

# Design of a cloud services platform for a multimedia teaching environment

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**ABSTRACT:** A teaching environment that is based upon a cloud computing services platform allows customised, collaborative teaching and personalised learning, as well as technical feasibility. Based on this concept, a multimedia teaching environment cloud services platform was constructed that covered all aspects of teaching. The teaching environment is one that supports a constructivist approach to education. This support includes a package of teaching services to assist teachers, while promoting communications between the teachers and their students, as well as students' collaborative learning.

## INTRODUCTION

The United States National Institute of Standards and Technology (NIST) defines cloud computing as: *...a model for enabling ubiquitous, convenient and on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction* [1]. The essence of cloud computing is resource integration; for education, this means the integration and management of numerous, complicated educational and data resources, and their intensive use in serving the cloud users.

## ADVANTAGES OF CLOUD COMPUTING IN TEACHING

### Shared Educational Resources and Individualised Teaching

In traditional classroom teaching, there are limited sources of information, thus, restricting constructivist learning. With the development of network technology, types and number of educational resources are increasingly abundant; however, educational resources are isolated and dispersed [2]. Cloud computing can integrate the scattered and independent network educational resources and provide convenient access, thus, allowing full use of the resources. Cloud storage provides unlimited storage capacity with foolproof security. Therefore, teachers and students can access learning resources from the cloud without separate storage devices and free from viruses [3]. The teaching environment based on cloud computing provides a convenient tool for on-line teaching. Teachers can obtain all the available teaching resources, and make use of the software storage and security provided by cloud computing, to build an individualised teaching environment supporting effective teaching that is convenient for learning [4].

### Communication and Teacher-student Interaction

In teaching, the interaction between the subjects of learning plays an important part in the construction of knowledge meaning. Teaching based on cloud computing attaches importance to collaborative learning and provides various convenient and fast means of information exchange. For example, in the discussion and answer area of the teaching platform, teachers, whether in the classroom or outside, can view and participate in discussions between students, as well as solve questions raised by students, and promote the development of students' advanced thinking and collective intelligence [5].

### Flexible Time and Space Access to Allow Teaching Anywhere at Any Time

Cloud computing can easily support data- and application-sharing among different devices, for it places little demand on the user's device; the required resources and services can be obtained as long as there is a computer, tablet or mobile

phone with Internet access [6]. Teaching activities are not limited by time and space in the cloud environment. Therefore, teachers can prepare and implement teaching (assign and correct homework, and answer questions), any time and anywhere, e.g. at home, in the office or on a business trip. Classroom teaching can be conducted by acquiring data and resources in a multimedia classroom; and practical teaching can be conducted in the computer laboratory. Students can download teaching materials provided by teachers, complete assignments and finish course tests in the dormitory, computer laboratory or on the lawn before the library!

Thus, it can be seen that cloud computing provides strong support for teaching and brings great flexibility and convenience to teaching activities. Cloud computing teaching has met the needs of current teaching and requirements for educational informatisation in China.

## CLOUD SERVICES PLATFORM FOR A MULTIMEDIA TEACHING ENVIRONMENT

A *multimedia teaching environment* refers to a teaching environment, which applies various multimedia teaching equipment and modern educational technology to teaching. In the cloud computing environment, the *cloud computing assisted instruction* uses the cloud computing platform to build individualised information-based teaching environments to assist teaching and learning. This promotes communication between teachers and students, and improves teaching quality [7]. In the cloud computing teaching environment, teachers can complete many teaching tasks at home.

### Teaching Environment Model

The multimedia teaching environment based on cloud computing comprises a cloud services platform and cloud services terminal. This platform consists of an educational administration system, equipment management system, multimedia resource library, on-line teaching platform, and classroom Web site, to provide users with unified cloud services. The cloud service terminal includes the multimedia teaching environment and mobile terminal. The model is shown in Figure 1.

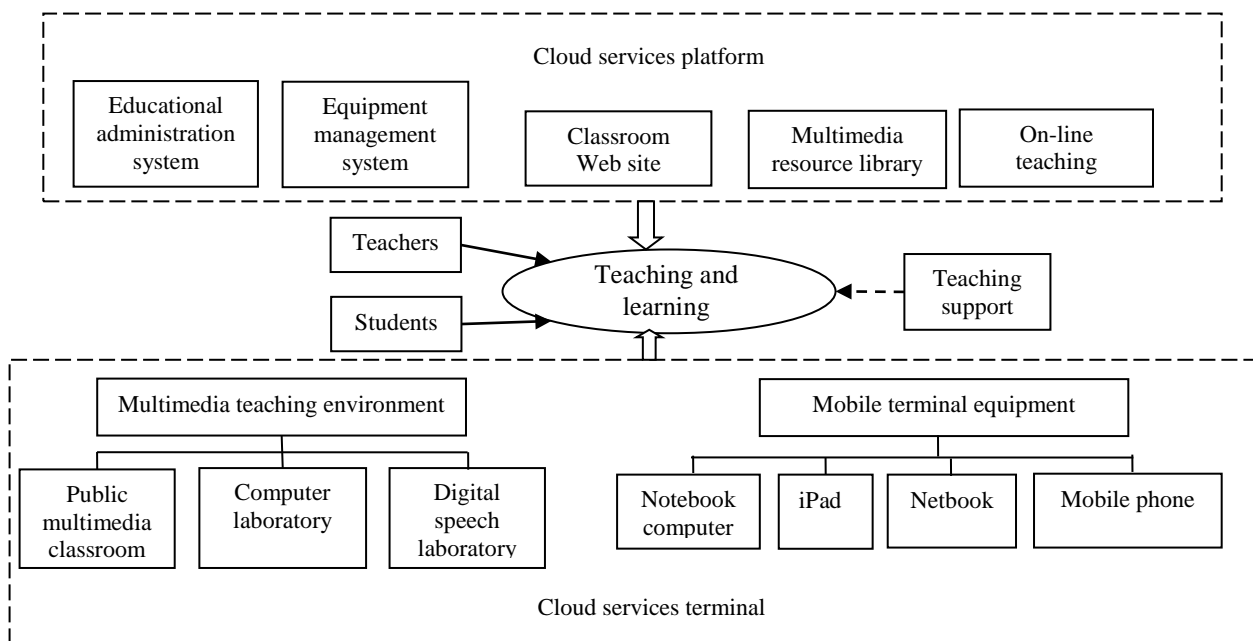


Figure 1: Multimedia teaching environment based on cloud computing.

- Cloud services platform:

Cloud computing integrates the educational administration system, equipment management system, classroom Web site, multimedia resource library and on-line teaching platform in an organic manner. These independently distributed systems interrelate, so as to support the whole teaching activity. The educational administration system is responsible for the course arrangement and teaching management. The equipment management system manages various instruments and equipment, including the teaching equipment. The multimedia classroom is the teaching place, and so the real-time control of classroom information is essential. The classroom Web site presents information and the running status of classrooms and equipment, as well as providing a reference for the arrangement of courses in the classroom. The multimedia resource library and the on-line teaching platform are the main places where the material is presented. Multimedia resources include teaching resources in various forms, with abundant content. This can express teaching content in vivid and intuitive ways, and maintain a large body of knowledge. This helps students establish the connection between old and new knowledge, and promotes meaning construction by students. Meanwhile, teachers can easily obtain resources from the teaching resource library,

to enrich the course and save the time spent searching for resources. The teaching platform supports the whole process of teaching, communication and evaluation by individualised and collaborative learning. Evaluation strategies and methods are also improved. In the teaching, co-operation and interaction between students and teachers, and students and students, stimulates students' initiative and creativity, and their overall understanding [8].

- Cloud service terminal:

The service platform supports multiple terminals through cloud management. The multimedia teaching environment enables teachers to teach in public multimedia classrooms, computer laboratories or digital speech laboratories. Mobile terminal equipment includes desktop computers, notebook computers, netbooks, iPads and mobile phones. Hence, learners are able to use multiple types of terminal to learn anywhere at any time and, thereby, meet the individualised needs of learners.

- Teaching support:

This includes teaching management personnel, teaching equipment maintenance personnel and cloud computing platform management personnel.

In the multimedia teaching environment using cloud computing, the resource pool and education applications are formed from highly virtualised education resources and education applications. Services can be provided for users by making use of the cloud services platform, which can be flexibly expanded to meet users' needs. In this student-centred teaching environment, students can give full play to their independence, and teachers act as the organiser and director of the teaching process, fully embodying the four elements of the teaching environment, viz. *situation, collaboration, conversation and meaning construction*.

#### The Multimedia Teaching Process using Cloud Computing

Multimedia teaching based on cloud computing involves a cloud services platform providing all-round teaching services. There are several requirements in order to achieve this:

- Preparation of teaching equipment:

The teacher inquires about his/her course arrangement on the classroom Web site, and checks whether the classroom teaching environment can meet the teaching needs. If the equipment configuration is insufficient, the teacher can file an application through the classroom Web site, to provide equipment for the classroom teaching without having to go to the classroom. In addition, the classroom Web site provides a classroom reservation function and support for examinations.

- Preparation of teaching resources:

At the beginning of each semester, the courses and students on courses will be available on the on-line teaching platform. Through the cloud services platform, teachers can upload lecture notes and teaching materials to the cloud, write learning objectives, and outline the focus and difficulties of the course. Assignments can be previewed and related resources recommended. Therefore, the teacher can complete the pre-class preparation from wherever is convenient.

- Support during the class:

The teacher can open the multimedia teaching equipment, after completing identity authentication by swiping a card. After logging in to the cloud services platform, the teacher can use lecture notes and other teaching resources that have been uploaded. Students can also download the courseware, raise questions to the teacher and to other students. Students can record their learning and experience. The teacher can view students' notes, to better understand learning difficulties and the psychology of the students; hence, teachers can adjust teaching strategies.

- Teaching out of the class:

Teachers and students can log into the teaching platform at any time, anywhere through a mobile device, and the platform can automatically remind them of the time and place of the latest class. The teacher can use the teaching platform to correct students' assignments, check for assignment completion and understand the learning of the class. Both teachers and students can exchange and share the learning experience through learning tools and learning exchange area provided by the cloud platform. In addition, the system automatically reminds students to submit assignments and informs them of their scores.

The application of cloud computing in education can achieve the sharing of massive educational resources, and provide convenient, flexible and open learning that is not restricted by time and space. Furthermore, it achieves individualised education, so that learners can arrange learning plans and progress according to their individual requirements.

## CONSTRUCTION OF A TEACHING ENVIRONMENT BASED ON CLOUD COMPUTING

At present, all colleges and universities have a relatively complete educational administration system and equipment management system. However, colleges vary in the development of multimedia teaching resource libraries and on-line teaching platforms targeted at multimedia teaching and classroom Web site support.

*Making Multimedia Courseware* is taught at the Guangzhou Vocational College of Technology and Business. A course Web site based on the Baihui Office on-line platform has been developed, to facilitate extracurricular teaching. The teaching environment based on cloud computing can be constructed in the following steps:

### Establish the Classroom Web Site to Manage Classroom Resources

In the initial stage, the classroom Web site should be constructed to complete the digitisation of various devices, resources and information in the classroom, and control the releasing and management of dynamic and real-time information. Following are the main functions:

- Classroom course administration: based on the educational administration system and includes the management of courses in the multimedia classroom, computer laboratory and digital speech laboratory;
- Management and control of classroom equipment: based on equipment management data and includes the release and management of equipment resources. Management includes the dynamic use, as well as maintenance, transactions, scrapping and update of information about equipment;
- Classroom reservations: the teacher can reserve a classroom and students can reserve a seat in the classroom;
- Classroom occupancy: a visual display of each classroom's occupancy is provided as a convenience when making a reservation and as a reference for students seeking their place in the classroom.

Equipment is an indispensable tool for teaching. The classroom Web site helps teachers master dynamic classroom information and understand the running status of equipment. A classroom Web site is shown in Figure 2.

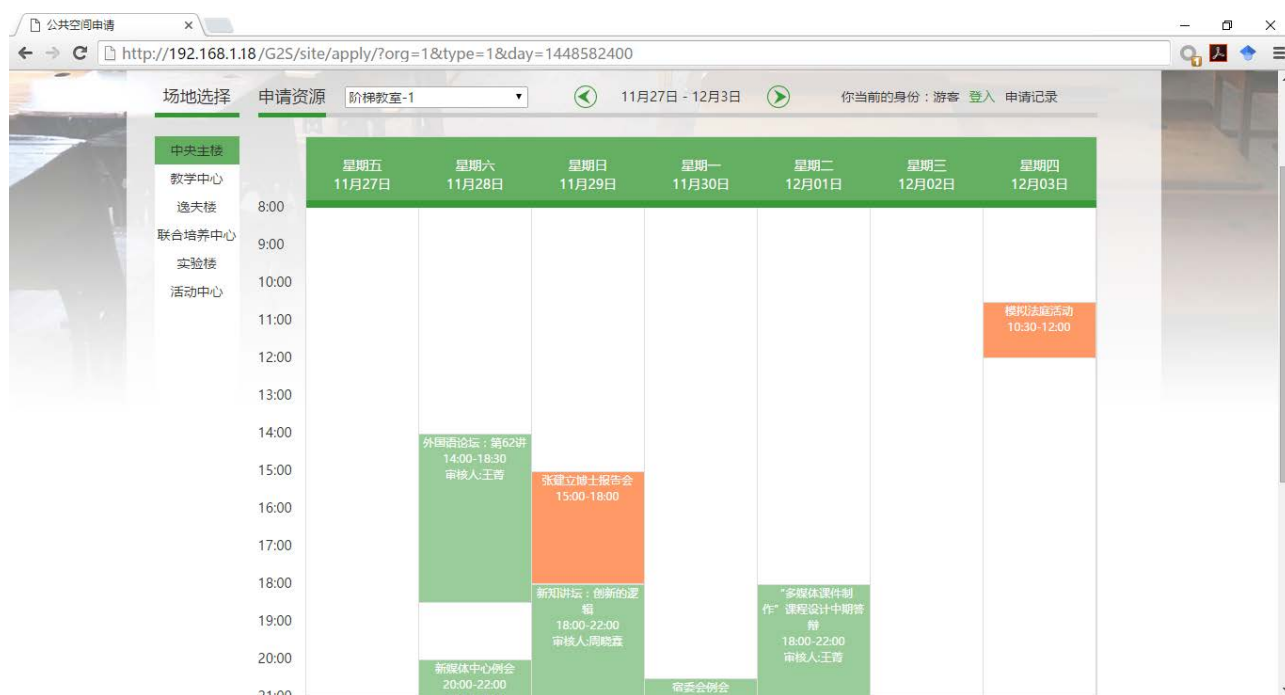


Figure 2: A classroom Web site [9].

### Construct a Multimedia Teaching Resource Library, to Enable the Sharing of Teaching Resources

The sharing of digital teaching resources is of great significance in the development of education informatisation. The teaching environment is based on a multimedia presentation of educational information, which can vividly express key and difficult points in teaching and facilitate the conversion of implicit into explicit knowledge. On-line teaching resources increase rapidly and resources are distributed widely with a low sharing rate. There is much duplicated material and the material is not satisfactorily organised. Therefore, users need to spend much time in finding the required resources. In addition, much storage space is required for teaching resources, and colleges have to spend a lot of money on the purchase and maintenance of storage equipment. These problems can be solved by adopting cloud computing.

The multimedia teaching resource library provides teaching subjects with learning resources and teaching support services. Constructed at a college or Chinese province level and funded by the relevant education departments,

the multimedia teaching resource library is a centralisation of massive teaching resources on the cloud, to provide convenient resource retrieval from the cloud's essentially unlimited storage. Hence, users having requirements in the office, during learning or in daily life, can acquire shared teaching resources and obtain services.

Teaching resources in the multimedia teaching resource library include media material, case material, literature, courseware, learning Web sites and information resource libraries. The material includes text, sound, animation, and video involving various disciplines and grades or levels. In the multimedia teaching resource library, resources are well organised into several categories, to enable users to find the required resources within the shortest time and to assist teachers to prepare lessons. The system is a platform for resource integration, and the centre for exchange between multiple discipline areas. To enable a college's resources to be shared, the resources that belong to the college and associated local services should be linked to the cloud to transform them into cloud services, thereby, making them available to other colleges and teachers. This maximises the value of education resources by achieving their reasonable and effective use.

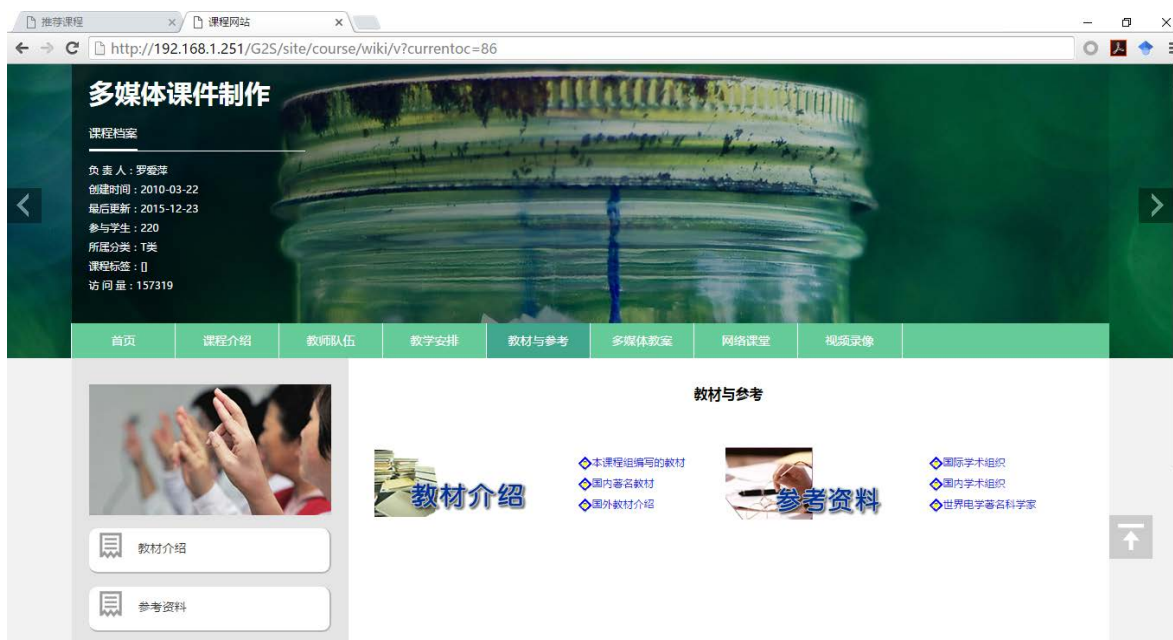


Figure 3: The course Web site for *Making Multimedia Courseware* [9].



Figure 4: The slideshow viewing page [9].

The course Web site that is used at the Guangzhou Vocational College of Technology and Business (<http://192.168.1.251/G2S/site/course/wiki/v?currenttoc=86>) includes mainly curriculum resources and study guides (see Figure 3). *Curriculum resources* presents the syllabus and links to many Web sites for excellent courseware, which provide rich on-line resources. This Web site was based on Baihui Wiki and all the teachers and students have read and

written permissions. In addition, some resources are available on SlideBoom (from iSpring Solutions Inc.), which can play slideshows (only supports .ppt and .pps currently). Figure 4 shows the slideshow viewing page.

#### Construct the On-line Teaching Platform, to Promote Communication between Teachers and Students

The on-line teaching platform is the virtual learning environment integrating teaching resources, learning resources and teaching support services [10]. In the cloud computing teaching environment, through cloud management, learning records are kept on the cloud, enabling users to learn using different terminals. Students can access the teaching platform anywhere and at any time to view the teacher's electronic teaching plans or video teaching. Teachers and students participate in discussions and interactions through various communication tools, to facilitate independent and constructive learning.

The teaching platform based on constructivism learning theory should include such function modules as frontier discipline, learning tools, on-line lesson preparation, resource sharing, question answering, discussion, assignment management and the examination bank. These support the communication and activities of the whole teaching process. Frontier discipline provides the introduction to the specialty and latest developments. On-line lesson preparation is used by the teacher to prepare lessons, provide focus and help with difficult areas. The teacher can store electronic teaching plans and courseware for the module, which are, then, available in any multimedia classroom. Students can download learning resources, e.g. courseware, lecture notes, learning materials, anywhere at any time, and store these on the teaching platform.

The teaching platform for the *Making Multimedia Courseware* course was constructed on Baihui Doc, and the on-line platform on Baihui Chat. Documents can be shared easily on Baihui Doc, while teachers and students can communicate any time on Baihui Chat. Through the teaching platform, the teacher can assign and correct assignments, view the status of assignment completion, display excellent assignments, provide key course content, answer questions and provide on-line examinations. Through the on-line platform, students can discuss questions, submit assignments, see their scores and teachers' comments and carry out on-line reviews. In the process of teaching, students and teachers, and students and students can achieve synchronous or asynchronous collaboration and discussion through the module of question answering and discussion.

#### CONCLUSION

A multimedia cloud services platform realises information digitisation of teaching environment elements, integrates each element of the teaching environment, to achieve data and resources sharing, and provides great convenience for teachers and students. With the rapid development of cloud computing, how to customise cloud computing services according to users' needs is an important issue. In the *cloud era*, new ideas and new methods of teaching should be grasped and adapted to the needs of education, so as to promote the rapid development of education informatisation.

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