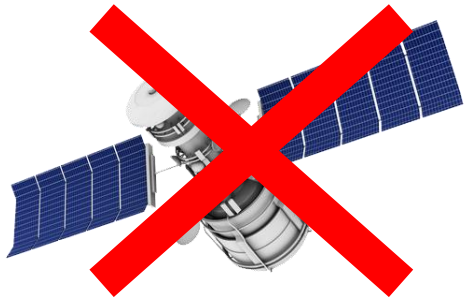
Interoperable Flood Sensors And Simulation with IoT Framework

AnaSystem
安研科技股份有限公司

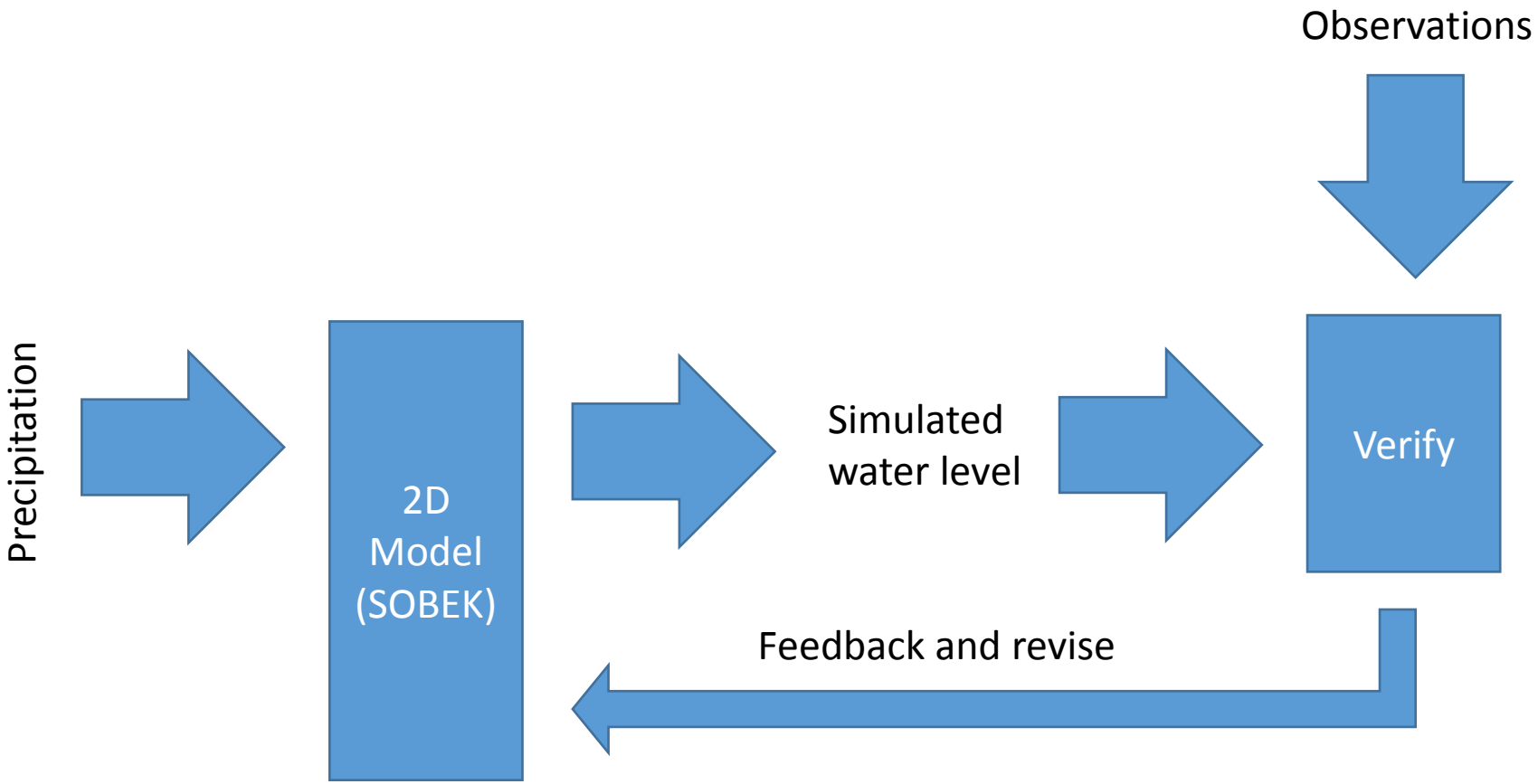
Chief of Executive Officer
黃思瑋 Richard Huang Ph.D

Goal

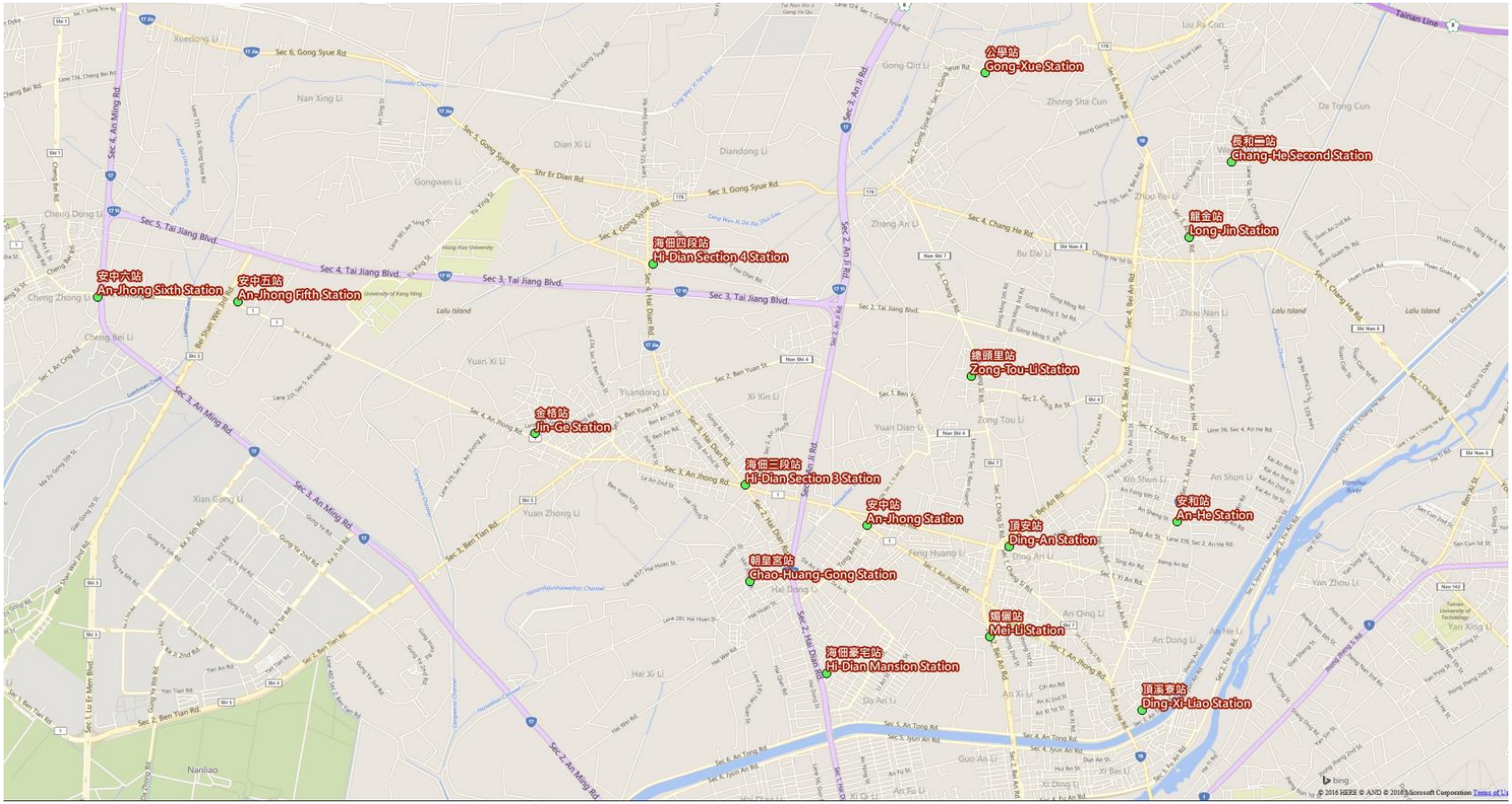
Generate real time 2-D inundation map in secs.



Built and Verify Model

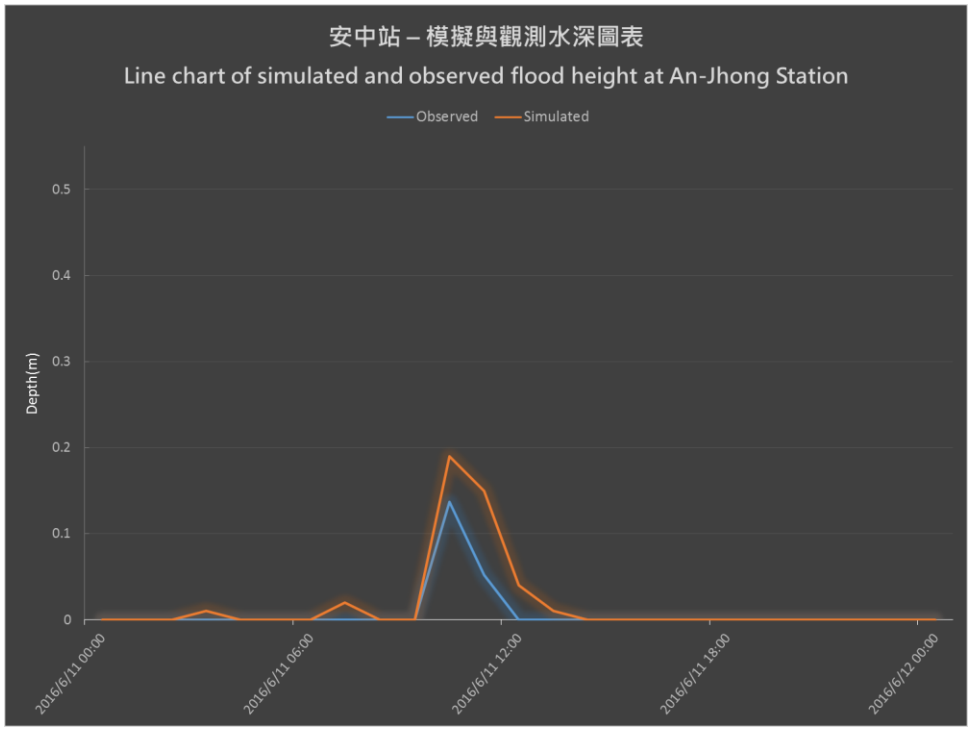


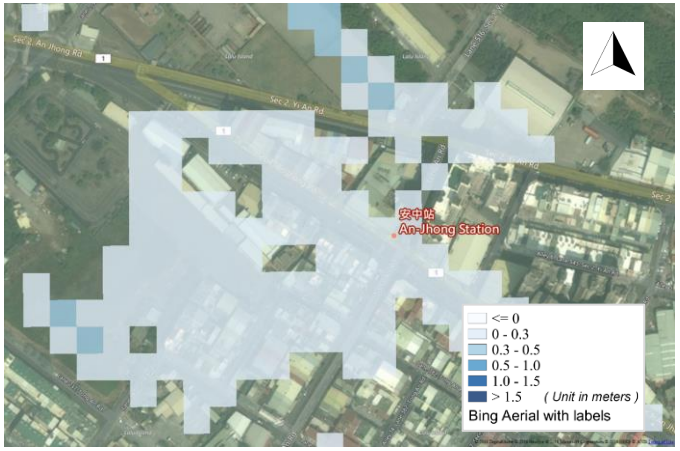
Stations in Tainan, Taiwan



Storm 11th, June, 2016

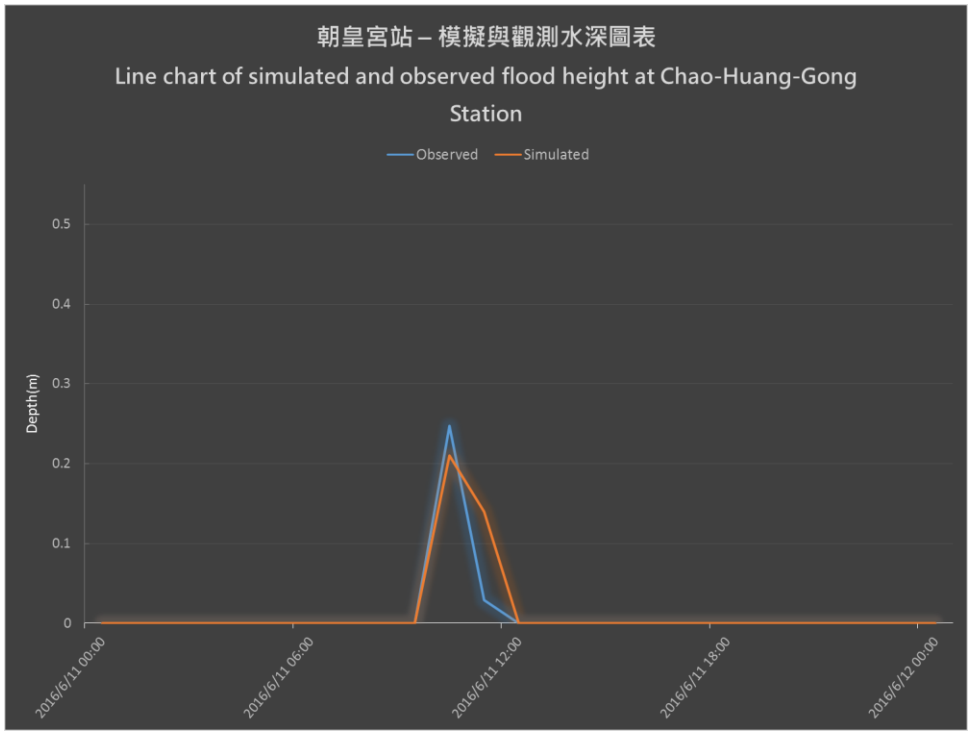
Flood at An-Jhong Station





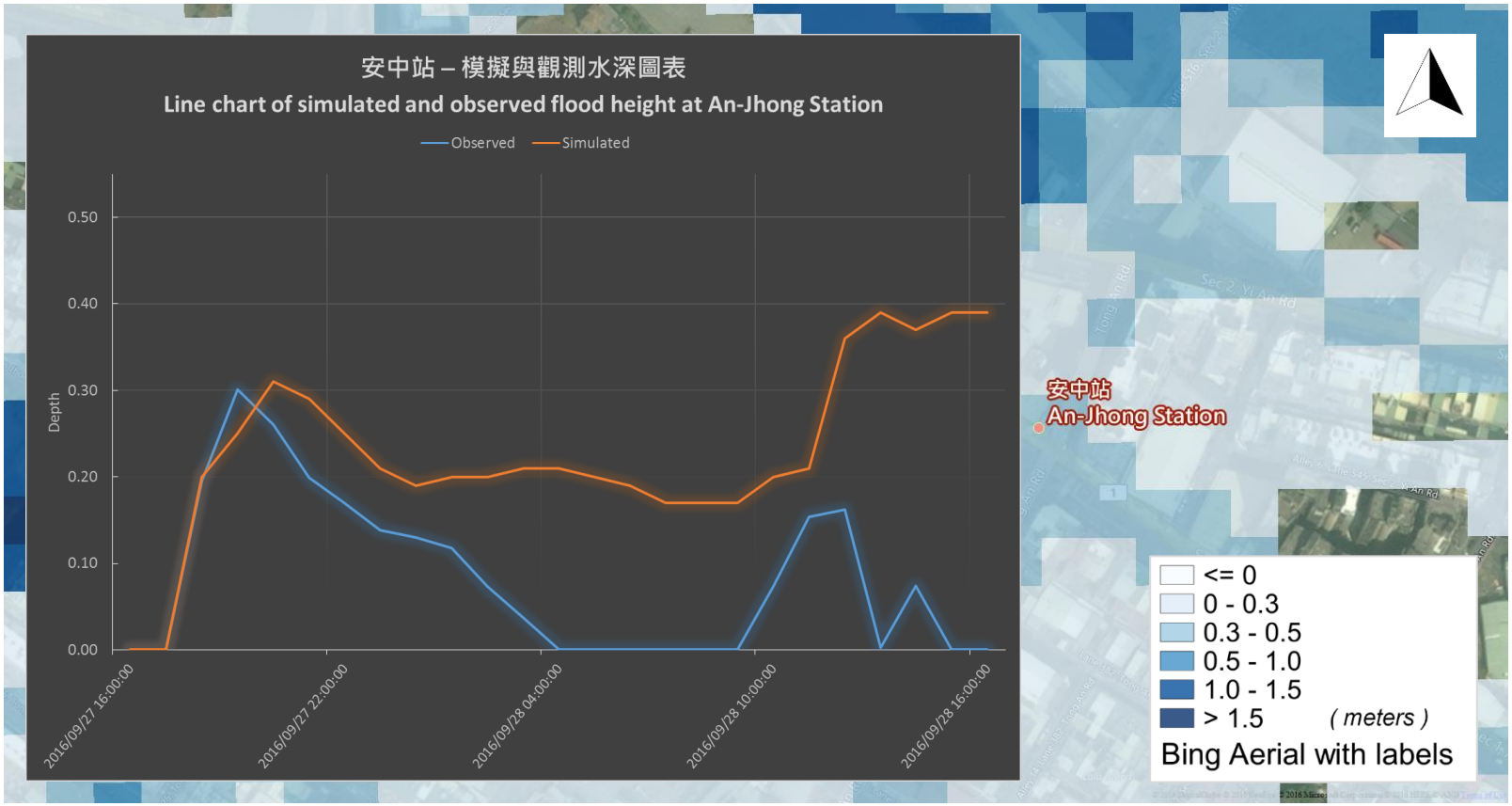
Storm 11th, June, 2016

Flood at Chao-Huang Temple



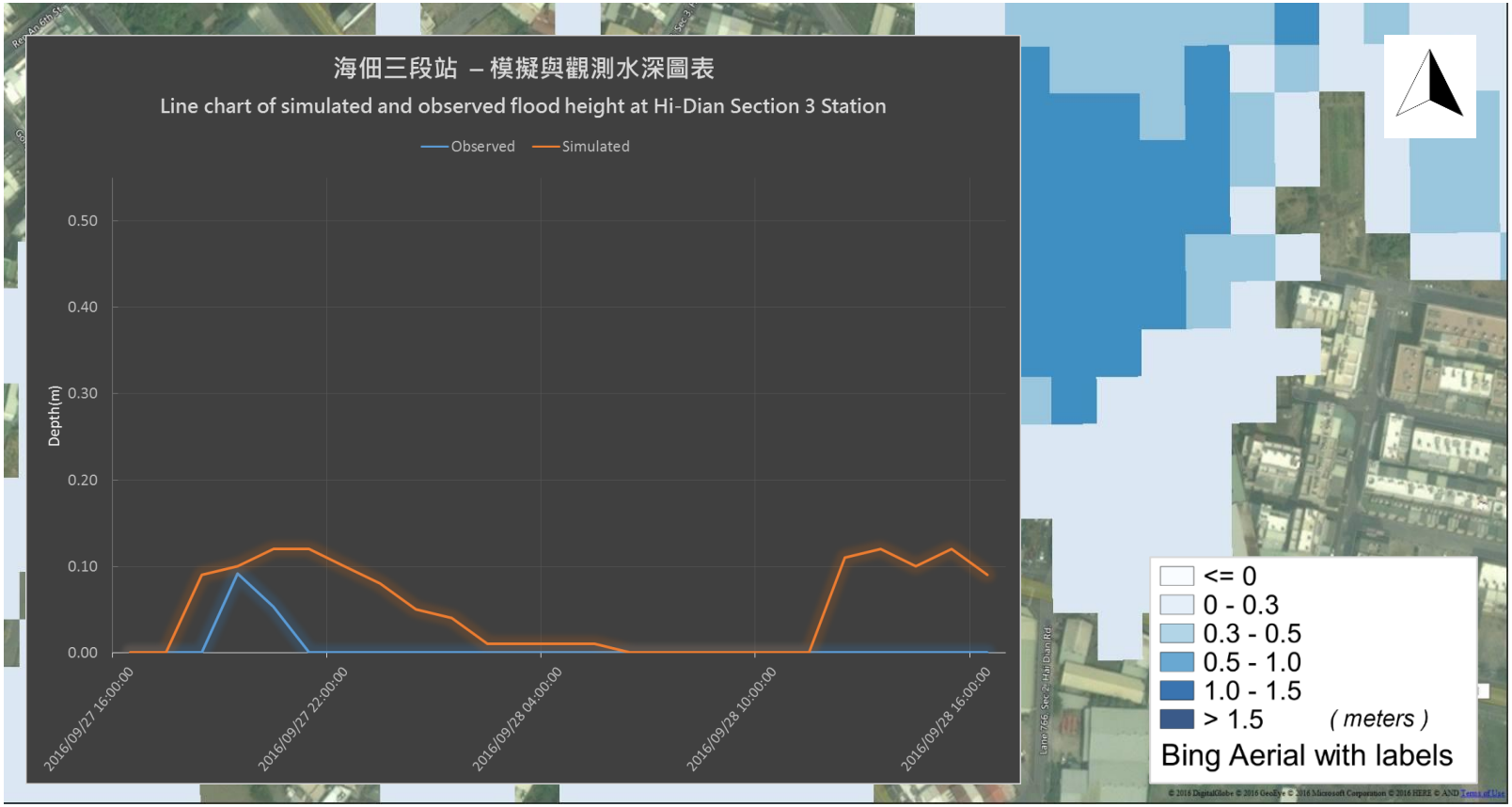
Typhoon Megi, No.1617. 28th, Sep, 2016

Flood at An-Jhong Station



Typhoon Megi, No.1617. 28th, Sep, 2016

Flood at An-Jhong Station



Prepare Simulated 2-D inundation diagrams

- Generates thousands of simulated 2-D inundation diagrams by using SOBAK model based on historical event and DEM data.

Searching best fit diagram

- Search the best fit simulated inundation map based on the real-time observed water level data.
  - Consider the time-series effect as well.

$$\varepsilon_{H_{T_{b,i}}} = \frac{1}{N_{gage}} \sqrt{\sum_{k=1}^{N_{gage}} \left(\hat{H}_{sim,t^*} - H_{obs,t^*} \right)^2}$$

Storm 11th, June, 2016. Tainan, Taiwan.

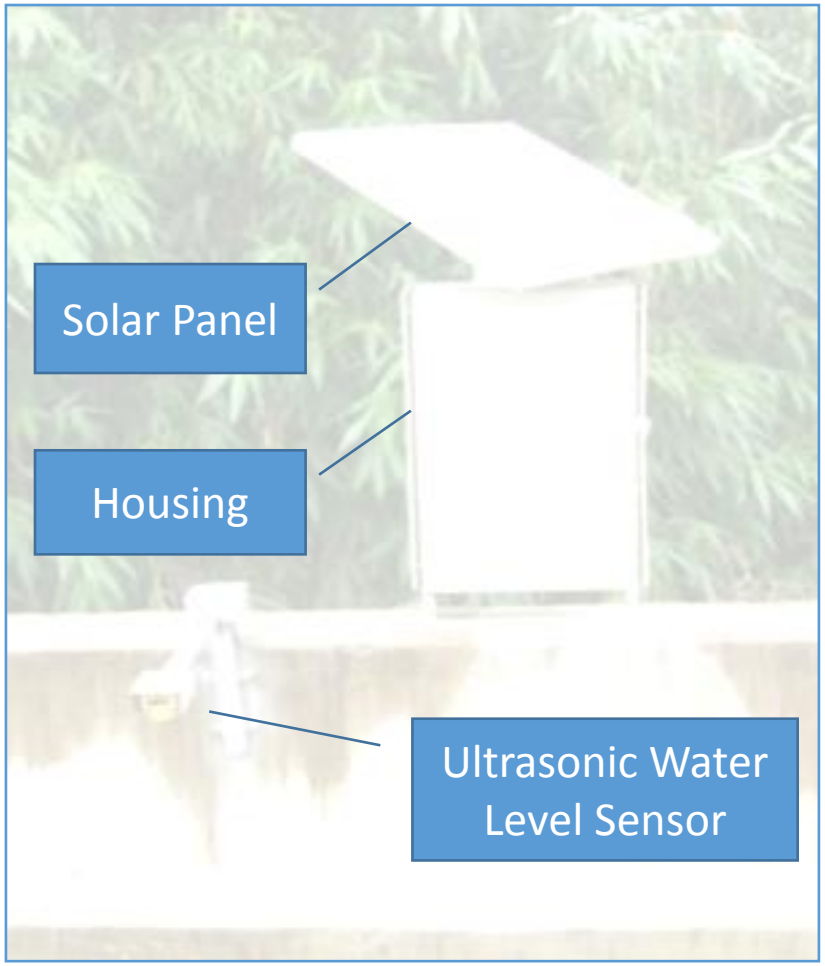
How do we achieve that?

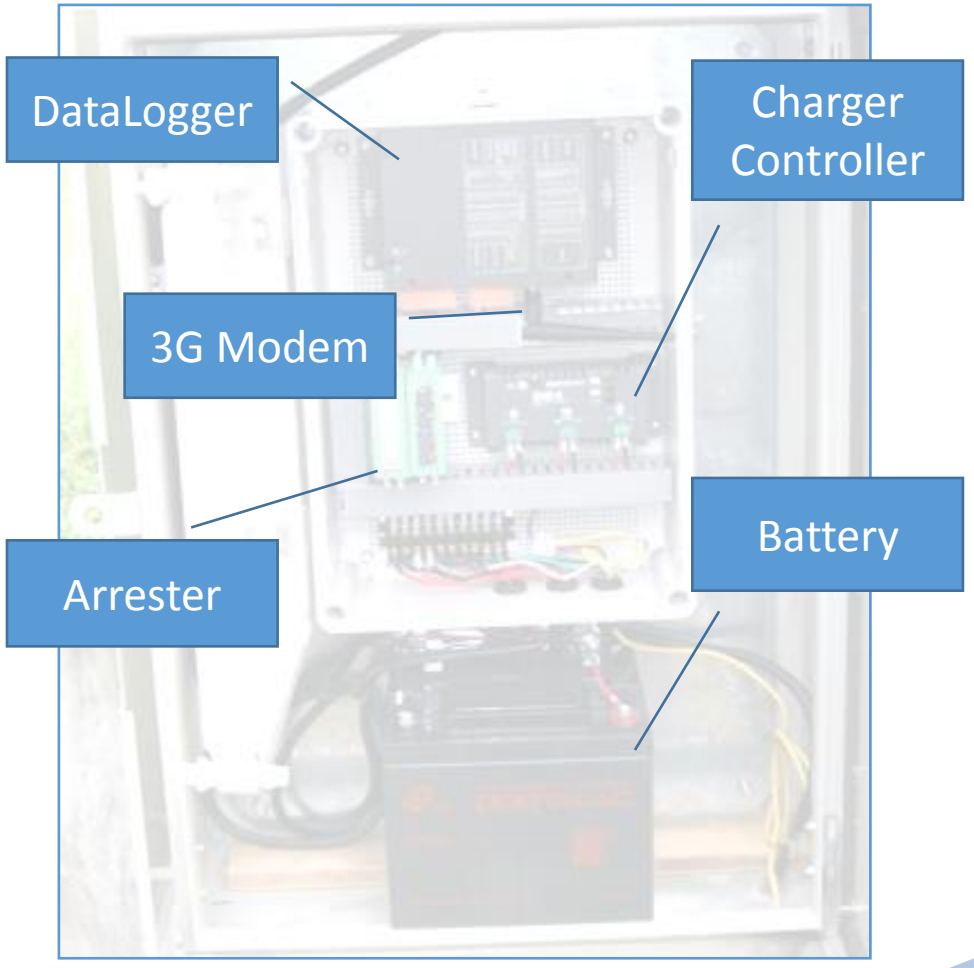
- Simulation and Searching Algorithm
- Integrated Sensor
- Big data
- Self-learning.

Integrated Sensor

A traditional system structure of a water level monitoring station

A traditional system structure of a water level monitoring station





We need..

- Deploy sensors / station density
- Small space required
- Low cost
- Long system life time, includes sensor life and battery life.

IoT Techs bring us..

- Energy Harvesting technology
- Low power chip
- Low power WAN
- New Battery technology
- Industrial standard chip but consumer product price.

Smart Water Level Gauge

AnaSystem

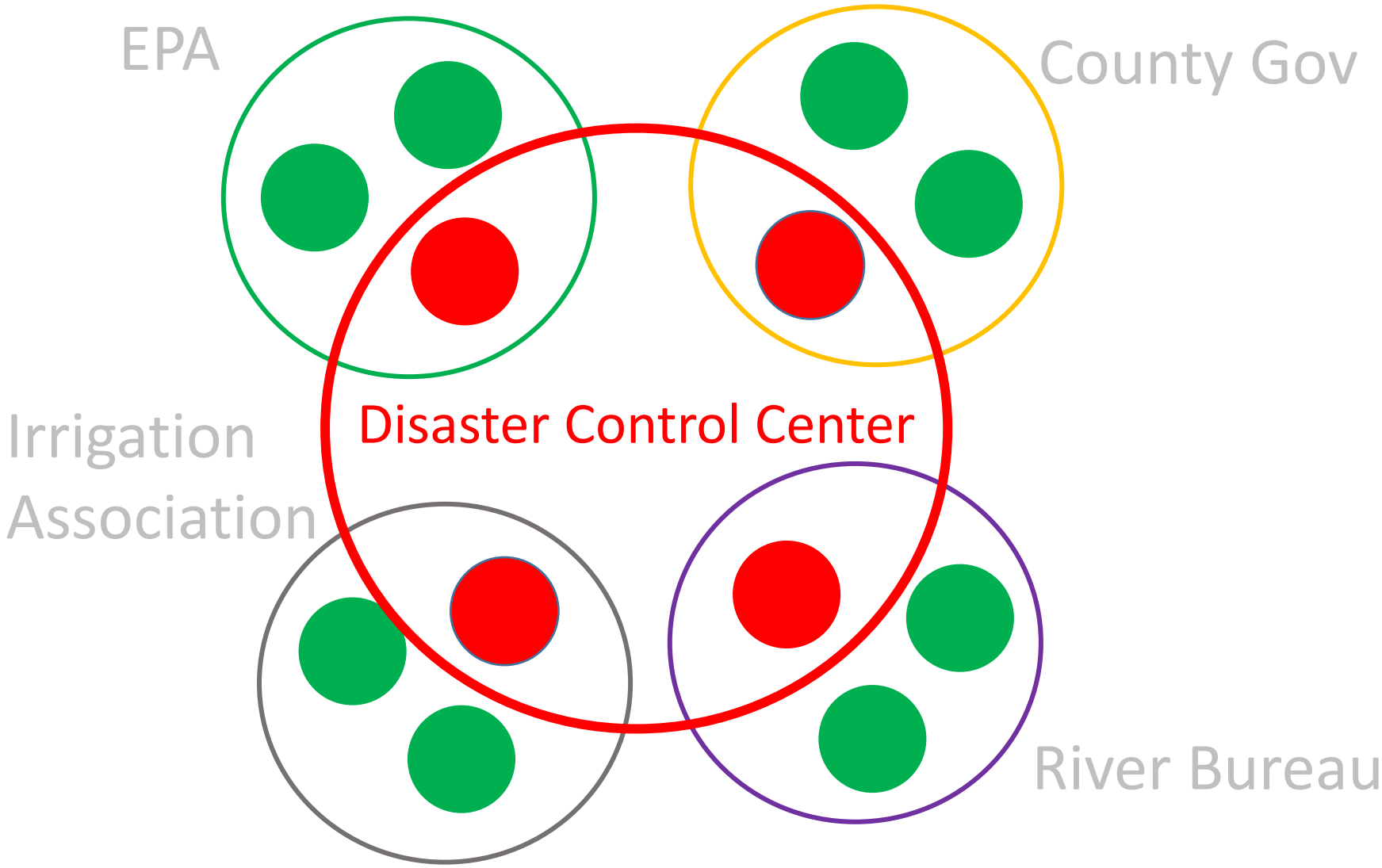
- Four-In-One Integrated Solution:
  RF Admittance Level Transmitter + Solar Charger + LoRaWAN + Cloud Software

Advantages of Low Power WAN

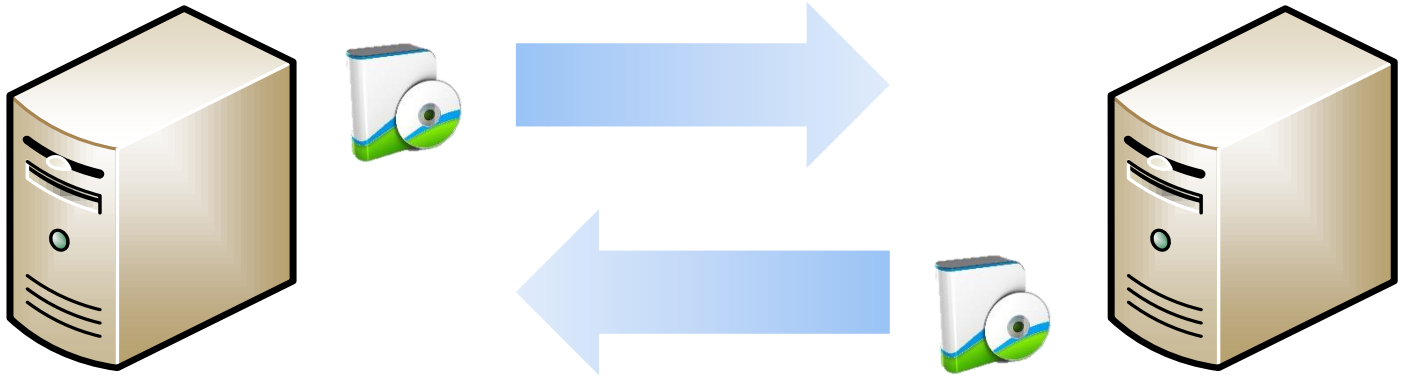
WAN	3G	LoRa
Max Transmit Range From AP to Client	~2Km	~15km
Power Conumption (Transmiting)	500mA – 1000mA	18mA
Power Consumption (Standby)	3.5mA	0.001mA
Time required from standby to transmitt complete	60 sec	1sec
Battery life 2000mAh (Transmitt 144 times / day)	25.6 hours	7.36 years

LIVE DEMO

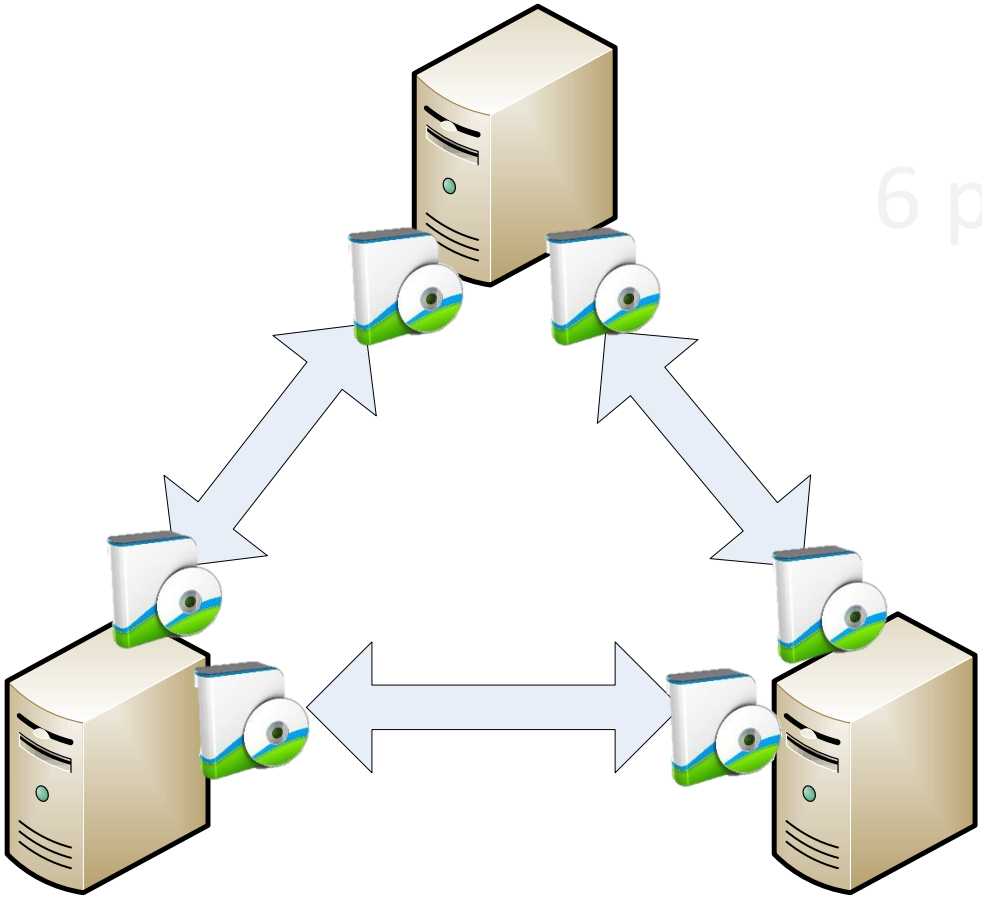
How to built a system owned by many different users?


EPA
County Gov
Irrigation Association
Disaster Control Center
River Bureau

Data Sharing between Data centers

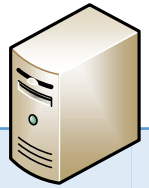
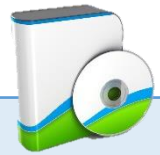


Data Sharing between Data Centers



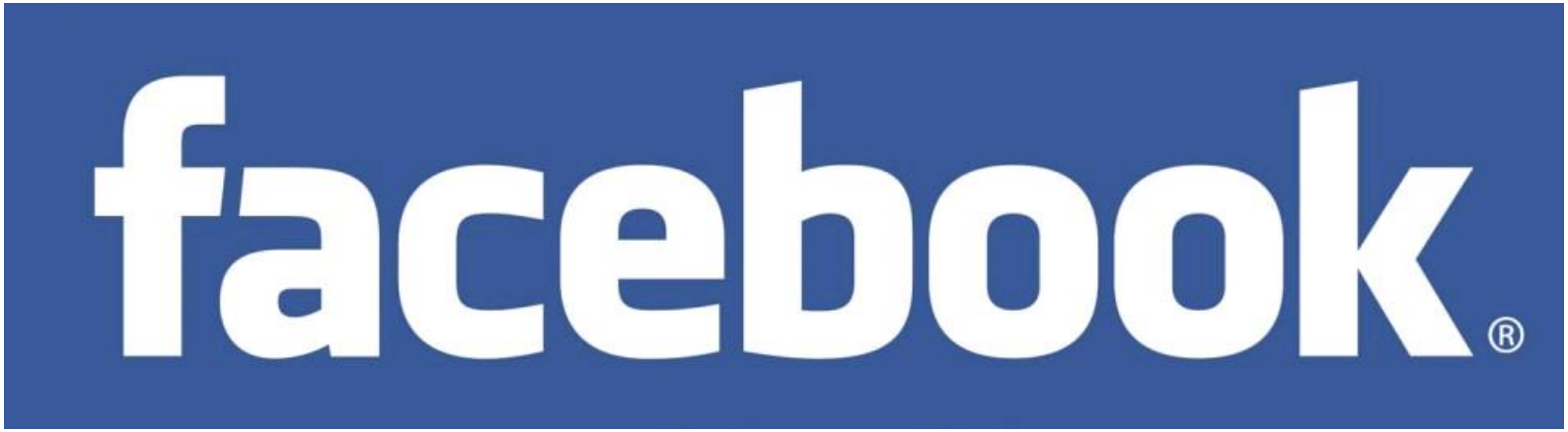
6 programs

Data Sharing between Data Centers

Num of Servers 	Num Of Data Exchange Software 
2	2
3	6
4	12
5	20

Multi-tenancy

Data Sharing



Sharing data without developing any program

Big Data

Storage / Write / Read

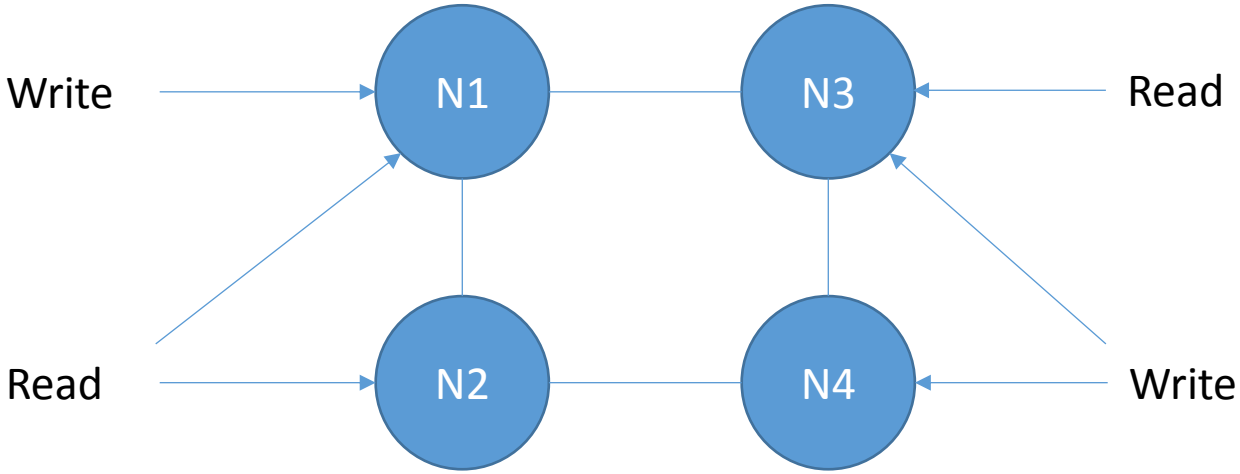
All data must be in operational database always

The foundations to deal with Big data

- Choose proper database for time series data

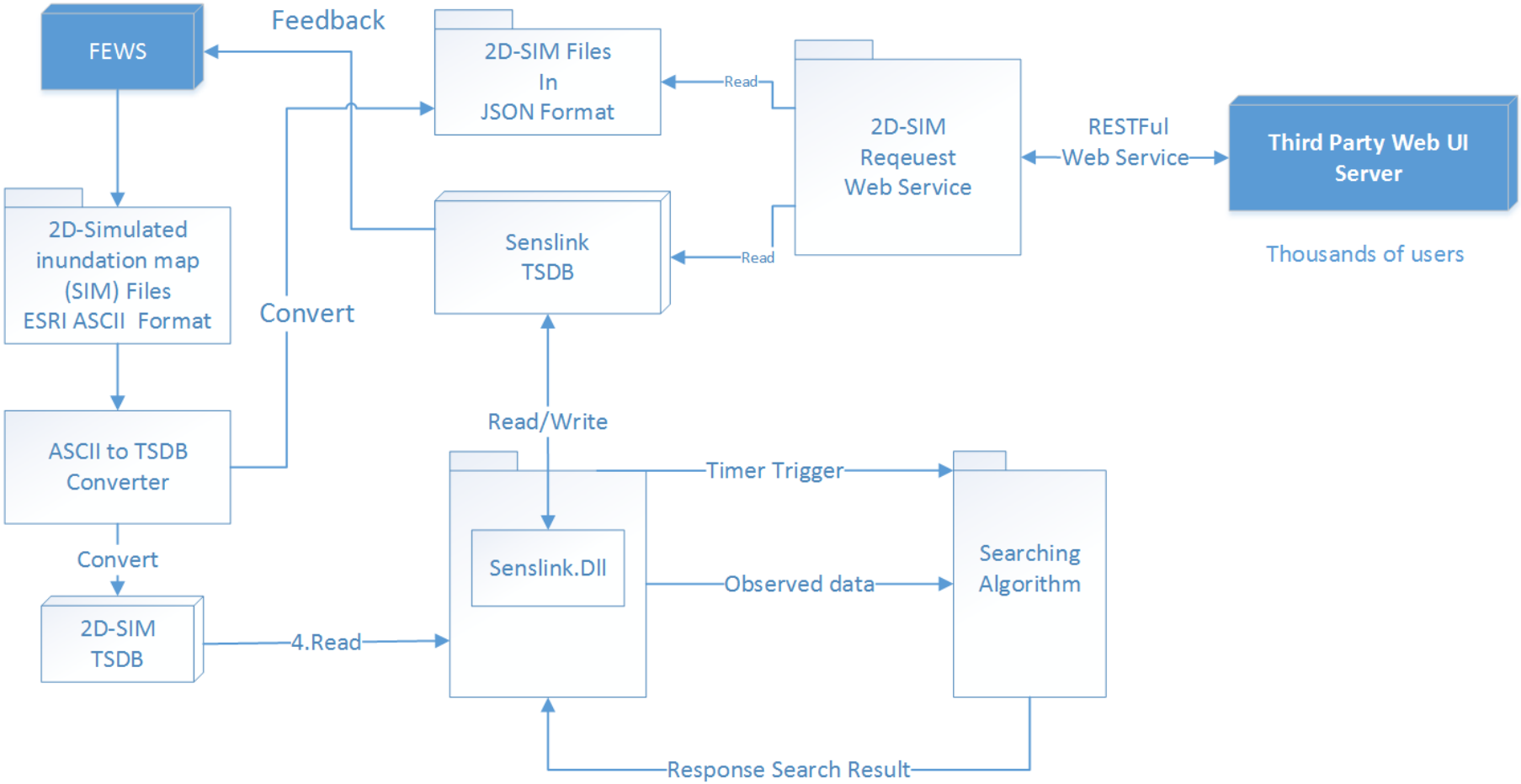
Distributed system – Extensible / Parallel read and write

The foundations to deal with Big data



Speed Comparison

- Condition and Environment
  - Intel i5, RAM 8G, OS: Linux
  - Record a physical quantities' value every second.
  - 60 x 60 x 24 x 30 ~ 2.6M Data Points / month
- Write
  - MySQL: about 7 min
  - TSDB: about 4 sec
- Read
  - MySQL: about 4 min
  - TSDB: about 7 sec


FEWS
Feedback
2D-SIM Files
In
JSON Format
Read
2D-SIM
Reqeuest
Web Service
RESTFul
Web Service
Third Party Web UI
Server
Thousands of users
2D-Simulated
inundation map
(SIM) Files
ESRI ASCII Format
Senslink
TSDB
Read
Convert
ASCII to TSDB
Converter
Read/Write
Timer Trigger
Senslink.Dll
Observed data
Searching
Algorithm
Convert
2D-SIM
TSDB
4.Read
Response Search Result

Future Plans

- Shorten the searching time
- Improve resolution
- Generates results with proper data format for different users
  - Insurance company
  - Options and Futures
  - Navigation system
  - Logistic company
- Create a model-self-adaptive system based on received new data.

Our Team

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