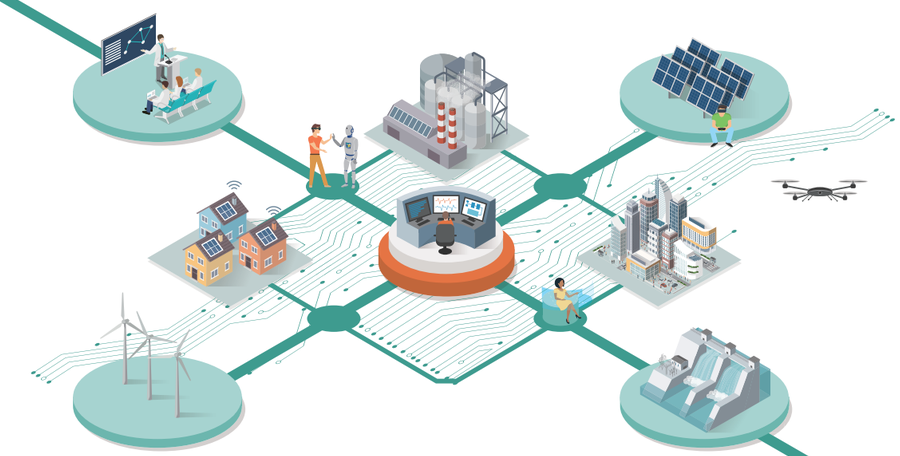
2017
International Conference on Geospatial Information Science
공간정보 국제컨퍼런스

KRIHS 국토연구원

2017 International Conference on Geospatial Information Science 2017.8

KRIHS 국토연구원

Smart Geospatial Expo 2017
2017 스마트국토엑스포

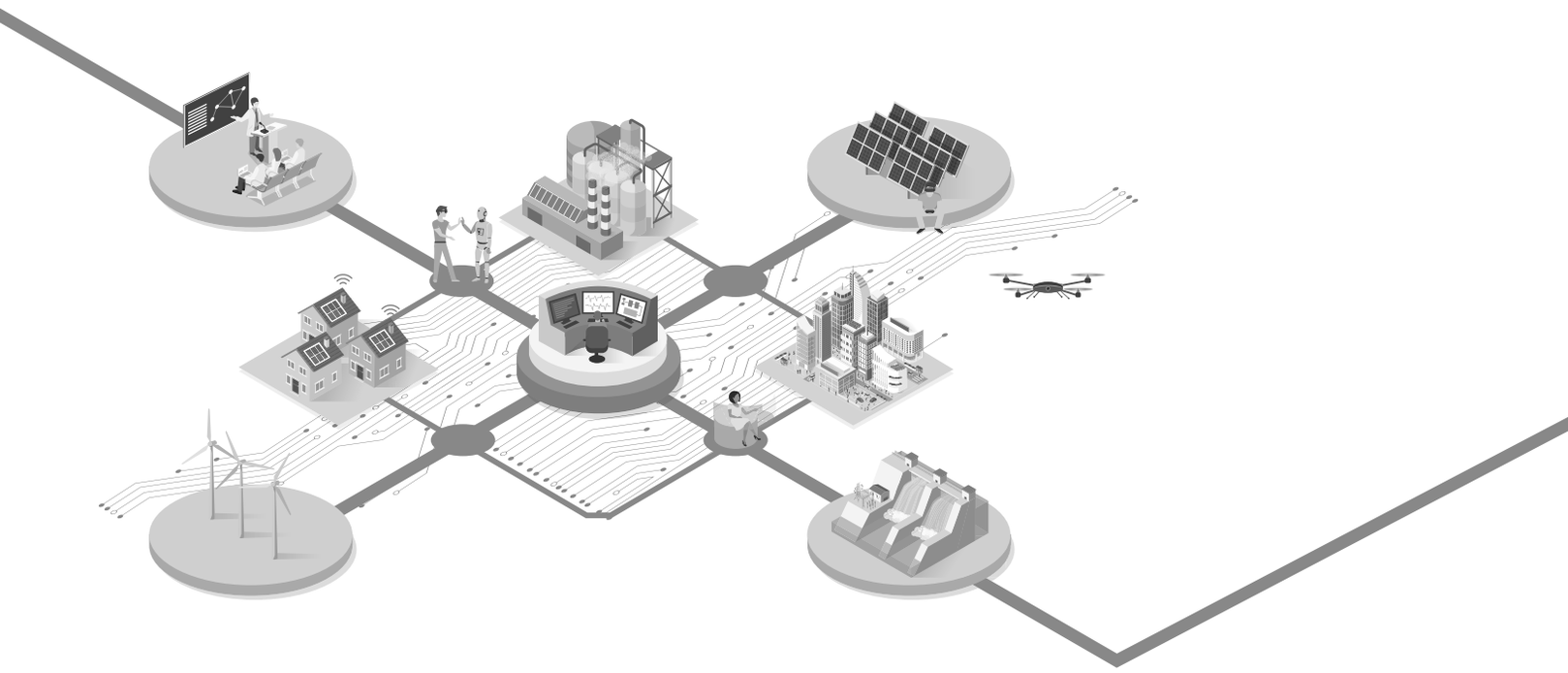


2017
International Conference on Geospatial Information Science
공간정보 국제컨퍼런스

2017. 8. 31(THU.)
09:00~18:00
aT Center Changjo-Room 1(aT센터 창조룸1)

KRIHS 국토연구원

Smart Geospatial Expo 2017
2017 스마트국토엑스포



2017
International Conference on Geospatial Information Science
공간정보 국제컨퍼런스

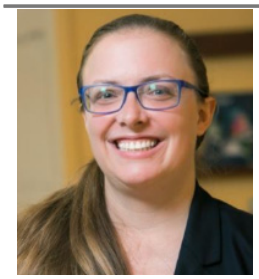
2017. 8. 31(THU.)
09:00~18:00
aT Center Changjo-Room 1(aT센터 창조룸1)

KRIHS 국토연구원

2017 ICGIS Programs

Geospatial Strategies for the 4th Industrial Revolution 4차 산업혁명기의 공간정보 발전전략	
09:00~10:00	Registration 등록
10:00~10:20	**Opening Remarks** / ***Dong-Ju Kim***, President of KRIHS 개회사 / 국토연구원 **김동주** 원장 **Congratulatory Address** / ***Sun-ho Park,*** Deputy Minister of Housing and Land Office, Ministry of Land, Infrastructure and Transport 축사 / 국토교통부 **박선호** 주택토지실장
기조연설 Keynote Speech	
10:20~10:50	**Keynote Speech 1(VTC)** "The geospatial data strategies via the collective intelligence"/ ***Kate Chapman,*** Chairman of OpenStreetMap **기조연설 1 (VTC)** "4차 산업혁명 시대의 집단 지성기반 공간 데이터 전략"/ **케이트 샤프먼,** 오픈스트릿맵 회장
10:50~11:30	**Keynote Speech 2** "Open source software strategy for geospatial: Building a Geospatial-Ecosystem through Industry-Academia-Government Collaborations"/ ***Venkatesh Raghavan,*** President and Co-Founder of OSGeo **기조연설 2** "4차 산업혁명시대 공간정보 기술혁신을 위한 오픈소스 전략"/ **벤카테쉬 라하반,** 오픈소스 공간정보 재단 공동설립자 및 회장
11:30~12:00	**Keynote Speech 3(VTC)** "NASA Open source technology: WorldWind"/ ***David Collins,*** NASA(technical manager) and ***Patrick Hogan,*** NASA(project manager) **기조연설 3 (VTC)** "미국 NASA의 오픈소스기술 WorldWind"/ **데이빗 콜린스,** NASA 기술매니저 및 **패트릭 호간,** NASA 프로젝트 매니저
12:00~13:30	Lunch 점심(회의장 내 도시락)
Session : Digital Twin Space Strategies and Bigdata Analysis 발표 세션 : 디지털 트윈국토 전략 및 빅데이터 데이터 전략	
13:30~14:00	"DTS, the future of geospatial data"/ ***Ho-sang Sakong,*** Senior Research Fellow of Geospatial Information Research Division, KRIHS "공간정보 디지털 트윈 전략"/ **사공호상,** 국토연구원 선임연구위원
14:00~14:30	"Virtual NUS, A GIS-Based Enabler for Smart Campus"/ ***Chen-Chieh Feng,*** Professor, National University of Singapore "버추얼 싱가폴대학, 공간정보기반 스마트캠퍼스"/ **펭 첸치에,** 국립싱가폴대학 교수
14:30~15:00	Coffee break 휴식
15:00~15:30	"Smart City Digital Twin by City Connectomics"/ ***Chang-won Ahn,*** Special Fellow, Electronics and Telecommunications Research Institute "도시 커넥토믹스 기반 스마트시티 디지털트윈"/ **안창원,** 한국전자통신연구원 전문위원
15:30~16:00	"A New Methodology for Geodemographics Using Open and Commercial Big Data"/ ***Alex Singleton,*** Professor, The University of Liverpool "오픈-커머셜 빅데이터를 활용한 지오데모그래픽의 새로운 방법론"/ **알렉스 싱글톤,** 리버풀 대학 교수
16:00~16:30	Coffee break 휴식
Agenda : What role should the geospatial information play in the era of 4th industrial revolution 주제 : 4차 산업혁명 시대 공간정보 역할은 무엇인가?	
16:30~17:00	**Keynote** *Keynote/* ***Ryosuke Shibasaki,*** Professor, The University of Tokyo *발제발표/* **료스케 시바사키,** 동경대학 교수
17:00~18:00	Round Table Meeting Moderator: ***Ki-Joune Li,*** Professor, Pusan National University 좌장: **이기준** 교수, 부산대학교 Discussant : Young-Ok Kang, Kwang-Woo Nam, Kyu-Sung Choi 토론 : **강영옥** 교수(이화여자대학교), **남광우** 교수(국립군산대학교), **최규성** 대표((주)이지매핑)
Closing 폐회	

Speaker



Kate Chapman, Chairman of OpenStreetMap Foundation

Kate Chapman has worked at the intersection of technology and nonprofits for the past 9 years. Kate served as a founder and first Executive Director of the Humanitarian OpenStreetMap Team, the Chief Technology Officer of the Cadasta Foundation and also has held board positions at multiple other non-profits working to help marginalized populations with open-source software. Currently, Kate serves as the Chairperson of the OpenStreetMap Foundation.

Venkatesh Raghavan, Osaka City University

Venkatesh Raghavan (aka Venka) is Professor of Geoinformatics at the Graduate School for Creative Cities, Osaka City University, Japan. He coined the FOSS4G acronym in 2004 to denote Free and Open Source Software for Geoinformatics and has been promoting FOSS4G ever since. He is also one of the founders of OSGeo and currently serves as President and also plays active role in OSGeo Local Chapters in Asia.

David Collins, NASA (WorldWind Team)

David works with Patrick Hogan at NASA. He is the technical director for NASA World wind. He studied at the University of Washington.

Patrick Hogan, NASA

Patrick is an environmental scientist with over 22 years of service to NASA, He has managed programs from Superfund subsurface investigations to education technology research for delivering NASA content into the classroom. Currently Patrick manages the NASA World Wind project, a team of world class engineers producing open source virtual globe software that has received National awards, including NASA Software of the Year for 2009.

Ryosuke Shibasaki, The University of Tokyo

He is a Professor of The University of Tokyo. He is a former President of Asian GIS Association, Board member of Japanese Society of Photogrammetry and Remote Sensing, Board member of IIB, GEO, member of Scientific Committee of WDS, ICSU, member of Space Strategic Policy Committee of Japanese Government. His research interest covers moving object tracking with sensors, human behavior understanding and modeling, analysis of mobile phone data, semantic data interoperability and integration and data assimilation of discrete objects.

Ki-Joune Li [Moderator], Pusan National University

Ki-Joune Li is Professor of the Department of Computer Science and Engineering of Pusan National University. He has been working on GIS and spatial databases since last decades he established an international standard working group in OGC, where he is working as a co-chair as well as the ACM SIGSpatial Workshop on ISA. He served as the president of Korea Spatial Information Society. Since 2016, he is also leading the UN Open GIS initiative as a co-chair and is a directive board member of SSTD Endowment.

Ho-Sang Sakong, Korea Research Institute for Human Settlements

Dr. Hosang Sakong is policy designer in the National Spatial Data Infrastructure (NSDI). He has diverse careers in the research fields such as land policy, urban planning, geospatial information and global development partnership in the KRIHS over the last 30 years. He served the Korea Association of GIS Studies(KAGIS) as a president from 2014 to 2015.

Chen-Chieh Feng, National University of Singapore

Dr. Chen-Chieh Feng is Professor of the Department of Geography at National University of Singapore. His research interests fall under the general theme of geographic information science with focus on geospatial data modeling and semantics, volunteered geographic information, 3D virtual environment, geocompuataion, geospatial metadata and provenance, as well as it applications. He has served as the director of the Master of Science in Applied GIS since 2015.

Chang-Won Ahn, Electronics & Telecommunications Research Institute

Dr. Chang-Won Ahn is a special fellow at Future Technology & Strategy Research Lab. ETRI. He has more than 19 years of experiences in SW and Data Technologies. Since 2013, he has concentrated on the research area of Social Simulation or Computational Social Science. He is now playing a role of a Future Technology Planner on Super Intelligence area that is claimed as an enabling pillar of 4th Industrial Revolution era.

Alex Singleton, The University of Liverpool

Alex is Professor of Geographic Information Science at the University of Liverpool. Alex's research concerns various aspects of urban analytics. In particular, his work has extended a tradition of area classification within Geography where he has developed an empirically informed critique of the ways in which geodemographic methods can be refined for effective yet ethical use in public resource allocation applications.

Contents

Keynote Speech

Session : Digital Twin Space Strategies and Bigdata Analysis

Agenda : What role should the geospatial information play in the era of 4th industrial revolution

Keynote Speech
기조연설

- **Keynote Speech 1(VTC)**
  "The geospatial data strategies via the collective intelligence"/ ***Kate Chapman,*** Chairman of OpenStreetMap

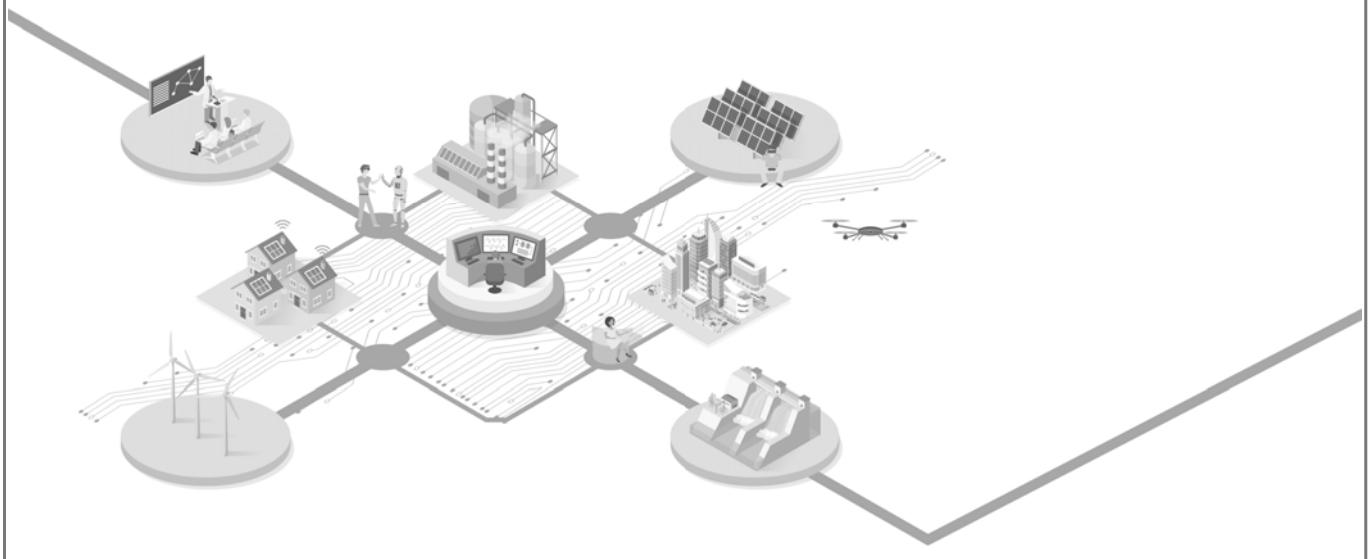
  기조연설 1 (VTC)
  "4차 산업혁명 시대의 집단 지성기반 공간 데이터 전략"/ **케이트 샤프먼,** 오픈스트릿맵 회장

- **Keynote Speech 2**
  "Open source software strategy for geospatial: Building a Geospatial-Ecosystem through Industry-Academia-Government Collaborations"/ ***Venkatesh Raghavan,*** President and Co-Founder of OSGeo

  기조연설 2
  "4차 산업혁명시대 공간정보 기술혁신을 위한 오픈소스 전략"/ **벤카테쉬 라하반,** 오픈소스 공간정보 재단 공동설립자 및 회장

- **Keynote Speech 3(VTC)**
  "NASA Open source technology: WorldWind"/ ***David Collins,*** NASA(technical manager) and ***Patrick Hogan,*** NASA(project manager)

  기조연설 3 (VTC)
  "미국 NASA의 오픈소스기술 WorldWind"/ **데이빗 콜린스,** NASA 기술매니저 및 **패트릭 호간,** NASA 프로젝트 매니저



Keynote Speech 1(VTC)

The geospatial data strategies via the collective intelligence

Kate Chapman

Chairman of OpenStreetMap

The geospatial data strategies via the collective intelligence

Kate Chapman
kate@osmfoundation.org
Chairman of OpenStreetMap

본 발표는 당일 원격화상회의(VTC)로 진행될 예정입니다.
발표자료가 필요한 분은 추후에 국토연구원으로 문의 부탁드립니다.

강혜경 연구위원 hkkang@krihs.re.kr
임시영 책임 limsy@krihs.re.kr
성혜정 책임 hjsung@krihs.re.kr

Memo

Memo

Keynote Speech 2

Open source software strategy for geospatial: Building a Geospatial-Ecosystem through Industry-Academia-Government Collaborations

Venkatesh Raghavan

President and Co-Founder of OSGeo

The OSGeo Foundation: Providing an Ecosystem for Geospatial R&D through Industry-Academia-Government Collaborations

Prof. Venkatesh Raghavan

e-mail venkat@osgeo.org

President, OSGeo Foundation, Osaka City University, Japan

Abstract

Open Source technologies have come to be a mainstay of ICT over the last few decades. In the geospatial realm, Open Source Software, Open Data and Open Standards are the three vital pillars of the sustainable geospatial ecosystem that facilitates implementation/deployment of interoperable and scalable Free and Open Source Solutions for Geoinformatics (FOSS4G). FOSS4G has gained wide spread acceptance the world over during the last decade catering to a wide variety of societal needs. Since 2006, the Open Source Geospatial Foundation (OSGeo) has been spearheading the collaborative development of FOSS4G, and promotes its widespread use.

This talk will focus on the evolution of OSGeo Foundation and ponder about what's in store for it in the near future. The speaker plans to narrate some anecdotes and personal experiences as experiential traveler for over three decades across the FOSS4G world. A gist of new initiatives being undertaken by OSGeo and priorities for coming years will be outlined. Lastly, the talk will discuss on opportunities for joint industry-academia-government initiatives for collaborative R&D and knowledge sharing for a geospatial enabled digital earth.

Open Source ~~Software~~ Strategy for Geospatial: Building a Geospatial-Ecosystem through Industry-Academia-Government Collaborations

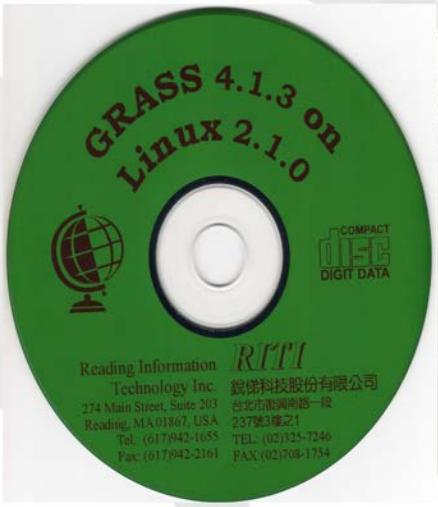
Venkatesh Raghavan

Osaka City University, Japan
President, OSGeo Foundation
raghavan@media-osaka-cu.ac.jp

OSGeo

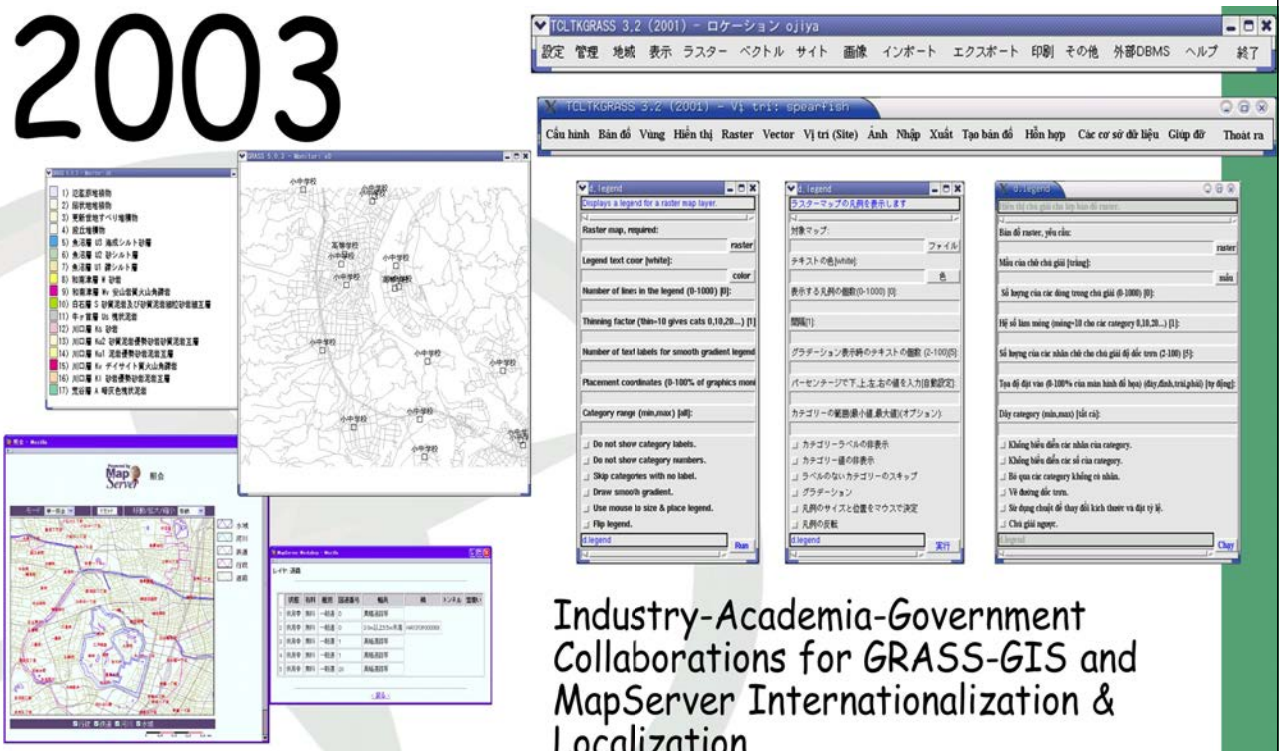
SINCE 1880 OSAKA CITY UNIVERSITY

1995



Free and Open Source GIS packaged in Asia!!

2003



Industry-Academia-Government Collaborations for GRASS-GIS and MapServer Internationalization & Localization

(Orkney Inc. and OCU Project funded by Information-technology Promotion Agency, Japan)

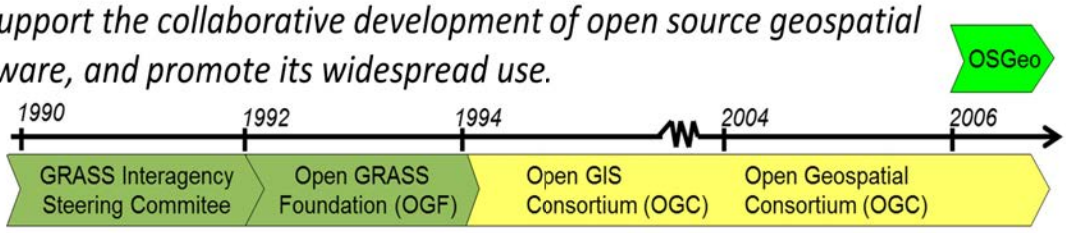
2004-2017

FOSS/GRASS User Conference 2004, Bangkok

Jeff, Markus and ?, FOSS4G-Europe 2017, Paris

OSGeo was born in 2006 with a mission

To support the collaborative development of open source geospatial software, and promote its widespread use.



- **OSGeo is a not-for-profit software foundation**
  - Provides projects financial, organizational and legal support
- **OSGeo does outreach and advocacy to promote**
  - Global adoption of open source geospatial technology
  - Partnerships for open approach to standards, data and education
- **OSGeo is a community-driven volunteer organization**
  - Membership from around the world.

OSGeo *Empowering everyone with open source geospatial*

OSGeo Foundation

- Working with Industry/Academic/Governments in:
  - **Open Source:** a collaborative approach to software development.
  - **Open Data:** freely available information to use as you wish
  - **Open Standards:** avoid lock-in with interoperable software
  - **Open Education:** Removing the barriers to learning and teaching
  - **Open Science:** Share data & software for reproducible research

OSGeo Korean Chapter

한국어 지부 OSGeo Your Open Source Compass OSGeo Korean Chapter

- **FOSS4G Korea 2016**
  - -31st Aug. to 2nd Sept.
  - -Around 300 attended
  - -1st co-organizing conference with LH Corp.

- **Technical Seminars**
  - -Ocean GIS Seminars(March 2017)
  - -Drone Mapping Seminars(May 2017)

- **Trainings & Outreach**
  - -Joint Open Source GIS Trainings

Tested & mature software for meeting any geospatial need

FDO MapGuide · MARBLE · MapServer · Mapbender · GeoTools · GEOS · GDAL · OSSIM · OpenLayers · GRASS · GeoNetwork opensource · deegree · GeoMoose · gvSIG · GeoServer · istSOS · geomajas · mapfish · zoo · OSGeo

@gwf2017

Try it, Learn it and feel free to use!

Proprietary (closed source) GIS Providers

- ESRI (Arc-GIS)
- Hexagon Geospatial (Geomedia)
- Clark University (IDRISI)
- Pitney Bowes (MapInfo)
- ...

Open Source & Proprietary Software

- We use the same language and tools
- We strive to achieve geospatial interoperability
- We ♥ Open Data
- Same goal, different approach

OSGeo Status Overview

Open, free membership:

4,886 members registered on wiki, as of 2017_08_01_24

29476 OSGeo mail server unique subscribers 2017_08_01

Thanks to for dataJeff McKenna

312 elected charter members:
developers, activists, advocates, distribution by year, region and country

http://bl.ocks.org/jsanz/raw/779f9b9954b92461fa50/

Thanks to Jorge Sanz for the graphics

Tie-ups with Global & National Organizations

More coming...

United Nations Committee

UN Open GIS INITIATIVE

UN Open GIS Initiative

- to identify and develop open source geospatial software and services that meet the requirements of UN operations, taking full advantage of the expertise of mission partners including partner nations
- technology developed by contributing nations, international organizations, academia, NGOs, and private sector.
- kickoff meeting in Brindisi, Italy, March 2016

Working Groups

- Spiral 1 – UN Open Geo-Portal (US DoD and Boundless)
- Spiral 2 – Capacity Building (GeoForAll)
- Spiral 3 – Geo-Analysis (OpenGDS)
- Spiral 4 – Data Acquisition (OPenGDS)

OSGeo Industry Sponsors

2017

GEOCAT Boundless CARTO Gaia3D GeoSolutions ASTUN TECHNOLOGY azavea FreeArt How 2 Map Geodan

Previous Sponsors

1Spatial
2ndQuadrant
Autodesk
Borealis
Camptocamp
First Base Solutions Inc.
INGRES
thinkWhere
ChameleonJohn
IGN, France
INPE, Brazil
Karttakeskus
LizardTech
Metaspatial
Ordnance Survey
PCI Geomatics
WhereGroup

http://www.osgeo.org/sponsorship

2017 - Conferences

15+ FOSS4G Industry/Academia/Government supported events

- **FOSS4G Asia, January 26-29, 2017**
- GFOSS Italy, February 8-11
- FOSGIS Germany, March 22-25
- FOSS4G SE USA (Knoxville, TN) May 19
- FOSS4G Finland, May 23
- OSGeo Irish Local Chapter symposium, May 26
- SIG Libre Spain June 1,2
- FOSS4GNL Groningen NL, June 28
- FOSS4G-JP Hokkaido - June 30
- FOSS4G Africa June 28 - July 1
- **FOSS4G Europe July 18 - 22**
- QGIS conference August 2-10
- FOSS4G -2017 August 14-19
- **FOSS4G-Korea, August 30 – September 1**
- FOSS4G-Tokyo/Osaka September 15-16 and October 15-16
- FOSS4G+SOTM Argentina October 23-28

Source http://www.osgeo.org/event , news and other on-line resources

Sponsors

Gold

Silver

Supporters

Institutional Partners

Media Partners

FOSS4G BOSTON 2017

Professional Service Providers

http://www.osgeo.org/search_profile A few logos out of many....

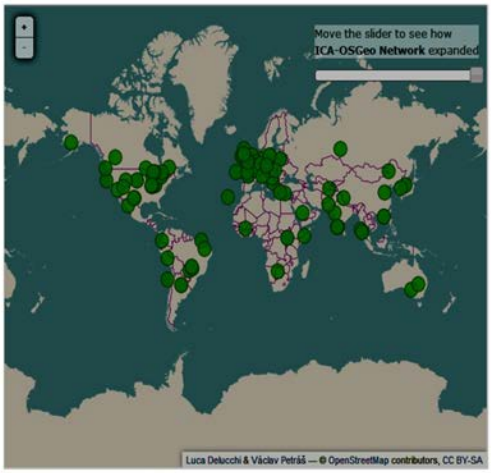
GeoForAll: co-creation of knowledge and academia and enterprise

- Establishing research and teaching opportunities in 'Open Geospatial Science'
- Build global open access teaching and research infrastructure
- Provide worldwide learning platforms and training opportunities
- Establish collaborations between Academia, Government and Industry around Open Geospatial Science and Education

How to Join

Visit http://www.geoforall.org/how_to_join/

GeoForAll Labs: OSGeo outreach project



120 labs established worldwide as of 19 August, 2017

Google Summer of Code

OSGeo is mentor organization since 2007.
Majority of mentors from Industry.

FREE & OPEN

Software
Data
Standard
Hardware

FOSS4G = **F**ree & **O**pen **S**ource **S**olutions for **G**eoinformatics

The grammar of the FOSS4G

- FOSS4G as a noun, represents an active entity, driven by Academic/Industry/Government Collaboration to exploit the value created by Open Innovation.

- FOSS4G as an adjective, characterizes a technology development model for geospatial enablement of our planet and empowerment of citizens.

- FOSS4G(ing) as a verb, denotes the action of making a smart choice for your Geospatial needs.

Have fun keep Open-Sourcing (verb)!!

Few thoughts

- **Who "Leads" Government-Academia-Industry collaboration**
  Equal partners on the road to geospatial innovation
- **Need for broader community engagements**
  Sprints, publications, certification, internship for students…
- **Steps required to change mindset?**
  Increase awareness of Open Source Licenses.
- **Open Source can be commercial?**
  Government-Academia-Industry all can gain
- **Government-Academia-Industry collaboration success stories?**
  OSGeo Software projects, GeoForAll, UN-OpenGIS, FOSS4G.

FOSS4G BOSTON 2017

FOSS4G SOTM ARGENTINA 2017 23-28 OCTUBRE

FOSS4G Europe 2017

FOSS4G Africa Johannesburg 2017

FOSS4G 2017 HOKKAIDO

FOSS4G 2018 DAR ES SALAAM

FOSS4G KOREA 2017

Thank You!

Keynote Speech 3(VTC)

NASA Open source technology: WorldWind

David Collins
NASA(technical manager)

Patrick Hogan
NASA(project manager)

NASA Open source technology: WorldWind

Dave Collins
paul@paulcollinssoftware.com
Technical manager at NASA

Patrick Hogan
Patrick.hogan@nasa.gov
Project manager at NASA

본 발표는 당일 원격화상회의(VTC)로 진행될 예정입니다.
발표자료가 필요한 분은 추후에 국토연구원으로 문의 부탁드립니다.

강혜경 연구위원 hkkang@krihs.re.kr
임시영 책임연구원 limsy@krihs.re.kr
성혜정 책임연구원 hjsung@krihs.re.kr

Memo

Memo

Session :
Digital Twin Space Strategies and Bigdata Analysis

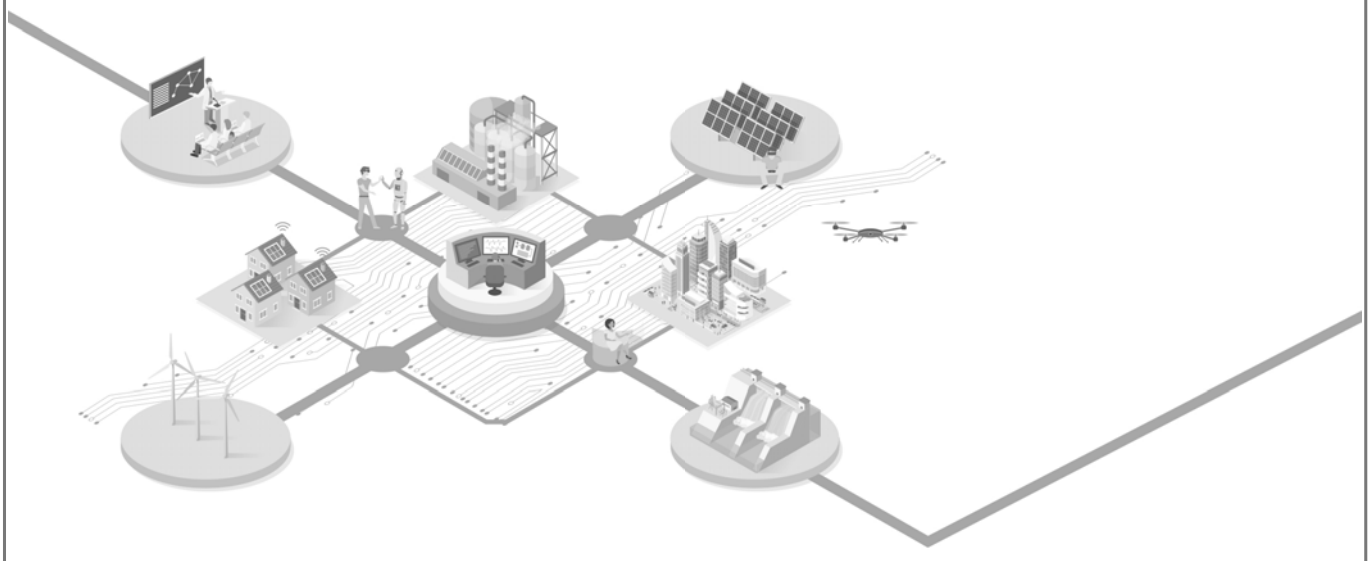
발표 세션 :
디지털 트윈국토 전략 및 빅데이터 데이터 전략

- "DTS, the future of geospatial data"/ ***Ho-sang Sakong,*** Senior Research Fellow of Geospatial Information Research Division, KRIHS
  "공간정보 디지털 트윈 전략"/ **사공호상,** 국토연구원 선임연구위원

- "Virtual NUS, A GIS-Based Enabler for Smart Campus"/
  Chen-Chieh Feng, Professor, National University of Singapore
  "버추얼 싱가폴대학, 공간정보기반 스마트캠퍼스"/ **펭 첸치에,** 국립싱가폴대학 교수

- "Smart City Digital Twin by City Connectomics"/ ***Chang-won Ahn,*** Special Fellow, Electronics and Telecommunications Research Institute
  "도시 커넥토믹스 기반 스마트시티 디지털트윈"/ **안창원,** 한국전자통신연구원 전문위원

- "A New Methodology for Geodemographics Using Open and Commercial Big Data"/
  Alex Singleton, Professor, The University of Liverpool
  "오픈-커머셜 빅데이터를 활용한 지오데모그래픽의 새로운 방법론"/ **알렉스 싱글톤,** 리버풀 대학 교수



Session

DTS, the future of geospatial data

Ho-sang Sakong

Senior Research Fellow of Geospatial Information Research Division, KRIHS

DTS, the Future of Geospatial Data

Ho-sang Sakong
hssa@krihs.re.kr
Korea Research Institute for Human Settlements (KRIHS)

Abstract

The 4th Industrial revolution will lead the Intelligence Information Society where new values are created and developed by commonly applying the Intelligence Information technologies to all area of economy, society and life. The Intelligence technologies are to implement high-level information processing (cognition, learning, reasoning) of human beings on machines through A.I.(Artificial Intelligence) and ICBM(IoT, Cloud, Big data, and Mobile). In these times, geospatial information data has to play a new role such as the new production factors of the economy, infrastructure platform for social and economic activities, and calm technology embedded in the services combined with other technologies. To accomplish such a role, we sought to predict the future of geospatial data in terms of human behavior, spatial technology, and related ICT technologies.

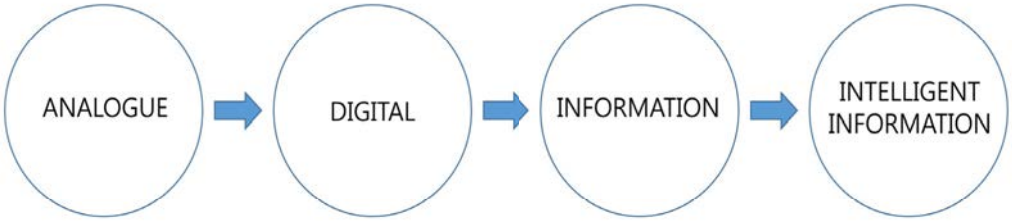
From this approach, we conclude the future of geospatial data is the DTS(Digital Twin Space) which represent the real in the digital world as equally as possible. DTS is composed of several Digital twins and the empty spaces between them. For achieving this goal, the existing NSDI frame has to be changed. So we suggest various policies (data, R&D, governance, eco-system, and laws) at the national level to build such DTS. It will be meaningful to replace the existing NSDIs and to present a new direction of the national roles for the future of geospatial data.

DTS, the future of geospatial data

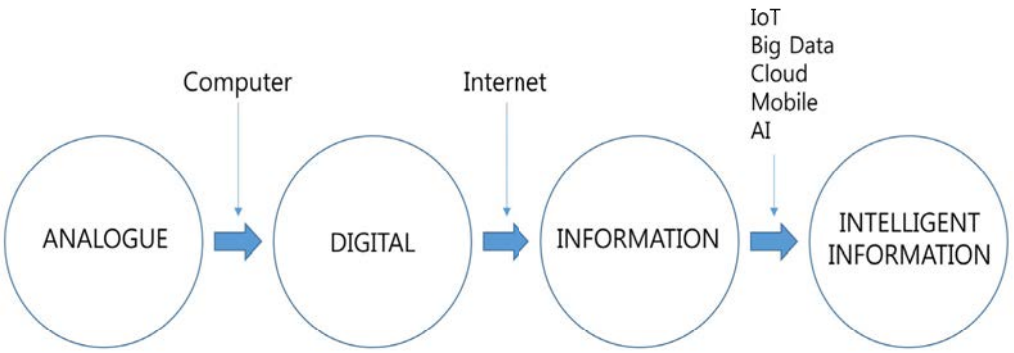
Hosang Sakong Ph. D.

Senior Research Fellow
Korea Research Institute for Human Settlements(KRIHS)
hssa@krihs.re.kr

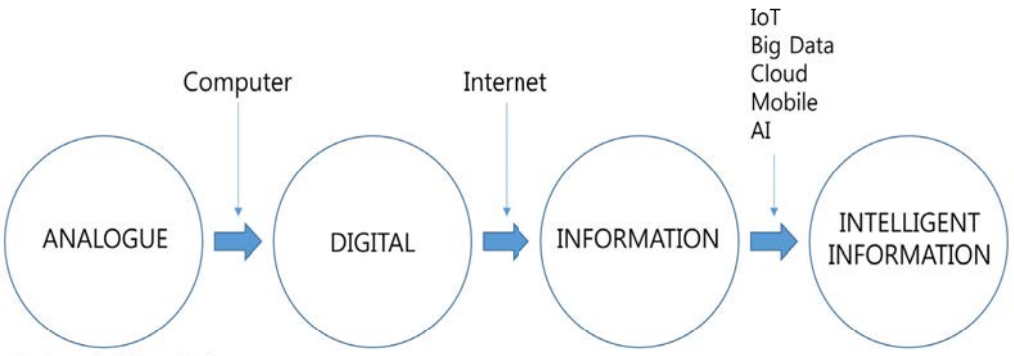
Technology / Social Change



Technology / Social Change



Technology / Social Change

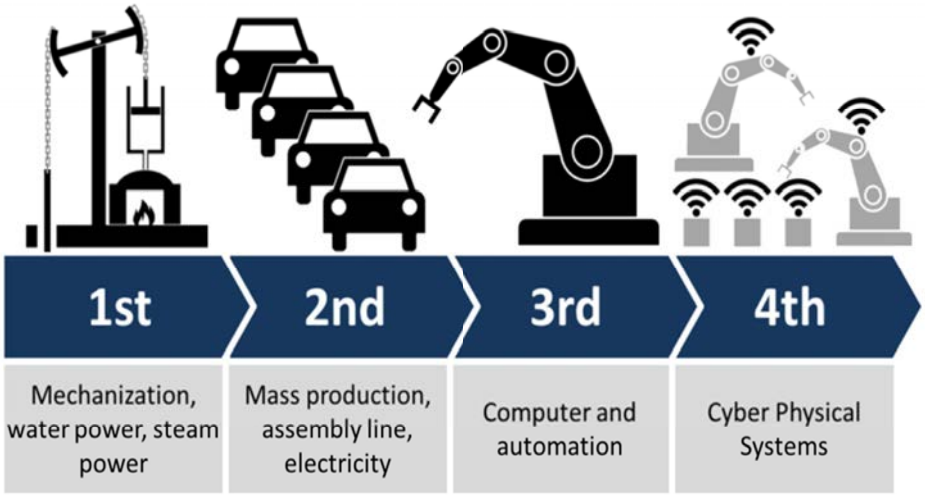


1st ,2nd Industrial Revolution
(Steam power(1784)
/ Electricity(1870))

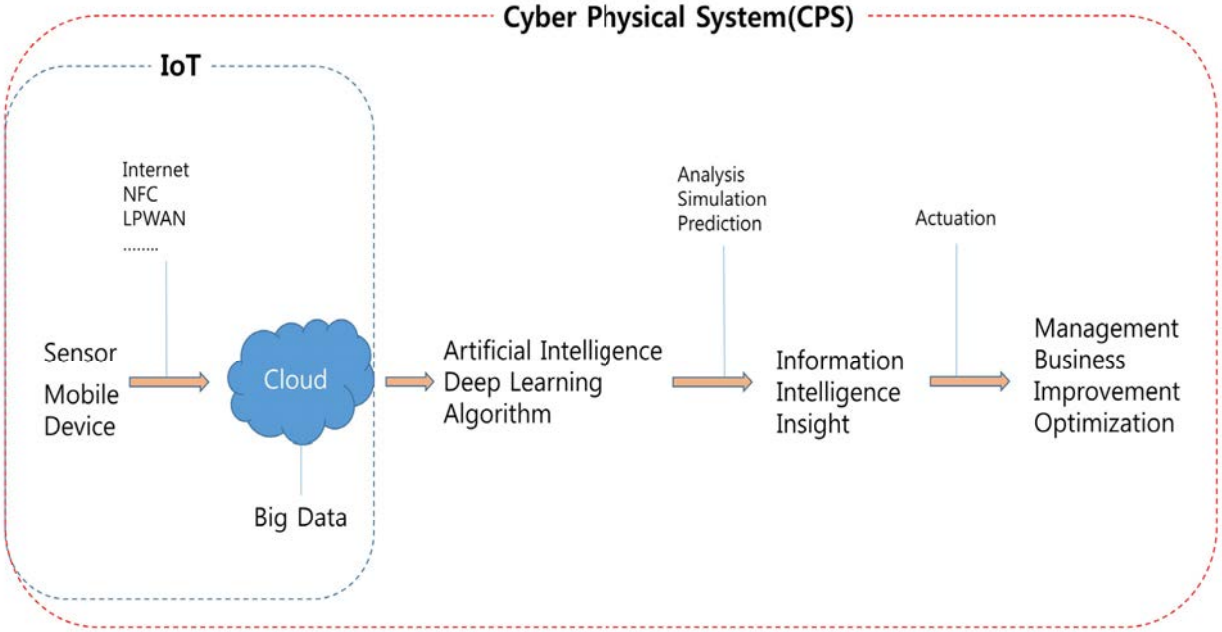
3rd Industrial Revolution
(Computer)

4th Industrial Revolution
(Cyber-Physical System)

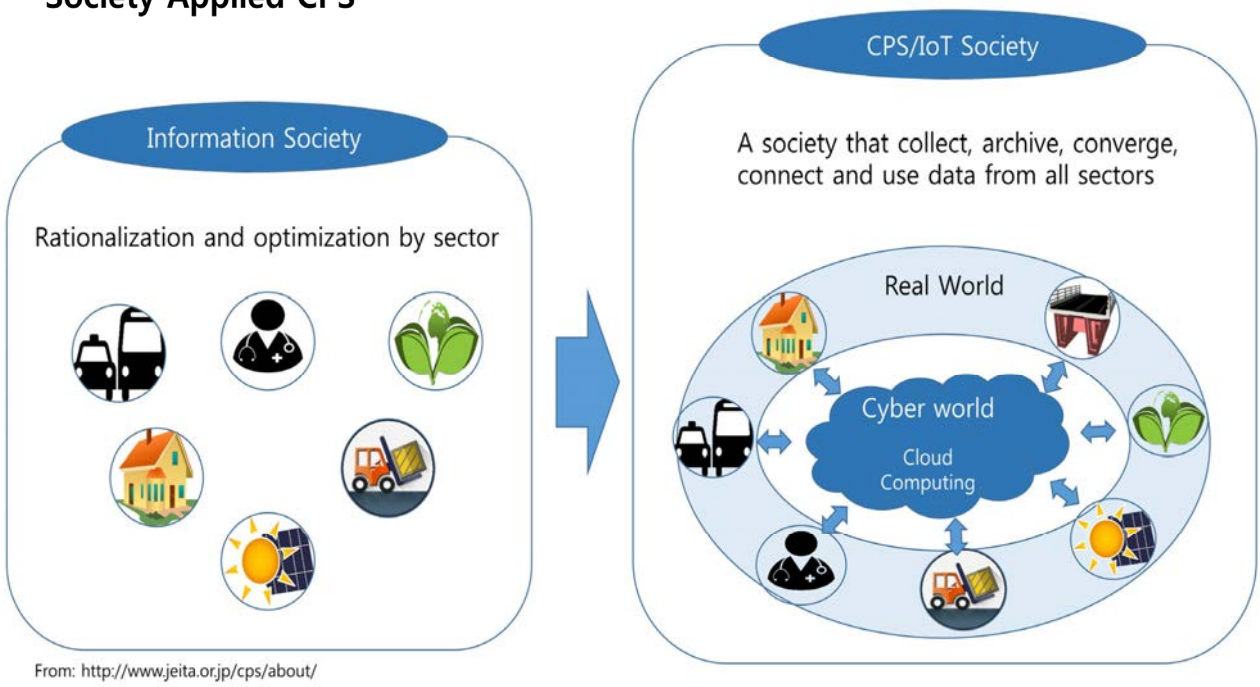
Changes of Industrial Revolution



From: http://www.inhapress.com/news/articleView.html?idxno=7226



Society Applied CPS

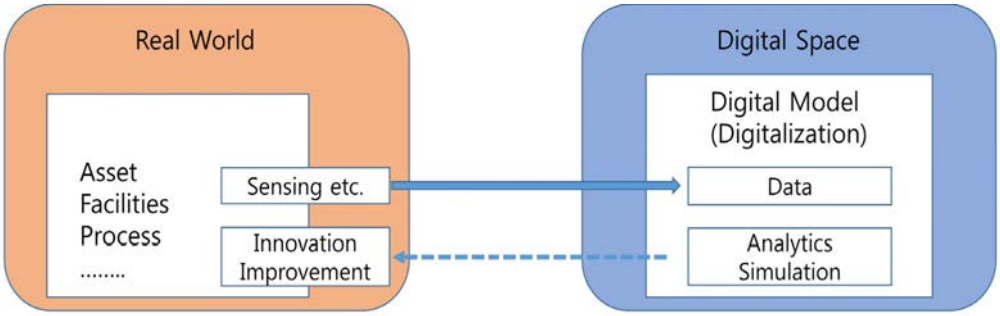


From: http://www.jeita.or.jp/cps/about/

Need CPS in our society

- CPS collects various data in real world(physical space) by sensor network, and analyze and makes knowledge using cyber space with big data processing technology. By using information and value created there, We can solve the problems.
- CPS needs to be introduced all the sectors in the society
  - ✓ To solve the problems facing Korean society such as traffic congestion, disaster management and environmental deterioration, etc.
  - ✓ To respond effectively to future problems such as population decline, low economic growth, inequality, and climate change
  - ✓ To create a new management methods and new business model
  - ✓ To improve productivity and increase the rationality of decision making

Concept of CPS



- The model on this cyber space is called "digital twin".
- These words have recently come to be seen in various places as application of IoT.
- Even with IoT, nothing happens by collecting and accumulating data from sensors and equipments.
- Value is created only by connecting data to improvement and reform.
- CPS not only focuses on an individual department and a part of processes, but also it can be said that it is a concept to build the whole model and to optimize based on the connection of each part.

From : IT Leaders, "Industry4.0やIndustrial Internet の根幹をなすCyber Physical Systemsの意義", http://it.impressbm.co.jp/articles/-/13188

CPS & Spatial data(Example)

CPS has spatial and temporal scales in the smart emergency response system(SERS)

From: https://kr.mathworks.com/company/newsletters/articles/implementing-a-cyber-physical-system-with-matlab-and-model-based-design.html

CPS & Spatial data(Example)

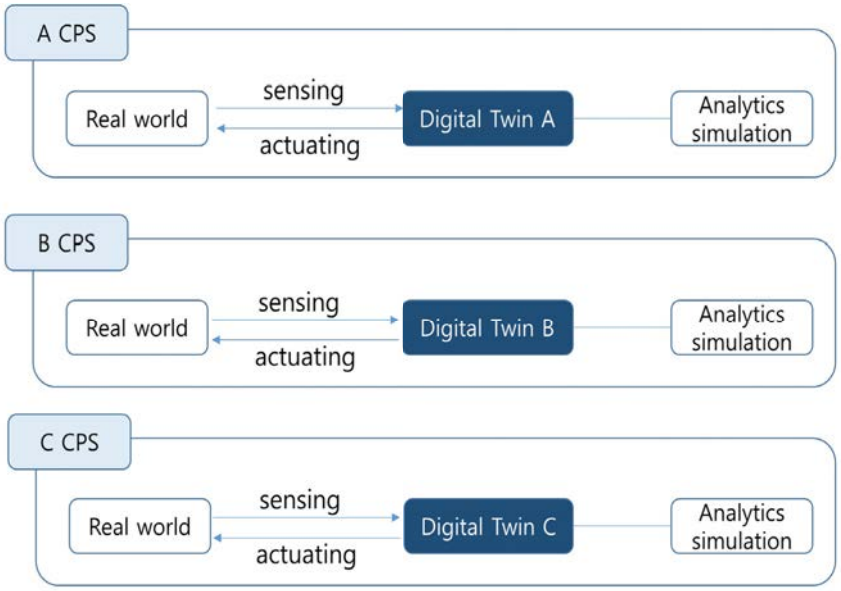
High-level SERS architecture.

From: https://kr.mathworks.com/company/newsletters/articles/implementing-a-cyber-physical-system-with-matlab-and-model-based-design.html

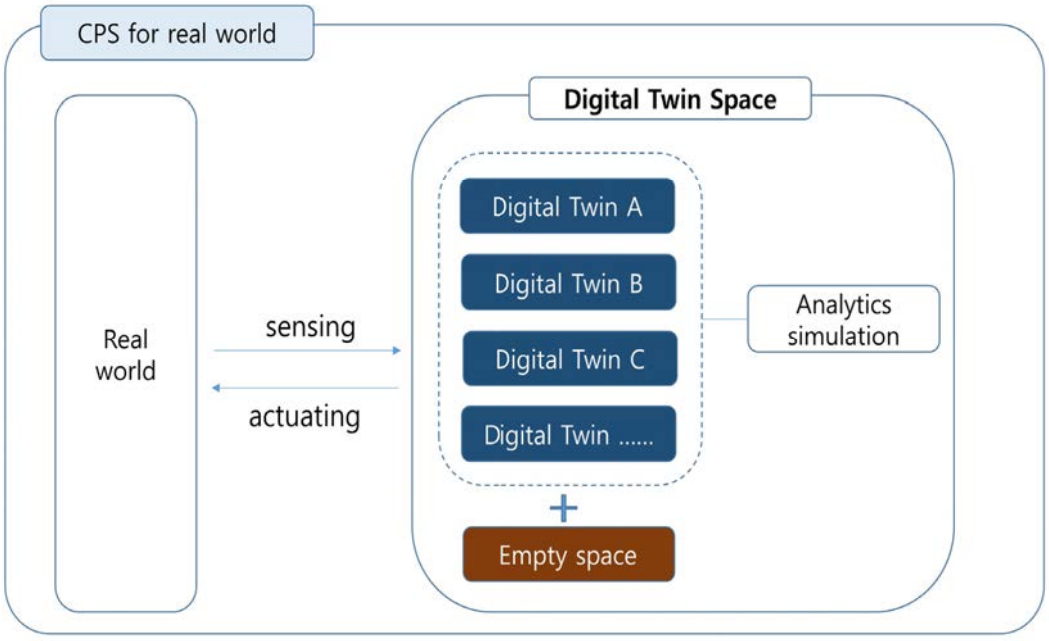
Spatial Data for CPS

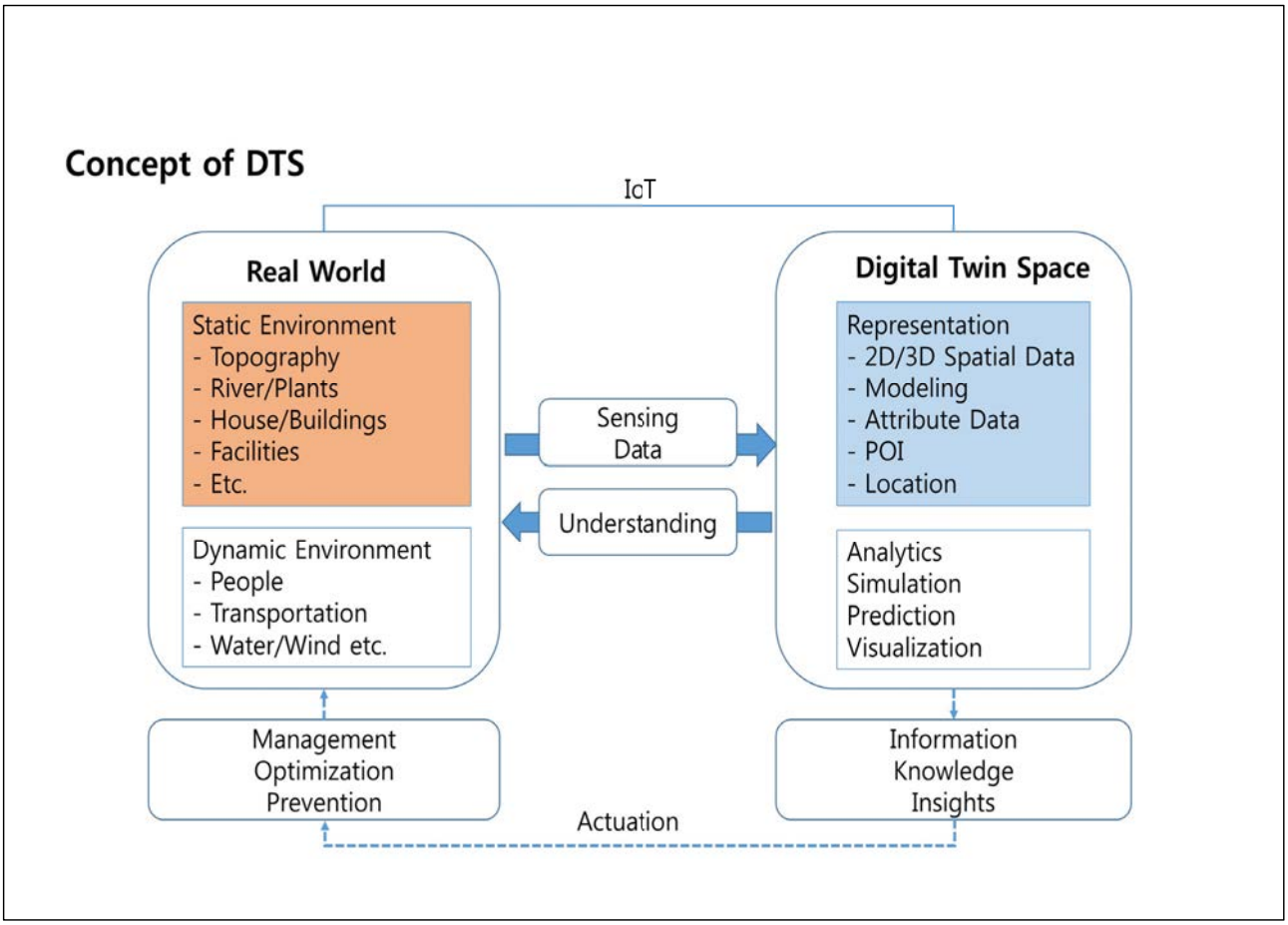
- Spatial data is a key component as an infrastructure of the CPS
- The digital space(digital twin) can be structured as follows
  - To implement various aspects and activities of society
  - Anyone can easily recognize and use
  - Same size, shape and color as the real world
  - Built with vector and grid data
  - Simultaneously implement 2D and 3D
  - 3D object data required for spatial analysis
  - Apply various level of detail(LOD) according to application
  - High precision location and objects are needed for autonomous vehicles

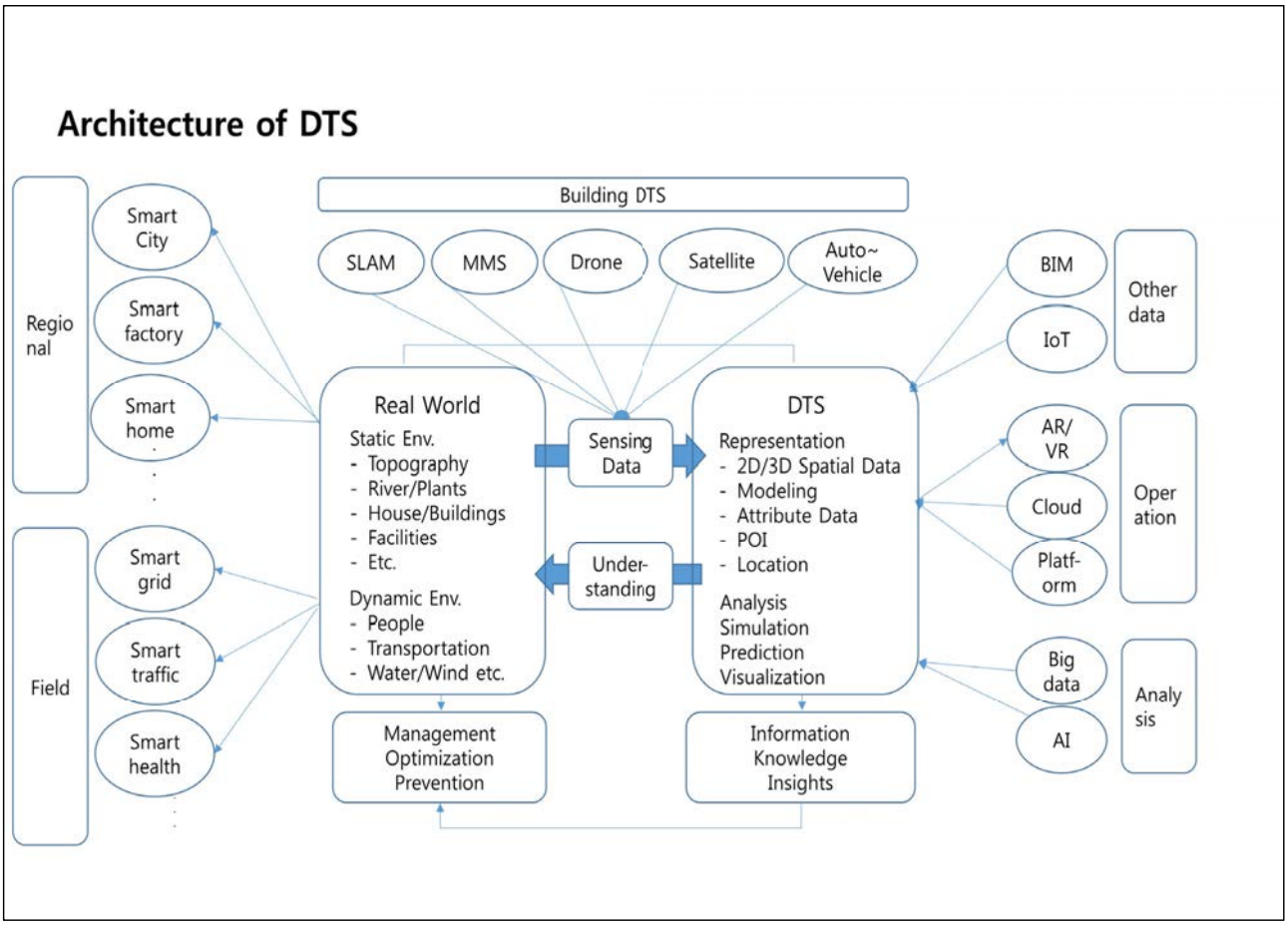
CPS/Digital Twin



CPS/Digital Twin Space(DTS)



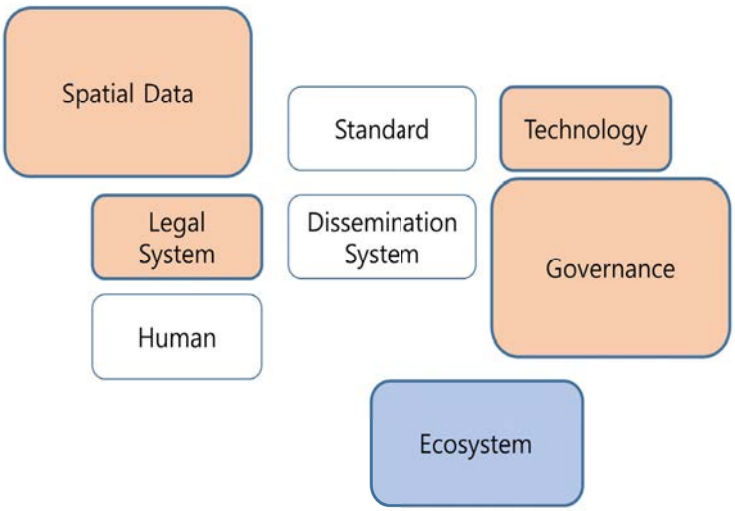

Concept of DTS
IoT
Real World
Static Environment
- Topography
- River/Plants
- House/Buildings
- Facilities
- Etc.
Dynamic Environment
- People
- Transportation
- Water/Wind etc.
Sensing Data
Understanding
Digital Twin Space
Representation
- 2D/3D Spatial Data
- Modeling
- Attribute Data
- POI
- Location
Analytics
Simulation
Prediction
Visualization
Management
Optimization
Prevention
Information
Knowledge
Insights
Actuation


Architecture of DTS
Building DTS
SLAM
MMS
Drone
Satellite
Auto~ Vehicle
Regional
Smart City
Smart factory
Smart home
Field
Smart grid
Smart traffic
Smart health
Real World
Static Env.
- Topography
- River/Plants
- House/Buildings
- Facilities
- Etc.
Dynamic Env.
- People
- Transportation
- Water/Wind etc.
Sensing Data
Under-standing
DTS
Representation
- 2D/3D Spatial Data
- Modeling
- Attribute Data
- POI
- Location
Analysis
Simulation
Prediction
Visualization
Management
Optimization
Prevention
Information
Knowledge
Insights
BIM
IoT
Other data
AR/ VR
Cloud
Platf-orm
Operation
Big data
AI
Analysis

Strategies for building DTS

Vision	Spatially Enabled Intelligent Information Society
Goal	Building DTS for Implementing Intelligent Information Society
Strategies	① (Data) Implementation of 3D / object-based realistic digital space ② (Technology) Development global level DTS technology ③ (Governance) A system of national and regional governance by agreement ④ (Ecosystem) Public / Private / Citizen Partnership ⑤ (Legislation) Legal system for securing practical performance

Key Components of DTS



Sectoral Strategy(1) : Data

❖ Implementation of 3D/object-based realistic digital space

❖ Main Task
- ① Data design through analysis of user demand
- ② Formulation of Data Model, Standard of 3D and LOD
- ③ Utilization and improvement of existing data
- ④ Introducing new technology and improvement of related legal system

❖ Action Plan
- ① The government provides only standards and framework data
- ② Establishment of data led by users such as local governments
- ③ Construct step by step considering utilization effect
- ④ Private and public participation
- ⑤ Utilization of private capital

Sectoral Strategy(2) : Technology

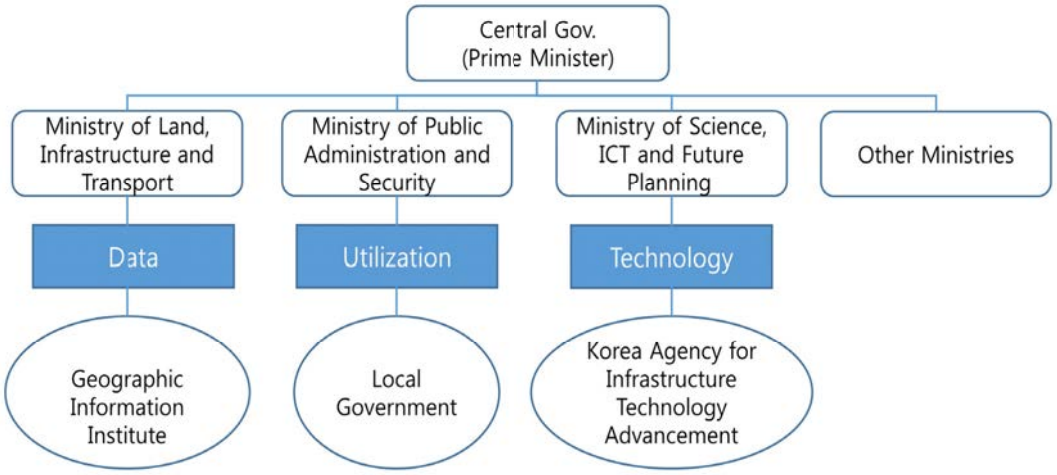
❖ Development global level DTS technology

❖ Main Task
- ① DTS building technology
- ② Real-world and DTS linkage technology
- ③ Spatial analysis and monitoring technology
- ④ Real world optimization and control technology

❖ Action Plan
- ① Promoting national R&D project
- ② Compliance with OGC, ISO standard
- ③ Developing Open Sources Software Technology
- ④ Development of fusion of spatial information + information and communication technology

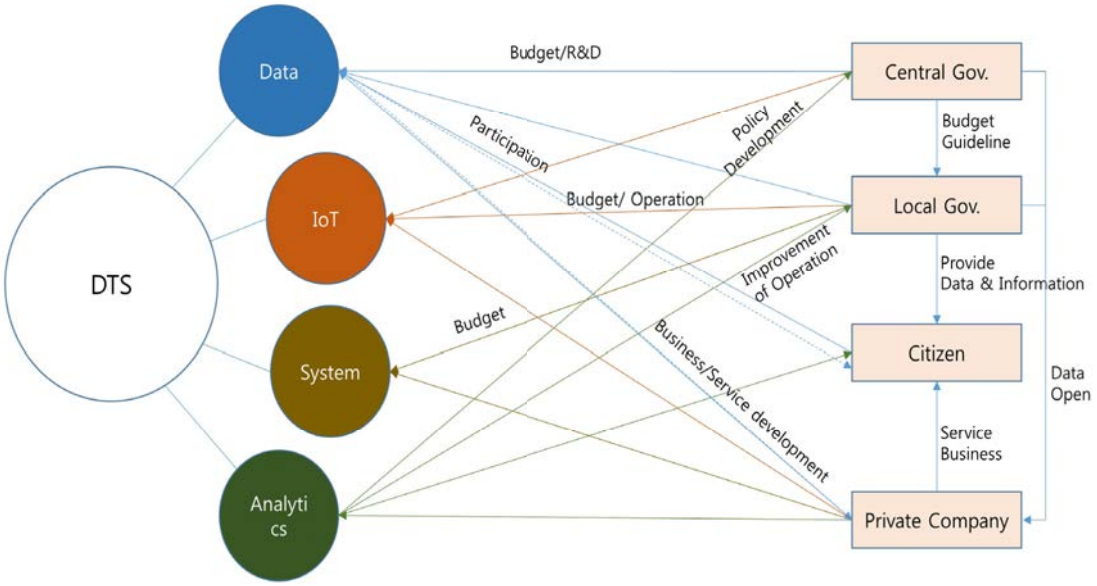
Sectoral Strategy(3) : Governance

❖ A system of national and regional governance by agreement
❖ Main Task
① Role sharing of central government / local governments / public institutions
② Ensure the practicality of DTS by agreement of DTS users



Sectoral Strategy(4) : Ecosystem

❖ Government / Private / Citizen Partnership
❖ Main Task
① Public / private cooperative / mutually beneficial role sharing
② Creating a sustainable and stable ecosystem



Sectoral Strategy(5) : Legislation

❖ Legal system for securing practical performance

❖ Main Task
① Establishment legal basis for DTS construction and utilization
② Establishment and improvement of legislation for introduction of new technology related to DTS
③ Improvement of security and privacy laws
④ Preparing legal system for sustainability and stability of DTS

❖ Action Plan
① Regulating the roles and obligations of government related to DTS
② Establishment and improvement of regulations for introduction of new equipment and technologies such as drone, MMS etc.
③ Preparation of the 3D data standard and LOD
④ Improvement of privacy regulation related to acquisition and utilization of spatial information

Closing Remarks

- Our society is rapidly advancing into a intelligent information society due to technologies such as IoT, Cloud, Big data, Mobile, AI and the fusion of these technologies.
- The cyber physical system(CPS) that connects the real world and the virtual space has been extensively applied in each field of society.
- Spatial information is very important as a platform to connect real world and virtual space.
- The digital twin(DTS) a key component of connecting real world is required as the infrastructure of the cyber physical system.
- Since the DTS is an important factor of national competitiveness, it should be systematically implemented at the national level.
- DTS will be a new strategy for national spatial data infrastructure(NSDI) in Korea which should be pursued.

Thank you

Session

Virtual NUS, A GIS-Based Enabler for Smart Campus

Chen-Chieh Feng

Professor, National University of Singapore

Virtual NUS, A GIS-Based Enabler for Smart Campus

Chen-Chieh Feng
geofcc@nus.edu.sg
Department of Geography, National University of Singapore (NUS)

Abstract

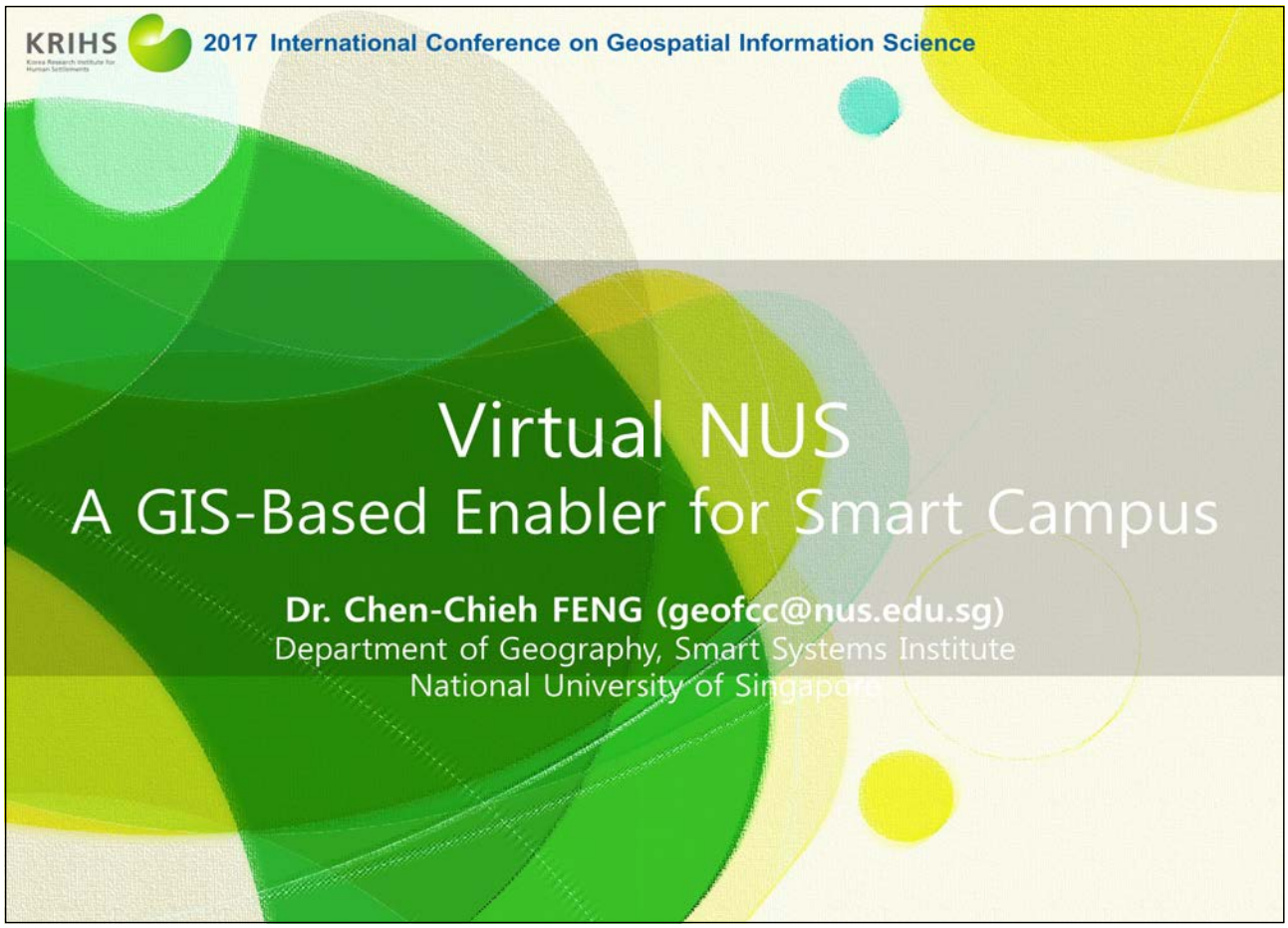
Since 2014, Singapore has been moving rapidly toward a smart nation that harnesses the power of networks, data, and information and communication technologies to improve living, create economic opportunities, and build a closer community. In the similar vein, National University of Singapore (NUS) has envisioned a smart campus environment where research, teaching, campus management and planning, and related businesses can be carried out in a more responsive and sustainable, thus smarter ways that enrich the experiences and well-beings of its staff and students. To materialize the vision, Virtual NUS, a GIS-enabled platform using NUS campus as a live testbed, has been planned and built in phases since late 2016.

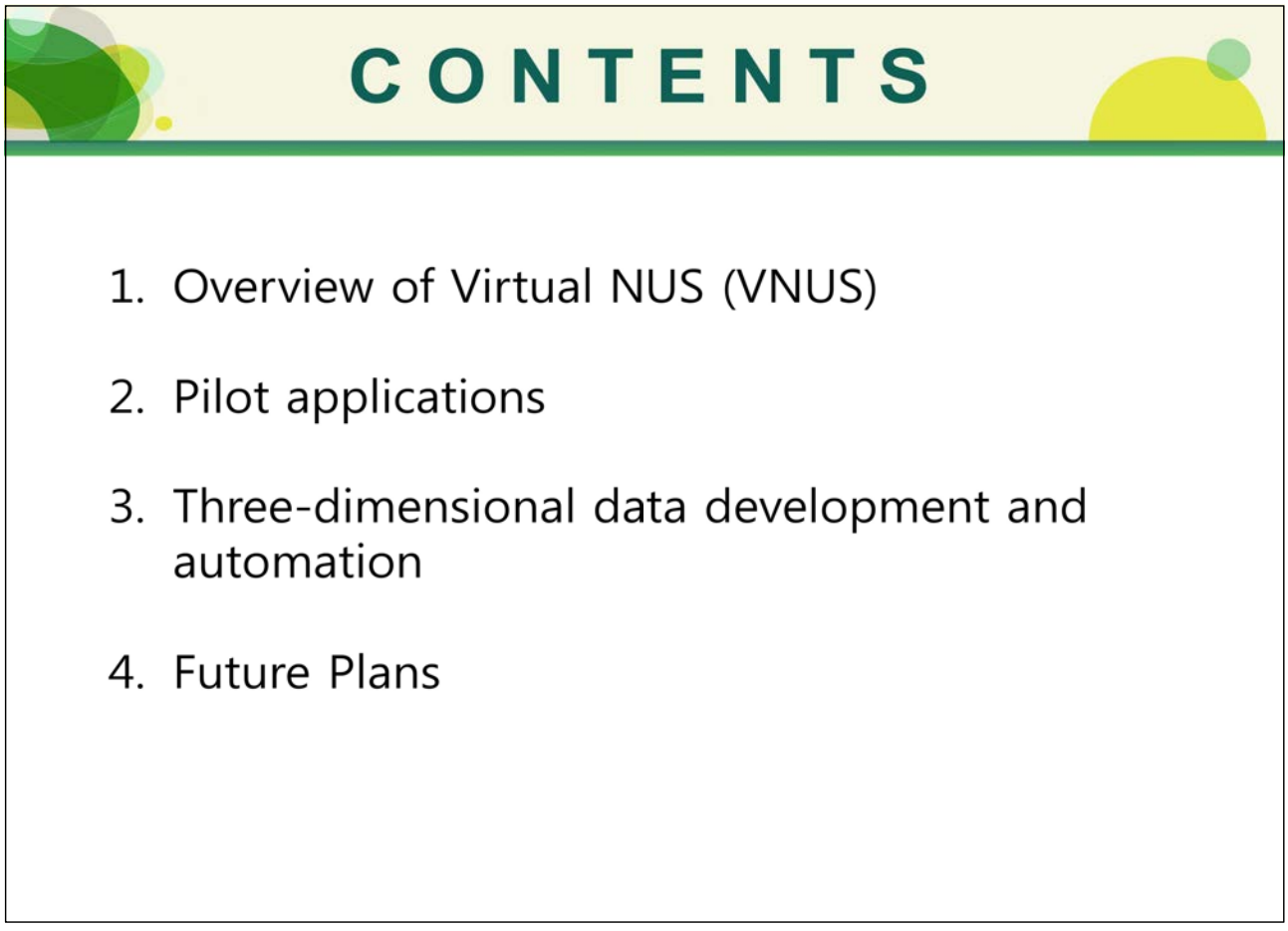
At the core of the Virtual NUS is a three-dimensional (3D) spatial infrastructure to enable data integration and location-based service provision. Leveraging on existing geospatial technologies, which include drones, terrestrial and handheld LiDAR devices, DGPS, and various GIS software packages, 3D building models and street furniture of the NUS campus have gradually been built and verified to be measurement worthy and visually pleasing. These largely geometry-based data are complemented with indoor floor plans and a network-based model to extend campus navigations from outdoors to indoors and from 2D to 3D. The spatial infrastructure then served as the basis for integrating data collected from various sensors and Internet of Things (IoT) devices that provide localized information, such as crowdedness of a particular region of campus or the air quality of a classroom, and as a means to support other smart applications concerning campus master planning.

In addition to a platform providing smart services, Virtual NUS is designed with the aim to promote research across the university campus. Existing research effort has been focusing on the automation of data production, especially on extraction of spatial information from point cloud to develop 3D building models and to examine ways to preserve semantics of building models when data exchanges are necessary. To ensure data accessibility, Virtual NUS is dedicated to

openness, with data accessible via application programming interfaces (APIs) when they are available and provided using international standards (e.g., CityGML). The open policy of Virtual NUS has spurred many research discussions within the university, especially in computer fluid dynamic (CFD) modeling and building information model (BIM) applications.

Despite being a platform, the centerpiece of Virtual NUS is its “residents” – the students and the faculty members, and visitors. Through developing a GIS-based spatial infrastructure and providing location-based services through integrating IoT-based data, the project will improve the experience of the people on campus through innovative spatiotemporal data applications and solutions.


KRIHS
2017 International Conference on Geospatial Information Science
Virtual NUS
A GIS-Based Enabler for Smart Campus
Dr. Chen-Chieh FENG (geofcc@nus.edu.sg)
Department of Geography, Smart Systems Institute
National University of Singapore


CONTENTS
1. Overview of Virtual NUS (VNUS)
2. Pilot applications
3. Three-dimensional data development and automation
4. Future Plans

Problem?

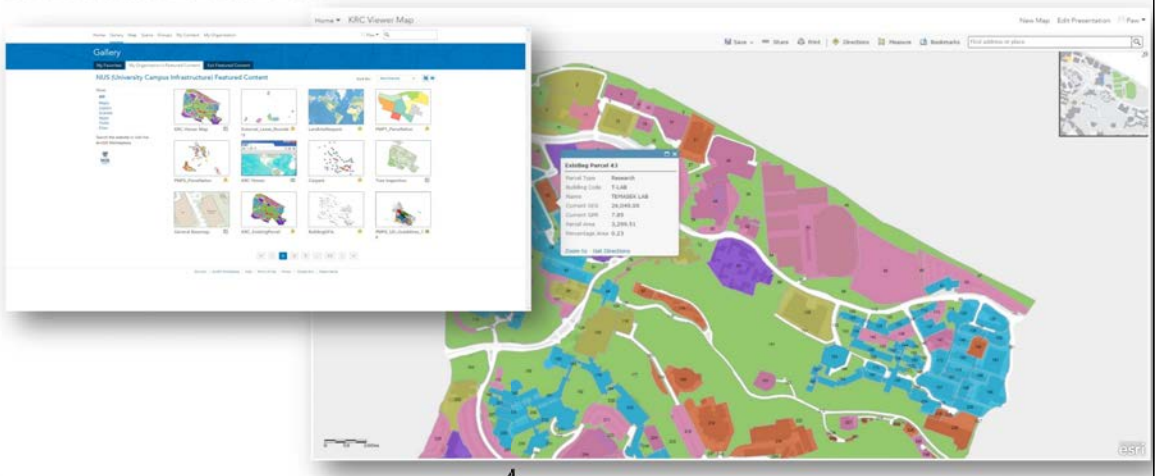
- National University of Singapore (NUS) campus

1966 (after independence) 1978 1988

- Management of campus infrastructure has become increasingly challenging

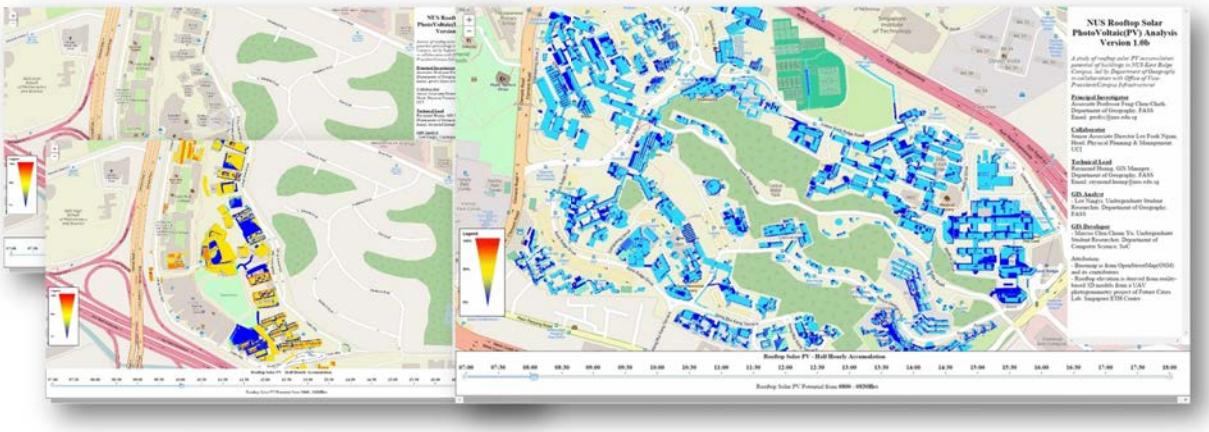
Main Goal of Virtual NUS (VNUS)

- Addressing the needs of the Office of the Vice President, University Campus Infrastructure for campus planning and maintenance



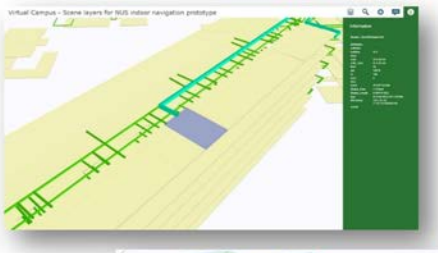
Main Goal of VNUS

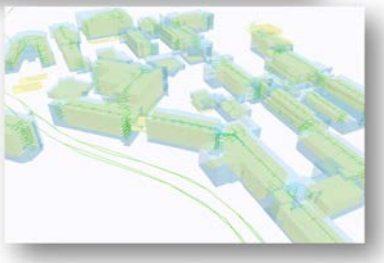
- Addressing the needs of the Office of the Vice President, University Campus Infrastructure for campus planning and maintenance



Vision of VNUS

- Addressing the needs of the Office of the Vice President, University Campus Infrastructure for campus planning and maintenance
  - Serving research and teaching needs of the NUS community
  - Improving student experience

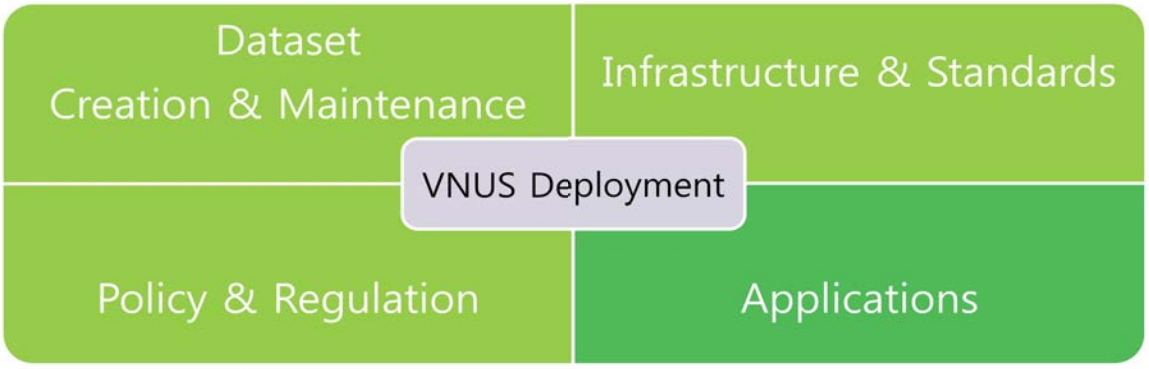




- The importance of GIS was promoted and later recognized

Applications and guiding framework

- A bottom-up approach to identify applications
  - Offers 3D room-to-room navigation and crowd map
  - Allows students to develop apps and run hackathons
  - Supports campus master planning
  - Supports management of underground assets



Collaborative Efforts

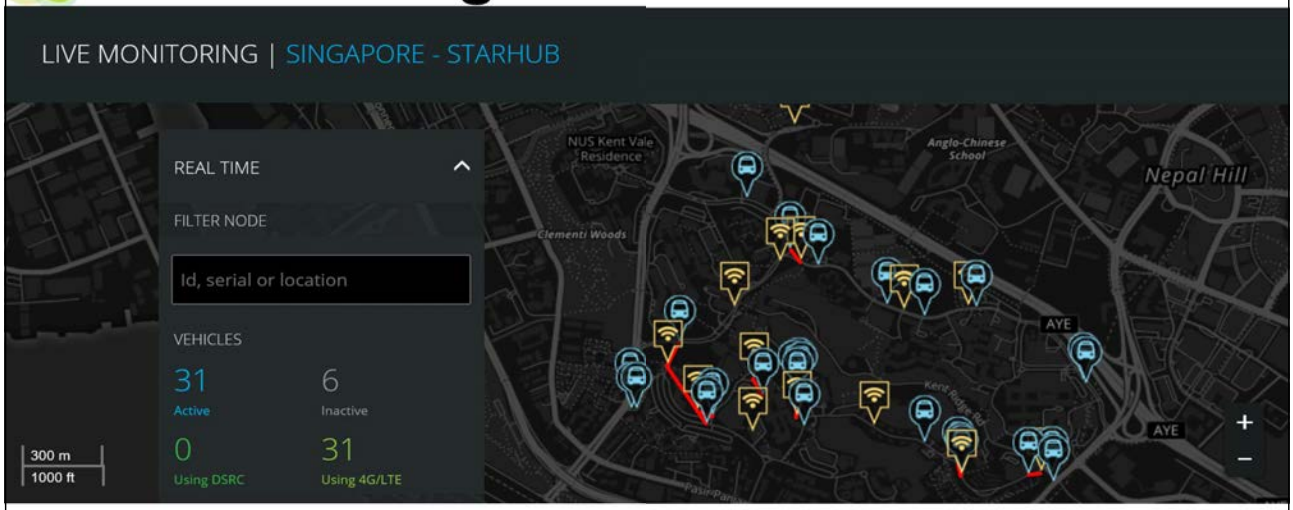
- Research expertise in
  - Wireless sensor network
  - Internet of Things
  - GIS (2D and 3D)
  - Localization
  - Machine learning
  - Data analytics
  - Event detection and analytics
  - Photogrammetry and building information model
  - Spatial cognition

Connection to **Smart Nation** of Singapore

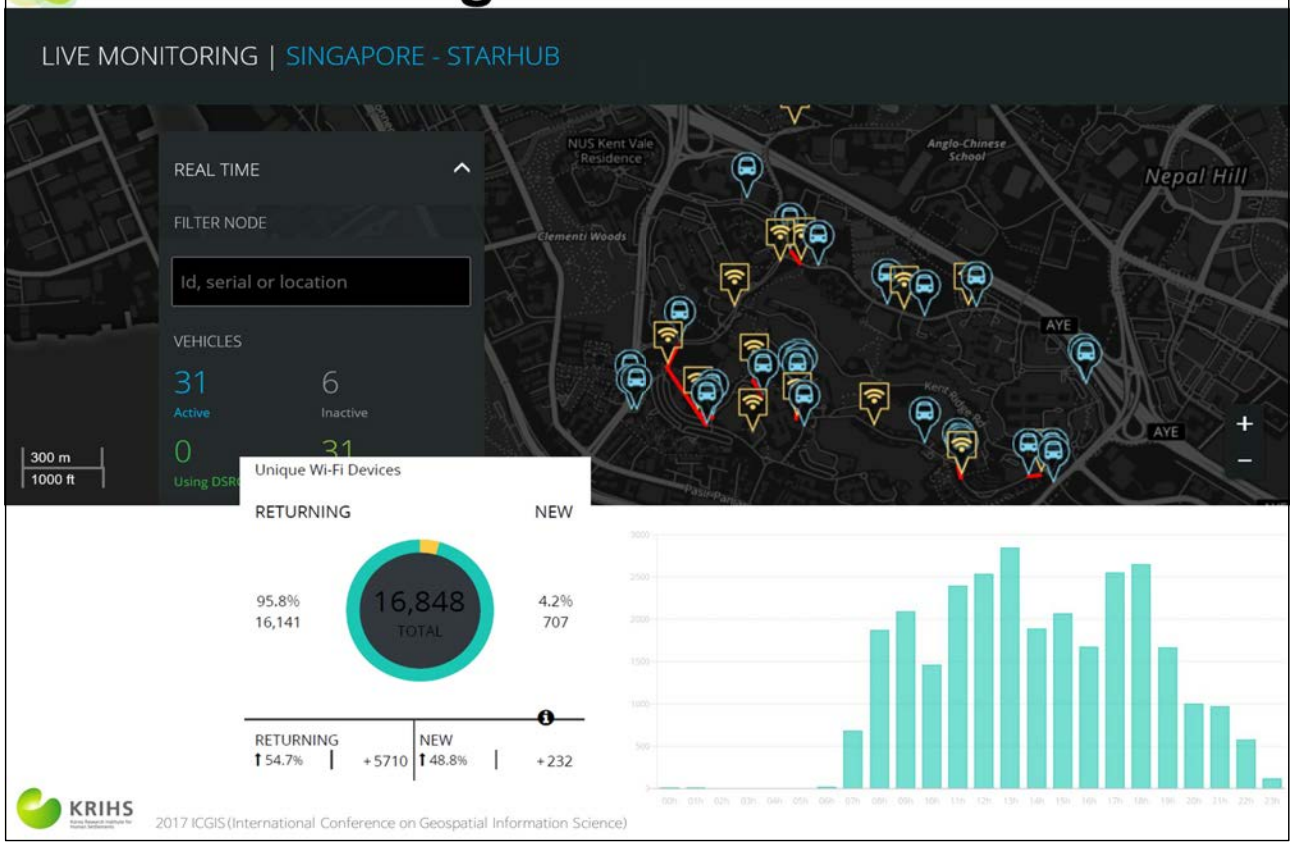
- A nation where **people** live meaningful and fulfilled lives, enabled seamlessly by technology, offering exciting opportunities for all
- Through harnessing the power of networks, data and infocomm technologies, we seek to improve living, create economic opportunity and build a closer community

Better living, more opportunities, and stronger communities

Bus Tracking and Localization



Bus Tracking and Localization



KRIHS

2017 ICGIS (International Conference on Geospatial Information Science)

Three-Dimensional Spatial Infrastructure

- Create an accurate virtual 3D campus to support various smart campus applications for both operations and research needs
- Treat our campus as a microcosm of a city
- Develop 3D virtual campus that
  - includes both indoor and outdoor
  - is LOD 2.5 with some key buildings reaching LOD 4
  - considers terrain (relief within the campus is about 60m)
  - incorporates landscape and street furniture

KRIHS

12

2017 ICGIS (International Conference on Geospatial Information Science)

A Hybrid Approach

- Drone-based photogrammetry approach combined with terrestrial LiDAR

- Post-processing of 3D Point Cloud
- 3D modelling and texture synthesis

Data Processing

- Drone-based photogrammetry approach combined with terrestrial LiDAR
  - "Garden city"
- Post-processing of 3D Point Cloud

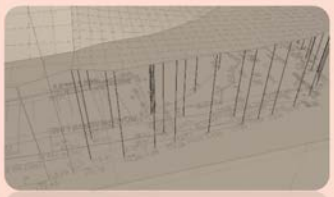
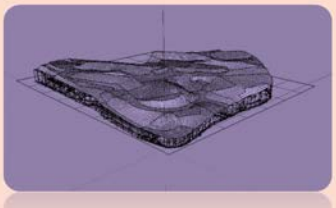
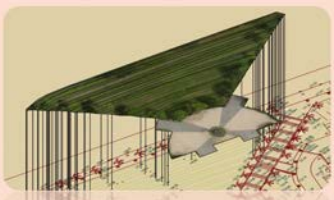
- 3D modelling and texture synthesis

Data Processing

- Drone-based photogrammetry approach combined with terrestrial LiDAR
- Post-processing of 3D Point Cloud
- 3D modelling and texture synthesis

Accounting for Terrain

- Topography survey as reference to terrain models

1 Extracting height from topo-survey	2 Creating surface of terrain model	3 Projecting texture onto terrain surface
		

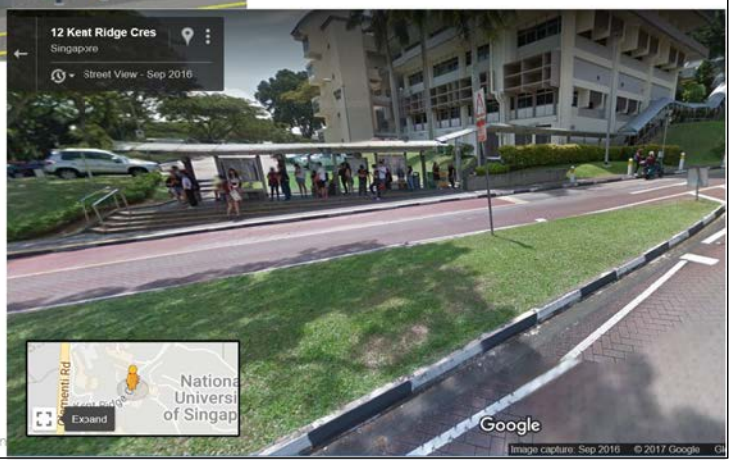
Faculty of Engineering, NUS

17

KRIHS

2017 ICGIS (International Conference on Geospatial Information Science)

An Example of Street Furniture



KRIHS

2017 ICGIS (International Conference on Geospatial Information

Indoor Map for Navigation

AS2, Level 4

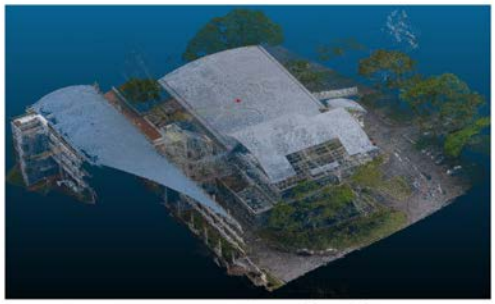
AS2, Level 3

AS2 building

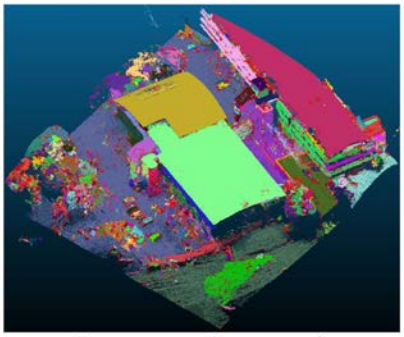
AS2, Level 2

KRIHS

Point Cloud Segmentation and Classification

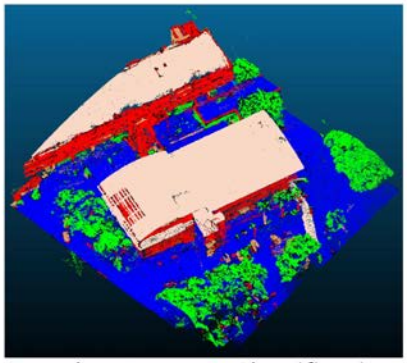


Input: Point cloud



Segmentation result

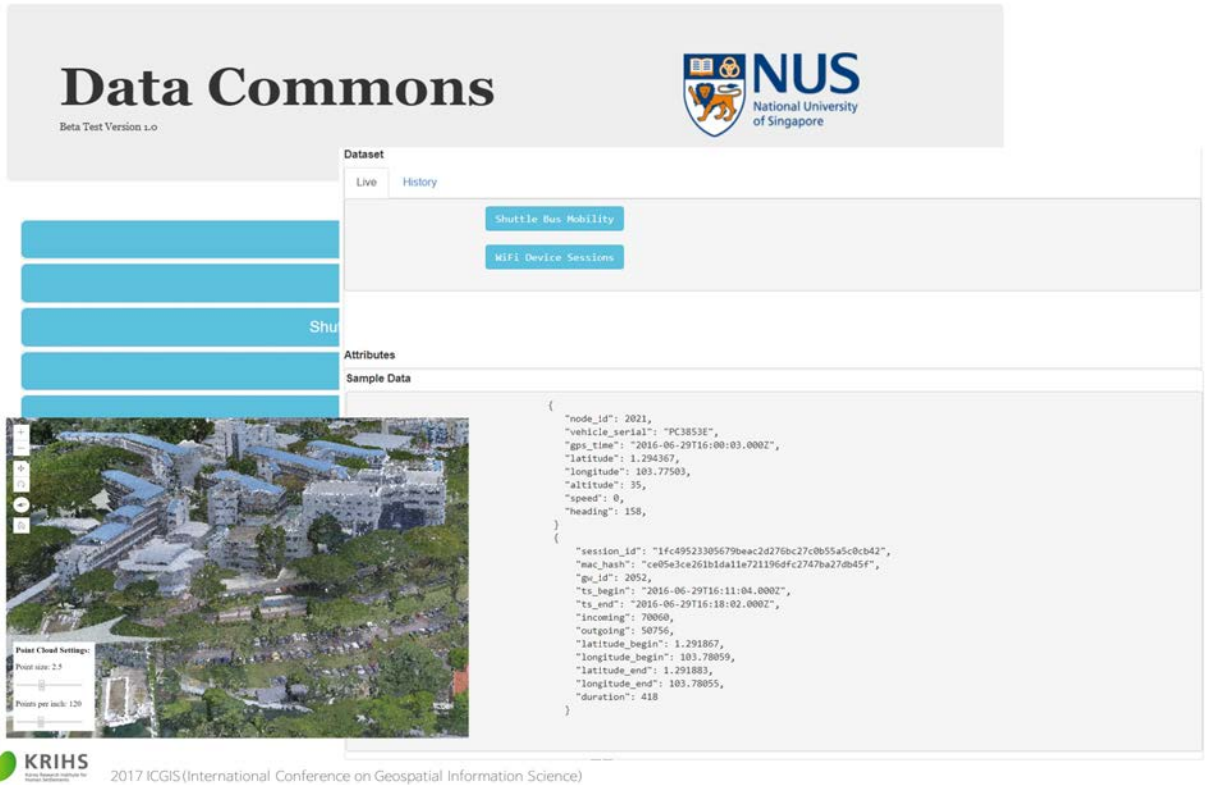
Roof
Wall
Ground
Tree
Grass
Car



(Random Forest) Classification result

KRIHS

Data Access and Its Future Plan



Future Plans

- Building Information Modeling
- CFD modeling of air flow
- Underground service corridor
- Preservation of campus history
- Augmented reality


KRIHS
2017 International Conference on Geospatial Information Science
THANK YOU

Session

Smart City Digital Twin by City Connectomics

Chang-won Ahn

Special Fellow, Electronics and Telecommunications Research Institute

Smart City Digital Twin by City Connectomics

Chang-Won Ahn
ahn@etri.re.kr
Future Technology & Strategy Research Lab., ETRI

Abstract

The smart city governance is aiming at implementing the scientific administration based on the evidence. In order to establish a long-term strategy for the future of the city as well as to resolve techno-socio-economic issues, it should be equipped with the ability to weave and analyze a variety of huge data, which express our city. In the 21st century of digital society, having a huge impact of the connections and interactions among individuals on social phenomenon with the social complexity, society is becoming more and more complex. Frequent occurrences of radical changes happen instantaneously. Exploring the potential possibilities of the future, which are unprecedented, and analyzing the dynamic changes of our society are necessary to identify the hidden causal effects and make the proper policies timely. Multi-dimensional analysis and long-term predictions for the various combinations of policy variables must be tested and evaluated on the holistic social simulation environment.

Smart City Digital Twin
by City Connectomics

- Big Data, AI, Dynamic Governance -

2017. 08. 31

Dr. Chang-Won Ahn
@ETRI

I am ...

Positions

- (2015~2016) Director of BigData Analysis Division, Ministry of the Interior
- (2015~Present) Expert Member, Presidential Committee on Ageing Society and Population Policy
- (1999~Present) Principal Researcher, BigData Intelligence Division, ETRI (Electronics & Telecommunications Research Institute)
- (2008~Present) Associate Professor, Computer & SW, UST (Univ. of Science & Technology)

Degrees:

- Ph.D., Industrial Engineering KAIST 1998
- M.S. Management Science KAIST 1994
- B.S. Management Science KAIST 1992

2

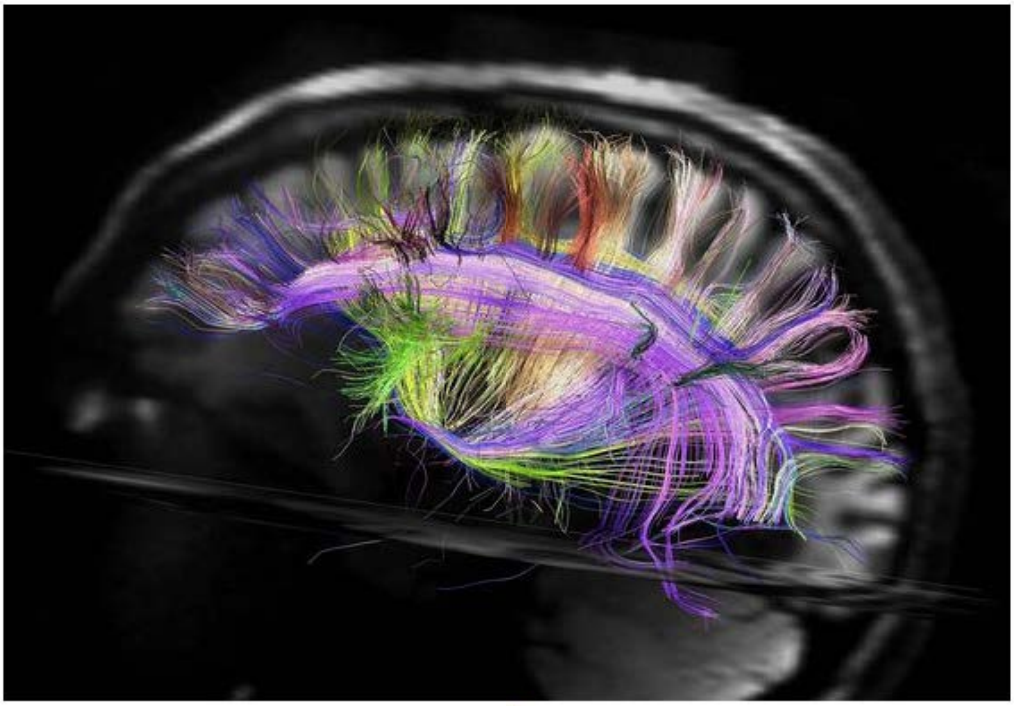
Big Data, AI, Smart Gov.

Gov. 3.0, Data-Driven Scientific Admin

Evidence-based Empirical Decision-Making

3

Connectome



4

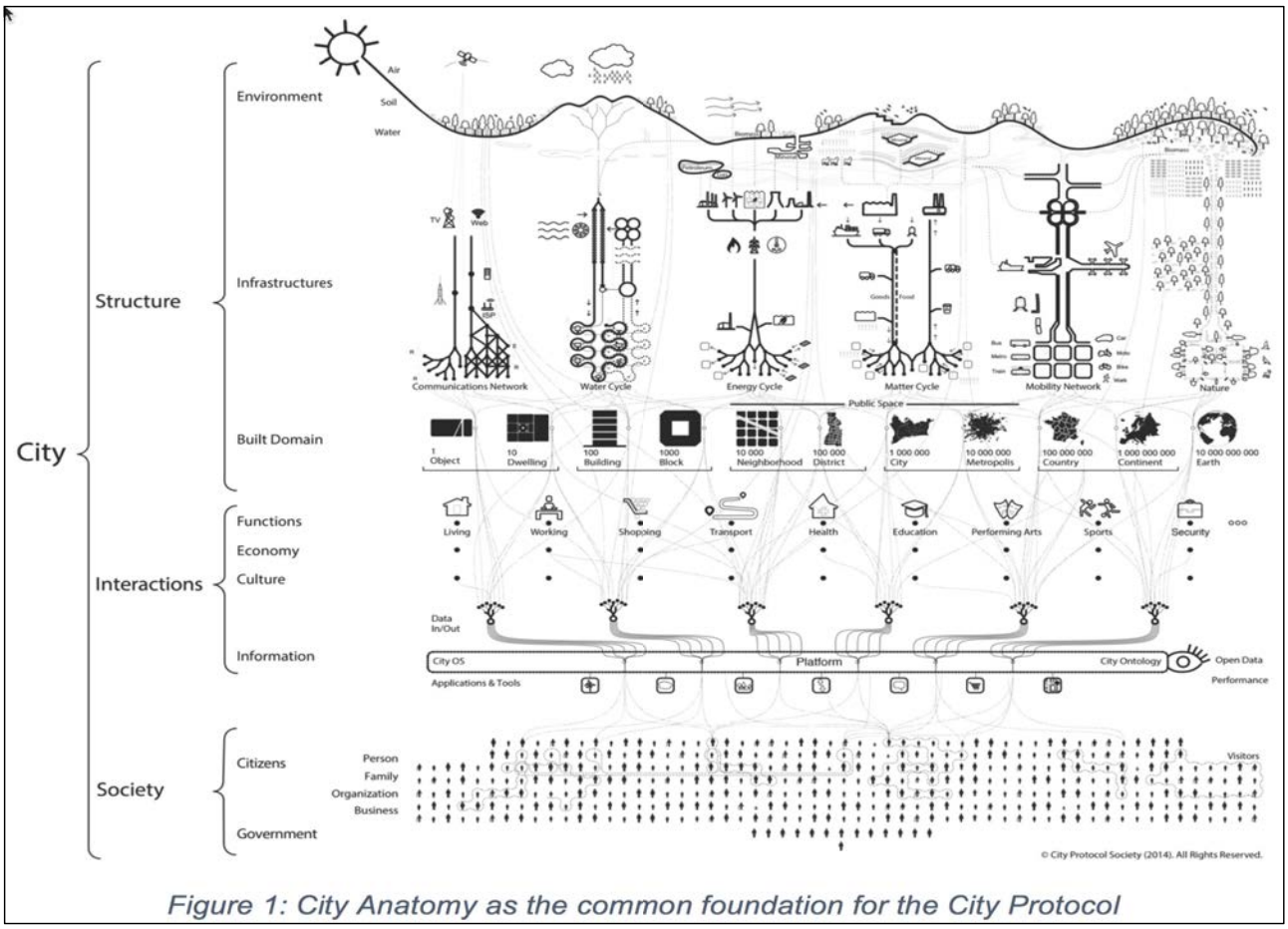
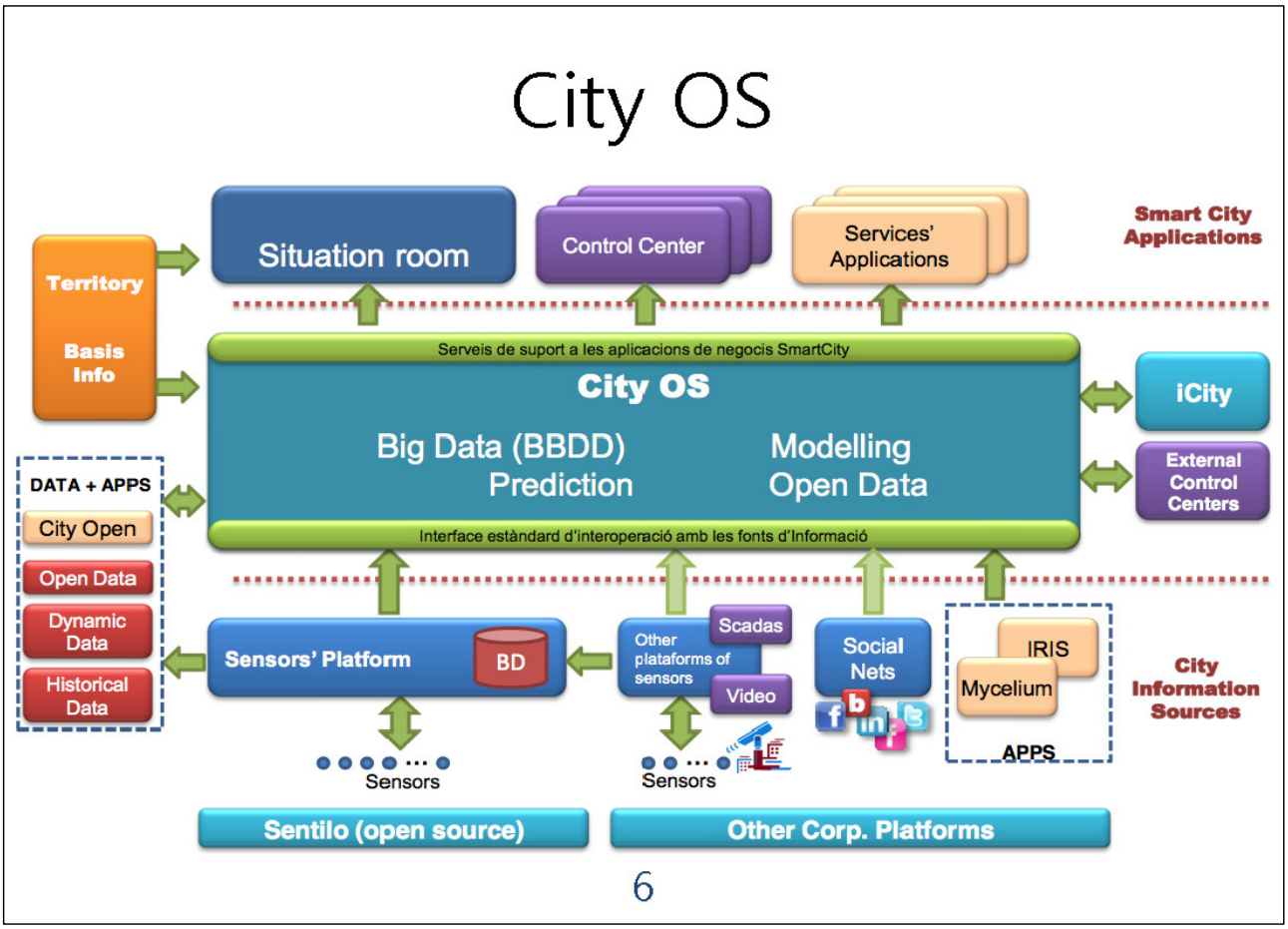


Figure 1: City Anatomy as the common foundation for the City Protocol



Real World vs. Realistic World
Big Data + IoT

DATA RESOLUTION

IBM 5 in 5

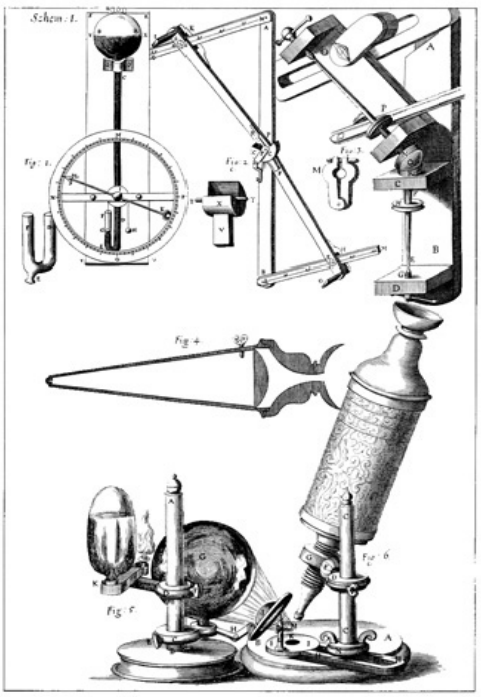
8

IBM 5 in 5 | Five innovations that will help change our lives within five years

The invisible made

Visible

10

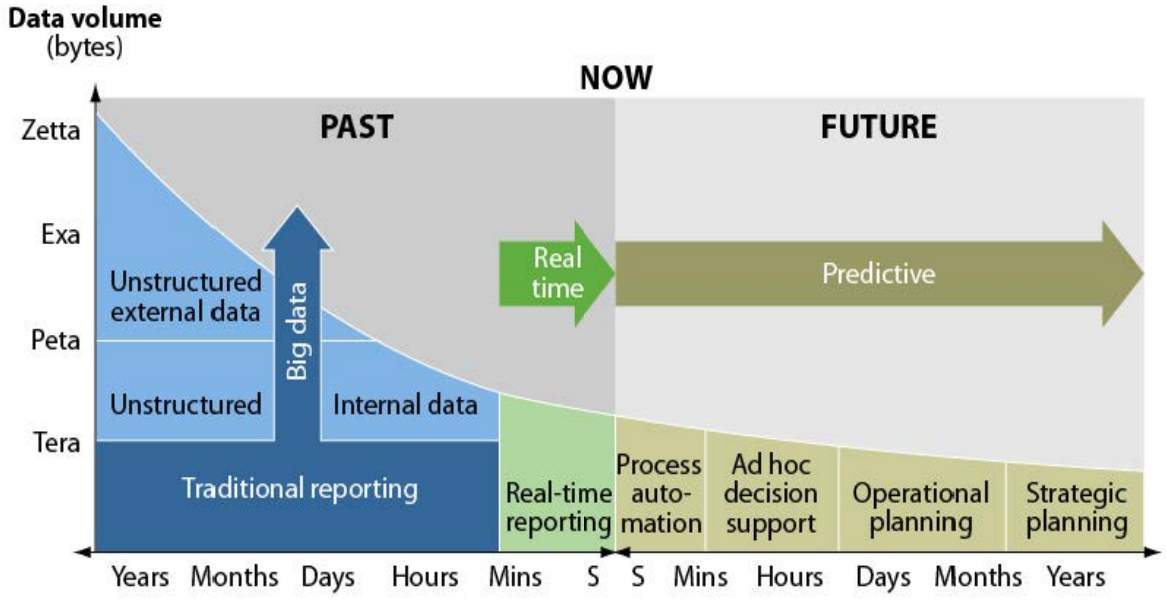


11

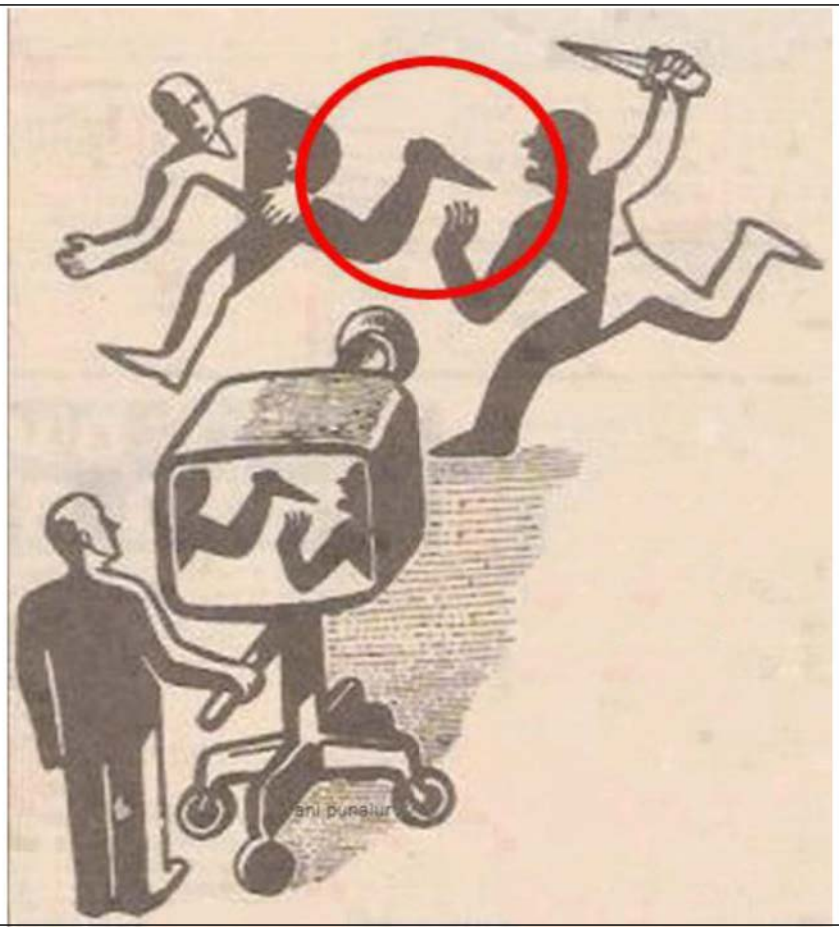
The United States are/is ...

12

Data → Insight → Foresight



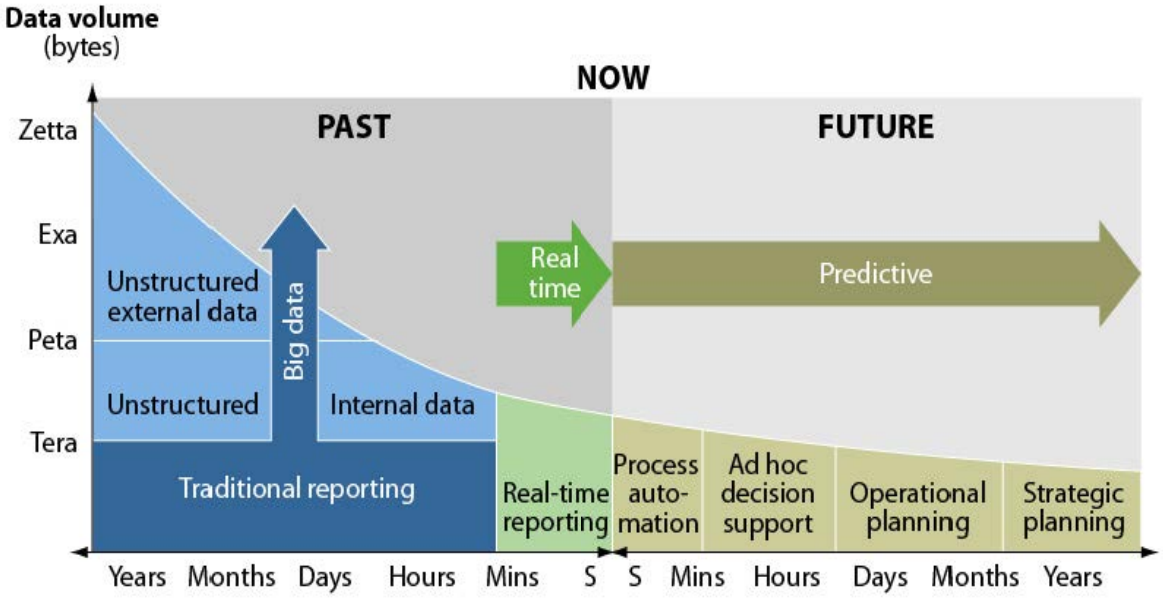
13



Cognitive Computing + Simulation

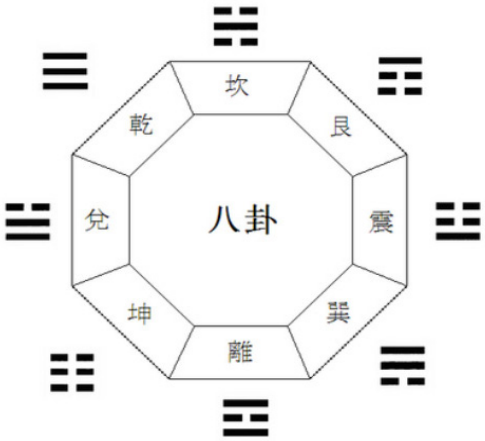
INTELLIGENCE RESOLUTION

Data → Insight → Foresight

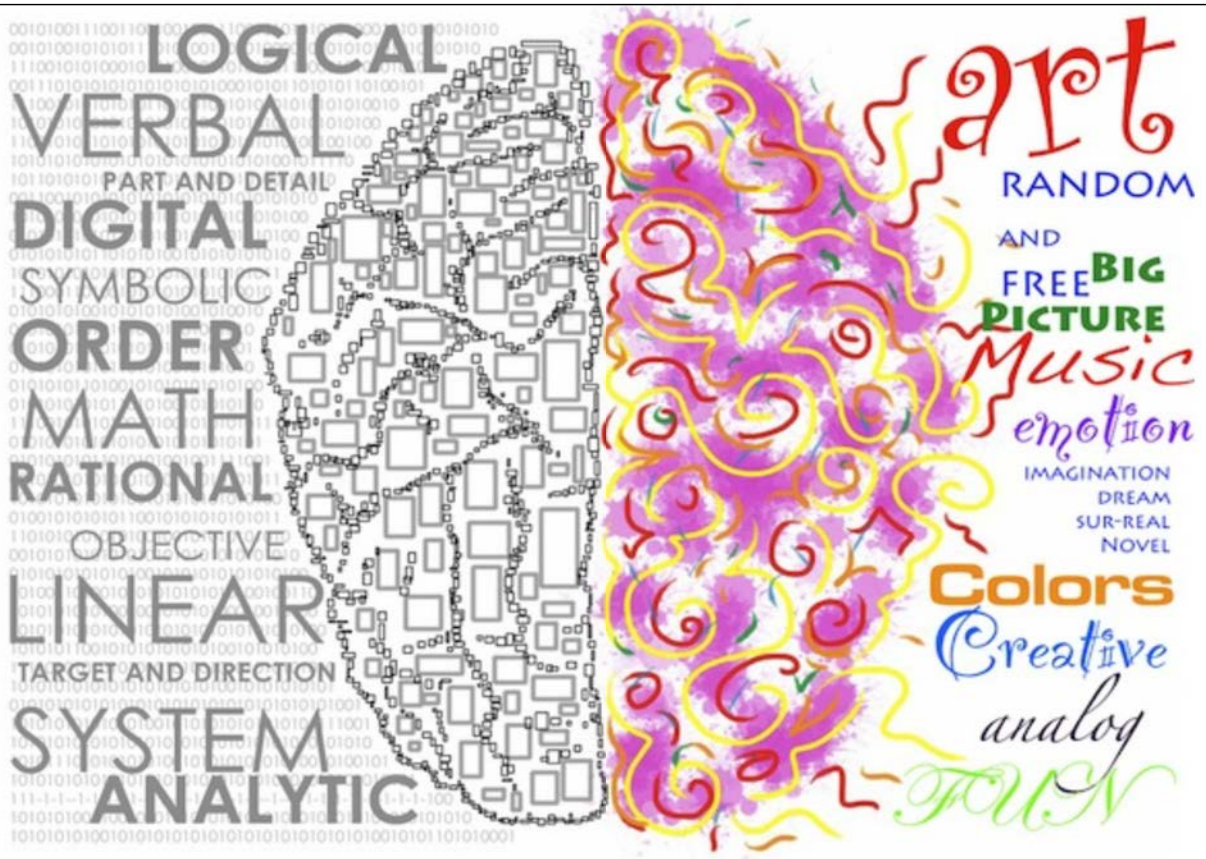


17

占

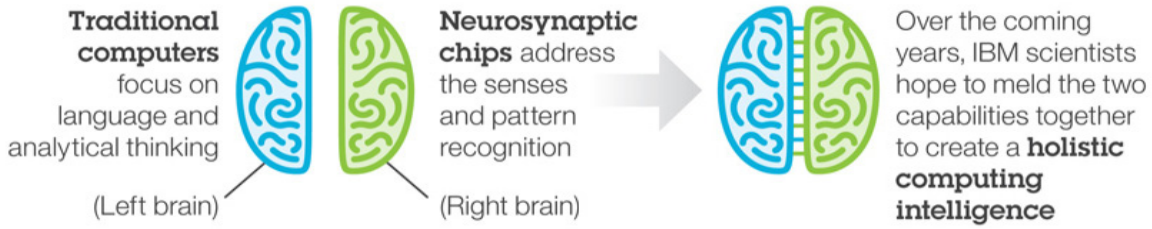


極數知來之謂占



21

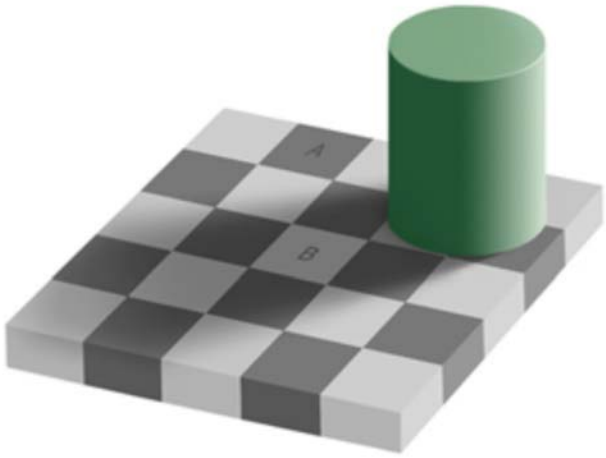
IBM, Neurosynaptic Computing



	2011	2014
Programmable neurons	256	1 million
Programmable synapses	262,144	256 million
Neurosynaptic cores	1	4,096

1/10th of a Watt powers the neurosynaptic chip's 256 million synapses
...with the goal to simulate 1 trillion synapses using only **4 kW of energy**

22

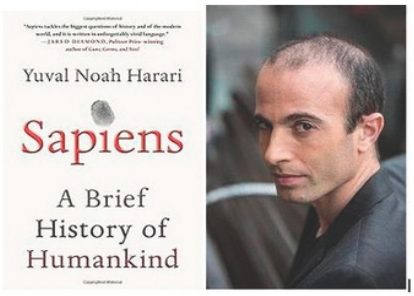


23

Shortsight, Myopia

"Human did not have the ability to grasp the overall results from their decisions"

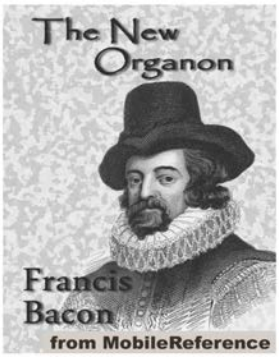
- From "Sapiens", Yuval Noah Harari



人間万事
塞翁之馬

24

Human Understanding …



"The human understanding when it has once adopted an opinion (either as being the received opinion or as being agreeable to itself) draws all things else to support and agree with it, And though there be a greater number and weight of instances to be found on the other side, yet these it either neglects and despises, or else by some distinction sets aside and rejects, in order that by this great and pernicious predetermination the authority of its former conclusions may remain inviolate."

- From "The New Organon", Francis Bacon (1622)

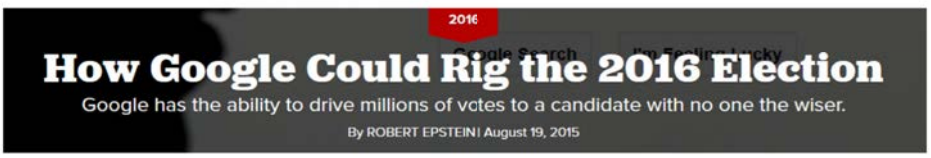
25

Big Nudge

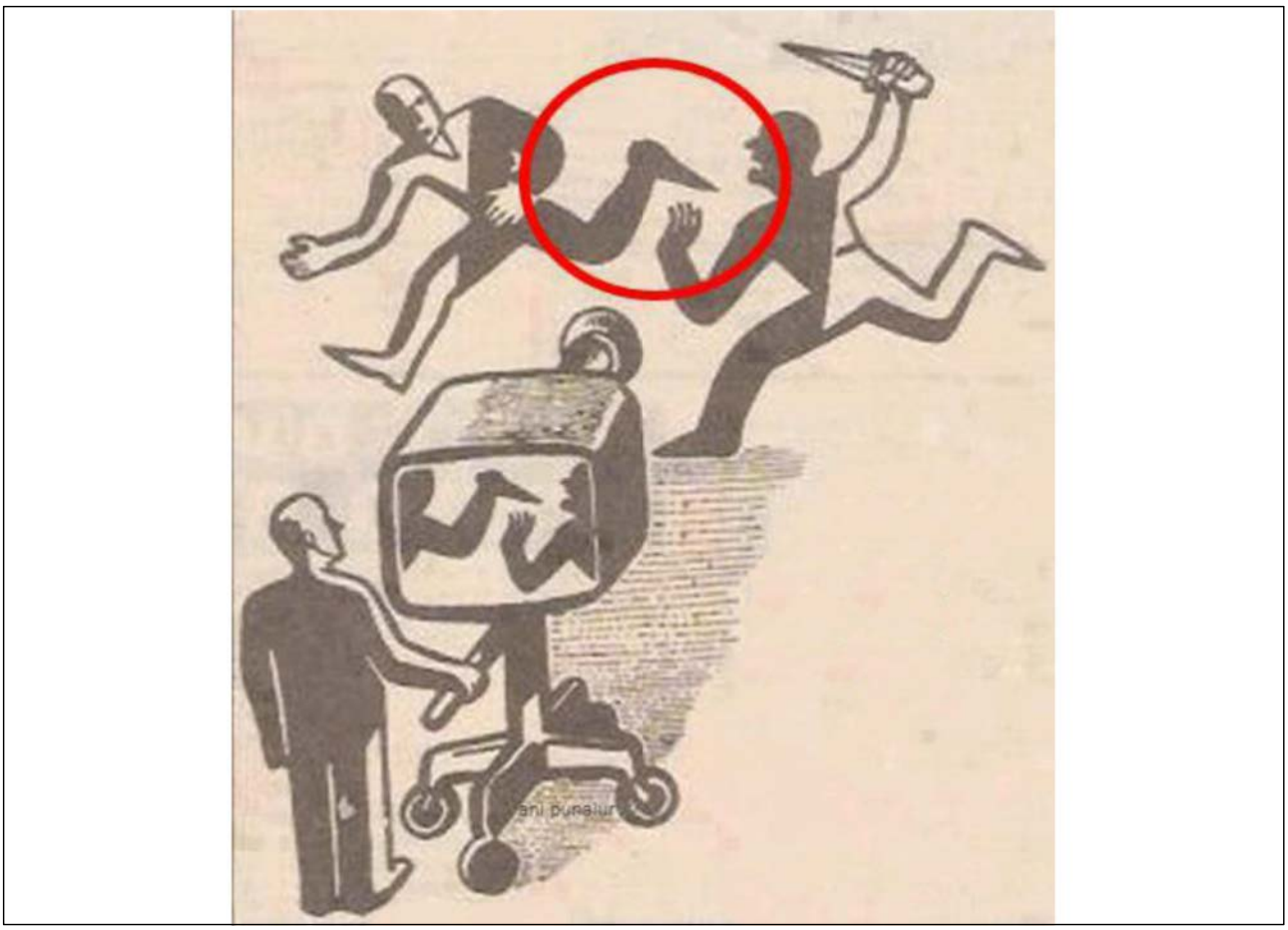
- (2012) Facebook deliberately made people sad.
  - Manipulating users' emotions (?)
  - https://www.theguardian.com/commentisfree/2014/jun/30/facebook-sad-manipulating-emotions-socially-responsible-company

- (2016) You may hate Donald Trump. But …
  - Manipulate voter behavior (?)
  - https://www.theguardian.com/commentisfree/2016/apr/19/donald-trump-facebook-election-manipulate-behavior?CMP=fb_gu

- Google's search algorithm can easily shift the voting preferences of undecided voters by 20 percent or more—up to 80 percent in some demographic groups—with virtually no one knowing they are being manipulated, according to experiments I conducted recently with Ronald E. Robertson



26



THE AVERAGE PERSON TODAY PROCESSES MORE DATA IN A SINGLE DAY THAN A PERSON IN THE 1500'S DID IN AN ENTIRE LIFETIME

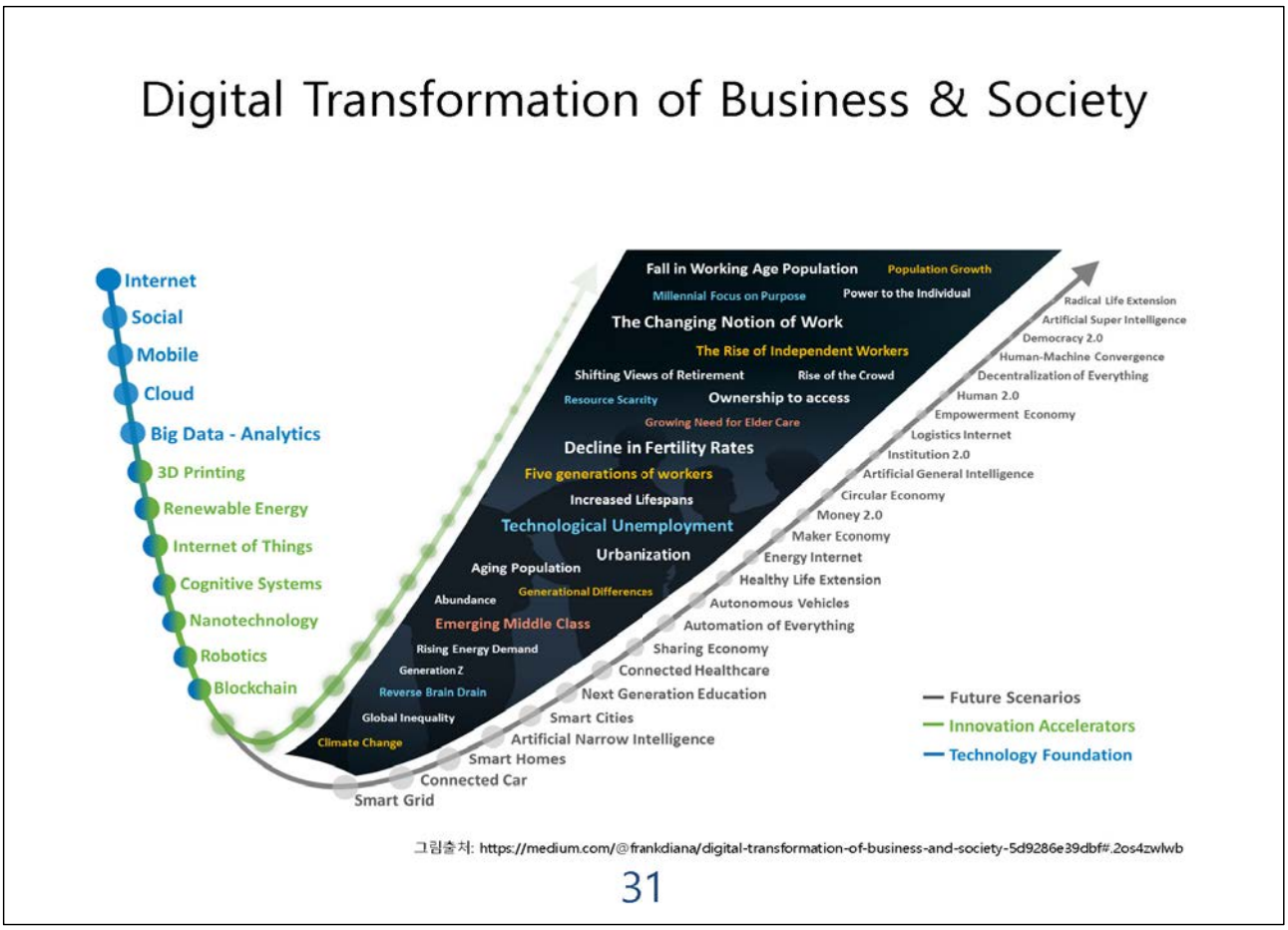
Google Books Project & Ngram Viewer

- Since 2004,
- Digitized more than 30 Million books
  - Havard U. (17M), Stanford U. (9M), Oxford U. (11M)
  - Russia National Library(15M), China (26M), Germany (25M)
  - Library of Congress, US (33M)
- Ngram Viewer for 8M books of them
  - https://books.google.com/ngrams

29

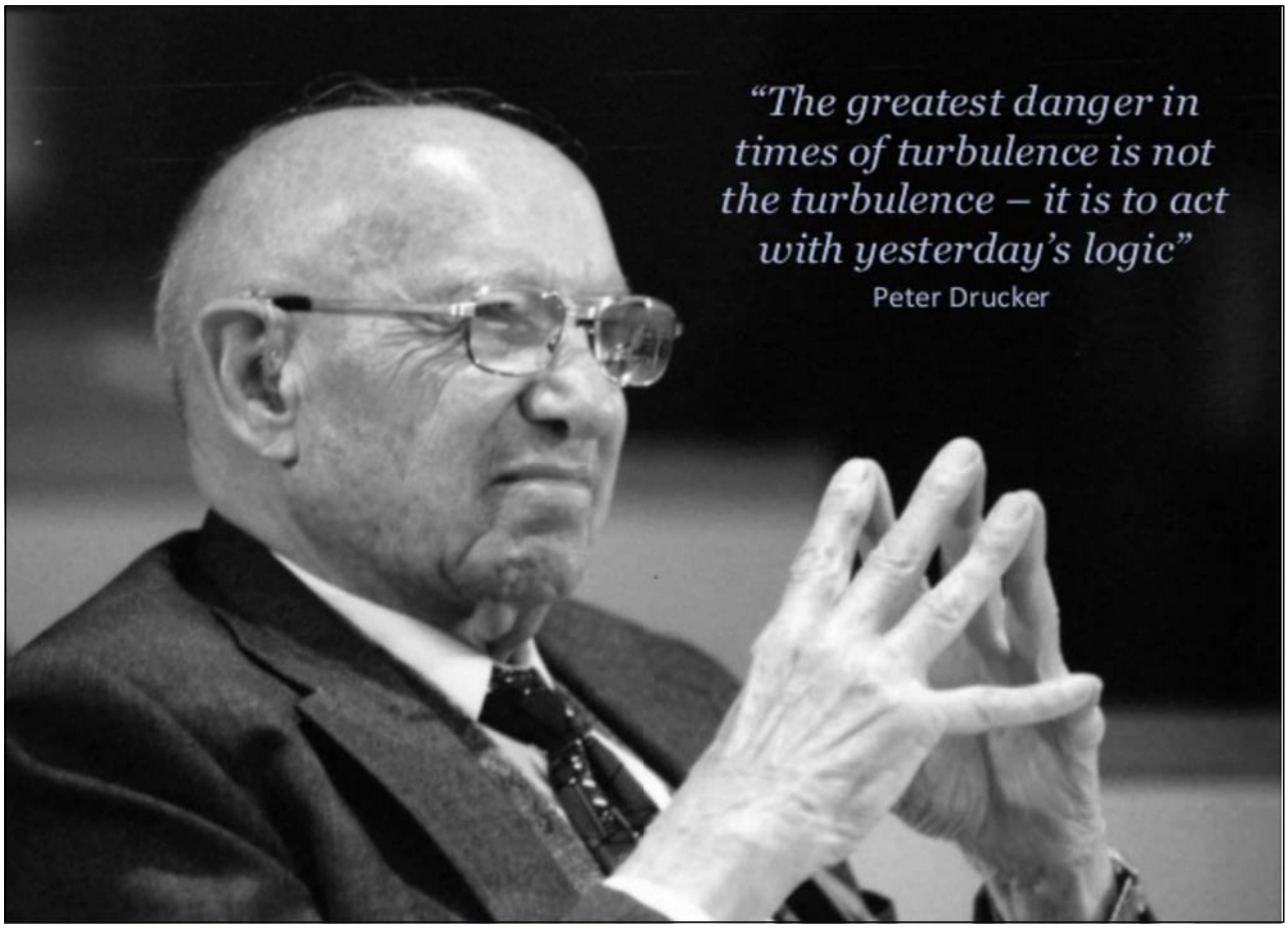
The United States are/is ...

30

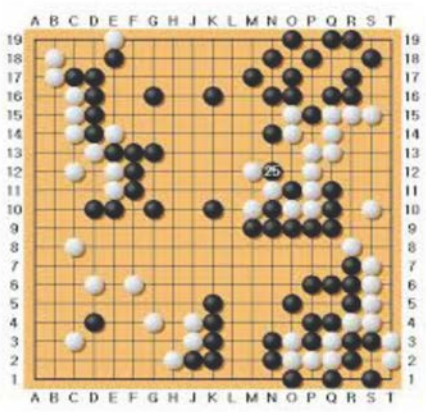


그림출처: https://medium.com/@frankdiana/digital-transformation-of-business-and-society-5d9286e39dbf#.2os4zwlwb

31



Machine Learning & Simulation



$361(19x19)! = 10^{800}$

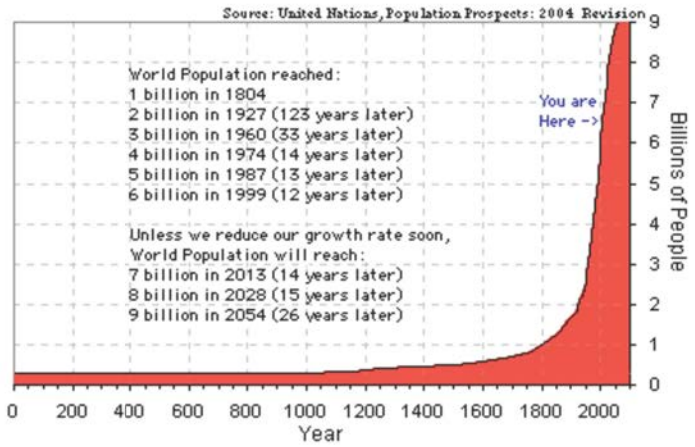
10^{120}

33

Machine Learning & Simulation

$361! = 10^{800}$ $10^{10} = 10$ Billion

Planetwide Scale → 10^{15}



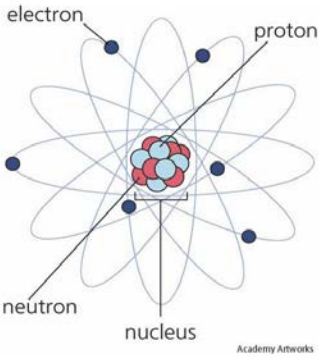
34

Machine Learning & Simulation

Atoms in Earth = 10^{50}

Stars in Cosmos = 10^{23}

Baryon in Cosmos = 10^{80}



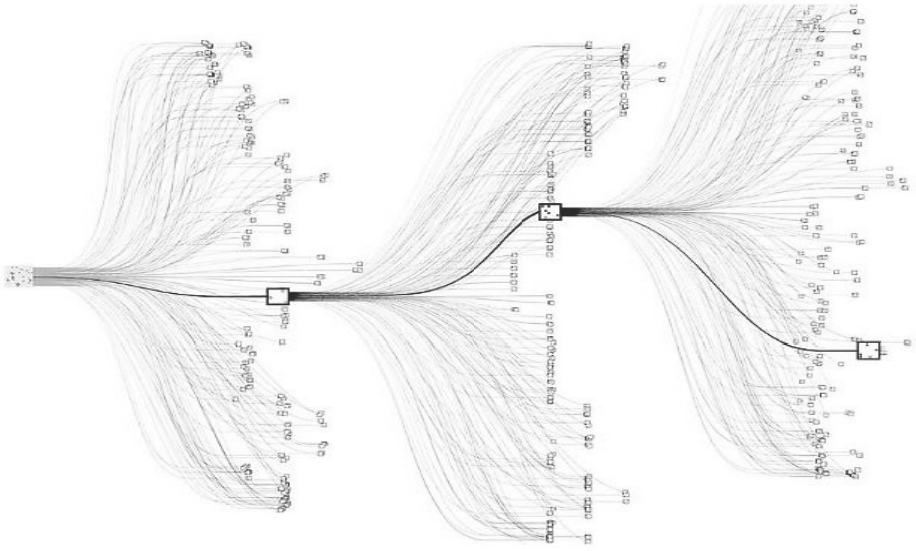
Cosmic Scale → 10^{50} ~ 10^{80}

35

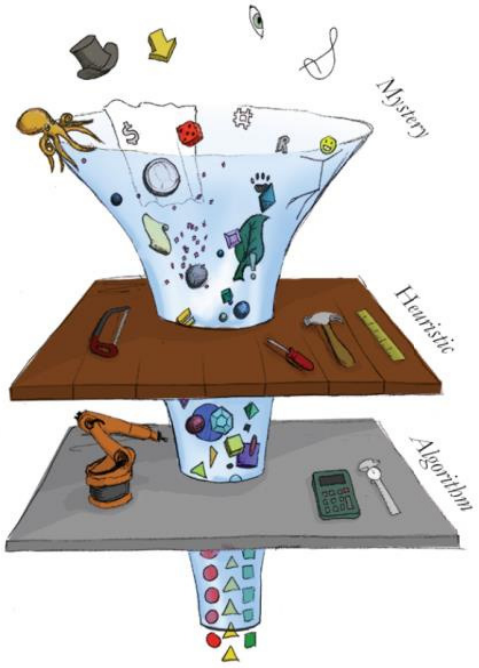
Machine Learning & Simulation

361! = 10^{800}

10^{80}



36



Big Data

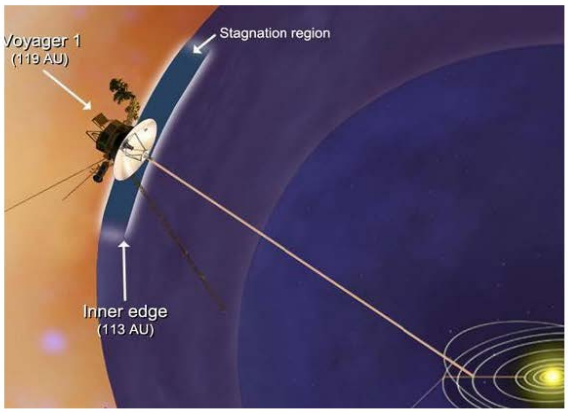
Cognitive Computing (Machine Learning)

Simulation

37

Voyager to the unknown event space

- AlphaGo has explored the unexperienced event space for the match
- Since 1977, Voyager has been reaching to the edge of the solar system
- AI (with Simulation) should explore the unknown event space for our society

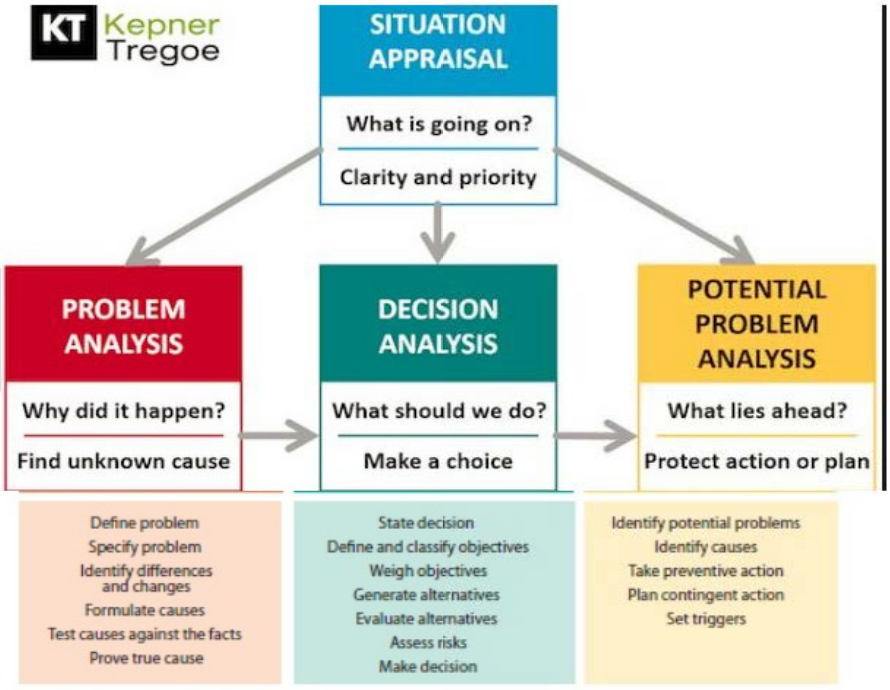


38

Government 3.0 vs. Industry 4.0
Simulation Business, Industry, Economy, Society

DYNAMIC GOVERNANCE

Kepner-Tregoe Analysis (1958)



41

Complicated vs. Complex

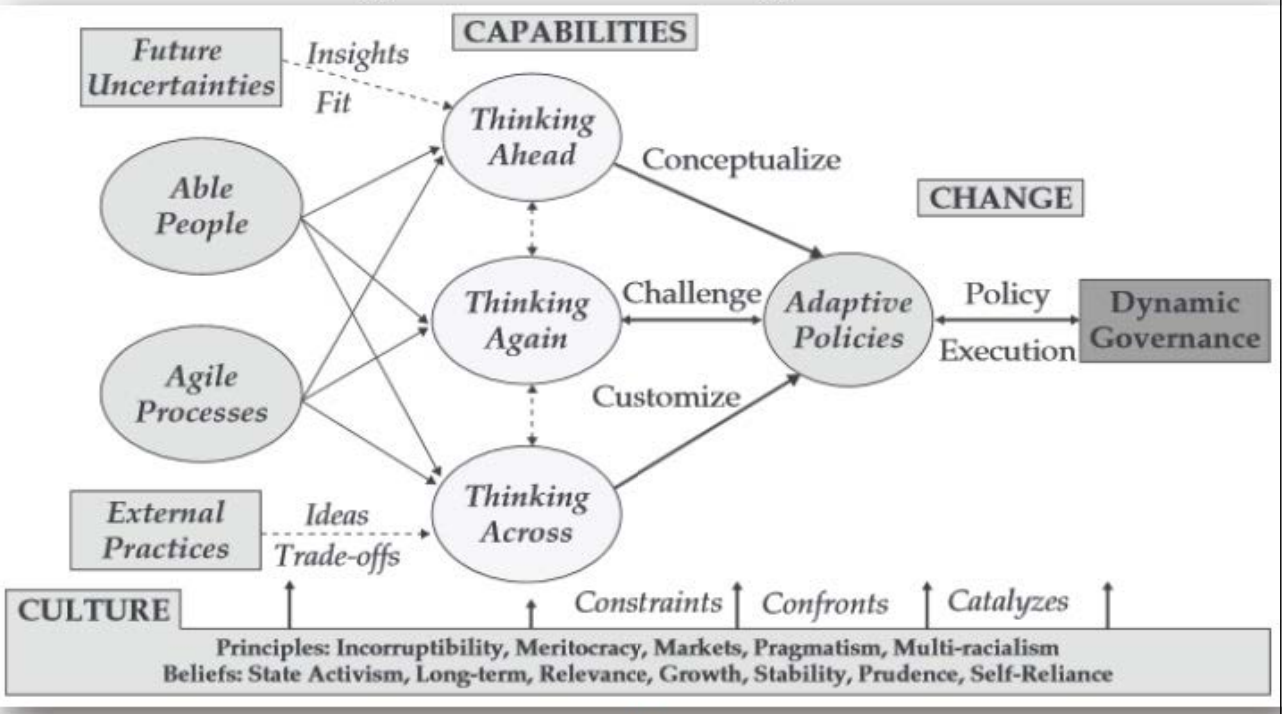
The difference between the complicated and the complex

- Complicated systems operate in standardized ways. Here, imprecision is diminished, non-objectivity and uncertainty are reduced as far as possible. Can be described through non-ambiguous cause-and-effect chains Are externally controllable.
- Any high-precision machine is complicated: Everything is cone to avoid imprecision/to increase precision. A watch, for example, is calibrated to diminish mistakes, uncertainty and illusion. It is configured to supply objective data, certainty and a minimum of illusion.

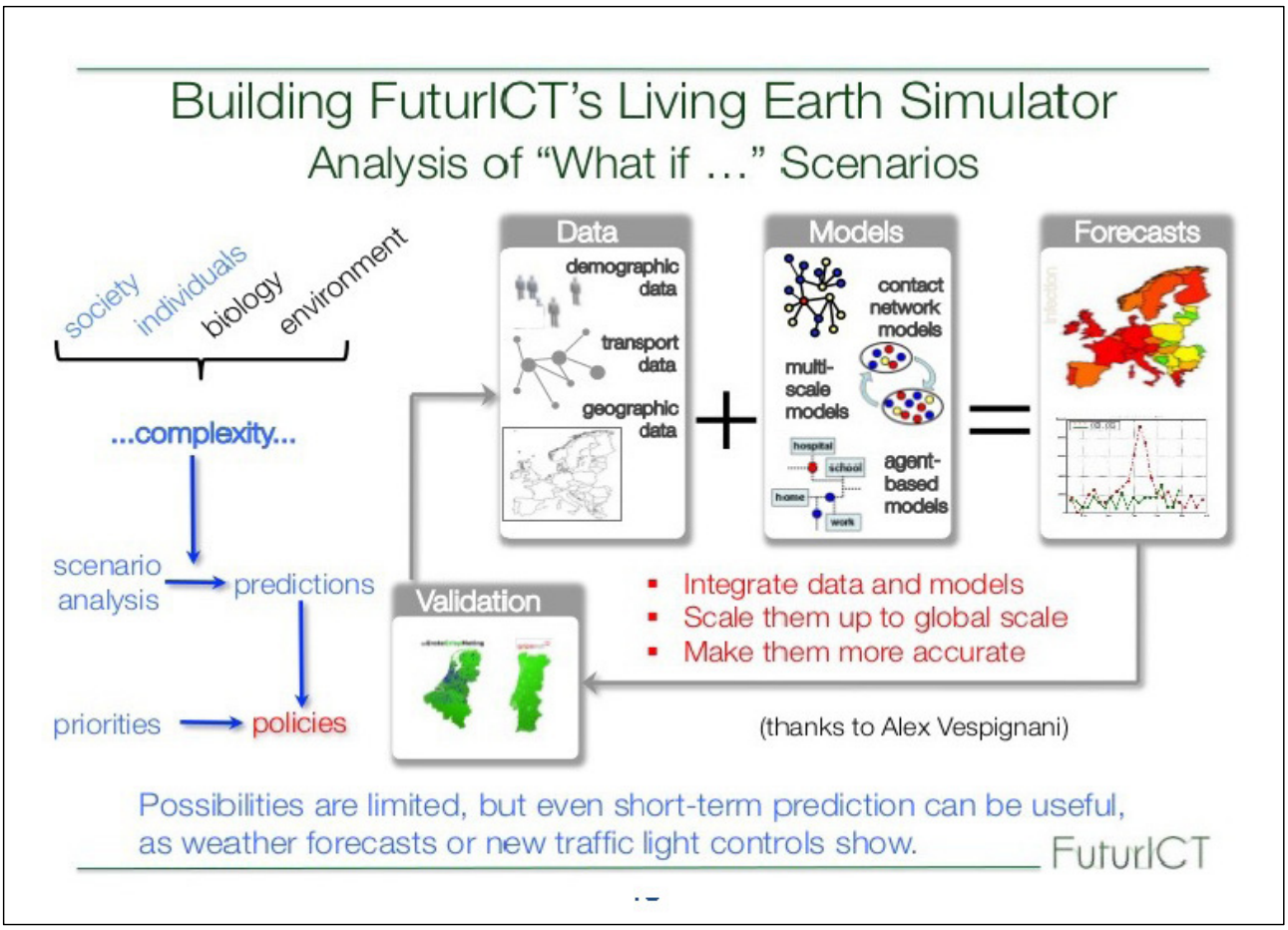
- Complex systems have presence or participation of living creatures. They are living systems - that's why they may change at any moment. Such systems are only externally observable – not controllable.
- A complex systems´ behavior is non-predictable. Here, it's natural that there is a level of error, uncertainty and illusion that is much higher than in complicated systems.
  A complex system may possess elements that can operate in standardized ways, but their interaction would be constantly changing, in discontinuous ways

42

Thinking Ahead, Again, Across



44



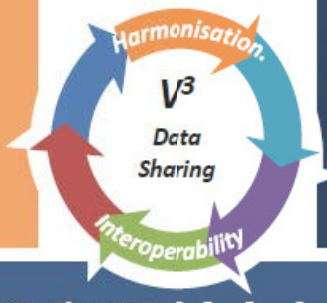
Data Sharing

- Cooperative Administration
  - Human, Process, **Data**
  - Boundaryless Data Flow ?
- Connect, Collect, Comprehend → Create (OpenData Foundation)
- Data Association, not just colleting
  - Data-rich vs. Data-driven

Virtual Singapore → Most accurate virtual representation

Data Platform

2D, 3D data, geometric/image data, information coordinated through existing geospatial and non-geospatial platforms (GeoSpace, OneMap, data.gov.sg, People Hub, Business Hub)



Apps / Modelling & Simulations

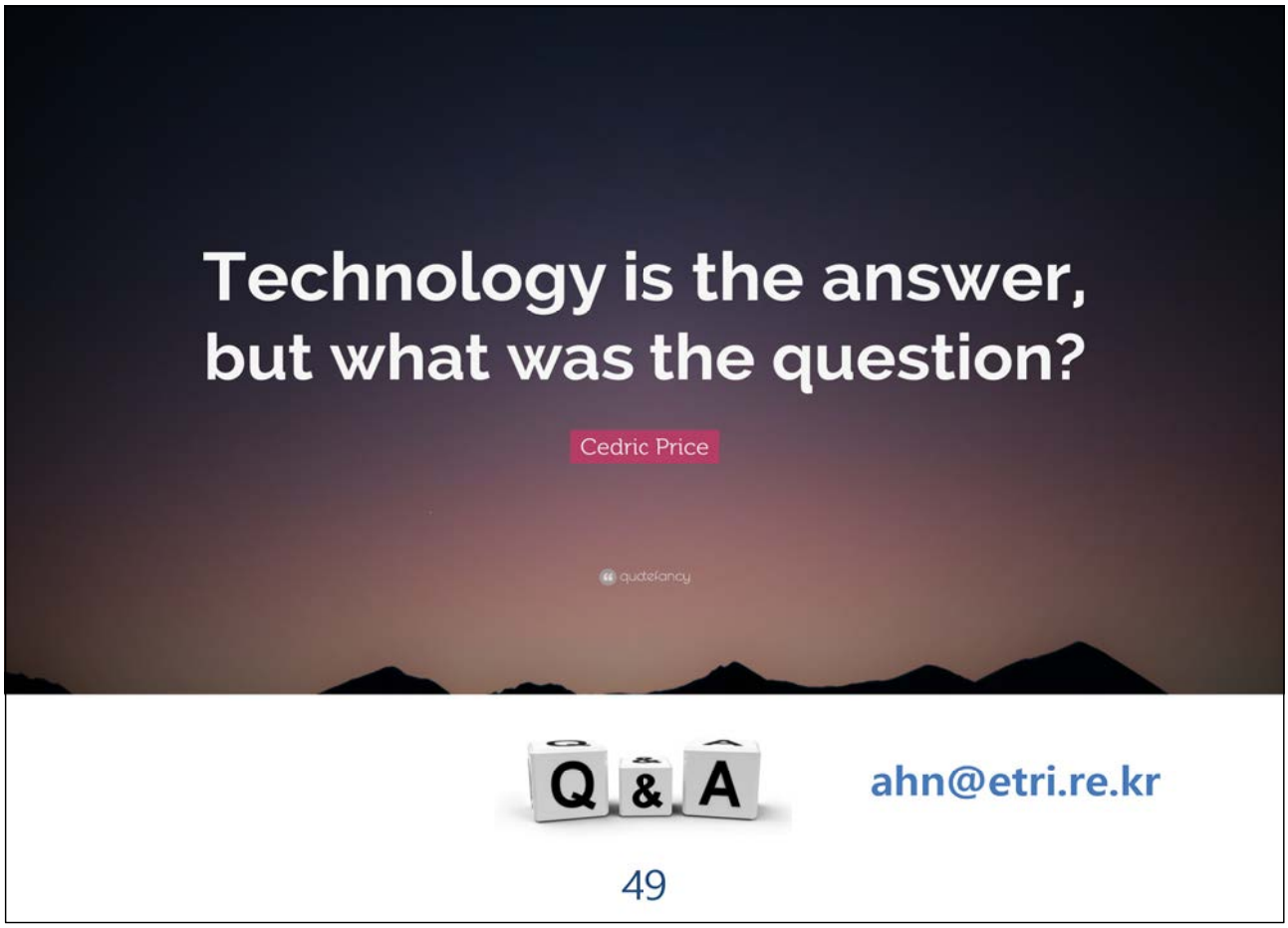
- Microclimatic Model,
- Noise distribution Model,
- Radio wave propagation Model
- Emergency Evacuation

3D City Model Platform

Most accurate digital model of Singapore City State

- Realistic and integrated three-dimensional (3D) model with **semantics** and **attributes** in Virtual Space
- Using advanced information modelling technology to infuse VS with different sources of static and dynamic city data and information e.g. demographics, movements, climates.

47



ahn@etri.re.kr

49

Session

A New Methodology for Geodemographics Using Open and Commercial Big Data

Alex Singleton

Professor, The University of Liverpool

A New Methodology for Geodemographics Using Open and Commercial Big Data

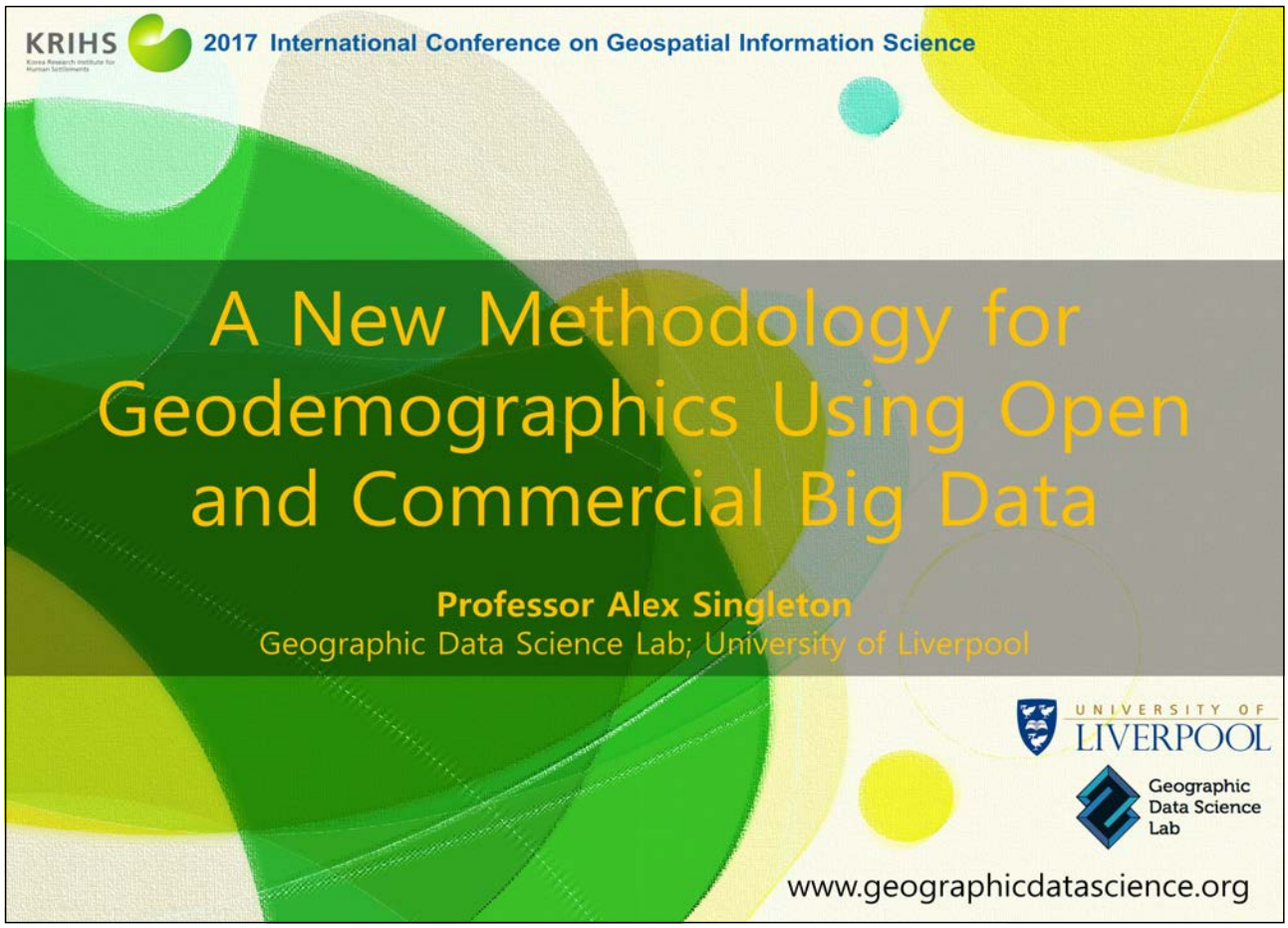
Alex Singleton

alex.singleton@liverpool.ac.kr

Department of Geographic Information Science, The University of Liverpool

Abstract

Abstract: Since the early to mid 2000s, the UK government has pushed to release open data concerning attributes of the population through both purposeful surveys such as the Census and also transactional data collected during the operation of public services. Unlike previous data dissemination regimes, an open license enabled the data to be more freely distributed and re-used for applications without cost, including commercial products. For research, principles of open geographic information science through automated workflows enabled more robust science to be produced, linking data, analysis and outputs. However, although showing great early promise, the realisation of a truly open data economy within the UK has been much more muted, and recent developments have in fact reversed these previously positive trends. This paper considers the changing political economy of open data in the context of building classifications of urban structure, which in the UK are commonly referred to as geodemographics. We present a new model of building geodemographics with a hybrid methodology that can accommodate the various licenses under which contemporary data within the UK are released.

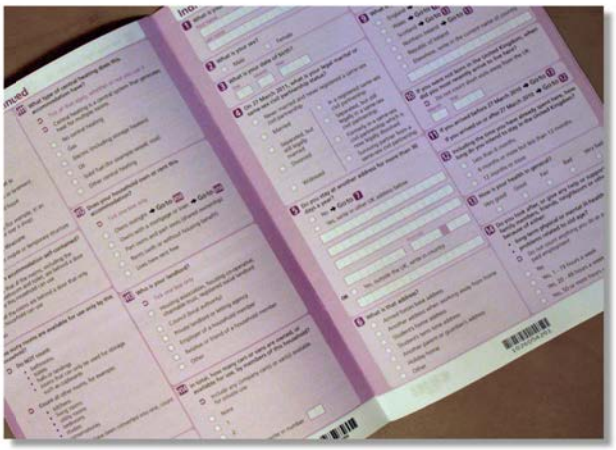


CONTENTS

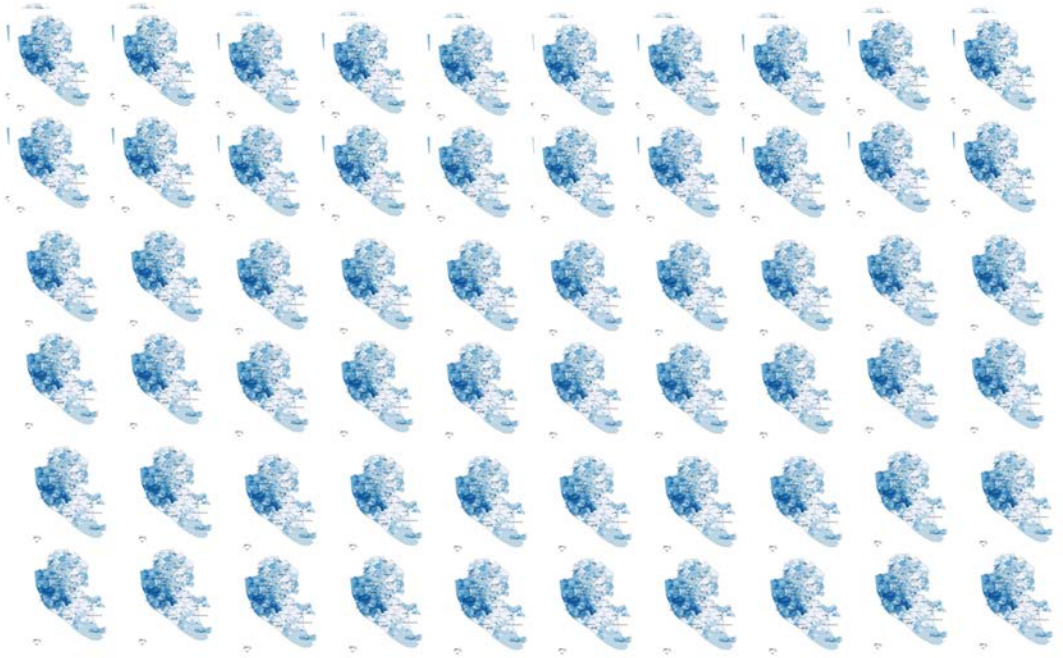
1. What are geodemographics?
2. Open Data and Open Geodemographics
3. Hybrid Geodemographics
4. London Workplace Zone Classification
5. Conclusions / Future

1. What are geodemographics

1. What are Geodemographics?



1. What are Geodemographics?

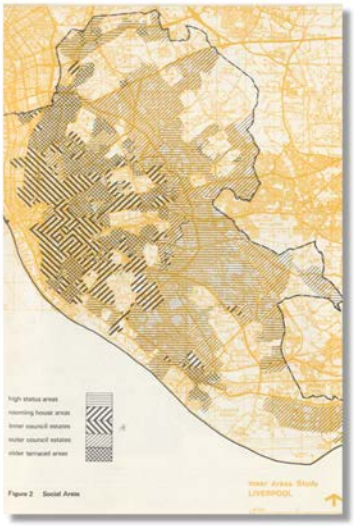


A New Methodology for Geodemographics Using Open and Commercial Big Data

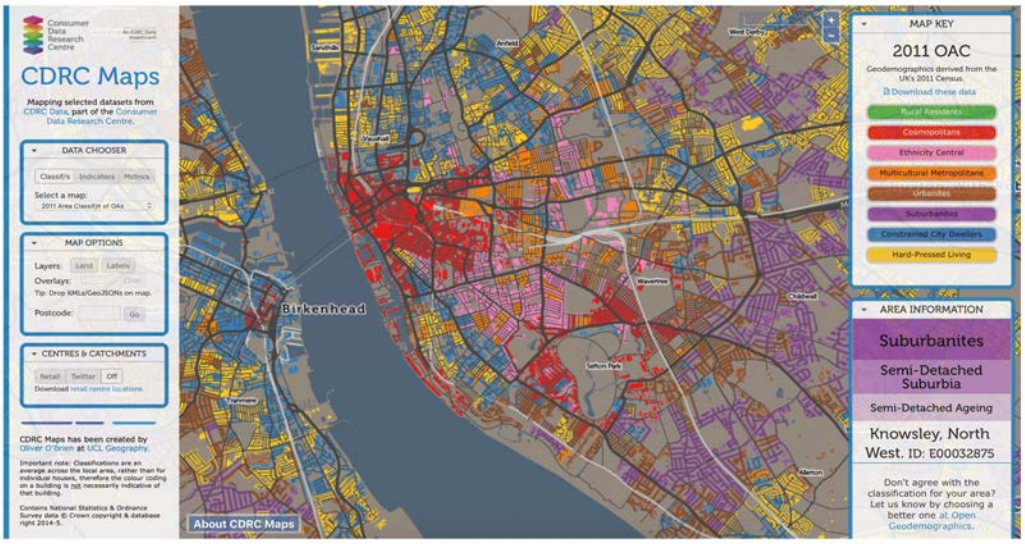
1. What are Geodemographics?

"What is needed is a solution which will **pick out pattern from the detail, without loosing too much of the original information**, and which will admit more detailed examination of parts of the pattern which become relevant to a particular issue or local area as and when required"

Webber (1978, 275).



1. What are Geodemographics?



https://maps.cdrc.ac.uk/#/geodemographics/oac11

1. What are Geodemographics?

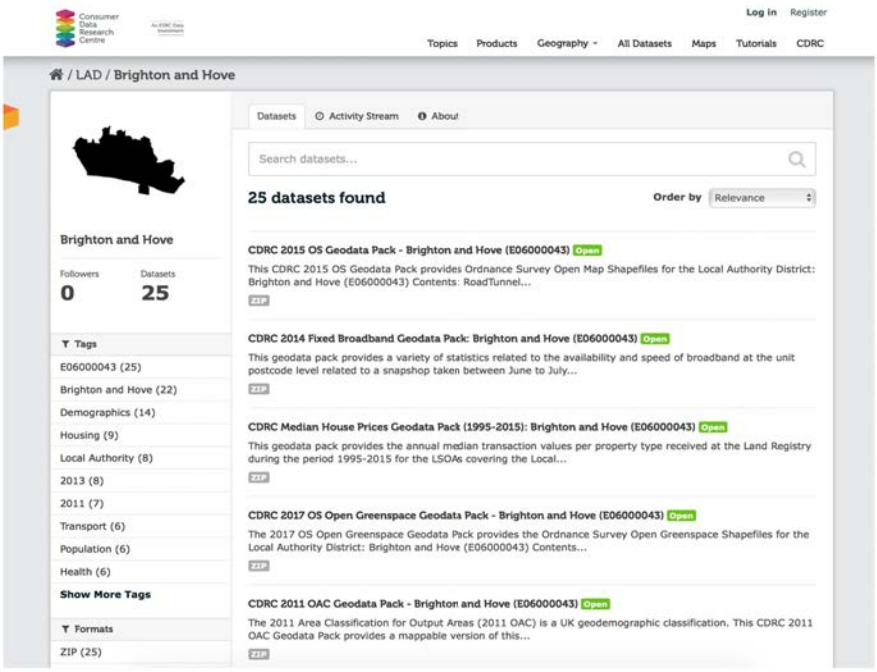
2. Open Data and Open Geodemographics

Open Data has many definitions

- Freely available to everyone
- Reused as people wish (even for commercial applications)
- Within the UK
  - Specific "*Open Government License*"

A New Methodology for Geodemographics Using Open and Commercial Big Data

2. Open Data and Open Geodemographics



data.cdrc.ac.uk

2. Open Data and Open Geodemographics

Types of Geodemographics

- Commercial

440 Variables
- 62% Experian Data
- 38% Census Estimates

67 Types
15 Groups

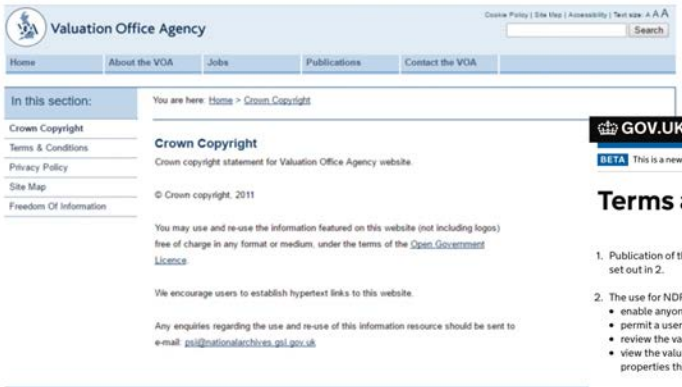
- Open

41 Variables
100% Census
7 SuperGroups
21 Groups
52 SubGroups

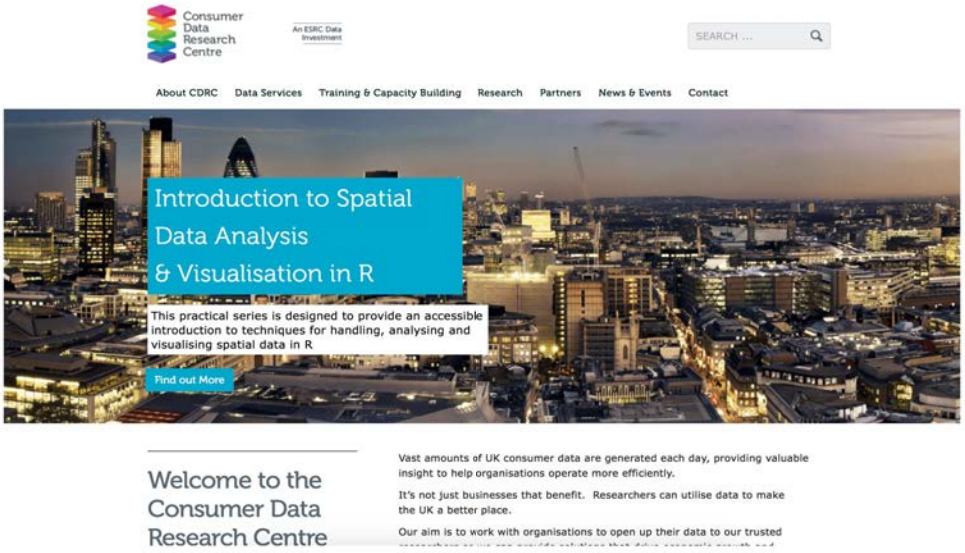
2. Open Data and Open Geodemographics

Some recent changes

- OGL – swapped for more restrictive licenses

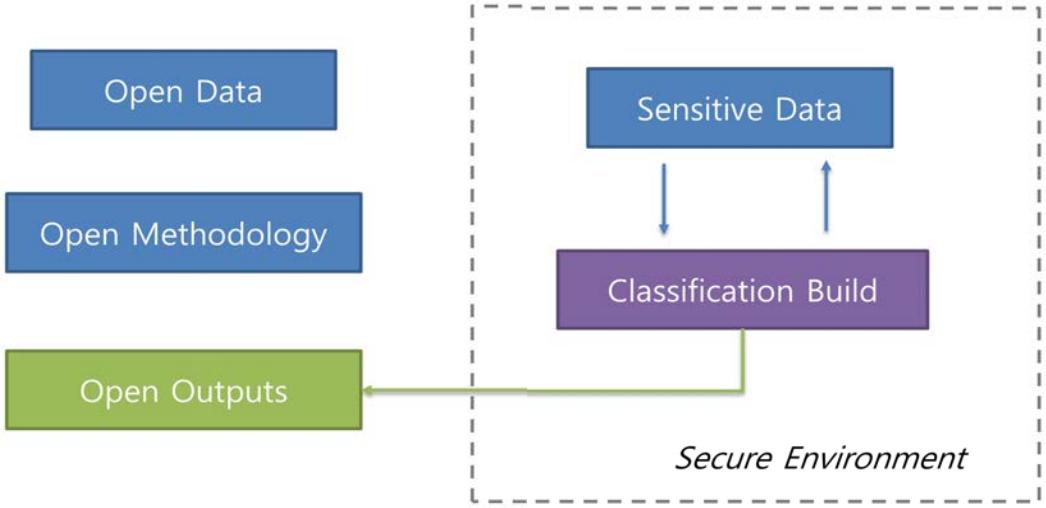


3. Hybrid Geodemographics

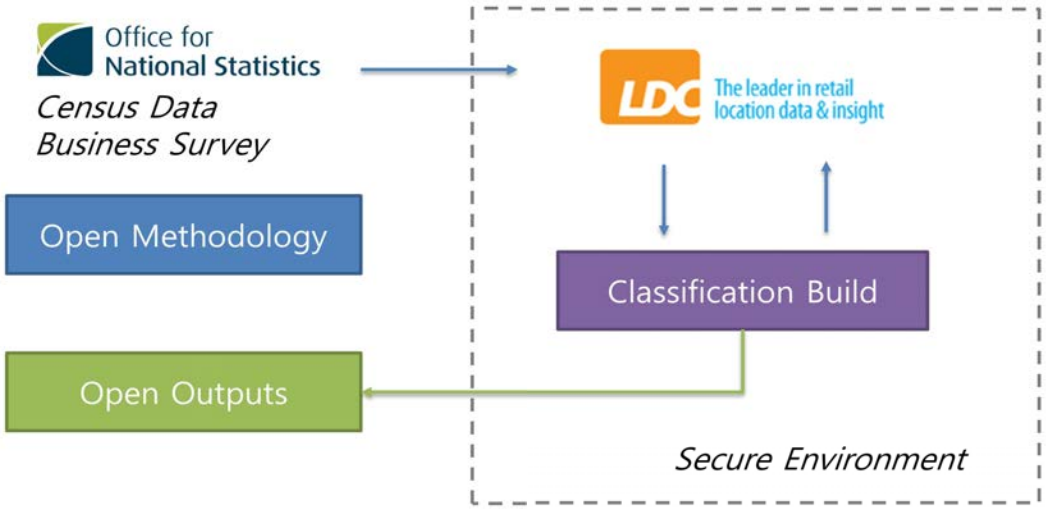


3. Hybrid Geodemographics

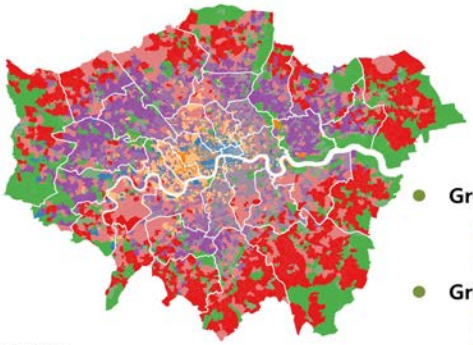
3. Hybrid Geodemographics



3. Hybrid Geodemographics

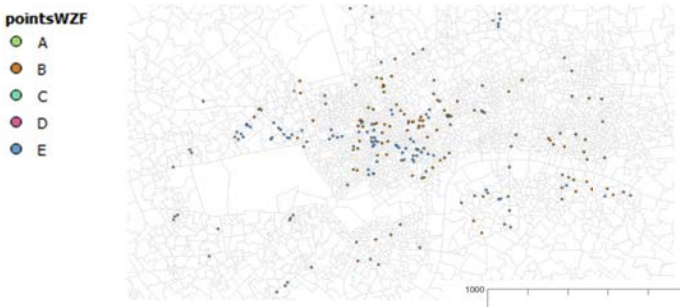


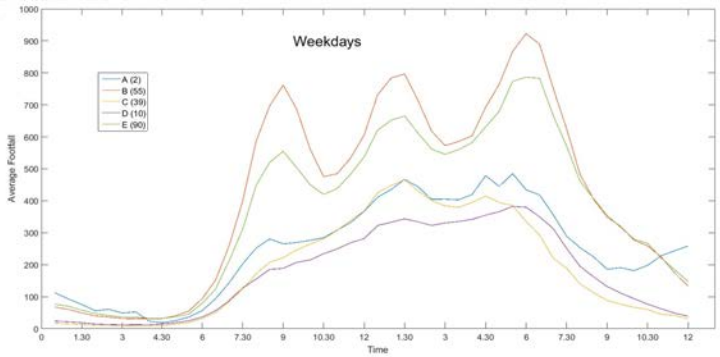
1. Overview



- **Group – A: Residential Services**
  - A1: Predominantly older, local education and health workers
  - A2: Lowly qualified workers in construction and allied local trades
- **Group – B: City Focus**
  - B1: Dynamic financial centres with extended operating hours
  - B2: Professional, retail and leisure Services in dynamic central locations
- **Group – C: Infrastructure Support**
  - C1: Younger customer service workers in wholesale or retail occupations
  - C2: Blue collar, manufacturing and transport services
- **Group – D: Integrating and Independent Service Providers**
  - D1: Health care support staff and routine service occupations
  - D2 Locally sourced, home helps and domestic or manual workers
  - D3: Travelling or home-based general service providers
- **Group – E: Metropolitan Destinations**
  - E1: High street destinations and domestic employers
  - E2: Accessible retail, leisure and tourist services

4. London Workplace Zone Classification





5. Conclusions / Future

- Open Data License tightening is a worry trend in the UK
- Potentially a problem for Open Geodemographics
- Hybrid geodemographics can offer a solution
- London WZ classification illustrates buy in from government of this approach
- Secure data infrastructure such as the CDRC are critically important in this evolved data economy

KRIHS 2017 International Conference on Geospatial Information Science

THANK YOU

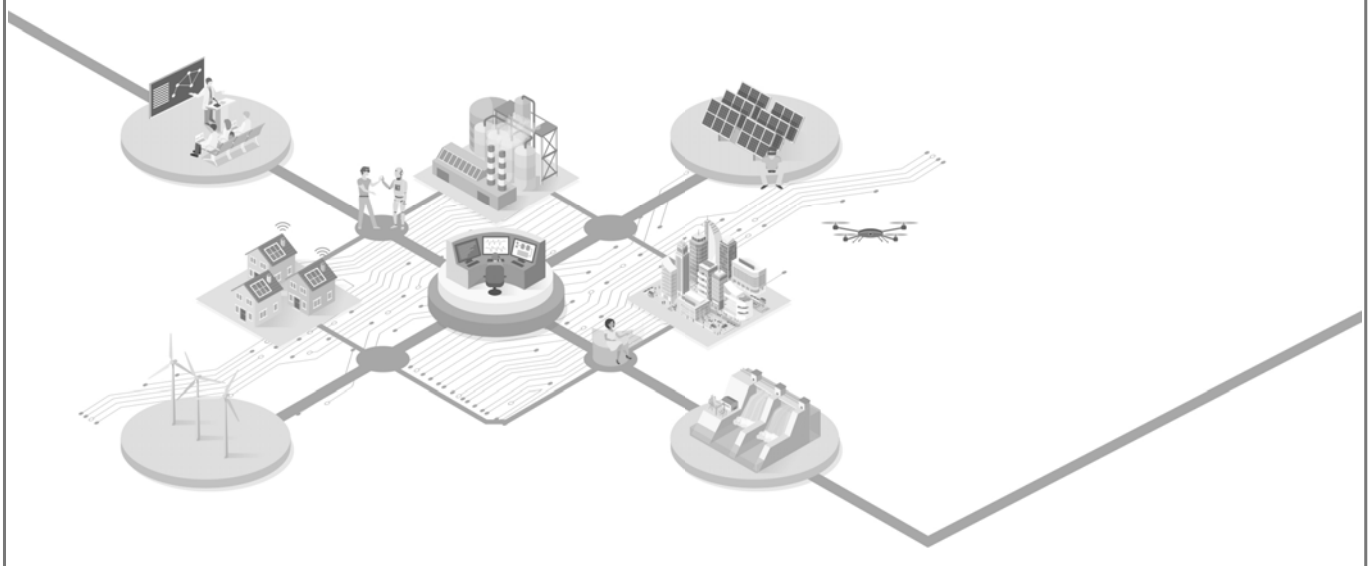
Agenda :
What role should the geospatial information play in the era of 4th industrial revolution

주제 :
4차 산업혁명 시대 공간정보 역할은 무엇인가?

- **Keynote**

  Keynote/ ***Ryosuke Shibasaki,*** Professor, The University of Tokyo

  발제발표/ **료스케 시바사키,** 동경대학 교수



Keynote

Ryosuke Shibasaki
Professor, The University of Tokyo

NSDI and its Future

Ryosuke Shibasaki
shiba@csis.u-tokyo.ac.jp
Center for Spatial Information Science, The University of Tokyo

Abstract

NSDI (National Spatial Data Infrastructure) started originally 1) to reduce the overlaps of geospatial data development among departments of national/local government and 2) to promote dissemination of public geospatial data products. NSDI has successfully accelerated the development of basic geospatial data products by a public sector, typically basic digital topo-maps as a common base map data, and a clearing house or geoportal that provide a one stop service of finding/downloading public geospatial products.

Nowadays, many companies in private sector have made a very large advances in terms of geospatial data acquisition and development, typically, real-time GPS data of vehicles and mobile devices (or people). Those emerging companies do not necessarily belong to traditional geospatial industries, such as mapping/surveying and GIS companies. Japan, through the experiences of a huge earthquake and tsunami disaster in 2011, learned that a very broad variety of geospatial data from the emerging companies could have a huge impact that could entirely change disaster response scenes. Nevertheless, NSDI tends to limit their scope to public geospatial data, assuming that new and innovative data applications could be developed if public data can be more easily accessed.

The author, however, believes that a major bottleneck of innovative geospatial data applications is not the accessibility to public data but the lack of efforts and schemes of encouraging integration of diverse data for unique applications. The author introduces recent efforts in Japan to promote the development of unique data applications based collaboration of diverse data holders and analytics experts.

What can (should) national government do to better usage or applications of geospatial information?

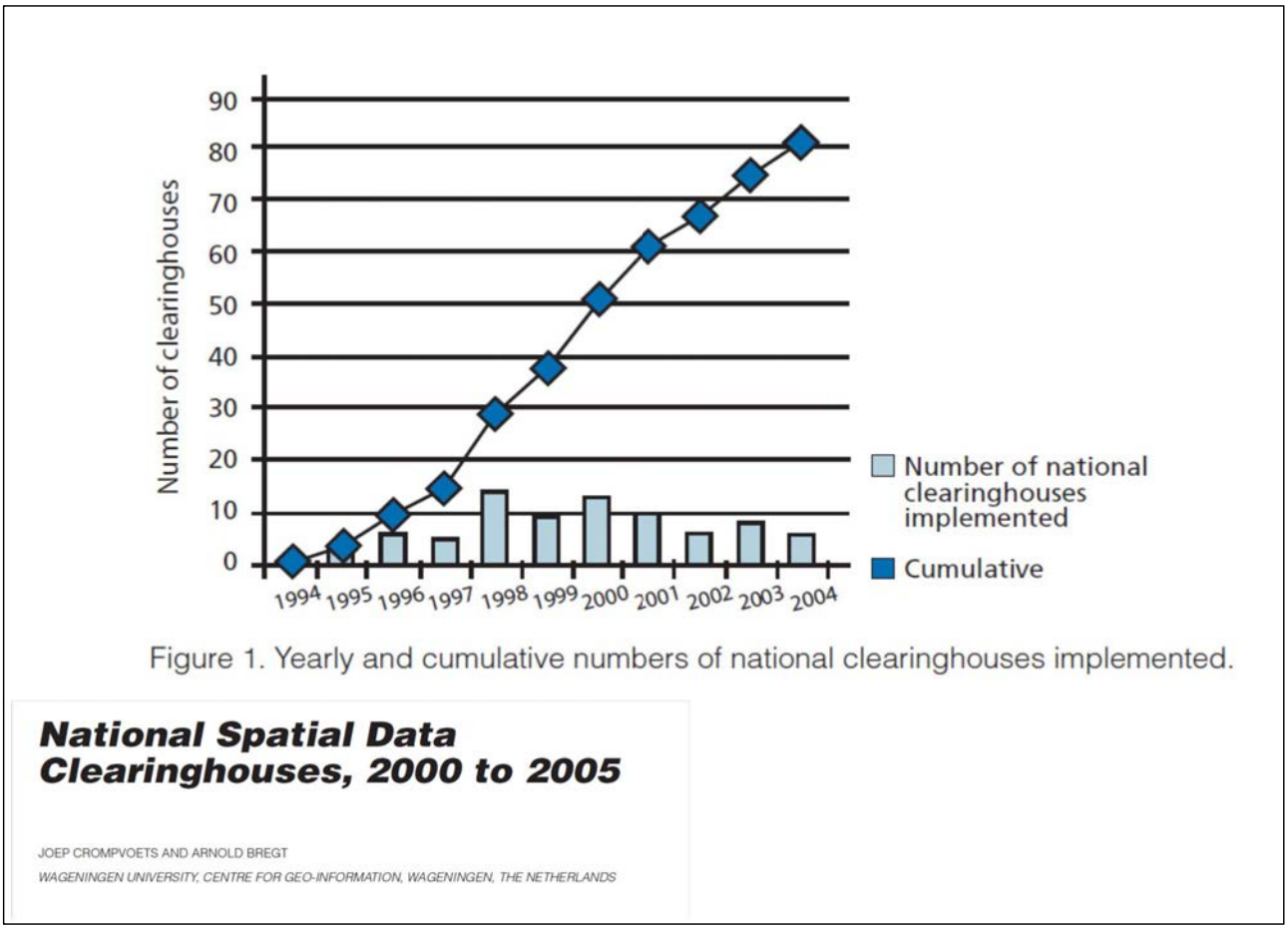


Figure 1. Yearly and cumulative numbers of national clearinghouses implemented.

National Spatial Data Clearinghouses, 2000 to 2005

JOEP CROMPVOETS AND ARNOLD BREGT
WAGENINGEN UNIVERSITY, CENTRE FOR GEO-INFORMATION, WAGENINGEN, THE NETHERLANDS

Article

Disappointing NSDI National Clearinghouse Survey - 28/09/2005

International Developments, Status, Suitability and Spatial Distribution

Joep Crompvoets, Arnold Bregt and Marjolein van Adrichem, Wageningen University, The Netherlands

Many countries are working on a National Spatial Data Infrastructure (NSDI) to create an efficient environment for accessing spatial data. One of the main components is the national clearinghouse. The authors conducted a web survey to trace current developments, status, suitability and spatial distribution of clearinghouse implementation around the world.

A spatial data clearinghouse may be defined as an electronic facility for searching, viewing, transferring, ordering, advertising and/or disseminating spatial data from numerous sources via the internet and, when appropriate, providing complementary services. A clearinghouse usually consists of a number of servers containing information (metadata) about available digital data.

National Spatial Data Clearinghouses, 2000 to 2005

JOEP CROMPVOETS AND ARNOLD BREGT

WAGENINGEN UNIVERSITY, CENTRE FOR GEO-INFORMATION, WAGENINGEN, THE NETHERLANDS

ABSTRACT

One of the key features of a national spatial data infrastructure is a national clearinghouse for spatial data, which can be regarded as a network facilitating access to spatial data and related services. Between April 2000 and 2005, a longitudinal Web survey was undertaken to assess all national clearinghouses throughout the world and to identify critical factors for coordinators and policy makers. By April 2005, 83 countries had established national clearinghouses. However, low suitability and declining trends in use, content, and management were found. The reasons for these troubling trends could be the dissatisfaction of the GI community with the functional capability of clearinghouses and the piecemeal funding of the majority of these facilities. The main critical factors for success were identified as public awareness, Web services, user-friendly interfaces, metadata standard ISO19115, and continuous funding.

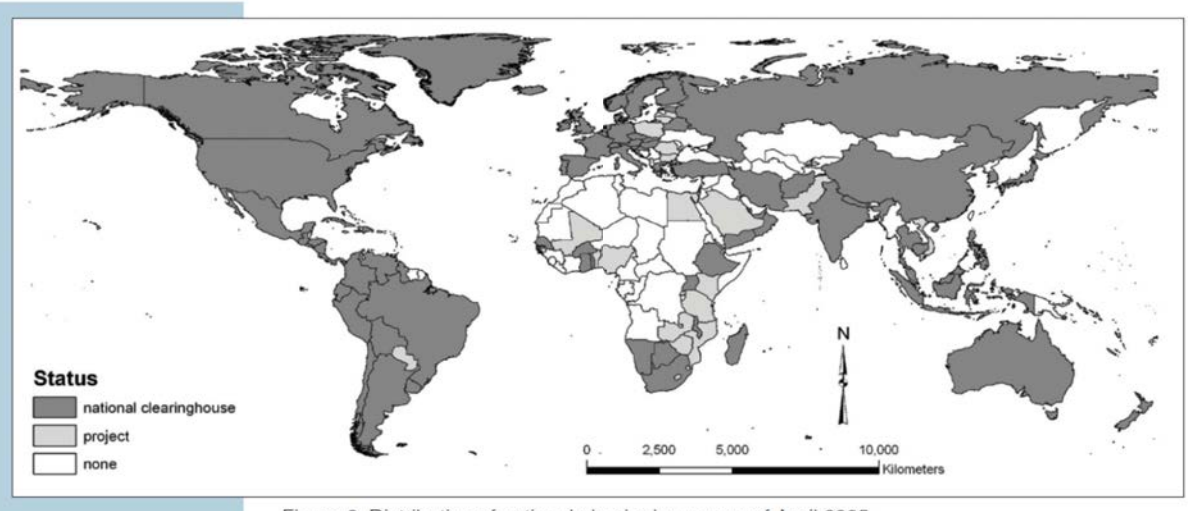


Figure 2. Distribution of national clearinghouses as of April 2005.
Courtesy of ESRI Data & Maps 2005.

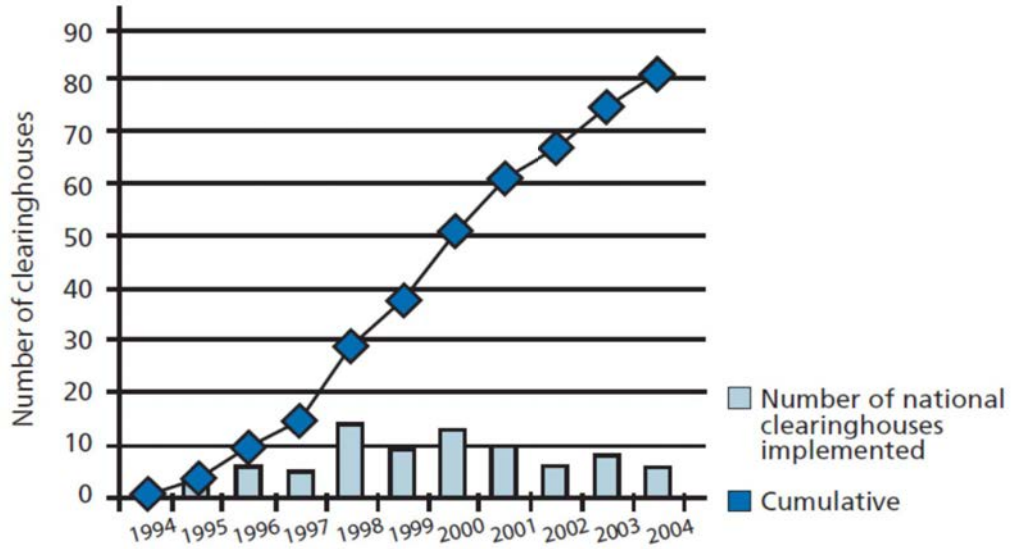


Figure 1. Yearly and cumulative numbers of national clearinghouses implemented.

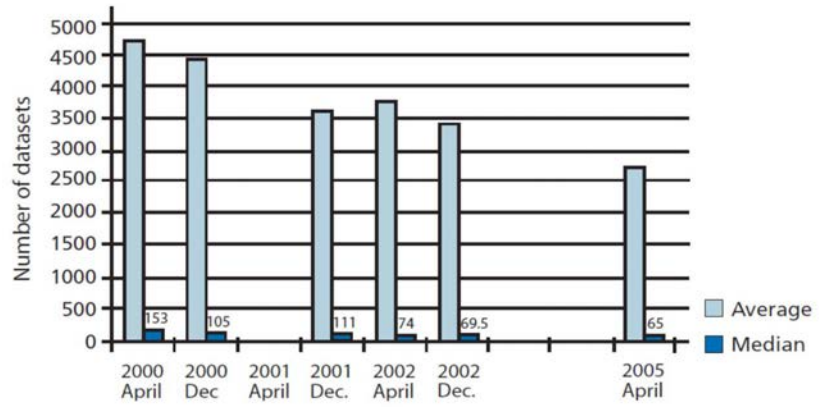


Figure 6. Numbers of datasets.

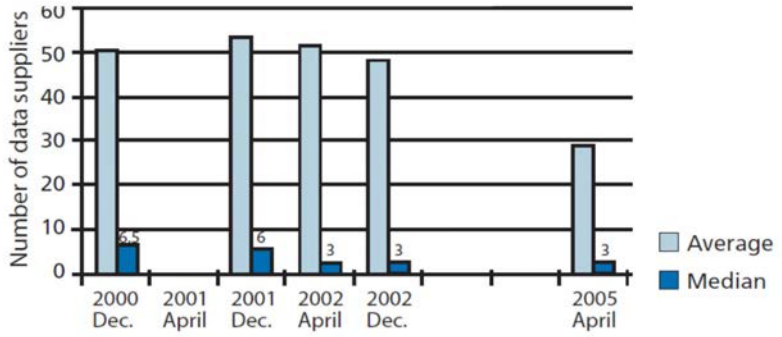


Figure 3. Numbers of data suppliers.

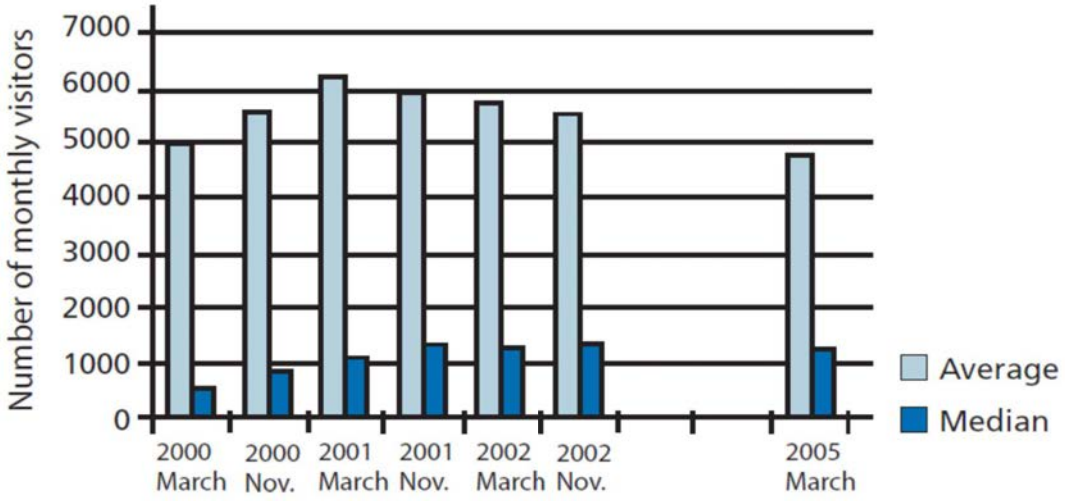
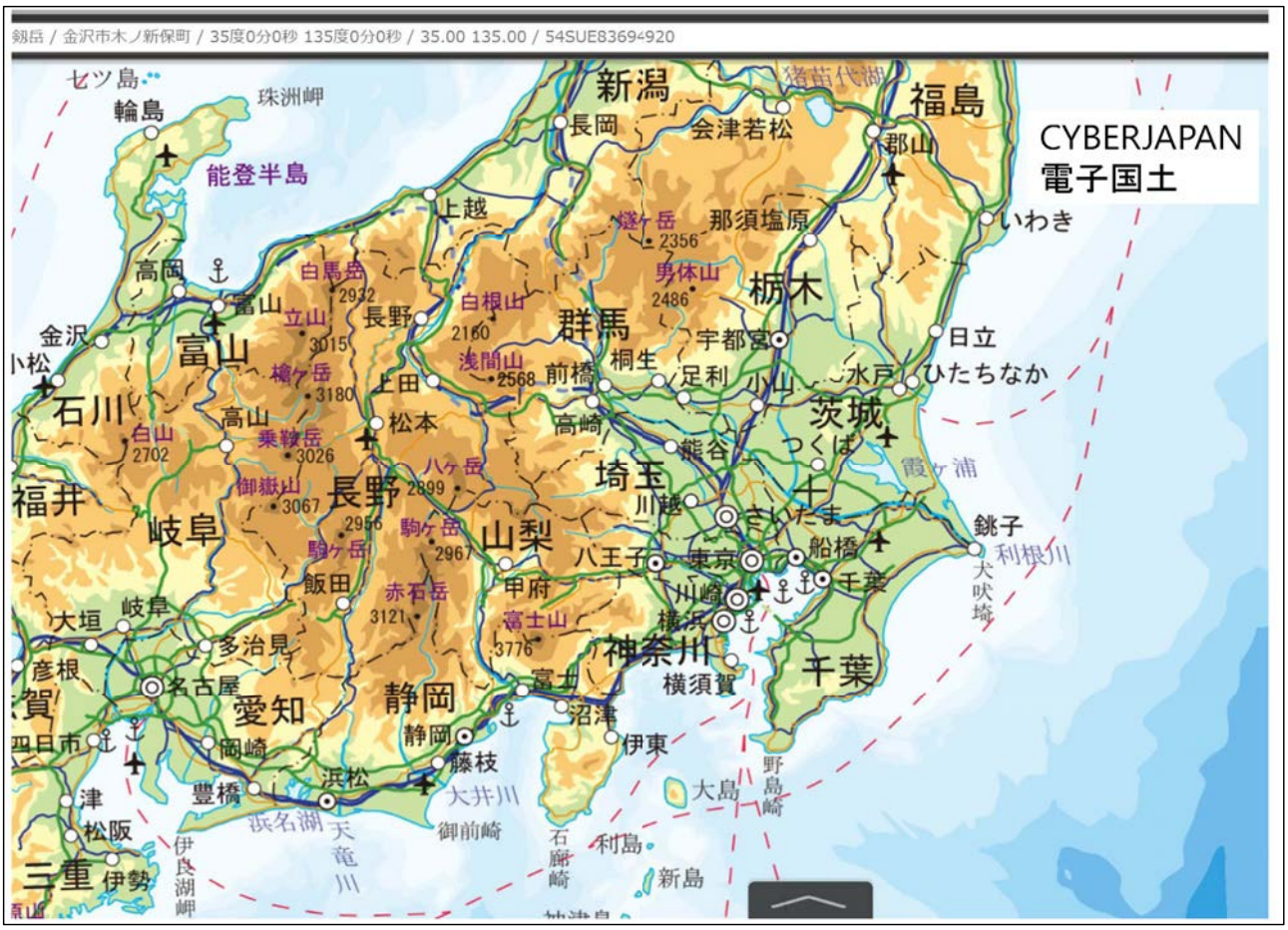
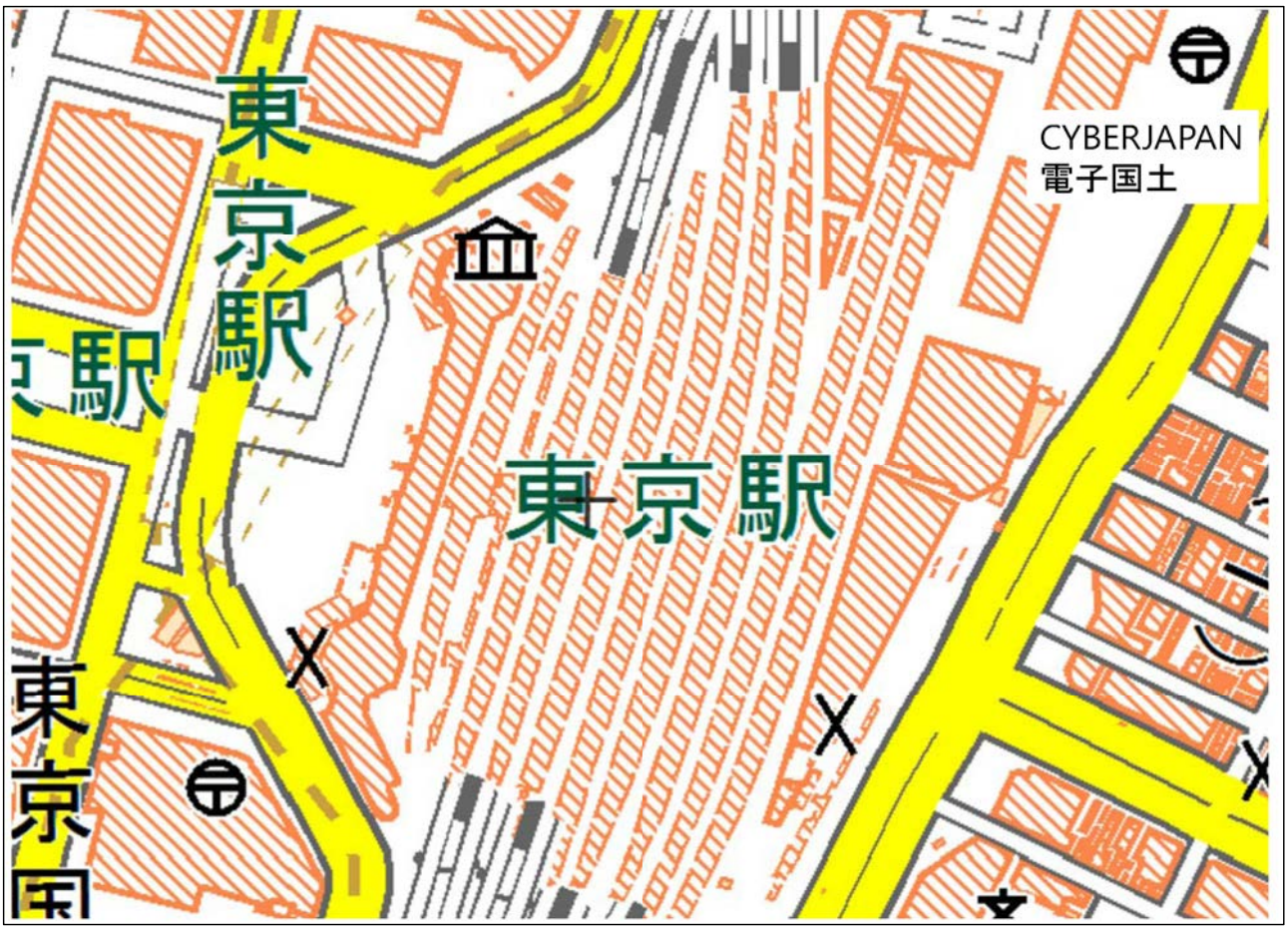


Figure 4. Numbers of monthly visitors.


CYBERJAPAN
電子国土
新潟
福島
長岡
会津若松
郡山
いわき
能登半島
上越
那須塩原
栃木
高岡
富山
長野
群馬
宇都宮
日立
金沢
小松
石川
前橋
桐生
足利
小山
水戸
ひたちなか
茨城
つくば
高山
松本
高崎
熊谷
埼玉
福井
岐阜
長野
八ヶ岳
川越
さいたま
銚子
利根川
八王子
東京
船橋
千葉
飯田
甲府
川崎
横浜
大垣
岐阜
多治見
彦根
名古屋
愛知
静岡
神奈川
横須賀
千葉
富士
沼津
静岡
伊東
岡崎
藤枝
浜松
豊橋
津
松阪
伊勢
三重
大島
利島
新島


CYBERJAPAN
電子国土
前橋
桐生
足利
小山
水戸
ひたちなか
高崎
茨城
熊谷
つくば
霞ケ浦
埼玉
川越
さいたま
十
銚子
利根川
山梨
八王子
東京
船橋
千葉
甲府
川崎
富士山
横浜
神奈川
千葉
横須賀
富士
沼津
伊東


CYBERJAPAN
電子国土
東京
東京
千代田区
CYBERJAPAN
電子国土



Open data policy?

- Transparency
- Innovation

ホーム > GitHub-Universe-government-Hidenori-Fujiwara

NEWS

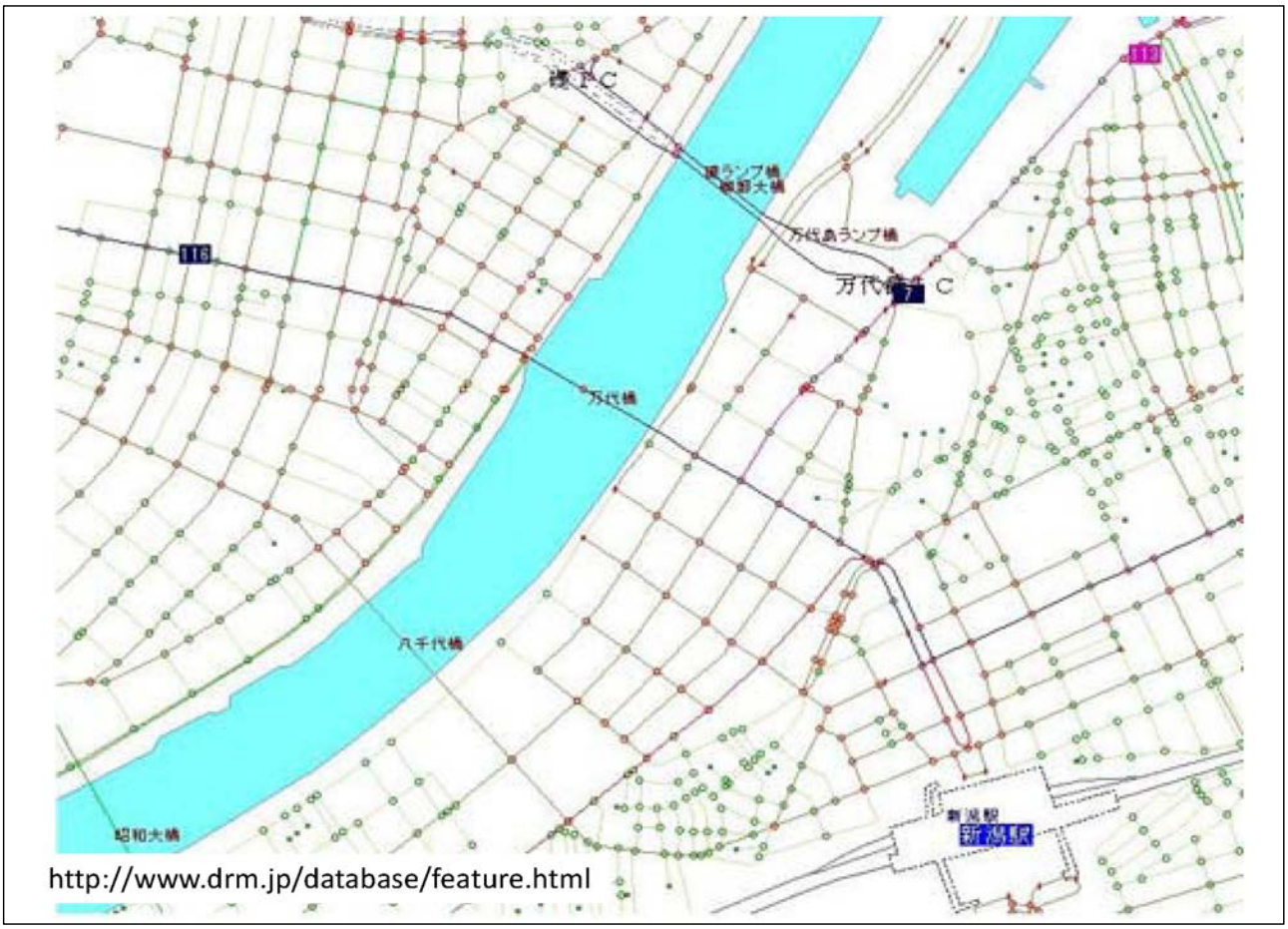
GitHub-Universe-government-Hidenori-Fujiwara

by Yukari Mitsuhashi on 2015.10.7

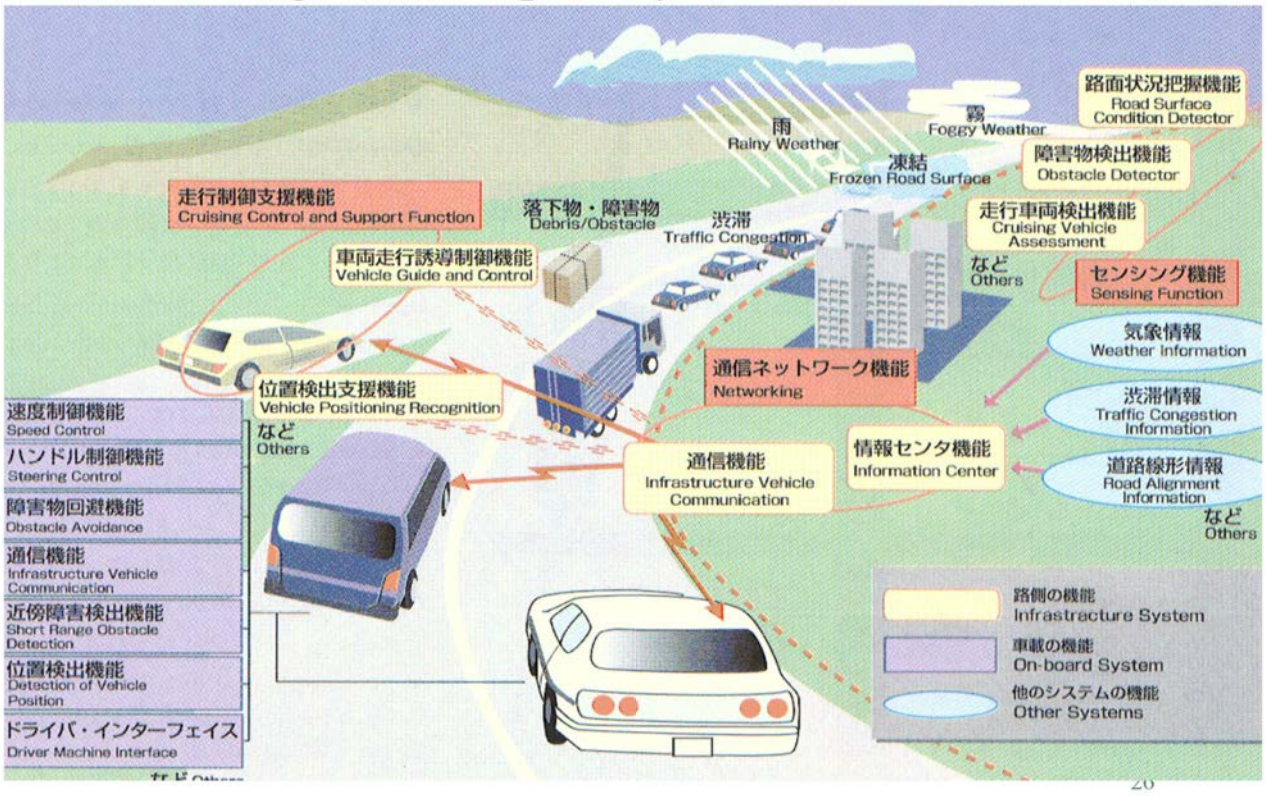
FacebookTwitterLinePocket

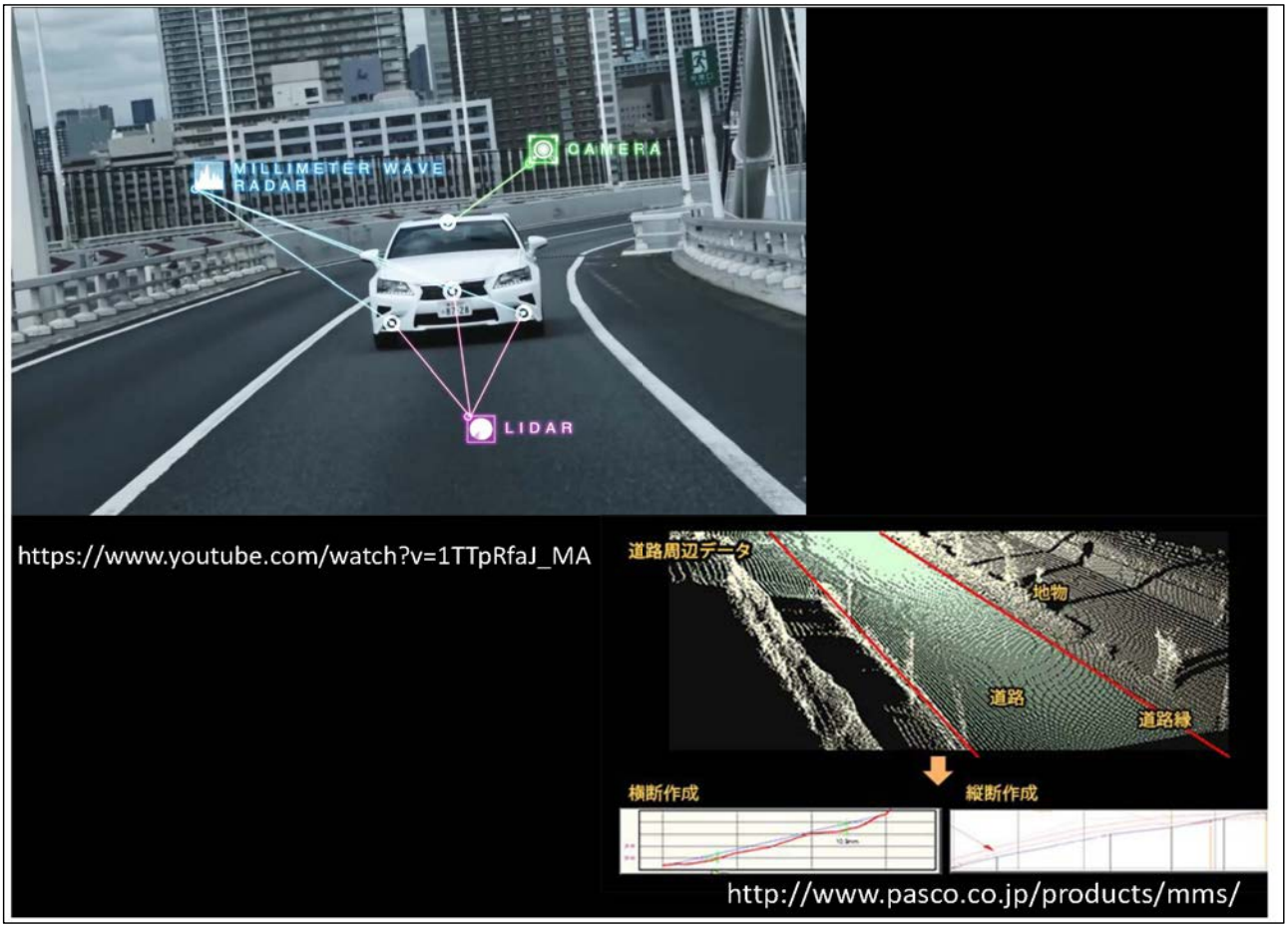
Develop a specific geospatial data to accelerate the development of applications


DRM
JAPAN DIGITAL ROAD MAP ASSOCIATION
HOME | contact | [Japanese日本語]
1988~
Based on PPP
Introduction
President's Message
History of the DRM
Supporting Members
What's the Digital Road Map?
Outline of the Digital Road Map
What's the DRM Database?
Database Creation and Update
Data Model of Road Networks
Characteristics of the Digital Road Map
More Precise Digital Road Map
Hierarchical Structure of Database
Digital Road Map Seen In Viewer
Uses of Digital Road Map
ITS and Digital Road Maps
Next-generation Digital Road Map
Activities Related to International Standardization
To use the DRM Database
Digital Road Map
The Essential Basis of ITS
for
Safer, Smarter and Cleaner Road Transport
DRM
JAPAN DIGITAL ROAD MAP ASSOCIATION
http://www.drm.jp/english/drm/e_index.htm

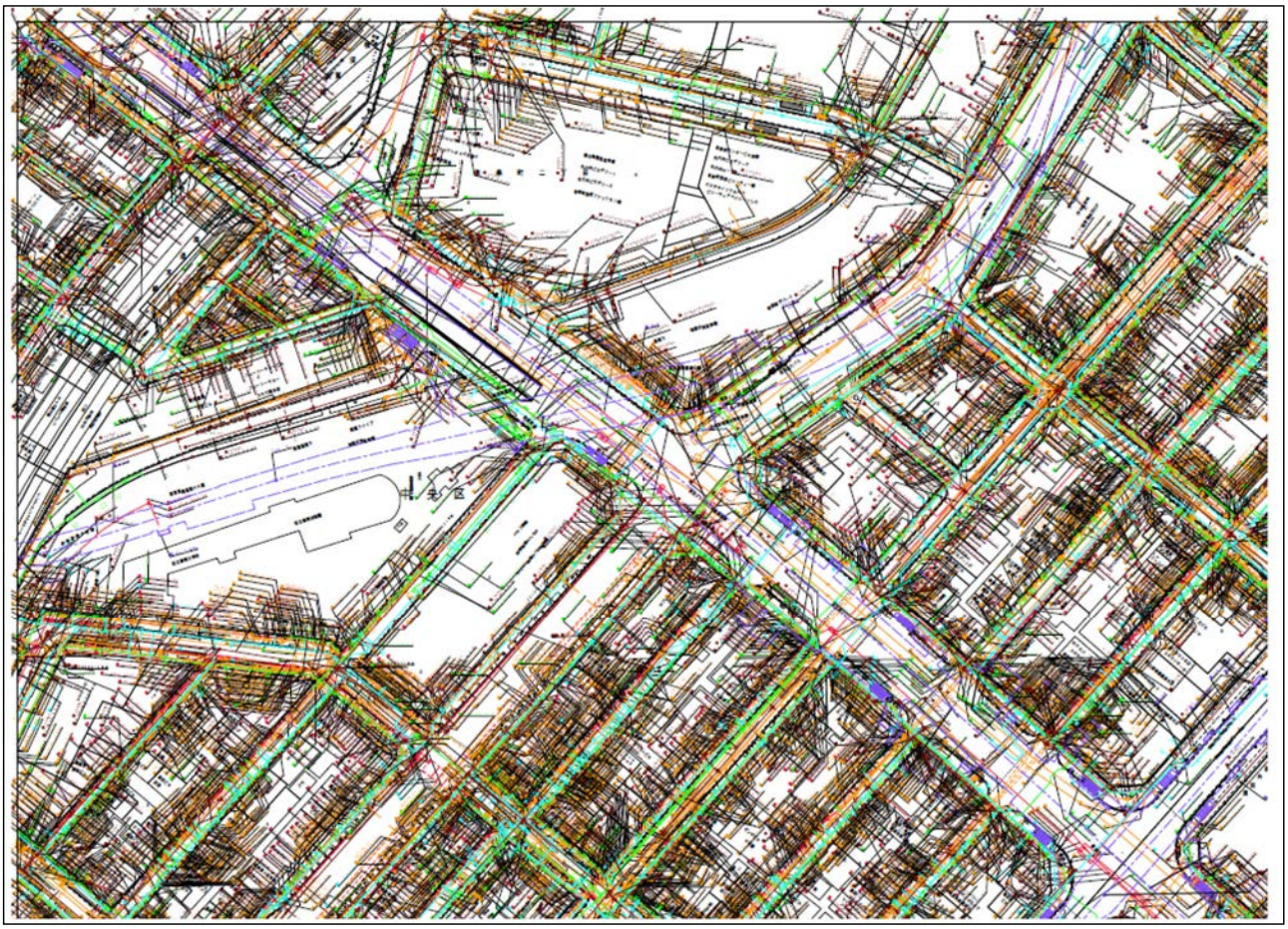

116
万代橋
八千代橋
昭和大橋
新潟駅
http://www.drm.jp/database/feature.html

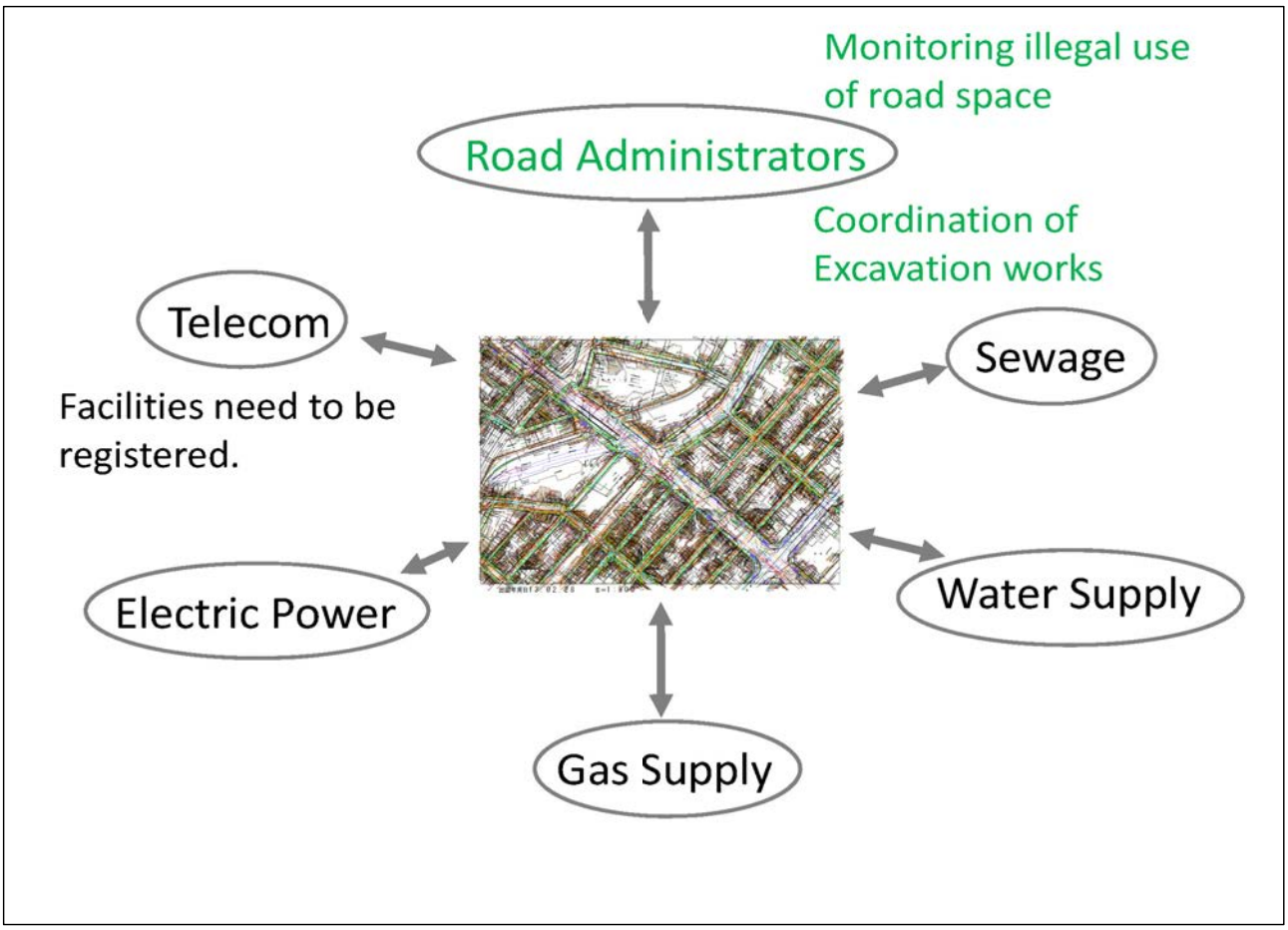
ITS（Intelligent Transport System）

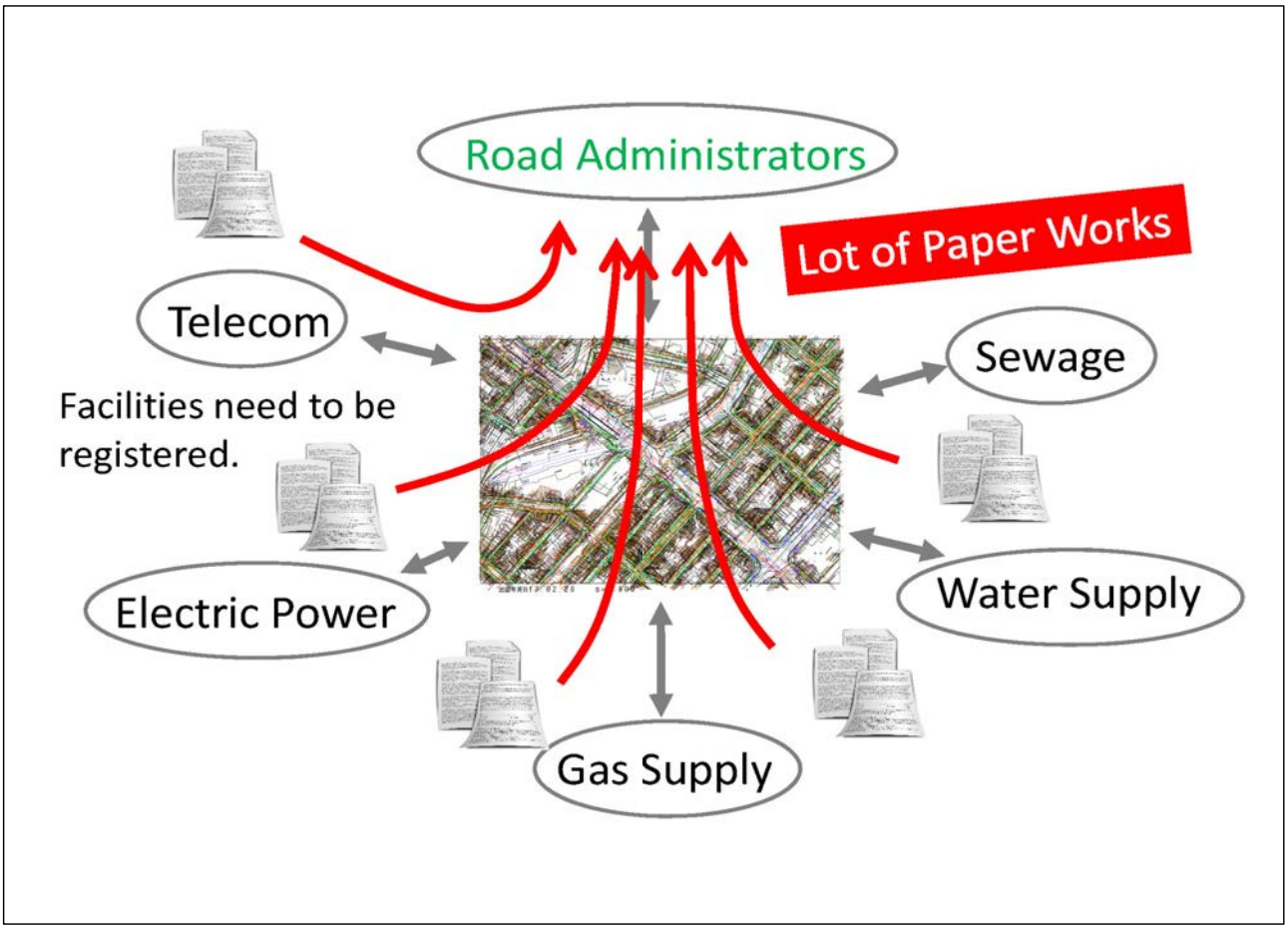


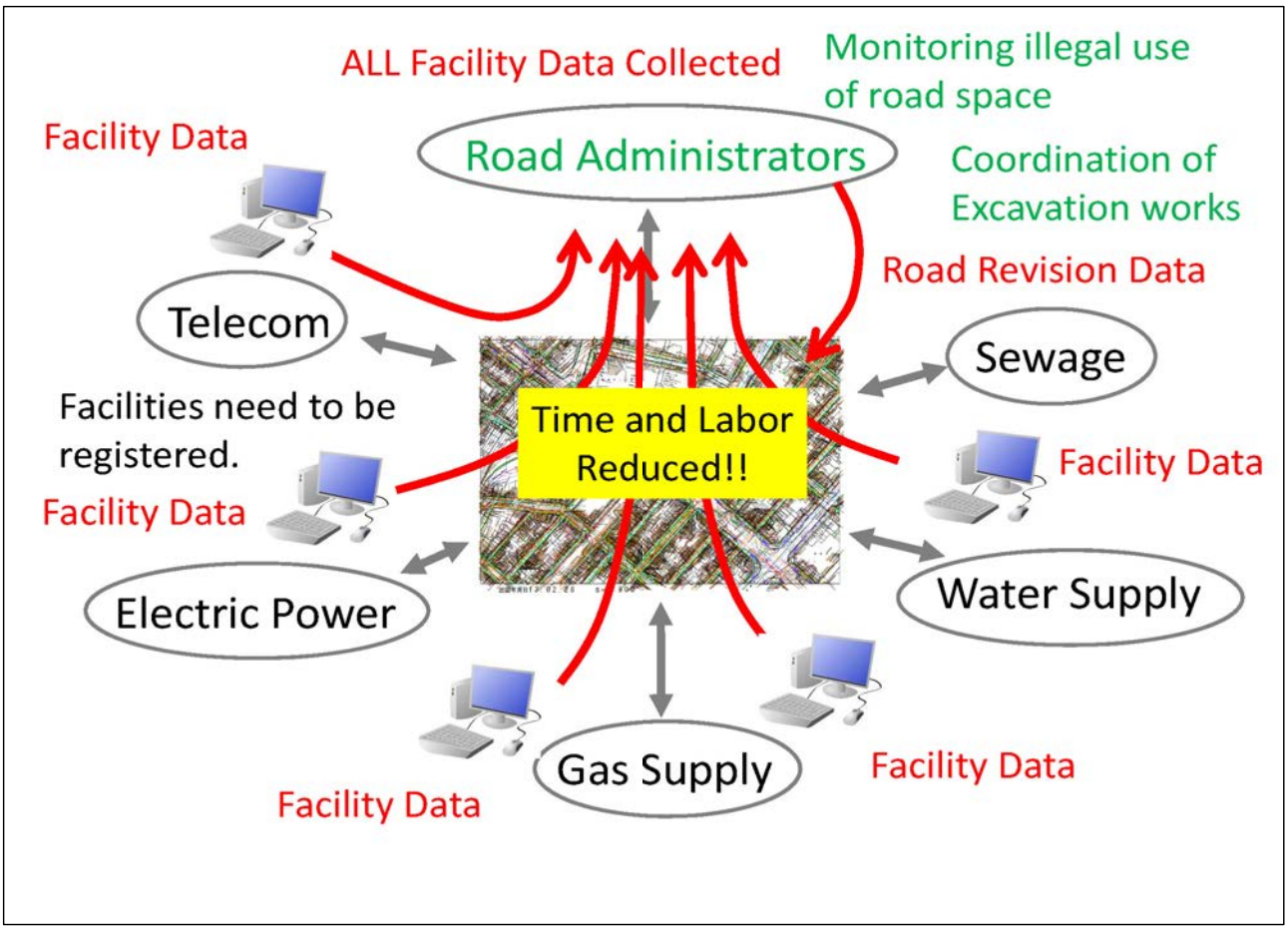


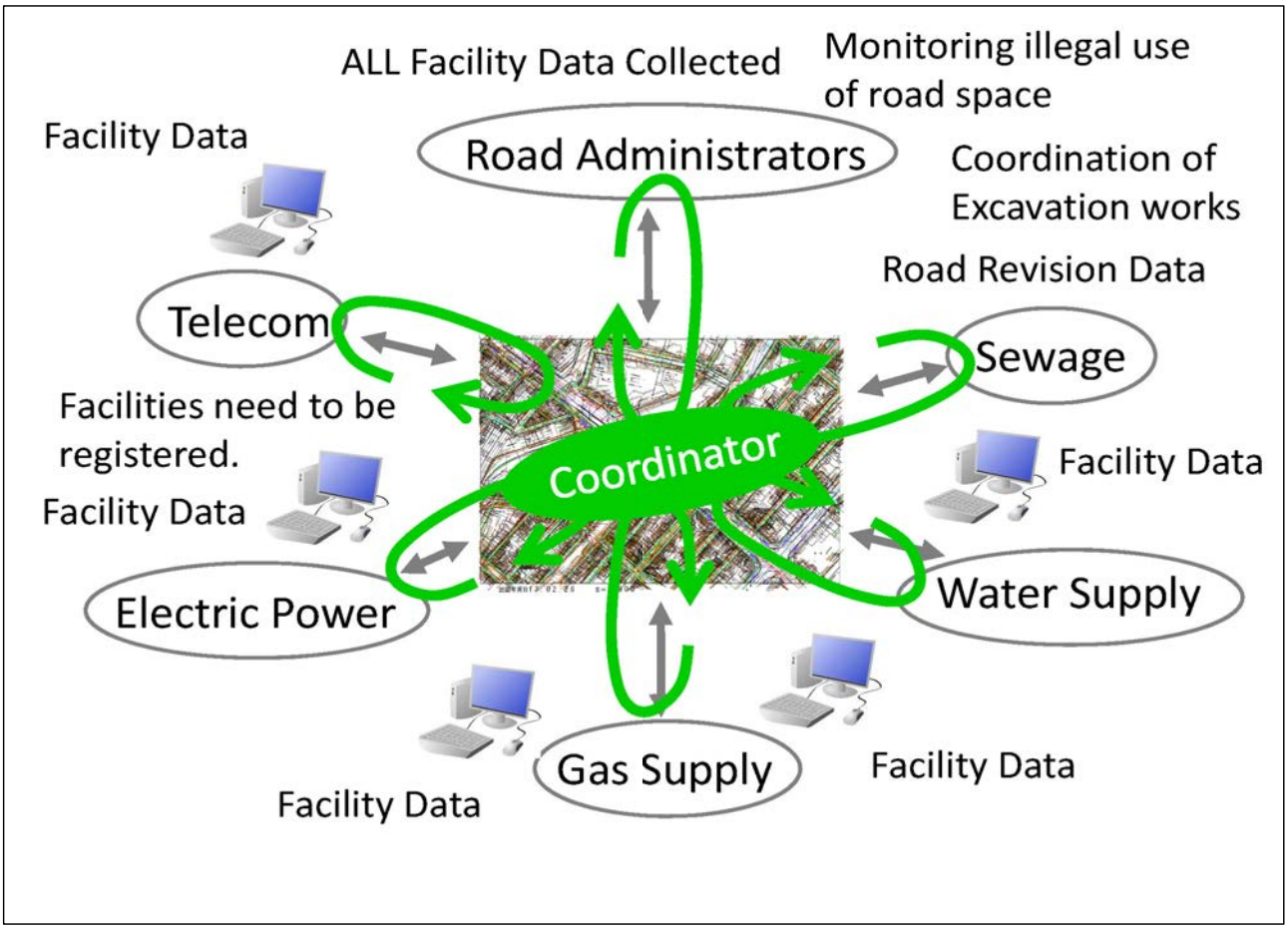

Urban Facility Management under Roads
(Road Administration Information Center)
1986~
Based on PPP
29




Monitoring illegal use of road space
Road Administrators
Coordination of Excavation works
Telecom
Facilities need to be registered.
Sewage
Electric Power
Water Supply
Gas Supply


Road Administrators
Lot of Paper Works
Telecom
Facilities need to be registered.
Sewage
Electric Power
Water Supply
Gas Supply


ALL Facility Data Collected
Monitoring illegal use of road space
Facility Data
Road Administrators
Coordination of Excavation works
Road Revision Data
Telecom
Sewage
Facilities need to be registered.
Time and Labor Reduced!!
Facility Data
Facility Data
Electric Power
Water Supply
Gas Supply
Facility Data
Facility Data


ALL Facility Data Collected
Monitoring illegal use of road space
Facility Data
Road Administrators
Coordination of Excavation works
Road Revision Data
Telecom
Sewage
Facilities need to be registered.
Coordinator
Facility Data
Facility Data
Electric Power
Water Supply
Gas Supply
Facility Data
Facility Data

Next Generation GNSS

GPS

- Development launched in early 1970's
- System comprises 31 positioning satellites
- GPS modernization planning currently underway (Target date: 2016)

Galileo

- Launches initiated with objective of starting services in 2013 or later (Objectives of GPS backup and EU autonomy)
- 30 satellite launches planned
- India, China, Israel, ROK participating or have stated intentions to do so

IGC

Locus for communication and coordination between all satellite positioning systems

GLONASS

- Satellite positioning system operated by the Russian Defense Ministry
- Planning underway to revive satellite positioning system, including launch of improved GLONASS satellites (Target date: mid-2010's)

Beidou(Compass)

- Positioning system to be formed of stationary and medium earth orbiting and quasi-zenith satellites (35 satellites in total) through five launches
- Independent split from Galileo project

Regional systems

QZSS Quasi-Zenith Satellite System

IRNSS Indian Regional Navigation Satellite System

36

Time table of GNSS implementation

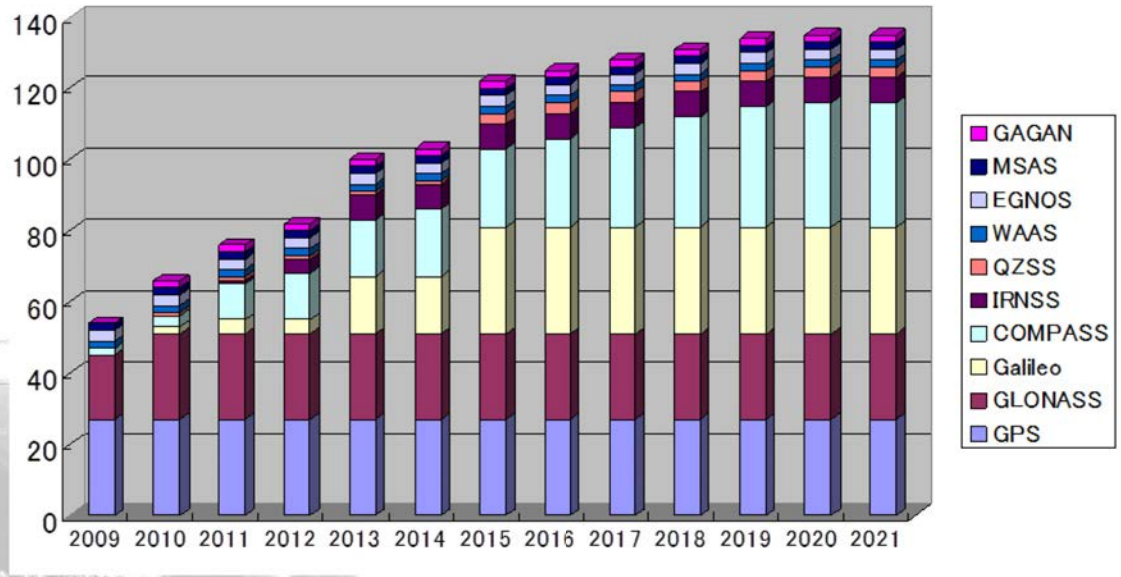
	System	2011	2013	2015	2017	2019
USA	GPS	31satellites in operation		△Next generation GPS(-Ⅲ)start launching		
Russia	GLONASS	▲24 sat full operation ▲Next generation "GLONAS-K" start launching				
EU	Galileo	▲In-orbit experiment sat. (4)		△18 sat in initial operation, preliminary service starts	△30 sat full operation	
China	Compass (Beidou)	▲10 sat launched △Asia Pacific service started ▲Experimental service started			35sat full operation, global service starts △	
India	IRNSS	▲1～3 sat start lauching		△7 sat in full operation		
Japan	QZSS	▲First sat launched.			△4 sat in full operation	(7 sat full operation △)

development operation

37

Tokyo University of Marine Science and Technology

Number of available GNSS(Global Navigation Satellite Systems)



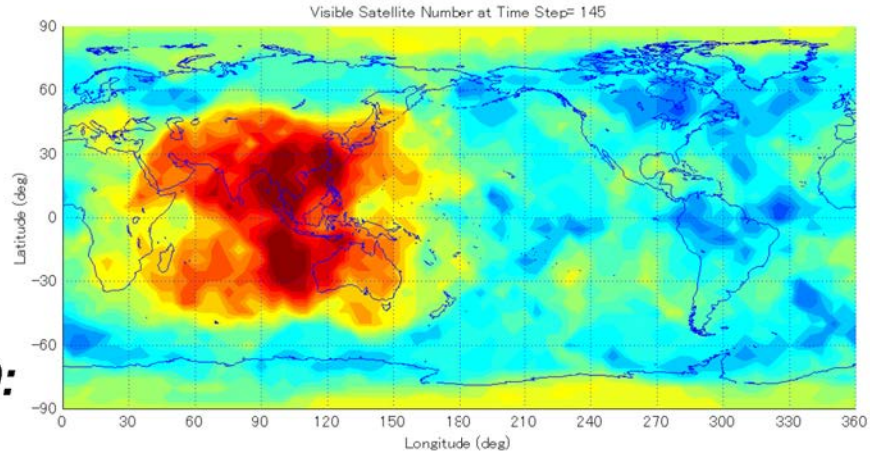
Laboratory of Satellite Navigation Engineering

38

Tokyo University of Marine Science and Technology

Asia: a Showcase of New GNSS

Number of visible satellites in Asia



2020:

GPS(27)+Glonass(24)+Galileo(30)+COMPASS(35)+IRNSS(7)+QZSS(3)+SBAS(7)

Laborator

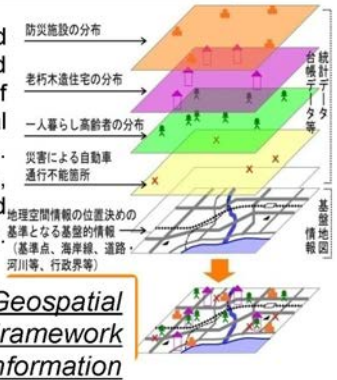
39

Basic Act for Promotion of Geo-spatial information (May, 2007)

Integrating framework of real-time positioning and geo-spatial data for "issue-resolving" services

Geographic Information System
Geographic Information System

-Integrated processing and management of geo-spatial information .
-Geo-visualization, analysis and decision support.

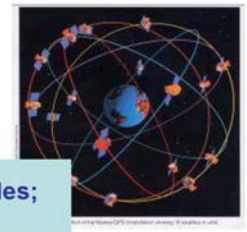


Geospatial Framework Information

Satellite-based Positioning
Positioning, Navigation and Timing (PNT)

Satellite-based Positioning

-Real-time positioning, navigation and timing
- Integration with real-time services.



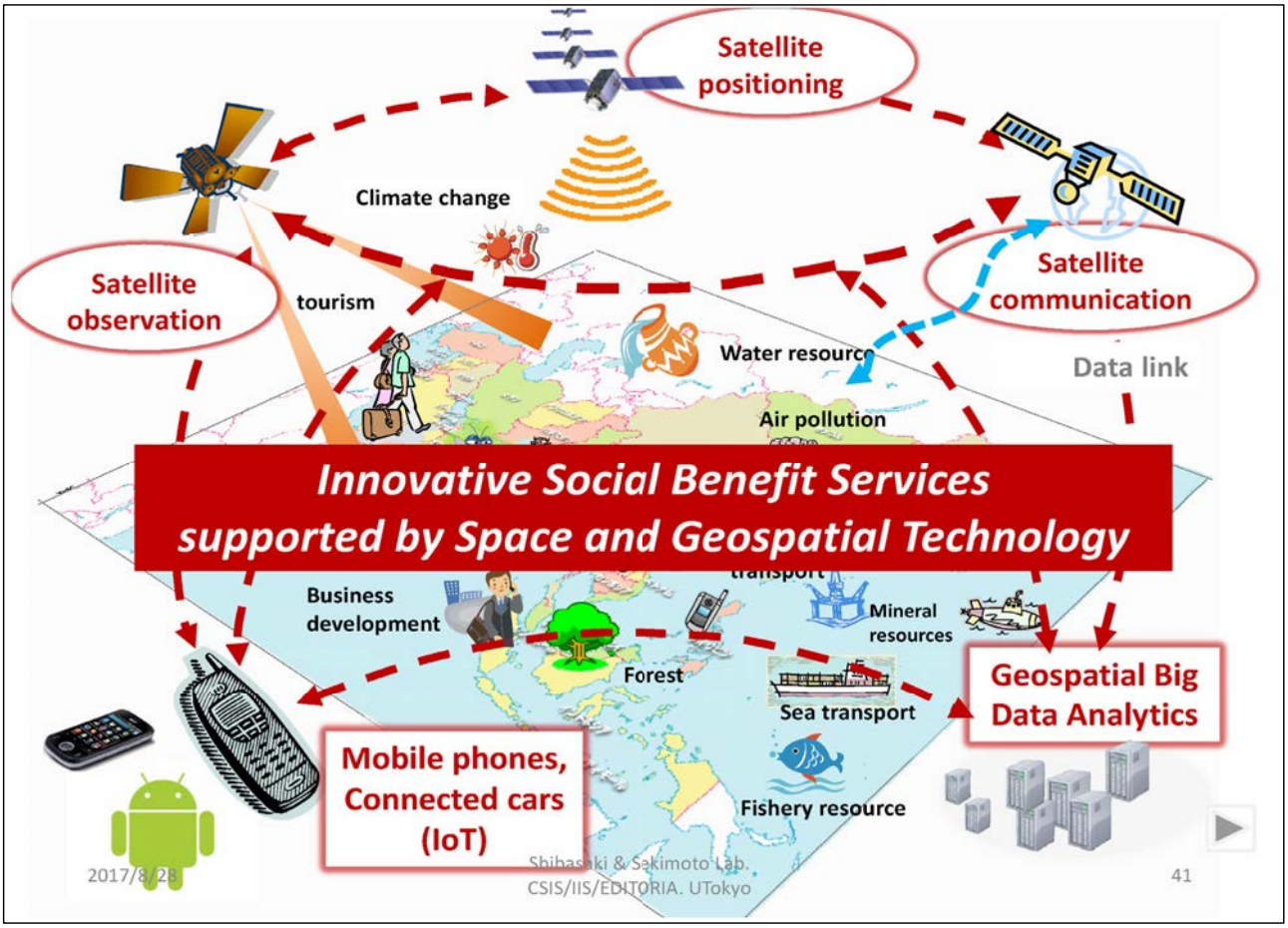
Explosion of Information
makes it hard to find necessary information when needed

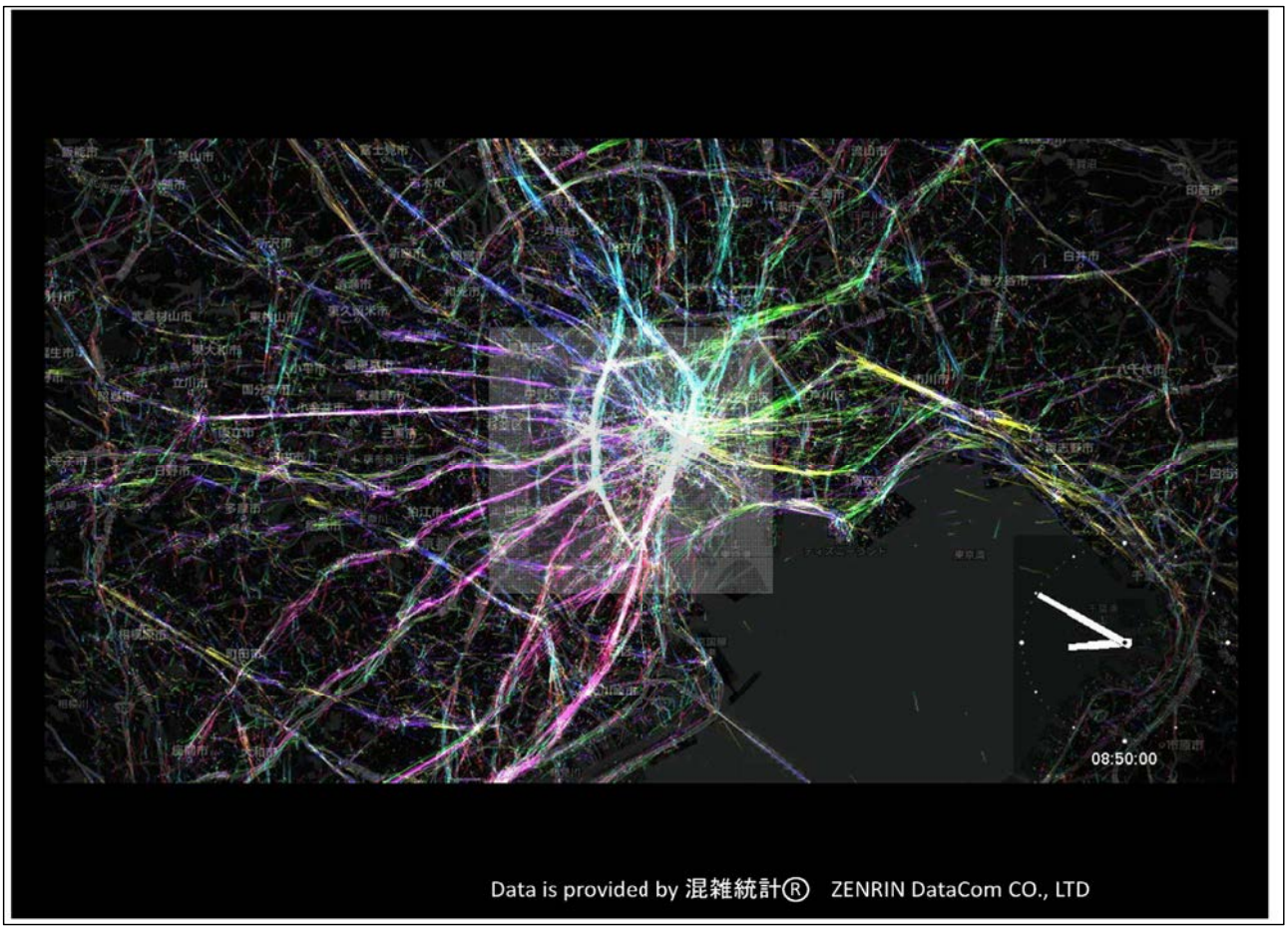
Better management of information with location/position as a common key

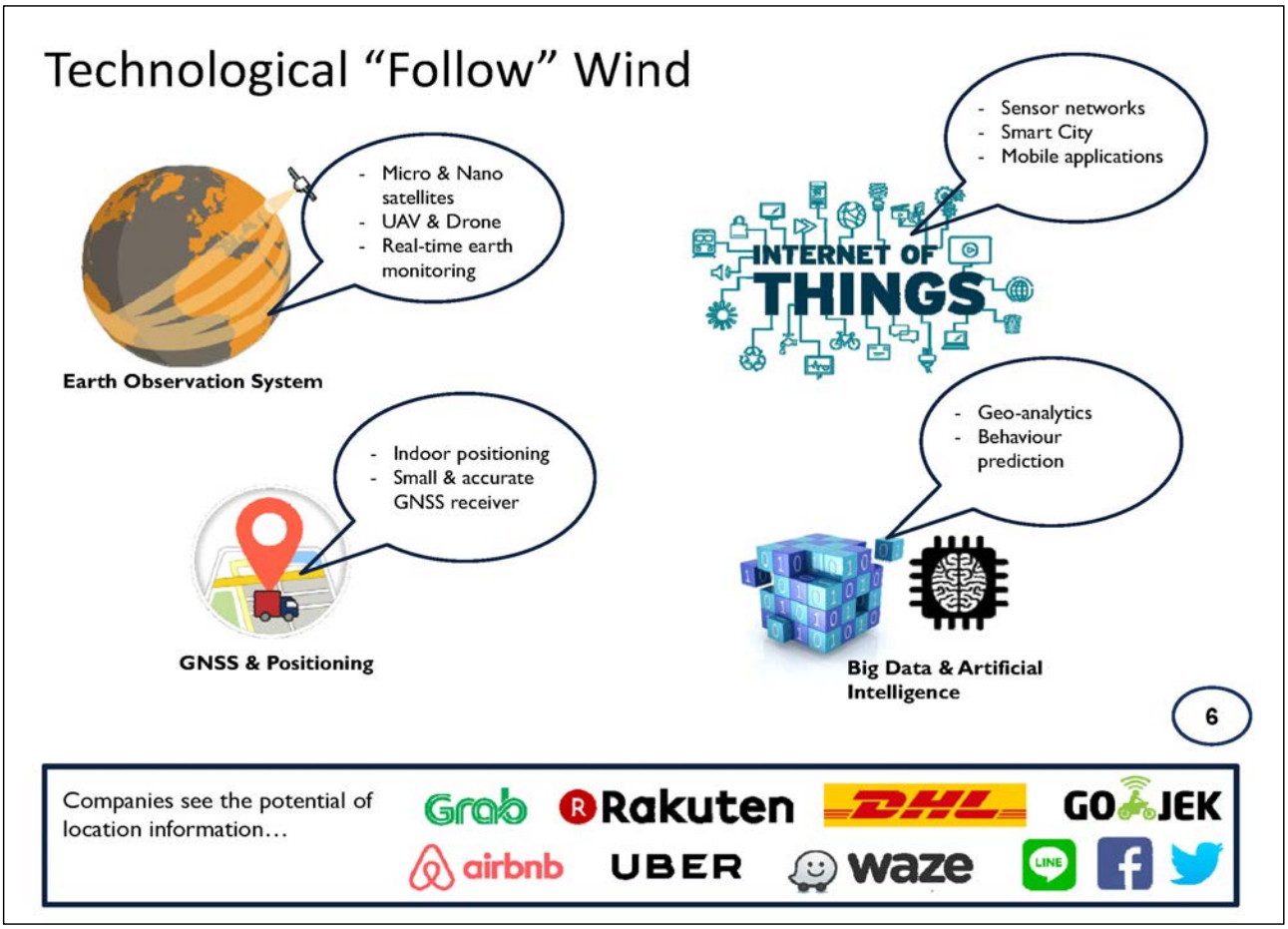
Integration of GIS and SBP enables;

-Real-time acquisition distribution, and sharing of info. with ICT,
-Linking of real world information with location or position,
-Well-informed decision making and real-time activity support services.

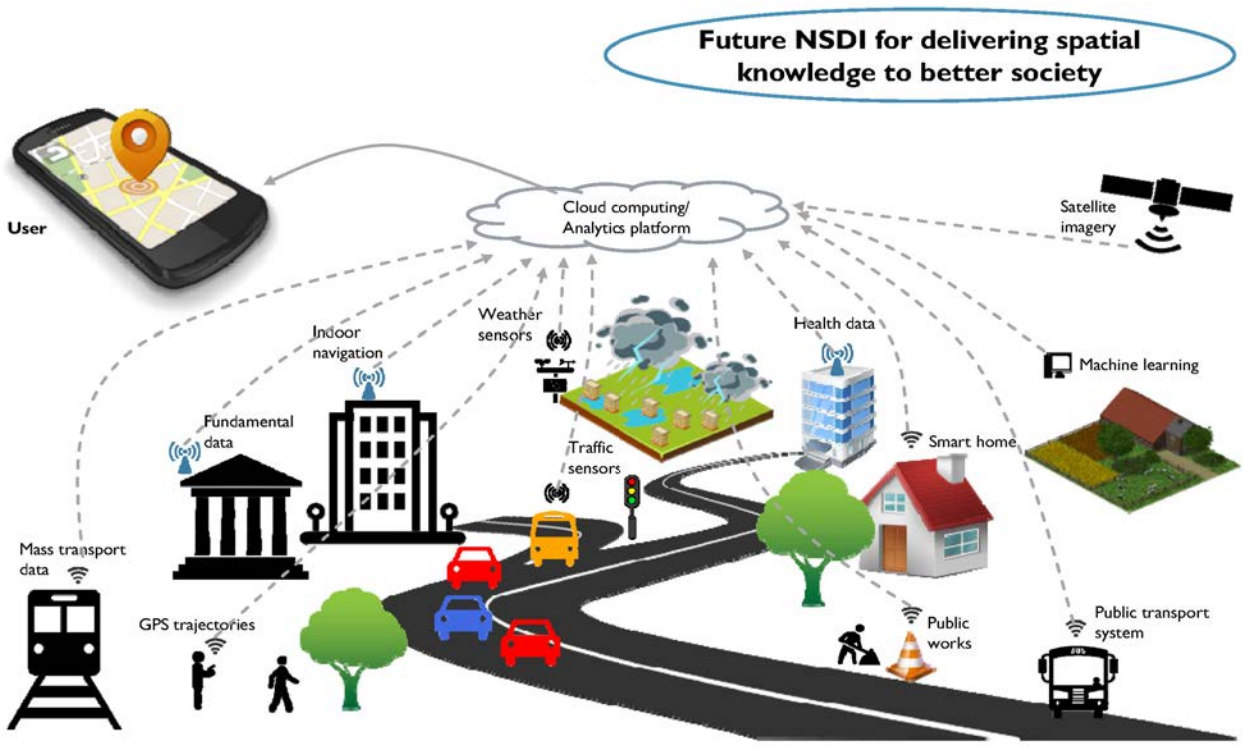
Everyone can use geo-spatial information easily when necessary for well-informed decision making and actions (Geo-spatially enabled society)




08:50:00
Data is provided by 混雑統計® ZENRIN DataCom CO., LTD


Technological "Follow" Wind
- Micro & Nano satellites
- UAV & Drone
- Real-time earth monitoring
Earth Observation System
- Sensor networks
- Smart City
- Mobile applications
INTERNET OF THINGS
- Indoor positioning
- Small & accurate GNSS receiver
GNSS & Positioning
- Geo-analytics
- Behaviour prediction
Big Data & Artificial Intelligence
6
Companies see the potential of location information…
Grab
Rakuten
DHL
GOJEK
airbnb
UBER
waze
LINE

Very Natural Expansion of NSDI?

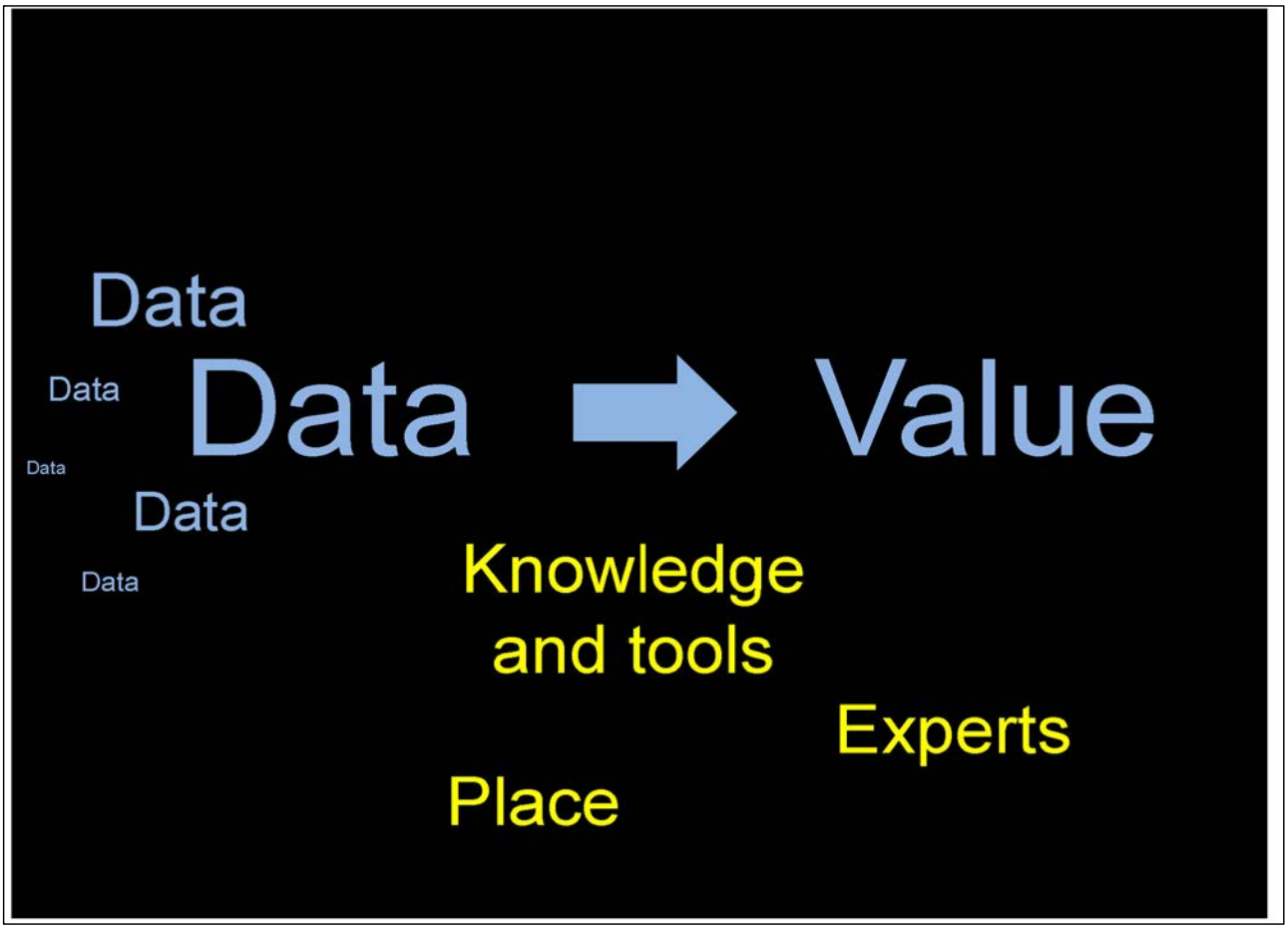


How to encourage value creation from Public/Private Data?

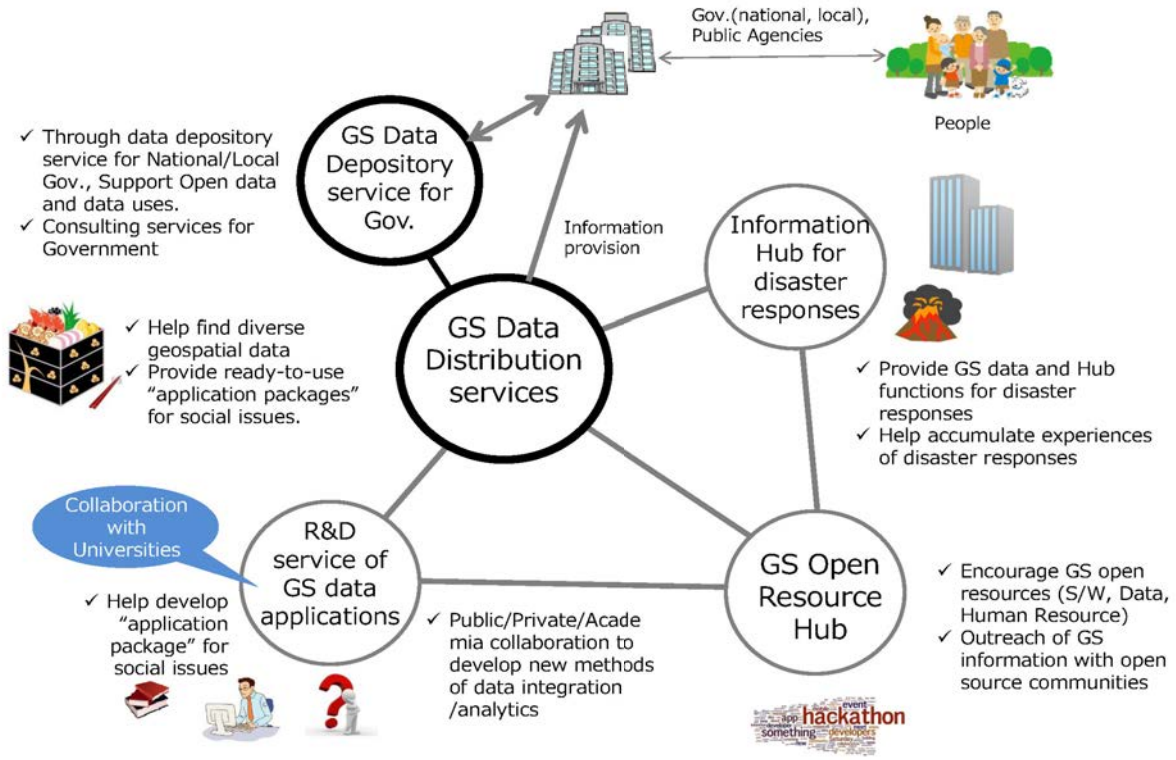
How to encourage private data applications for social benefit services?

How to finance the above activities?
Only Public?


G-Spatial Information Center
Start of the operation：
Nov.24, 2016
Datasets handled
593 datasets (open/closed)
(as of Aug, 2017)
https://www.geospatial.jp
AIGID
一般社団法人社会基盤情報流通推進協議会
Association for Promotion of Infrastructure Geospatial Information Distribution
47

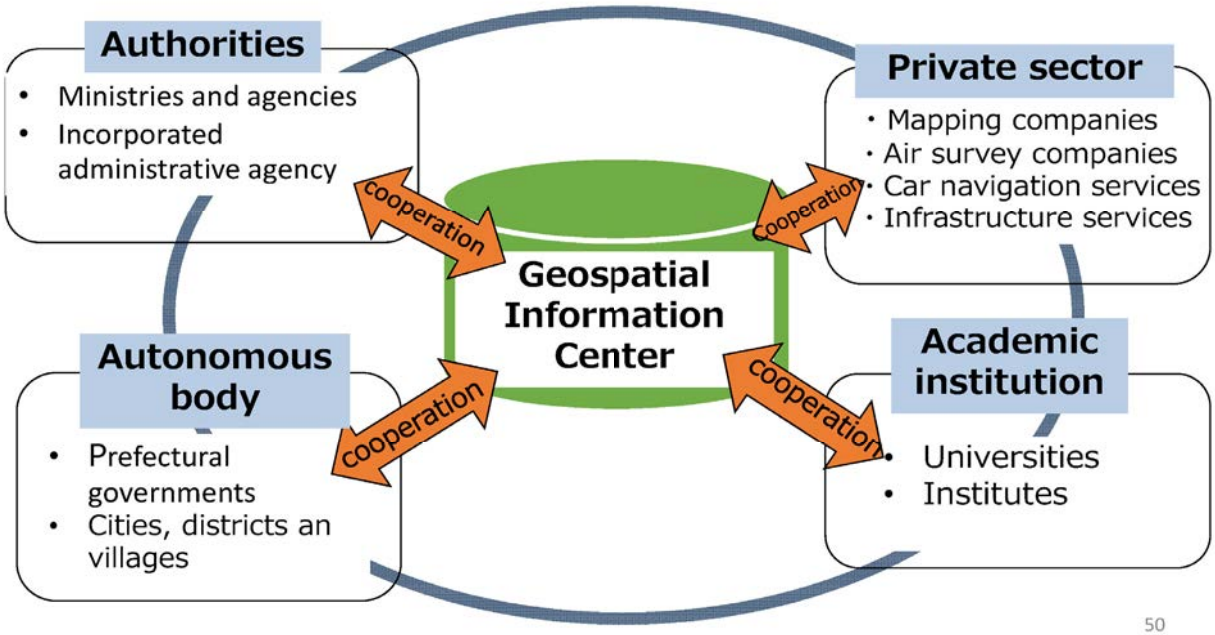

Data
Data
Data
Data
Data
Data
Value
Knowledge
and tools
Experts
Place

Activities of G-Spatial Information Center



Information infrastructure based on Public-Private-Partnership

A goal to reach of Geospatial Information Center is to be a distributed and integrated hub for geospatial information.



Handling information (Aug. 2017)

	Categoly	Data	Data Holders
Authority	Base information	Base map, earth map, aerial photo, terrain map, digital land map data, national land numerical information, detailed location data, waling space network data, maritime ledger, microtopography	MLIT MIC Autonomous body
Authority	Geography・Geology・Land classificaiton	Geological map, geological survey map, natural resource map, terrain classification, land-use, hydrological map, national numerical information	MLIT, AIST, JOGMEC
Authority	Disaster prevention・reduction	Volcano map, land classification based on volcano location, emergence road map, shaky land map	MLIT Cabinet office AIST
Authority	Meteorological observation	Riverine monitoring camera, water-level observation data, phased array radar data	MLIT, NICT
Authority	Environment	National inventory data, 10 m grid land-use data, vegetation type data	MOE, MLIT
	Categoly	**Data**	**Data Holders**
Private※	Dynamic data	Taffic volume data, drive record data, car-mounted camera, tourism statistic data, congestion data, population fluidity data, tourist velocity data	Pioneer Zenrin DataCom Agoop NaviTime Japan
Private※	Static data	GEOSPACE aerial photo, digital map, admin vector data, MMS points data, urban 3D model, 3D map Aerial photo, good-3D DSM points data Distortion free aerial photo image, MMS road information data	NTT, Asia Air Survey, Asahi Air Survey, PASCO, Kokusai Air Survey

※ : for compensation

51

Major Functions of G-Spatial Center

The first platform of distributing/exchanging GS data of public/private and academic sectors.

Data finding with
- Category
- Geographic areas
- Keywords

52

Results of query

Further data exploration could be made by adding more conditions.

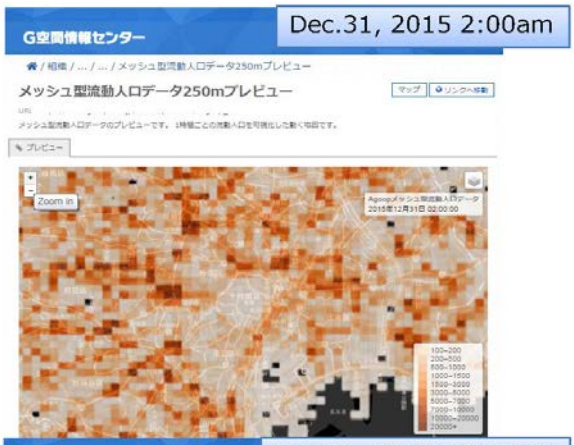
53

Pre-view

Through visualization, users can understand better about data they find.

Example of Dynamic Data

※Grid-based dynamic population data (Agoop inc.) Movie is generated to see the dynamics of the data.



54

Example of Static Data

※Distribution of maximum values of seismic motion caused by Nankai Trough Earthquake

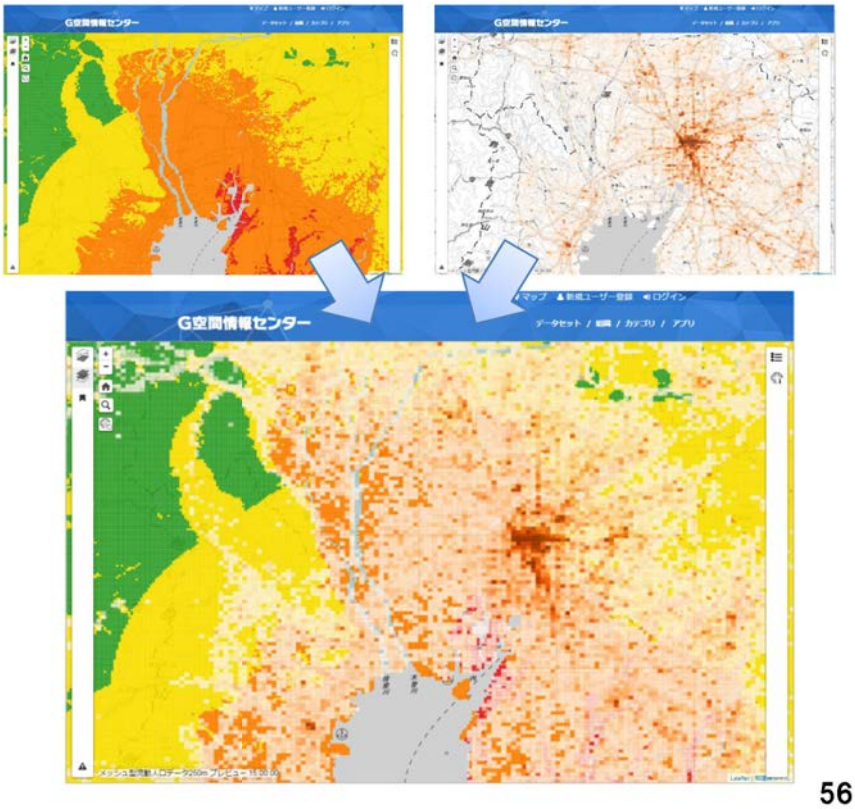
55

Distribution of maximum values of seismic motion caused by Nankai Trough Earthquake (Cabinet Office)

Grid-based dynamic population data (Agoop inc.)

Map overlay

Layers can be overlaid with Web-GIS



With this overlay, population at each location could be aggregated by severity of earthquake. It may help better rescue and evacuation guidance.

56

Introducing Use cases

Use cases of GS applications are introduced as showcases

・Outline, data used, conditions for uses are described.

・Links are provided to data used. Users can use identical data for their own purposes.

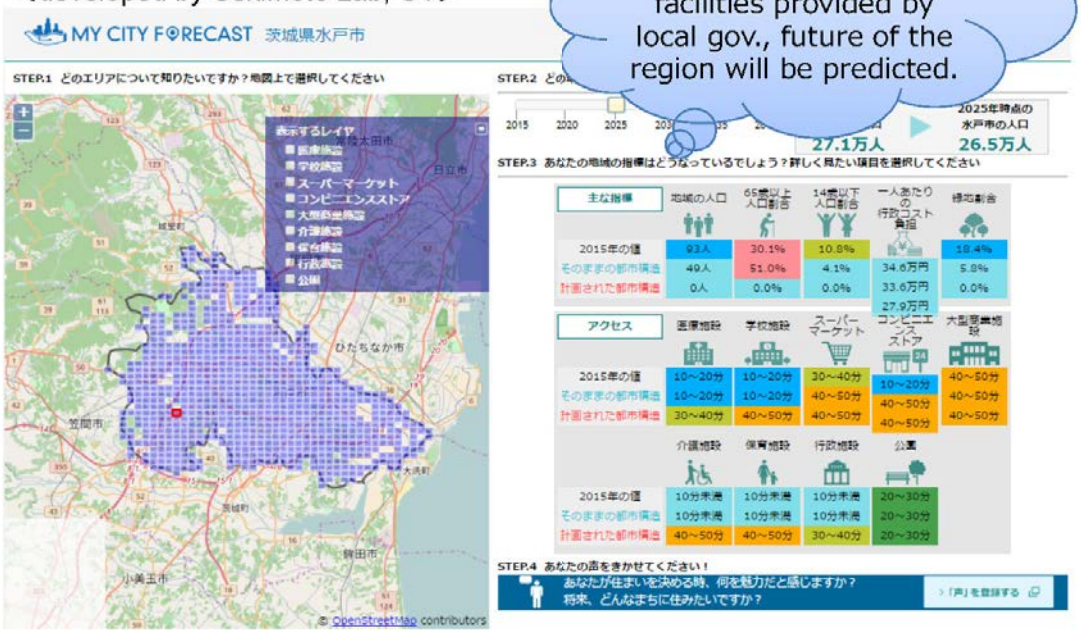
57

Introducing GS Apps

GS Apps are introduced, that are actually applied to problem-solving.

<developed by Sekimoto Lab, UT>

Using open data on population and public facilities provided by local gov., future of the region will be predicted.



58

Available information in Disaster

■ Pre-disaster arrangements are made with the private sectors for quick and easy information sharing when disasters happen (on going)

e.g.; it took one month to publish for evacuation shelter situations in KUMAMOTO earthquake.

■ Data providers

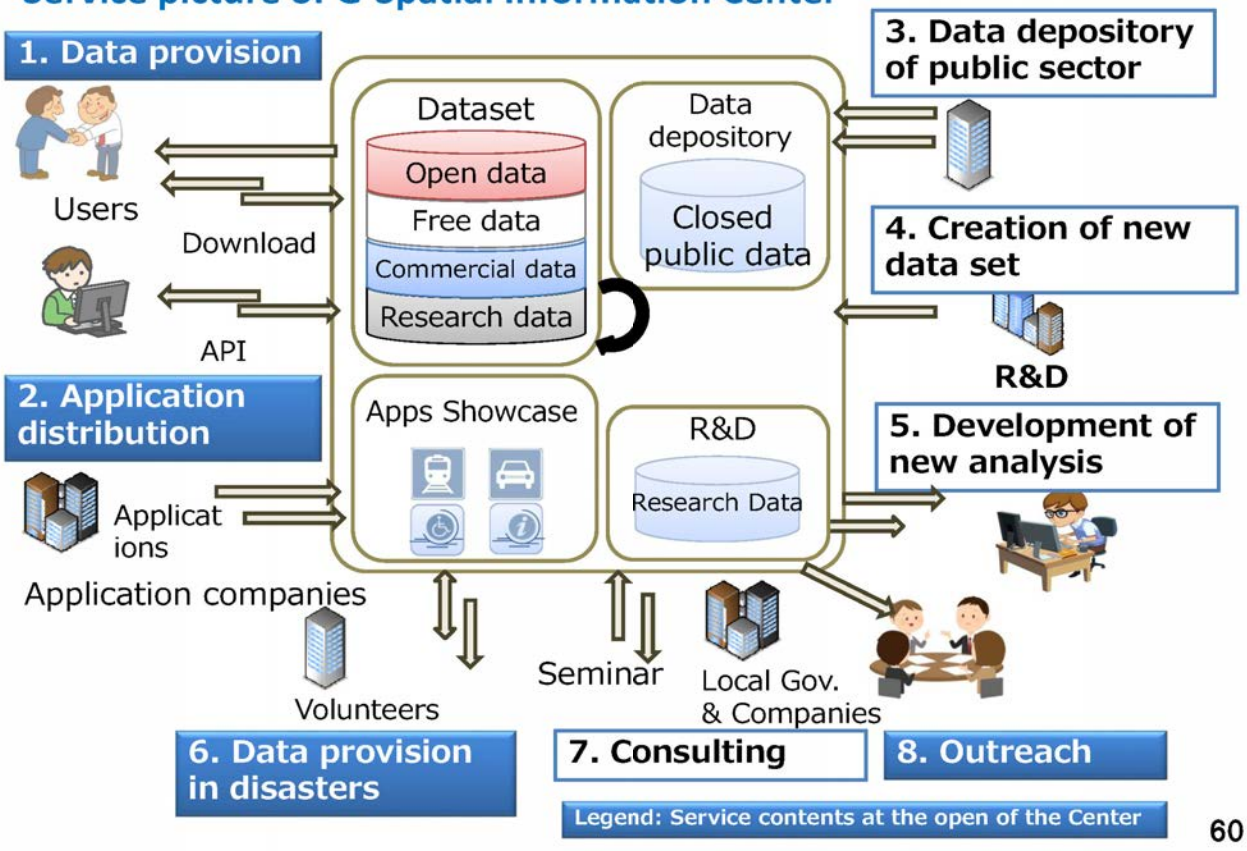
Provider	Signed (data will be provided)
Map data	NTT Space Information, GeoSpace
Aerial survey data	Kokusai; aerial photo/laser scanning data PASCO; aerial photo/laser scanning data Aisia air survey; aerial photo/laser scanning data Asahi air survey; aerial photo/laser scanning data
Dynamic data	Navi Time Japan; Link Travel data Agoop; fluid population data

■ Data users

Purpose	Signed
Making damaged map	Crisis Mappers Japan(specified non-profit corporation) OpenStreetMap Japan (OSMFJ)
Supporting IT software development	Gensai-info Information Technology Disaster Assistance and Response Team (IT DART) OSGeo Japan
Education	Center of Education and Research for Disaster (CERD)

59

Service picture of G-Spatial Information Center



60

Registrations to G-Spatial Information Center

■ User registration

: Process to create a user account

Various services are available for logged-in users

■ Institutional account registration

: Process to create an institutional account

Required to create an institutional account for registering and publishing data through the Center

■ Data registration for sale

: Process to register data for sale through the Center

Required to get agreement between AIGID before selling data

■ Application registration

: Process to register applications

61

Concluding remarks

1. NSDI successfully accelerated data sharing and reduction of data redundancy among governmental institutions, and geospatial data development as well.
2. But NSDI may limit its scope to better distribution of governmental geospatial data.
3. It is very necessary to cover geospatial data of the private sector to encourage the development of diverse social benefit services by unleashing the potential of the technology, including space technology.
4. Real-time services (e.g. high precision positioning services, location authentication services) should be covered to realize autonomous driving and robotics application in outdoor environment.
5. NSDI should broaden the scope and renovate functionalities and "business model".

KRIHS

62

2017 ICGIS(International Conference on Geospatial Information Science)