The Research of Data Center Construction for Smart City

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Abstract. Basic support is provided for system operation and analysis by Data Center, which is used as an important infrastructure of Smart City. Data Center is related to network, system integration, information security, data base, data mining, etc. The quality of Resource sharing and integration is influenced directly by construction effect of Data Center. The connotation and the composition of Data Center are researched, and according to the construction request of Data Center, a certain architecture of Smart City is put forward, and the content of data center is discussed, and the approach of construction idea is researched, and the application of data center for Smart City is discussed in this paper.

1. Introduction
With the rapid development of computer network and the gradual improving of information technology, the demand for data storage, data transmission, data processing and data management is requested higher and higher. Many information systems are constructed by governments and companies to solve a certain urban problems with the further advance of Smart City[1], but the general plan and the design coordination are rarely considered in specific application and data association of these systems, then data sharing and data utilization are very difficult between two systems. The data is not used enough so that requirements of integrated business management, public information service and government decision analysis can not be met, furthermore once the data is lost, huge economic loss or even social upheavals will be caused. Currently, a huge amount of money is invested in the construction of data center around the world, and Smart City has been push forward in depth with the rapid development of data center.

2. Data center architecture
2.1. Data center annotation
Various demands including people’s well-being, environmental protection, public safety, city service, business activity and so on can be responded intelligently by Smart City, which using information technology and communication technology to sense, analyze, and integrate all key message of core system for urban operation, substantially urban management and operation can be realized intellectually through advanced information technology, furthermore better life can be created for the people in the city[2]. An ecosystem can be regarded as by Smart City for the city itself, which is made up of citizens, transport, energy, business, communication, water resources and so on. By the aid of the new generation of internet of things, cloud computing, big data and other information technology, physical infrastructure, information infrastructure, social infrastructure and business infrastructure can be connected together to be new generation of intelligent infrastructure through instrumented, interconnected, intelligent type. It looks like a network neural system installed for the city in order to carry out command decisions, real-time response and coordinated operation.
Data center is the integration of electronic data and the computer network environment including information network, server, memory device, computer room environment, database, data warehouse and relevant application system in various fields of city. Data collection, data analysis and data integration are implemented from different heterogeneous databases via unified data definition, architecture and intensive data environment to realize data sharing and application.

2.2. Data center feature

Compare with common enterprise data center, although data center of Smart City is composed of software and hardware to realize business collaboration, unified data management, comprehensive decision analysis and other functions, there are differences in data size, integration range, application area and other fields.

The scale of data management of data center of Smart City is larger. Every aspect of common life and operational management is involved in Smart City in which all kinds of data are produced in every field so that only in several minutes the scale of data reaches a high level, about tens to hundreds TB, however only several applications is involved in common enterprise data center whose data scale is smaller, processing procedure is very simple.

The range of integration of data center of Smart City is wider. Not only the related data of remote data center is needed to integrate, but also the data from many application systems in traffic, logistics, security, medical treatment, education and other fields is needed to integrate in order to meet the needs of data management, data query and analysis.

The application area of Data Center of Smart City is larger. The data services is supplied not for a certain application system but for multiple domains, multiple industries and multiple applications to implement comprehensive decision analysis, data management and collaborative application that propose higher demand of data storage, data transmission, data usage and data management.

2.3. General logical architecture

According to the traditional architecture theory and current situation of city information, a certain general logical architecture which can be divided into the source data layer, the data collection layer, the data storage layer, the data application layer and the data display layer is presented [3], as shown in figure 1.

![General architecture of data center](image-url)
Data source can be made up of every built and to be built operational system, every saved file and non-digital data resource in the source data layer.
In the data collection layer, original data can be collected and cleaned up via data interface, and non-digital data resource can be collected via data entry [4]. The data from operational systems can be collected via data interface to realize data separation, data cleaning, data transformation and data loading into subject database and data warehouse of the data management layer in which place data can be integrated and extracted and purified.
In the data storage layer, every intermediate data collected can be handled and integrated into unified information resource via unified data definition according to the standard of the original data and resource directory. The information resource which is supplied to data storage and data management environment for enterprise subject is saved in central database.
In the data application layer, data support platform for operational processing and data management platform are supplied to realize meta data management and data coding management. Data warehouse is built on this basis to supply service via data sharing interface to get related data for all kinds of operational systems very conveniently and precisely.
In the data display layer, unified user management and system resource management can be realized by data query, statistics, analysis and other functions developed based on central database via unified data display page. Standardized management of business data and efficient query, statistics and on-line analysis processing can be carried out on this basis, furthermore unified and comprehensive data support can be supplied for the managers at all levels and the general public.

3. Data center composition
The traffic, the security, the medical treatment, the education and other fields are involved in Smart City, and application system is constructed for industrial characteristics in various fields. Mass data including fundamental data, subject data and synergistic data is produced in daily operational process, these data needs to be saved, transformed, transferred, analyzed and disposed in order to realize information coordination, decision analysis and general management. The data center of Smart City is composed of hardware infrastructure, data exchange platform, central database system and operational management system.

3.1. Hardware infrastructure
Hardware infrastructure including computer room LAN system, server storage system, load balancing system and standby system is the physical base and basic premise of the construction of data center of Smart City. LANS which is the basic platform of data center provides connection service between data center and various departments of the city as well as between data center and Internet. IPSAN technology is used to constructing storage hierarchy in the storage system, cluster technology is used to improve efficiency of application server. The amount of access of application server can be increased in load balancing system including servers and load balancing of internet export.

3.2. Data exchange platform
As the framework of service oriented architecture, data exchange service is provided to realize unified control and standard management in data transformation and transmission process by data exchange platform which is based on Enterprise Service Bus and built in a loosely coupled manner. The data exchange platform is composed of the connection layer, the transmission layer, the transformation layer and the monitor management layer; the connection layer provides connectors and adapters to heterogeneous systems under the premise of changing the information system in order to extract and release data to information bus according to a certain strategy. The transmission layer transfers data and message among all the systems to realize command communication of data and service. The transformation layer carries out unified data processing including the transformation of heterogeneous data and the inspection and the analysis of data validity. The monitor management provides powerful monitoring management tools to realize dispatching management, deployment management, configuration management and unified monitor management in the exchange and integration process.
3.3. Central database

Subject database, fundamental database and application extended database and data warehouse of data center of Smart City is composed of data systems from different application levels. The important fundamental subject data included in the subject layer is the standard, break-even and original basic data which is confirmed in enterprise overall data planning process generally, meanwhile the global data dictionary and the business data code is built on enterprise data model so as to provide the possible of data sharing.

The data extraction, cleaning, import, transformation, loading and other works are carried out in the ETL processing system[5]. The backstage processing technology is realized with meta database. The meta database is composed of source data described, standardized data of central database described and the rules of business code correspondence.

ODS is used to storage data which is extracted from operational system directly, these data is in accordance with business system in the aspect of the data structure and the logical relationship between data, then the complexity of data transformation is greatly reduced in data extraction process. Some detail data which is not permanent reserved and is needed to query in a period of time for users can be left in ODS, then the storage pressure of data warehouse and data market may be relieved, and also fast inquiry can be provided for users. ODS has the characteristics of OLTP, the sharing and real-time performance can be realized in ODS, as shown in figure2.

3.4. Operational management system

Operational management system is composed of security system, maintenance system and so on. The main function of the security system which guarantees the security of central network and data is composed of firewall, intrusion-detection system, auditing system, antiviral system and related rules and regulations of safety management. The system has the functions of network security scan, intrusion detection, access control, security audit, IP embezzlement prevention, hidden danger scan, bug fix and so on. The maintenance system which is composed of condition monitoring of network and...
servers, equipment management, network traffic inspecting management, WEB business management, fire control monitoring, temperature and humidity supervision, video monitoring, entrance guard and so on realizes the monitor of network operational status of data center.

4. Construction method and thinking

4.1. Construction method

The construction of data center of Smart City is involved massive heterogeneous data, thus the higher demand for back-up storage and data exchange process. The visualization of storage systems and servers, integration of heterogeneous data, data exchange and other methods are needed to realize.

Through increasing the use rate of servers and storage systems to reduce the amount of machine use, and integrating various of service or functions, management simplification and background complexity concealment can be achieved by visualization technology. In order to achieve optical storage effect, a visualization solution combined with hardware and software when a new data center is deployed. Storage visualization and server visualization can be used to realized the reasonable allocation of storage resources. Many physical disks can be visualized to a logical storage device to realize the unified management of users and reasonable dispatch of data storage location and concurrency by storage visualization. A physical server can be visualized to some logical servers to help users to deploy different operating systems and applications on every logical servers by server visualization.

Information is integrated and associated orderly by advanced data analysis method, also data is displayed and analyzed flexibly so as to provide decision support for management, on-line analysis process and data mining. Data integration is not simple extraction all the information from various business systems, but selective integration business data according to the needs of all aspects, especially shared data, data for management decision, data for public service and final result information, thus there is no need to pay attention to procedure information from each business system. Data integration process contains the data combing, data acquisition and verification, data analysis and transformation, data integration and storage. Related business process and data flow are sorted out to confirm the only data source in data combing process. Data from data source can be acquired and completely verified, also the duplicate data is removed by data exchange platform. Data formats can be transformed on the basis of business logic and unified data standard. Data from multiple sources can be integrated to central database according to data integration logic.

Various of application systems can be interconnected by unified data exchange standard to realize data exchange and sharing between heterogeneous systems of Smart City. As an exchange platform, data storage layer and application layer of application systems can be shielded for users by data center. Data can be exchanged cross data bases, operational platforms and even development platforms. Seamless exchange and shared access can be carried out through backstage interface of data process. Original application systems are not needed to be modified or redeveloped, they can not only provide general data services for upper application by using data center to deal with business data between them and various systems, but also carry out operational management and maintenance relatively and independently. Web service, XML and middle-ware technology are used to realize unified parsing, transformation, encapsulation standard and complete message services.

4.2. Construction thinking

It is a very complicated systematic engineering for the construction of data center. First, business demand research is needed to be carried out, current situation of various industries of Smart City, demand for decision analysis are needed to be understood, various business data should be combed, data center is designed according to information standard, data in each system is divided into private data which is used in the department only and shared data which is related to the data from other systems. Second, the extraction and transformation tools are needed to be designed, the data conceptual, the data logical model and the physical model are needed to be built, then data storage methods and strategies are distinguished, data from each system is integrated to data center by extracting shared data and transforming into unified standard data form. Third, the administrator of data
center system assigns permissions and practices management for the whole data center. Last, the required data is proposed from standard data center by each system according to different privileges given, different needs can be met by using synchronous or asynchronous update.

5. Conclusion
According to the demand for data integration and data analysis service of Smart City, the architecture and the composition are researched and presented combined with the development situation of Smart City, the method and the thinking of the construction of data center are analyzed and discussed, some approaches of the data center of Smart City are presented, important reference is provided for the follow-up construction of data center of Smart City.

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