Digital Twin for Ocean

Making the Invisible Visible with the Digital Twin

Nov. 9th, 2023

Dr. Chang-Won AHN

Smart City & Digital Twin Lab.

@MEGAZONECLOUD

- **MEGAZONE CLOUD** (2023 ~)
  - Director of **"Smart City & Digital Twin Lab."**
- **VAIV Company** (2019 ~ 2023)
  - Director of Smart City Institute
- **ETRI (Electronics & Telecommunications Research Institute)**
  - Principal Researcher / JUNE 1999 – SEPTEMBER 2919, Daejeon, South Korea
  - Director of IDX Cognitive Informatics Research Section SW Content Research Laboratory
  - Super Intelligence Future Technology Planner Future Strategy Research Laboratory
  - BigData Special Fellow, SW Content Research Laboratory
  - Director of System Architecture Research Team BigData SW Research Laboratory

- **UST (University of Science Technology)** (2008 ~ 2019)
  - Adjunct Professor / School of Computer & Software
- **Sejong Special Self-Governing City /** Smart City Advisor (2019 ~ 2021)
  - Mayor's Special Advisor on Smart City
- **Daegu Urban Cooperation /** Smart City Advisor (2019~2022)
  - Technical Advisor on Smart City
- **Ministry of Interior /** Senior Deputy Director (2015 ~ 2016)
  - Director of BigData Analysis Division
- **Presidential Committee on Ageing Society and Population Policy** (2015 ~ 2017)
  - Expert Member

1. Who is “MEGAZONECLOUD”?
2. What is “Digital Twin” & “Metaverse”?
3. Why Digital Twin for Smart City?
4. How to build up a Digital Twin for Smart City?
5. “Digital Twin” on the Cloud

MEGAZONE
Cloud Innovator

Google

aws

1998

MEGAZONE Founded

as a Web Agency and Hosting Service Provider

2006

Three Business Units

1. Digital Marketing
2. Digital Agency
3. Platform Service

2009

Entering SaaS

as the first Google Apps Partner in Korea (#1 Share today)

2012

Entering IaaS

As the first AWS Partner in Korea (#1 Share & Premier today)

2018

Cloud & Digital

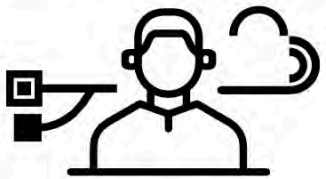
Refocus Cloud and Enter into Digital

2020

Digital & Globalize

Focus Digital and Globalize

Digital = Cloud
It's Technology



Cloud < Digital
Technology + Business

Digital Business

MSP

Cloud **M**anaged **S**ervice **P**rovider

TSP

Tech **S**ervice **P**rovider

DSP/DBP

Digital **S**ervice **Platform**
Digital **B**usiness **Partner**

MEGAZONE CLOUD

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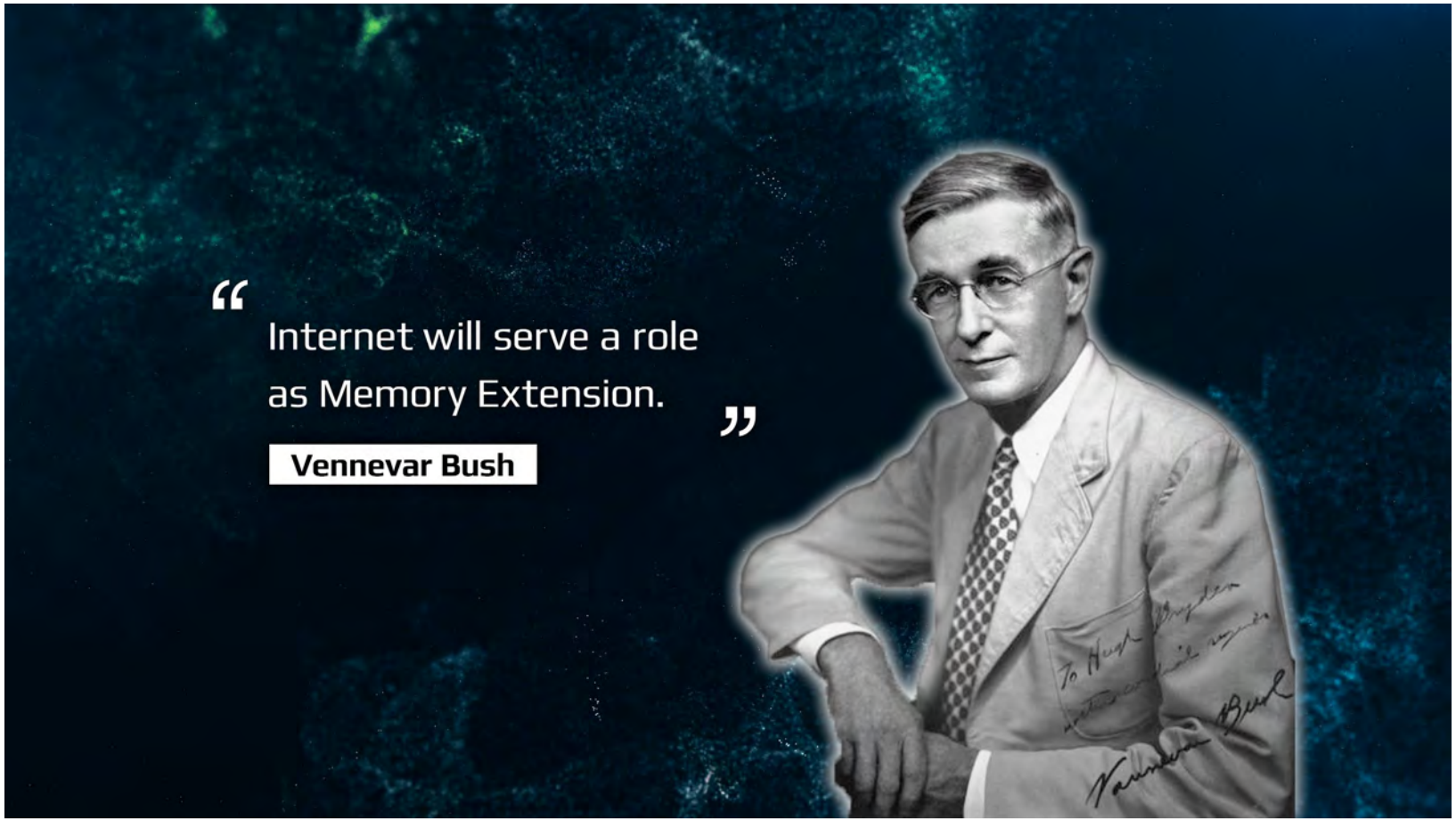


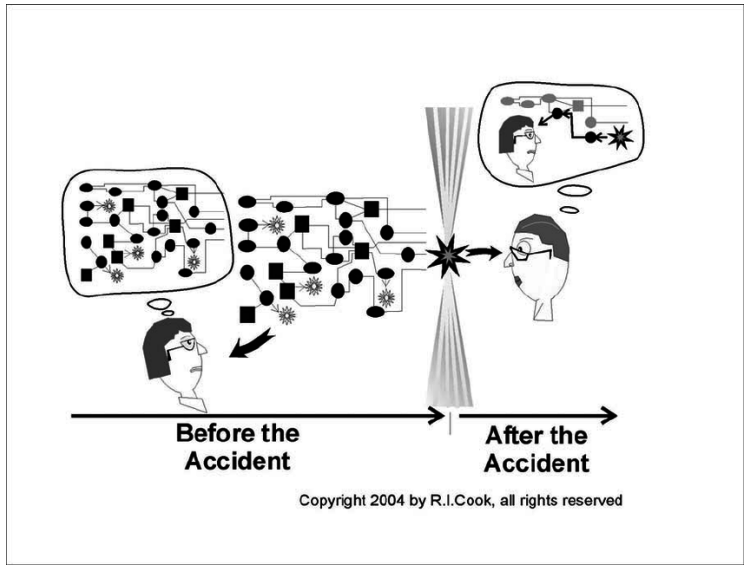
“Metaverse” as Experience Extension

“Digital Twin” as Experiment Extension

DistribuTech 2018:
Big Data, Artificial Intelligence and 'Digital Twins'

Distributed energy is bringing changes to the power grid that only machine learning can solve.

JEFF ST. JOHN JANUARY 26, 2018

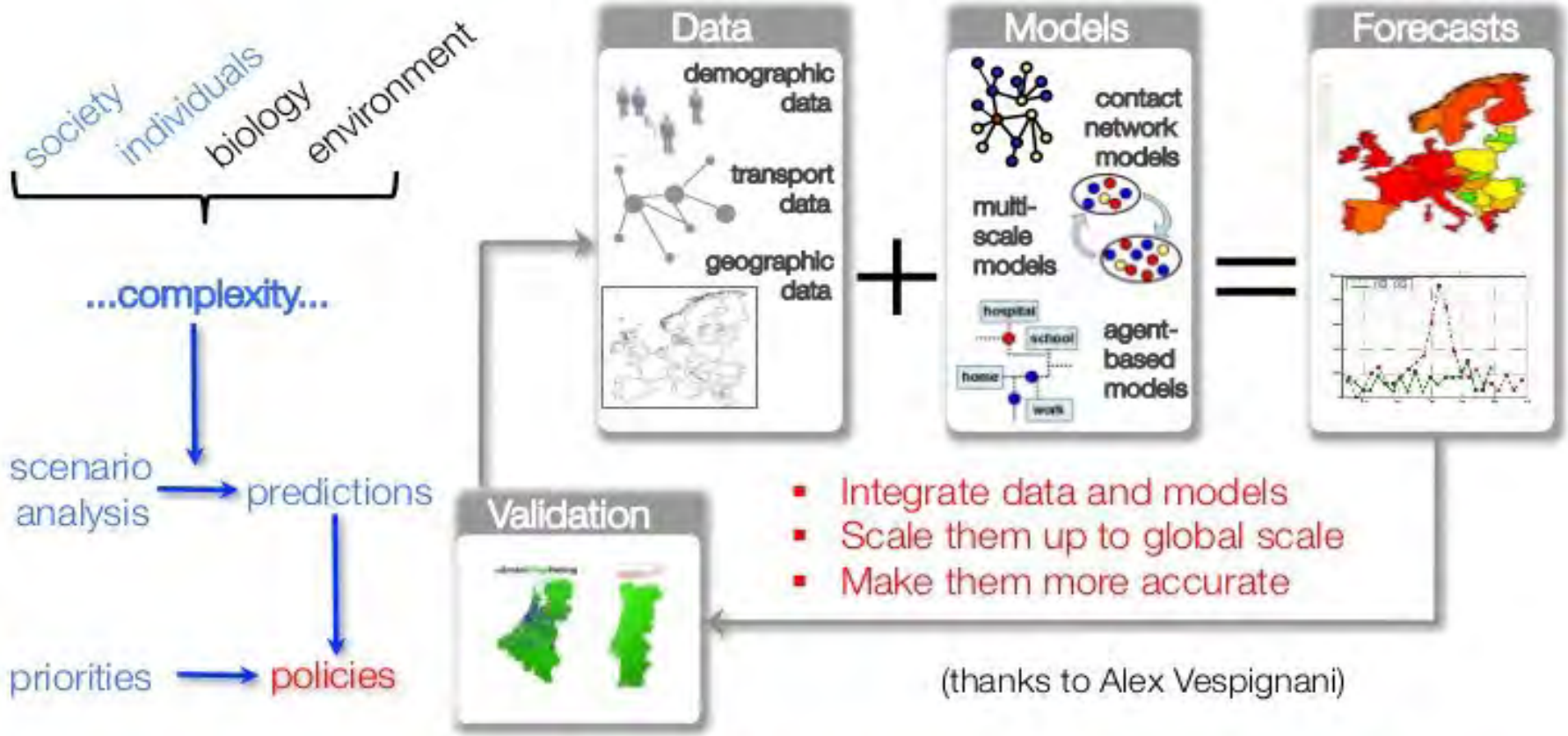


A **digital twin** is a **simulation** of a turbine, engine or some other highly complex device, rendered out of real data, and run through **millions of different scenarios** to try to gain insight into how its real-world equivalent will perform its best, or when it will fail.

In 2012, EU Flagship Project …

Building FuturICT's Living Earth Simulator

Analysis of "What if …" Scenarios

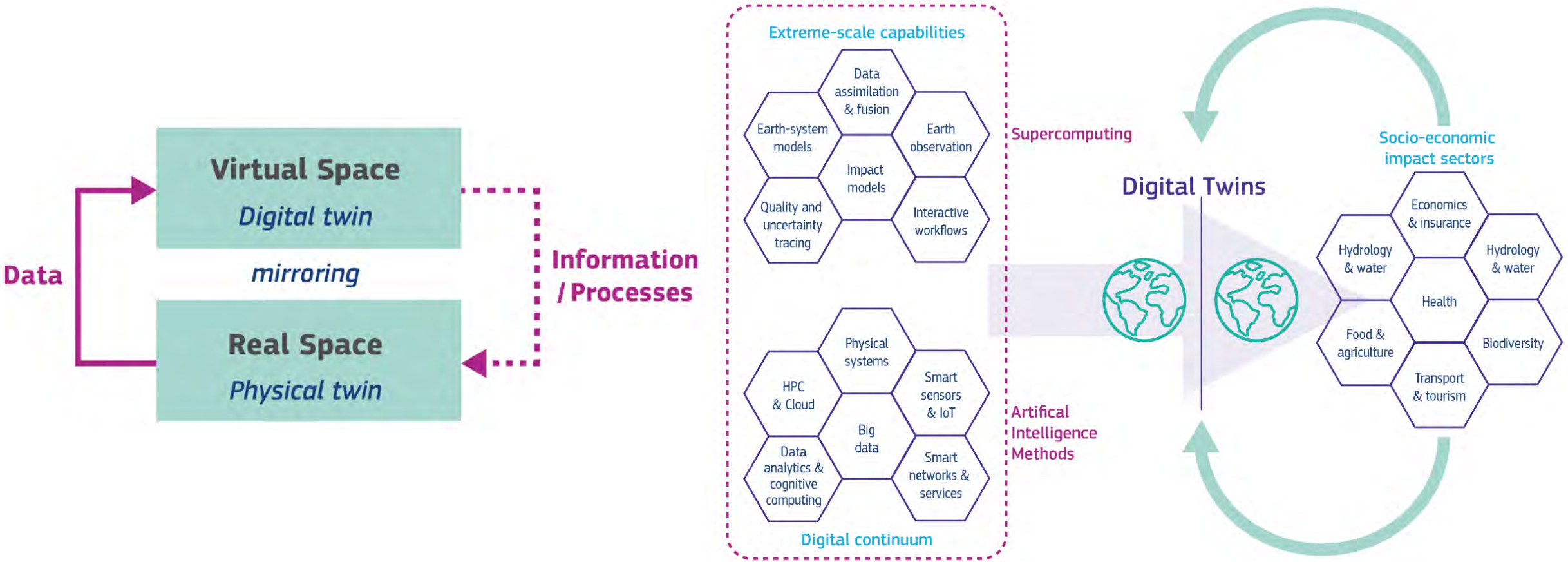


Possibilities are limited, but even short-term prediction can be useful, as weather forecasts or new traffic light controls show.

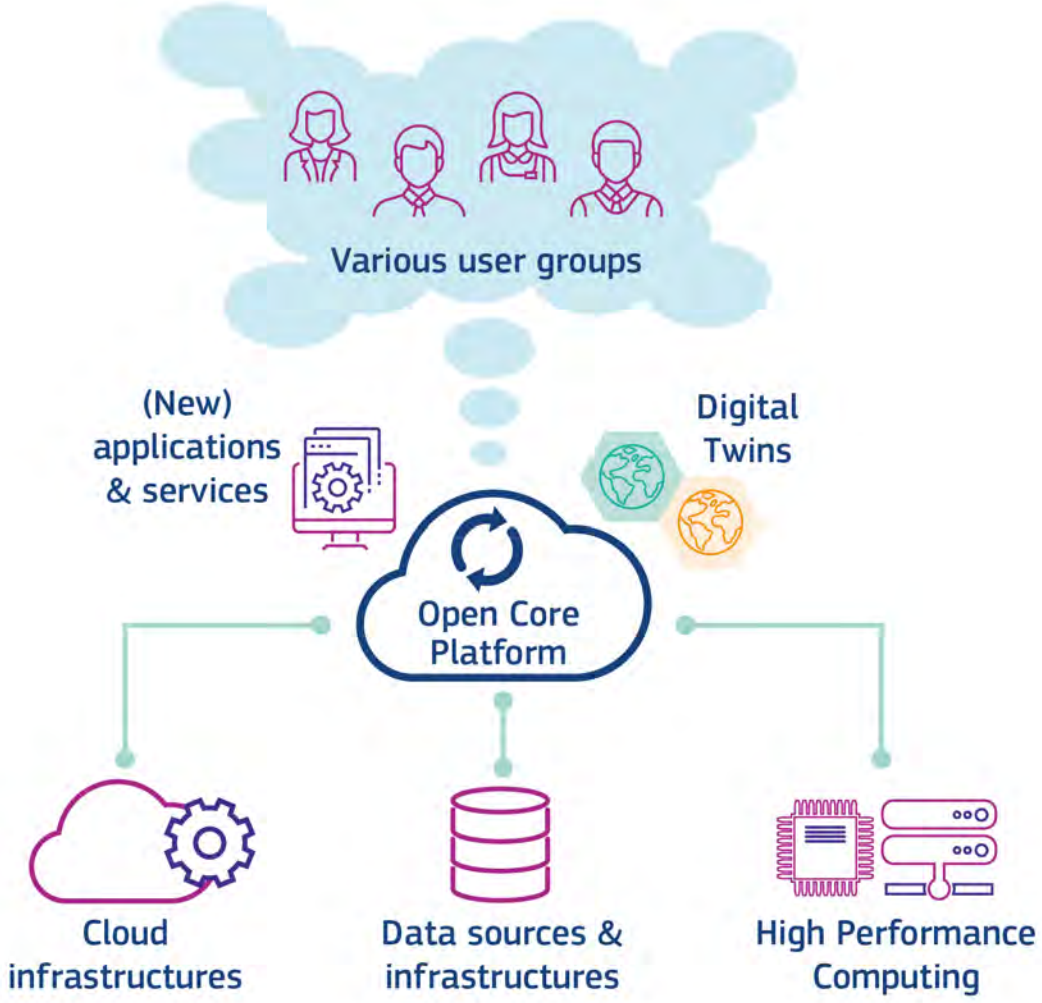
FuturICT

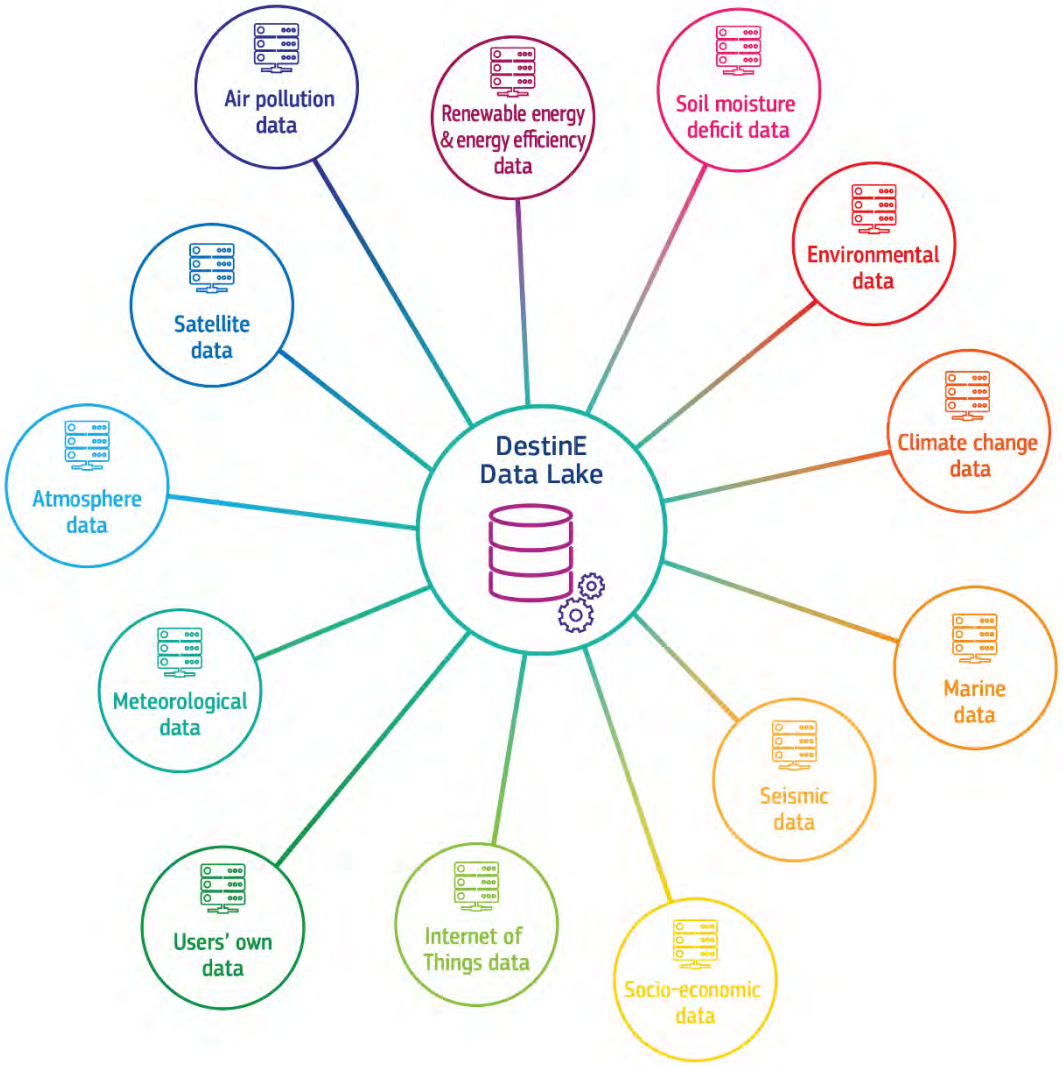
Again in 2021, Destination Earth

The DestinE Digital Twin



Key Components of DestinE





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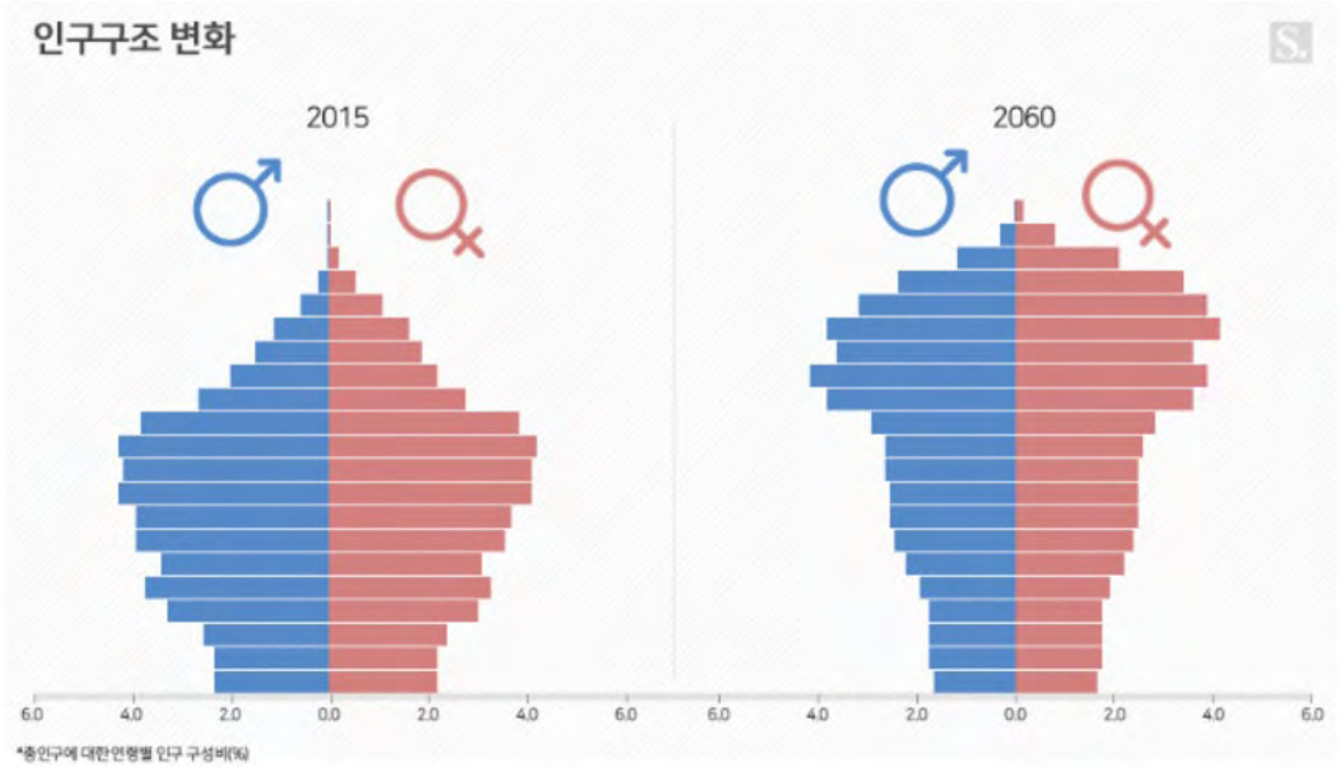
Grand Challenge_1_Demographic Crisis



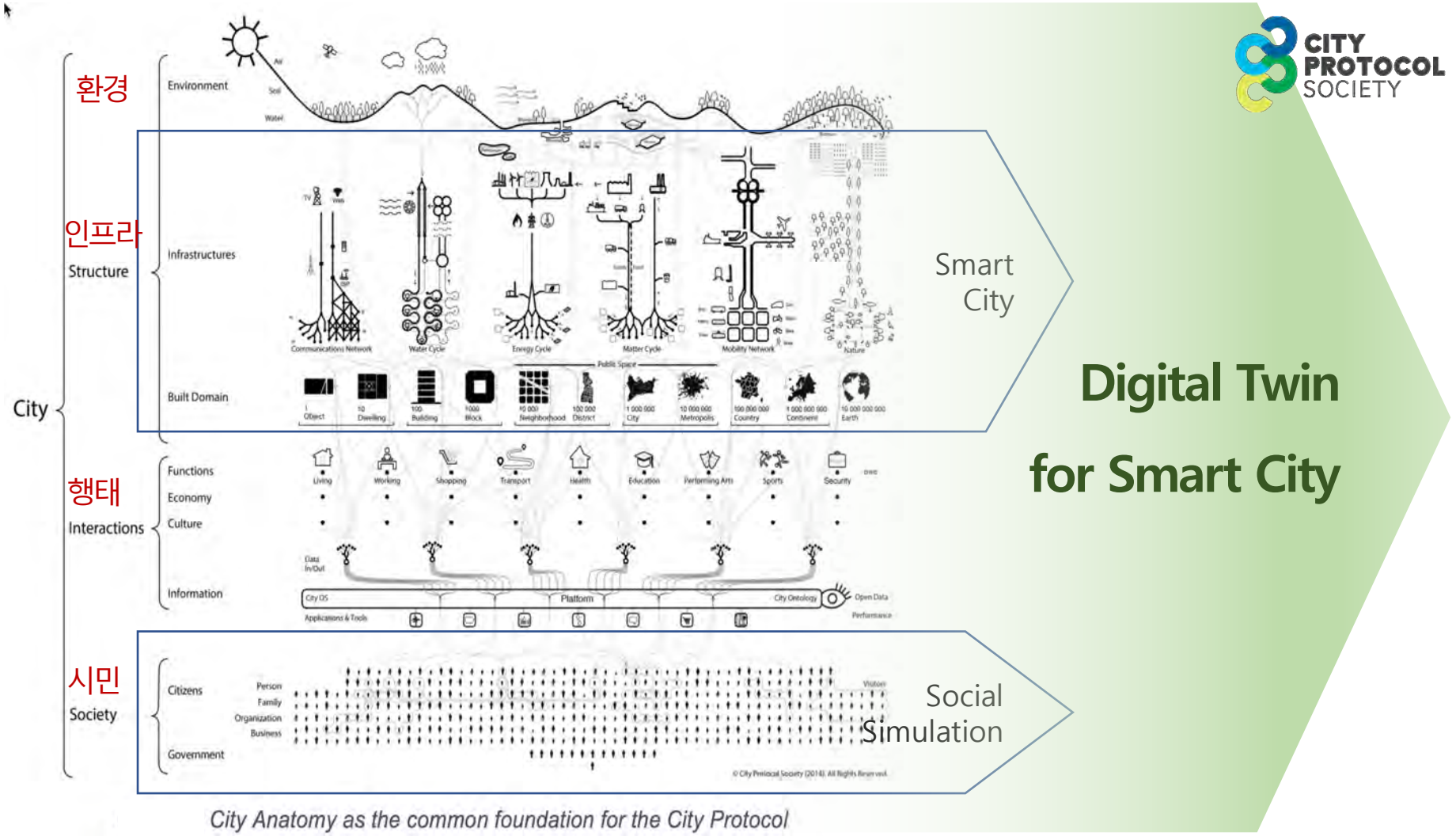
South Korea is the **Oldest** Country in the World in 2050!

Grand Challenge_2_Climate Crisis

Arizona Limits Construction Around Phoenix as Its Water Supply Dwindles

In what could be a glimpse of the future as climate change batters the West, officials ruled there's not enough groundwater for projects already approved.

City Connectomics



City Anatomy as the common foundation for the City Protocol

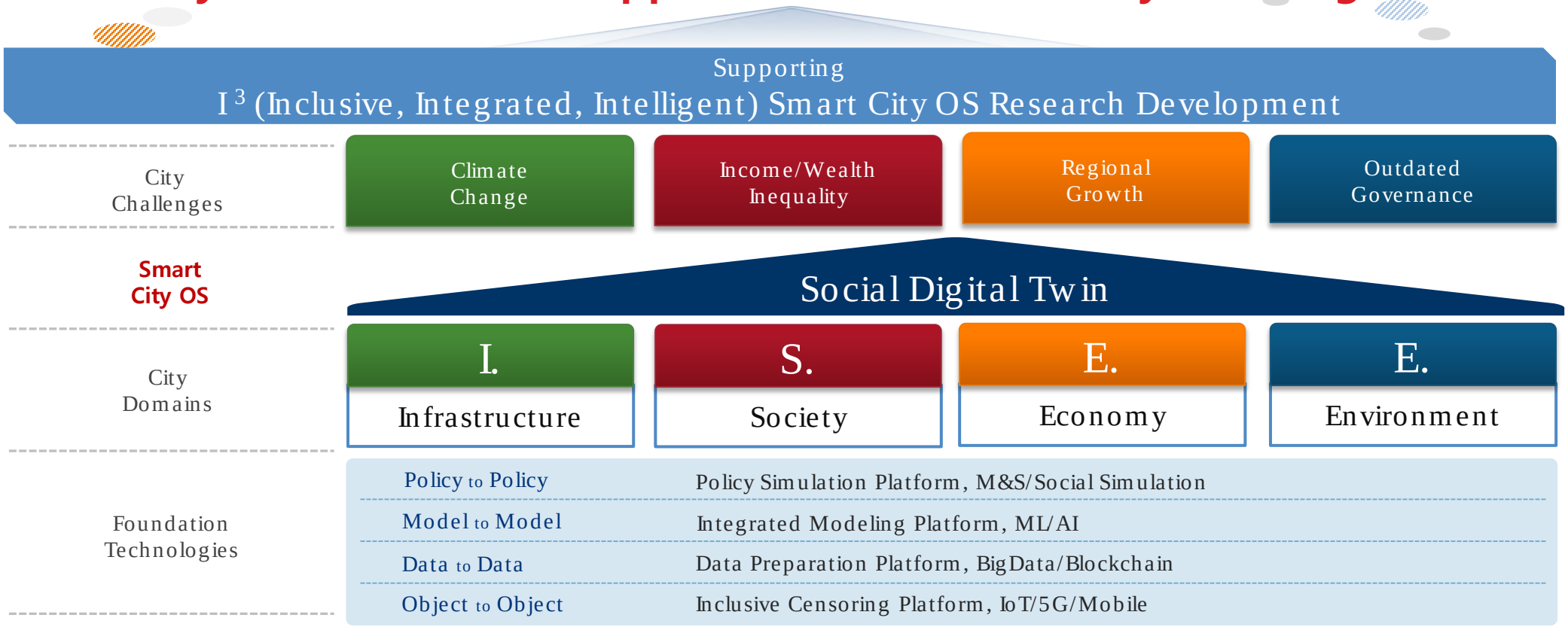
http://cityprotocol.org

Social Digital Twin for Smart City

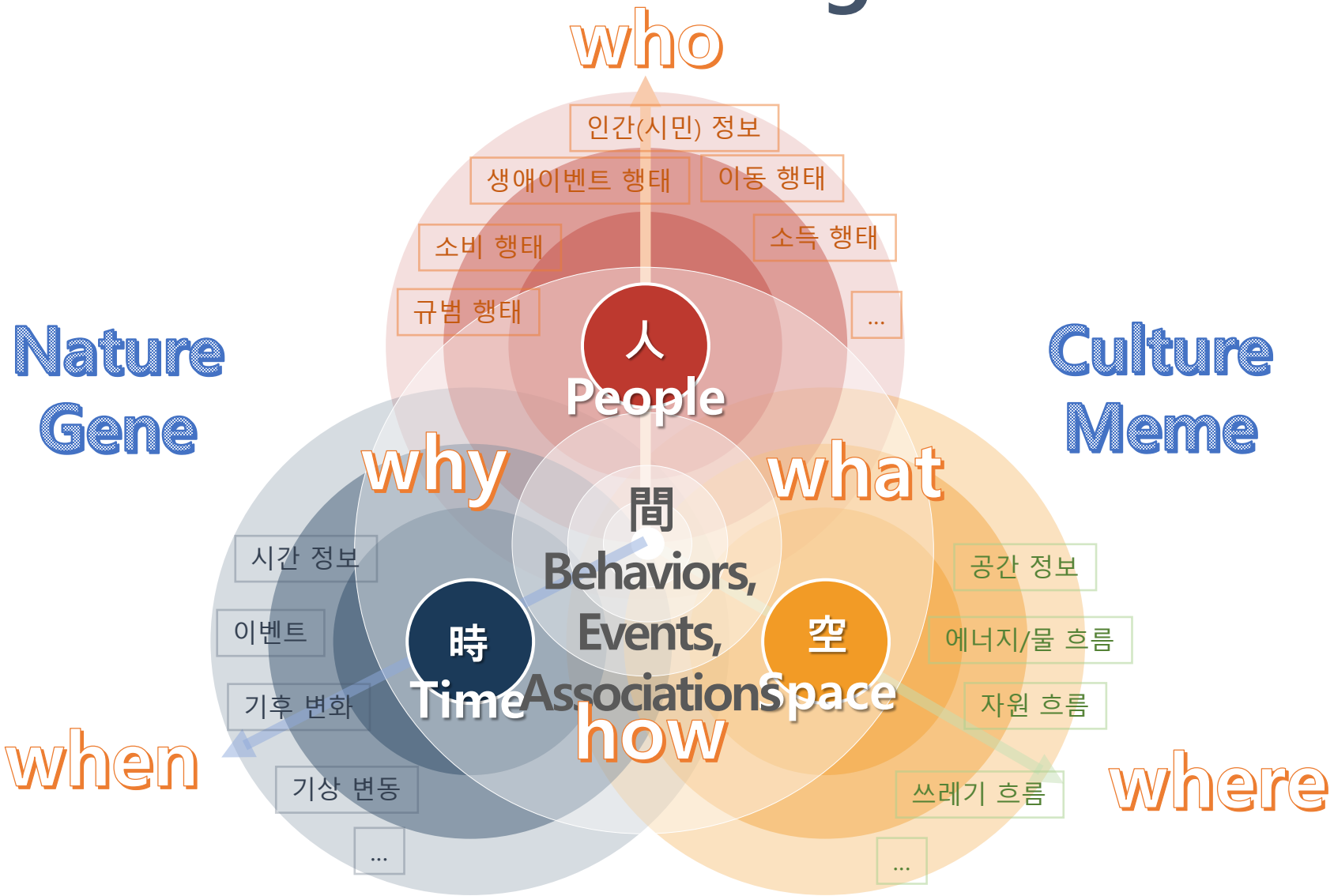
➢ City-scale Social Modeling & Simulation Platform → Smart City Precision Policy Process

We see the city through it social digital twin. (I.S.E.E)

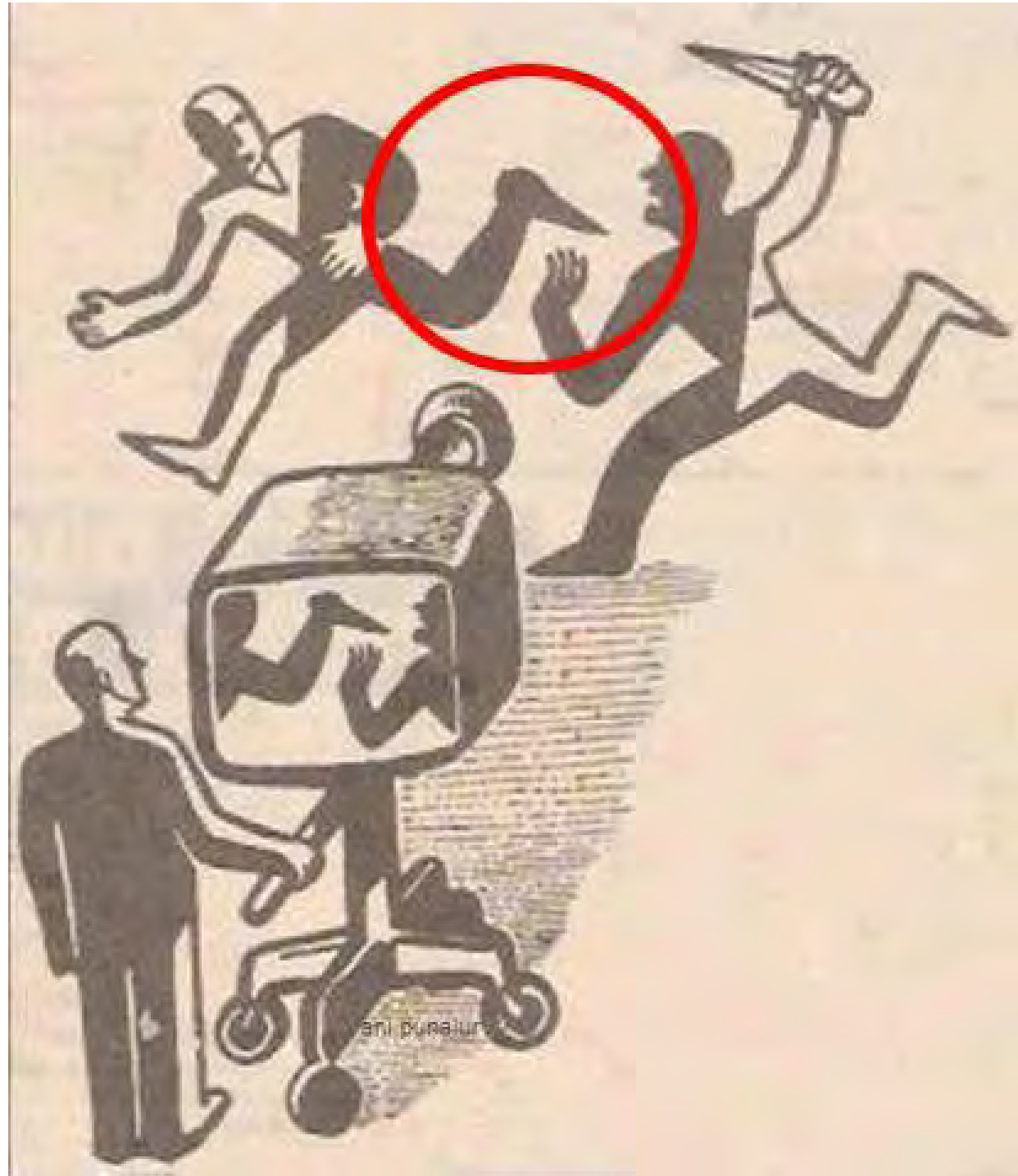
Dynamic & Holistic Approach to Solve the City Challenges



Spatiotemporal
Human Behavior Modeling



duga blog



SYSTEM 1

Intuition & instinct

95%

Unconscious
Fast
Associative
Automatic pilot

SYSTEM 2

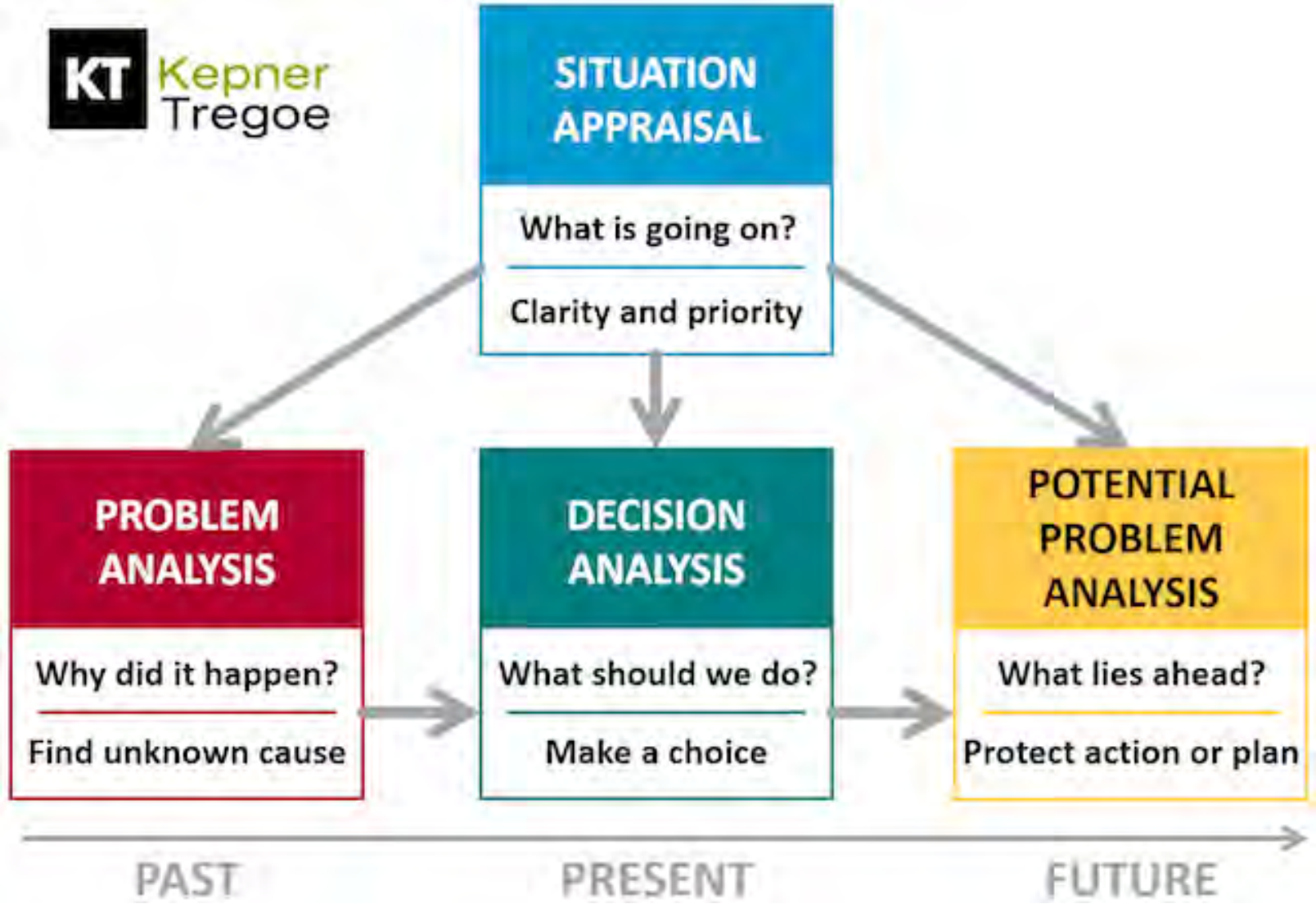
Rational thinking

5%

Takes effort
Slow
Logical
Lazy
Indecisive

Source: Daniel Kahneman

Kepner-Tregoe Analysis (1958)



경복궁

경회루 → 강녕전

강녕전 ↓

사정전 ⇢ 정책과정

사정전 ↓

근정전 ⇢ 운영과정

근정전 ↓

홍례문 → 경회루

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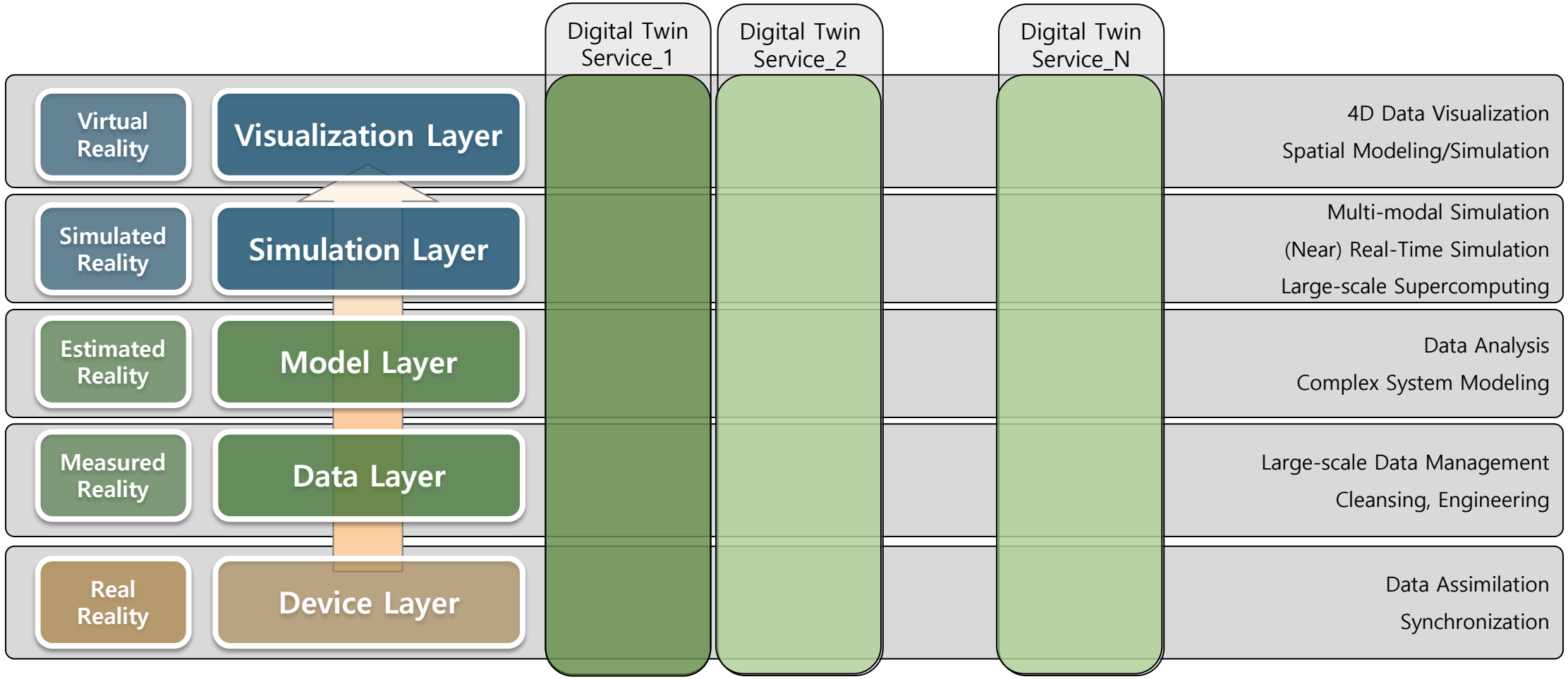
Digital Twin Layers

➢ City-scale Social Modeling & Simulation Platform → Smart City Precision Policy Process



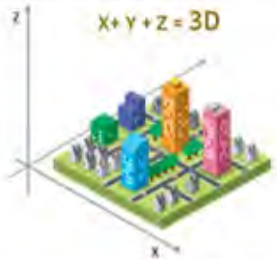
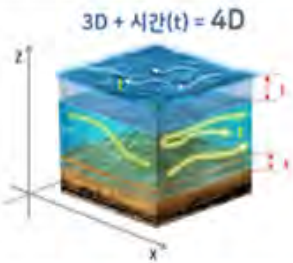
3I_Inclusive, Integrated, Intelligent Data Platform

3기신도시
남양주왕숙2 > 공공주택지구
메뉴
지구정보
일조정보
계절별 태양위치
봄 여름 가을 겨울
시간별 태양위치
일출 정오 일몰
교통계획 프리미엄 주요시설

Korean Ocean DT R&D Project

Need for three-dimensional marine use and management reflecting marine ecosystem

Need to study unique digital twin technology of ocean reflecting unique characteristics of marine space

Land Digital Twin Model	Marine Digital Twin Model
	

In Korea, the difference between tidal waves occurs up to 8-10m due to the geographical characteristics (typically 2m)

The Concept of K Ocean Digital Twin

Real world information(Big data platform of Ministry of Oceans and Fisheries)

Observation of ebb and flow/tidal current/wave/ water temperature/salt

ebb and flow /tidal current | a sea breeze | water temperature /salt

Exploration of depth/submarine/submarine formation

Unstructured Refined Data | Model Analysis Forecast Data

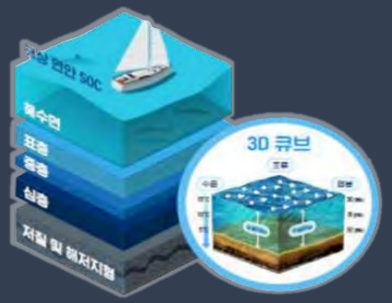
aerial photography

Measurement of Coastline and mud flat | coastal topographi space | Monitoring

Collection and Linkage

1 Details

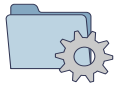
Ocean Digital Twin Data



DT-type standardized data

static data

Ocean Digital Twin Framework



a visualization engine | 3D modeling/simulation results

Utilization Interface | Simulator/utilization system linkage

Platform Operating System | Data/system/Security Management

3D computational numerical data

Simulation Results

2 Details

Integrated Marine Space Management Utilization System

Scenario-based policy simulator

Establishment of Utilization Services

3 Details

Customized marine forecasting (numerical model) information service

Sources: Ministry of Oceans and Fisheries

Ocean Space Policy Simulations

Development of Ocean Space Policy Simulation Technology

- Scientific and objective marine space planning and management support technology
- Diversification of activities and technologies in marine space and securing responsiveness to future uncertainties
- Securing technology to support compartmentalization and utilization/environment/safety management of marine space
- Linkage of Ocean Space Integrated Information System and Digital Twin-Based Simulation and Decision Support

Ocean Space Value Change Assessment Simulator

Ocean Space Monitoring and Management Simulator

A Simulator for Predicting and Utilizing Changes in the Fishing Environment

Ocean Tourism Forecast/ Use Value Assessment Simulator

Simulator for Analyzing the Impact of Physical Environment on Utilization and Development

Simulator of Conflict and Future Demand Analysis of Ship Activity

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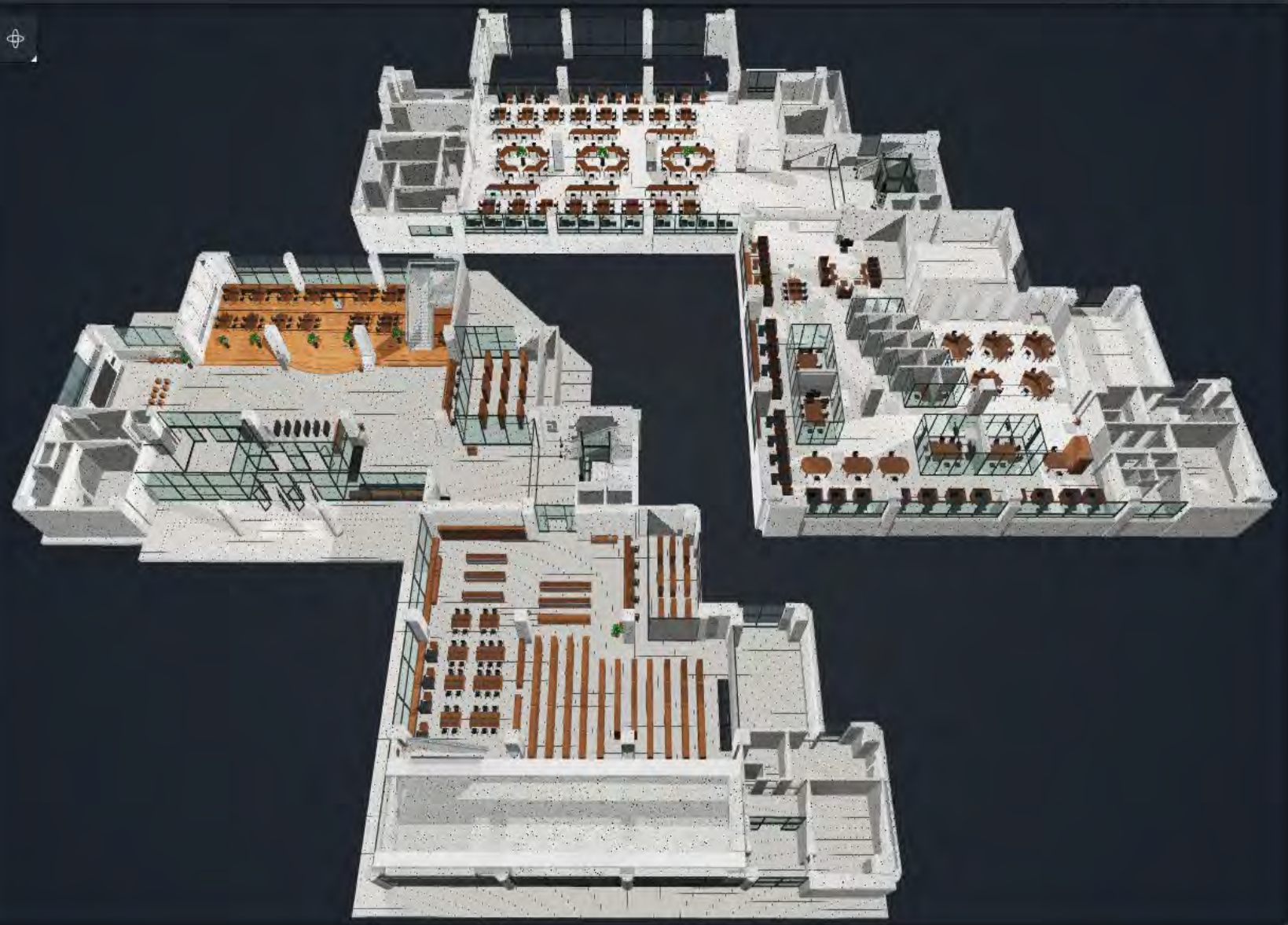
AWS IoT TwinMaker

Azure

Google Cloud Platform
Supply
Chain Twin

숙명여대 도서관

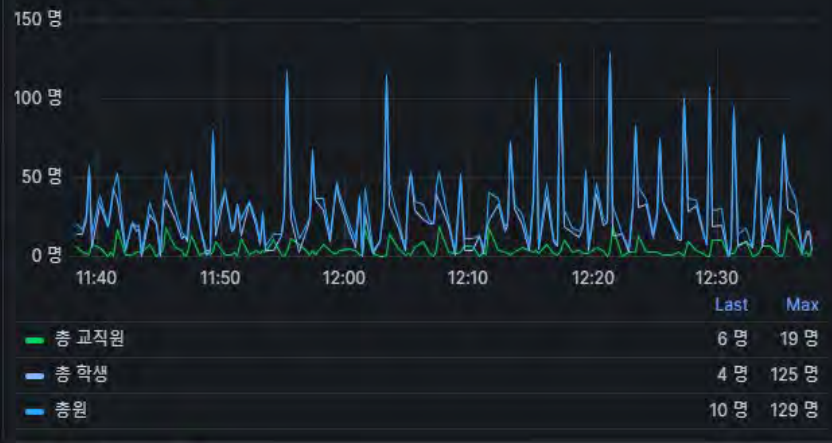
Camera View



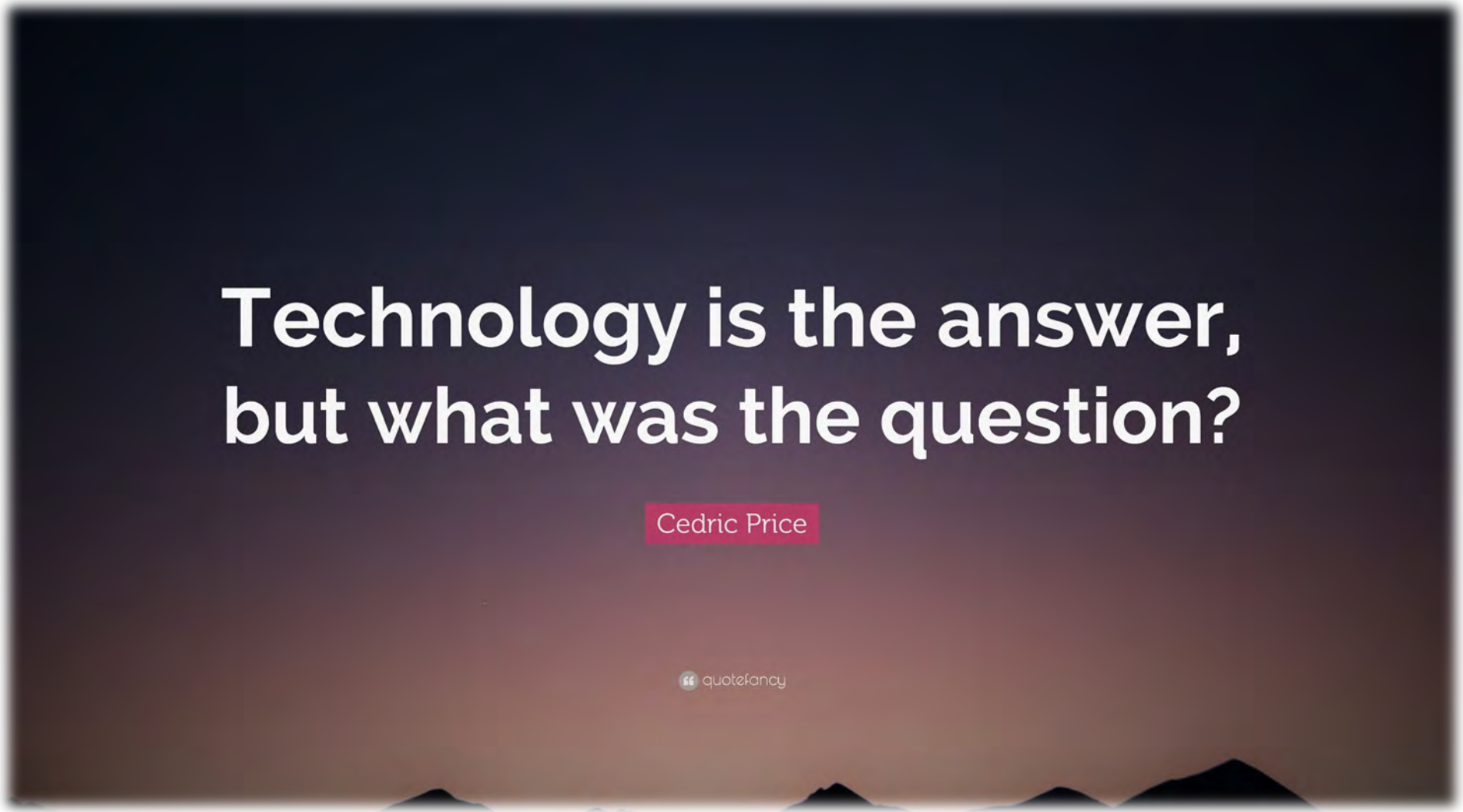
공간 정보

층	공간명	탁자 수	의자 수	최대 수용	면적	등록자
1층	홍은원 미디어 Lab	0개	21개	25명	33.3 m²	jaebin.joo@meg
1층	세계 여성 문학관	43개	47개	50명	55.6 m²	jaebin.joo@meg
1층	신한 로비	52개	52개	52명	40 m²	jaebin.joo@meg
2층	스마트 플라자	134개	134개	134명	90 m²	jaebin.joo@meg
2층	DICA 플라자	62개	62개	62명	100 m²	jaebin.joo@meg

방문자 그래프



습·온도 평균



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