

State-of-the-art Cloud Computing in Sudanese Higher Education Institutions

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Abstract: Cloud computing is one of the technology innovations. Provided users with a range of services ranging from store data and access those programs over the Internet. With it mobile learning via mobile devices availability, simplified and significantly which enabling students to learn more fully from a traditional system. An important aspect is that clouds have reduced learning costs, making learning more accessible; that can happen anywhere at any time when Internet access is available. The future refers to the development of mobile learning applications, thus introducing new concepts of education for young people, children, not only mobile learning for schools and universities, but also part of workplace training, creating new horizons for lifelong learning. We encourage Sudanese universities to adopt these ideas, which embrace mobile learning through cloud computing technology, to a system of learning processions of modernity and evolution, through this technology, different generations can participate in lifelong learning in an effective and time-saving manner.

Keywords: Cloud Computing , M-Cloud , M-Learning.

I. INTRODUCTION

It is an expression was initially used to refer to the Internet and networks in the schemes, where he knew that an initial fee for the cloud are used to represent the transfer of data from data centers to its final position on the other side of the cloud. The idea of the cloud (cloud) is not considered new, but the concept has been handled extensively as a result of a recent major expansion in the business world and the scope of investments, which is completely dependent on online services to get the job done accurately and professionally. Considered a model to provide appropriate access and permanently at any time and from any device to the network to share a wide range of computing resources that can be deployed and provided the minimal effort or interaction with the service provider. Using of cloud computing in universities is becoming necessary because of its advantages, making it an economic choice, It does not require significant costs, as it provides interesting participation services, it provides the opportunity for rapid access to various applications, systems and resources through the Internet, and thus can become a new trend of e-learning [37].

II. CONCEPT OF CLOUD COMPUTING

Cloud computing (CC) defined by the National Institute of Standards and Technology (NIST) as "a model to enable a common conveniently accessible on the network on demand common set of computing resources that have been configured (such as networks, servers, and storage, and applications) And can be saved and launched quickly with lower service provider interaction or minimal management effort [36]. In cloud computing it is practically that was transfer of the treatment process from the user's PC to the maid devices online and save user files, the user can access them from anywhere and any device, and programs are just services on the user's PC. Cloud computing emerged practical solution and optimal after the provision of the infrastructure of network and web in various parts of the world , and became the contact is not an obstacle , especially after the rapid development in the side of smart phones that managed to connect to the Internet, the emergence of the network share files and multimedia [34].

Cloud Computing Models: The Public , Private, Hybrid, and Community Cloud [32].[31].[30].[29]

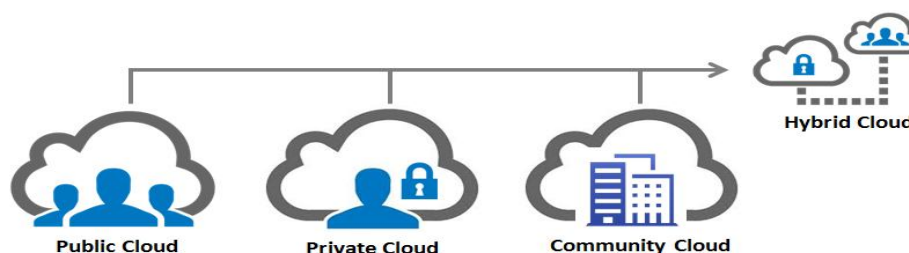


Fig.1: Type of Cloud Computing

III. CLOUD COMPUTING AND EDUCATIONAL

Services of cloud computing are forms of modern software is used widely in most countries of the world. However, it recently introduced as an idea to be used in the areas of distance education and e-learning, as well as mobile education, with cloud computing transformed from a theoretical concept to an actual application in the field of e-learning, design of the tests takes place directly on the network, as well as testing and assessment marks. Cloud computing can help colleges and universities to:

- Understand the rapid increase in the use of mobile device.
- Store extensive amounts of sensitive data and information that is easily accessible.
- Stay updated (eg, provide a digital warehouse for students within the university to store study notes, notes and projects).
- Get the latest software and application updates.
- Simplifying the processes of admission and admission to universities which are processes that are expensive and time consuming
- The tendency to contribute with the availability of development and the provision of options. [28].

Some other potential values for cloud computing in educational, cloud computing service also includes many advantages for learners, such as:

- Personalization of learning.
- Increase access and mobility opportunities.
- The ability to share and disseminate information in directly.
- Flexibility and stimulate innovation and cooperation.
- A truly global experience.

IV. MOBILE CLOUD COMPUTING

H. T. Dinh et al, they defines mobile cloud computing as: “using mobile resources (Hardware & Software) via the Internet, offering you a service, which you do not care about the manner in which they operate this service, or how to operate it, or contact with each other, and how the network is set up between them, and the software installed on them [27].

M. R. Prasad et al, the define MCC as " infrastructure where data processing and storage outside of the mobile device. In MCC, is performed computing power and data storage away from mobile phones and into the cloud , MCC is not just smartphone users but also includes a wide range of mobile phone subscribers" [26].

Mobile cloud computing can be divided into two sections cloud computing and mobile computing, Architectural and mobile computing are summarized in the following Fig 1:

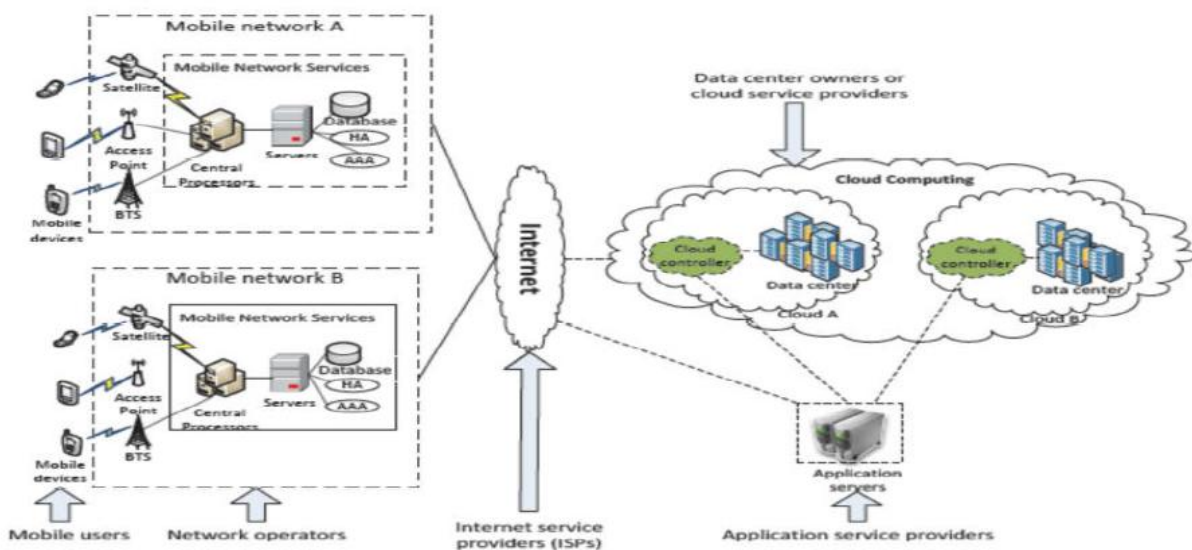


Fig.2: General Mobile Cloud Computing Architecture [27]

Cloud-Based Mobile Learning: Cloud computing mobile integrates both mobile computing and cloud computing, and wireless networks. This new technology aims to enhance the capabilities of mobile devices with limited resources to rich applications across clouds.

The cloud mobile applications benefit from the idea of the cloud, where the data is stored away from mobile phones, which is limited to smart phone users only and not for mobile phone users. There is evolution in both sides of the mobile computing and cloud computing, cloud computing mobile is a combination of two technologies [25]

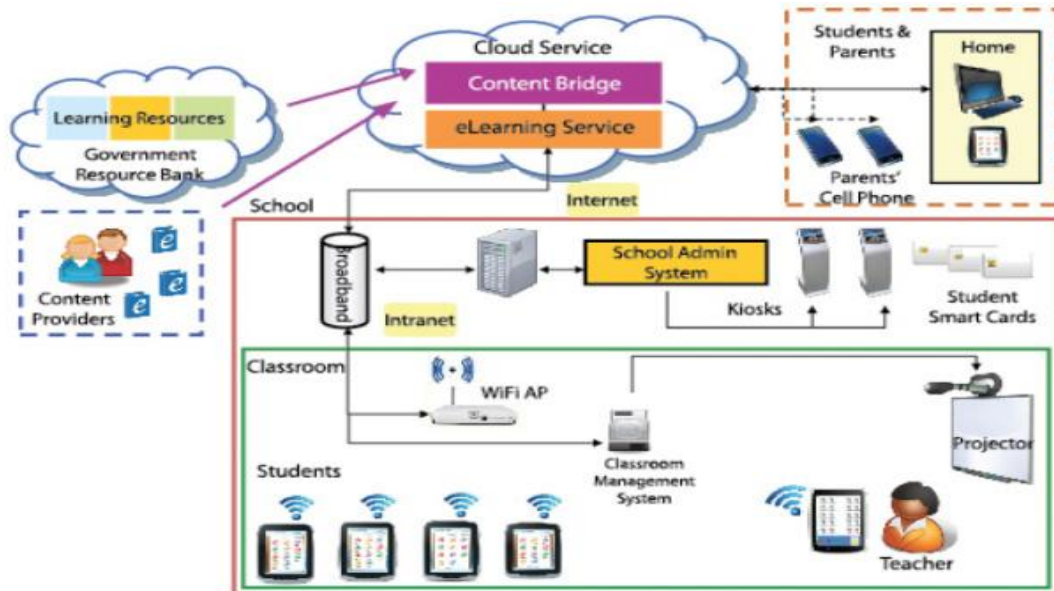


Fig.3 Concept of mobile cloud learning (ASTRI's total e-Learning solution).[24]

V. STATE OF ART / LITERATURES REVIEWS

With the acceleration of the ICT revolution, e-learning application technologies have diversified, making e-learning a continuous development to mediate with the evolution of information technology.

Therefore, some studies that dealt with education and technology in general, in order to provide education and achieve what is available, educational institutions seek to improve and develop the process of education and quality, using available resources, with keeping learning modernity.

The exploration of previous relevant studies has revealed that most of them are still in the process of identification and exploration to access cloud computing. The use of cloud computing in higher education is necessary, for economic reasons, to reduce costs, share resources, services, and cloud infrastructure, and continuing learning.

In this section, we review the previous literature on education and its components. Our current study aims to identify the stages of the development of teaching and learning. Therefore, we have to focus on literature on the pros and cons of the previous stages to design scalable models.

Numerous studies on learning, distance education, online education, as well as information technology and its role in the educational process. Some of them addressed the mobile learning system on the basis of e-learning, in the context of mobile cloud computing, there is a trend to embrace cloud computing in academic institutions, the implementation of some of the solutions proposed partly in the MCC, cloud computing is emerging technology, to reduce the disadvantages in the CC is one of the future trends, this paper focuses on the discussion of advantages and disadvantages in this area.

TABLE 1 SUMMARY OF STUDIES ON EDUCATION AND TECHNOLOGY IN GENERAL

Title of Paper	Focus of initiative/ Contribution	Limitation
Kwang B.Lee at el /2014.[1]	Introduces new approach for designing and developing an effective MCL environment using android platform.	Limited to a specific operating system, did not consider the future of mobile services
Erhan Suri at el /2017.[2]	Attitudes towards two different learning methods web based and mobile learning.	The study is located in just one University
Dr. Pranav patilin /2017.[3]	Introduced Cloud computing as an emerging technology, significant benefits, and important challenges	Did not address the issue of security and various services
Kiran Yadav /2014.[4]	Cloud computing provide high-quality and useful education	Ignored to identify The concept of quality in CC learning environment

M Issa Al-Zoubi at el /2016.[5]	investigate the factoring may affect the acceptance of mobile learning among HEI students	Not covering the behavioral factors of students and their perceptions for design m-learning system
S Bholia / 2017.[6]	Shed light on the use of modern technologies in the field of HE	Did not provide suggestions to avoid these cons.
Dr.henockmulugeta at el /2015.[7]	propose a conceptual framework for Cloud Based M-Learning for HEI.	This framework specifies the virtualization technology, v is future network trends for CC
Krishna Prasad Parajul /2016.[8]	exploring using mobile technologies in HE in semi-urban and rural areas in the Gorkha district of Nepal	The challenges of managing the design and development of educational materials
John Gyang Chaka at el /2017.[9]	designed to determine perceptions of students towards m-learning	Ignoring expectations of learners compared to teachers , so the scope of this study can be expanded
Weam Alghabban at el /2017 .[10]	A Proposed Conceptual Framework on the Factors Affecting to Adopt E-learning	The critical factors for measuring e-learning vary according to readiness levels
Haysam A. Ali Alamin at el /2014.[11]	Highlight the main factors of e-learning technology	- Ignoring issues of effective design, implementation, and how to develop e-learning strategies.
Shaker Khairallh Saleh at el /2014. [12]	The paper aims to identify the usefulness and feasibility study of cloud computing in education	There are many considerations to consider when choosing the cloud services model
Hanna. Eltayeb at el/ 2014. [13]	Mobile Learning	The study is located in just one faculty
Prof. Dr. Al Samani A. Ahmed at el /2014. [15]	The paper concludes with Issues and role of E-learning to applied in Sudan	Challenges of managing e-learning systems, because there are many variables that can be conflicting,
Ashraf G. Elsid Abdalla at el /2014. [16]	Presenting the role and benefits of cloud computing in Sudanese higher education institutions.	Only an exploratory study, did not propose a model can be applied
Omer A.Rahim M. at el /2015. [17]	Provide an overview of Cloud Computing and Its Role in Education in Sudan	Ignoring factors measuring the effectiveness of e-learning
Mohamed S. Adrees at el /2015. [18]	Applied Cloud computing services in education	Ignore steps that can be taken to avoid the risks when applying cloud computing
Esam Idris K. Al Hassan /2015. [19]	Mobile learning technique can be contributing to the development of DLC in Sudanese universities	did not introduce suggestions to avoid the research problems.
Mohamed S. Adrees at el /2016. [20]	Suggesting cloud computing scenarios applicable in HEI in Sudan	An exploratory study, ignoring solutions to obstacles
Fadl elmoula A.Idris at el /2017. [21]	assessment of adoption e-learning at Al-Jazira University	Limited sample study did not include students
The current status of e-Learning in Sudan. [22]	Explained the current status of e-learning with a vision of future development	Inadequate information, based on previous studies

VI. DISCUSSION

The success of e-learning projects depends on the design, implementation of effective strategies to create innovative creative generations able to deal with different knowledge sources, and employ the potential of advanced technology in scientific and professional life.

Thus reviewing programs, curricula, and strategies to implement them, in order to accommodate the concepts of electronic and technological revolution in the classroom. Educational institutions seeking to improve and develop the educational process and quality, using available resources, keep up with modernity. The use of cloud computing in higher education has become a necessity; because of its features, for economic reasons, reduce costs, share resources, services, infrastructure cloud, this technique represents a paradigm shift in the field of sustainability education. Accelerated pace of technology leads to the development of education, the new trend is the use of cloud computing, scalable cloud computing will continue to have a significant impact on the educational environment in the future. It is



an alternative to educational institutions to benefit from products on a low-cost basis, enabling students to Internet access 24 hours a day.

From our vision and knowledge of education literature, the development of cloud computing in the education sector requires some issues and policies to provide quality education useful to students, teachers, and higher education institutions. Many of the obstacles to MCC must be carefully covered, such as security ..., some, ignored to identify the concept of quality in CC learning environment, others not covering the behavioral factors of students and their perceptions for design m-learning system, and others did not provide suggestions to avoid these cons. Cloud computing has emerged as a workable and optimized solution for the provision of Internet infrastructure in various parts of the world. Communication is no longer a barrier to cloud contact, especially after the huge boom in smartphones and their ability to connect to the Internet, as well as the possibility of dealing with various information on networks and multimedia.

In our research, we concluded that these studies do not cover how these techniques are used while ignoring the expectations of students compared to teachers, and the scope of these studies can be expanded. The critical factors for measuring e-learning vary according to the levels of technical readiness, so the measurement of skills, attitudes, and factors Affect the readiness of e-learning. We conclude that there are management challenges, technical challenges, and behavioral challenges, so there is a lot of literature in this area, some of which define the framework of virtual technology, and the latest approach to cloud computing. Another aspect that deals with design axes and the development of educational materials that can absorb the cultures, traditions, and standards of Arab learners should be considered. Some studies are presented in the next paragraph.

This aspect of the study dealt with the explanation and analysis of literature on e-learning, which indicate the importance of using mobile in education, especially if used in the development of some skills, which opens the way to our current research to develop the skills of mobile education through the applications of cloud computing, because of their great importance in achieving many of the educational goals that we seek To achieve them in aggregate and in detail, next, we present these studies as a synthesis of our importance in this conceptual framework of our study.

VII. OPEN ISSUES

From the literature review previous, it is clear an open researches gabs (limitations). There is still an open research issues that need to be addressed:

- Some researchers neglected other solutions.
- Some researchers limited in research scope.
- Some researchers did not address the issue of security and various services
- Some researchers have insufficient information, based on previous studies
- Some researchers ignore the expectations of learners compared to teachers
- Lack of data collection researcher did not include any qualitative evidence.
- Some researchers did not follow the policies of improving learning paradigm.
- Some researchers did not cover multiple cultures factors and educational content
- Some researchers did not introduce suggestions to avoid the research problems.
- Some researchers have overlooked factors that measure the effectiveness of e-learning
- Certain research is limited to a particular operating system, did not consider the future of mobile services
- Some studies do not cover the behavioral factors of students and their perceptions of design m-learning .
- Some researchers ignore the challenges of managing the design and development of educational materials
- Some researchers did not concern about effective design, implementation, and how to develop e-learning strategies.
- Some researchers have ignored steps that can be taken to avoid the risks that may arise when applying CC
- Some studies have a lack of considerations to consider when choosing the cloud services model
- Some researchers did not concern about the future trends of cloud computing network
- Some researchers ignored the concept of quality in CC learning environment.

VIII. PROPOSED MODEL

The hybrid cloud model results from the integration of the cloud service provider and a private cloud platform, which used within the educational institution, so many organizations will benefit from using this model to keep their sensitive data safe within their facilities on their own cloud, as well as to benefit from cloud services and applications.

Our objective is to propose the optimal method for using cloud computing in Sudanese higher education institutions, taking advantage of it, and potential development scenarios, academic and educational institutions can also use the hybrid cloud model during registration and exams to expand their graphic capabilities.

The trend towards adoption of hybrid cloud began due to the flexible characteristics of this model, as well as its scalability. It can expand through the general cloud services while maintaining sensitive data inside its buildings.

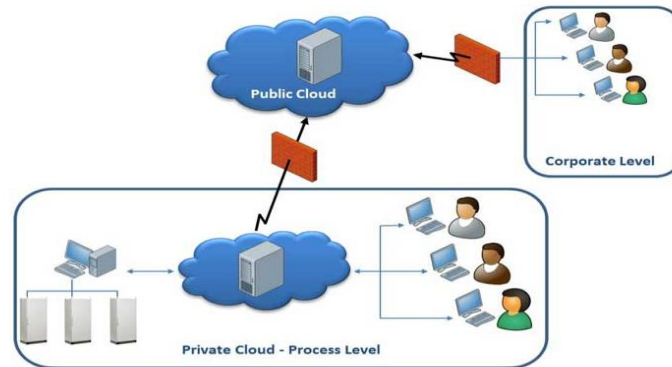


Fig. 4. The Proposed Hybrid Cloud Computing

Another advantage of using this model is to save time, money and effort on local infrastructure and the use of external companies only when needed.

It is time to pave the way for a new generation of cloud computing services, the future of the hybrid cloud model means more expansion, more flexibility, more efficiency, and lower cost.

IX. CONCLUSIONS

The study reached to the following points; during the electronic revolution which affects the natures of education nature, mobile phones can change the concept of distance learning; by creating a new pattern of distance learning, which spreads all over the world and serves millions of learners with regard to essential role that distance learning achieved to reach individuals at anytime and anywhere.

Mobile phones in light to immersing information and telecommunication in education; can also provide multiple and useful benefits for education process, and creates new opportunities for traditional classes and continuous education outside classes.

To apply mobile learning correctly, the parts of education process must be aware of the role of these devices in serving learning and education.

Cloud computing has the ability to change the entire educational system. In the current scenario of mobile learning through cloud computing, will definitely help in the development of education provided to the students and increase the quality of education provided to them.

Finally, due to the reason that mobile learning is newly presented, and the debate around its importance, the researchers thinks that recommends running more research on the feasibility of mobile learning model and how can be utilized and used in the learning process.

X. FEATURE WORK

The previous studies have a great impact on guiding our current study in the formation of a general conception of mobile learning, its role in academic achievement, and students' acceptance of the possibility of implementing it in institutions of higher education in Sudan. Based on the study of literature and its results compared to the experiences of other countries, the researcher recommends the following[33]:

- Encourage higher education institutions to employ mobile learning.
- Provide financial resources and qualified staff to use mobile learning.
- A more important aspect is that sharing resources among Sudanese universities to create a collaborative learning.
- An effective model must be designed, enabling us to integrate different cultures to maximize the benefits of m-learning.

For the need to transfer and develop regional expertise and employ it with mobile learning technology in Sudanese HEI, therefore, the researcher is recommended to carry out studies and research on mobile learning and its application, finally take the directions of students and teachers and the area of their applications, taking into account other factors not addressed in our current research.

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