Data Markeplace Initiative

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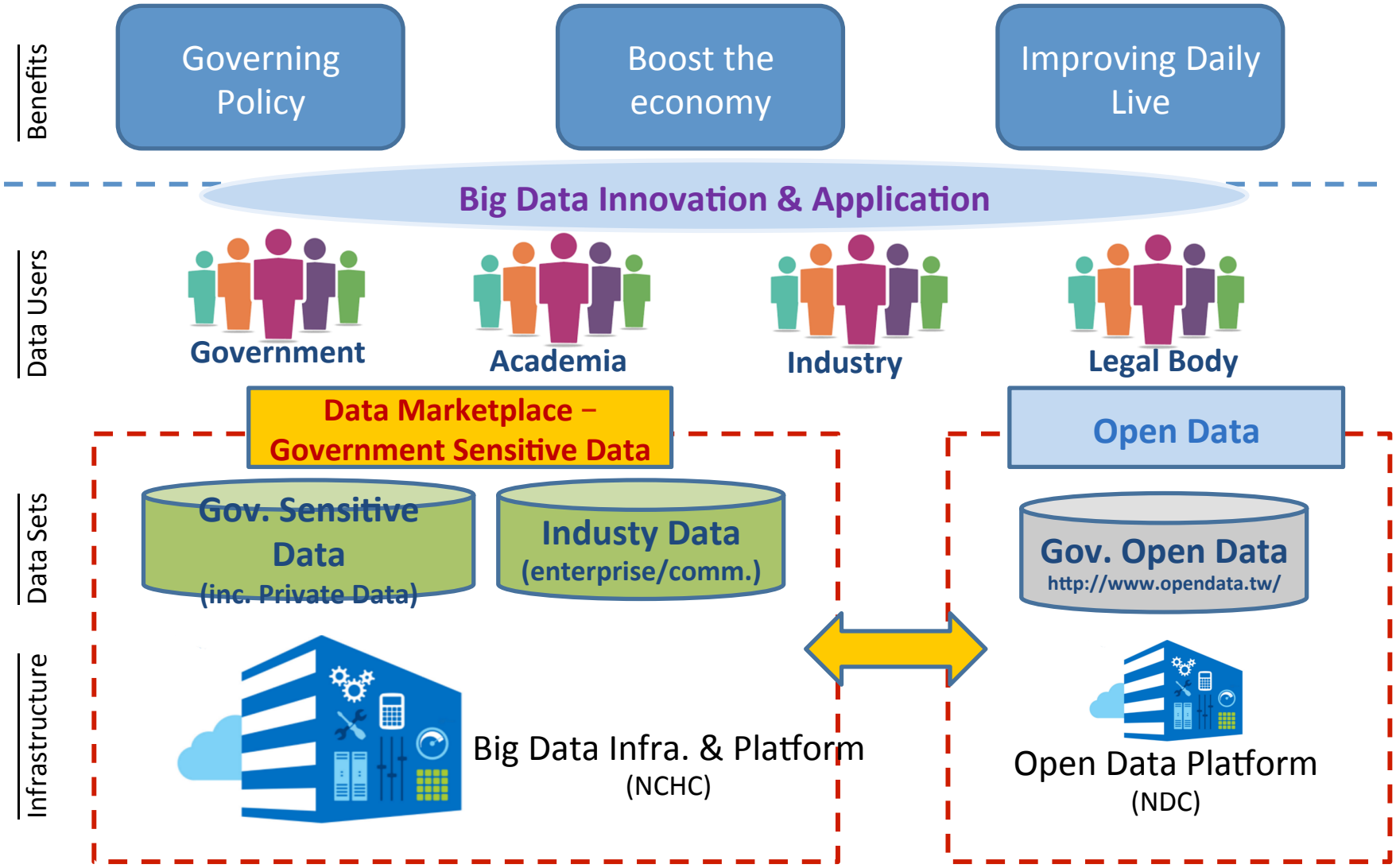
Contents

- Goal
- Activity
  - Legal obstacles
  - mechanism
  - Tool/Software
  - Platform & Service

Vision of Data Mart

- Data Economy requires the application of “sensitive” data.
- Secured Data Platform shared by the government and industry, can boost the data value



Data Marketplace

1 Data Cloud & Data Integration

- **Data backup**：hosting important/sensitive data w/o utilizating cold data
- **Large scale computing**：Big Data Analysis Platform, e.g. Hadoop, … etc.

2 Tech. & efficiency

- **Variety of Data Analysis tools**：big data toolkits, data processing tool, … etc. Tool/tech. for Big Data **Applications**：promoting Big Data tools to gov. agencies

3 Data Analysis & Vis.

- **Data Processing, promote data value**：data cleaning, catalogue, aggregation, … etc. work with the Data Analysis.
- **On-line visual analysis tool & env.**：selection and adoption of tools/software

Benefiting Gov. Agencies

Security & low cost

- Reduce the cost of hardware/software
- Shared data center & data management

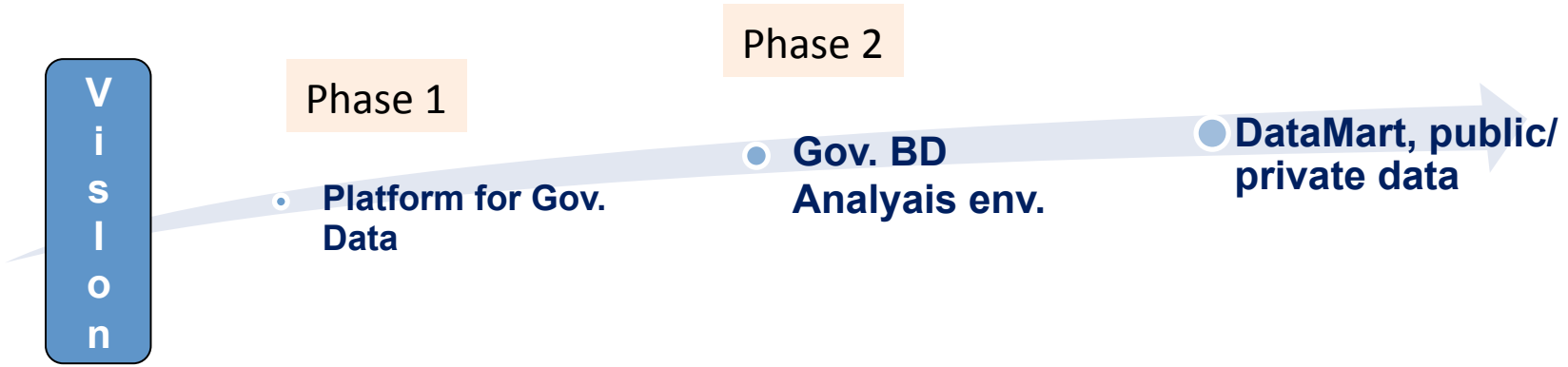
High performance platform on demand

- Shared big data analysis tools, w/updated version
- Reduced IT efforts, training time & cost

Result deplay

- Data processing mechanism is taken cared of
- Data analysis via web page

資料市集三階段發展重點

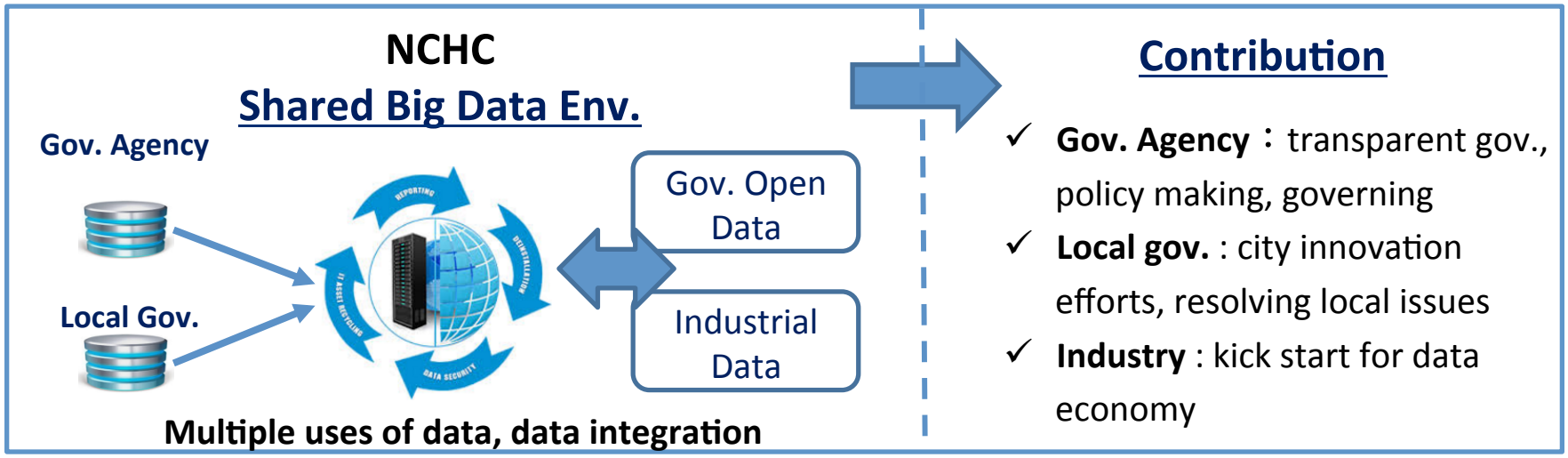


Major Work

Data Upload	Data Exchange	Data Application
• Identify data source • Data upload mechanism & legal document/contract • Data management envo.(storage, de-ID, data integration)	• Enhancement of the quality & the quantity of data uploaded • Data application via merging of various data sets. • Data sharing mech. & legal doc. • Data analysis infra., tools, env. (Data hub, data screening, …etc.)	• Data application promotion • Legal management of Data analysis results • Data analysis module & tool (vis. Analysis function)

Shared Data Env., for Gov. data application

goal		Non-open data from gov. agencies, co-located to NCHC's shared env., Provide to gov. and academia application
merit	Env.	• Secure & flexible data analysis env. & tools w/lowered hardware & software investment and data management cost • Simplified gov. data integration for better data application efficiency
	Ap.	• Identify core data sets that meet the demand from gov. agencies (Top-down research topics) & public concerns (such as education, society security, safety, … etc.) • Gov. agencies identify research topics, academia answer the call for proposal, MOST support the research projects



Conclusion – Legal Issues

- Goal：Recommendation of legal adjustment for big data application
- Based on :
  - Study of International cases
  - Study of Domestic law & regulation
- Resolution
  - de-ID
  - Case by case investigation for data from gov. agencies, No single solution that fits all
    - Purpose of data collection, nature of the data, data policy of gov. agency
  - Merging of Gov. data and civilian data
  - Single Gov. entity or single platform
  - One-stop service

Mechanism

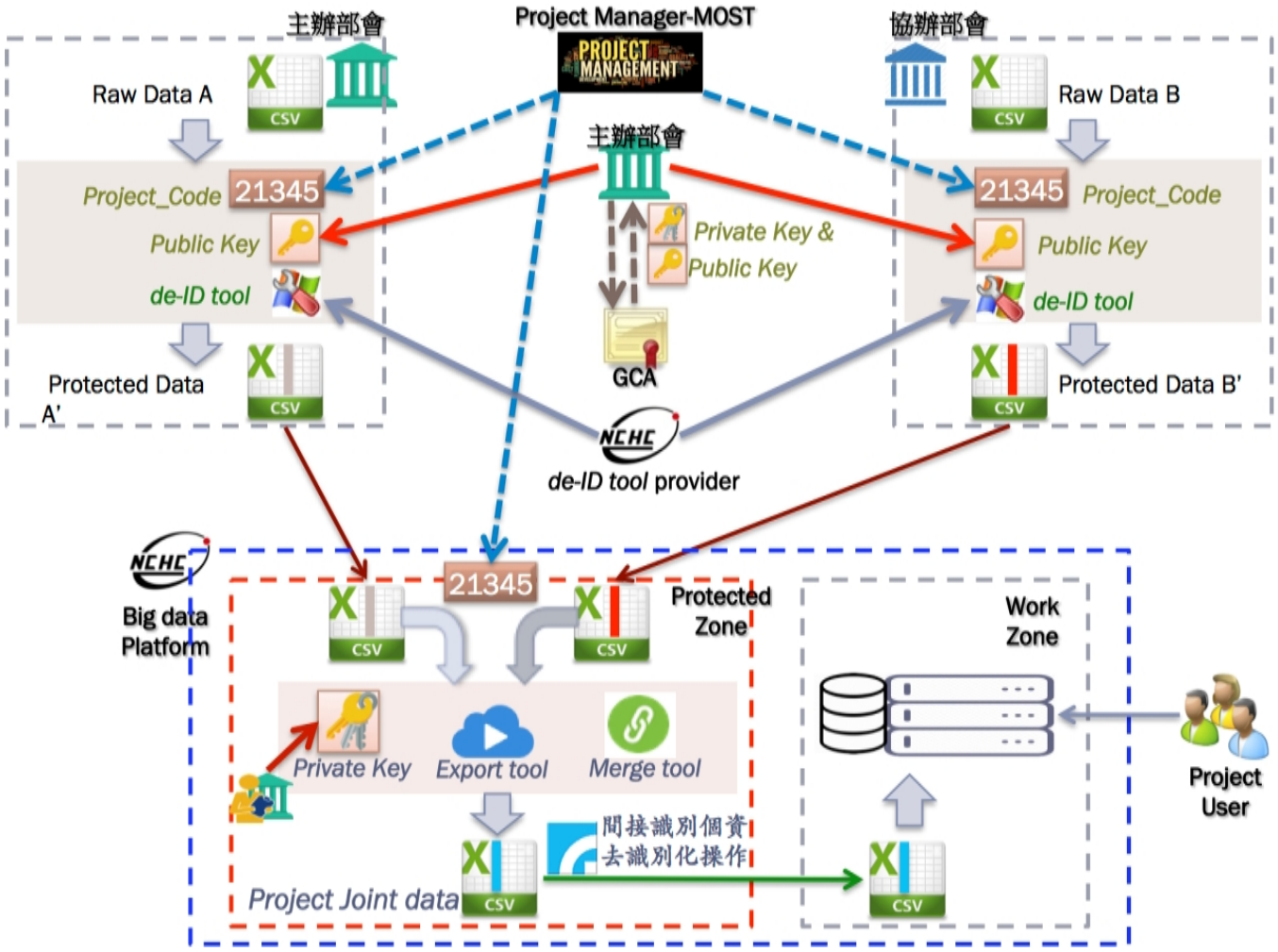
- Goal：Recommendation on the mechanism for the project
  - Surrounding the development around specific application, with 4 major arenas
    - Disaster Mitigation, Security, Traffic, Medical and Health application
  - Delivered by integrated project or data competition
- Based on
  - Study of International cases related to common data analysis environment as well as cases for data marketplace
  - Study of the status of Domestic data applications

Tools & Software

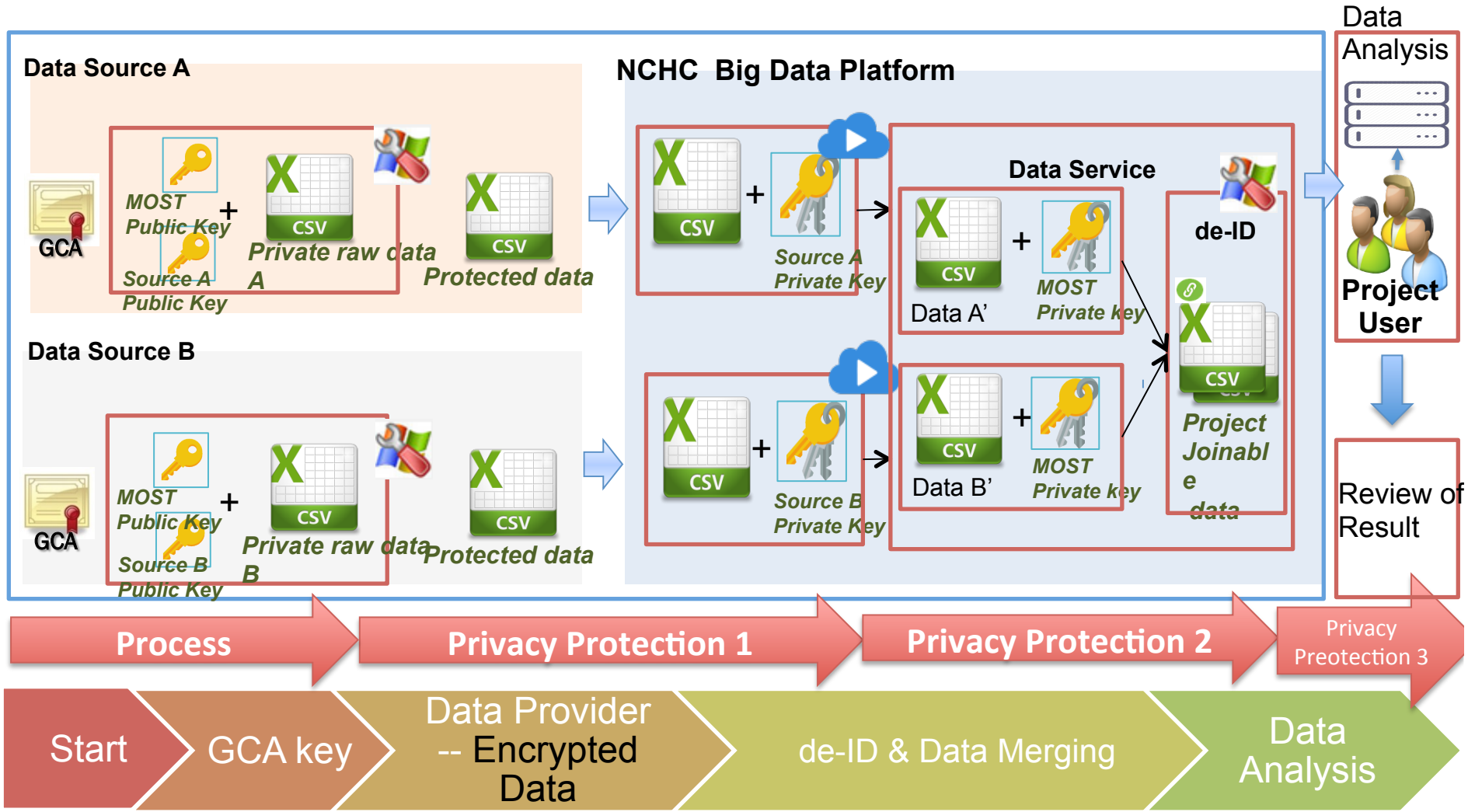
- Goal：provide sensitive data from Gov. agencies for academia to analyze
- Tools：
  - Mechanism for de-Identification
    - Randomizing of direct IDentification information
    - Anonymizing in-direct IDentification information
  - Data integration across different agencies\

Tools & Software

- Mechanism for Randomizing the direct ID



Tools & Software



Tools & Software

- Tool for Randomizing the direct ID
  - Provided to the data owner

Tools & Software

- Example of Randomized direct ID

Original Data File

身份證字號,地址
B391987589,40646臺中市北屯區 北屯路 雙 30號至 56巷
A399274755,40678臺中市北屯區 陳平一街 單 133號至 139號
G399741197,30348新竹縣湖口鄉 長富路２段 全
D399078461,10843臺北市萬華區 峨眉街 雙 120號以上
G397129977,51442彰化縣溪湖鎮 民生街 全
F399293757,26144宜蘭縣頭城鎮 武營路 全
H399225240,32060桃園市中壢區 內定二街 全
B392762833,32656桃園市楊梅區 上陰影窩 連 62號至 81之 1號
B399510515,33456桃園市八德區 高城三街 全
F393098274,41447臺中市烏日區 自強街 全
F395266496,24841新北市五股區 成泰路３段 單 579號以上
H392706057,30266新竹縣竹北市 新寮街 單 73號以上
H391994284,30642新竹縣關西鎮 新德街 全
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H394767850,43252臺中市大肚區 華山路 連 57號至 160號
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E399933808,33064桃園市桃園區 南豐二街 全
D398245299,40859臺中市南屯區 文山二街 全
D397441495,24890新北市新莊區 五工五路 雙 8號以下
C396056651,33372桃園市龜山區 楓樹三街 全
C391552012,50243彰化縣芬園鄉 大彰路２段 連 934號以下
A391468140,23542新北市中和區 德光路 77巷全
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C397015449,50862彰化縣和美鎮 愛永街 全
A391615434,11570臺北市南港區 南港路３段 雙 54號至 80號
D394984537,42076臺中市豐原區 豐東路 250巷全

de-ID Data File

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Tools & Software

- Example of Randomized direct ID
  - the rainbow table

de-ID & encrypted ID	Original ID
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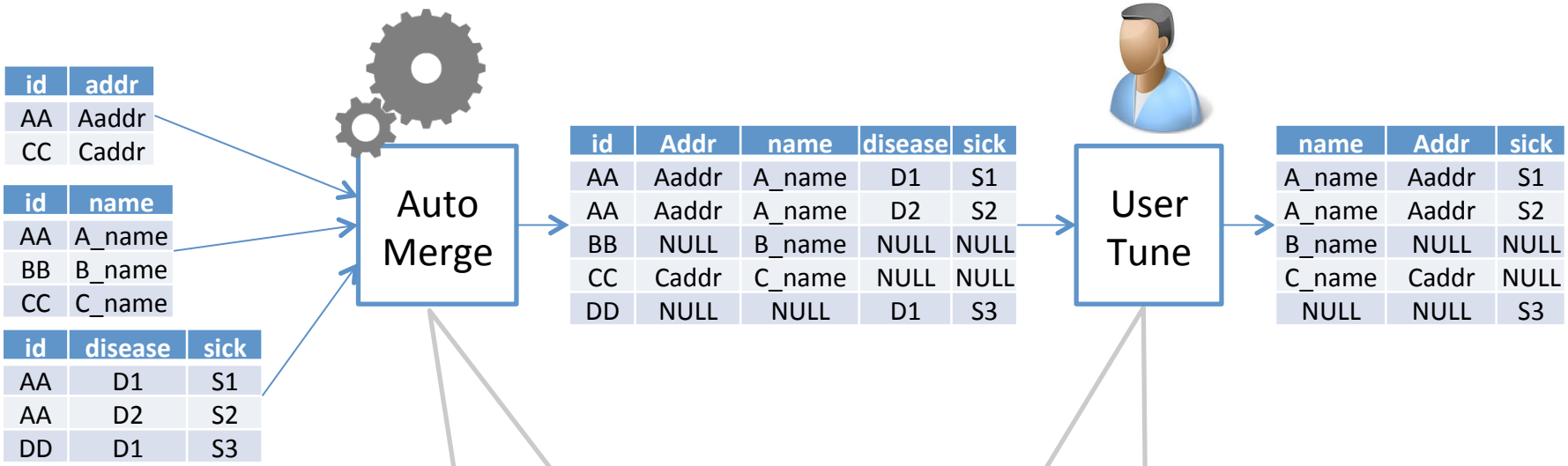
Tools & Software

- Performance of Randomizing the direct ID
  - Parallelization
    - Multi core ：processed by multi-servers simultaneously
    - MapReduce ：parallelization based on Hadoop cluster
  - Performance
    - 24 millions records
    - Non-Parallel : > 100 hrs
    - Multi-core (4 nodes) : 35hrs
    - MapReduce (13 nodes) : 17.25 hrs

Tools & Software

- Merging of data from various Gov. agencies

Design by ELT (Extract – Load – Transform)

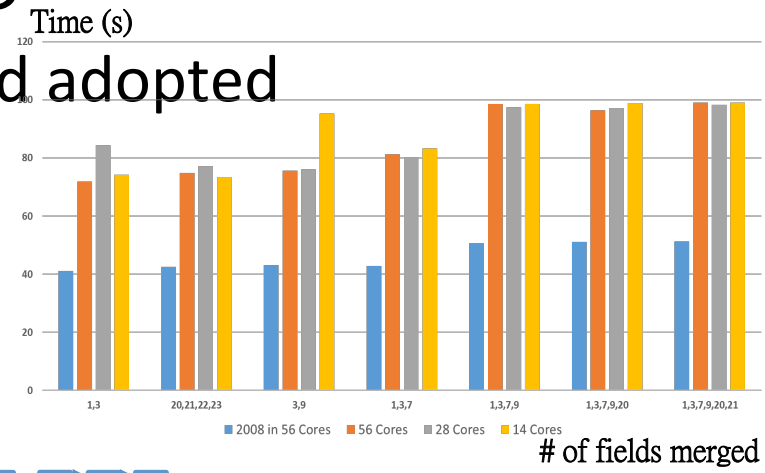


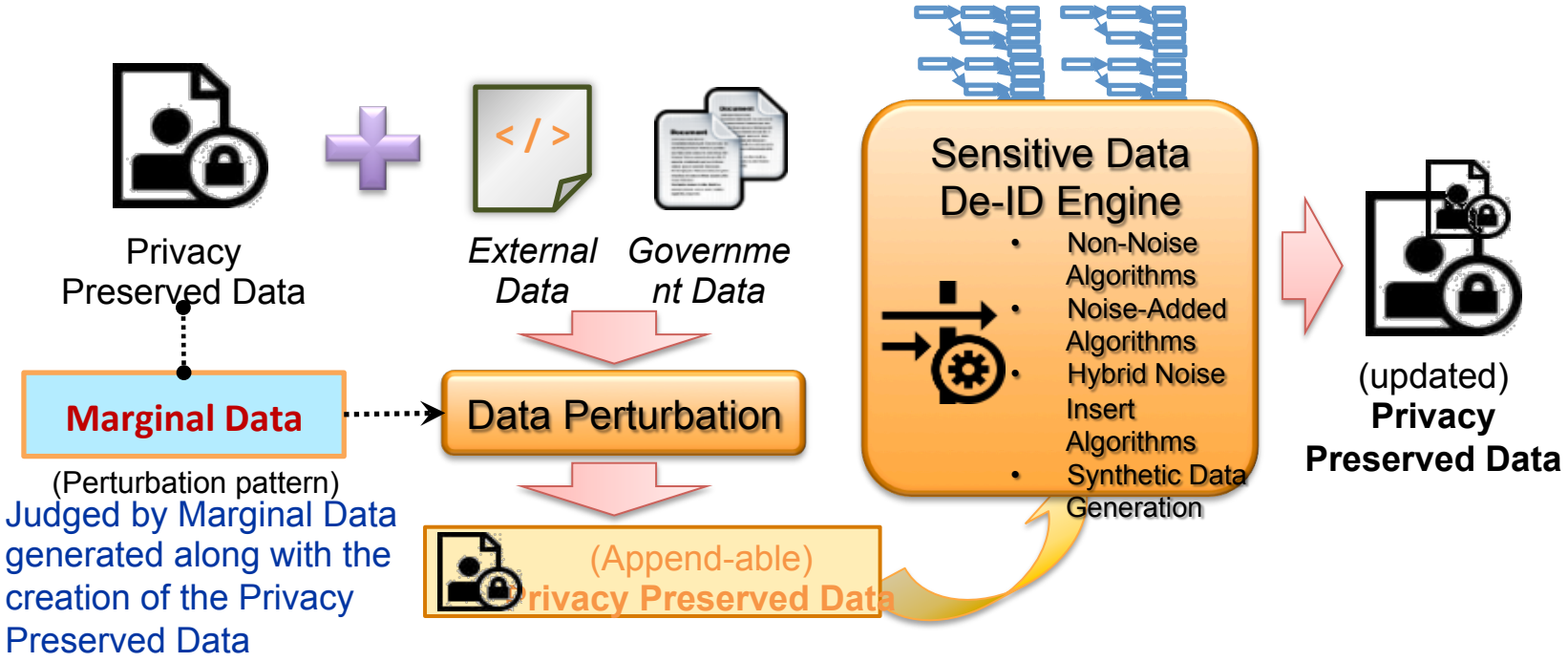
- Program to auto parse
  - # of data files
  - Fields of individual data file
  - ID field
  - Handling the field divider such as “,”
  - Maximzing the filed
  - Corresponding 1st filed

- **User need tune on web**
  - Filter fields
  - Adjust field order
  - Extra customized function should seft define the hive QL

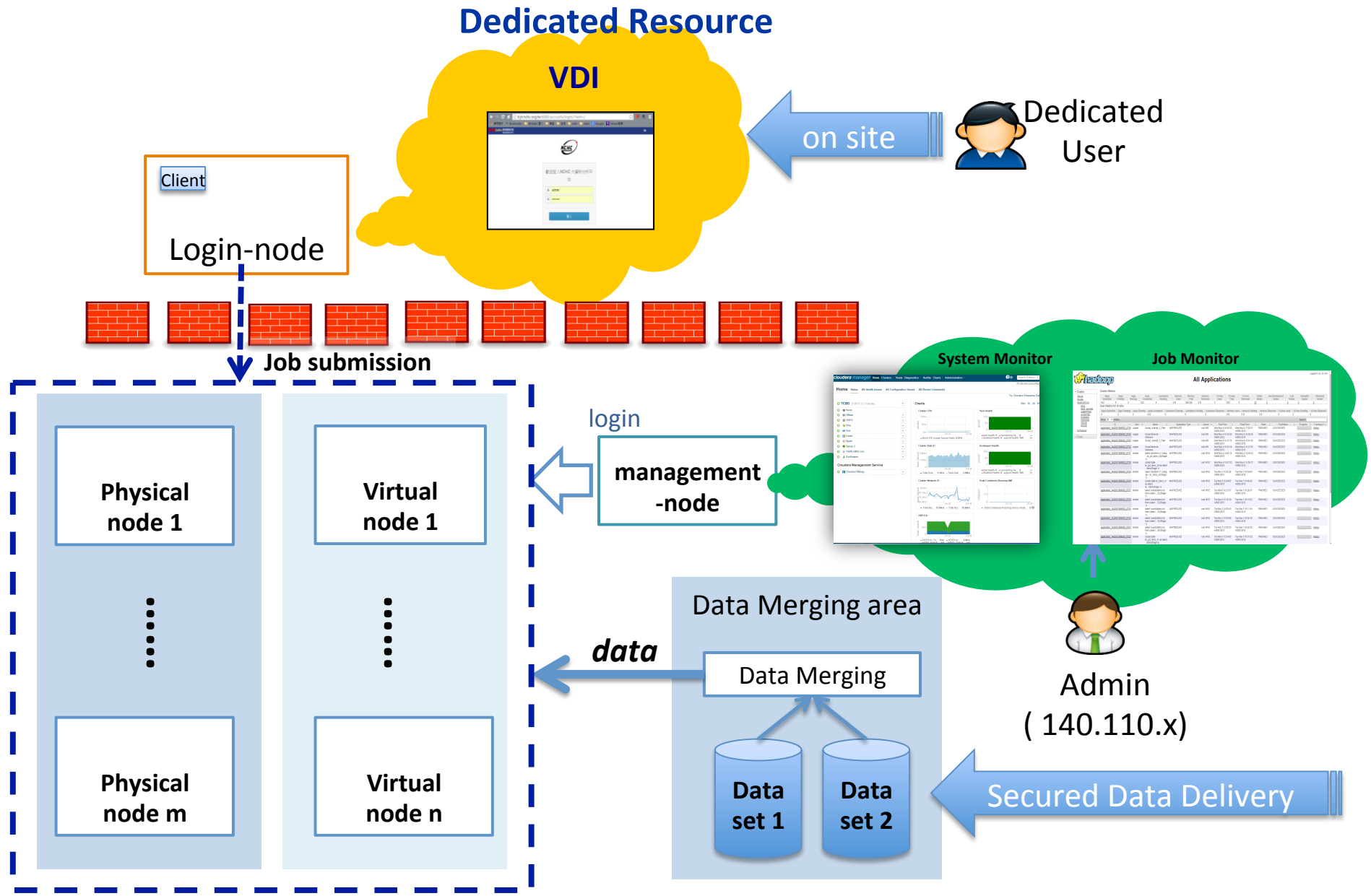
Tools & Software

- de-IDentification of in-direct ID
  - Parallelized K-anonymity method adopted
- Performance
  - 1.4 billions records in 4 ~ 5 hr
    - w/5 fields managed and verified



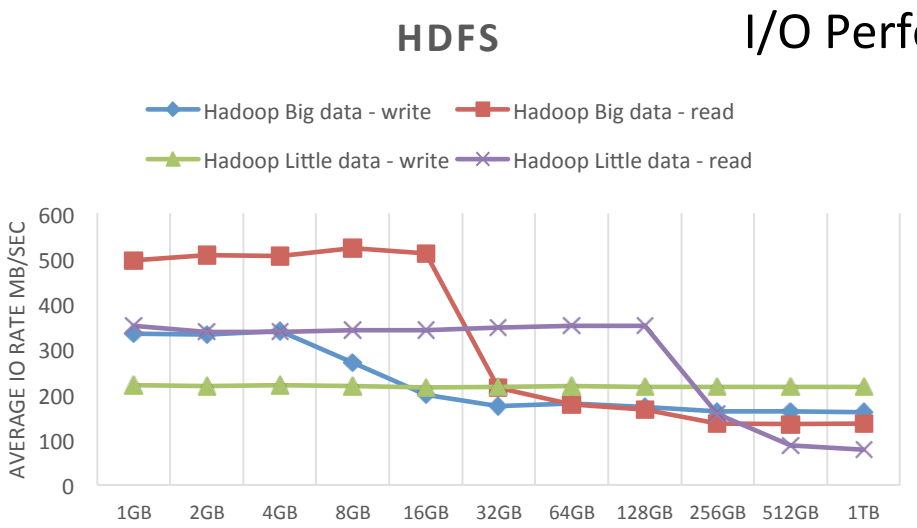


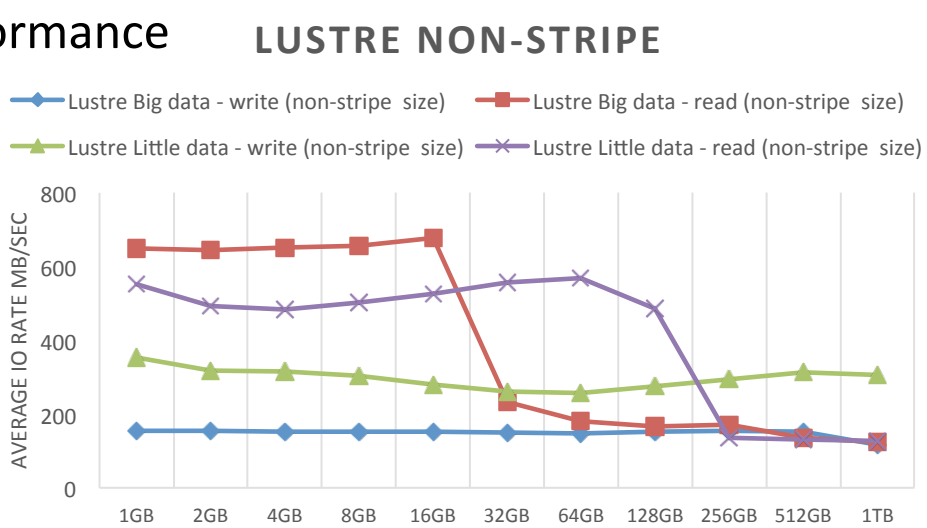
Platform & Service

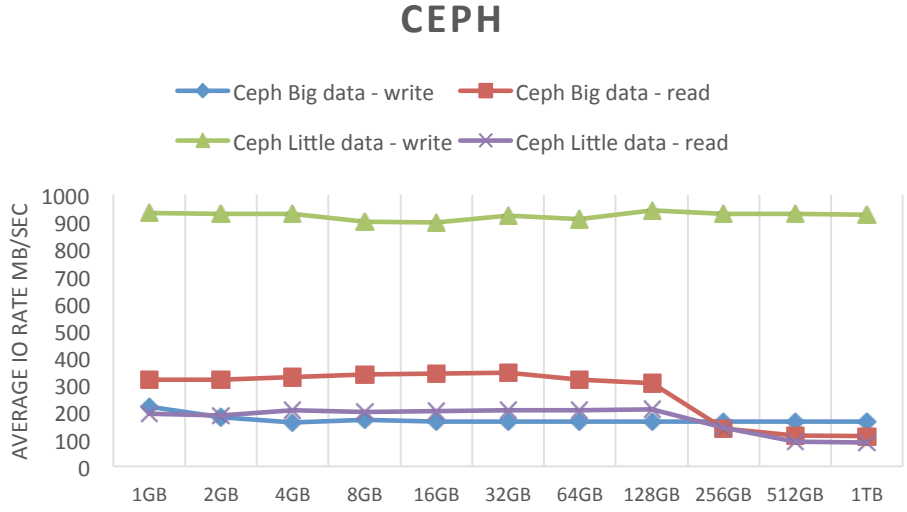


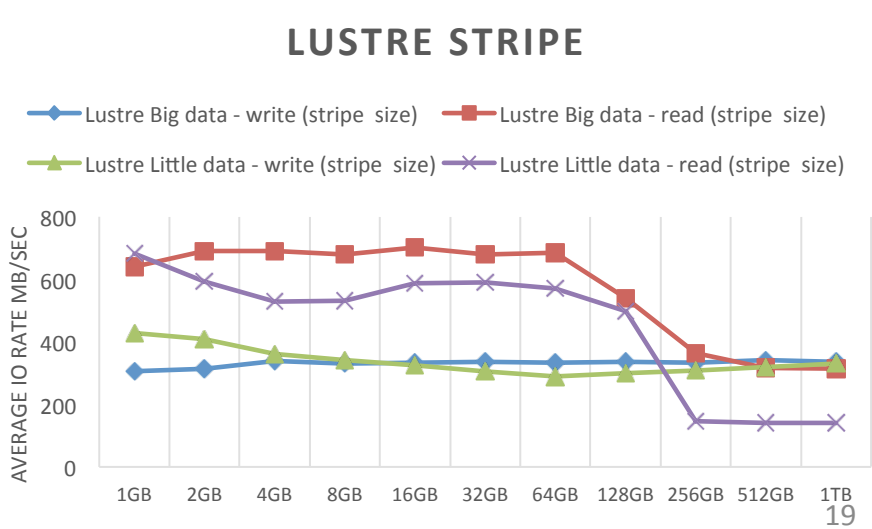
Performance Comparison of File System

I/O Performance

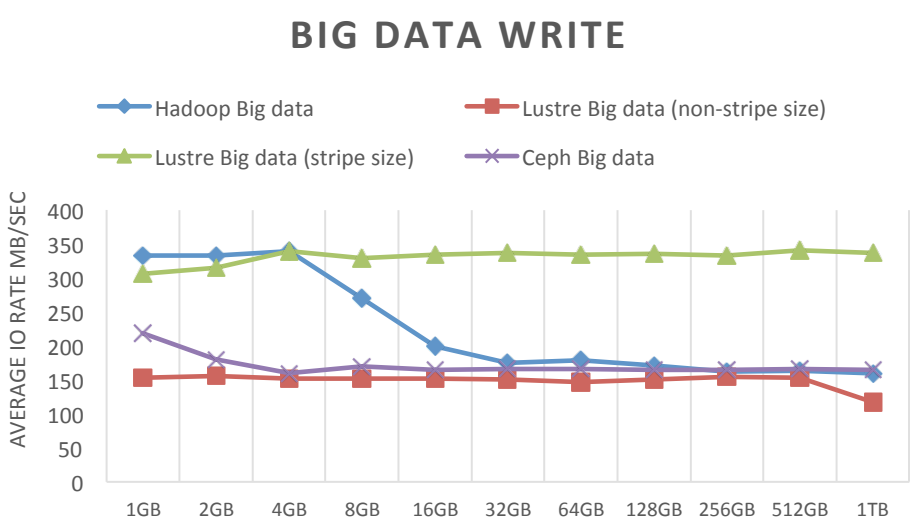


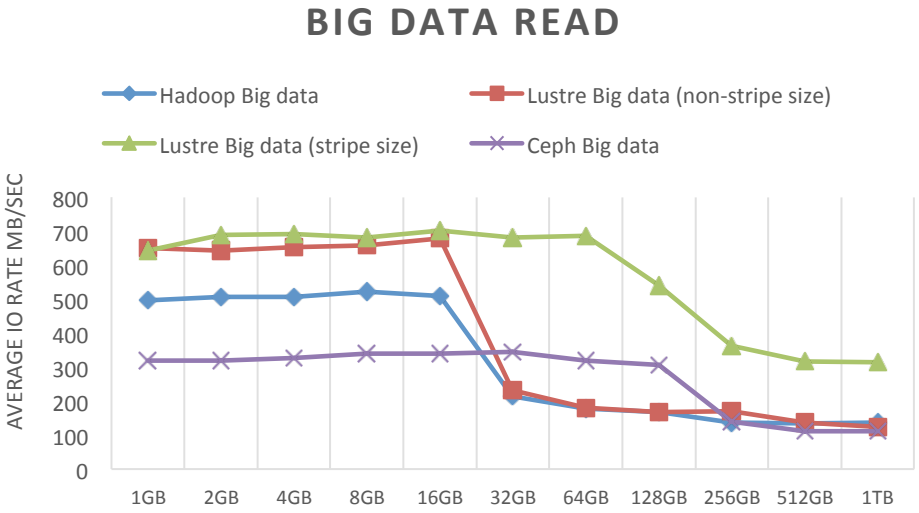


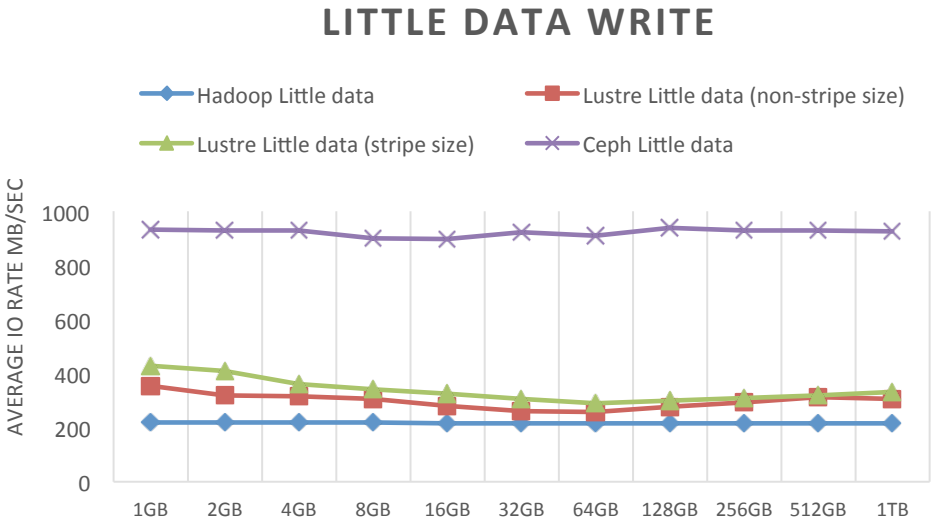


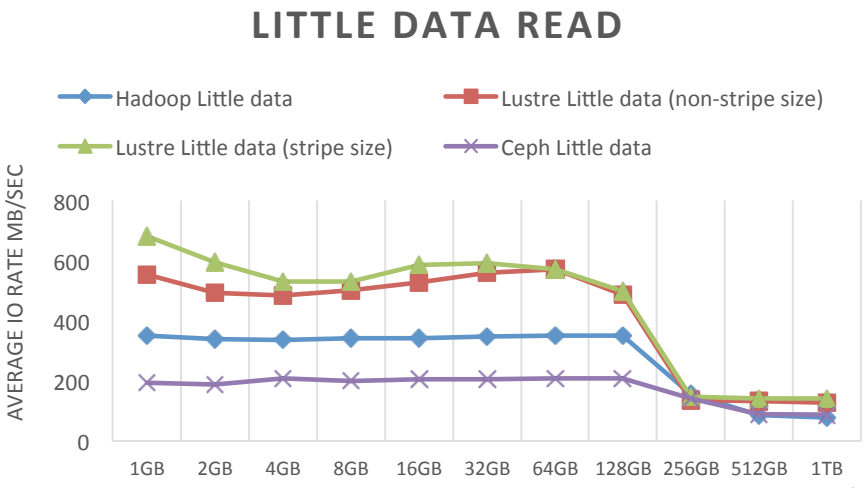


Performance Comparison of File System



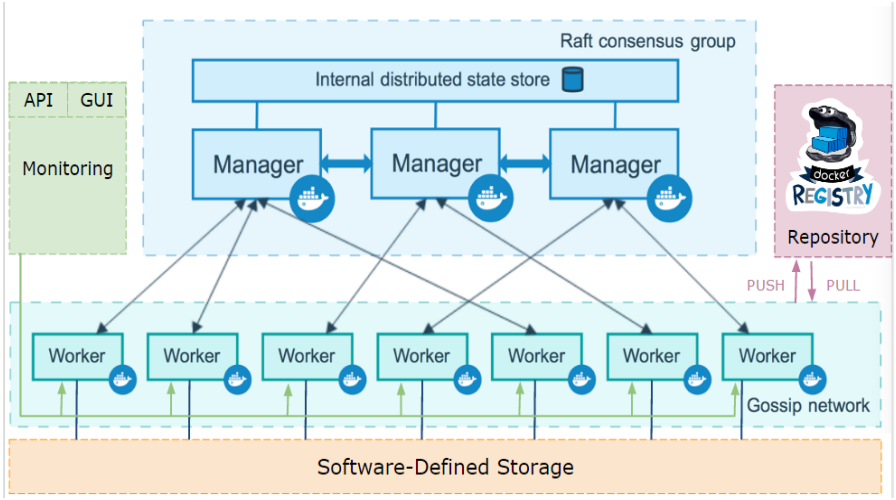


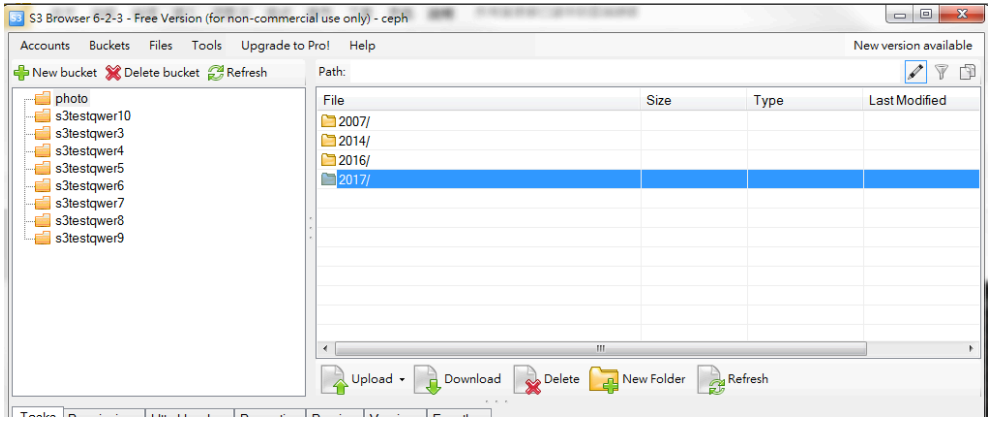


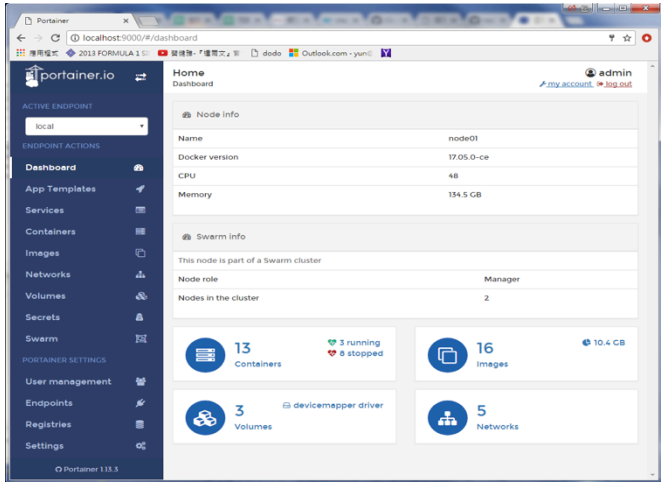


Platform & Service

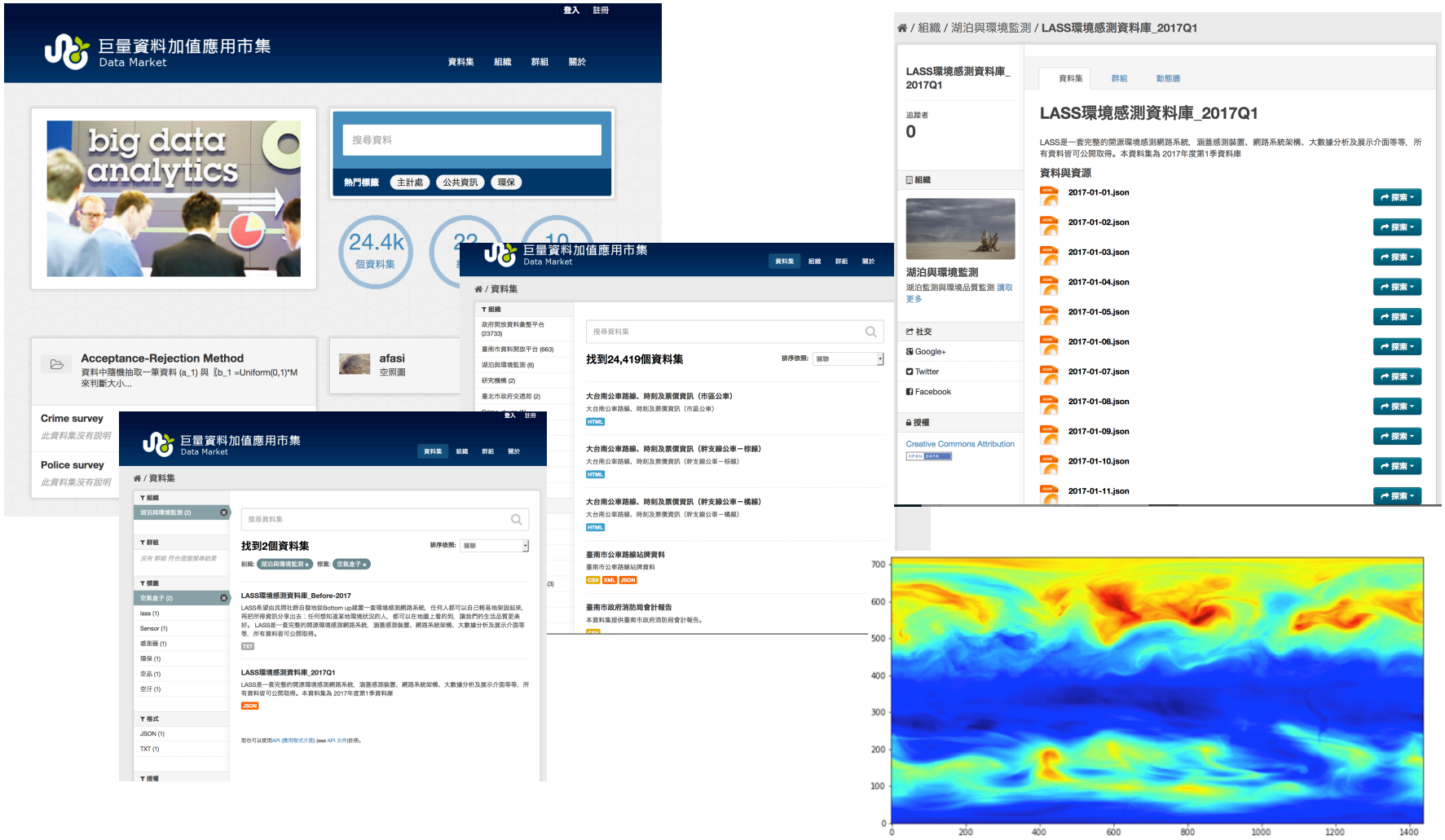
- Application Repository
  - Virtualized Data Analysis Applkication Sharing
  - Container based
    - Swarm as Manager
    - Jupyter for Interface
    - Example：GATE image
  - Ceph File System
    - Block Device for DataMart
    - Object Storage：DataMart Intererfaing







Data Marketplace Initiative

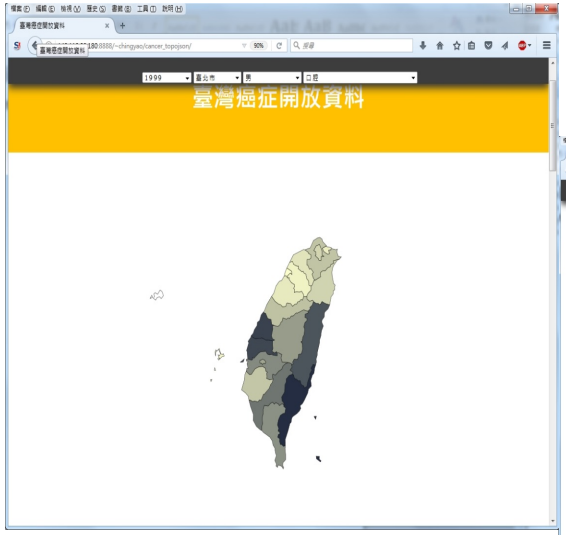


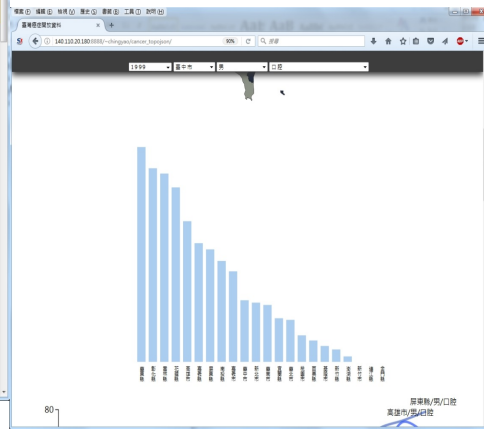
Most data : public available

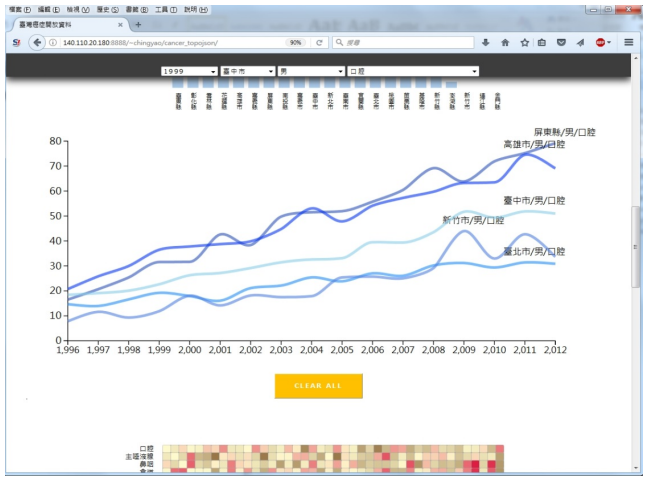
Restricted sensitive data : ~ 5TB, 5 billions records

Data Application Example

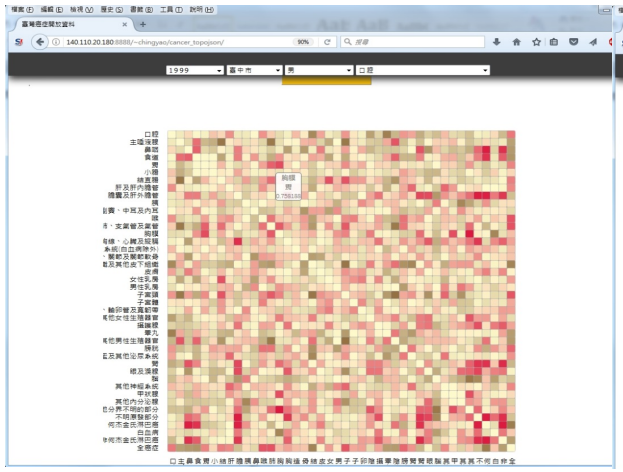
- Cancer Open Data
  - 1996 ~ 2012
  - Pierson Analysis



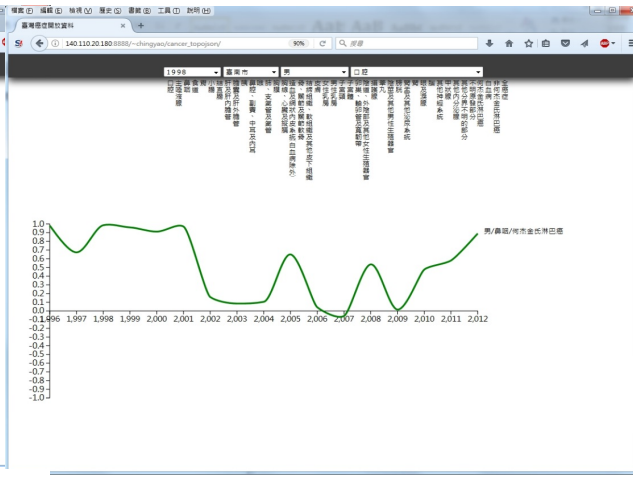




Geographical Distribution of Cancer



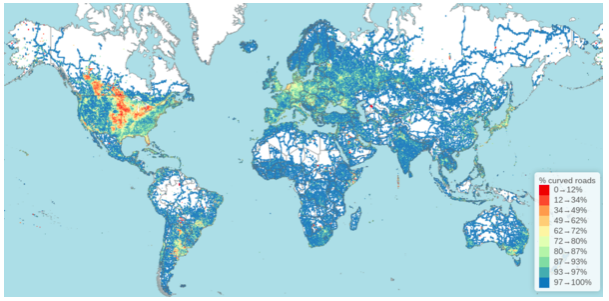
Pierson Analysis : relation between cancers



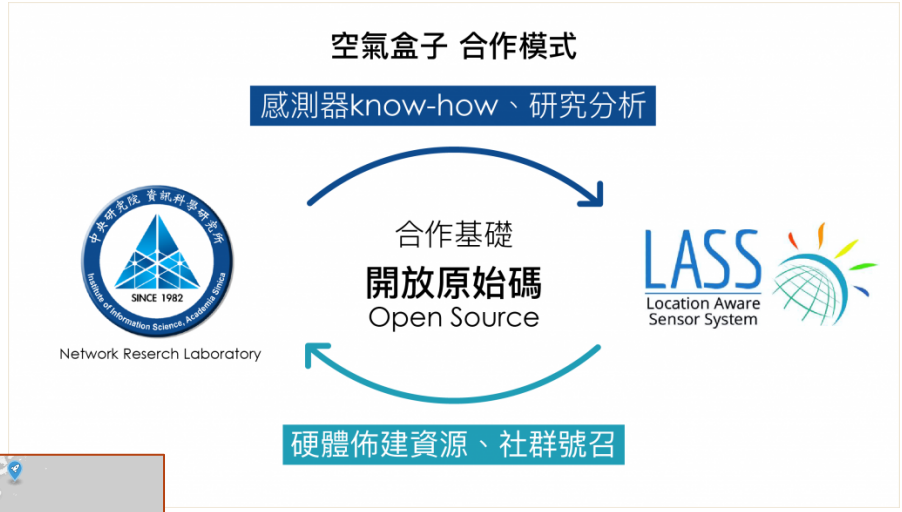
Pierson Analysis : 1995 - 2012

Data Application Example

- OpenStreetMap(OSM)
  - The only mirror site in Asia
  - Integrated with Overpass turbo, Umap, Planet
- Location Aware Sensor System (LASS)
  - AirBox for PM2.5



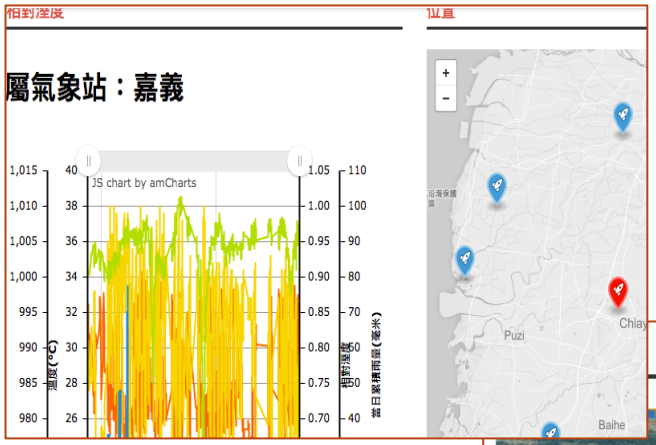
* Image source: http://www.openstreetmap.org

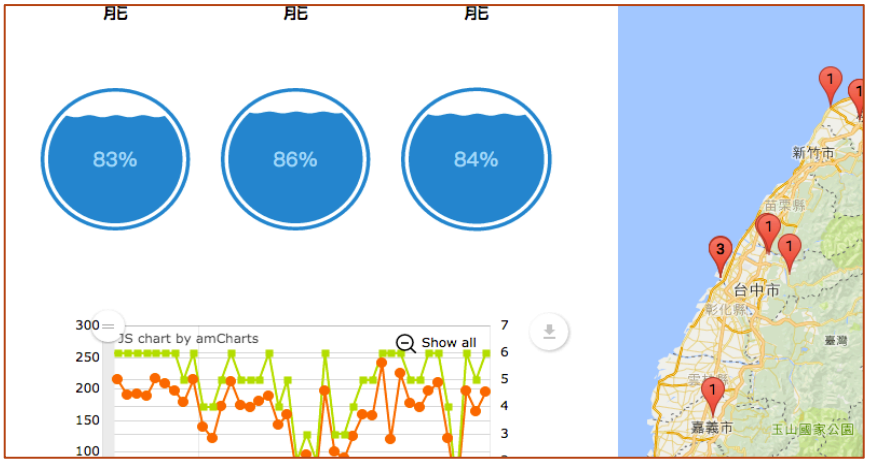


: http://research.sinica.edu.tw/pm25-air-box/

Data Application Example

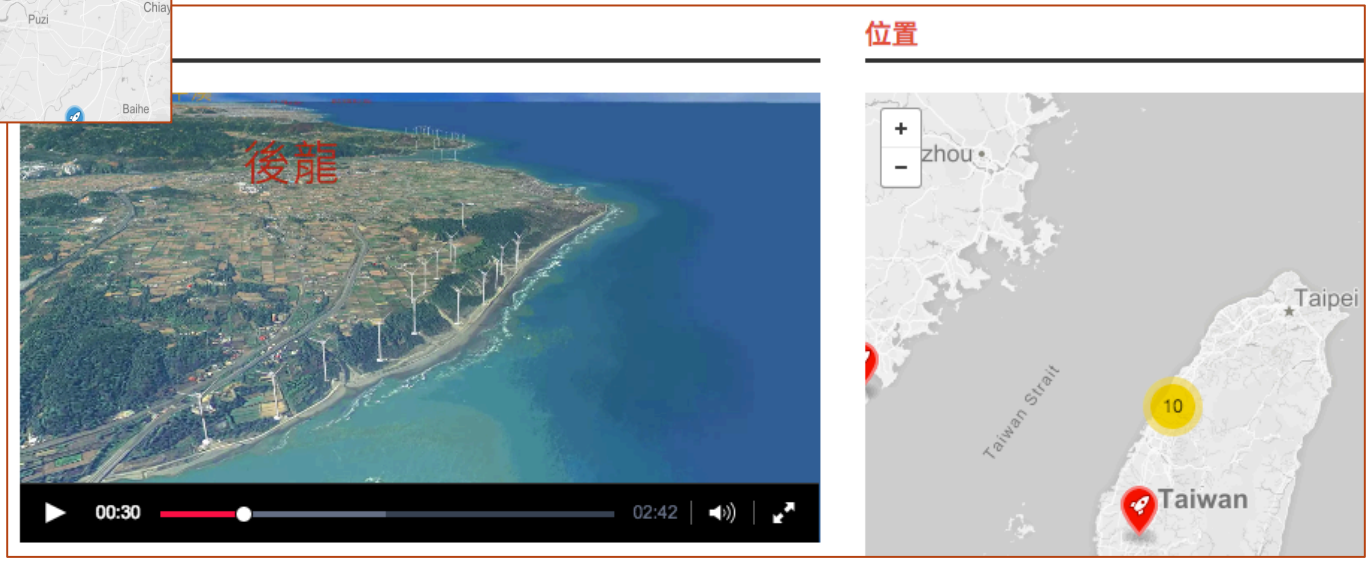
- Renewable Energy
  - Solar & Wind





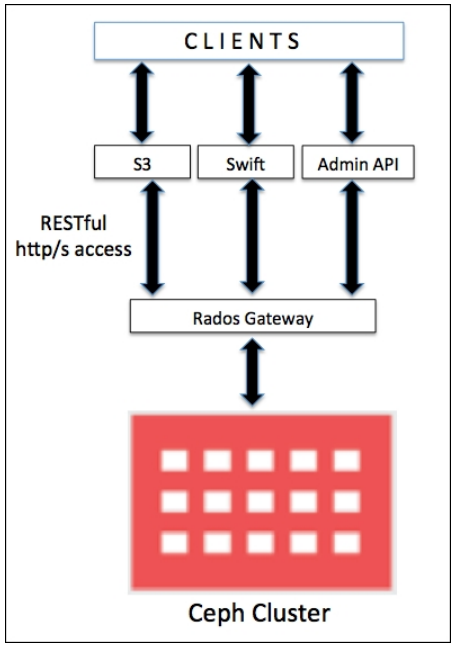
Solar energy

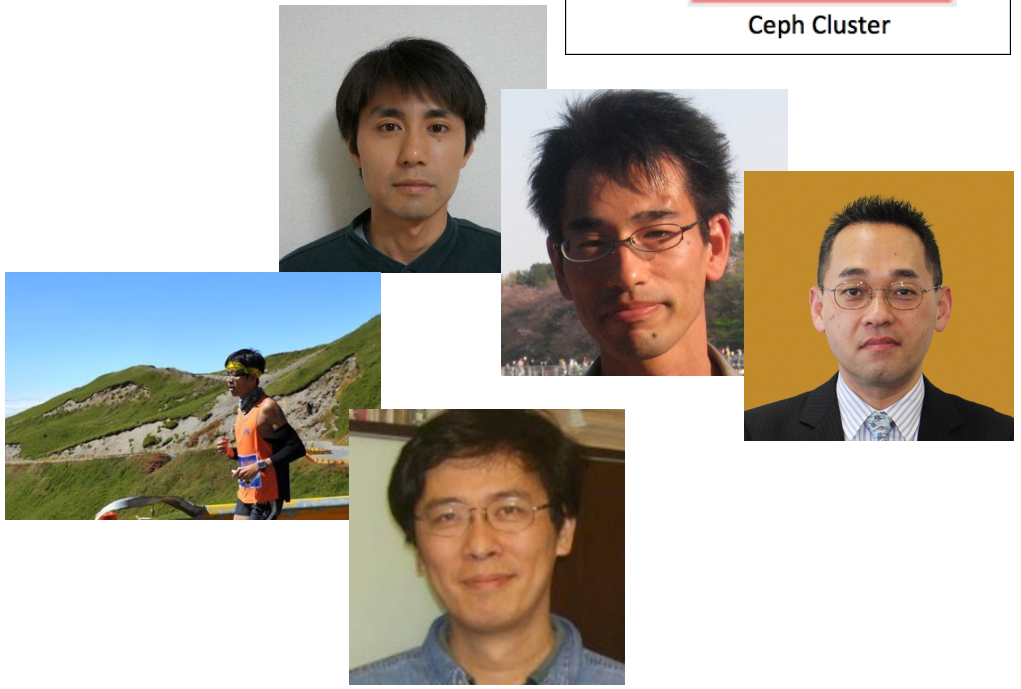
Wind energy



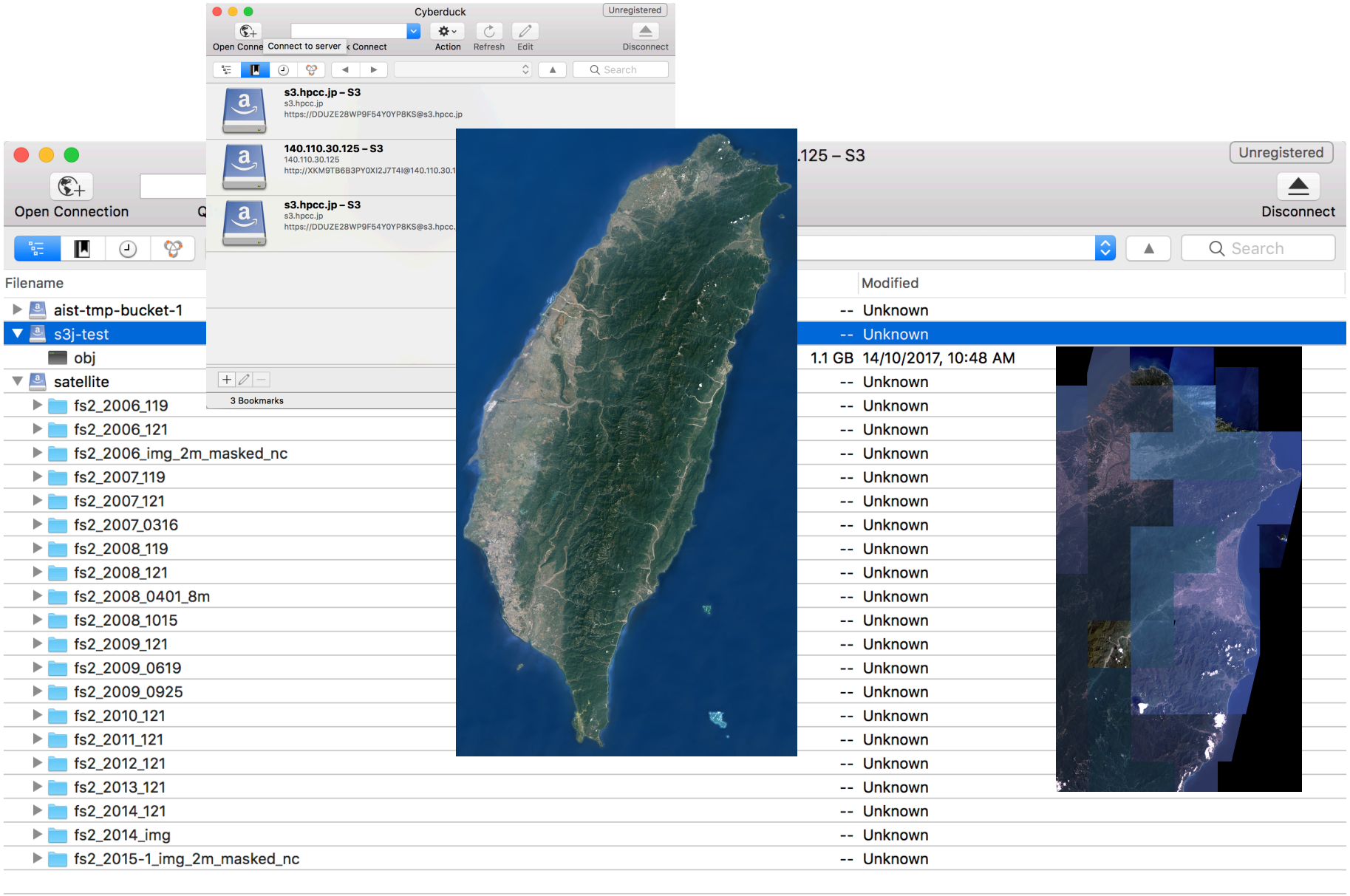
Out Reach

- Data Cloud initiative
  - International Collaboration
    - AIST Japan
      - Yusuke Tanimura
      - Ryousei Takano
      - Yoshio Tanaka
    - NCHC Taiwan
      - Max Yu
      - Weicheng Huang
  - Ceph, S3





Out Reach


Cyberduck
Unregistered
Open Conne
Connect to server
Connect
Action
Refresh
Edit
Disconnect
Search
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s3.hpcc.jp
https://DDUZE28WP9F54Y0YP8KS@s3.hpcc.jp
140.110.30.125 – S3
140.110.30.125
s3.hpcc.jp – S3
s3.hpcc.jp
3 Bookmarks
Open Connection
Unregistered
Disconnect
Search
Filename
Modified
aist-tmp-bucket-1
-- Unknown
s3j-test
-- Unknown
obj
1.1 GB 14/10/2017, 10:48 AM
satellite
-- Unknown
fs2_2006_119
fs2_2006_121
fs2_2006_img_2m_masked_nc
fs2_2007_119
fs2_2007_121
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fs2_2008_0401_8m
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fs2_2009_121
fs2_2009_0619
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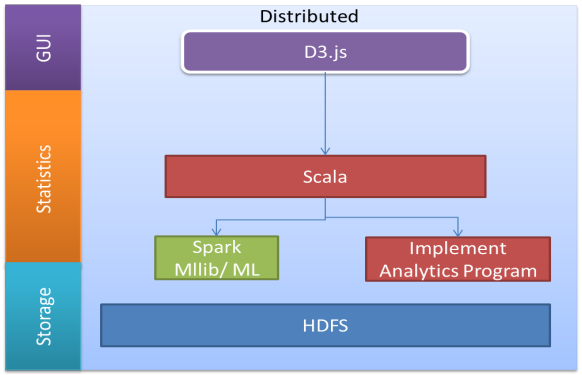
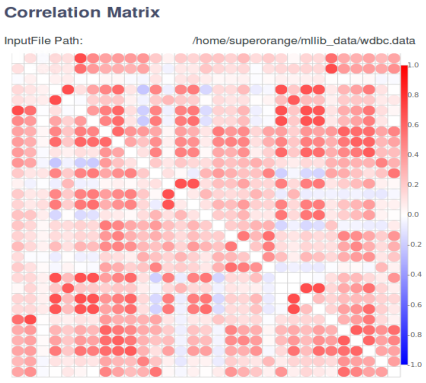
fs2_2011_121
fs2_2012_121
fs2_2013_121
fs2_2014_121
fs2_2014_img
fs2_2015-1_img_2m_masked_nc

Spark for Machine Learning

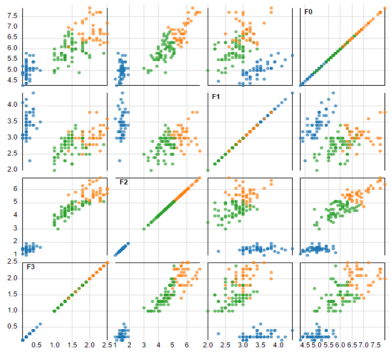
- Data Preprocessing, Analysis w/UI
  - Analysis capability via Open Source
  - ML process w/parallel processing
  - Features
    - Data Visualization : 15
    - Data Pre processing : 5
    - ML model : 4
  - To lower the barrier for using Spark
  - Better performance



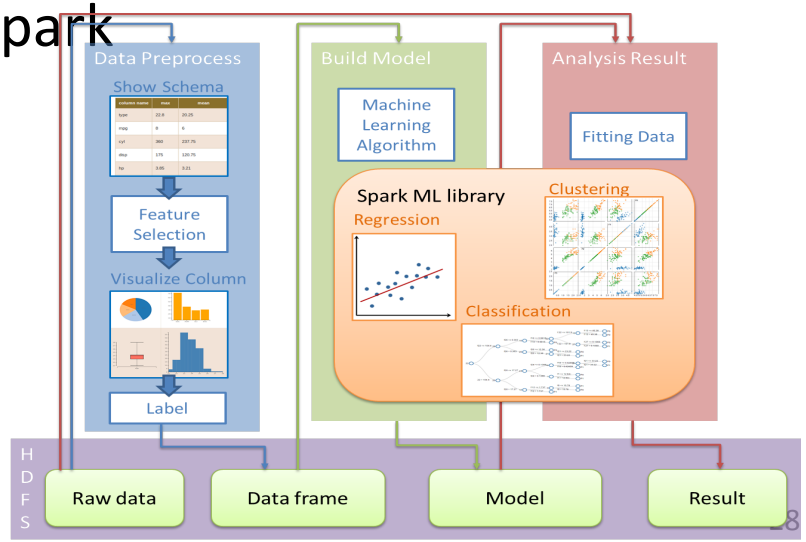
Spark ML Platform



Correlation Matrix map

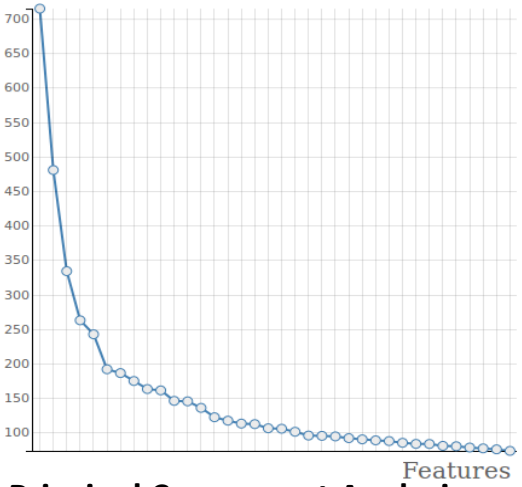


K-means

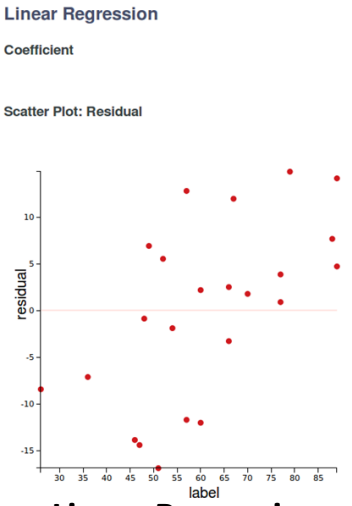


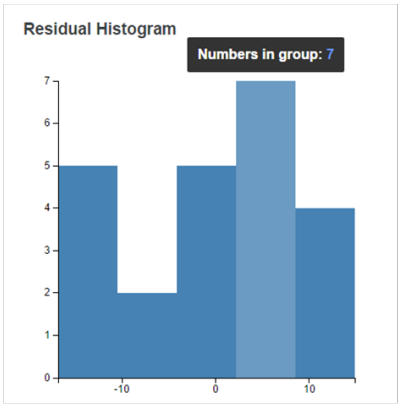
Spark ML Features

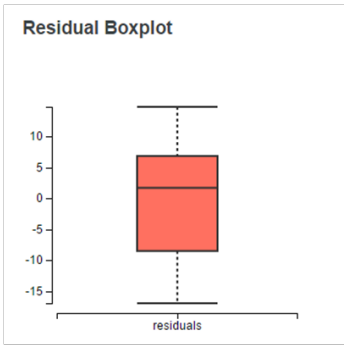
Spark – ML w/Visualization



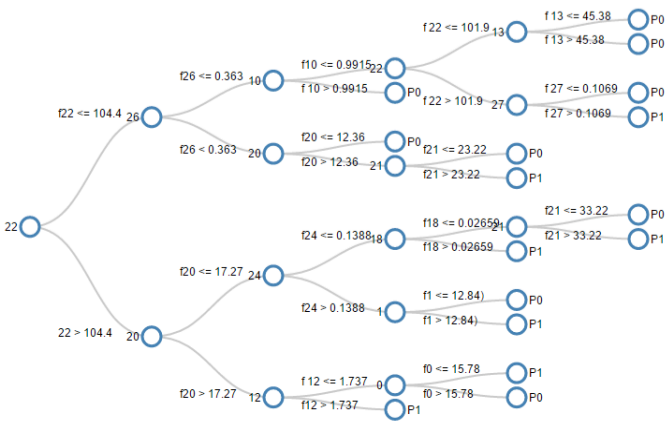
Principal Component Analysis



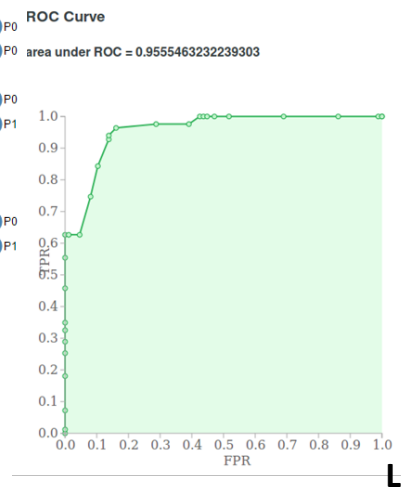


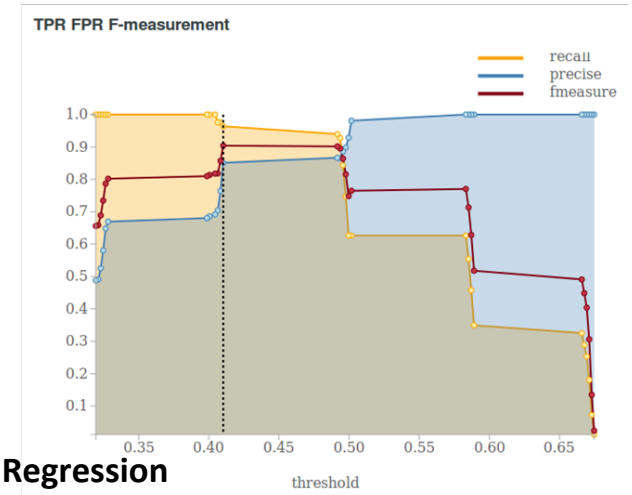


Linear Regression: residual & label, residual histogram, residual boxplot



Decision Tree

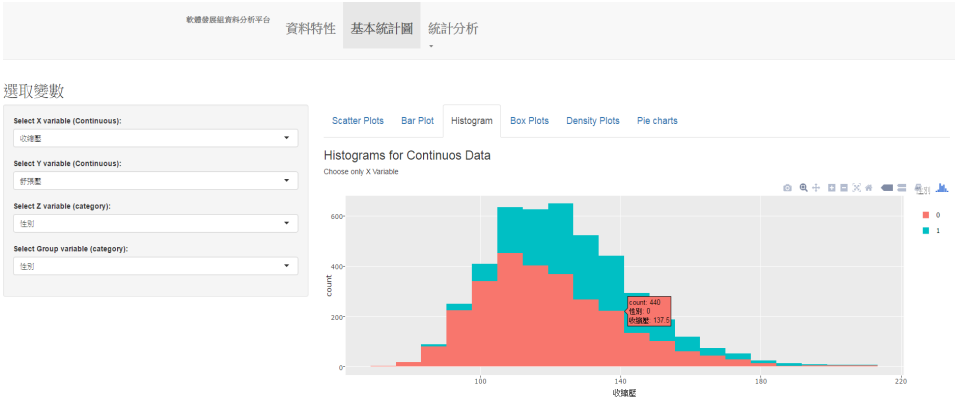




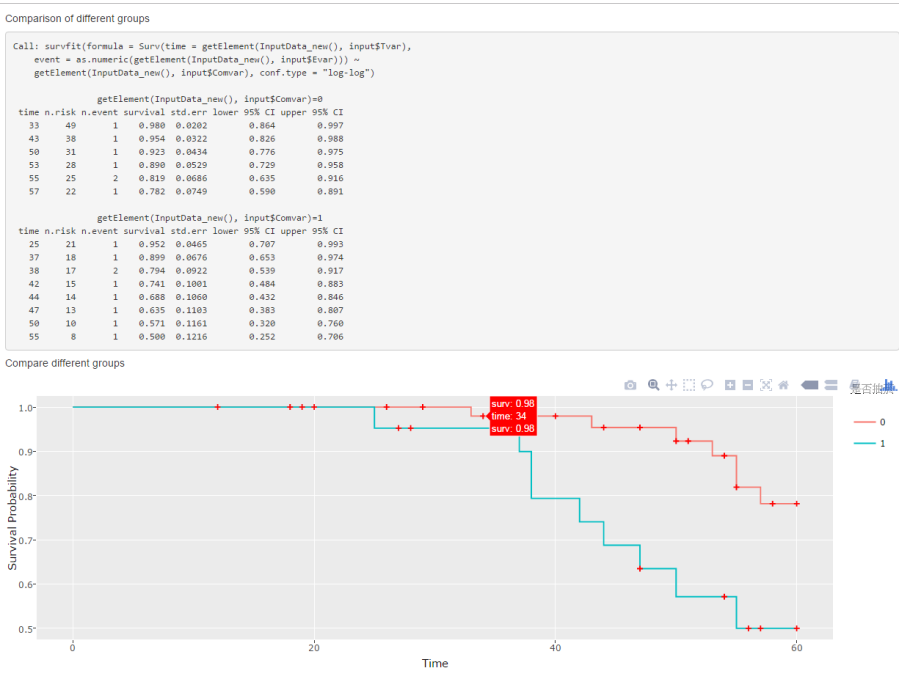
Logistic Regression

Web-based Data Analysis Platform

統計散佈圖

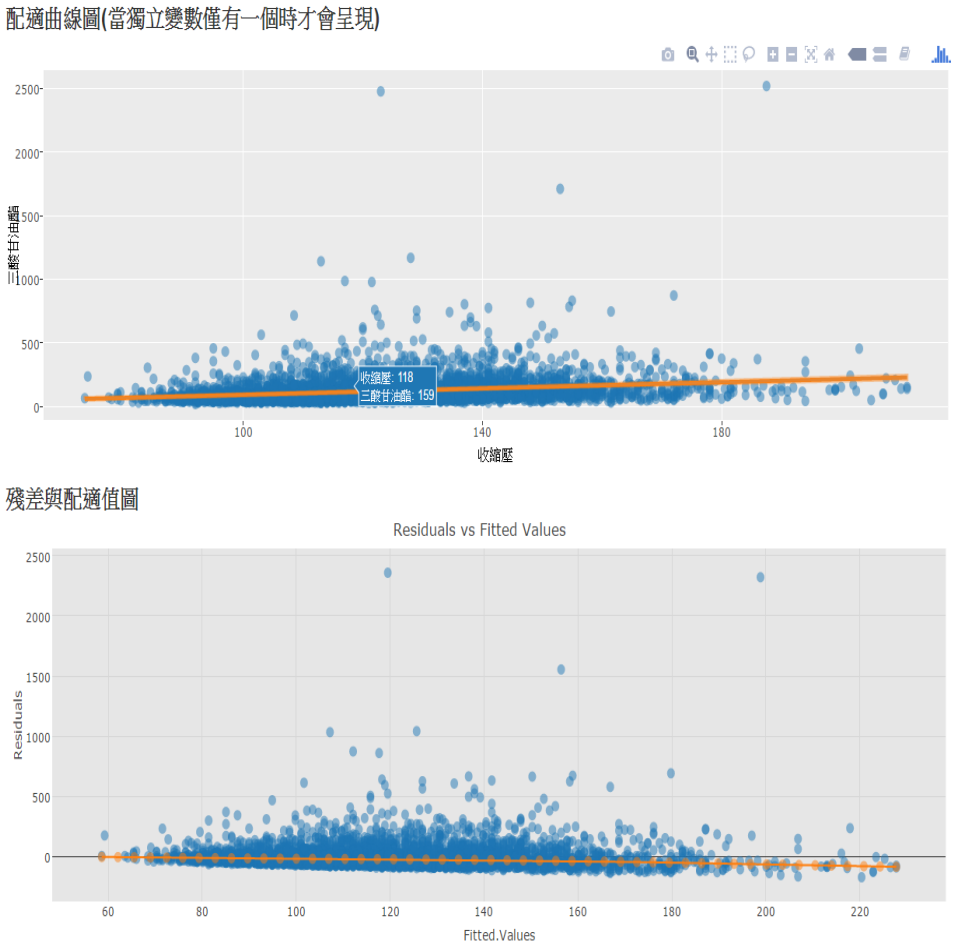


直方圖



存活分析

Web-based Data Analysis Platform



迴歸分析

Web-based Data Analysis Platform

- Data Cleaning : 3
- Data Integration
- Statistics tool kit : 8
- Statistics chats : 5
- Text mining : 4
- API w/R & Python