

The Research and Design of Cloud Computing Framework Model Based on SOA

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Abstract—Cloud Computing is a new service-oriented computing paradigm. As the inheritance and development of SOA (service oriented architecture), it has become the hot point of cyber research. After introducing the characteristics of SOA and Cloud Computing, this paper analyses the relation between the SOA and Cloud Computing, and then talk about the probability of the cooperation between the two and present a model of Cloud Computing framework based on service oriented architecture.

Key words—Cloud Computing; SOA; service; cooperation

I. INTRODUCTION

The traditional way of resource approach relies on complex and diverse software and hardware systems. However, with the continuous development of computer and Internet technology, the network resources continuously enriched and the types of them become more and more different, such as software resources, data resources, service resources, and so on. Therefore, with the increasing number of resources, the traditional approach has resulted in a conflict between the rich resource and the underutilized resource. Thus, it can't meet the customers' demand. And it is very expensive and complex for customers to install, deploy and maintain the hardware systems, database management systems, operating systems which are required by the software systems. However, when the new business needs arise, it will be re-developed, re-deployed. So it requires developing a safe, convenient, low cost, scalable architecture to solve the above problems. In view of this, the Cloud Computing architecture based on service oriented architecture will reflect its practical significance.

II. SOA AND CLOUD COMPUTING

A. SOA and Its Characteristics

In order to solve the problem of the need of business integration under the Internet environment, and to accomplish a specific task by connecting a separate functional entity that proposes a service-oriented architecture (SOA). SOA is not a technology. In essence, it embodies a kind of ideological architecture. It is a new

architecture component model, and it packages applications or systems into different functional units which is called "service", and connects these units according to the various contracts and interfaces of every service^[1]. It has the characteristics of high cohesion, loose coupling, interoperability, coarse grain, and so on. The generation of SOA result from two reasons: on the one hand, it is to solve the problem of information isolated island; on the other hand, it is to solve the problem of legacy systems^[2].

The basic features of SOA:

- a) Separate functional entity;
- b) Access to large amounts of data under a low frequency;
- c) The way to transmit message based on text.

The key features of SOA^[3]:

- a) Providing application development and integrated architecture, strategy on the level of thought way, and no longer only focusing on the technical level.
- b) Providing a model of component that is functional unit what can be used.
- c) Providing the way to integrate the functional units and make them interact with each other.
- d) Providing the standardized interfaces, which are independent of the operating systems, hardware platforms and programming languages.

B. Cloud Computing and Its Service Levels

1). The Concepts of Cloud Computing

Cloud Computing packages the hardware resources such as CPU, servers, storages and the software resources such as integrated development platforms, application softwares, as services to provide the users. The users can access these services they need through the Internet. However, these services provided by the providers are transparent for the users. The users can acquire these services without understanding the technology which is used to provide services, and they needn't to understand the knowledge associated with this area, and they also needn't to have the ability to operate related equipment. The network providing these resources is called "cloud." Cloud Computing is a super-computing model based on the Internet. It is the development of the Parallel Computing, Distributed

Computing, Grid Computing, SOA, and so on, or we can say that it's their commercial implement^[4].

2). The Service Levels of Cloud Computing

Cloud Computing integrates the technical advantages of Parallel Computing, Distributed Computing, Grid Computing, Utility Computing and so on. It is a kind of business model called--"all resources are services"^[5]. According to the type of service, Cloud Computing can be divided into three different service levels^[6]: SaaS (Software as a Service), PaaS (Platform as a Service) and IaaS (Infrastructure as a Service). The three levels of Cloud Computing services as Figure 1:

- a) SaaS (Software as a Service): The SaaS's service providers have deployed a variety of application softwares or systems in their own servers. The softwares or systems are managed and maintained by the service providers. In addition, the service providers also provide the hardware facilities which the softwares need to run the system. What it provides is an application framework.
- b) PaaS (Platform as a Service): The direct customers of PaaS are system developers. The PaaS's providers provide users with the required system development environment, hardware resources, server platforms, databases, application servers, and other services. The users can just simply develop the software systems on the platforms provided by the service providers. What it provides is an integrated environment.
- c) IaaS (Infrastructure as a Service): The IaaS is commonly known as the hardware platform. It is mainly to provide users with virtualized computing resources, communication resources, storage resources and network resources. It includes all the hardware facilities such as CPU, memories, servers, etc. What it provides is a software application environment.

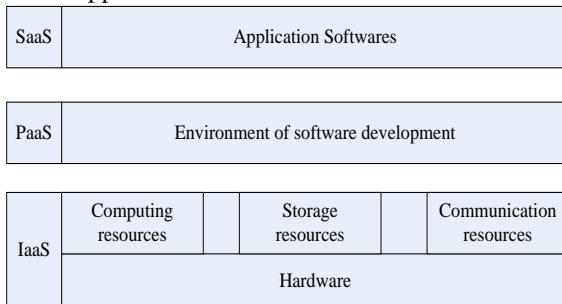


Figure 1. Three levels of Cloud Computing services

III. THE INTEGRATION BETWEEN SOA AND CLOUD COMPUTING

Today, there are many different points of view on the relationship between the SOA and Cloud Computing. But I think that a broader perception is: SOA can prepare for Cloud Computing, and we can say that the Cloud Computing is the development of SOA. It is the technical and ideal extension of SOA. The SOA product manager Tim Hall who works in HP Software Division believes that the application of SOA can help enterprise prepare to use Cloud Computing in the future^[2]. Because when the enterprise applications transform to the SOA, the methods and

techniques used by these applications can provide help to the integration of the more challenging and more powerful cloud service^[7].

The core of SOA is the service, which packages all components as services. It solves the problem of business requirement in the form of service. And the specifications of Web Service which is as one of the realizable mechanisms of SOA, have many characteristics, such as standard, simple, cross-platform, cross-operating system and cross-language. It is generally followed by the Grid Computing, Cloud Computing^[8]. Thus, Cloud Computing as a new Web Service based on the SOA, can easily coexist with other Web Services, and can interoperate with each other. But for users, they just need to know what kind of service they need, just need to understand how to access services without having to know who is to provide services in the end.

SOA is a software-oriented structure, allowing enterprises to get more than one service (a service that is a function module) from the service provider, and then forming a service that they need through a combination of different mechanisms. All resources are services in the Cloud Computing; the enterprises can purchase Hardware service, Platform services, and Software services from the Cloud Computing provider, and make the resources they have bought as a service provider. The Cloud services offer a number of services which are available to be integrated for the SOA. Since the function provided by a single Cloud service is often unable to meet the business needs, so you need to integrate and combine Cloud services to solve the specific business problems, and SOA services can be effectively integrated and combined. So it is both necessary and possible to integrate the two.

It can be said that the Cloud Computing integrates lots of advantage of the SOA's technologies and ideas. There is the possibility of integration between Cloud Computing and SOA. We can see from the Figure 2 that there are two ways possible to integrate the SOA and Cloud Computing: one is SOA provides services totally depending on using Cloud Computing; the other one is SOA provides services partly depending on using Cloud Computing. It should be noted that, standards should be made between SOA and SaaS, PaaS. Only in this way can it be possible to achieve interoperability between the two, and to achieve the blend between the two.

I believe that, the ideal way of integration between SOA and Cloud Computing is seamlessly integrating the SOA into the Cloud Computing platform and adopting Cloud Computing to provide services.

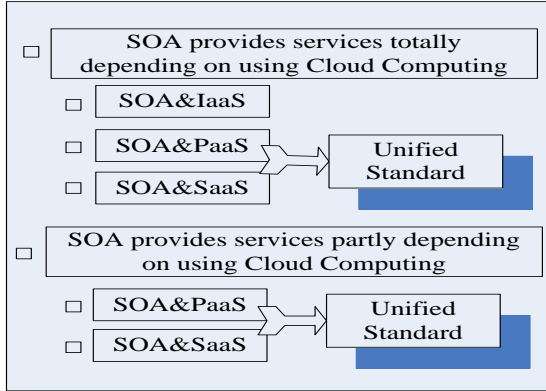


Figure 2.The possible ways of integration between SOA and Cloud Computing

IV. THE DESIGN OF CLOUD COMPUTING FRAMEWORK MODEL BASED ON SOA

The emergence of SOA has effectively solved the problem of information isolated island and legacy systems. It has not only achieved the integration and sharing of resources, but also met the various needs of the business development and made a significant contribution to the reform of the enterprise business systems. However, with the continuous development of the computer and Internet technology, with the increasing amount of resources, the traditional approach has been unable to meet the demand. The emergence of Cloud Computing offers the possibility to solve this problem, the Cloud Computing architecture based on SOA can not only make full use of hardware and software resources existed, but also save costs, be good for maintenance, which reflects its practical significance.

1). The Introduction of the Framework

According to the characteristics of the possibility of integration between SOA and Cloud Computing, when we design the Cloud Computing architecture based on SOA, the architecture includes multiple levels containing the applications and hardware systems. An alternative reference architecture shown in Figure 3, Bottom-up can be divided into: Hardware Platform Layer, Cloud Management Layer, SOA Structure Layer and Application Service Layer.

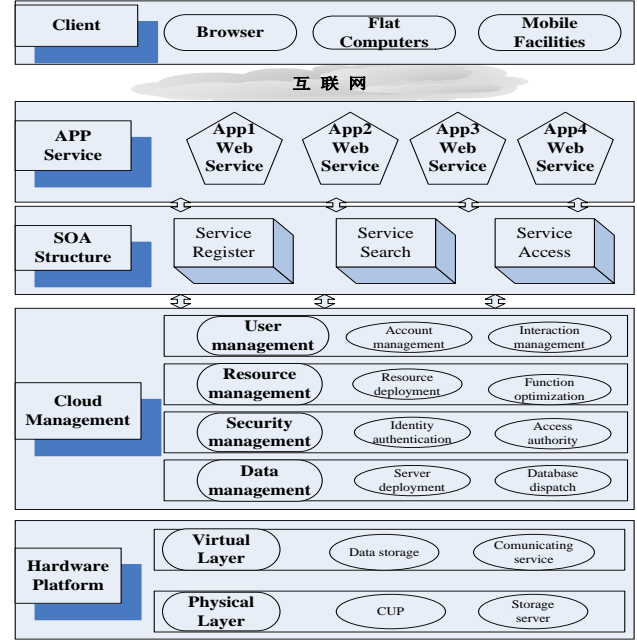


Figure 3.The design of Cloud Computing Framework Model based on SOA

a) **Hardware Platform Layer:** that is, the so-called IaaS in the Cloud Computing, it includes physical and virtual service layer. It is the basic layer in the structure of Cloud Computing. Its main role is providing clients with virtualized storage resources, computing resources, network resources, and communication resources. And the hardware it provides containing storage servers, CPU, computers, and so on. The CPU resources can provide the services of data computing and processing for the users, the capacity and speed of data processing is much better than the client's computer. The memory resources can provide for users far more storage capacities than the client's [9]. Computer cluster can provide distributed computing, greatly improving the speed of computing.

b) **Cloud Management Layer:** that is, the so-called PaaS in the Cloud Computing. The function of this layer is that: it has the capability of User Management which contains Account Management, User Interaction Management; Cloud Resource Management which contains Resource Deployment, Performance Optimization; Cloud Security Management which contains Identity Authentication, Access Authority Management, and Cloud Data Management which contains Server Deployment, Database Dispatcher Management [10]. This layer ensures that the various resources can be applied safely and efficiently.

c) **SOA Structure Layer:** This layer can package the Cloud Resource Management, Cloud Security Management, Cloud Data Management, User Management which come from the Cloud Management Layer into the standard Web Services, then put them into SOA system for the efficient use and management. This layer includes the components of Service Registration, Service Search, Service Access, and so on, enabling the system to quickly respond to various levels of service (IaaS, PaaS, SaaS).

d) Application Service Layer: that is, the so-called SaaS in the cloud. This layer provides for users services which are packaged by the SOA Structure Layer. The end-consumers can customize or get the services they need through a specific entrance into the Center of Cloud Computing. Through the Cloud Computing application service layer, end-customers can save a lot of overhead used in the application development and improving machine performance to use the much better machine performance in the area of complex computing or storage work.

2). The Way to Get the Service

In this model, we can learn to use the idea of SOA to get the Cloud Computing service, the core idea is the interaction between the service requesters and the service providers. The main roles include Cloud Computing service requester, Cloud Computing service providers (covering Cloud Computing services and basic resources) and Cloud Computing Service Repository (in the SOA Structure Layer). The Service requestor is an application, a software module or another service requiring a service. Service provider is a virtual service in the Cloud Computing environment that accepts and executes requests from users. It publishes the services and interfaces contract to the Service Repository so that service users can discover and access the services. It contacts the basic services and infrastructure resources to complete the demands of the service requestor. A Service Repository is a supporter for discovery of a service, it contains a repository of available services and allows users to find service interfaces that they are interested.

V. CONCLUSION

Cloud Computing is the core of a new generation of IT. As a new and promising service pattern, the Cloud Computing is the inheritance and development of SOA in some ways. The appearance of Cloud Computing must be able to promote the change of the computer applications. This paper analyzes the possibility of integration between SOA and Cloud Computing and then presents a design model of Cloud Computing architecture based on SOA. The concept of the design model adopts the feature of loose coupling of SOA. It increases the flexibility of the applications by packaging all types of resources as services, and publishes services through the "cloud". The integration of SOA and Cloud Computing will bring a bright future. However, we shouldn't be blindly optimistic, because the cloud is not very mature. And so far, there hasn't existed a uniform standard about Cloud Computing architecture, and the appearance of it increases the difficulty of design somewhat, so it requires a long process to seamlessly integrate SOA and Cloud Computing.

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