

# Literature review of recent research on Cloud Computing in Education

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## Abstract:

*The education system in rural and semi-rural areas of developing and underdeveloped countries are facing many challenges. The limited accessibility and challenges to the education are attributed mainly to political, economic and social issues of these underdeveloped countries. We propose a “Feasible Rural Education System (FRES)” based on Cloud to enhance the accessibility to education in rural areas. Cloud Computing provides resources and capabilities of Information Technology (e.g. applications, storages, communication, collaboration, infrastructure) via services offered by CSP (cloud service provider). Cloud computing has the capacity of scaling and elasticity which is perfect for such an environment.*

## CLOUD COMPUTING

### (I) Cloud Computing

Cloud computing is a tool to make IT related services available in a simplified manner hiding the complexities of those services, without really knowing and getting involved in the technicalities of how and what to do in providing the needed services. The term “cloud computing” is given to this approach because the users do not really need to know who is providing those services and users consider that the services are rendered by the cloud – an unknown to them. The charm of cloud computing is that the services may be availed whenever and wherever needed. It also reduces the cost of availing those services drastically. At the same time, it offers involvement of very less manpower and maintenance of those services. It also makes users free from certain concerns such

as buying software, maintaining them up to date, maintenance of data etc. All these issues would be taken care of by Cloud providers. Cloud computing offers various models based on user requirement.[1]

## (II) Characteristics of the Cloud

Cloud computing is more than a technology which provides a platform for hosting applications as service, storage services and development environment for IT developers. It is a dynamic provisioning of IT tools and capabilities from third party over an established network. It is a form of remote computer with the help of web based tools can access and use through a web browser as it was locally available on end user's computer. Cloud computing has many distinct characteristics which makes this technology quite different from conventional networking and grid concept. The distinct characteristics have been described here (White and Maganti, 2010):[3]

### **On-demand self-service**

A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring

human interaction with each service's provider. [3]

### **Broad network access**

Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g. Mobile phones, Laptops and PDAs {Personal Digital Assistants}). [3]

### **Resource pooling**

The world IT industry has gathered huge amount of data having restricted accessibility to the real users. Large companies having those data centres can easily sale these data and computing power on rent basis to other organizations and get profit out of it and also make the same resources available needed for running data centre (like power) utilized properly. Companies having large data centres have already deployed the resources and to provide cloud services they would need very little investment (Ghosh, 2010). The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in

that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g. country, state or datacenter). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.[3]

### **Rapid elasticity and scalability**

Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale up and rapidly released to quickly scale down. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time. Scalability is provided dynamically to the users. Users get as much resources as they need.[3]

### **Most fitting and handy:**

Cloud users need not to take care about the hardware and software they use and also they don't have to be worried about maintenance. The users are no longer tied to someone traditional system. Virtualization technology gives the illusion to the users that they are having all the resources available.[3]

### **Measured Service**

Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g. storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported providing transparency for both the provider and consumer of the utilized service. Cloud users can use the resources on demand basis and pay as much as they use. So the users can plan well for reducing their usage to minimize their expenditure.[3]

### **(IV) Type of Cloud Computing**

Basically, clouds are of three categories. IT organizations can choose to deploy applications on public, private, or hybrid clouds, each of which has its trade-offs. The terms public, private, and hybrid do not dictate location. While public clouds are typically “out there” on the Internet and private clouds are typically located on premises, a private cloud might be hosted at a collocation facility as well (Sun Microsystem Inc., 2009)[3]

### Private cloud

The cloud infrastructure is operated solely for one organization. It may be managed by the organization or a third party and may exist on premises or off premises. This is used solely for their internal purpose. Many companies and corporate are moving towards this setting and this is the first step for an organization to move into cloud.[3]

### Community cloud

The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g. mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on premises or off premises.[3]

### Public cloud

The cloud infrastructure is made available to the general public or a large industry group on demand basis and is owned by an organization selling cloud services. Services are provided to the users using utility computing model[3].

### Hybrid cloud

The cloud infrastructure is a composition of two or more clouds (private, community or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g. cloud bursting for loadbalancing between clouds). This type of cloud is composed of multiple internal or external clouds. This is the scenario when an organization moves to public cloud computing domain from its internal private cloud.[3]

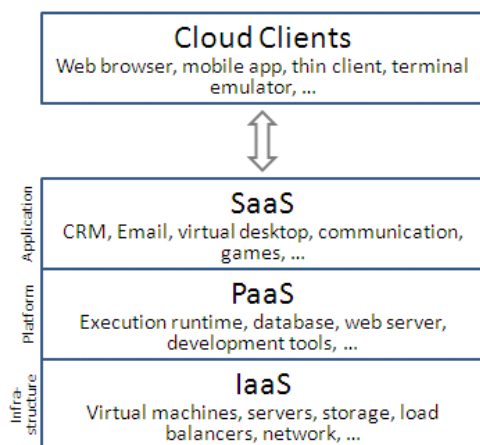
### (V) Structure of Cloud Computing

Three of the most basic cloud computing models are:[1][3]

- **Software as a Service (SAAS):** It includes the ICT working environment tools such as software, web applications etc., without buying/downloading and installing in specific machines. Another characteristic of this model is that the users are charged for whatever has to be used for a specific duration, against the traditional way of buying and paying for the full application. [1]
- **Platform as a Service (PAAS):** It provides clients the computing platform for designing and developing

specific applications with minimum redundancy. It also takes care of hosting of those applications without concerning about hardware and data storage requirement. It also guarantees the availability of most recent platforms and their security.

- Infrastructure as a Service (IAAS):**  
 This model usually includes tangible as well as intangible components used in availing ICT services, such as virtual computers, traffic monitoring and re-directing, basic network components etc. This is the most prominent benefit of cloud computing as the organizations invest the most in establishing infrastructure.



**Fig. 1 Structure of Cloud Computing**

### Indian Rural Education and Cloud Computing

A typical rural education system contains three main components namely: Teacher, Student and Infrastructure. In spite of the various ICT projects in India, the country is still facing various challenges:[2][5]

- lack of commutation to schools situated far off from villages,
- playing in streets, want of setup area meant for play
- studying under street lamps, want of electricity at home
- lack of good curriculum or educational material
- lack of full-pledged laboratory or library facilities etc

Cloud computing is going to solve these challenges .By using the cloud technology.our education system is divided in to three fases.student get benifited in respective manner:

- An interesting and challenging representation of free education material, so that attention of the student holds.
- Communication in learner’s language.
- Limited dependence on teacher’s

instruction and on non-availability of other modes of learning.

□ More interaction with students of other schools of the same curriculum. Up to date and accurate representation of curriculum.

Teachers getting advantage from cloud computing technology in those manner:

□ The large gap between rural and urban technology in facilitating teaching and learning process.

□ Limited availability of facilities like study materials, language friendly multimedia.

□ Very less or non-availability of resources for accelerated and quality learning.

□ Huge cost involved in procuring and maintenance of infrastructure- mainly software and hardware.

□ Lack of communication between schools handling the same curriculum, hence shortage of updated information and mentoring programs.

A big problem for rural education is Infrastructure. by the use cloud computing rural education system can be effectively changed by respective manner:

□ Free availability of resource materials in the form of text, video or audio classes.

□ An effective teaching guide to support the teachers and learners.

□ Challenge based or game based learning curriculum that can hold the attention of learners.

□ An effective educator system that can take care of mentoring and supporting of rural educators.

□ Availability of technology (software and hardware) without the maintenance and cost issues.

□ A user friendly interface preferably in the local language of the user

□ Low cost systems and lab facilities.

#### **Advantages:**

• **Data management:** The data will be managed by the service provider, a team of professionals. That guarantees a better and organized management of data.[1][3]

• **Data readiness:** This provides data from the e-data bank databases to its entire

stakeholder at any time and at any location.[1][3]

• **Local and global Communication:**

This makes the communication between different users much faster, easier and cheaper. Also the communication will be secured.[1][3]

• **Rural-urban migration:** A major problem of India is rural-urban migration. It can be reduced as this provides its services all over the state and may also all over country at any time no matter how remote the place is. This will also help in controlling unemployment problem in the state and country.[1][3]

• **Motivation:** It will motivate the students and researchers to get involved more and more into studies as any communication will be result oriented. That will result in overall development of this sector in the nation.[1][3]

• **Security:** It provides an enhanced security as the resources will be stored in cloud and will be maintained centrally by the service providers. Thus, it is not a cause of concern for its users.[1][3]

• **Reduction of technical issues:** It cuts short the man power, maintenance and infrastructure requirement drastically, as it will be provided by the service providers.[1][3]

**Proposed Model**

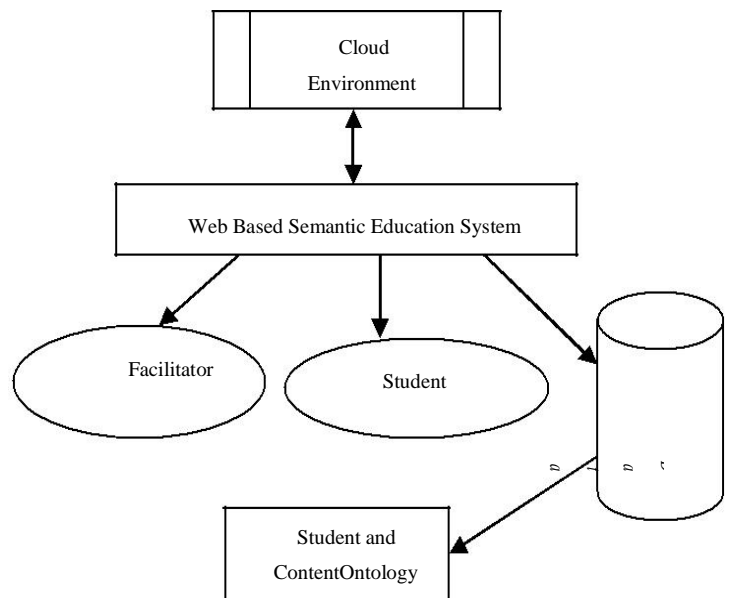


Figure 1: Architecture of Rural Education System

**Use Case Scenario**

Understanding the shortcomings and the difficulties of a student from a rural background is important aspect to consider in the teaching learning process. Since the system can be categorized as an e-learning space, all the characteristics of classroom learning if not more must be incorporated into the system. The rural education system has basically three entities:[2]

*Domain model, student model and Facilitator’s model.* Three requirements of the Semantic Web Education System for three different entities are discussed below.

**1) Student requirement:**

- Student needs a guide as he sits through the learning system. She needs an interactive system that guides him through his learning process Her preference of the learning style :Audio, Video, Text or Incorporation of all formats
- The dynamic flow of learning material that suits his understanding capability. She does not have to go through the entire material but that suits his need of knowledge
- Learning material presented depending upon his cognitive learning style
- A good and friendly user interface
- Student data to be stored with respect to his interest, his learning mode etc
- High quality information
- Student community

## 2) *Domain requirement*

- Storing of content's metadata or its relevance in the learning repository
- Structure definition: Organization of each content material or the learning sequence of the learning material
- Format of the resource material like video. Website , Audio etc
- Reusability of the content

- Dynamic updating of the content
- Quality assurance
- Automatic of display of Content depending on user's input

## 3) *Facilitator's requirement:*

- Uploading of resource material in any format.
- Updating of content
- Questionnaire in relevance with the content
- Evaluation procedures
- Guiding of students online or offline
- A secured and an user friendly interface

## **Effect of cloud computing:**

The study of "vSaaS: A Virtual Software as a Service Architecture for Cloud Computing Environment" had provided a solution and the solution is that platforms are built with virtual personal desktop environment and remote display technology . Users use the client device to access the cloud operation system just like using the local computer so that the study showed the feasibility and effectiveness for the vSAAS system. The IT education environment of elementary and junior high



schools consist two parts: class IT equipment and computer classroom, as shown in Table 1. The current environment of IT education of elementary and junior high schools consists of two parts: the IT equipment of in normal classroom and the computer classroom. There were interactive whiteboard, personal computer, projector and wireless network access point for the IT equipments of classroom that can provide teachers to incorporate information technology into Teaching. A computer classroom was a main place for training student's information ability and it also could be used for incorporate information technology into teaching. There were two kinds of systems that were used for implementing the computer classroom and they are system with disk and diskless system, respectively For disk system, the client's computer is equipped with hard disk, operation system and application program were installed at local disk and recovery system was installed to protect data from been erased. For diskless system, client's computer does not need to install hard disk, operation system and application program were installed at diskless server as image files and student's computer read image files of servers through intranet for starting.[4]

### **Case study(example of various countries which uses cloud computing in education)**

New Zealand started IT education for elementary and secondary schools in 1990. The project, Professional Development Cluster which promoted at 1999, was to let the seed schools of IT to help neighboring schools for the development of IT education. The plan called Kaupapa Ara Whakawhiti Matauranga (KAWM) and released in 2001 was to help Maori schools which located at underdeveloped area is to reduce the information gap. The lease project of teachers' notebook computer for junior high school was released to enhance the teachers' ability of IT teaching between the year 2002 and 2003 (Hsieh, 2008). A study attempts to review on challenges and infrastructure of e-learning in developing countries specially Iran (Omidinia et al., 2011). Taiwan's Ministry of Education released the infrastructure project of IT education in 1997 and the project content consists of subsidizing the elementary and junior high schools for building computer classrooms, purchasing software and constructing campus network. The IT education of elementary and junior high schools was formally incorporated into

the curriculum since 2001 and the Curriculum was begun from Grade 1-9 .[4][10]

### **why cloud computing is beneficial for various institutions as follows:**

#### **1. Low cost and free technology:**

There has been a huge growth in low cost and free technology for social interaction, publishing, collaborating, editing, content creation, computing, etc.[5]

**2. Content growth:** The amount of content (art, expression, opinion, true and false information of all forms) is growing at an exponential rate, available to the board audience, and anyone can contribute.[5]

**3. Collaboration:** Technology is rapidly improving the ability to communicate collaborate with others.[5]

### **Conclusion:**

Cloud computing is a solution to many problem of computing. Even we are in IT ages complication of computing has created much disaster to computer world. Lots of crisis has happen in business world as well as in academic environment. Data security, storage, processing power is limited while

using traditional computing. Data are also in risk and not available all time. But by using of cloud computing the entire problem is solve. Computer in academic environment must have the latest hardware and software. Due to cost many couldn't fulfill the availability of resource to student and staff by using cloud computing in academic environment we can solve all the issue. Cloud computing is new technology suitable for any environment.

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