

Service based Personalized Learning System in Cloud Computing Environment

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Abstract. Cloud computing is a new paradigm of IT. It can provide all resources such as software (SaaS), platform (PaaS) and infrastructure (IaaS) as a service over the internet. It also offers the opportunity to store a huge amount of data relatively cheaply. In cloud computing, user can access the services regardless of their location or computing device/platform they use. In these advantages, many researchers of e-learning area attempt to apply their process to cloud computing. In this research, we propose service based e-learning system in cloud computing. In order to provide personalized learning process considering user's characteristics, we use the user profile data. Also, in our system architecture, we consider virtualization technique for hardware and software resources for controlling and managing their services in cloud computing.

Keywords: Cloud E-Learning, personalized learning, service based software, web service, SaaS

1 Introduction

Cloud computing has brought us a new era of Internet based data storage and processing power. The cloud offers enormous benefits to businesses such as reduced costs, since they no longer need to spend large amounts of capital on buying expensive application software or sophisticated hardware that they might never need. Instead they can perform their tasks using cloud services - either software, infrastructure or platform services (SaaS, IaaS and PaaS respectively) - and pay only for the resources they consume, when they need them. Cloud computing offers the opportunity to store a huge amount of data relatively cheaply. Using the cloud, users can access the services or applications regardless of their location or computing device/platform they use [1]. In these advantages, many researchers of educational part and teachers want to apply the cloud computing technique to their educational program and learning system process. Many higher education institutions and corporate organizations are embracing e-learning as a means of providing learning and increasing training efficiency. From the viewpoint of consumer behavior,

voluntary learners are no different from customers in e-learning settings in their demand for both learning quality and satisfaction. From organizational and management perspectives, the key prerequisites for e-learning success include appropriate staff and faculty members to support services as well as effective technology, instructional design and course evaluation. Furthermore, as with any other information system (IS) or service, the success of an e-learning service depends on both its initial adoption (acceptance) and its continued usage. The acceptance of new technologies has been the subject of many studies in the past two decades [2]. Personalized learning is one of them. E-learning also needs personalized mechanisms to help learners learn more efficiently. To provide personalized learning strategy is urgently needed for most e-learning systems currently. And the system has to consider learner/user preferences, interests, and browsing behaviors when analyzing learner/user behaviors for personalized services. These systems neglect the importance of learner/user ability for implementing personalized mechanisms. On the other hand, some researchers emphasized that personalization should consider different levels of learner/user knowledge, especially in relation to learning. That is, the ability of individuals may be based on major fields and subjects. Therefore, considering learner ability can promote personalized learning performance [3].

In this paper, we propose a service base personalized learning system and their process. Also the system was considered with cloud computing environment. The service based learning process means web service which is used in SaaS (Software as a Service) of cloud computing. In order to provide personalized learning process, we analyze users' learning pattern and manage their profile data.

2 Cloud computing and personalized learning system

2.1 Cloud computing

Cloud Computing is a combination of several services, such as Infrastructure-as-a-Service (IaaS) like Amazon™ Web Services provides virtual servers with unique IP addresses and blocks of storage on demand. Whereas Platform-as-a-Service (PaaS) is a set of software and development tools hosted on the provider's servers, such as Amazon Elastic Cloud, EMC Atmos, Aptana and GoGrid are providing these services preventing users the mammoth costs of buying hardware, software and related technology as well as, to maintain and supporting their IT infrastructures [4]. The recent evolution of cloud computing has borrowed its basics from several other computing areas and systems engineering concepts. Cluster and Grid Computing on one hand, and virtualization on the other hand are perhaps the most obvious predecessor technologies that enabled the inception of cloud computing. However, several other computing concepts have indirectly shaped today's cloud computing technology, including peer-to-peer (P2P) computing, SOA and autonomic computing. MapReduce is an example of programming models that demonstrated a simpler way to develop data-intensive applications for large distributed systems, which can be leveraged to utilize resources available through the cloud. In this respect, a

fundamental understanding of the extent that cloud computing inherits its concepts from these various computing areas and models is essential to understanding the landscape of this novel computing field and defining its potentials and limitations [5]. Ra'ul et al., [6] illustrated a schema of cloud computing service as shown Fig 1.

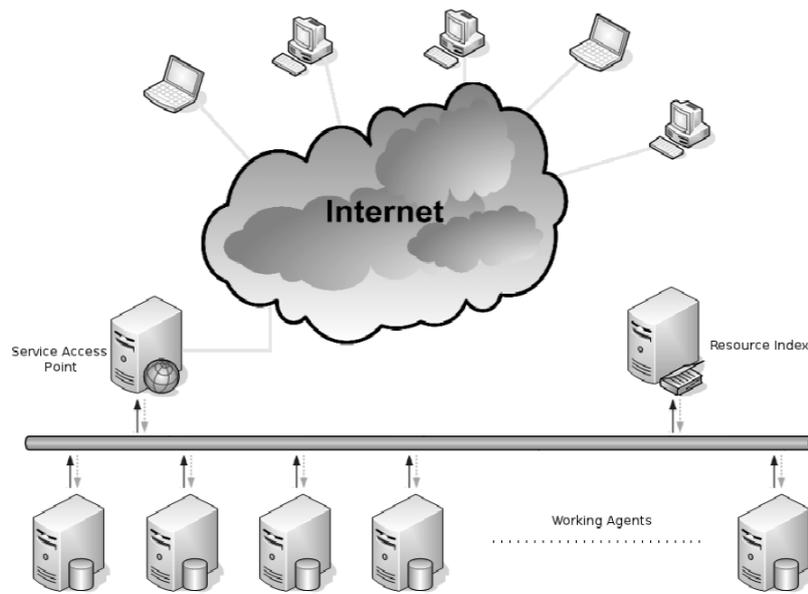


Fig. 1. Cloud Computing Service Schema by Ra'ul et al., [6]

2.2 Web service in SaaS

The services that can be offered by cloud computing can be listed in the following three main areas [7].

- Infrastructure as a Service (IaaS): Products offered via this mode include the remote delivery (through the Internet) of a full computer infrastructure (e.g., virtual computers, servers, storage devices, etc.);
- Platform as a Service (PaaS): To understand this cloud computing layer one needs to remember the traditional computing model where each application managed locally required hardware, an operating system, a database, middleware, Web servers, and other software. One also needs to remember the team of network, database, and system management experts that are needed to keep everything up and running. With cloud computing, these services are now provided remotely by cloud providers under this layer;
- Software as a Service (SaaS): Under this layer, applications are delivered through the medium of the Internet as a service. Instead of installing and maintaining software,

you simply access it via the Internet, freeing yourself from complex software and hardware management.

Especially, SaaS is a software distribution model in which customers can acquire services on demand by ordering and receiving various kinds of software application services via the Internet. Compared with traditional service models, SaaS has very many advantages such as investment reduction, performance improvement, time saving, easier collaboration, global accessibility, etc. A well-designed SaaS application must have three features, namely multi-tenant efficiency, scalability and configurability, even though not all existing SaaS applications support all of these features. SaaS markets all over the world will continuously increase until 2013 according to Gartner's report. The SaaS application framework may have the following structures. First is the service transport layer which guarantees accurate information. The schedule layer supports the user in choosing the services required and wraps them. The service technology layer provides API or Web service applications through the SaaS platform. The application and services layer provides API and a special Web service for the upper formation transfer implemented by a package to meet the needs of the market demand. Finally, the data and services management layer uses three ways to manage multiple-user data, such as independent databases, shared databases and isolation data schema [8].

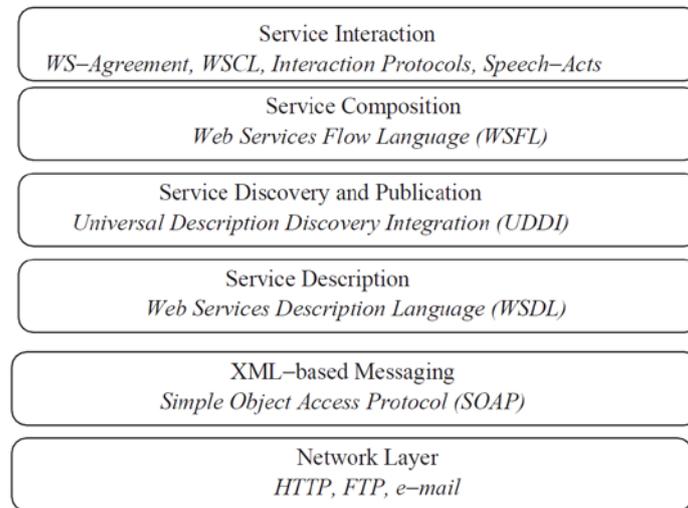


Fig. 2. Web services architecture stack

A Web Service, specifically, describes particular business functionalities that a company wants to expose through the Internet with the purpose of providing to other companies a way for using them. The key is on-the-fly software creation through the use of loosely coupled, reusable software components. Web Services promises to facilitate automated application level business integration using the ease of connectivity to and global presence of the Internet infrastructure and replacing proprietary interfaces and data formats with a standard web-messaging infrastructure

exploiting XML technology [9]. Shamimabi and Nicholas [10] depicted the structure of web service stack as shown in Fig 2.

2.3 Personalized learning system

Many researchers have recently endeavored to provide personalization mechanisms for web-based learning. Therefore, personalized learning strategy is needed for most e-learning systems currently. Learners enjoyed greater success in learning environments that adapted to and supported their individual learning orientation. Nowadays, most recommendation systems consider learner/user preferences, interests, and browsing behaviors when analyzing learner/user behaviors for personalized services. These systems neglect the importance of learner/user ability for implementing personalized mechanisms. On the other hand, some researchers emphasized that personalization should consider different levels of learner/user knowledge, especially in relation to learning. Therefore, considering learner ability can promote personalized learning performance. Also most e-learning systems lack the presence and control of an instructor to the learning process to assist and help learners in these environments (also known as human touch). Thus modeling the behavior of the instructor and provide instant feedbacks is an important task in these environments [11].

In “Personalized Information delivery: An analysis of Information Filtering methods” by Foltz and Dumais [12] present results of an experiment aimed at determining the effectiveness of four information filtering methods in the domain of technical reports. Goldberg, Nichols, Oki, and Terry [13] use collaborative filtering to weave an information tapestry. They describe an experimental system that manages an incoming stream of electronic documents, including Netnews, e-mail messages, newswire stories and Netnews articles.

3 Service based personalized learning system in cloud computing

Table 1. The data of user profiles

Classification	Item
Private	Age
	Gender
	Access account (ID and Password)
Learning level and process	Academic
	Know level
	Learning preference
	Learning difficulty
	Total count for learning system per a day
	Average score each of learning unit

In order to provide personalized learning service according to the user's characteristics, we identify the user profile as shown in Table 1. The profile consists of two main parts: *Private* and *Learning level and process*. And all the data of user profile was stored during the user access and study the learning system. Using this profile data, we proposed personalized learning system as shown in Fig 3.

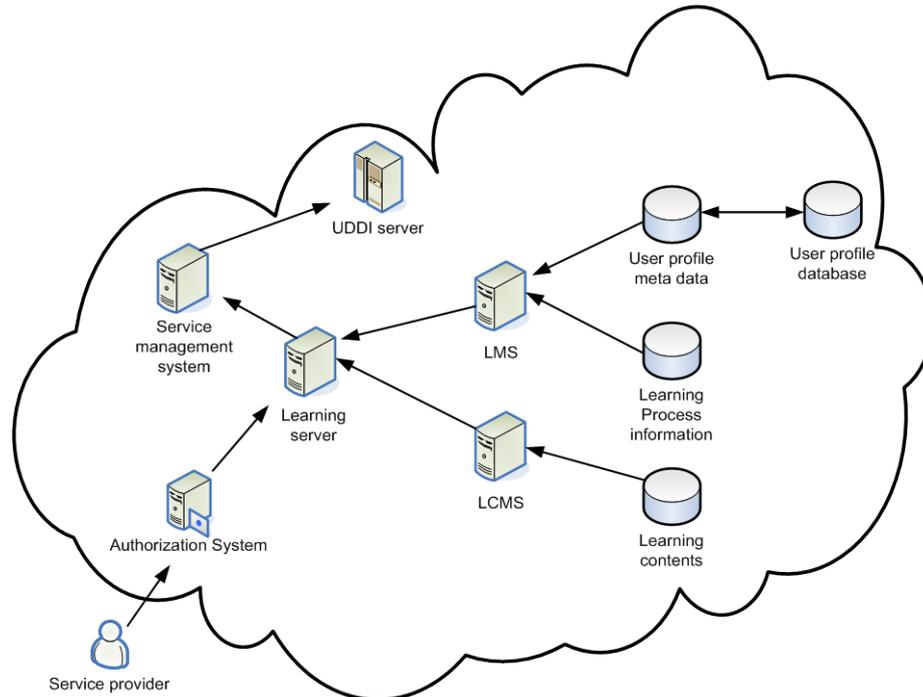


Fig. 3. Proposed system structure for learning process with user profile

In this system, there are two servers (Learning server and UDDI server) and four systems (Service management system, Authorization System, LMS (Learning Management System) and LCMS(Learning Contents Management System)). Through this structure, we depict service base learning system considering for cloud computing environment as shown in Fig 4. Proposed system performs the e-learning process as a service in cloud computing environment. In this system, all services of software (e-learning process) should be uploading on the *UDDI server*. And *Service Management System* performs to control and distribute their works to share software and hardware resources using virtualization technique. The *Service resource management* deals with adjust and share to control the software and process resources: *User account data, User profile data and Network information*. *Resource management* works to control hardware resources such as *CPU, memory and devices for software* as a VM (virtual machine). Finally, user can access the *UDDI server* to find the learning service what he/she wants to using *Service searching engine*. After *Service management system* get user's request, the system find the learning process with

software and hardware resources using virtualization technique. And then the learning process is provided to user by *Service publishing system*.

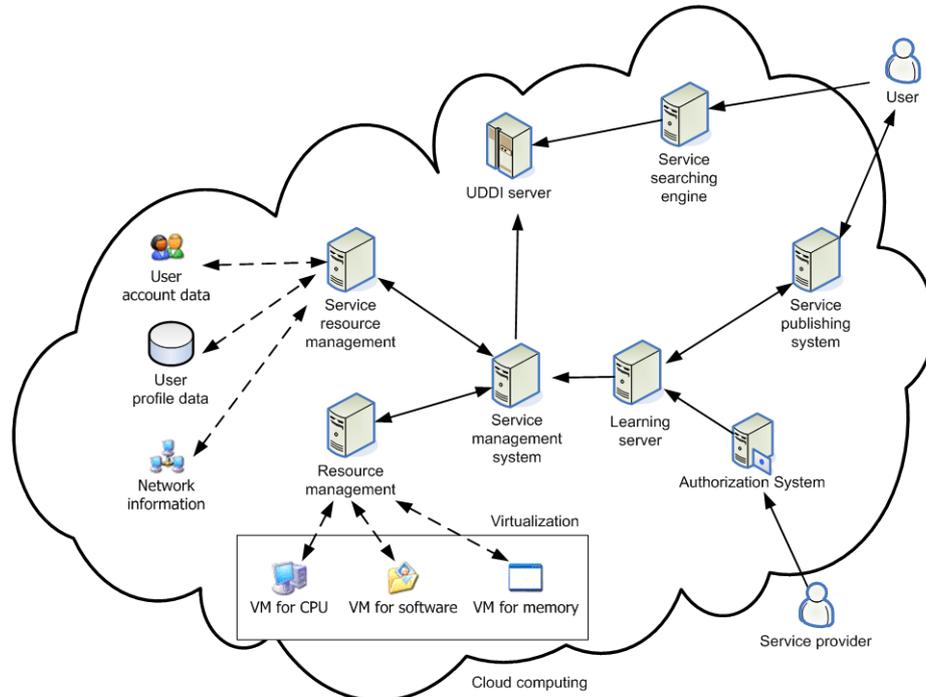


Fig. 4. Service based learning system for cloud computing environment

5 Conclusion

Computing is being transformed the process (software) or devices (hardware) to a model consisting of services. Lots of computing paradigms have promised to deliver this computing transformation. This trend can be Cluster computing, Grid computing, and more recently Cloud computing. Cloud computing has continues a new trend started with on-demand, strategic outsourcing, to provide all of IT resources as a standardized commodity. Many researchers for E-learning system attempt to apply the cloud computing to their learning system architecture due to this new trend of IT, cloud computing.

In this research, we proposed service based e-learning system for cloud computing environment. Also our learning system was considered personalized learning process using user profile in order provide efficient learning process according to user's characteristics. Proposed system consists of two management systems for controlling hardware and software resources as virtualization, service management system for managing their system and software process, three servers (learning server, LMS and LCMS) for learning system, and UDDI server for

managing learning process as a service. Finally, user can access and use the learning process as a service from learning server in cloud computing environment.

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