Research on the Processes and Strategic Points of SOA Project Implementation

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Abstract. As an important methodology in service science, SOA is already used in the software development in recent years. It can most adapt to the ever-changed requirements. But the strategic points in the SOA project implementation and the interrelated standards about SOA are very confused for most users. Through the many years' practices about SOA project implement, it analyzed the strategic points and misapprehending on the application of SOA in detail. It gave some reasoning and suggestions for the implementation of SOA. It also explores the SOA standards and shows a sample about the light-weight SOA product model. The relevant technologies about SOA and Web service to realize the application systems have been also researched.

Keywords: SOA, Component Oriented, Project Implementation, Strategic Points

1. Introduction

The service concept derives from the social and economic fields. It means the reciprocal process and behavior between the consumers and providers to create and implement values. But it is often acted as the network component in field of the information and communication science and technology. With the centre of service and values, the service computing is used to solve the practical problems in building, deploying, operating and maintaining the applications [1].

SOA (Service Oriented Architecture) was put forward by Garter Group in 1996. It started the important development stage of service computing. From 2003, service oriented programming paradigm' decoupling, based on open standards interoperability, large particle reuse, supporting dynamic expanding technologies have begun enjoys popular support. SOA is hot and getting hotter [2]. More and more projects have begun to use SOA methodology in EAI (Enterprise Application Integration) and other application fields to seek the software reuse, flexibility, low cost and rapid development.

But the strategic points in the SOA project implementation and the interrelated standards about SOA are very confused for most users. On that account, this paper has analyzed the problems in SOA project implementation and given some reasoning and suggestions for the uses of SOA. All of those came from the many practices in SOA project implantations. Such as the refinery EAI projects, the power enterprise projects and document processing in internet and other fields.

2. Research on SOA

2.1. The Development of SOA

SOA is an important and effective approach to realize the large systems. The development processes of SOA are divided into three phases [3]: Firstly, SOA focuses on the integration in enterprise and resolves One-to-One relations. It starts from 2003 year. Secondly, SOA focuses on the value chains between the credible associate enterprises and resolves One-to-Many relations. It begins from 2007 year. Thirdly, SOA Focus on

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finding new associate and new services. It resolves Many-to-Many relations. However, the start year cannot be confirmed. It depends on the advanced research and application about SOA and other new technologies.

In SOA, services are wrapped as loosely coupled reusable Web services. However, at implementation time, there is no way to loosely couple a service or any other interaction between systems. The systems must have some common understanding to conduct an interaction. Instead, to achieve the benefits of loose coupling, consideration should be given to how to couple or decouple various aspects of service interactions, such as the platform and language in which services are implemented, the communication protocols used to invoke services, and the data formats used to exchange input and output data between service consumers and providers. ESB (Enterprise Service Bus) can carry the services out between requesters and providers.

The various services are usually accomplished by components [4]. The component oriented technique is an effective and feasible method to actualize SOA.

2.2. Analysis of the Misapprehending on SOA

SOA has become the hottest topic in the software field, and is the new landmark which shows the progress of technologies and reconstructing of software industry. But SOA cannot be used in all-purpose; it has its special application scene.

In SOA, services are wrapped as loosely coupled reusable Web services. But it may bring some expenses on the system performance. It is difficult to control the business logic in small granularity. We must know the adapted scales of SOA so that to avoid the non-necessary complication and costs.

Firstly, the big granularity principle should be persisted in to avoid the abuses of SOA.

There are some scenes below which are not adapted to use SOA:

- To develop a simple single application.
- To develop a high throughput or real-time application.
- The network speed is very slow or non-reliable.
- The service interface is not assured or not steady.
- To develop the high security application.
- The business process has very strict request on the transaction integrality.

Which scenes or business problems are adapted to use SOA? The initial idea of SOA is to resolve the reuse of the IT carry-over applications, and to build the ever-changing business systems agilely. Therefore the application fields of SOA are mainly at the exchange of data, the communication each other among the business applications and the process automation of Web services.

Another misapprehending is the attention on the interrelated SOA product more than the attention on business itself.

Actually, most users concern how to connect the new technologies with their professional value-chains. Thus it is very important to analyze the professional application business activities and the value-chains in deeply. The professional component libraries can be realized according to the profit points and KPI (viz. Key Performance Indexes). To build the component libraries is very important to realize the large applications based on SOA and component oriented technologies. Of course to use the base component libraries and SOA platform from the third-party can speed up the development of the special applications. But the professional component libraries and business process constructing must be developed and not replaced by the third-party products.

2.3. The Relevant Standards to Actualize SOA

At present SOA technology system and its standards is still quite complex. SOA technology system usually includes three aspects, the first is basic structural elements of SOA, the second is a set of technologies related to SOA project and the third is a set of underlying technology related to distributed system common problems.
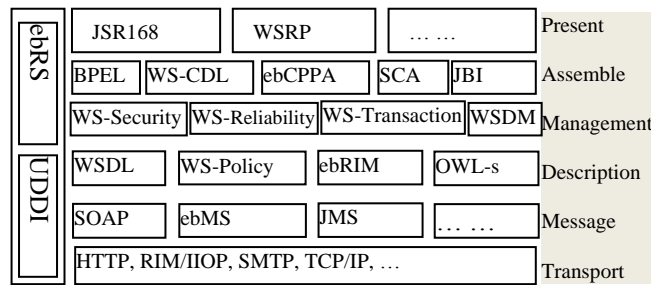
Fig. 1. SOA Protocol Stacks

Currently, there have been many SOA related standardization or industry organization, different organizations (W3C, OASIS, WS-I, OMG, OSOA etc.) have developed a variety of SOA-related standards or specification. According to the preliminary statistics, SOA-related standards or specifications are more than eighty. In this context, the SOA standards and their implementation are varying in the industrial sectors. This will make the connection and communication difficult among the different products.

One of the classification methods about SOA standards is the one according with the functions in SOA. They can be divided as three classes, namely the service information alternation standards, the foundation communications standards and meta-data standards [5]. The SOA protocol stacks can be divided into six levels by the standard functions in SOA. It shows as Fig. 1. From the bottom to top, they include transport layer, message layer, description layer, management layer, assembling layer, present and service finding register layer. The most of them have been used in the SOA applications except of ebXML and other e-business standards.

Faced with such a huge SOA technology system and so complex SOA standards and specifications, we urgently need some light-weight SOA platform solutions. It is must be more simple, easy to use and to shield complex technical details.

3. Research on SOA Project Implementation

Just as other projects, SOA projects have the same implantation processes shows as Fig. 2.
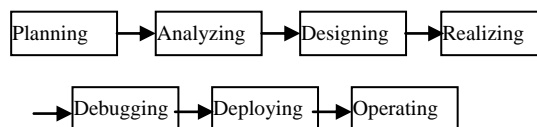

Fig. 2. SOA Project Implementation Processes

There are nothing special points just seeing from the surface of several processes in SOA project implementation. To reflected SOA features is showing in project implementation process in the each a specific links in the SOA implementation, as planning stage on standard of consider, analysis stage on business of more description and defining, design stage about technology schema defining (including logic schema and physical schema), implementation stage more rely on service defining and not coding, and operation and maintenance stage focus concern on service run situation.

Below are the key points in the process of implementing SOA project.

3.1. Planning Phase

At this stage there are many important things to do. This will determine the success or failure of implementing SOA projects.

Firstly, need to identify the project target, for system functional goals should be clear, apart from that we need to focus on is why adopting SOA, what objective is to achieve. At this point we need to understand what SOA can bring to us, what we want, and whether the two are matched, also need to know what does SOA fit, not for what, whether we build projects and SOA for adaptation. If they are matched well, we can rest assured

the next step. Otherwise, it will have to consider whether to adopt SOA, the use of other's ideas and technology architecture is enough to solve the problem. Here we'll look at the characteristics of SOA: emphasis on reuse of business services support, the business adoption of flexible reconstruction, stressed in a loosely coupled stress standards.

Secondly needs to consider the scale of the system, it is recommended that the first selected SOA projects is not too large, you need to limit the size of project, so that to guarantees the project can be successfully implemented in a short time to ensure the success of the project. The accumulation of experience through the project, create a good situation for the next SOA project and the environment. SOA itself features support the progressive realization of the project, you can scroll continuously improved methods to implement the project.

Then is considered standards, where the standards contain two areas: business and technology criteria. To determine the standards in the process have been considered in the whole issues, in the analysis and the design phase the standards need to be considered also and the final standards to finalize the project have been determined.

Business standards can specify services, processes, and data; technical standards can help determine the technical framework, determine the use of technology, you can ensure that the reuse of services or components, assembly and operation and maintenance.

Last is to form a team, to implementing SOA projects, need to ensure reasonable members of the team. First of all, take part in a project under the leadership of a guarantee of success, SOA projects typically involve more than one sector, or collaboration among enterprises, without leadership participation and attention, such projects will be very low likelihood of success.

Business personnel involvement is also an important factor, SOA service is highlighted in business services, not technology implementation services. Business service definition, classification, determination of business processes, analysis of business data, all of those cannot be basically carry out if no business involvement. At this stage it is not particularly realistic to make business personnel to become directly involved in the design and implementation, but with the maturity of SOA technologies and products, business staffs have been involved in the design, even the implementation phase are possible, only so as to better ensure the success of SOA project implementation in order to better reflect the value of SOA.

3.2. Analysis Phase

Analysis stage mainly analyzes and rearranges the business, including: business service definition, business process definitions, analysis of business data and organizational structure. At this stage needs to determine what business needs to implement in the SOA projects, how to reuse business, how to thread business together to complete a work process, and what data and data relationships needs to be used in the implementation of business processes.

Business defining needs to consider the following factors:
- Who has business service?
- Who needs using business service? How to do authorizing management?
- What is the business' basic identifies information?
- What is the business' function description?
- What is the business service' using constraints conditions?
- What is the business service' using of data information?
- What is the business service' quality characteristics? Such as reliability, security and transaction.
- What is the business service level information? Such as service response time, can provides service time and service charges.
- What is the business service' life cycle?
- Which information is needed to concern in running?
- Organization schema analysis need to consider the following factors: actual organization schema, roles in organization schema, role management and permission in using service and process and data. You can use a table to describe and define them.
- Then needs to consider a combination of organization schema and services, to define a business process, determine which services are in a business process, which departments/roles to use these services. These can be defined by a graphic description. At the same time needs to define business processes, business rules, and so on.

3.3. Design Phase

Design phase is actually into the technical areas. You first need to determine the technologies architecture, the specific technologies, tools and products. And to determine the technical standards, to define the physical environment of the SOA project, as well as the mapping between the logical framework and the physical environment, last need to refine the design details of the entire project.

In determine technology schema need to consider the following factors:
- How to storage and use service description?
- How to implement service? You can choose packaging the existed business system, or implementing them or assembling the several services as a new service.
- How to use the defined services? How to be assembled as a new service and used in the business process?
- How to implement the communications in the services? You need to select communications agreement, need to consider reliable, efficiency and security factors.
- How to obtain the service running information? How to apply the service running information?
- The definite technologies should be determined according to the actual truth, which can be traditional technologies or Web service technologies.

Service in the SOA is not necessarily equal to Web service. Using Web Services more generally are considered from a standardization perspective, in order to achieve heterogeneous system interconnection and more applied to multiple departments between systems or interoperability between enterprise systems. But the already mature technologies can be selected in implementing SOA, such as messaging via JMS (Java Message Service). It can guarantee the efficiency and reliability of transmission.

The second aspect of realization technology is to consider whether the business process implementation needs to use BPM (Business Process Management) systems, or through the service assembly technology, combine several services by encoding application. BPM should in general be used for real-time business processes that require less processing; and for business processes that require continuous run processing, you can be achieved through service Assembly.

Achieve the third aspect technical you need to consider how to implement services, as to use existing IT systems through the service packaging, or recoding. Packaging the existing system as service is not necessarily to be packaged as Web services, service descriptions are generally uniform, implementation can be either Web Services or EJB (Enterprise Java Bean) or BPEL (Business Process Execution Language), or General JAVA or C/C++ program. During the design phase need to implement the mapping between the logical schema and the physical schema. In the overall architecture design we consider more from a logical perspective, and business needs to be converted into IT technology architecture. At the same time also requires physical schema planning, and determines the logical schema mapping to the physical schema.

The physical architecture need to consider how many independent running nodes in the whole system, the number of existing business systems and the new business systems need to establish. You need to consider these existing or new business systems running on which nodes. Then you need to consider how to communicate between business systems, and convert communication among business systems to communication among the nodes.

BPM system usually has a separate server engine; server engine can run on multiple business processes. In general, a business process execution engine running on one server under the existing technology. If you need engine across multiple servers, you will need to define a process as a sub-process and packaged as a service, for use by another process.

In the framework of physics need to consider whether there is a separate service registry centre, you need to decide whether is online or offline between service registry centre and running node.

The main job in the design stage is to refine system design work. It has included the service definition of refinement, including information such as service interfaces, quality attributes, service level, in addition to deployment information can be defined in the implementation, and deployment phases.

In order to refine service and assembling service needs to determine what an atomic service (non-split) is in the design stage, which is assembling service, which is the process service. At the same time need to define the service implementation (the original systems, re-implemented, service organizations, service processes) defined business processes, through tools defined business processes, including exception handling. Define

the data objects that apply to service. It requires effective management of the service, so you can easily find related services, ensures authorized personnel to use the relevant service, or modify the service.

3.4. Realizing, Debugging and Deployment Phases

There is more difference between SOA project and traditional IT project. In traditional project implementation almost all code is written in, or uses an existing public code base. But a lot of work is done by defining in SOA implementations. Such as services interface and the service process in the design phase, this does not require hand-coding, and more of a definition of information through tools for graphical operations.

During the implementation phase there are other definitions works to be done, such as definition of data objects. Different services use different data objects may not be exactly the same, in order to achieve smooth communication between services, need for data conversion between the data object, which can also be defined by the tool to achieve, of course, can also be achieved by encoding conversion of the data object. Another definition is service adapter definition which makes existing business systems as a service interface. Furthermore, there are environment definition and service packaging and deployment.

In the SOA implementation phase, it is possible to have some programming work, such as the implementation of the new service, conversion between a complex data object, responsible for business system service package. In SOA projects, debugging of the system would be a more complex and difficult task, different from the general application system you can debug by step track system as a whole.

Some debugging tools (such as BPM debugging) can be used to bring the part function of trace debug in SOA implement. There are a lot of works needed to write the log to track and check the running if meet the design requirements.

Deployment of SOA projects can benefit from some product tools to achieve automatic deployment. Without these tools support deployment will be more complicated, because of multiple distributed nodes, you need to connect different systems. Through tools for deployment, deploy also has an automatic online and offline deployment in two modes. As automatic online deployment, you can through the tools automatically deploy the packaged file to run on the node, and the system can automatically start and run. But manual deployment will need to manually install the packaged files to run on the node, and must run commands about expanding and executing so that to make the system running normally.

3.5. Operation and Maintenance Phase

Operation and maintenance phase of SOA projects is also a key part of the project as a whole. By tracing the running process on track you can understand the operation of the entire system, such as what services are requested most frequently, which services are running the most stably, which services is not desirable for service design requirements (such as response time exceeds requirements). You can find out which nodes running load higher, and can know the data communications traffic. From this information, you can estimate the whole system if meet the system's initial demand. On the other hand it can provide basic data for the optimization of the system. Through these monitoring data, you can better optimize system perfect and reflect the characteristics of SOA gradually improved.

4. The light-weight SOA product model

At present, some SOA development tool products have been proposed and applied. They can speed up the SOA project implementation. Here we show a sample about the light-weight SOA development kit which is recently proposed by the Beijing ChangFeng Open Standards Platform Software Alliance [6]. It consists of SOA tool set (include in Modeling Tool, Integrating Tool, Running Administer Tool etc), SOA base product (include in Service Container, ESB, Process Engine, Service Libraries, Safety Components, Service Adapters etc.), SOA universal business service product (include in Interface Service, Form Service, Organization Login-right Service etc.), and SOA application service product (include in Resource Management Platform, Share and Exchange Platform, Business Coordinating Platform etc.). Fig. 3 shows a sample of light-weight SOA development kit.
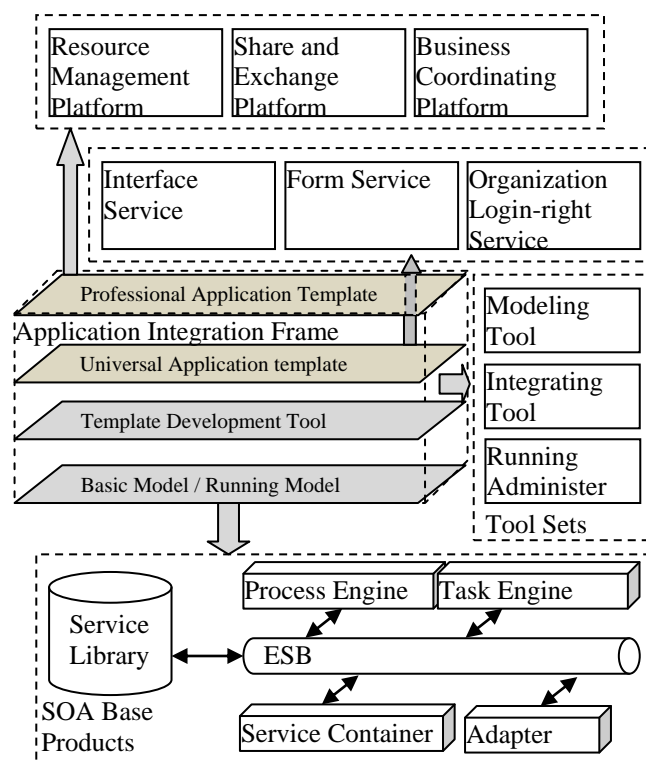
Fig. 3. A Sample of SOA Development Kit

It can be used to both developers and end users with the implementation and development tools and SOA basic product support. And it can provide standardization, common patterns / templates and application processing software for the different industries in the area of SOA integrators. It effectively shortens the distance between SOA technology and business application, and to reduce the difficulty of implementing SOA, promoting the standardization of SOA. Of course, the above product should comply with the up to date SOA standards and specifications, such as SCA (Service Component Architecture) [7] / SDO (Service Data Object) [8] standards.

5. Conclusion

In short，the implementation of SOA project and the construction of traditional IT projects still have a large difference [9]. First concern is the service in a SOA project, from the service definition, using service to running management. Second one is to emphasis on standards and model-based development process. Then the defined activities in the achieving process is the emphasis in project, through the combined application of the service, shorten the construction period, all of those need to be focused in the implementation process of the project.

6. Acknowledgment

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