# A Virtual Learning Community Based on Cloud Computing and Web 2.0

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**Abstract**

A virtual learning community is an E-learning system which needs to improve its infrastructure, which can devote the required computation and storage resources. Cloud computing and Web 2.0 are all the mainstream technology in the Internet, which can provide a low cost solution to educational faculty and learners. In this paper cloud computing is integrated as a platform with web 2.0 for building intelligent virtual learning community. The objective of the paper is to combine various technologies to design applications as services over the internet on a flexible infrastructure.

***Keywords:*** *Virtual learning community, Web 2.0, E-Learning, Cloud Computing, Microsoft windows azure, Software as a services (SaaS), Infrastructure as a services (IaaS), Platform as a services (PaaS).*

## 1. Introduction

Virtual learning community is a distance education network teaching support platform based on the constructivist theory, the computer information processing technology, computer network resource sharing technology and multimedia information display technology; and it is also a new kind of learning organization, which is an important form of informal learning [1]. With the development of information society and acceleration of the pace of life, Learners are looking forward to have a learning schedule and network learning environment, which can meet their own needs. During the era of Web 2.0, Internet brought convenience to instructors and administrators of virtual learning community, which mainly used interactivity of information. However learners still need a more intelligent efficient and personalized system [2]. Also, a virtual learning community has faced challenges in optimizing resource allocations[3], dealing with dynamic demands on getting information and knowledge anywhere and anytime, handling rapid storage growth requirements, cost controlling and greater flexibility, improving its infrastructure[4], which can devote the required computation and storage resources Deficiency in learning content (The information may not inspire the users successfully), Lack of personalization (The currently available platforms to learners are of the same content, so when learners have different learning demands and different learning roles, they have to enter different learning systems which reduce the learning desire and initiative) [5]. An integration between cloud computing and Web 2.0 meets this need above. In this paper cloud computing is integrated as a platform with web 2.0 for building intelligent virtual learning community.

The structure of the paper is as follows: Firstly, the system structure of a virtual learning community is designed based on cloud computing and Web2.0; and then the oriented cloud computing application development method was chosen, a key solution to the problem is given; finally a prototype of the system is realized.

## 2. System Architecture Design

### 2.1 Cloud computing

Cloud computing is an excellent alternative for academic institutes which are especially under budget shortage in order to build, host and operate their virtual learning community effectively without spending any more capital for the computers purchase software, licensing new software, power, cooling, servers, storages, network devices, technical team, maintenance team or do not have the resources and infrastructure needed to run e-learning effectively [6]. If we look closely at the cloud, we will see three Cloud Computing services into three distinct categories (Fig 1).

Fig 1. Cloud Computing

A) Software as a Service (SaaS)

The NIST definition of cloud computing defines: It is one of the clouds computing delivery model in which the consumer uses an application, but does not control the operating system, hardware or network infrastructure on which it's running. It delivers applications to the browser of user or customer from the cloud. It helps academic institutes with limited IT resources to deploy and maintain needed software in a timely manner while, at the same time, reducing energy consumption and expenses.

B) Platform as a Service (Paas)

The NIST definition of cloud computing defines Platform as a Service (SaaS): It is one of the cloud computing delivery model in which the consumer uses a hosting environment for their applications. Platform as a Service (PaaS) deliver a computing platform and/or solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications. It facilitates a reliable, secure and scalable development and deployment of applications without the cost and complexity of buying and managing the underlying infrastructure (hardware (server, storage and network), and associated software (operating systems virtualization technology, file system)).cloud platform provide all of the facilities required to support the complete life cycle of building and delivering web applications and services entirely available from the Internet.

C) Infrastructure as a Service (Iaas)

The NIST definition of cloud computing defines infrastructure as a Service (IaaS): It is one of the cloud computing delivery model in which the consumer uses "fundamental computing resources" such as processing power, storage, load balancers, a firewall, cables networking components or middleware. The consumer can control the operating system, storage, deployed applications and possibly networking components such as firewalls and load balancers, but not the cloud infrastructure beneath them.

Virtual learning community can use benefit from cloud computing using:

Infrastructure: use e-learning on the provider's infrastructure.

Platform: use and develop an e-learning based on the provider's development interface.

Services: use the e-learning given by the provider.

## 2.2 Web2.0

As well known, Web 2.0 is recognized as the next generation of web applications proposed by T.O'Reilly [7]. The main feature of Web 2.0 applications is that they provide a medium for the sharing and exchange of resources [8]. These resources can be considered as a kind of cloud resource, such as Web feed and Web API, allow SaaS developers to take advantage of these resources to enrich their own applications or produce new integrated solutions by integrating resources, which they could not have provided on their own. This paper intends to advance in the direction based on Web 2.0 Mashups for integrating Web 2.0 technologies into SaaS. One major feature of Web 2.0 is to adopt Web feeds to build a more maintainable and cooperative Web. A Web feed contains a structured information source which is written in XML to facilitate the machine-readable. This means that Web feeds can be used to automatically transfer resource sharing information from one system to another, without any human intervention. Web feeds allow community members to publish frequently updated information such as work log, social bookmark, task presentation, report, and action items. RSS is currently the main format of Web feed.

## 2.3 Proposed Architecture

The session describes the proposal architecture based on cloud computing and web2.0. In larger IT environment, the need to control and direct IT infrastructure is critical. When numerous, disparate application architecture co-exist and sometimes even integrate, the demands on underlying hosting platforms can be complex, which is why architecture specifications often are maintained by the same group of individuals. Continuing our previous analogy, there have been many new advances in the computing field in recent times. Cloud Computing and Web2.0 are two such areas that are beginning to significantly impact how we develop, deploy and use e-Learning application. Web 2.0 combines tagging culture. It will use internet to make connections with information. Cloud Computing presents a new way of deploying applications. Today we can get Infrastructure as a Service (IaaS), Platform as a Service (PaaS) or Software as a Service (SaaS). There are elastic clouds where memory and processing power get allocated based on computing

resources required at the time. Moreover, learning environment must be productive, scalable, flexible and adaptable towards learners' needs and learner preferred information and communication technologies. This raises the question of whether cloud computing and web2.0 can meet the indicated requirements. To answer this question, Fig 2 introduces the proposed architecture with new technologies, integration between cloud computing and web2.0. Microsoft Windows Azure offers a monitoring functionality similar to that of Amazon. Therefore, systems level behavior may be monitored in a similar fashion. How to react to the monitored information has to be programmatically implemented by the application developer, whereas the behavior is merely configured when using Amazon. In this paper the intelligent virtual learning community can use benefit from Microsoft windows azure using:

·Platform: use and develop intelligent virtual learning community based on the Microsoft windows azure development interface.

·Infrastructure: use intelligent virtual learning community on the Microsoft data center.

·Services: use intelligent virtual learning community given by the provider.

Fig 2. The proposal architecture based on the Windows Azure platform

**Firstly:** when we use cloud computing as platform intelligent virtual learning community will be benefited from Microsoft windows azure as follows.

**Secondly:** when we use cloud computing as infrastructure, Servers are better (cheaper, faster, more fault tolerant, and more secure than traditional servers).

**Thirdly:** when we use cloud computing as services, we will use Microsoft Azure Market: educational institutes using the cloud to find, evaluates, and purchase our intelligent e-Learning application. The goal of Windows Azure Marketplace is to make these things easier to do.

## 3. Development Method

In this paper, the development method adopted is referenced from the literature [9]. We introduced a catalog of architectural patterns to guide developers during the design of cloud applications. We also used the uniform pattern format to describe different cloud types and their offerings. Especially, we identified existing patterns from other domains, such as message-based application or standalone application that are useful in the area of cloud computing. These patterns were altered if necessary to respect the specifics of cloud environments and were expressed in the same pattern format as the rest of the catalog. Such a homogenization of information in a common format eased perception for application developers. Additionally, the environment in which a pattern may be applied can be specified more easily, because pattern descriptions for cloud types, cloud offerings, and cloud service models may be used to set its context. Other existing architecture patterns that target the domain of cloud computing or other related domains were referenced with patterns contained in the catalog. The catalog structure depicted in Figure 3is divided into four sections: cloud types, cloud service models, cloud offerings, cloud application architectural patterns, and the newly introduced class for cloud management patterns (dashed lines). This new class contains patterns that describe how cloud applications developed according to the other patterns may be managed after their deployment. Existing architectural patterns identified by others are referenced from patterns contained in the catalog, if they describe good solutions to problems arising during the application of a pattern. For example, many of identified cloud architectural patterns face security challenges. Most of these are equivalent to security challenges in non-cloud applications which have been expressed as patterns. To provide a linkage between these existing security patterns and the cloud patterns in the catalog informal references are made. Other security issues arise specifically due to the use of cloud computing mainly due to the sharing of cloud resources with other cloud users. In this scope, legal implications are also quite different due to cloud computing, because providers may be legally responsible for employees but not for other users. Since significant work already exists on patterns describing the misuse of cloud computing, we did not compile this information into the used pattern format but referenced them in the cloud patterns catalog. Further domains for which we found existing patterns related to or used in cloud computing are also depicted in Fig 3.

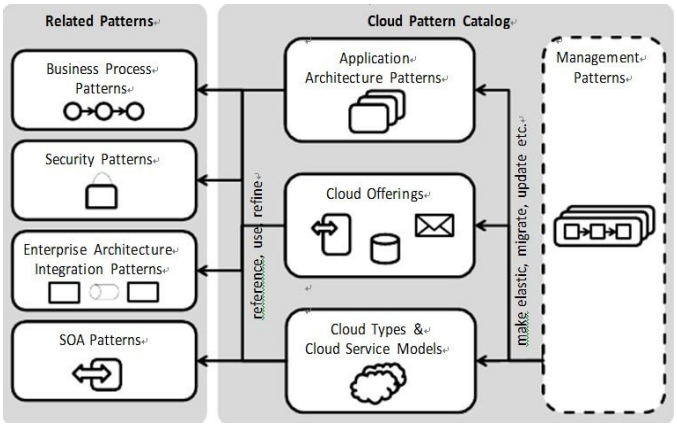


**Fig 3.** The development method based on the pattern catalog

Messaging patterns as defined by [10] are often used to enable asynchronous communication in the cloud to loosely couple application components. This componentization is also a fundamental concept of the service-oriented architecture (SOA) patterns. Similar componentization can be found in object-oriented programming. The management patterns introduced in this paper contain a management flow that may be modeled according to business process patterns described in [11]. The .NET Workflow service operates, let's build a workflow that consumes the public Twitter feed and sends the latest entry to any subscribed TweetNotifierApp instances through the .NET Service Bus. The first thing I need to do is create a new CloudSequential Workflow project in Visual Studio 2008. At this point you should see the traditional WF designer. If you expand the activity toolbox, you will see the restricted set of activities that you are allowed to use. The public Twitter feed every 60 seconds. So first I drag the while activity onto the workflow design surface, and then specify that the condition with be a Declarative Rule Condition(shown in fig 4).

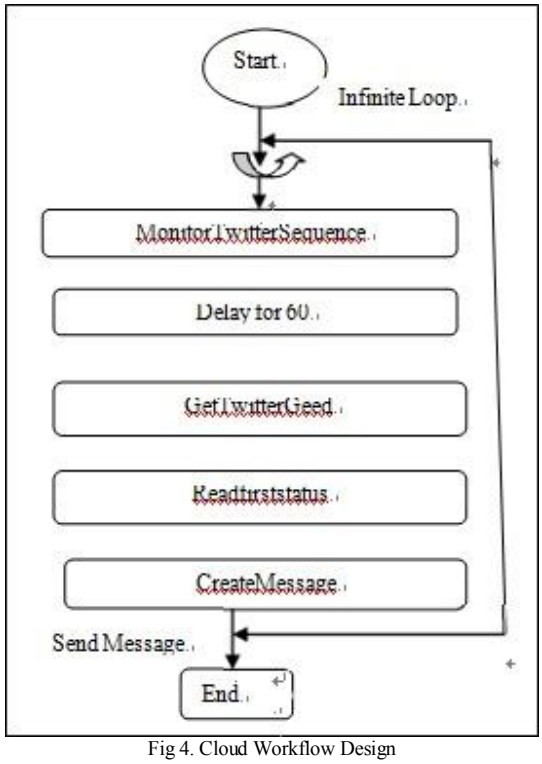


Fig 4. Cloud Workflow Design

## 4. Critical Problem

Web Feed is a typical data resource, while Web API is a typical service resource. Major Internet companies, such as Google, Microsoft, Yahoo, Amazon, and eBay, have published APIs based on web standards that allow developers to access their services and data. In this paper, Web feeds was adopted to support to publish dynamic information, including Blog, social bookmark, task presentation, report, and Web multimedia. The existing websites, such as Blog, Facebook, Twitter, YouTube, Delicious, and SlideShare, provide RSS as Web feed to deliver dynamic information. The developer adopts Web 2.0 Mashups to integrate Web Feed and Web API to create E-learning system on local computers. The source code of system can be uploaded to Google App Engine through HTTP proxy. End users can access the system with various clients, such as browser, RSS reader, and mobile phone.

RSS and Atom are currently the two main formats of Web feed. RSS is a family of Web feed formats specified in XML standard. There are three different version of RSS, namely Rich Site Summary, RDF Site Summary and Really Simple Syndication. The Really Simple Syndication (RSS 2.0) is the most widely used. Unlike RSS, Atom is proposed RFC 4287 and is defined with

XML schema. This study adopts RSS 2.0 to present the metadata of knowledge and experience sharing. Using RSS feeds to present the metadata of knowledge sharing have a few advantages. (1)Community members can be notified of new knowledge sharing information without needing to visit the websites. (2) RSS feeds provide metadata of knowledge sharing information together with hyperlinks to the full versions of the Web-based information content. (3) RSS feeds allow community members to pull the knowledge sharing information they are interested in rather than data being pushed to the team members.

This study develops a RSS-based Community Resource Sharing method which is based on RSS feeds to support community members to publish heuristic documents, including work log, social bookmark, task presentation, report, and action items. Knowledge sharing information of community can be acquired from heterogeneous and distributed Web 2.0 application platforms, including Blog, Social Bookmark, and Web Multimedia.

The heterogeneous and distributed knowledge resources, such as Blogger, Facebook, Delicious bookmark, and SlideShare use RSS feeds to facilitate resources reusability. The main modules of our developed system include: Member Query Module, RSS Clawer Module, and Database Module. In the system, knowledge sharing information is described with RSS feeds and collected through the RSS Crawler Module, transferred and stored into the Database Module.

**RSS Crawler Module** consists of Crawler Engine and RSS Parser. The Crawler Engine is a program which collects the RSS feeds from distributed Web 2.0 application websites, including Google Blogger, Delicious bookmark, and SlideShare. The RSS Parser reads the RSS feed and converts it into Resource Database.
**Member Query Module** comprises Manager Interface and Resource Filter. The Manager Interface listens to the member's request and interacts with other components of the RCRSS. The Resource Filter receives and filters the information from the Manager Interface and Resource Database.
**Database Module** is composed of Resource Datastore and Member Datastore. The profile of project community member is stored in Member Datastore. The RSS feed of community resource is stored in Resource Datastore.

## 5. System Implementation

Windows Azure and .NET Services require different invitation tokens, as you move towards cloud computing, workflow provides a simplified approach for coordinating complex service interactions in the composite cloud solutions you build. The .NET Workflow Service provides a scalable hosting environment for running and managing WF workflows in the cloud. Because the hosting environment is built on Window Azure, it's capable of scaling on demand, and because the WF runtime is being used, workflow instances are not pinned to any particular server-they are free to move from one server to another for each episode of execution. The .NET Workflow Service relies on a WF persistence service that leverages Microsoft SQL Services to save the state of running workflows and to ensure recovery capabilities, you build workflows for the cloud using Visual Studio and the same workflow designer that you've always use. You ultimately create XAML workflows and rules file. These XML files are then deployed to the .NET Workflow Service where they can be sued to create workflow instances.
Based on the use of the core technology, a system prototype is implemented (shown in Fig 5).

Fig 5. System prototype

## 6. Conclusion

With the wider adoption of cloud computing efficient management of large number, diverse cloud resource relies on a flexible, scalable and robust information service. Cloud computing can help us or at least manage our infrastructure costs better and allow availability of our application and data over the Internet. One must be able to ensure that data is available anytime one needs it and

having good software and a seamless connectivity to the service is essential in this regard. I believe proposed multi-tenancy platform will be a useful addition to architectures. The development of virtual learning community cannot ignore the cloud computing and web2.0 trends. There are many benefits from using the integration between cloud computing and web2.0 for e-learning. Using cloud computing and web2.0 for e-learning influences the way an e-learning software projects are managed. There are specific tasks that deal with finding providers for cloud computing, depending on the requirements (infrastructure, platform or services). Also, the cost and risk management influences the way the e-learning based on integrating the cloud computing and web2.0 are managed. An intelligent virtual learning community based on an integration between cloud computing and web 2.0 has been developed in order to enhance the efficiency of learning environment, provide flourish; growing, up-to-date, self-regulated, stability, QoS-guaranteed (Quality of Service), equilibrium, reliability, scalability, time reduction, efficient resource use, flexibility, and sustainability of e-learning system.

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