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Study on Design Method of Logistics Platform Based on SOA & ESB

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Abstract. The quick development of internet technology and electronic commerce has driven the demand of internationalization of logistics services. The internationalization trend of logistics requests that local logistics system should integrate with other information systems in terms of data, business and knowledge. However, the integration among heterogeneous systems has always been the key problem to the development of internet technology. More and more information systems of the logistics enterprises become "information solitary islands", due to the incompatibility of IT environment, database format or knowledge structure. As the demand of business and technique changing, a large number of "solitary islands" are destined to be legacy systems, which causing a great waste of resources. The article employed the SOA (Service Oriented Architecture) framework and ESB (Enterprise Service Bus) technology to solve integration problems among heterogeneous systems. SOA is a software architecture theory, which based on services as components. ESB is employed to supply SOA with base architecture of message-oriented middleware in the term of incremental bus. However, there isn't any integrated design method for logistics system based on SOA & ESB up to now. To fill the gap, this article presents an integrated design method through analyzing the integration environment of logistics platform, building service directory, designing system architecture and service components. The most significant results show that Firstly, this article has presented a stratified implementation model for logistics platform to implement SOA concept into system model framework, so as to guide the design and development. Secondly, it also presents methods of system analysis and design with samples in following steps: service catalogue design, integral architecture design, service design, service and module depending design and service implementation design. The whole design method has been used successfully in actual project of design and development of international logistics platform. It is proved that this method can efficiently create integrated service logic, reduce the cost of design and development, and improve the compatibility of logistics system.

Introduction

With the rapid development of internet technology and electrical commerce, logistics technology is challenged by new demands constantly, which results in equivalent trend of fast development in logistics. The internationalization trend of logistics requests that local logistics system should integrate with other information systems in terms of data, business and knowledge. However, the integration among heterogeneous systems has always been the key problem to the development of internet technology. More and more information systems of the logistics enterprises become "information solitary islands", due to the incompatibility of IT environment, database format or knowledge structure. As the demand of business and technique changing, a large number of "solitary islands" are destined to be legacy systems, which causing a great waste of resources.

SOA is one of the most effective ways to solve integration problems among heterogeneous systems. SOA is a software architecture theory, which based on services as components, can make systems reusable and easily integrated by reducing coupling degree during system modules [1]. Through standard and coarse-grained encapsulation of system function, SOA can realize a large scale of reuse of atom services [2]. But as the amount of services increasing, the consumption caused by the communication among services may decrease the efficiency of system integration seriously. As a result, ESB is brought forward to supply SOA with base architecture of message-oriented middleware in the term of incremental bus [3, 4].

In order to meet the demand of business reform, the platform of international logistics need increase the agility and expansibility, pay attention to exploring and mining the service value, and adopt standardized module technique widely. This article will offer a method on service design and system reconfiguration for international logistics platform, based on SOA and ESB, so as to increase its ability of flexible, dynamic and standard integration.

Implementation model for logistics platform

The meaning of SOA implementation model of logistics platform is to implement SOA concept in system model framework, so as to guide the design and development. LAN [5] has proposed an implementation model facing service architecture. It combines the three tools of Service Data Object (SDO), Service Component Architecture (SCA) and Business Process Execution Language (BPEL) to implement system in three separately layers of information, service and process. Based on these we have designed 7 layers in implementation model, as shown in Fig1. The details can be seen as follows.

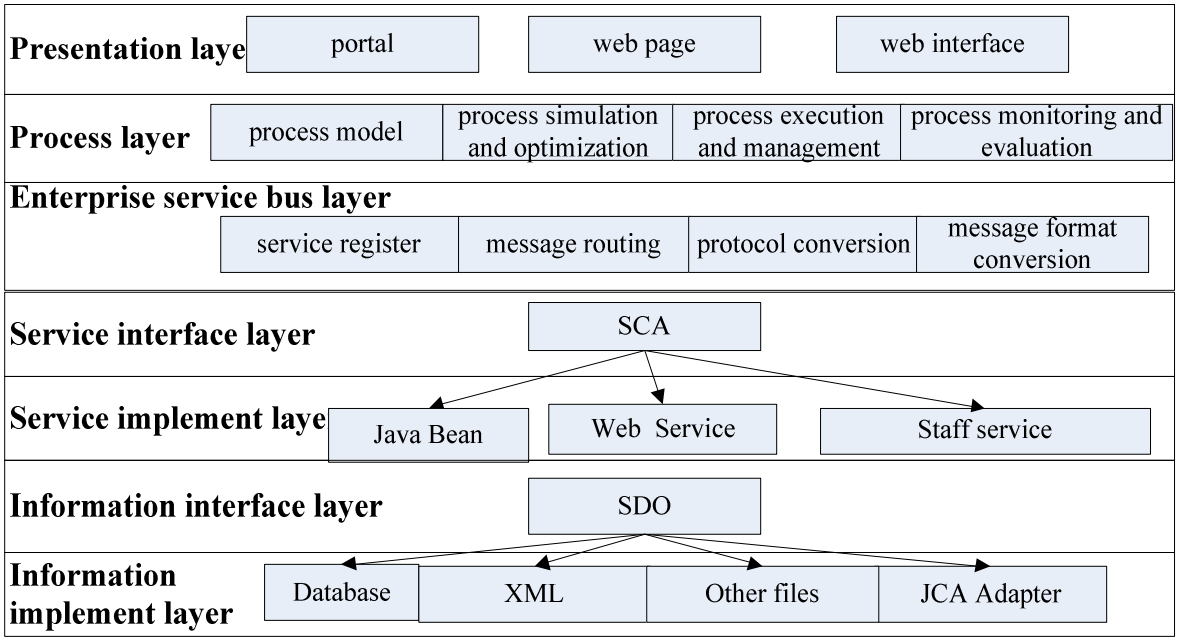

Fig. 1. SOA implementation model of logistics platform

Presentation layer is an interactive layer which directly faces platform user. In order to meet the customized demand of users, the presentation layer commonly use portal technology to integrate complicated services. Further it maybe web page or interface technology based on Web2.0.

Process layer is the layer to execute process, using BPEL as language of process modeling. It can carry out a whole process design through process modeling, simulation, optimization, execution, management, supervision and control.

ESB layer is a basic architecture and important tool of SOA implementation. It makes the communications between service components location-free and protocol-transparent. As a result, the service integration becomes easier.

Service interface layer is designed for shielding service heterogeneousness**.** It uses SCA to stipulate the characters which has nothing to do with program language, in order to provide the uniform invocation mode for service components.

Service implement layer is the carrier to services, which the key elements of SOA. It normally can be fulfilled by Java Bean, Web Service standard interface and staff service.

Information interface layer is to use standard SDO to simplify the treatment of heterogeneous data forms. Application program can use SDO to visit and operate different data in uniform way.

Information implement layer is the carrier of data and information, existing in the form of data base, XML, document and Adapter in JCA (Java Connector Architecture) from legacy system.

Design of logistics platform

At present, the method of system analysis and system design has been principal method in software engineering, with widely theoretical basis. Its development has gone from procedure-oriented, object-oriented to service-oriented. Service is the core of method of system analysis and design based on SOA, which is different from traditional object and component. When modeling and designing, it needs pay attention to service identification and service description; meanwhile it also needs consider service arrangement, service bus and decision of service granularity. During the stage of system analysis, the service catalogue will be build through analysis of system business environment, IT environment, business process and key function. During the stage of system design, the common design route is going from integral architecture design, service design to platform implementation design.

Service catalogue design. The precondition of design for service catalogue is the analysis to system business process and key function, which has three steps:

(1) Boundary analysis: It analyzes enterprise or business of departments among enterprise from external angle. It is treated as black box by analysis department. And the emphasis is laid on external interface.

(2) Business analysis: It analyzes enterprise or business operation of departments among enterprise from internal angle. Contrary to boundary analysis, it pays attention to the implementing way of all kinds of business function. It always characterizes the business process through three aspects of information, person and process.

(3) Service identification: It confirms the candidate list of potential services in a certain scale, which is important result of SOA system analysis based on boundary analysis and business analysis. Indentifying service may compose service catalogue.

In order to save article space, we only choose order management of logistics platform as the example of service catalogue design. First, it will begin with boundary analysis to order management business. In figure 2 you can find the relationship among logistics platform and logistics service supplier, logistics service consumer and arbitration unit. From figure 2, we can find that order management business needs interact with external user roles. Second, it will analyze order management business as follow:

(1) Information: Logistics order management needs to treat the following information: logistics service information, logistics supplier information, logistics consumer information, logistics order information, order executing condition, arbitration condition, paying condition…
(2) Person: The persons directly related to order management include: individual, enterprise, arbitration unit and paying unit…
(3) Process: order management has following process: receiving process of logistics order, process of logistics order execution and supervision, arbitration process of logistics order…

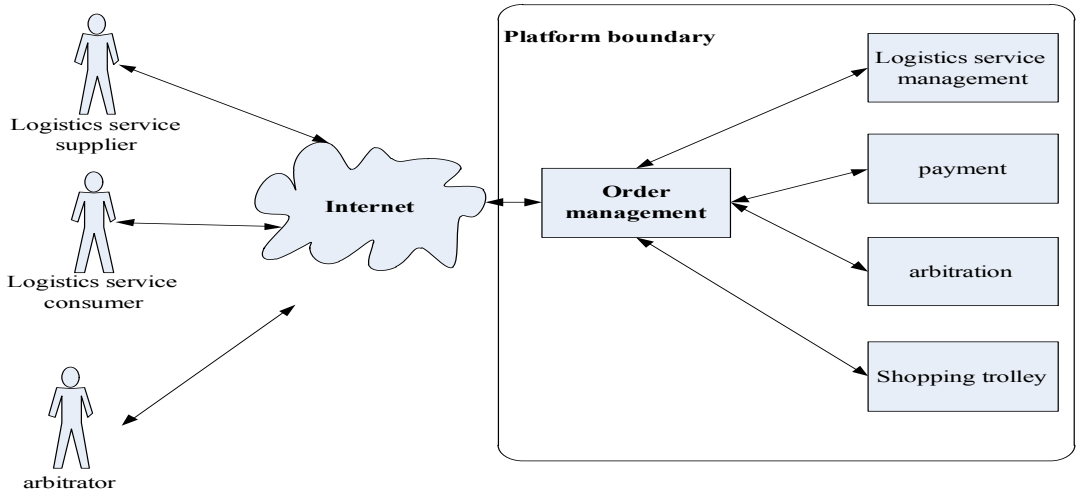

Fig. 2. Boundary analysis of order management of logistics

Finally it will build service identification for all kinds of users based on boundary analysis as entry point. For example, here is an enterprise user who consuming logistics service, some parts of whose service catalogue are shown as follows:

a) Logistics information inquiry service
b) Logistics order management service
   i Order management service ii Order release service iii Order inquiry service
   vi Payment service v Rollback service for order applying payment
c) History inquiry service of logistics order
d) Account inquiry service
   i Inquiry service of balance ii Chargeable service iii Extracting cash service

Integral architecture Design. Design for integral architecture of logistics platform describes each layer of platform and relations between them, and it is blueprint of the whole project design. The integral architecture drawing refers to the implementation model, can be realized by designing from component, service, and process to appearance, see Fig 3.

In platform portal layers, we customize portal page with combined services according to role of user, in which the enterprise portal refers to common consuming enterprise, and logistics enterprise specially refers to one can supply logistics service to other users.

In process layer, we combine and arrange atomic service into process according to platform business demand, which may be called by portal. This layer is established based on standard and normative enterprise service bus, which can save our considering on service position and source.

Service layer is standard and normative atomic service which encapsulates business components according to the demand from process and service catalogue. Service layer is established on base of SDO, which supplies the service with visiting interface of uniform data

Data layer is the form of all kinds of data which involve in logistics platform. They can be stored in different databases or documents by all kinds of forms. They supply data support for upper layer through SDO interface.

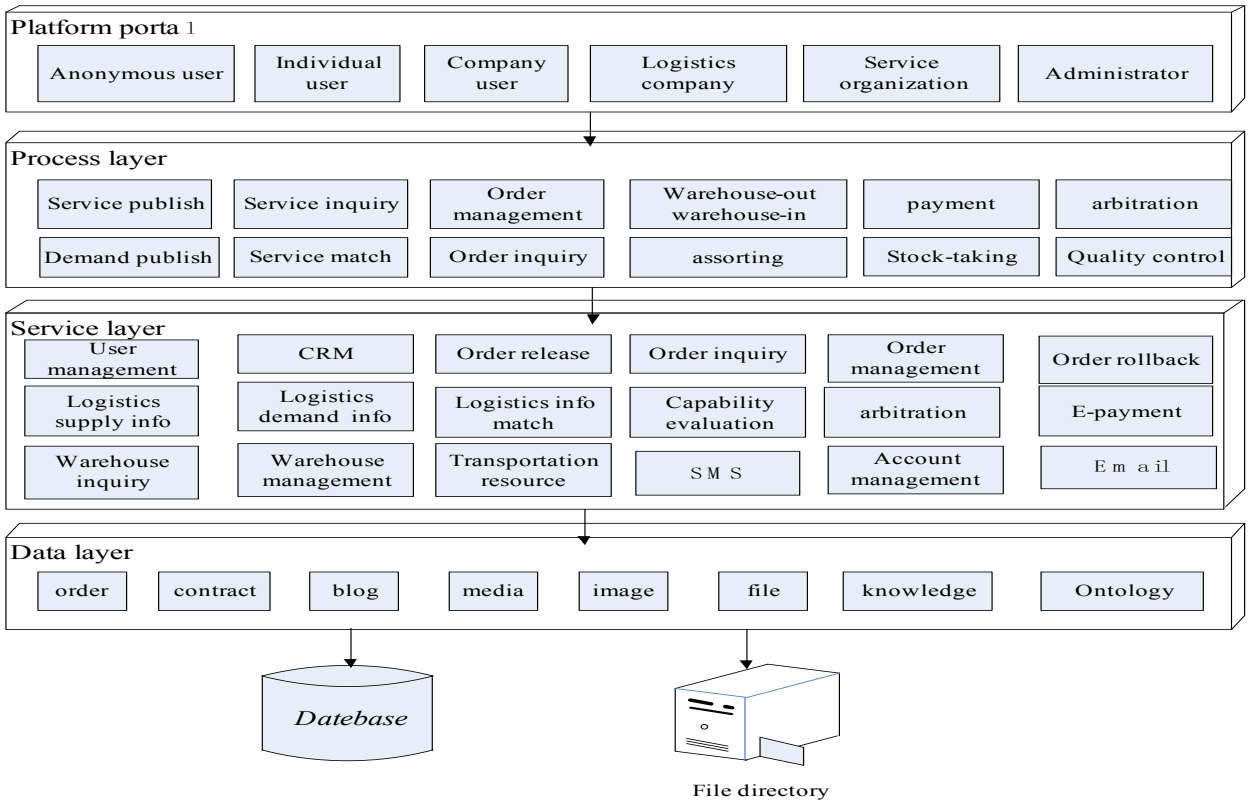

Fig. 3. Design of integrated architecture for logistics platform

Service design. Service design is the detailed explanation to service attributes after design of service catalogue, including the function and performance such as service operation interface, input/output information, safe restriction and response time.

During the design for service, the first step is to decide which candidate service should be exposed, and what additional restrict from safety and function should be satisfied if exposing this service. Secondly, we will describe the characters of each aspect to service using traditional analysis and design way. For example, the descriptions to the service of logistics order release in service catalogue are as follow:

Logistics order release: this service is manual service, and the executant is person who needs logistics service. The service inputs include logistics service ID and information of buying price. The service output is one piece of information including ID of logistics service order.

Design of service and module depending. Design of service and module depending is to carry out relations mapping between services and modules which are deployed in each application. There are two steps in design of service and module depending. The first step is to design module catalogue. The difference between module catalogue and service catalogue lies in that module catalogue based on current IT environment & application system, builds catalogue by extracting function module which can be reused, but service catalogue is designed according to business demand. The second step is to confirm match between service and module. One service can be mapped to one or more modules. For example, the mapping of order inquiry service and order management service is shown in Fig 4.

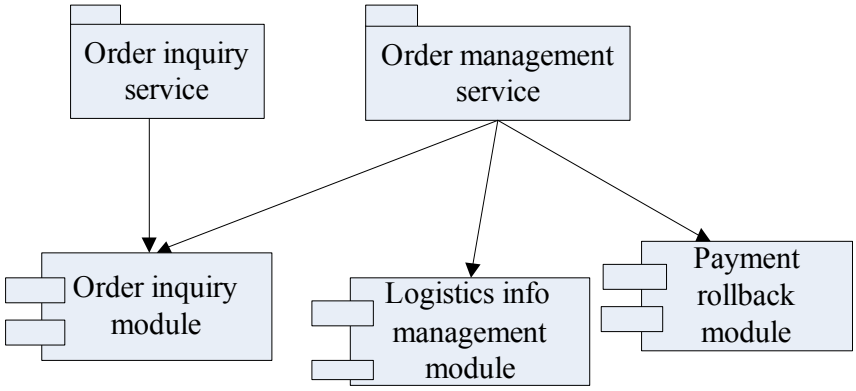

Fig. 4. Service and module mapping

Design of service implementation. Design of service implementation focuses on implementing strategies and technical decision, which includes: whether service encapsulates the existing modules, or rebuilds them, and which kind of regulation the modules which service depends on are based on. For example, modules that logistics order release service depends on can be rebuild by using spring technology, and modules that logistics order inquiry service depends on still use order inquiry module in the existing application system.

Conclusions

This article offers a set of design method based on SOA logistics platform under the background of international development demand for logistics platform, aiming at the integration difficulties between platform and most heterogeneous systems**,** by utilizing the technology of SOA and ESB to accomplish system analysis and design for logistics platform. Firstly, this article has proposed a stratified implementation model for logistics platform to guide framework design of the system. Secondly, it also presents methods of system analysis and design with samples in following steps: service catalogue design, integral architecture design, service design, service and module depending design and service implementation design.

This article focuses on study for design method of logistics platform based on SOA & ESB, as a result, some questions remain need solving, such as the analysis and design of ESB, design and implement of service terms, description and restriction mechanism of service performance. These questions are to be studied further in the future.

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