AUTODESK® UNIVERSITY

90 minutes to build an Autodesk Forge application for project management

Phuc Le (Ken)

Technical Specialist, Autodesk

in Phuc Le Hieu Hong

Uy Vo Le

BIM Developer, Cofico

in Uy Vo Le

About the speaker

Phuc Le Hieu Hong (Ken)

Phuc Le is a Digital Consultant, BIM Advisor, BIM Application Expert & Forge Developer.

He currently serves as a Technical Specialist at Autodesk Asean, supporting firms and organizations in the AEC sector to successfully implement Building Information Modelling, Cloud Collaboration, Computational Design, and Generative Design.

About the speaker

Uy Vo Le

Uy Vo Le has a degree in civil engineering but he has been working as a BIM Developer for more than 4 years at Woh Hup, Singapore, and now at Cofico, Vietnam.

In line with his career objective "Bring as many benefits of IT as possible to Construction Management", his works focus on developing Revit add-ins and Forge application.

Class Description

Project scheduling is an important factor that needs to be strictly controlled to ensure the success of a project. Therefore, project team needs a simple, useful application that can also be accessed online in order to perform project management tasks with BIM models during the construction process.

In this class, you will learn how to build a Forge application to visually manage project progress by utilizing BIM models. Forge platform is Cloud-based developer tools from Autodesk. We will introduce Forge APIs by walking through a sample code demonstrations to help you gain access to your BIM data. Forge APIs also provide you the way to manipulate and update more information in BIM models on the cloud.

If you are interested in learning Forge, a powerful cloud application, to innovate the way you work and make the best use of your data then this class is for you.

Learning Objectives

1	**2**	**3**	**4**
FORGE OVERVIEW	**VIEW MODELS**	**CUSTOMIZE DATA**	**BUILD YOUR OWN APP**
Understand how the Autodesk Forge platform can help overcome challenges in project management	Learn how to use the Forge APIs to upload, convert and display your models in a web browser	Learn how to use the Forge APIs to access and customize your cloud data and create dashboard	Learn how to use the Forge tool to build a project schedule management application of your own

Agenda

AUTODESK FORGE OVERVIEW – FORGE APIS

What is Forge

Introduce Forge APIs

What you can do with Forge

Forge application for Project Management

BUILD YOUR FORGE APPLICATION FOR PROJECT MANAGEMENT

Application overview

Setup the environment

Understand the code

Run the code

CONCLUSION

Summary

Next steps

What is Forge?

- **FORGE is a *set of web service* APIs* that power the future of making things.**

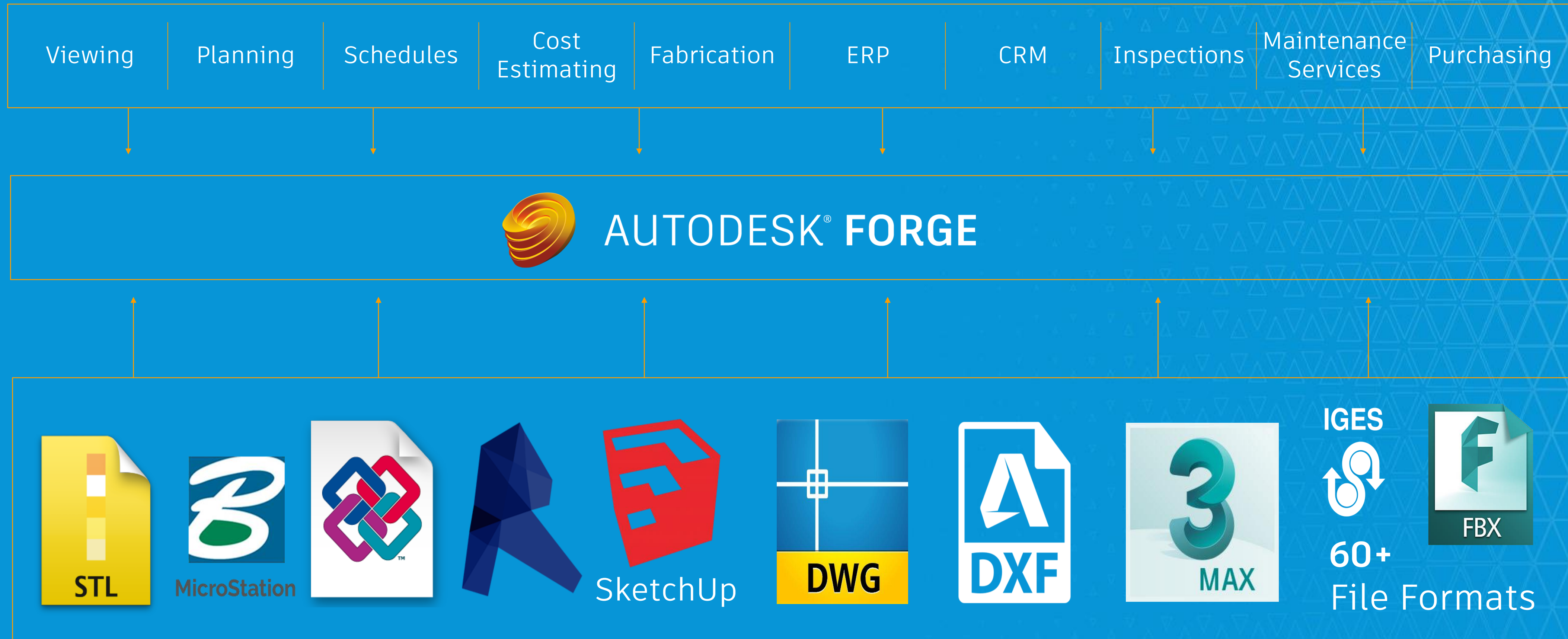 *Application Program Interface

- **Technology:**

Forge takes components from Autodesk's powerful library of software and delivers them as cloud-based building blocks for companies to create their own new solutions.

Valuable information about how things are designed, made and used is generated, but not always connected

Viewing	Planning	Schedules	Cost Estimating	Fabrication	ERP	CRM	Inspections	Maintenance Services	Purchasing

X   X   X   X   X   X

STL   MicroStation   SketchUp   DWG   DXF   MAX   IGES   60+ File Formats   FBX
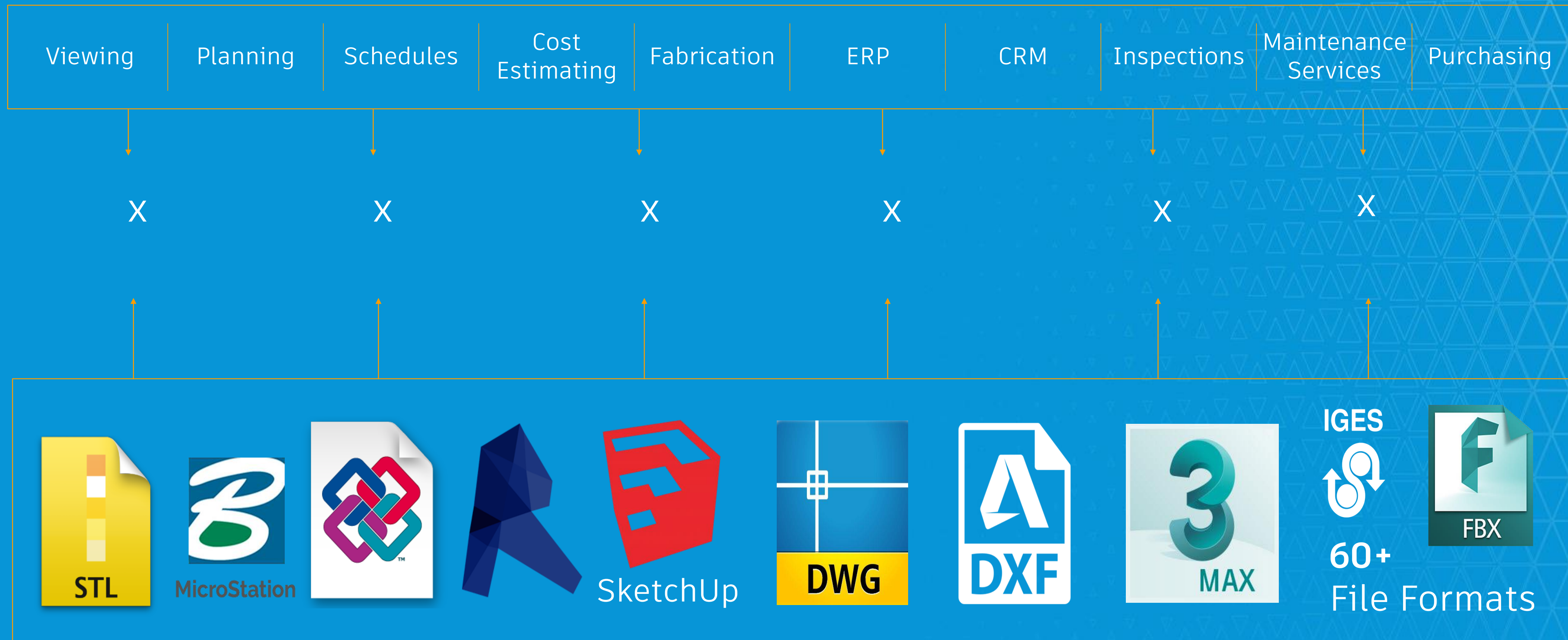
The Forge platform makes connections and delivers data

Viewing	Planning	Schedules	Cost Estimating	Fabrication	ERP	CRM	Inspections	Maintenance Services	Purchasing

AUTODESK® FORGE

STL · MicroStation · SketchUp · DWG · DXF · 3 MAX · IGES 60+ File Formats · FBX

Components of Forge

TECHNOLOGY

Cloud services

RESOURCES

Information & Tools

COMMUNITY

Partner and customer ecosystem

Forge APIs

Viewer

Render 3D and 2D model data within a browser. The models can come from a wide range of applications such as AutoCAD, Fusion 360, Revit, and many more.

Webhooks

Subscribe to and receive notifications of the occurrence of events within the Forge eco system.

Data Management

Access data across BIM 360 team, Fusion Team, BIM 360 Docs, and the Object Storage Service to build apps to display and extend your data in ways that add value to your users.

Model Derivative

Derive outputs viewable by the Forge Viewer from more than 60 CAD file formats, and extract metadata about the models as well as the individual objects within the model.

BIM 360

Integrate with the Autodesk BIM 360 platform to extend its capabilities to reach segments of the construction ecosystem that don't have direct access to BIM data.

Reality Capture

Convert digital images into high resolution textured meshes, dense point clouds and orthophotos.

Design Automation

Automate repetitive tasks by leveraging on the scale of the Forge Platform and running scripts on your design files in the cloud.

Token Flex

Access Autodesk Token Flex Usage Data platform to generate reports on consumption, usage, and contract details.

Authentication

Generate tokens based on the OAuth 2.0 standard to authenticate requests made to Forge APIs and SDKs.

Who is Forge for?

CUSTOMERS

APP DEV PARTNERS

SYSTEM INTEGRATORS

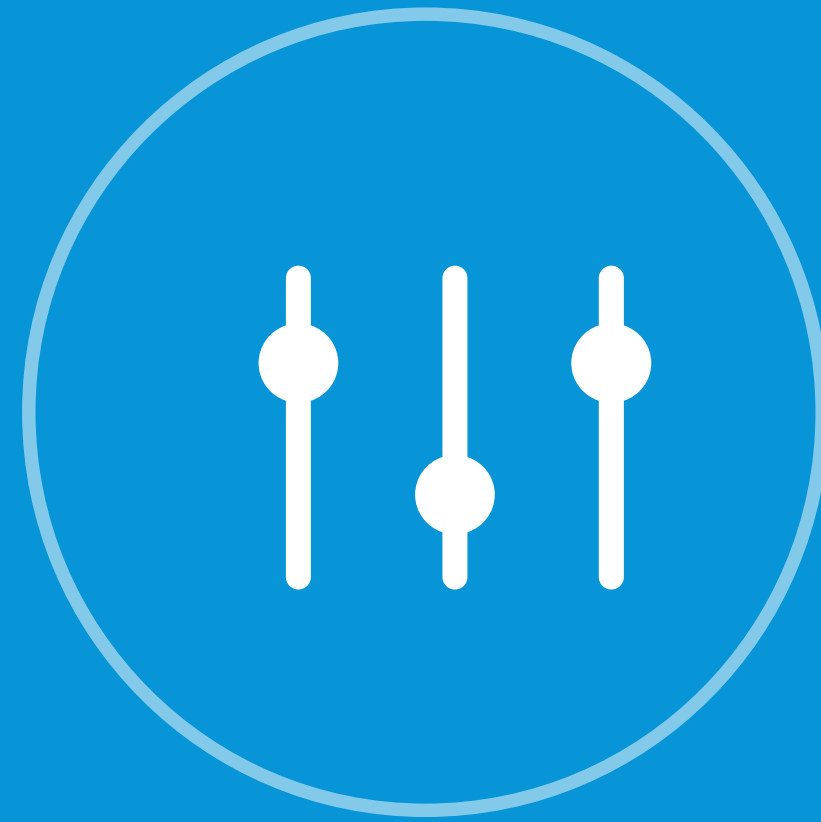# What Customers and Partners Build

Data Visualization & Analysis

Digital Twin

Augmented & Virtual Reality

SaaS Integration

Catalogs

Configurators

Design Automation

Photo to 3D

Next challenges in project management

- **The need for customization:**

  o *Customers* who want to improve their project management workflows or create new ones that both drive internal digital innovation and improvements.

  o *App DEV Partners* who want to develop new apps to fill in project management workflows.

  o *System Integrators* who are looking for a platform to provide software development and consulting services to help companies accelerate their business productivity.

- **One of the customization needs for project management is scheduling. To perform project management tasks in sync with BIM models during the construction progress.**

How Forge platform can help overcome these challenges

- End-to-end solution

- Allow to customize

- Cloud-based application

- Forge APIs

- Integration

- Mobility

Build your own Forge application

AUTODESK® FORGE

Forge application for project management

Value Drivers:

- Add valuable context to your data by presenting it on a 3D model.

- Streamline the tracking and management of construction project objects from design through handover

- Give stakeholders access to project data without requiring them to install a desktop application.

- Single source of truth with BIM models on cloud
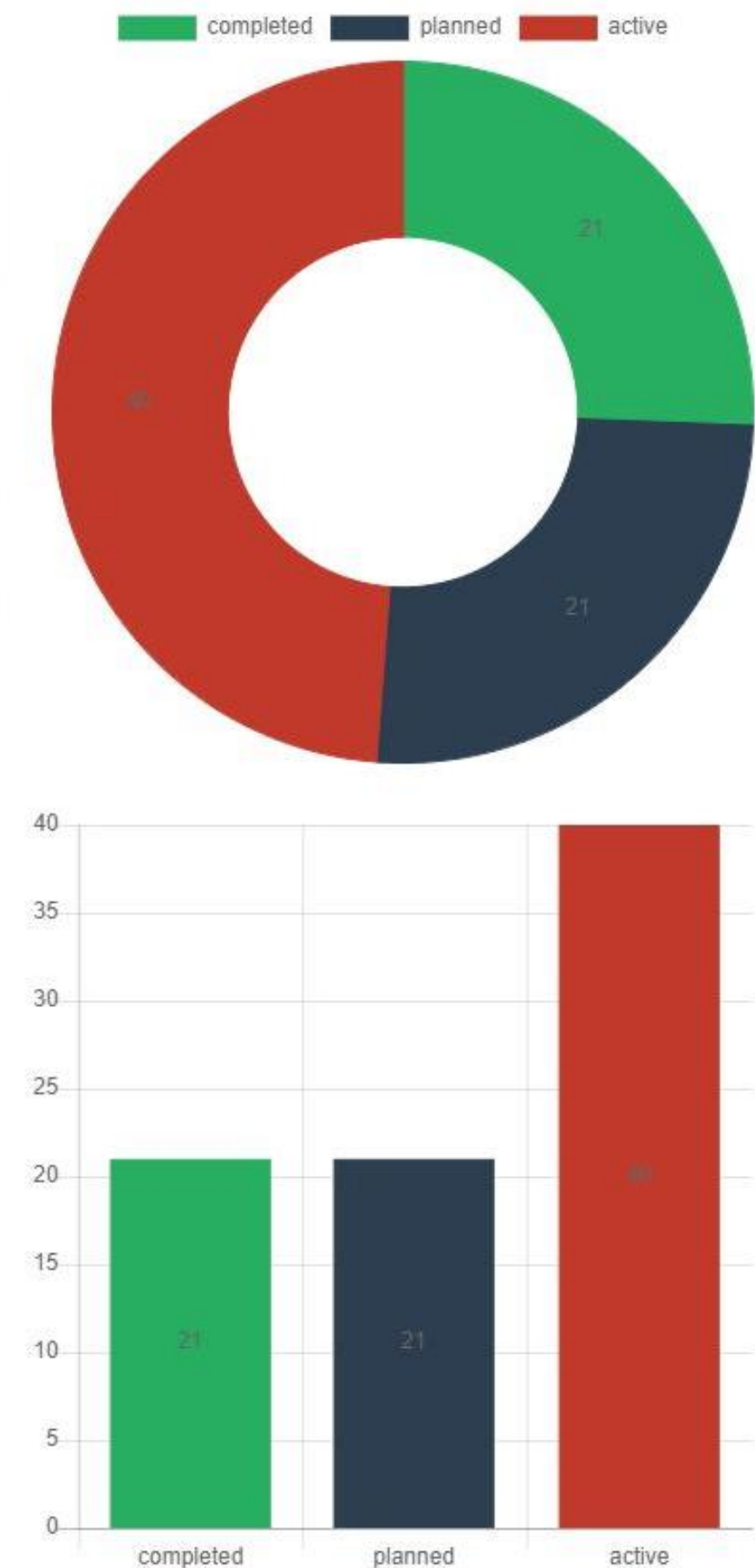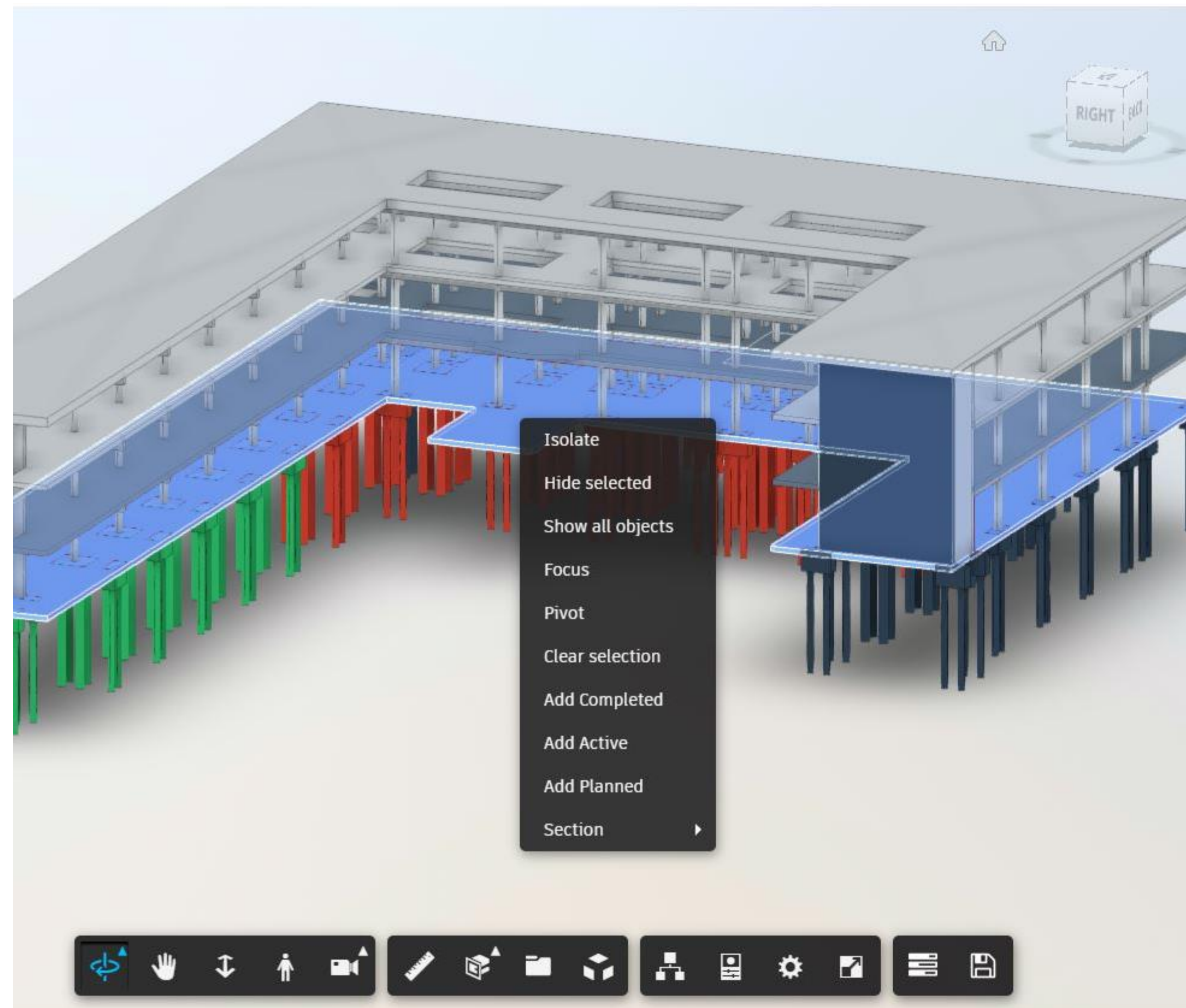
Generic workflow

Display BIM models on your Website → Add/Custom your Data
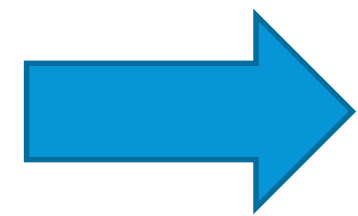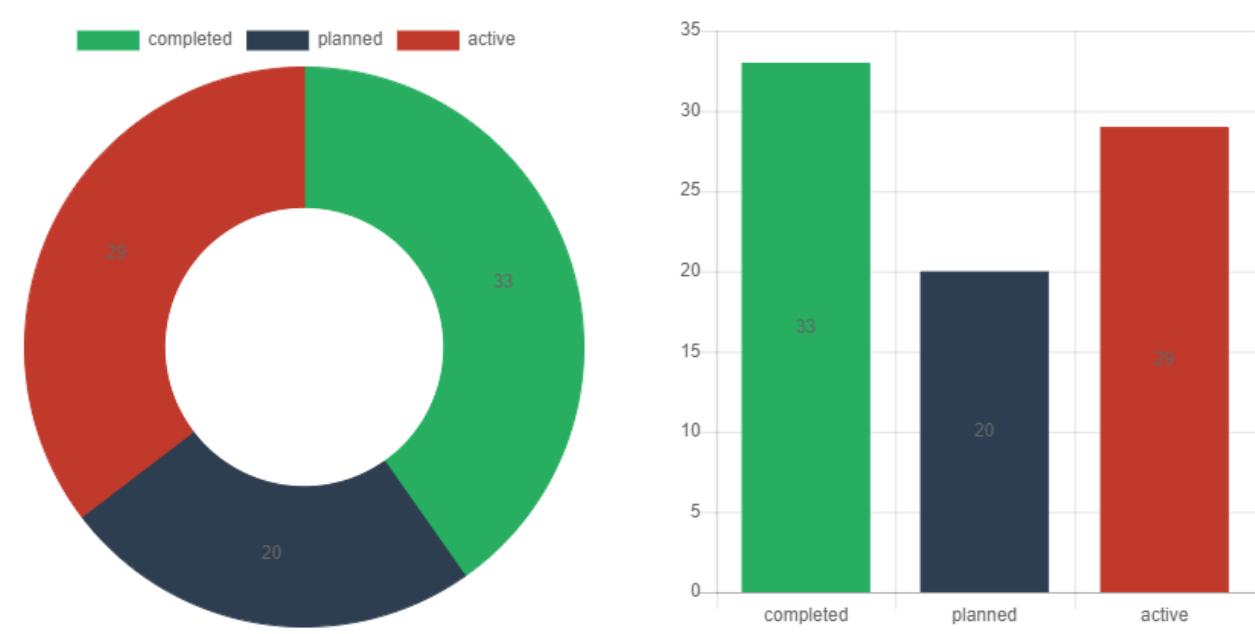
**Tracking Construcion Progress
Color-Coding Model Components**
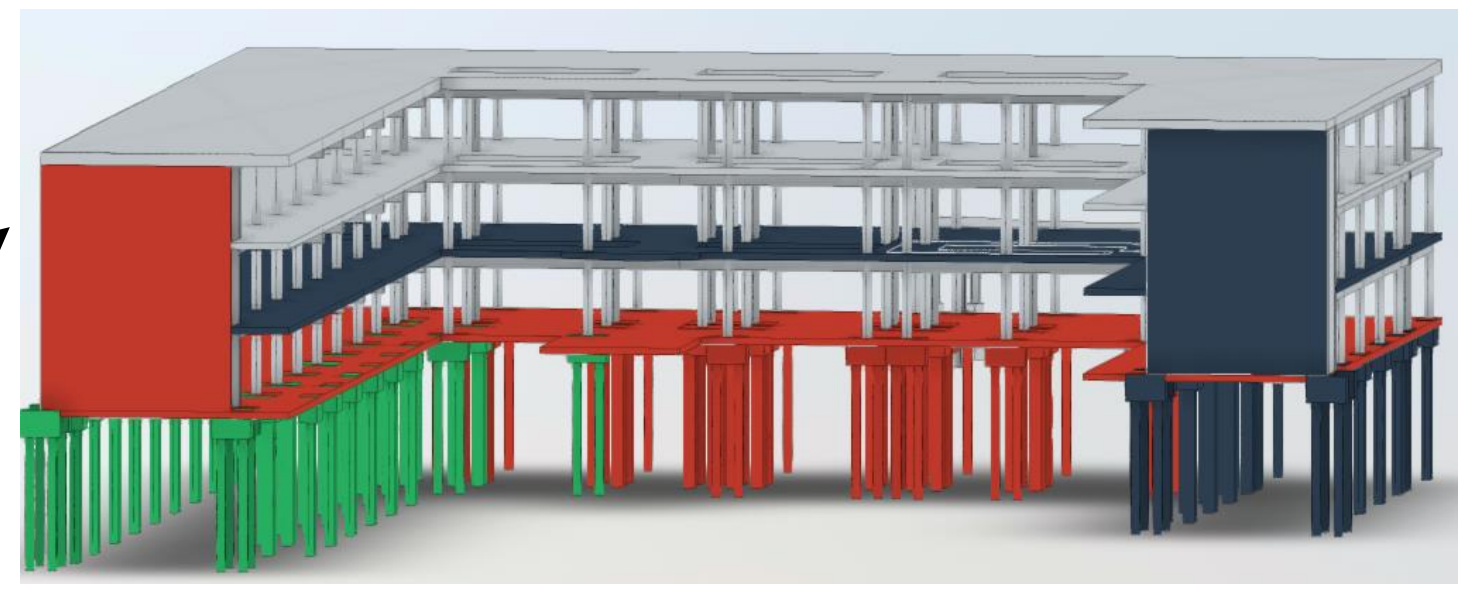
Displaying associated data
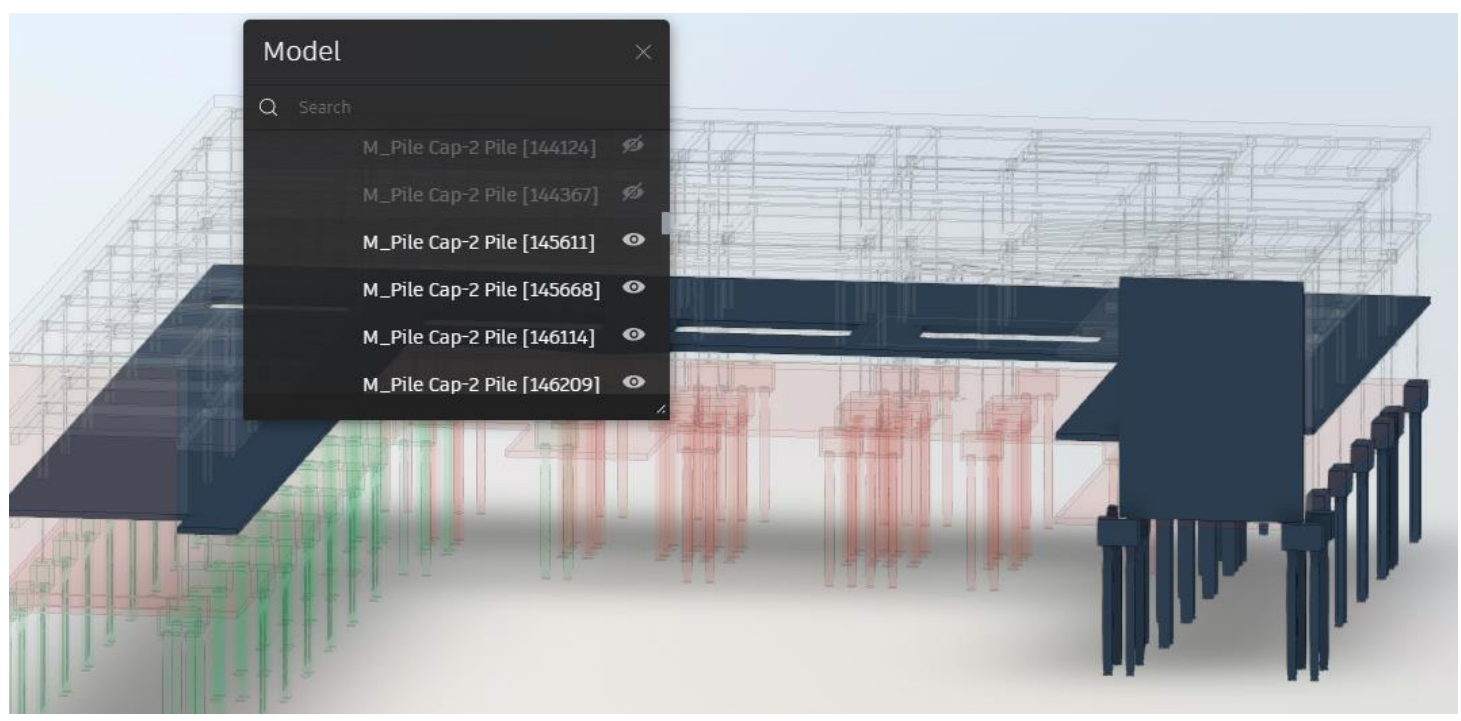
Visualization with charts
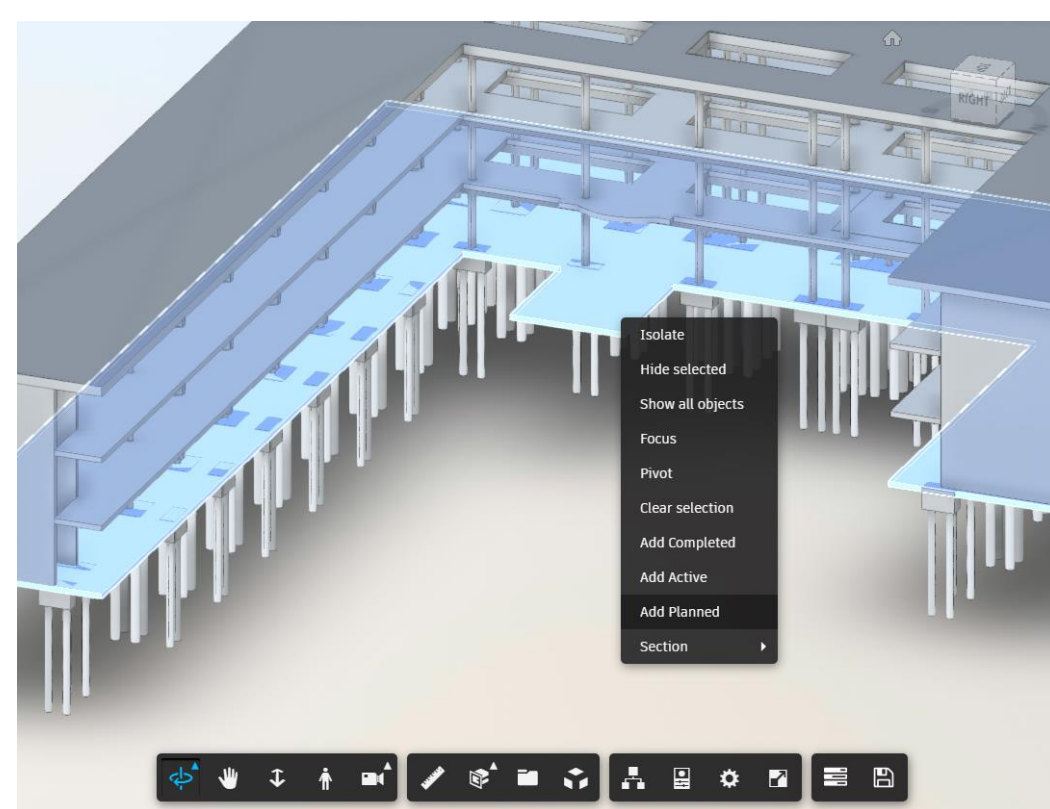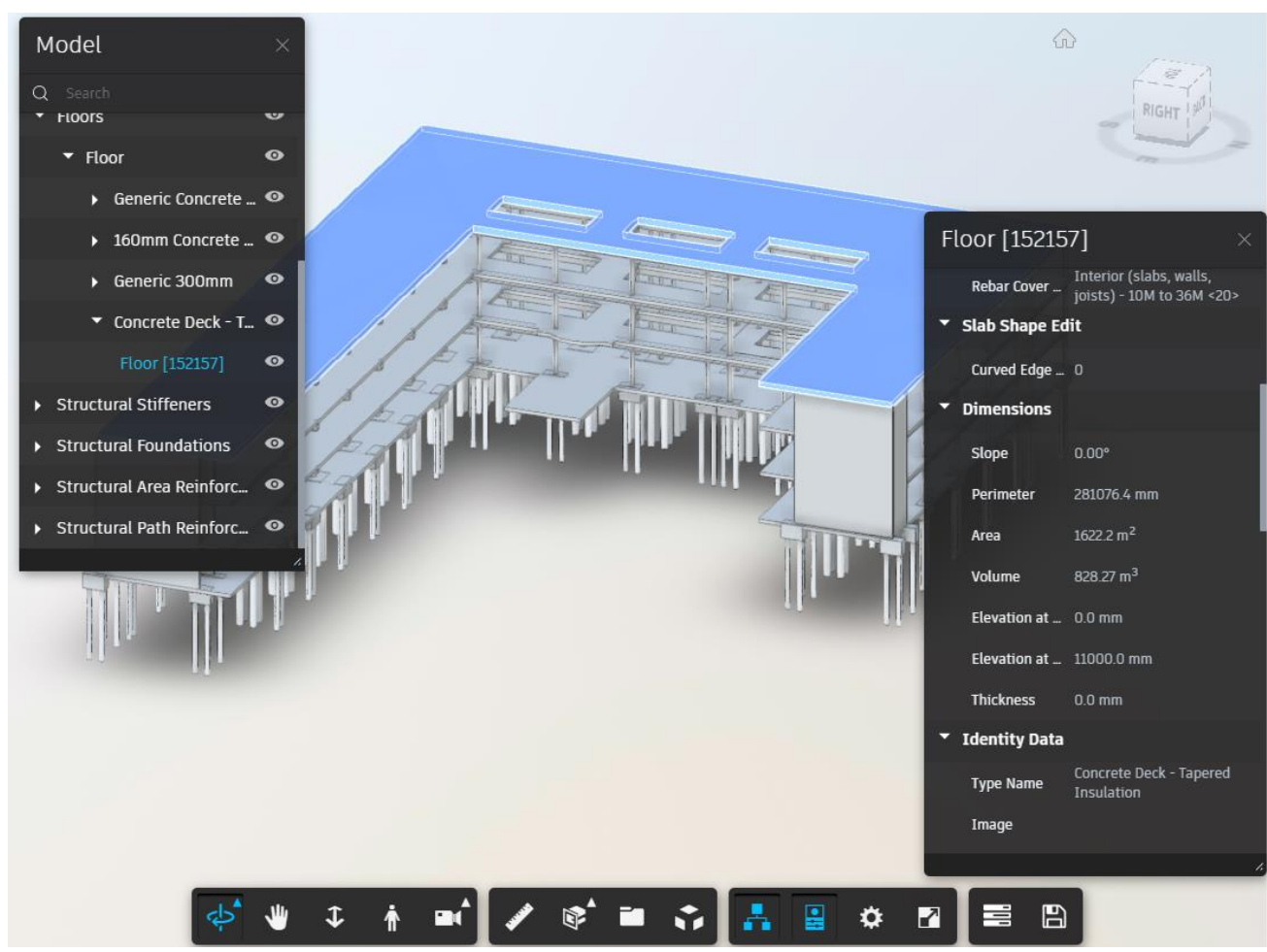
Forge application for project management

- **Who is this for**

For those who are interested in Forge

- **What is required**
- A Forge account
- A text editor
- Basic knowledge of:
    - HTML and CSS
    - JavaScript
    - Node.js Command Line (for Windows users)
    - Terminal (for Mac/Linux/Unix users)
    - Express Basic Routing
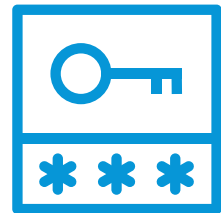   - Module FS
    - jQuery

Web development

Forge APIs used in this application

- **Authentication (Oauth)** is used to *generate* tokens based on the Oauth 2.0 specification

- **Data Management API** is used to *upload* a file or to access a file stored in Autodesk Cloud storage.

- **Model Derivative API** is used to *translate* the file to prepare it for viewing

- **Forge Viewer API is used to:**

  - *Display* an interactive 3D view of the translated model on a webpage.

  - *Detect* when a user *clicks* on a model component. The web application may then query a database for data related to that component.

  - *Query object data* from the model to prepare data for creating charts in dashboard

Live hands-on
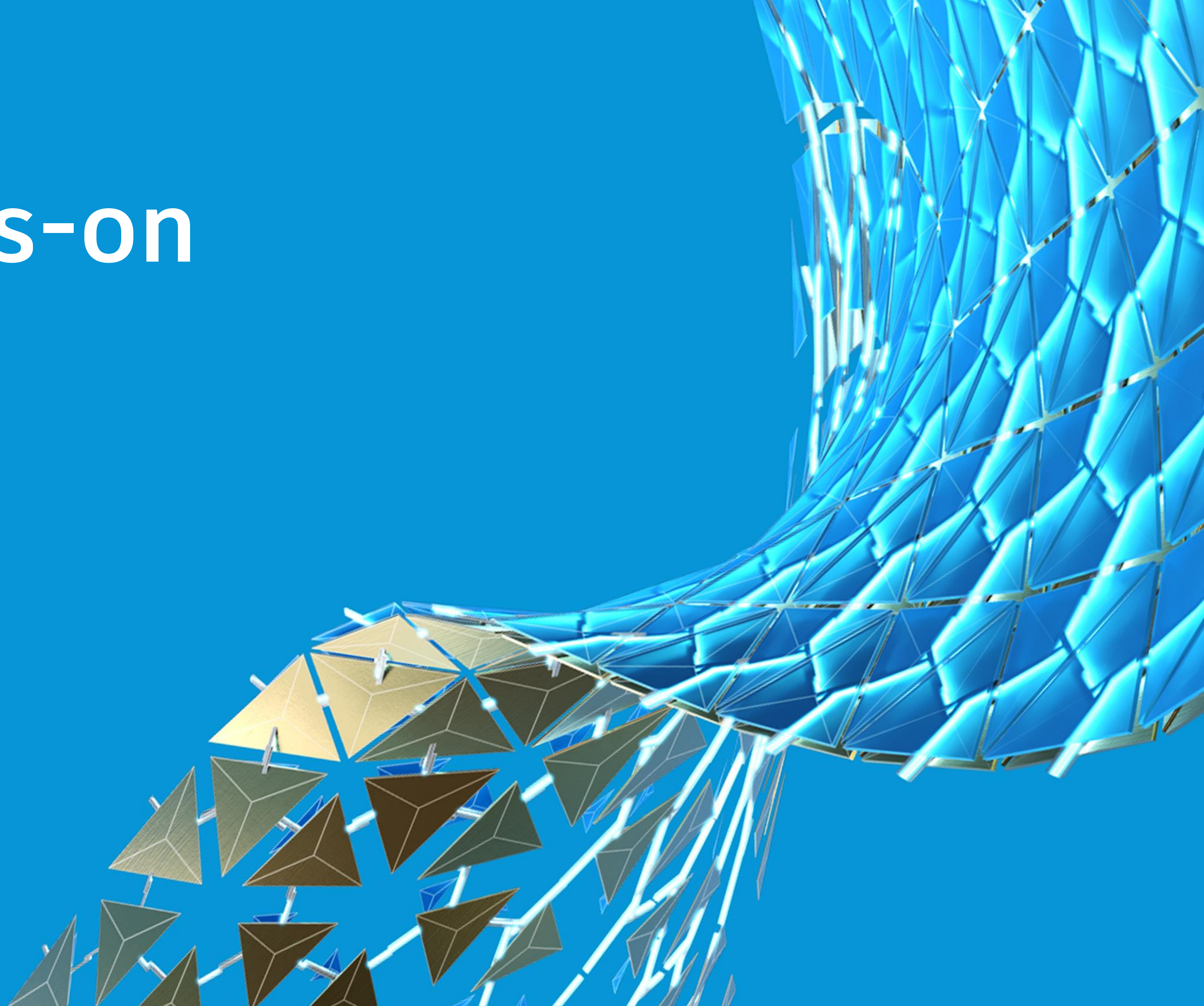
Step-by-step walkthrough

3 – RUN THE CODE

DEBUG & TESTING

2 – UNDERSTAND THE CODE

- VIEW MODELS
- UPDATE DATA
- CREATE DASHBOARD

1 – SET UP

- TEST ENVIRONMENT
- CREATE FORGE APP
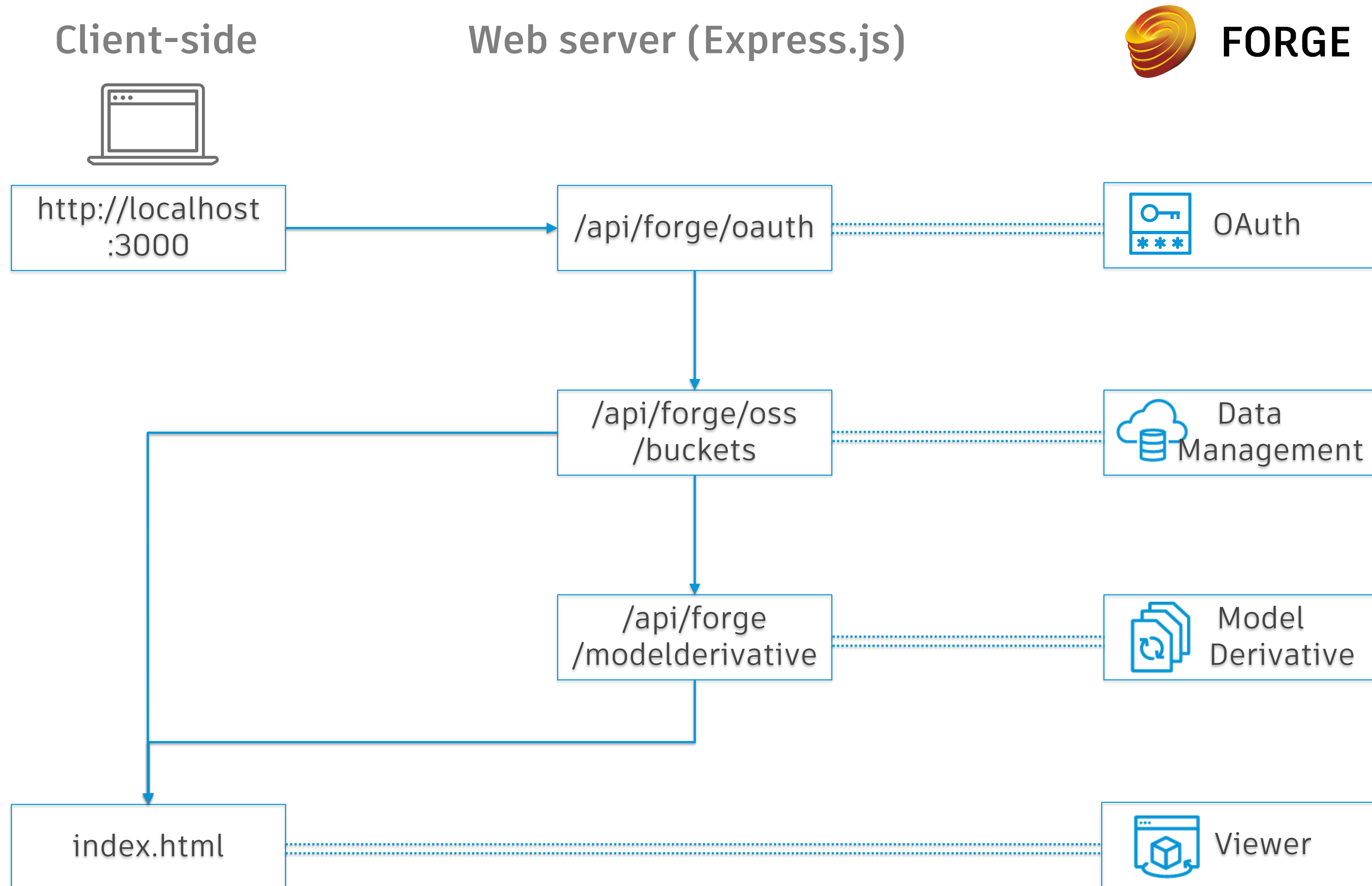- GET THE DATASETS

Set up

- Getting test environment:
  - Node.js
  - NPM
  - Visual Studio Code
- Creating your Forge app and Getting Forge Client ID and Forge Client Secret
  - Registering an app
  - Forge Client ID
  - Forge Client Secret
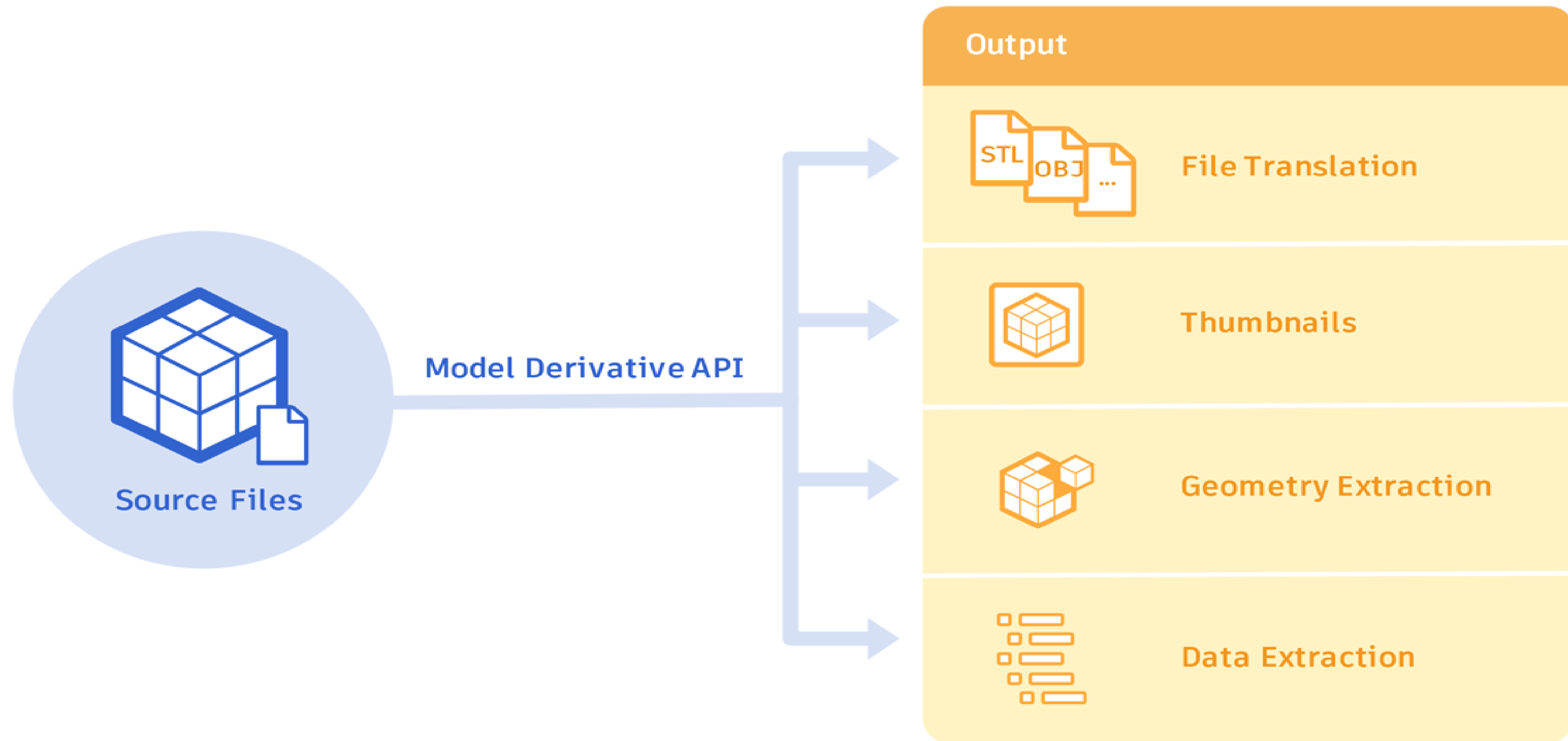- Getting the datasets

View your models - Workflow

Client-side

Web server (Express.js)

FORGE

http://localhost
:3000

/api/forge/oauth

OAuth

/api/forge/oss
/buckets

Data
Management

/api/forge
/modelderivative

Model
Derivative

index.html

Viewer

Bucket key & Policy key

Note that bucket keys must be of the form [-_.a-z0-9]{3,128}

Each bucket also has a [retention policy](#) that determines object retention time, it is the policy key:

- **transient**: Cache-like storage that persists for only 24 hours, ideal for ephemeral objects.

- **temporary**: Storage that persists for 30 days.

- **persistent**: Storage that persists until it's deleted.

Model Derivative API

Source Files

Model Derivative API

Output

STL OBJ ... File Translation

Thumbnails

Geometry Extraction

Data Extraction

Frontend JS vs Backend JS

Frontend JavaScript	Backend JavaScript
Referenced from within an HTML file.	Not placed inside or accessed from within an HTML file.
Runs on the end user's web browser and hence is visible to end users and can be changed by them.	Runs on a Node.js server and is not visible to end user on their browser.
Changes to the code only require a page refresh.	Changes to the code require restarting the Node.js server.
The script must not contain any sensitive data.	Can contain sensitive data such as the API key.
Example: index.html	Example: start.js

Update model data - Workflow

Client-side   **Web server (Express.js)**   FORGE

Viewer
Extensions

Custom Menu

Status Toolbar
Button

/api/forge
/saveFile

save   get

statusfile.json

Data structure

```
{
ModelId: string,
AddCompleted: string[],
AddActive: string[],
AddPlanned: string[]
}
```

Local file

MySQL database
SQL server
Mongo DB

Design
Automation

index.html

Viewer
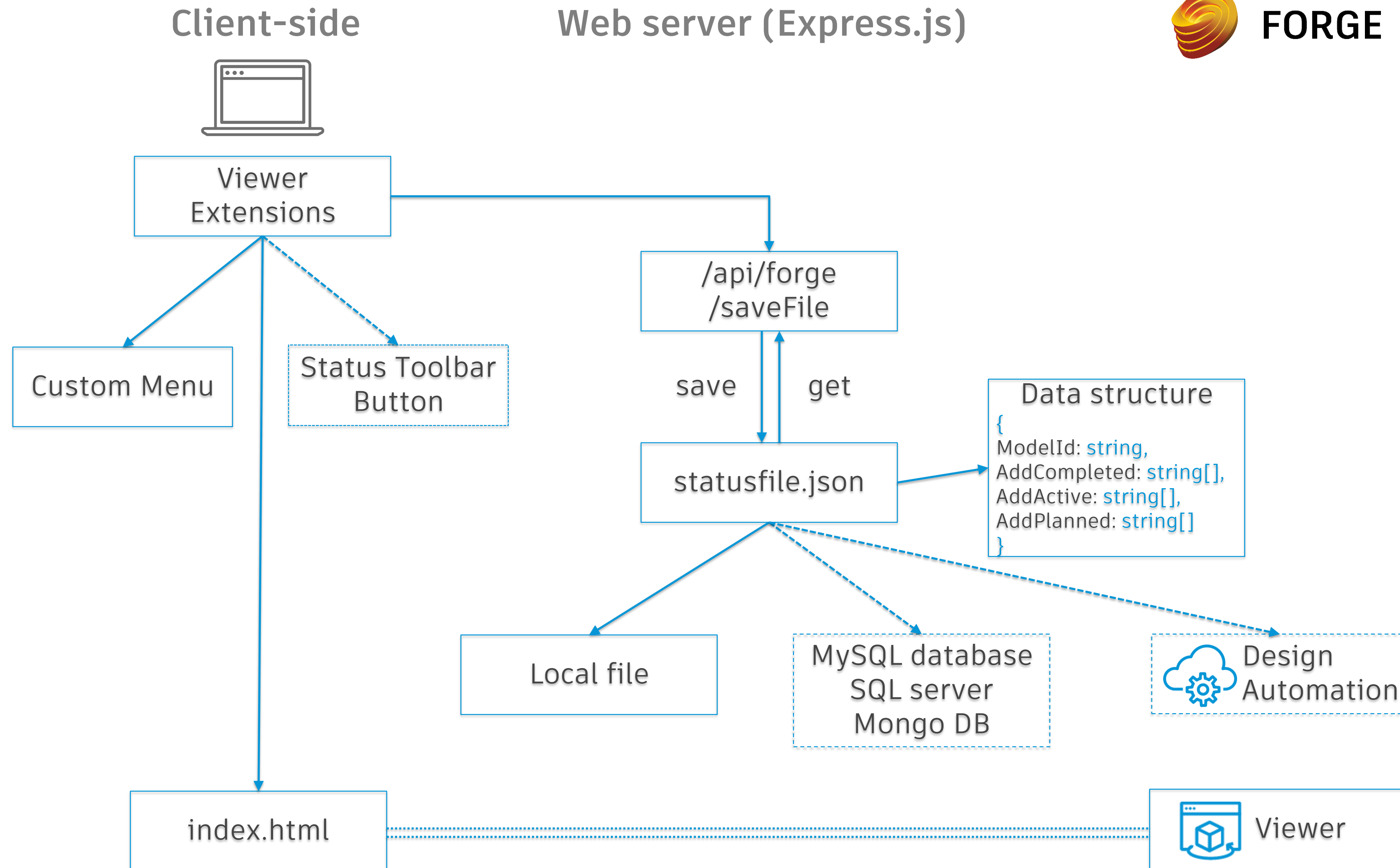
Create Dashboard - Workflow
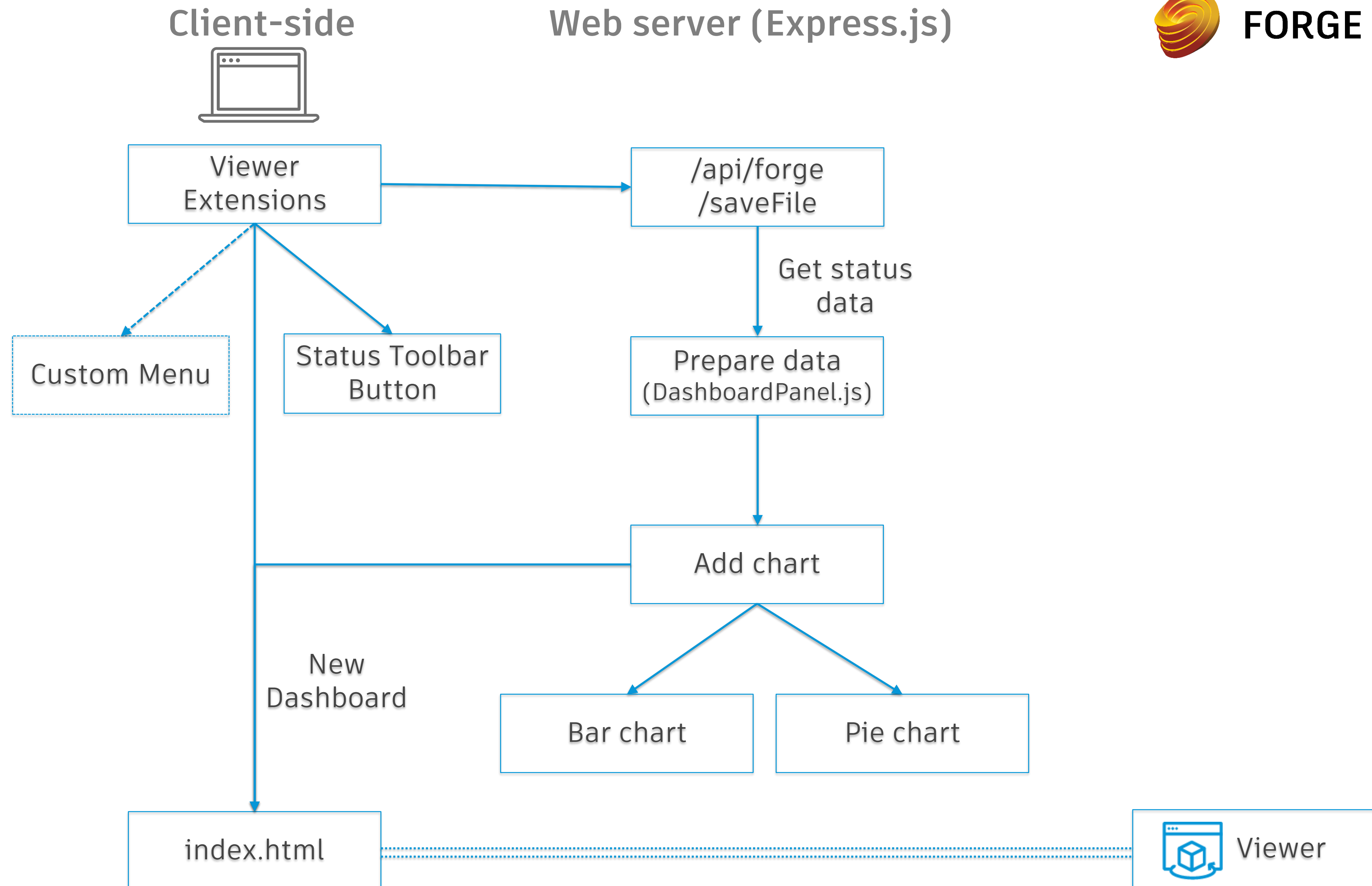
Client-side   **Web server (Express.js)**   FORGE

Viewer Extensions → /api/forge /saveFile

Viewer Extensions ⇢ Custom Menu

Viewer Extensions → Status Toolbar Button

/api/forge /saveFile → *Get status data* → Prepare data (DashboardPanel.js)

Prepare data (DashboardPanel.js) → Add chart

Viewer Extensions — Add chart

Add chart → Bar chart

Add chart → Pie chart

Viewer Extensions → *New Dashboard* → index.html

index.html ⋯ Viewer
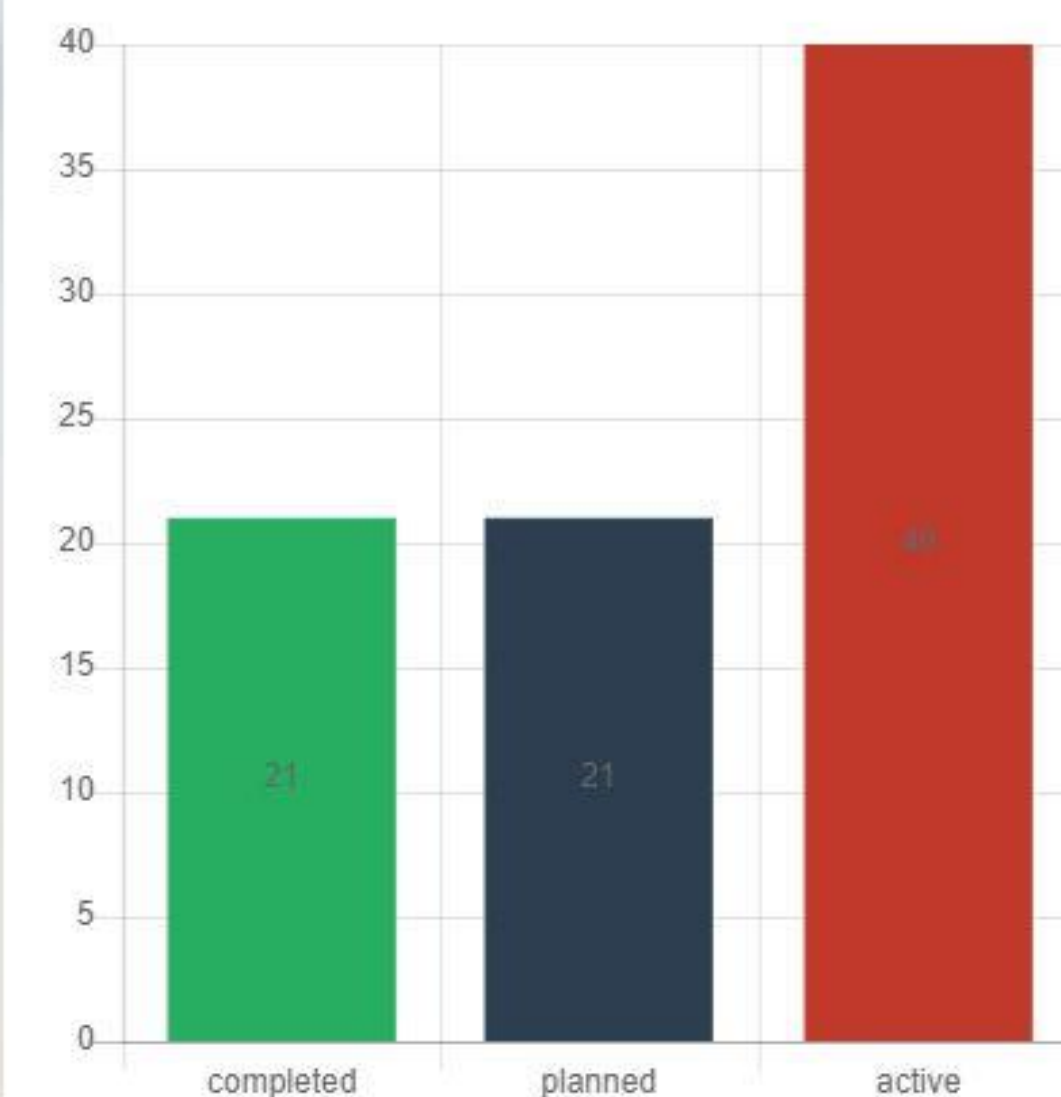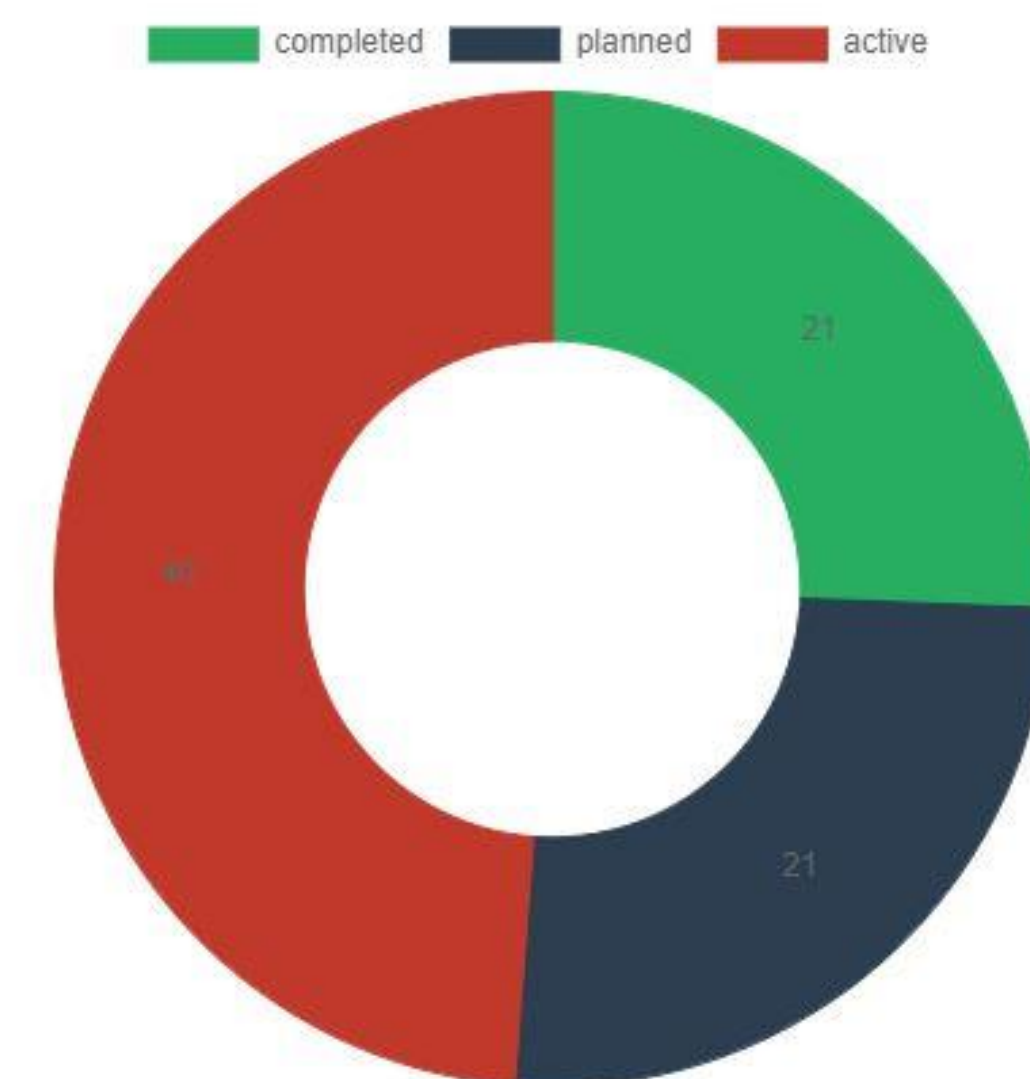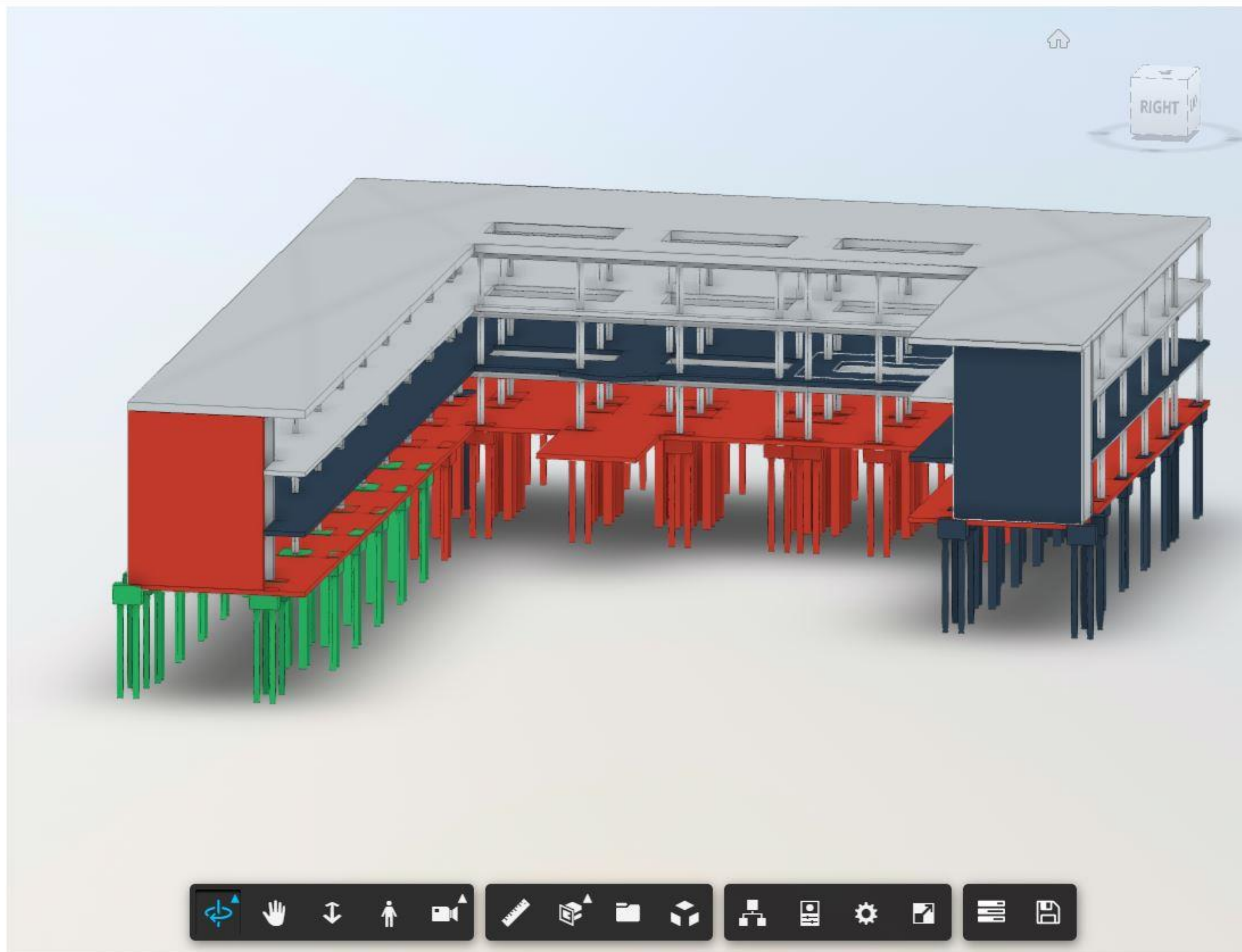
Forge application for project management

Conclusion

Summary

In today's session, we learned how to

- Set up a simple Express web server

- Two-Legged Authentication using the Forge Authentication APIs

- Create a bucket (Data Management API)

- Upload a file and save it as an object in a bucket (Data Management API)

- Read objects from a bucket (Data Management API)

- Translate the object into the SVF format (Model Derivative API)

- Display the SVF data in a web browser (Viewer API)

- Add custom properties to models' objects. (Viewer Extension)

- Save added data.

- Getting current data of models.

- Retrieve added custom data for displaying on dashboard.

- Add dashboard: bar chart and pie chart (Viewer API)

Benefits
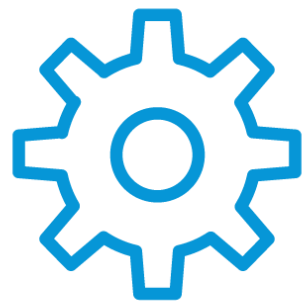
Increased Productivity

Enhance project status
visibility, easily customize
and view objects statuses

Streamlined Workflow

Connect objects information
with BIM models and
issues, checklists
in a centralized repository

Share Data Across Teams

Instantly collaborate with
team members located
anywhere in office or
constructon site

Next steps

- **Deployment:**
  - Amazon Web Services
  - Microsoft Azure
  - Heroku

- **Advanced Forge application**

  - Integrate your apps and services with BIM 360

- **Support & Online resources**

  - Developer Portal is the "source of truth" on Forge!
  - Samples: Autodesk Forge on Github
  - Blog: Forge Blog

- **Getting help**

  - https://forge.autodesk.com/en/support/get-help
  - https://forge.autodesk.com/FAQ

Learning Objectives

1
FORGE OVERVIEW

2
VIEW MODELS

3
CUSTOMIZE DATA

4
BUILD YOUR OWN APP

Understand how the Autodesk Forge platform can help overcome challenges in project management

Learn how to use the Forge APIs to upload, convert and display your models in a web browser

Learn how to use the Forge APIs to access and customize your cloud data and create dashboard

Learn how to use the Forge tool to build a project schedule management application of your own

Thank you!

If you have any questions or concerns, please feel free to comment on the class page.

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