

Design of SOAML in Social Network

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Abstract—In the information age, IT companies pay more and more attention to the quality of service. Social network service providers concentrates on saving the cost and developing products with better quality. The explosion of Web service has provided good opportunities for these companies, and also brought severe challenges to them. Therefore, the efficiency and the reusability would be the important factors that developers should consider about. In order to meet the requirements above, this paper designs the model of social network service with Service-Oriented Architecture Modeling Language (SOAML), which supports the service-oriented modeling and design. The service-oriented modeling method focuses on abstracting the different services and finding the relationships among them. The key steps of this method contain decomposing the business processes, selecting the candidate services and extracting the control processes. After comparing with other modeling methods, it turns out that the SOAML modeling method introduced by this paper is of high efficiency, high reusability and low cost.

Index Terms—service-oriented architecture, modeling, SNS

I. INTRODUCTION

With the constant development of social network, it plays an important role in people's lives. So the social network services draw more and more users. The main users of social network are well educated young people with good income. These people have high and flexible demands in social network. The following characteristics are shown when they use social network services. The viscosity of the users is high, but the degree of participation is not deep enough. From the perspective of the use circumstance, many users do not use it after registration. Users of this kind make up the largest percent of people registered. And there are many observers but few commentators; the percentage of the users who write the logs or build the photo albums is the smallest.

The number of applications that are based on social network is increasing, and the scale of social network is becoming larger and larger, resulting in chaos in the architecture. The modeling method of SOA (Service-

Oriented Architecture) introduced by this paper can solve this problem. Building the social network model aims to establish a new type of network service architecture that provides the coarse-grained encapsulation of functions and pursues the reusability of the software. Service-oriented architecture has a lot of advantages. First, it can reduce the cost and improve the rate of return on investment. Second, using existing services can save the time of development. In addition, the reuse of services could improve the stability of the system.

In this paper, we study the application of the service-oriented architecture modeling in social network, and build the models for social network services with SOAML [1]. In the first section, the background of the social network is introduced as well as the basic knowledge of SOA. The Second section mainly describes the related works of SOA modeling method. In the third section, the service-oriented architecture theory is introduced in detail. The fourth section focuses on building the models of social network services. The fifth section carries on the analysis of SOA modeling method, and shows its advantages. The sixth section includes summary and prospect.

II. RELATED WORK

The concept of SOA (Service-Oriented Architecture) is proposed by Gather Group in paper [2]. With the development of Internet and the appearance of Web services, SOA technologies have been used in different fields widely. And a large number of SOA standard are made under the joint effort of researchers and engineers [3].

Paper [4] mainly discusses SOA technologies for interactive collaborative learning system. In the paper, the author accurately illustrates the importance of SOA in the e-learning. SOA could improve the effectiveness of collaborative learning system. Paper [5] focuses on studying the economic potential of SOA. The author not only provides IT Industry with good evidence that SOA could be helpful to develop the products, but also makes the common framework for the others to understand the economic potential of SOA. Because the number of SOA

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applications is increasingly fast, paper [6] analyzes the key challenge faced by software maintainers and devises the new static and dynamic analysis methods. With the development of cloud computing, SOA has also been applied in this field. Paper [7] studies the current cloud computing architectures, and then builds a new cloud computing architecture based on SOA. To test and evaluate the SOA-based systems, several methods have been devised. Paper [8] analyzes the limitations of these methods, and summarizes the support conditions of these methods in context of service-oriented architectures. And papers [9, 10, 11] introduce the applications of the service-oriented theory in other fields.

III. SERVICE-ORIENTED ARCHITECTURE MODELING

The W3C (World Wide Web Consortium) defines service as: "After a set of work has been finished completely by service providers, the end results are delivered to users. The results usually change the users' state, and sometimes the state of the provider, or both of them." Service providers and service users are both involved in the definition [12].

The OASIS (Organization for the Advancement of Structured Information Standards) defines service as a kind of mechanism that can be used to get access to one or more functions. The access uses the interfaces that have been defined before, and is consistent with the constraints and strategies described by the service.

The definitions above are all abstract, and only describe one aspect of service. The definitions have not thoroughly demonstrated the characteristics of service [13]. However, the characteristics of service can be summarized systematically in the service-oriented architecture.

A. The Hierarchical Structure of the Service

In the service-oriented architecture, service can be divided into three types [12].

1) Application level service

Application level service is usually called technical function service, which is mainly used to complete functions of the bottom layer. The application level services are commonly used to realize functions that related with technology platform, so as to abstract the technology of the bottom layer, thus to provide the upper layer with a platform not related with technology. The application level services realize general functions that are independent of specific business, and because of that they are highly reusable. The typical application level services include log service, safe service and encapsulation service. Parts of the functions of the system are encapsulated and the interfaces of them are provided, so that the users can access to the services in a unified form.

2) Business level service

Business level service is used to realize some specific business operations and business logics. In the concrete implementation, the business level services combine the application level services and business rules to realize the business logics. Generally, they can be divided into two types, i.e. task-centered service and entity-centered service. The business logics which task-centered service realizes

are mainly specific ones. And entity-centered service usually realizes encapsulation of some service entities.

3) Process level service

Process level service provides the support of process automation for specific business. This kind of service is usually a service such as submitting the application of loan, checking the credit of the user etc., which enterprise provides to external customers or partners. The process level services usually have corresponding business process model, and use WSBPPEL to realize the services which greatly improves the flexibility of the process reorganization, so as to meet the users' new requirement.

In the service-oriented architecture, the services can be combined into a three layer structure. As shown in figure 1. The bottom layer is the application level service, which realizes the abstraction of technologies and platforms thus to provide a general toolkit service. The middle layer is the business level service, which abstracts the business logic, and it only cares about the business logic that it needs to realize, but not about the specific technologies and platforms. The top layer is the process level service, which supports business processes, encapsulates the business rules, and calls the business level service to execute the business process.

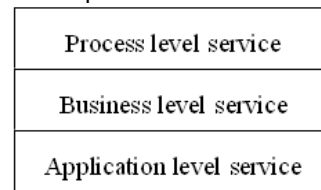


Figure 1. Hierarchical graph of the service

B. Service-oriented Analysis Process

In current IT environment, the new analysis process mainly includes the following three steps as shown in figure 2.

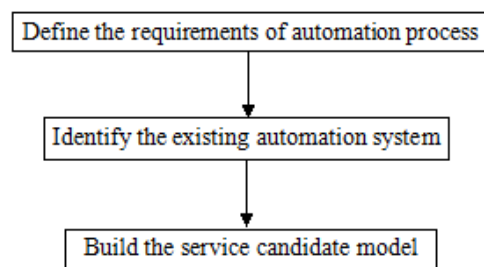


Figure 2. Service analysis flow diagram

1) Define the requirements of automation process

No matter how business requirement gathers information, it needs to use documents to start the analysis process [14]. Imaging that the analysis focuses on finding service-oriented solutions, and then only the requirement related to the solution should be considered. The business requirements should be considered carefully, which is a good method to define high quality automation process.

2) Identify the existing automation system

No matter in what degree, the existing application logics have already realized the automation process. When service-oriented analysis cannot make sure how to

encapsulate the services accurately or how to replace the original application logics, this step assists us to confirm the range of the system that may be affected.

3) Build the service candidate model

Service-oriented analysis introduces the concept of building service models, which can identify service operation and divide them into different logic context groups [15]. These groups would eventually form service candidates, and be aggregated to an experimental composite model. This model expresses combinational logic of service-oriented applications.

C. Service-oriented Architecture Implementation Strategy

In general, service-oriented architecture implementation strategies mainly have three kinds, which are respectively top-down method, bottom-up method, and meet-in-the-middle method.

The start angle of top-down method emphasizes the business process of the enterprise. This method makes the strategic plan of service-oriented architecture implementation from the whole level of the enterprise, and its foothold is the present situation of the enterprise information management system. Using this method, the enterprise can obtain more standard service which has a good reusability. However, there are some disadvantages of top-down method. The top-down method is with high cost and time-consuming. And the design range of top-down method is so wide, the enterprise has difficult to grasp.

The bottom-up method emphasizes the partial aspects of the enterprise and aims at a specific application realized in the service-oriented architecture. This method extends the idea of service-oriented to the entire enterprise gradually and builds the enterprise-level service-oriented architecture finally. In contrast to the top-down method, the bottom-up method is with low cost and of high efficiency. Because the bottom-up method focuses on the partial aspects of the enterprise, the service obtained in this method does not take into account the overall situation, and therefore it performs relatively poor in terms of reusability, and sometimes even may lead to redesigning service.

The meet-in-the-middle method combines the advantages of both top-down method and bottom-up method. It fully considers the risks of enterprises in the initial implementation, such as the changes in business needs, not familiar with development platform or technology. First, it provides a reference model and a reference framework. By starting from the small projects, it gradually masters the service-oriented architecture, and then builds fundamental service-oriented architecture in the enterprise. After a series of preparation, the service layer of the enterprise will be constructed. Finally, the service-oriented architecture would be fully applied to the enterprise. It turns out that meet-in-the-middle method is a more viable strategy compared with the other two.

IV. MODELING OF SOCIAL NETWORK SERVICES

There are three kinds of social network services shown as follows:

- Traditional community service;
- New type of interactive service;
- Entertainment plugin service.

To build the model of social network services, the service should be extracted first, and then the model can be designed. The principles of selecting services are as follows [16]:

- Services operated by the users manually, such as entering the account or password should not be selected as candidate service;
- For the remaining logical process of the existing system, the encapsulation of candidate services, such as the service which is the encapsulation of previous system would not be a candidate service;
- The four key characteristics of the service in selecting candidate services are reusable, autonomic, stateless and visibility.

After studying the framework of Facebook and other social network websites, the overall structure of social network service could be described as figure 3. The social network services mainly consist of the following five categories such as login, fresh news, diary, photo albums and music. The models of the service can be built with SOA modeling method.

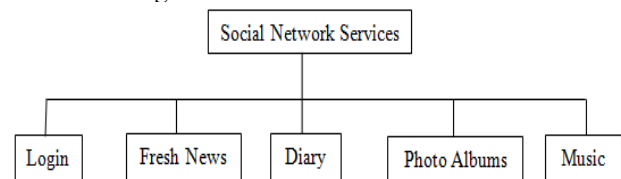


Figure 3. Social network service architecture diagram

A. The Model of Login

1) The flow diagram of login function is shown in figure 4.

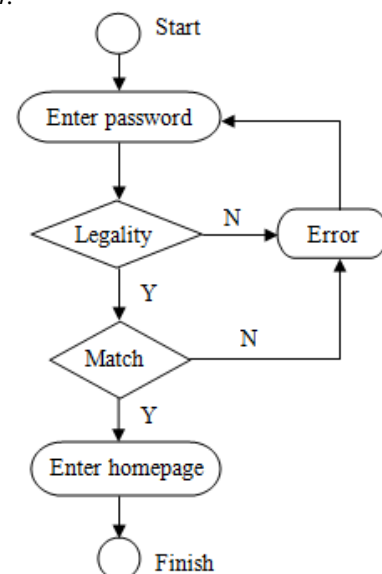


Figure 4. Login function flow diagram

2) The analysis of each step of the login process is as follows:

- Enter the account and password: this step is done by user manually, so it is not a candidate service;
- Check the validity of the input: when the system gets an XML file, it will use XML Schema to check the validity automatically. No additional operation is needed. This should not be a candidate service.
- Check the correctness of the account: the bottom code of the system will automatically do the searching and matching, which can be regarded as an application level service;
- Enter the personal homepage: this is a part of login service, and not a service;
- Prompt error message: this is a part of login service, and not a service.

3) Candidate services:

- The whole login service: a business level service;
- Check the correctness of the account: an application level service.

4) Build the model of login service

The login function diagram is shown in figure 5.

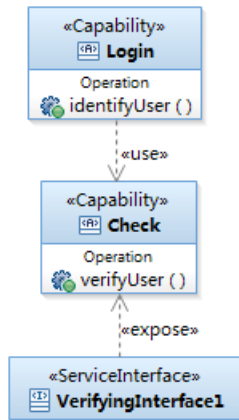


Figure 5. Login function diagram

The component diagram of login is shown in figure 6.

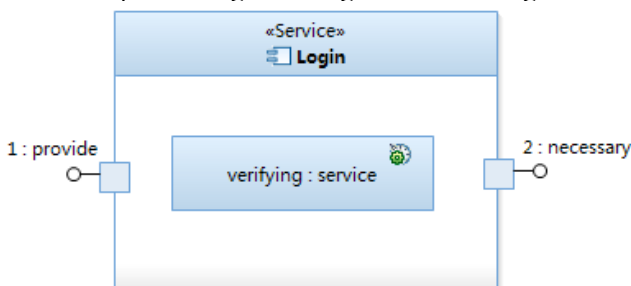


Figure 6. The component diagram of login

B. The Model of Fresh News

1) The flow diagram of fresh news function is shown in figure 7.

2) The analysis of each step of the fresh news process is as follows:

- Login: this is a business level service provided by login service above;

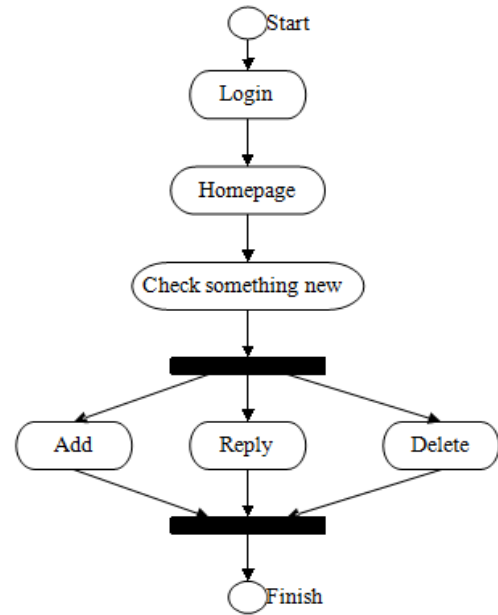


Figure 7. Fresh news function flow diagram

- Personal homepage and fresh news display: it tries to find all the user's friends' updating information, and return the searching results, which can be part of the business level service;
- Browsing the fresh news: as a component developed independently, which can be used as part of the ordinary business level service;
- Share: the same as above;
- Message reply: the same as above;
- Delete: it is used to delete fresh news from fresh news list, which is part of the fresh news service.

3) Candidate services:

- Login service: providing account ;
- Personal homepage displays fresh news: as a business level service;
- Scanning the fresh news: the same as above;
- Share: the same as above;
- Message reply: the same as above.

4) Build the model of fresh news service

The fresh news function diagram is shown in figure 8.

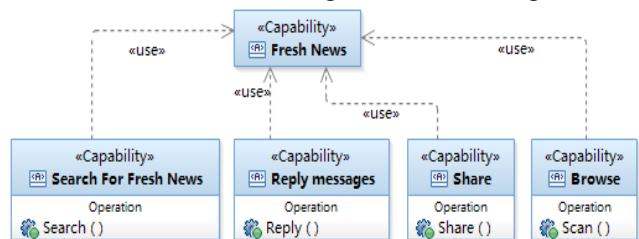


Figure 8. Fresh news function diagram

The component diagram of fresh news is shown in figure 9.

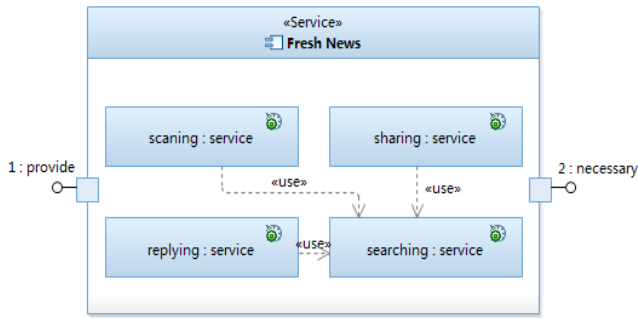


Figure 9. The component diagram of fresh news

C. The Model of Diary Function

1) The diary function flow diagram is shown in figure 10.

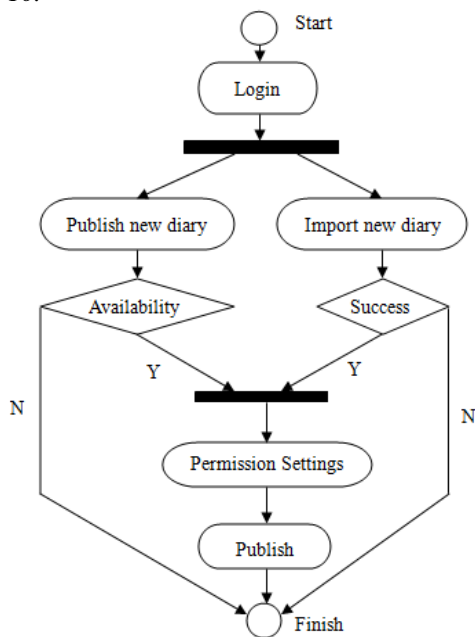


Figure 10. Diary function flow diagram

2) The analysis of each step of the diary process is as follows:

- Login: this is a business level service provided by login service mentioned above;
- Publishing new diary: this is completely done by user manually, it is part of the process but not a service;
- Checking the validity of the diary: when the system gets an XML file, it will use XML Schema to check the validity. It is not an independent operation or a service;
- Importing new diary: it is a component developed independently, which can be a candidate service;
- Checking the validity of the import: as a part of process of importing diary, it is not a candidate service;
- Permission settings: as a component that was developed independently, it can be an ordinary candidate service;

- Posting: it is a part of the process, and not a candidate service.

3) Candidate services:

- Login service: providing account;
- Importing diary service: providing address;
- Permissions setting service.

4) Build the model of diary service

The diary function diagram is shown in figure 11.

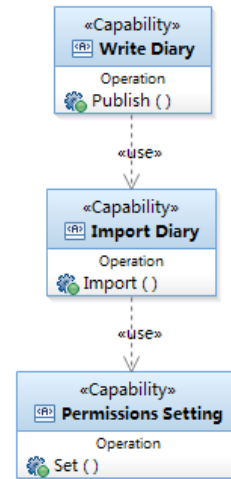


Figure 11. Diary function diagram

The component diagram of diary is shown in figure 12.

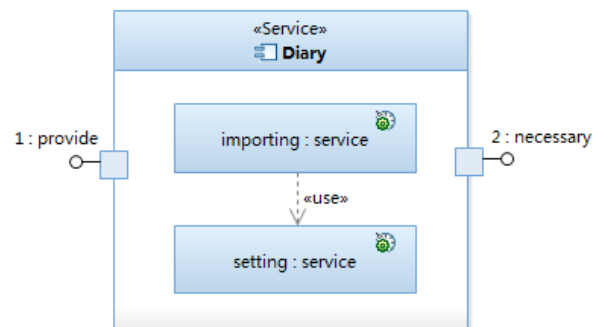


Figure 12. The component diagram of diary

D. The Model of Photo Albums Function

1) The photo albums function flow diagram is shown in figure 13.

2) The analysis of each step of the photo albums process is as follows:

- Creating new photo album: it is manual input, and not a service;
- Permission settings: it is the same as diary permission setting service;
- Selecting upload album: as part of the process, it is not a service;
- Adding a photo: it is done manually, and not a service;
- Uploading: as part of the process, it is not a service;

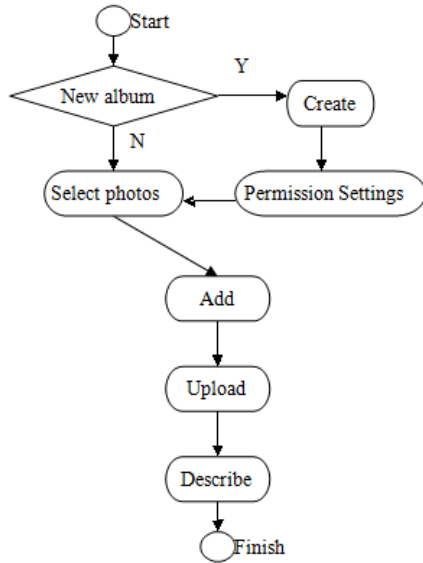


Figure 13. Photo albums function flow diagram

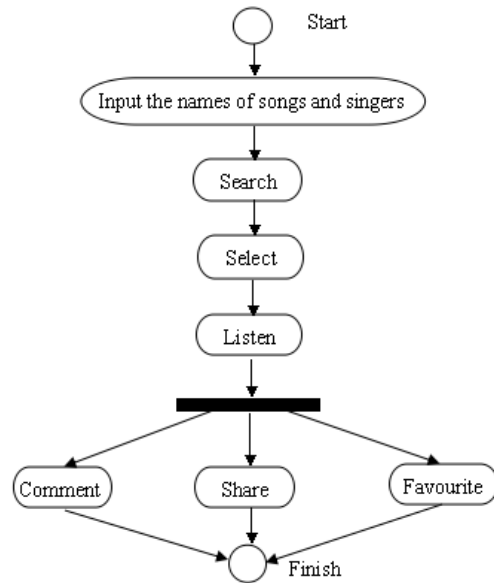


Figure 16. Music function flow diagram

- Setting description: it is manual input, and not a service.
 - 3) *Candidate services:*
 - Permissions settings.
 - 4) *Build the model of photo albums service*
- The photo albums function diagram is shown in figure 14.

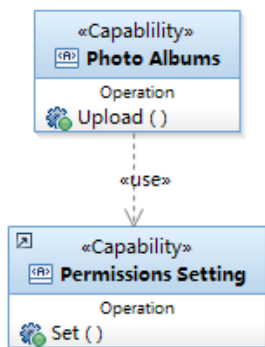


Figure 14. Photo albums function diagram

The component diagram of photo albums is shown in figure 15.

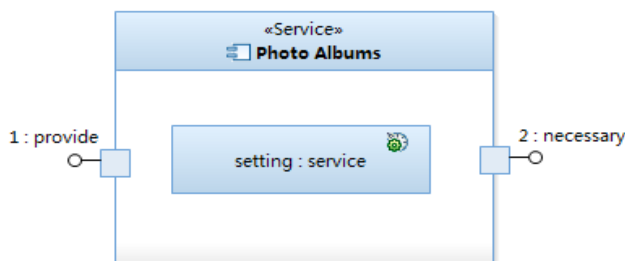


Figure 15. The component diagram of photo albums

E. The Model of Music Function

- 1) *The music function flow diagram is shown in figure 16.*

- 2) *The analysis of each step of the music process is as follows:*
 - Inputting the names of songs and singers: as a manual input, it is not a service;
 - Searching: it is a component developed independently or can call other search services;
 - Selecting singer and songwriter: it is a selecting operation, part of the process, and not a service;
 - Playing music: it is part of the process, and not a service;
 - Comment: an independently developed component, it can be used as ordinary business level service;
 - Sharing: as an independently developed components, it can be used as ordinary business level service;
 - Collecting: as an independently developed component, it can be used as ordinary business level service.
 - 3) *Candidate services:*
 - Searching service;
 - Comment service;
 - Sharing service;
 - Collecting service.
 - 4) *Build the model of music service*
- The music function diagram is shown in figure 17.

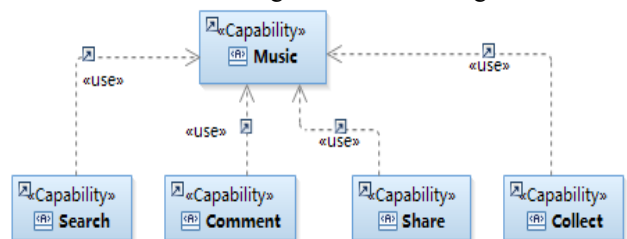


Figure 17. Music function diagram

The component diagram of music is shown in figure 18.

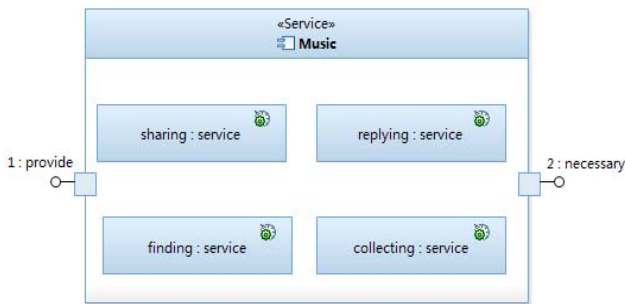


Figure 18. The component diagram of music

V. COMPARISON OF SOA AND OTHER MODELING METHODS

SOA methodology is an inheritance and development of the existing methodologies [17]. On one hand, the old methodologies cannot solve the problems brought up by introducing the concept of service; on the other hand, service is a horizontal concept, not a vertical concept. In the process of designing and analyzing services, to deal with the relationship between the service and the existing methodology is needed. So the major tasks of analysis and design are to discover services, define services as well as realize services, and to guide how to complete these tasks in conjunction with other methodologies.

1) BPM and SOA

In the social network modeling process, some measures of BPM (Business Process Modeling) focus on the modeling itself. But in the application of SOA methodology, all kinds of modeling results of BPM are important inputs of service-oriented analysis and design. In comparison, SOA is the method to build basic framework [18], but BPM is a business process. Therefore, using BPM to build the model in social network, cannot really define a service. However, SOA can accomplish the task to connect business process with the base system. Thus SOA can save time and cost of developing products.

2) EA and SOA

All kinds of EA (Enterprise Architect) technologies lack the blueprint of the business field to help design the enterprise architecture. From the perspective of the SOA methodology, on one hand, by combining BPM, service-oriented analysis and design method can divided the business into various types of services to help design the enterprise architecture; On the other hand, the result of enterprise architecture design is an important reference to the realization of the services. In the field of business, application program, middleware and data, more details are shown in SOA than EA. Because what SOA invokes is only the service, this is just one form of resources of EA. So SOA is a special case of the service. With the development of social network, the applications' category and amount are getting more various in the future. Therefore, using SOA architecture can reduce operation cost and improve the efficiency of management [19].

3) OOAD and SOA

With the rapid development of social network, the complexity of the whole business is increasing. OOAD

(Object Orient Analysis Design) methodology has some deficiencies in the management of the big data. But SOA can solve this problem. By providing the social network with autonomous, loose coupled and stateless Web services, each part will become completely independent services with transparent address, thus to reduce the complexity.

OOAD contains all of the business rules, but the shortcomings of the method do exist. If modifying process or workflow, the code will have to be changed. But SOA drags the service out from the process. The service model only has to define local service interface and operation. Because different services are independent, the design of the service will not be affected when the process need to change. For instance, in music function model, the permissions setting service will be added in the future. For OOAD, once there is need to add new business process, the class design has to be modified; but for SOA, different business process should be designed first and by changing the sequence of process, the task can be finished, thus to save time and cost of the development.

Conclusively, OOAD defines the operation of SOA, EA defines the component or the service of SOA, and BPM defines the business process of SOA. Therefore SOA is not a new design pattern, but a comprehensive pattern that designs the business model from the different angles.

Based on the analysis above, SOA has the following advantages [20]:

- It can increase the efficiency of developing new product and improving the quality of the existing product;
- It can reduce implementation cost and the cost of ownership as well as the cost for integration of the IT system;
- It can simplify the process of the integration when needs to merger and obtain the services;
- It can make better use of the resources of IT and get a better return on investment;
- It can complete the implementation of business process independent of the application system and the development platform.

VI. CONCLUSION

In this paper, the service-oriented architecture modeling method is applied to build models by IBM Rational Software Architect V7.0, and the common social network services are chosen as the modeling objects. The modeling method mainly includes analyzing the business processes, decomposing each process in domain, extracting candidate services, and designing the models of the services. SOA modeling method can realize encapsulating the same faction modules into a service, thus can improve the reusability of software and reduce the cost of development and test. We compare the service-oriented architecture modeling method with the traditional modeling method. The results demonstrate that SOA have many advantages in social network services.

In the future, the scale of social network is expanding. And the reusability of the services is conducive to the development of social network. The SOA technologies will give the development of social network a new chance because it can provide good reusability of services and reduce the cost. Consequently, the models of social network services built in this paper will provide important examples to the social network service providers. The developers can make better products for the users with SOA.

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