Konsep Pengembangan Smart City

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2. From Digital City to Smart City

- Smart Cities have attracted worldwide attention in recent years, as they may provide solutions to the problems that urbanization brings to global society.
- **Smart Cities** aim to develop systems for intelligent management of population, industry, space, land, environment, social life and public service, etc.
- The Smart City concept itself is still emerging, and the work of defining it is in progress.
- Various cases also contain different approaches. Some similar terms are digital community, smart community, digital city, information city, e-city.

- But, Digital City and Smart City refer to entirely different definitions.
  - The demarcation of Digital City and Smart City occurred in 2008 **when the idea of a Smart Planet** was proposed by IBM.
  - IBM defined its view of a Smarter Planet system through three IT characteristics or dimensions: Instrumented, Interconnected, and Intelligent

(a) Digital City

- Digital Cities integrate urban information and create public spaces for people living in the cities, using digitization, information, networking, and visualization technologies to attain urban information about population, resources, environment, economics and social statistics.
- Digital Cities refer to ***the huge information systems of an entire city which is managed by computer databases and communication networks through digital processing***.
  - It is on the foundation of a broadband metropolitan area network and geo-spatial data, supported by a global positioning system, remote sensing, a geographic information system, virtual reality, data fusion, dynamic interoperability and other technology.

- Digital Cities constitute data fusion from multiple sources of various levels with multimedia and virtual reality technology.
- Prime examples are as follows:
  - Digital City Amsterdam (1996),
  - Helsinki Arena 2000 Project (1996), and
  - Digital City Kyoto (1998).

(b) Smart City

- The concept of Smart Cities was born from IBM's Smarter Planet.
- A Smart City makes **full use** of the IT technology in all walks of life, **integrating Digital City**, **Internet and the Internet of Things (IOT)**, which **embeds sensors** into all corners of the city through power grids, railways, bridges, tunnels, highways, buildings, water supply systems, dams, oil and gas pipelines, etc.
  - ***Then through supercomputing and cloud computing, an urban system integrates data transfer and information, enabling smart management and service.***
- In short, "**Smart Cities = Internet of Things + Internet**".

- **The unique feature lies in the "system of system"** breaking the "information island" barriers which results from unbalanced regional development and department interest divisions. Breaking these barriers would result in functional subsystems sharing resources as well as collaborative operations among every region or industry.
- **Typical projects of Smart Cities include**:
  - the "I-Japan 2015" in Japan,
  - the **WestOrange project, the Geuzenveld project, the EnergyDock project, and the ITOTower project** in Netherlands,
  - the **Stockholm Intelligent Transportation System** in Sweden,
  - the **U-Korea and Seoul IPTV government** in Korea,
  - the **"iN2015"** in Singapore,
  - the **Multimedia Super Corridor** in Malaysia and
  - the **T-city** in Germany.

3. General Concepts

3.1 Blueprint and Perspective

- Considering the Internet of Things is the basis of a Smart City, Smart Cities will enhance the urban comprehensive management level while improving the ability of reducing and preventing disasters and handling emergencies.
- A Smart City operates with the interaction of water, energy, communication, transport, business, and people through integration systems.
  - Extensive application of smart technology in these core areas maximizes the benefits of the resources.
  - It is a new city mode full of inter-communication, integration, collaboration and innovation. The current stage in China is to

- Smart Cities will promote city-wide public resource sharing and enhance the flow-ability of people, materials, information and funds.
- Smart Cities show us a blueprint of what will be: that government operation can be more efficient, industries more advanced, higher quality of life for citizens, and the public service and information infrastructure can be near perfect.
- Through further mining, integrating and allocating of relevant tangible and intangible resources of political and economic society, deep integration will arrive

3.2 Key Technology, Model and Framework

A Smart City can be described as an ISGBP model.

- It consists of five parts: Infrastructure (I), Service (S), Government (G), Business (B), and Public (P).
- Among them, the G, B and P compose the main body, and
- the intelligent service is emphasized and is divided into three parts: data service, function service and model service.
  - Between the substance element of I and the people element of G, B, P, there exists a variety of related relationships: G-I, B-I, P-I, G-B, G-P, B-P, B-B, P-P relations, etc., which associate through the intelligent service.
  - Each relationship extends to a series of specific services that combine with each other to make up a higher level of services and a more complex relationship structure, finally forming a stereoscopic-cross intelligent service system.

- Smart Cities involve a large number of technologies:
  - the Internet of Things,
  - cloud computing,
  - communication,
  - networking,
  - GIS,
  - satellite positioning,
  - high performance computing,
  - Artificial intelligence,
  - software engineering,
  - system engineering,
  - information security technology,
  - modeling and simulation, etc.
- For the moment, the IOT and cloud computing technology is emphasized as the key technologies

IOT

- The IOT collects real-world object information by sensing equipment such as RFID.
  - It also transmits information to a processing center with the aid of the internet, wireless networks or optical fiber technologies.
  - After comprehensive analysis of the huge amount of information, intelligent control and management can be realized and the urban efficiency operations are improved.
- The IOT integrated the contact relationship of people-object and object-object.
  - It makes them “communicate” with each other, thus allowing the whole city to display and utilize intelligent characteristics.

- Research and employment of IOT will mainly focus on
  - the wireless sensor network node technology,
  - the WSN Gateway,
  - system miniaturization,
  - UHF RFID,
  - intelligent wireless technology,
  - the communication and heterogeneous network,
  - network planning and deployment,
  - comprehensive perception and information processing,
  - the middle ware platform,
  - code resolution service,
  - search, tracking, and information distribution.

Cloud computing

- Cloud computing develops on the basis of
  - parallel computing,
  - distributed computing and
  - grid computing.
- It is a mixed bag of technologies which evolves from
  - virtualization,
  - utility Computing,
  - SaaS,
  - SOA and more related technologies.

- Cloud storage refers to a system that, through cluster application, grid technology, and the distributed file system, interconnects and facilitates collaboration among different types of storage equipment of networks, providing data storage and transaction access servers.
  - Cloud storage has unlimited expansion ability which can support mass data of hundreds of TB to PB.
  - It uses parallel computing so as to achieve massive data computing ability.
  - It employs high-availability, guaranteeing the system at any time normal operating conditions are available, even with hardware malfunction.
- Cloud storage system architecture usually consists of four layers: the storage layer, basic management layer, application interface layer, and the access layer

- The solution of cloud computing provides
  - public cloud, private cloud and mixed cloud (public&private) computing environments with
  - three-level services at the same time throughout
    - SaaS (Software as a Service),
    - PaaS (Platform as a Service), and
    - IaaS (Infrastructure as a Service).

Smart network

- Smart network is an important and integral part of a Smart City.
- CPSM is developing to help realize smart management of city pipelines, which carry out the web-integration of urban network resources.
  - It also offers application sharing and supports assistant decision - making.
  - It links the intelligent sensors which are implanted in network facilities, realizes full perception of pipelines and associated networks, and processes intelligent analysis on perceived information with cloud computing technology.
  - The key technology of CPSM covers:
    - portal integration, web service,
    - data warehouse, data acquisition,
    - network communication, intelligent software and sensor technology.

Architecture of a Smart City

- The architecture of a Smart City basically follows the"3 I" features proposed by IBM: Instrumented, Interconnected and Intelligent.
- Therefore, it is logically divided into a Sensing Layer, Network Layer and Application Layer.
- In fact, putting the information transmission and processing at the same layer or the processing and application at the same layer effectively limits the scope of information processing. This results in a closed loop application.
- It is not conducive to sharing and reusing resources among different applications or different items.
- Therefore, information transmission and processing both tend to be separated.
- The general and public information processing are independent in IOT infrastructure, and can be commonly used by multiple applications.
- Thus the architecture is divided into four levels as shown in the figure1: a Sensing Layer, Transmission Layer, Processing Layer and Application Layer.

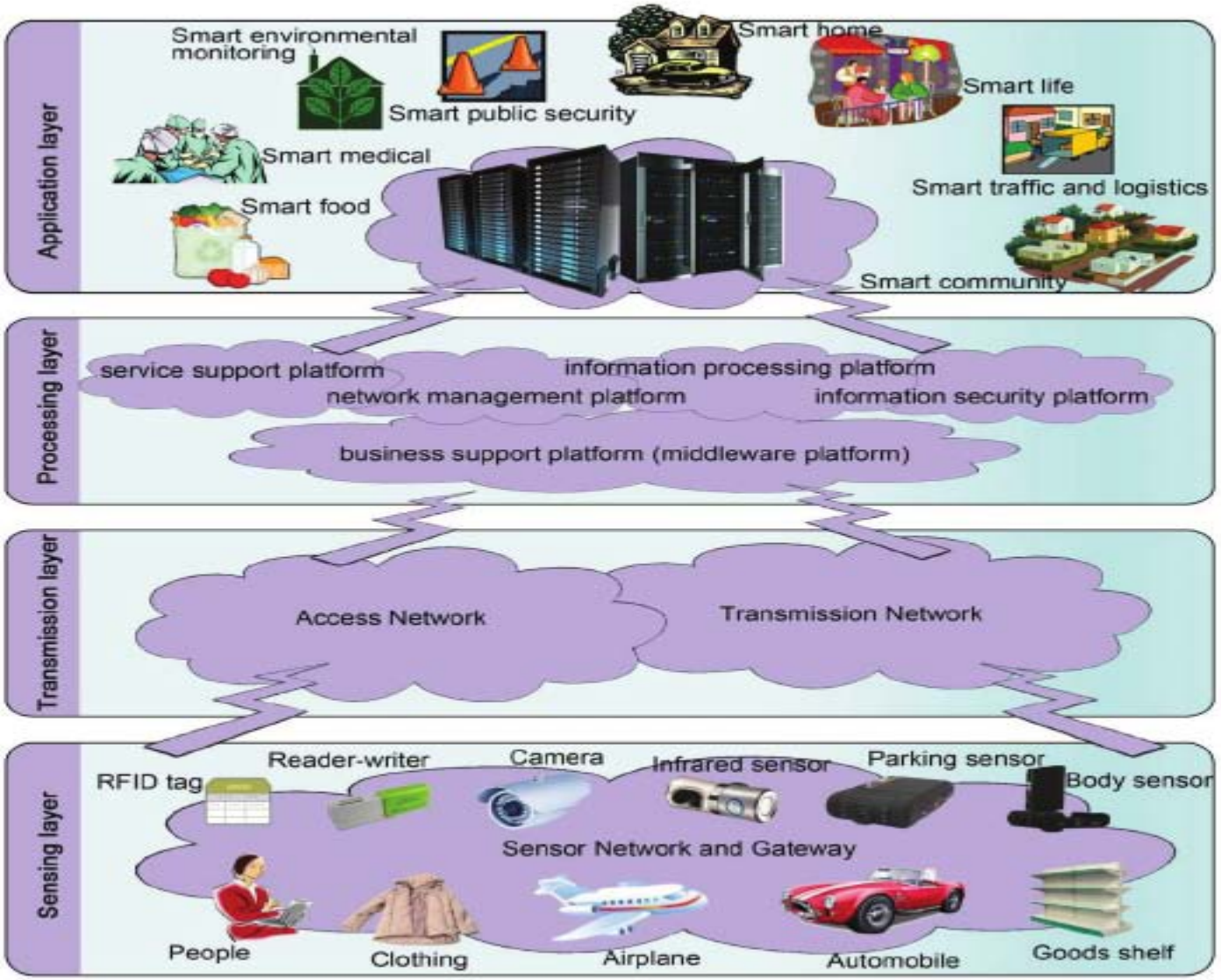

Figure 1. The four-layer architecture of a Smart City

(1)The Sensing Layer is mainly responsible for the object identification and information collection with the IOT as its core.

- It has two main components: a basic identifier or sensor (such as RFID tags, reader-writers, multiple kinds of sensors, cameras, GPS, two dimensional barcode labels, etc.), as well as a fusion network with inductors (such as sensor network).
- The Sensing Layer involves the technologies of electronic radio frequency, emerging sensors, wireless networking , field bus control.
- It also has a part in the products of sensors, electronic tagging, sensor nodes, wireless routers, wireless gateways, and more.

(2)The Transmission Layer undertakes all kinds of access and transport options.

- It is the path of information exchange and data transmission, including the Transmission Network and Access Network.
  - The Transmission Network includes a telecommunication network, broadcast and television network, the Internet, electric power telecommunication network, private network, and a digital trunked system.
  - The Access Network includes fiber access, wireless access, Ethernet access, satellite access and other kinds of access, completing the bottom of the sensor network as well as the last aspect of accessing of RFID networks

(3)The Processing Layer plays an intelligent function of processing and controlling perceived information as well as utilizing decision making.

- The Processing Layer **is composed of** a business support platform, middleware platform, network management platform (such as M2M management platform), information processing platform, information security platform, service support platform, and more.
- It implements coordination, management, computing, storage, analysis, mining, and provides services and other functions for industries and public users.
- Typical technology and the service model include middleware technology, virtual technology, high-reliable technology, a cloud computing service model, and the SOA system architecture approach.

(**4) The Application Layer** offers solution sets of widely intelligent applications, combining the network and industry field.

- Smart Cities can finally realize the depth of fusion between information technologies and industry-specialized technologies through the Application Layer.
- It has an extensive effect on the national economy as well as social development.
- This layer ’s key problems are socialization of information resources sharing, and safeguarding information security.

3.3 Application Range and Scope

The application of Smart Cities mainly includes:

1. **Smart meshing regionalized management**: The city can be more effective in management and service.
2. **Smart food**: It ensures the food safe and free from contamination from the source to the consumer through the smart safety management system and tracking control system, production evaluating system, and emergency system, etc. Citizens just need to press the keys of their mobile phones, learning about food origin, growth condition, nutrition facts, even cooking methods and recipe suggestions.
3. **Smart water resource**: With the help of management systems, relevant organizations can bring the water situation under real-time monitoring, providing fast response times to water pollution emergencies. Smart water resources also ensure intelligent deployment of limited water reserves, thus providing proper utilization.

4. **Smart traffic**: As people, vehicles, roads and the environment mutually exchange the information on traffic, flow, noise, accidents, weather, temperature, etc., Smart traffic improves the efficiency aspect of mobility and accessibility as well as reduces the energy consumption and protects the environment. The transportation system predicts traffic flow and gets dynamic control of road conditions in advance so that diversions appear before congestion, allowing drivers alternative routes to alleviate traffic congestion.
5. **Smart medical**: All kinds of medical information and resources integrate through the electronic medical record and medical information integration platform, so doctors can refer to patients' history records in which they find out symptomatic regularity. This helps ensure that patients get fast, consistent and accurate health care in different hospitals.
6. **Smart electric power**: There is not only the current flow, but also the information flow in the power grid. Through effective information retrieval, the smart electric power system can be constructed by clean power transmission, dynamic distribution and reasonable usage, thus allowing on-demand electric use without a risk of overload

7. **Smart public security service**: Urban security monitoring is established in public places, residential districts, transport facilities, campuses, construction sites, etc.
8. **Smart home**: Inter-communication comes into effect when data is exchanged among various of home appliances through different communicative methods. Every family enjoys more convenient style of living and a higher quality of life through these aspects.
9. **Smart education, smart parks, and smart enterprises**: Embedding, connecting, sensing and mass information processing technologies apply in all aspects of work and life. They enable cities to step into a new stage of management and development of urban infrastructure, education, scientific and technological activities, public safety, community service, etc.
10. **Other typical applications and practices include outdoor streaming of media and emergency response linkage systems**. Smart Cities attempt to achieve the comprehensive intelligence that eliminates the gap between urban and rural areas, as well as promote economic development , and improve government efficiency and public security.

4. Discussion and Suggestion

- Smart Cities involve technology and systems that, once they are out of control, cause panic and disaster which can affect the national level dramatically
- Data is heavily dependent on the system. How the data will be used for other systems in the future is a question on account of close correlation between data design and software systems. The more the data exists, the greater the risk will run
- If a Smart City upgrades, huge costs will be hard to bear considering as presently many technology schemes have not been clearly defined. An example is the design scheme of cloud computing.

- The construction of Smart Cities is the complicated system engineering with difficulties which persist for a long period and demand large capitals. Any problem in any part will bring huge losses. Therefore, overall planning and gradual development are necessary.

Some suggestions

- There are some suggestions about how to form the Smart City strategy suited for local situations, making reference to the experience of cases and lessons we learned.

1. Policy guidance and top design at the national level should come earlier
2. National standard on the Internet of Things and other information management system should come earlier
3. Urban and regional planning should be more far-seeing and coherent, while also paying attention to actual local conditions.

4. The national broadband plan and infrastructure construction should be set up and strengthened as soon as possible.
5. Information security should be considered all the times.
6. The implementation of Smart Cities should be people-oriented, stage-by-stage and step-by-step.
7. Great attention must be paid to the cultivation and management of talented persons and professionals.

- The process of constructing Smart Cities is also an evolution of the institutional system and technical standards on a large scale involvement of capital, technology, talents, cities, industry, academia, organizations, and society.
- Some organizations such as the City Protocol are making effort for the development of better cities worldwide, which is an international group of cities and technology companies that will develop standards for Smart Cities using methods similar to those used to develop the Internet Protocols.

5. Conclusion and Prospect

Smart Cities change the interactive way among the government, enterprises and people, making quick and intelligent response to all kinds of demands of people's livelihood, environment protection, public security, urban services and industrial and commercial activities.

Smart Cities improve urban efficiency, and outline a vision for a better urban life. They will make a difference in the future:

1. Comprehensive perception. The IOT, as an important part of Smart Cities, will interconnect urban public facilities, home appliances, office Supplies, etc., and make a real-time sensing method for urban operation system.
2. Integration in full. The IOT and the Internet will be completely connected and combined, integrating data into the full view of core urban operation system, and providing the foundation of smart facilities.

3. Collaborative operation. Each operation system, platform and participant cooperates harmoniously and efficiently. The city will be in the best cooperating condition.
4. Clean energy will become the major use of urban energy. Solar photovoltaic power, wind energy, biomass energy, tidal energy, and other new energy of advanced technologies will be applied on a large-scale.
5. Knowledge-based service industry will become the main form of future urban industry as a whole. dustry around the Knowledge-intensive services industry will flourish in future cities, such as financial service, modern logistics, information service, education and research service, and idea and product design.
6. Megalopolis, urban agglomeration and city group will boom. Convenient information and traffic network will close cities which develop cooperatively and complement each other with respective characteristics. There have formed London Metropolitan Area, North American Great Lakes cities group, German Ruhr cities group, Chinese Yangtze River Delta, Pearl River Delta, etc.
7. Active service. Personalized service will be provided and prepared in advance, as finding out the demands of enterprises and the public is automatic.

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