DISCIPLINE AND INFRASTRUCTURES OF CONSTRUCTING SERVICE OVERLAY NETWORK

Junjie Tong, Meina Song, Junde Song and Ke Xu

School of Computer Science, Beijing University of Posts and Telecommunications, Beijing, China

Keywords: Service overlay network, Discipline of constructing, Peer-to-peer technology.

Abstract: The economies of the world are shifting labour from agriculture and manufacturing into services, and service is a trend of the future. To implement the service in the current existing networks, there have been several frameworks or infrastructures and theories proposed. To facilitate the creation and deployment of value-added Internet services, how to construct the service overlay network while considering the bandwidth provisioning, QoS, services availability and etc. is coming up. In this paper, we propose the discipline of constructing service overlay network basing on the theory of the service and relative theories, and infrastructures considering the peer-to-peer technology and the content delivery network.

1 INTRODUCTION

Service Science integrates science, engineering and management aims to study the service phenomena occurred in human society, and develop service systems for better society. (OLRSS) As the service science developing, there many other theories have been proposed to supplement and deepen its discipline and theory. SSME (Service Science Management and Engineering) is for studying the service systems, and aims at the application of scientific, management and engineering discipline to improve service systems, particularly those involved in complex, IT-enabled services. In the recent decades, more and more academies and research centres focus on it. On one hand, some people focus on how to construct the curriculum to make it to be an academic department and it is still an open question. On the other hand, some people focus on service computing, service engineering and service model to evaluate and improve effectiveness basing on the standard web service technologies and service-oriented structures.

Service systems connect people, technology and organizations with value-creation. They aim for providing services operating on the computing infrastructure for service clients in IT outsourcing (Maglio et al., 2006). And as to implement the service architectures and systems well, service overlay network has also been proposed as an effective means to address some of the issues including end-to-end quality of service (QoS), facilitating the creation and deployment of the service applications. But as the existing Internet has now become a large complex non-linear network. Between network nodes, the node and data packet protocols arise from the non-linear effects, as well as cooperation and competition between users, so that network behaviour showing a high complexity and unpredictability (Chuang and Yuan, 2004). As the developing of service science and service systems, the Internet has not only used for keeping connectivity of the nodes for service delivery but also be concerned to construct overlay over the existing network for evaluating and improving the service quality, bandwidth provisioning , QoS, services availability and etc. There many overlay solutions and frameworks have been proposed as focused on different effective issues.

Nowadays, voice and video streaming transmissions have occupied most of the bandwidth of the internet. And how to delivery the large size contents with good performance, tolerant ability and feasibility becomes a big problem. The p2p technology has solved this problem to some extent, but also brings other problems. So there is a trend to combine the p2p technology and content delivery network to solve the backups of the self-organized p2p applications including lack of controllability and manageability, particularly the expensive costs between different ISP (Liu et al., 2008).

In this paper, we give some discipline or principles of constructing the service overlay network by defining and separating the different roles on network and particularly explore the infrastructures by implementing the service science, service theory and service-oriented structures in the streaming applications.

2 DISCIPLINE

In this section, we will give discipline on constructing the service overlay network on the base of the service and SSME theories. First, we define the different roles in the service and its corresponding responsibilities. Second, we define the different roles at another side. At last, give some discipline and principles of constructing service overlay network.

2.1 In the Practical Environment

First, let's consider the definition of service.

James Fitzimmons defines a service as "A service is a time-perishable, intangible experience performed for a customer acting in the role of co-producer" (Fitzimmons, 2005).

And in (Gadrey, 2002), it defines the services in terms of relationships and actions among service provider, service client, and service target.

From the above theory, we define the roles in the practical services including the service provider, the service client and the service agent in this paper.

2.1.1 Roles' Definition

The service provider: We can divide the service provider into different kinds by different standards. For example, we can divide them into individual, organization service provider etc. And we also can divide them into clothes, eating, housing and travelling service providers. We consider the service provider as the following definition: The entity has certain resources or abilities to provide certain services for the service clients directly or through the service agents indirectly.

The service clients: We can also define the service clients into different kinds by various standards. On one hand, we can divide them into individuals and organizations. And on the other hand, we can divide them into the public and private clients. But the essence of the service clients is: The entity needs services and has the capability and willing to pay for them.

The service agent is at the middle of the service provider and the service client. On one hand, it facilitates the service provider sells its service even without thinking about the selling processing. On other hand, it facilitates the service clients to use the service with more comfortable and feasible experience. But the service may flow directly to the service clients without going through the service agents.

2.1.2 Roles' Responsibilities

The service provider, the service client and the service agent construct an integrate service environment. We list the three components' conditions and responsibilities in Table 1.

Table 1: Conditions and Responsibilities of the Three Components.

	Conditions	Responsibilities
Service Provider	Constructing the resources	Available Service
	Developing the service basing on the resources	Maintain and Evaluate the services
Service Client	Needs to use No servicing ability	Pay for the services
Service Agent	Communicating between providers and clients	Integrated the services
	Effective solutions or means	Feasible and comfortable Environment

We define the components' conditions and responsibilities in the practice environment. But to analyze and develop the service systems, we have to change our point to figure the different roles in the service processing.

2.2 In the Service Systems

In paper (Cai, 2007), it separates the service system into three layers as shown in figure 1.

The above bottleneck structure is covering the service requirements and lifecycles. And at the same time, it proposes the corresponding components of the service system including the service processes, service information, service staffs and service partners.
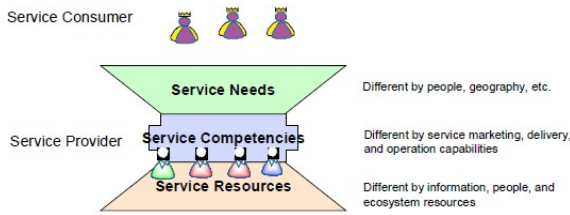
Figure 1: The Three Layers of the Service System.

But the above structure isn't considering the network which plays a more and more important role in nowadays systems.

2.2.1 Roles' Definition

In the Internet, we can divide the system into the following parts or processing: publish the service, search the service, transmit the service and receive the service. After all, we can use the service at the client.

The Internet has to offer the abilities of publishing, searching, transmitting and receiving the service even integrating the services.

The entities can also be the three ones as proposing before, but the roles' condition and responsibilities are changed a lot.

2.2.2 Roles' Responsibilities

We emphases the functions of the Internet and we concern much more about the roles and responsibilities of the Internet while implementing the service system.

Table 2: Considering the Role of the Internet.

	Conditions	Responsibilities
Service Provider	Providing computing and caching abilities	Providing available and constant services
	Change the abilities into various services	
Service Client	Needs	Pay
	No serving ability	
	Accessing to the agent or provider	
Service Agent	Compose the services	Publish, deliver and adapt the existing services
	Make the services invisible and feasible	

2.3 Discipline and Principle

In this paper, we concern the role of the Internet in designing and developing the service systems. And as shown in the Table 2, the Internet can be considered as the service agent between the service provider and the service client. Its main goal is to publish, deliver and adapt the services which the provider provides and evaluate the performance and other features.

In paper (Hai-hong et al., 2010), it proposes four basic principles of services and service network including: the invisibility and networking of services, the differences and compatibility of service, service reusability and service integration, loosely coupled and autonomous of services. It lists the principles from the essence of the service itself.

We propose the discipline or principle as the Internet plays as an agent or a middleware in the service systems.

As a service container. As there various service providers provide various service in different deploy environment, it is important and critical to recognize, collect and compose the services. The Internet plays as a container which can contain different services without thinking about the differences of designing and deploying the services.

As a service provider. As the client can get the service from the service provider directly or get the service from the service agent indirectly, we can consider the service agent or the Internet as a special service provider. The Internet plays as a service provider, it has to publish and transmit the services with corresponding mechanisms to ensure the performance, quality of the services and other issues.

From the above description, we can figure out the principles easily.

Integrate the service. It has to make the differences invisible.

Publish the service. Let the client know the services' information and functions.

Transmit the service. As the complexity of different network constructing and circumstances, it has to enable the services arrive to the right address. It at least contains services delivering and routing.

Make promise. On one hand, to ensure the service availability, constant for the service clients, the Internet should adopt some mechanisms or solutions to promise the performance and users' experiences. On the other, for itself, it has to take the value and bandwidth provisioning into account.

3 NEW INFRASTRUCTURE

As the peer-to-peer attract more and more academic and researching entities, we can consider using this technology of constructing the service overlay network. This can evaluate the services on the peer-to-peer overlay and also expand the range of the service overlay network.

In paper (Zhou et al., 2005), it proposes a service overlay network framework called ALASA (Application Layer Active Service Architecture) to provide a solution for distributed on-demand services across the Internet. It contains the following main four functions: service description, service discovery, service composition and service reputation. The end user can use the service through the service broker form the special service provider after looking up the service in the service directory first.

And other architectures have also been proposed concerning the QoS (Song and Mathieu, 2007), service availability (Lee and Kim, 2009) and other issues. In paper (Kim et al., 2010), it enables the service using DSON (Dynamic Service Overlay Network) by composing a dynamic service overlay network for in p2p environment.

In this paper, we consider the two important computer resources: computing ability and memorizing ability. We can use the peep-to-peer technology and overlay network to provide the computing and memorizing ability for the service provided for the end users. We propose the following infrastructure by dividing the Internet into three layers.
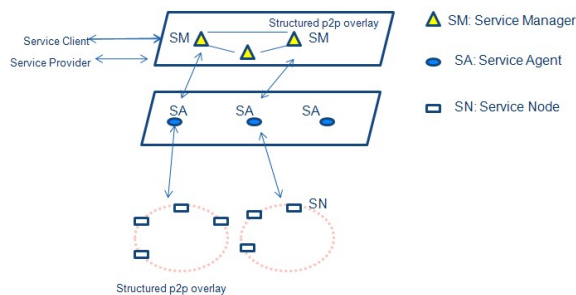

Figure 2: The Three Layers of this Infrastructure.

The service manager receives and integrates the service; assigns and manages the service agent for the service client.

The service agent requests and manages the service processing; constructs the basic service nodes for serving the services.

The service node affords its computing and memorizing abilities for processing the services.

And in the first layer, the service managers use the p2p technology and facilitate the service searching and service routing. It is also responsible for service publishing.

In the second layer, the service agent request for certain service nodes and acquires the authorization. And then constructs the service nodes into peer-to-peer overlay to facilitate the management and computing.

The service invisibility, availability, integrating can be deployed by the service managers. And service fast routing and constant high performance can be deployed by the service agents. And the loosely located service nodes are important for distributed computing and memorizing. And the service provider can provide various accessing means for the service manger recognize and compose the services even providing the API or an overlay network such as content delivery network for providing contents.

And the p2p technology in the infrastructure is important for the distributed idea combining with service science and its implementation.

4 CONCLUSIONS

In this paper, we propose the discipline of constructing service overlay network basing on the theory of the service and relative theories, and propose a new infrastructure considering the peer-to-peer technology and the content delivery network. The Internet plays as a middleware between the service provider and service client enabling the service provider doesn't have to concern the different implementing environment and the service client uses the services much more feasible and comfortable.

ACKNOWLEDGEMENTS

REFERENCES

http://wiki.service-science.ctm.nthu.edu.tw/index.php/ Main_Page

Paul P. Maglio, Savitha Srinivasan, and Jerrery T.Krulen. "Service Systems, Service Scientists, SSME, AND Innovation" Communications of the ACM, July 2006. Vol 49. No.7.

Lin Chuang, Ren Feng Yuan. Controllable, trustworthy and scalable new generation Internet, [J]. Journal of Software 15(12), 2004.

Jiangchuan Liu, Sanjay G. Rao, Bo Li and Hui Zhang, "Opportunities and Challenges of Peer-to-Peer Internet Video Broadcast", Proceedings of the IEEE, volume 96, No.1, January 2008.

Fitzimmons J, Service management: operations, strategy, information.: McGraw-Hill/Irwin, 2005.

Gadrey, J. "The misuse of productivity concepts in services: Lessons from a comparison between France and the United States" Productivity, Innovationand Knowledge in Services: New Economic and Socio-EconomicApproaches. J. Gadrey and F. Gallouj, Eds.. Edward Elgar Publisher, 2002.

Hong Cai, Jen-Yao Chung and Hui Su. "Relooking at services science and services innovation". ICEBE 2007.

E Hai-hong, Song Mei-na, Song Jun-de, Li Yan, Ren Zhi-jun. "Research of Service Network on Complex network" 2010 International Conference on Service Science.

Zhou, S., Hogan M., Ardon S., Portman M., Hu T., Wongrujira K. and Snevirtne A. "ALASA: When Service Overlay Networks Meet Peer-to-Peer Networks" 2005 APCC.

Meng Song and Mathieu B. "QSON:QoS-aware Service Overlay Network" 2007 CHINACOM.

Hyun Yong Lee and JongWon Kim. "A Service Availability-aware Construction of Profitable Service Overlay Network" 2009 ICACT.

Yangjung Kim, EungKyu KIM and Ilyoung Chong. "An Architectual View of Service Overlay Network Platform for Future User-Centric Network" 2010 ICUFN.