

Research on Security Construction of Smart City

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Abstract

Based on the traditional city, smart city is a new city that is constructed by Internet of things, mobile Internet, cloud computing, big data and other information technologies. Smart city can change interaction way of people, improve the real-time processing capability of information and response speed; promote comprehensive and sustainable development of various social works of smart city. But because Internet of things connected the real world and cyber space, in the smart city operation, not only include the traditional security problems, for example, the related equipment and building destruction, also include through software and instruction to damage network information, city construction and so on, which will bring a big challenge to smart city operation. To solve the security problem of smart city should put forward a system security mode from the view of system engineering. Through analyzing smart city architecture and security risk, put forward smart city security platform, studied the physical equipment protection, information security technologies, effective management, laws, personal information security literacy of smart city.

Keywords: *Smart City, Internet of Things, Mobile Internet, Cloud Computing, Big Data, Security System*

1. Introduction

Now, many cities in the world are studying, planning and constructing the smart city. Based on the traditional city, smart city is a new city that is constructed by Internet of things, mobile Internet, cloud computing, big data and other information technologies. In the Internet of things, the various sensors could be embedded and equipped into the power, railway, bridge, tunnel, highway, building, water supply system, dam, oil and gas pipeline, automobile, home furnishing and other objects, people can also wear the watch, bracelet, even the induction chip was embedded in the people body to perceive their own health status, integrate the Internet of things and the existing Internet to realize the integration of human society and physical system [1]. On the basis, human can manage the production and life in a more refined and dynamic manner, achieve wisdom state, improve resource utilization and productivity, improve the relationship between man and nature, and conveniently make city managers to monitor the real-time running status of the natural environment and the city. Smart city can provide some effective solutions for the city traffic congestion, the existing medical problems, food safety, environmental protection and other issues. However, because Internet of things connected the real world and cyber space, in the smart city operation, not only include the traditional security problems, for example, the related equipment and building destruction, also include through software and instruction to damage network information, city construction and so on, which will bring a big challenge to smart city operation [2]. To solve the security problem of smart city, should put forward a system security mode from the view of system engineering. Through analyzing smart city architecture, characteristics of smart city and security risk, put forward smart city security platform, studied the physical equipment protection, information security technologies, effective management, laws, personal information security literacy of smart city.

2. The System Function Architecture of Smart City

The smart city is an intelligent system. Through the Internet of things, mobile Internet and cloud computing, can promote convenient and efficient government administration, public services and sustainable industrial development. Figure 1 showed system function architecture of smart city. The smart city consisted of four-layer structure of sensing, transport, platform and application [3]. Sensing layer collects data by sensors, two-dimensional code, RFID, GPS, Beidou satellite system and a variety of cameras. Transport layer transfers data by fiber, satellites and a variety of network devices. The platform layer consisted of data center, a variety of operating systems and application software to store and process data. Application layer could provide many services such as smart transportation, smart house, smart medical, smart education, and smart environmental protection and so on.

Application Layer	Smart Transportation, Smart Medical, Smart Education Smart House, Smart Environmental Protection
Platform Layer	Data Security Platform, Data Store Platform Data Processing Platform, Software Development Platform
Transmission Layer	Optical Transmission, Wireless Transmission Network Equipments, Communication Equipments
Sensor Layer	Sensors, RFID, Two Dimensional Codes Cameras, Scanners, GPS/Beidou Satellites

Figure 1. System Function Architecture of Smart City

3. Characteristics of Smart City

3.1. Openness

The wireless sensor technology and wireless broadband technology will be widely applied in the smart city, a large number of network signal will be exposed in the air. If the security measures are not strong, the wireless signals emitted by the electronic label, not only can be perceived by the owner of the objects, other people can also track, locate and read. Due to electronic tag cost and technology were limited, the strong password mechanism can't be used, and the data can be more easily broken in the electronic tag [4]. Even for the wired network, because now more and more enterprises use the VPN mode to construct their network on the Internet, the boundary between internal and external network has been very fuzzy, most of the networks are opening and sharing network.

3.2. Mobility

Mobility is an important feature of smart city, also is an evaluation index in the smart city evaluation standards in the European Union [5]. The core objective of smart city is to make anyone get any information at any time and any place. The realization of this goal depends on the popularization and application of ubiquitous network and handy terminals. The traditional concept of the Internet will be gradually replaced by mobile Internet. Cloud computing technology can achieve reallocation of computing tasks, some complicated calculation can be accomplished by the cloud platform, thus reduce the handheld terminal load. The future smart city will be the city that based on mobile networks and mobile devices as the core information infrastructure [6].

3.3. Centralization

Smart city will adopt a large number of cloud computing technologies, and cloud computing means the information resources centralized. A cloud platform is a huge pool of IT resources, is a large scale computing center, storage center, data center and user center. The

centralized IT resources promote resource sharing and improve resource flexibility, at the same time, also will bring the huge potential risks [7].

3.4. Collaboration

Smart city can be "wisdom", because all the objects of smart city can use cloud computing, Internet of things and mobile network technologies to percept, transmit and response information each other. Therefore, many information systems in the smart city have beyond single institution and organizational boundaries; become a kind of social, open and collaborative system [8]. In the future, there will be more and more information systems of enterprises, government departments and social organizations develop towards networking, externalization and collaboration, except for a few secret information fields, most of the information systems will be open collaborative systems.

3.5. Permeability

In the smart city, the network information technology will be more deeply penetrating into every corner of society [9]. From the network perspective, Internet of things is the key infrastructure of smart city. The traditional Internet realized the connection between the computers each other, and the Internet of things can connect all items to be embedded sensing chip, the network scale increases greatly, and wireless broadband network further eliminates the limit of network time and position to be used by people. Therefore, whether in space or in time dimension, penetration level for network to human society will greatly enhance in the smart city.

4. Traditional Information Security Challenges

Information security system is a general term of a series of equipment, technologies, policies, laws and management measures for protecting information network, system and content to be used by legal users, and prohibiting the illegal users, hackers and attackers to use, theft, destruct information resources [10]. The smart city security system includes public information security literacy, security laws, effective management, information security technology and physical equipment security, as showed in the figure 2.

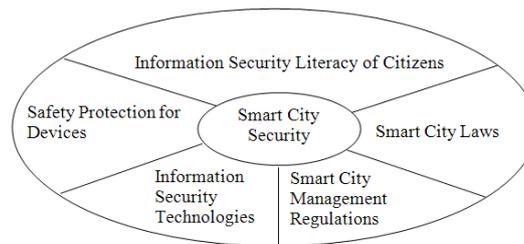


Figure 2. Security framework of Smart City

4.1. Physical Equipment Security Challenges

Smart city has mobility characteristics, a large number of sensing devices and user terminals will be laid and used, and it will bring new challenges to the information management. One hand, the computing ability, power supply and access rate are limited in the mobile devices and terminals of smart city, its own defense capability are weak, virus infection and attack probability increases greatly, and communication security and personal privacy of users are under great threat. On the other hand, sensing terminal equipment of smart city are often laid in the outdoor and even in the wild field, lacked effective monitoring, easy to cause information leak.

4.2. Information Security Technology Challenges

The development of information security technology has experienced two phases, first phase was the information security technology based on single machine isolation, and second phase was the information security technology based on user authentication. The former put a computer in the isolation security environment to prevent illegal users to access the computer. The latter confirmed user's identity with the account and password, so that only certain users could access network system. In the smart city, most of the information systems are open and collaborative, different systems interconnect each other, continue to carry out information transfer and exchange, traditional information security techniques will be challenged.

4.3. Information Management Regulation Challenges

In the traditional information environment, the information security management regulation mainly prevented the illegal hacker intrusion and other external threats. But in the smart city environment of cloud computing and Internet of things, information security threats become more serious from interior of IT service provider [11]. Therefore, in the smart city environment, information security management regulation must be reformed.

4.4. Information Security Laws Challenges

In the smart city, not only use the software and instruction to steal, destroy and illegal use information, but also can use software and instruction to destroy entity construction and equipment, but punishing such criminals can only reference the existing criminal law and Internet laws. Therefore, it is need to study laws for punishing the criminals in the Internet of Things.

4.5. Public Information Security Literacy Challenges

Under the condition of informatization, public's information security literacy includes information security awareness, knowledge, ability, ethics and other specific contents [12]. Although there are user information security literacy in the traditional information security system, but it mainly emphasis on the individual users' literacy in technology level, which can't meet the need of information security literacy in the smart city environment.

5. Information Security System Construction of Smart City

5.1. Cloud Computing Center Construction of Smart City

In the smart city, cloud computing platform is the core of data storage and processing, therefore, must attach great importance to design cloud computing security platform. Figure 3 showed the function of cloud computing security platform. The security service platform of smart city mainly includes security service supporting system, service operation system, service organization, standard specification service flow. The security service supporting system mainly includes the network trust service subsystem, data security service subsystem, security policy configuration service subsystem, security monitoring and situational awareness service subsystem, evaluation and assessment advisory services subsystem, emergency support service subsystem, security training and attack-defence service subsystem. Cloud security platform of smart city will form network trust, data security, policy configuration, security monitoring and situational awareness, grade assessment and evaluation consultation, emergency support, safety training, attack-defence practice and other security service ability to provide information security support services for smart city business system users, provide interfaces for information security supervision management departments and the platform operators.

5.2. Information Sharing and Analysis Center Organization Construction

In the smart city, Internet of things connects objects and objects, people and people, people and objects. Sensor, RFID, satellite equipment constantly aware objects, people and space information state, transport the sensing data to the cloud computing center through the Internet, cloud computing platform processes the data by big data technology, to analyze data from various running status of the city. How to interpret and use the data must be accomplished commonly by professionals and city managers. Therefore, should strengthen information sharing and analysis center organization construction in the smart city. In addition to general data processing departments, should set up a data analysis and application leadership team, the team leader should be held by smart city mayor, deputy team leader should be held by the data analysis technical personnel, members should be formed by relevant departments of the executive, every day online study smart city data report to make the results of data analysis timely apply to city management.

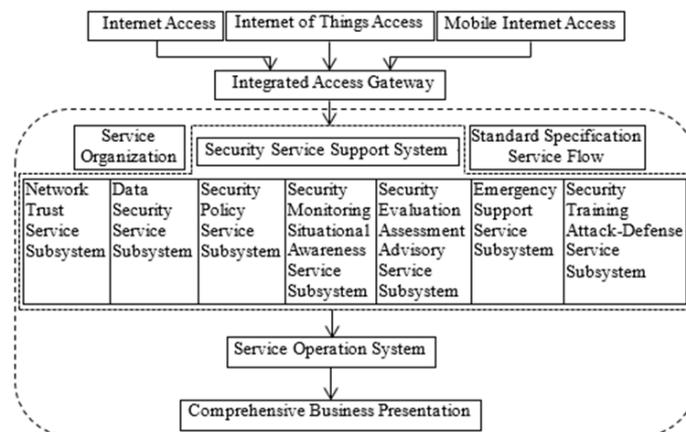


Figure 3. Cloud security platform of smart city

5.3. Construction of Social Information Security System

The information security problems of smart city has exceeded the scope of a person or an organization, all people and institutions must face it, collaborative prevent it, should establish social cooperation information security system.

(1) All people participation. In order to improve all enterprises and personal information security abilities, the government should strength educating and promoting information security to the majority of enterprises and public, adopt various ways and means, popularize information security knowledge, improve people's information security awareness, provide the relevant standards and recommends of information security protection to all enterprises and citizens, provide information security protection training and guidance for all enterprises and individuals, set up a good soft environment of smart city [13].

(2) The whole society collaborative response. Cloud security development and application provides the technical foundation for the entire society to deal with the information security problems. Each access information security service cloud user is a service object, but also an information node of completing distributed discriminant function. With the help of cloud security platform, hundreds of thousands of client machine collaboratively collect, analyze, share, and learn the new virus, hacker attacks and vulnerabilities to improve the accuracy and timeliness of information security.

(3) Information security management regulation. The construction of information security management regulation should consider the network and data security, external and internal security to form a full range of management institution. With smart city constant construction, information resource intensive risk will grow with each passing day, relatively information security protection objects should be changed to the network equipment protection and

information resources protection. In order to deal with threat internal tendency of information security of smart city, management focus on the future information security will continue to do well firewall and foreign intrusion detection system, as well transfer to the internal information security management. One hand, the organization should adopt active encryption, desktop management, network monitoring and audit system and other new security technology, on the other hand, to improve information management regulations, strengthen staff training, establish key data responsibility system, through management and technology two aspects to protect internal information security.

(4) Laws construction. The laws construction of smart city is to use the law to ensure physical space and network space security of smart city, at the same time, make smart city to be efficiently and coordinately operating. In the Internet of Things, through the virus, hacker attacks and other means can disrupt the intelligent vehicle, intelligent home appliances, even for industrial facilities, city buildings can be destroyed, so people's life and city society can be caused serious damage, and even cause social unrest. Because Internet of Things crime concealment and destruction are larger than physical space, so under the same property loss situation, should increase the punishment degree of Internet of Things crime, should be several times of physical space crime punishment, to make the punishment effect increase, and reduce crime activities of Internet of Things. At the same time, to strengthen the study of international laws of punishing cyber-crime, strengthen international cooperation, to form a good situation that the global commonly fight against network crime, ensure the security environment of Internet [14].

5.4. Development of New Information Security Technologies

(1) Intelligent recognition technology. Information security technology in the smart city open environment should be based on intelligent discrimination. This new information security technology can not only confirm the user in an open network, but also can real timely track user's information behavior, judge whether he brings the security problem, and take corresponding measures in a timely manner.

(2) Active defence technology. The future information protection means should be changed to active defence from passive defence, should use the active encryption system level information protection strategy, when data are transmitted between the different users, local and cloud platform, the organization and the cooperation organization, the security system can encrypt and decrypt the data, so as to ensure data security around the clock.

(3) Trusted computing technology. Trusted computing refers to security chip architecture is introduced in the smart city hardware platform to improve the security of terminal system through its' providing security features. Trusted computing can achieve three main functions, first is to defend the virus attacks through a trust chain, second is to set up a trusted identity to confirm counterfeit platform, third is to seal data into a safe area to achieve high safety data protection. Trusted computing can provide higher strength security and more flexible protection ways for the smart city [15].

6. Conclusions

Smart city construction, should from the view of system engineering, attaches great importance to the construction of information security system. Through the promotion of smart city citizens' information security literacy, strengthen laws construction, improve the information management regulations, carry out information security technology innovation, and strengthen protection of the physical equipment to ensure security and efficient operation of smart city.

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References

- [1] R. Q. Cui, Z. G. Wang and F. Lin, "The development of internet of things in China and related issues discussion," *Information China*, no. 4, (2013), pp. 66-69.
- [2] G. Yang, G. Geng, J. Du, Z. H. Liu and H. Han, "Security threats and measures for the internet of things," *Tsinghua Univ (Sci & Tech)*, vol. 51, no. 10, (2011), pp. 1335-1340.
- [3] C. S. Lee, G. M. Lee and W. S. Rhee, "Smart ubiquitous networks for future telecommunication environments", *Computer Standards & Interfaces*, no. 36, (2014), pp. 412-422.
- [4] A. S. Elmaghraby and M. M. Losavio, "Cyber security challenges in smart cities, safety, security and privacy", *Journal of Advanced Research*, no. 5, (2014), pp.491-497.
- [5] G. Song and L. Wu, "Smart city in perspective of innovation 2.0", *City Management*, no. 9, (2012), pp. 53-60.
- [6] E. Khorov, A. Lyakhov, A. Krotov and A. Guschin, "A survey on IEEE 802.11ah an enabling networking technology for smart cities", *Computer Communications*, no. 58, (2015), pp. 53-69.
- [7] G. Piro, I. Cianci, L. A. Grieco, G. Boggia and P. Camarda, "Information centric services in smart cities", *The Journal of Systems and Software*, no. 88, (2014), pp. 169-188.
- [8] D. R. Li, Y. Yao and Z. F. Shao, "The concept, supporting technologies and applications of smart city", *Journal of Engineering Studies*, no. 12, (2012), pp. 313-323.
- [9] J. Xu, "Key techniques of smart city and path to realization", *Telecommunications Science*, no. 8, (2013), pp. 123-126.
- [10] X. S. Zhan, "Promoting the construction of information security system," *Information Security and Communications Privacy*, no. 5, (2013), pp. 9-12.
- [11] Y. Han, Y. Gao, "Multi angle study of cloud computing security," *Modern Science & Technology of Telecommunications*, no. 6, (2013), pp. 74-78.
- [12] L. Luo, "The cultivation of national information security literacy," *Library and Information Service*, no. 3, (2012), pp. 25-29.
- [13] Y. Q. Zhu, "Research on soft environment construction of smart city", In *RSSC*, (2014), pp. 515-522.
- [14] K. X. Wang, "Analysis of the international cooperation mechanism of network security", *International Forum*, vol. 15, no. 5, (2013), pp. 1-7.
- [15] D. G. Feng, Y. Qin, D. Wang and X. B. Chu, "Research on trusted computing technology", *Journal of Computer Research and Development*, vol. 48, no. 8, (2011), pp. 1332-1349.

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