GEO DESIGN+BIM
23-24TH NOVEMBER 2017 | VENUE: NOVOTEL AMSTERDAM CITY, THE NETHERLANDS

mago3D

# A web based BIM/GIS integration platform on top of open source

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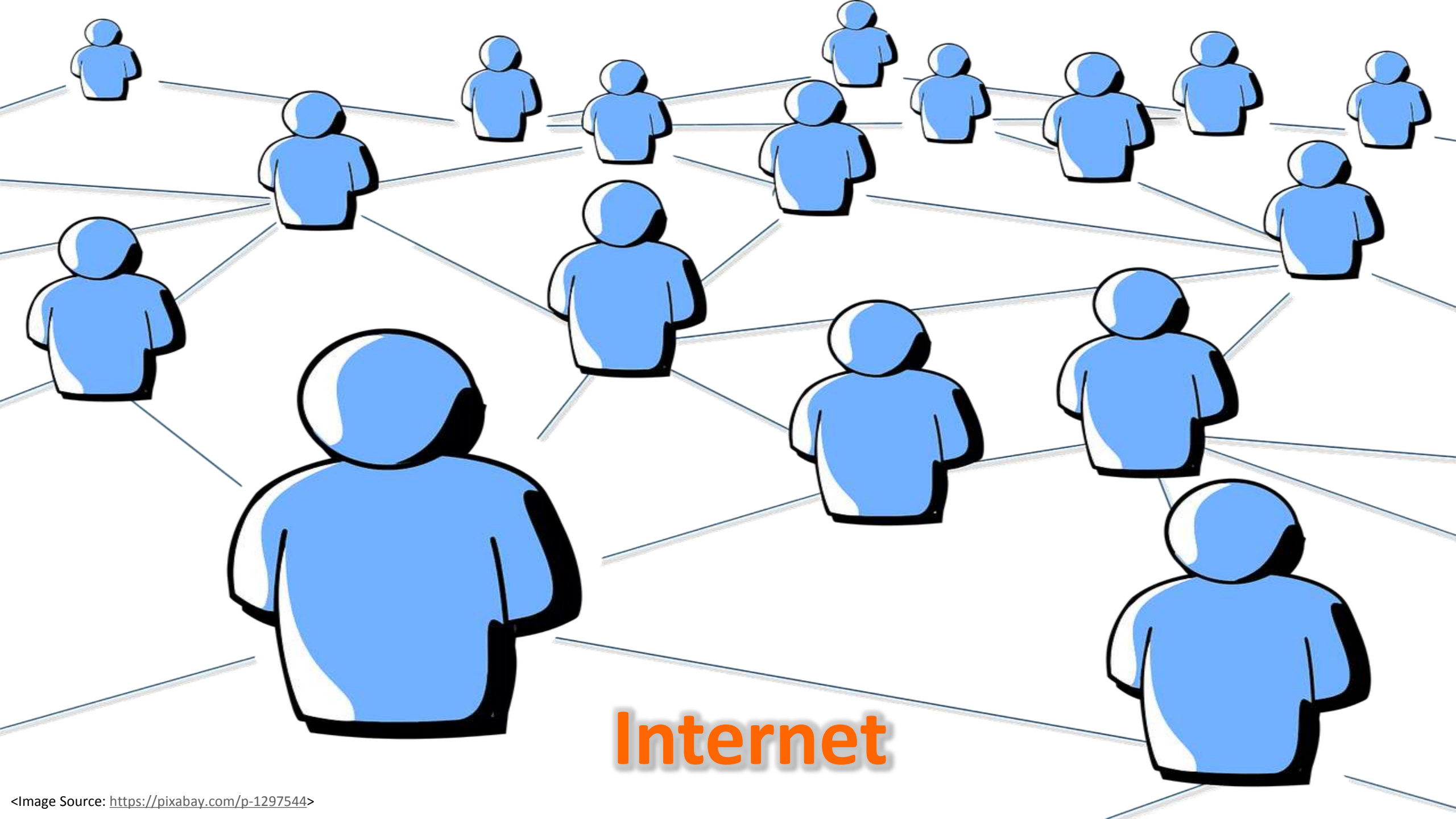
Gaia3D
The GeoSpatial Company

# Innovation?



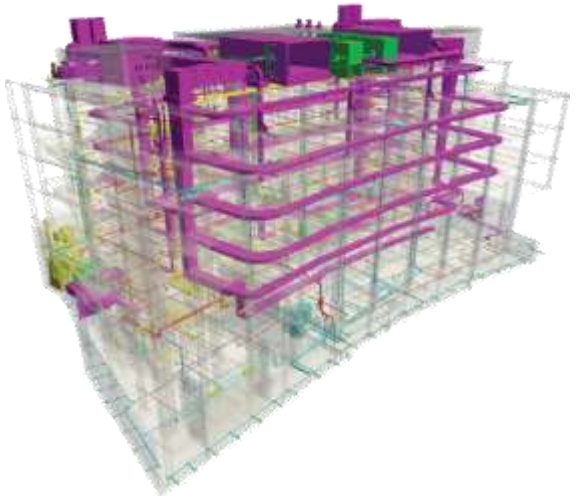

<Image Source: https://pixabay.com/p-1297544>


# Smartphone

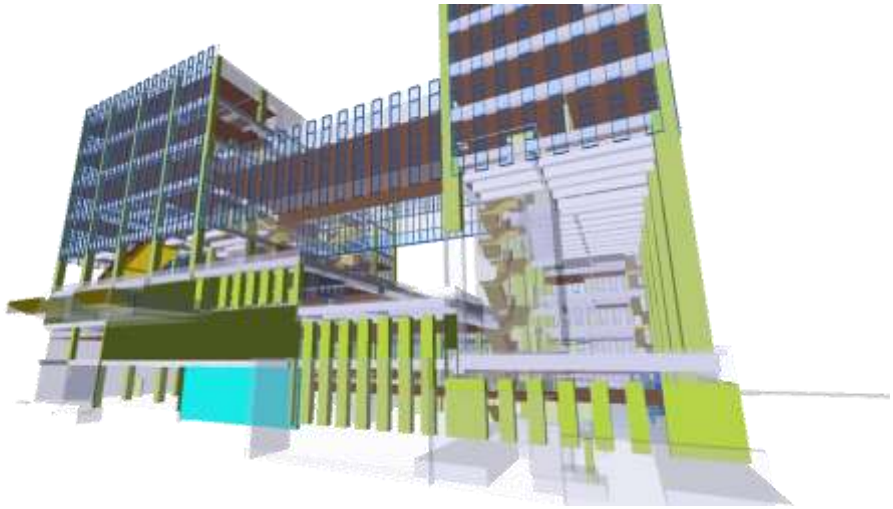

iPhone
Canon
EOS
SONY
240
Broadway
tomtom

Innovation is all about

Access!!



# So, what about BIM?

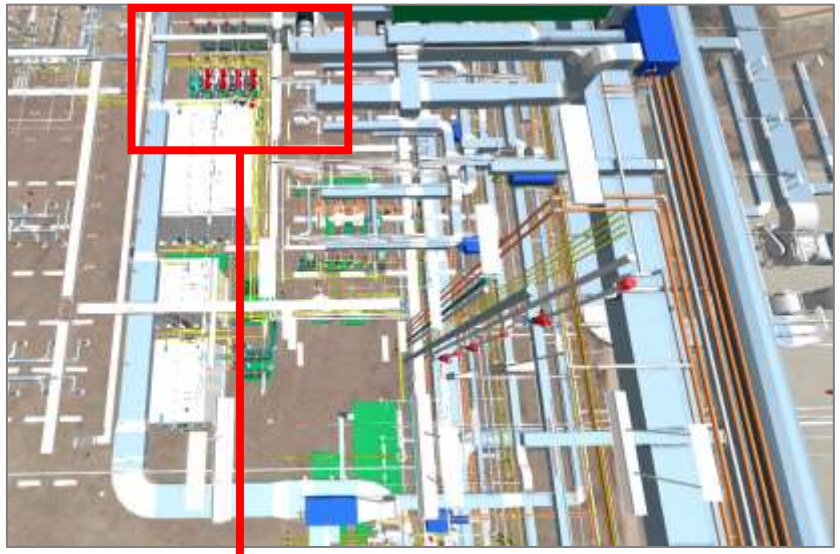


**Building Information Modeling (BIM)**
is a digital representation of physical and functional characteristics of a facility.

**Current BIM**

1. Hard to access & see the BIM data
2. Closed and proprietary technology
3. Loosing geospatial context

# BIM data is quite big and complex!



➔ Hard to see and access BIM data without specific software!

# Technologies are closed and proprietary!

- 3DMF — QuickDraw 3D Metafile (.3dmf)
3DS, MAX — 3D Studio Max Model (.max, .3ds)
3DT — 3D Topicscape The database in which the meta-data of a 3D Topicscape is held. A 3D Topicscape is a form of 3D concept map (like a 3D mind-map) used to organize ideas, information and computer files.
ATY — 3D Topicscape file, produced when an association type is exported by 3D Topicscape. Used to permit round-trip (export Topicscape, change files and folders as desired, re-import them to 3D Topicscape).
AC — AC3D Model (.ac)
AN8 — Anim8or Model (.an8)
AOI — Art of Illusion Model (.aoi)
B3D — Blitz3D Model (.b3d)
BLEND — Blender (.blend)
C4D — Cinema 4D (.c4d)
Cal3D — Cal3D (.cal3d)
CAG - Lego Reference System
CFL — [illegible]
COB — Caligari Object (.cob)
CTM — OpenCTM (.ctm)
DAE — COLLADA ([illegible])
DTS — Torque Game Engine (.dts)
EGG — Panda3D Engine
FACT — Electric Image (.fac)
FBX — Autodesk FBX (.fbx)
FES — 3D Topicscape file, produced when a fileless occurrence in 3D Topicscape is exported to Windows. Used to permit round-trip (export Topicscape, change files and folders as desired, re-import them to 3D Topicscape).
G — BRL-CAD geometry (.g)
GLM — Ghoul Mesh (.glm)
LWO — Lightwave Object (.lwo)
LWS — Lightwave Scene (.lws)
LXO — Luxology Modo (software) file (.lxo)
MA — Autodesk Maya ASCII File (.ma)
MB — Autodesk Maya Binary File (.mb)

- MD2 — Quake 2 model format (.md2)
MD3 — Quake 3 model format (.md3)
MDX — Blizzard Entertainment's own model format (.mdx)
MESH — New York University(.m)
MESH — Meshwork Model (.mesh)
MM3D — Misfit Model 3d (.mm3d)
MM — FreeMind mind map file (XML).
MMP — Mind Manager mind map file.
TPC — 3D Topicscape file, produced when an inter-Topicscape topic link file is exported to Windows. Used to permit round-trip (export Topicscape, change files and folders as desired, re-import them to 3D Topicscape).
NIF — Gamebryo NetImmerse File (.nif)
OBJ — OBJ (.obj)
OFF — OFF Object file format (.off)
PRC — Adobe PRC (embedded in PDF files)
POV — POV-Ray Document (.pov)
RWX — RenderWare Object (.rwx)
SIB — Nevercenter Silo Object (.sib)
[illegible] Gallery Model[1] (.u3d)
[illegible] (.skp)
SLDASM — SolidWorks Assembly Document (.sldasm)
SLDPRT — SolidWorks Part Document (.sldprt)
SMD — Valve's format. (.smd)
U3D — Universal 3D file format (.u3d)
WINGS — Wings3D (.wings)
X — DirectX 3D Model (.x)
X3D — Extensible 3D (.x3d)
Z3D — Zmodeler (.z3d)

**3D formats are usually created with professional CAD software**

- 3dmlw - 3DMLW (3D Markup Language for Web) files
3dxml - Dassault Systemes graphic representation
ACP — VA Software VA - Virtual Architecture CAD file
AR — Ashlar-Vellum Argon - 3D Modeling
ART — ArtCAM model
ASC — BRL-CAD Geometry File (old ascii format)
ASM — Solidedge Assembly, Pro/ENGINEER Assembly
BIN, BIM — Data Design System DDS-CAD
CCC — CopyCAD Curves
CCM — CopyCAD Model
CCS — CopyCAD Session
CAD — CadStd
CATDrawing - CATIA V5 Drawing document
CATPart - CATIA V5 Part document
CATProduct - CATIA V5 Product document
CATProcess - CATIA V5 Manufacturing document
cgr - CATIA V5 graphic representation
CO — Ashlar-Vellum Cobalt - parametric drafting and 3D modeling
DRW - Caddie Early version of Caddie drawing - Prior to Caddie changing to DWG
DWG — AutoCAD and Open Design Alliance applications
DFT — Solidedge Draft
DGN — MicroStation design file
DGK — Delcam Geometry
DMT — Delcam Machining Triangles
DXF — ASCII Drawing Interchange file format - AutoCAD
DWB — VariCAD drawing file
DWF — AutoDesk's Web Design Format; AutoCAD & Revit can publish to this format; similar in concept to PDF files; AutoDesk Design Review is the reader
EMB - Wilcom - Wilcom ES Designer Embroidery CAD file
ESW - Agtek format
EXCELLON, or Excellon file
FM — FeatureCAM Part File
FMZ — FormZ Project file
G — BRL-CAD Geometry File

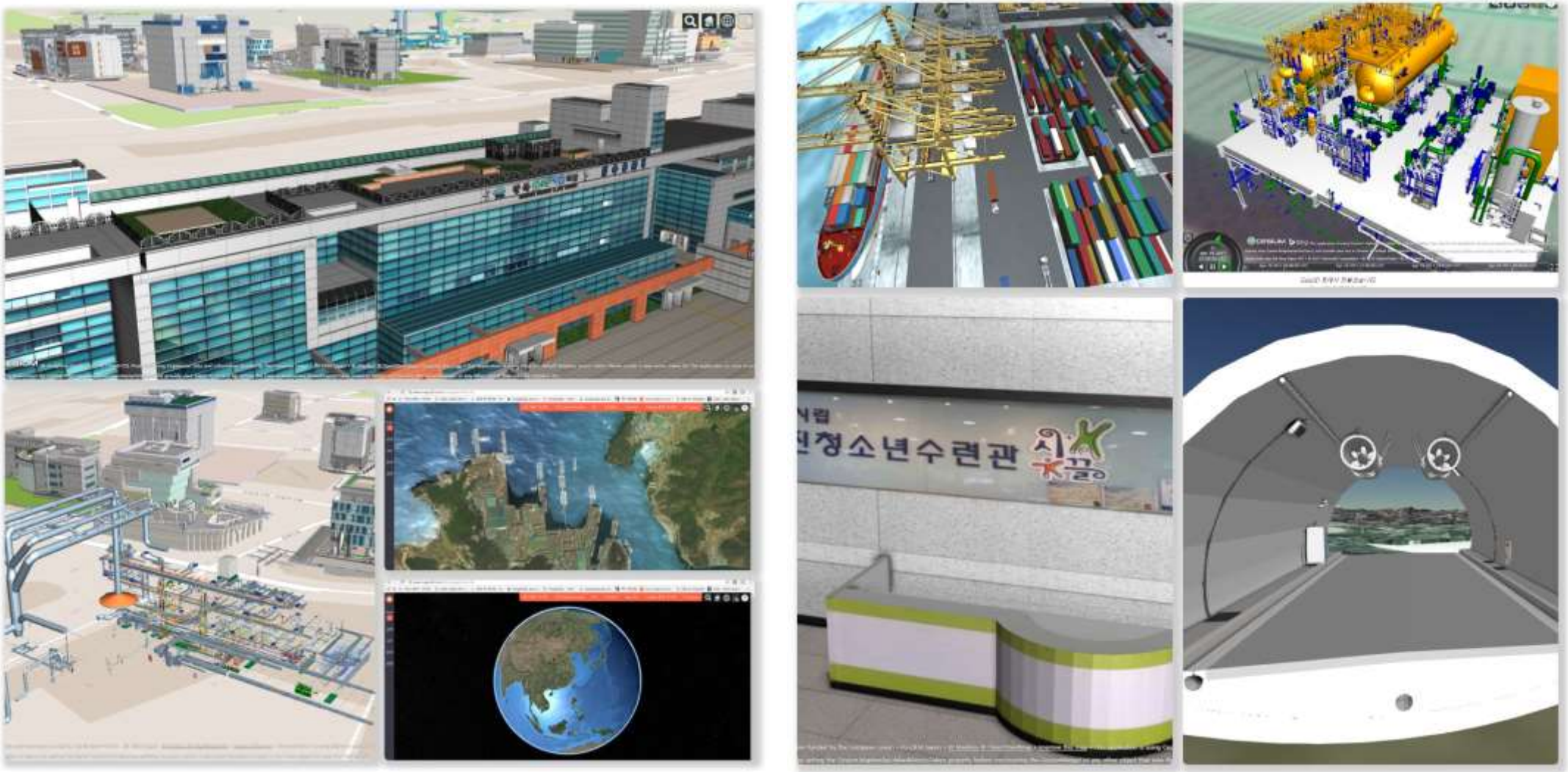
- IAM — Autodesk Inventor Assembly file
ICD — IronCAD 2D CAD file
IDW — Autodesk Inventor Drawing file
IFC - buildingSMART for sharing AEC and FM data
IGES— Initial Graphics Exchange Specification Intergraph's Intergraph Standard File Formats
IPN — Autodesk Inventor Presentation file
IPT — Autodesk Inventor Part file model - CATIA V4 part document
PAR — Solidedge Part
PRT — NX (recently known as Unigraphics), Pro/ENGINEER Part, CADKEY Part
PLN — ArchiCad project
PSM — Solidedge Sheet
PSMODEL — PowerSHAPE Model
PWI — PowerINSPECT File
PVT — Pathscene File
[illegible]
RLF — ArtCAM Relief
[illegible] files
RFA — AutoDesk Revit family files
SLDASM — SolidWorks Assembly drawing
SLDDRW — SolidWorks 2D drawing
SLDPRT — SolidWorks 3D part model
Softimage's dotXSI
STEP — Standard for the Exchange of Product model data
STL Stereo Lithographic data format (see STL (file format)) used by various CAD systems and stereo lithographic printing machines.
TCT - TurboCAD drawing template
TCW - TurboCAD for Windows 2D and 3D drawing
VC6 — Ashlar-Vellum Graphite - 2D and 3D drafting
VLM — Ashlar-Vellum Vellum, Vellum 2D, Vellum Draft, Vellum 3D, DrawingBoard
VS — Ashlar-Vellum Vellum Solids
WRL Similar to STL, but includes color. Used by various CAD systems and 3D printing rapid prototyping machines. Also used for VRML models on the web.
XE — Ashlar-Vellum Xenon - for Associative 3D Modeling

**Many 3D formats are proprietary with low inter-operability**

Source: http://artist-3d.com/free_3d_models/graphics- file-formats.php

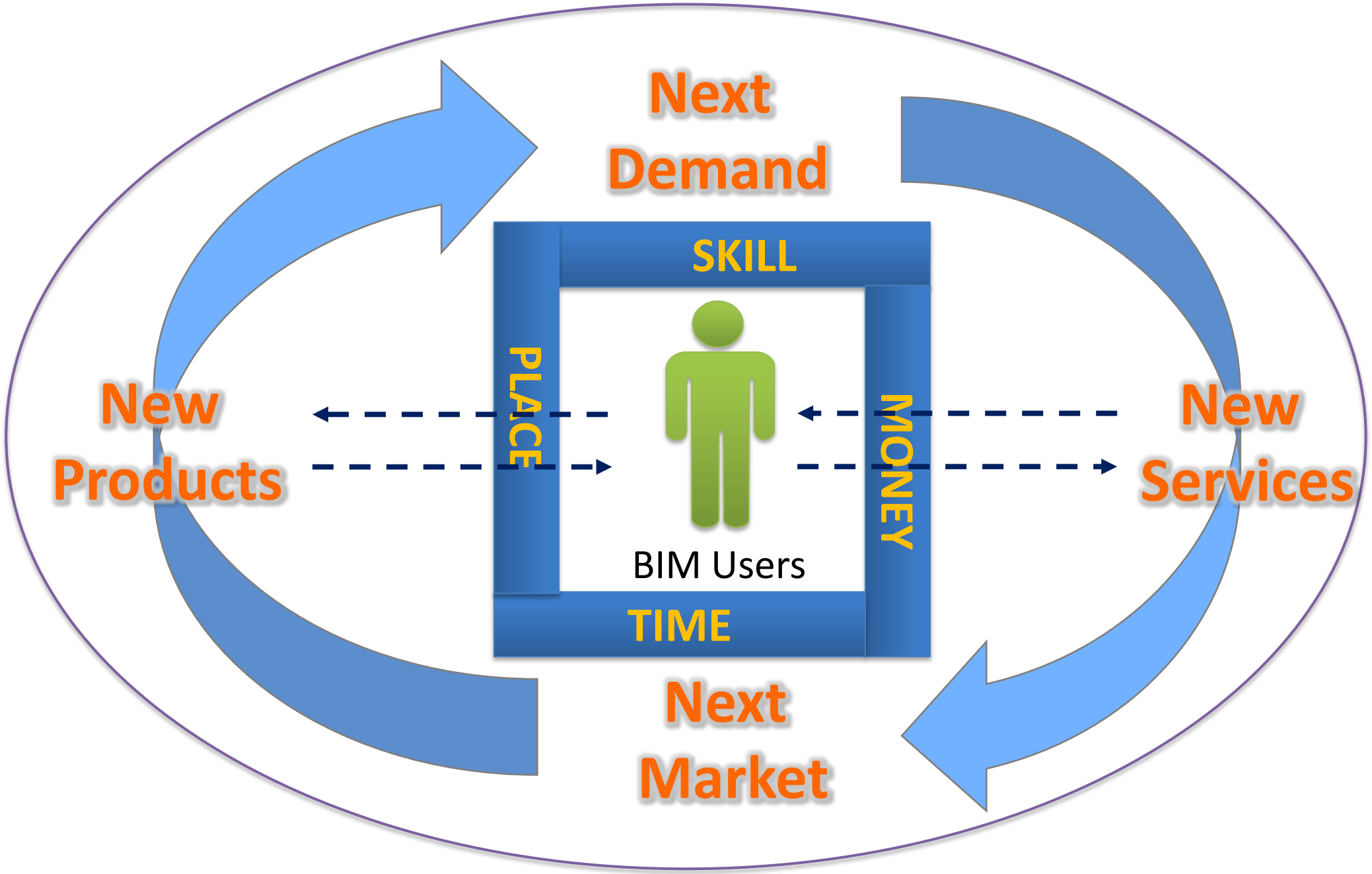
**→ Hard to access proprietary technologies and formats!**

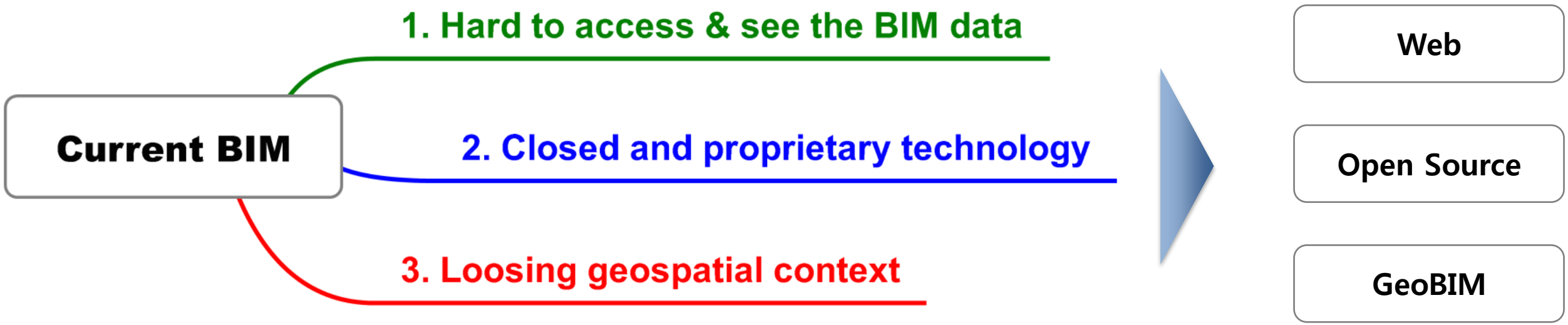
# Geospatial Context Matters!




➔ Need to manage facilities and processes in geospatial context!

# How to overcome these hurdles?


Next
Demand
SKILL
PLACE
MONEY
TIME
BIM Users
New
Products
New
Services
Next
Market



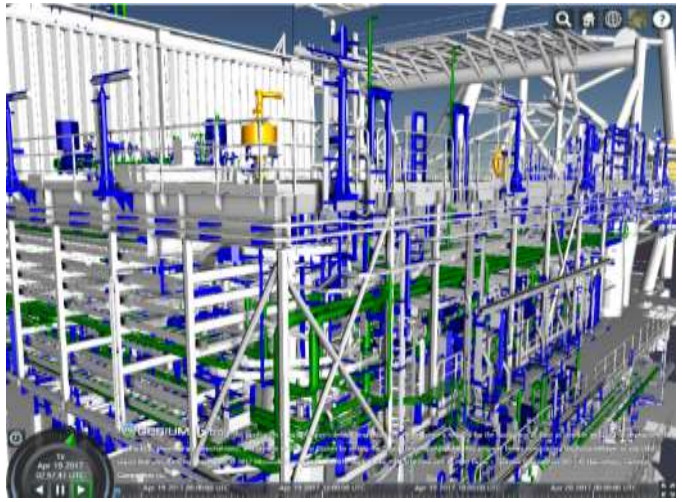

# Let's Access to the GeoBIM through Web!!

# Introduction to mago3D

mago3D

# mago3D is a platform for …

1. Visualizing massive and complex 3D objects including BIM on a web browser



2. Seamless integration of BIM/AEC and 3D GIS in a single space

3. 'Digital Twin' that can create parallel worlds in a virtual reality with numerous IoT, sensor data

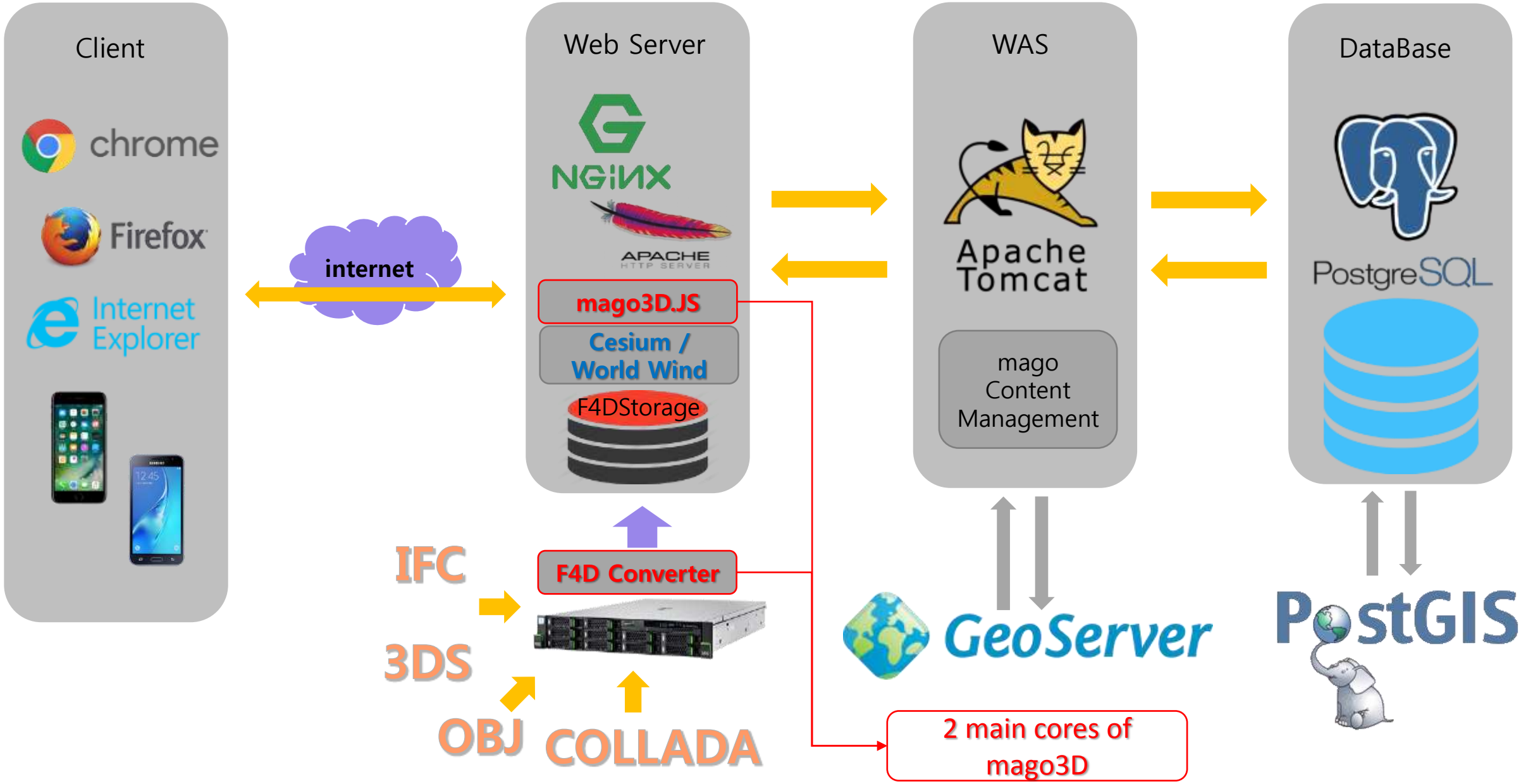
4. Web based collaborative issue/process management

# Key Features

- BIM/AEC and 3D GIS integration in a single space
- Web based – no need to install additional program
- Massive and complex 3D objects rendering
- Open source – Apache and AGPL license
- Supports industry standard formats(ifc, 3ds, dae, kml, gltf…)
- In-Browser 3D objects moving/rotation/heading adjustment
- Highly extensible architecture

mago3D

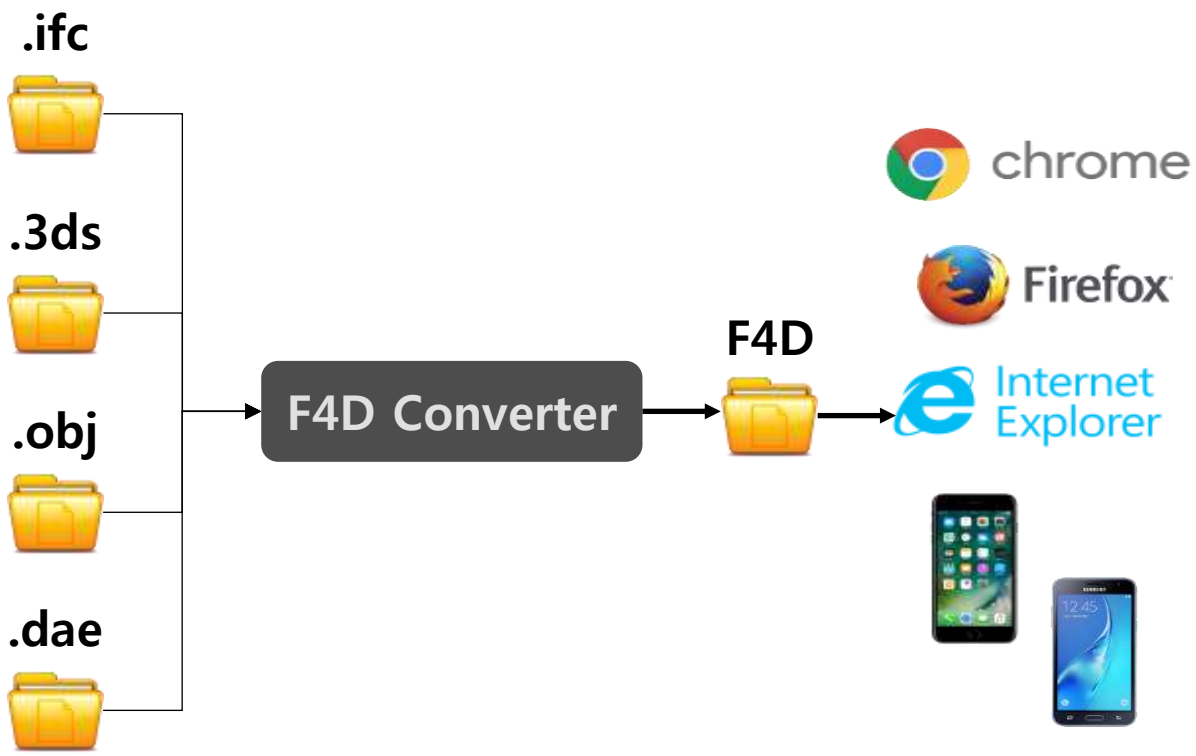
# Overall System Architecture



# 2 Main Cores of mago3D...

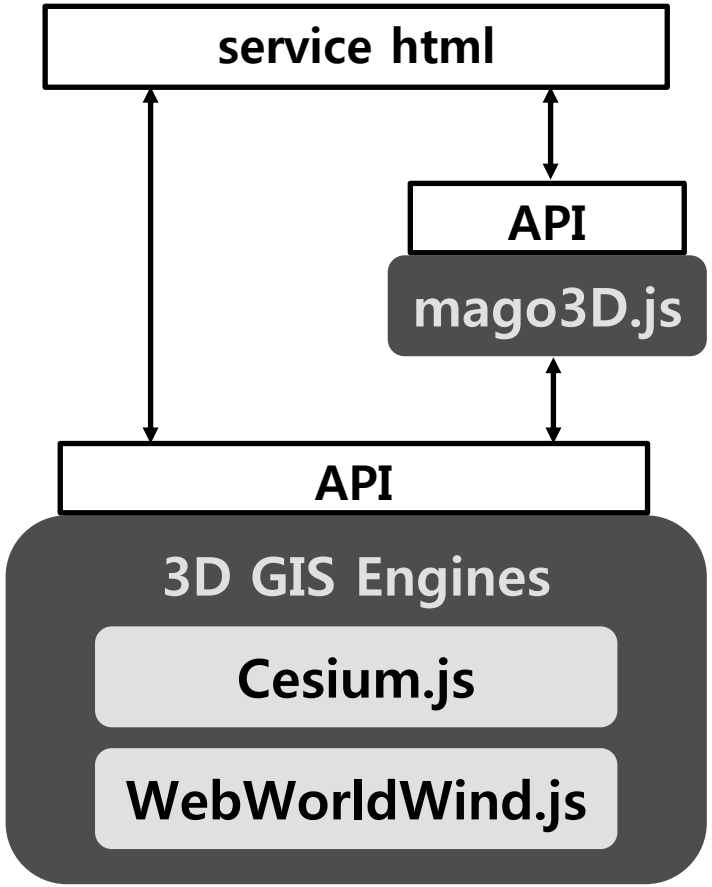
## F4D Converter

F4D Converter converts 3D formats(IFC, 3DS, OBJ, DAE, JT) to 3D internet service format F4D. It carries out data size reducing and pre-processing for fast rendering.




## mago3D.js

JavaScript that expands existing WebGL Globe's features to support BIM and indoor space.

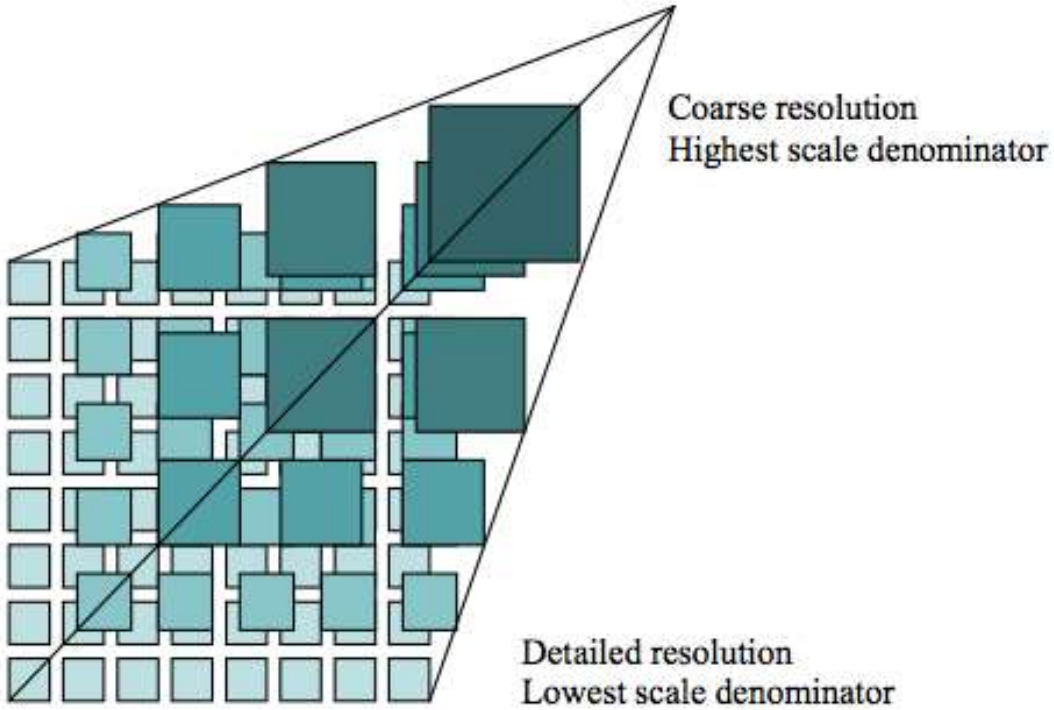


# F4D: Objectives

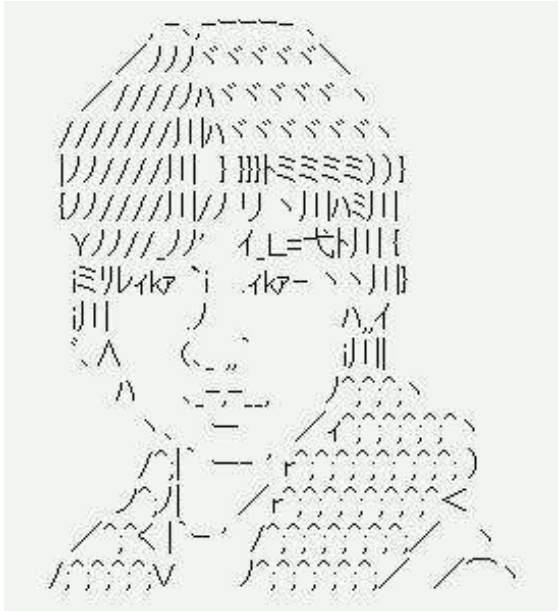
Objectives of F4D are:

1- Reduce size of data for network traffic.
2- Create LOD (Level Of Detail) on service data.
3- Make visibility index for occlusion culling.
4- Divide and group data into spatial octree.

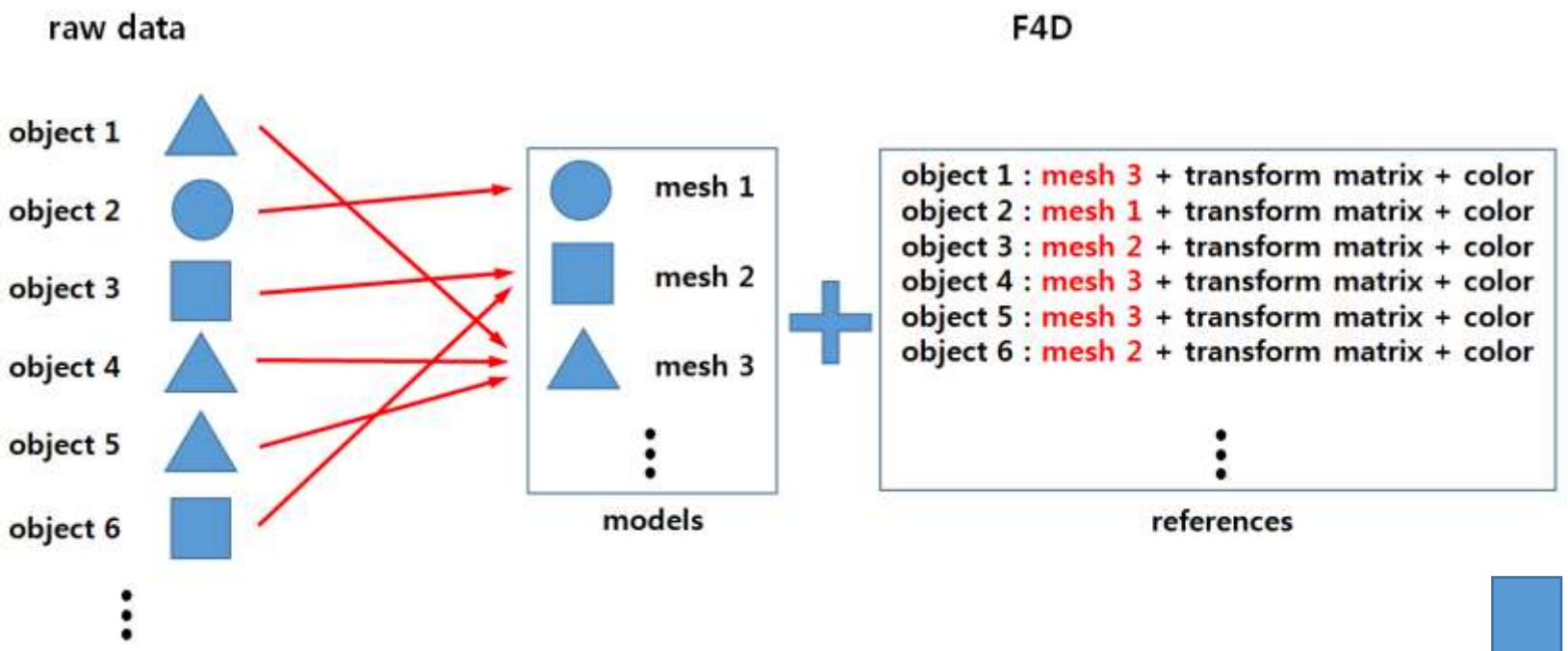
# F4D: Service Format Optimized for Web Service

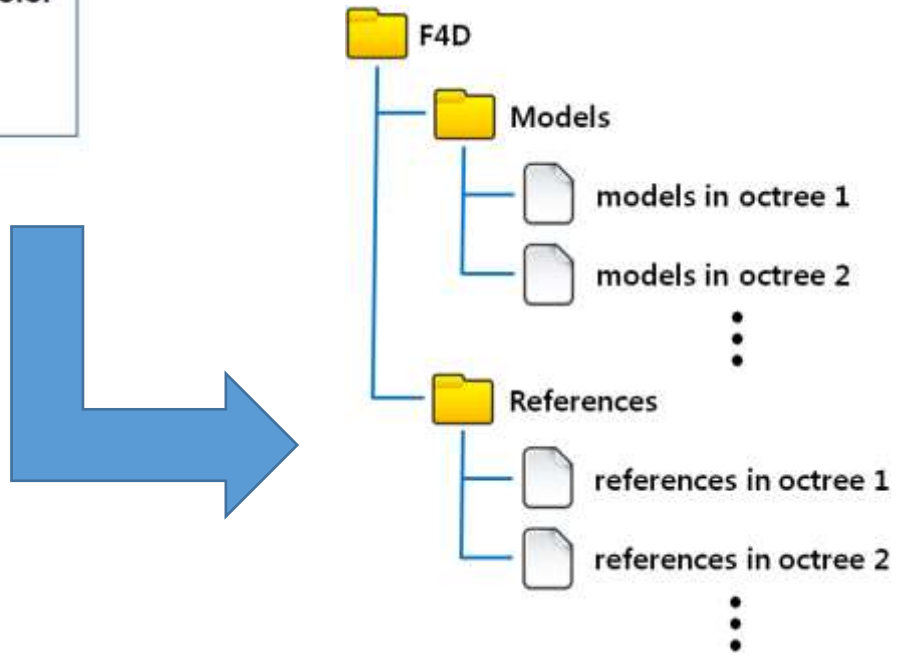



VS



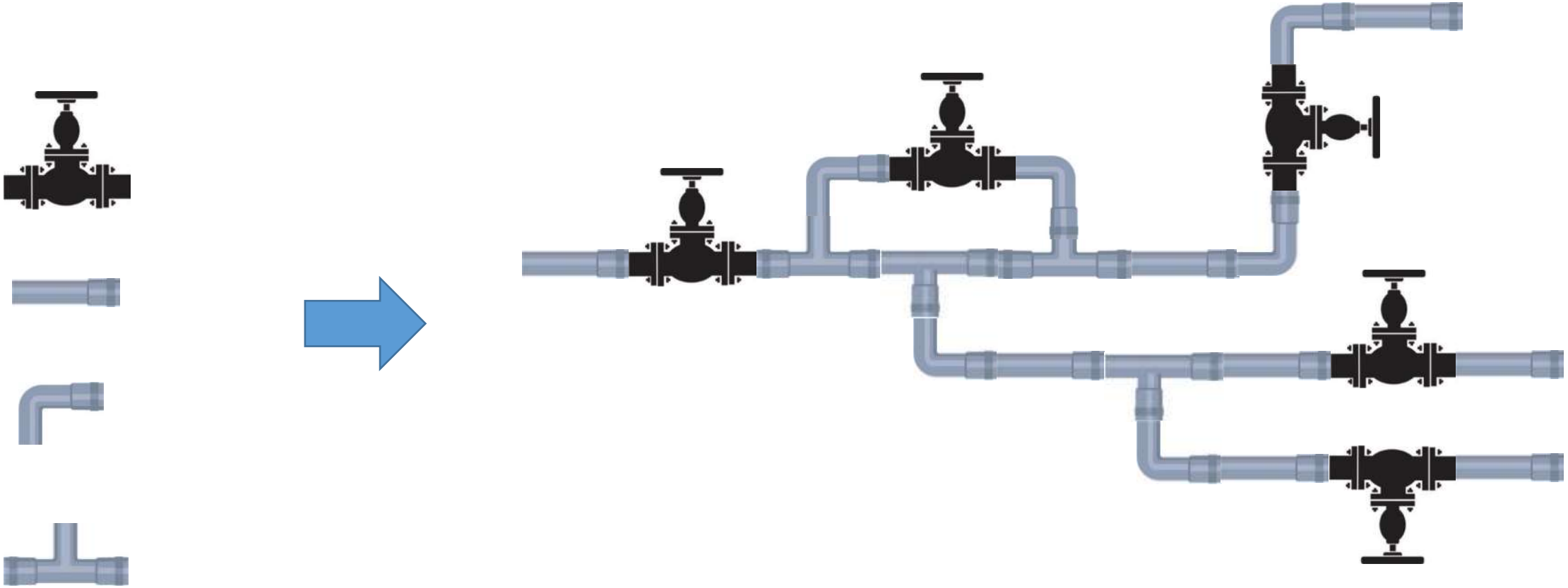
# F4D: Model-Reference Concept




➔ Model is 3D geometry info, while Reference is real instance of this model

# F4D: Model-Reference Concept

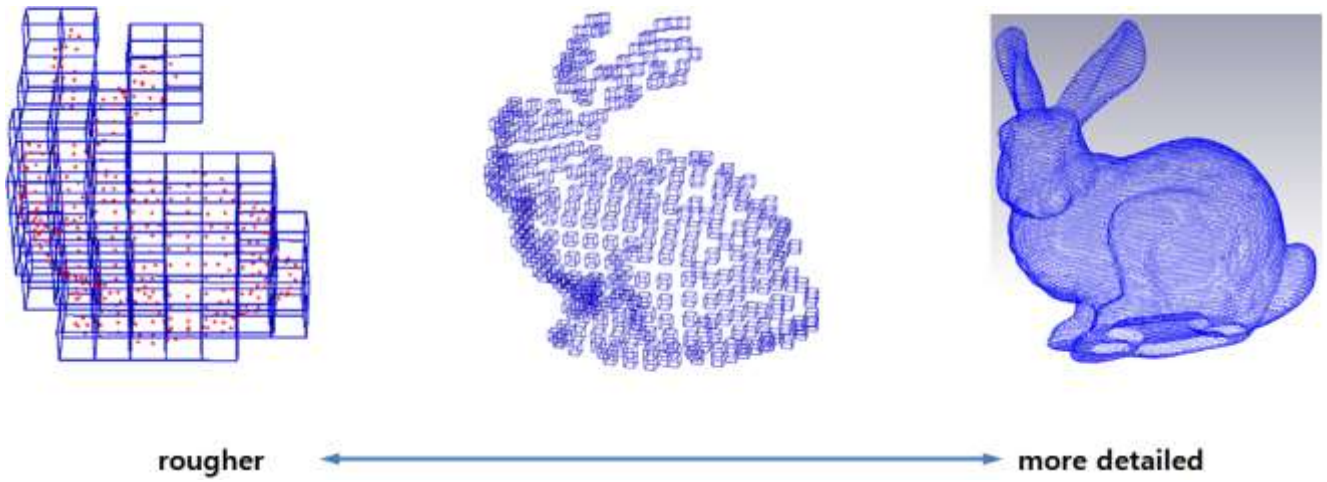


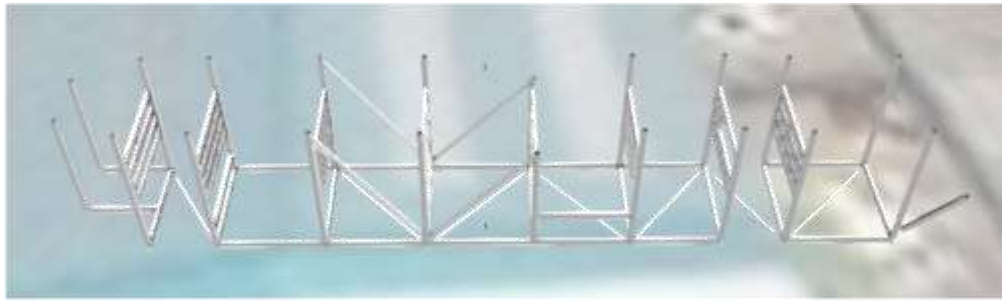
With 4 geometric meshes - 4 models

23 objects are created. - 23 instances

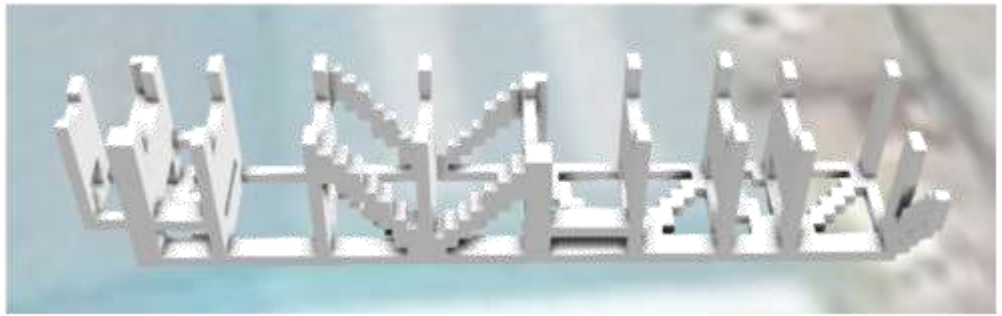
Image source : www.vecteezy.com

# F4D: Lego Style Service for LOD



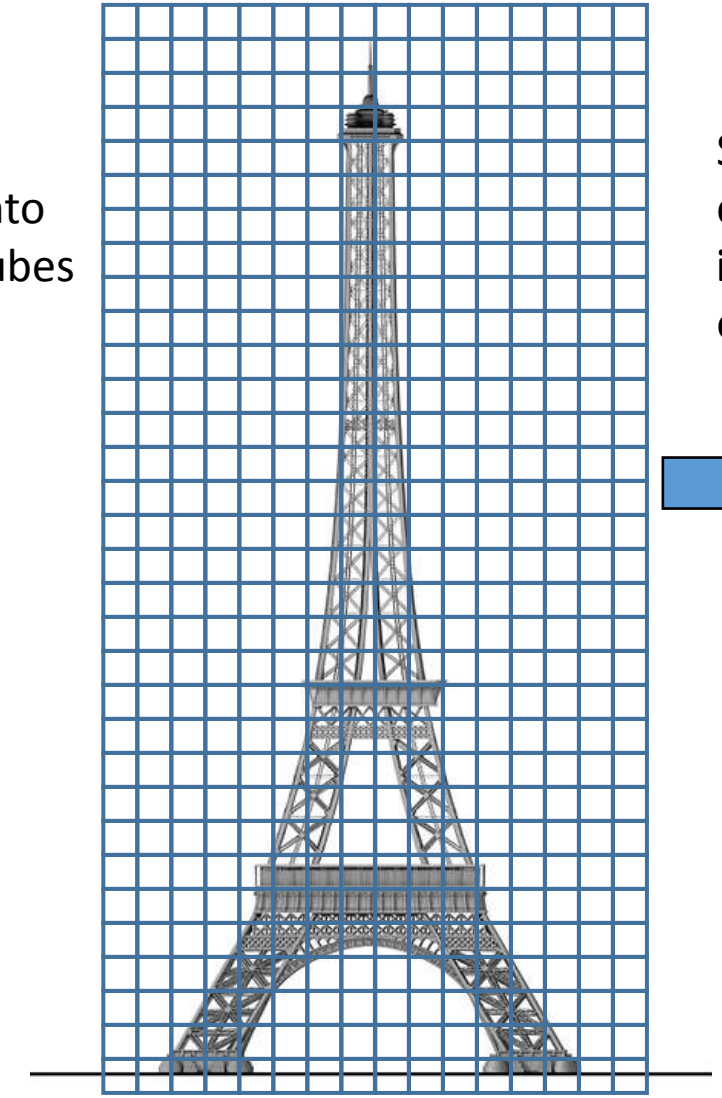
Detailed Resolution



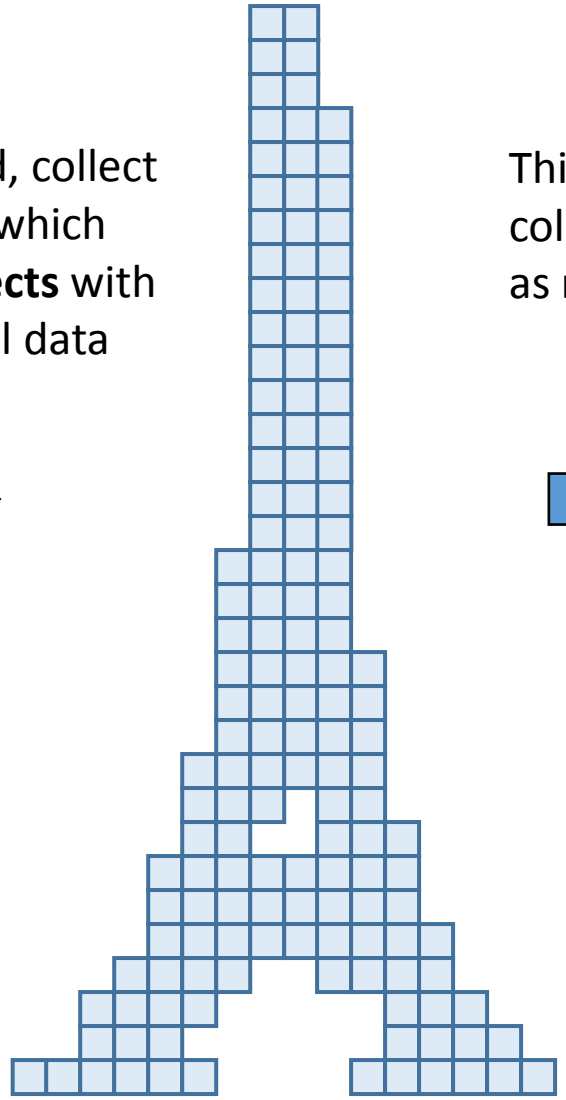
Coarse Resolution

# F4D: How to Make LOD

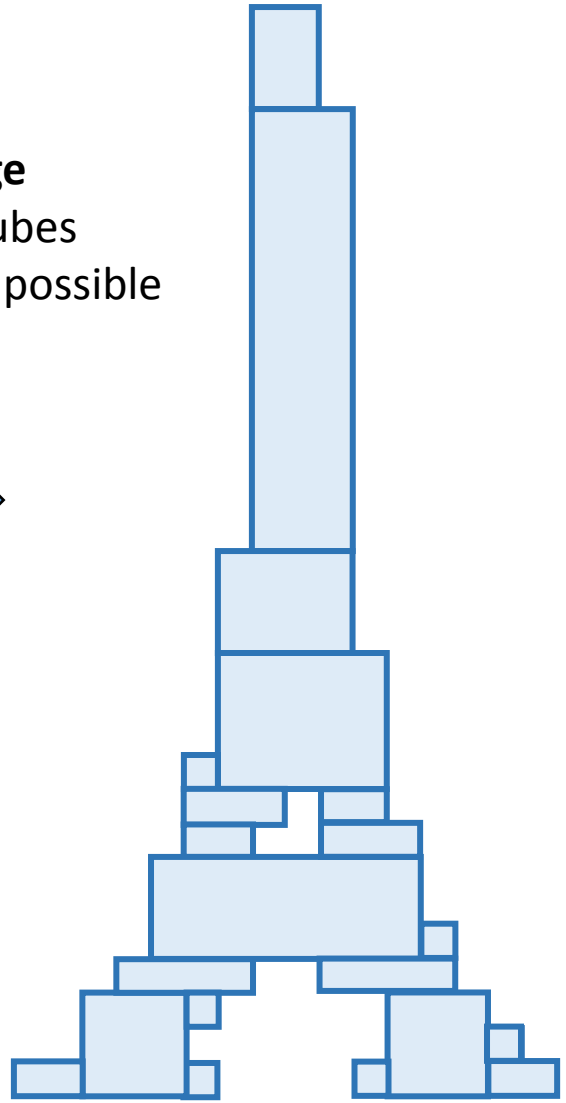
First, divide the Bounding Box into enough small cubes for each LOD



Second, collect cubes which **intersects** with original data

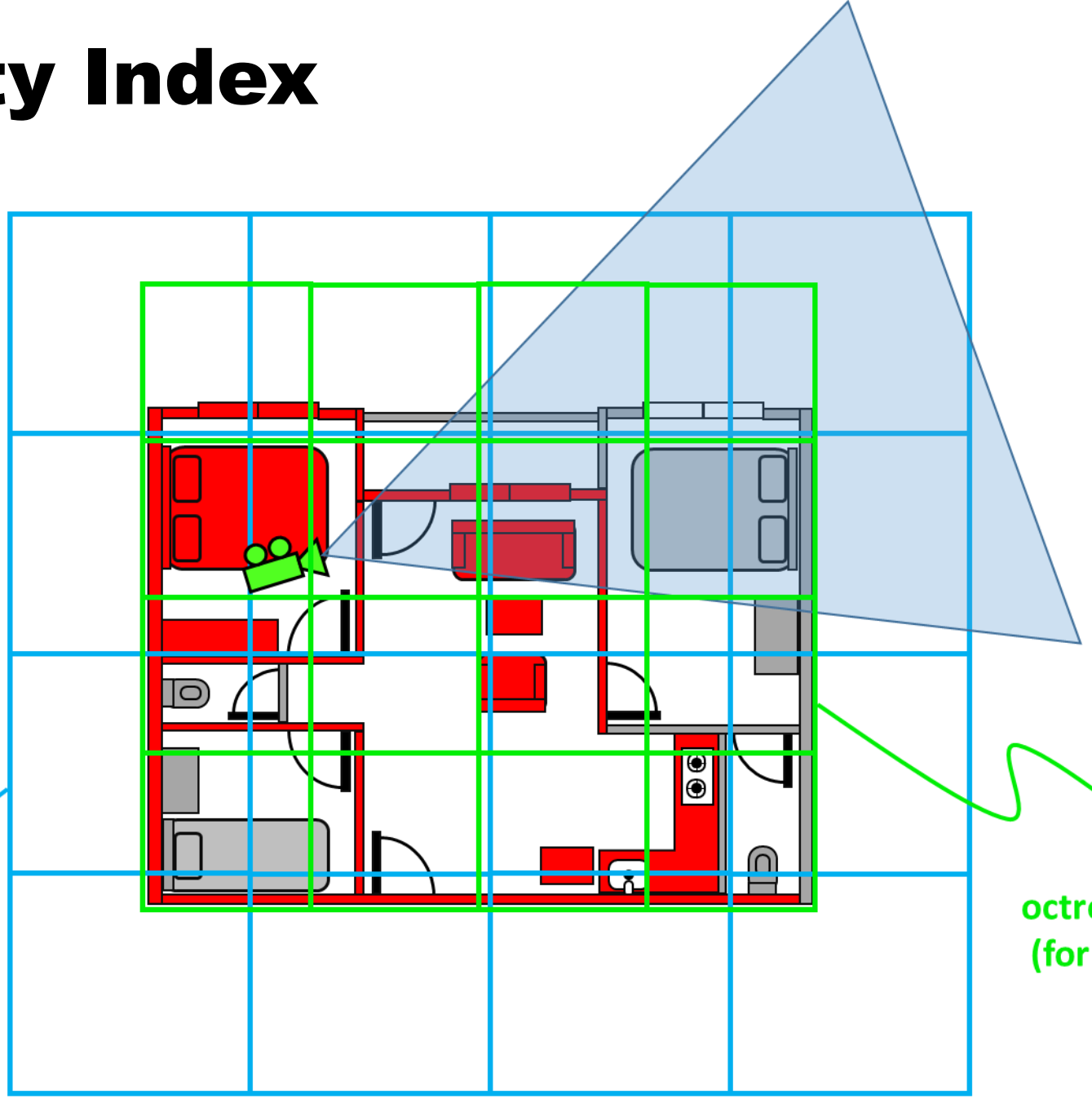


Third, **merge** collected cubes as **much** as possible



# F4D: Visibility Index

Perform frustum culling on spatially divided octree before occlusion culling



octree for spatial division (for frustum culling)

octree for visibility indexing (for occlusion culling)

# mago3D.js: Let’s Piggyback!!

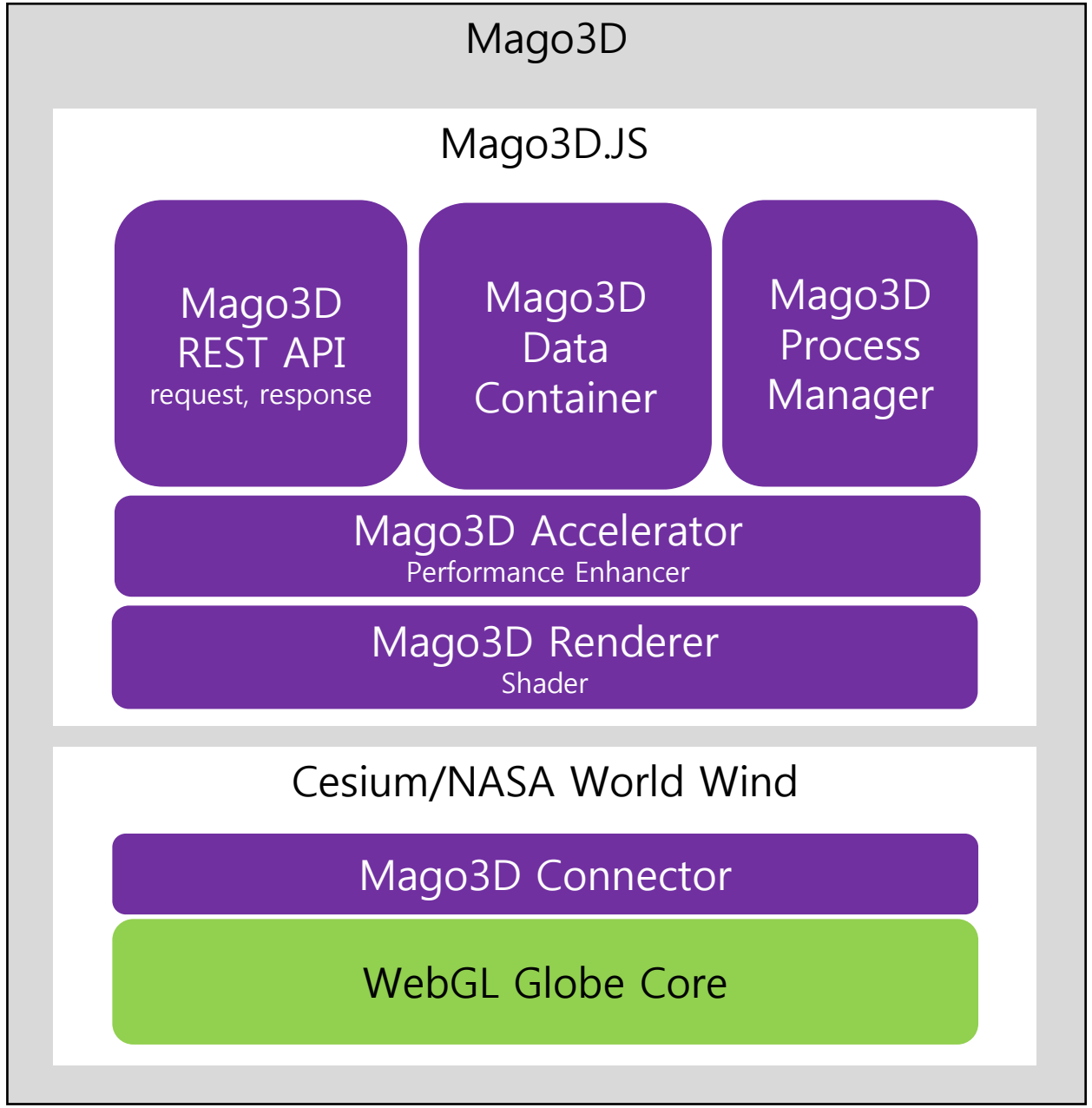

**mago3D.js** is

1. A plug-in to any web 3D engines based on WebGL.
2. A set of JavaScript for web developments.
3. Not an WebGL Globe, But a just Java Script.

# mago3D.js: Components

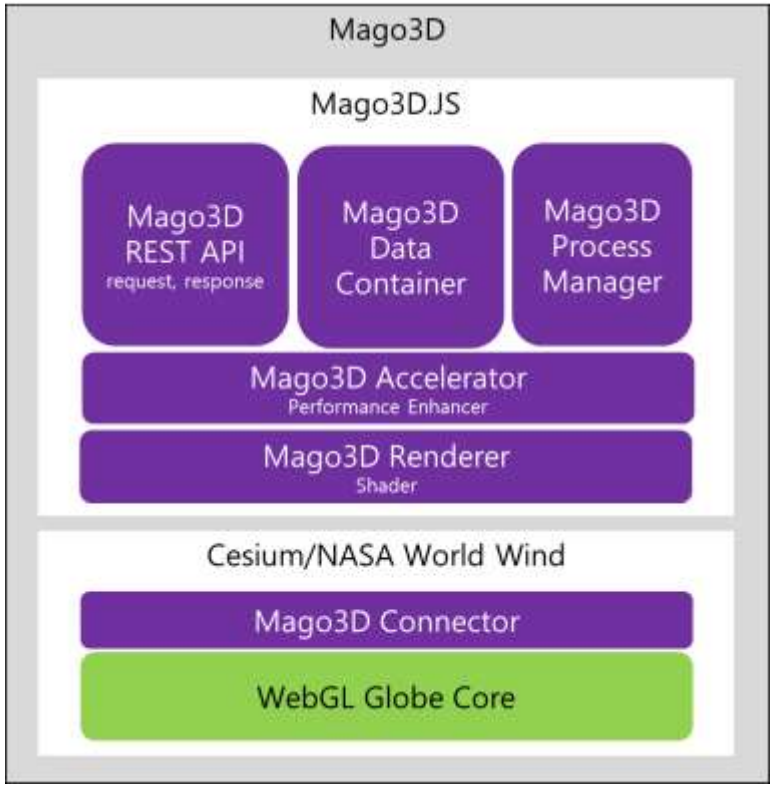
1. **maog3D.js** has been designed and developed as an independent plug-in to the existing WebGL Globe.

2. **mago3D.js** added new functionalities and enhanced performance of existing WebGL Globle.



# mago3D.js: Components

1. mago3D Connector that interacts with WebGL Globe such as Cesium, World Wind.
2. mago3D Renderer that shades and renders 3D data.
3. mago3D Accelerator that enhance performance such as frustum & occlusion culling, indexing, LOD(Level Of Detail) handing.
4. mago3D Data Container that contains and manages 3D data.
5. mago3D Process Manager that manages whole process from data receiving to rendering.
6. mago3D REST API that provides API for 3D data sending and receiving.



# mago3D.js: Screen Space Ambient Occlusion

<Before>

<After>

# mago3D.js: Screen Space Ambient Occlusion

<Before>

<After>

# BIM Integration


scene from indoor to outdoor through windows

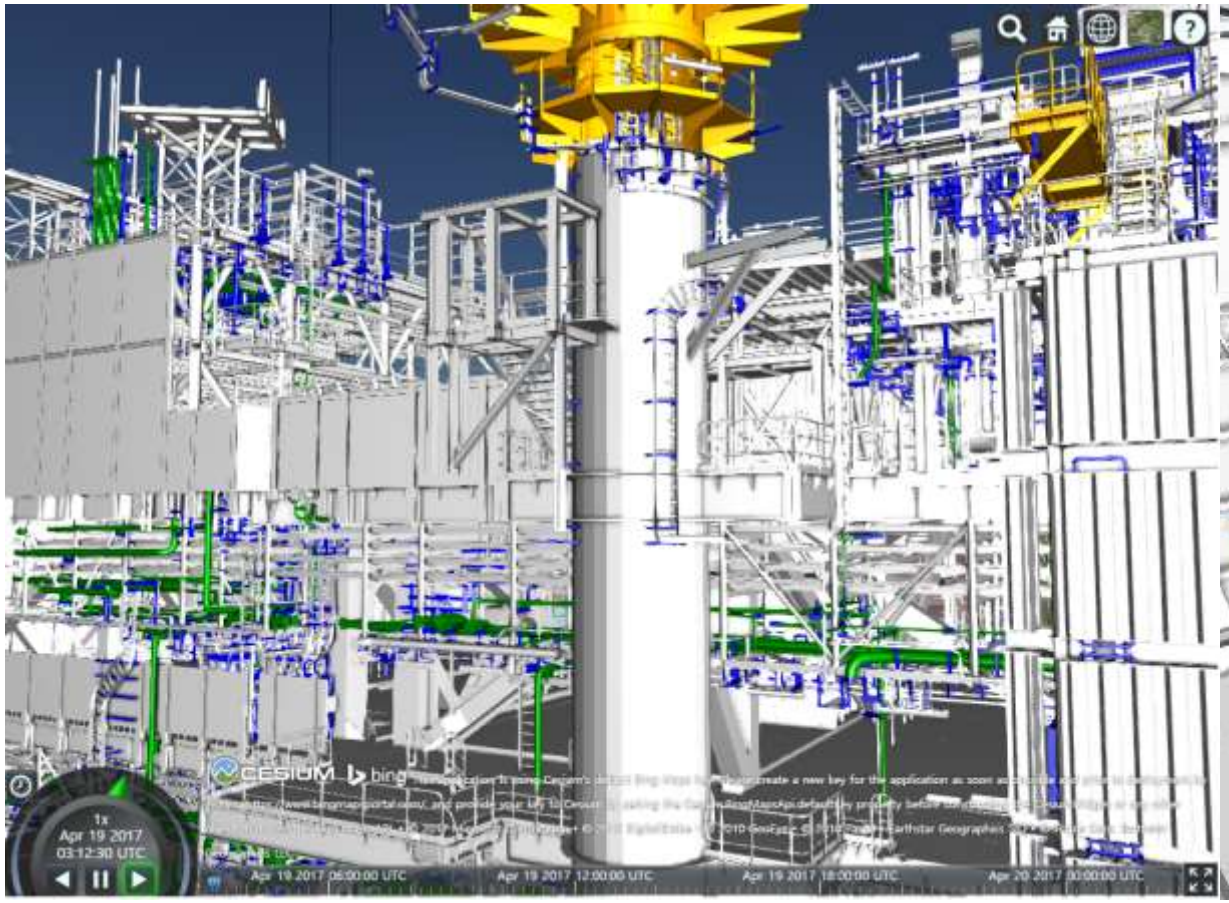
Scene from outdoor to indoor through windows

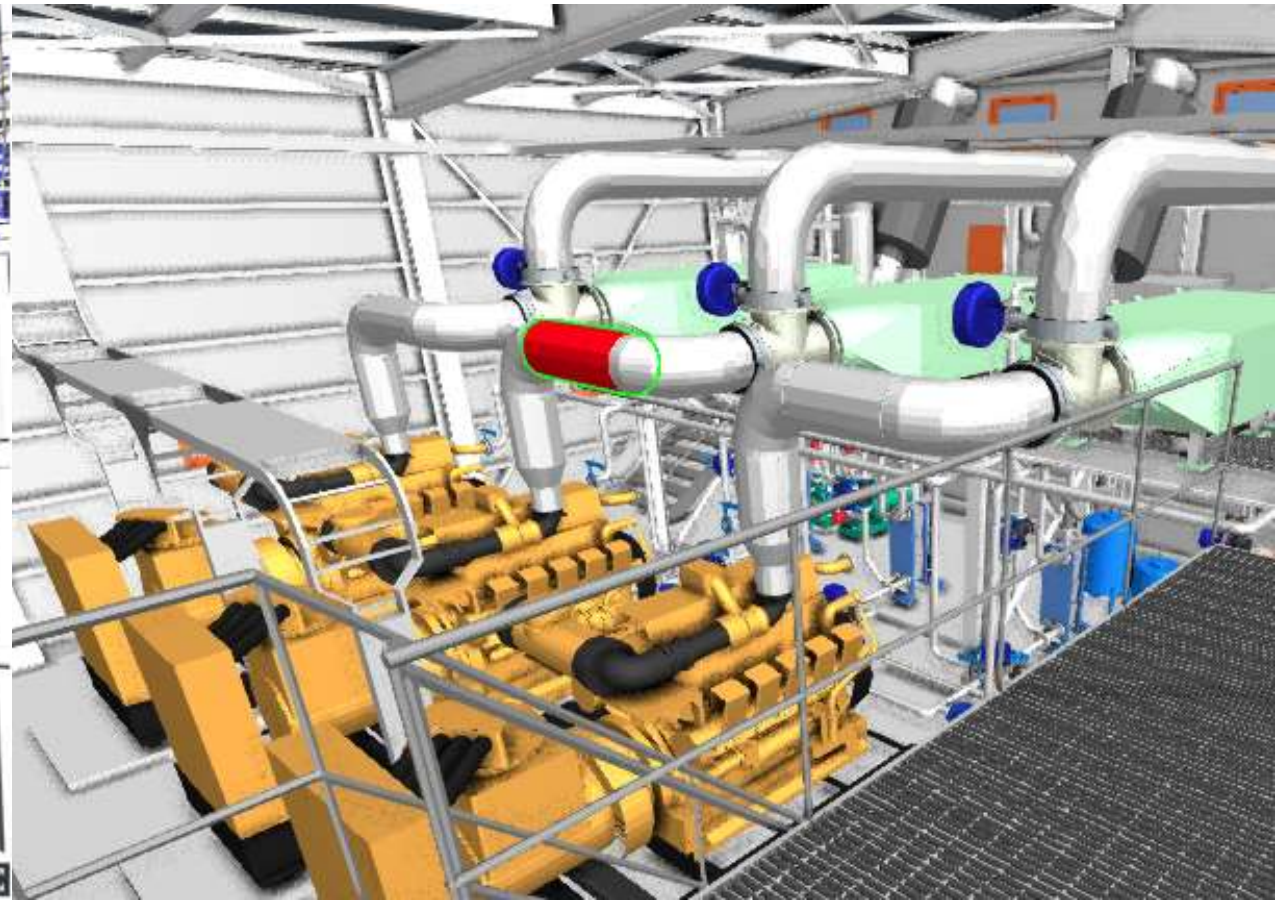
**Seamless integration** of **BIM and 3D GIS**
on the same platform

# MEP Integration


**Integration of large size MEP and 3D GIS**
on a web browser

# AEC Integration



**Integration of large size AEC and 3D GIS**
on a web browser

# Implementation Results

# mago3D runs on any device

# Source access to mago3D

https://github.com/gaia3d

Gaia3D / mago3djs

Code | Issues 15 | Pull requests 0 | Projects 0 | Wiki | Insights | Setti

Branch: develop | mago3djs / src / mago3d / core / VBOManager.js

sdson Merge branch 'develop' into feature/origin_of_coords

2 contributors

313 lines (265 sloc) 7.76 KB

```
'use strict';

/**
 * 어떤 일을 하고 있습니까?
 * @class VBOManager
 */
var VBOManager = function()
{
        if (!(this instanceof VBOManager))
        {
                throw new Error(Messages.CONSTRUCT_ERROR);
        }
};

/**
 * 어떤 일을 하고 있습니까?
 * @class Buffer
 */
var Buffer = function()
{
```

Gaia3D / mago3d

Unwatch 6 | Star 6 | Fork 3

Code | Issues 4 | Pull requests 0 | Projects 0 | Wiki | Insights | Settings

Branch: master | mago3d / mago3d-core / src / main / java / com / gaia3d / domain / IssueFile.java | Find file | Copy path

cheonjeongdae 임시 커밋 398eee7 on 10 Jul

1 contributor

41 lines (36 sloc) 738 Bytes | Raw | Blame | History

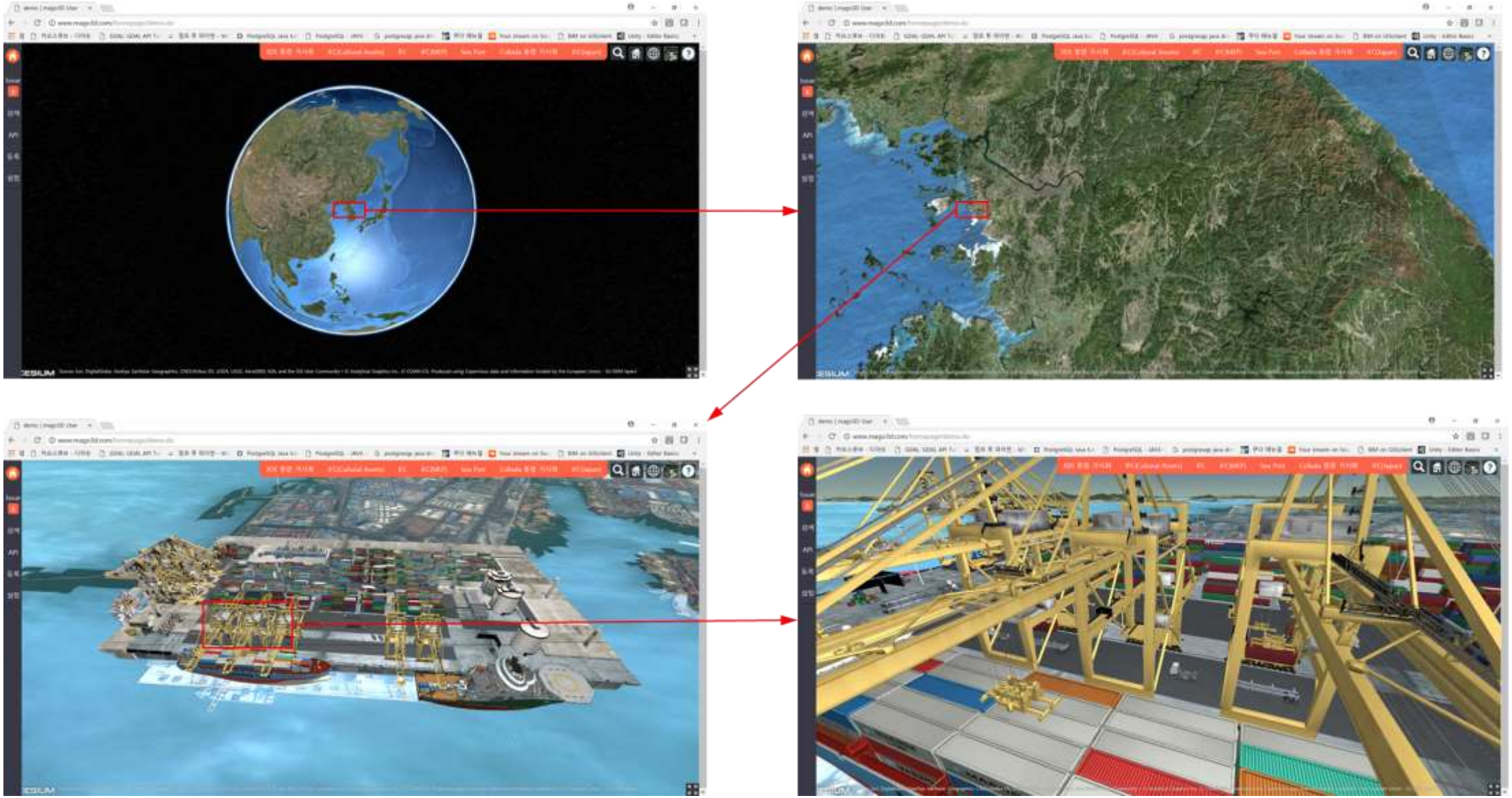
```
package com.gaia3d.domain;

import lombok.Getter;
import lombok.Setter;
import lombok.ToString;

/**
 * 파일 관리
 * @author jeongdae
 *
 */
@Getter
@Setter
@ToString
public class IssueFile {

        // 고유번호
        private Long issue_file_id;
        // 이슈 고유번호
        private Long issue_id;
        // 파일 이름
```

# GeoBIM: GIS + BIM




3DS 통합 가시화
IFC(Cultural Assets)
IFC
IFC(MEP)
Sea Port
Collada 통합 가시화
IFC(Japan)
Issue
13
검색
API
등록
설정
CESIUM
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community • © Analytical Graphics Inc., © CGIAR-CSI. Produced using Copernicus data and information funded by the European Union - EU-DEM layers

# Future Plan

# Future Plan

## Public Cloud Service


A mago3D | B mago3D | B mago3D

## Supporting More 3D Formats

IFC

Obj

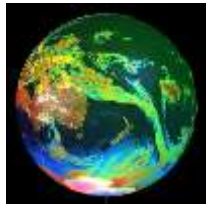
3DS



Revit

JT


Collada



weather data

**To the Digital Twin Platform**

## Participatory System

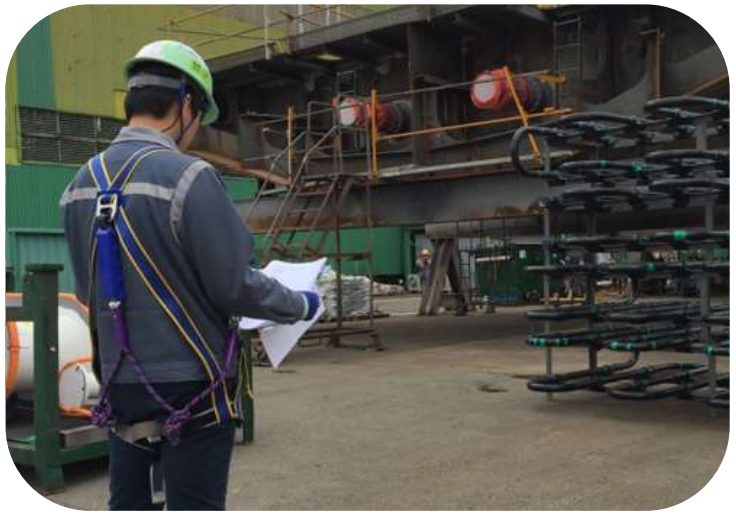

## Improved CMS, OpenAPI, Statistics/Analytics

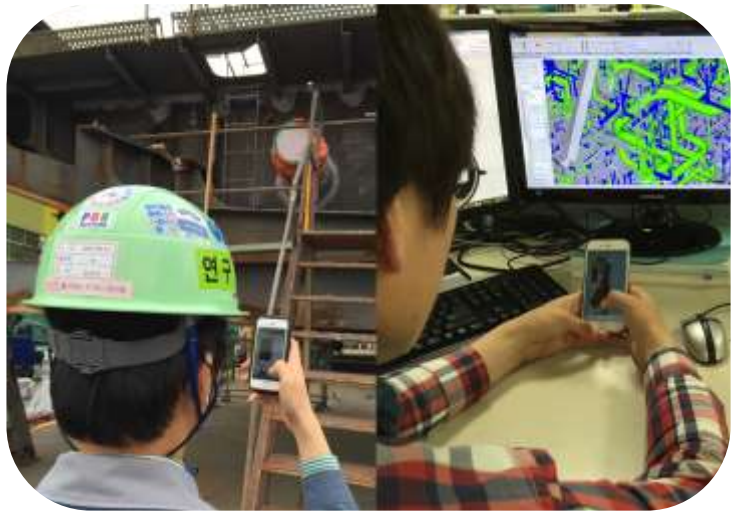

# Success Story

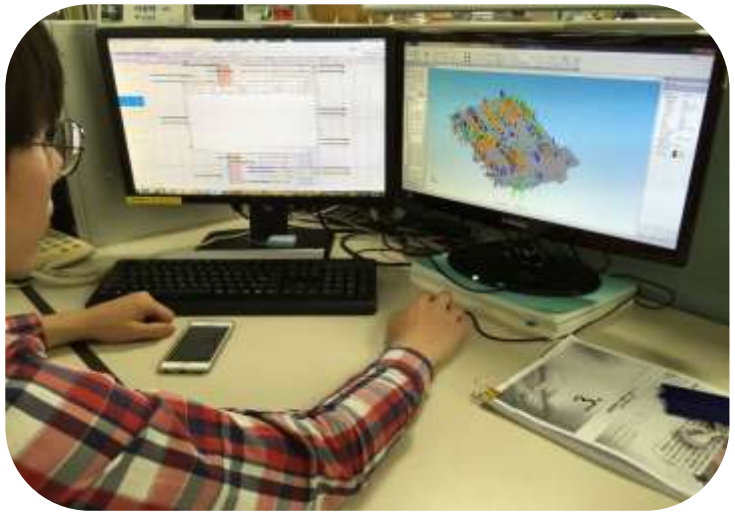
# Success Story: Samsung Heavy Industries

SAMSUNG HEAVY INDUSTRIES

❑ **Issues around ship building process…**

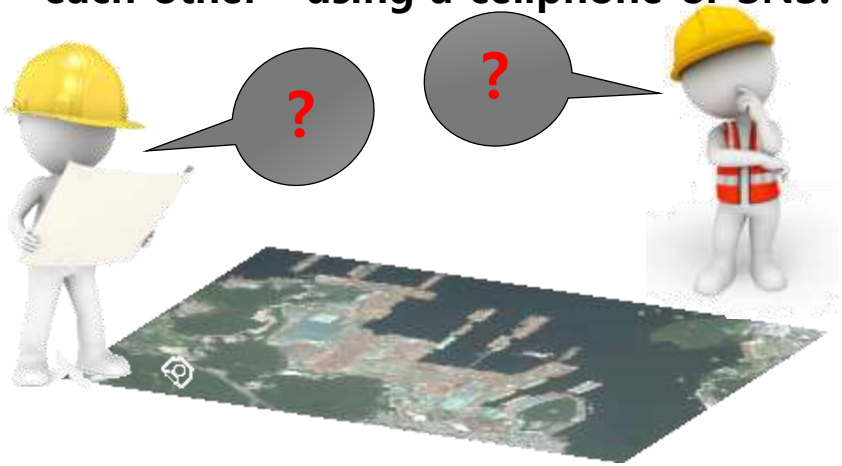






## → Ship yard is too big & wide

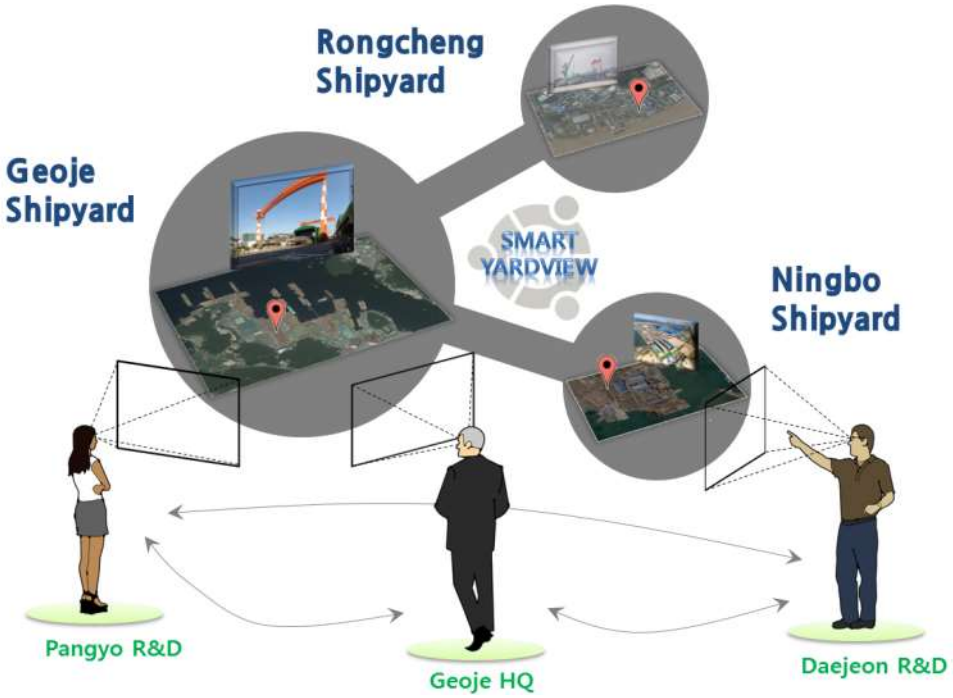
- Usually waste the time to search a ship block.
  ※ 20 mins/block (mean time)
- Easily fail to find out the issued parts when use the drawings only.
- Also feel difficult to communicate with each other using a cellphone or SNS.



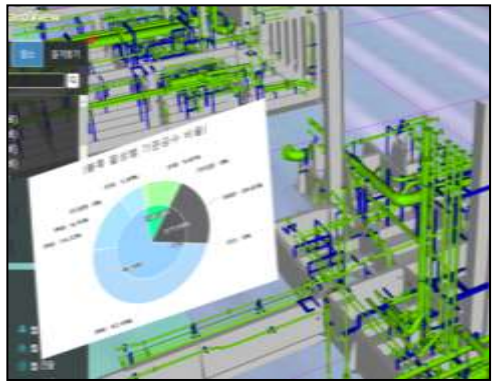
# Success Story: Samsung Heavy Industries

SAMSUNG HEAVY INDUSTRIES

- **Expected Benefits:**
  - Increased productivity
  - Short response time to issues
  - Reduced fail cost
  - Easy collaboration between different team



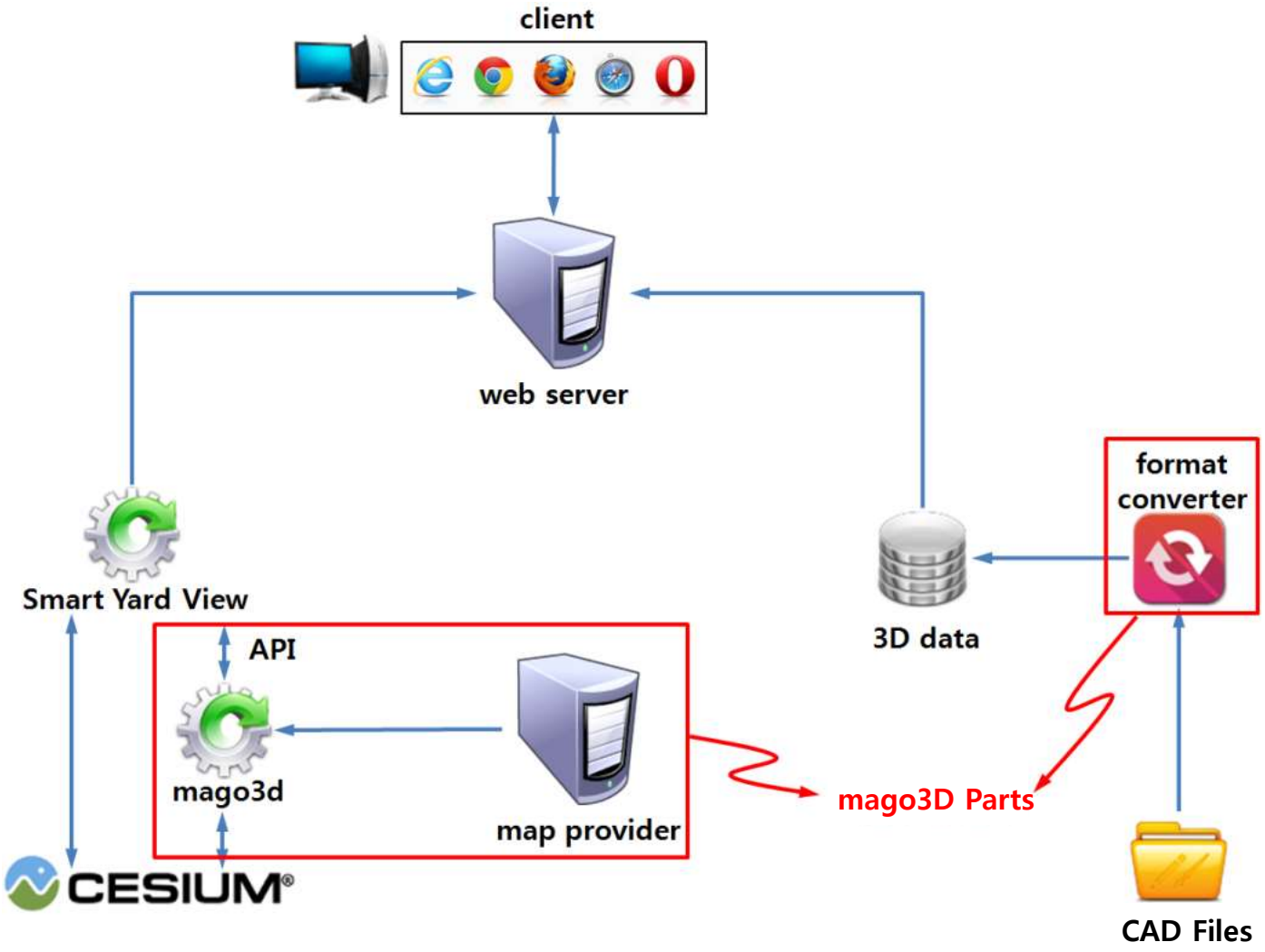


# Success Story: Samsung Heavy Industries

SAMSUNG HEAVY INDUSTRIES

- ❑ **Project Name: SHI Smart Yard System**
- ❑ **Goal: Monitoring the ship building process in 3D CPS(Cyber-Physical System)**



# Success Story: Samsung Heavy Industries

SAMSUNG HEAVY INDUSTRIES

- **Project Name: SHI Smart Yard System**
- **3D Models in Service**


Factories


Cranes

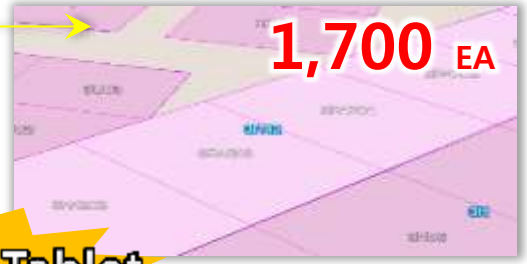

Ships


Blocks


Office Buildings


Docks

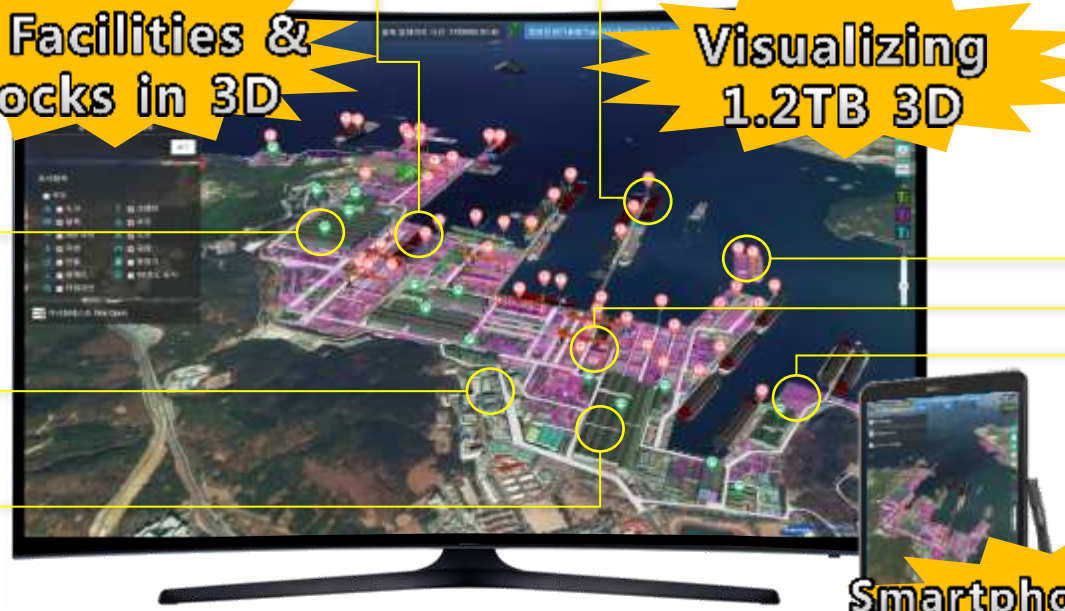

Smart Welding Machine




Yards

All Facilities & Blocks in 3D

Visualizing 1.2TB 3D



Virtual Yard on Web Browser!

Smartphone, Tablet, Laptop & PC

# Success Story: Samsung Heavy Industries

SAMSUNG HEAVY INDUSTRIES

# Executive Summary

- mago3D is a web based 3D objects visualization and management platform that can int egrate BIM/AEC and GIS.
- It can visualize massive and complex 3D objects including BIM on a web browser witho ut installing additional program or plugins.
- It utilizes open source WebGL Globe - Cesium, World Wind or others to expand those fe atures and functions to indoor level.
- mago3D itself is a open source project with Apache and AGPL licenses.
- It supports many industry standard formats such as ifc, 3ds, obj, dae, kml, gltf...

mago3D

For more information, please visit http://mago3d.com
All the source codes are available at https://github.com/gaia3d

# Thank you!

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Gaia3D
The GeoSpatial Company