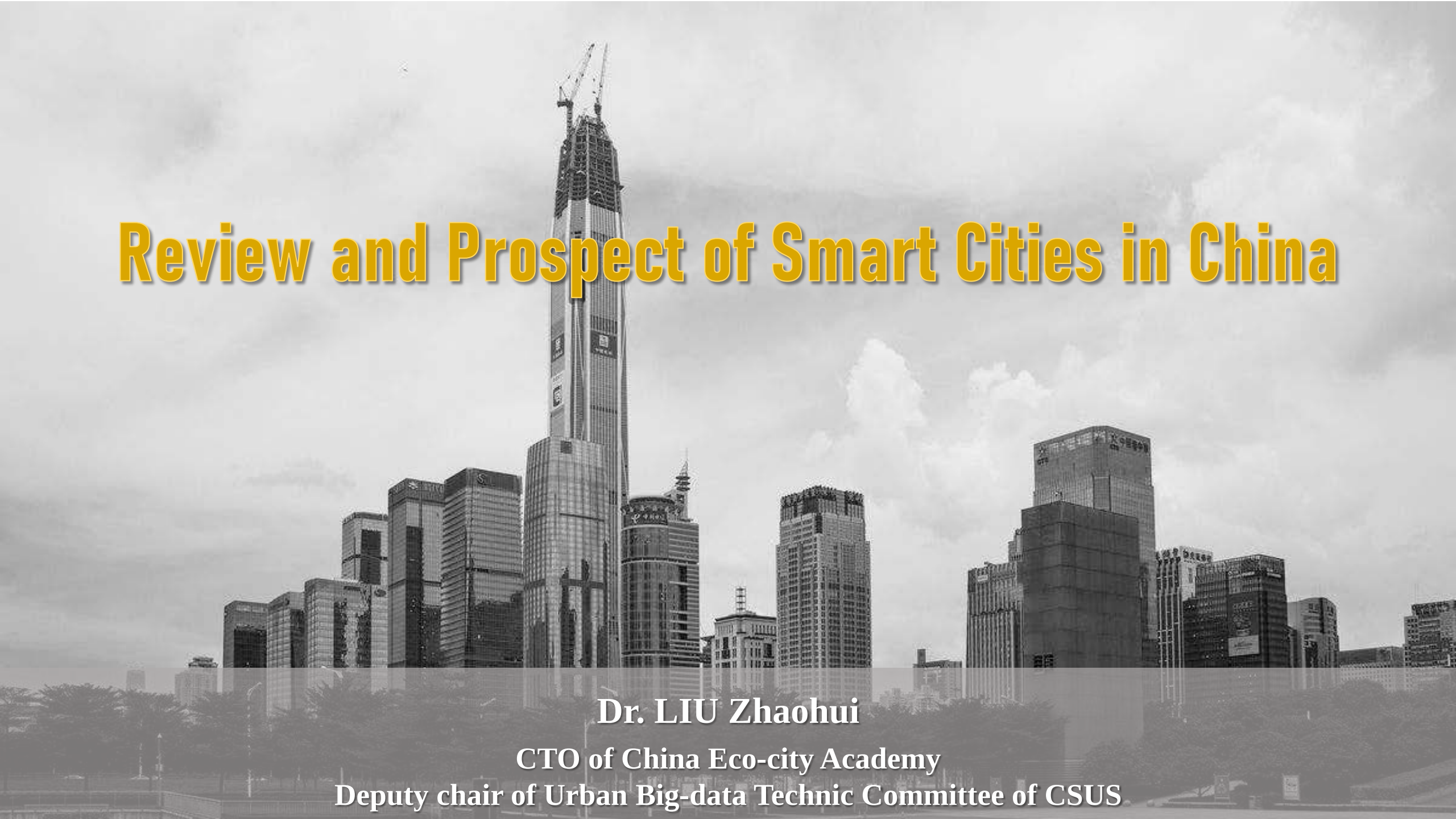


Review and Prospect of Smart Cities in China

Dr. LIU Zhaohui

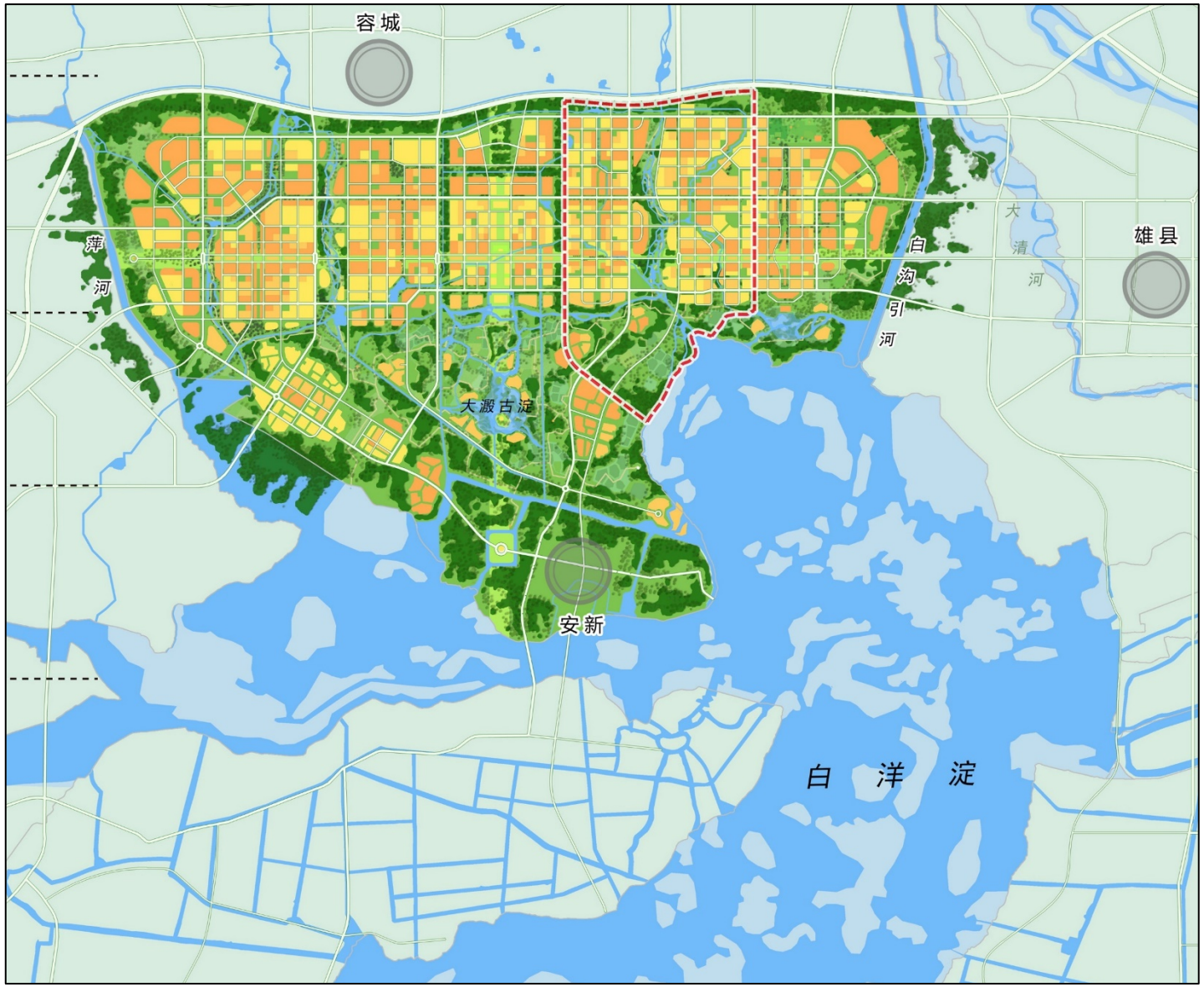
CTO of China Eco-city Academy

Deputy chair of Urban Big-data Technic Committee of CSUS

277 National Pilot Smart Cities (2012-2014)

277 cities, districts and towns were listed in the National Pilot Smart Cities Initiative from 2012 to 2014.

More than 600 cities announced to build smart city in government documents.



Xiong’an Digital twins

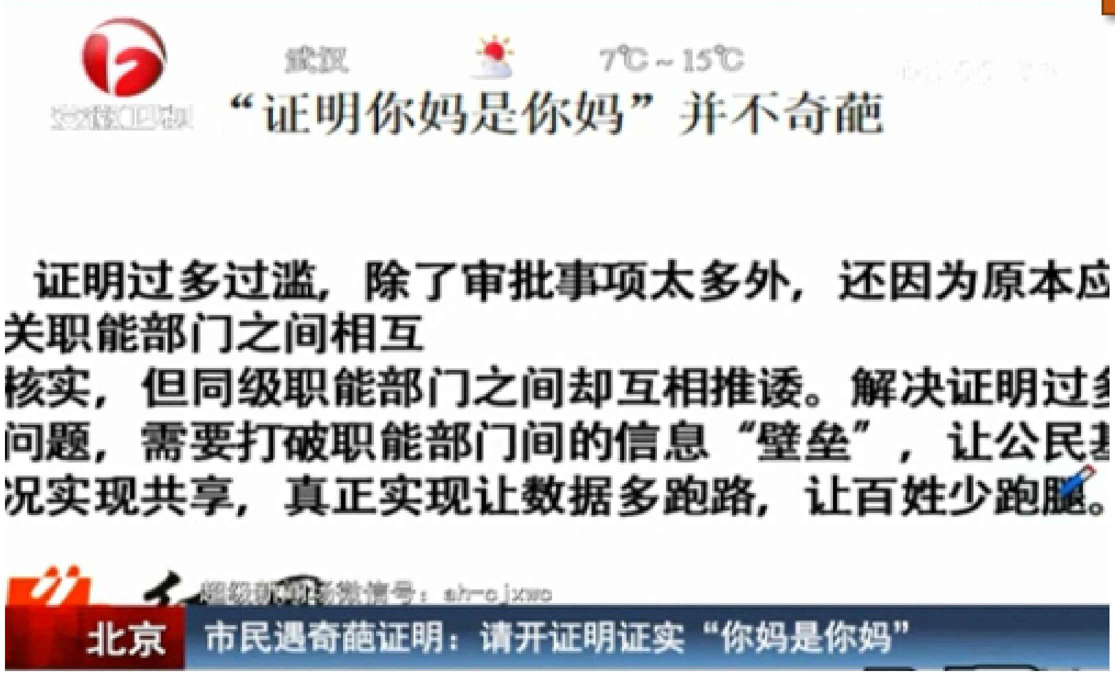
It is necessary to plan and build the digital city and physic city synchronously, appropriately advance the layout of intelligent infrastructure, establish and improve the big data asset management system, and build a global leading digital city with in-depth learning ability.

——Planning Outlines of Xiong'an New District

Many provinces and cities have established big data management bureaus to integrate government and social data resources and optimize business processes, so as to promote the development of smart cities.

National integrated online government service platform has been built, breaking the regional restrictions of government services.


请开具证明证实
你妈是你妈
开证明


武汉
7℃～15℃
“证明你妈是你妈”并不奇葩
证明过多过滥，除了审批事项太多外，还因为原本
关职能部门之间相互
核实，但同级职能部门之间却互相推诿。解决证明过
问题，需要打破职能部门间的信息“壁垒”，让公民
况实现共享，真正实现让数据多跑路，让百姓少跑腿。
北京
市民遇奇葩证明：请开证明证实“你妈是你妈”


封条
二零一五年一月十二日
封条
二零一五年一月十二日


最多跑1次
改革加速度
请你来点赞
等你来建言
浙江省“最多跑一次”改革办公室
浙江发布
联合推出

广州荔湾区案例：一窗式政务服务
Case of Liwan District, Guangzhou

“One -window” government services

- Multi-tier approval was replaced by centralized approval
- Different functional windows were replaced by one comprehensive window
- Old vague pre-conditions were replaced by the standard lists
- Renewed personnel system echoes separation of audit and approval
- Broke departmental information silo and established “shared two networks and one platform"

北京案例：街乡吹哨、部门报到

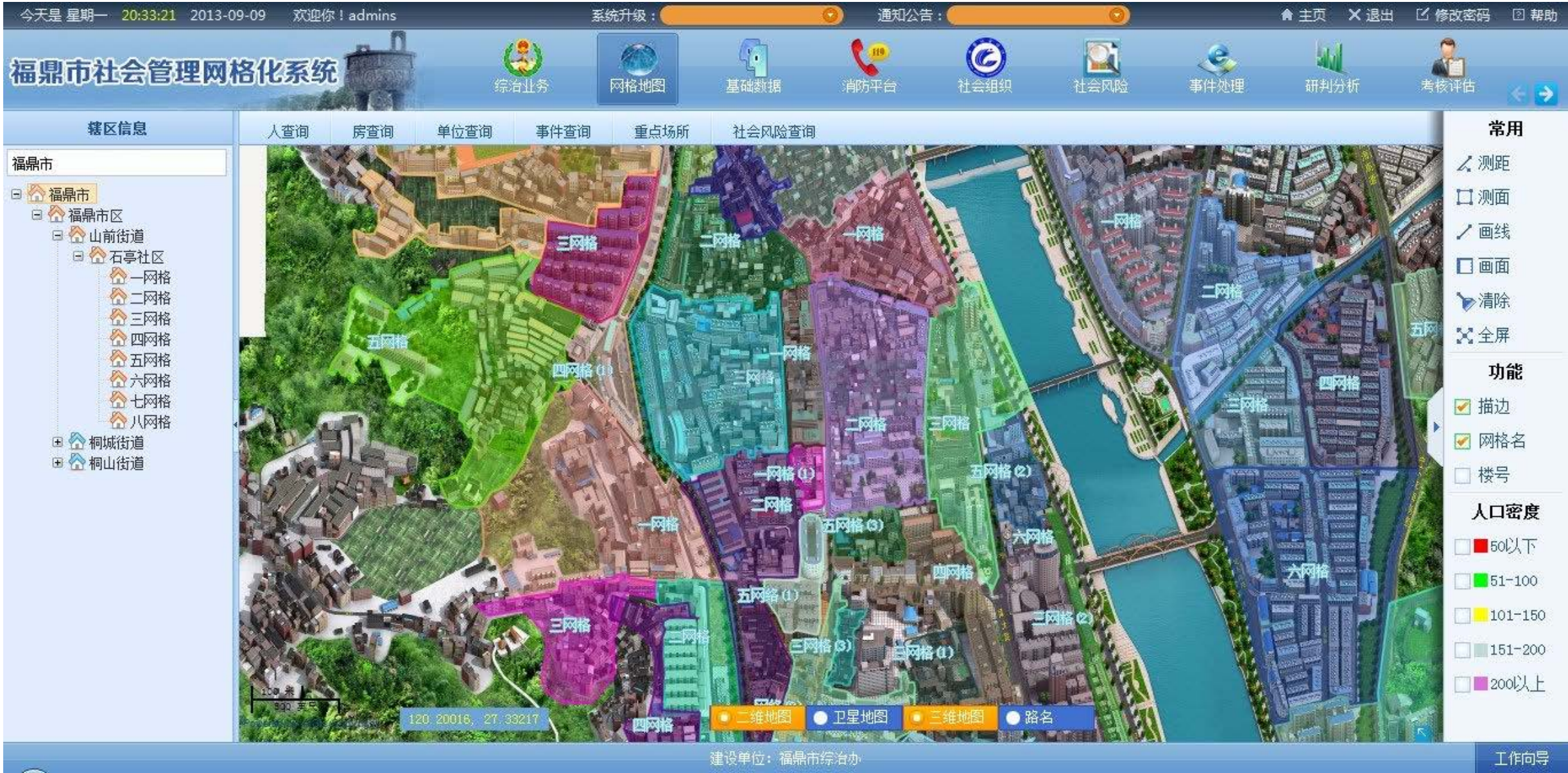
Beijing Case: “Whistling and Report” Mechanism of community empowerment

Beijing has reformed the events starting and disposal process in urban management. “Whistling and Report” Mechanism confirms that communities are the initiator of urban management cases, and all responsible government departments must report to the community and complete relevant tasks. The 12345 mayor's hotline will also forward the received complaints to the relevant communities.

东城：“小巷管家”嵌入城市基层治理
西城：“大数据思维”助力吹哨报到
朝阳：“七步工作法“打造吹哨报到闭环流程（哨源形成、街乡分析研判、街乡吹哨、区级平台受理（联审、立项、派发）、部门报到、评价监督和结果反馈）
丰台：“跨区联合哨”破解城市治理尴尬
石景山：老街坊议事厅“吹”来责任部门
通州：“吹哨报到”破解工业大院腾退“硬骨头
昌平：“五方共治”解决超大型社区治理难题
大兴：亦庄综治中心“一键指派”高效报到
延庆：新型自治方式使脏乱地摊蜕变整洁商业区

城市管理案例：网格化城市管理系统

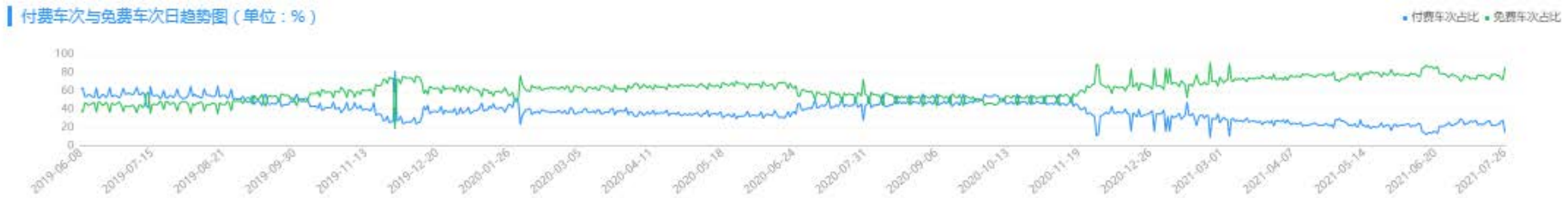
Case of urban management: Sectioned urban management has become a symbolic application



交通治理案例：停车、交通组织、替代交通

Case of smart transportation

- The intelligent parking system of Hangzhou east railway station has significantly improved the proportion of free parking and the turnover efficiency of parking spaces;
- The roadside parking system based on image recognition in Beijing has greatly improved the efficiency and reduced illegal parking;
- Sharing bicycles based on Internet services provides citizens with alternative modes of transportation, solves the problem of "the last kilometer" of travel, and contributes to a low-carbon development model;
- Many cities have optimized the setting of traffic lights through artificial intelligence to alleviate congestion.



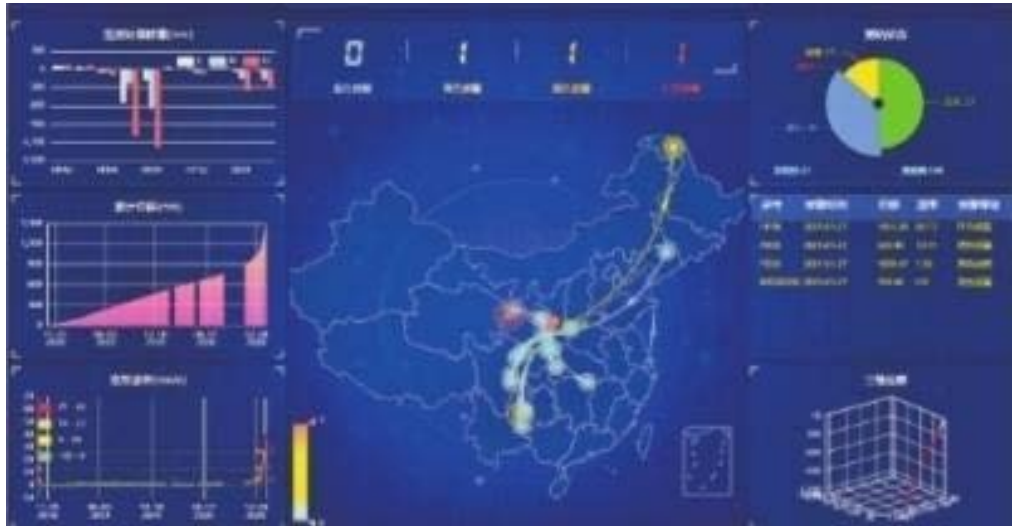
基础设施案例：供水和供暖

Case of smart infrastructure: water supply and heating system

By applying smart technology, civic management efficiency can be significantly enhanced.

With precise management,

- For water supply system, the leakage rate is reduced from an average of 15% to 3%.
- For heating system, the energy consumption is reduced by 40%.

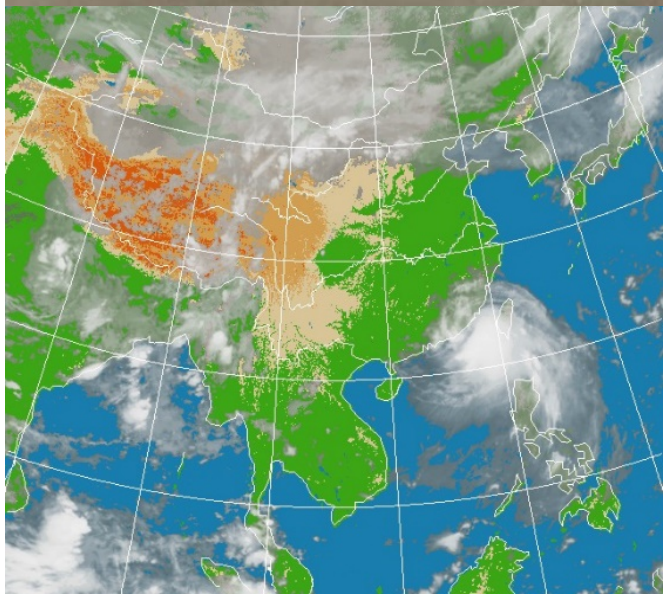


智慧防灾案例：地质灾害预警

Case of smart disaster prevention: geological disaster early warning

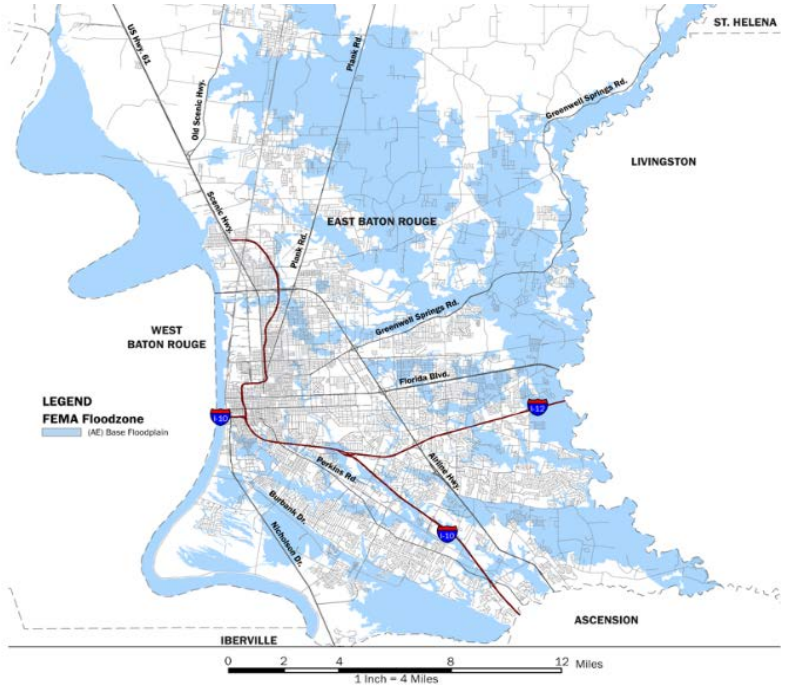
For areas with frequent geological disasters such as landslide and debris flow, Sichuan and Gansu provinces have established relevant early warning systems. When the sensor detects relevant changes, the early warning information will notify the local government, geological disaster emergency center and local geological disaster inspectors by SMS and e-mail, so as to take response measures in advance and organize personnel evacuation.

urban waterlogging



Old drainage management

- The basic rainfall formula is too rough;
- Climate change leads to the failure of the original empirical model;
- Neglect the drainage, flood storage and flood regulation capacity of the natural environment;
- Ignoring the impact of buildings and site layout on surface water collection;The cost of raising infrastructure standards is very high.



Drainage management in smart cities

- Integrate infrastructure construction and emergency management;
- More application of refined meteorological data;
- Rational layout of flood regulation and storage space;
- Make Drainage Impact Assessment on site planning and layout;
- Multiple departments work together to deal with threats.

Online education, online health care and online meeting ensured normal development and social and economic, and bring new changes to future urban life.

Experience of Smart cities movement in China

1. Emphasis on top-level design and systematisms

The goal of smart city has been included in the national five-year plan and local plan for many times. These plans emphasize the top-level design of the composition and project arrangement of smart city from the perspective of systematicness and integrity.

2. Smart city is widely accepted and practiced

It is generally accepted in the whole society that the application of information technology can significantly improve the operation efficiency in relevant fields. Different departments are applying smart technology to improve their service level, resulting in a large number of spontaneous innovations. For example, hospitals, municipal industries, urban planning departments, retail industry, and epidemic prevention and control QR code.

3. Fruitful achievement in urban governance area

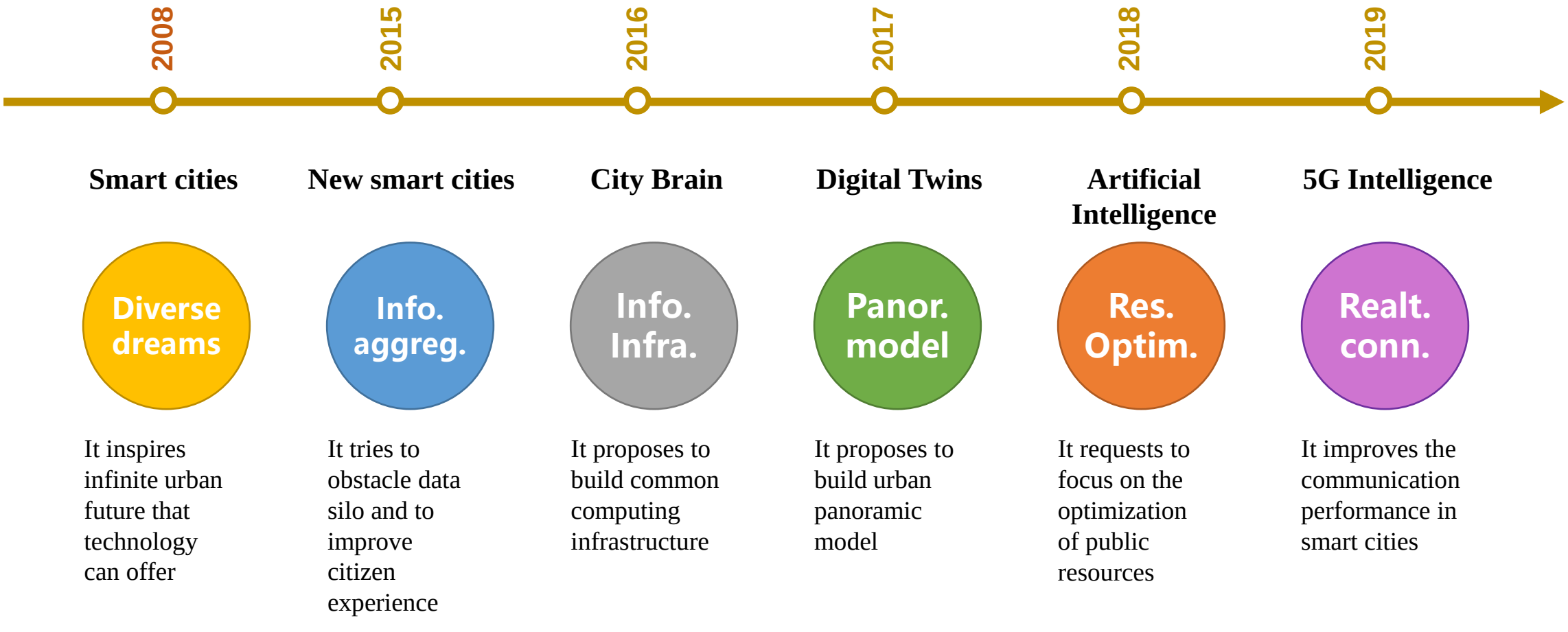
The efficiency of the government has been greatly improved, and urban governance, e-government and business environment have been greatly improved.

4. Mechanism optimization is a key

Information system plays a good role as a tool, but the reconstruction of process is the key factor.

5. Connectivity is still an important issue

As the society generally recognizes the importance of data value, people pay more attention to privacy and data ownership, and the willingness of the owner to share becomes lower.



Each step can be fully justified by providing new solutions to the problems faced by smart cities. However, the contradiction was not resolved:

- between theory and practice - recognized the problem and put forward the answer, but the procurement content has not changed;
- between ideas and decisions - recognized that reform is more important than technology, but the project form has not changed;
- between goal and perspective -recognized that data-based decision-making should be promoted, but the focus was lost.

The implicit hypothesis behind the understanding of smart cities

Hypothesis 1: Smart cites affairs are governmental affairs

表现
Express

- The original concept of smart cities suggested by IBM was to sell IT products to the government
- It is generally believed that the government should be responsible for the construction, operation and management of cities
- The contribution of market and society to improve the level of urban sustainable development and quality of life is usually excluded 。

公共自行车一辆8530元？回应：含后台和5年服务费用

2015-01-30 08:31:39 来源: 广州日报(广州)

[redacted]公共自行车单价近万元 官方称采购合法 有何内幕 什么自行车一辆一万？

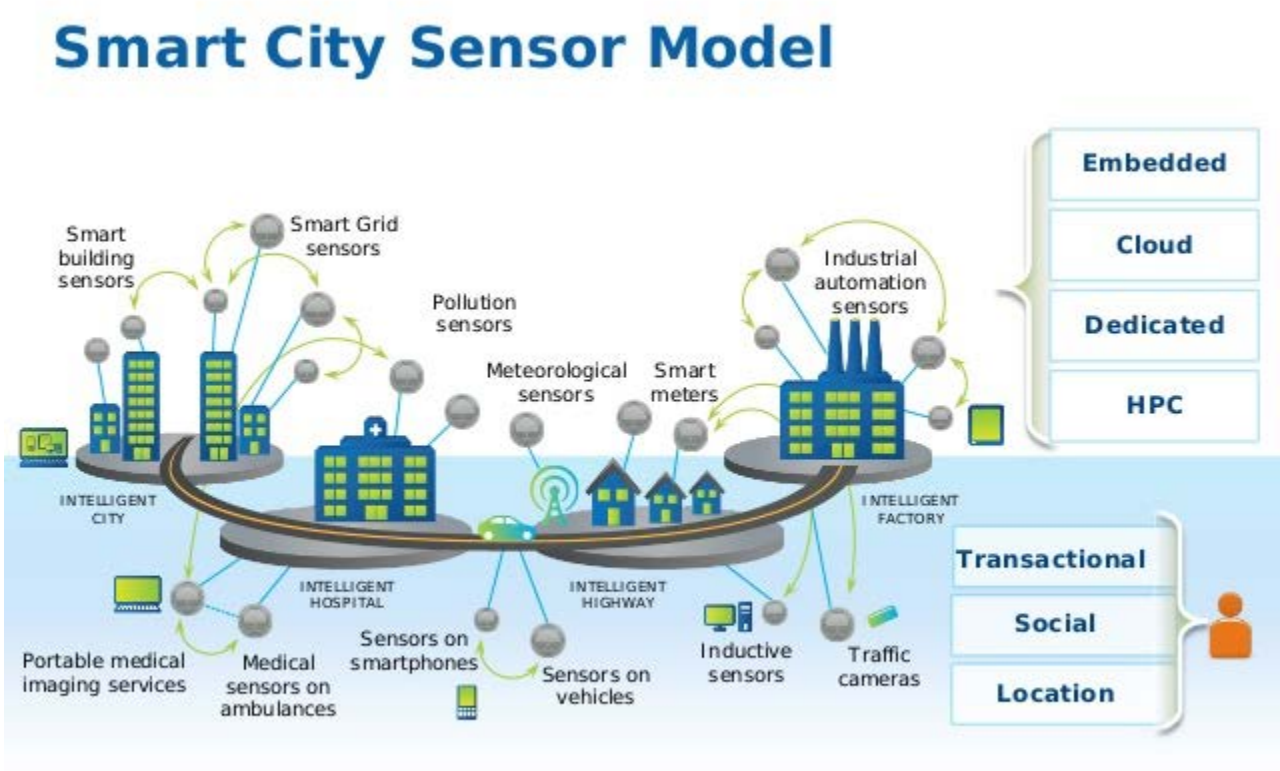
来源：网易新闻 发布时间：2015-1-31 11:27:36 225人浏览 1人评论

导读： 近日，有律师在微博爆料[redacted]花费6488万元采购6500辆自行车及配套服务，每辆自行车总成本达到9981元。这名律师质疑，[redacted]的公共自行车采购项目耗资过高。对此，[redacted]官方今日向南都记者回应，采购合法合规，经得起考验。律师[redacted]称，2014年10月29日，[redacted]市公共机构节能领导小组办公室以6488万...

Hypothesis 2: Data can be gathered completely

It was often assumed that as long as the data is sufficient, all events can be predicted and all problems can be solved in various smart cities and city brains implementation schemes. The gap between the actual results and expectations can be attributed to the lack of data. Data silo are the best excuses to escape responsibility.

Smart cites based on complete data is unrealistic because that **data is always insufficient and decisions are always made under insufficient information in the real world**. We should question any idea of trying to build a complete urban data set. It is feasible and wise to propose a minimum data set based on the need to solve the problem.



Hypothesis 3: City operation can be fully controlled

The popular smart cities methodology regards the city as a machine that can be ordered and controlled, and believes that the most effective way of city operation achieved through rigorous data analysis, and the operation state of the city can be adjusted through the central command.

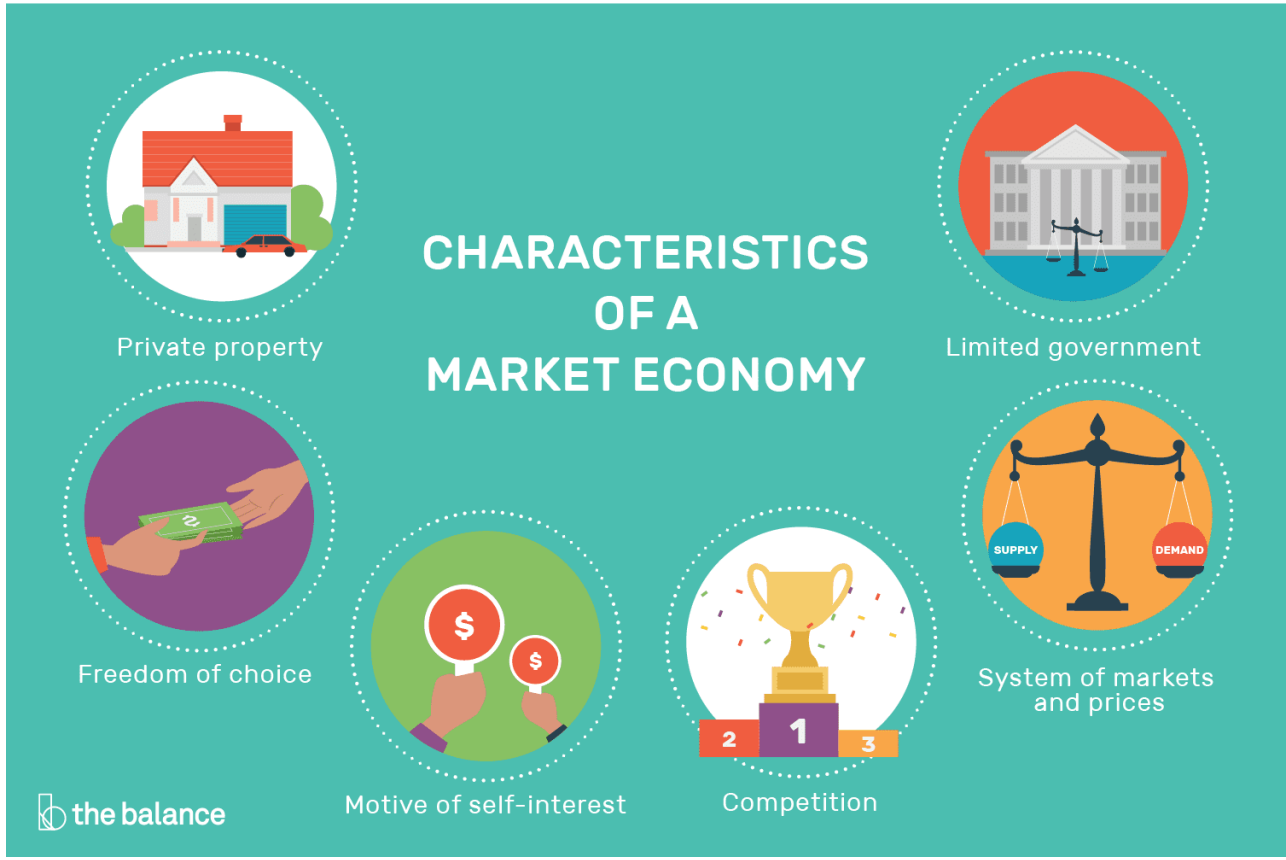
A city is not a machine, and the center intervention is only one of the countless system inputs which determine the final operation state of the city. There is no linear relationship between the command input and the result output.

Hypothesis 3: Smart cities should be supported with unlimited resources

The smart city methodology is not based on the rareness of resources.

Popular opinion advocates that smart city must be the top leader’s project. The unspoken words actually are that: firstly, the smart cities program offends the interests of many people; secondly, all resources should be unconditionally subject to the construction of smart city; thirdly, smart city is likely to be fail without unlimited supply of resources.

This assumption makes the concept of smart cities stand in the invincible position of "give me everything, I can tell you everything".



New understanding of smart cities

- Cities are self-organizing and self-adaptive. The various elements in the city will automatically reach a certain balance and resist external interference.

  For example: an optimized road will quickly attract more traffic and then return to its previous state; newly opened subway lines will usually become crowded within a few years; the only way to restrict the number of visitors in a tertiary grade A hospital is that only limited patients are able to register..

- Smart city is a tool, and the use of tools by humans must be conscious. Therefore, when constructing a smart city, we must consider what impact will the use of such tools have. We need to consider the future of cities and the future of smart cities within the framework of the relationship among physical space, cyberspace and human society.

- Smart cities designed in advance cannot adapt to the complexity and diversity of the cities. Therefore, smart cities should widely absorb the contributions of the whole society in order to achieve common goals.

The power of smart city comes from connection, but not central control, from the contribution of everyone, but not top-level design

Prospect of future smart cities

1. Strategic design, not top-level design

The strategic design of smart city should comply with the key trends and driving forces affecting urban development: green and low-carbon, new logic of urban layout and high-quality urban operation

Four principals of making strategic

- What are the **positions** and **strategic goals** of the city? How can the various information technologies associated with smart cities support the realization of these goals?
- What changes will the smart technology brought to the way of industrial organization and daily live? Is it necessary to **redefine** the goals and development paths of the city?
- What are the key **constraints** and **supporting** factors for smart cities?
- What are the perceptible indicators for evaluating smart city strategies? What **actions**, **policies** and **control** measures are needed to ensure its realization?

Strategic Suggestion for Smart Beijing

Vision: A Pioneer Smart City

"Smart +"

- Fully integrate smart technology and urban development
- Build Beijing into a modern city with multiple characteristics of creativity, innovation, ecology, resilience and livability

"Smart ×"

- Give full play to the amplifier effect of Beijing's "smart city"
- Drive the development of relevant manufacturing industries through smart city solutions

"Smart -"

- Orderly organize the transfer of social and economic activities into virtual space to relieve of stress of physical space
- Connect physical space and virtual space construction through urban planning to create the next generation of lifestyle

"Smart ÷"

- Build a "smart Beijing" capable of continuous self perception, self-learning, self correction and self-improvement
- Realize the long-term sustainable development with the help of people's collective wisdom based on the concept of "distributed smartness"

2. Multiple modules, not one single structure

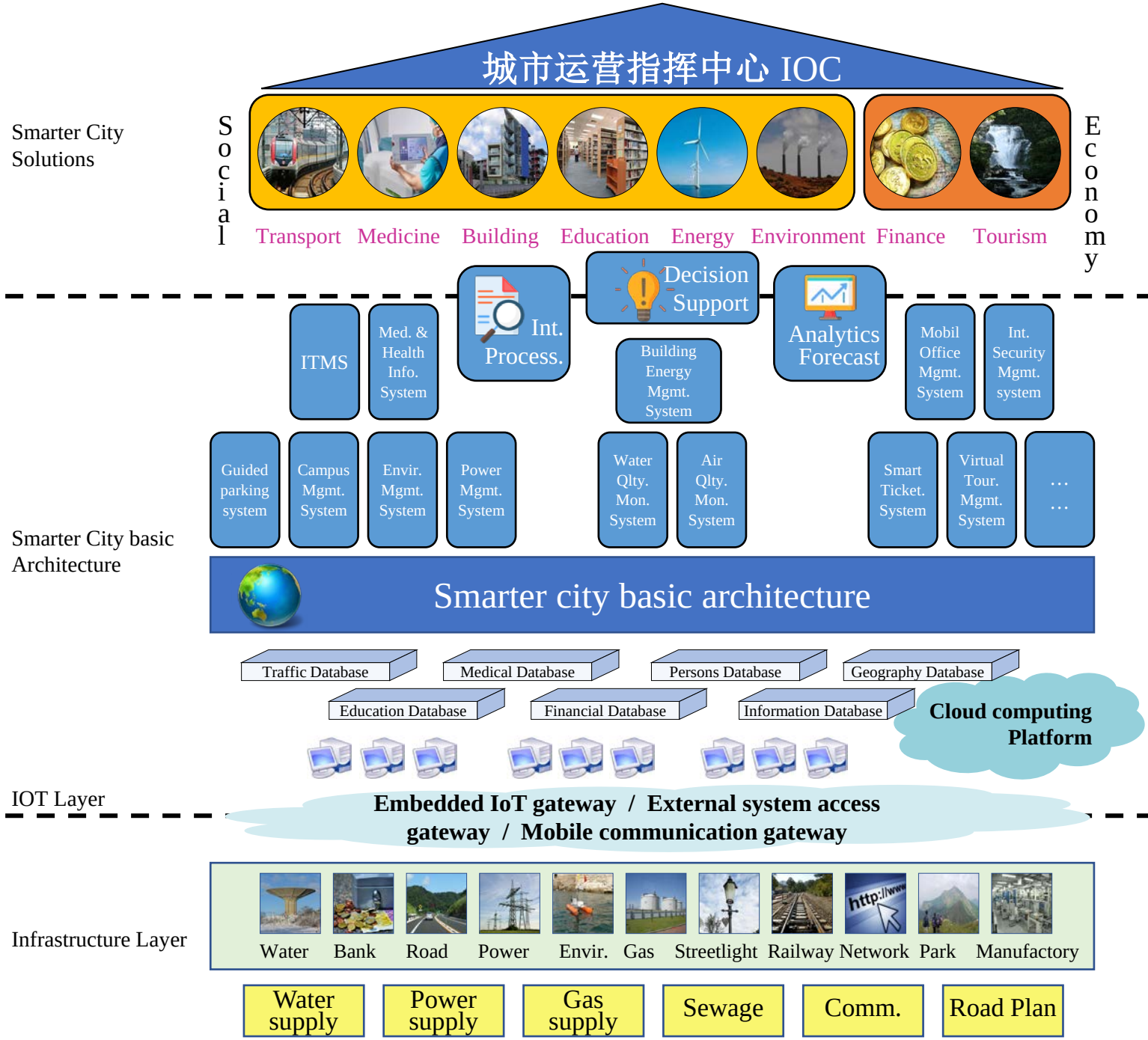
Popular Structure of Smart City

Based on cloud computing and big data center, there will be an operation command center to schedule the operation of the whole city.

All urban operation data and sensor data will be sent to the big data center of the city for collection and analysis.

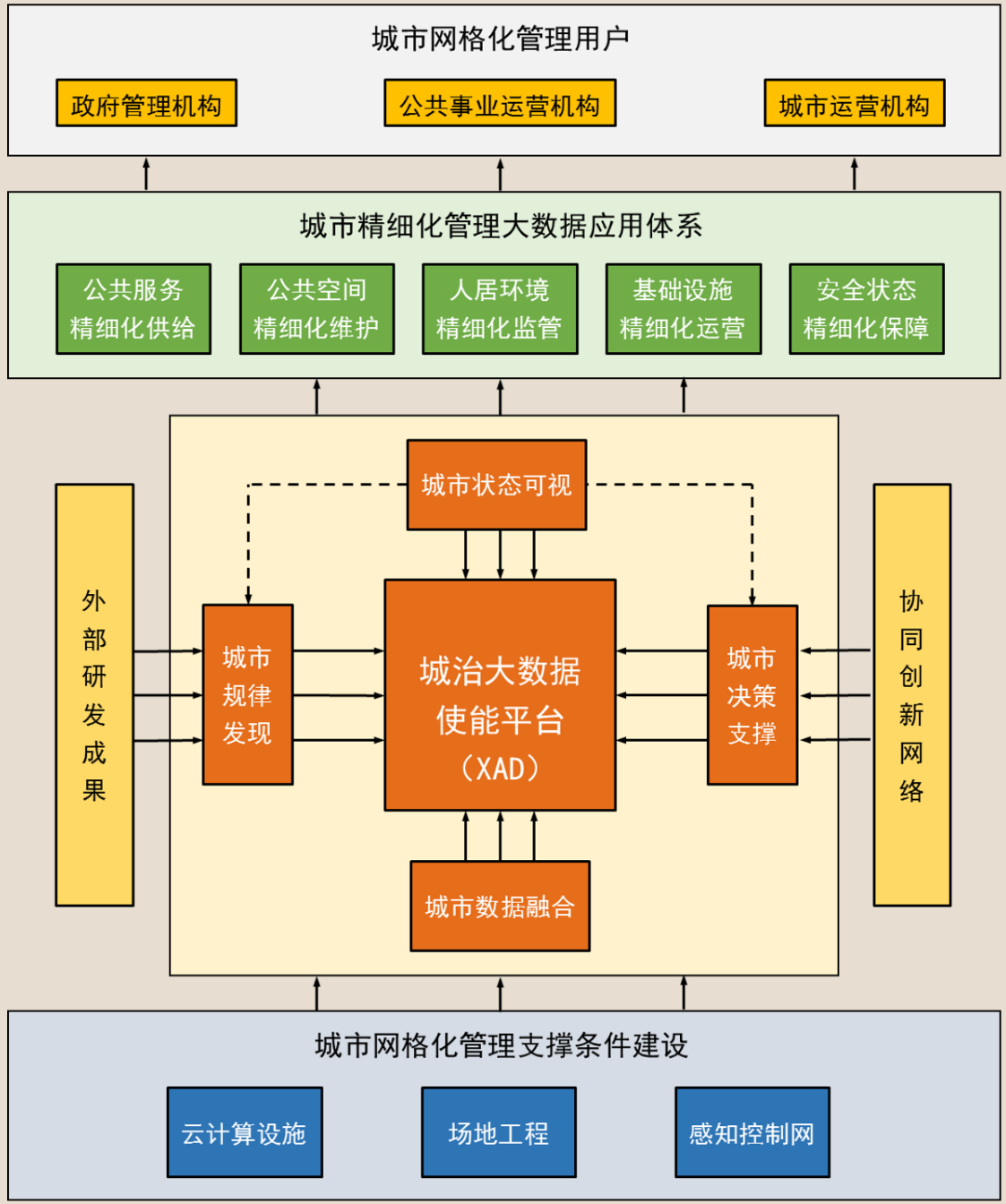
Ideally:

- All departments will share data to avoid repeated construction;
- Efficient data analysis will bring unprecedented performance improvement;
- Cities will have unprecedented ability to regulate and manage.



Smart city with Open structure

- Highlight the construction of big data basic capacity and common capacity, and reduce the construction and operation costs of different urban management systems;
- Highlight the principles of collaboration and openness, so that external technological modules can be transplanted and applied quickly, and internal data can effectively support social innovation;
- Highlight the in-depth application of artificial intelligence technology in urban governance and services.



Diversification

On the one hand, the future smart city should have diversified technical system structure. In some megacities where the market size is large enough, it is still possible to adopt the centralized system structure. What needs to be changed is to enhance its openness and collaboration. For some small and medium-sized cities or small towns with limited market size, it is necessary to expand the market size and reduce construction costs through cloud services. In the horizontal and vertical fields, the structure design of smart cities also needs to derive diversified architectures based on the actual demands.

modularization

On the other hand, smart cities should adopt more modular splicing structure. As emphasized repeatedly in this article, the state of a city is the collective actions of individuals in the city. Smart cities should cooperate with the market, society, and its citizens. The city could achieve best governance by gathering the contributions of different actors. To reflect on the system structure, a network-like structure should be widely adopted, where the resources are accessible and adjustable, capabilities can be invoked and shared, and modules can be competed and expanded in order to form an open and collaborative smart city system.

3. Make rules, avoid extreme methodology

There are two extremes to the construction of smart cities: one is completely led and designed by the government, and the other is to let market compete and conflict. Both methods are unwise.

Based on the understanding that smart cities should be jointly constructed by the whole society, the optimal path for building a smart city is to motivate the participation and investment of the whole society, and to form a stable ecosystem through the design of rules and mechanisms. It is necessary to have a set of rules of competition, cooperation, and interdependence.

Type I rules are about rights and responsibility, which should be mandatory;

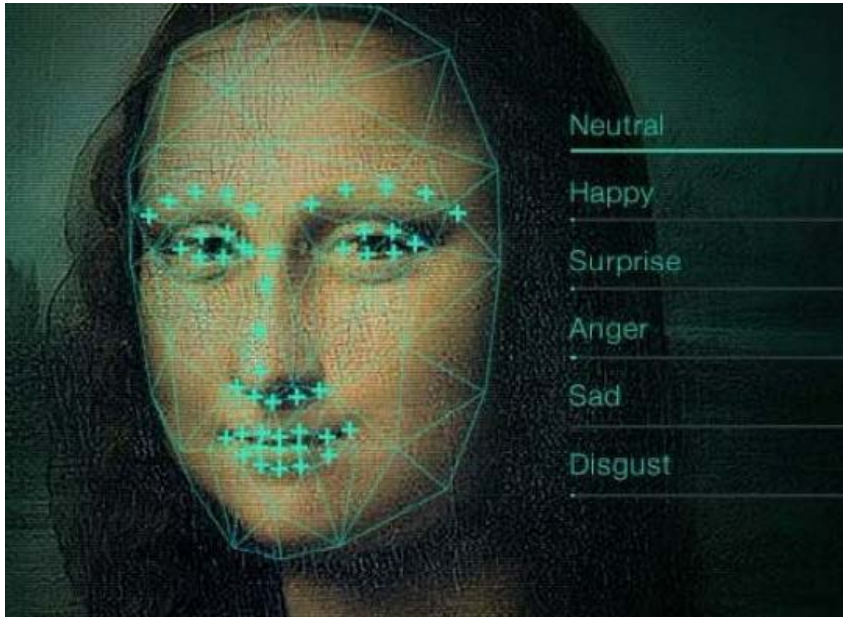
Type II rules are about trust and certification, which are the public products in the digital age;

Type III rules are about cooperation and transaction, which are instructive and incentives based.

Type I rules - mandatory rules

define rights and responsibilities

- The rule of making rules, which defines who has the right to make digital rules and what procedures to make rules, can effectively restrict the violation of individual rights by public power and the kidnapping of individuals by algorithms.
- Rules on the definition of rights, intellectual property protection and privacy protection of digital assets. These are very important for the healthy development of the market, avoiding decision-making risk and business risk.
- The rules define the boundary between the public sphere and the market sphere. It helps to clarify which areas the government should take the initiative, which areas should be handed over to the market for free development, which areas the government should regulate and regulate, and which areas can be subject to public-private cooperation.



Type II rules – public goods

Help to provide trust and certification

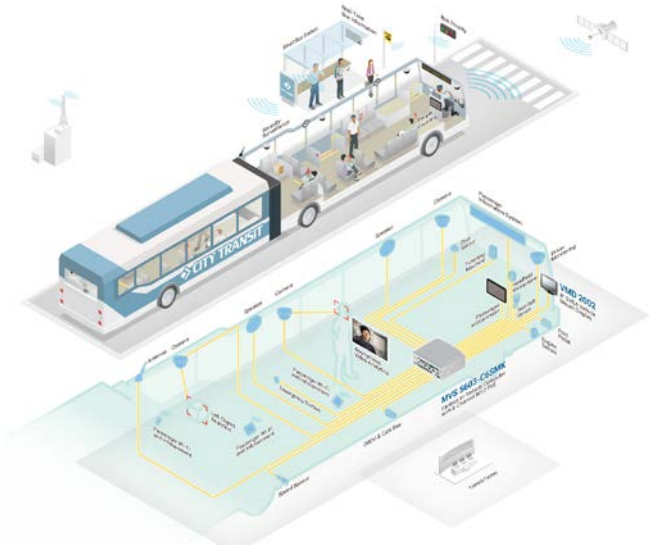
When "smart" is increasingly embedded in all aspects of production and life, the identification and authentication of identity and the credibility of individuals constitute the passport of the digital age. However, the disorderly proliferation of biometrics, the massive disclosure of individual privacy, unfair, opaque, and involuntary individual portraits or credit ratings have become the biggest hidden threat to social security. Therefore, trust and certification should be provided and managed as public products instead of allowing enterprises to operate freely.

Type III rules – instructive and incentive

Can boost cooperation and transaction

Smart city theoretically means great improvement in operating efficiency of social organizations that should be profitable. However, in reality, the cost is far greater than the visible output. This partly results from that the one-time input cost is too large while the output is limited to the public welfare field which is dominated by the government. Only the cooperation can help share the cost and make the market the buyers of smart cities in order for smart cities to truly achieve sustainable advancement. This requires the establishment of certain cooperation and transaction rules to allow a large number of transaction activities to occur[13]. Some of these rules can be formulated by the government to inspire the market. The other part should be produced in the process of market running.

3. Focus on scenario, instead of application



Common references to "smart application" include "smart government", "smart urban management" and "smart transportation". The subject behind is technology. When " smart technology" (subject) "is applied" (predicate) in a field, it becomes the " smart application" in this field. Therefore, "smart application" usually deals with the real world from the systematicness of technology itself.

When we start to think from the perspective of scenario, we must consider

1. Who are custmers
2. What are their pain points
3. What we can creat for them

：在同仁医院门口排了五分钟队之后，我发现这个队是挂眼科号的，急忙找对地重新排，在排了四十五分钟之后挂到了47号（据说一共只有50个号）我还挺幸运。接着在分诊台等了两个小时终于听到了我的名字进了诊室，大夫检查聊病情十分钟完事，再去排半个小时的队交费五元。花了大半天拿了一小瓶滴耳液回家了

8月21日 20:57 来自新浪微博 转发 | 收藏 | 评论

Cost: Transportation 120 mins+waiting 210 mins

Gain: talk with doctor 10 mins

“卫生云”整体架构

- The solution based on hospital expanding can only solve the problem for a period while the full service capacity is the only factor that determine the volume;
- The smart hospital application aiming at informatization can not solve the problem completely.

■ Improve the procedure

- Establish hierarchical medical system;
- Minor and common diseases can be treated through the Internet;
- Establish independent testing centers;
- Reduce repeated queuing.

■ Optimize hospitals distribution

When we understand

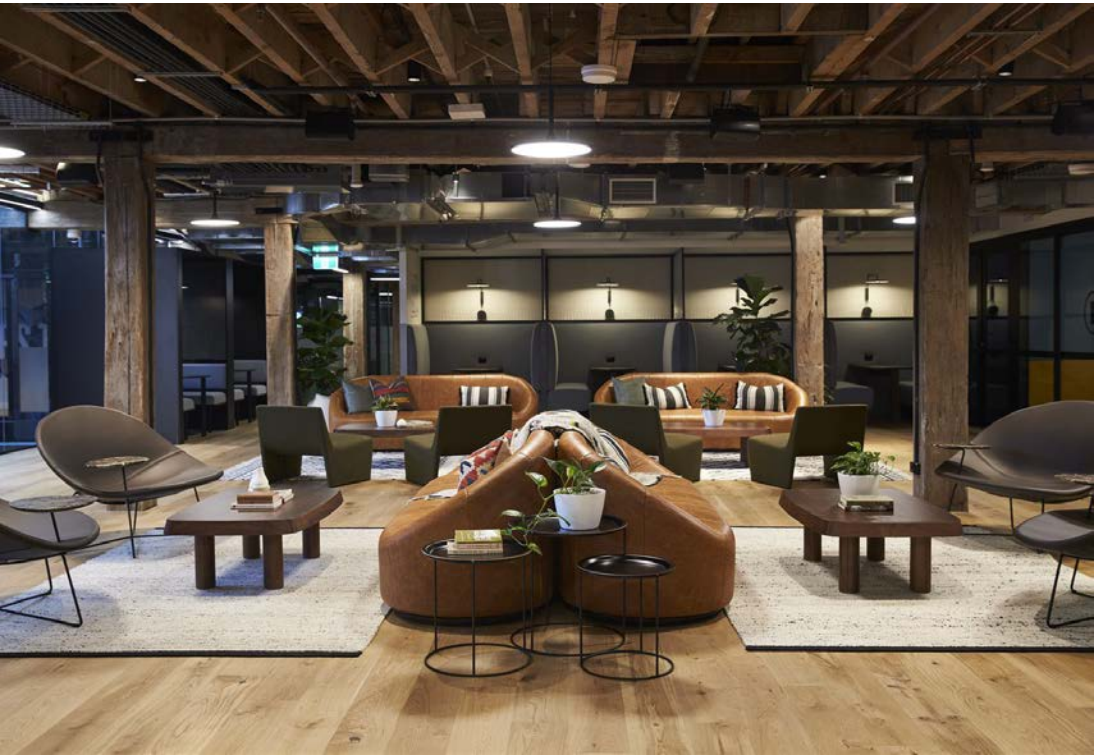
- the patient source structure,
- the patient condition composition,
- and the transportation mode of patients,

then, we can

- optimize the hospital distribution layout according to the source structure of patients;
- well connect hospitals with large flow with transportation system;
- relocate high level specialized hospitals which are not necessary in city center.

Three principle of scenario design

- **User centric**. Smart scenes must be substituted into the experience of users, understand their difficulties in dealing with various affairs in the city, solve these difficulties, and even create a better urban experience. This requires distinguishing the needs of different users in different time and different space, deeply understanding the concerns of these different users and effectively solving their problems, so that the smart city can be supported and accepted.
- **Problem oriented**. There are different priorities for different problems. Some problems in urban operation cannot be changed by information technology alone, such as those caused by institutional mechanisms or material construction; There are also some problems. Information technology can not provide the best answer. The traditional planning, construction or management means are cheaper or more efficient.
- **Innovate with experience**. Only by innovating in the future citizens' experience and making them feel real changes, can a smart city be deeply accepted. Smart neighborhoods, settlements and families have broad imagination space in the future. More importantly, once we create such a city, it will have special charm.



Future smart cities

data-based decision making（rational）

Process reengineering（reformed）

Experience recreate（innovative）

Information symmetric（transparent）

more liveable and sustainable cities


Thank you !