International Journal of Smart Home
Vol.8, No.3 (2014), pp.49-60
http://dx.doi.org/10.14257/ijsh.2014.8.3.05

A Proposed Scheme for City Family Health Information System

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Abstract

This paper presents a proposed scheme of City Family Health Information System (CFHIS). According to investigation, we have found out lots of drawbacks in the existing Electronic Healthcare Records. Here puts forward a scheme of CFHIS to give a solution to the problems like information isolation, dead data and fluent population management with technologies as follows: system hierarchical model, SOA-based Web Service platform, heterogeneous data integration, data exchange platform, multi-level data center, data warehouse, dynamic data updating, knowledge service model, portal service, etc.

Keywords: *Heterogeneous information integration, e-Health Record, data exchange platform, multi-level data center, data dynamic updating*

1. Introduction

As a country of one fifth of the world population, China's population has long been an overall and fundamental problem in the process of China's primary stage towards socialism and also it is the key factor that is influencing the economic and social development. It is urgent to establish a Population Holo-System through the confluence of human resources and information resources which combine different sectors, different divisions and different subjects. The Population Holo-System, which would be contrary to the traditional Population (household registration) Management System that usually as a closed system separated with others, should pay close attention to Family as a unit and mainly concern civilian rights and interests. Horizontally speaking, the traditional Population Management System lacks of expanding ability and information exchange with other systems. For instance, one cannot access the medical health records with the other one. Vertically speaking, it lacks of network access for information uploading and downloading, which leads to management departments at all levels of government are unable to monitor and manage the dynamic population data. Besides, there also exist troubles and inefficiencies when dealing with the fluent population especially with the women of childbearing age under traditional population management system.

Currently, we should highlight peoples' all-round development by breaking up information isolation and actively promoting Human-Centered Technology and e-Health. Based on Holo-System Engineering which was put forward by Song Academy and with the orientation towards requirements and services, the establishment of City Family Health Information System (CFHIS) crossing different divisions, different sectors, different fields and different subjects as a whole would on no doubt contribute

ISSN: 1975-4094 IJSH

to promote accumulation and development of the population holo-resources, to improve population service environment and optimize the population structure. Also, CFHIS could guide the rational distribution of population, and enhance the cooperation and resources sharing among sectors. To some extent, CFHIS would help forward the transformation from a country with a large population to the one with great power of human resource, and also it would be beneficial to a coordinated and sustained development of population, economy, society, resources and environment.

2. Requirements Analysis

According to the prior investigation and study we put forward the idea of overall design of CFHIS aiming to address the existing problems emerged in the aspect of population management. CFHIS's users include service requester (terminal user) and service provider (such as hospital, public health center, sanitation institutions, consultants from all areas). Here we mainly focus on the terminal users and analyze their requirements, then separate these requirements into five classes which compose the data of e-Health Record. The users were divided into two groups: one is under the constant circumstance and the other corresponding to the emergency situation. Finally, the significance of confidential of E-Health Record data and the establishment of information platform was put forward.

(1) E-Health Record

After investigating and studying the user's requirements, we generalize the information contained in the E-Health Record as follows.

- Personal ID and family registered information.
- Basic health information including physical and mental information.
- Conduct information related with health.
- Health experience and medical reception experience.
- Health medical and reception record.

(2) Constant State and non-constant State Groups

Constant state groups are those under stable social environment circumstances and without occurrence of emergency. Non-constant state groups are those suffering earthquake, flood, snowstorm, infectious disease, emergency of health sanitation and those victim-related people are also included. The two kinds of requirements mentioned above are different.

a) e-Health Information Collection: The existing e-Health Record's information collection is completed through medical worker's paying visit to users, asking, recording and inputting relative information to the computer with hand operation. Problems come up when doing those procedures (according to ZhaBei district community sanitation service center in Shanghai):

- Tedious and lots of work load are needed.
- There still calls for much longer time to wholly record all the people alive in this district.
- The existing E-Health Record has more than 450 data items and the format design is not personified.
- Inaccuracy and error happens frequently when collecting E-Health Record data.
- So far, there has been no record for updating the existing E-Health Record which bare little benefit to the terminal users

CFHIS data collection could be done through the co work by user and consultant in the process of service, study and usage, which eventually accomplish the "co-creation" of user and service providers'. Intelligent terminals such as PDA can access users' E-Health Record data to e-Health database

b) Patterns for Information Service: To date, information isolation is a nationwide phenomenon. CFHIS would break up the information isolation by connecting separate medical institution, sanitation sectors, health advisor center, and the specialists themselves. CFHIS's information platform is supposed to contain all the detailed information (name, address, work site, specialty) of the service advisor and provider. Users of illiteracy would find it is hard and inconvenient to record his or her information. Then the consultant team is expected to turn up to help the illiteracy to access his or her information and to help seek for the suitable service provider.

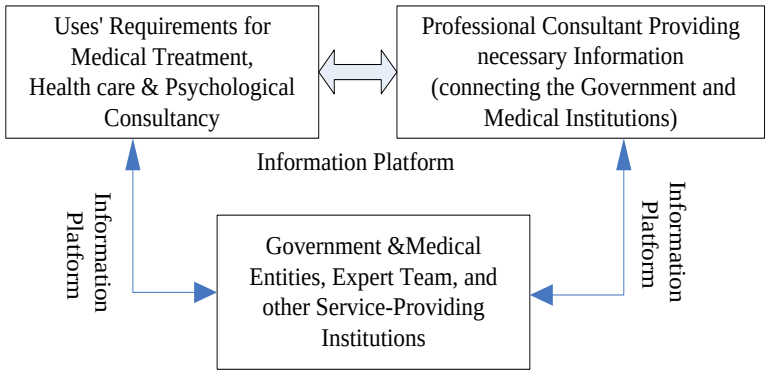

Figure 1. Patterns for Information Circulation

c) Consultant Team Building: Consultant team building refers to the consultant team developing of various domains, including psychologist consultant, health care consultant and so on. The consultant would play an important role in connecting the service advisor and the provider. Therefore, like a bridge, the consultant must hold comprehensive and the latest information of both the service providers and the service advisors.

3. Overall Design for CFHIS System

(1) Guiding Principle

With Population Holo-System Engineering proposed by Song academician as the reference frame and Human-Centered Technology & Electronic Health as the starting point, Co-Creation by users and service providers as the method, we can establish a cross-region, cross-sector, cross-field information platform by the usage of computer and information technology. CFHIS information platform should adhere to "one network, one platform and one data standard" principle and integrate technology, consultant service, E-Health Record management, human resources and information resource into a whole.

(2) Overall Design

a) Integration of Human Resources and Information Technology:

CFHIS would integrate human resource and information resources. Occupational health consultant is expected to be the human resources, which were transformed from Population & Family Plan workers, medical and health workers and social workers

throughout urban and rural areas. Information resources covers the population (structure, fluency, distribution), sanitation filed (food security, living conditions) and the population related information (social, economic, resource). Besides, non-constant state information (such as earthquake, snowstorm) should be also count in.

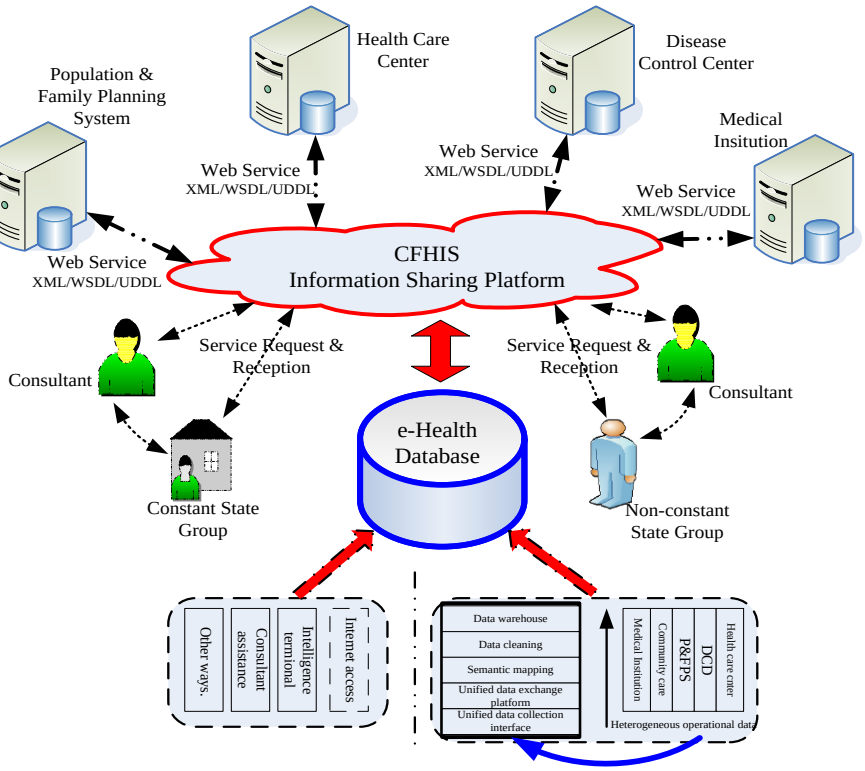

Figure 2. CFHIS Overall Structure Framework

b) Technology Support:

We could make full use of the information technology, including information exchange platform, middleware, data center, data warehouse and data mining, to construct national-wide CFHIS information sharing platform. The information sharing platform would combine the Population and Family Plan network, medical treatment network and health care service network.

c) Overview of CFHIS Functions:

CFHIS's functions are expecting as follows: Constructing an national-wide Family-Population and Health information management system; providing health care for all the people; integrating existing operation systems into a comprehensive one; realizing the cooperation among different institutions and organizations of different levels; combining the national medical treatment sectors with health care institutions; building an e-government platform for population and health care management.

4. Technology Developing Scheme

CFHIS technology developing scheme would contain following parts: the first part generalizes CFHIS system's hierarchical model which should resolve the whole data uploading from heterogeneous systems to data warehouse, and then through Business

Intelligence model to help realize decision making analysis and data mining service; the second part focuses on CFHIS's developing platform; the third part summarizes the standard system; the fourth part elaborates the technology products as follows: heterogeneous system data integration, data exchange platform, multi-level data center, data warehouse, business intelligence model, dynamic data updating, knowledge service model and service portal.

(1) System Hierarchical Model

Heterogeneous System (built on population and family plan network) is the data infrastructure of the CFHIS. Unified data collection interface should meet the requirements of the operational system. Through unified data exchange platform, data from unified data collection interface converges to regional data center. Regional data center deliver the operational data to data warehouse by semantic mapping service and data cleaning service. Business intelligence would help construct mathematic model that fit for family-population and health data, to implement management and decision making service [1].

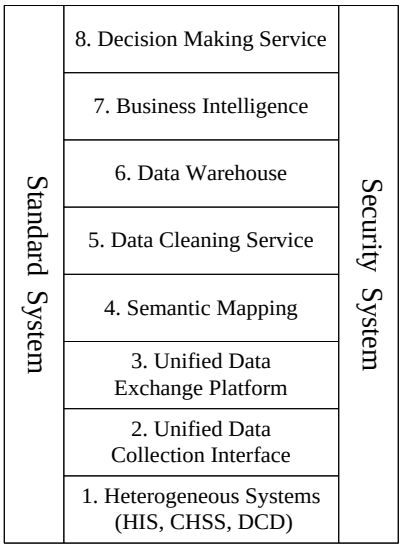

Figure 3. CFHIS Hierarchical Model

Consequently, decision making service portal would display the computing results through browser and Geographic Information System (GIS) service.

(2) SOA-based Web Service Platform

As an architecture model, SOA's (Service-Oriented Architecture) core is service. SOA architecture can easily integrate different information systems into one to improve parallel integration among systems, to enable different systems to access to CFHIS. Essentially, SOA completely separates service from technology, thus realize the service integration and reorganization to the maximum extent possible.

SOA is based on three rules (service provider, service requestor, service registry) and three actions (release, find, binding). Service provider describes its Web Service through WSDL (Web Service Description Language), and then transmits the web service to UDDI (Universal Description, Discovery, and Integration) [2]. Service advisor transmit service request to

service provider through SOAP (Simple Object Access Protocol). Service registry center mainly helps search services catering for advisor's request in UDDL.

Web Service enables these totally different system platforms to interoperate with each other and to call on the internet. Through HTTP protocol, XML language and Web Service technology (using SOAP, UDDL, WSDL standard), each heterogeneous system can interact its application program with others' [3].Besides, Application program can be applied to Windows clients, Web clients, cell phones, PDA or any other intelligence equipment that has access to the internet, which would achieve a cross-platform, cross-system distributed applications and solve the problem such as information isolation.

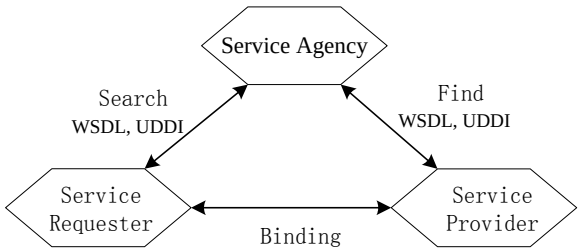

Figure 4. SOA Architecture Framework

(3) Standardization

CFHIS's standard system should be based on national-wide family-population & health information sharing and data communication among different systems. The standard system can be summarized into the following three parts:

- Basic data set standard of CFHIS.
- Index items classification system of Family population and Health.
- Heterogeneous subsystem exchange interface standard of CFHIS.

(4) Technology Products

a) Heterogeneous data integration:

According to the semantic net technology, there is no need to standardize the data collected from Heterogeneous system clients. As long as matching the medical description, the data can be uploaded to data center through unified data interface [4]. Data center delivers data to data warehouse after semantic mapping and data cleaning by means of semantic network service. Semantic net technology helps deploy system and enable the data collecting and extracting rapidly. The biggest advantage of semantic net is that computer would be able to intelligently evaluate the data stored in network space, and thus it seems as if the computer itself bares the ability to understand, judge and deduce [5].

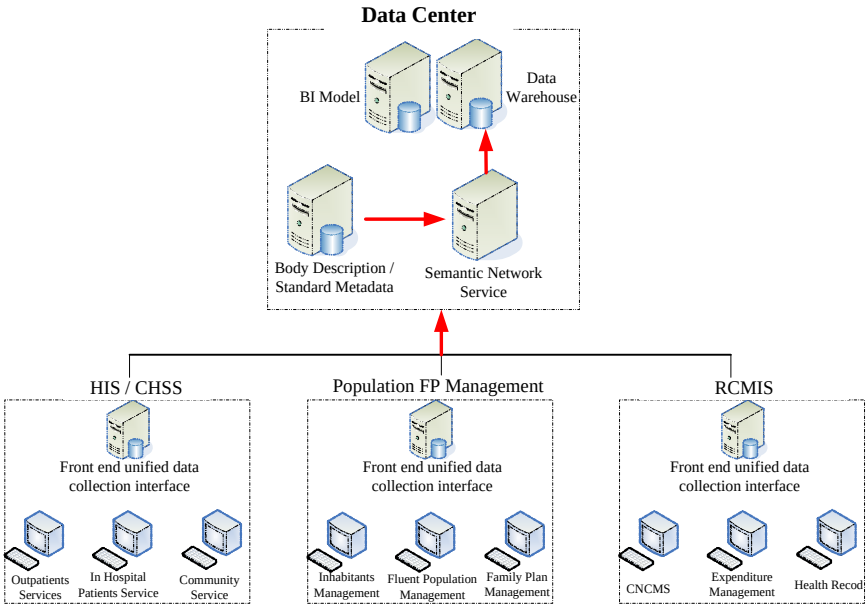

Figure 5. Heterogeneous Data Integration through Semantic Net

b) Data exchange platform:

Data exchange platform would be the common platform for data exchange in internet environment. CFHIS design is based on J2EE architecture, which makes the operation system bare no relation to database. So, the users could select the different operation systems and database platforms according to their actual condition.

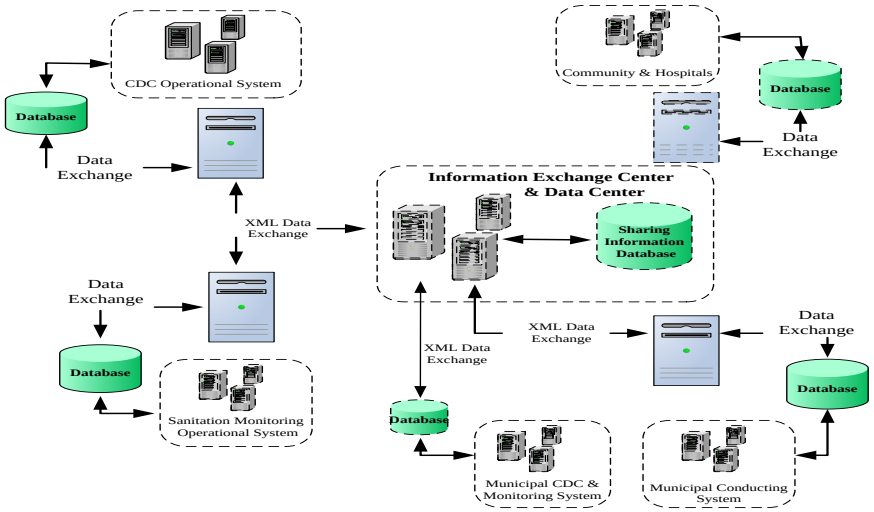

Figure 6. Data Exchange Platform Schematic

Found on Web Service, encapsulated through XML format, data exchange becomes extraordinarily convenient [6]. Exchangeable data mainly composed of public health records, electronic medical records and user's basic ID information.

Multi-level data center: Figure 7 shows city-level data center interconnect with state-level data center through unified data exchange platform, achieving distributed deployment and E-Health Record information synchronizing of CFHIS [7]. Contrary to the traditional family plan management system, CFHIS could enable the grass-root management systems of National Population and Family Plan Commission interconnect with each other and, these systems could also exchange and share the information with other sectors like Hospital Information System, Community Health Management System and Rural Cooperation Management Information System. Through collecting and sharing different operational systems' data, on one hand we could obtain intact family-population and health information and, on the other hand, CFHIS could provide service for users through expert's team system. One can access his or her E-Health Record information through data exchange platform in different regions [8].

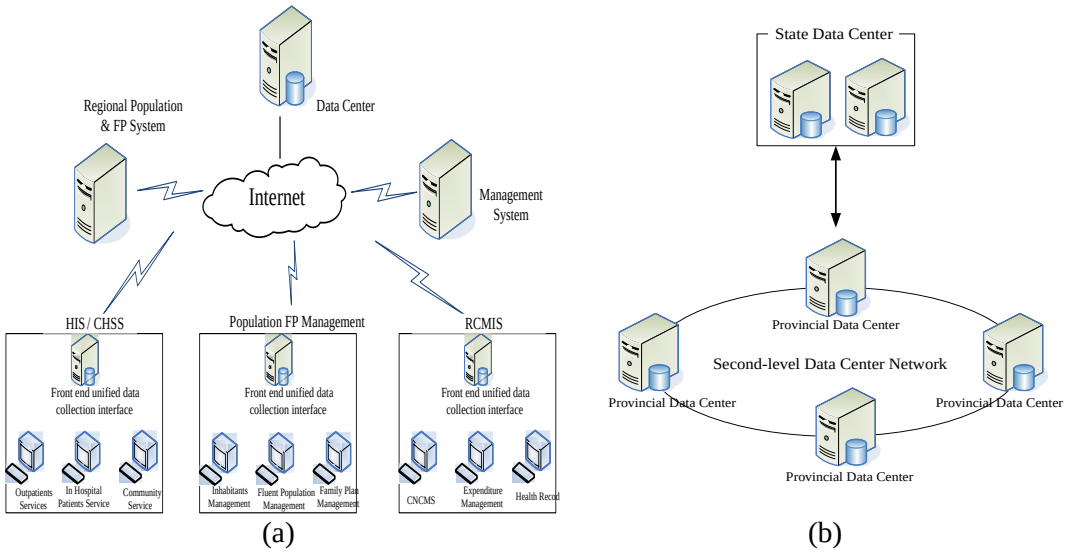

Figure 7. Multi-level Data Center

c) Data warehouse and mathematic model:

Data warehouse could integrate E-Health Record data from different heterogeneous systems. Data warehouse highlights decision maker's data modeling and data analysis other than dealing with everyday matters [9]. BI model means by use of the modern data warehouse technology, online analytic processing technology, data mining and data displaying technology to realize commercial value. Mathematical model is the core of Business Intelligence. Through the four steps of defining problem, building model, verifying model, deploying model we could establish a management and decision making multi-dimensional data model. The establishment of mathematical model would be a dynamic process and should be modified according to the concrete requirement conditions. The process could be separated as following steps: define problem; prepare for data; browsers data; verify model; deploy and update data. Fig.8 shows apparently it is a circulation process; however, each step can flip over the next step instead of going straightly to the next step [10].

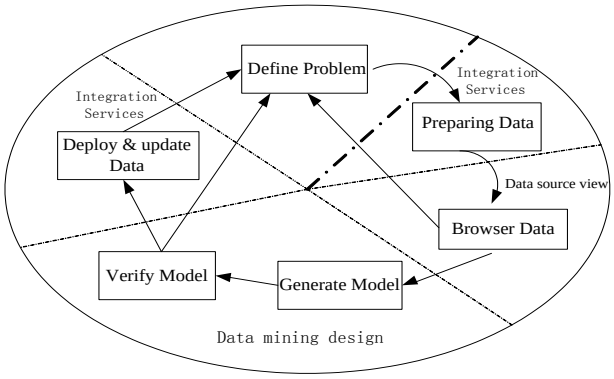

Figure 8. Mathematical Model for Business Intelligence

d) Dynamic Data updating:

Ajax adopts long-distance script call technology, asynchronously achieving web page data updating. Contrary to the traditional Web technology, there is extra mesosphere (Ajax engine) between client and server. Consequently, not all of the requests are submitted to the server but partially. Only when it is necessary to access data from server can client call Ajax engine through JavaScript and send Http request to the server. When the XML data reverse back from the server, Ajax engine receives these data and appoints JavaScript to finish corresponding web page updating other than refresh the whole page, to achieve asynchronous response between user operation and server [11].

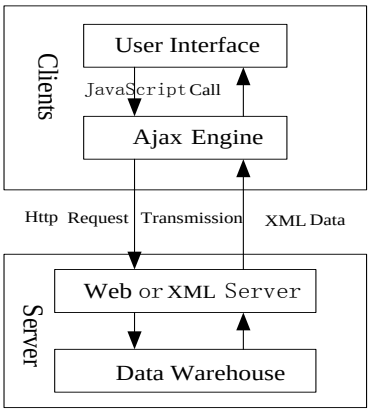

Figure 9. Ajax Technology Support System for Data Updating

Knowledge Service Model: Knowledge service model (under the semantic net environment) would be composed of several parts: user requirements, intelligence agency, field body, deduction engine, unified information resource spaces and intelligence query [12]. The user requirements block could receive users' requirement information by virtue of visualized web page; intelligence agency could mainly in charge of semantic description on user's requirements and obtain individual information; field body would stress on the definition and description of semantic clearance and field knowledge; deduction engine carries out deduction and analysis on the user's requirements in line with the deduction rules and tactics; unified information resources spaces enable information resource libraries interoperate with each other; finally, through intelligence inquiry from the unified information resources space we could obtain user's expecting information.

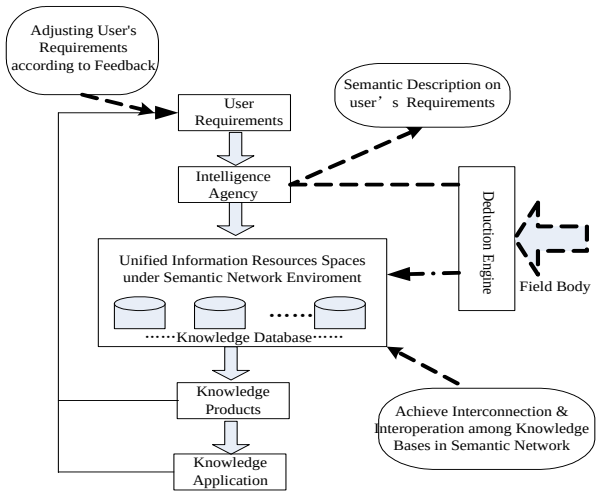

Figure 10. Knowledge Service Model

Portal Service: Portal service, with its architecture based on credence and unified authorized service platform, would integrate service portal and each application systems. The architecture follows "one entrance, one exit" principle, providing application services for sectors through unified service portal [13]. Responding to upper layer's application service request and calling lower layer operational system resources, the portal service could realize the running of workflow and dataflow which driven by events. Figure 11 shows the population and health service platform framework is an open system. Population and health portal services systems and application systems and other existing application systems could be seen as components interposed to CFHIS platform, or as blocks of portals managed by portals.

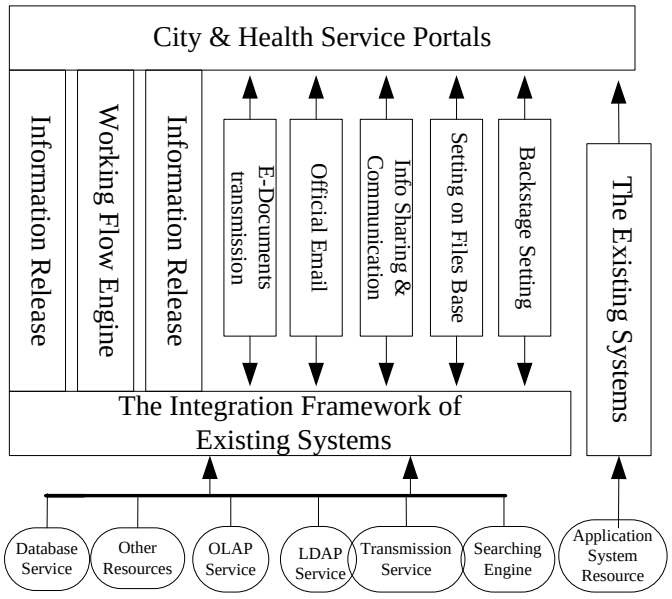

Figure 11. Service Portal

5. Conclusion

For dealing with the problems and troubles encountered in the existing E-Health Record and Family-Population & Health information management, we would like to put forward the CFHIS scheme. The CFHIS scheme would give a solution to the problems like "information isolation" and "dead data" Also, it could combine the human resources with information technology, building a national wide dynamic data updating system to realize real-time monitoring on City Family-Population & Health data while providing overall service for the whole population. However, much effort should be made before accomplishing this object and the combining of human resources and information technology is really a hard one.

Acknowledgements

This work was supported by *2012 Shanghai the Twelfth Five-Year Plan connotation construction projects* No.085-X12543, and *Young University Teachers Training Plan of Shanghai Municipality under Grant* No.SXY12003, No. ZZSD13008. *Management department of Shanghai Business School* NH1-2-1-1316. We gratefully acknowledge and thank those who provided data and suggestions. The anonymous reviewers and the editor of this paper are also acknowledged for their constructive comments and suggestions.

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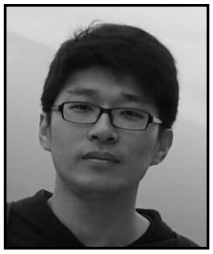

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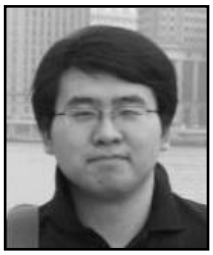

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