6th International Workshop on
Early Warning and Crisis Management
in the Big Data Era

Big Data in Smart City

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1 Smart city and its application

* What is a smart city?

– A smart city is built upon the infrastructure of the digital City. It integrates the real world and the digital world with the internet of things, and perceives the states of everyone and everything in the real world. Then the sensed data is transferred to the cloud computing center for computation and understanding, providing intelligent service for economic development, city management and publics.

– The smart city is a key component of the smart earth.

Smart city=digital city+internet of things +cloud computing

Cyber physic space

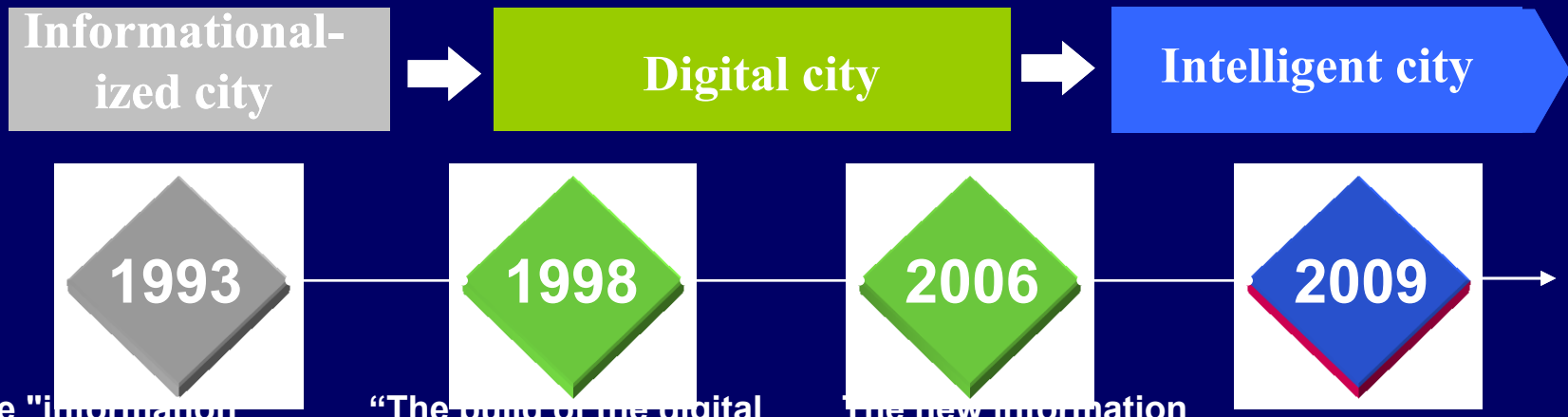
Do everything on web

Do every

Cyber space

See everything on web

The development of the smart city



The smart city is based on the information infrastructure and the digital city, It pays more attention on the integration of the digital city with the real city through ubiquitous sensor networks, puts more emphasis on the intelligent control and the automatic feedback. **It is a more advanced stage of the digital city, and a high-degree integration of the industrialization and information technology.**

The motivation and goal of the smart city in China

Urbanization

Industrialization

Informationizing

Smart City

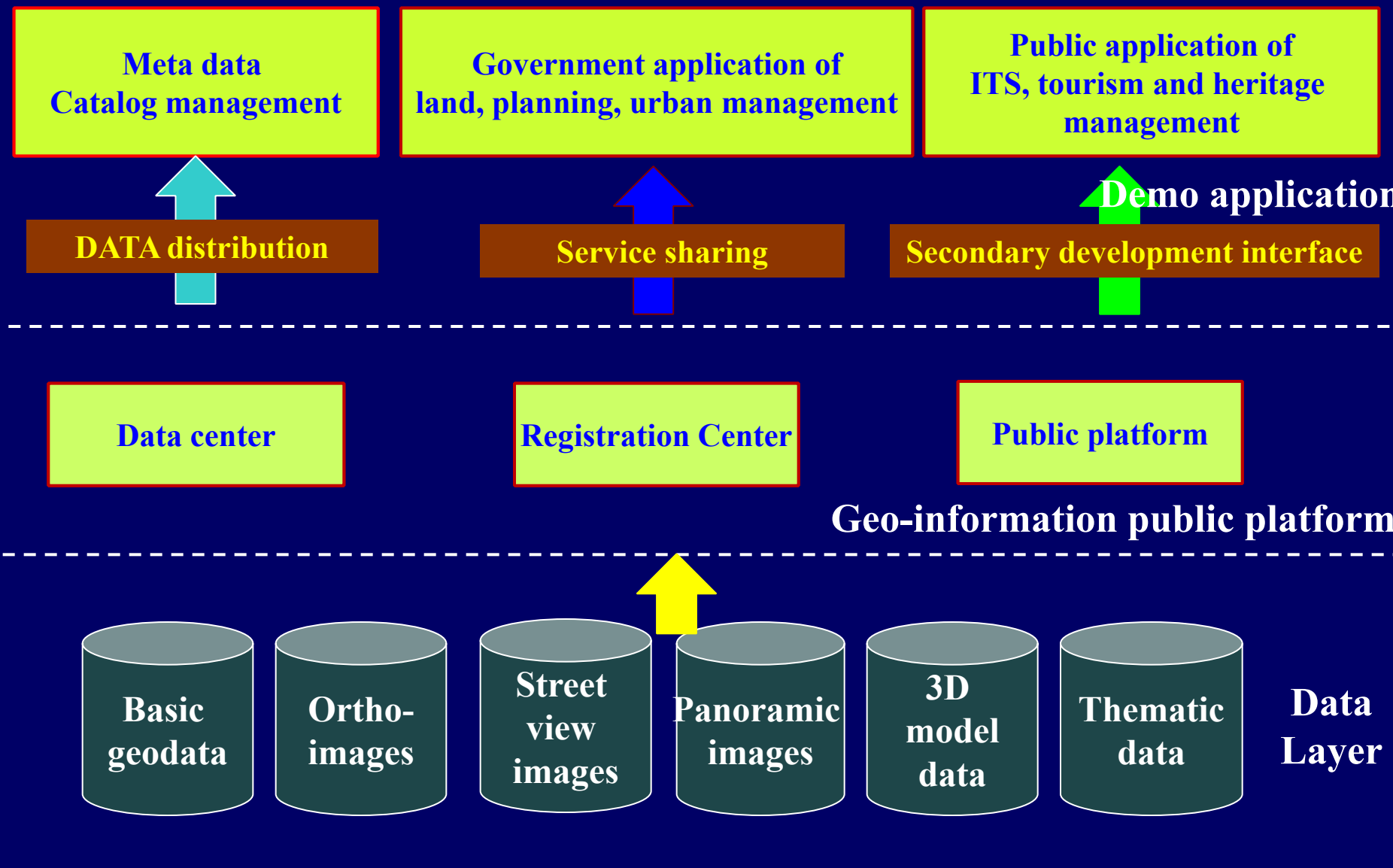
Low-carbon

Green

Sustainability

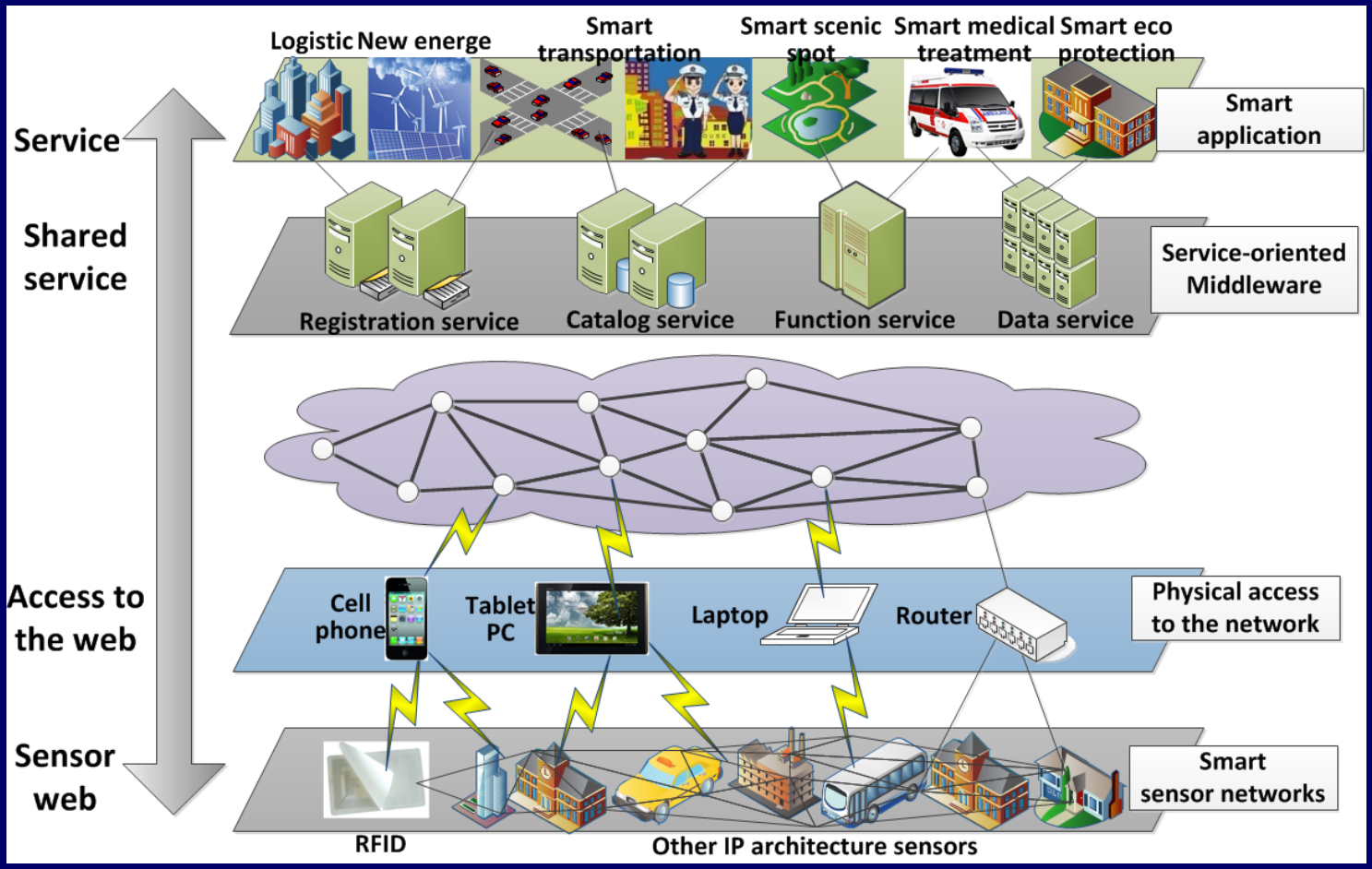
Realize the Chinese dream !

Digital city infrastructure

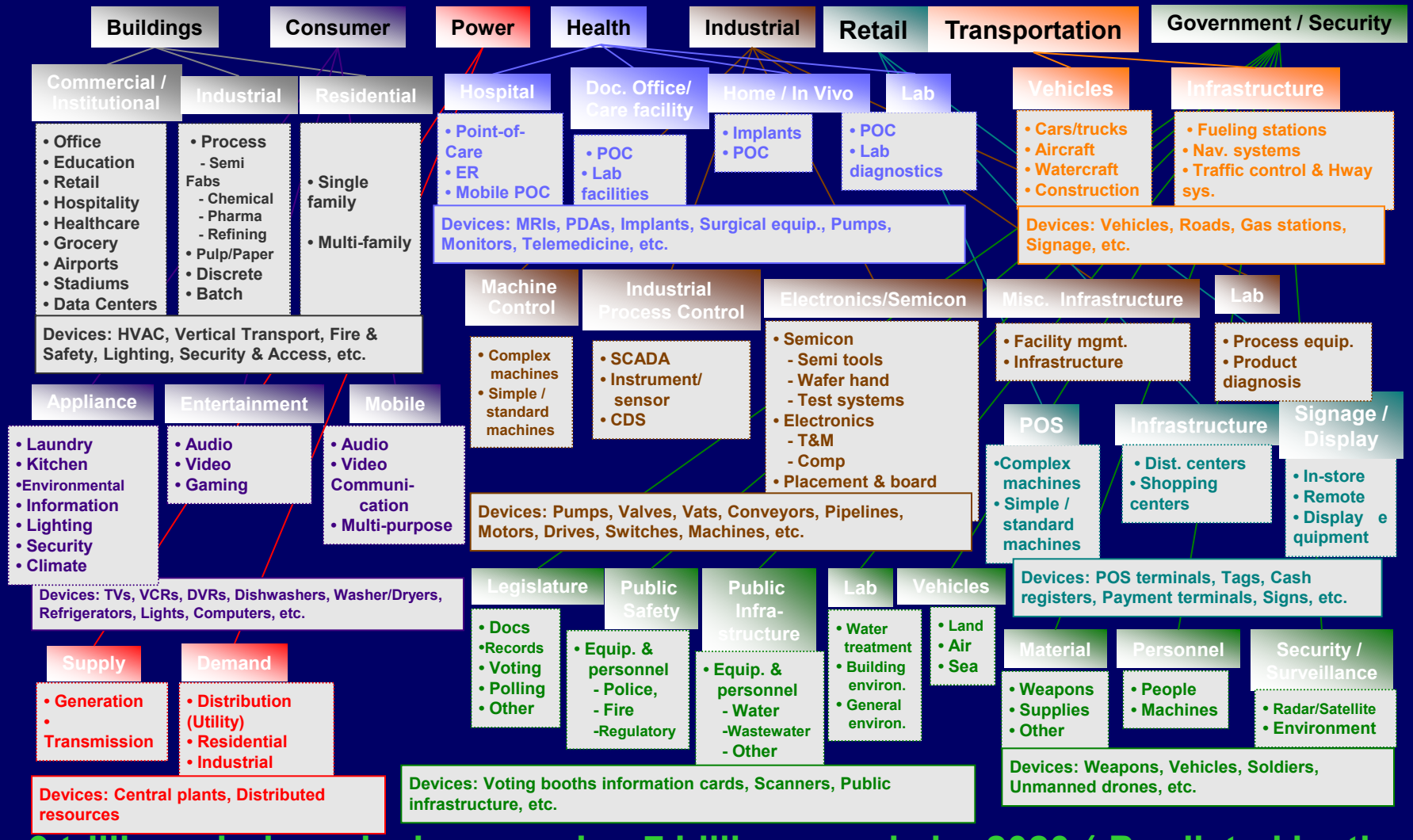


Internet of things

Realize the interoperability between human and human, human and machine, machine and machine.



The ubiquitous internet of things



9 trillion wireless devices serving 7 billion people by 2020 (Predicted by the international authoritative organizations)

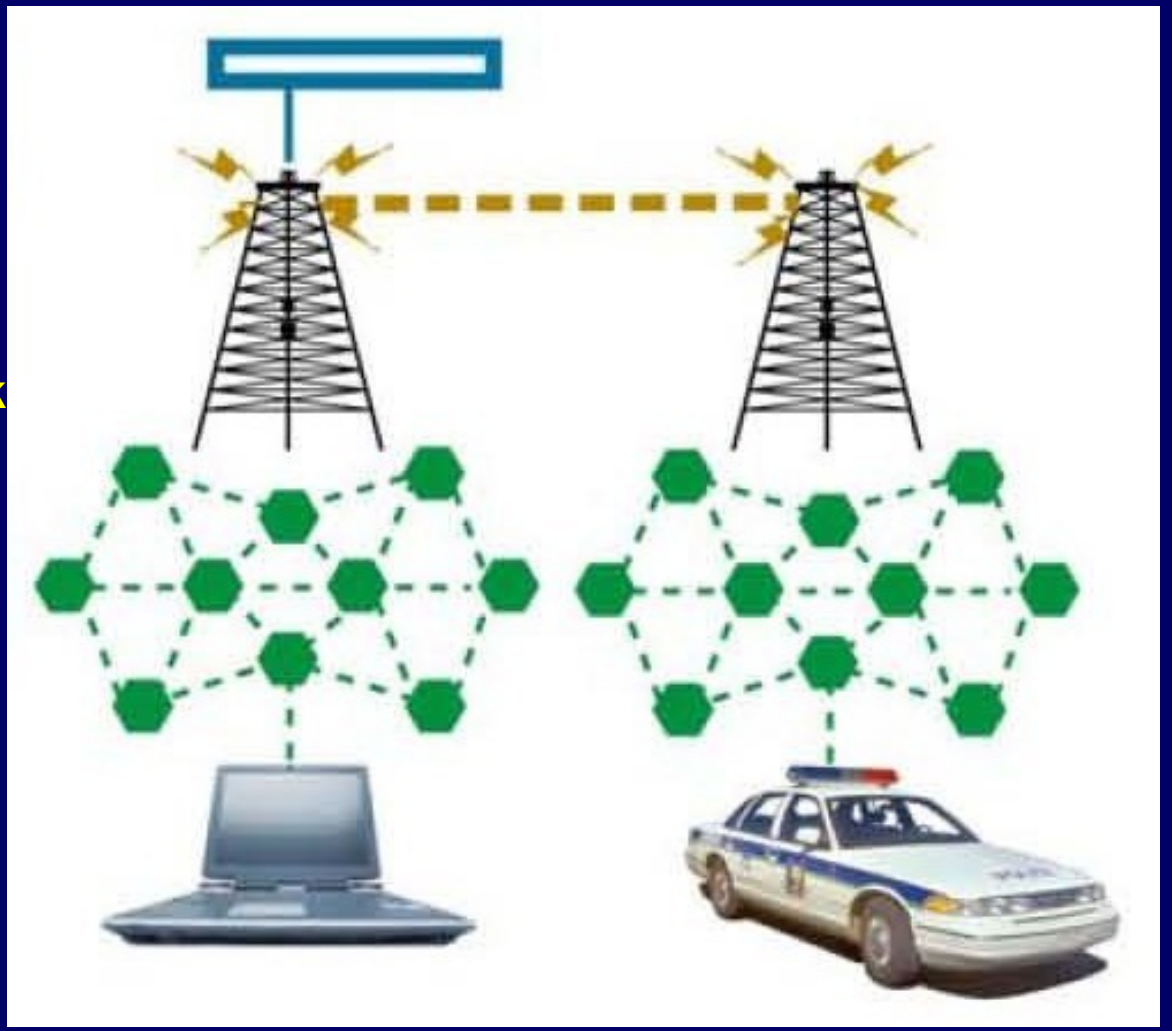
The ubiquitous web infrastructure

Core:
Fiber Optic Cable

Transmission :
Metropolitan area network

Access:
Local area network

User: fixed, nomadic,
mobile applications



Applications of the smart city

City functions	Smart city functions
Human settlement	Smart security \ eco protection\ energy \ urban managers\ smart urban planning \ community \ home …
Economic development	Smart manufacturing \ industrial internet \ logistics ...
Social interaction	Smart transportation \ shopping \ community integrated management …
Cultural enjoyment	Smart outdoor streaming media \ education \ travel …

2 Big data in smart city

During the construction and application of the smart city, the ubiquitous sensor networks may collect and generate TB, PB or even EB level amount of data in real time, bringing our world to the era of “big data”.

The construction of thesmart city is moving into the era of big data

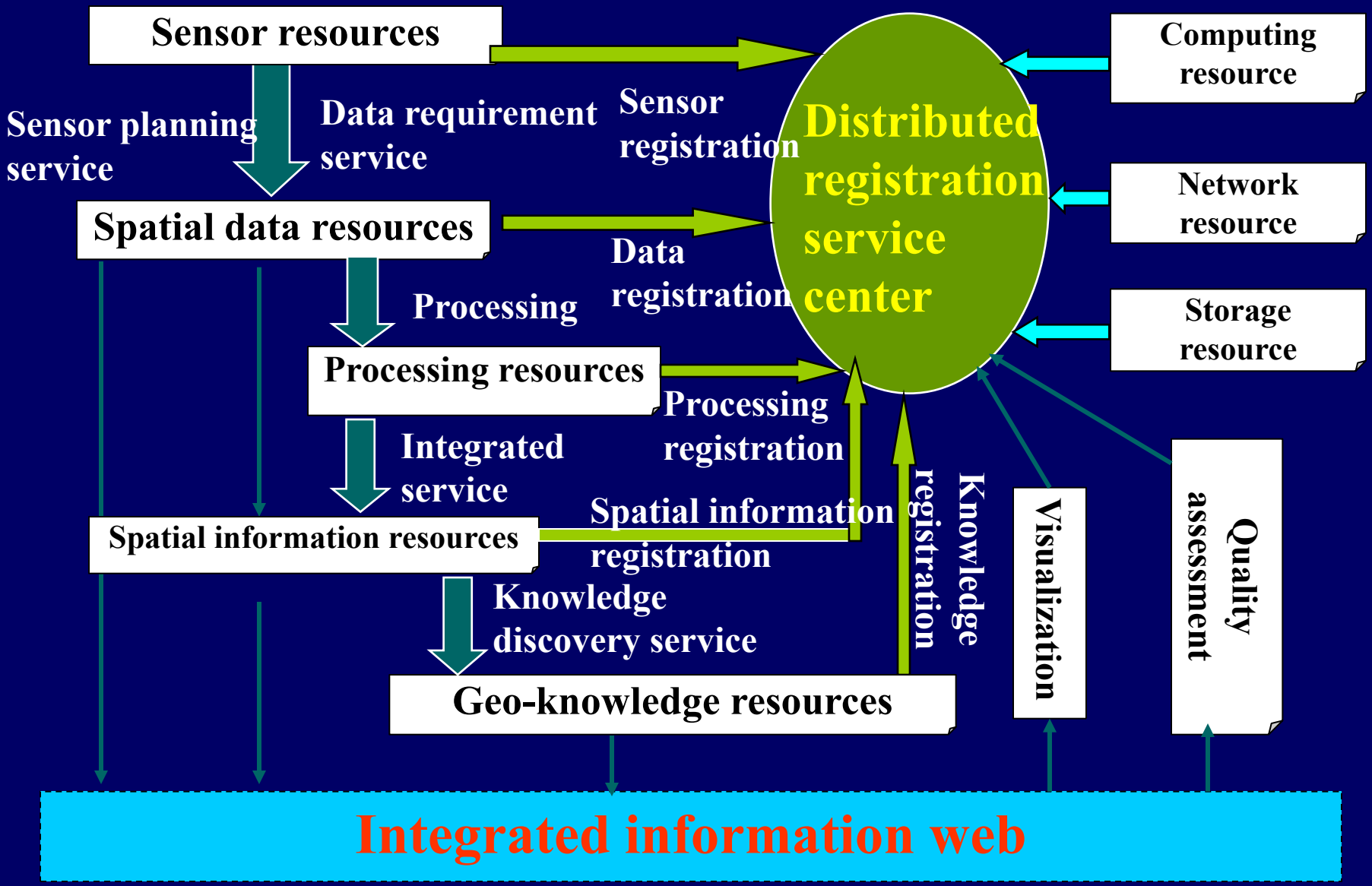
The era of big data is coming

In Feb, 2011, Science noted the arrival of big data era

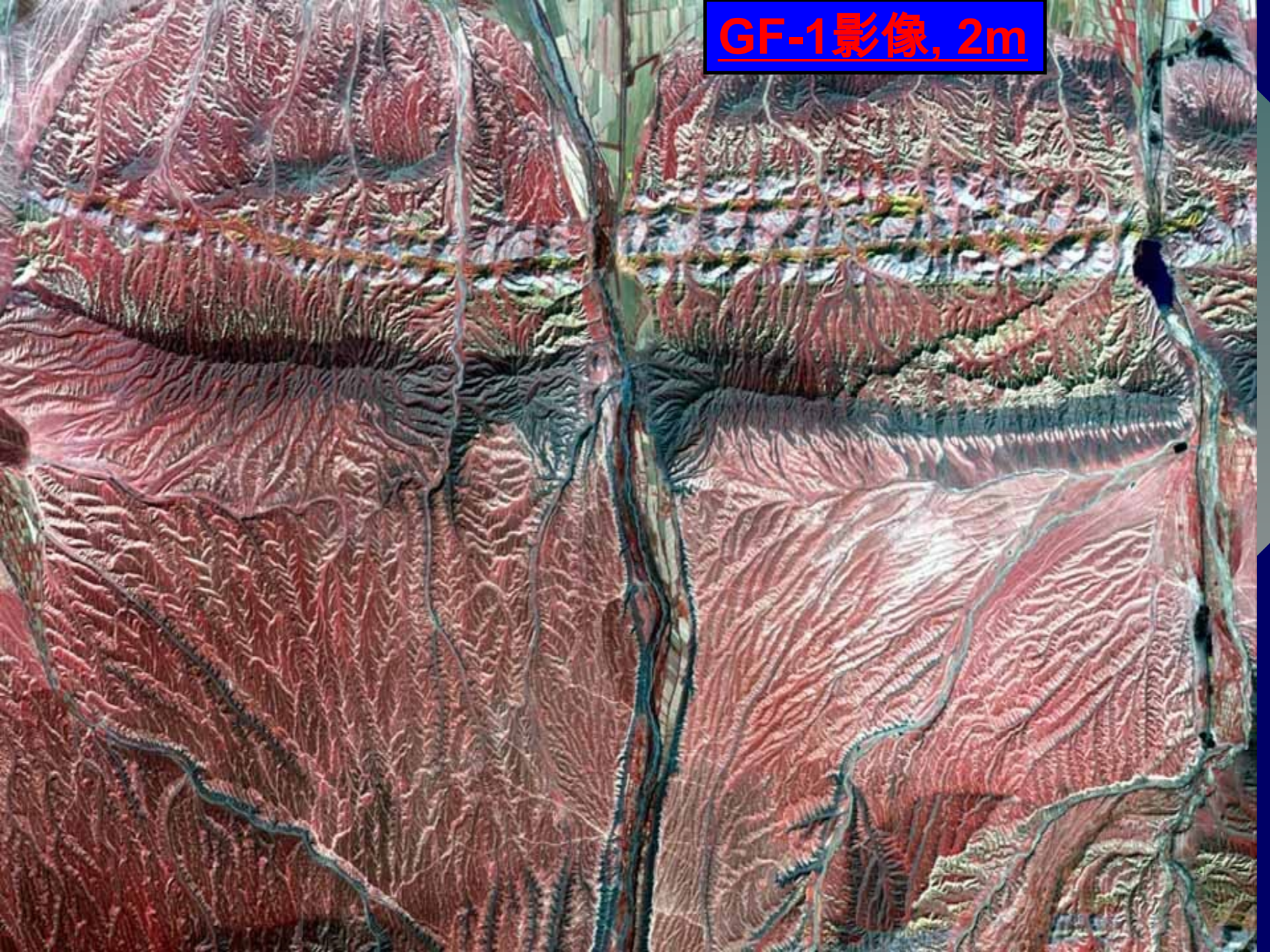
Eric, from American Academy of Engineering, said: “We are in an exciting era that we can use big data to make prediction and modeling, visualization and discovery of new laws”

Obama announced that the U.S. government officially launched the "big data research and development program“. He regarded big data as the oil of the world is future world. The significance of this program is comparable to the last century’s "information superhighway plan"

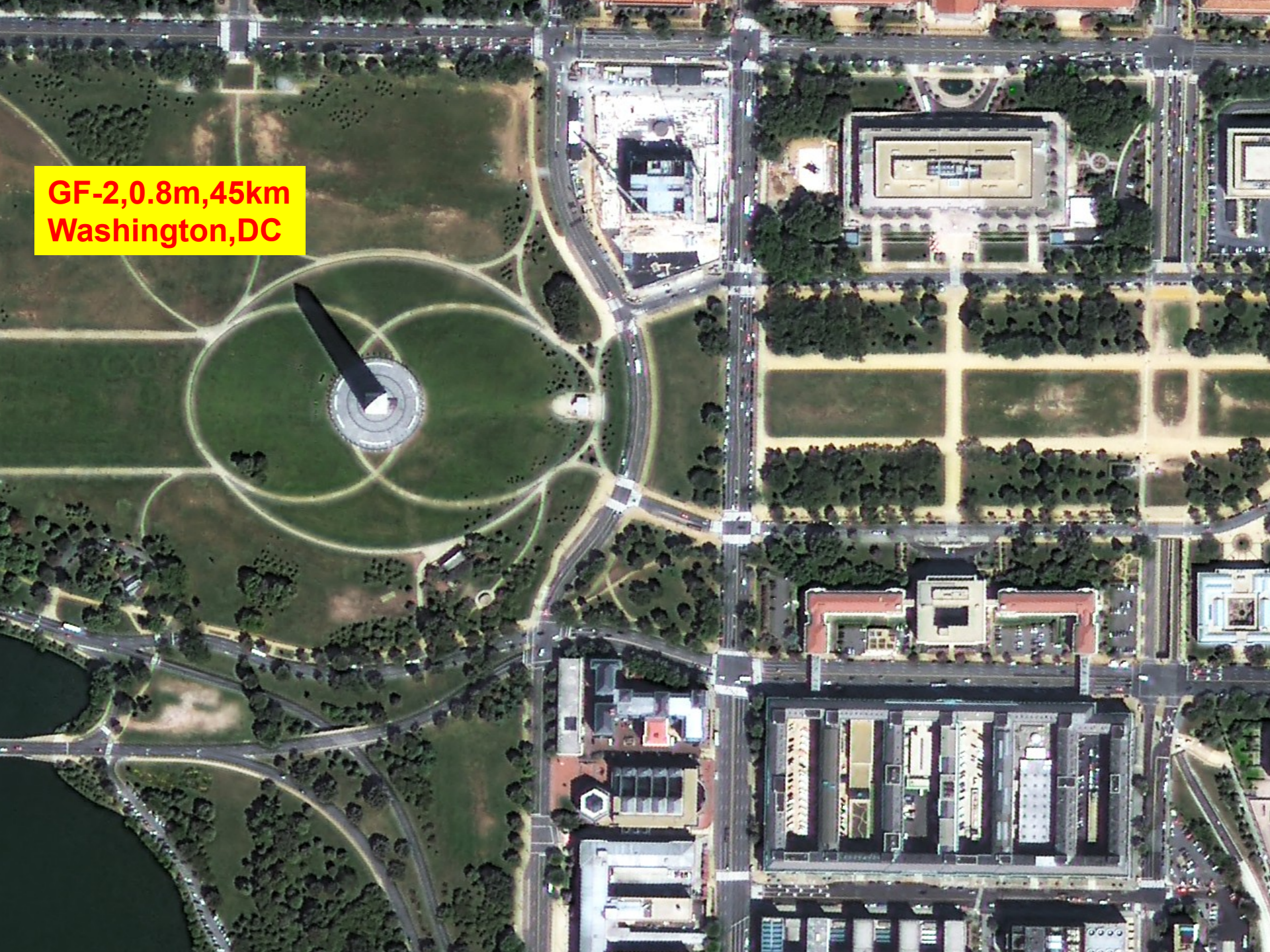
Geospatial Information Resource Network Service Model



ZY-3 Products - Palm Island,Dubai


GF-1影像, 2m


GF-2,0.8m,45km
Paris


GF-2,0.8m,45km
Washington,DC


High RS , 1m


High RS , 0.5m

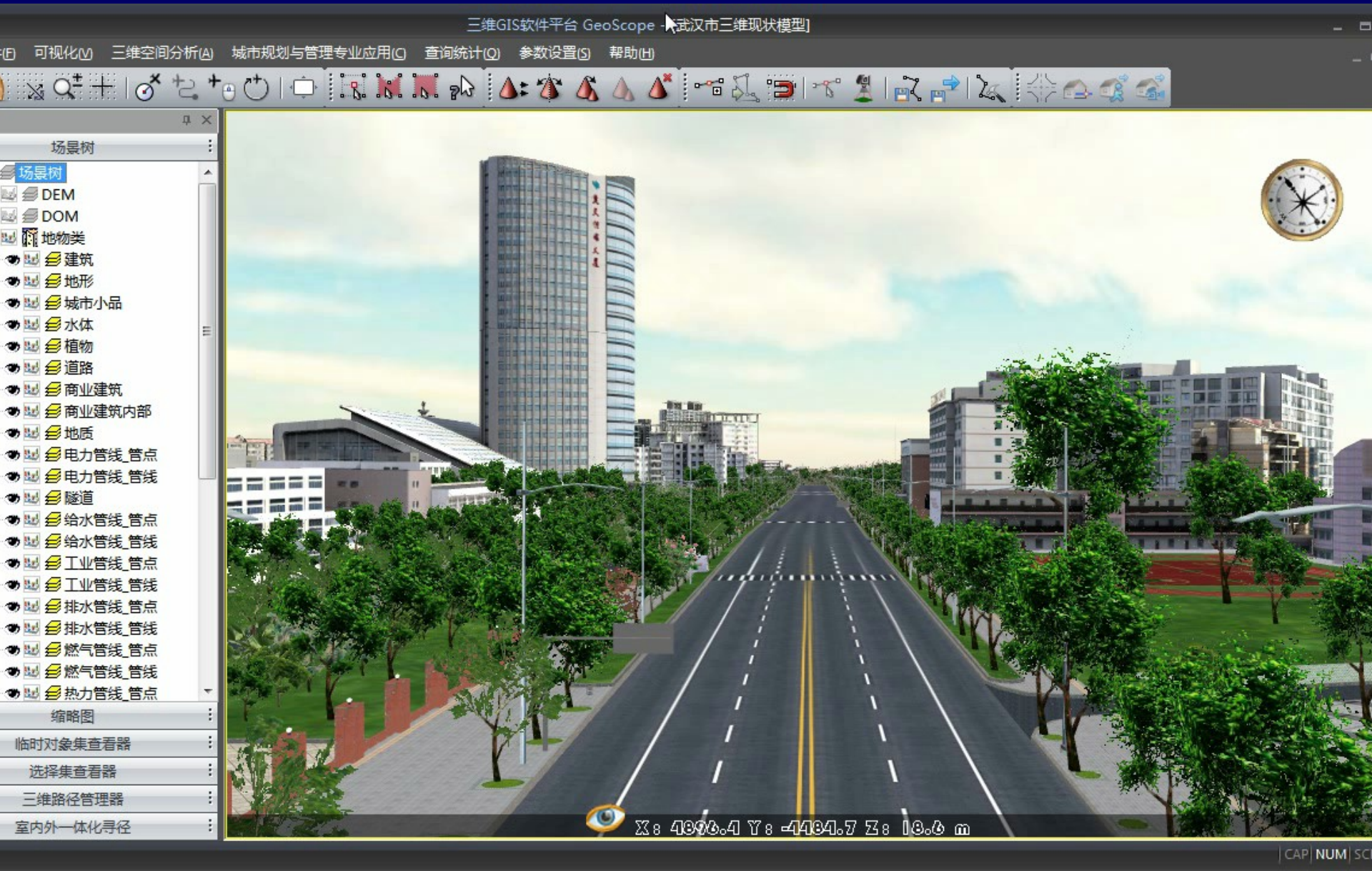
A typical high-resolution remote sensing images: Beijing West Railway Station, GeoEye, resolution 0.4 m

3D city modeling with 4+1 tilt cameras

录制工具
KK 录像机

由倾斜相机匹配生成的一个视角点云

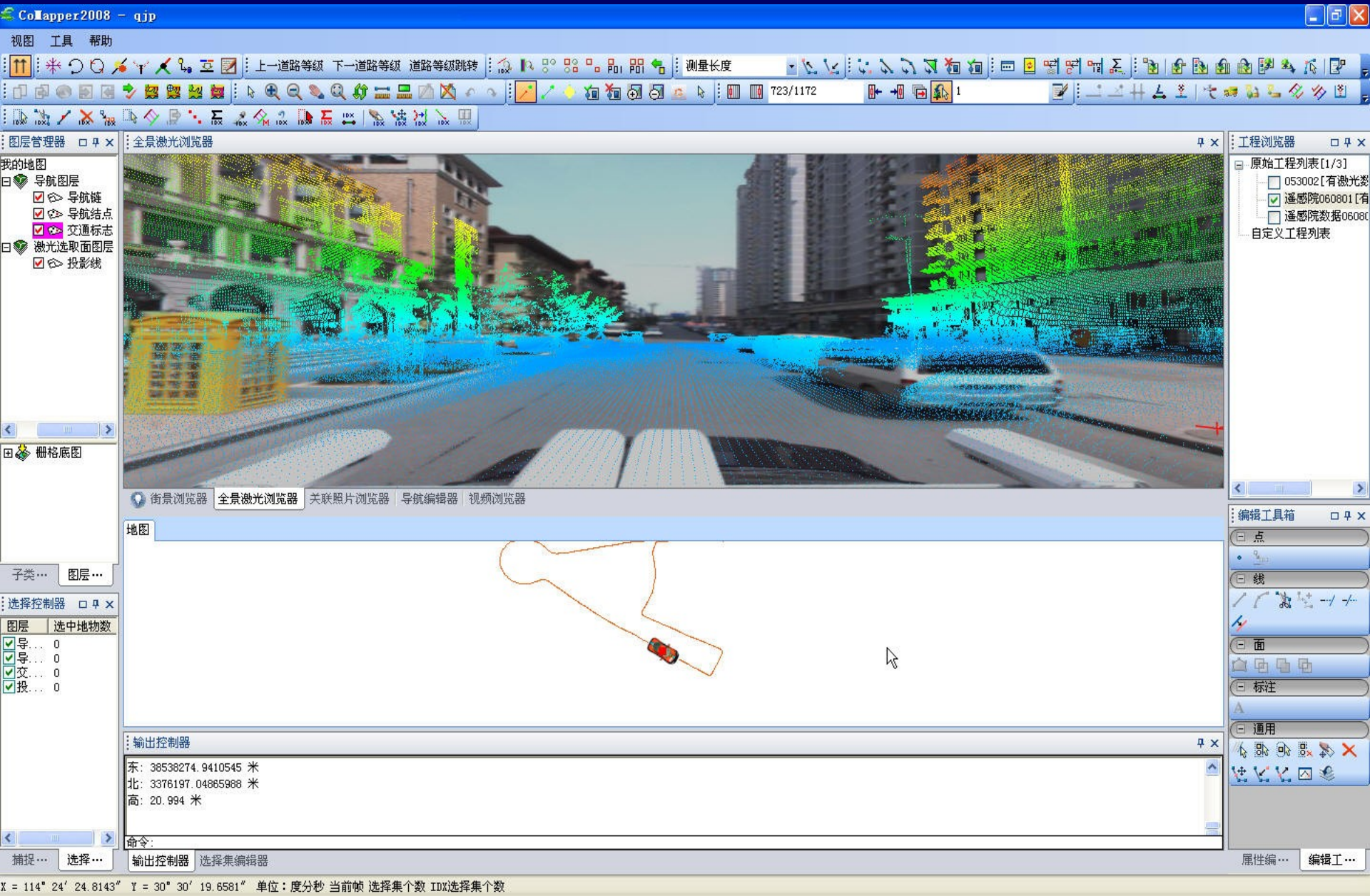
Ground / underground 3D integration (Wuhan)



Massive spatial data scheduling and management （100TB）

I show China: Live Maps in 300 cities (300TB)

Fusion of panoramic images and LiDAR



Integration of GIS and videos

China has built the world's largest video surveillance network

In 2005, the State Council started the construction of the "Safe City"

关于印发《关于深入开展城市报警与监控系统应用工作的意见》的通知

公科信[2010]30号

各省、自治区、直辖市公安厅、局，新疆生产建设兵团公安局：

为深入实施科技强警战略，充分发挥安全技术防范的重要作用，提高社会治安防控体系技术支撑能力，在组织开展两批城市报警与监控系统试点建设工作的基础上，公安部制定了《关于深入开展城市报警与监控系统应用工作的意见》[illegible]发给你们，请结合本地实际，认真组织实施。

中华人民共和国公安部

二〇一〇年四月六日

的意见

为深入实施科技强警战略，充分发挥安全技术防范的重要作用，增强安全防范技术支撑公安工作的能力，提升公安机关预防、制止、惩治违法犯罪活动的效能，提高社会治安防控体系技术水平，维护社会治安大局的稳定，现就进一步深入开展城市报警与监控系统的应用工作提出以下意见：

The world's first large-scale urban construction monitoring network

Five levels of monitoring networks: Street, district, municipal, provincial, national

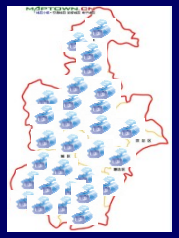
National multi-level network monitoring project will be built up this year

The challenges of big data – cannot afford to save

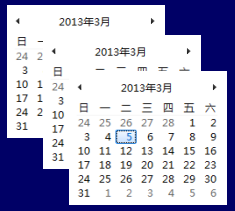
IMS Research forecasted in 2011：The storage volume for the new monitoring equipment in 2012 will reach to 3300 PB.

A Case Study of Tianjin：the future storage cost:

The HD cameras generates 3.6GB of data per hour



In 2015, Tianjin will install 600,000 cameras



The video storage volume is for 3 months

In 2015, the data volume of the monitoring data in Tian jin will be:

4665.6PB

The 4TB storage server is over 50000 yuan

Equals to the GDP of Tibet in 2013.

The Storage device costs 58.32 billion yuan

The rapidly growing storage volume and investment is an important factor that restricts the development of city surveillance system

The situation is even more severe in the era of big data

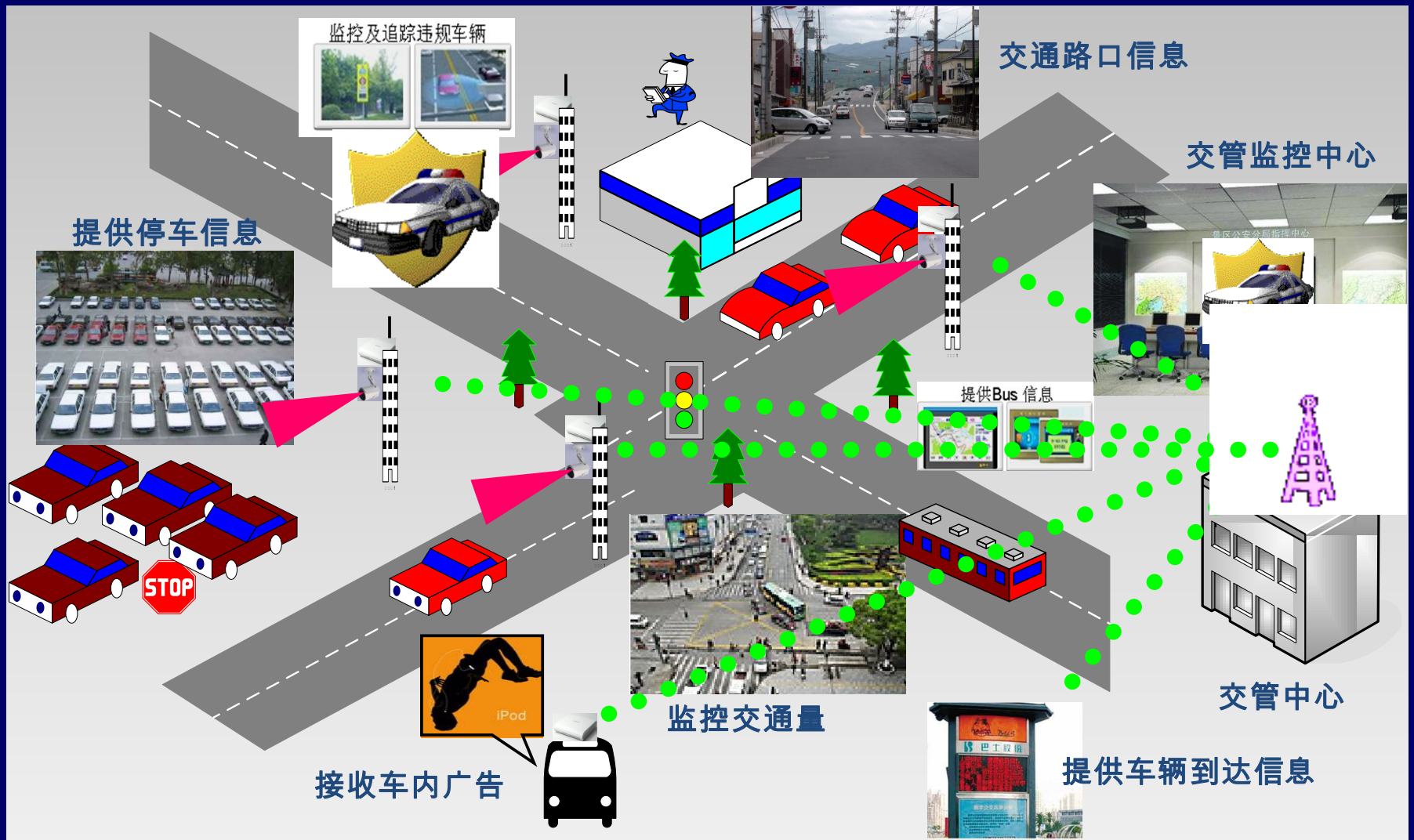
The rapid growth of data has led to a large amount of false alarms that the manual handling cannot follow up

The rapid growth of data has exposed the shortages of the traditional warning techniques

The U.S murderer Iris Abrazan stabbed more than 20 people (5 were dead) in three states.

The big data in the application of the smart city

Smart transportation (hundreds of millions of people and cars)



The application of the smart city

Smart security (365 days x 24 hours)

Anti-theft in residential quarter

The subway

Campus security

Roads

Building sites

CPE

CPE

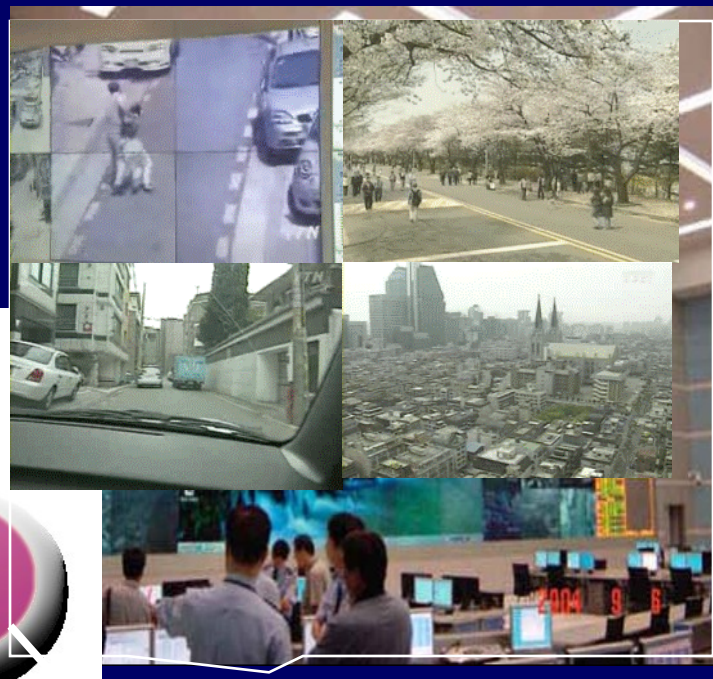
CPE

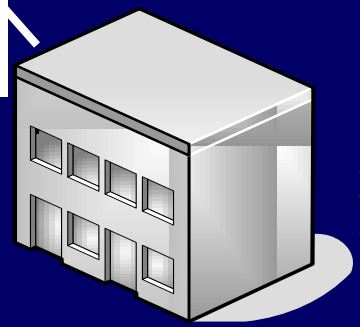
CPE

CPE

Wireless base station

Cell phone user

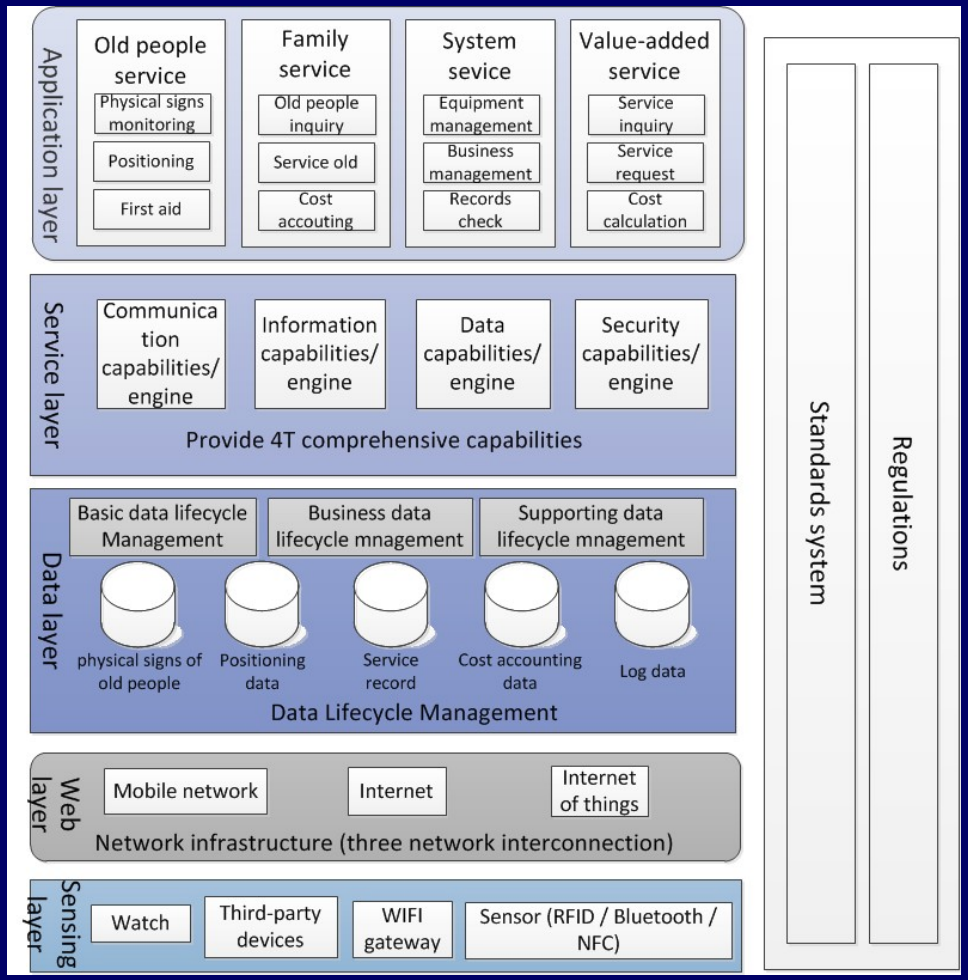




Monitoring center

The application of the smart city

Smart provision for the aged people （ 200-250 million people in China ）



Features of big data

- **Volume:** TB, PB, EB level of data waiting to be processed.
- **Velocity :** The data stream waiting to be response should be processed in seconds or even milliseconds is continuously generated.
- **Variety:** Data sources and types are various. Text, pictures, videos and other structured and unstructured data are exist;
- **Veracity:** Because of the noise, loss, inconsistency and ambiguity, the uncertainty should be taken into consideration.
- **Value:** Big data contains great values. It offers an unprecedented possibility to quantify and understand the world. The ultimate goal of big data is to find the great values within them.

This "5V" also translated as: volume, speed, diversity, authenticity and value.

3 Cloud computing and data mining

- 3.1 Cloud computing
- 3.2 Data mining

Jim Gray: the 4th Paradigm

Science Paradigms

- Thousand years ago:
  science was **empirical**
  describing natural phenomena
- Last few hundred years:
  theoretical branch
  using models, generalizations
- Last few decades:
  a **computational** branch
  simulating complex phenomena
- Today: **data exploration** (eScience)
  unify theory, experiment, and simulation
  - Data captured by instruments or generated by simulator
  - Processed by software
  - Information/knowledge stored in computer
  - Scientist analyzes database/files using data management and statistics

$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{4\pi G p}{3} - \mathrm{K}\frac{c^2}{a^2}$$

3.1 Cloud computing

Cloud computing, of which the computing resources (including computing power, storage capacity, the interoperability) is dynamic, scalable, virtualized and provided as a service, allows the public to participate in and supports information services.

Socialization, intensification and specialization

Information service based on cloud computing

Changes of Internet resource configuration

Server clusters and virtualization

Virtual service

Service management

The amount of server is increased dramatically

Professional service causes the server to diverse

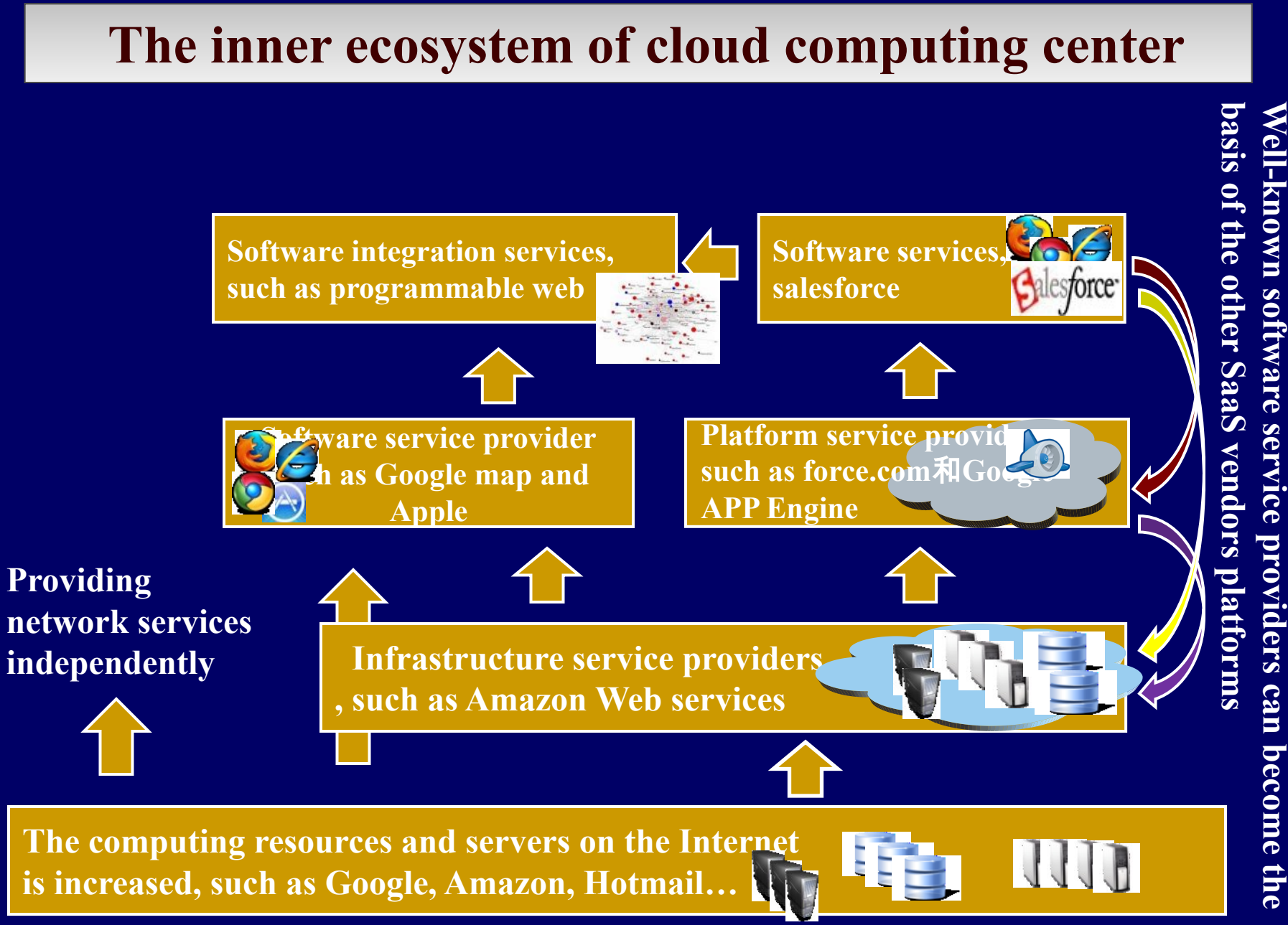
Browser/Server

More jobs are undertaken by servers

Client/Server

The emergence of servers

The inner ecosystem of cloud computing center

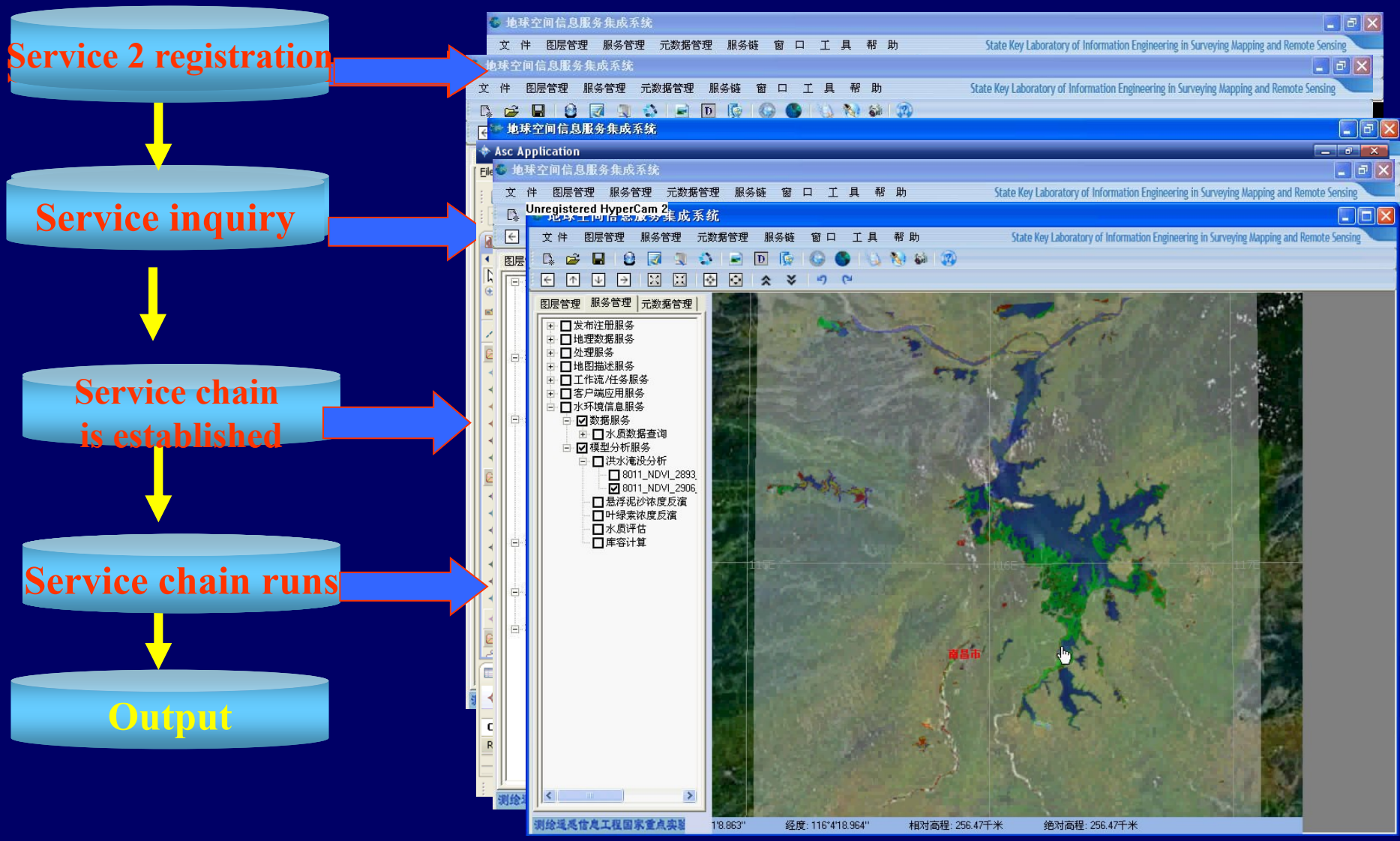


Remote sensing cloud

Remote sensing data, processors and analysis methods are at the remote cloud computing platforms. Users can get the final result after they choose the data and processors, requiring no local computing environments any more.

Remote sensing cloud ——OpenRS-Cloud

An example of remote sensing cloud service



The abstract service chain is mapped to the BPEL execution services chain

Positioning cloud

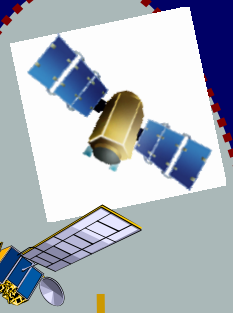
The GNSS signals that the mobile phones receive, as well as the other positioning information, can be transferred to the cloud computing center. These information is computed in real-time to achieve the goal of indoor / outdoor continuous positional and navigation.

Geographical conditions monitors, disaster reporters, forest investigators, geological survey team, land investigators, urban management staff, traffic police and other civil servants and vehicle networking users.

Positioning cloud

GNSS

- Satellite positioning
- Wireless signal positioning
- Sensor positioning
- Integrating positioning



Sensors

elerometer

Gyro

ctronic compass

Phone camera

Wireless signal

RFID/ NFC

Bluetooth

WLAN

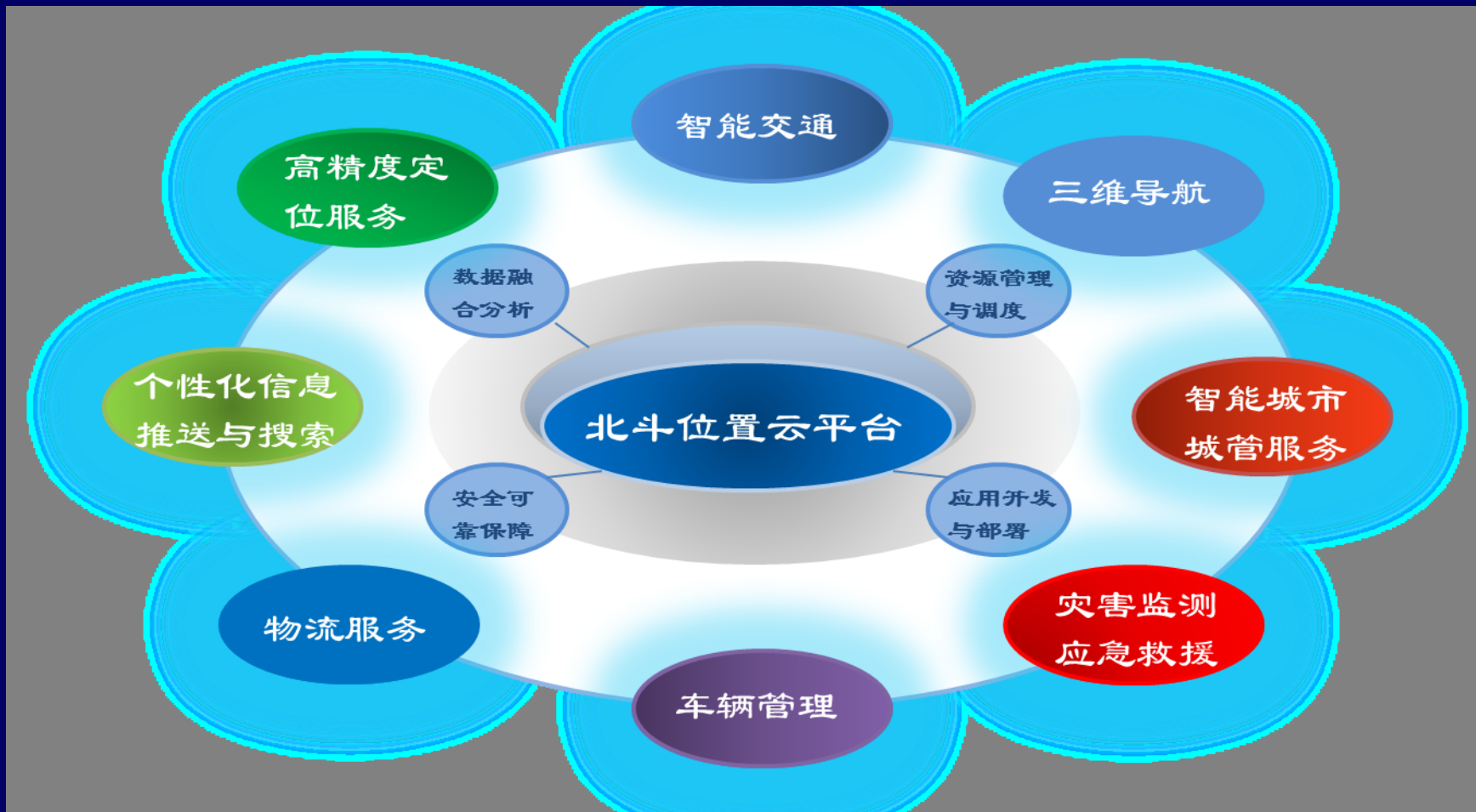
Cellular network &

Wireless digital television signals

Navigation from outdoor into indoor

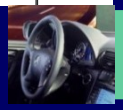
Positioning cloud

- Public service platform of Beidou positioning cloud



Chinese Beidou system begins to run and provides services

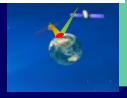
Positioning accuracy: 10 meters (both in horizontal and vertical directions)



Speed measurement precision: >0.2 m/s

Timing Accuracy: 50 ns (one-way)

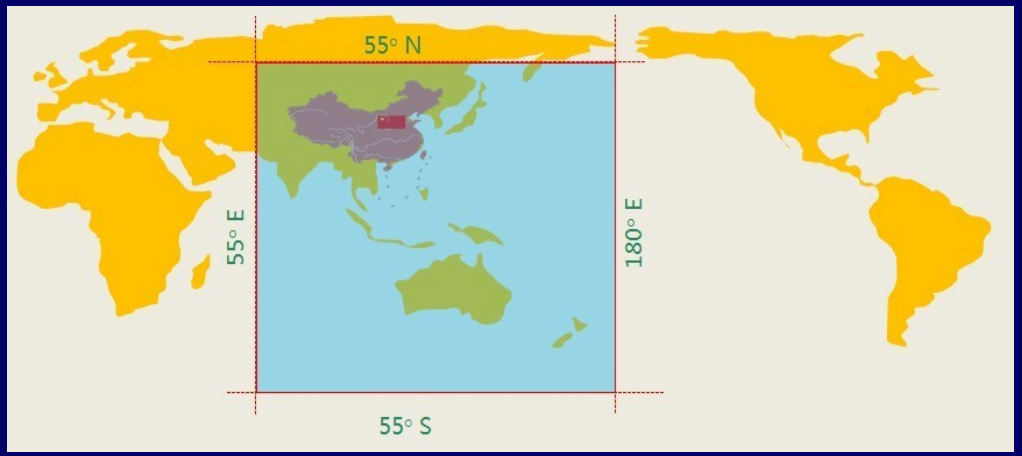
Short message communication



Wide Area Differential & ground-based enhancement

- ★ In Dec 27, 2012, Chinese Beidou system begins to run and provides services for China and the surrounding countries.
- ★ The State Council Information Office held a conference for Beidou system, officially announced the space control signal interface file.

Service covering area

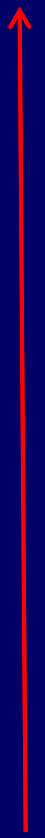


The demo validation of Beidou ground-based enhancement system in Hubei

- **Overall objective :**
  - To provide high-precision navigation and positioning service capabilities in Hubei Province by the ground-based enhancement system.
- **Detailed objectives :**
  - Establish 6 frame network reference stations that uniformly distribute in Hubei, with an average side length of 220km.
  - Establish 24 regional reference stations, with an average side length of 60km, to provide the regional tri-band centimeter-level precision positioning service.
  - Establish a precise positioning service system in Hubei, to provide services for surveying/mapping, meteorology and transportation industries.

Performance analysis of real-time precise positioning

Positioning model	Ambiguity fixing success rate	Initialization time (in seconds)	Inner precision / m (Average)		Out precision / m (Average)	
			Plane	Height	Plane	Height
GPS double frequency +BDS triple frequency	100%	5.76	0.004	0.018	0.010	0.036
GPS double frequency +BDS triple frequency	80%	27.46	0.003	0.015	0.011	0.042
BDS triple frequency	83%	16.40	0.007	0.020	0.013	0.052
BDS double frequency	40%	50.78	0.003	0.015	0.014	0.045
GPS double frequency	44%	40.28	0.006	0.021	0.012	0.048



Performance analysis of high-precision navigation

It can be used for intelligent transportation vehicle control and intelligent driving

Accuracy analysis of Thailand Beidou ground enhancement system

Accuracy and performance of Beidou is better than that of GPS in the low latitude area of ASEAN such as Thailand.

In Nov. 2013, the center has built the first oversea Beidou CORS station at Chonburi, Thailand.

Accuracy analysis of Thailand Beidou CORS station

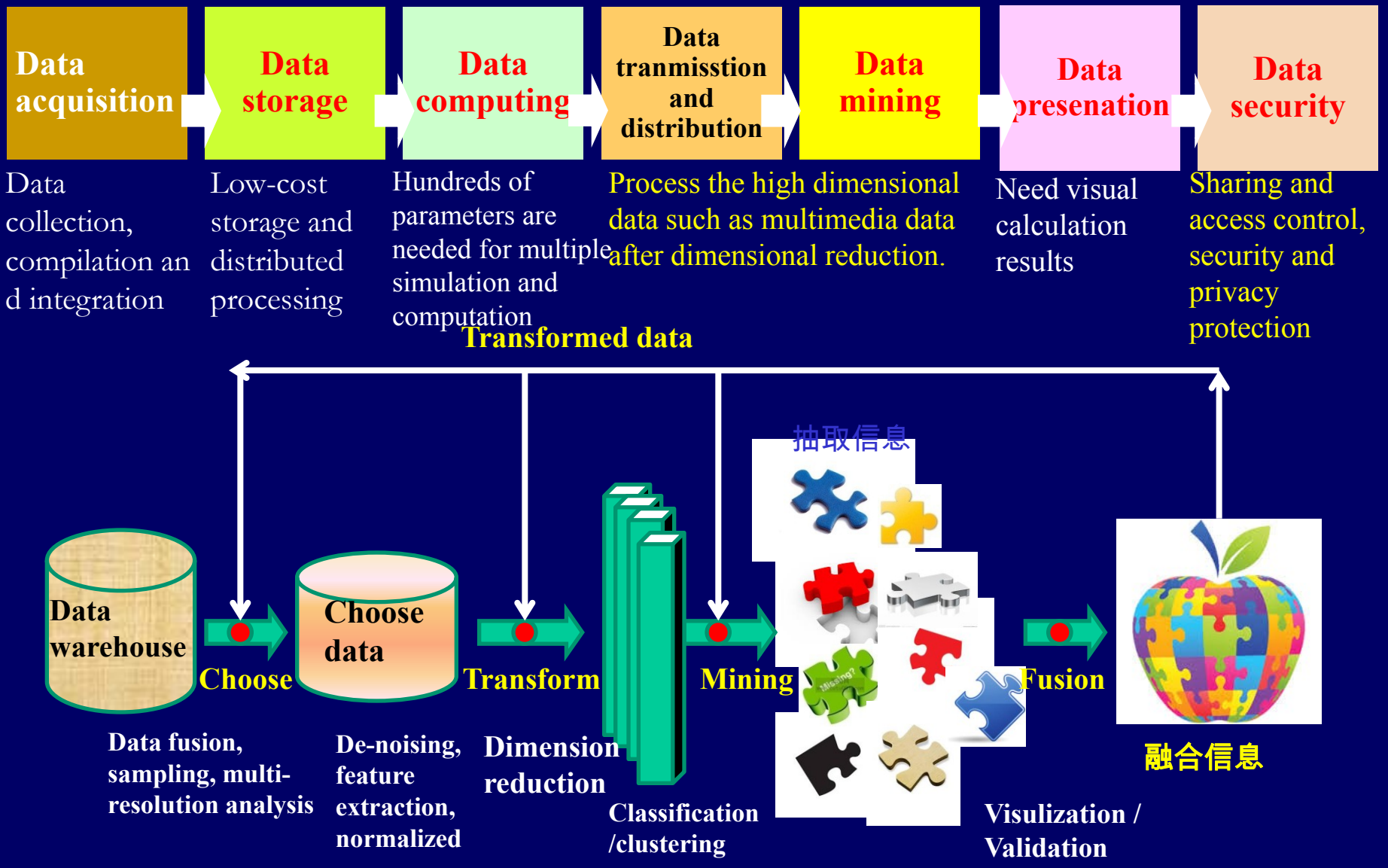
		GPS	Beidou	GPS+Beidou
Test in one station	Available satellites	6-8	13-14	19-22
	Satellites in use	6-8	13-14	19-22
	HRMS（m）	3.55	1.65	1.60
	RMS（m）	7.84	3.44	3.03

	Content	Target
Test in three stations	Carrier	Car, max speed: 80km/h
	Positioning accuracy	Plane 2cm, Height 5cm
	Navigation accuracy	Plane 0.5m（Lane-level accuracy navigation）

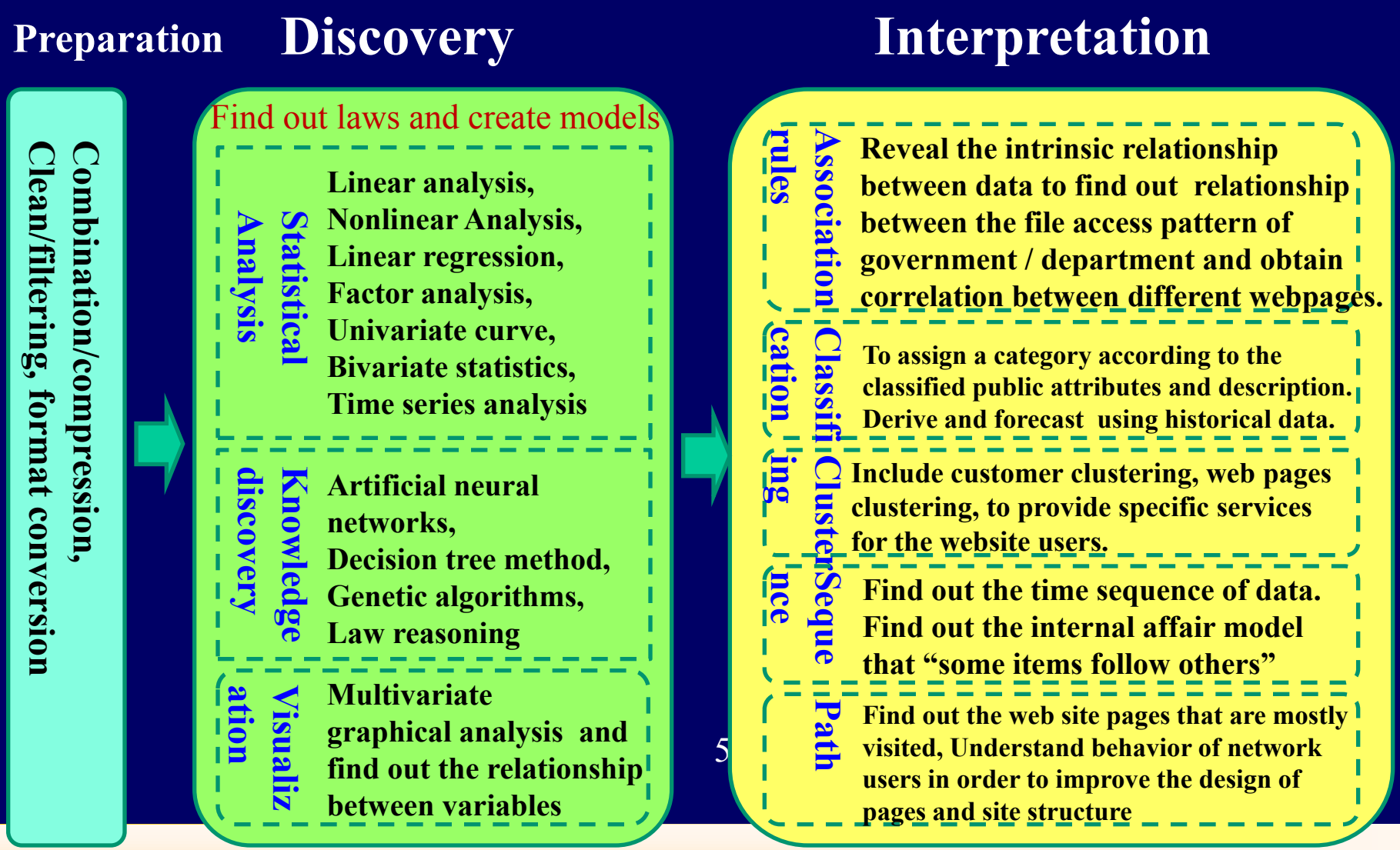
Definition of data mining

- A process that automatically discover and extract implicit, non-obvious patterns, rules and knowledge from the massive, multi-source big data .
- Data mining is more difficult than data processing and information extraction because it requires intelligent reasoning based on big data and knowledge base.
- The purpose is to find out the laws of nature and society changes, people's behavior and preferences, trends of the social thinking and public opinion, in order to infer the market reaction to various aspects of products, services or policies, etc.

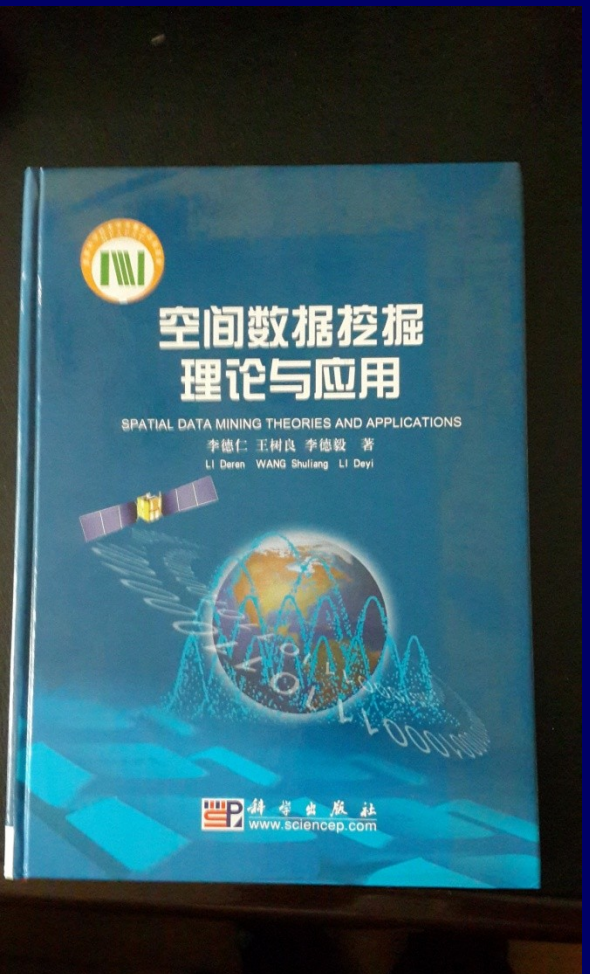
Process of data mining

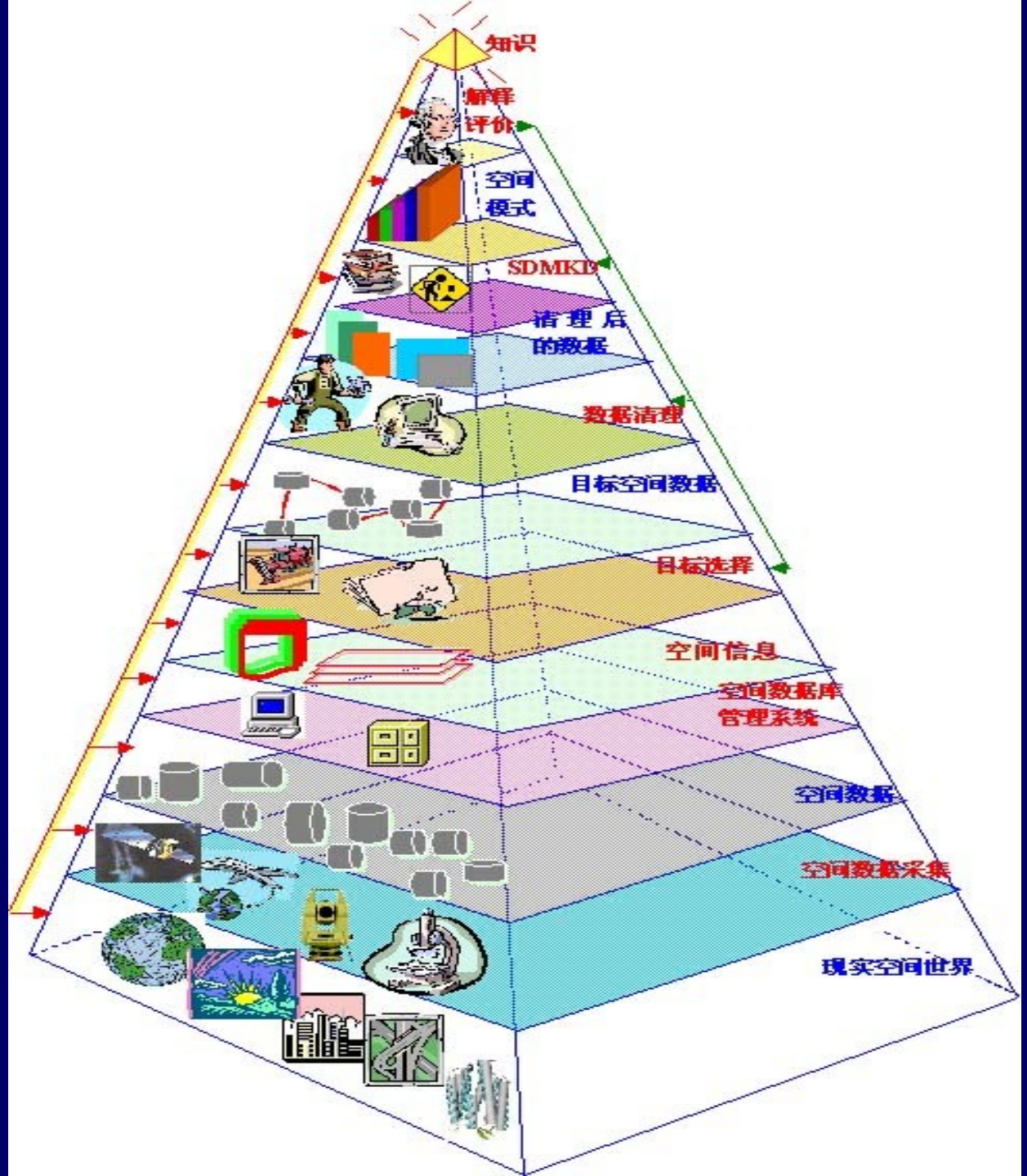


Data mining algorithm



Pyramid of Spatial Data Mining

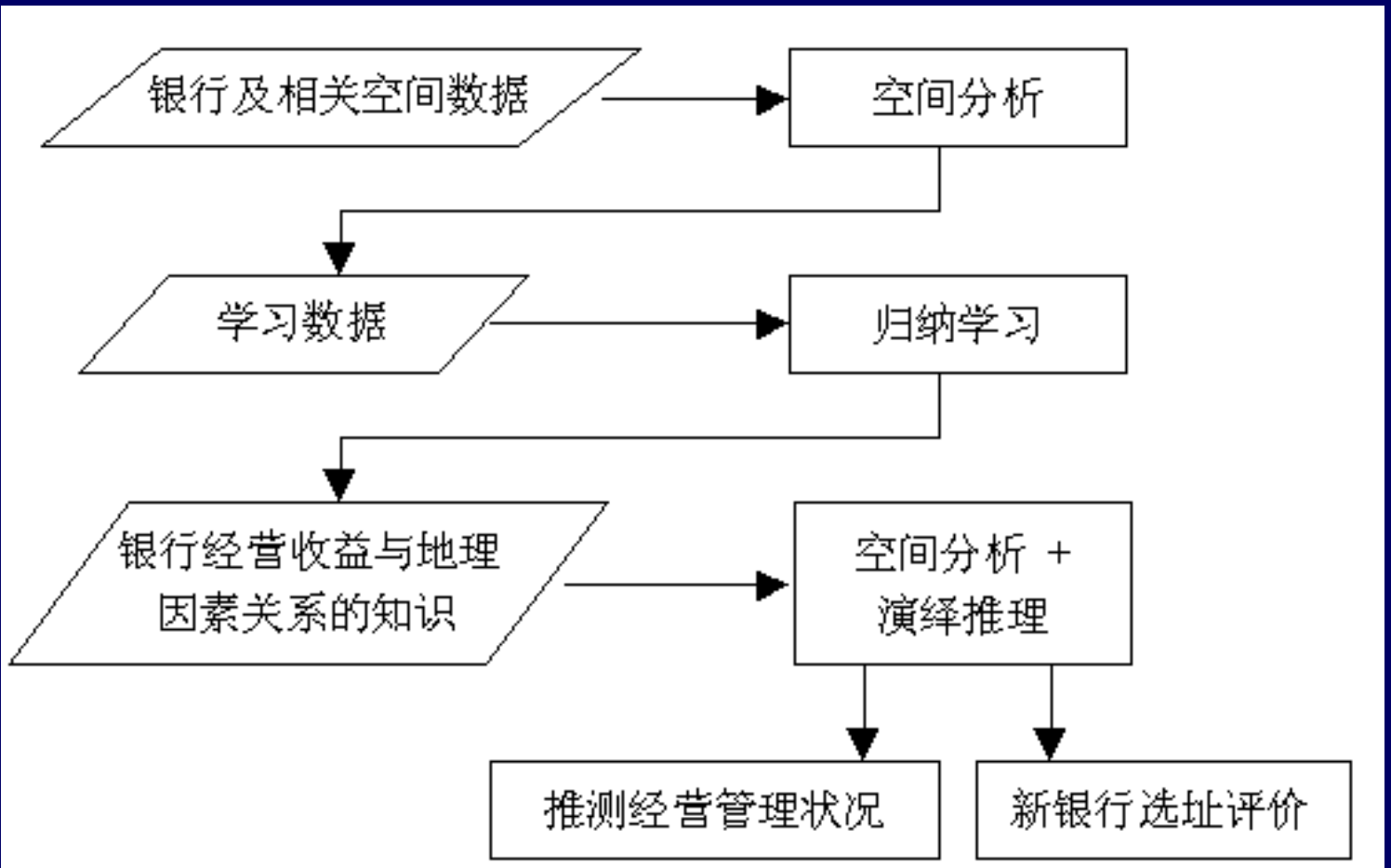




Methods of space-time data mining and knowledge discovery

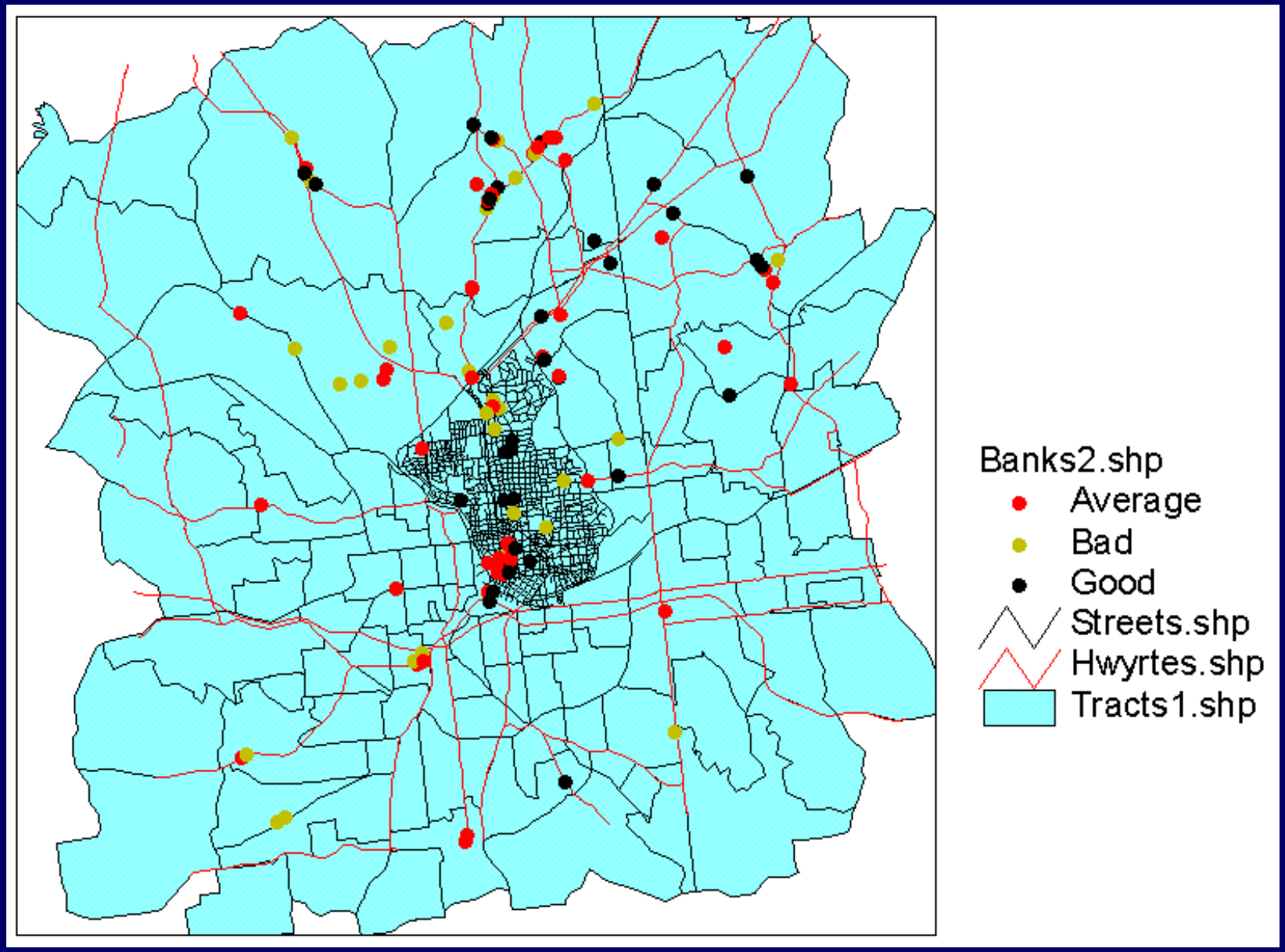
- **Statistical methods and spatial statistics**
- **Inductive methods**
- **Clustering methods**
- **Spatial multi-measurement, multi-temporal analysis methods**
- **Exploratory data analysis**
- **Rough set approach**
- **Data field and cloud model**
- **Image analysis and pattern recognition**
- **Neural networks, evidence theory, genetic algorithms, mathematical morphology ...**

Inductive learning of banks operating income analysis and site evaluation



归纳学习用于银行经营收益分析和选址评价的流程图

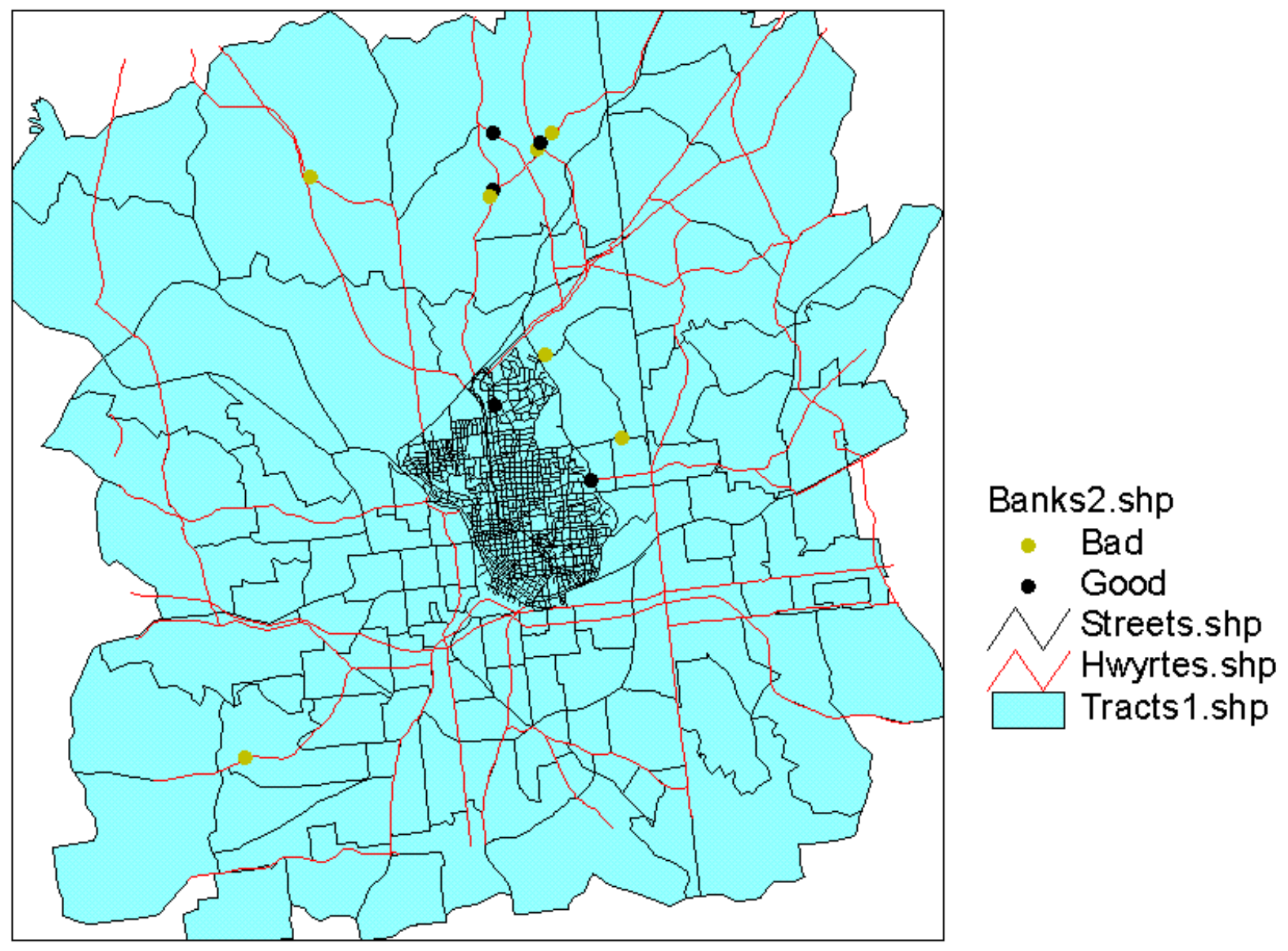
The bank, road network and census site map of Atlanta



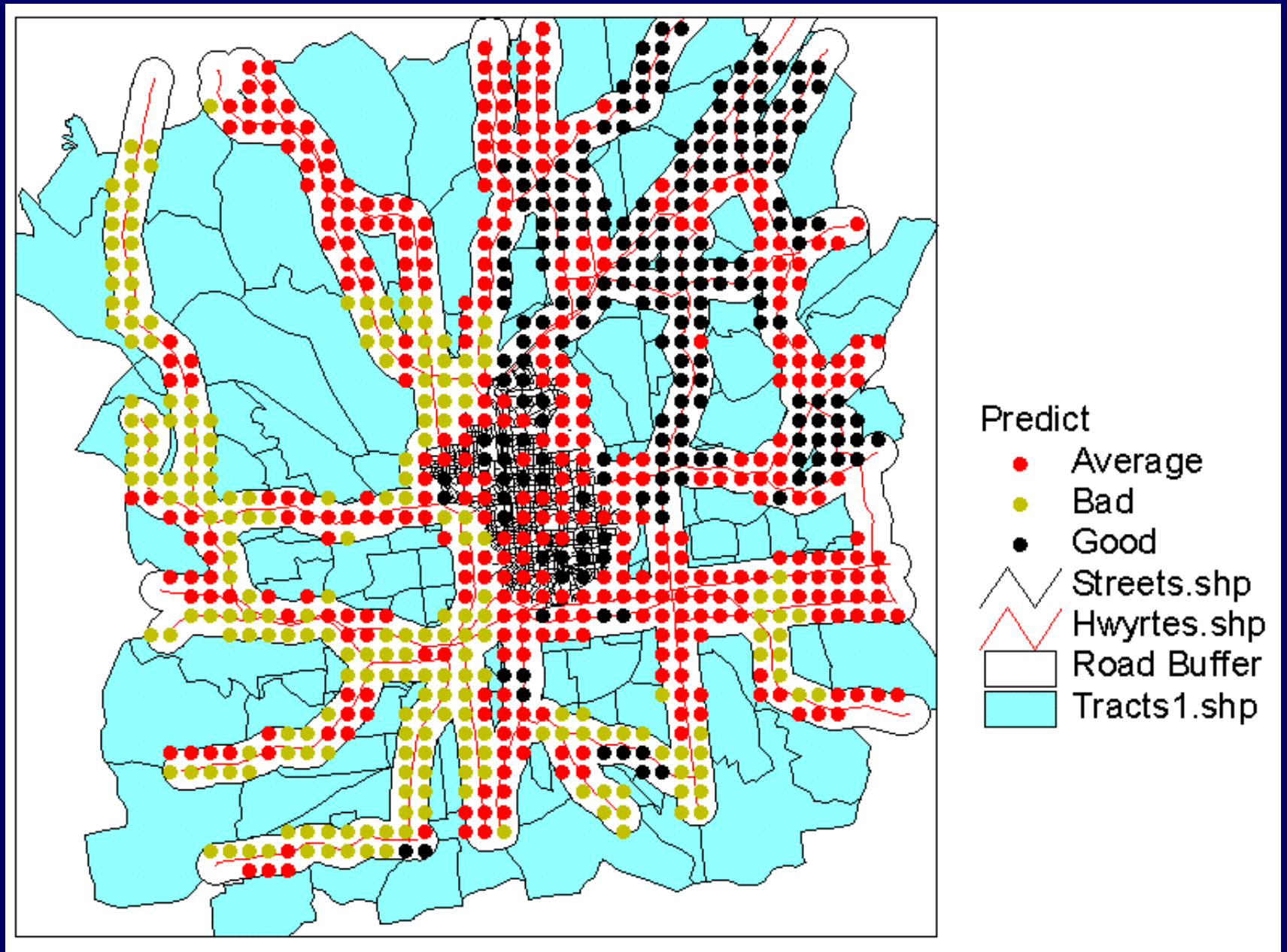
Relationship between bank income and geographical factors

```
Rule 1: (cover 5)
    PCT ASIAN > 3.06
    AVG INC > 36483.52
    DIST CLOSEST BANK > 0.663234
    ->  class Good  [0.857]

Rule 2: (cover 4)
    SQ MILES <= 0.312
    POP GROWTH > -6.62
    ->  class Good  [0.833]

Rule 3: (cover 2)
    NO CLOSE BANK > 18
    X COORD > 1065.441
    ->  class Good  [0.750]

Rule 4: (cover 18)
    YEAR ESTABLISHED <= 1962
    POP GROWTH > -6.62
    PCT ASIAN > 0.88
    X COORD > 1064.672
    ->  class Good  [0.700]

Rule 5: (cover 17)
    YEAR ESTABLISHED > 1924
    PCT BLACK <= 4.09
    ->  class Good  [0.526]

Rule 6: (cover 8)
    PCT BLACK > 4.09
    MED AGE > 35.43
    X COORD <= 1064.672
    ->  class Average  [0.900]

Rule 7: (cover 5)
    POP GROWTH <= -6.62
    X COORD <= 1065.441
    ->  class Average  [0.857]

Rule 8: (cover 4)
    YEAR ESTABLISHED <= 1965
    PCT BLACK <= 4.09
    PCT ASIAN <= 3.06
    ->  class Average  [0.833]

Rule 9: (cover 4)
    PCT OTHER > 1.32
    DIST CLOSEST BANK <= 0.376229
    ->  class Average  [0.833]

Rule 10: (cover 4)
    YEAR ESTABLISHED <= 1924
    POP GROWTH > -6.62
    DIST CLOSEST BANK <= 0.179002
    ->  class Average  [0.833]

Rule 11: (cover 4)
    POP GROWTH <= -6.62
    NO CLOSE BANK <= 18
    ->  class Average  [0.833]

Rule 12: (cover 8)
    YEAR ESTABLISHED > 1951
    YEAR ESTABLISHED <= 1962
    PCT ASIAN <= 0.88
    AVG AGE > 31.34
    ->  class Average  [0.800]

Rule 13: (cover 8)
    YEAR ESTABLISHED > 1951
    MIN DIST Road > 0.093013
    PCT BLACK > 4.09
    X COORD > 1064.672
    ->  class Average  [0.800]

Rule 14: (cover 7)
    YEAR ESTABLISHED > 1962
    PCT BLACK > 4.09
    DIST CLOSEST BANK <= 0.050138
    ->  class Average  [0.778]

Rule 15: (cover 2)
    PCT BLACK <= 4.09
    PCT MALE <= 42.71
    ->  class Average  [0.750]

Rule 16: (cover 2)
    PCT ASIAN > 3.06
    AVG INC <= 36483.52
    ->  class Average  [0.750]

Rule 17: (cover 5)
    PCT ASIAN <= 3.06
    MED AGE <= 35.43
    DIST CLOSEST BANK > 0.376229
    X COORD <= 1064.672
    ->  class Bad  [0.857]

Rule 18: (cover 4)
    YEAR ESTABLISHED > 1960
    PCT OTHER <= 1.32
    MED AGE <= 35.43
    X COORD <= 1064.672
    ->  class Bad  [0.833]

Rule 19: (cover 3)
    PCT ASIAN <= 3.06
    AVG AGE <= 31.34
    ->  class Bad  [0.800]

Rule 20: (cover 3)
    YEAR ESTABLISHED > 1924
    YEAR ESTABLISHED <= 1951
    SQ MILES > 0.312
    AVG AGE <= 36.22
    ->  class Bad  [0.800]

Rule 21: (cover 20)
    YEAR ESTABLISHED > 1962
    MIN DIST Road <= 0.093013
    SQ MILES > 0.312
    PCT BLACK > 4.09
    PCT ASIAN <= 3.06
    AVG AGE > 34.1
    DIST CLOSEST BANK > 0.050138
    X COORD > 1064.672
    ->  class Bad  [0.773]

Rule 22: (cover 2)
    YEAR ESTABLISHED > 1981
    PCT BLACK <= 4.09
    PCT ASIAN > 0.82
    PCT MALE > 42.71
    ->  class Bad  [0.750]

Evaluation of learning result:

      Rules           (a)   (b)   (c)      <-classified as
----------------      ----  ----  ----
  No      Errors       33     1            (a): class Good
                        3    42     4      (b): class Average
   22   12(10.3%)       3     1    30      (c): class Bad
```

Speculate about the “well-managed”and “weak-managed” banks according to rules and exceptions.



The new bank site evaluation map



Night light remote sensing analysis for socio-economic information

- The visible and near-infrared brightness of the earth surface obtained by remote sensing satellites (such as DMSP, NPP) can be used to characterize the urban range, GDP, population distribution and other socio-economic factors
- Economic growth, urbanization, humanitarian disasters are likely to be reflected as the brightness changes of remote sensing images within a period of time.

Image of night light in east Asia (taken in 2012 by DMSP/OLS)

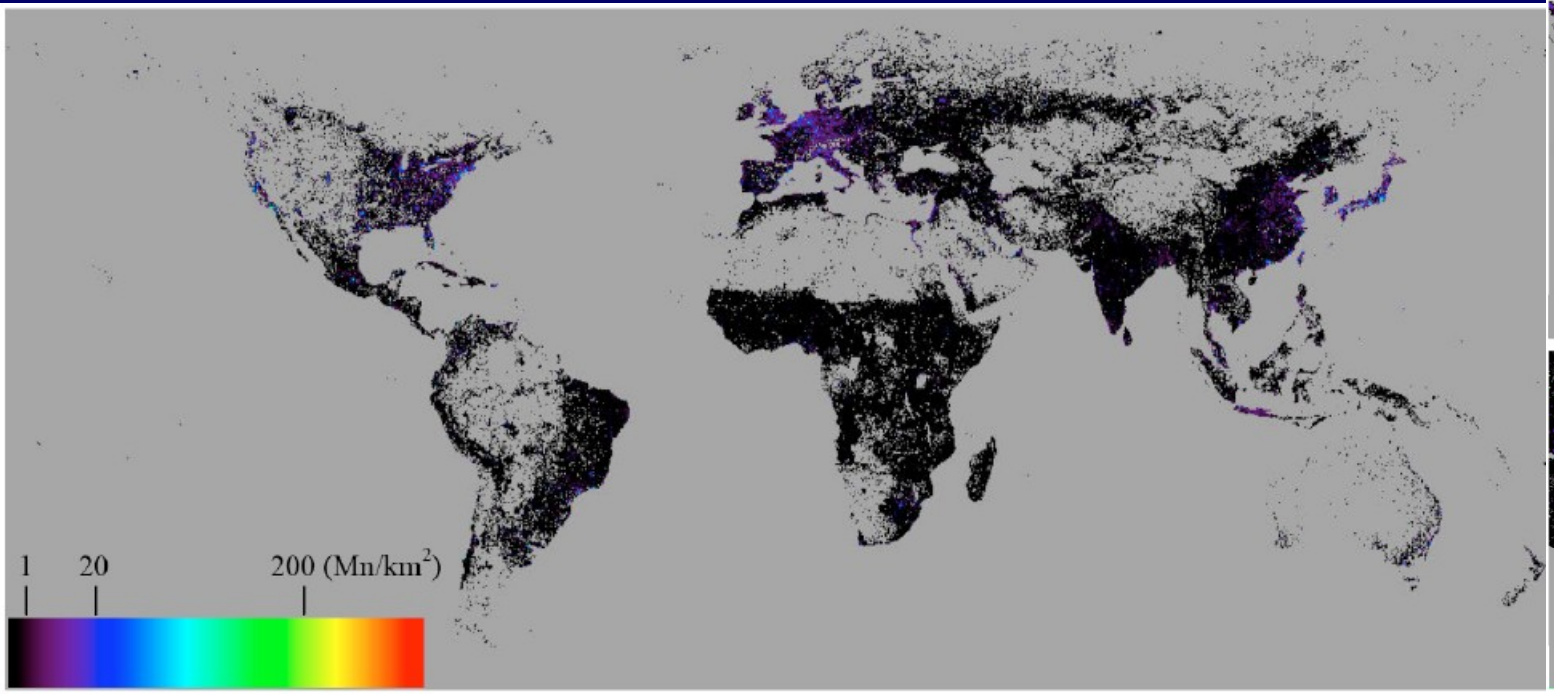
Beijing CBD

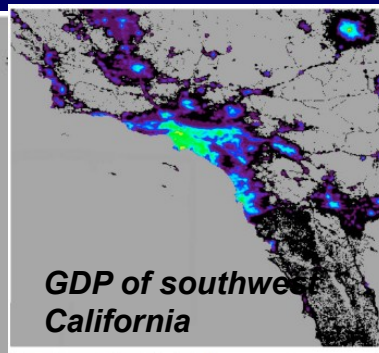
Tokyo Ginza

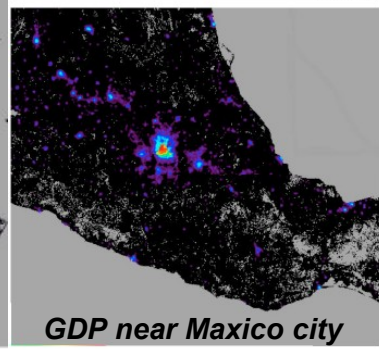
Wuhan Chuhe&Hanjie

Night light remote sensing for economic statistics

- **Traditional GDP investigation takes an administrative unit as the statistical unit, which is not accurate enough.**
- **To obtain the grid GDP data by allocating the GDP of an administrative unit into different grids via economic statistics, light images, population distribution and land cover types, etc.**



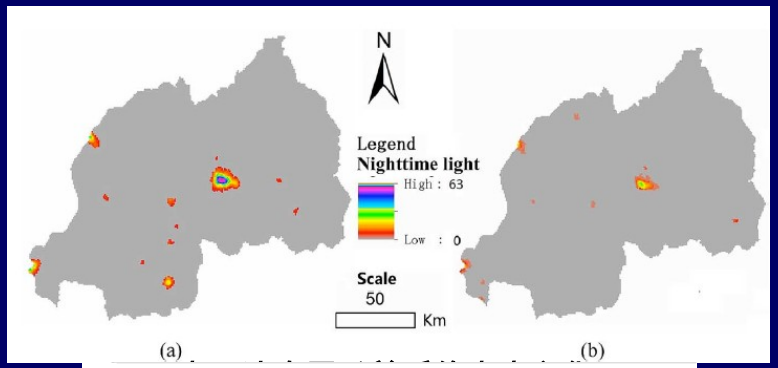


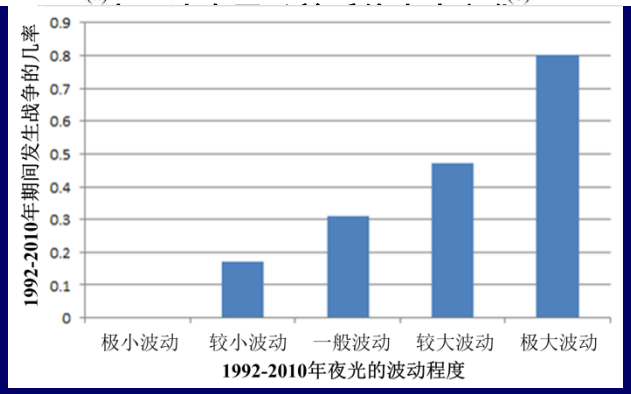


Global GDP grid in 2006 obtained by data mining

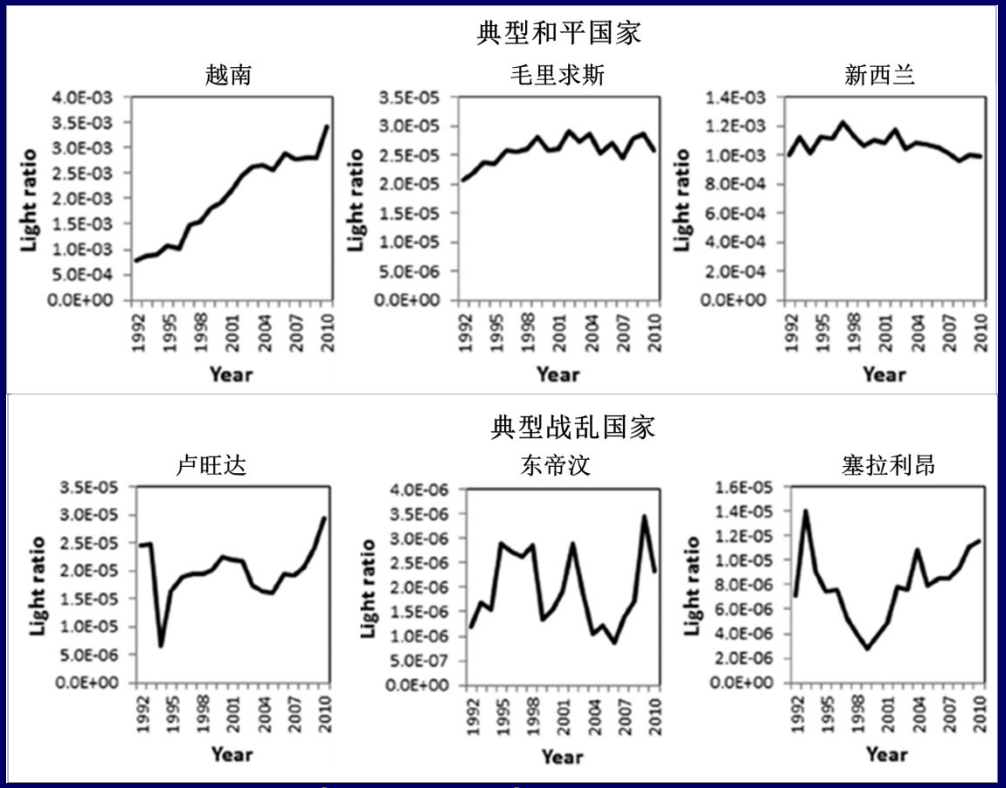
Assess the humanitarian disaster by time-series night light remote sensing images

- A sudden decrease of night light may be caused by a reduction in power supply, or a large-scale resident migration, indicating a possible humanitarian disaster occurs.





Possibilities of breaking a war with different night light fluctuation extent

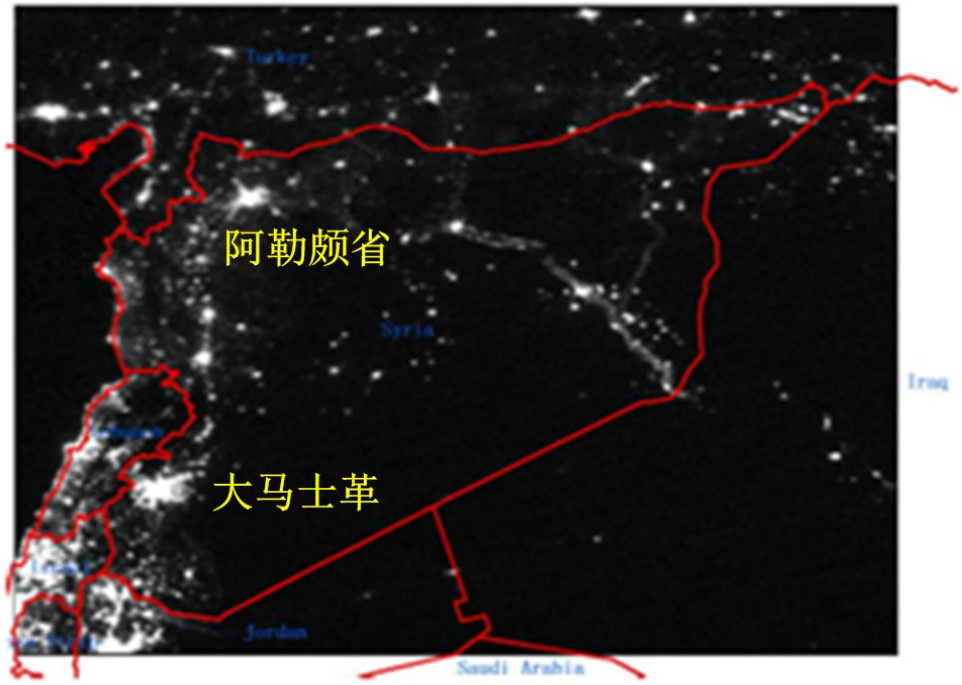


Typical night light fluctuation of peace countries and countries in war

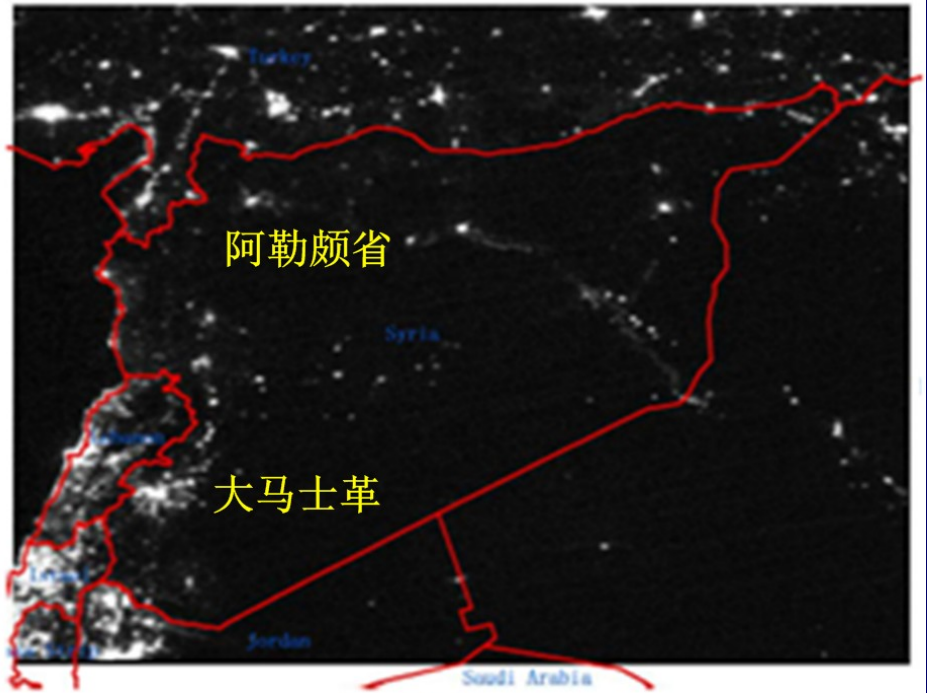
- By analyzing the night light fluctuation in 169 countries, we find that a sudden decrease in night light indicates a war is broken. While a sudden increase in night light show the reconstruction begins.

Assessment of Syria civil war by time-series night light remote sensing images

- Since Mar. 2011, the Syrian civil war has killed at least 100,000 people. Most of the reports on Syria cannot reflect the whole picture of the war.
- Night light remote sensing images provide a way to assess the situation in Syria.
- The following images show that the Syrian civil war has led to a significant reduction in the night light in Syria.



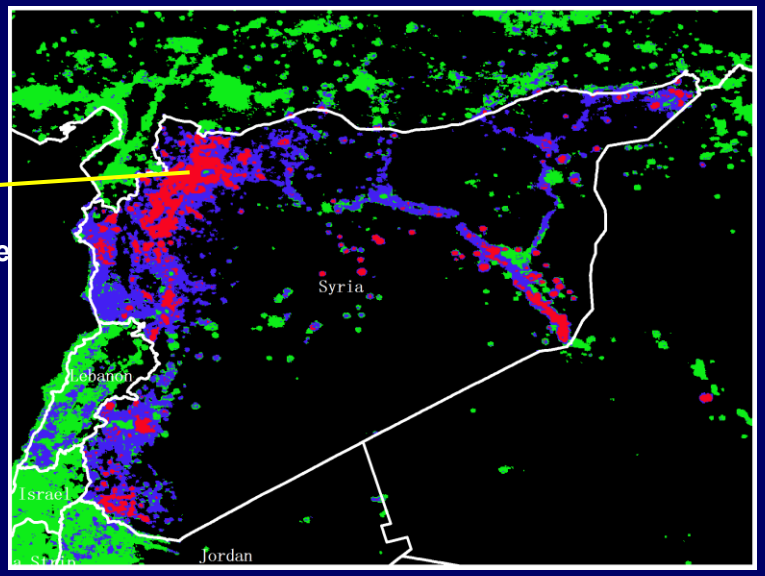
Jan. 2011

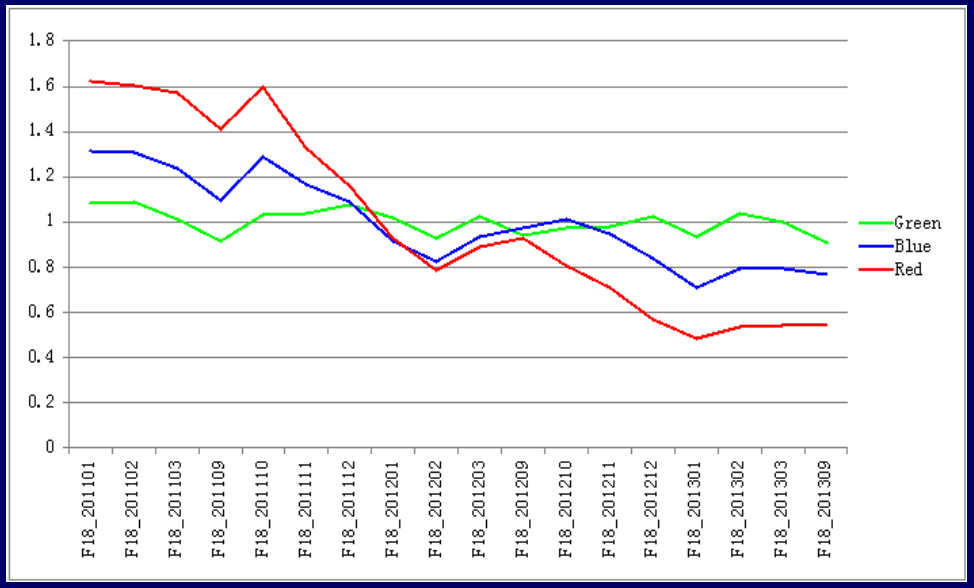


Jan. 2013

Assessment of Syria civil war by time-series night light remote sensing images

- ✓ By developing new space-time analysis techniques, the night light images are clustered to find out the space-time model of the Syria cival war.

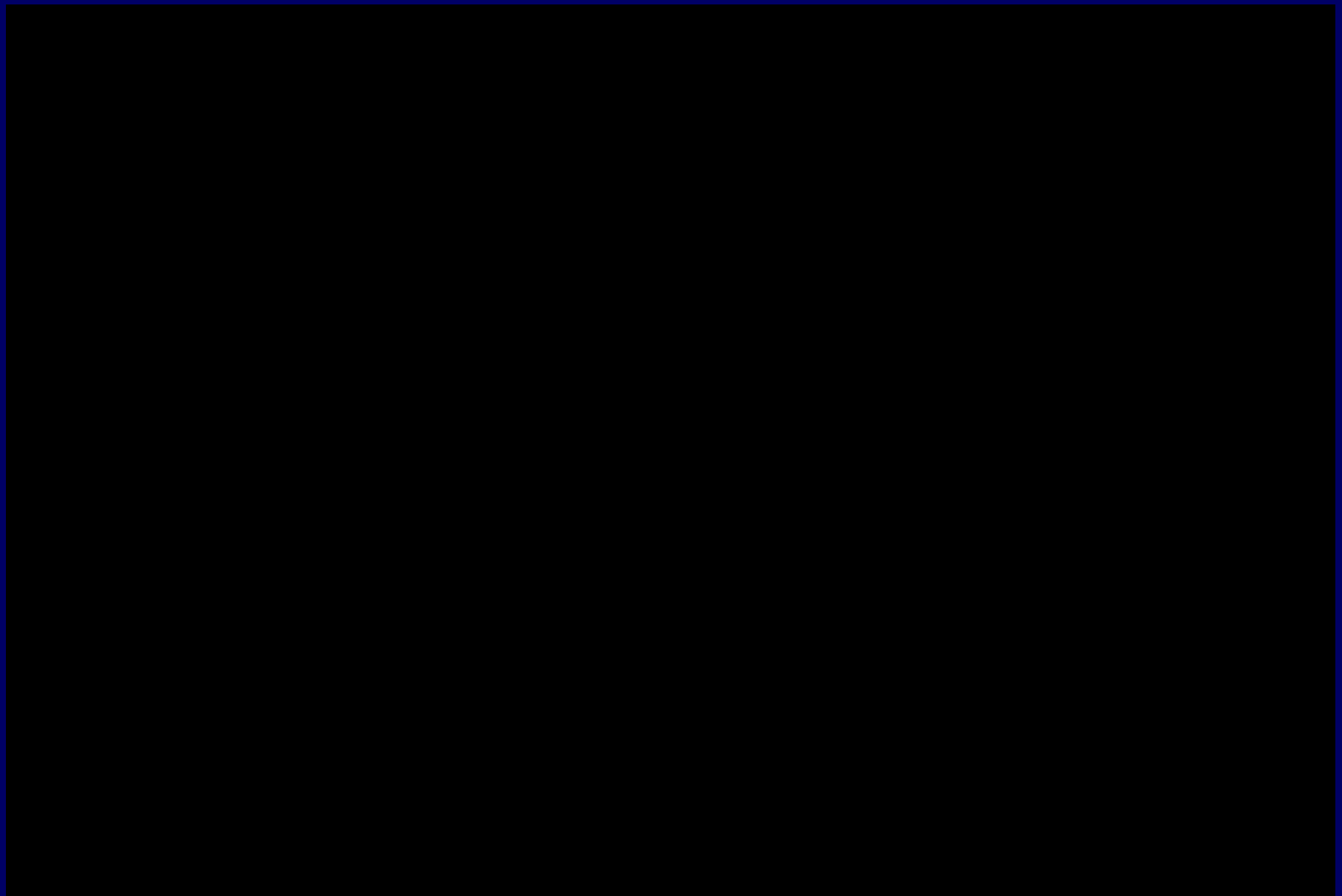




(a) 3 space-time distributions of night lights (b) 3 corresponding trends of night lights (by DMSP-F18)

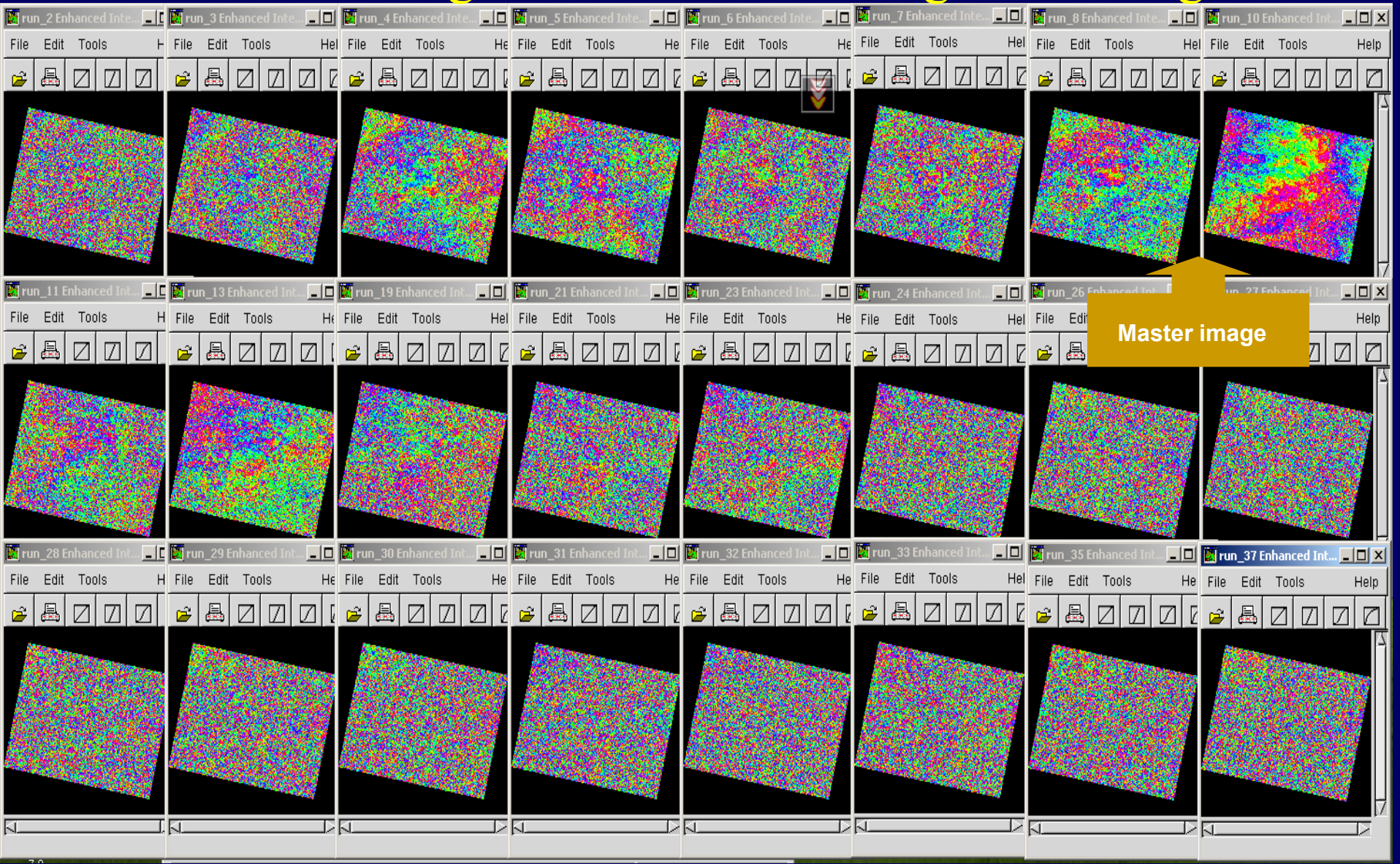
- Three models show significant regional characteristics:
- ✓ The night lights of the neighboring countries of Syria keep stable (in green).
- ✓ The night light of Syria reduce significantly, including two modes, i.e. red and blue.
- ✓ Allepo province, in which the war is the most intense, shows a dramatic reduction (in red) in night lights.

Assessment of Syria civil war by time-series night light remote sensing images (2011-2015)



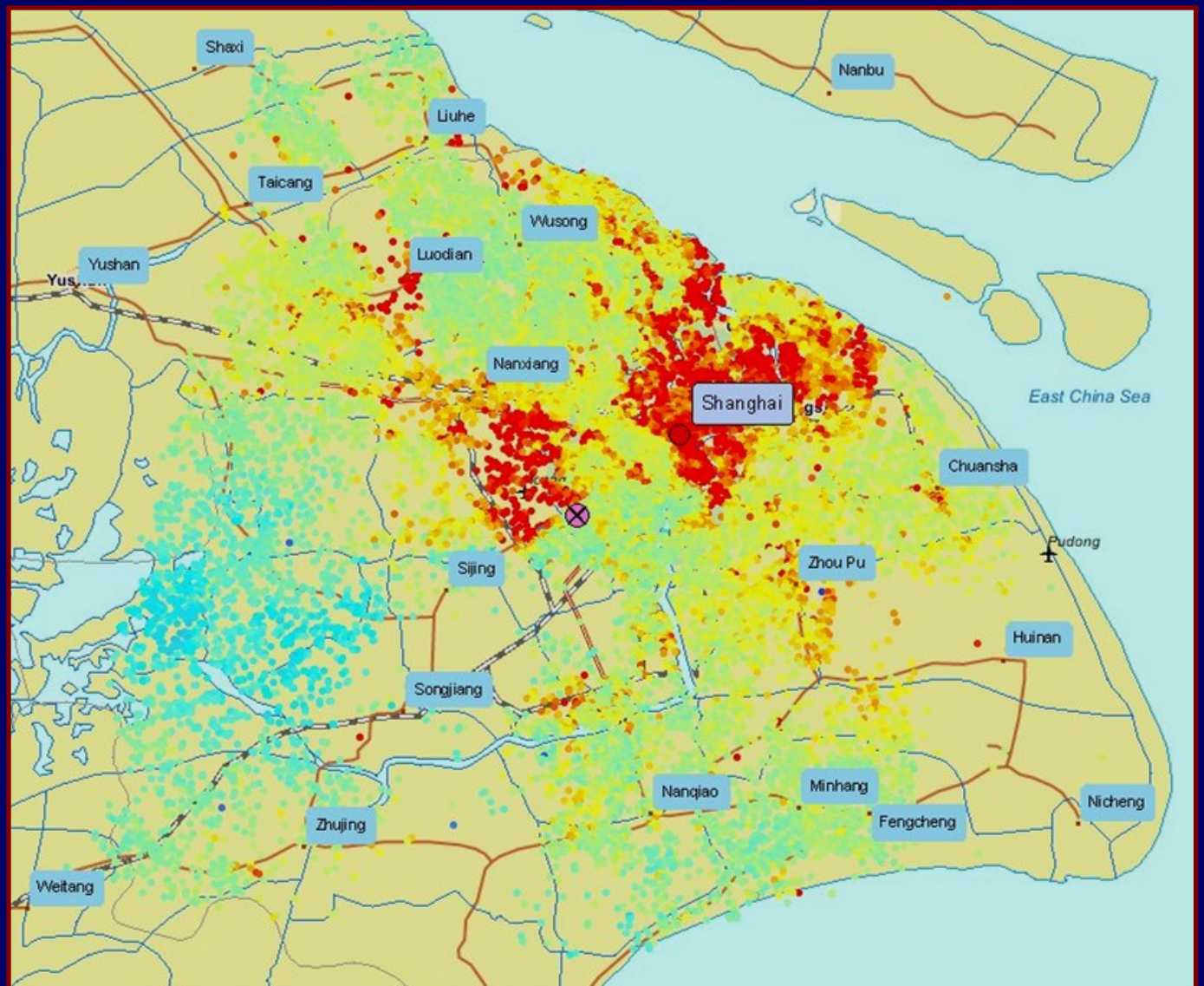
City subsidence monitoring by data mining from The multi-temporal SAR data

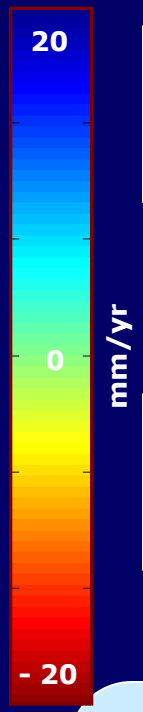
24 Interferograms from ERS images of Shanghai



Shanghai subsidence velocity by the differential interferometry PS method

Result of PS InSAR from Prof. Rocca





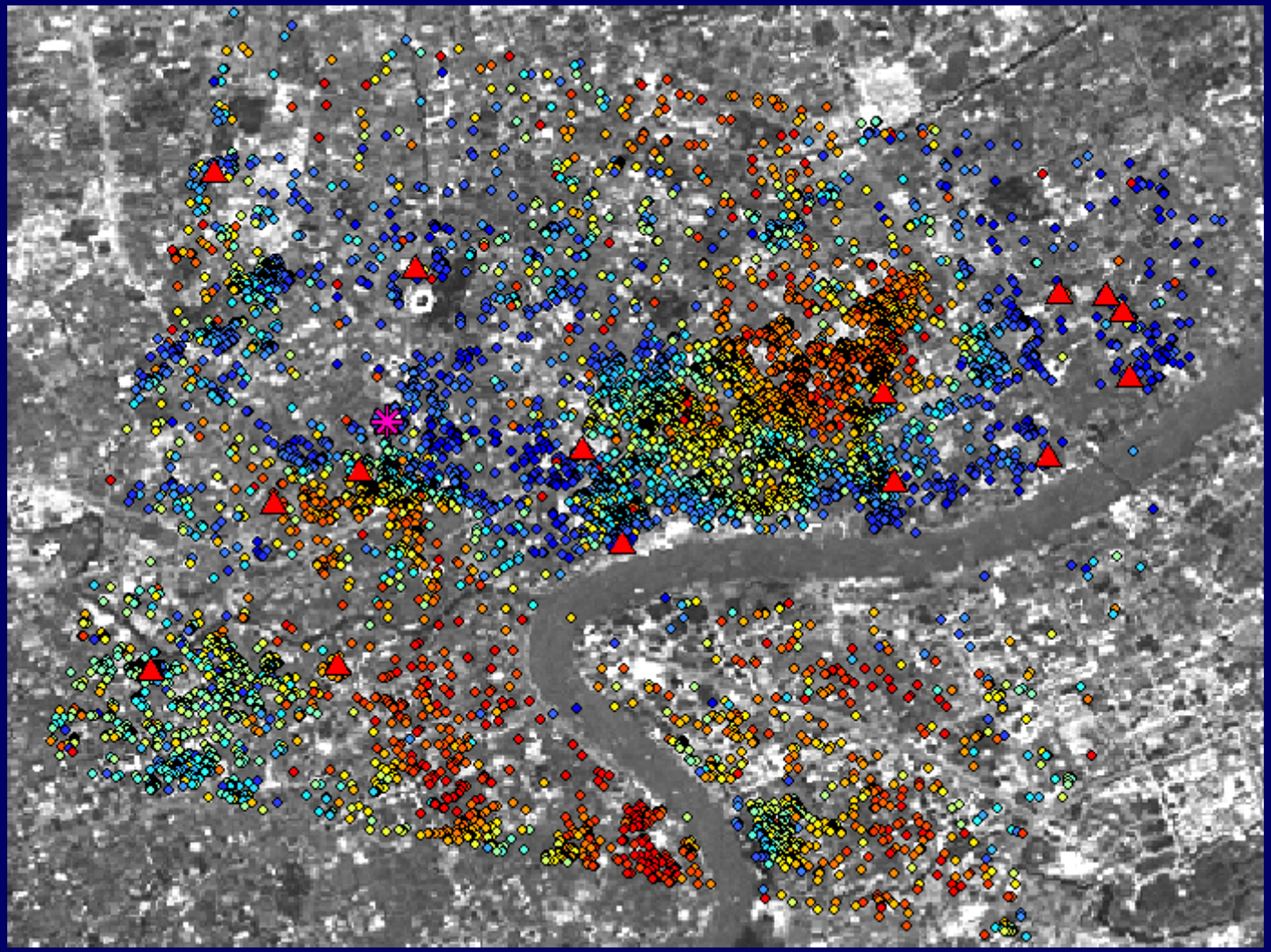
More than **20.000 PS** identified

Reference point, assumed motionless

Velocity has been saturated for visualization purpose. Much higher rates have been detected in Shanghai urban center.

Shanghai subsidence velocity by the Coherent Target Analysis (CTA) method

Result of CTA in Shanghai



Distribution of benchmarks and CTs in the test site

Cross Validation of PS and CTA results

Benchmark	Leveling(mm/y)	CT(mm/y)	Diff. at CTs	PS (mm/y)	Diff. at PSs
0- 64	-39.13	-39.15	0.02	-32.43	-6.695
0-113A	-15.88	-12.61	-3.27	-20.02	4.145
0-120	-17	-17.18	0.18	-14.75	-2.25
0-139					
0-155					
0-192					
0-221					
0-222					
0-223	-11.38	-10.33	-1.05	-5.05	-6.325
0-225	-11.63	-7.3	-4.33	-6.53	-5.095
0-289	-6.63	-13.37	6.74	-1.77	-4.855

- ***Difference between leveling and PS***

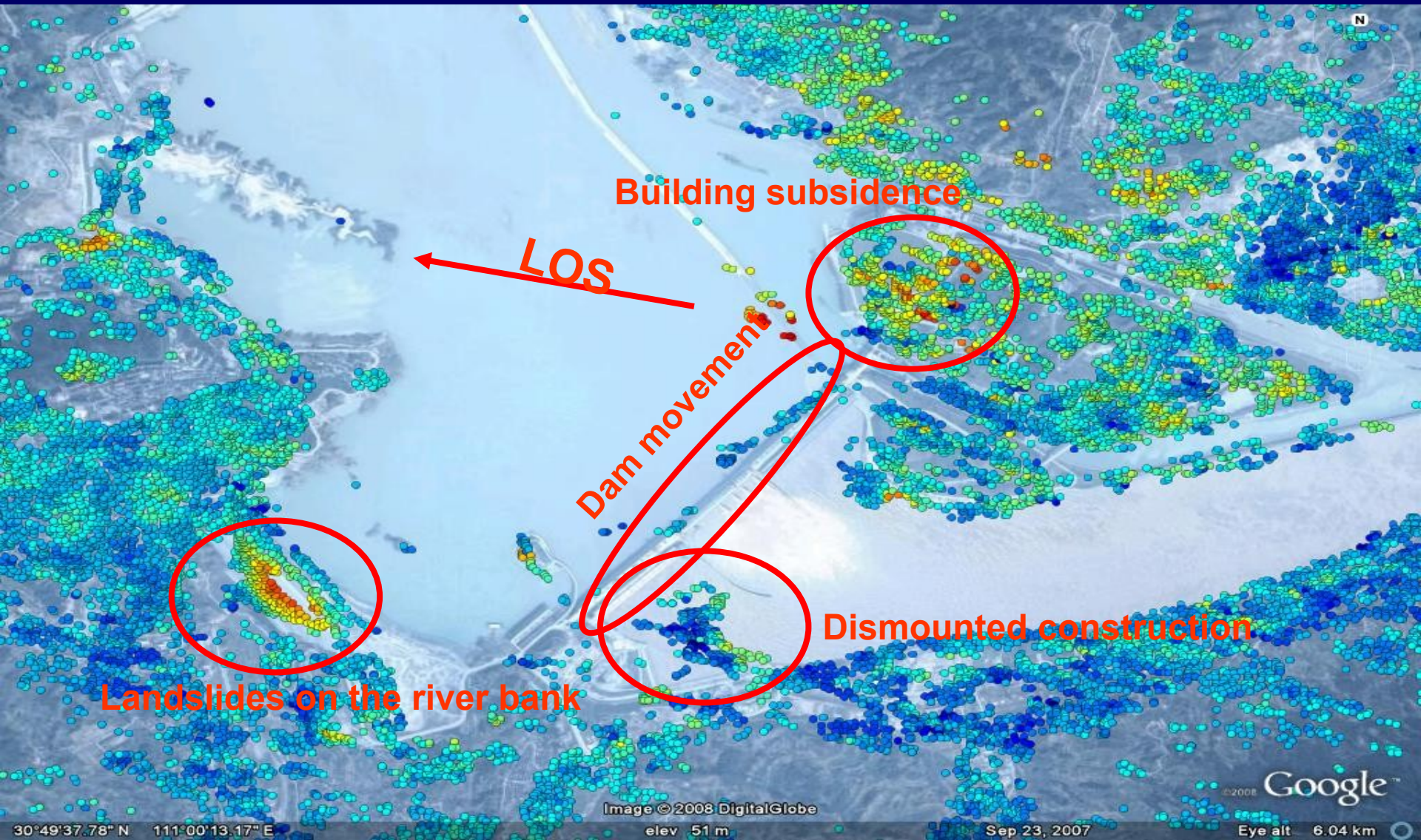
  Average : 4.088mm/year , STD. : 3.73 mm/year

- ***Difference between leveling and CT***

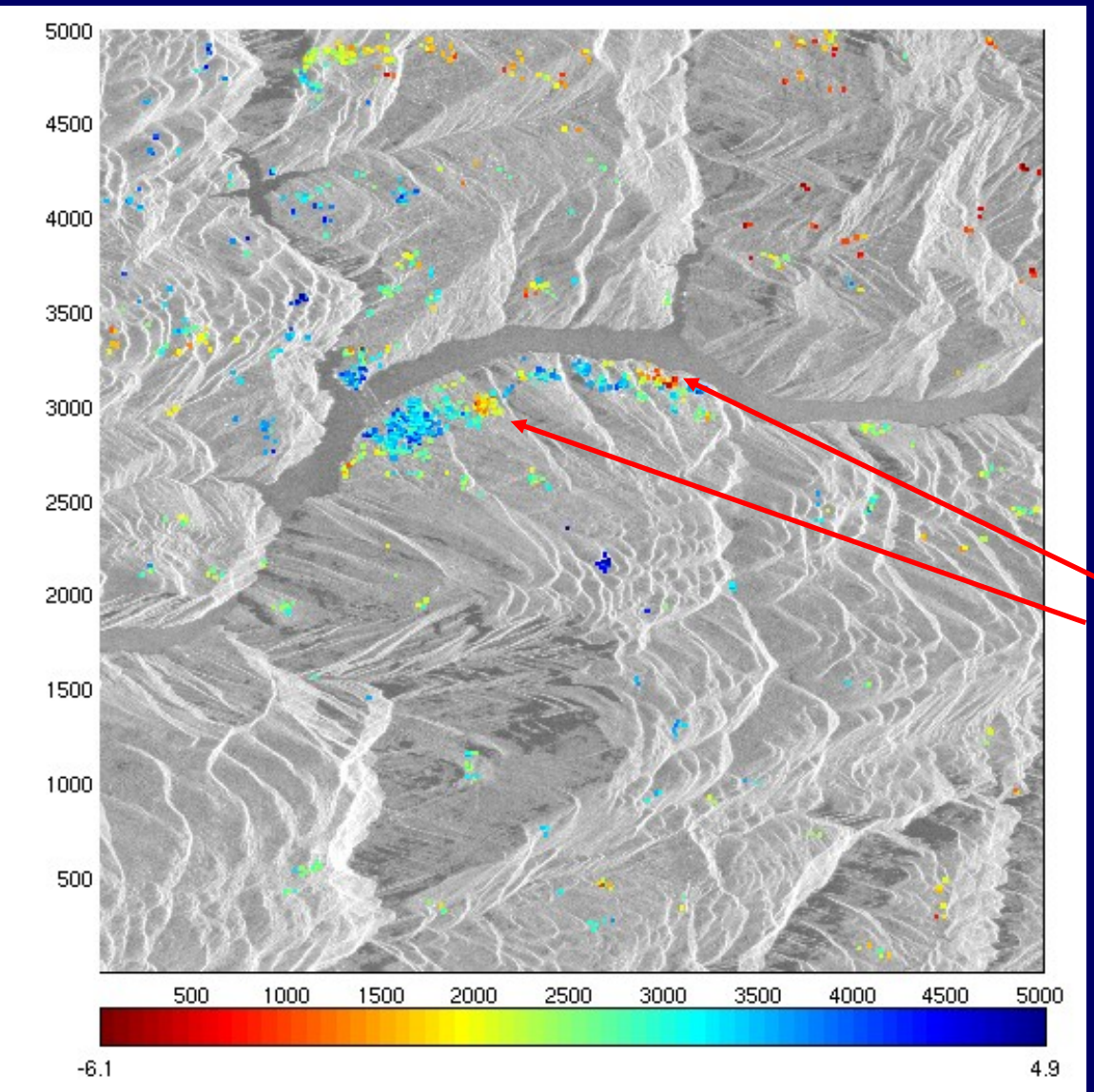
  Average : 2.315 mm/year , STD : 2.50 mm/year

Comparison of results from PS-InSAR and CTA in the overlay area of Shanghai test site

Preliminary results: deformation distribution at the Three Gorges Dam



Monitoring landslide in Badong, Three Gorges Area



Data set:
Envisat images 34 scenes from Aug, 2003 to June, 2007

Two deformation regions are identified with PS-InSAR

Agricultural data mining based on remote sensing big data

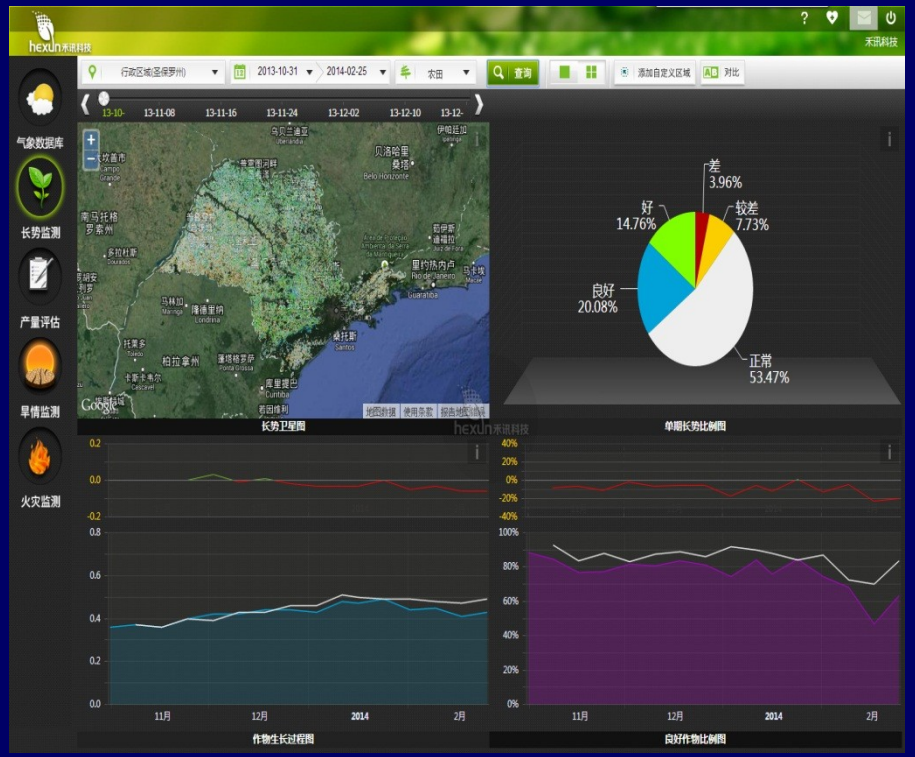
- The world's main producing areas (China, USA, Brazil, Argentina, Malaysia, Indonesia, Australia, Canada, India, Thailand, etc.)
- Soybeans, cotton, corn, palm oil, rapeseed, sugar cane, wheat, rice.
- Growth monitoring, yield estimation.
- The average yield estimation accuracy is better than 97%, which is released half month earlier than USDA. Wind, Shanghai Evening Post, Sina Finance, Mandarin Finance and Futures Daily relay in real time.
- Later release the first-hand data of global nonagricultural macro-economic data.

Customer: agricultural financial market participants, government departments

Products

- Global weather monitoring

- Global Crop Growth Monitoring



Wind资讯金融终端2013 - [禾讯农产品估产]

文件 股票 债券 商品 外汇 基金 指数 新闻 宏观 资管 量化 帮助 CNS 60 F9 F6 WEI WP HKS 7 6 NEWS RPP 5 IBQ ECO IPO STC F1

禾讯农产品估产

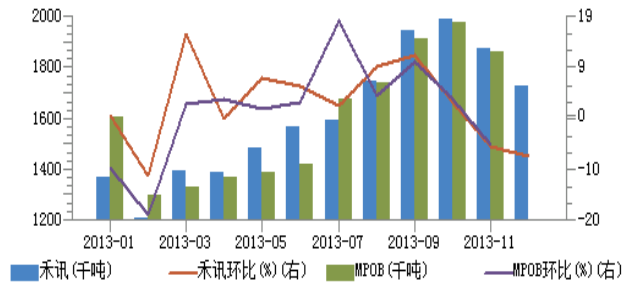
报表栏目

选择栏目

- 禾讯农产品估产
  - 大豆
  - 玉米
  - 油菜籽
  - 棉花
  - 棕榈油
  - 甘蔗

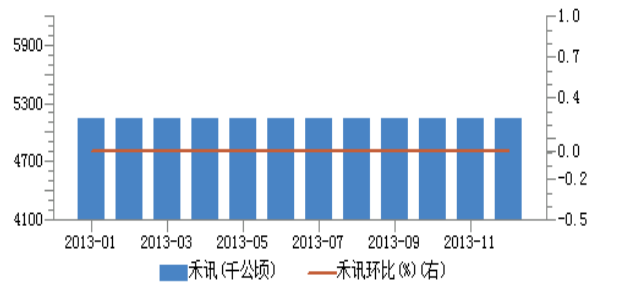
禾讯估产报告 长势监测报告 气象报告

马来西亚棕榈油估产(月)



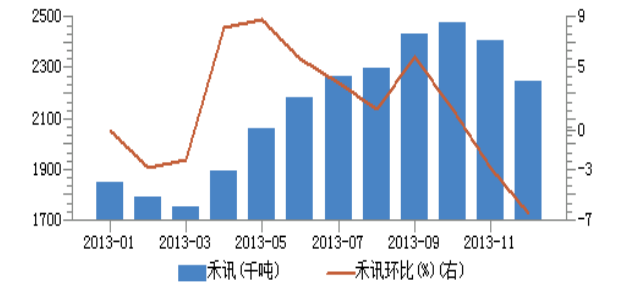
指标名称	最新报告期	最新值	上期值
棕榈油:产量:马来西亚(千吨)	2013-11	1,861.11	1,972.28
棕榈油:产量:预测年度:马来西亚:禾讯科技(千吨)	2013-12	1,725.30	1,872.50

马来西亚棕榈油播种面积(月)



指标名称	最新报告期	最新值	上期值
棕榈油:收获面积:预测年度:马来西亚:禾讯科技(千公顷)	2013-12	5,150.00	5,150.00

印度尼西亚棕榈油估产(月)



指标名称	最新报告期	最新值	上期值
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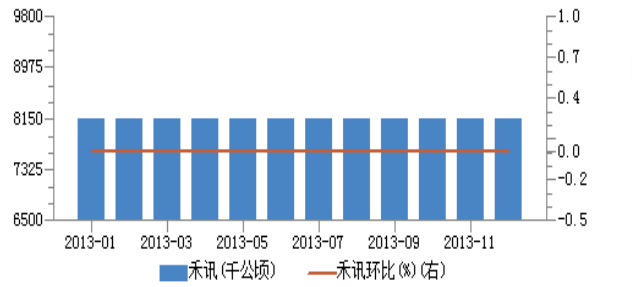
印度尼西亚棕榈油播种面积(月)



指标名称	最新报告期	最新值	上期值
棕榈油:收获面积:预测年度:印度尼西亚:禾讯科技(千公顷)	2013-12	8,140.00	8,140.00

棕榈油(R90020)

沪: 1991.25 -13.70 482.99亿 深: 7524.33 -20.24 863.63亿 港: 0.00 0.00 0 德国: 9715.90 -27.06 -0.28% 09:07:13

09:05 刘璨入选"百千万人才工程"国家级人选(林业局) 09:05 国际环保纺织协会公布2014版OEKO-TEX? 标准更新(中国纺织助... 美元: 81.1900 +0.0700

QQ邮箱 - 收件箱... Wind资讯金融终... Wind Messenger 棉花 - 画图 9:07 2014/1/21

Video Data Mining

1

* Safe behavior intelligent analysis

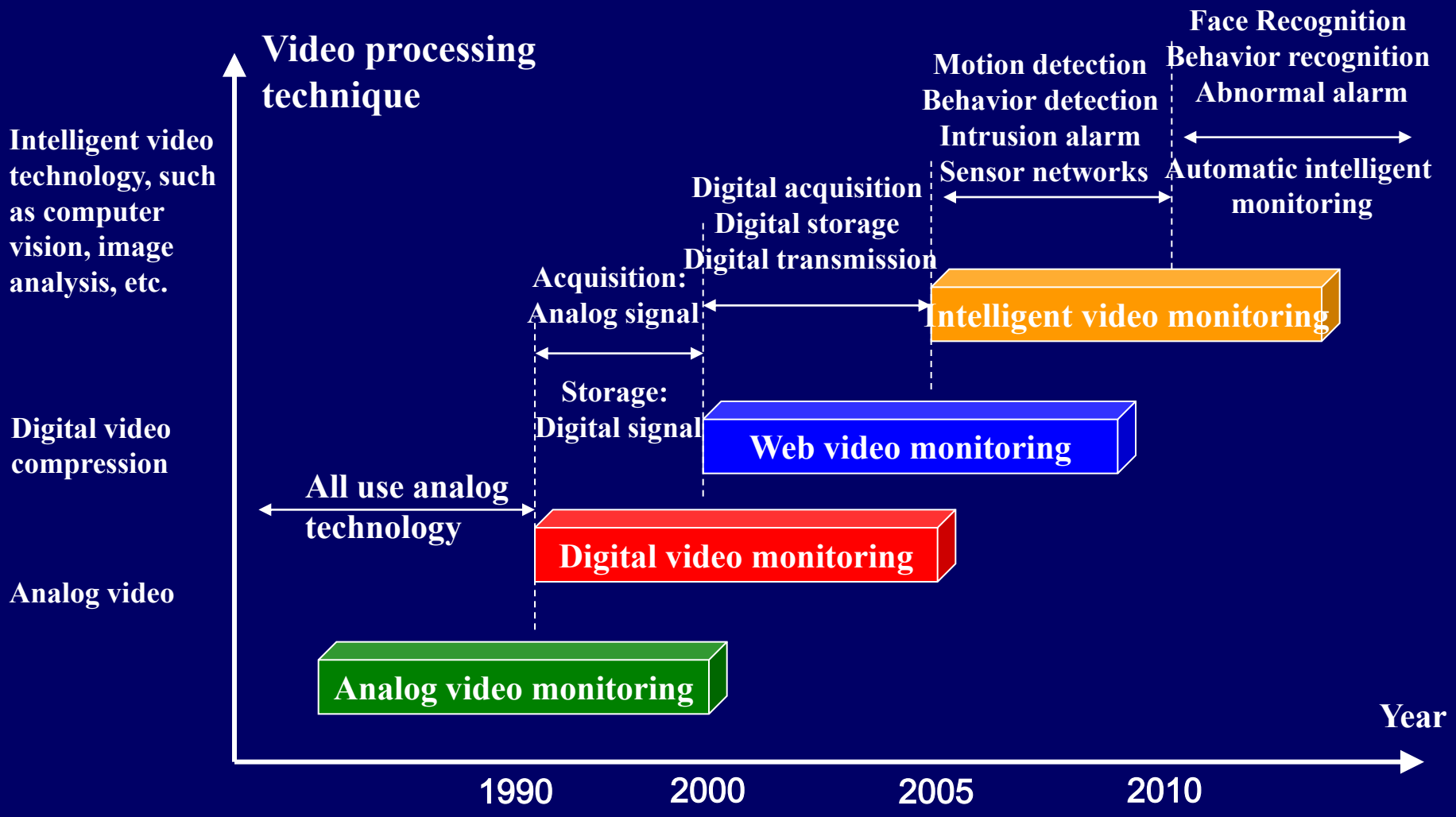
2

* Automatic video data understanding

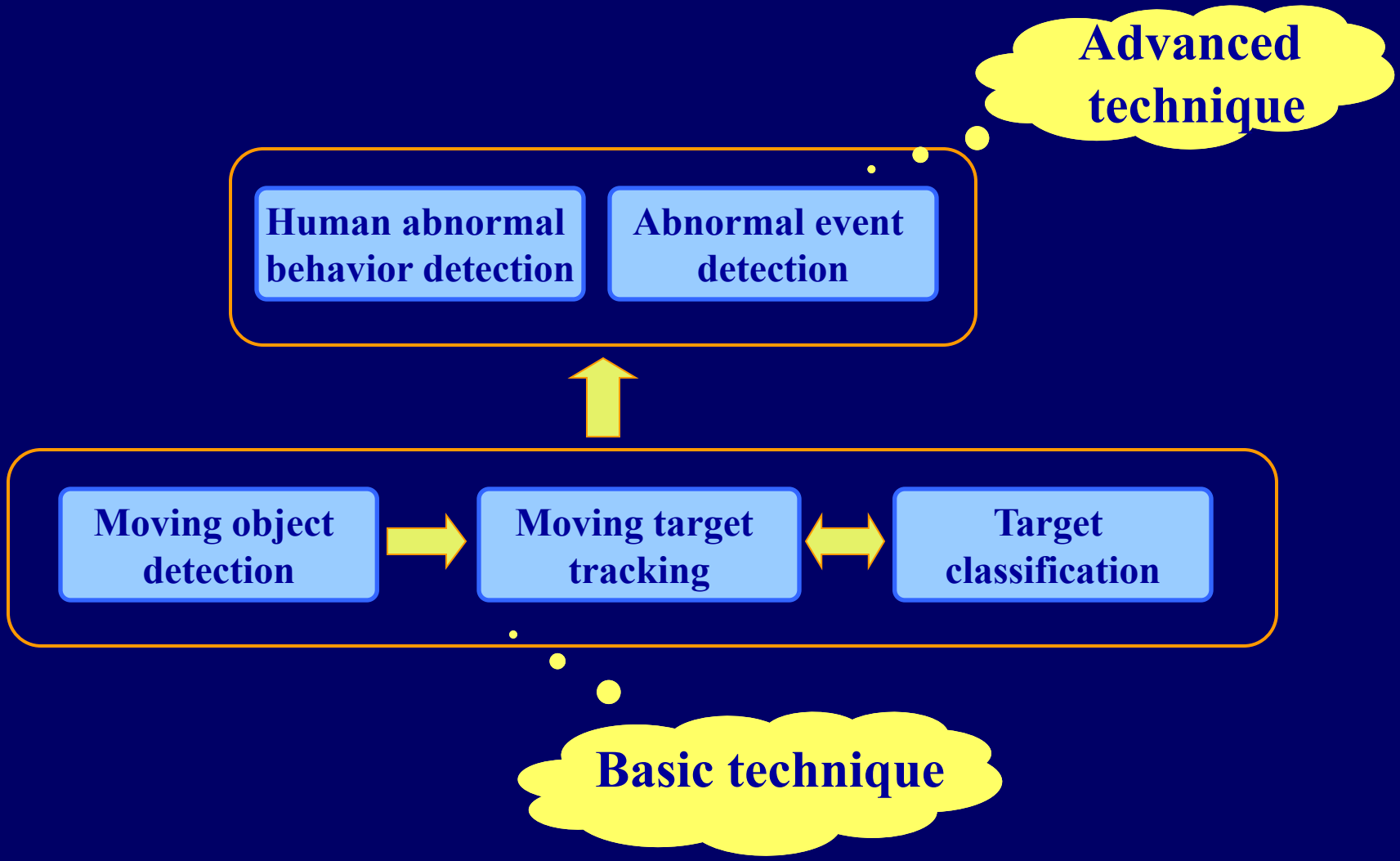
* Automatic video data compression

5

Intelligent recognition system is the recent trend of development of monitoring systems



Processing flow in intelligent surveillance video analysis system



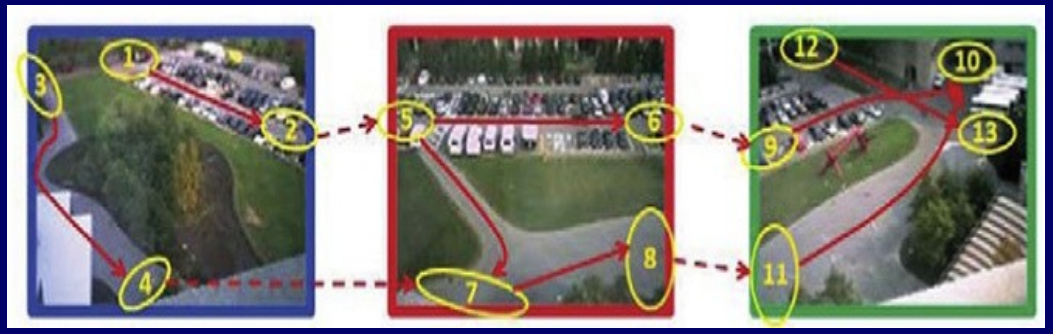
Human behavior recognition for video investigation

◆ The main functions and features

- Get key information in video to focus, observe, and analyze suspects.

Climb over the wall

Aggregation | Running | Climb over the wall | Wandering



Behavior analysis under multiple cameras

Video data mining

Traditional monitoring systems

- In the large-scale network monitoring system in the city, the TV wall in the monitoring center can display dozens of monitor screens simultaneously. It is easy to miss abnormal events if only rely on human eyes.
- Research shows that professional monitors will miss 95% of the behavior after 22 mins if watch 2 screens.

Defects

Cannot prevent the crimes.

In July, 2005, a severe bomb explosion was occurred in London subway. The clues were found after an time-consuming investigation on the large number of monitoring videos. The crime could not be prevented beforehand.

Video data mining

Traditional monitoring systems

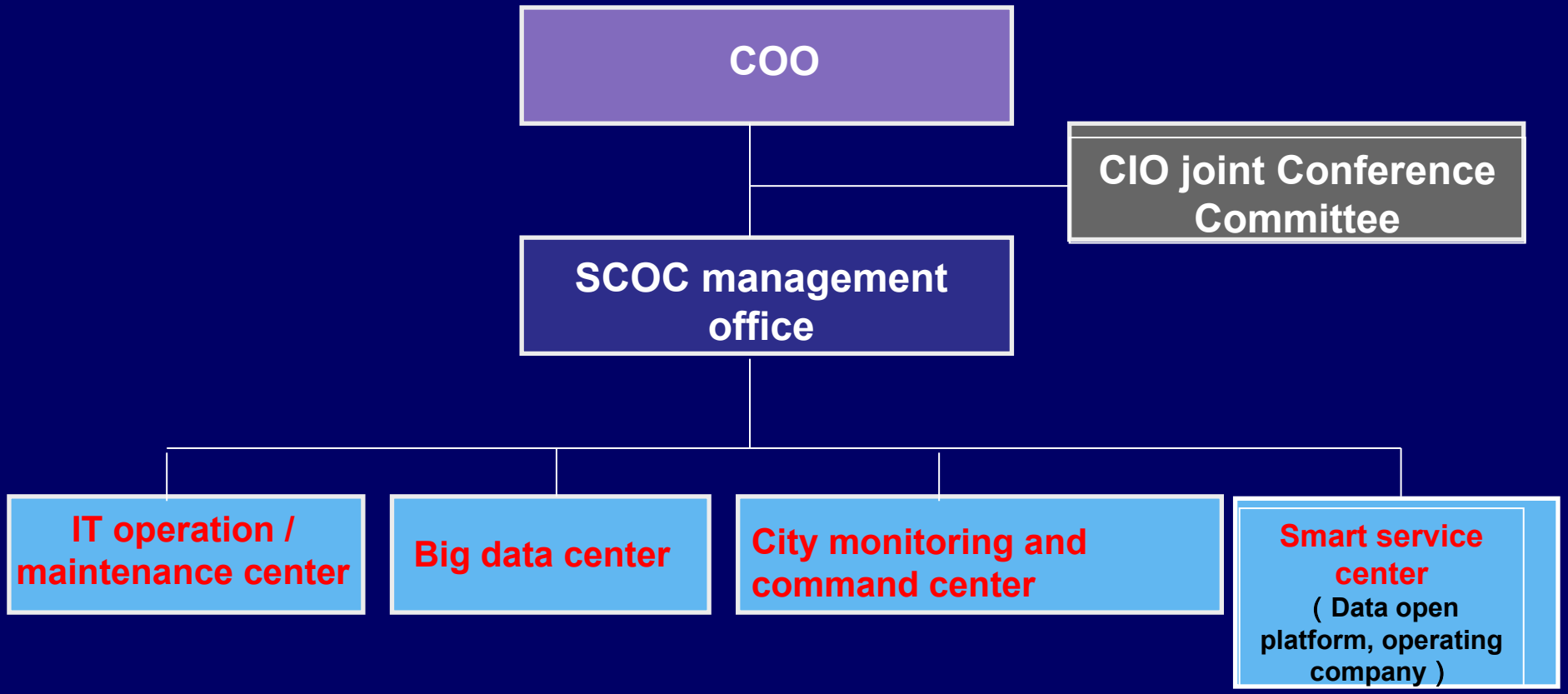
- In the large-scale network monitoring system in the city, the TV wall in the monitoring center can display dozens of monitor screens simultaneously. It is easy to miss abnormal events if only rely on human eyes.
- Research shows that professional monitors will miss 95% of the behavior after 22 mins if watch 2 screens.

Intelligent video analysis

- The computer can understand the content of the videos by digital image processing and analysis.
- Detect, separate, and track moving targets in dynamic scene videos automatically. Effectively identify the behavior of the target.

4 SCOC：Smart City Operation Center

The municipal leaders establish the SCOC and assign the chief operation officer (COO). This is very important for smart city.



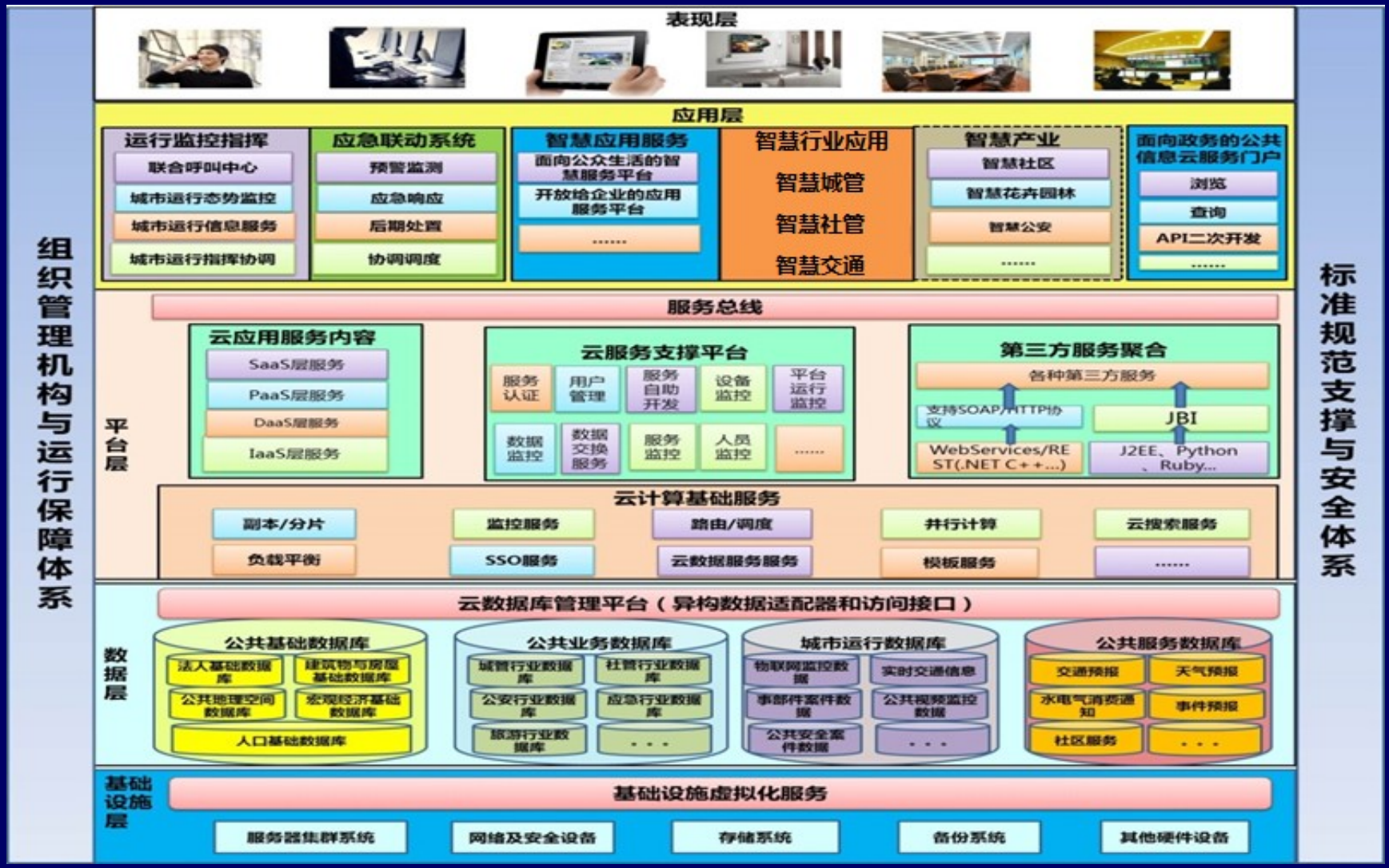
Functions of SCOC

*Participate and review the top-level design of smart city ;
*Plan and review the target, framework, tasks, and operations manager system o the information development for various industries;
*Develop relevant policies, regulations and standards;
*Responsible for urban integration, information resources sharing, and integrated monitoring of urban running;
*Collaboration between different departments;

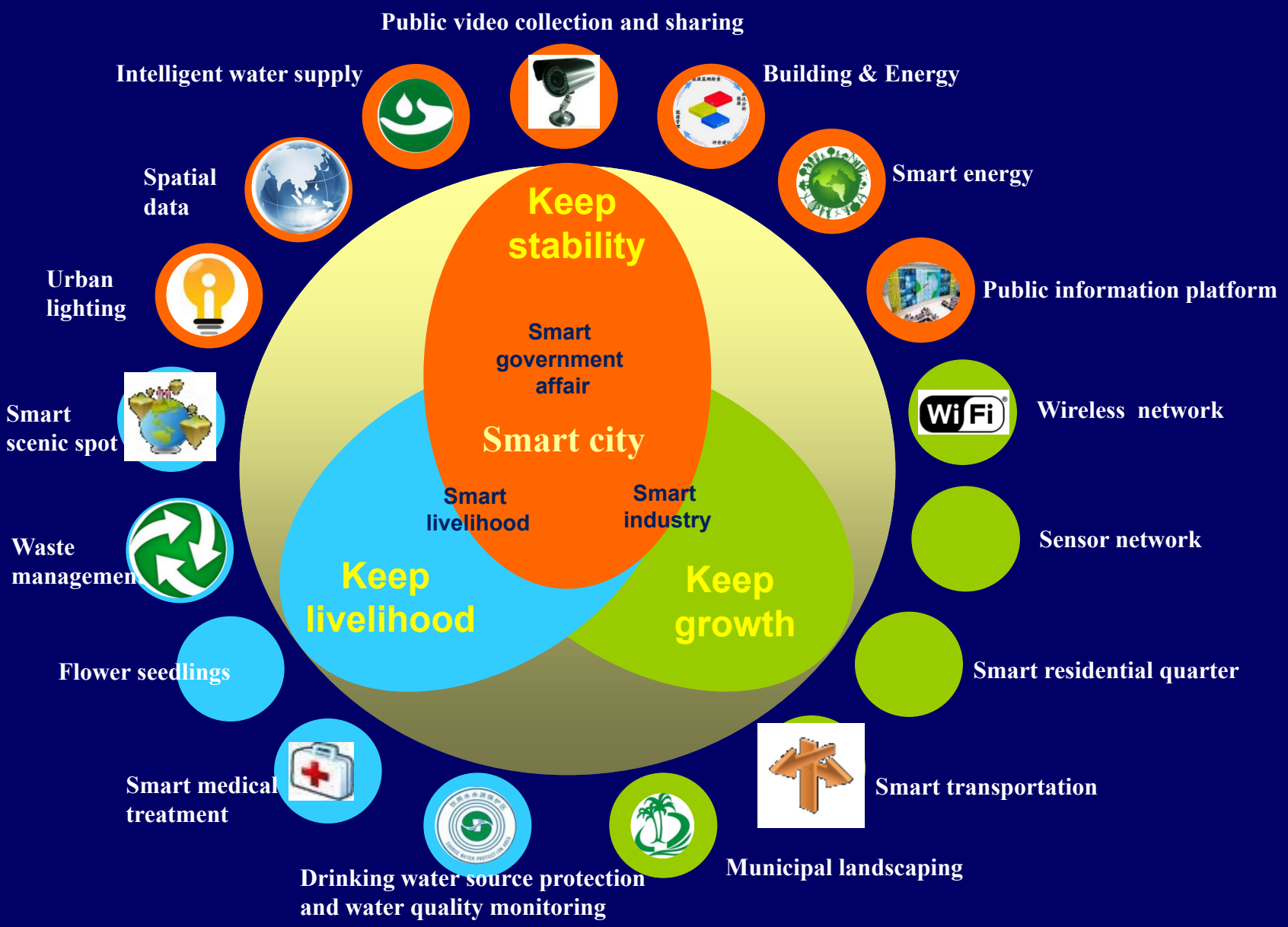
*Promote society-oriented big data applications and trading system.

Overall architecture

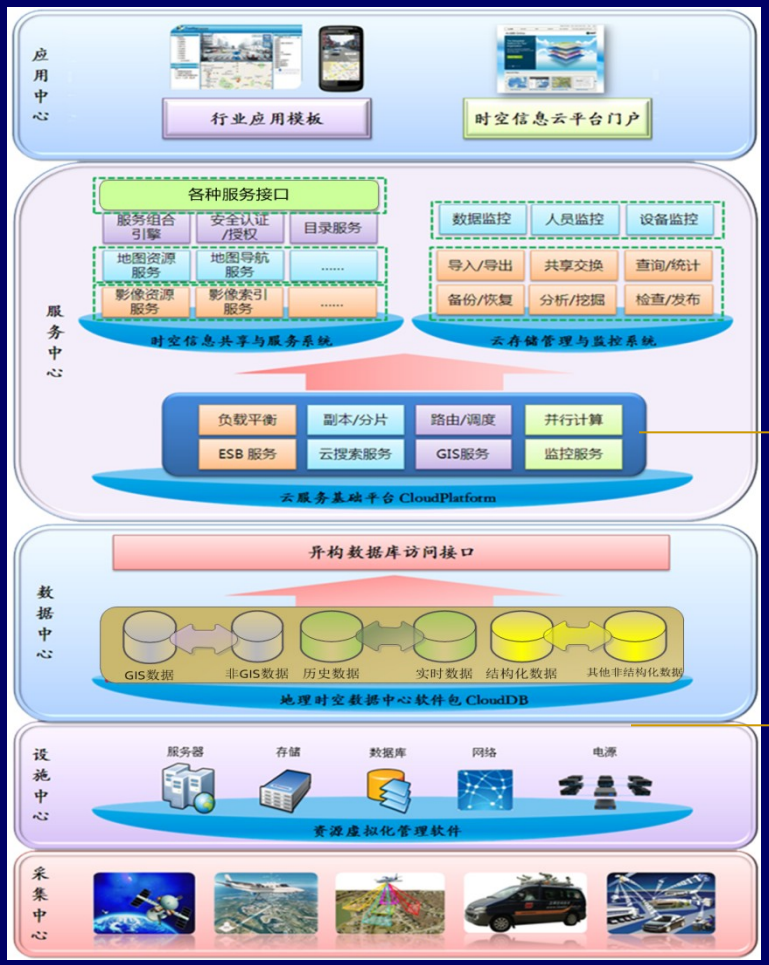
——Build SCOC on the cloud-based open architecture



Develop smart applications



Core: Public Information cloud services platform



Application layer

Smart urban manager

Smart police

……

Smart tour

Public information platform

Software development and runtime layer

IaaS

DaaS

PaaS

SaaS

Infrastructure layer

Server

Network

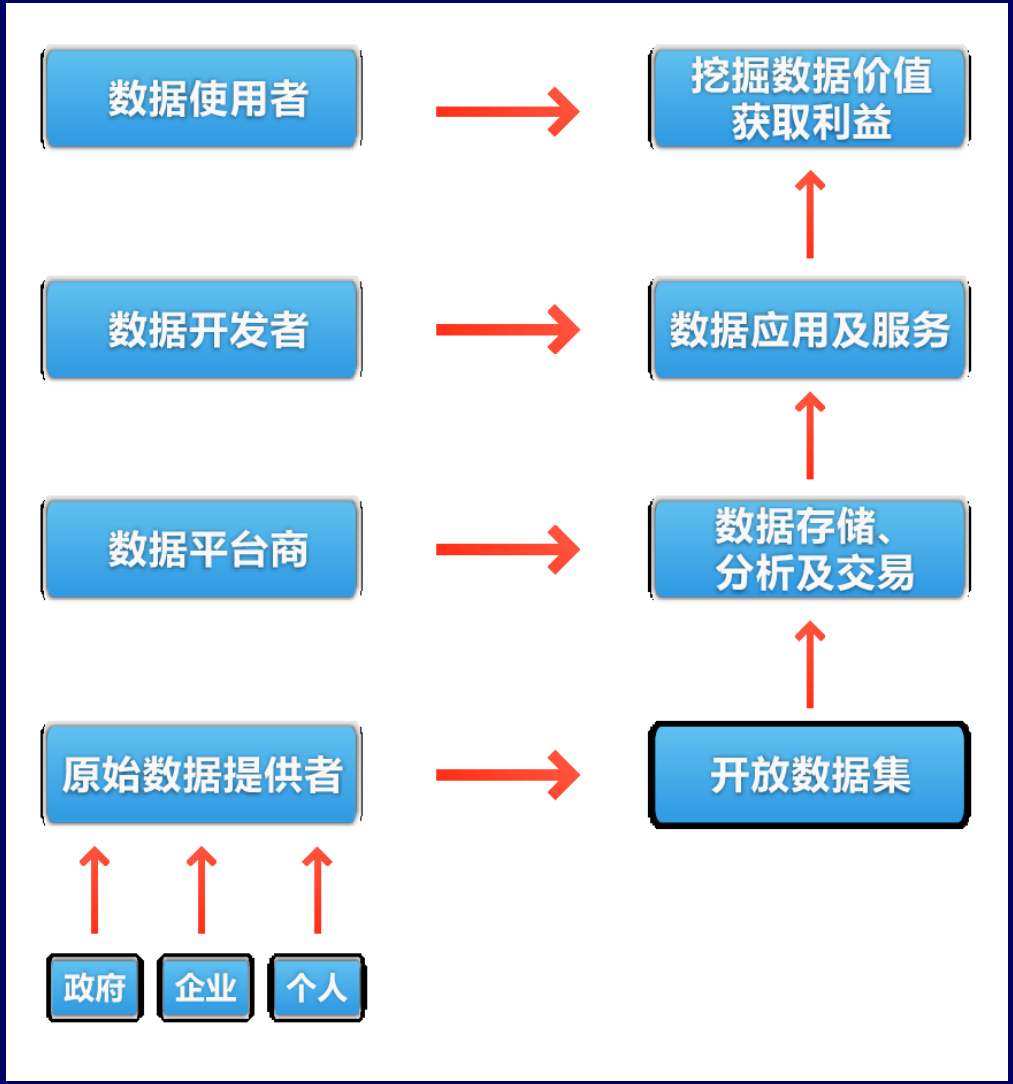
Storage

Computer room

Sensors

Big data ecology in smart city

IT cooperation in the era of smart city is related to big data: data acquisition, processing, storage, cleaning, mining, decision making, and control / use services.



Big city monitoring and dispatching based on big data

Smart service center

City governance mode changes from management to service, traditional government IT information architecture will be replaced by "cloud-end" interaction in smart city

SCOC - heart of the smart city

- **Resource pool** of big data in city
- **Hub** of internet of things in city
- Urban **monitoring and operations command center**
- **Overall perception** of urban operations data
- Cross-functional, cross-regional, cross-system **collaborative and efficient emergency response.**
- Social enterprises and public **service platform**
- **Reduce** urban informatization construction and operation and maintenance **costs.**
- **Minimize costs, improve urban efficiency.**

European authorities later reducing administrative costs of $ 250 billion after using big data tecunique (McKinsey)

SCOC makes innovation to create a new e-government platform

Governance: "Facts based on truth" ---√

"Subjective will" ---X

"Influence of interest groups" ---X

City running： *Visualization, control, intelligence, predictable and quantifiable assessment, and continuous optimization.* The government will become more open, accountable and more efficient, thus minimizing the risk of administration.

Enterprises：Reorganize production resources by big data, improve business modes and obtain greater income.

Public: Smart service will run through "birth, medical treatment, education, employment, marriage and child rearing, pension, funeral mourning" to enhance the well-being of urban residents.

5 Conclusions and future works

- Smart city is the integration of real world and digital world. It is based on the digital city, internet of thins and cloud computing.
- Smart city has broad prospects in economic restructuring and development, urban management and public intellectual service, so that a more coordinated development between man and nature can be achieved.
- The realization of smart city should based on a more perfect information infrastructure, to ensure the various applications of smart city is useful and affordable.
- New opportunities and challenges are brought by big data in smart city. We should make innovations in techniques to stimulate the development of digital services industry to realize the various applications in smart city.
- The realization of smart city is complex. Top-level design and overall planning should be made to found the SCOC according to the characteristics of different cities.

Thank you !