THE BENEFITS AND LIMITATIONS OF CLOUD COMPUTING IN HIGHER EDUCATION INSTITUTIONS OF KOSOVO

Edmond Beqiri
University of Peja "Haxhi Zeka", Kosovo, edmond.beqiri@unhz.eu

Abstract: Higher education is one of the pillars of the development of society. Through collaboration between universities, government and industry, researchers and students have witnessed their contribution to the transformation of society and the entire world economy. Various research is being developed to improve current IT infrastructure, especially in the field of education. Cloud computing can be a welcome alternative to higher education universities and institutes. IT industry has a better choice and flexibility by building highly-intensive computer infrastructure, created only once and utilizing this infrastructure several times. With the help of cloud computing, platform and applications, user utilization can be either inside the campus or outside of the campus, or a combination of both depending on the institution's needs.

Historically, the education sector has a continuous symbolic relationship with technology. While on the one hand, education has been a cradle for many technological innovations, on the other hand technology has played a key role in the development of education and education. Informatics, in particular, has played an unrivaled role in transforming education into a more cooperative and more interactive process.

The education sector is one of the cornerstones of socio-economic development. it's widely acknowledged that education contributes to reducing poverty and economic growth, which at the same time leads to a better standard of living. This also enables an individual to participate in wealth-generating activities, leads to job creation, and the overall development of society.

The education sector, like other sectors, has also had negative and falling moments, where some countries have lowered their education budget. However, governments are making genuine efforts to ensure that education remains one of the top priorities, so the sector in question is on a steady rise. This is mainly because education is considered to be a pillar in the economic sphere. The Government of the Republic of Kosovo and the private sector are investing in the education sector to reinforce the future educational supply opportunities.

In addition to the apparent use of technology in the organized education segment, technology has also penetrated into the unorganized segment. Training programs, private tutors, bloggers and professional audio programs are some of the services that are being offered through the use of technology in the unorganized segment.

In the absence of regulations, this sector has so far had a non-uniform use of technology.

The purpose of this paper is to identify the features of using Cloud Computing in higher education in Kosovo. Mainly, the risks and benefits of Cloud architecture have been taken into account and a Cloud Computing framework for educational institutions is proposed. The study also provides the elements for a Cloud Computing adaptation strategy, suitable for universities. The research discusses various topics for Cloud, Cloud Computing types, service delivery models, and similar concepts.

The rest part of the paper discuss the benefits and limitations of Cloud Computing in higher education institutions. This research investigates the potential benefits of using Cloud Computing in learning environments to overcome the learning limitations and the current service delivery system.

Keywords: ICT, Cloud Computing, Education, Ecosystem

1. CLOUD COMPUTING AND THE EDUCATION SECTOR

The education sector is one of the cornerstones of socio-economic development. It is widely accepted that education contributes to poverty reduction and economic growth, which at the same time leads to a better standard of living. It also enables the individual to participate in activities that generate wealth, leads to job creation, and the overall development of society (Beqiri Edmond, 2015).

Like other sectors, the education sector has had negative and declining moments, with some countries lowering their education budgets. However, governments are making genuine efforts to ensure that education remains one of the top priorities, the sector in question is on the rise. This is mainly because education is considered to be a pillar in the economic field. The Government of the Republic of Kosovo and the private sector are investing in the education sector to strengthen the opportunities of the education sector in the future.

The Ministry of Education has taken several initiatives to improve education in Kosovo. Some of these initiatives are:

Training of professors / Management staff:
-    Restructuring teacher training programs towards creating better qualities

- Expanding research programs / projects and stimulating research projects through publicly funded projects / research.
- Fulbright Program Competition for the academic year 2015-2016

Budget Extensions:
- Increase the budget for the expansion of higher education facilities.
- Construction of new university facilities.
- Cloud computing laboratory for students of the Faculty of Informatics and Computer Engineering in Prishtina
- Construction of research laboratories in some Public Universities (eg: "University of Prishtina", Facultz of Electrical and Computer Engineering).
    - High performance computing laboratory
    - Laboratory grid, for parallel and distributed processing
    - Server Laboratory
    - Advanced Web Technology Lab
    - System on Chip Design Laboratory
    - Lab for innovative technology and technology
    - Laboratory for intelligent robotics
    - Laboratory for semantic technologies
    - Software Engineering Laboratory and Advanced Programming Techniques
    - Laboratory for information systems, multimedia and visualization
    - Laboratory for mobile and multimedia applications
    - Laboratory for comprehensive mobile and semantic experience - LaMUSE
    - SMART Laboratory for interactive and collaborative teaching
    - CISCO computer network laboratory
    - CUDA Teaching Center by NVIDIA
    - FORTINET Laboratory for Information Security
    - NOKIA Center for the development of mobile applications
    - Regional Center for Social Innovation
    - Laboratory for Eco-Informatics

Electronic testing and curricula:
- External testing
- Electronic Diary (E-Diary)
- SMS notifications
- E-Books (Electronic Education Books)

2. THE ROLE OF TECHNOLOGY IN ECO-EDUCATION

The education sector has historically shared a symbolic relationship with technology.

While on the one hand, education has been a cradle for many technological innovations, in other words technology has played a key role in the development of education and schooling. Informatics, in particular, has played an incomparable role in transforming education into a more collaborative and interactive process (Beqiri Edmond, 2015). In today's education system, students and educators are using technology in many areas such as:
- Interactive teaching in the classroom
- Online exams
- Online books and magazines
- Online information forums

Similarly, educational institutes are using technology for:
- Educational content management and schedule setting
- Enrollment of student information
- communication
- Student admissions process management.

In addition to the obvious use of technology in the organized segment of the education sector, technology has also penetrated the unorganized segment. Training programs, private tutors and professional voice programs are some of the services that are being provided through the use of technology in the unorganized segment.

In the absence of regulations, this sector has had a non-uniform use of technology. Some of the technology tools that are or may be available from this sector:
- Hosting programs

- Content Management Systems (CMS)
- Interactive learning systems
- Automated student enrollment processes

Some of the impacts of technology on various aspects of education are:

Tools and Methodologies

- E-Books
- Virtual Learning Environment (VLE)
- Desktop / laptop / Supercomputing

3. CLOUD COMPUTING IN THE EDUCATION SECTOR

Cloud Computing is based on the collection of many old concepts and only a few new concepts in some research areas such as Service-Oriented Architecture (SOA), distribution and virtualization, in recent years has created a lot of interest. and special attention in this regard. This was as a result of its great potential to face technological advances (Gail Staines, 2017).

In this sense, cloud computing can be considered a new computer model that allows users to temporarily use computer infrastructure through the computer network, provided as a service by the Cloud provider at perhaps one or more abstract levels or methods.

The education sector has traditionally been wary of supporting new technology due to factors such as costs and risks. But the 21st century has brought new financial, demographic, and industrial pressures to the education sector that have become essential for schools and universities to adapt to the latest technology. In such a scenario, Cloud can offer a very acceptable solution for the education sector, helping it to implement technologies that are evolving at no great cost and with minimal complexity. We have already begun to feel the presence of the Cloud in the education sector globally. Schools have begun using Cloud for student e-mails, collaborative tools, and virtual desktops. Cloud also provides cost-effective and low-maintenance solutions for online and distance education programs. Positive feedback from earlier Cloud implementers promises widespread and efficient use of this technology in the education sector.

Figure 1: OpenNebula Virtual Infrastructure Components

Source https://opennebula.io/publication-of-the-opennebula-cloud-os-architecture-in-ieee-computer/
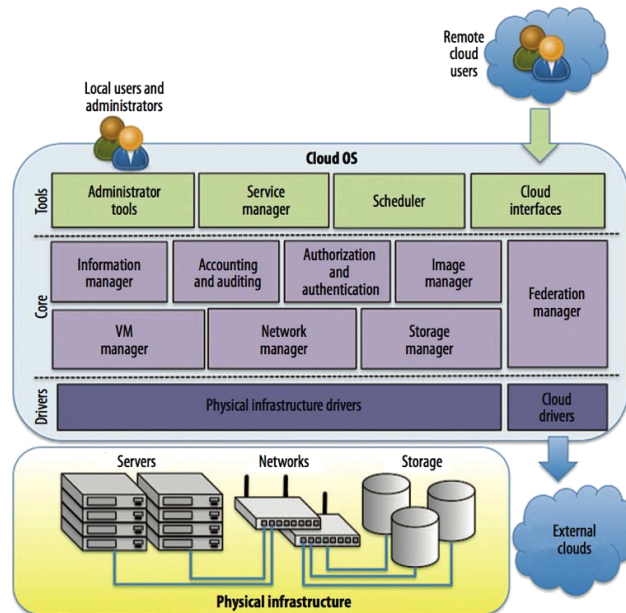
Cloud Computing offers universities the opportunity to focus more on teaching and learning activities instead of IT configuration and complex systems, with a quick implementation. In addition, Cloud can be used to support "interactive" learning and "social" learning theories, using computer technology to support collaborative learning methods.
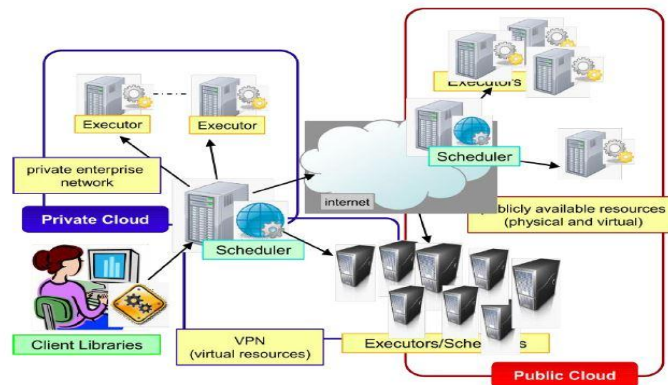
4. CLOUD COMPUTING BENEFITS AND RESTRICTIONS

Due to the recent development of IT technologies, infrastructure and continuous updates in software and hardware has put great pressure on the budgets and expenditures of universities and educational institutions. Cloud technology development offers many universities an opportunity to take advantage of new IT technologies at an affordable cost. The following are the benefits:

- ***Cloud Computing in the preparation of lectures***

With the development of private and educational Cloud, new internet applications such as LectureTools, Slideshare etc. allows the teacher to perform their work on their web browsers instead of storing and storing them on disks. This offers advantages such as:

- o Access to files and documentation from anywhere
- o Create a backup of your data
- o No worries about additional software licenses
- o Distribute information more easily

Figure 2: A typical Aneka Cloud setting

Source https://opennebula.io/publication-of-the-opennebula-cloud-os-architecture-in-ieee-computer/

- ***The other benefits are:***
- o Access to applications from anywhere
- o Support for teaching and learning
- o Pay as much as you use
- o 24 / 7 access to infrastructure and content
- o Access to various universities and advanced research
- o Environmental protection, using green technology
- o Exposing students to new IT technologies
- o Increased functional skills
- o Offline use with later synchronization options

Despite the many advantages that Cloud has to offer in the education sector, there are still challenges that need to be overcome to enjoy its full potential.

- ***Some of the shortcomings of Cloud Computing:***
- o Not all applications run on Cloud
- o Risk related to data protection, security and integrity
- o Organizational support
- o Risk to intellectual property
- o Security and protection of sensitive data
- o Lack of trust
- o Speed and lack of internet can affect the work process

5. PRIVACY AND THE RISK OF IDENTITY THEFT

These issues from a legal and administrative point of view are more problematic than from the last user - students, as the latter are not aware of the issue of privacy. Educators and research communities need to be concerned about storing sensitive research data beyond the boundaries of their university. Further, the use of Cloud during the

process of accepting and evaluating students through the Internet raises doubts about the validity of the information and identity theft (R.Krutz, R. Vines, 2010).

Privacy: Another challenge of Cloud approval by research institutes is the protection of intellectual property. Researchers and school administrations are unsure about storing confidential data on servers outside the university. They are even more rigorous to store such information on servers distributed by some users provided by the public Cloud.

Although the education sector has historically been in doubt over the support of new technologies, this sector in many countries has quickly begun the process of evaluating and approving Cloud services. Cloud can be said to be one of the pillars to achieve some of the social goals of the education sector such as "education for all" and "affordable education".

6. CONCLUSSION

The paper identifies some features of the possibility of using Cloud Computing in higher education in Kosovo. Mostly, the risks and benefits of the Cloud method were taken into account and we showed the benefits of Cloud Computing for educational institutions. The study is also an initiative for the introduction of Cloud Computing in Higher Education Institutions in Kosovo. This research discusses various topics for the implementation of Cloud in education, as well as some service delivery models and similar concepts.

We also discussed the benefits and limitations of Cloud Computing in higher education institutions. This research explores the potential benefits of using Cloud Computing in learning environments to expand the learning opportunities and service delivery system to date. Our proposal in this paper for the implementation of the Cloud Computing platform will be used as a descriptive opportunity for further study on this issue. As discussed within the Cloud Computing paper it will be a big IT revolution so it's time to take the first steps in this direction. The description in this paper can be found in the implementation of a virtualized and ecosystem-based Cloud ensemble for teaching and service delivery. This opportunity can first be tested in various IT departments before it can be fully implemented for all educational institutions at the local level.

Our proposal in this paper for the implementation of the Hybrid Cloud Computing platform will be used as a descriptive tool for further study on this issue. As discussed in paper, there will be a big implementation of Cloud Computing, so it's time to take the first steps in this regard and start building Cloud laboratories at higher education institutions.

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