Design of SOA Integration for 3C Distribution Channel

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Abstract: - In today's market, peer competition is getting vigorous and distribution channel has become the key for enterprises to obtain competitive advantage and bargaining power. In the global competition business environment, market and demand is changing everyday, company's distribution channel strategy must be agile enough to adopt change, while effective management of distribution channel is an important key for enterprises success. For many years, the development of business application is getting huge and complicated. Meanwhile, the system maintenance cost is getting higher. In addition, today's variable business environment is continuously testing software's lifecycle of these applications. In the keep changing business market, emerging technology and design model both enhance software development scale, and make it more complicated. This paper is aiming on rapid response on market demand and integrating of enterprise's business process in global economy competition environment, meanwhile, flexibly adjust business rule to meet key ability of enterprise development. This paper proposes the standard specification of this blueprint, to enable every system in 3C Channel Distributor can support each other well. To formulate reliable component interfaces, we can deploy dynamically to achieve a better flexible SOA system. This paper also explains the integration bottleneck and difficulty of enterprise internal heterogeneous system and supplier's heterogeneous data, in addition to solve problem and increase system agility to enable developers easily maintain system. We expect adopting SOA can increase enterprise and its supplier's operating incoming and cost down.

1 Introduction

In today's market, peer competition is getting vigorous and distribution channel has become the key for enterprises to obtain competitive advantage and bargaining power. In the global competition business environment, market and demand is changing everyday, company's distribution channel strategy must be agile enough to adopt change, while effective management of distribution channel is an important key for enterprises success. Nowadays, enterprises realized even though owning superior products, strong marketing and proper pricing, market share is still possible to decrease if there is no focus on distribution channel strategy. Because of this, more and more enterprises deem distribution channel establishment and maintenance as an important issue. However, how to establish distribution channel and how to connect after establishment is one of key issues for enterprises development. If distribution channel is not running smoothly, pricing is disordered and benefits are imbalanced, all these will limit the promotion of enterprises' brand and the increase of sales volume.

For many years, the development of business application is getting huge and complicated. Meanwhile, the system maintenance cost is getting higher. In addition, today's variable business environment is continuously testing software's lifecycle of these applications. In the keep changing business market, emerging technology and design model both enhance software development scale, and make it more complicated. When Information Technology (IT) enterprises organization's scale is getting huge, their software system assets also need some changes at the same time. Some companies will enhance their exiting system to match the flexible business needs, or through merge and acquisition between companies, combine other business application system to existing one. During this period, IT department is facing the urgent needs of different system integration, and they understand the difficulty of replacing traditional application system. These existing systems are not only responsible for core business operation process, but also restore huge valuable enterprise resources and all important works. To use framework model to integrate existing system and other different

software system should enable business operating process more efficient. Meanwhile, it can reduce repeated work and data, hence improve whole business display.

In the end of 1990's, the emerging of Service Oriented Architecture (SOA) has become new generation of software development theory by mean of standard interface to handle enterprise's system integration. SOA absorbs the benefits from both architecture and object oriented program development, then provides simple design principle. Through gradual steps, IT department can continue to keep and reuse the existing programming codes.

This paper is aiming on rapid response on market demand and integrating of enterprise's business process in global economy competition environment, meanwhile, flexibly adjust business rule to meet key ability of enterprise development. Internet has connected some enterprises, clients, suppliers and channel distributors, but it is not easy to connect enterprise's internal and external information system. That is because every individual system adopts different platform, communication protocol, data definition and security mechanism. So, the goal of SOA is establishing communication standard, to eliminate Application-to-Application communication barrier, to realize business process automation, and to support the innovation of business model.

This paper will explain the integration bottleneck and difficulty of enterprise internal heterogeneous system and supplier's heterogeneous data, in addition to solve problem and increase system agility to enable developers easily maintain system. We expect adopting SOA can increase enterprise and its supplier's operating incoming and cost down. This paper is organized as follows: Section 2 describes the overview of distribution channel, such as the classification, the members and the operation. And we present the literature review including SOA, some standards for web services, some SOA applications and Model Driven Architecture. All of the above details are in Section 3. Section 4 proposes the design of SOA for 3C channel distributor, which comprises the overall structure, the components and the strategy analysis of user requirements. Section 5 discusses the SOA templates and the system integration on real business environment. Finally, the last section is our conclusion.

2 Overview of Distribution Channel

The definition of distribution channel is wide. As long as it can match the transaction between manufacturer and consumer, it can be called distribution channel. In traditional economy model, the cost is very high for dispatching from manufacturer to consumer, sometimes producer does not know how to find consumers, or vice versa, so distribution channel has its value. However, nowadays distribution channel becomes various due to improvement of technology and information transparency.

What is the connection between distribution channel and product? General speaking, the decision of distribution channel is the key of product success. There are two points to mention: First, understanding the marketing ability of distribution channel: before deciding co-operate with which distribution channel, we conduct to survey on customer level, service procedure, marketing performance and displayed products analysis; Second, we select distribution channel base on channel survey together with product attribution, to select appropriate marketing channel, e.g. for product with high unit cost and request explanation service, then need proceeding by direct contact with customers.

The classification of distribution channel varied from "Tiers" [14]. Manufacturer dispatches the product ownership to end user, we called it as "Channel Tier". In general distribution channel structure, there are four types of distribution channels base on numbers of intermediaries: zero-tiered channel, one-tiered channel, two-tiered channel and three-tiered channel. By the way, the members of distribution channel includes retailer, wholesaler and channel distributor. Retailer means the business organization whose sales volume comes from retailing. From the whole distribution value chain system, the existence of retailer is because it can bring additional added-value for consumers. Wholesaler means the organization for engaging in wholesaling, not end user. Channel distributor means the process of transfer the ownership of manufacturer's products and services through agent, wholesaler and retailer, then to consumer. We also called this process as "distribution channel" and the people who perform the channel are named "channel distributor", also "distributor" in short.

However, how to dispatch the product to customers smoothly, not only promise low distribution cost, but also guarantee customer's request on delivery time, delivery volume, installation service and other questions. As product kinds are more variety than before, distribution policy may become more difficult to formulate. Due to excess of brand products, channel distributors seemed relatively less,

hence distribution channel has bargaining power, try to make more profit from manufacturer.

Distribution channel is powerful in the market. They have a lot of strengths, such as own sufficient cash, huge sales networking, familiar with local market, a certain scale of sales team, and better market control. More than 80% products are dispatched to end user through distribution channel.

3 Literature Review

3.1 Introduction of SOA

Service Oriented Architecture (SOA) is the methodology of constructing application procedure of distributed system, which can transmit application procedure to end-user by using "service". Many application developers think SOA can help enterprise rapidly grow business, and efficiently adapt market changing. SOA can increase the repeated use and simplify the interconnectivity with traditional applications or systems. SOA could be an evolution, rather than revolution. It catches past architecture's best implementation and real application. Moreover, SOA fulfills user's application needs, and helps the interaction between service broker and service provider, these are all related to standard SOA. SOA is based on traditional application-oriented IT framework, wrapped business application into loosely-coupled components. According to business needs, connecting different components into necessary service of real process, enterprise can repeatedly use existing application, then further integrate the independent applications into new services, that can protect business existing investment, meanwhile, compose the services quickly, without developing the IT services for new developed business process. There are some basic SOA entities for operation [18] , shown on Fig. 1:

1. Service Consumer

Service consumer can be end-user, application or other service consumer. It will be looking for suitable service in service registry, then confirm the location of service, bind service, and perform the function of service. Meanwhile, when service consumer performs service, it will transmit request in accordance with the contract.

2. Service Provider

Service provider is an entity with network-addressable. It can accept and perform the request from service consumer, and service provider can make request by using mainframe, service or other software. However, to enable service consumer

access easily, service provider needs to publish its own contract on service broker.

3. Service Broker

Service broker is similar to service dictionary, which has UDDI (Universal Description, Discovery and Integration) function, responsible for receiving and storing the contract from service provider, then provides the contract to service consumer which need it.

4. Service Contract

Service contract explains the interaction between service consumer and service provider. Both service request and service response have concrete defined format. Service contract may rule required terms for pre- and post-event, these are using for explaining that service can be performed only under some certain conditions.
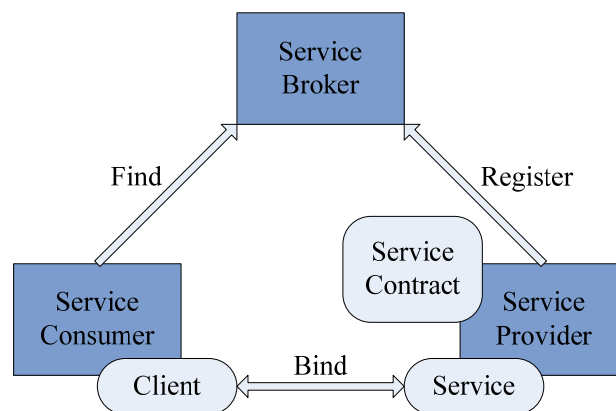

Fig. 1. Basic SOA Entities for Operation

SOA gradually draws more attention from enterprises, some system manufacturers are engaging in the formulation of SOA standards, develop SOA-related technologies together, and continue to revise drafts and specifications [27] . For the time being, one of the major standards, formulated by these system manufacturers, is Service Component Architecture (SCA). SCA is a model for supporting SOA to establish application or system, which enables the SOA-based application or system more simple and easy. OASIS (Organization for the Advancement of Structured Information Standards) has regulated final version 1.0 SCA specification in March 2007, which includes Service Composition Assembly Model, SCA Policy Framework, and various language implement SCA specifications.

SCA is open standard, which can support many SOA implement technologies, help enterprise to flexibly accommodate current technologies. Meanwhile, it is compatible with system for constructing under SCA model and future use. Therefore, SCA becomes the ideal model for

constructing SOA application. SCA helps to construct information system of enterprise application by using composition, no need to directly go through concrete technology details. This method makes the application easier to modify and deploy [3] .

SOA is much emphasizes on interface, protocol, communication, coordination, working process, search, cooperation and publication, that is the difference between SOA and traditional application architecture. All these are by way of XML, SOAP, WSDL, UDDI and HTTP, using the common standard. This allows development in different platform and data exchange. Besides, SOA utilizes searching service when running in Internet, which is the data we want. In addition to using the policy to dominant, coordination and control various services, the policy also processes additional development to designate more checkpoints and enforcement on the policy, then further to control during the whole procedure to ensure reliability and accuracy of the data. While server environment is under distributed system, that can use Enterprise Service Bus (ESB) to perform mutual communication mechanism.

SOA has the following technical characteristics [19] :

1. Distributed Architecture
SOA component is mixed by various system which are distributed on the net, either LAN or WAN. For instance, web services are using Internet HTTP protocol to connect each other on SOA. By this way, web services become a useful technology for all the platforms in Internet.

2. Loosely-Coupled Interface
The traditional system is divided application function requirement into connected components (e.g. modules, objects or components). The developer has to make efforts on figuring out how to design and utilize these components, to confirm no violation on connecting limitation on these components. Therefore, it is difficult if somebody intends to use different components to replace for the original design. By contrast, SOA combines the applications base on interface standard, one that meet interface requirement, these components will then replace upon request, which can enhance the flexibility on the changes.

3. Open Standard
The open standard is core for SOA. The old software platforms like CORBA, DCOM, RMI and J2EE were using exclusive protocol as connection standard, which caused no compatibility for components on different platforms [4] . By contrast, SOA is focused on standard and interaction, to avoid the integration problem from different platforms like NET Web Services [30] and Java Web Services [12] .

4. Process Centric
When building the application, firstly we have to know specific working process, and divide them into service interfaces (includes input and output data format), then other developers will choose suitable components to complete the work based on service interfaces.

Since SOA is service oriented, that will treat all existing applications or components as service models, communication between services is through message exchange, it solves the system integration problems by using of the loosely-coupled models. The paper [26] is focused on some issues which enterprise needs to evaluate before SOA solution. It focused the discussion on advantages and disadvantages for adopting SOA, and as soon as SOA is implemented what we need to care about? Enterprise has to evaluate explicitly if their information system will adopt SOA to raise a best solution.

3.2 Introduction of Some Standards for Web Services

3.2.1 XML
XML (eXtensible Markup Language) is a set of rules for encoding documents electronically, and can define portable structured data as data description language. It is defined in the XML 1.0 Specification produced by W3C and other relevant specifications, and all are free-of-charge open standards.

The goals of XML design emphasize simplicity, generality and usability in Internet. It is a textual data format with strong support via Unicode of the languages in the world. Though the design of XML is focused on documents, it is widely used for the representation of arbitrary data structures, e.g. in web services.

There are various programming interfaces that software developers may use to access XML data, as well as several schema systems are designed to aid in the definition of XML-based languages. As of 2009, hundreds of XML-based languages have been developed, includes RSS, Atom, SOAP and XHTML. XML-based formats have become the default for most office-productivity tools, including Microsoft Office (Office Open XML), OpenOffice.org (OpenDocument) and Apple's iWork.

3.2.2 SOAP

Simple Object Access Protocol (SOAP) is kind of standardized communication specification, majorly used in web services. The emerging of SOAP is for simplification. When web server retrieves the data from XML, it is not necessary to waste time on formatting. Different applications can exchange data by using XML formant under HTTP protocol, which makes it independent from program language, platform and hardware. This standard was jointly proposed by IBM, Microsoft, UserLand and DevelopMentor in 1998, and supported by IBM, Lotus and Compaq, and then they made the proposal to World Wide Web Consortium (W3C). The existing SOAP 1.1 version is the common standard for the industry, which belongs to 2nd generation XML protocol. (The represented technology for 1st generation is XML-RPC and WDDX).

We use a simple example to explain the process of using SOAP. A SOAP message can be sent to a web which has web service function, e.g. a database with product pricing information, the message parameter will remark it is a inquiry message, the checkpoint will return an information with XML format, which including inquiry results (price, location, specification or other information). As data is transmitted by standardized and analyzed structure, which can be utilized by third party.

SOAP Envelop defines the content of description message, who send it, who should receive and handle it, and the way to deal with their frame.

1. SOAP Encoding Rules
It indicates the rules that data types of instance need to follow in applications.
2. SOAP RPC Representation
It represents protocol of remote procedure call.
3. SOAP Binding
It uses bottom layer protocol to exchange information.

SOAP use OSI Application Layer to be its transmission protocol. Both of SMTP and HTTP protocols can using for transmitting SOAP message, but in view of HTTP is performing well on Internet nowadays, especially it still runs smoothly under firewalls, hence it is being adopted widely. SOAP can also process encrypted transmission on HTTPS.

3.2.3 WSDL

Web Services Description Language (WSDL) is XML format for describing web service. WSDL describes public interface of web services. This is a XML-based format for describing how to communicate with the services and how to utilize web services. That is, the required binding protocol and message format describe the interaction with web services which is listed in the directory. It usually adopts abstract language to describe the interface and message which is supported by this service. When using it, that will bind real protocol and message to this service.

3.2.4 UDDI

UDDI is the abbreviation of "Universal Description, Discovery and Integration". It is a cross platform description specification based on XML. UDDI enables enterprise to publish their own providing service in Internet.

UDDI is one of open project proposed by OASIS, it enables enterprises to mutual discover in Internet, and defines business interaction. The register of UDDI includes three components:

1. White Pages: address, contact and known identifiers.
2. Yellow Pages: industrial categorizations based on standard taxonomies.
3. Green Pages: technical information about services exposed by the business.

UDDI is one of core web services standard. It passed SOAP to conduct message transmission, using WSDL to describe the utilization of web service and interface.

3.2.5 ESB

In computing, an Enterprise Service Bus (ESB) is consisted of a software architecture that provides fundamental services for complex architectures through an even-driven and standard-based messaging-engine, also called as "the bus". Developers basically implement and ESB by using technologies found in a category of middleware infrastructure products, mostly based on recognized standard.

An ESB usually provides an abstraction layer on the top of implementation of enterprise messaging system. That allows integration developers to exploit the value of messaging without writing code. An ESB builds on base functions broken up into their constituent parts, with distributed deployment when needed, working in harmony as necessary, unlike to the classical Enterprise Application Integration (EAI) approach of a monolithic stack in a hub and spoke architecture.

An ESB does not implement a SOA by itself. However, it provides the features with the one which implement SOA. An ESB builds upon standard and provides flexibility, supporting many

transport mediums to implement both SOA services and Web 2.0 architecture. ESB intends to isolate the coupling between the services and transport mediums. Most ESB providers construct SOA principles and allow for independent message format.

3.2.6 BPEL

BPEL means "Business Process Execution Language" which is a kind of XML-based format, and the language is for describing business process. Every single step of the business process will be realized by web service. In 2002, IBM, BEA and Microsoft developed BPEL together, and introduced BPEL as the language of describing web services.

This description can also be provided by web services, and utilized by web services. Through BPEL, it can describe a web service interface which participates a web service process, e.g. the order for input message; however, BPEL can not coordinate a business process.

BPEL is acting as the conductor of operating services, describes process controls, e.g. branch, loop, parallel handling, correlativity and exception handling, and so on. BPEL is a method for using XML to describe business process, then produce new solution by linking different web services. Such composition is more flexible and easier to manage for comparing to the previous way of connecting services by programming. User can rapidly change or produce new solution through different compositions.

3.3 Introduction of MDA

Model Driven Architecture (MDA) [21] was proposed by Object Management Group [20] in 2001. MDA's core concept abstracts Platform Independent Model (PIM), which is not related implement technology, but that can completely describe business function. Then MDA focuses on different implement technology to formulate some transformation rules. By using of these transformation rules and auxiliary tools, that transforms PIM to Platform Specific Model (PSM) which is related to concrete implement technology. Finally, it can transform from complete PSM to programming code. By mean of PIM and PSM, the purpose of MDA is to separate business modeling and underlying platform technology, to protect the outcome of business modeling won't be affected by technology change.

We can notice that OMG emphasized MDA should be based the standard of OMG, as software industry is developing for many years. There are too many cases stated the success standards are naturally derived. The purposive and ideal standard is very difficult in consideration of business interests and other factors. However, in recent years, MDA develops rapidly in industry, and it produces some excellent business tools. Microsoft and IBM both have entered this field, but too many tools from both companies don't comply with OMG's standard.

MDA is applied the life cycle of software development in design, deployment and integration. MDA complies with a serial of open standards, for example, UML, XML, CORBA, etc. MDA's modeling is based on functionality, rather than a specific language, platform or implementation technology. MDA can simplify system integration, shorten development cycle, and save enterprise resources. "Model" usually describes a system and its environment by using the form of graph and text. The way of model driven is using "Model" to guide the system's design, development and maintenance. MDA is using system model to derive system architecture [1] .

3.4 Introduction of Some SOA Applications

SOA is an emerging IT software architecture, through the open and standardized Internet transmission technology, to achieve system integration and software sharing, and flexible business process. Due to the global competition in recent years, enterprise's requirement on instant response IT architecture and system integration is increasing. Hence driving the market development on SOA and promoting international industry to open standard, it is good for SOA's long term development.

Currently, that enterprise adopts SOA technology to construct system mainly utilizes in the integration of various systems, including data integration, process integration and interface integration. According to the real situation of enterprises, such as cross-department resources sharing, integration inside enterprise and integration in different enterprises, all can adapt various changes in the future, not only protect original resources, but also simplify development process.

In recent years, in the application of heterogeneous integration, IT resource sharing has been rapidly applied to many real enterprises, to reduce IT investments, to improve system flexibility and efficiency of IT resources. These IT resources sharing practices mainly focus on hardware like mainframes, storage and other devices, in view of its advantage in reducing investments and improving

efficiency. There are certain technologies that help to achieve the function of IT resources sharing. However, many solutions will be limited due to enterprise's unique requirements. This paper [22] is mainly focused on inner-enterprises resources sharing. Integration IT resources will benefit enterprises largely by increasing reuse times and decreasing cost. In this way, it will provide more competitive power for related enterprises. To achieve such expectation, firstly enterprise itself needs to open its internal resource base on both requirements, then we can bilaterally obtain the following 4 viewpoints:

1. By remote call of many public accessible resources, we can well control about their states and lifecycle, so it needs to have the functions of management and remote control.

2. For the reusable resources, it needs to publish their functions, interfaces and parameters. Thus, service providers can release their reusable components.

3. This system must be having security mechanisms to protect request and response messages, and need to have certain policies to against attacks. For the requirements of securities and policies, it needs to be very robust.

4. Every component is possible for reusing repeatedly, so it needs to manage these components' states. Sure it includes lifecycle management, version management, identification certification, cost management, security management, and so on.

Hewlett-Packard SOA Competency Center in Bangalore India also mentioned about their integration experience on heterogeneous system integration [15] . Because majority of enterprises' information systems consist of both legacy and modern systems, many applications may not be communicated or shared data among themselves due to lack of common standards. Of course, to integrate the disparate systems seamlessly and to enable the communication among these systems on various applications in the daily business transactions, it is not easy to do. Besides, all the data should be coexisted in new system and legacy system, so it is suggested to adopt SOA-based integration approach to solve interoperability problems.

Furthermore, in globalized business environment, supply chain needs more inter-enterprises' business cooperation in the links of procurement, production and sales. Many information management of traditional IT architecture is unable to meet variety requirements from enterprises, so many researchers proposed SOA concept, to help enterprises dynamic requirements and agile systems for quick response.

In a paper [6] regarding supply chain application, it mentioned majority of retailers, manufacturers and distributors are facing the problems of redundant process and additional distribution cost. They also invested many re-engineering on their supply chains to improve process and enhance productivity, lower unit cost, as well as reduce retail price with margin retaining. At the meantime, the author described if there is no interoperability of systems, the benefits of e-commerce is difficult to be effective [7] . In traditional commerce, both customers and vendors may be automated internally, but their systems are usually isolated from communicating to each other. If it needs to interoperate with external enterprises, it will be handled manually. So the author proposed an integration concept which the main idea is enabling "management" and "business resources" be formed by "services".

On the paper [8], it proposed enterprise need to effectively response under the fast change of business environment, and strives mass customization issue to competition strategy. In the principal of diversified market integration, mass production and individualization have then been derived. The information system needs to support the entire value chain, especially the complexity of production management and process. In view of co-ordination with different vendors, the IT service needs to play an appropriate role, so SOA can integrate all information then further construct on shoe-maker industry.

In many SOA related case study, some papers used to mention the successful cases in different industries. There was a paper [11] described the inter-company applications in airlines, hospital supplies and finance. In addition, another paper [10] analyzed the failure of B2B marketplaces, meanwhile, it tendered many suggestions for B2B marketplaces in the future.

4 The Design of SOA for 3C Channel Distributor

Many enterprises are discussing how to apply information technology to develop organization's competitiveness and enhance performance, to fulfill the requirement of the business operation, further achieve organization's target. Generally speaking, channel distributors have to manage some complicated industry specified systems (including planning, procurement, distribution and POS application) and core applications, to provide related service, financial and human resources function. However, it's a pity that most of channel

distributors implement their applications in different system, which is not easily interactive for others, as the function and data are not integrated, that resulted in the status of manual implementation and data duplication. In more and more competitive industry, the top priority is to ensure IT investment is able to strengthen store operation and sales function. Meanwhile, enable customers can have distinguish shopping experience no matter what channels they chose.

To improve store's operation and enhance efficiency on supply chain, channel distributors realize that the importance of integrating various applications, as the cost of operation and data duplication can't be inspected thoroughly by manual, need to take some action as it's too expensive. Meanwhile, if the Return On Investment (ROI) is not achievable or insufficient, the channel distributors will not reform the entire IT fundamental structure and inject new funds. Hence, well utilize the existing IT investment and rewarded rapidly, that's the must-know integration way.

From current trends, SOA is one of best IT resources integration ways, not only enable you to utilize the existing asset, but also help you to construct fundamental structure, so you can deal with various challenge, and provide new dynamic applications. By using SOA, the function of application is no longer limited by underlying architecture. Hence, customers can use existing and new services through the network.

In 2007, IBM proposed SOA reference architecture [2] . The SOA reference architecture uses the easy way to define every development stage of SOA, as well as business development itinerary and requirement on IT services. This reference architecture only explains the focused and planned services while constructing SOA system, not related to specific platforms or technology suppliers.

This SOA reference architecture tells us, what functions will be required for the implement of SOA, and these functions can be added to system depending on enterprise's schedule and requirement, not a one-shot deal [5].

4.1 The Overview Structure of 3C Channel Distributor

This paper proposed the SOA-based 3C channel distributor structure which bases on IBM's SOA reference architecture [2] as basic principle, majorly focuses on integration of users, process and information relevant services, as well as provides the integration for services on enterprise internal and partner vendors. Currently, the 3C channel

distributor has constructed many applications and databases, due to the platform, technology and language difference on these applications, resulted in some problems like data component, definition, formation or duplication among databases, that confused enterprise's integration.
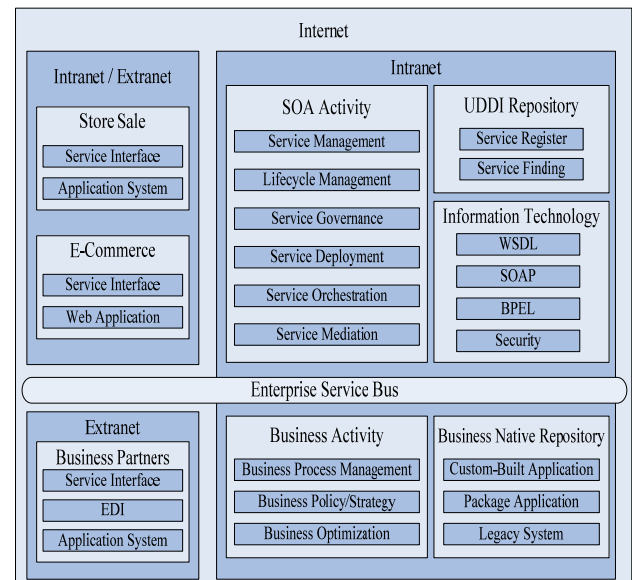
Fig. 2. The Overview Structure of Entire 3C Channel Distributor

Fig. 2 is the overview structure of entire 3C channel distributor. This structure includes internal business, retailing stores and external partner vendors, and there is Internet connection between each others. Among them, Business Native Repository is current operating system about mostly custom-built applications or package applications, and a lot of legacy systems. These application systems all covered the required information system from the headquarter, warehouses and retailing stores. SOA Activity must cover all usable service components' mechanism on management, deployment and composition, to control all service components by using UDDI repository, then to inquire all usable service components. However, the enterprise may develop by itself or outsourcing for needed service components, and processing access of service components upon the enterprise's requirement. The enterprise's requirements are processing according to different enterprise procedures and targets. These can be defined by Business Activity. In Addition, Business Partners are the 3C channel distributor's co-operation partners, which major function is business data exchange. These partners usually divided into two categories: commodity partners or distribution partners. The commodity partners are mainly applied in new commodities' registration,

order distributing, sales stock and amount settlement, while the distribution partners are mainly applied in the distribution scheduling for customer's orders and real distribution processes. Furthermore, Store Sale are concrete retailing stores, and E-Commerce could be electronic commerce website, they are processing the sales activity directly. For constructing on Intranet, that will be direct-selling stores, and for franchise-stores, that could be constructed on Extranet.

For every part under this architecture needs to be connected by network, no matter Internet, Intranet or Extranet, which are operating on ESB. ESB offers easy-management or performance-enhancement while the enterprise constructing its SOA. Hence, the process, data or system of both internal and external of the enterprise could be applied within inter-enterprise or cross-enterprises, even directly integrated through network services.

4.2 The SOA Structure and Components of The Overview Structure

SOA is the major developing tendency of information integration currently. This paper is following the tendency to plan the SOA of 3C channel distributor, and we aim to integrate current enterprise resources on separate heterogeneous systems, under accessible platform framework to effectively apply various resources.
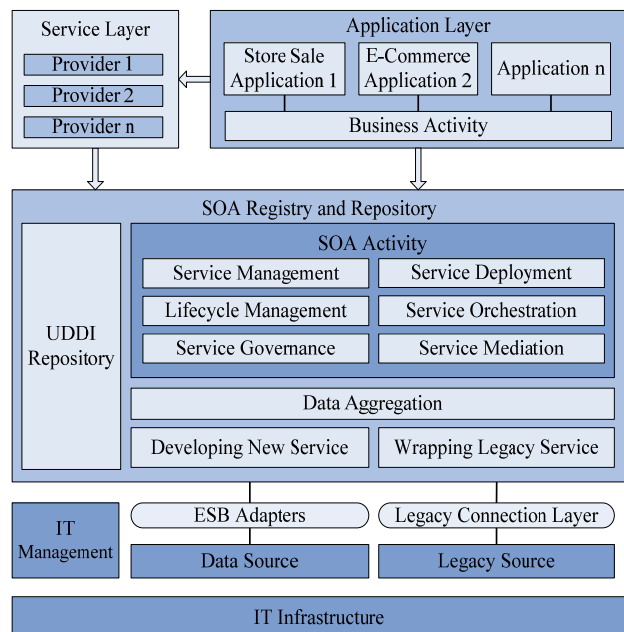
Fig. 3. The SOA Structure and Components of The Overview Structure

This paper is processing the research and evaluation on the SOA structure of 3C channel distributor. The

SOA structure will process the system planning and process design on 3C channel distributor, includes Service Layer, Application Layer, SOA Registry and Repository, as shown on Fig. 3. The explanations are as follows:

1. Service Layer

Service Layer is the layer which mainly designs service components and management of it. It is maybe designed by the business partners of 3C channel distributor, outsourcing company or the third parties, easy for them to design for enterprise and to provide services. In essential, the design of the related service component should adopt open standards, and meet loosely-coupled interfaces, then to provide complete service and to support for enterprise's SOA. Technically, it must publish service designed by itself, register to UDDI Repository, and also can be bound and consumed by Application Layer.

2. Application Layer

Usually, Application Layer is some retailing stores and E-Commerce website. These can deploy, manage and maintain everywhere, and connect each other by Internet. They can follow Business Activity's process rule to search available service resource on UDDI Repository, then access service resource from head quarter and vendors.

3. SOA Registry and Repository

This part is the most important part and also the major contribution of this paper. This part includes UDDI Repository, SOA Activity, Developing New Service, Wrapping Legacy Service and Data Aggregation. All these will be described in detail as follows.

A) UDDI Repository:

UDDI Repository can register whole service components of 3C Channel Distributor, and all services and components developed by all external partner vendors. To enable developers can use Web Services to integrate internal service components of 3C Channel Distributor, and to process inter-integration on cross-network and partner vendors. Through UDDI's function, we can establish and mediate more smart and reliable application programs.

B) SOA Activity:

● Service Management:

In SOA Service Management, every service has its own task, and produces certain specification and result, then hands over to next service. If lack of management or error caused by result of previous process, the whole SOA will possibly fail.

● Lifecycle Management:

For any service component, we need to experience requirement analysis design, development test, integration test, installation and implementation, to the end of disuse.

● Service Governance:

This activity controls service execution in SOA. Service Governance cares how to utilize resources to bring value for enterprises. SOA needs a standard method, includes agreement like strategy, contract and service. By using services, we can rapidly construct or modify business process. Hence, SOA enhance the needs of well governance, which helps to dispatch decision authority, role and responsibility.

● Service Deployment:

In terms of service, we can utilize various services to construct required application programs. By using of deployable services to deploy these application programs, we will implement the execution environment of SOA.

● Service Orchestration:

Usually, it is in SOA due to different business relationship, automatically compose, co-ordinate and manage. It owns an inherent intelligence or implicit autonomy. Service Orchestration is always discussed on SOA issues.

● Service Mediation:

Sometimes, some service components are difficult to modify interface. They need Service Mediation to provide composition and co-ordination of service execution. This technology can be used on service interface transformation, transmission protocol change, or data format transformation, etc. These functions mostly use intermediate software to implement.

4. The Strategy Analysis of User Requirements

As for enterprise real situation, legacy system should be considered to put into SOA. In addition to understanding original business process and system process, we should also evaluate if reuse legacy components by wrapping way or re-design new components. The other part is developing new services, which is a brand new module. It is a necessary module for rapid change of business environment.

According to business experience, the interviews of user's requirement should be able to cope with rapid change of business environment, and need to realize current system capability for adopting new development way or extracting legacy components way, as shown on Fig. 4.
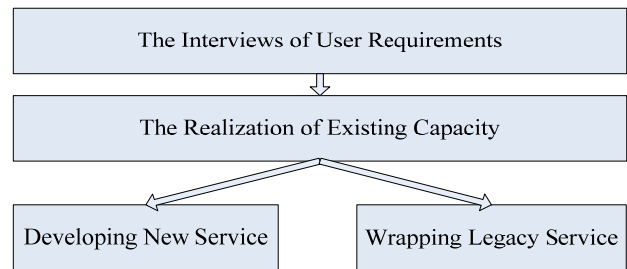
Fig. 4. The Analysis Stages of User Requirements

A) The Interviews of User Requirements:

This is the interview communication with leaders or operation staffs of required departments [16] . The major purpose is know-well the user's concrete requirement aspect or future tendency in a macroscopic way, to have a clear idea about existing organization architecture, business process, software/hardware environment and performing system. Then it can cope with the business diversified tendency in the future.

B) The Realization of Existing Capacity:

Based on realizing existing organization architecture, business process, software/hardware environment and performing system, we can combine with existing software/hardware implementation solution, to formulate a simple operational process plan. Meanwhile, we can also retrieve previous experience to judge whether using new development or adoption of legacy components. After detailed analysis and evaluation, we can obtain the accuracy of complete design. We need to consider if the software systems and hardware devices on the infrastructure are affordable for all execution capacity. Otherwise, some potential "Weak Points" will cause service suspension issues [28] [17] . On the basis, we need to do concrete process description and component confirmation, and to provide prototype design, clearly to describe system objective, then to complete analysis and discussion.

5. Developing New Service

SOA emphasized loosely-coupled and cross-platform integration, and this meets with MDA. However, MDA did not separate CIM and PIM, and it sets PIM as starting point. The first step of MDA is having an UML model for desired system. MDA will offer a PIM model to express function requirement of the system, then it can transform to PSM model. If these PSM model are sufficient and detailed, they can then produce the required programming code.

Based on MDA concept, we can process the modeling on MDA. On this basis, we will

implement various modeling transformation for SOA implementation, as shown on Fig. 5.
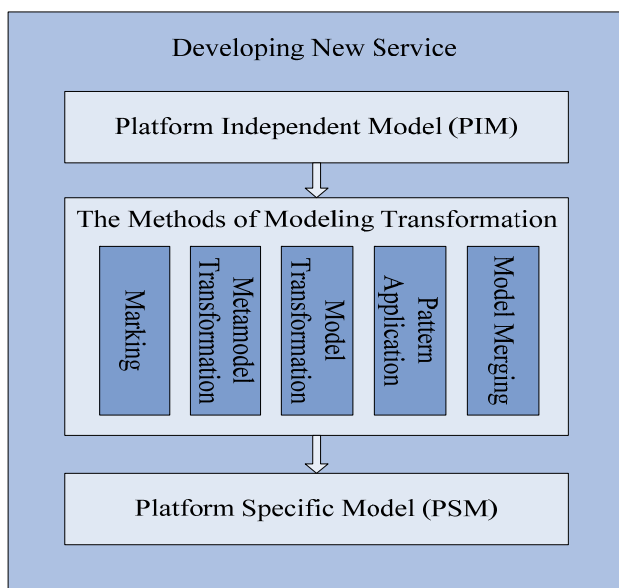
Fig. 5. The Methods of Modeling Transformation for Developing New Services

A) Marking:

To establish a marking platform in PIM and PSM is related to the specification of specific platform. In PIM, when it refers to marking of specific platform, we can then use this specific marking to transform it into required specific platform.

B) Metamodel Transformation:

We can establish a metamodel in PIM and PSM respectively, and we also establish a transformation model between PIM and PSM. During the transformation, we can process the establishment of specific platform base on the specification of PIM model and PSM model.

C) Model Transformation:

This transformation model is establishing the characteristic and type of required specific platform. During the transformation, the sub-type PIM and the sub-type PSM will be transformed via intermediate platform.

D) Pattern Transformation:

To establish another model for type and pattern during transforms, it is base on this model to process correspondent transformation.

E) Model Merging:

To establish a merging model for type, specification and definition during transforms, we can merge these two models into a new PSM.

6. Wrapping Legacy Service

In this part, that will be a serial of steps for wrapping legacy service, including: Selection of

Candidate Components, Estimating Value of Candidate Components, Extraction of The Legacy Codes, Wrapping The Legacy Codes, and Transforming into The Service Components. As shown on Fig. 6, each detail will be described as follows.
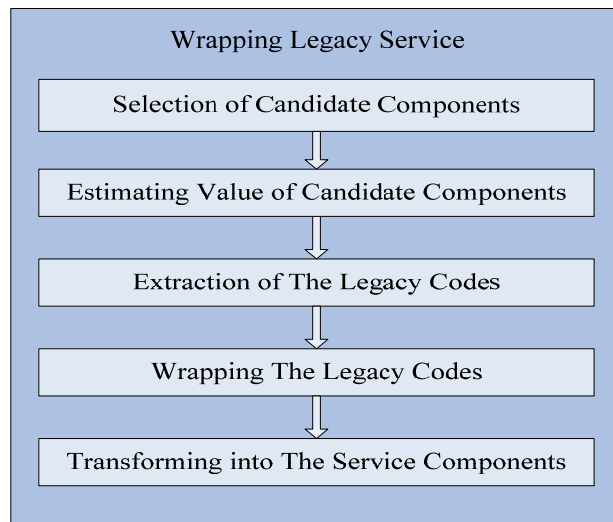
Fig. 6. The Detailed Description for Wrapping Legacy Service

A) Selection of Candidate Components:

The searching of components usually is limited inside the company, as it will establish its own reusable components in the company, and no need to concern about the potential risk derived from the components of external vendors. Next, from the list of the candidate components, we will select the components which meet user's requirements. This step is sometimes simple, nevertheless, the different requirements need one or more components. Then we have to consider what kind of component combination is able to cover mandatory requirement. After selecting, we also need to confirm if components execution meets expectation, then we can adopt it into system. For all components in enterprise, we will list them base on different component items.

B) Estimating Value of Candidate Components:

When the list of all components have completed, we need to process estimation on these component items to make sure the reusable value. In these component items, first priority is to distinguish some complicated components [24] , for example, some component items may cover a serial of business process or function. Meanwhile, we need to estimate the details for the business process or function. The value analysis of candidate components is a multi-dimensional analysis for the legacy systems. We can analyze on time-spending

rate, efficiency rate or suspension rate. These can be computed based on historical records, even we can estimate on availability, reliability, scalability, maintainability and security [29]. Every component item has a quantity number for computing the reuse value of candidate components, to obtain the final candidate decision. Since these candidate components have been analyzed and evaluated, and they have the real business value. Next it will come to the stage of extracting the legacy codes.

C) Extraction of The Legacy Codes:

When the estimation of whole candidate components is completed, we need to process extraction of legacy codes. On realistic situation, some business functions have deployed on different code blocks. Meanwhile, these business functions sometimes reside in application software. In this stage, we don't mean to reproduce it in another form, and we will follow practical solution to extract them into usable components. One block of codes may deal with some business functions, so the possible way is base on result to trace backwardly the whole execution status. Next, we extract the code and re-assemble it, we will enable these codes can be individual modules and correspondent interfaces. Finally, we can call the interfaces to use these code blocks.

D) Wrapping The Legacy Codes:

The purpose of wrapping process is for providing the methods of usable components. When extracting from the legacy codes, that will provides input/output ability, same as WSDL interface. The technique is using each code's entry point into a method, then transforms each parameter into an XML data element. The wrapped component has two additional modules: One module is for parsing the incoming message and extracting the data from it. The other module is for creating the return message from the results. To provide more interoperability and integration, the paper [13] proposed the meta-model of the multi-functional service to define the simple interfaces and the multi-view interfaces, to operate input messages and output messages.

E) Transforming into The Services Components:

A component can be treated as a service provider because a component is an independent and executable entity. All services and communication of components are through interface. We need to define component when it transforms to service component. We can establish component model to define the component implementation, description document and deployment standard, to make sure component can interoperate. In component model, we designate how to define the interface, and it also includes the namespace, parameter and exception. Finally, the component model should produce some description documents for user reference.

7. Data Aggregation

As more and more requirements on enterprise integration of internal/external business process, the adoption of SOA is now a common consensus. When constructing SOA, we need to perform estimation design on legacy system before hand, and perform model design on new developed service component as well, to smoothly integrate into SOA. Nowadays, when enterprises promote the upgrade of information system, in addition to the key points on heterogeneous system and legacy data integration, it also needs to re-construct business process or to develop new service components, to cope with the rapid change of business environment. Apparently, if enterprise wants to enhance productivity, reduce cost or raise operation efficiency, it needs to treat data integration as the most important policy. That is, on the issue of data aggregation, we need to collect information and present it in the form of summary, and that can be applied in statistic analysis. A common purpose of data aggregation is for collecting more variables in enterprises, for example, the information on relationship between merchandise status, member data and partner vendors, etc.

Data aggregation can use any kind of analysis tools to discover the relationship between model and data in huge database. We can use the relationship for decision-making, to solve current problem of data-excess and information-insufficient. For enterprises, these are mandatory and indispensable.

5 The Discussion of Real Business Environment

5.1 The SOA Templates for 3C Channel Distributor

The information system using by 3C Channel Distributor is a system which is constantly changed, no matter in merchandise procurement, merchandise distribution, pricing modification, maintenance, marketing promotion, customer service and telephone interview, even internal performance report and auditing, etc. As SOA provides loosely-coupled interface, it meets the flexible requirement of 3C Channel Distributor.

Generally speaking, every department has its individual business behavior, and has individual

requirement to cope with marketing promotion, it is hard to integrate smoothly by single system. Hence, it needs to develop various systems separately, but that results in resource-wasting. However, through SOA, we only need to adopt consistent architecture format, then the correspondent resource can be analyzed, compared and integrated. The co-ordination between different components not only saves resources, but also reaches integration by well-utilized all departments' information. Then we can obtain higher quality of architecture design.

Base on SOA's characteristic and the principle of 3C Channel Distributor architecture plan, we can work out a SOA integration platform architecture which is foresight and expandable. This architecture enables information connectivity of all departments and enhances departments' self-synchronized ability, in order to elaborate the synergy and adoptability. To achieve the target of rapid integration, we can focus on the templates of the process for merchandise procurement, merchandise distribution, home delivery service, maintenance, instant pricing modification, marketing promotion, customer service and telephone interview. All these required the establishment of a clear and accurate blueprint on existing business resource, process and relationship.

5.2 The Topics about Integration of New and Legacy Systems

The integration of new and legacy systems, or even data integration, that will face a big challenge, and that becomes more important. The main reason is because informatization degree of most enterprises has been matured. These systems developed in different periods and the derived data are gradually facing the new issue of the systems and data integration. This emerges of informatization tides, and all enterprises are speeding up their informatization path due to the fear of losing market competition ability, but few enterprise thoroughly considers integration issue of different techniques on the very beginning of informatization. However, when integration concept emerges, there will be too many systems and technologies come out.

First of all, we need to realize what makes integration issue become so important in enterprise [23]. The scale of organization is the important factor that influences system integration and execution performance. As enterprise grows, the volume of system constructing may increase heavily. When the volume of system is huge, the complexity of system integration will be raised. Besides, as enterprise grows, the logic of enterprise operation

may become diversified. That makes users in enterprise need for additional different requirements, so that requires information system to deal with it. From the analysis of competitiveness, the enterprise's valuable data resides in different systems. The only way to integrate these data into valuable information for decision-making is integration. However, in view of the complexity of heterogeneous systems in enterprise, there still exists different data structures and standard interfaces, together with most enterprises do not well-utilize tools to solve data integration problems [29] . They still prefer using hand-coding way to solve integration problem. The above-mentioned problems make the integration issue as a trouble. Hence, the paper [9] summarized major practical requirements from SOA projects and provided an overview of method imperatives that addressed the requirements.

To solve the integration problems, many enterprises used to eliminate legacy systems thoroughly, replaced by brand new technology systems, and it is the ultimate solution of integration problems. Nevertheless, it is not a practical solution because there is no systems can well-cover an enterprise's internal operations. Furthermore, enterprise is not allowed any single day of suspension. In current competition situation to create better margin, we need to well-utilize the existing investment. Hence, in the field of enterprise system integration, we suggest the first priority of enterprise is formulating strategy and develops a set of standard processes, and to enable legacy system resources can be well-utilized [25] . Besides, when adoption of new technology, we can make sure it can integrate with legacy systems in shorter time.

Currently, when most enterprises face the decision of system integration, they adopt the most popular SOA technology. The purpose of using SOA is providing a distribution architecture and loosely-coupled interface, to enable the use of service can follow the business process for accessing the required service components. After the emergence of SOA concept, IT industry begins to launch SOA application products, but all of them are focusing on how to transform those existing non-opened interfaces in systems into public Web Services, or develop Enterprise Service Bus (ESB) directly, to access all retrievable services, then it will enhance the function of Web Services more closely.

6 Conclusion

In highly competitive business environment, enterprise starts to look for the system that can

rapidly react the market changes and speed up the schedule of product manufacturing, to meet the multi-requirements of time-saving, cost-down, high return and low risk. To achieve this goal, this paper asserts that a Business Process Management (BPM) constructed on SOA can assist enterprises to solve problems, accumulate business benefits in earlier time, and provide positive results.

This paper proposes the standard specification of this blueprint, to enable every system in 3C Channel Distributor can support each other well. To formulate reliable component interfaces, we can deploy dynamically to achieve a better flexible SOA system.

Apparently, when enterprise's business target is in accordance with IT construction, the enterprise will be more efficient on operation. That is, when decision-maker works out the objectives, IT department needs to follow this to formulate appropriate software and make sure the availability of IT systems and architectures. In the past, business process management is a difficult and expensive issue. After adoption of SOA concept, business process management then becomes a major part of total solution. Enterprise can process modeling, monitoring or re-design, to enhance system's competitiveness.

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