International Federation of Surveyors, FIG

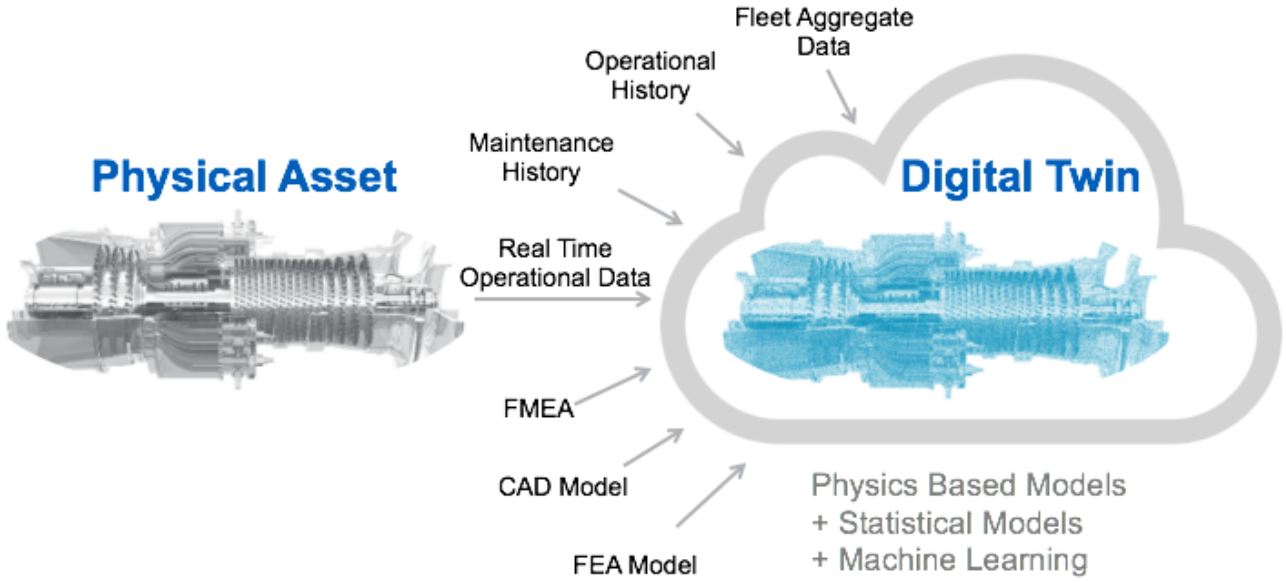
The GeoSpatial Company

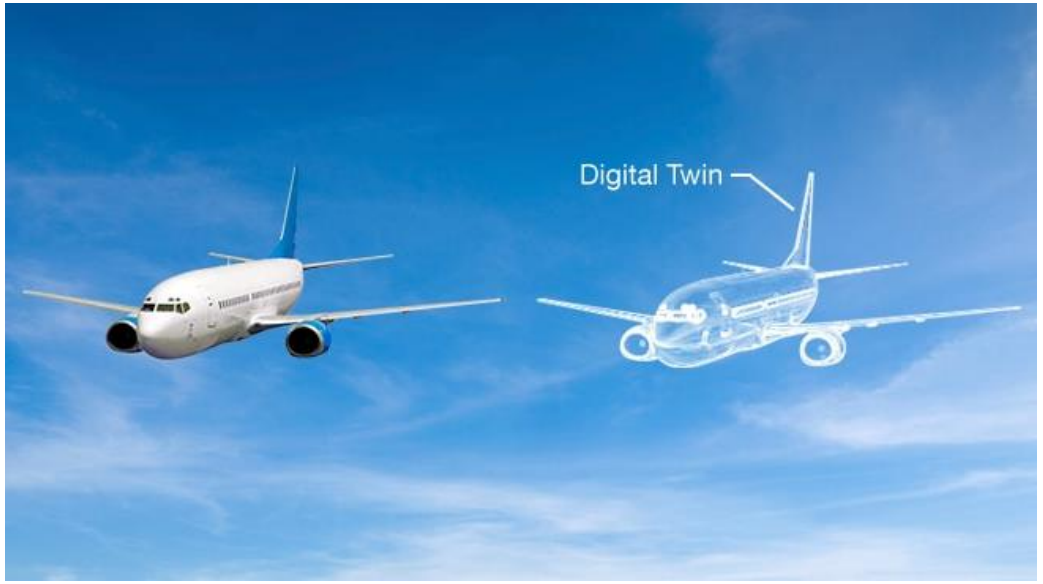
Digital Twin and Smart Spaces

6th August 2019

Sanghee Shin(shshin@gaia3d.com)

Digital Twin



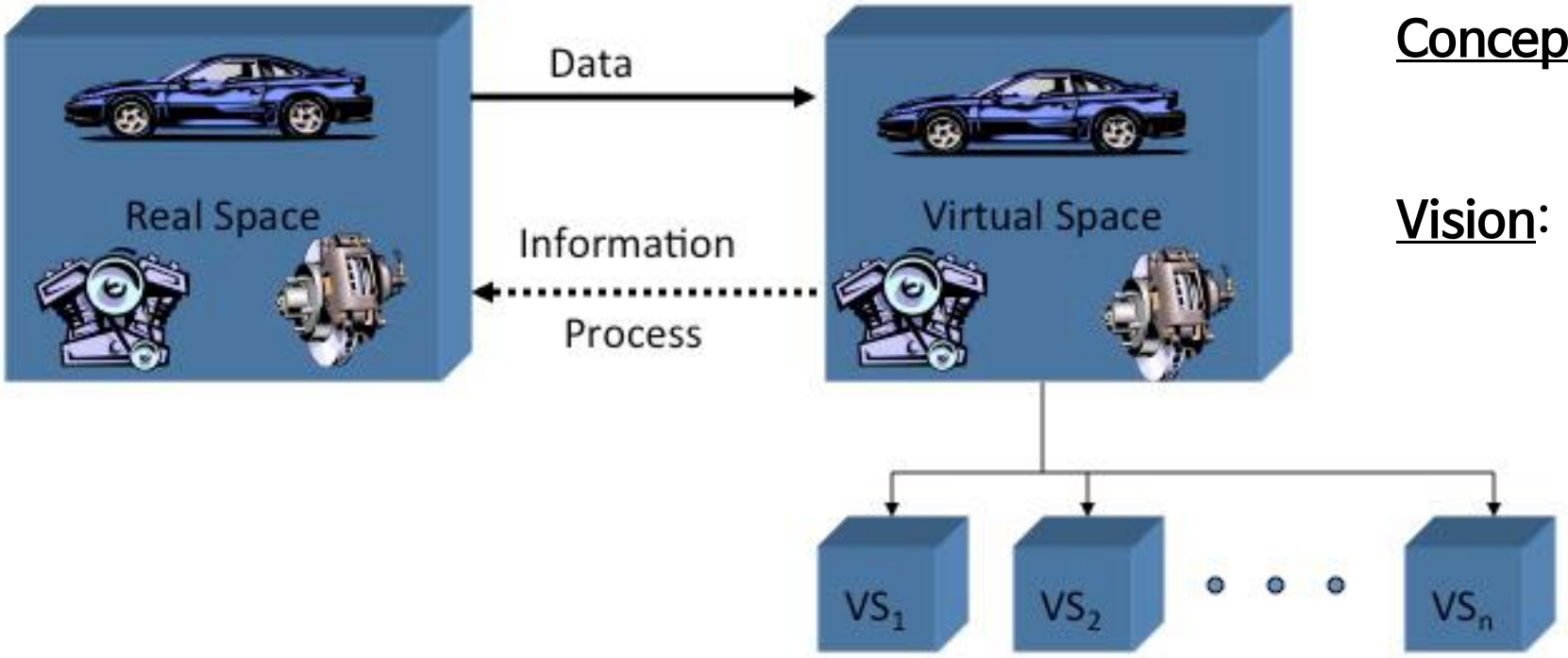


Digital Twins

A digital twin is a virtual representation of a physical object or system across its lifecycle, using real-time data to enable understanding, learning and reasoning.

Origin of Digital Twin

Conceptual Ideal for PLM

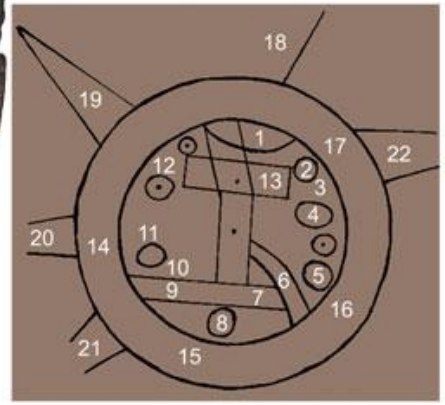


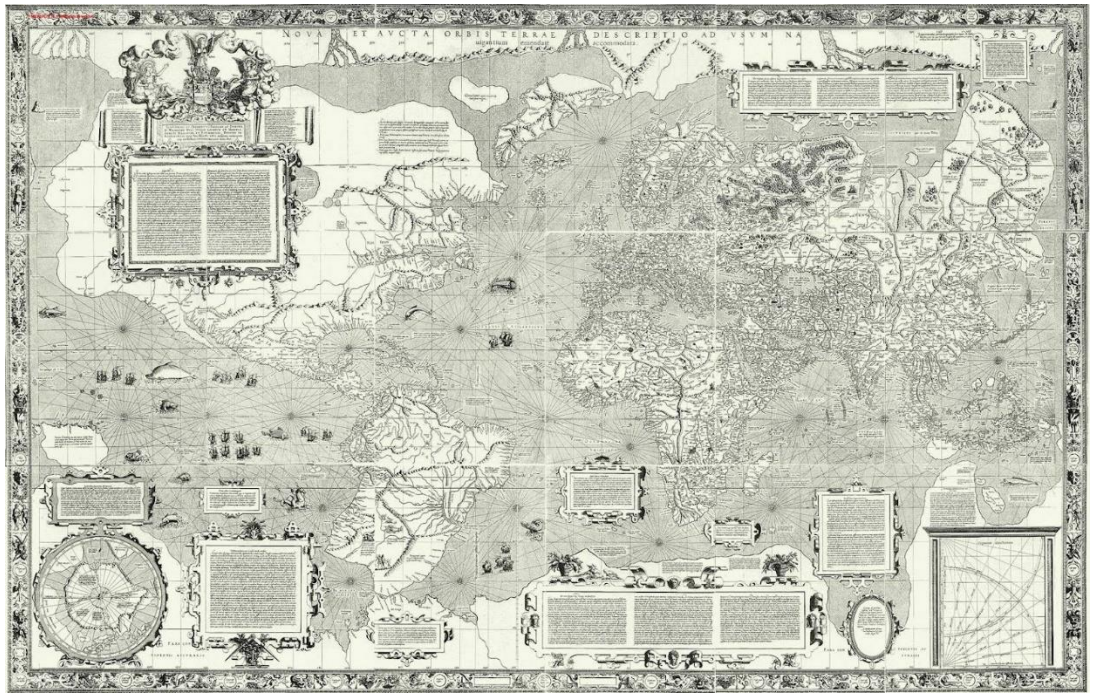
Concept: Digital Informational Construct

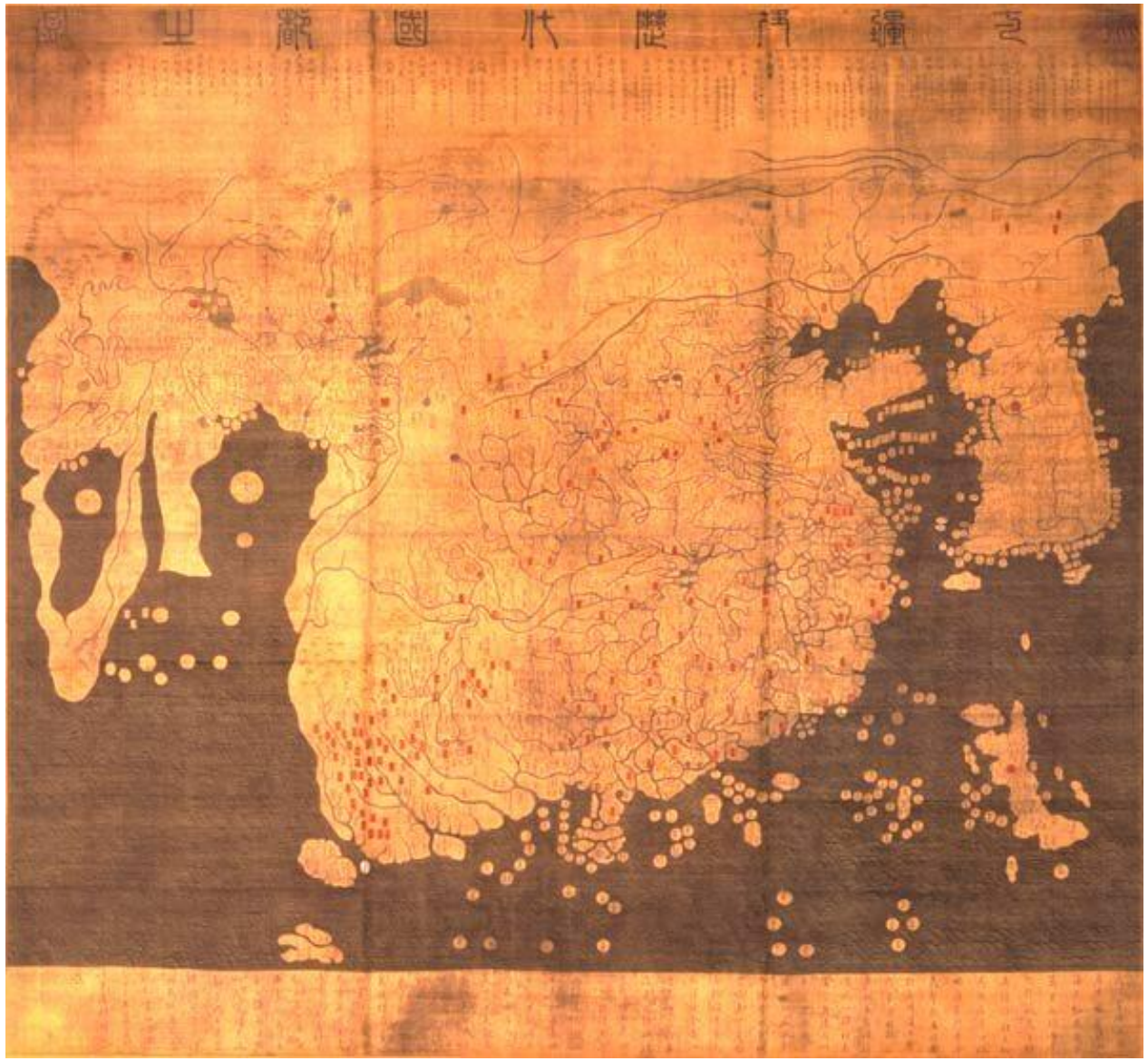
Vision: Create, Test, Build

<Source: Dr. Michael Grieves, University of Michigan, Lurie Engineering Center, Dec 3, 2001>

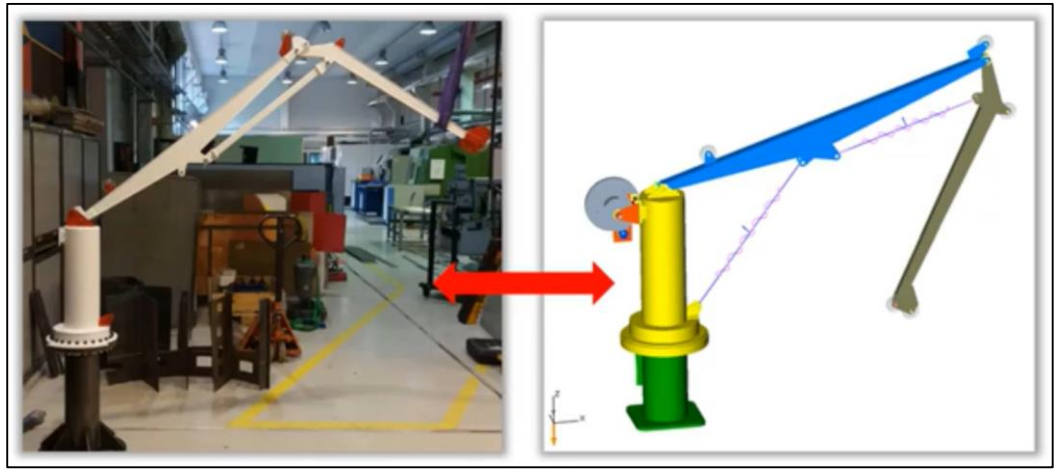
Analog(?) Twin

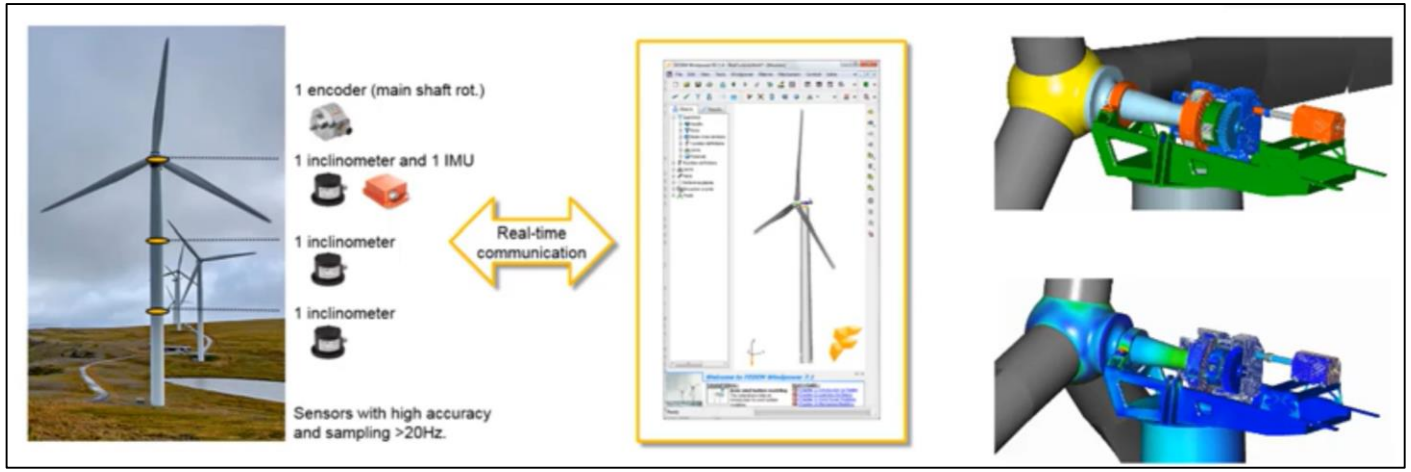






Examples of Digital Twin





<Source: https://www.youtube.com/watch?v=u7DqoX9PrnY>

Examples of Digital Twin

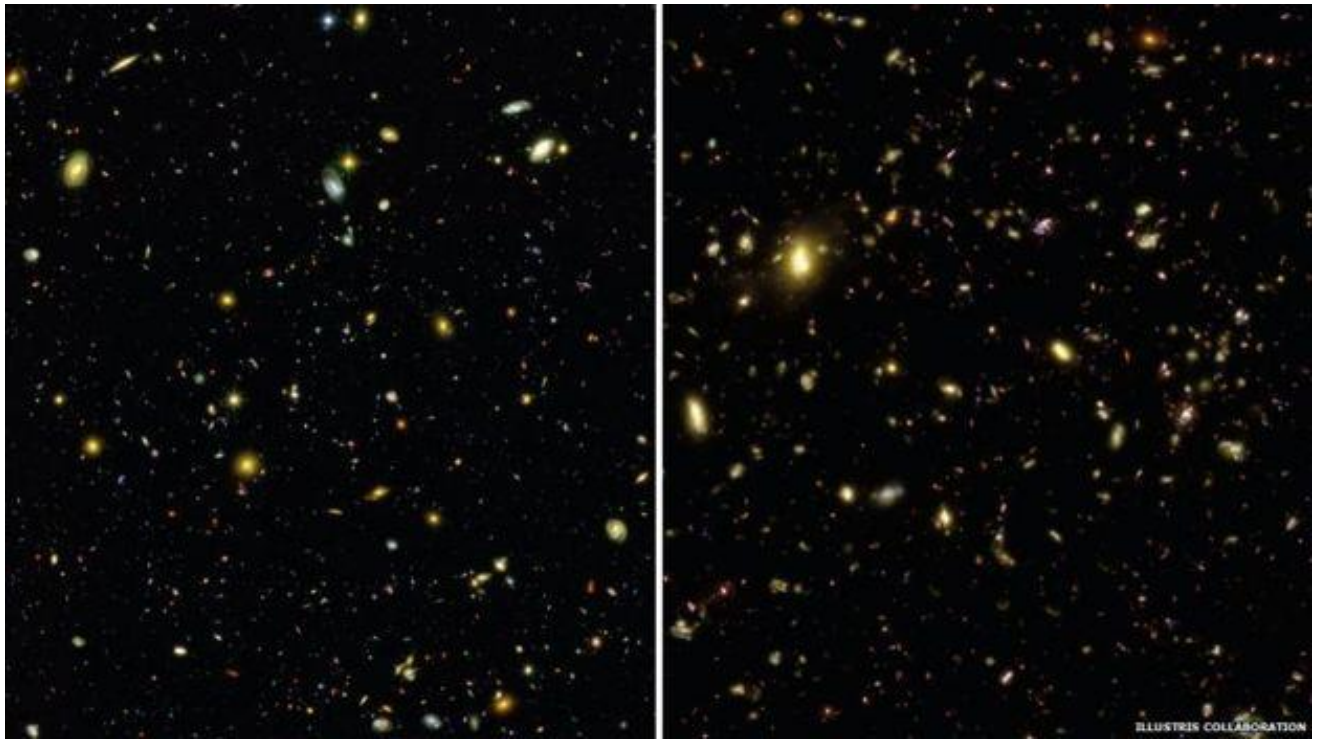
Universe evolution recreated in lab

By Pallab Ghosh
Science correspondent, BBC News

7 May 2014 Share

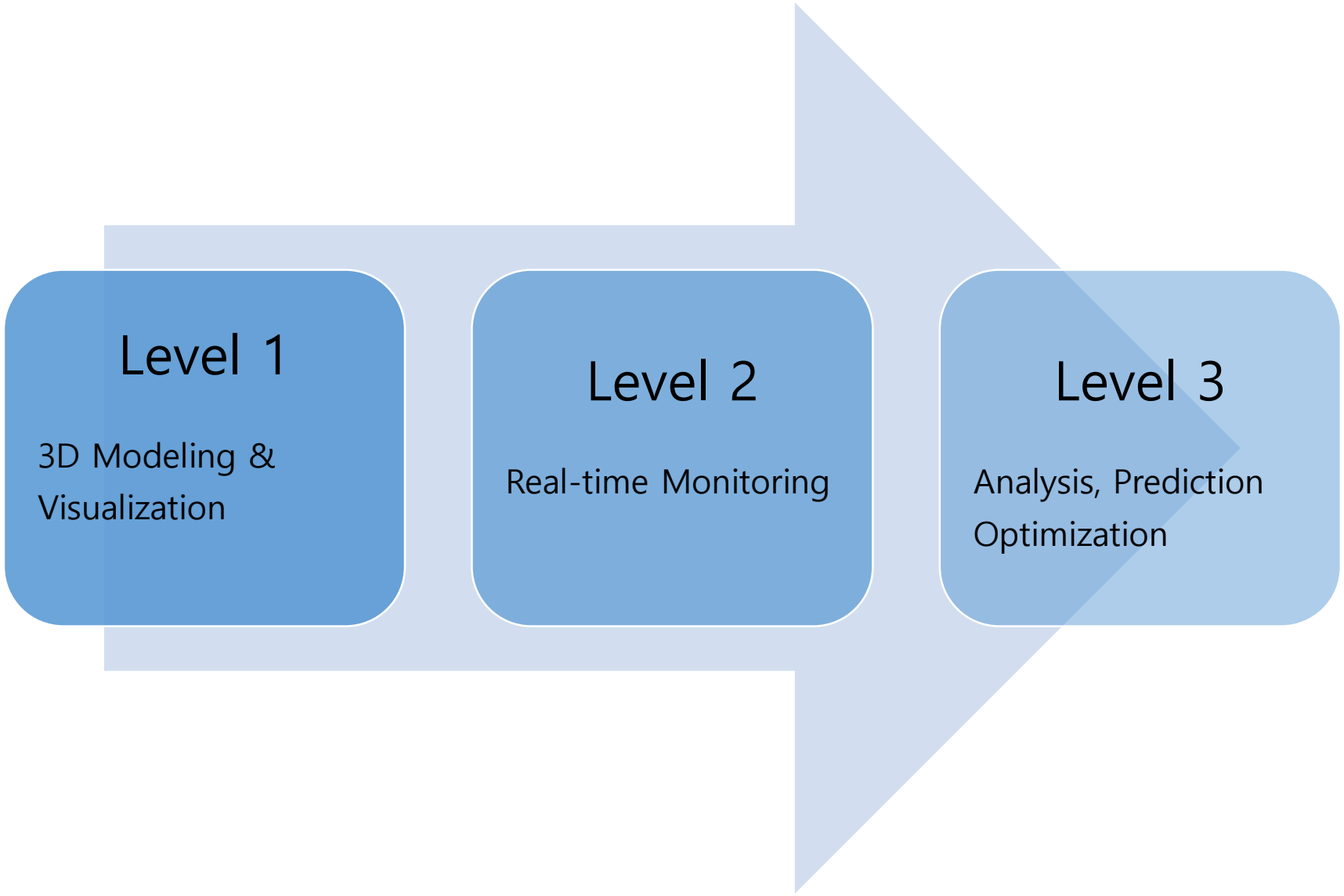
Pallab Ghosh explains the significance of the visual simulation

An international team of researchers has created the most complete visual simulation of how the Universe evolved.



<Source: http://www.bbc.com/news/science-environment-27299017>

Levels of Digital Twin



<Source: Use the IoT Platform Reference Model to Plan Your IoT Business Solutions, Gartner>

Smart City as a Digital Twin

26
OCT
2017

3

‘Digital Twin’ is the new ‘Smart City’

AGI, digital twin, GeoCommunity / Gemma / 0 /
Geo events

By Jeremy Morley, Chief Geospatial Scientist

‘Digital Twin’ is the new ‘Smart City’. It’s a term that has little consensus on its meaning, but critical importance for those who understand its significance and role in a prosperous future for the UK.

Earlier this month, at the Digital Twin Data Challenge, we saw academics and professionals compete to create a digital model of Bristol: a virtual ‘echo’ or projection of the city, created in digital form.

The University of Manchester shown in the emerging 3D context model based on point clouds derived from aerial

디지털 공간에 현실이 동일하게 구현되는 국토 가상화(Digital Twin) 기술을 개발하고, 지문 등 생체정보 이용 탑승수속 등 공항 프로세스를 자동화하는 스마트공항도 조성한다는 계획이다.

김현미 국토부 장관은 “국토공간이라는 그릇에 4차 산업혁명과 혁신성장을 스마트하게 담아내겠다”며 “혁신성장을 통해 개인의 삶을 풍요롭게 하는 것은 물론, 미래 대한민국의 새로운 먹거리 발굴에 적극 나설 것”이라고 전했다.

The Rise of Digital Twins in Smart Cities

The rise of digital twins in smart cities

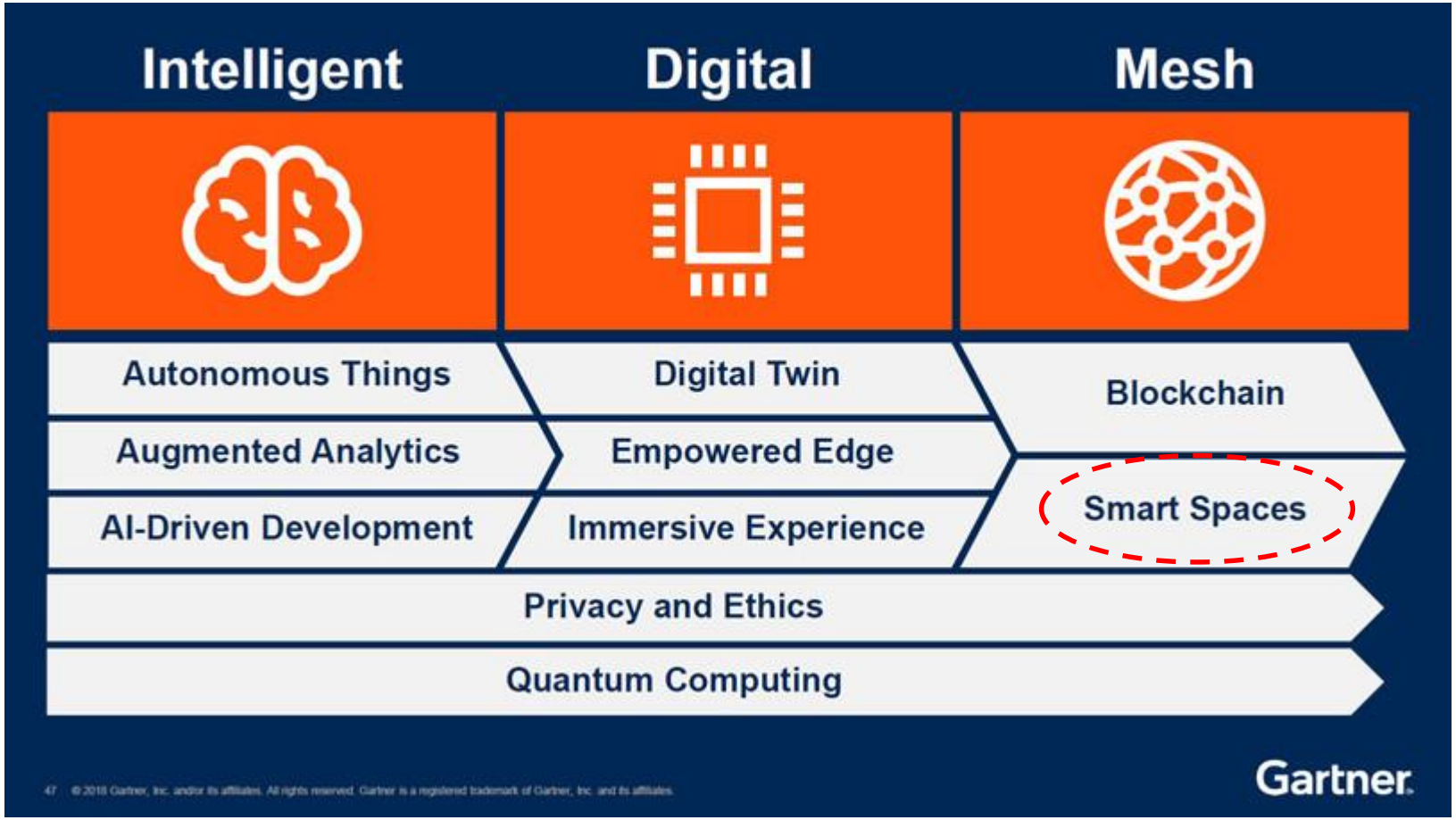
Special Reports | 06 Jan 2019 | by Sue Weekes: News editor, Smart Cities World

2019 could see virtual 'twins' help to make smart cities a reality.

The digital twin of Amaravati, a smart city being built in India

<Source: https://www.smartcitiesworld.net/special-reports/special-reports/the-rise-of-digital-twins-in-smart-cities>

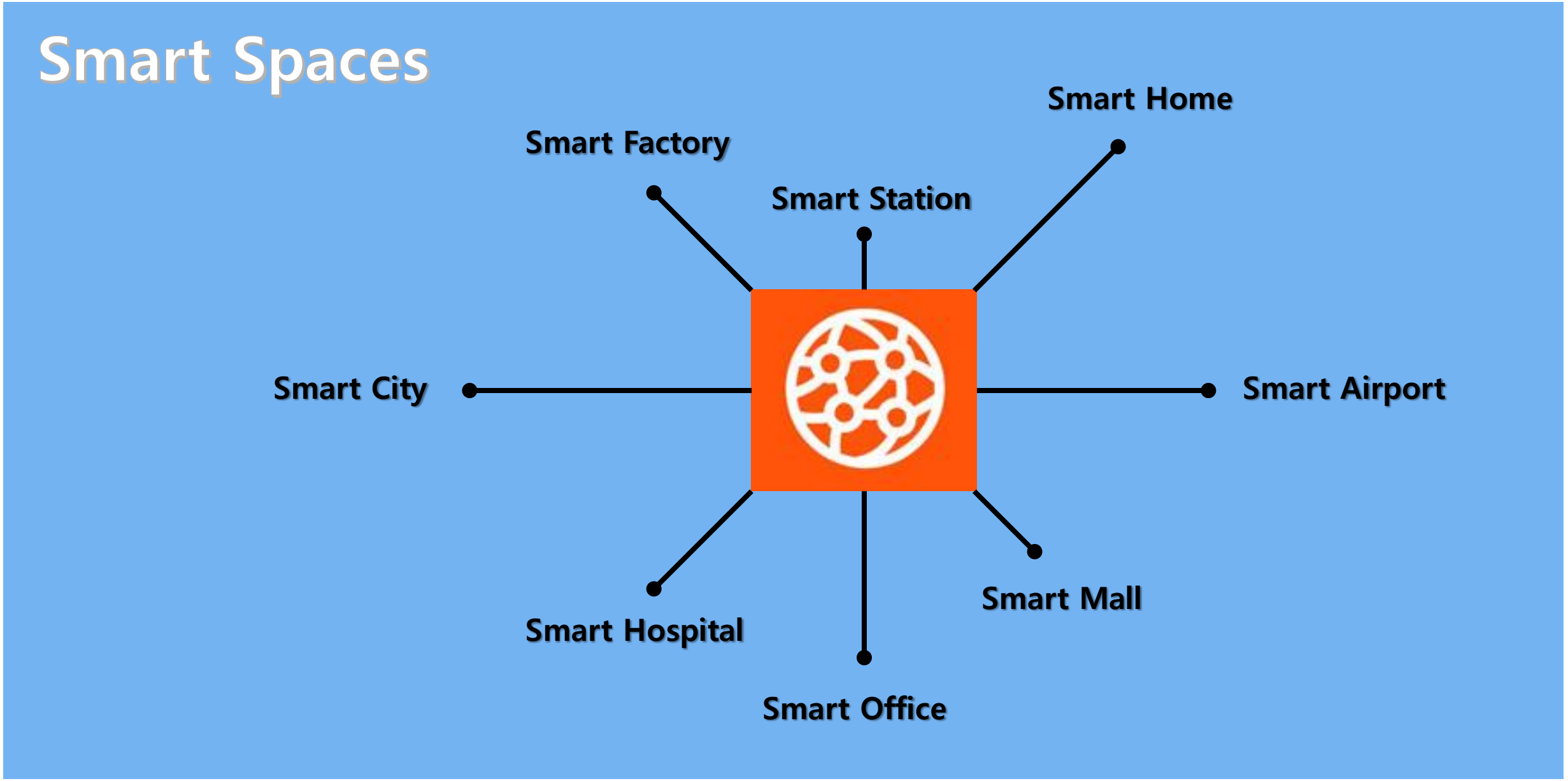
Smart Spaces



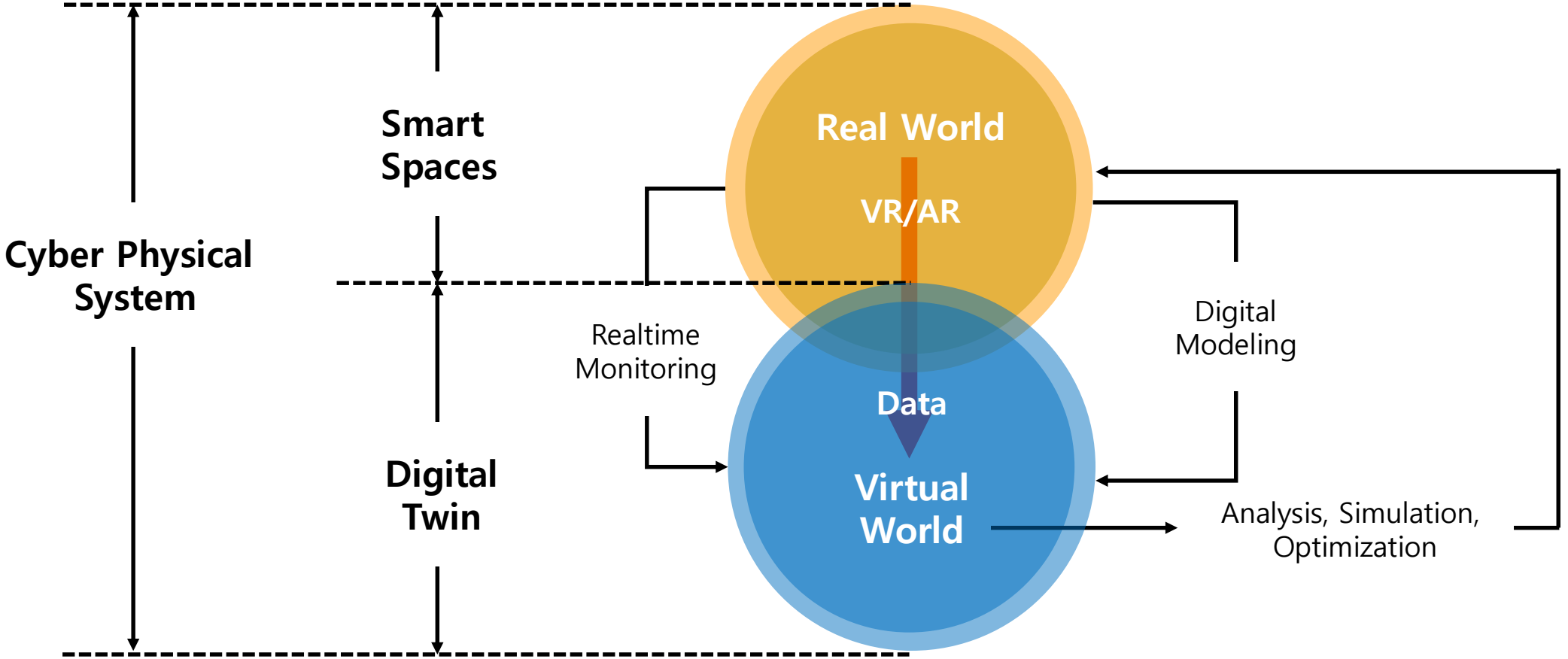
Smart Space

Smart spaces are not some sort of virtual reality, but rather physical environments decked out with technology. They are implemented with monitors and sensors that enable humans and integrated technological systems to interact.

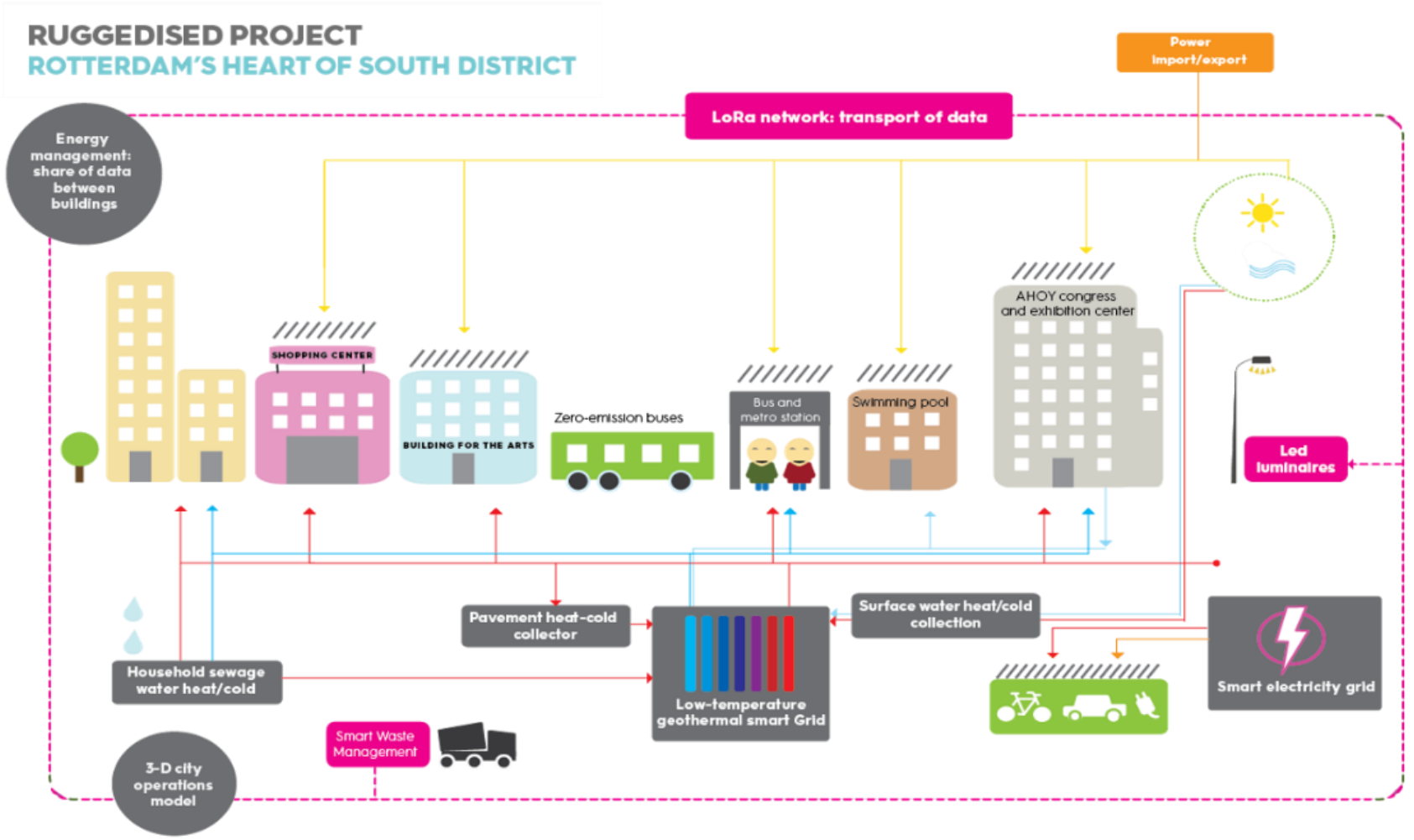
Examples of Smart Spaces



Digital Twin + Smart Spaces



Digital Twin + Smart Spaces



<Source: https://eu-smartcities.eu/news/rotterdams-digital-twin-redefines-our-physical-digital-social-worlds>

Bottle Neck

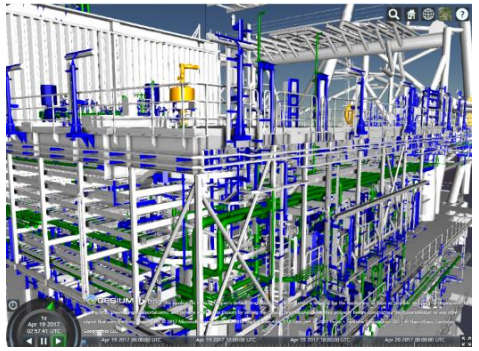
Bottle Neck!

Introduction – mago3D

mago3D = 3D + Web + Open Source

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

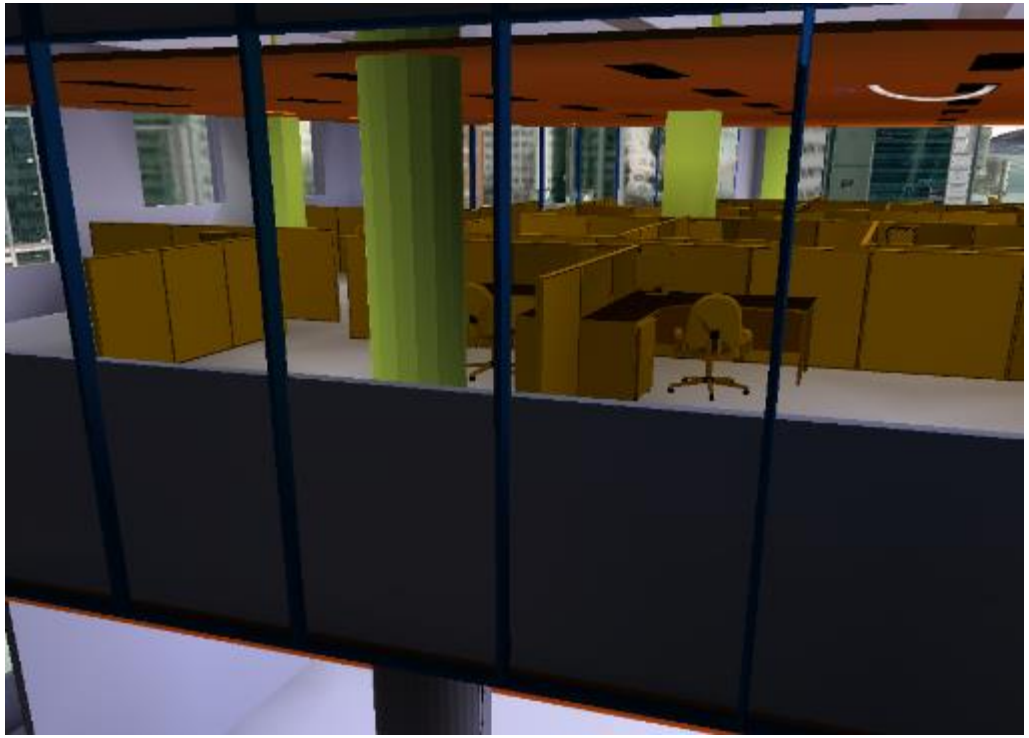


Introduction – mago3D

mago3D runs on any device

Results: BIM(Indoor/Outdoor) Integration

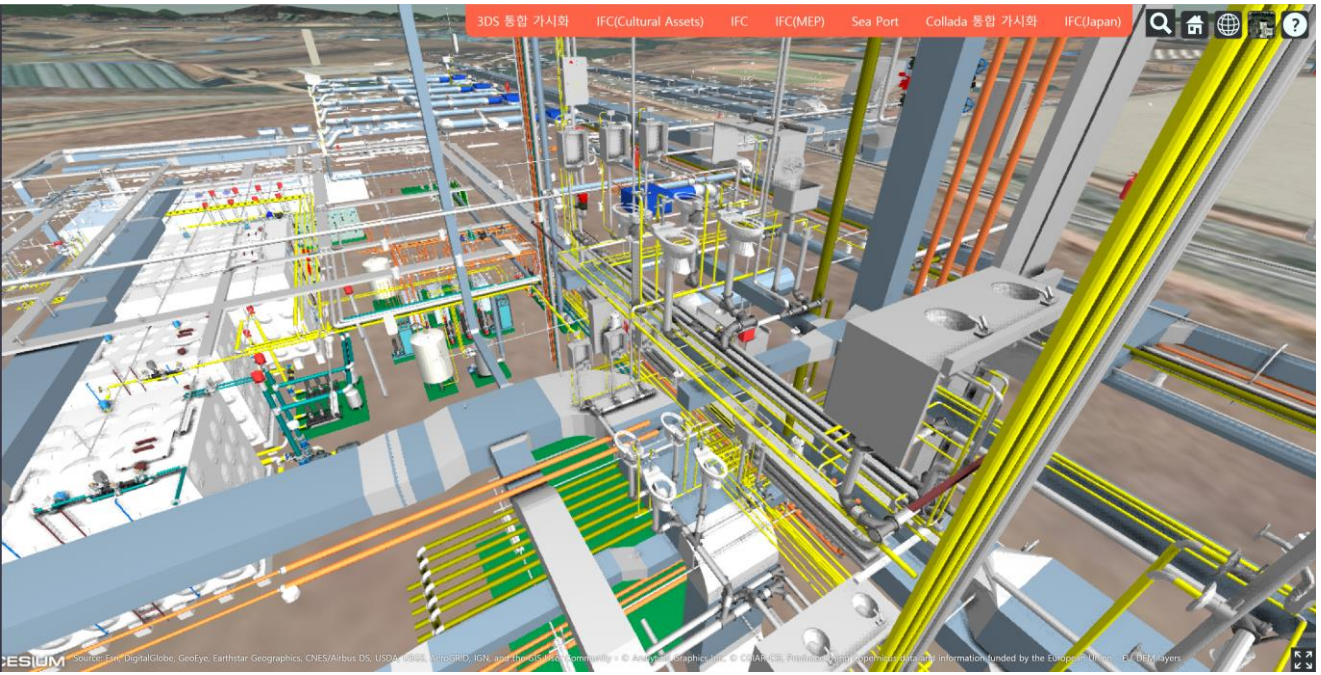
Scene from indoor to outdoor through windows

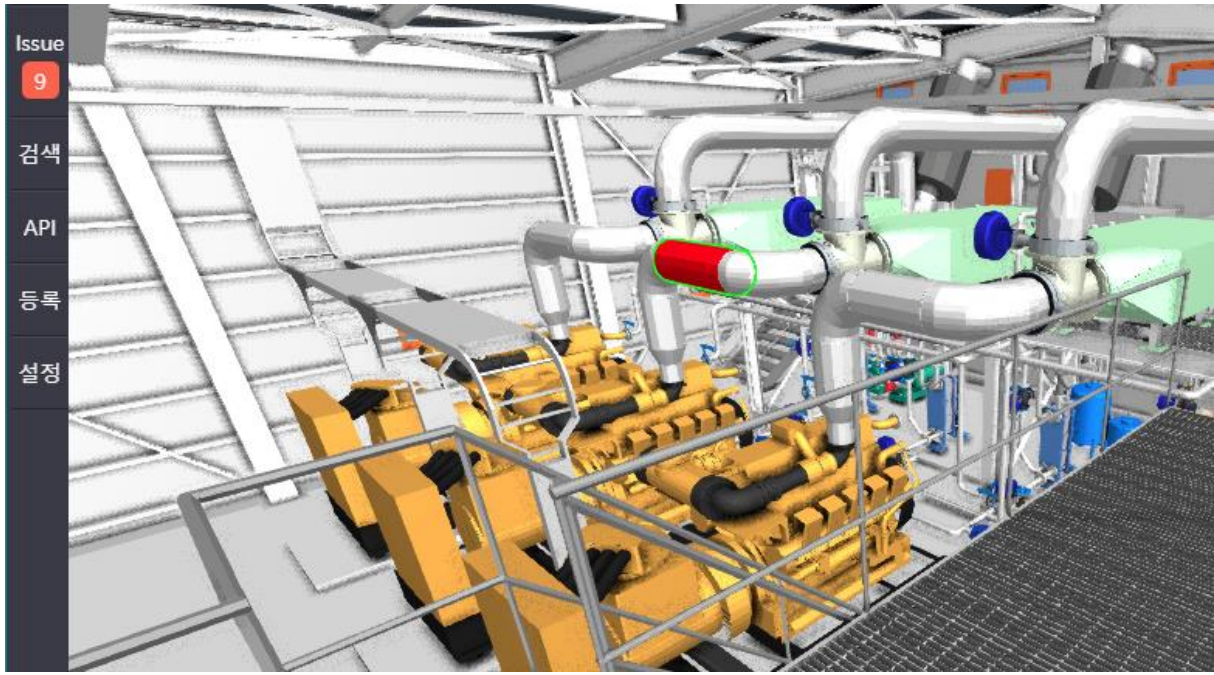


Scene from outdoor to indoor through windows

Seamless integration of **indoor and outdoor space** on the same platform

Results: AEC Integration





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

Results: CityGML Integration

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

Results: Point Cloud Integration

Integration of large size Point Cloud and 3D GIS on a web browser

Results: OGC WPS Integration

Integration of OGC Web Processing Service

Cases – Digital Twin based Ship Building Monitoring

- Project Name: Ship Building Management System
- 3D Models in Service

Factories

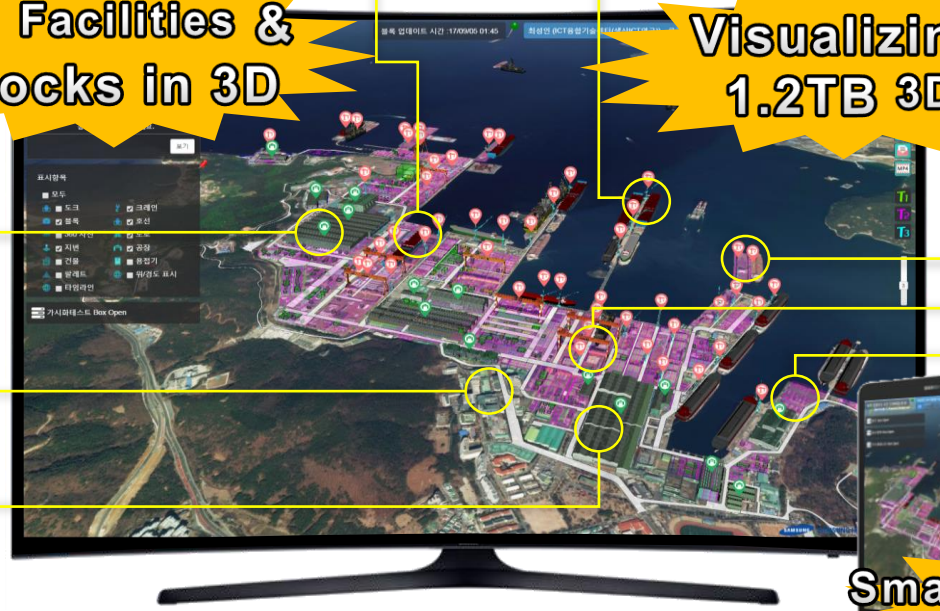
Cranes

Ships

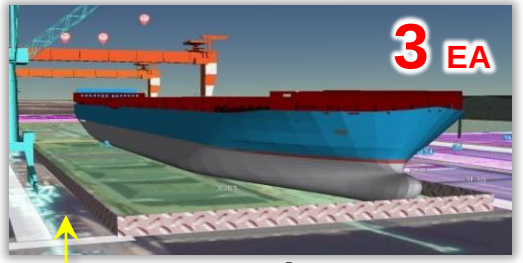
Blocks

Office Buildings

All Facilities & Blocks in 3D



Visualizing 1.2TB 3D

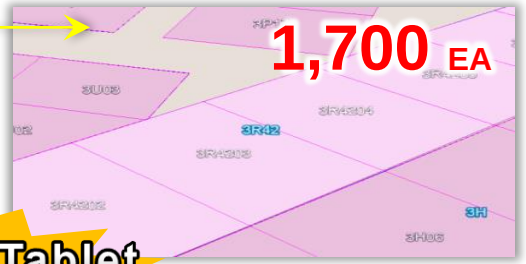


Docks

Smart Welding Machine

Virtual Yard on Web Browser!

Smartphone, Tablet, Laptop & PC



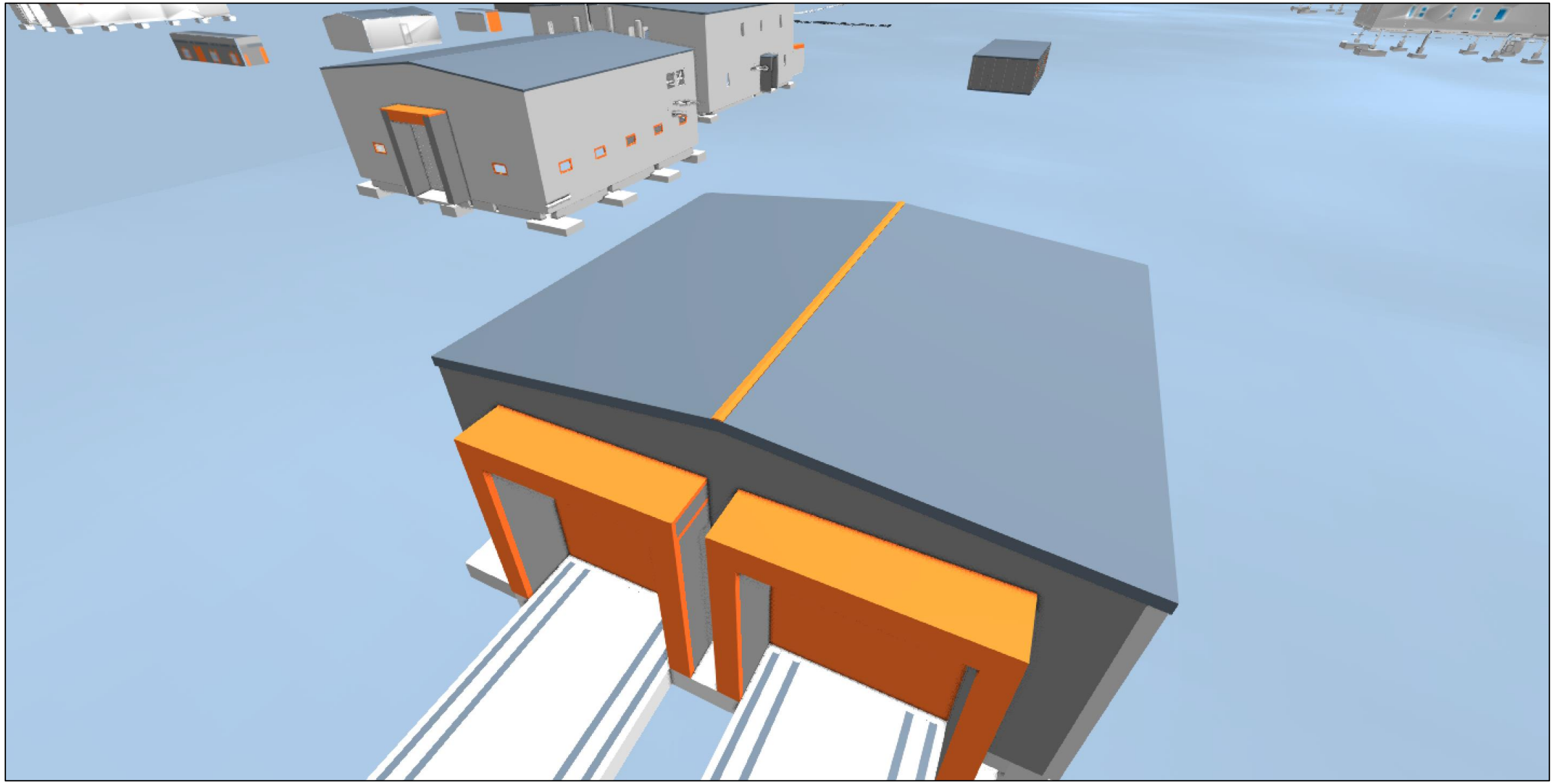
Yards

Cases – Seoul C-ITS

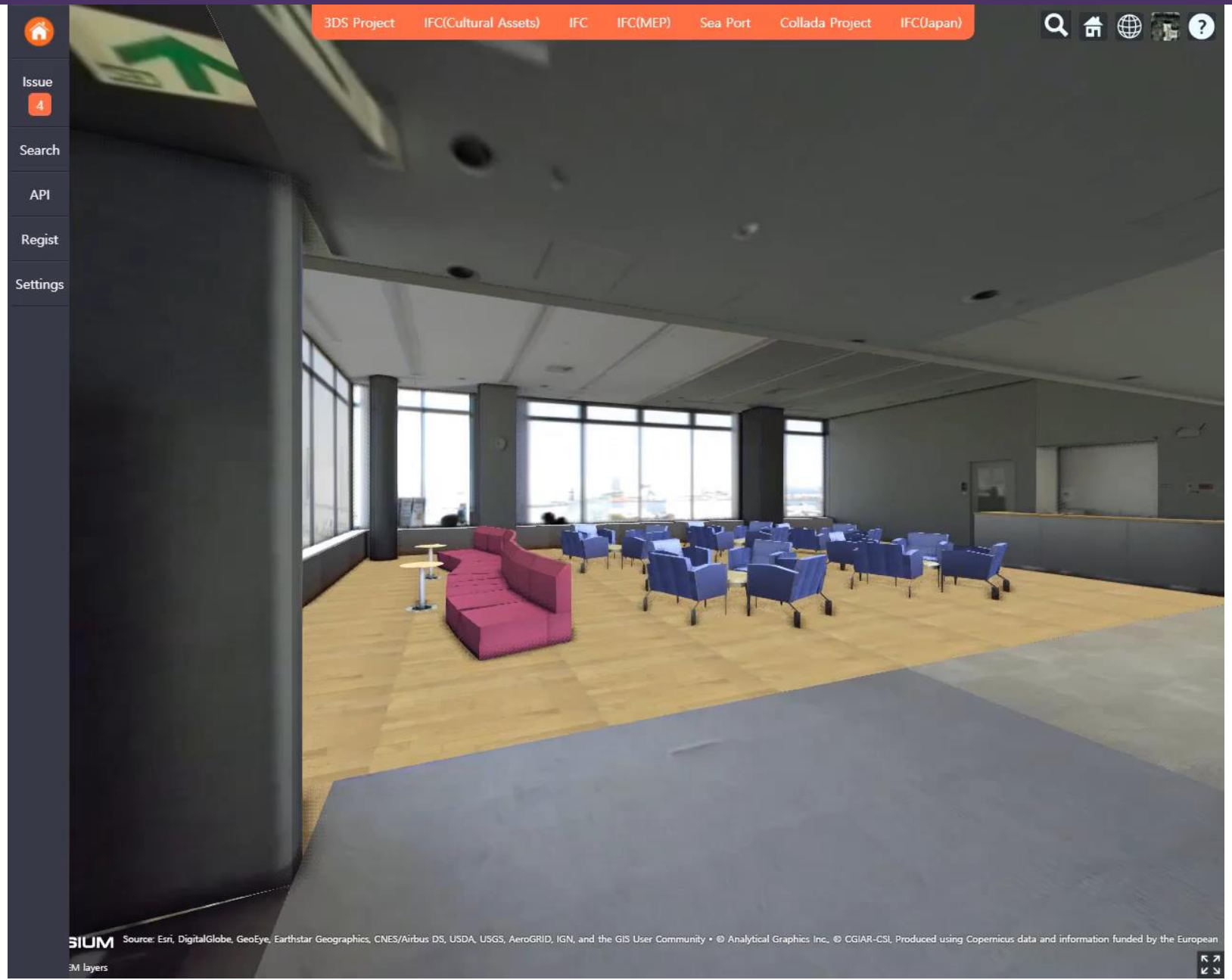
- Project Name: Seoul Autonomous Vehicle Monitoring and Command Center

Cases – KOPRI(Korea Polar Research Institute)

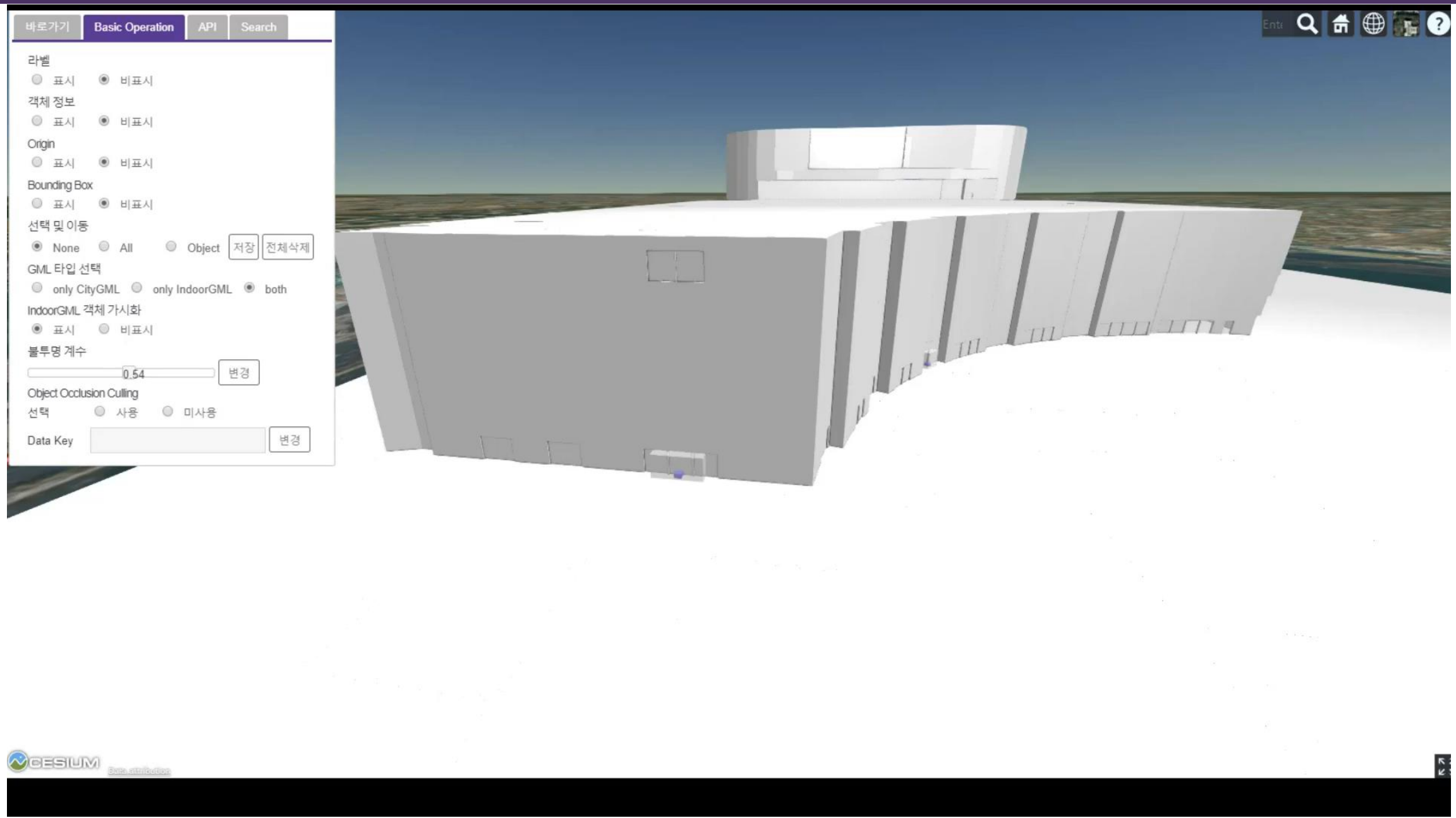
- Project Name: King Sejong Antarctica Research Base Facility Management System



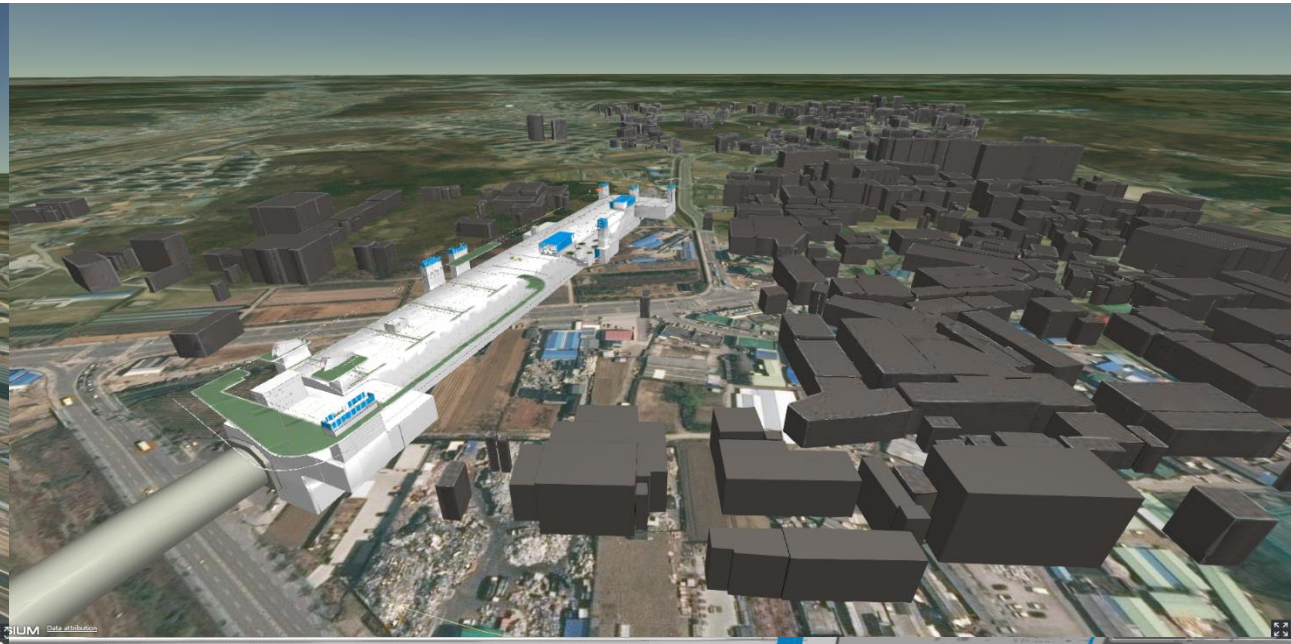
Cases – National Institute of Advanced Industrial Science and Technology, Japan

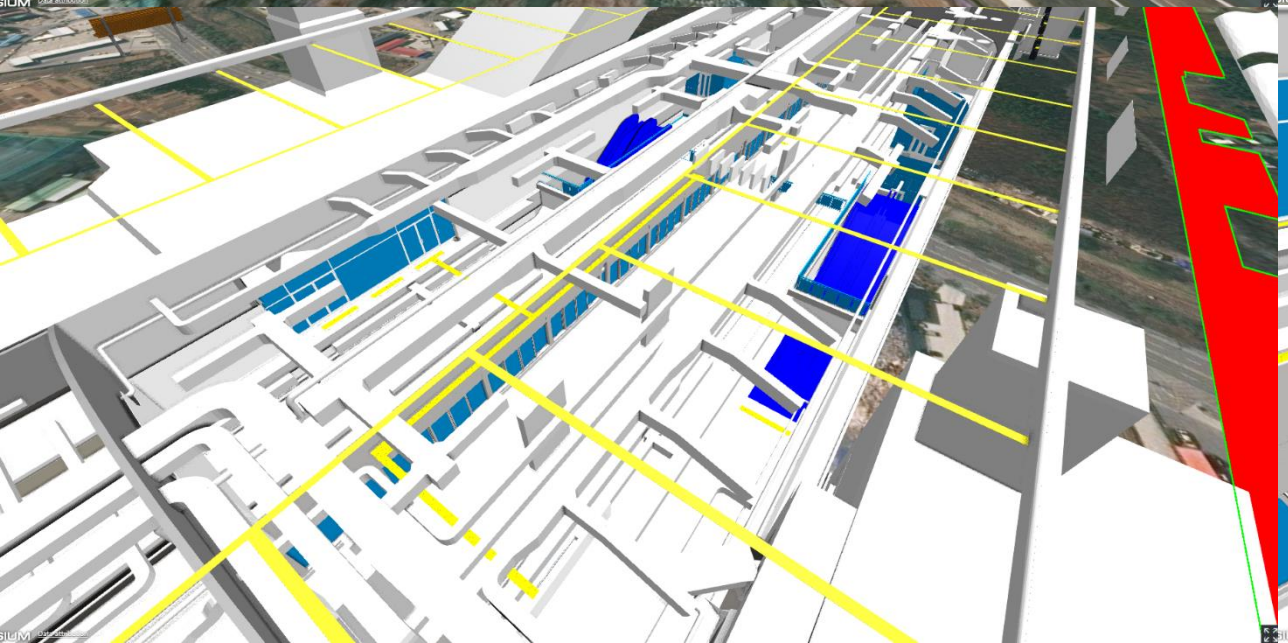


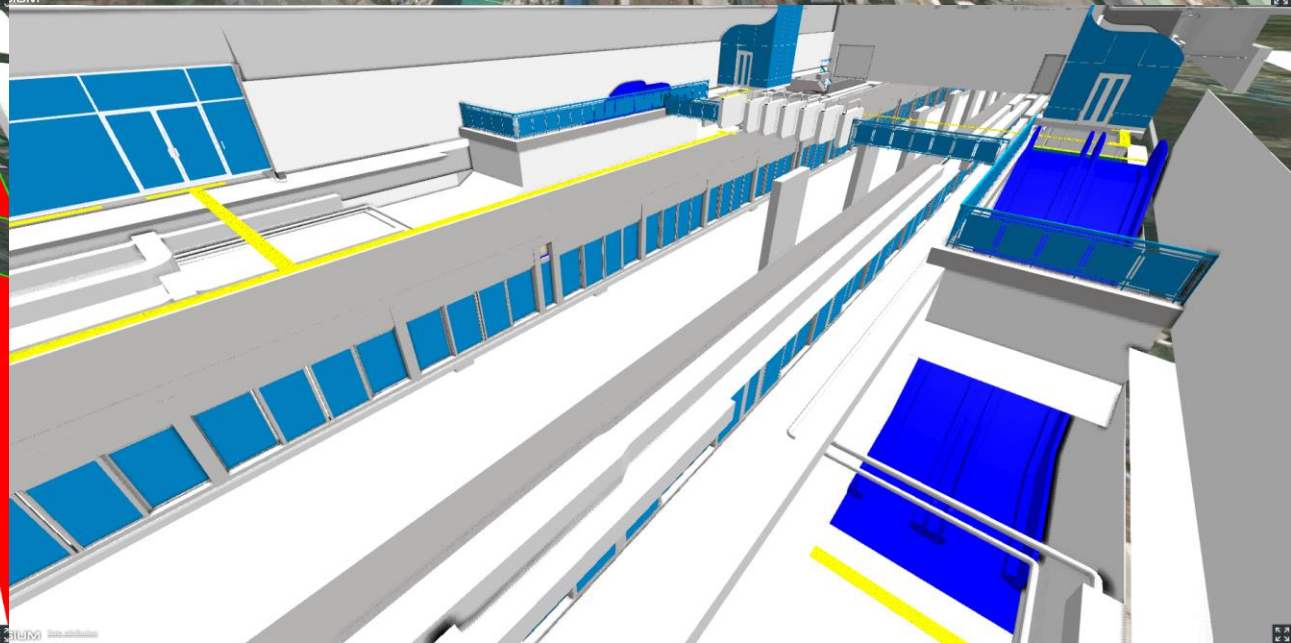
Cases – OpenIndoorMap Project



Cases – Others







Lessons Learnt

- Benefits of Digital Twin and Smart Spaces are still unclear.
- Visualizing large and complex objects is still challenging.
- Many clients just want to see *PRETTY* picture!
- 3D analysis, 3D simulation are among wish list that clients want to see on top of full of mago3D platform.
- It’s still doubtful how 3D gives any real benefits over 2D.
- 3D is expensive and Digital Twin is more expensive!
- Standards are not widely accepted across industries.
- Standard based modular and distributed architecture is very important for extensible system.

In Future

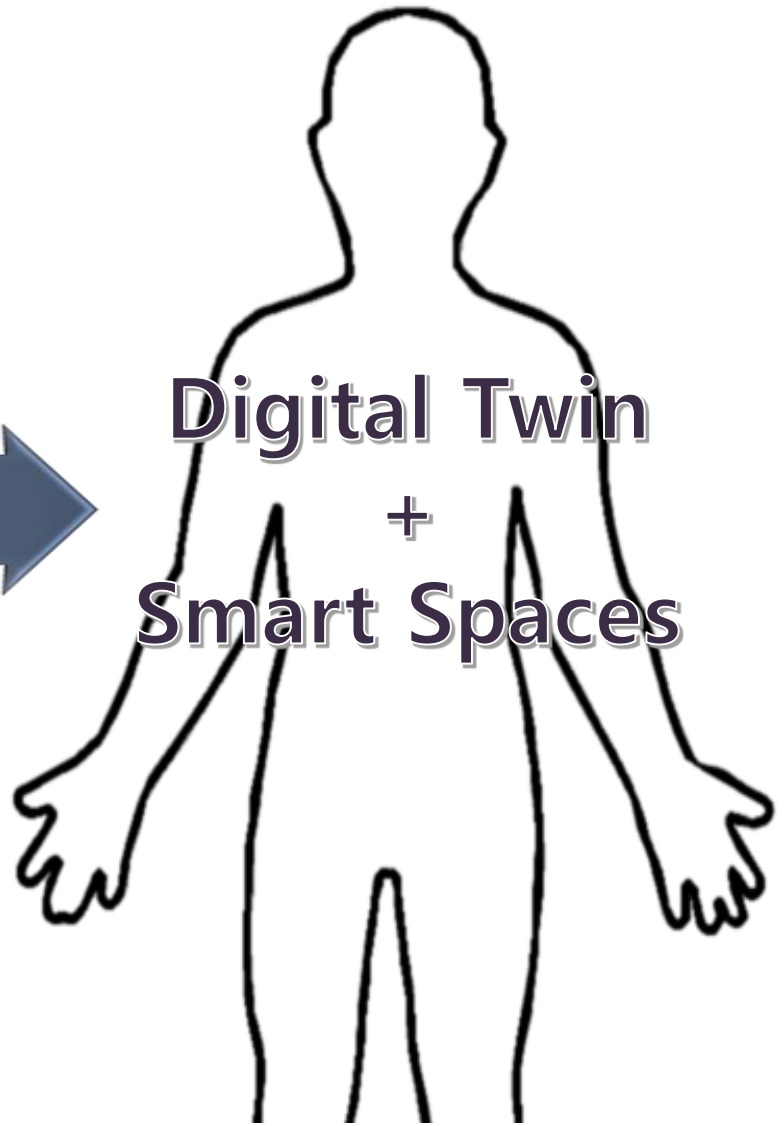
{Indoor, Outdoor}

{Static, Dynamic}

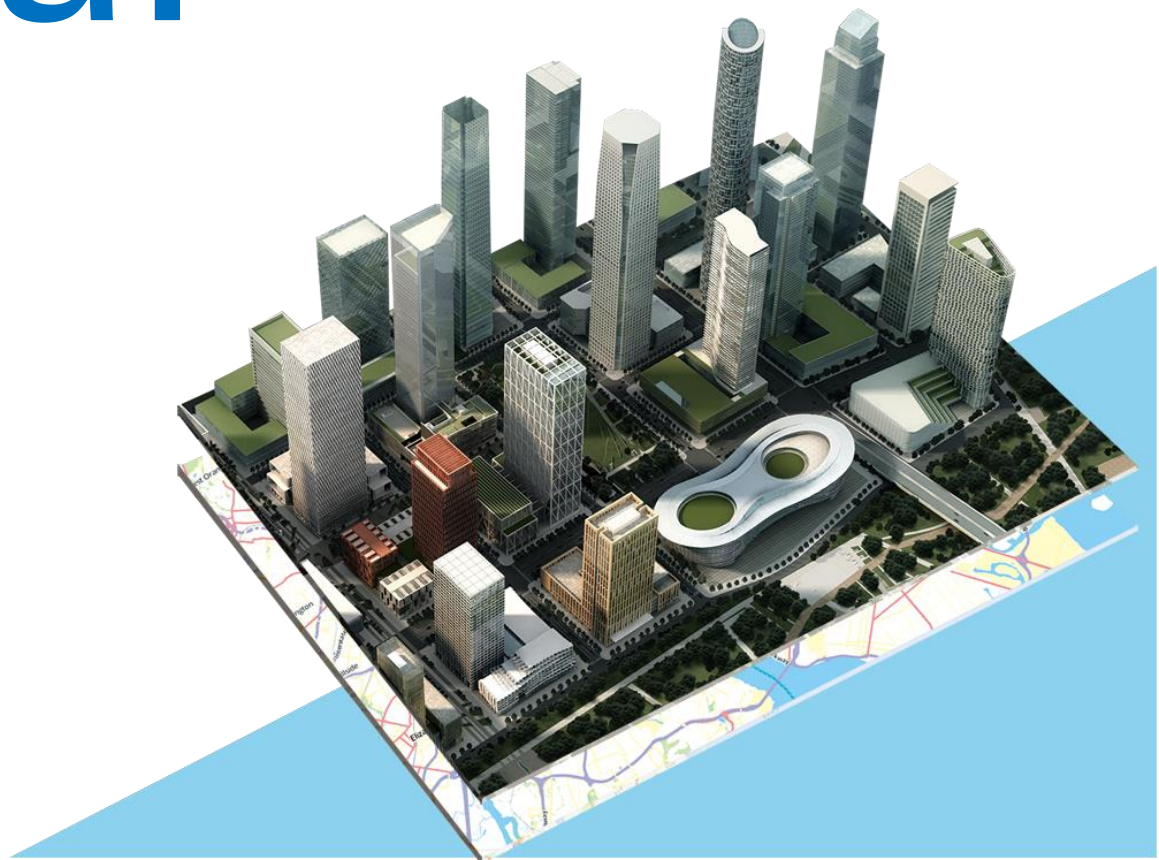
{Objects, Phenomena}

{Overground, Underground}

{Multi-Sensor, Multi-Source}



Gaia3D
The GeoSpatial Company

Thank you!

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