

THE DESIGN AND IMPLEMENTATION OF THE INTEGRATED DECISION SUPPORT SYSTEM ON LABOR MARKET

Dongjin Yu^{1,2}

¹Hangzhou Dianzi University, Hangzhou, 310018, China

²Zhejiang Gongshang University, Hangzhou, 310018, China

Shixin Feng

Information Center of Labor and Social Security, Hangzhou, 310003, China

Guangming Wang

Zhejiang Gongshang University, Hangzhou, 310018, China

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Abstract: Nowadays labor resources in China face the fierce situation in their employment. The decision support system on labor market helps the government to have a sound grip of the composition, migration and trend of regional labor resources' supply and requirement. This paper proposes an integrated architecture of the decision support system on regional labor markets, which leverages the Service Oriented Architecture. The real system implemented on this architecture, called as LMDSS, is also presented to show the features of the multi-dimension analysis of job introducing.

1 INTRODUCTION

Since 1990s, significant changes have taken place in the labor market of China. According to Chinese statistical yearbooks, the number of registered unemployed persons in urban areas rises steadily from 7.70 million in 2002, to 8.00 million in 2003, 8.27 million in 2004, 8.39 million in 2005 and 8.47 million in 2006 at the registered unemployment rate no less than 4.0% approximately each year (National Bureau of Statistics of China. (ed), 2002 to 2007).

With the implementation of so-called Golden Security Project launched since 2001, many cities in China have established the Labor Market Information Systems (LMIS), which provide the capabilities of employment related information services. LMIS focuses on business functions such as unemployment registering, job introducing, professional training and unemployment fund allocation. Although LMIS usually stores a large amount of historical business data, it does not support decision making. However, the decision makers in government agencies usually want to

discover the composition and its migration for both the regional unemployment and employment. Questions frequently arise as: which group is most vulnerable to unemployment? Which kind of irregular employment is most popular? Only with these information at hand, could they adopt the effective and positive employment policies.

Decision Support System (DSS) represents the promise of enhancing managerial effectiveness by improving the quality of decision making, in terms of depth of analysis, breadth of synthesis, timeliness, and systemic perspective (Gonzalez, 1993). Since the concept of DSS was first launched by Gorry and Scott Morton (Gorry and Morton, 1971), substantial research has been conducted, especially in its different application fields. Study on DSS with the area of labor market commonly focuses on the selection of candidates for recruitment. For instances, Nina gives a Decision Support System based on fuzzy logic model for Human Resources Appraisal and Selection (HRAS) (Ruskova, 2002), and Liang-Chih Huang constructs a novel model for evaluation of managerial talent in DSS through fuzzy

neural network (Huang and Huang, 2004). The Recommender System for job seekers and employers is another application field given much attention. Tobias Keim presents a unified multilayer framework supporting the matching of individuals for recruitment in (Keim, 2007). However, the analysis of composition, migration and trends for regional labor market is less concerned.

This paper introduces the framework and its implementation of decision support system for labor market, called LMDSS. Based on Services Oriented Architecture, LMDSS accomplishes the interaction with other related information systems. It is constructed on the data warehouse, and leverages the technology of Online Analytic Processing (OLAP) and data mining. OLAP helps ad-hoc query via data slice, dice, drill up, drill down and swap, while data mining helps discover the implicit and valuable information such as patterns, trends and characteristics.

The paper proceeds as follows. Section 2 shows the overall architecture of LMDSS, as well as its features. Section 3 discusses its characteristic on services orientation. The implementation of LMDSS is presented in Section 4, especially on its multi-dimension analysis of job introducing. Finally, in Section 5, some concluding remarks and interesting open issues are sketched.

2 THE ARCHITECTURE OF LMDSS

The overall architecture of LMDSS mainly consists of the framework, meta-data management module, data collection module, data online analysis module and data mining module as showing in Fig 1.

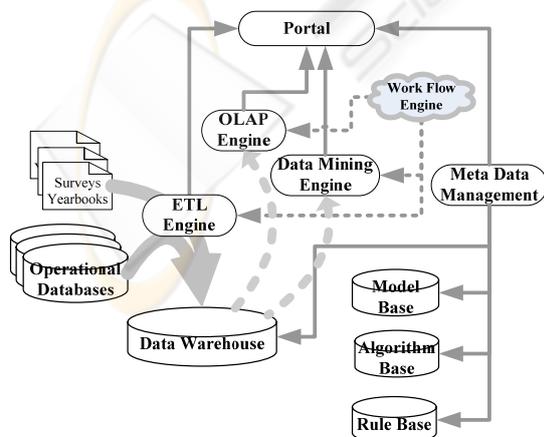


Figure 1: The Architecture of LMDSS.

The framework provides the running-time environment, supporting portal, workflow management, security control and knowledge sharing, while the meta-data management module maintains the related models, algorithms and rules.

The core of system implements data collection, analysis and mining. It integrates the records via the ETL (Extract-Transform-Load) engine from the related operational systems, the survey results and the economic leading index published in yearbooks, and then constructs the data warehouse. Currently, LMDSS stores the following themes of data: registering of unemployment, unemployment funding, enterprise employment, individual job-hunting records, and the urban and rural labor resources.

The data analysis module focuses on the multi-dimensional drilling of certain regional labor market measures, like the number of posts wanted, the amount of unemployment fund paid, etc. The data mining module offers the medium-short-term forecast of the overall labor resources' supply-demand, the medium-long-term forecast of its components, and also the profit-loss analysis of unemployment fund. In addition, certain key features could be discovered through the process of data classification, clustering and association.

The resource layer in Fig. 1 is composed of the data warehouse providing the standard JDBC interfaces and other data sources located by JNDI, including the model base for schemes of themes, the algorithm base for data mining and the rule base for constraint. For system administrating, the interface layer provides the desktop application based on Eclipse. Meanwhile, the browser based pages are also given for data presentation.

3 DESIGN OF SERVICES ORIENTED INTEGRATION

LMDSS is not independent and needs to interact with other systems like the labor market operational system, the social security operational system and so on. For instances, LMDSS retrieves post-wanted records from the labor market operational system and unemployment payment records from the social security operational system. Besides, operational systems reuse the algorithms provided by LMDSS to implement their own business analysis.

Traditional DSSs are somewhat difficult to integrate new functions or connect to other systems

due to the deficiency in openness (Chi et al., 2005). The specific adapters are usually developed to connect all these heterogeneous systems. Instead, LMDSS leverages the Service Oriented Architecture to achieve the application coupling. Service Oriented Architecture (SOA) is a paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations.

Using the standard SOA approach, LMDSS provides open access to its OLAP engine with multi-dimensional data through web services. In LMDSS, the execution of MDX (Multidimensional Expressions) statements is provided as web services via XMLA (XML for Analysis) protocol, which specifies a set of XML message interfaces that use the industry standard Simple Object Access Protocol (SOAP) to define data access interaction between a client application and an analytical data provider working over the Internet. Once receiving requests of multi-dimensional queries, the OLAP engine in LMDSS parses the MDX statement into SQL statement and then access the data warehouse. Finally, the OLAP engine reformats the result with SOAP and returns the messages back to the client.

In addition, the core data mining algorithms are encapsulated as SCA (Service Component Architecture) components. Therefore, with the help of WSDL defined interfaces, LMDSS provides the capabilities of on-demand invoking of it's inner mining algorithms for outside systems.

4 THE IMPLEMENTATION OF MULTI-DIMENSION ANALYSIS

The data online analysis module in LMDSS is implemented through OLAP technology. The multi-dimension data set is organized as cubes, measures and dimensions, while the dimensions are further expressed by hierarchies and levels. Once fetched from the data warehouse, the result set is temporarily kept in the server's memory. If the new query could be calculated directly from the data in memory, no more reading of warehouse is needed. Moreover, the frequently used joins of fact tables and dimension tables are materialized in advance. If possible, the SQL statements are rewritten to access the materialized tables instead of the underlying fact

tables and dimension tables. Experiments have shown the performance of data retrieving could be significantly improved.

Fig. 2 gives the screen shot for the analysis of job introducing in LMDSS, which presents 3 dimensions as unit types, data issued and education levels, and also 2 measures as the number of the wanted and the number of the successfully introduced.

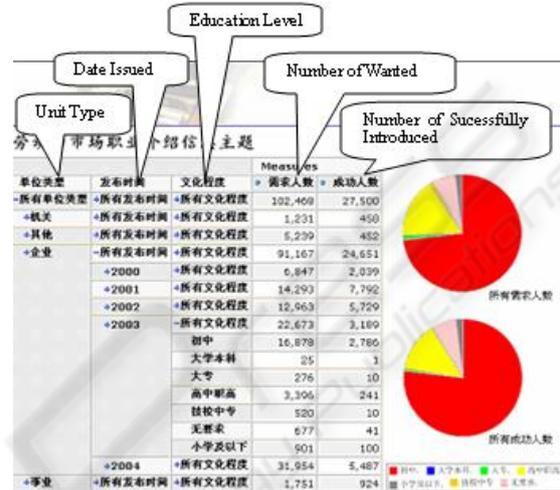


Figure 2: The screen shot for the multi-dimension analysis of job introducing.

5 CONCLUSIONS

The decision support system for labor market need to be architecturally flexible and extensible. LMDSS leverages the SOA and aids the decision-makers by presenting multi-dimension analysis. The data source are mainly the records retrieved from the labor market information systems, plus the statistical data from surveys and yearbooks.

Because of the huge amount of related operational records and their distribution, the model of distributed data analysis need to be further studied. For the next step, LMDSS is expected to be migrated to the grid platform, and Globus is thought to be the ideal candidate.

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