

Implementing Smart Cities; Standards, Interoperability and Deep Learning for Disasters Monitoring

Tien-Yin Chou

Director/Distinguished Professor

GIS Research Center, Feng Chia University, Taiwan

jimmy@gis.tw





Jimmy Tien-Yin Chou

- Director-General, GIS Research Center, Feng Chia University (FCU), Taiwan
- Distinguished Professor, Dept. of Urban Planning and Spatial Information, FCU, Taiwan
- President, Taiwan Association of Disaster Prevention Industry
- Chair, OGC Asia Forum
- Secretary-General, Asian Federation for Information Technology in Agriculture (AFITA)

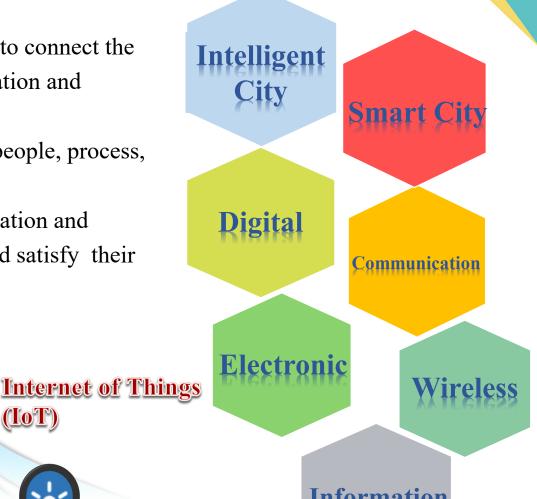
GIS Research Center, Feng Chia University (GIS.FCU)

was officially founded in 1995. Being the first officially approved GIS research center in Taiwan, the center aimed to advance the applications of GIS. With the intention of integrating geospatial information and the insistence on innovation, GIS.FCU supports the environmental decisions making by utilizing the core knowledge of GIS, GPS, and RS, making efforts in the research of technologies and the development of systems, promoting geospatial teaching and technology research in schools. The Center has been authorized by public and private institutions to participate in research and to undertake nearly thousand projects.



The core Values of Smart City

- ✤ The core value of a Smart City is to connect the network of everything by Information and Communication Technology.
- Make networked connections of people, process, data, and things.
- Smart applications deliver information and services, improve people's life and satisfy their needs.



aking location count.

strumented Smart devices provide Innovative services

Interconnected **Broadband and smart** network provide convenient services

(**IoT**)

0

Intelligent

Smart system and innovative technology services provide valueadded services



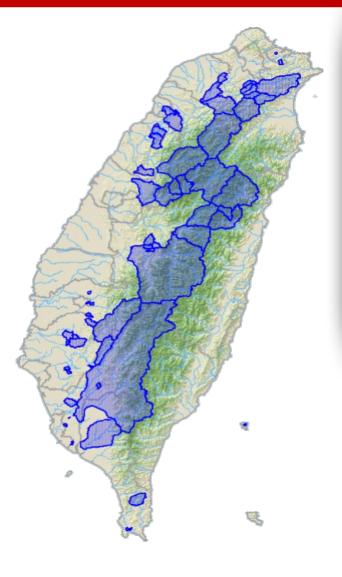
Multi-Scale & Multi-Dimensional







What we've concerned



Environmental monitoring

- Most area in Taiwan is fragile and sensitive.
- Various equipment used to detect and monitor all kinds of environmental characteristics





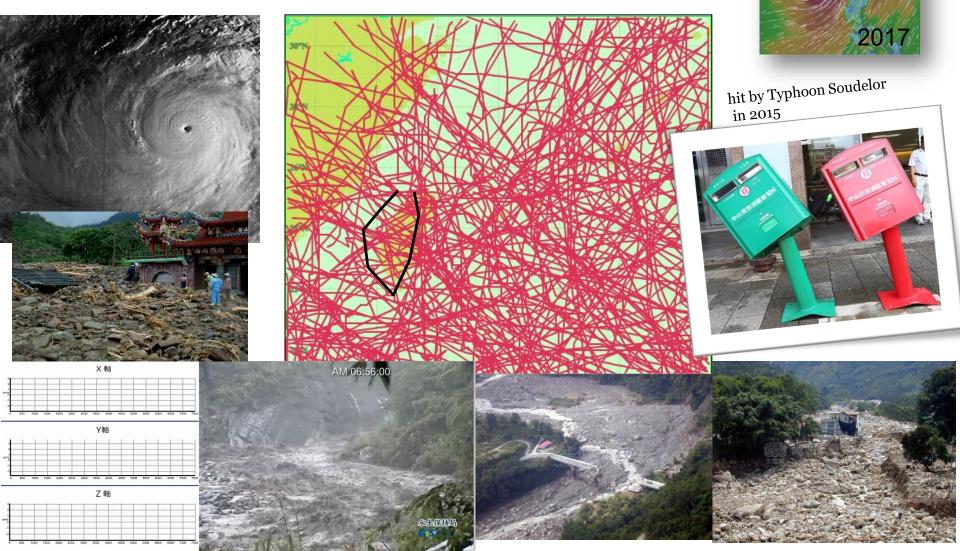
44,000 earthquakes a year in average more than 900 > M 4.0

7≤M	2010 0	2011 0	2012 0	2013 0	2014 0	2015 0	2016 0	2017 0	Intensity	Observation	Magnitude
6≤M<7 5≤M<6	2 32	0 15	3 21	4 19	1 22	4 26	4 27	1 15	I	No effect	1 to 2
4≤M<5	133	147	151	152	138	208	172	108	П	Noticed only by sensitive people	2 to 3
3≤M<4 2≤M<3 1≤M<2	1,253 8,814 12,496	1,347 8,505 11,333	1,106 7,115 18,782				1,381 8,778 28,863		Ш	Resembles vibrations caused by heavy traffic	3 to 4
0≤M<1 Total	543 23,273	448 21,795	· ·	· · ·	· · · · · · · · · · · · · · · · · · ·		10,192 49,417	,	IV	Felt by people walking; rocking of free standing objects	4
Felt Events	754	776	1,012	1,272	975	908	1,573	154	V	Sleepers awakened; bells ring	4 to 5
Felt Reports	153	172	214	166	154	100	112	60	VI	Trees sway, some damage from falling objects	5 to 6
1.200	AL		Ĩ		* 🔊	M 7+			VII	General alarm, cracking of walls	6
		2				6~7 5~6 4~5			VIII	Chimneys fall and some damage to building	6 to 7
	•	A		-	•	2-			IX	Ground crack, houses begin to collapse, pipes break	7
		ł			Depini	0			х	Ground badly cracked, many buildings destroyed. Some landslides	7 to 8
1	and the second				and the star	35 60			XI	Few buildings remain standing, bridges destroyed.	8
10	km			1921		150			XII	Total destruction; objects thrown in air, shaking and distortion of ground	8 or greater





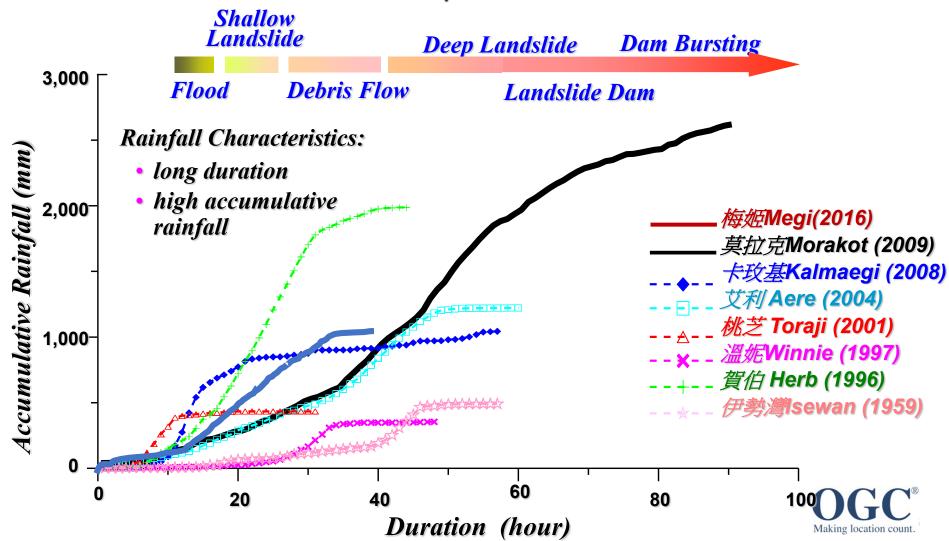
Typhoon invaded Taiwan in these 2 decades





Rainfall-Duration Curve of the Morakot & Recently Typhoons

Compound Hazards



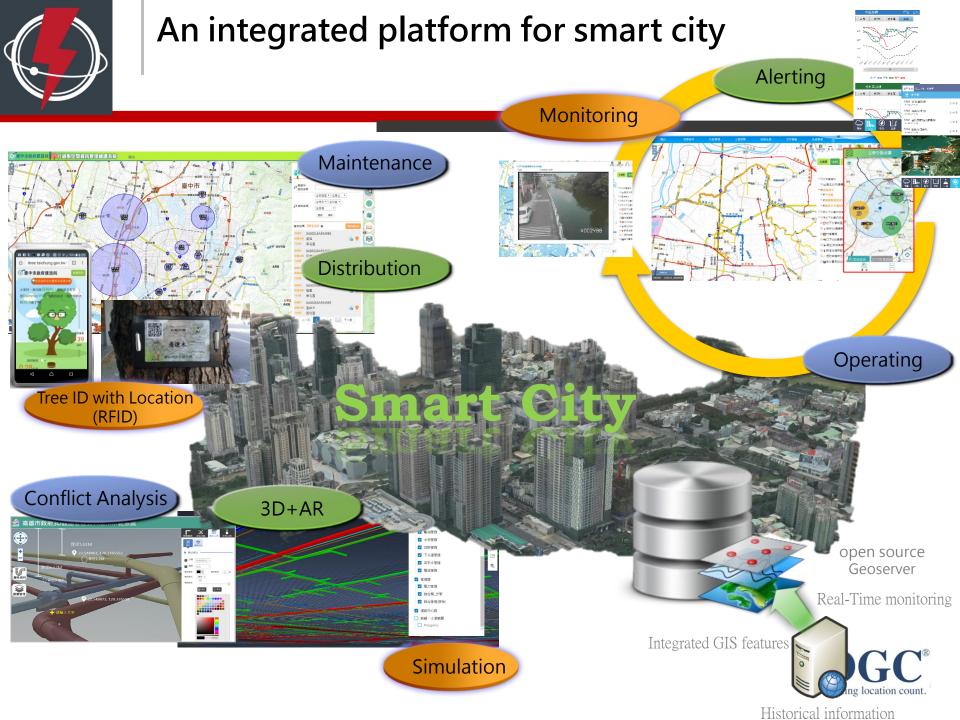








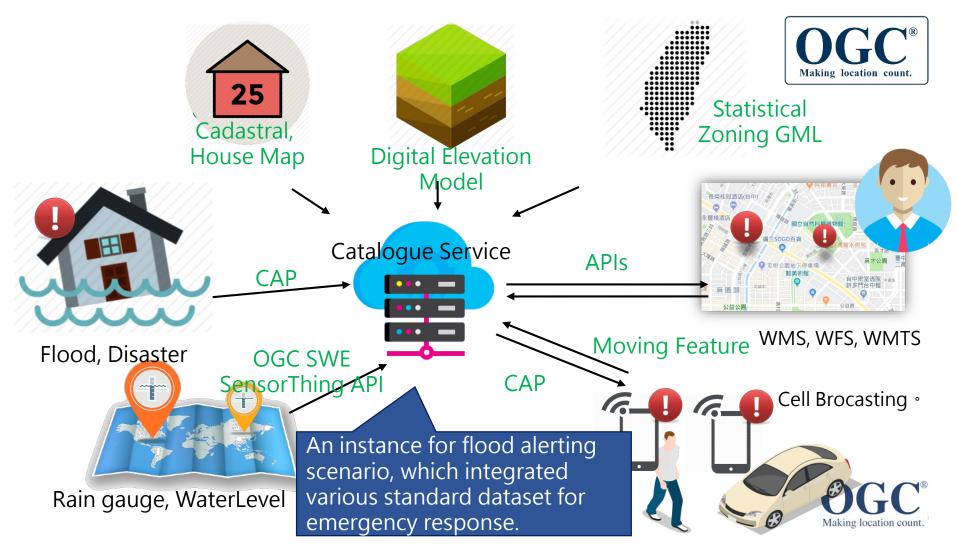
Making location count.





international standards application

• Dataset Integration based on OGC and ISO Standards











Intelligent Municipal Governance

Dashboard



- Analyzing **big data** to explore people needs and solve problems. Adjust the municipal planning and policies based on data analyses.
- Meet people needs and drive the innovation to raise the public satisfaction.
- Establish the platform to share open data and encourage citizens to add values for applications.



Real-time Information on Dashboard

We focus on real-time information monitoring, incident reports and feedbacks while providing statistical analysis and information broadcasts.

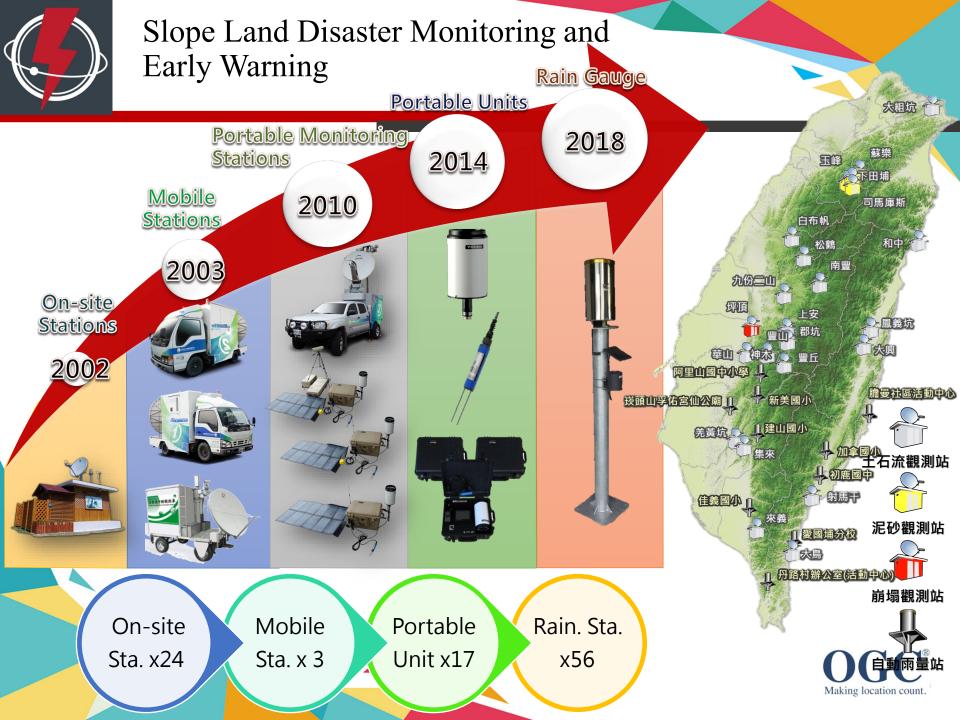


Traffic Control



Disaster Response









What we've concerned

Monitoring

Spatial Information Cloud Computing Open Data Big Data

Integration

Interoperability

GC® tion count.

SWE implemented in monitoring information service platform

Service

按一下這裡以取得完整的作業清單。

RequestSOS

測試

若要以 HTTP POST 通訊協定測試作業,請按一下 [叫用] 按鈕。

參數	值
requestXML:	
	叫用

SOAP 1.1

下列是 SOAP 1.1 要求與回應的範例。預留位置顯示之處必須代入實際的值。

POST /FCU GIS SOS/Service.asmx HTTP/1.1 Host: 210.241.45.102 Content-Type: text/xml; charset=utf-8 Content-Length: length SOAPAction: "http://www.gis.fcu.edu.tw/RequestSOS"

<?xml version="1.0" encoding="utf-8"?> <soap:Envelope xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xsd="</pre> <soap:Body> <RequestSOS xmlns="http://www.gis.fcu.edu.tw/"> <requestXML>string</requestXML> </RequestSOS> </soap:Body> </soap:Envelope>

HTTP/1.1 200 OK Content-Type: text/xml; charset=utf-8 Content-Length: length

<?xml version="1.0" encoding="utf-8"?> <soap:Envelope xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xsd=" <soap:Bodv> <RequestSOSResponse xmlns="http://www.gis.fcu.edu.tw/"> <RequestSOSResult>xml</RequestSOSResult> </RequestSOSResponse> </soap:Bodv> </soap:Envelope>

- **Monitoring information service** has been integrated to debris flow forecasting system.
- Users can click on sensor location and inquire observation data directly.
- **External AP can request** observed data published in the service platform.

Cite observed data

External AP

SWE implemented in monitoring information service platform



- Monitoring information service has been integrated with debris flow forecasting system.
- User can click on sensor location and inquire observation data directly.



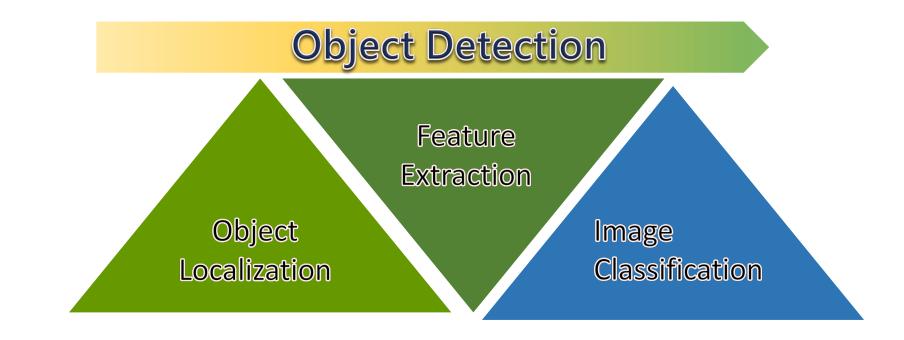
RISER

100%

smlns="http://www.opendis.net/sos/1.0"



object detection from deep learning process



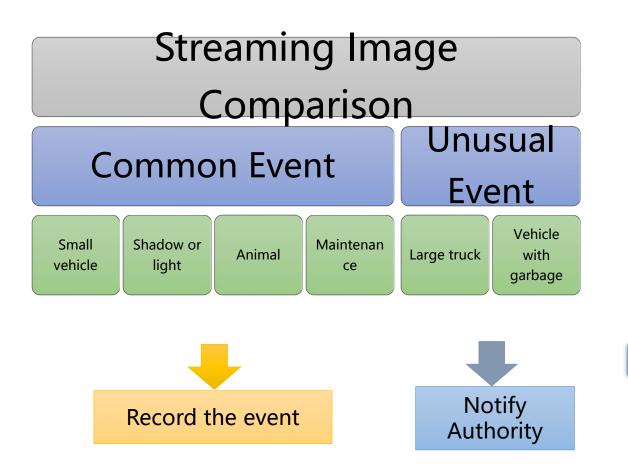




um



Remotely Monitoring Center



















Artificial Intelligence

Step1:

Camera will take series pictures if changes are detected

Step2: Event Recognition Module

Step3:

Notify

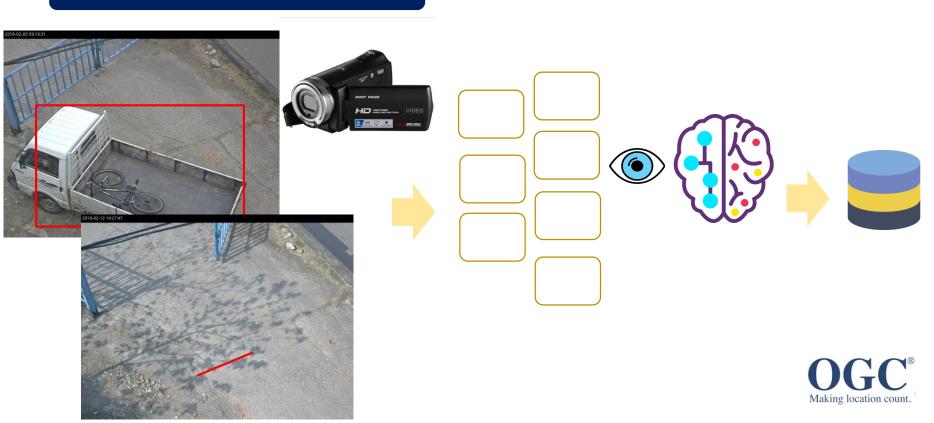
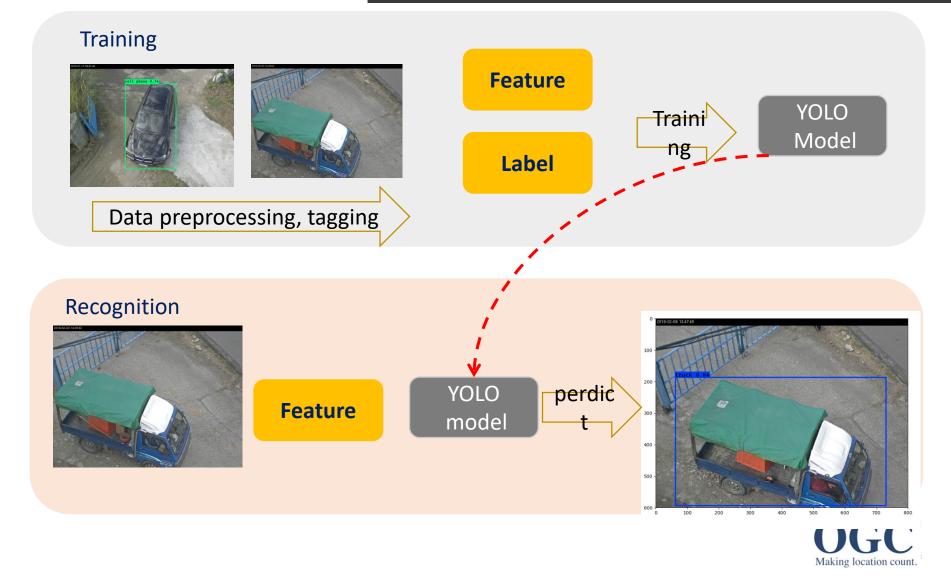


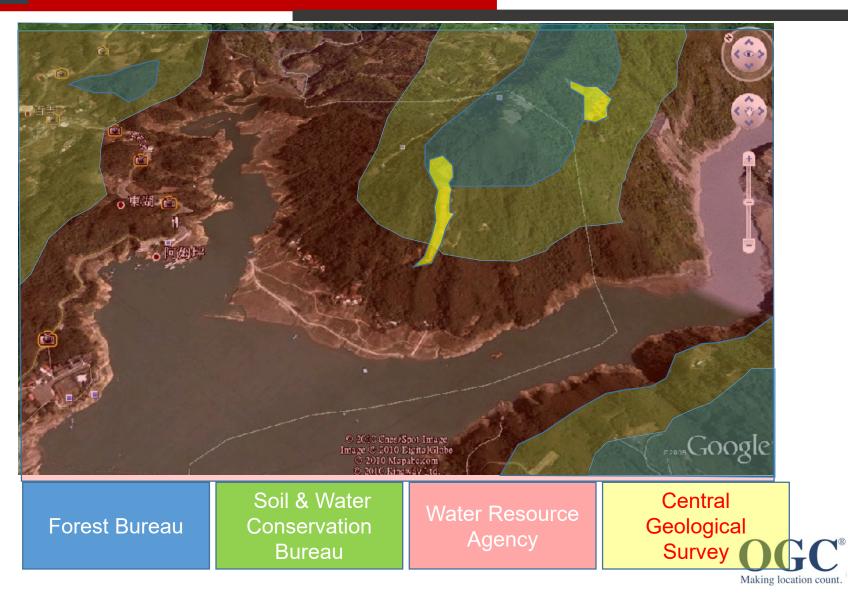


Image training model





The urgent need for Interoperability between agencies





Disaster does not matter that much...





Making location count.

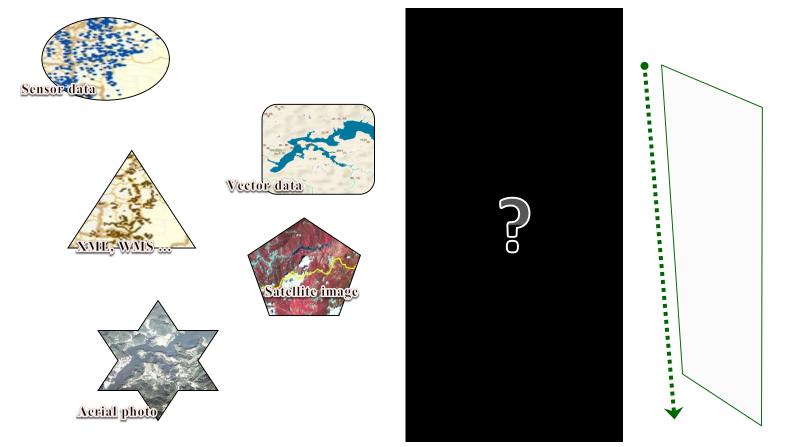


Making location count.



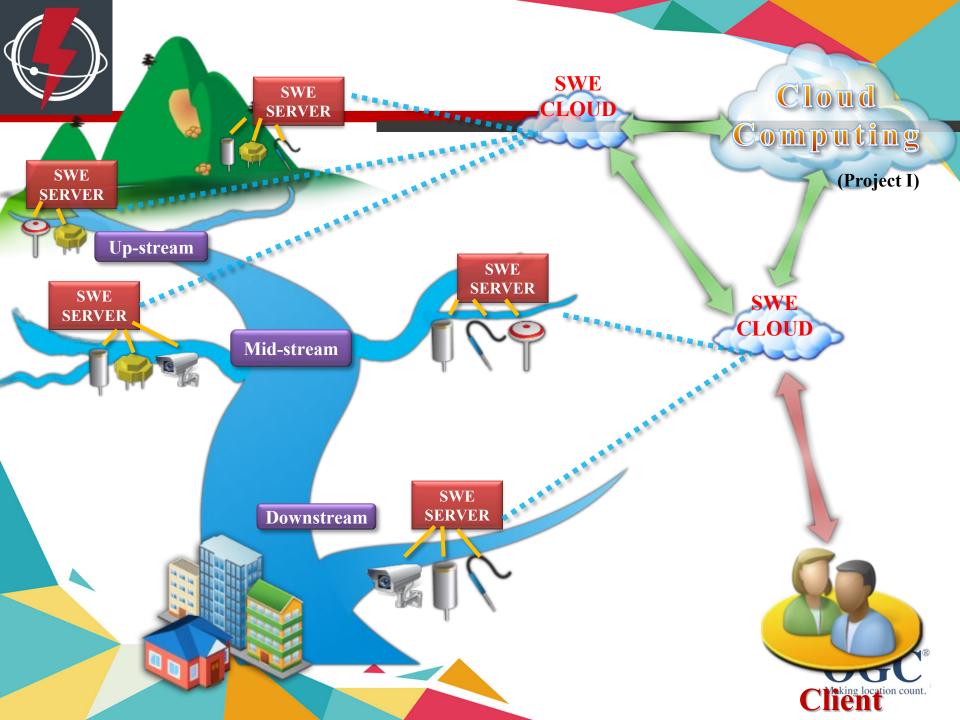
What we confront with

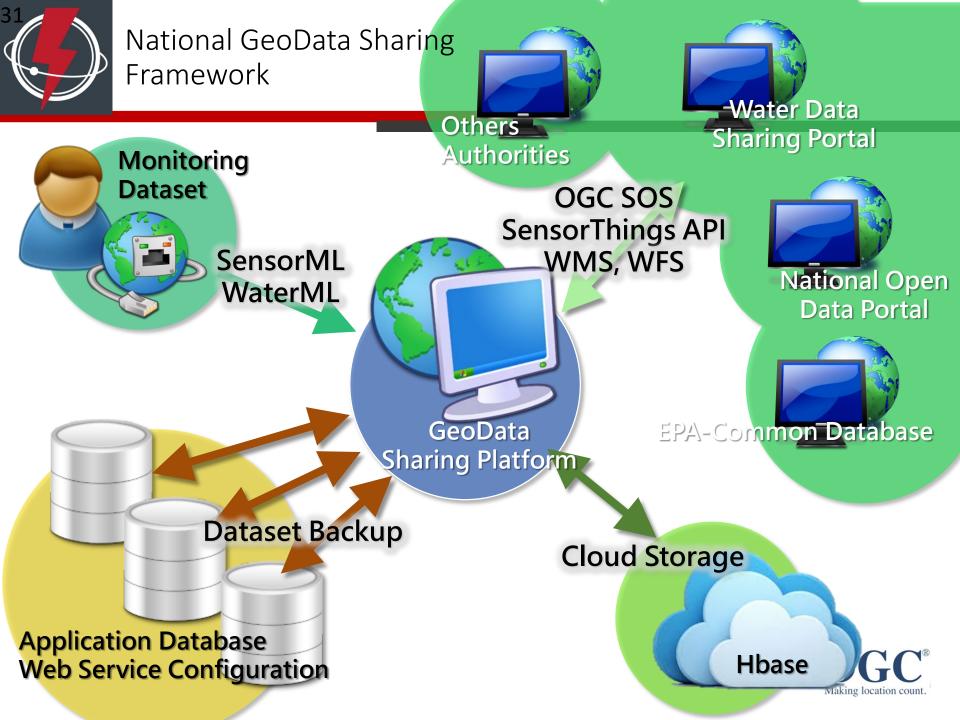
A great quantity of heterogeneous data vs. low quality of process efficiency













Internet of Things

簡易式觀測站

> CCD攝影機

行動式觀測車

智慧營運中心

R & D

Sensor R&D

地聲

- Installation and Maintenance
- **Customized Design**

Integration

- **Monitoring Cloud**
- Smart Operation Center Info Integration



海底電纜監測

> 水位計

> 淹水監測站



Standards applied for establishing floods ontology

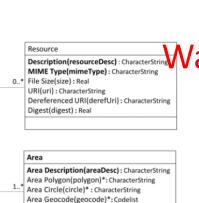
OASIS Common Alert Protocol(CAP) for event

Alert Message ID(identifier) Sender ID(sender) Sent Date/Time(sent) Message Status(status) Message Type(msgType): Codelist Source(source) : CharacterString Scope(scope) : Codelist Restriction(restriction) : CharacterString Address(address) : CharacterString Handling Code(code)*: CharacterString Reference IDs(reference) : CharacterString Incident IDs(incidents) : CharacterString



Language(language) : Codelist Event Category(category): Codelist Event Type(event): Codelist Response Type(response type)*: Codelist Urgency(urgency): Codelist Severity(severity): Codelist Certainty(certainty): Codelist Audience(audience): CharacterString Event Code(eventCode) : Codelist Effective Date/Time(effective): Datetime Onset Date/Time(onset) : Datetime Expiration Date/Time(expires): Datetime Sender Name(senderName): CharacterString Headline(headline): CharacterString Event Description(description): CharacterString Instructions(instruction): CharacterString Information URL(web): CharacterString Contact Info(contact): CharacterString Parameter(parameter)*: CharacterString

1.*



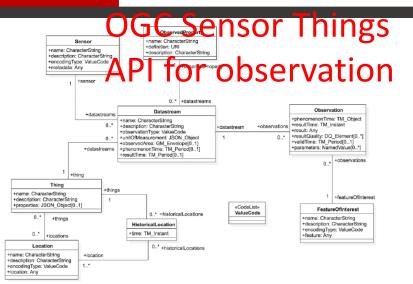
粗體為必要項目

斜膛為必須有內定值之項目

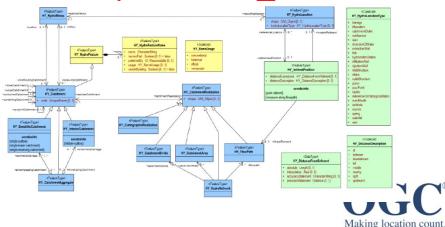
Altitude(altitude): Real

Ceiling(ceiling): Real

加註*者為允許多個項目同時存在



Resource Description(resourceDesc): CharacterString MIME Type(mimeType): CharacterString MIME Type(mimeType): CharacterString





3D Sewerage Sytem





AR / VR technology



Making location count.



Taiwan Data Cube



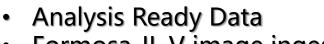


Welcome to the Open Data Cube

CEOS is using the power of the Open Data Cube to help address the needs of satellite data users, giving them a better picture of their land resources and land change.

· Ease of use and access to satellite-based data

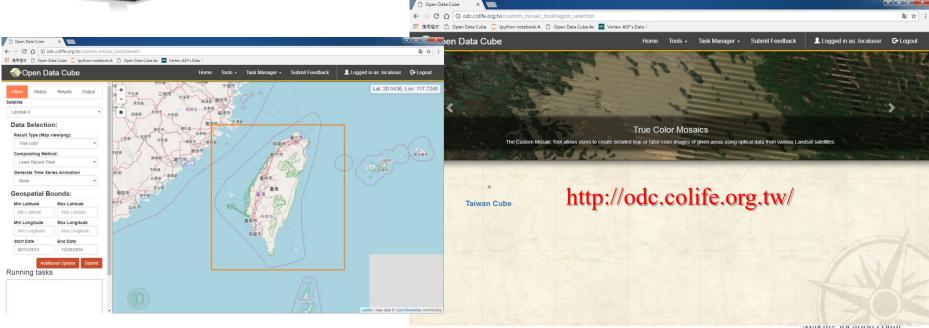
- · Multiple dataset interoperability and spatial consistency · Use of "Analysis Ready" Data Products
- · A Shift in Paradigm from Scenes to Pixels



Formosa-II, V image ingestion ٠

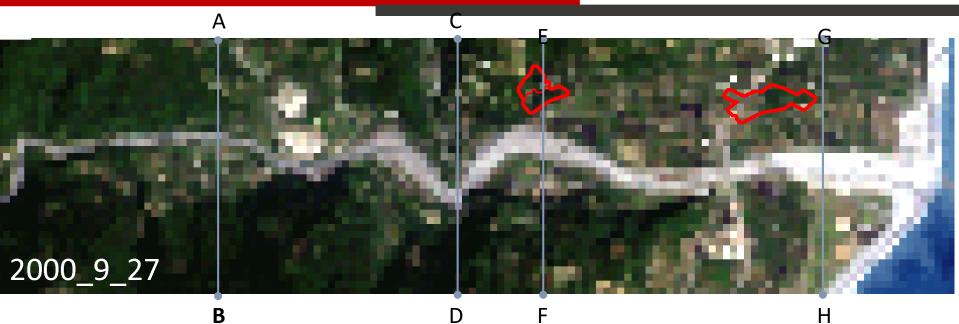
National Applied Research Laboratories

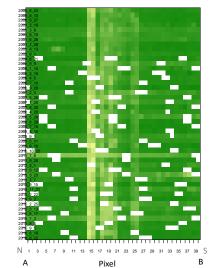
National Center for High-performance Computing



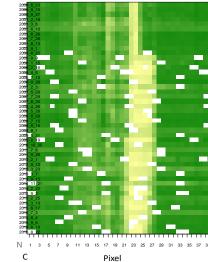


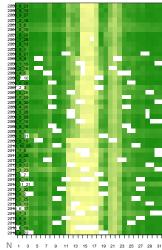
NDVI Spatio-temporal Transect analysis





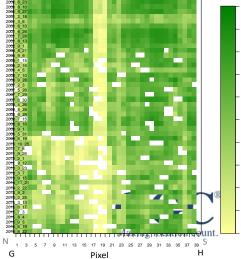
Date





F



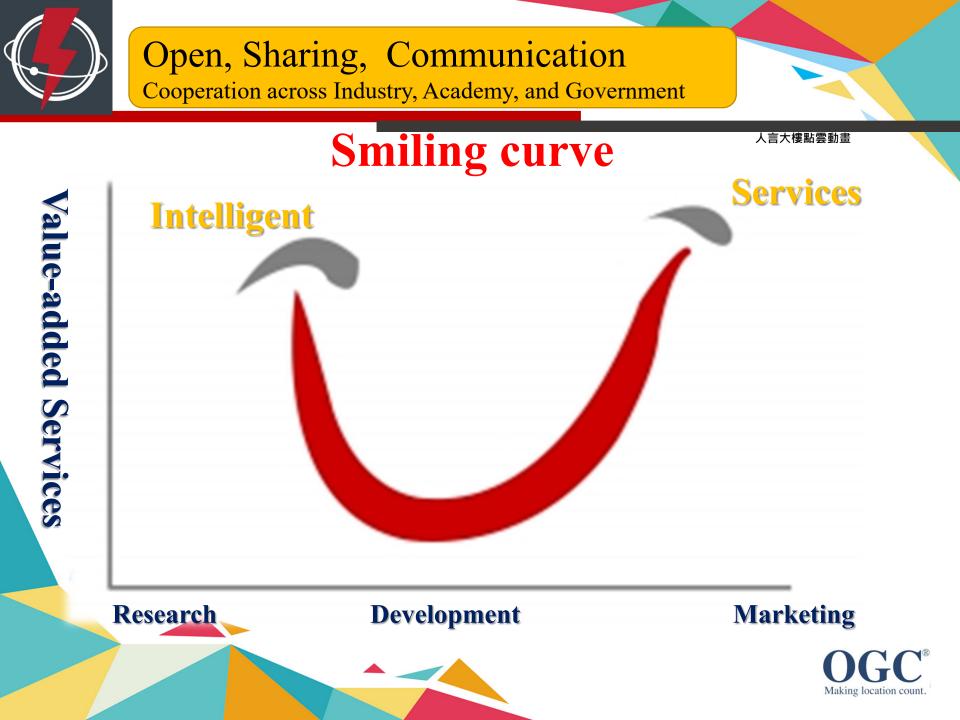




Next AI steps of GIS.FCU

Software Level	AI Technologies	
Application	AI, Classification, etc	Domain Experts, Production/Solution
Framework	<i>Caffe, TensorFlow</i> , etc	Open Source Applying Implementation
Library Language	<i>cuDNN, OpenCL</i> , etc	Model Developing, Academic Research
Hardware	GPU, CPU	Cooperate with National High Performance Center OGC [®]

Making location count.





How to effectively strengthen the enforcement and incentive of geospatial data sharing for smart city implementation?

What is the next step for International Geospatial Standard toward disaster monitoring and early warning? GeoAI? Open Data Cube?

