Study on the Integrated Framework of Supply Chain Core Enterprise Data Center Based on SOA

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Abstract-In order to establish the supply chain core enterprise data center, problems among business sectors and partners, such as "data isolated island" and so on, need to be solved. This paper is comprised of two components, the first is an integrated framework of enterprise data center based on Service-Oriented Architecture (SOA). In the second part of our paper, we apply the realization of the idea to a certain enterprise's data management platform. The frame has formed the general model after extraction and successfully implemented in an enterprise group. Practice has proved that, the application of the data platform has solved the data sharing problem. Moreover, it has improved the efficiency of the historical data comparison and data decision analysis.

Keywords-supply chain core enterprise; data center; SOA; integrated framework

I. INTRODUCTION

In order to ensure the benefits of supply chain, the enterprise and inter-enterprises must realize the sharing of information, therefore the construction of core enterprise data center is critical. Enterprise data center is the integration and sharing platform for business systems and data resources. Unified enterprise data center platform will effectively improve data sharing and utilization, provide support for enterprise management and decision-making, and make the supply chain enterprises to respond rapidly to changes of external. However, the creation of enterprise data centers faces the data sharing problem among business sectors and partners; Enterprise business systems such as ERP systems, procurement systems, ITSM systems operate independently and these independent, heterogeneous, closed systems form the "information isolated island ", limiting the efficiency of the core business.

In response to these problems, the current solution is the traditional data integration technology through a dedicated point to point interface program to achieve information sharing and exchange [1]. However, this kind of technology is unable to adapt to frequent changes in business processes needs by ignoring the logic of the business association although it may solve the problem of heterogeneous data. In order to maximize the reuse of existing information systems and to develop services for demand rapidly, this paper proposes a service-oriented architecture-based (Service-Oriented Architecture, SOA) integration approach to support the integration of the business, making it a interrelated, reusable business or service in order to effectively achieve information systems reusability, interoperability, so that business staff can quickly and swiftly implement business services.

II. INTEGRATED FRAMEWORK BASED ON SOA

A. SOA Technology

SOA is a component model, which links different application functional units (called services) through well-defined interfaces and contracts. Interfaces are defined in a neutral manner, which is independent of the hardware platform, operating system and programming language, so that the services can interact by unity and common means [2]. SOA support business integration, making it flexible and reusable services. SOA is a business-driven architecture, which has the characteristics of reusability, abstraction, formality and Clarity [3].

SOA as a systematic framework ideology, not a language, not a specific technique, nor is it a specific technology, but a kind of design method [4], the main implementation technologies are Web Service, ESB, etc…

As Web Service has better reliability, scalability and openness, it is widely used. Web Service technology is the core of SOA, and it is a kind of distributed computing technology which is developed on the basis of XML. Web Service uses XML-based message processing as the basic data communications, eliminating the differences among use different component models, operating systems and programming language, so that heterogeneous systems can be used as part of computing network to realize operating collaboratively [5].

ESB is the combination product of SOA, Web Service and XML technology, and it is a distributed integration framework which is a concrete realization of the concept of SOA architecture. In accordance with the message mapping, ESB data adapter converts the message format of requesting party to the ones that service provider interface can accept, thus reducing the coupling of system integration. ESB as the information exchanging HUB, providing a connectivity infrastructure for SOA as well, is used to connect the SOA service. This mode helping to reduce the number and complexity of the application interface is an effective method to solve enterprise integration between heterogeneous systems, and to achieve accurate and efficient information integration [6].

B. Integrated Framework Based on SOA

This paper constructs a SOA-based, flexible and scalable integrated framework, which is divided into five layers: application system layer, integration layer, service layer, business layer and the presentation layer. As shown in Fig. 1, the user sends a request message from the presentation layer and the server receives the message and makes processing. Application service interface provides services to the presentation layer in the form of interface. Presentation layer obtains Web service description information then it achieves dynamic binding with business layer. The services bond can process the request message, and access to integrated data from the application layer.

Following the specific description of integrated framework above:

1) Application system layer

Various business systems are encapsulated to loosely coupled Web service by Web Service method. This framework uses Web Service technology to encapsulate various business systems, in which the Web Services Description Language (WSDL) is used to describe abstract definitions and specific deploy, and it defines the operations and messages related to Web service calls and communications by the abstract way which is independent on platform and language. Different systems have different data sources, including structured data and unstructured data. Data in application system layer is transmitted through the SOAP protocol by converting it into Extensible Markup Language (XML), which contacts various business systems to the Enterprise Service Bus (ESB).
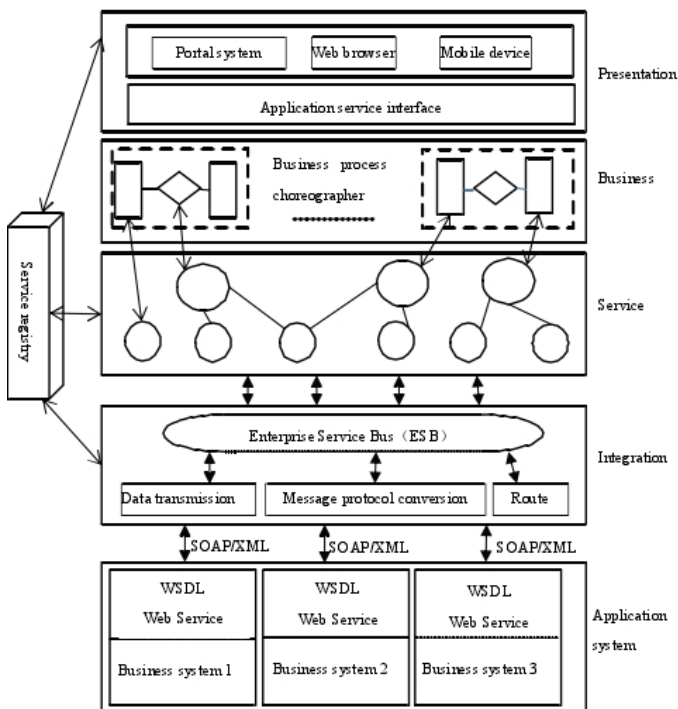

Fgue 1. Integrated framework for enterprise data center based on SOA.

2) Integration layer

ESB plays an intermediary role, providing the functions of data transmission, message protocol conversion and routing. As a service message forwarding agency, ESB provides message call based on SOAP among different levels of Web services. ESB focuses on information integration, which is the basis of business integration [6]. ESB provides the interface for packaged services and communicates with the upper using SOAP protocol. The layer above does not care service implementation details, so the services achieve a loosely coupled integration.

3) Service layer

The service layer has got rid of the fine-grained service limits from the sub-layer service system and has achieved the single service abstraction and encapsulation of business system. The size of service granularity determines the reusability and coupling of the service. Coarse granularity services are suitable for external calls directly, while fine-grained services are suitable for combination to form coarse-grained services. Therefore, the service layer formed size appropriate services to provide services to business process choreography of the business layer.

4) Business layer

Business layer provides the business process of flexible arranged. This layer calls related services for Business Process Choreographer based on business logic to form business processes. When the market demand changes, the business logic is changed, then business layer simply need to re-orchestrate business processes, thereby greatly enhancing the enterprise agility to respond to market changes. Flexible scheduling service embodies the loose coupling and reusability.

5) Presentation layer

Presentation layer provides the portal system, Web browsers and mobile devices. The presentation layer transmits the service in the bottom to the user through application service interface. Application service interface enables business processes and services presented to the user in an open form. The user sends request information through the portal system, Web browsers, mobile devices and other channels. The server receives the information for processing and returns the results through application service interface.

III. THE PRACTICAL EXAMPLE OF SYSTEM INTEGRATION

The frame has formed the general model after extraction and successfully implemented in an enterprise group. The group has a number of oil and gas exploration and development points, which are distributed in different areas. These points use various application systems. Currently, in order to realize downstream integration, unify those points' application systems within the Group, improve collaboration between systems, and enhance our overall competitiveness, the Group's systems are dynamically integrated using the framework presented above, its structure as shown in Fig. 2.
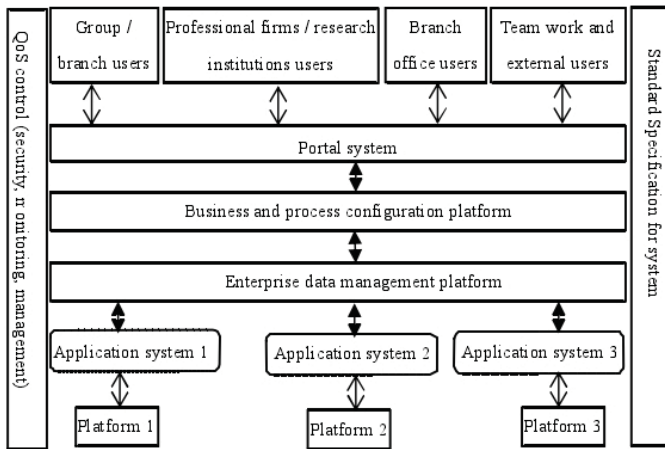
Figue 2.An instance of system integration architecture diagram.

Following the specific description of the instance of system integration architecture:

1) *Enterprise data management platform*

The platform integrates data for business systems to realize data distribution and synchronization of various systems, providing a complete business process log, data distribution log, synchronization log and other security monitoring and automatic feedback mechanism, which provides a reliable guarantee for the Group's business system master data's consistency and integrity. Taking the people management interface (Hr. interface) for example, the data integration process is described in detail in Fig. 3.

Where X system for the service requester, the data management platform for service providers, which both use the request / response message exchange pattern to achieve real-time data updates.
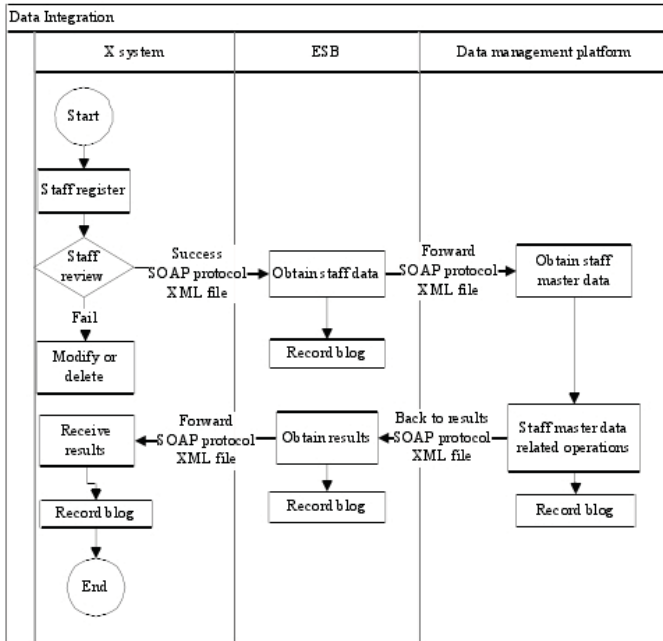

Figue 3.Schematic diagram of data integration process.

ESB manages a list of service interfaces which are provided by service providers. X system, according to the service request, sends data to the data management platform through the ESB using the SOAP protocol. And data management platform receives data and returns results to the X system through the ESB after a series of processing, which achieves data synchronization to ensure data consistency.

2) *Business and process configuration platform*

This platform dynamically arranges business services, reporting services and business process management in consideration of the user demands. Different business systems are arranged flexibly to achieve working together. The platform is corresponding to the service layer and business layer of architecture, reflecting the loosely coupling and reusability of the various services.

3) *Portal system*

Portal system provides a unified entrance for the group / branch users, professional firms / research institutes users, branch users and operations teams and external users. To ensure system security, the system must authenticate the users while users single sign on, then it gives users appropriate control authority which is set in advance. System provides personalized services for each user and different users can perform transaction processing only in their own control authority.

The data integration system is a small module of the instance of system integration, as shown in Fig.2 enterprise management platform. The platform, based on the framework, has realized the information sharing function, and has further promoted the unification of all kinds of master data standard, the unified data management and distribution, which has provided support for this group information system data integration and decision making.

The platform is achieved by: using Oracle11g to build database platform, using the way of combination of Apache and Tomcat to build a WEB application server platform, using J2EE technology and Web services technology, and using the JDK1.6 version, selecting Service Mix as an enterprise service bus, using XML for data unification conversion, achieving the portal interface through a combination of HTML, JSP and Java Servlets technology.

IV. CONCLUSIONS

Supply chain node enterprises' independent, heterogeneous, closed business systems form "information isolated island ", which restricts the construction of the supply chain core enterprise data center. This paper presents a SOA-based integrated framework for enterprise data center and it elaborates the integrated framework logical association at all levels in detail and the abstract model of the framework is applied to a group into the implementation of a common data management platform. The application of data management platform has reduced the "information isolated island" and it also has improved the historical data comparison, data analysis and decision-making efficiency, so as to excavate the value of the enterprise information data.

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REFERENCES

[1] Yi Zheng Rong, Bu Wei, GE sequence wind, etc. SOA-based data collaboration model. Computer Engineering .2009, 35 (4): 261-264.

[2] Patterns: Service-Oriented Architecture and Web Services. [2009-08-11]. http://www.redbooks.ibm.com.

[3] Hu Dehua. SOA of the Road: ideas, techniques, procedures, and practices. Shanghai: Shanghai Jiao tong University Press .2011

[4] Wang Weixing, Wang Chenguang.SOA-based enterprise information system integration framework. Computer Engineering .2010 (09)

[5] Chen Fang. Portal-Based enterprise information portal system. Computer and Digital Engineering, 2009

[6] Zhang Qiwen. Supply chain heterogeneous system integration research based on SOA. Donghua University, 2011