

xeokit

a Web Programming Toolkit
for BIM & Engineering
Graphics

WebGL Meetup, 18 November, 2020

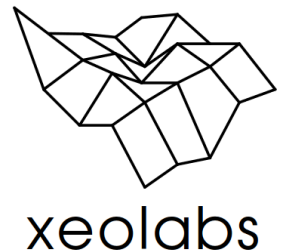


<https://slides.com/xeolabs/xeokit-sdk>

Lindsay Kay

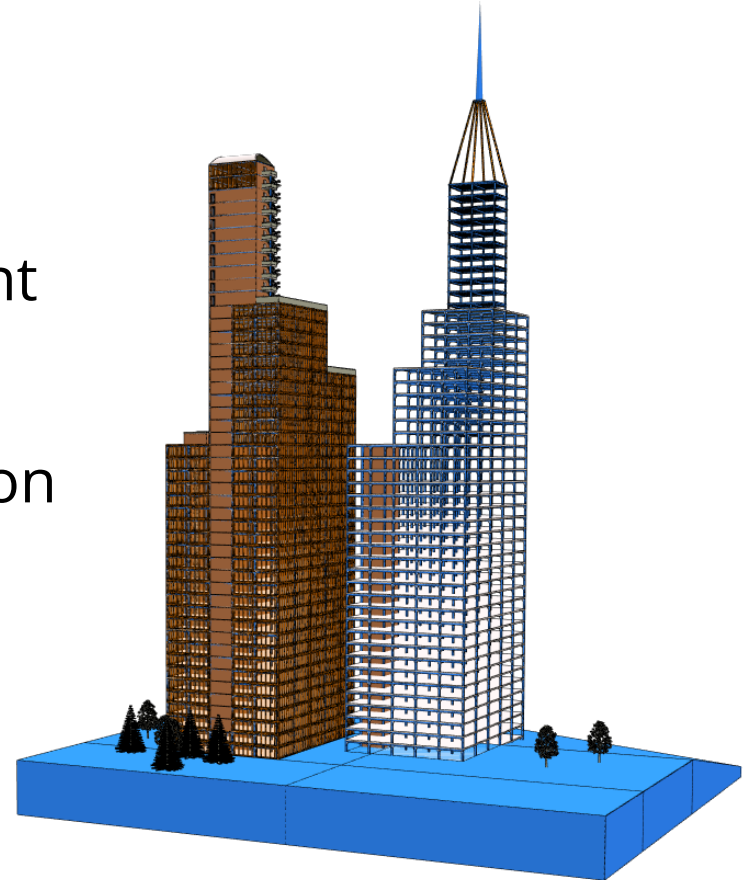
3D software developer at xeolabs.com

- [@xeolabs](https://twitter.com/xeolabs)
- github.com/xeolabs



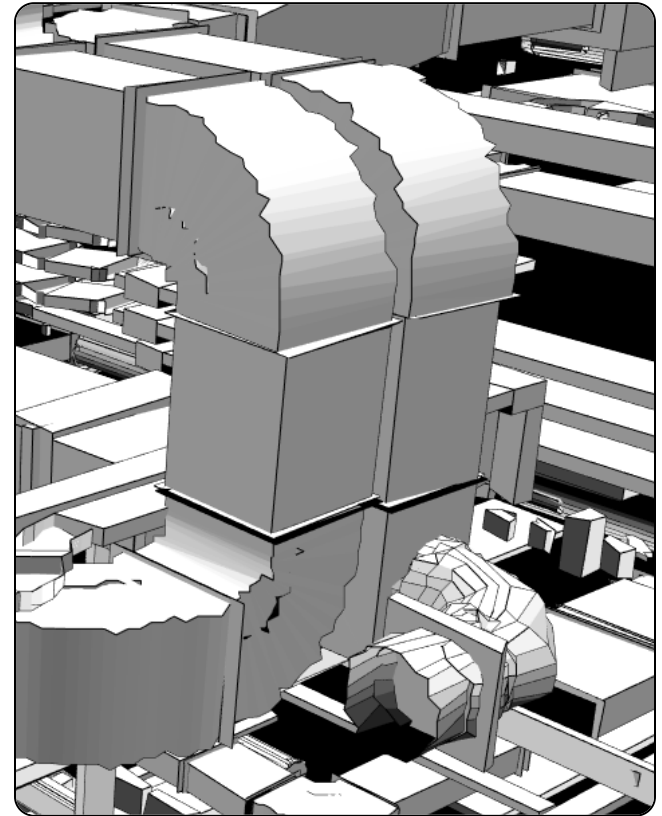
1. What is BIM?

- Building Information Modeling
- Digitized construction management
- Centered around a meta model, provided by the Industry Foundation Classes (IFC)
- Use models to collaborate on planning, design, construction and maintenance



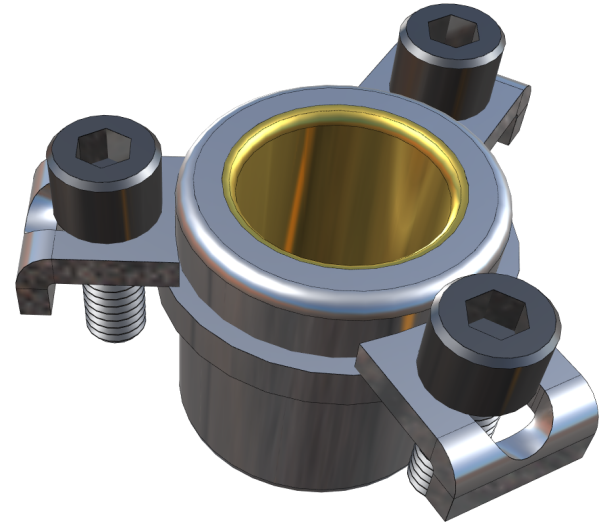
2. WebGL BIM Challenges

- Load large models quickly
- Fit large models in browser memory
- Draw many objects, interactively
- Navigate precisely, in both open and tight spaces
- Accurately render full-precision geometry



3. What is xeokit?

- A JavaScript SDK for developing model viewers for BIM and engineering
- Uses WebGL (1)
- Loads and views big models, at full-precision
- Loads IFC, glTF, OBJ, STL, 3DXML, XKT & metadata to classify objects
- Convert models with open source tools & host them on your own server



```
const viewer = new Viewer({
  canvasId: "myCanvas"
});

viewer.camera.eye = [0, 0, 10];
viewer.camera.look = [0, 0, 0];
viewer.camera.up = [-0, 1, 0];

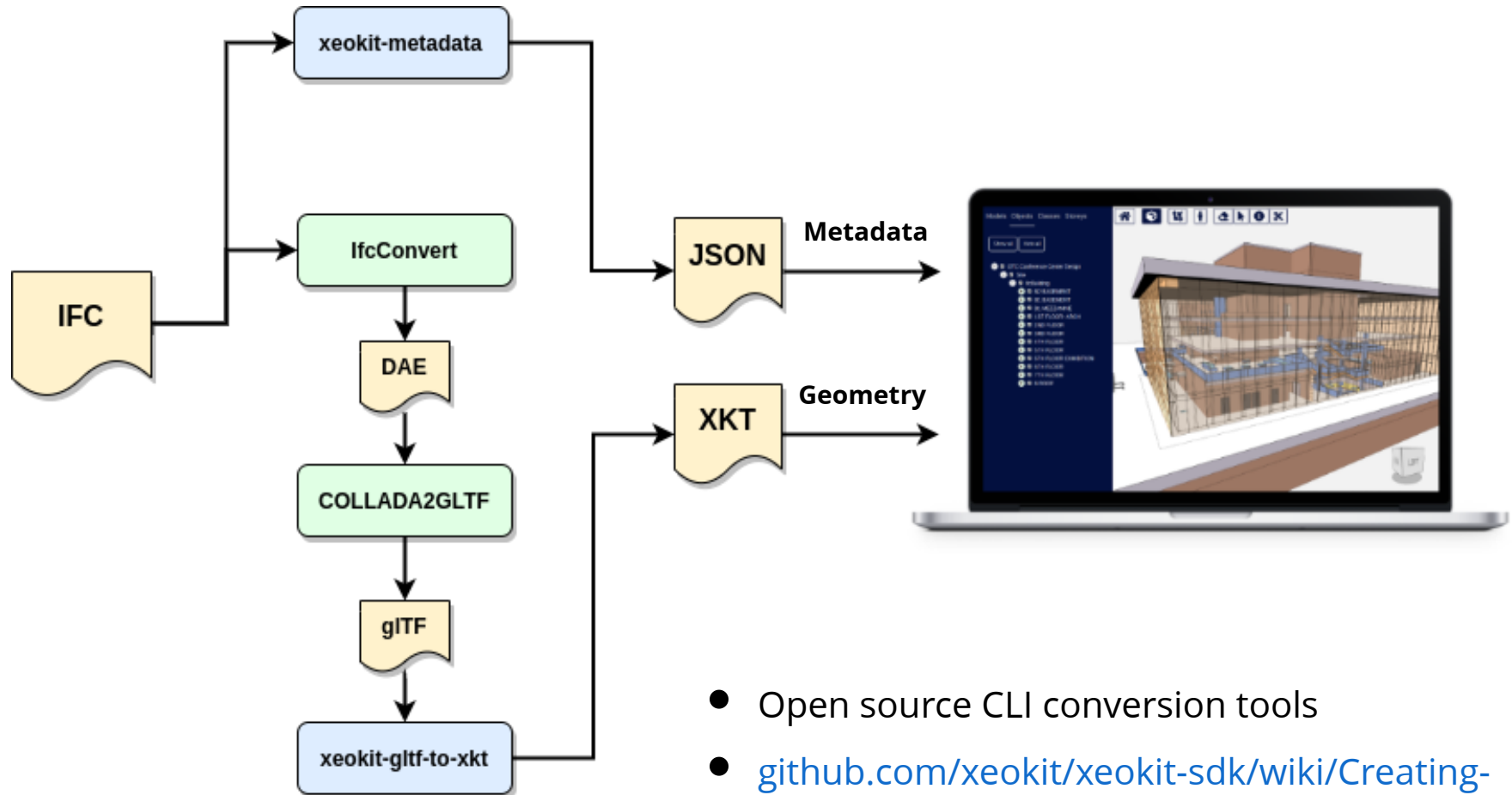
const xktLoader =
  new XKTLoaderPlugin(viewer);

const model = xktLoader.load({
  src: "myModel.xkt",
  metaModelSrc: "myModel.json"
});
```

5. Loading Big Models Quickly

- xeokit has a native, binary geometry format called "XKT"
- Quantized, tiled RTC vertex positions & oct-encoded normals
- 48 bits per position, 16 bits per normal
- Pre-computed wireframe indices
- Convert IFC to XKT using open source CLI tools

6. Converting IFC Models for xeokit

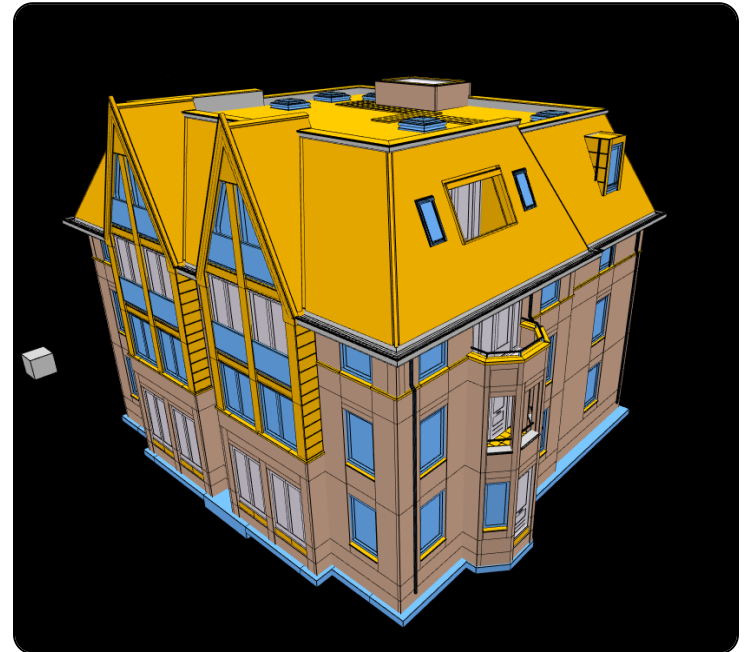


- Open source CLI conversion tools
- github.com/xeokit/xeokit-sdk/wiki/Creating-Files-for-Offline-BIM

7. Loading IFC Models into xeokit

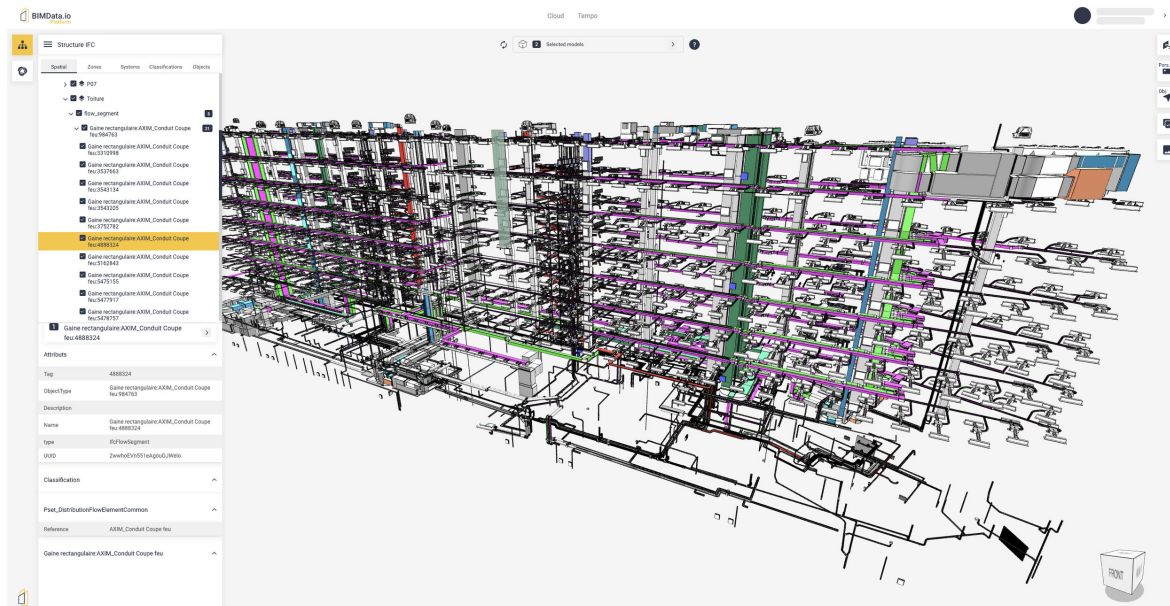
Minimal example

```
1 import {Viewer} from "../src/viewer/Viewer.js";
2 import {XKTLoaderPlugin} from
3   "../src/plugins/XKTLoaderPlugin/XKTLoaderPlugin.js";
4
5 const viewer = new Viewer({
6   canvasId: "myCanvas"
7 });
8
9 viewer.camera.eye = [1842022, 10, -5173301];
10 viewer.camera.look = [1842022, 10, -5173401];
11 viewer.camera.up = [-0.0, 1.0, 0.0];
12
13 const xktLoader = new XKTLoaderPlugin(viewer);
14
15 const model = xktLoader.load({
16   metaModelSrc: "metadata.json",
17   src: "geometry.xkt"
18 });
```



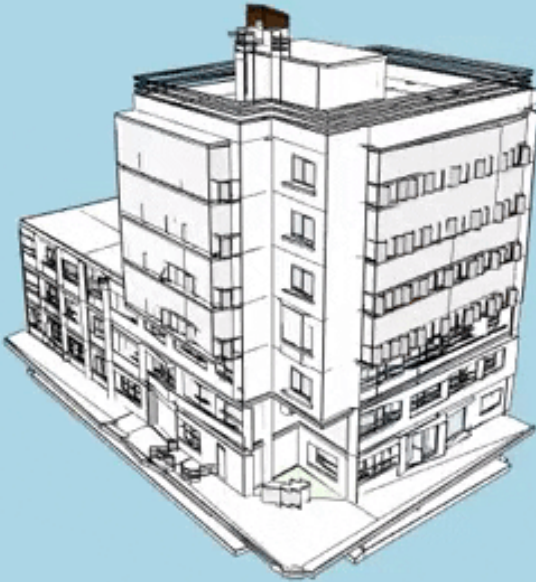
8. Minimizing Memory Footprint

- xeokit stores geometry on the GPU, not in browser
- Quantized RTC vertex positions, oct-encoded normals
- 48 bits per double-precision position, 16 bits per normal



A large plumbing model at [BIMData.io](https://bimdata.io)

10. Accurate Rendering - Rounding Jitter on WebGL

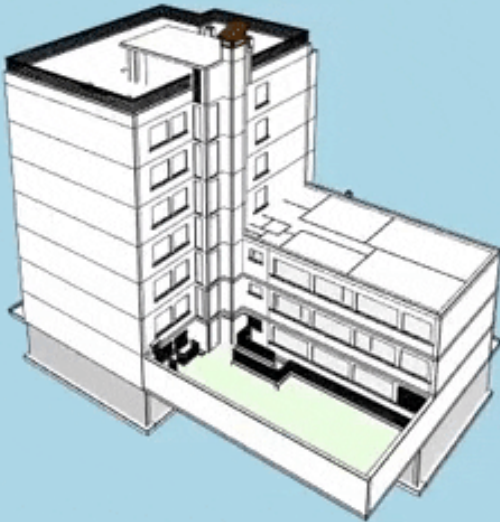


- Many BIM models use double-precision coordinates
- GPUs are usually only single-precision, however
- **Need to emulate double-precision rendering to eliminate rounding jitter**

Model centered at (1842022, 10, -5173301), provided by [BIMData.io](https://bimdata.io)

xeokit.github.io/xeokit-sdk/examples/#loading_XKT_jitter_singlePrecision_MAP

11. Accurate Rendering - Eliminating Rounding Jitter

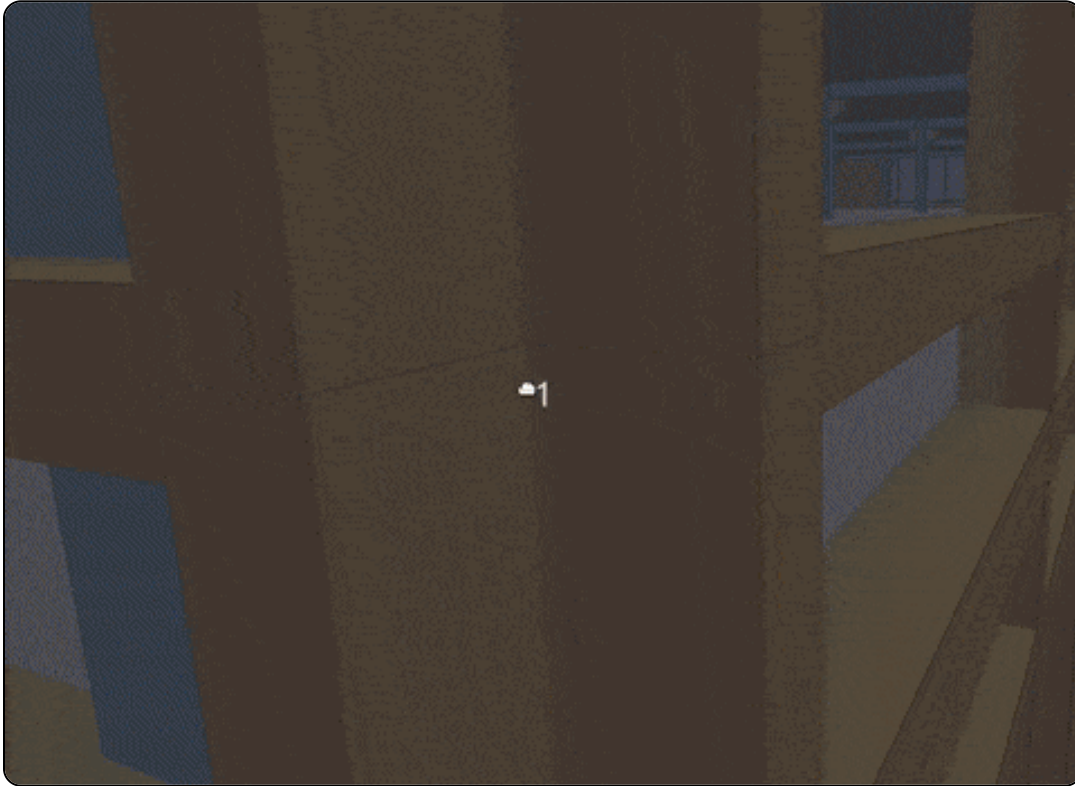


- **Tiled, relative-to-center (RTC) coordinates**
- Coords are 32-bit offsets from their 64-bit tile centers, rendered using modified view matrix
- Memory bonus: full-precision without the cost of storing double-precision values

xeokit.github.io/xeokit-sdk/examples/#loading_XKT_jitter_fullPrecision_MAP

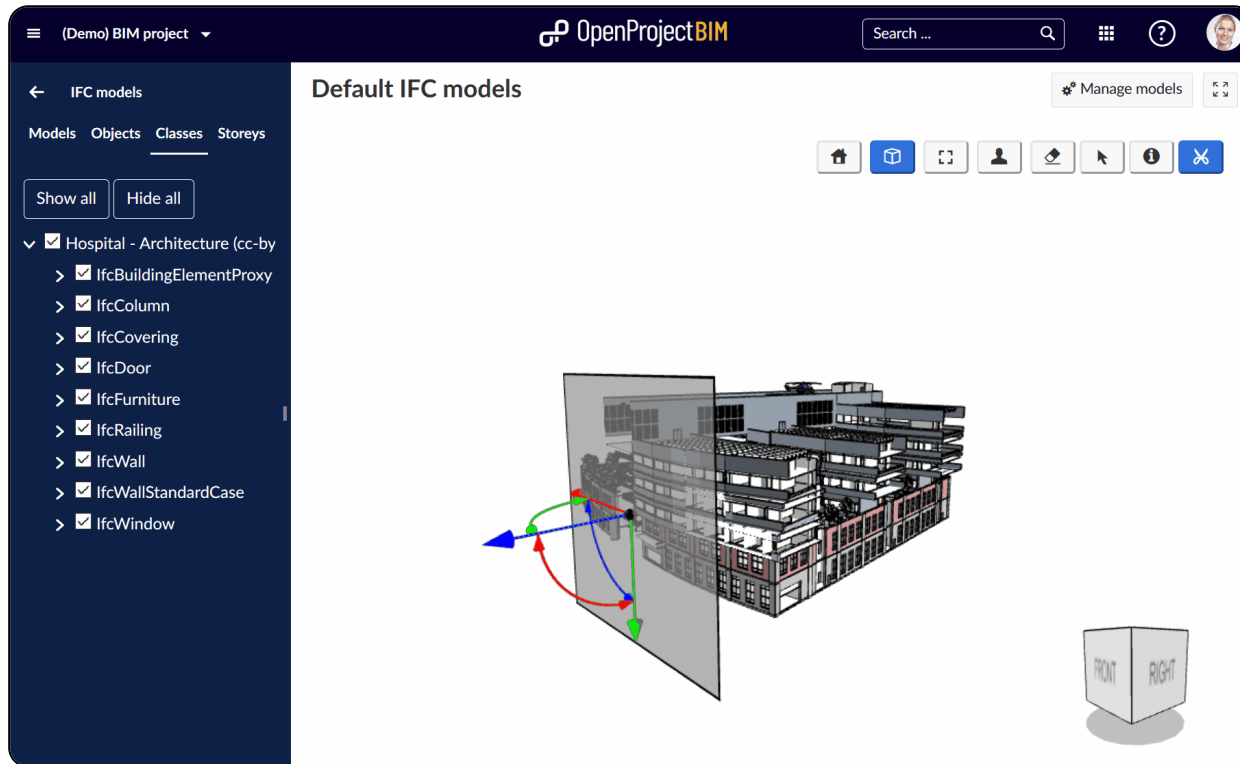
Read about RTC coordinates in virtualglobebook.com

12. Navigating Precisely



- Distance-proportional rate of forward/backward movement
- Move fast in open spaces, move slow in tighter spaces
- Ray-cast every n frames to find distance to nearest object, scale dolly and zoom rates accordingly

13. xeokit in the Wild : OpenProject GmbH



- View multiple models
- Share issues via BCF
- Slice, highlight, X-ray
- Plan views

- https://youtube.com/watch?v=qOTdYnWz_YA
- github.com/xeokit/xeokit-bim-viewer
- openproject.org/openproject-bim-10-4

Thanks!

- xeokit.io
 - github.com/xeokit/xeokit-sdk
 - xeokit.github.io/xeokit-sdk/examples/
-
- [@xeolabs](https://twitter.com/xeolabs)
 - xeolabs.com