CLOUD COMPUTING IN RURAL EDUCATIONAL SECTOR: ENLIGHTENING BENEFITS AND CHALLENGES

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ABSTRACT

The objective of this paper is to study and analysis on Cloud computing benefits and challenges and how it is important for rural educational sector. The use of cloud computing in rural areas substantially increases availability of necessary educational computing services and applications to students and educators through the infrastructure it provides. Cloud computing is growing rapidly, with applications in almost any area, including education. Different Online-learning systems usually require many hardware and software which can be heterogeneous in nature. As there are many schools and colleges in rural areas that cannot afford such investments, and cloud computing is the best solution. However, there are some limitations that are worth mentioning when it comes to the use of cloud computing in the education sector.

KEYWORDS: Benefits, Challenges, Cloud Computing, Rural Education

INTRODUCTION

India’s 72.2 % of population resides in the rural areas and villages [1]. India’s huge population has a great potential to make it an economic as well as an IT superpower but the major obstacle is the lack of infrastructure for the development of the Educational schools and colleges in rural areas. With the introduction of the new cloud computing paradigm these problems can be easily eliminated because it doesn’t require the end users to have any type of infrastructure, as all of them are delivered as services (whether it be infrastructure as a service (IaaS), Platform as a service (PaaS), Software as a service (SaaS)) on a pay per-use basis (utility computing) virtually which makes it easier and cheaper for the people living in rural areas to actively involve themselves in the this sector [2].

The major hurdle for development of IT related education in the rural areas is the lack of school and colleges with proper infrastructure to provide top level of education as a result of which top level of education is only available to those who can afford to come to cities to study which is a minimal percentage of the actual rural population. To be able to tap the maximum potential of the rural India it is very important that these Educational Centers must be located in the rural areas itself with proper tools such as proper applications, proper infrastructure and appropriate development platforms. Till now none of this is possible in rural areas because of the huge amount of money spent on buying software licenses, setting up proper infrastructure required for computation, storage etc. But with the three fundamental units of cloud computing i.e. IaaS, PaaS and SaaS, The capital required for setting up this kind of learning organization can be reduced by huge percentages as these organization Don’t need to buy expensive software licenses when they can pay for it on a pay-per cycle basis whether it be software development packages or working platforms. Don’t need to setup huge and expensive infrastructure (such as high speed processing computers or huge data storage devices) when they can use these resources from the cloud providers.

DEFINITION OF CLOUD COMPUTING

As defined by the National Institute of Standards and Technology (NIST), “Cloud computing is a model for
enabling convenient, 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”.

CHARACTERISTICS OF THE CLOUD

- **Elasticity**- is an important core feature of cloud systems and restrict the capability of the underlying infrastructure to adapt to changing, potentially non-functional requirements, for example amount and size of data supported by an application

- **Reliability**- is essential for all cloud systems – in order to support today’s data centre-type applications in a cloud, reliability is considered one of the main features to exploit cloud capabilities. Reliability denotes the capability to ensure constant operation of the system without disruption, i.e. no loss of data, no code reset during execution etc. Reliability is typically achieved through redundant resource utilization. Interestingly, many of the reliability aspects move from hardware to a software-based solution

- Quality of Service support is a relevant capability that is essential in many use cases where specific requirements have to be met by the outsourced services and / or resources. In business cases, basic QoS metrics like response time, throughput etc. must be guaranteed at least, so as to ensure that the quality guarantees of the cloud user are met. Reliability is a particular QoS aspect which forms a specific quality requirement.

- Availability of services and data is an essential capability of cloud systems and was actually one of the core aspects to give rise to clouds in the first instance. It lies in the ability to introduce redundancy for services and data so failures can be masked transparently. Fault tolerance also requires the ability to introduce new redundancy (e.g. previously failed or fresh nodes) in an online manner non-intrusively (without a significant performance penalty). With increasing concurrent access, availability is particularly achieved through replication of data /services and distributing them across different resources to achieve load-balancing. This can be regarded as the original essence of scalability in cloud systems. Cost reduction is one of the first concerns to build up a cloud system that can adapt to changing consumer behavior and reduce cost for infrastructure maintenance and acquisition.

- Scalability and Pay per Use are essential aspects of this issue. Notably, setting up a cloud system typically require additional costs – be it by adapting the business logic to the cloud host specific interfaces or by enhancing the local infrastructure to be “cloud-ready”.

- **Pay per use**: The capability to build up cost according to the actual consumption of resources is a relevant feature of cloud systems. Pay per use strongly relates to quality of service support, where specific requirements to be met by the system and hence to be paid for can be specified. One of the key economic drivers for the current level of interest in cloud computing is the structural change in this domain. By moving from the usual capital upfront investment model to an operational expense.

BENEFITS OF CLOUD COMPUTING

According to Dr. Bruce White, There was a time when every household, town, farm or village had its own water well. Today, shared public utilities give us access to clean water by simply turning on the tap; cloud computing works in a similar fashion. Just like the water from the tap in your kitchen, cloud computing services can be turned on or off quickly as needed. Like at the water company, there is a team of dedicated professionals making sure the service provided is safe
Cloud Computing and available on a 24/7 basis. Best of all, when the tap isn’t on, not only are you saving water, but you aren’t paying for resources you don’t currently need. Some other benefits are:

- **Economical**: Cloud computing is a pay-as-you-go approach to Rural Educational Centers, in which a low initial investment is required to get going. Additional investment is incurred as system use increases and costs can decrease if usage decreases. In this way, cash flows better match total system cost.

- **Flexible**: The Educational Sectors that be hopeful of fluctuations in infrastructure load do not have to scramble to secure additional hardware and software. With cloud computing, they can add and subtract capacity as its network load dictates, and pay only for what they use.

- **Consistent Service**: Cloud computing can offer a higher level of service and reliability, and an immediate response to emergency situations.

- **Increased Effectiveness**: Cloud computing frees the user from the finer details of IT system configuration and maintenance, enabling them to spend more time on mission-critical tasks and less time on procedure and maintenance.

- **Energy Efficient**: Because resources are pooled, each educational community does not need to have its own dedicated infrastructure. Several groups can share computing resources, leading to higher utilization rates, fewer servers, and less energy consumption.

**CLOUD DEPLOYMENT MODELS**

- **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.

- **Public Cloud**: The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

- **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.

- **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.

**CLOUD SERVICE MODELS**

- **Cloud Software as a Service (SaaS)**: Provides the consumer the ability to use the provider’s applications running on a cloud infrastructure. The applications are accessible from various client devices through a client interface such as a web browser (e.g., web-based e-mail). The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.

- **Cloud Platform as a Service (PaaS)**: Provides the consumer the ability to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network,
servers, operating systems, or storage, but has control over the deployed applications and possibly application hosting environment configurations.

- **Cloud Infrastructure as a Service (IaaS)**: Provides the consumer the ability to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems; storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls).

The connectivity and configuration of the Cloud based Rural Education System is based on the Rural Educational centers and data center with different cloud services. As shown in figure.1 Internet is the main communication link between the cloud service provider and the Rural Education center. Many cloud applications do not require specific software on the client and instead use a web browser to interact with the cloud application required at Rural Education Center for communication purpose. The Rural education centers can access different services by using public clouds, which provide services available publically. When user requesting some sort of service from cloud the service providers like Amazon, Google Apps, Windows Azure and many more provides the required services according to the functionality required.

![Figure 1: Architecture for Rural Education with Cloud Computing Services](image)

**CHALLENGES WHEN THINKING OF CLOUD**

However, there are some Challenges that are worth mentioning when it comes to the use of cloud computing in the Rural Education Sector (Miller, 2009). The main challenge to cloud computing is how it addresses the security and privacy concerns of Rural Educational Centers thinking of adopting it. The fact that the valuable enterprise data will reside outside the Educational Center firewall raises serious concerns.

Hacking and various attacks to cloud infrastructure would affect multiple Rural Centers even if only one site is attacked. Another issue regarding cloud computing is the fact that data stored in cloud are not completely secured. Because of the fact that data is stored online, it would mean that these data would be susceptible to theft and hacking. These risks can be mitigated by using security applications, encrypted file systems, data loss software, and buying security hardware to track unusual behavior across servers.

Cloud computing needs a constant and fast internet connection. Basically, this is a very modern technological advance. And, like all of the other advances, it cannot really work independently without the internet. In other words, the absence of the internet would totally hamper important communications and processes.
CONCLUSIONS

The cloud computing seems to be really helpful in rural educational sector. There is a tremendous promise for cloud computing infrastructure in the Rural Educational School and Colleges. Cloud computing would help Rural Education centers to achieve efficient use of their hardware and software investments and to increase proficiency in rural sector by improving the utilization of resources to the maximum. Not only will it lead to better education in these rural areas but also in huge business opportunities and better educational facilities. However, there are some challenges that are present when it comes to the use of cloud computing in the Rural Educational Sector. All these challenges should not be considered as street chunk in the chase of cloud computing. It is rather important to give serious consideration to these issues and the possible ways out before adopting the technology.

REFERENCES

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