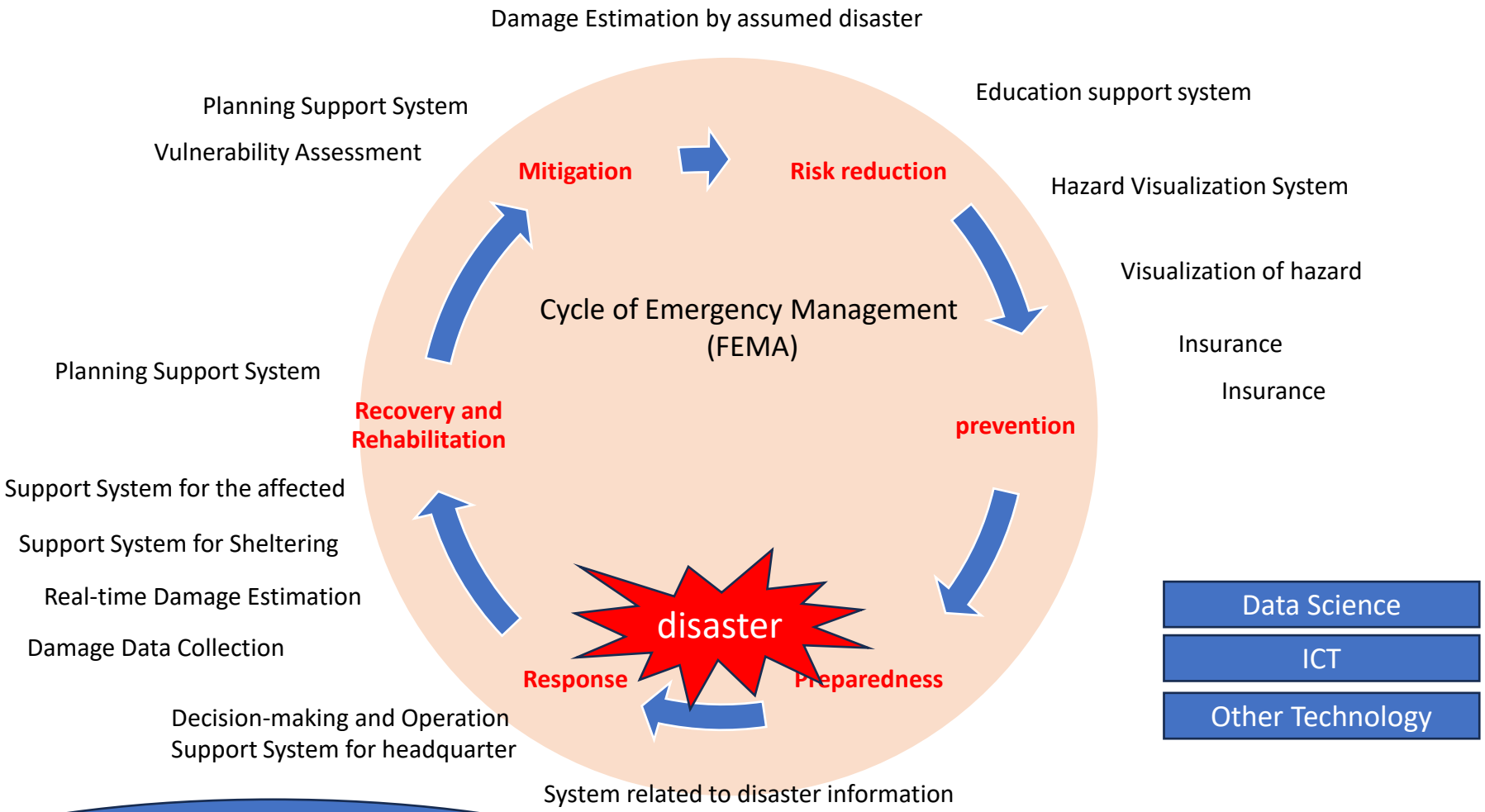
Digital Transformation for Disaster Management



Important Keywords:
Society5.0, DX, Digital Twin,
Smart City, ・・・・

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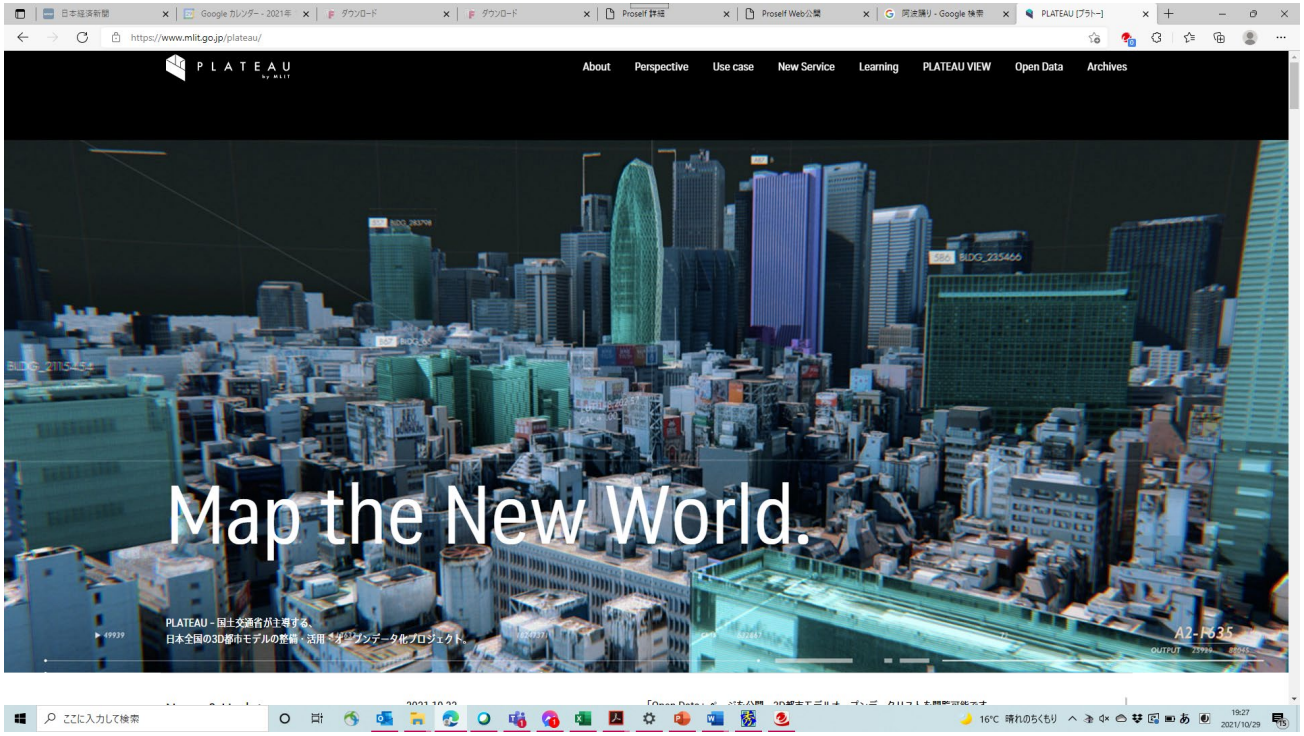
eginal Planning, Disaster Management, Social Safe System)

Prospects for digital twin in cities and regions

Society5.0, DX, Digital Twin, Smart City, ・・・・



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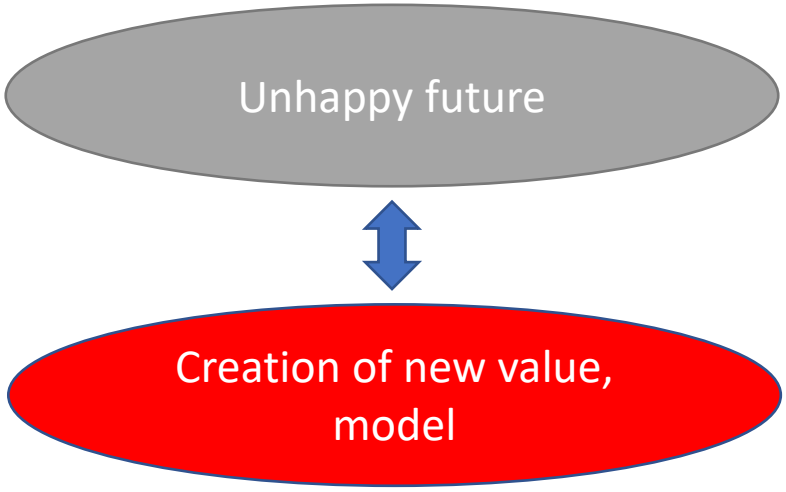
Undesirable future of Society 5.0

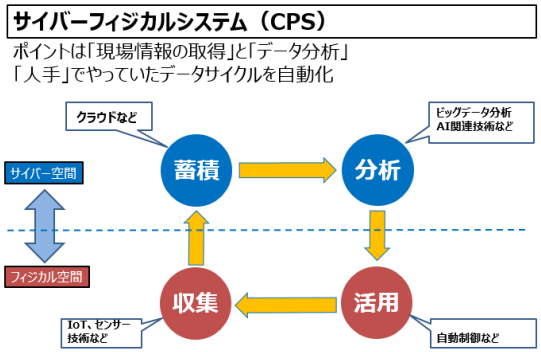
Hunting-based society (1.0) → Agriculture-based society (2.0) → Industrial society (3.0) → Information society (4.0)

- There are many social issues such as the declining birthrate and decreasing productive population. This is especially serious in regional cities. Due to the lack of people, even the bare minimum of work to maintain the area, including infrastructure maintenance, is difficult.
- DX regions and digital twins for cities and have saved labor and helped address the labor shortage.
- 少子化，生産人口減等，社会課題が山積している．特に地方都市では深刻である．人出不足によって，インフラのメンテナンス含め，地域維持のための最低限の仕事すら困難である．
- DXや都市・地域のデジタルツインによって作業が省力化され，人手不足に対応することができた．



What is a digital twin?

- General definition:
  - “Twins in digital space”. "Technical concept of collecting objects and environmental conditions in real space and copying and reproducing them in digital space"
- In the fields of Engineering:
  - Optimization of Design（CAE（Computer Aided Engineering））
  - ➡ Optimization of manufacturing processes（accident prevention）➡ Creation of new services



- Target fields of digital twin in urban and reginal plan and disaster management:
  - Disaster Management, urban development, mobility, energy, nature, wellness, education, work style, industry—

What is a digital twin?

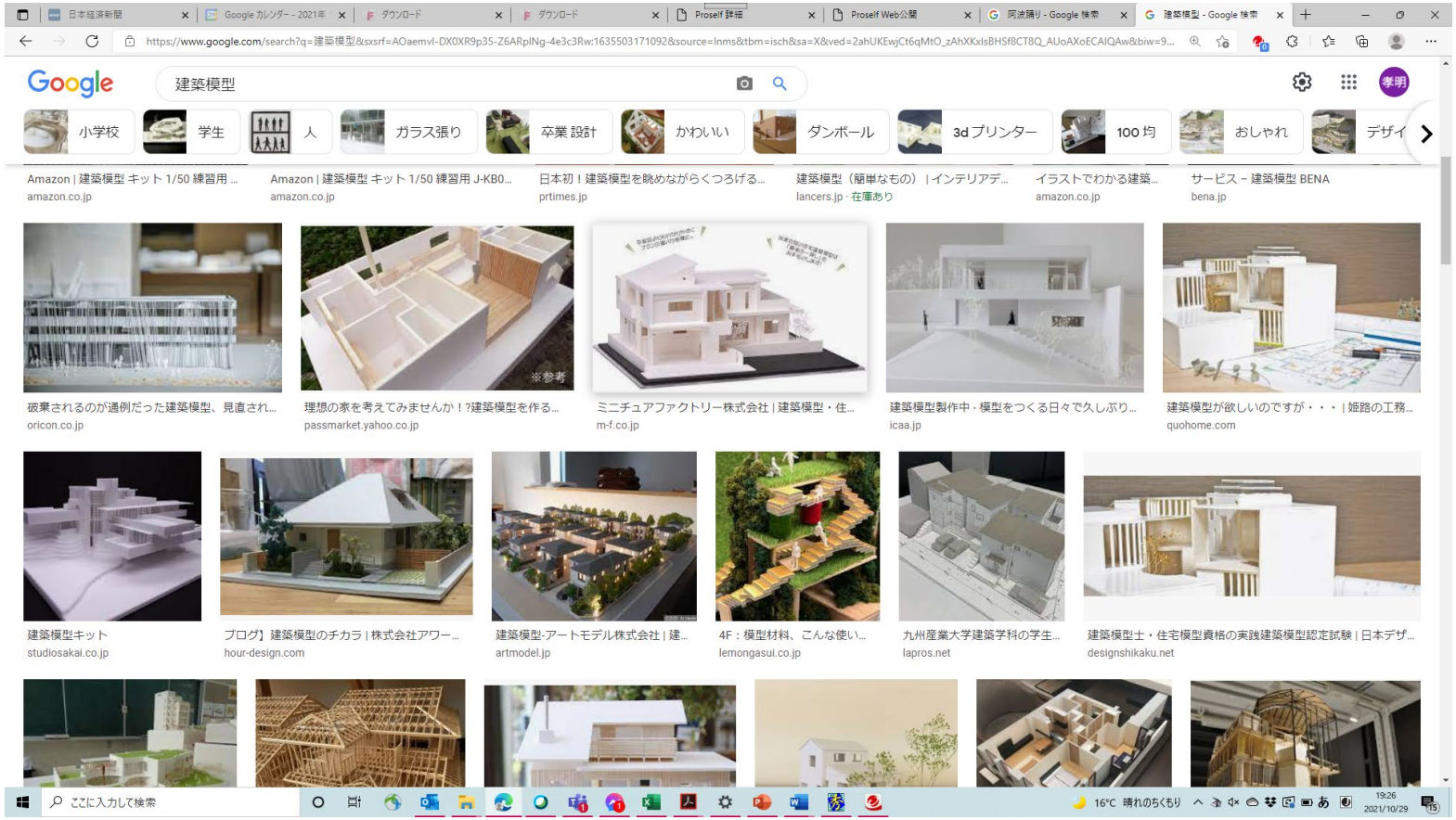
- Digital twin has two meaning: twin and digital

- The significance of twin: Considering from concept of analog twin

- Significance of digital
  1. Visualization
     - Category 1: Visualization of things that are visible but difficult to understand.
     - Category 2: Visualization of things that exist but cannot be seen.
     - Category 3: Visualization of things that are invisible inherently such as functions and performance
  2. Real-time Monitoring
  3. Simulation
  4. Mashed-up visualization of many kinds of data
  5. Creation of new value
     - A place where AI grows

What is a digital twin? ： Considering from the perspective of analog twins
デジタルツインとは？：ツインの意義：アナログツインから考える

architectural model



- We can check from various angles and refine design with a model.

What is a digital twin? ： Considering from the concept of analog twins

- Apollo 13 was launched on April 11,1970 at 13:13 CT, aiming to become the third manned mission to the moon.
- Two days later, an accident occurred: a short circuit in the electrical wires caused a spark whiich caused the oxygen tank in machine room to explode. Severe power and water shortages occurred.
- It was safely returned to Earth through making power consumption reduce to the limit
- It was praised as a "successful failure" and a "glorious failure".

Real world in space

analog twin

control room on the earth

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What is a digital twin? ： Significance of digital

- Visualization: category 1
  - Visualization what is visible but difficult to understand.
- Digital can visualize of things that cannot be seen spatiotemporally as whole image
- Examples:
  - People-flow data
  - Airplane location data

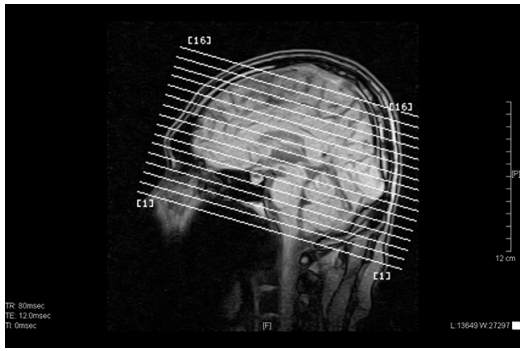
Shibuya ward before the coronavirus pandemic as an example of People–flow analysis
https://www.unerry.co.jp/service/activity-data-visualization/

Haneda airport control tower
https://www.yasui-archi.co.jp/factbook/design13.html

Display Image of Traffic Control support system for airplane
https://www.mlit.go.jp/koku/15_bf_000333.html

What is a digital twin? ： Significance of digital

- Visualization: category 2
  - Visualization of things that exist there but cannot be seen.
- Example:
  - Visualization of inside the skull for brain surgery
  - Infrastructure under the ground



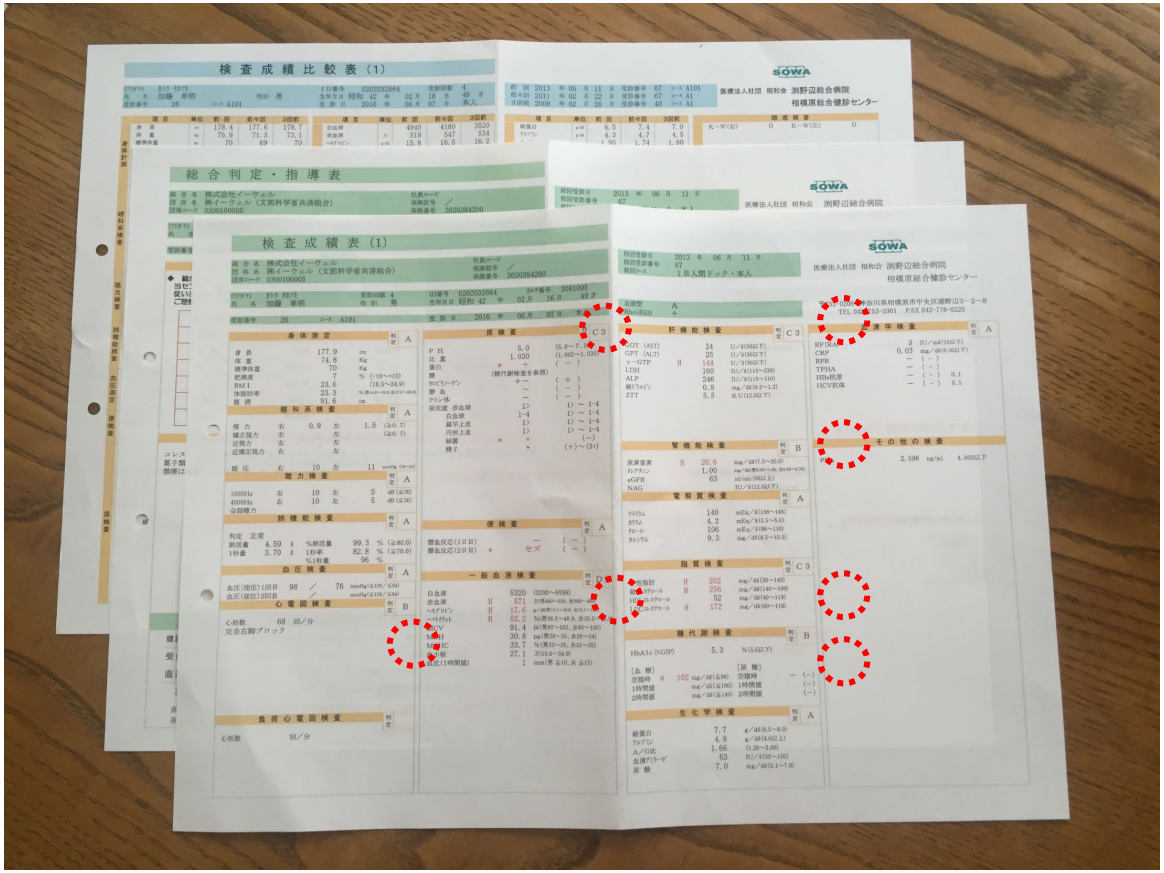
MRI検査で何がわかる？ CT検査との違いや発見できる疾患 - 人間ドックなび (docknet.jp)
https://www.docknet.jp/media/brain-dock-13/

地下埋設物の位置情報を3次元で可視化する技術 地上・地下インフラ3Dマップ｜大田区中小企業 新製品・新技術コンクール　受賞企業紹介｜公益財団法人大田区産業振興協会 (pio-ota.jp)
https://www.pio-ota.jp/concours/c31/3_3d.html

地下埋設物可視化システム｜技術・ソリューション｜清水建設 (shimz.co.jp)
https://www.shimz.co.jp/solution/tech343/index.html

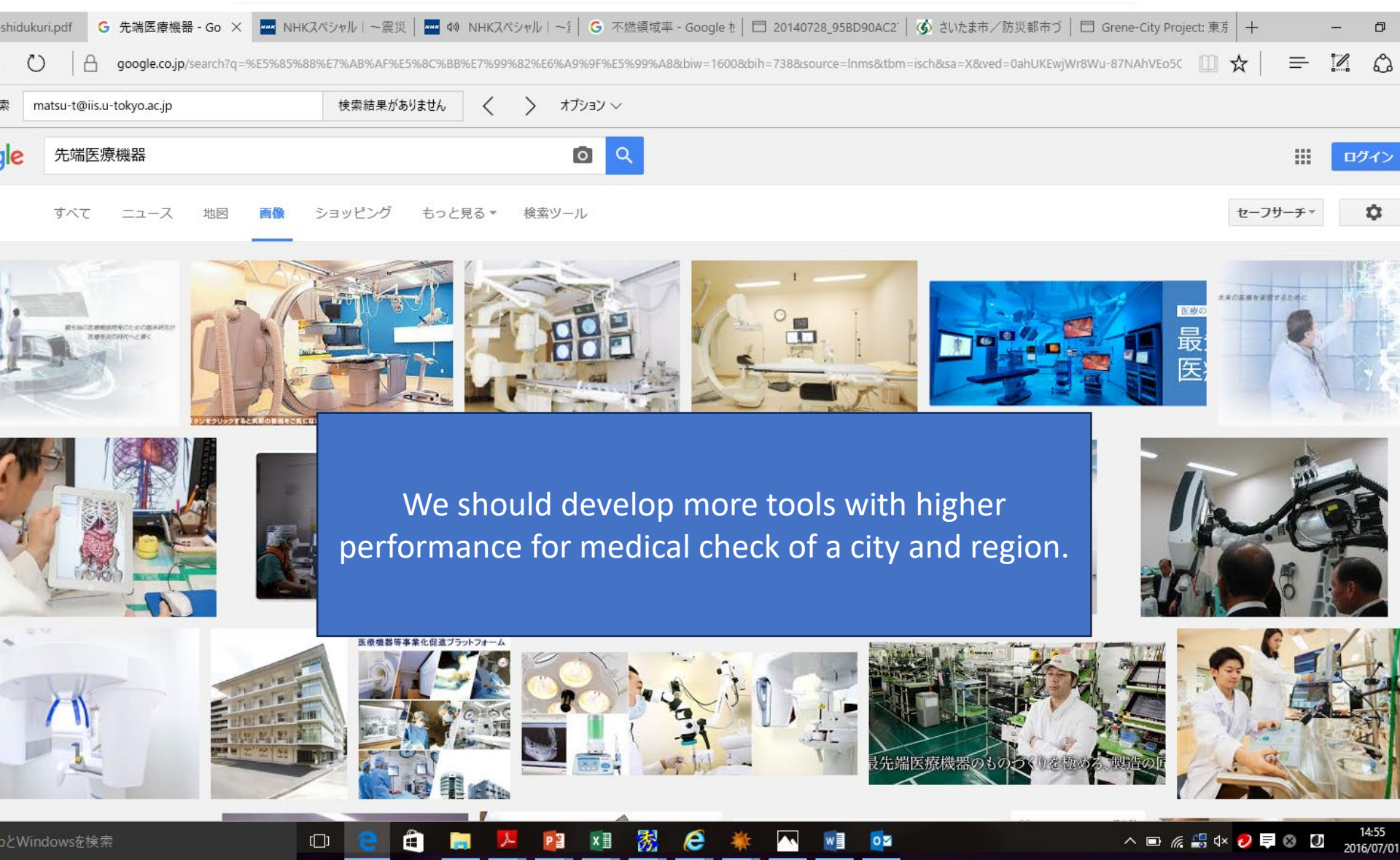
What is a digital twin? ： Significance of digital

- Visualization: category 3
  - Visualization of things that are invisible inherently such as functions and performance



My medical check

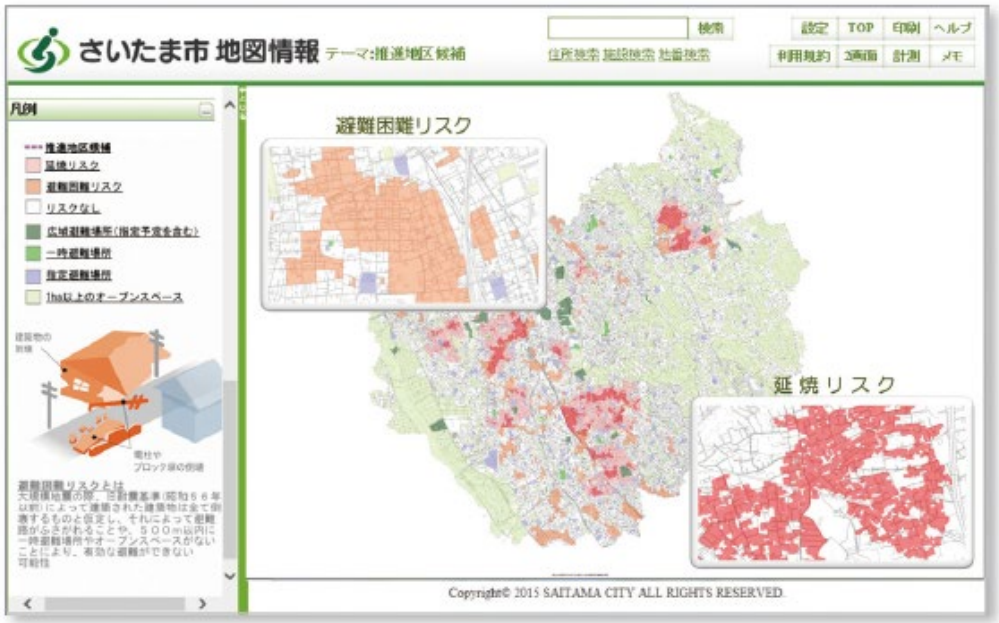
How can we do medical check for a city and region?
– Medical field has many kinds of diagnose tools such as stethoscope, ultra sonic wave, X-ray, CT scan, and MRT,



Assessment tool for vulnerability to urban fire spreading in post-earthquake by fire-spreading cluster named by T. Kato(2006)

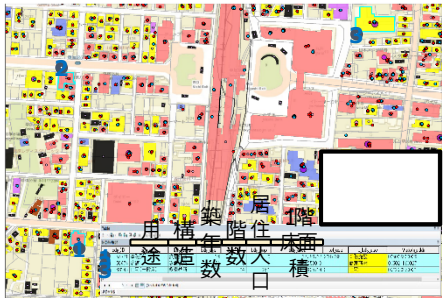
Saitama city earthquake disaster damage risk check system based on GIS

さいたま市：防災都市づくり計画、GISベースのリアルタイムの災害リスクモニタリングシステム



■GIS(※) による災害リスクのモニタリング

Risk Check system based on GIS in Urban Planning Division of Saitama City



Hazard

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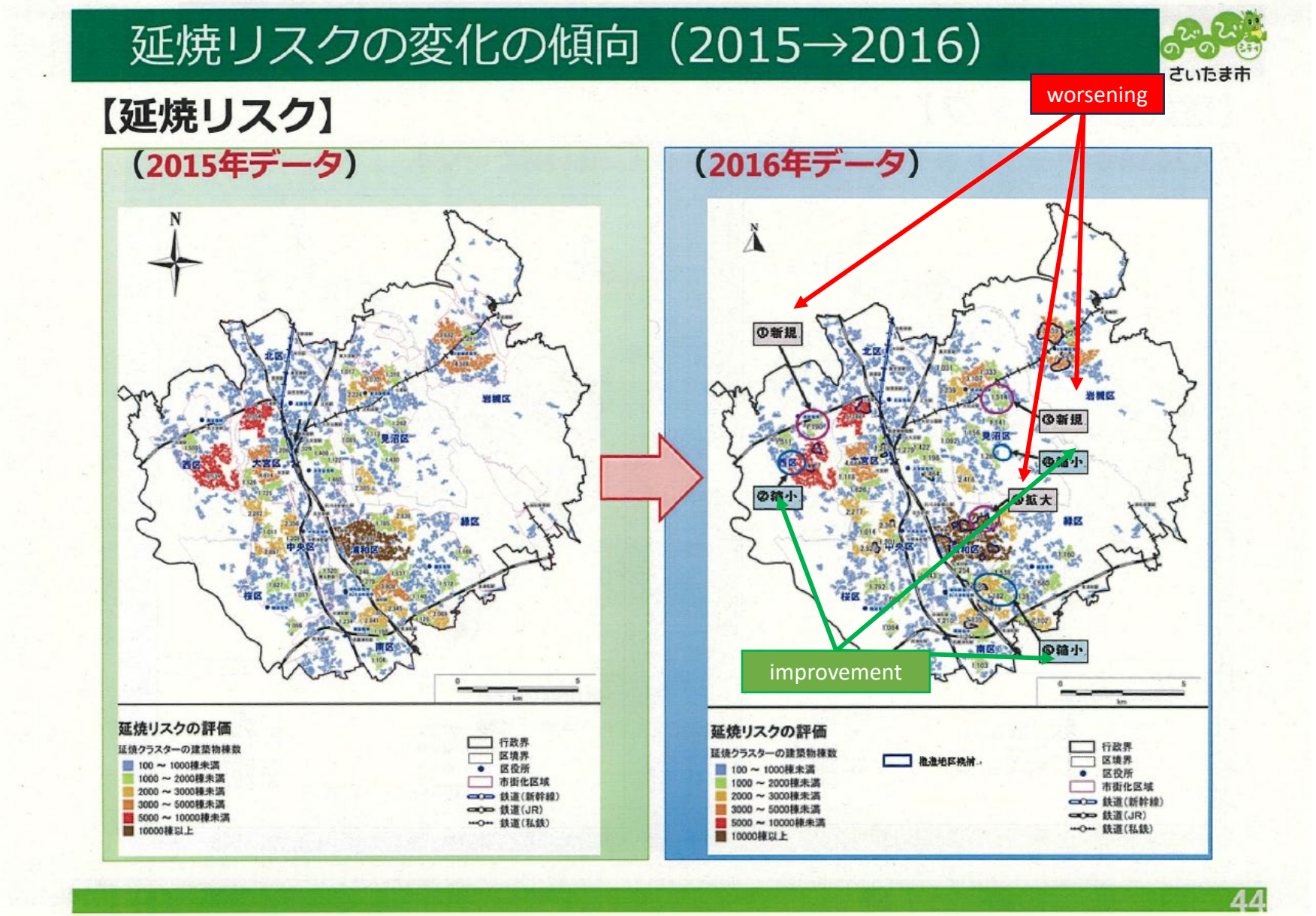
Building data linked with the Property Tax Ledger

（Check once a year）

Result of risk check about urban fire-spreading (2015-2016)



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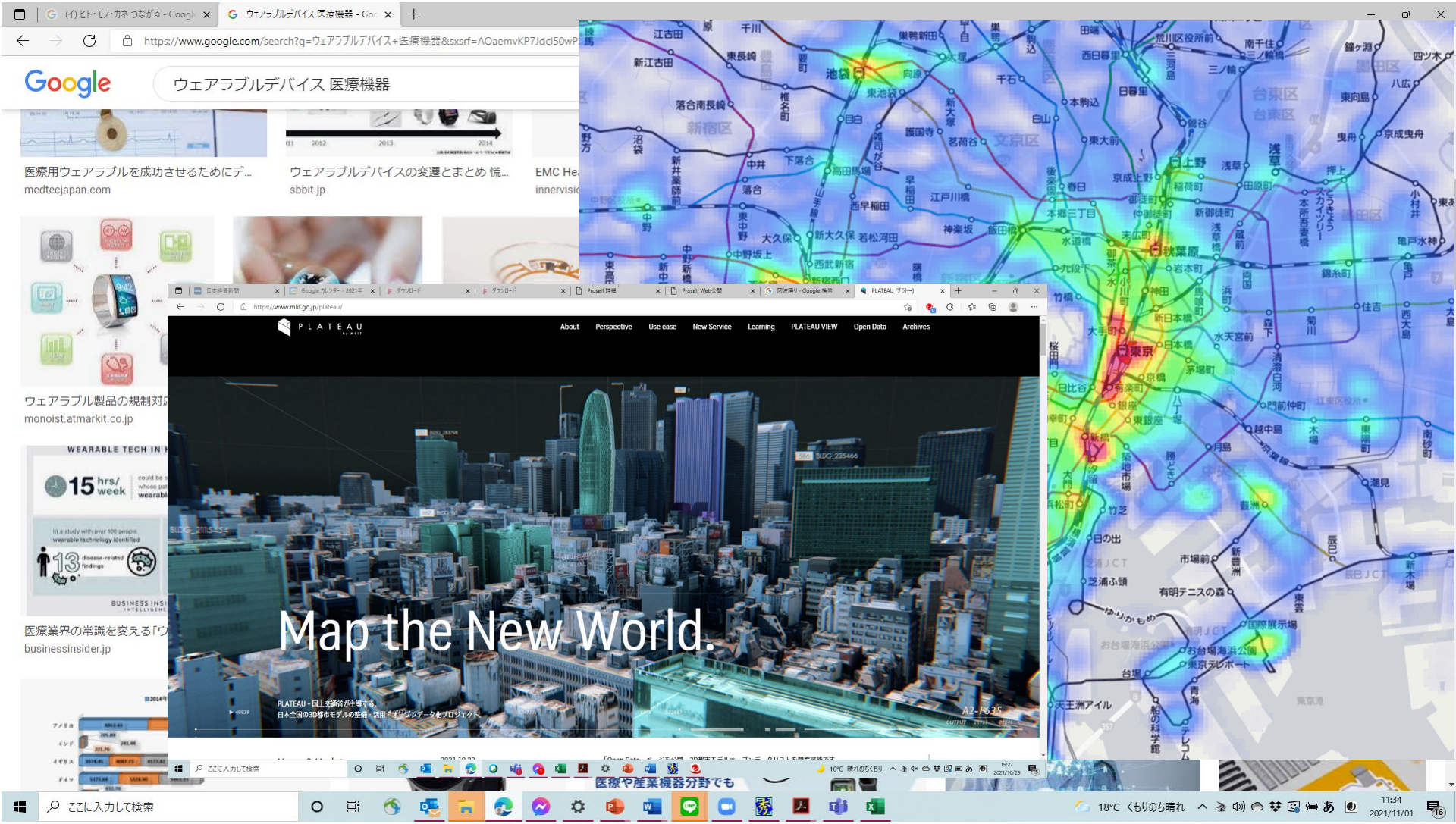
What is a digital twin? ： Significance of digital

- Real-time monitoring is necessary for every decision-making



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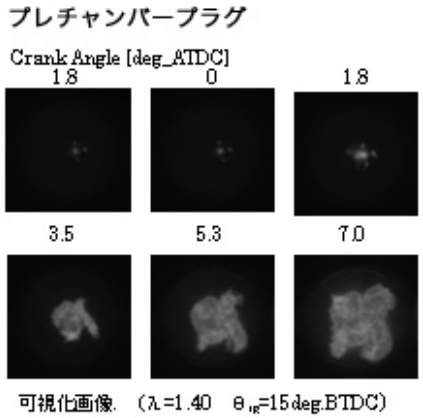
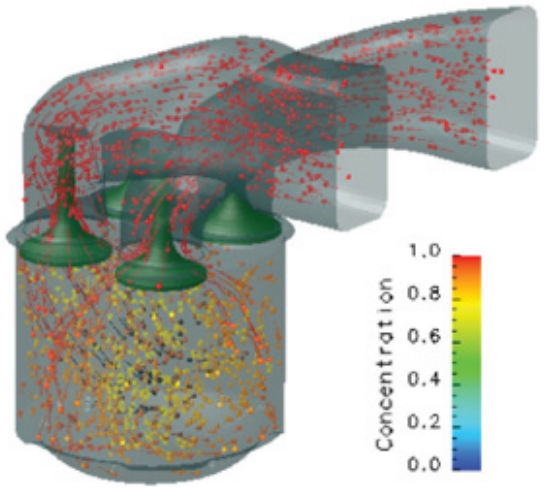
What is a digital twin? ： Significance of digital

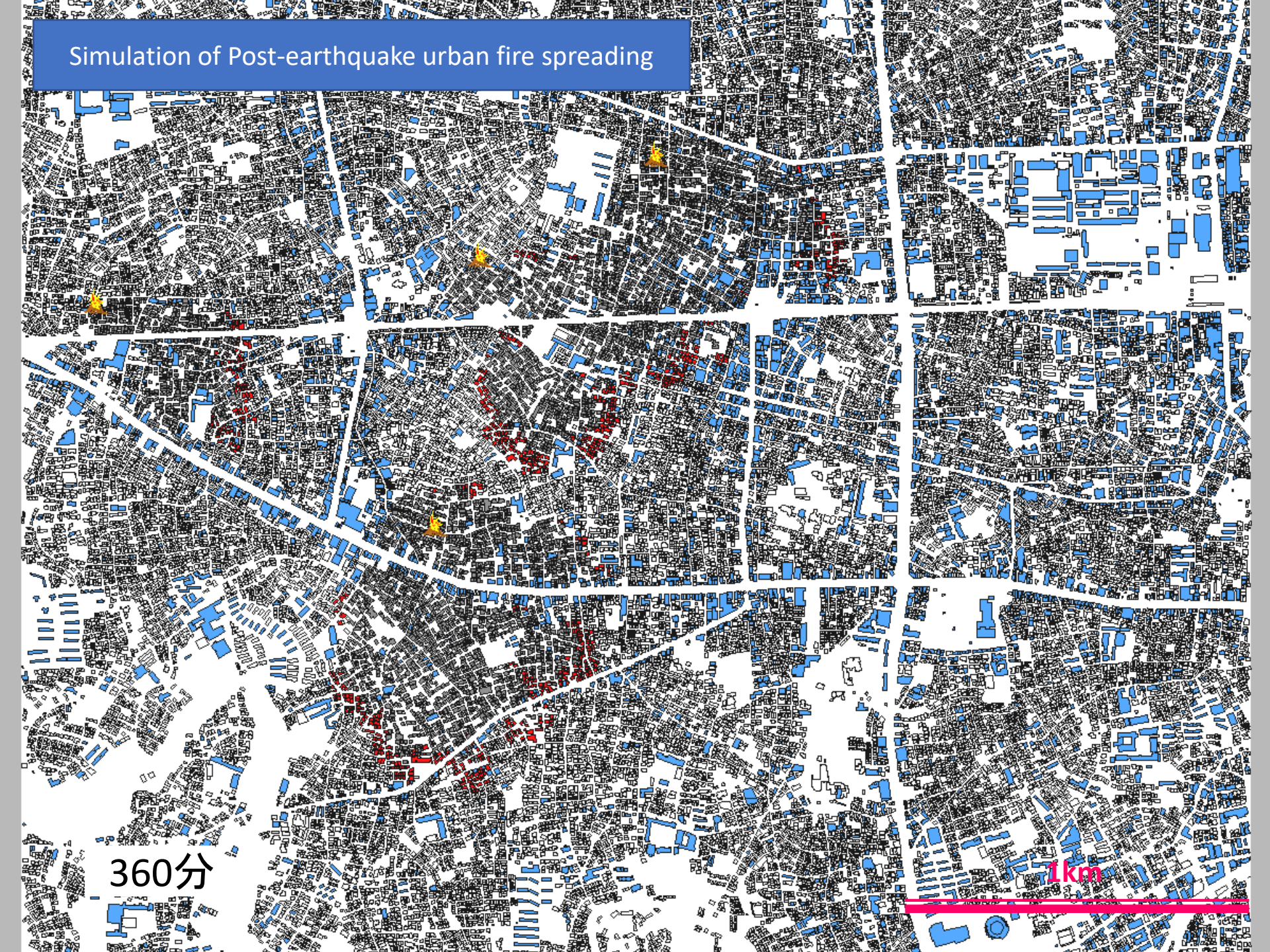
- Simulation
  - It should not only save labor in prototyping and experimentation, but also contributes to create something new.
  - Innovation of simulation technology is required.
- シミュレーション
  - 試作・実験の省力化にとどまらず，新たな創造.
  - シミュレーションの革新・複合化



可視化エンジン試験結果



シミュレーション解析例


Simulation of Post-earthquake urban fire spreading
360分
1km

Evacuation simulation combined with urban fire-spreading simulation

The university of Tokyo
Kozo keikaku engineering inc.

Suginami city with one million of population

Assumption

- **Number of fire breakpoint: Estimatable maximum numbers**
- **called well-behaved model**
- **etc.**

Moreover, it should be combined with real-time monitoring in the future.

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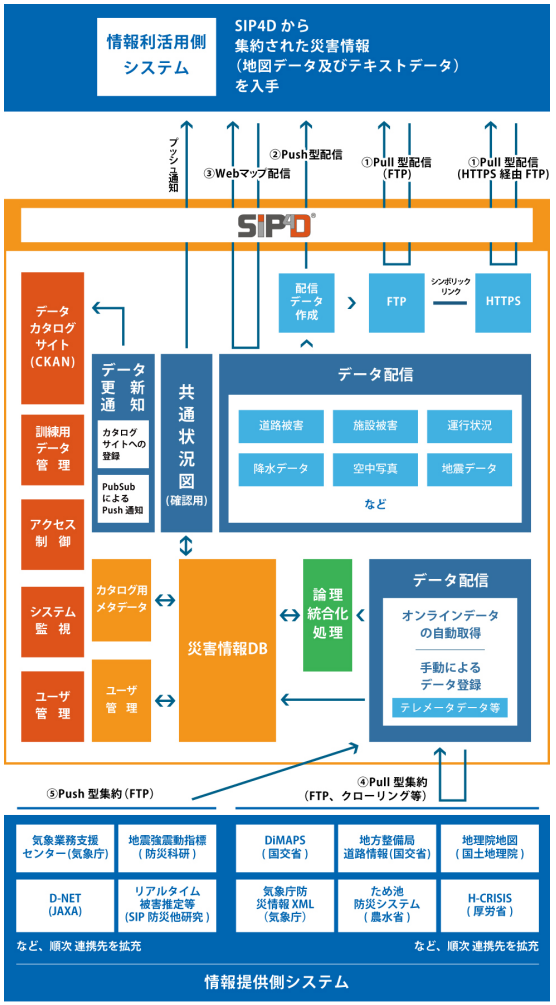
What is a digital twin? ： Significance of digital

- Mashed-up visualization of many kinds of data
  - 1+1>2　Creating synergies

Geospatial mash-up service for related Information to disaster by GITA-JAPAN（～2011）



SIP4D promoted by CAO(at present)
Data share system for governments

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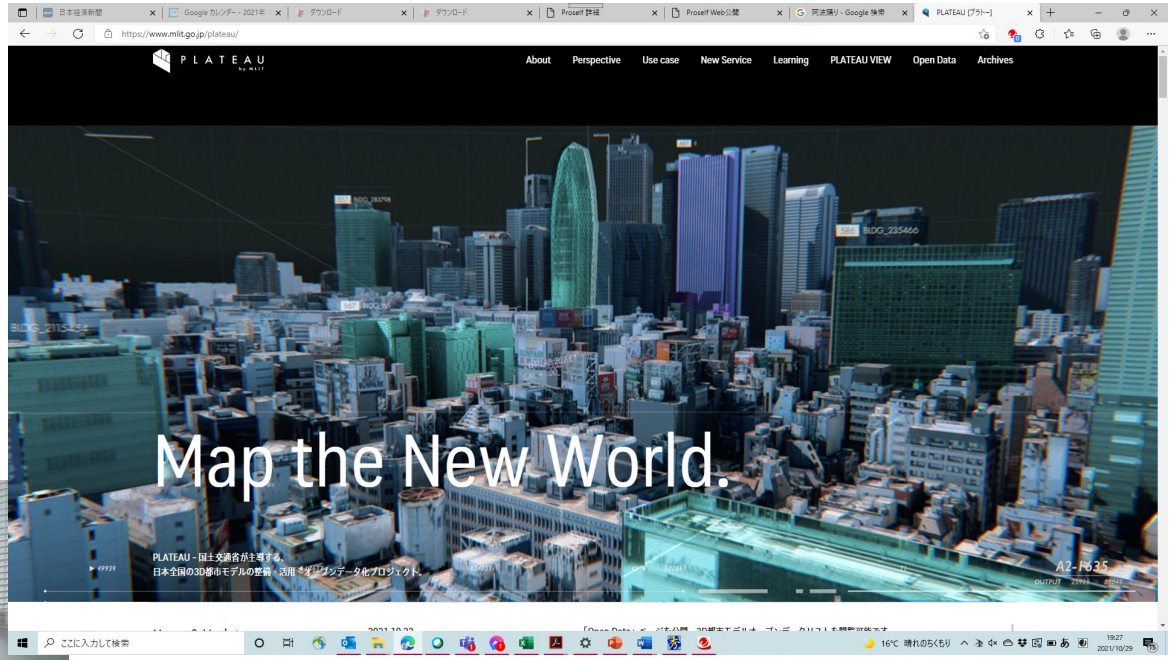
What is a digital twin? ： Significance of digital

- Digital twin can be a kind of incubator for babies called AI.



Plateau by MLIT

Summary:
Try to consider from the viewpoint of Neo digital-native

- Toward Society 5.0
  - Hunting-based society (1.0) → Agriculture-based society (2.0) → Industrial society (3.0) → Information society (4.0)
- In a sense, Society 3.0 and 4.0 might be based on the enslavement of humans.
  - Humans give instructions, but as a result, more humans are being used by machines or computers.
- In Society 5.0, AI will liberate humans from boring tasks. We will go towards a society where "**human sensibility and creativity**" are utilized.
- We may need to consider discontinuously rather than thinking from society 4.0 from the perspective of a world where people, things, money, and data are connected online.

Tokyo metoropolitan government

Thank you for your kind attention.

Indigenous character in legend called “Namahage”
(OGA City Tourism Association)

Local efforts for disaster prevention → common sense → culture