

NARLabs

National Applied Research Laboratories
National Center for
High-performance Computing

The Development Progress of 3D geospatial Infrastructure in Taiwan

Y.L. SHIH

2021/06/17

HPC

Cloud

Big Data

Network

Commitment · Passion · Innovation



AGENDA

1. Introduction
2. The development progress of 3D GIS infrastructure.
3. The applications of geospatial technology in NCHC



Position



The Ministry of Science and Technology (MOST)

is the government ministry of the Republic of China (Taiwan) for the promotion and funding of **academic research**, development of **science** and **technology** and **science parks**.



The National Applied Research Laboratories (NARLabs)

is the institution resulted from the combination of national laboratories into an independent nonprofit institute.



NARLabs 財團法人國家實驗研究院

國家高速網路與計算中心

National Center for High-performance Computing **Founded In 1991**

National Center for High-performance Computing (NCHC)

Taiwan's only national-level supercomputing center. The NCHC possesses a large computing and networking platform facilities for use by domestic academia and the general public.

Vision and Mission



Become a World-Class Supercomputing and Big Data Center



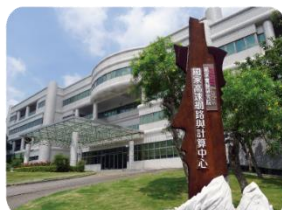
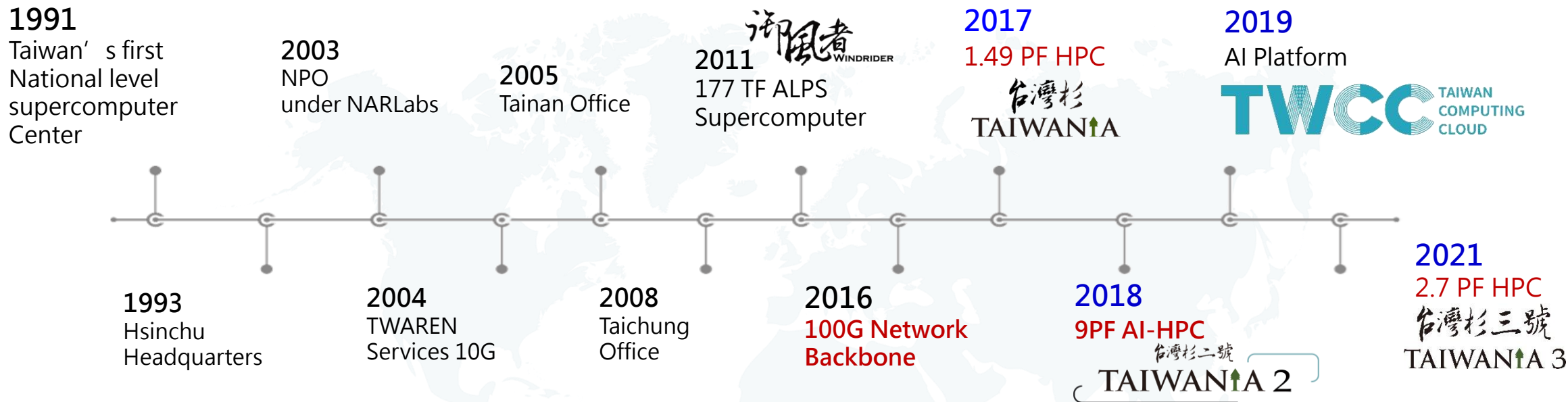
Enable Scientific Discoveries & Technical Innovation through prospective computing technology and platform



We are the Taiwan AI-HPC Enabler



NCHC Milestones



Hsin Chu Headquarters



Taichung Office



Tainan Office

Certifications



- ✓ ISO 9001 (Plus Award)
- ✓ ISO 27001
- ✓ ISO27017
- ✓ ISO27018
- ✓ ISO20000
- ✓ CSA STAR Level 2 Gold Award
- ✓ BS 10012

Taiwania 1



- A general purpose supercomputer with a large number of compute nodes and an independent file system, high security mechanisms
- Supports multiple fields of application, including physics, chemistry, mathematics, atmospheric, engineering and life sciences.

 425 million computing hours/year

 900+ projects/year

 4300+ accounts/year



launch in May 2018

Supplier : Fujitsu

<https://iservice.nchc.org.tw>



Computing cores:27,760

CPU : 1.33 PF

GPU : 0.4 PF

Storage : 3.4 PB

Networks:100Gbps

Efficiency : 4 GFLOPS/W

PUE < 1.3

2017. Nov. ranking

Taiwania 2



2018. Nov. ranking



Directed by



Specification setting by



Manufactured by Taiwanese companies



The NCHC is accelerating AI innovation in Taiwan

Hardware - whole system

- 252 nodes / 9072 CPU cores / 2016 GPUs
- 193.5 TB memory
- 10 PB storage
- EDR InfiniBand 100 Gbps
- 1.2 PUE (Warm Water Cooling)

Hardware - single node

- Intel Xeon Gold CPU x 2
- Nvidia Tesla V100 w/32GB x 8
- 768 GB memory
- 240 GB SSD + 4TB NVMe

Software Environment

- Slurm / Kubernetes
- Nvidia NGC Docker
- Ceph
- Spectrum Scale (GPFS)
- CentOS

AI Framework

- Tensorflow
- Caffé / Caffé 2
- PyTorch / Torch
-and more



Taiwania 3

2021 June, Coming soon!!



916 Nodes
50,400 Cores



2.7 PF
Rmax

- CPU:
 - Intel Xeon Platinum 8280 Processor
 - # of CPUs: 2 (CPU/GPU node); 4 (fat node)
 - cores/threads: 28; 56
 - frequency (GHz): 2.7 (Base); 4.00 (Turbo)
- Memory:
 - CPU/GPU node: 192 GB
 - fat node: 6TB
- Local disk: 3.2TB NVMe
- Interconnection: 100GB InfiniBand
- Software Environment : CentOS7

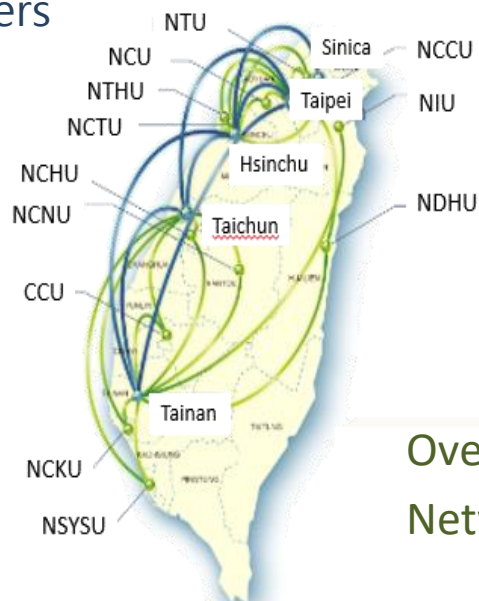
Research and Education Network

TWAREN TaiWan Advanced Research and Education Network

- **TWAREN** (Optical, dedicated bandwidth)

- ✓ 100G Bandwidth
- ✓ 12 GigaPOPs
- ✓ 94 universities & research institutes
- ✓ 500 K. users

- ✓ Sharing underlying optical network with **TANet** (4000 schools, 4.5 M. users)
- ✓ Network Availability: 99.99% ↑
- ✓ 20G International Bandwidth w/30 int' l research networks



Over 99.99%
Network Availability

TWAREN Domestic Backbone

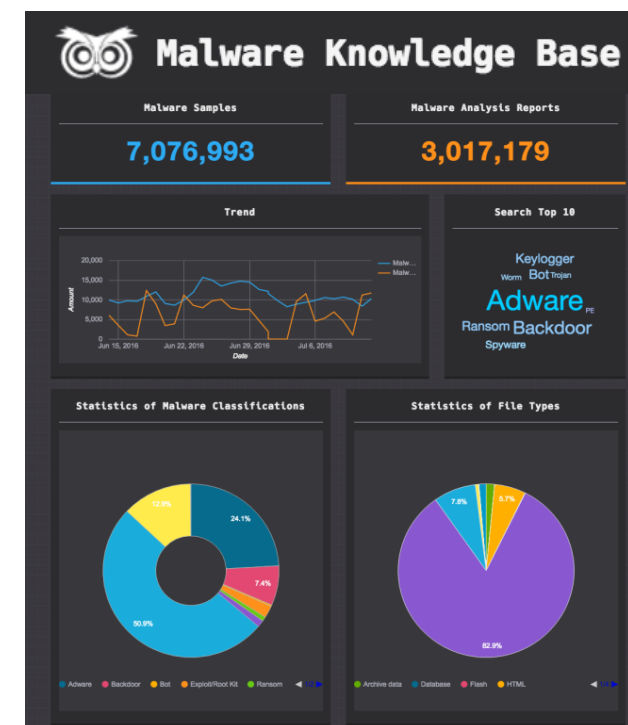


TWAREN International Connection

Cyber Security

Malware behavior analysis

- Build the **Malware behavior knowledge database (13+ M malware samples)** , the only one in Taiwan
- Deploy a large-scale Honeynet platform (**6,000+ Honetpot & 65+ GB/Day**)
- Operate **TWCSIRT** (Taiwan Computer Security Incident Response Team) for Intelligence sharing and analysis in the cyberspace
- Organize the **IRCON** (Incident Response Conference) in Taiwan to connect with the other CERT/CC, CSIRT in the global



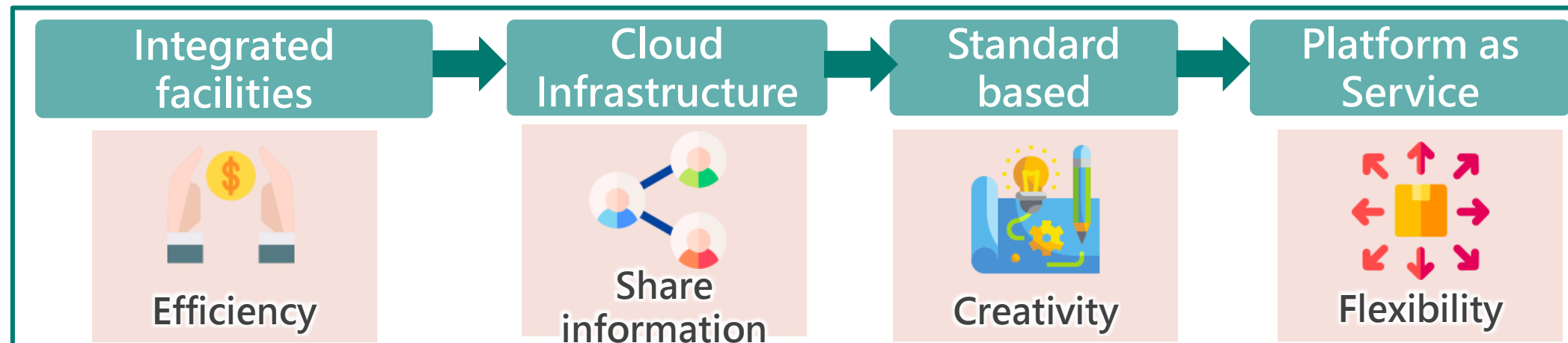
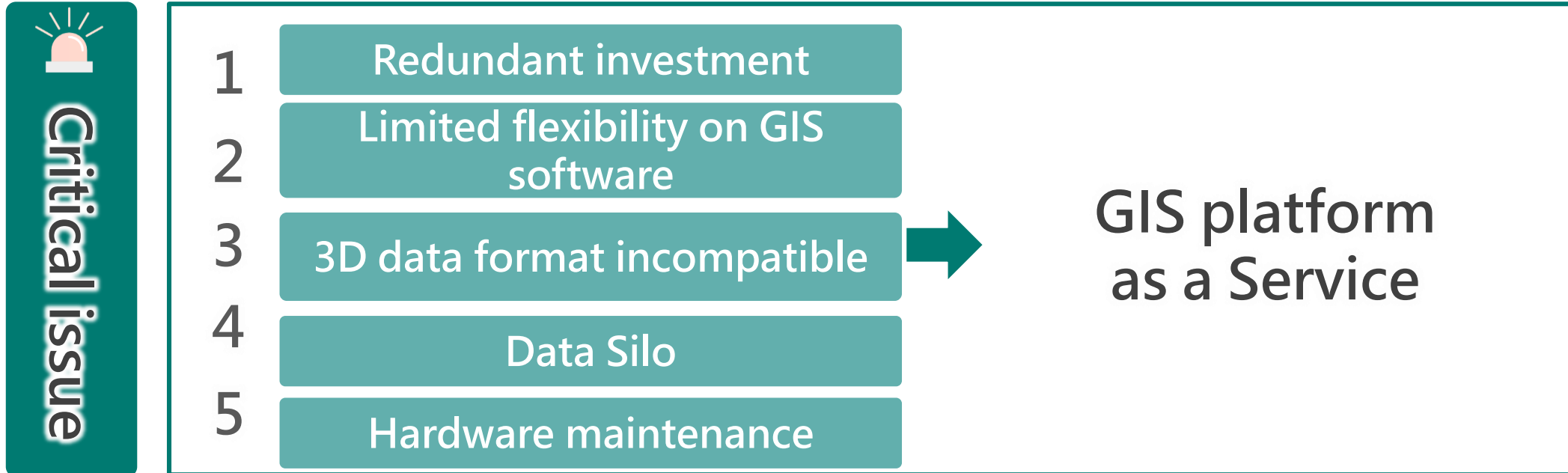
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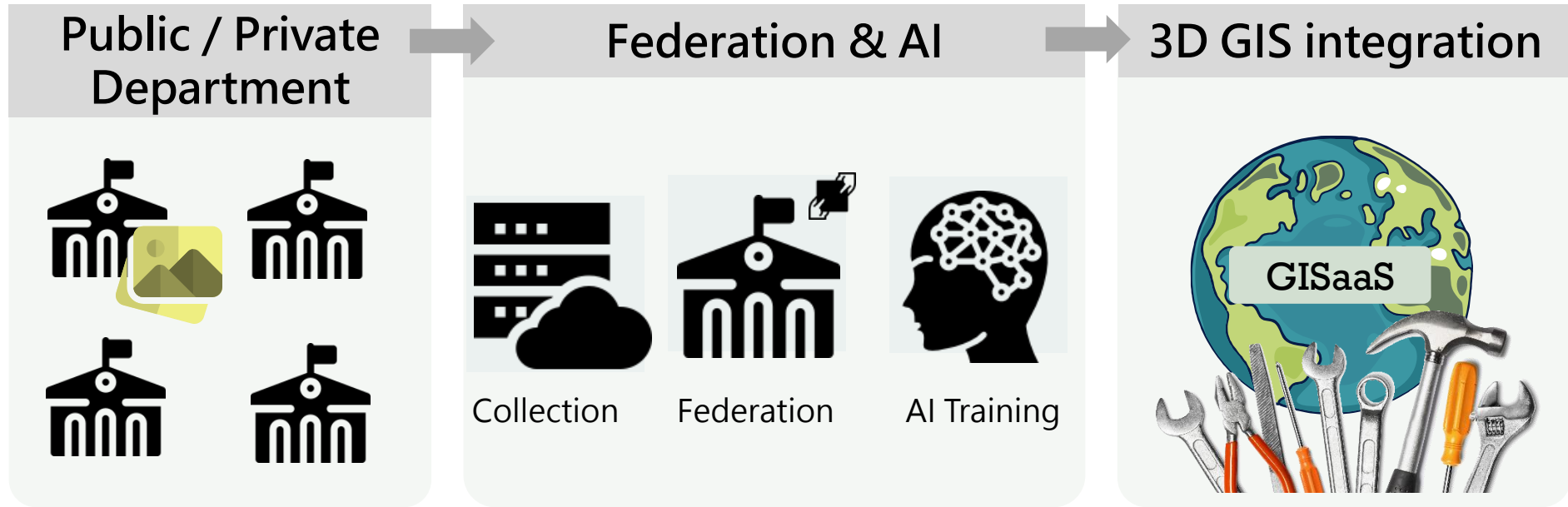
The development progress of 3D GIS



The problems of 3D GIS Platform development



The scope of 3D GIS Platform as a Service



NCHC Infrastructure

ISO 27001 驗證
資安管理系統

BS 10012/PIMS 認證
個人資訊管理

ISO 27017 認證
安全雲端環境

ISO 27018 認證
個人隱私資料保護

ISO 9001 驗證
品質管理

ISO 9001 Plus
Award 2019
95% Score
GIS Knowledge
Management Benchmark
知識管理品質典範獎

TAIWANIA 1

TAIWANIA 2
CPU/GPU主機

TAIWANIA 3
(建置完成・今年運轉)

高效能異地儲存

政府公部門整合網路
(籌備中)

雲端聯網中心
(籌備中)

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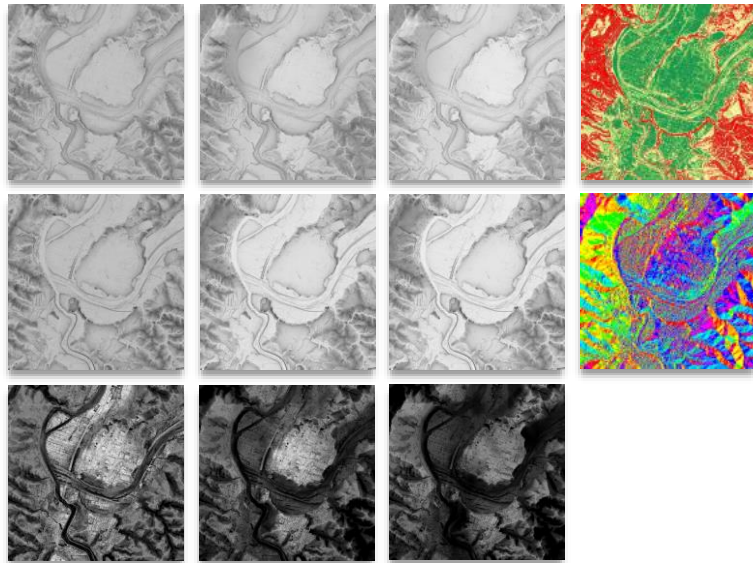
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The applications of geospatial technology in NCHC



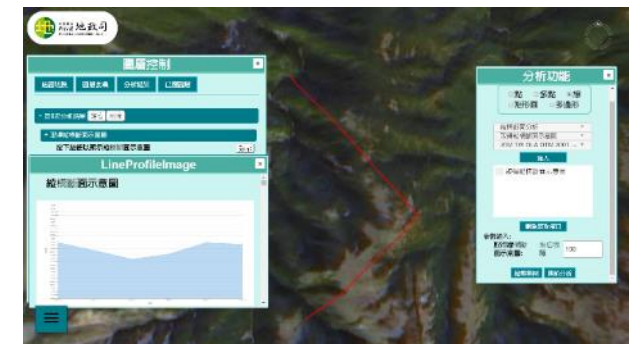
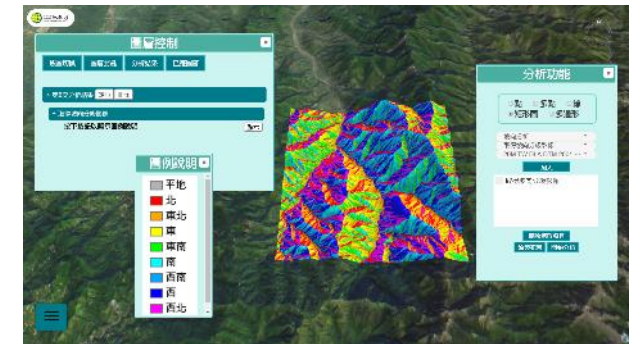
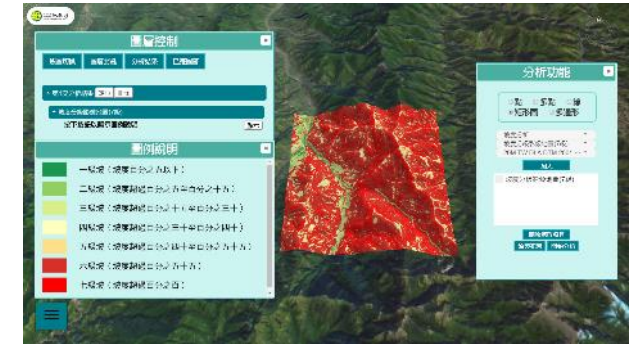
High-Speed Process for DTM Value Added

- 降低數值地形模型資料使用與處理技術門檻。
- 透過數值地形模型網路服務機制，提供各機關使用。
- 推廣到中央各機關及地方政府之圖資交流與應用。
- 降低政府財政負擔，並達到資料永續保存之目的。



國別	委託單位	資料年份	解析度	資料
TW	DLA	92 - 94	20M	DEM
TW	DLA	99 - 104	20M	DEM
TW	DLA	92 - 94	5M	DEM
TW	DLA	99 - 104	5M	DEM
TW	DLA	92 - 94	5M	DSM
TW	DLA	99 - 104	5M	DSM
TW	DLA	99 - 104	1M	DSM
TW	DLA	99 - 104	1M	DEM

A total of 8 items

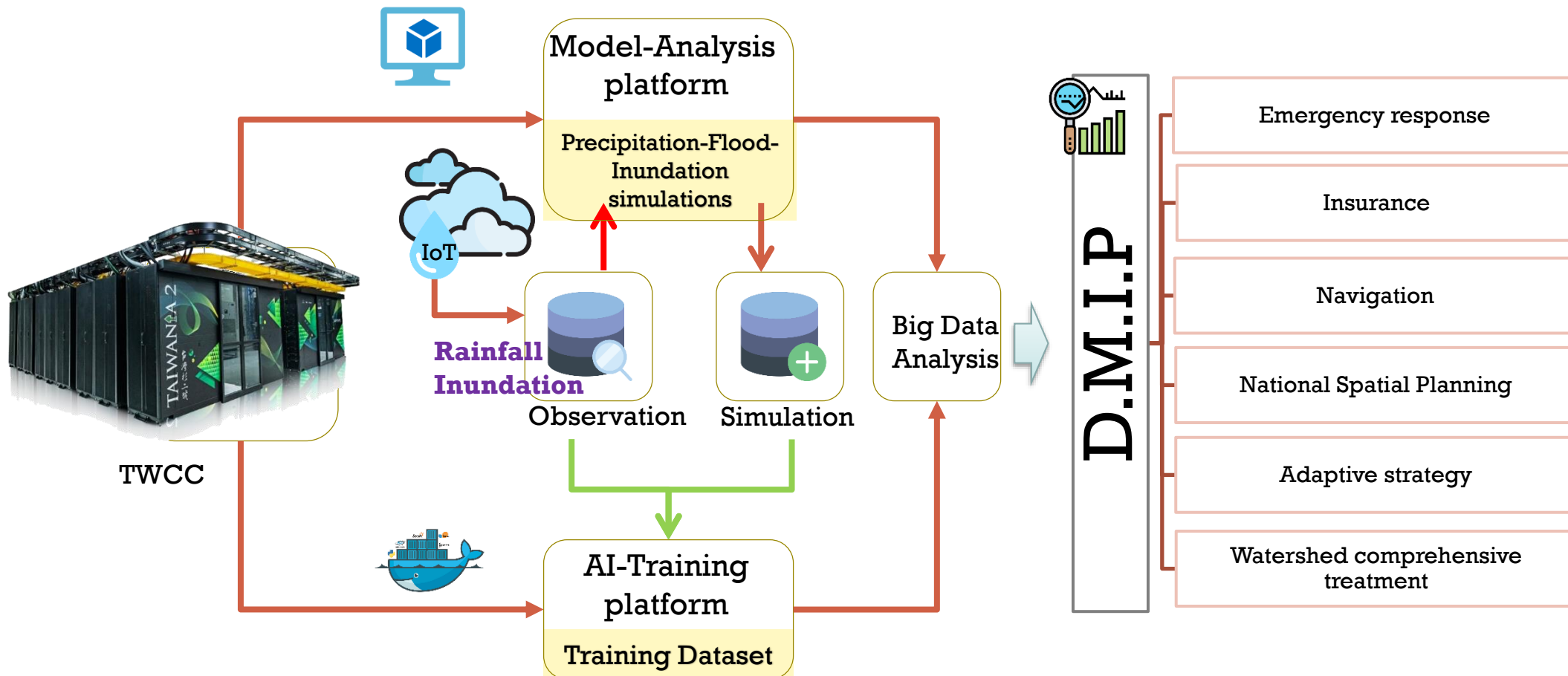


Integrated Smart-flooding Proofing System

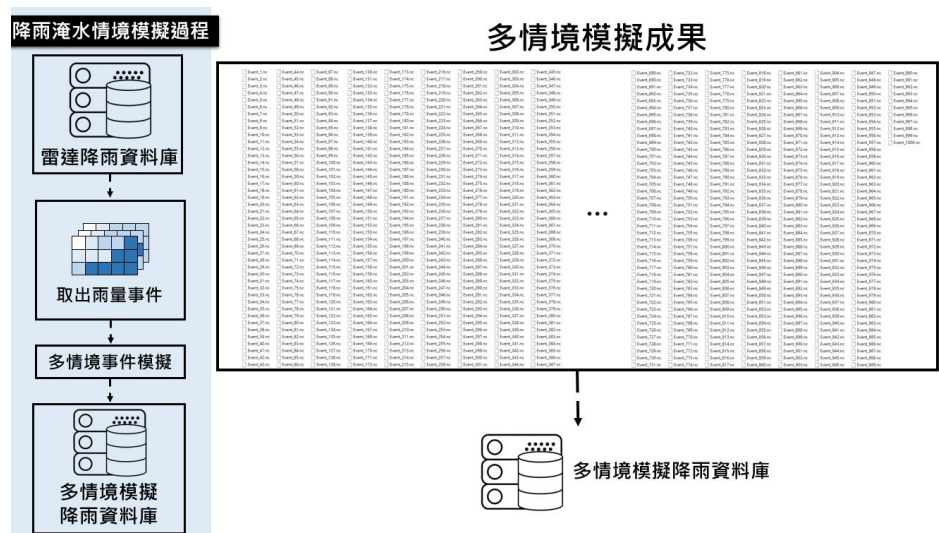
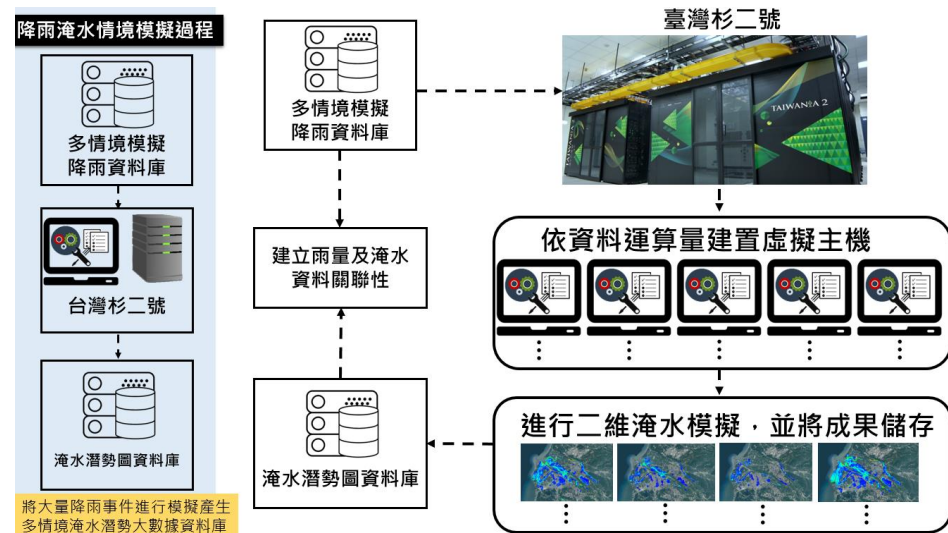
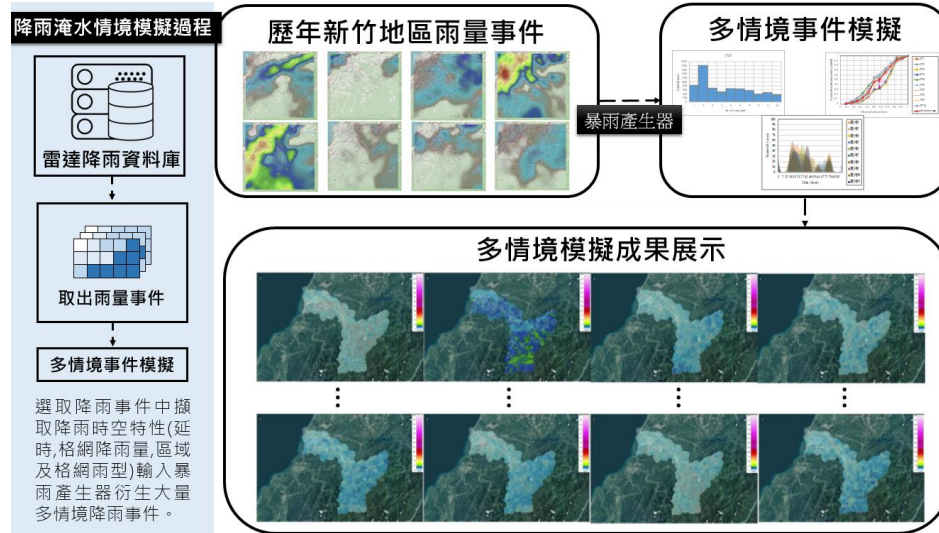
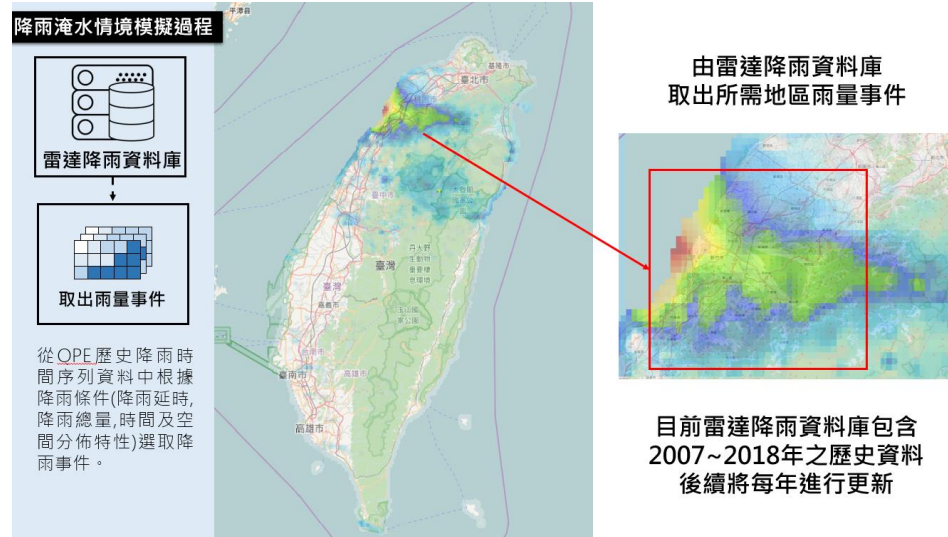
Cloud Platform

Simulation & AI Training

Application and Display



Integrated Smart-flooding Proofing System



Integrated City IOT Data with SensorThings API

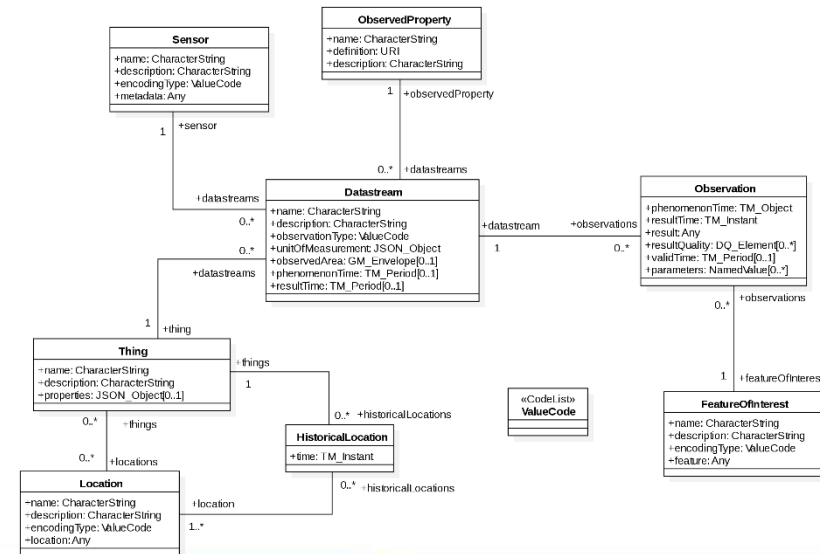
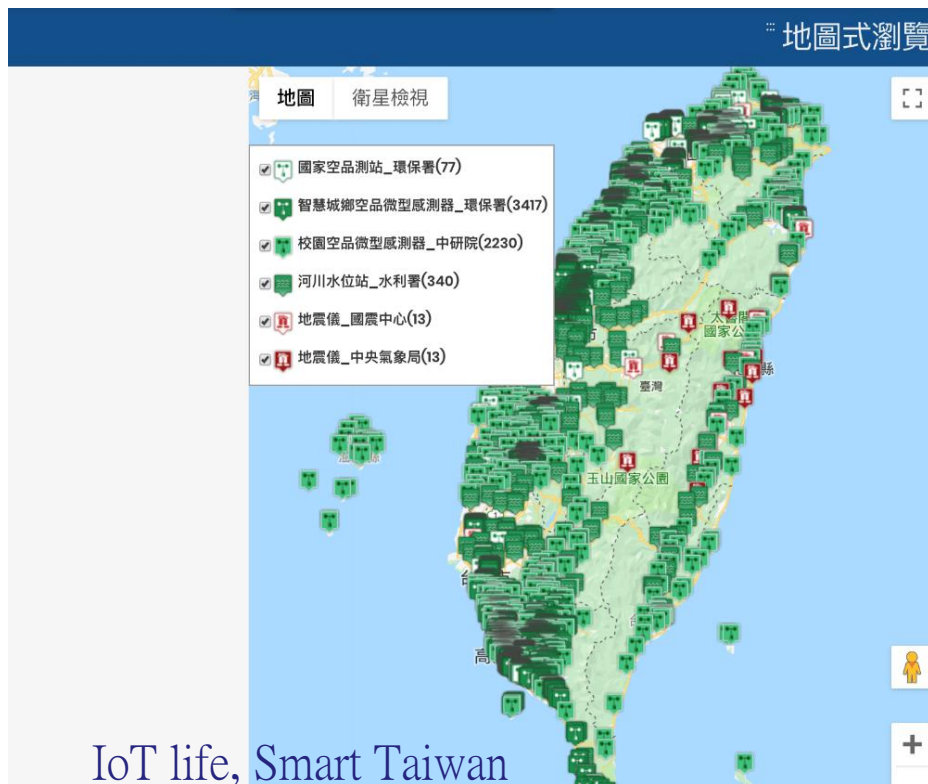
- 降低感測器資料使用與處理技術門檻。
- 建立全國一致SensorThings API資料標準。
- 推廣到中央各機關及地方政府之圖資交流與應用。
- 降低政府財政負擔，並達到資料永續保存之目的。

民生公共物聯網 資料服務平台

地圖式瀏覽 資料目錄 API說明 關於平台 EN 民生公共物聯網

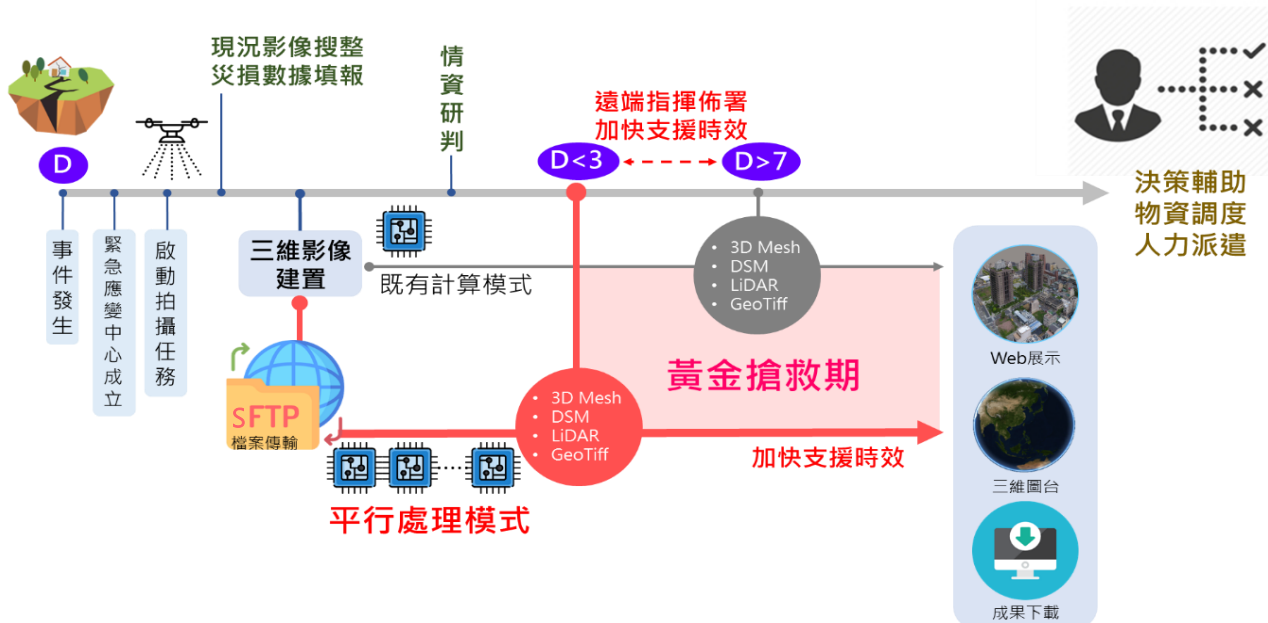
「民生公共物聯網」資料集

領域	提供單位	項目	數量	更新頻率	起始時間	API網址	歷史資料
空氣品質	環保署	國家空品測站	77站	每小時	1998年	API網址	下載
		智慧城鄉空品微型感測器	3417站	3分鐘	2017年6月	API網址	下載
	中研院	空氣品質監測即時影像	64站	10分鐘	NA	API網址	NA
		校園空品微型感測器	2230站	5分鐘	2017年9月	API網址	下載
地震	中央氣象局	地震儀	149站	有感地震事件發生後	2017年1月	API網址	下載
		地震儀	74站	有感地震事件發生後	2017年1月	API網址	下載
防救災	災防中心	災害示警	32項	不定期	2013年3月	NA	下載
	消防署	災情通報	41項	應變中心開設後	2015年	NA	下載
		河川水位站	340站	10分鐘	2012年1月	API網址	下載
		區域排水水位	152站	10分鐘	2019年-迄今	API網址	下載



Processes enhancement for generating 3D models

- High-speed process of 3D Reconstruction.
- Integrate 3D model of real-world with GIS Platform.
- Automatic process API of 3D reconstruction.



Integrated Raster data management & AI

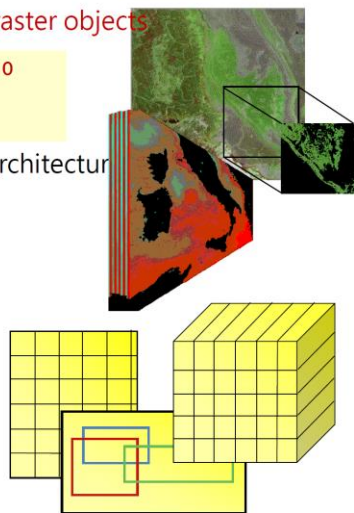
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敏捷地矩陣分析-雲端多元尺度資料即時分析能力

- „raster data manager “: SQL + n-D raster objects

```
select img.green[x0:x1,y0:y1] > 130
from LandsatArchive as img
where avg_cells( img.nir ) < 17
```

- Scalable parallel “tile streaming” architecture
- In operational use
 - OGC Web Coverage Service
 - Core Reference Implementation



3D GIS fusion platform on the Cloud

災害管理資訊研發應用平台

Disaster Management Information Platform for Research and Development

D.M.I.P 3D GIS技術研發

- D. 資料處理(Data Preprocessing):**
彙整不同來源之感測資料(Sensor Data)與政府開放資料(Open Data), 包含結構化與非結構化資料型態, 進行資料預處理。
- M. 模式評估與分析(Model Prediction):**
結合國內外專家學者所研發之預測模型, 套用DMIP彙整之資料, 預測災害成因與未來事件影響評估。
- D. 資訊展示(Dispal):**
適當的視覺化展示, 能有效提升人類對空間場域的認知, 從既有的2D圖台提升至3D圖台之技術層次, 能有效提高資料的透視。
- M. 情境應用串接(Scenario Managemnet):**
以災害事件為單元, 綜整相關資訊以提供指揮官與民眾即時的災害風險認知, 並做出最有效的處置措施。



災害影像圖資雲

圖層選擇 | 地圖工具 | 分析模組 | 應用案例 | 2D模式

縮小 | 臺灣 | 飛行

WGS84: 0.00000, 0.00000
TWD97: 0, 0

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Thank you

<http://www.nchc.org.tw>

