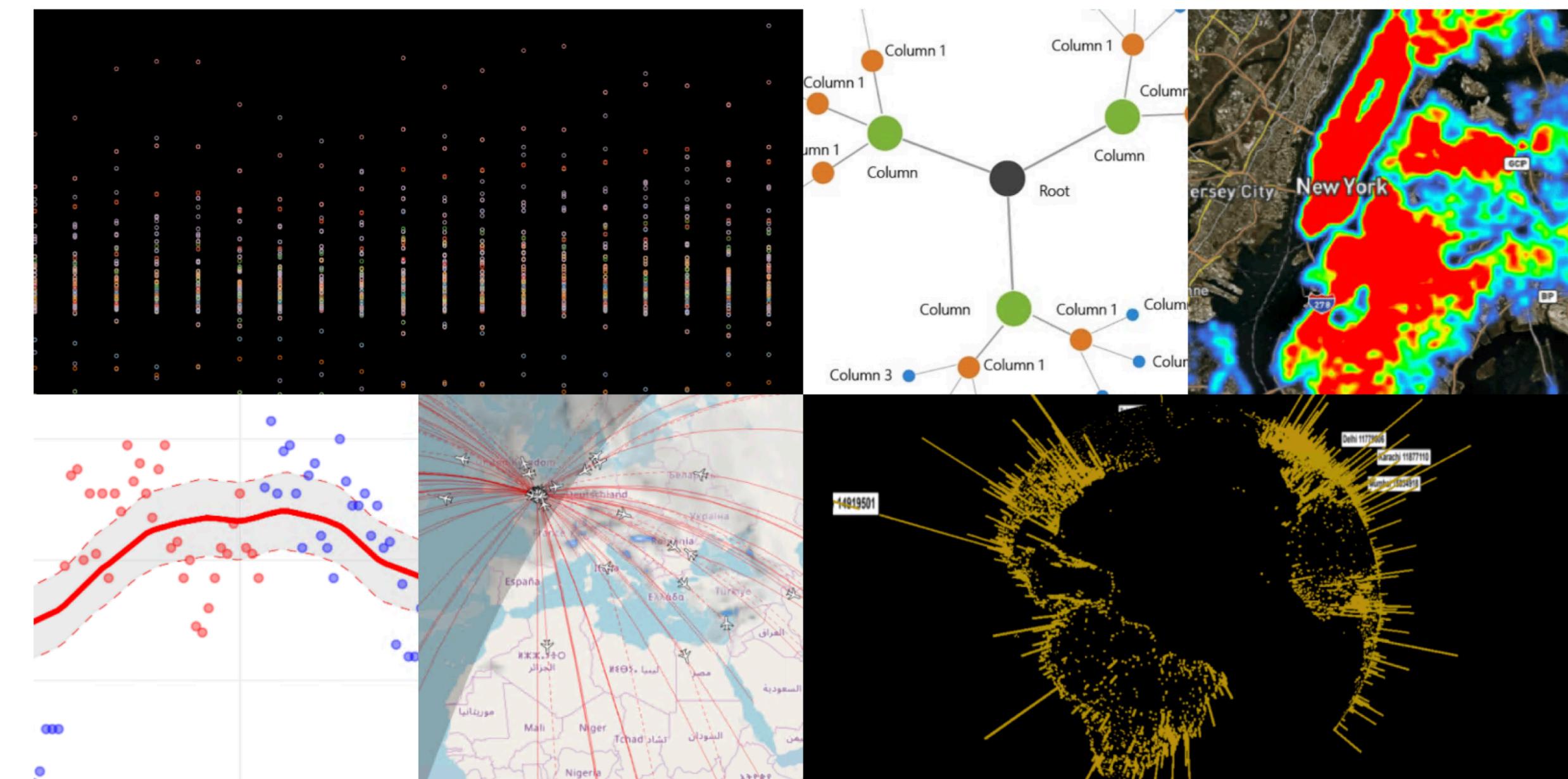
FORGE VIEWER

- A browser based container that can load and render 3D model or 2d drawing
- No plugin, no installer, browser only
- Complete model/drawing data
- Plentiful built-in extensions
- Rich API (JavaScript) for app integration



POWER BI CUSTOM VISUAL

- Visualize data by your own way
- Rich library of fully-customizable, open-source data visualizations
- HTML5, TypeScripted, easy to integrate with known JavaScripts libraries.
- Package into redistributable visual across products or in AppSource.



Load Forge Viewer Dynamically

EXPLORER

... TS visual.ts X

FORGEVIEWER_EMBED_IN_POWERBI_REPORT

- > forge-model-properties-excel
- forgePowerbiView
 - > .api
 - > .tmp
 - > .vscode
 - > assets
- < dist
 - PowerBI_ForgeViewer_Visual.pbviz
- > node_modules
- src
 - TS settings.ts
 - TS visual.ts
- > style
- {} capabilities.json
- {} package.json
- {} package-lock.json
- {} pbviz.json
- {} tsconfig.json
- {} tslint.json
- > help
- ❖ .gitignore
- 🔑 LICENSE
- ⓘ README.md
- TS upated-forge-viewer-index.d.ts

src > TS visual.ts > {} powerbi.extensibility.visual > PowerBI_ForgeViewer_Visual > loadForgeViewerScriptAndStyle > <function> > forge

```
130
131
132     private async loadForgeViewerScriptAndStyle(): Promise<void> {
133
134         return new Promise<void>(reslove, reject) => {
135
136             let forgeviewerjs = document.createElement('script');
137             forgeviewerjs.src = 'https://developer.api.autodesk.com/modelderivative/v2/viewers/viewer3D.js';
138
139             forgeviewerjs.id = 'forgeviewerjs';
140             document.body.appendChild(forgeviewerjs);
141
142             forgeviewerjs.onload = () => {
143                 console.info("Viewer scripts loaded");
144                 let link = document.createElement("link");
145                 link.rel = 'stylesheet';
146                 link.href = 'https://developer.api.autodesk.com/modelderivative/v2/viewers/style.min.css';
147                 link.type = 'text/css';
148                 link.id = "forgeviewercss";
149                 document.body.appendChild(link);
150                 console.info("Viewer CSS loaded");
151
152                 reslove();
153             };
154
155             forgeviewerjs.onerror = (err) => {
156                 console.info("Viewer scripts error:" +err );
157                 reject(err);
158             };
159
160         });
161
162     };
163
```

DEMO

Embed Forge Viewer inside Power BI Report

Power BI Embedded in Web App with Forge Viewer



BIM 360 Projects List

- Zhong Revit File Upgrader Project
- my_test_project_for_case_3391_12
- Forge Demo ZW DA
- xiaodong_change_project_name_by_API
- Xiaodong-test-MC**
- Forge Concert Hall
- my_test_project_for_case_3391_11
- Forge Demo XL API
- Flow Test
- Sample for Phil by Zhong2

ModelSets

XiaodongMCTest-2019-10-31-17-19	
AUDemo-New	v-2
AUDemo	v-1
MC_20190925130256	v-2
MC_20190924075642	v-2
MC_20190829164612	v-2

Matrix View by Object Count of Active Clash

▲ {3D}_Audubon_Structure.rvt {3D}_Audubon_Architecture.rvt {3D}_Audubon_Mechanical.rvt

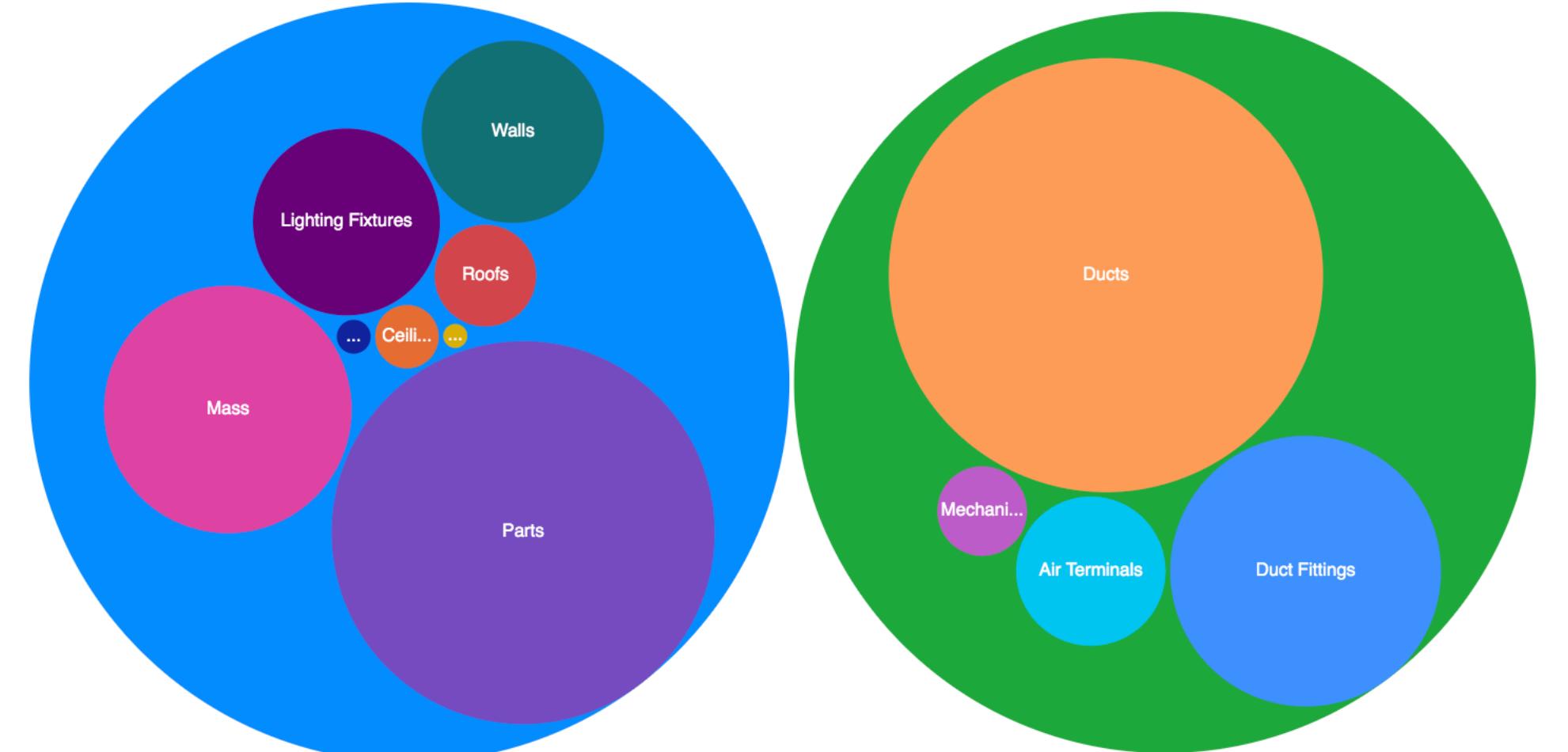
{3D}_Audubon_Architecture.rvt	723		216
{3D}_Audubon_Mechanical.rvt	89	244	
{3D}_Audubon_Structure.rvt		327	45

PowerBI Analyze by Object Category and Clash Count

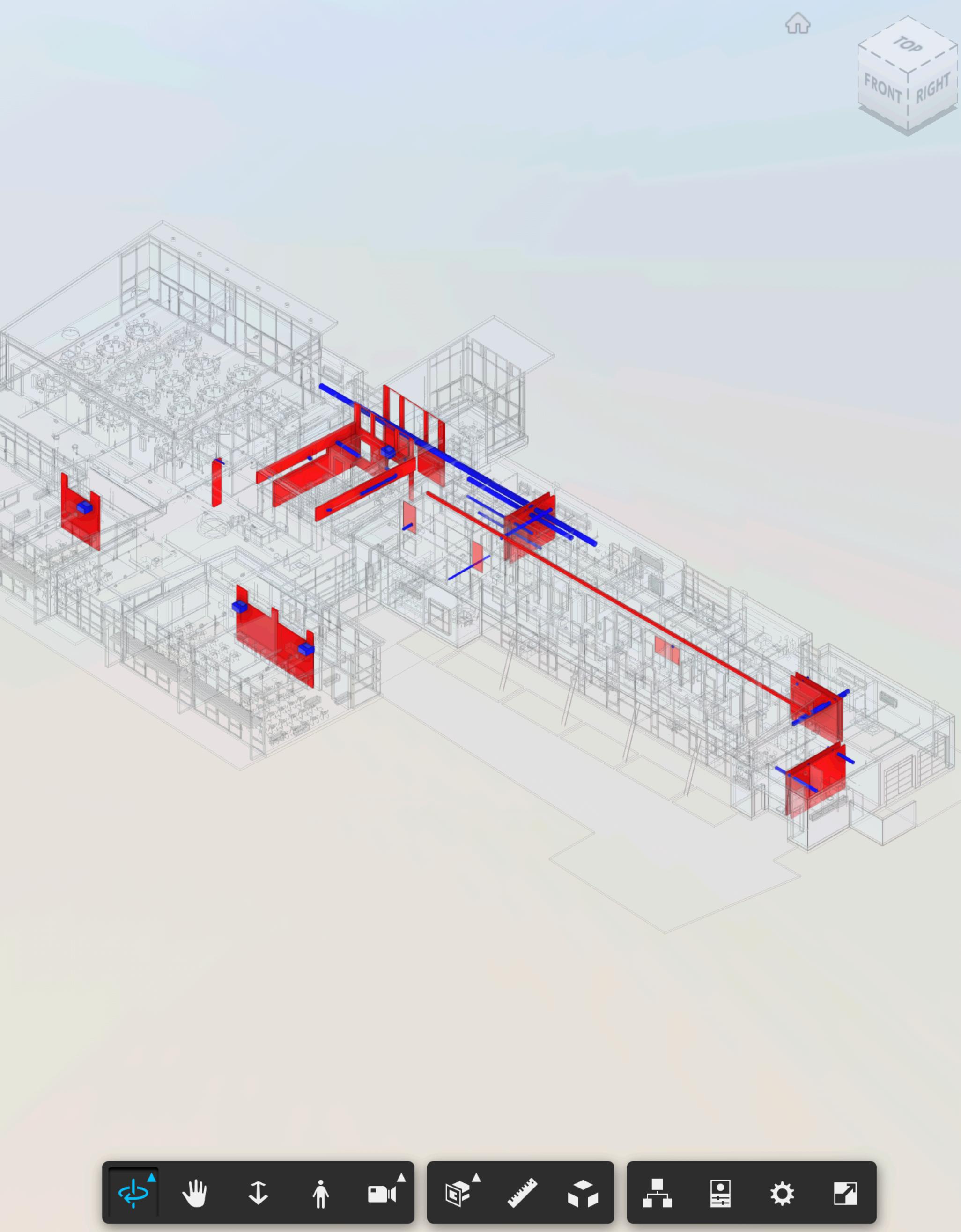
Total Clash Count: 510

Clash Count by Category Cluster by Document

docname ● {3D}_Audubon_Architecture.rvt ● {3D}_Audubon_Mechanical.rvt



cat	docname	clashcount	clash	fam	id	rn
Parts	{3D}_Audubon_Architecture.rvt	1	100;	null	79	
Parts	{3D}_Audubon_Architecture.rvt	2	102;73;	null	79	
Parts	{3D}_Audubon_Architecture.rvt	1	108;	null	79	
Ducts	{3D}_Audubon_Mechanical.rvt	5	108;62;25;12;11;	Round Duct	10	
Parts	{3D}_Audubon_Architecture.rvt	1	109;	null	79	
Parts	{3D}_Audubon_Architecture.rvt	1	11;	null	79	
Parts	{3D}_Audubon_Architecture.rvt	1	110;	null	79	
Parts	{3D}_Audubon_Architecture.rvt	1	114;	null	79	
Ducts	{3D}_Audubon_Mechanical.rvt	3	114;49;17;	Round Duct	10	
Ducts	{3D}_Audubon_Mechanical.rvt	2	118;90;	Round Duct	10	
Parts	{3D}_Audubon_Architecture.rvt	1	119;	null	79	
Parts	{3D}_Audubon_Architecture.rvt	1	12;	null	79	
Parts	{3D}_Audubon_Architecture.rvt	2	120;15;	null	79	
Walls	{3D}_Audubon_Architecture.rvt	5	122;93;89;44;36;	Basic Wall	79	
Ducts	{3D}_Audubon_Mechanical.rvt	2	122;96;	Round Duct	10	
Parts	{3D}_Audubon_Architecture.rvt	3	123;81;77;	null	79	
Ducts	{3D}_Audubon_Mechanical.rvt	1	125;	Round Duct	10	
Walls	{3D}_Audubon_Architecture.rvt	3	125;118;59;	Basic Wall	79	



DEMO

Analyze Clash Data by Power BI Component + Forge Viewer

Prerequisites of Power BI

Register and Create Power BI App

Azure portal. [Learn more](#)

Application Name

Enter a display name to identify your application in Azure

Xiaodong AU Test

Application Type

Server-side web application (for web apps or web APIs)

Home Page URL

Enter your application's homepage URL

(e.g. https://powerbiapp.contoso.com)

Redirect URL

Enter a URL where users will be redirected upon sign in so your application can receive an authorization code.

- Use a default URL (Choose this if you'd like download a pre-configured sample app when you finish this process)
- Use a custom URL (Choose this if you know the target application's URL)

<https://www.getpostman.com/oauth2/callback>

API access

Select the APIs and the level of access your application needs. You can change these settings later in the Azure portal.

[Learn more](#)

Select all

Read only APIs ①

- Read all datasets
- Read all dashboards
- Read all reports
- Read all workspaces
- Read all capacities
- Read all storage accounts
- Read all dataflows
- Read all gateways
- Read all Power BI apps

Read and write APIs ①

- Read and write all datasets
- Read and write all dashboards
- Read and write all reports
- Read and write all workspaces
- Read and write all capacities
- Read and write all storage accounts
- Read and write all dataflows
- Read and write all gateways

Create APIs ①

Create APIs

By clicking Register, you agree to the [terms of use](#)

Note: An application registered here can't be used as a service principal. [Learn how to register a service principal](#)

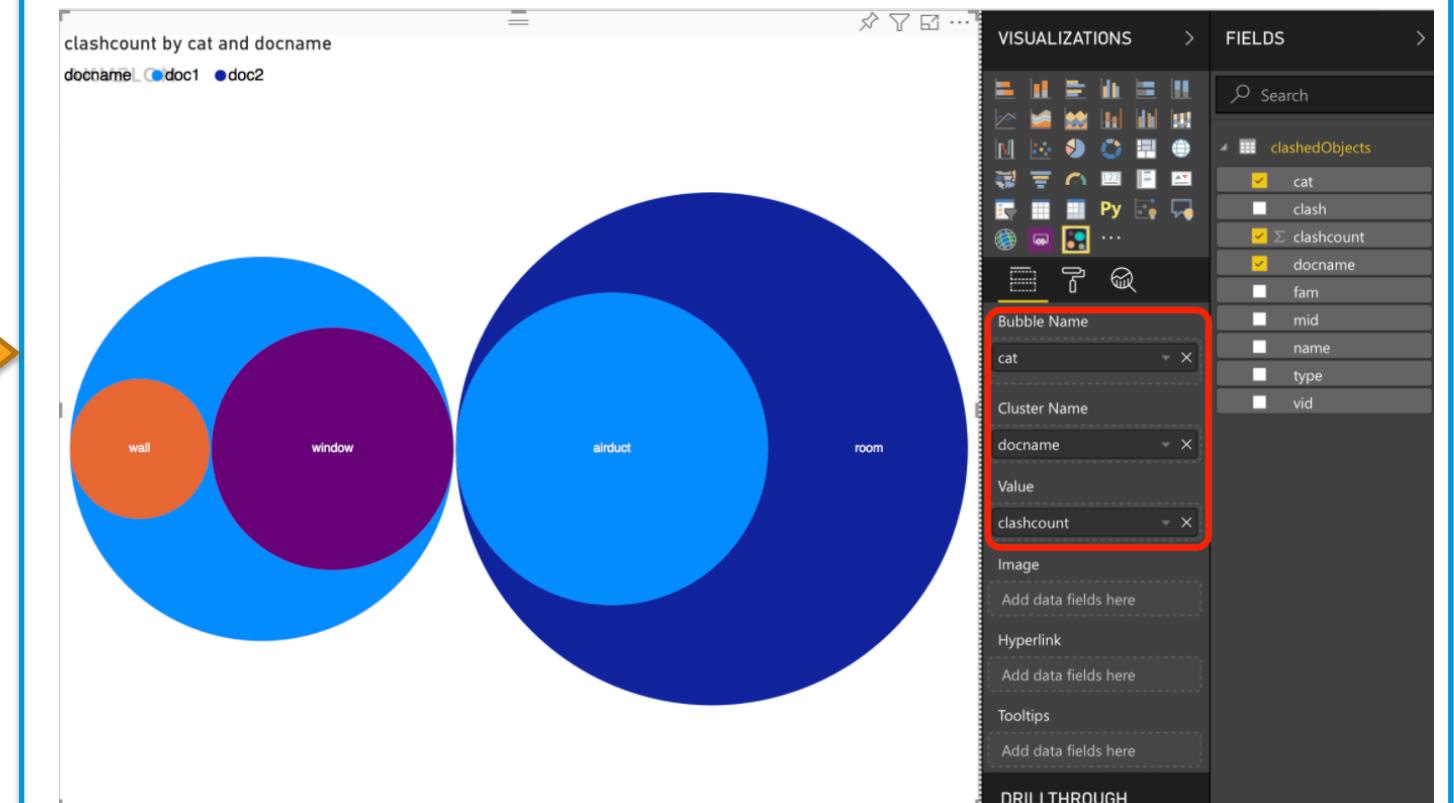
Register

Create Data Source by Push Data Format

```
{"name": "dataset_name", "tables": [{"name": "", "columns": [{"name": "column_name1", "dataType": "data_type"}, {"name": "column_name2", "dataType": "data_type"}, {"name": "..."}]}]}
```

{JSON}

Make a Report with Dummy Data (Bubble Chart and Table View)



Power BI Embedded Playground

Microsoft Power BI Embedded Playground

Sample tool

Code

Embed Interact

Select mode to embed your report in:

View mode ⓘ
 Edit mode ⓘ
 Create mode ⓘ

Select token type:

Embed token
 AAD token

Fill in the fields below to get the code to embed your report

Embed Token H4sIAAAAAEAB2Wxa7FDI6E3-XfpqXgCbTUizAzZxdm5ozm3ef27Eu2VI

Embed URL <https://app.powerbi.com/reportEmbed?reportId=f6bfd646-b718-44dc-a>

Report ID f6bfd646-b718-44dc-a378-b73e6b528204

Code

Run Copy

```
permissions: permissions,
settings: {
  panes: {
    filters: {
      visible: true
    },
    pageNavigation: {
      visible: true
    }
  }
};

// Get a reference to the embedded report HTML element
var embedContainer = $('#embedContainer')[0];
```

Log

Copy Clear

> Loaded
> Rendered

Embedded view

Desktop Phone

Q&A Date Manufacturer Product Region

1/1/2014 12/31/2014 All All Central East West

Total Category Volume Unit Market Share

49,832 32.9%

67.14% % Category Compete Share 0.46% % Unit Market Share YOY Change

Total Category Volume Total Unit of VanArsdel Units Market Share

Category Breakdown

VanArsdel Performance: ● Low ● Medium ● High

Product	Total Category Volume	% Units Market Share
Maximus UM-70	2,359	14.41%
Maximus UM-11	2,118	12.94%
Maximus UM-54	1,917	11.71%
Maximus UM-12	1,066	6.51%
Maximus UM-66	651	3.98%
Maximus UC-50	599	3.66%
Maximus UM-56	591	3.61%
Maximus UM-76	568	3.47%

Total Category Volume Over Time by Region VanArsdel Performance: ● Low ● Medium ● High

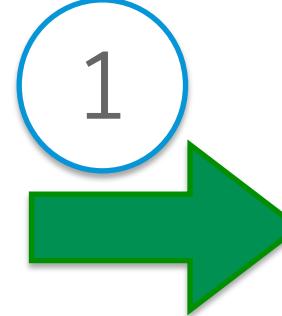
DEMO

Embed Power BI in Web App

App Workflow

Get Clash Results

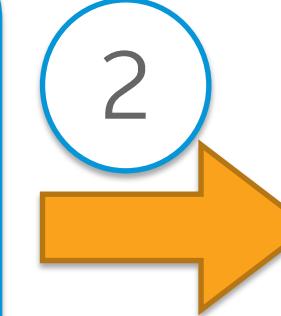
```
{
  "scope": "07a267aa-0e6e-456e-b674-d3c9796dc1a9",
  "version": 2,
  "clashes": [
    {
      "id": 1,
      "clash": [
        482,
        148
      ],
      "dist": -0.19088,
      "status": 1
    },
    {
      "id": 2,
      "clash": [
        ...
      ]
    }
  ]
}
```



Generate Matrix View

Matrix View by Object Count of Active Clash

	{3D}_Audubon_Structure.rvt	{3D}_Audubon_Architecture.rvt	{3D}_Audubon_Mechanical.rvt
{3D}_Audubon_Architecture.rvt	723	216	244
{3D}_Audubon_Mechanical.rvt	89	327	45
{3D}_Audubon_Structure.rvt			



Get Elements Properties

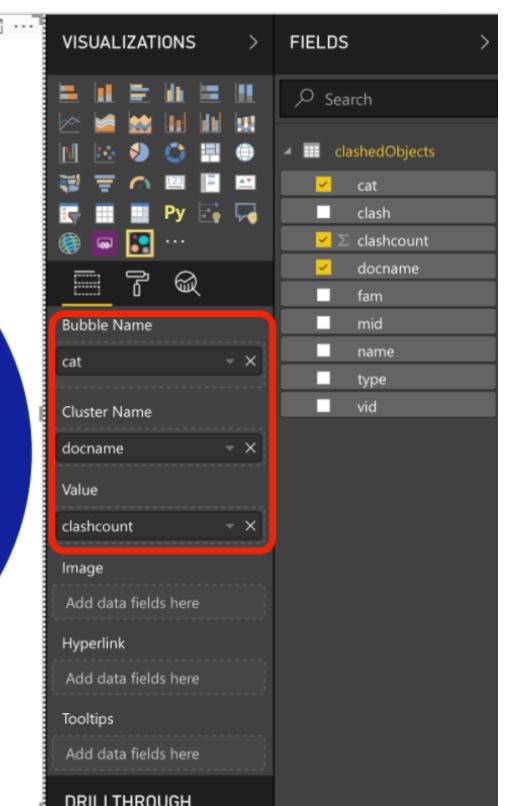
```
[{"0": [{"file": "76137261", "db": "a274659"}, {"1": [{"file": "7960883e", "db": "b834bb65"}]}], [{"0": [{"id": 2398, "name": "HSS-Hollow Structural Section-Column [259914]", "category": "Structural Columns", "family": "HSS-Hollow Structural Section-Column", "type": "HSS6X6X.1875"}, {"1": [{"id": 4076, "name": "Rectangular Mullion [1040998]", "category": "Walls", "family": "Curtain Wall", "type": "Storefront"}]}]}
```



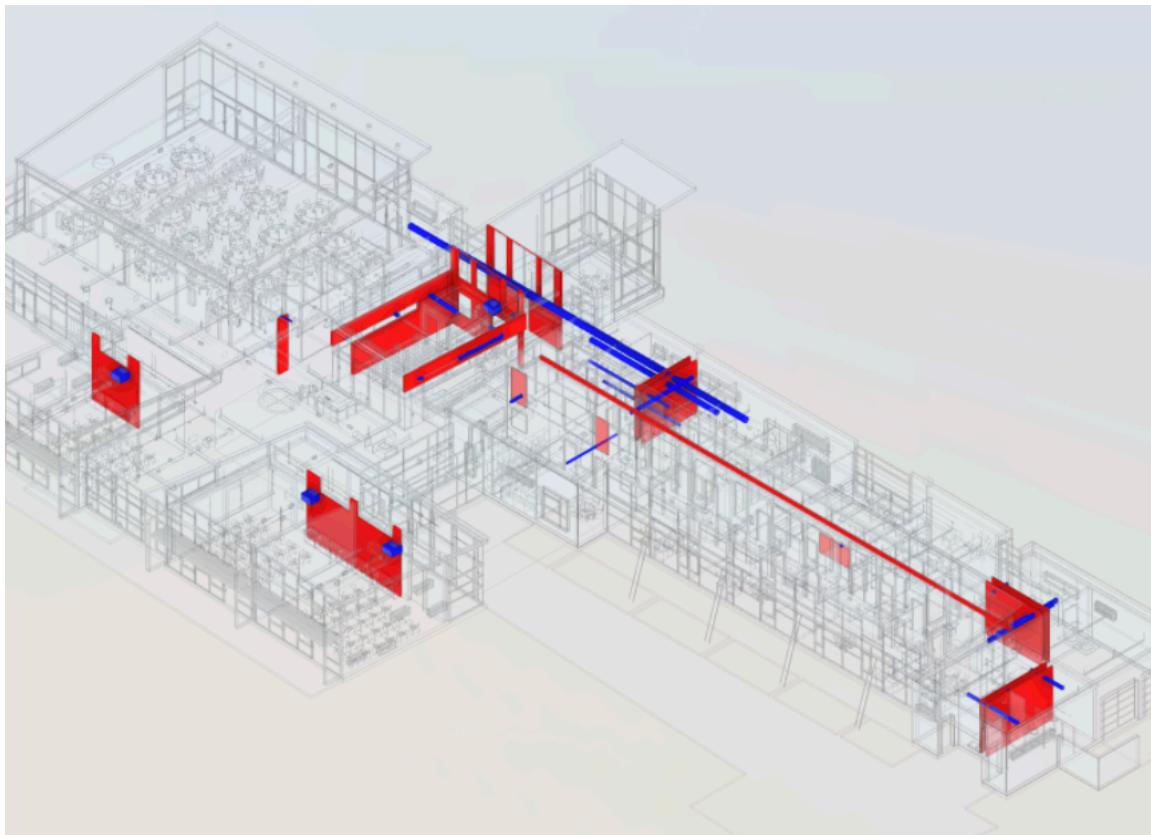
Push Property Data to Power BI Report Template

clashcount by cat and docname

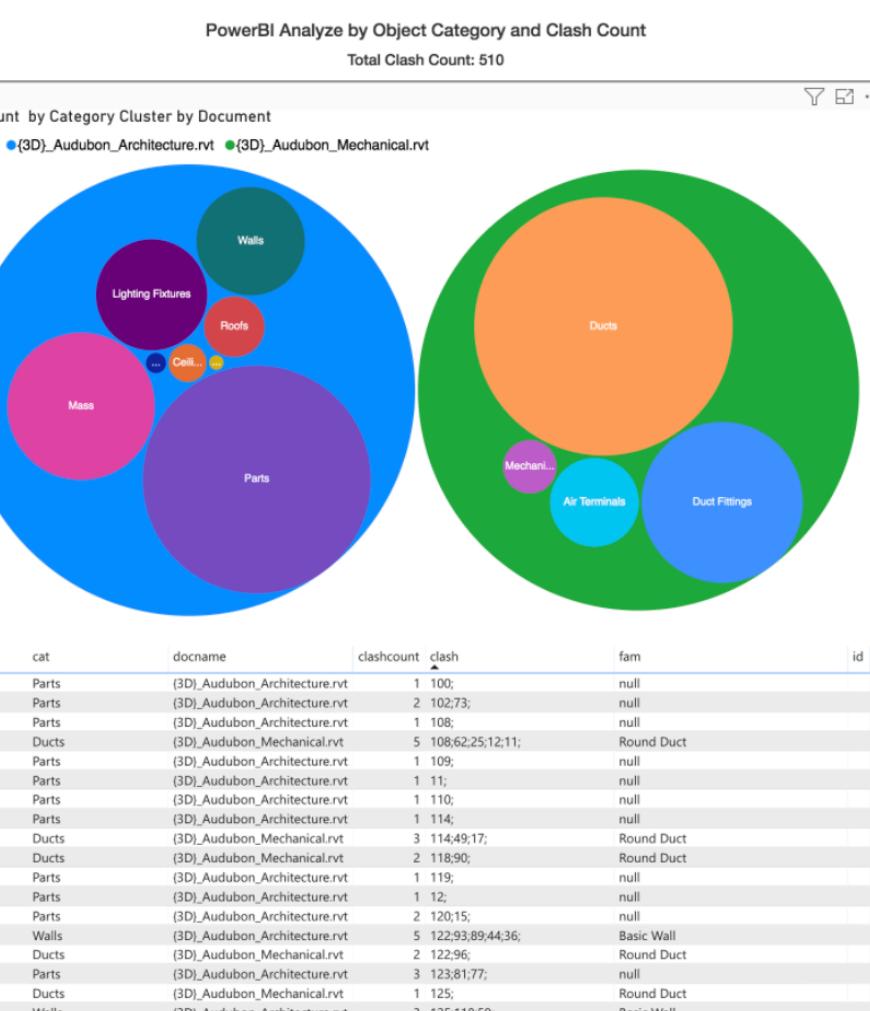
docname... doc1 doc2



Load Pair of Documents to Forge Viewer



Render Report in Web App



1

2

2

5

4

```

//add dummy rows to the table
const data =
  [
    {
      cat: "wall", clash: "123,567,890", clashcount:"3",
      docname:"doc1",
      fam:"wall",name:"wall_xxx",type:"wall",vid:"12345"
    },
    {
      cat: "room", clash: "345,762", clashcount:"2",
      docname:"doc2",
      fam:"room",name:"room_yyy",type:"room",vid:"56789"
    }
  ]
const addRowsRes =
  await pbi.pushDataToDataset(dataset_id,
  config.pbi.table_name,
  data)

```

```

{
  "scope": "07a267aa-0e6e-456e-b674-d3c9796dc1a9",
  "version": 2,
  "clashes": [
    {
      "id": 1,
      "clash": [
        482,
        148
      ],
      "dist": -0.19088,
      "status": 1
    },
    {
      "id": 2,
      "clash": [
        ...
      ]
    }
  ]
}

```



`SELECT * WHERE ...`

Push Data as source for Power BI

- No refresh limit: update data and report any time
- Use Power BI Restful API to create data source and push data

Model Coordination API

- Clash API:
 - Get clash instances collection: dbIds, documents etc
- Index Property API:
 - Get properties of clashed elements on backend

Home > xiaodongdummyorg > Users - All users > xiaodongdummytest - Assigned roles

xiaodongdummytest - Assigned roles

User

Manage

- Profile
- Assigned roles**
- Groups
- Applications
- Licenses
- Devices

Administrative roles
Administrative roles can be used to grant access

Search
Search by name or description Type All

Role

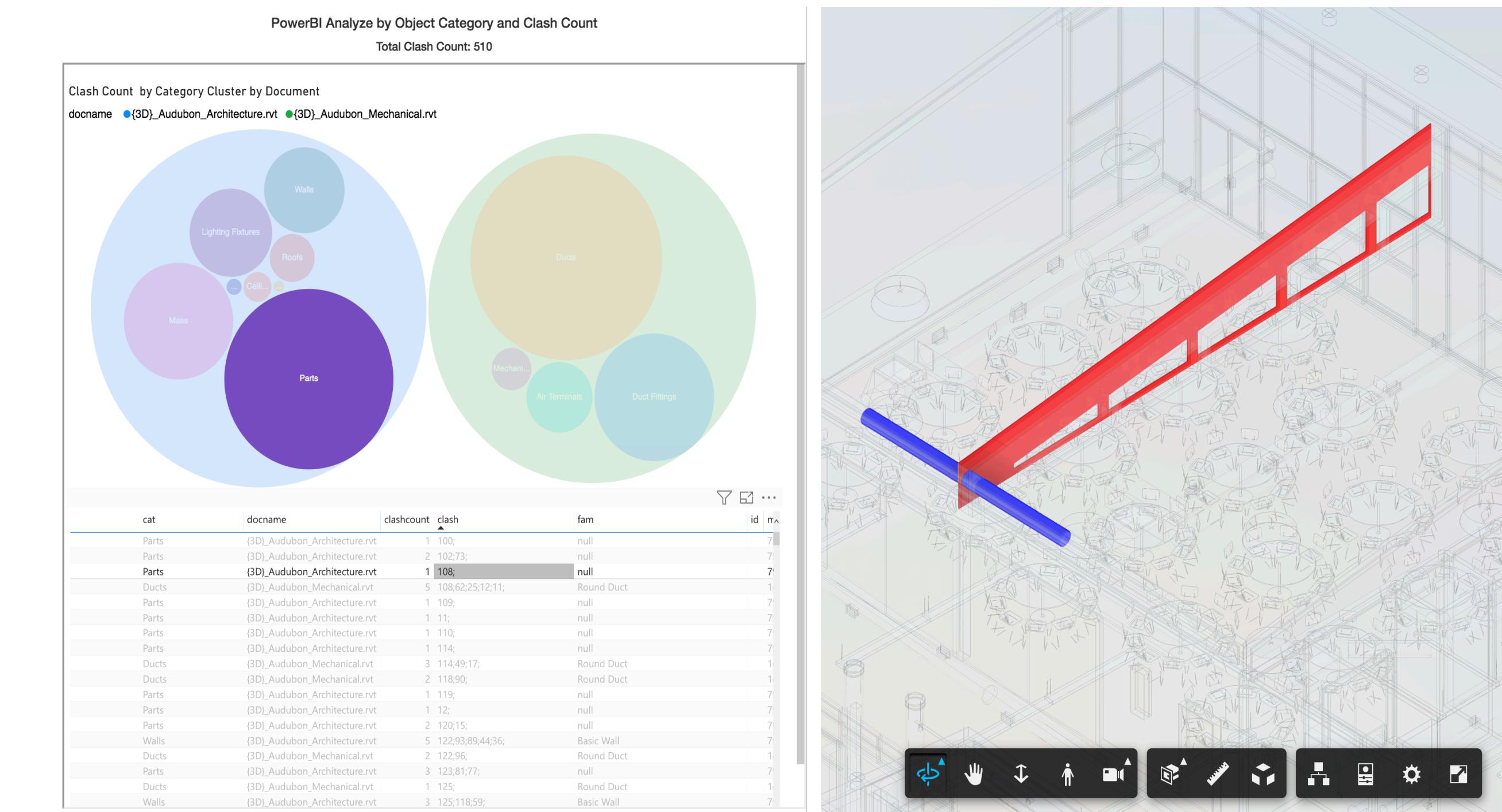
Application administrator

Configured permissions

Applications are authorized to call APIs when they are granted permissions by users/admins as part of the consent process. The list of configured permissions should include all the permissions the application needs. [Learn more about permissions and consent](#)

+ Add a permission Grant admin consent for xiaodongdummyorg

API / Permissions	Type	Description
Azure Active Directory		
User.Read	Delegated	Sign in and read user profile
Power BI Service (18)		



Enable non-login access of Power BI

- Get OpenId token without authorization workflow
- Assign admin role with the user
- Grant admin consent

- ## Selection Events of Power BI with Forge Viewer
- Table view
 - Bubble chart
 - Get summarized data (by cluster) firstly, and find corresponding table rows with cluster data, and finally get those clashes.

Summary

- No programming
 - Data Connector
 - Partner Card
 - Extract/Export functionalities
- A little programming
 - Call BIM 360 API by Restful tool such as Postman, exporting data in Json format
 - Use R scripts/templates to execute the extracting
- More programming
 - By more advanced programming such as Node.js. customized based on BIM 360 Export Tool
- Comprehensive programming
 - Embed Forge Viewer inside Power BI report
 - Embed Power BI report inside a Forge app

Get Started with Forge

BIM360 API Documentation

The screenshot shows the BIM360 API v1 documentation page. The top navigation bar includes links for Success Stories, Solutions, Getting Started, Documentation, Community, Support, and Pricing. A sidebar on the left contains sections for Developer's Guide, Step-by-Step Tutorials (with 'Getting Started' expanded), Account Admin, Issues, RFIs (beta), Document-related (Pushpin) Issues and RFIs (beta), Checklists, Document Management, Model Coordination, Cost Management (beta), Relationships, API Reference, and Change History. The main content area features a section titled 'Get Access to a BIM 360 Account' with sub-sections for 'Before You Begin' and 'Step 1: Provisioning a BIM 360 Account'. It also includes a 'Development Account' section with instructions for creating a trial account.

LearnForge Tutorial

The screenshot shows the LearnForge tutorial interface. On the left, a sidebar lists various Forge services: Type to search, Autodesk Forge (Home, Before you start coding, Tools, OAuth, View your models, Create a server, Authenticate, Upload file to OSS, Translate the file, Show on Viewer), View BIM 360 & Fusion models (Create a server, Authorize, List hubs & projects, User information, Show on Viewer, Modify your models, Create a server, Basic app UI), and a bottom section with three green bars. On the right, there is a 3D viewer showing a house model with various tools at the bottom. A text box provides instructions for viewing the model.

View BIM 360 & Fusion models

This tutorial will guide you creating a webapp with the following UI: on the left a list of **Hubs**, **Projects**, **Folders**, **Items** (files) and respective **Versions**, on the right a 3D viewer to view them.

To view your model, you need the following steps:

1. [Create a server](#) << First time developer? You should start here
2. [Authorize](#)
3. [List hubs & projects](#)
4. [User information](#)
5. [Show on Viewer](#)

Materials

- [Power BI Templates for Construction](#)
- [Power BI Partner Card](#)
- [BIM 360 Admin Data and Documents Extraction by Postman Scripts](#)
- [BIM 360 Documents Extraction by R Scripts](#)
- [BIM 360 Data Extraction by Node.js](#)
- [Power BI Visual of Forge Viewer](#)
- [Power BI Embedded in Web App with Forge Viewer](#)

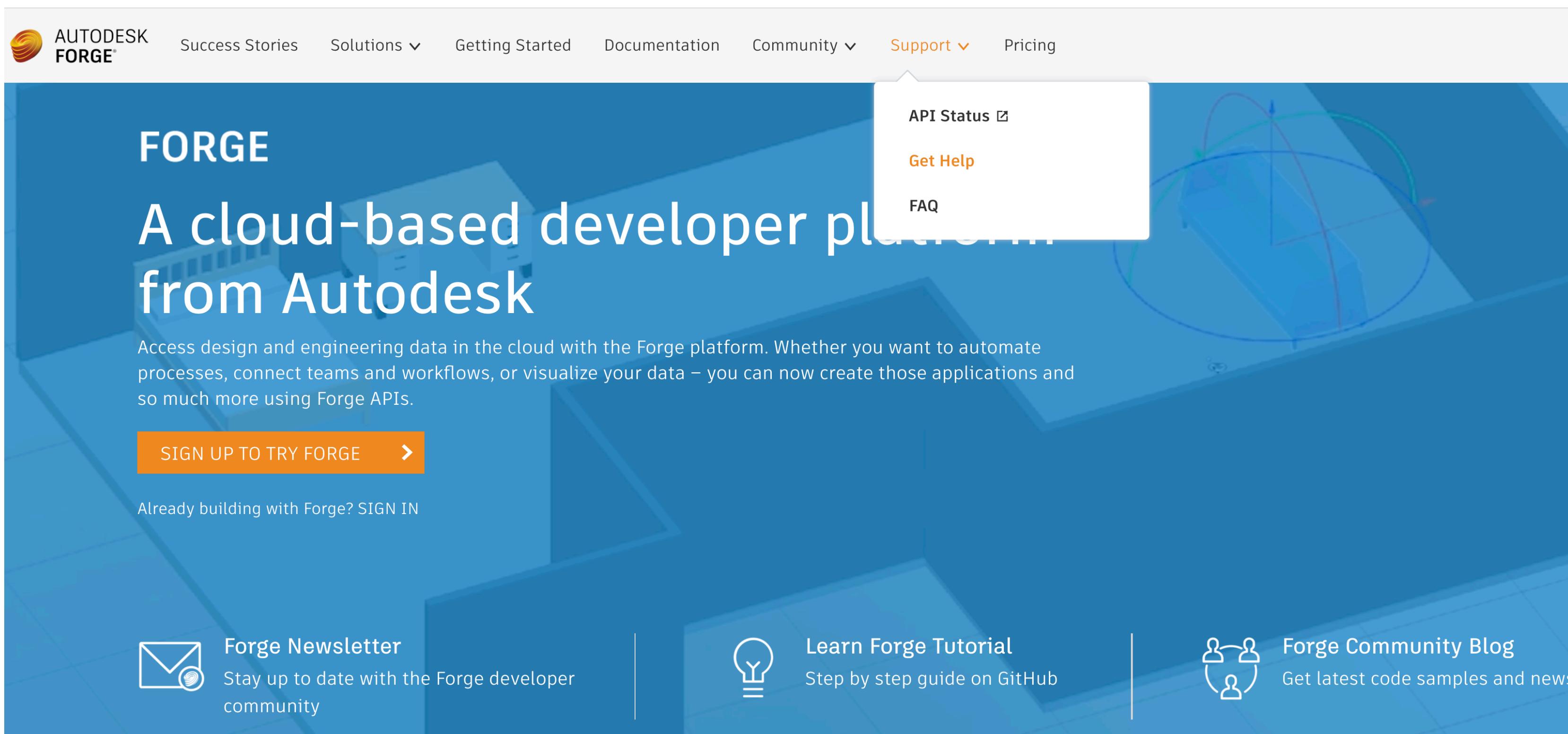
Get Help

Join us at
Forge Answer Bar of AU

Xiaodong.liang@Autodesk.com

forge.help@autodesk.com

Thank you!



The screenshot shows the Autodesk Forge homepage. At the top, there's a navigation bar with links for Success Stories, Solutions, Getting Started, Documentation, Community, Support (which is currently active, indicated by an orange underline), and Pricing. Below the navigation, the main heading reads "FORGE A cloud-based developer platform... from Autodesk". A subtext below it says: "Access design and engineering data in the cloud with the Forge platform. Whether you want to automate processes, connect teams and workflows, or visualize your data – you can now create those applications and so much more using Forge APIs." There's a prominent orange "SIGN UP TO TRY FORGE" button. In the bottom right corner of the main content area, a white callout box is open over the "Support" link, containing three options: "API Status", "Get Help" (which is highlighted in orange), and "FAQ". At the very bottom of the page, there are three footer links: "Forge Newsletter" (with an envelope icon), "Learn Forge Tutorial" (with a lightbulb icon), and "Forge Community Blog" (with a people icon).



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