Research of Service-oriented Analysis and Design Method

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***Abstract*—In order to solve the problem of rigidity in IT architecture and the existence of heterogeneous information islands within most enterprises, a novel service-oriented IT architecture-SOA (service-oriented architecture)emerges. The realization of SOA is embodied in the accomplishments of various IT applicable functions in the form of service encapsulation and the interconnection and interoperation of services in the form of loosely coupling. Service-oriented Analysis and Design (SOAD) is a specially designed mode of software modeling and developing based on SOA. This paper analyzes the structural model in a service-oriented application system. In accordance with the development code of RUP (Rational unified process), it demonstrates a SOAD mode and an example centered on architecture and activated with business process and use case.**

Keywords-SOA; SOAD; RUP; Business Process Activation

I. INTRODUCTION

As newly-emerged software architecture, the appearance of SOA serves as a solution to the numerous puzzles and problems of development and application of IT system in modern enterprises. Service, an autonomous and open network component with no relation to any platform, betters multi-utilization, flexibility and expendability of distributed application. As a whole, SOA is designed and realized as a series of interactive services, which enhance system flexibility by realizing certain functions by means of services. System evolution occurs when new service is added. SOA defines the services which constitute the system, describes the interaction among services and maps the service to the realization of one or more specific techniques[1]. In general, the main contribution of SOA lies in the fact that it enables the resources to be gathered in loosely coupling and the advantage it provides exists in its high multi-utilization, flexibility, extendibility and applicability.

Software architecture base on SOA represents the latest trend for software development. The core for designing and establishing a high-quality application for this newly emerged software architecture is SOAD (service oriented analysis and design). As a new field, the work of research and recognition is still on the start. Presently, there has been no systematic technique and technology, unlike OOAD (object-oriented analysis and design), which serves as a perfect reference for SOAD. By making improvements on the application of the guiding principle of software development, RUP in OOAD, The thesis introduces an SOAD mode centered on architecture and activated with business process and use case. And a specific example of application is provided in the paper.

II. SERVICE ORIENTED ARCHITECTURE

SOA is derived from an early distributed computing mode based on components. It gains popularity and becomes a generally accepted specification under the influence of OMG and IONA. With the emergence of Java, EJB component mode and the development of J2EE application service market, SOA was further established. The basic structure of SOA comprises three participants and three basic operations as are shown in Figure 1.

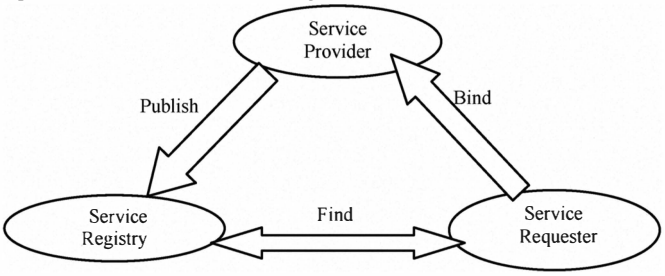

Figure 1. Service Oriented Software Architecture

The three different component roles in SOA are [2,3], (1) Service Provider, who publishes his service and responds to requests for his own services; (2)Service Broker, who registers services published and provides searching; (3)Service Requester, who finds the service(s) needed from the Service Broker and uses the service(s). Components of SOA shall take one or more roles of those mentioned above but employ three operations among the three roles, (1) Publish. Publishing enables the Service Provider to register its functions and accessing interfaces at the Service Broker; (2)Find. Finding enables the Service Requester to find services of a specific kind; (3)Bind. Binding enables the Service Requester to actually use the services provided by the Service Provider.

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III. GENERAL ACCOUNT OF THE PROCEDURE OF SOAD

Following the account of the models for service-oriented architecture, the main tasks and modes of service-oriented analysis and design is made clear in the example of SOMA （Service Oriented Modeling and Architecture） of IBM. SOMA of IBM divides service-oriented analysis and design into four main procedures[4], that is identification, service categorization and aggregation, specification and service realization. Service realization involves the realization of services, components and service assembling. show in Figure.2:

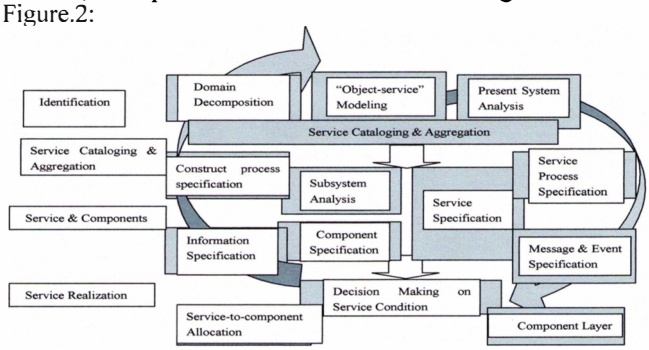


Figure 2. General Layout of service-oriented modeling and architecture

The activities and definitions of each procedure is referred to as follows[5]: Identification; Service Cataloging and Aggregation;Service specification;Service Realization. Each of the above procedures contains great details and abstract conceptions which are related to methodology and not really ready for practice for the fact that many factors shall be accounted into consideration. This thesis summarizes, concludes them and puts into some of the author's views as well. For further information, the reader can refer to works in my reference [8，9].

IV. AN EXAMPLE OF APPLICATION

In order to illustrate every procedure and activity in SOAD and better understand the difference between object-oriented and service-oriented analysis and design, we apply SOAD to a specific example, SCM (Supply-chain Management), to account the abstract procedure in detail.Supply chain is a functional network which consists of enterprises such as supplier, manufacturer and retailer to obtain materials, process products and deliver the products to a final user. The flexibility and decentrality of supply chain accounts for its complexity, however, the newly-emerged SOAD software modeling and development provides us with fruitful technical support.

To our knowledge, supply chain management involves clients, retailers, warehouses, logging facilities, manufacturers and other participants. In accordance with the realization procedures of SOAD, we take the first process, identification.

Firstly, we conduct a domain decomposition for the purpose of performing service analysis and business use case identification as service candidates. This activity falls into two sub-steps, as is shown in Figure. 3

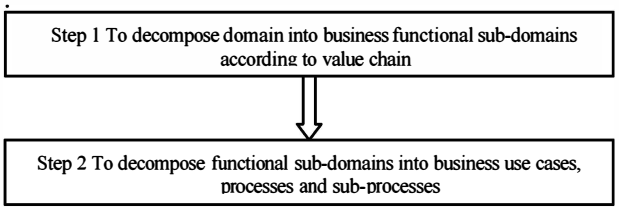


Figure 3. Two Steps of Domain Decomposition

The final products are business use cases, business processes and sub-procedures with business use case as the service candidates and business processes the candidates for compound services.

The two steps are as follows: Step 1. The whole domain is disposed into business functional sub-domains in terms of value chain, as is shown in Figure. 4. the whole domain is divided into various business functional sub-domains such as clients, retailers, warehouses, manufactures and logging facilities;

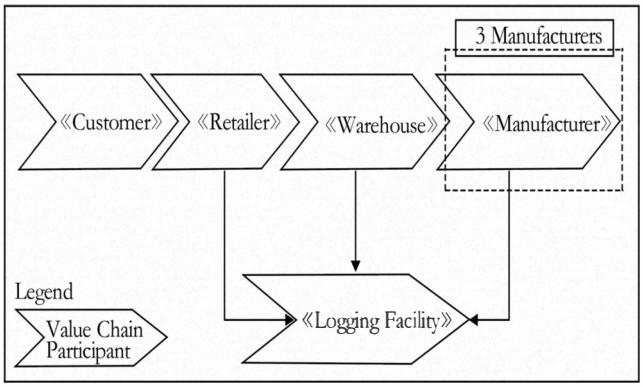


Figure 4. Service Domain Discomposed into Business functional Sub-domain

Step 2 The specific business functional sub-domains are further divided into business use cases, processes and sub-processes. Figure .5 shows the decomposition of business functional sub-domain into business use-case models which includes the following ones:

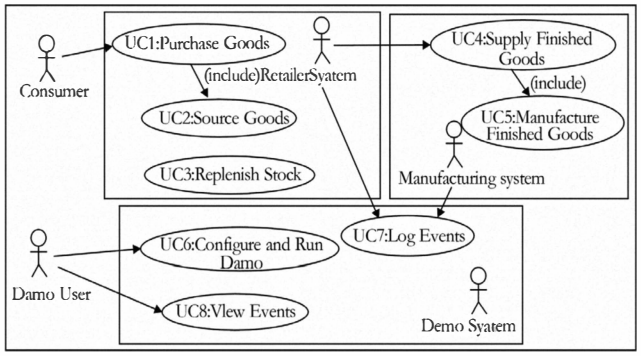
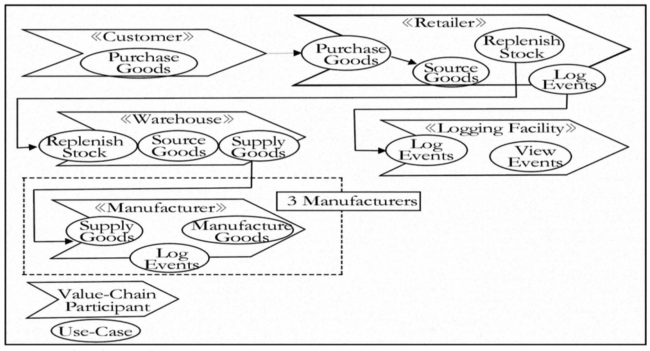


Figure 5. Service Use-case Model

①UC1:Purchase Goods;
②UC2: Source Goods;
③UC3:Replenish Stock;
④UC4:Supply Finished Goods;
⑤UC5:Manufacture Finished Goods;
⑥UC6:Configure and Run Demo;
⑦UC7:Logging Events;
⑧UC8:View Events.

Those business use cases gained through this process are the optimum candidates published in the form of web service.

After the identification of business use cases, sub-domain decomposition can be further conducted by making use of them, as well as identification of business processes and sub-procedures. Figure. 6 demonstrates a general business process based on business use cases.



Sub-domain Discomposed into Business Process and Business use case

In such a way, the business use cases and business processes resulted from sub-domain decomposition are the candidate services. Details on this issue are available in books numbered six and seven in the reference[6,7].

Process 2 Service Cataloging and Aggregation.In service cataloging, the services we have identified in terms of business relevance can be divided into two groups, business services and technological service[9]. The former includes retailer service, warehouse service and manufacturer service, while the latter is made up of only one service that is logging service. As far as aggregation is concerned, for a consumer, all the services identified are for the purpose of catering for their purchase needs, so all these services could be aggregated as one compound retailer service. By doing these, we realize the classification and integration of services and better understand the services identified.

Process 3 Service Specification. Issues discussed in this section are related to three aspects, which are system analysis, component normalization and service specification. services and sub-systems are in a one-to-one correspondence. Services identified in the process of identification represent the interfaces which the sub-systems open[8]. Figure. 7 shows the analytic result of the retailing sub-system. Business components and technological components are provided as well as the sub-system interfaces offered in the form of service.

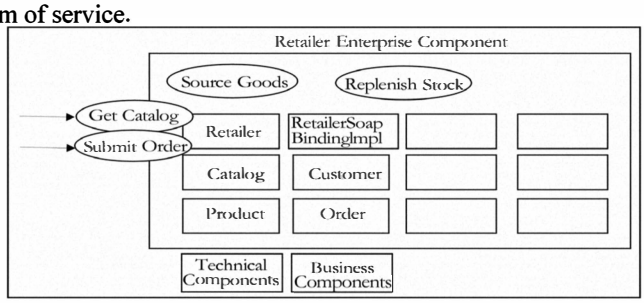


Figure 6. Analytic Result of Retailing Sub-system

Components under the term component normalization refer to those which are specifically defined. Figure. 8 offers a module for component specification, on which component definition can be based.

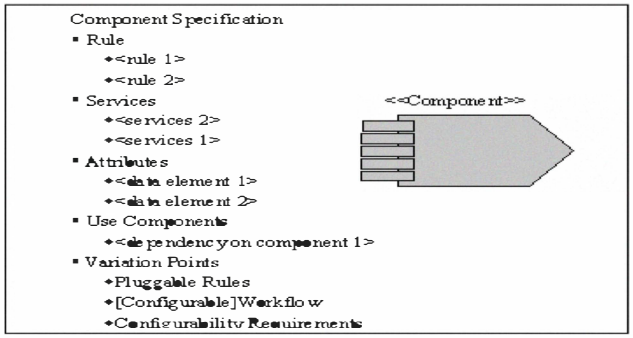


Figure 7. Component Specification Mould

Process 4 Service Realization. The issue of service allocation in service realization has been addressed in the above parts. As is mentioned, the fundamental principle of service allocation is to achieve a one-to-one correspondence between service and sub-system[9]. And decision making is performed in terms of whether the legacy system shall be used. In this example here, logging service is realized by a legacy system.

In this way, undergoing the above four processes, we center on service, identify service, catalogue, specify and realize service at the very end in terms of use case and business process activation model. On the issue of service realization, the fundamental principle of service allocation is to achieve a one-to-one correspondence between service and

sub-system. Service shall be in full accordance with the business components and technological components of sub-systems. Favorably, we have relative reliable equipments and technology for component development. This kind of new ides of modeling proves to be practical and effective to loosely-coupling distributed system based on SOA.

V. CONCLUSIONS

Service oriented architecture is a new type of software architecture, it accomplishes a kind of transformation from integrated computing mode to distributed computing mode and successfully overcome the shortcomings of tight coupling in a distributed object model [10]. In order to design and build high-quality applications by using this novel software architecture, a vital problem that is needed to be solved is SOAD.

Taking the angle of software engineering, this paper introduces, with an example of application, a mode of service-oriented application based on SOAD and centered on architecture. Due to the fact that service engineering is just on the start, the mode established in the paper is far from perfect and further research is needed. But our analysis and introduction in exemplifications are effective and worthy for service-oriented application development. There have been some books and papers on introduction to views of problem solving with SOAD and SOMA modeling, to which the readers could refer.

Further study shall include research on the favorable principles in OOAD, EA (Enterprise Architecture) and BMP (Business Process Modeling) in terms of software development methodology and combination of the principles in these rules with many other specific principles to construct a new service-oriented mode so that the quality of SOAD could be bettered and made more effective.

Acknowledgment

This work is supported partially by the Natural Science Foundation of Inner Mongolia Autonomous Region (20080404MS0904), the College and University Foundation of Inner Mongolia Autonomous Region (NJ09068) and the Foundation of Inner Mongolia University of Technology (ZD200801, X200803).

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