



State of mago3D, An Open Source Based Digital Twin Platform

2021년 10월 29일

신상희(shshin@gaiad3.com)





MAGO

Goddess of Earth in Korean old myth

mago3D - History

2014

Project started.
NSIP Program

2017

GeoBIM Platform
Version1.0 released.

2019

Digital Twin Platform
Version2.0 released.



2016

Live 3D Geo-Platform
Alpha version released.

2018

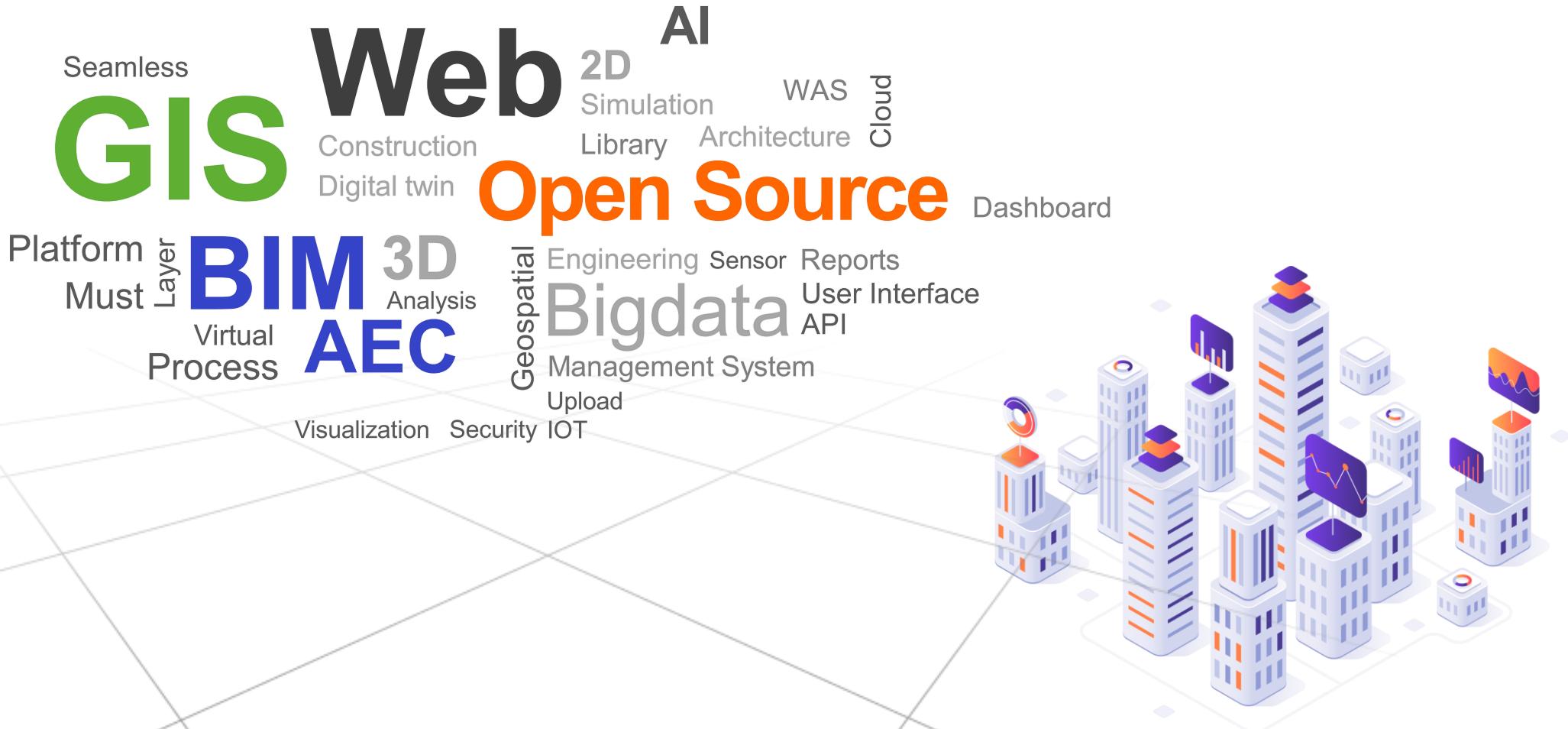
OpenIndoorMap opened

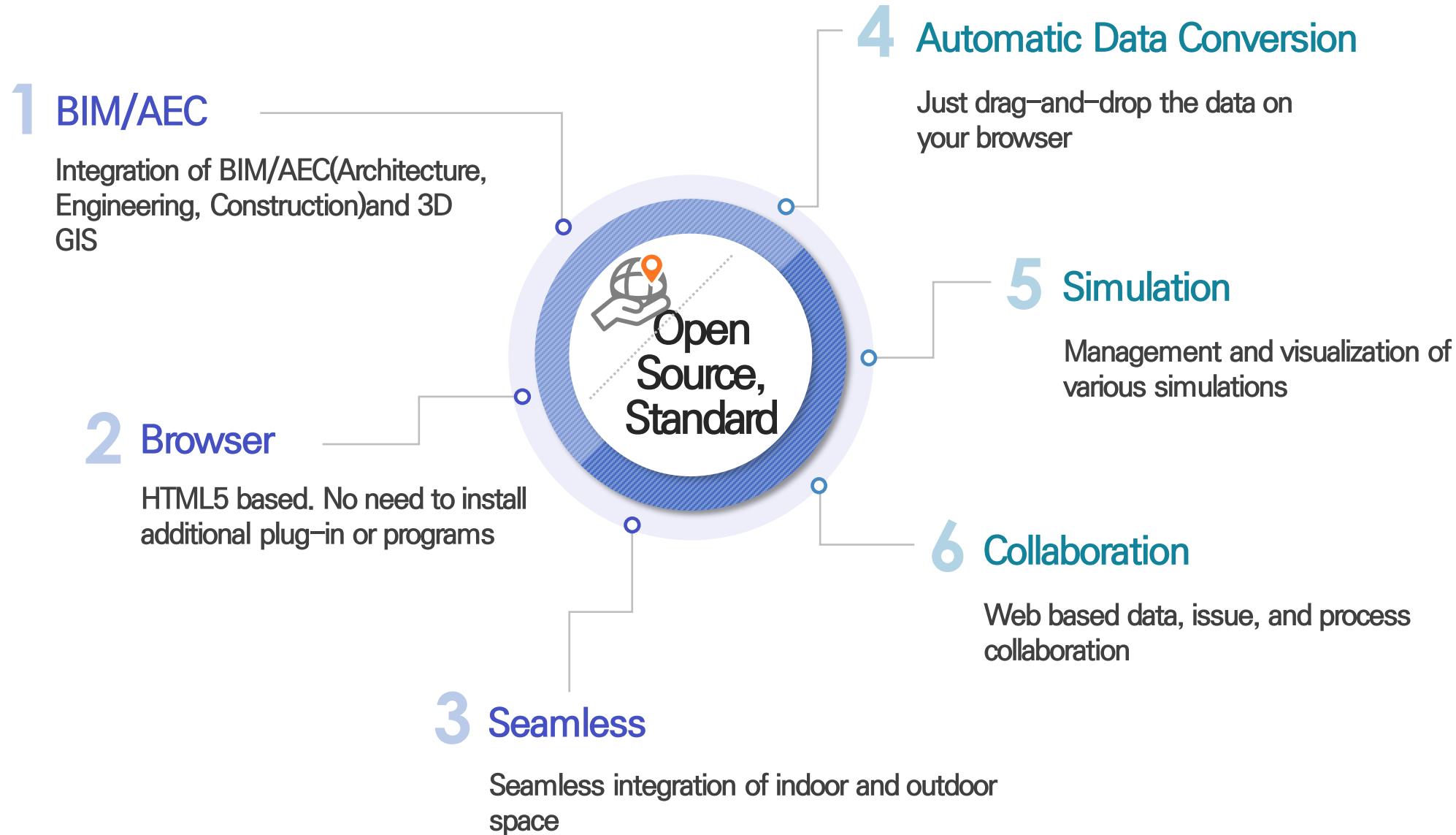
2021

Digital Twin Platform
Version2.5 released

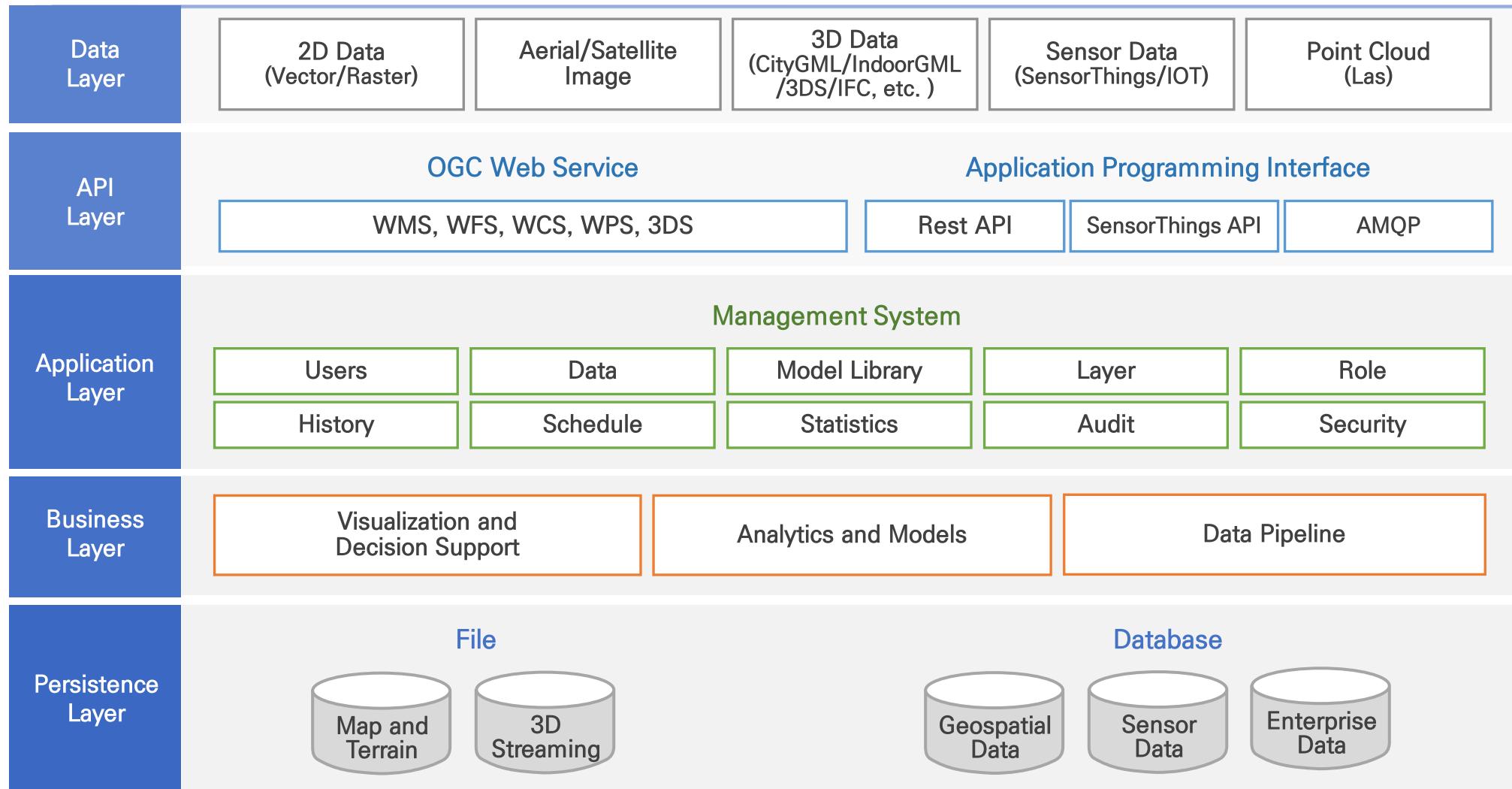
mago3D - Overview

mago3D is an open source based **Digital Twin Platform** that can replicate and simulate the real world objects, processes, and phenomena on web environment. mago3D can integrate, manage, and visualize various kinds of data such as CityGML, IndoorGML, LAS, IFC, 3DS, IoT, and other popular GIS formats.

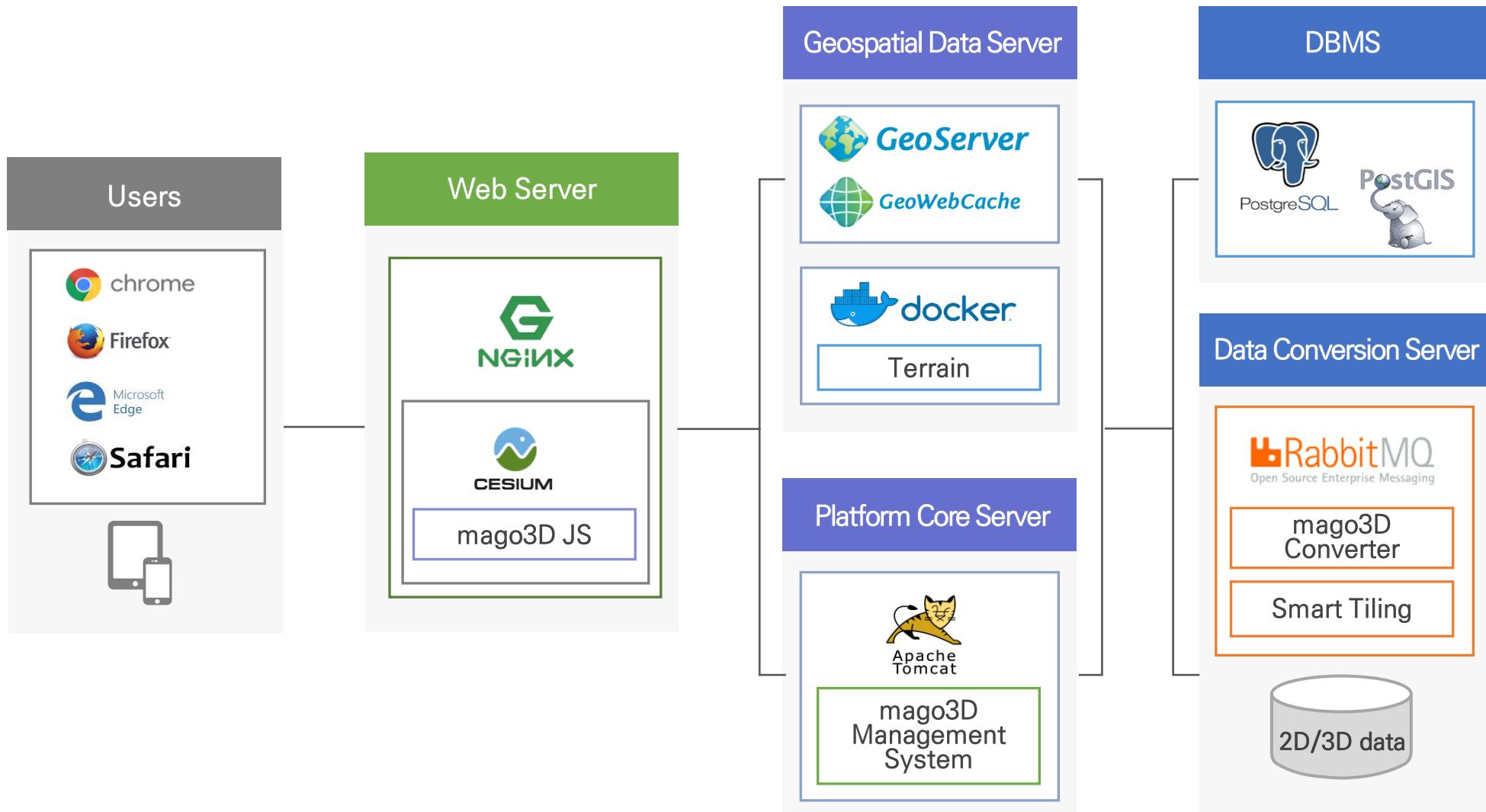




mago3D - System Layers



mago3D - System Architecture



mago3D - Software Components

| | | |
|-----------------------|------------------------|--|
| BackOffice | Log/Build | Logback / Gradle 6 |
| | Schedule/Report | Quartz 2.4.0 / JasperReports 7.5 |
| Presentation Layer | View | HTML5 + Thymeleaf 3.0.11 + Chart js 2.9.3 |
| | WebGL Globe | CesiumJS 1.70 + mago3D JS |
| Persistence Layer | RDBMS | PostgreSQL 12 + PostGIS 3.0 |
| Data Conversion Layer | Message Queue | HTML5 + Thymeleaf 3.0.11 + Chart js 2.9.3 |
| | Data conversion Server | CesiumJS 1.70 + mago3D JS |
| Geospatial Data Layer | Terrain Server | GeoServer 2.17.0 + GeoWebCache 1.15.0 |
| | Geospatial Data Server | Docker Engine – CentOS(Community) / window 2.3.0.2 |
| Business Layer | Business Server | mago3D Management System (User, Admin) |
| | Framework | Spring 5 (Spring boot 2.3) + Mybatis 3.5.4 |
| Infrastructure Layer | Language | Java (OpenJDK 11.0.2) |
| | WAS | Tomcat 0.0.35 |
| | Web Server | Nginx 1.16 |
| | OS | Linux Centos 7.6 / Window Server 2019 |

mago3D - Main Features

Automatic Data Conversion

Hassle free data display(Data Uploading → Automatic Data Conversion → Data Display)

Various Formats Supporting

3DS, OBJ, FBX, IFC, CityGML, IndoorGML, LAS, SHP, GPKG, GeoTiff, etc.

Rule Based Management System

Rule based 2D/3D data management for flexible system

Smart Tiling

Increasing large size 3D data streaming speed and rendering quality

Simulation

Sunlight, Shadow, Air pollution, Wind, Town design simulation, etc.

API

Rest, Restful APIs for data, screen handling

Dashboard

Dashboard for monitoring user activities, data, APIs, system health, schedules, etc.

Standard Compliance

Compliant with OGC, buildingSMART, W3C's standards.

2D/3D Data Upload and Automatic Conversion

3D Data Uploading

| | | | |
|----------|--|------------|----------|
| 데이터명 * | IFC 파일 자동 변환 | 데이터 그룹 * | 기본 |
| 공유 유형 * | 공통 | 데이터 타입 * | IFC |
| 높이 설정 방법 | Terrain(지형)으로 부터 높이 설정 | 대표 위치 (경도) | 127. |
| 용도 * | <input checked="" type="radio"/> 단일형 <input type="radio"/> 복합형 | 설명 | IFC I... |

파일 업로딩

| | |
|-------------|-----------------------------------|
| Image | GeoTiff |
| Vector | GPKG, SHP, GML |
| 3D | CityGML, IndoorGML, 3DS, OBJ, DAE |
| BIM | IFC |
| Point Cloud | LAS |

0.2 MB
KSJ_271.itc

15.8 MB
KSJ_240_N...

2D Data Uploading

데이터 그룹 선택

| | | | |
|------------------|---|-----------------|---|
| Layer 그룹명 | 행정구역 | Layer 그룹 찾기 | |
| Layer 명 | 시도/시군구 | Layer Key | district |
| OGC Web Services | WMS | Cache 사용 여부 | <input checked="" type="radio"/> 사용 <input type="radio"/> 미사용 |
| Layer 타입 | Vector | 도형 타입 | Polygon |
| 비ект론 색상 | #E47467 | 비ект론 두께 | 1 |
| 제우가 색상 | #11FF00 | 투명도 | 100% |
| 레이어 표시 순서 | 1 | 표시 순서(EZ Index) | 1 |
| 기본 표시 | <input checked="" type="radio"/> 사용 <input type="radio"/> 미사용 | 사용 여부 | <input checked="" type="radio"/> 사용 <input type="radio"/> 미사용 |
| Label 표시 여부 | <input checked="" type="radio"/> 표시 <input type="radio"/> 비표시 | 설명 | district test |
| 좌표계 | EPSG:5176 | SHP 파일 연보단 | UTF-8 |

파일 업로딩

| | | | |
|----------------------|---------------------|-----------------------|--------------------|
| 0.5 KB 시도/시군구.shp | 10 KB 시도/시군구.gml | 0.1 KB 시도/시군구.json | 84 b 시도/시군구.tif |
|----------------------|---------------------|-----------------------|--------------------|

Upload Reset List

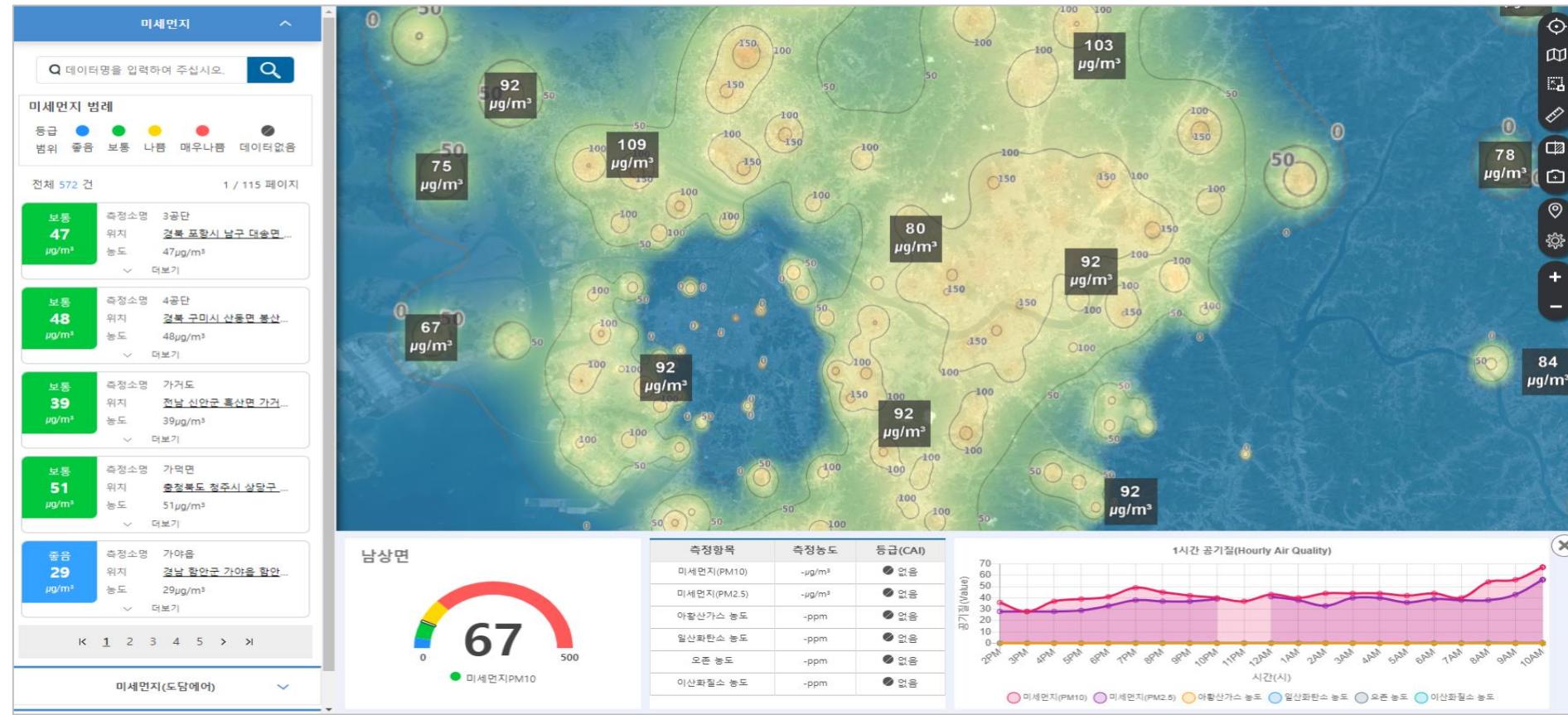
| 2D/3D Display

The screenshot displays the mago3D visualization interface. On the left, a sidebar contains various tools and settings: 검색 (Search), 데이터 (Data), 범위 (Range), 공간분석 (Spatial Analysis), 샘플라이선 (Sample License), 시민참여 (Citizen Participation), 레이어 (Layer), and 환경설정 (Environment Settings). The main area shows a 3D rendering of a city with numerous buildings and infrastructure. A search bar at the top left reads "검색어를 입력하세요." (Enter search term). To the right of the search bar are buttons for "데이터 그룹" (Data Group) and "데이터 목록" (Data List). Below these are fields for "데이터명" (Data Name), "데이터그룹" (Data Group) set to "[공통] 세종-도로표지판", and "타입" (Type) set to "전체" (All). A "검색" (Search) button is present. A legend indicates data types: 공유 유형 (Shared Type) with icons for 공유 (Blue), 공개 (Green), 비공개 (Orange), and 그룹공개 (Blue). A table titled "전체 : 63 건" (Total : 63 items) shows five entries, each with a number, name, type, status, and manager information. An inset image in the bottom-left corner illustrates "Smart Tiling" with a grid diagram, accompanied by the text: "Smart Tiling: Increasing large 3D data streaming speed and rendering quality."

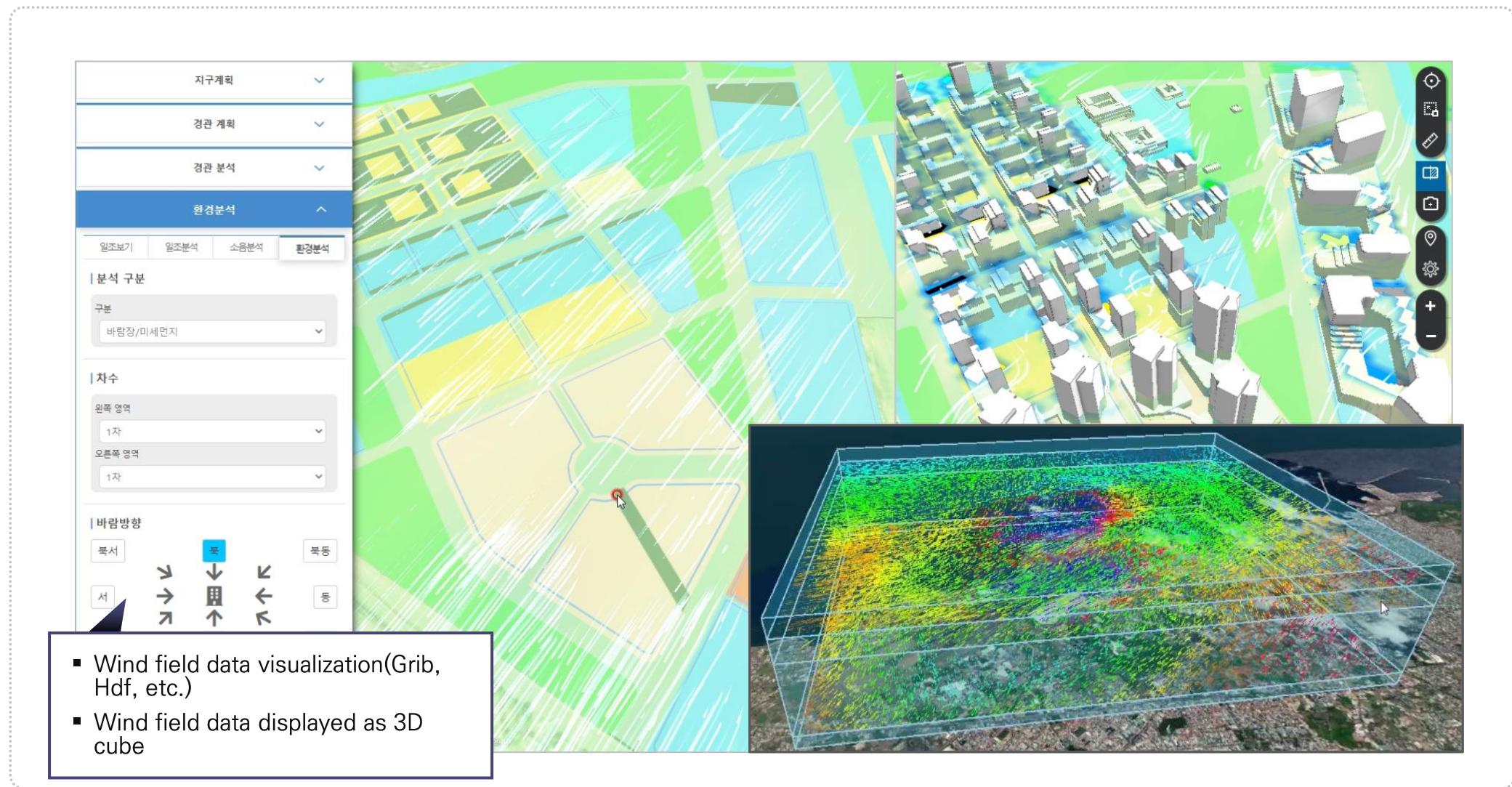
Smart Tiling:
Increasing large 3D data
streaming speed and
rendering quality.

| IoT – SensorThings API

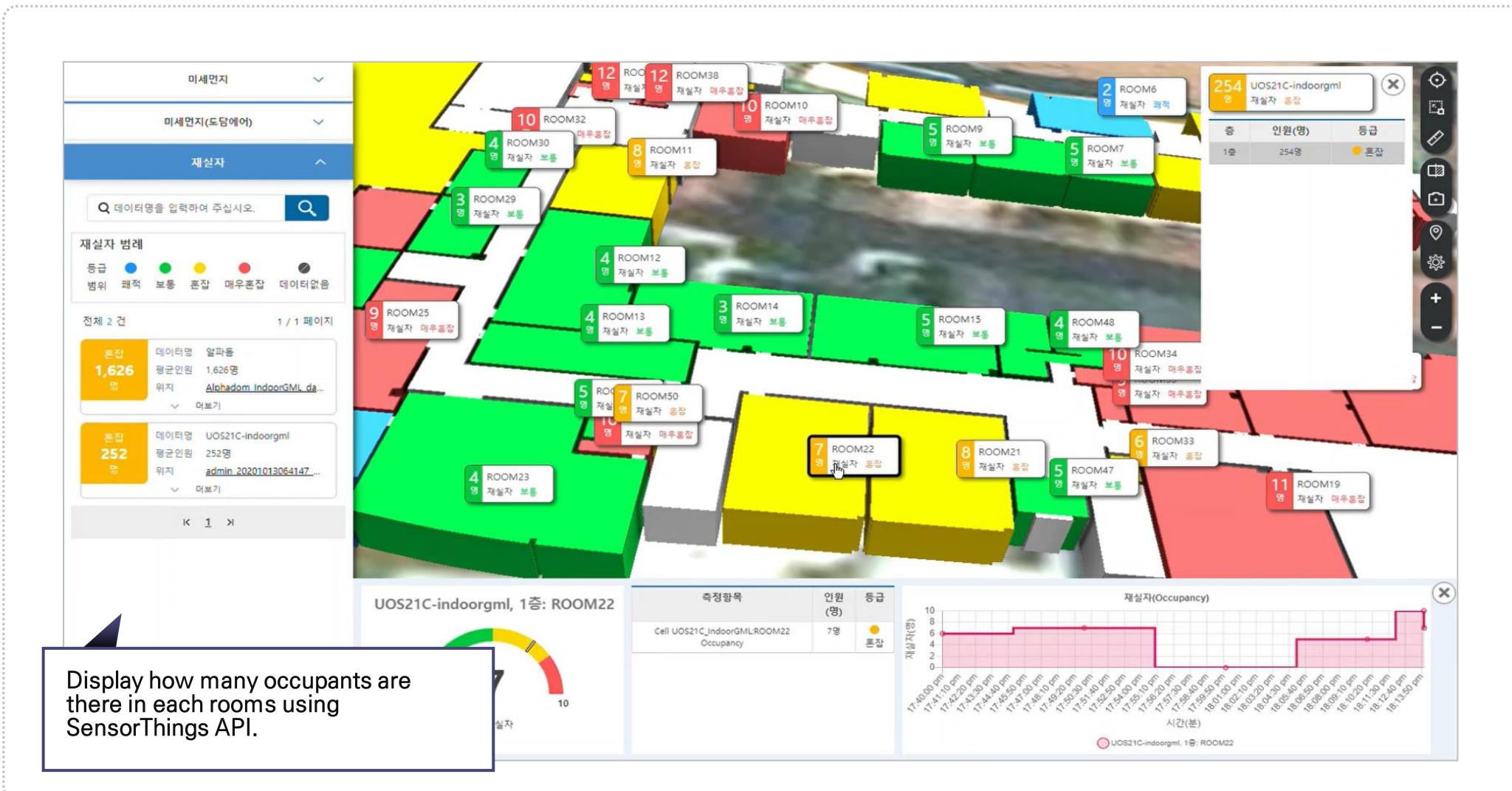
- GDAL Grid : Create 2D grid from scattered sensor data
- GDAL Contour : Extract isoline from grid data



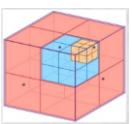
Wind



Indoor Occupant(SensorThings API)



| Point Cloud



Optimized performance using
pyramidal data structure

Town Planning

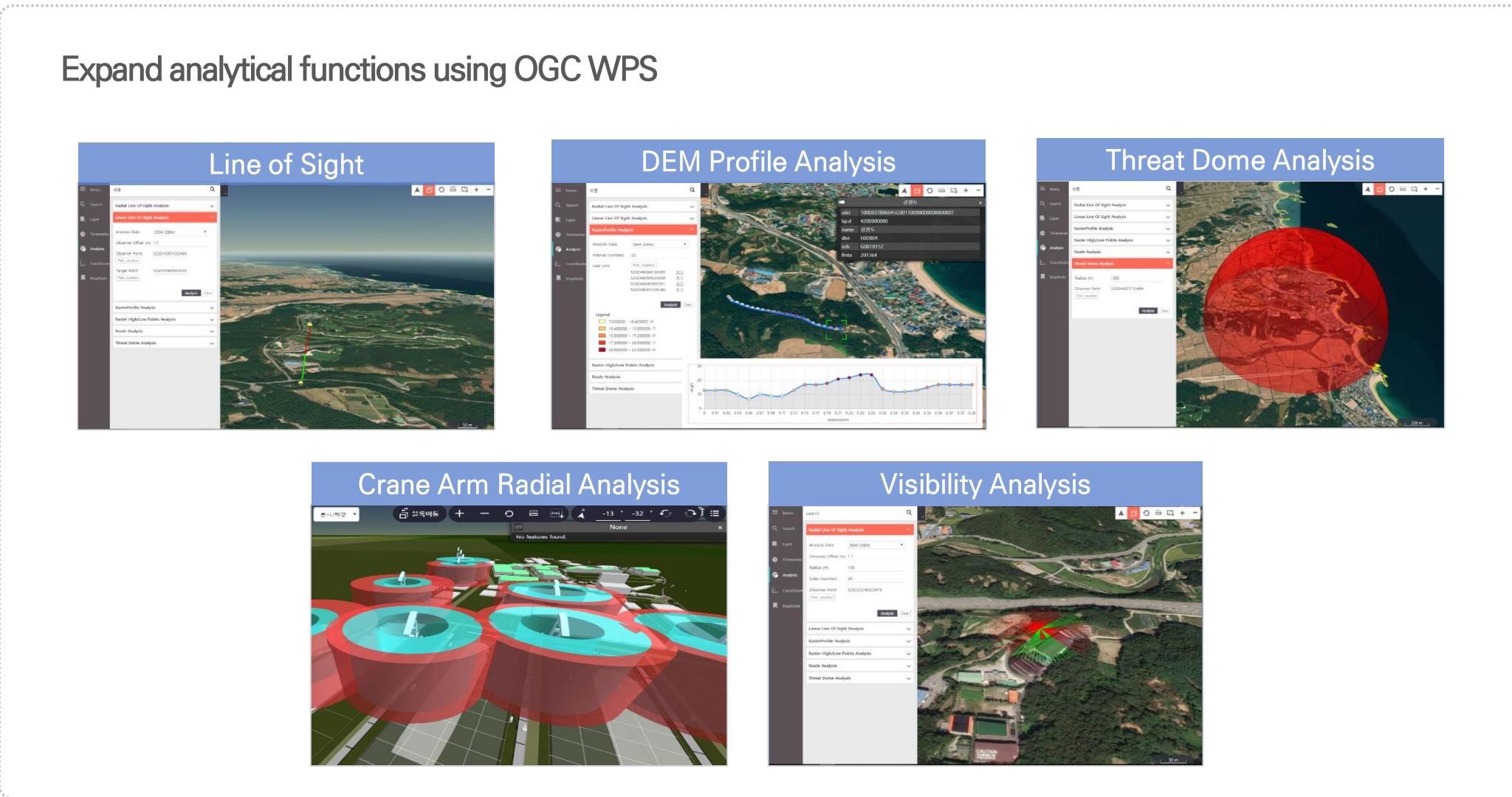
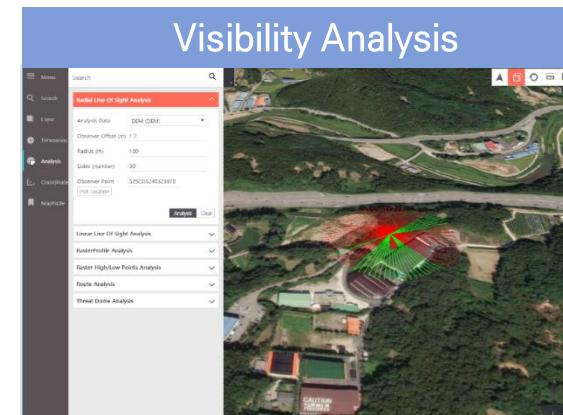
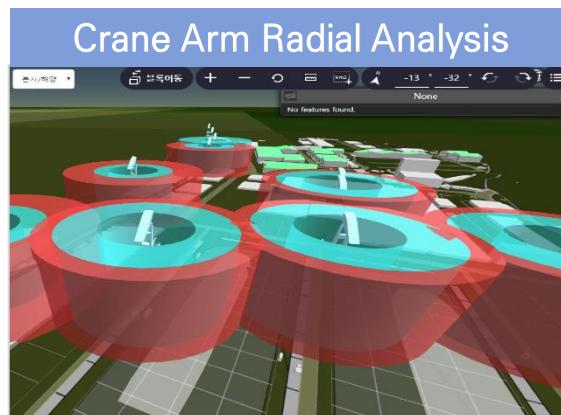
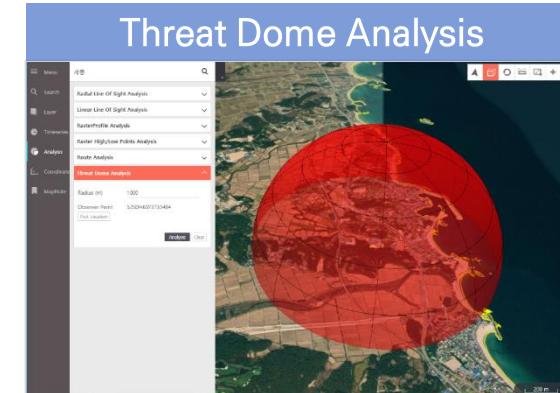
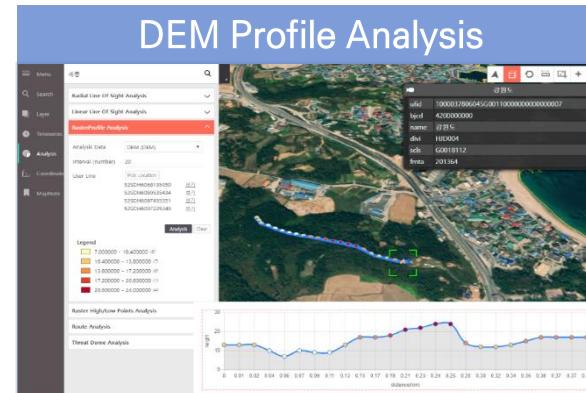
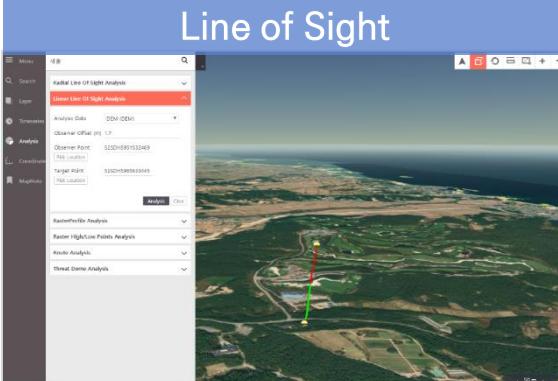
The screenshot displays the mago3D Town Planning simulation interface. On the left, a vertical toolbar includes options like '지구계획' (Area Planning), '경관분석' (Scenic Analysis), '일조분석' (Sunlight Analysis), '모델리' (Model), '데이터' (Data), '변환' (Transform), '레이어' (Layer), and '환경설정' (Environment Settings). A secondary panel titled '단지가시화' (Site Visualization) shows dropdown menus for '신도시' (New City) and '사업자구' (Business District), along with a list of analysis types and tool buttons for '평균높이분석' (Average Height Analysis) and '시각연분석' (Visual Analysis).

The central area features a detailed 3D rendering of a cityscape with buildings, roads, and green spaces. Two floating windows provide specific data: the top one for the 'Business District' (事业자구) and the bottom one for the 'Site' (단지). Both windows show tables with metrics such as population density (구분 갑), employment rate (사업자구 개업자구), and projected values (계획 인구수).

At the bottom left, a modal window titled 'Town Planning Simulation using 3D Library' displays a library of 3D assets. It includes categories for 'Trees' (Trees), 'Lights' (Lights), and 'Buildings' (Buildings), each with corresponding icons and Korean labels: 벚나무 (Plum Tree), 소나무 (Cypress), 은행나무 (Buckeye), 양날형 (Double-blade), 현날형 (Curved-blade), 고층 (High-rise), 저층 (Low-rise), and 주상복합 등 (Mixed-use).

2D/3D Analysis

Expand analytical functions using OGC WPS



Autonomous Vehicle Monitoring



Dashboard

사용자 | 데이터 | 레이어 | Extrusion Model | Business Rule | 디지털트윈 서비스 | 통계 및 이력 | 환경설정 | 게시판

데이터 변환 현황 2021-03-16(오늘)



신규 변환 건수 0개



변환 성공 건수 0개



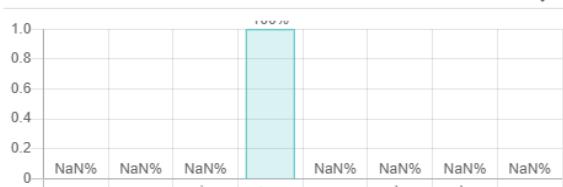
변환 실패 건수 0개

사용자 현황 2021-03-16 00:33:12기준



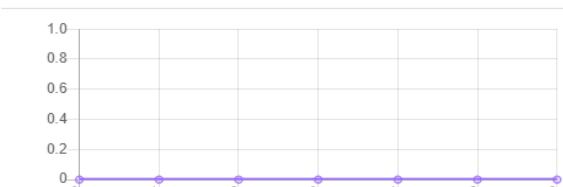
| 상태 | 비율 (%) |
|----------|--------|
| 사용 중 | 100% |
| 사용 종료 | NaN% |
| 잠금(비밀번호) | NaN% |
| 휴면 | NaN% |
| 만료 | NaN% |
| 논리 삭제 | NaN% |
| 임시 비밀번호 | NaN% |
| 승인 대기 | NaN% |

데이터 타입별 현황 2021-03-16 00:33:12기준



| 타입 | 비율 (%) |
|-----------|--------|
| 3ds | NaN% |
| collada | NaN% |
| obj | NaN% |
| ifc | 100% |
| dae | NaN% |
| citygml | NaN% |
| IndoorGML | NaN% |
| las | NaN% |

데이터 변환 현황 2021-03-16 00:33:12기준



| 날짜 | 값 |
|------------|---|
| 2021-03-10 | 0 |
| 2021-03-11 | 0 |
| 2021-03-12 | 0 |
| 2021-03-13 | 0 |
| 2021-03-14 | 0 |
| 2021-03-15 | 0 |
| 2021-03-16 | 0 |

디지털트윈 서비스 현황

| 서비스명 | 요청 URL | 등록일 |
|-------------------------|--------|-----|
| 디지털 트윈 서비스 사용 이력이 없습니다. | | |

서비스 상태

| 번호 | 서비스명 | 상태 | 등록일 |
|----|------------------|---------|---------------------|
| 1 | SensorThings API | unknown | 2021-03-16 00:00:14 |
| 2 | 시뮬레이션 서버 | unknown | 2021-03-16 00:00:04 |
| 3 | SensorThings API | unknown | 2021-03-15 23:00:14 |
| 4 | 시뮬레이션 서버 | unknown | 2021-03-15 23:00:04 |
| 5 | SensorThings API | unknown | 2021-03-10 16:00:00 |

리소스 현황

Disk 사용량



| 상태 | 비율 (%) |
|------|--------|
| Used | 80% |
| Free | 20% |

19

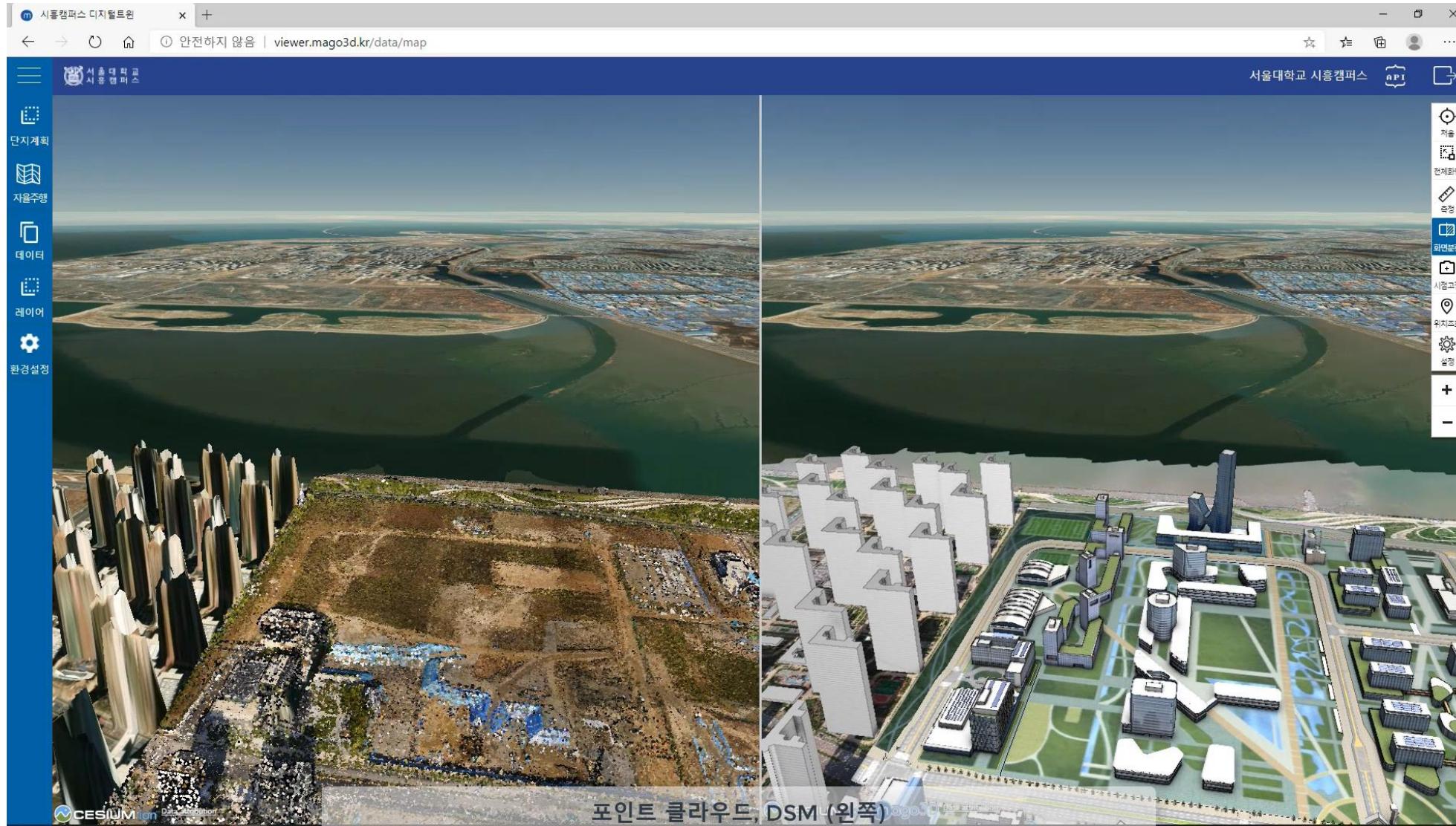
Real Cases - BIM Integration

Building Locale Neighborhood City Region Nation



Real Cases - Before & After Construction

Building → Locale → Neighborhood → City → Region → Nation



Real Cases - Town Planning

Building

Locale

Neighborhood

City

Region

Nation



LH Digital Twin

LH 디지털트윈 플랫폼

두번째 스토리 - 지구계획 시뮬레이션

Real Cases - Town Planning



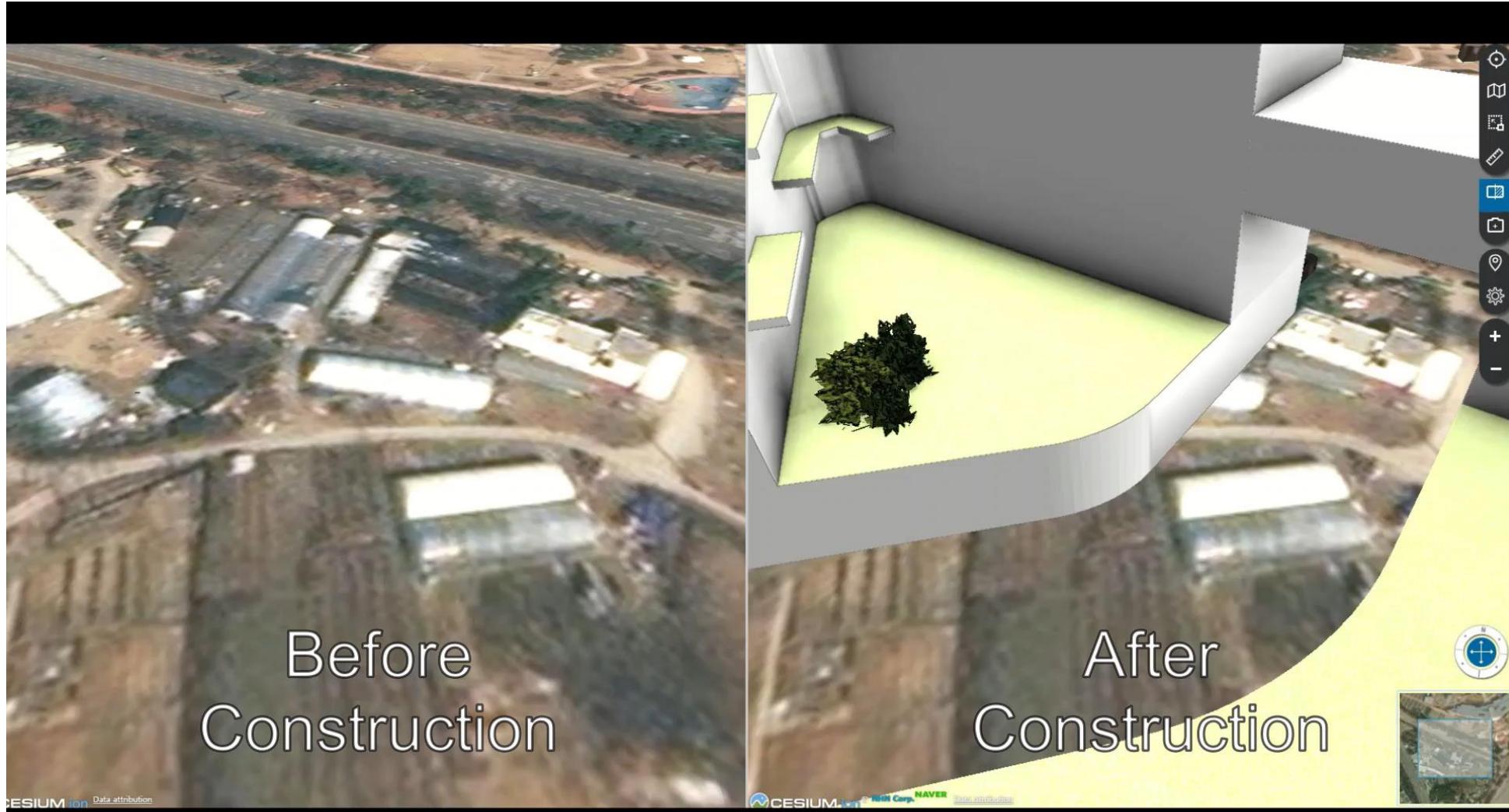
LH Digital Twin

LH 디지털트윈 플랫폼

네번째 스토리 - 일조분석 시뮬레이션

Real Cases - Wind Simulation

Building Locale Neighborhood City Region Nation



Real Cases - Wind Field

Building

Locale

Neighborhood

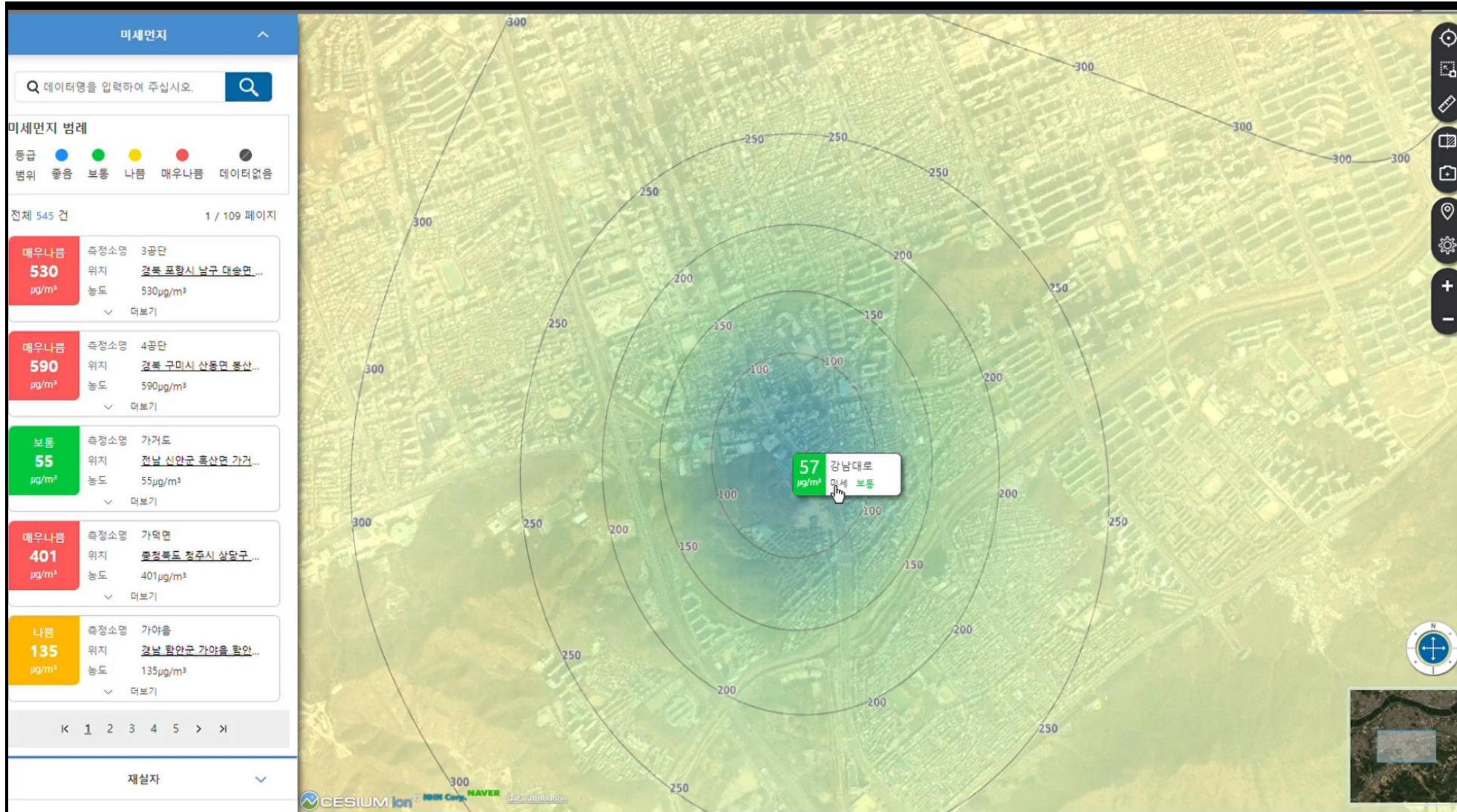
City

Region

Nation



Real Cases - Fine Dust



Real Cases – Global Weather

Building

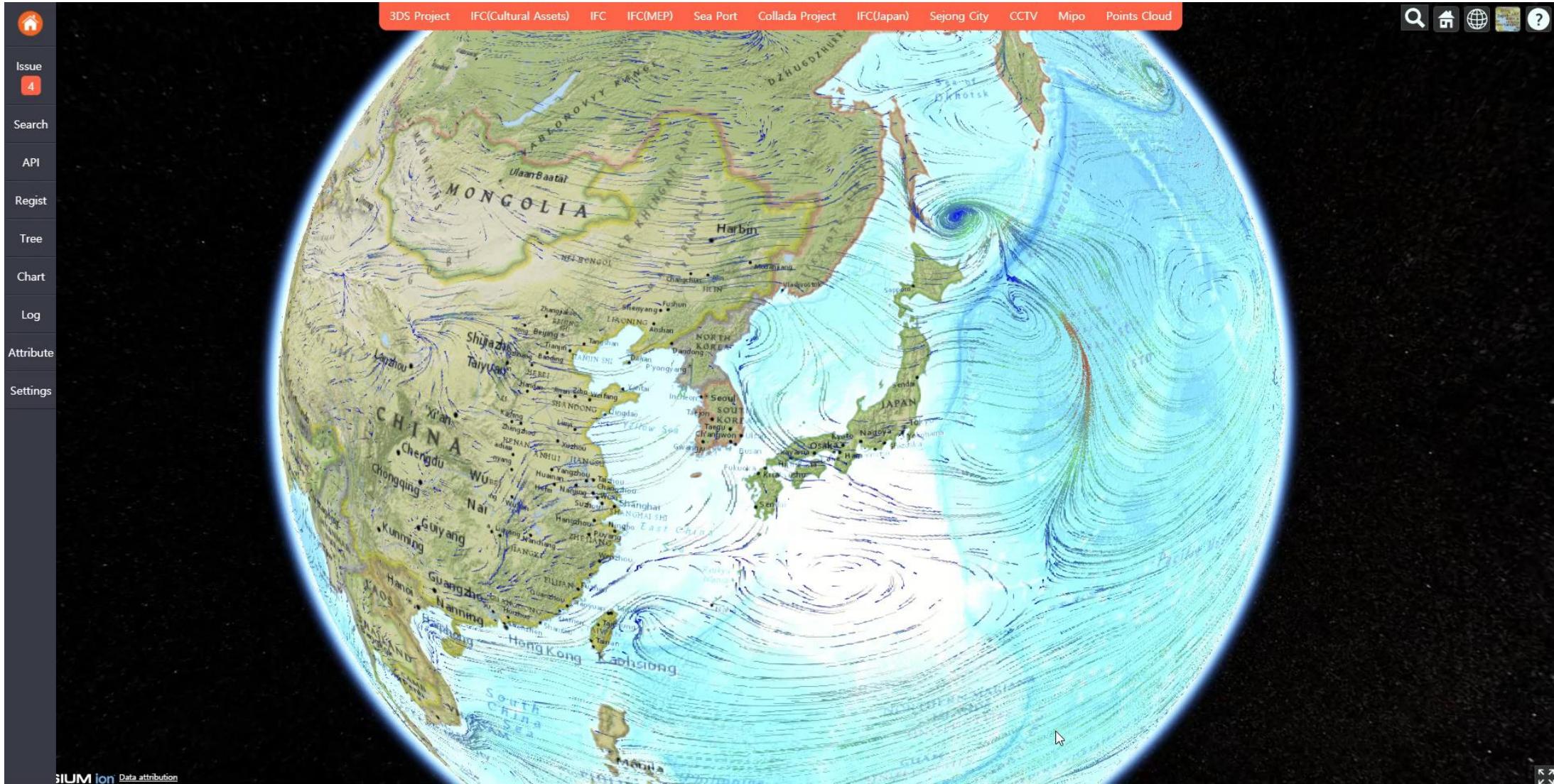
Locale

► Neighborhood

City

Region

National...



Bright and Dark Side

- Increased visibility in the Korean market
 - Successful large-scale projects
 - Reference sites
 - Improved rendering speed and quality
 - Expanded to enterprise solution
 - Many experiences about data and other systems
 - ...
-
- Almost isolated only in Korea
 - Small number of core programmers with little community
 - Hard to deploy due to much dependencies on other projects
 - Getting more complicated, complex, and huge
 - Lack of manuals, guides
 - Lack of clear roadmap
 - ...



For more information, please visit <http://mago3d.net>

All the source codes are here:

<https://github.com/Gaia3D/mago3d>

Thank you!

신상희 shshin@gaiad3.com

