Role of Cloud Computing in Education

1st Masar H. AlDuhisat
Department of Computer Engineering,
College of Engineering,
Mutah University, Jordan,
620220436026@mutah.edu.jo

2nd Hala G. AlKhresha
Department of Computer Engineering,
College of Engineering,
Mutah University, Jordan,
620220436020@mutah.edu.jo

3rd Nidal A. Al-Dmour,
Department of Computer Engineering,
College of Engineering,
Mutah University, Jordan,
nidal75@yahoo.com

4th Karamath Ateeq
School of Computing,
Skyline University College,
University City Sharjah,
Sharjah, UAE
karamath.ateeq@skylineuniversity.ac.ae

5th Omer N. Maaitah,
College of Engineering,
Mutah University, Jordan,
abponkm@mutah.edu.jo

***Abstract*—Education is a crucial factor in economic and social progress are interdependent and crucial for societal development. In the present-day society, students are increasingly technologically savvy, and learning and teaching are incorporating new technologies. Various educational institutes utilize cloud-based applications offered by service providers enables students and other users to carry out academic and various tasks. The education sector is experiencing advancement and growth due to the influence of cloud computing. educators and students are able to access a diverse array of resources and applications easily and at reasonable cost, enabling them. Cloud computing offers storage solutions that are both dependable and transparent. This paper examines the significance of cloud computing in the education sector and how we can leverage cloud-based technology to facilitate the sharing of high-quality education.**

Keywords—cloud computing, Infrastructure, Saas, Paas, Iaas.

I. INTRODUCTION

Over the past two decades, distributed computing has revolutionized the way commercial and scientific applications work, leading to the development of various new applications. Cloud computing, which is the most recent development in distributed computing [1]. To put it simply, cloud computing refers to the practice of storing and accessing data and programs via the Internet rather than on a computer's hard drive. Essentially, cloud computing enables the utilization of resources, software, and information over the internet on a pay-as-you-go basis.

Cloud computing can be a beneficial option for universities and educational institutes when it comes to their studies and operations. It provides IT departments with greater choice and flexibility by allowing them to build a multipurpose computational infrastructure that can be used for various purposes multiple times. Teaching is no longer confined to the classroom, as education heavily relies on information technology nowadays.

However, keeping up with the rapidly changing IT technology can be financially burdensome for institutions. The constant need for hardware and software upgrades can be costly and challenging to maintain. Cloud computing offers a solution to this problem. With cloud computing, users such as students and staff can access platforms and applications on-campus, off-campus, or a combination of both, depending on the institution's needs. This service is available at a minimal cost, allowing users to get it anywhere and anytime.

II. CLOUD COMPUTING

Cloud computing, an extension of distributed computing, allows users to access shared resources, software, and information via the internet. It facilitates widespread, convenient, and on-demand connectivity to a flexible pool of computing resources.

Cloud computing is a form of Internet-based computing where communal resources, software, and information are delivered as a services accessible to computers or mobile devices on request.

The Realm of education, cloud computing is widely employed, as both learners and educators utilize cost-effective or free cloud-based services for various purposes, including learning, social interaction, content creation, publication, and collaboration. Examples of these services encompass Google Apps, YouTube, Twitter, and Dropbox.

However, before universities and institutions can make use of cloud services, they must first define their requirements and carefully consider critical and privacy concerns. There are different types of cloud services available: [2]

A. Infrastructure as a service (IAAS):

This service enable universities and institutions to meet the global or local infrastructure requirements of their students, faculty, or researchers by providing specific hardware configurations tailored to particular tasks.

B. Platform as a service (PAAS)

Some providers offer application platforms that enable customers to build their own applications without the need to buy and manage the underlying hardware and software layers. This reduces cost and complexity.

C. Software as a sevice (SAAS)

In this model, the application service provider hosts the application, which can be accessed and interacted with

2024 2nd International Conference on Cyber Resilience (ICCR) | 979-8-3503-9496-2/24/$31.00 ©2024 IEEE | DOI: 10.1109/ICCR61006.2024.10532895

through a web browser, hosted desktop, or remote client. This eliminates the need for customers to install and run the application on their own computers, simplifying maintenance and support.

III. ARCITECTURE OF CLOUD COMPUTING

In the overall architecture shown in figure 2, cloud computing divides into two integral components: the front end and the back end, which are interconnected through a network. Front is what the user sees where as the rear and is the cloud of the system [4].

A. The Hardwre layer:

This layer is tasked with overseeing the tangible components, such as servers, switches, routers, cooling systems, and power management.

B. The Infrastructure layer:

Utilizing virtualization technologies, this layer forms a reservoir of storage capacity and computing resources by partitioning physical resources.

C. The Platform layer:

Builds upon the infrastructure layer and includes operating systems and application frameworks.

D. The Application layer:

This layer comprises actual cloud provisions like Business Applications, Multimedia & Web Services [6].

IV. SCENARIO OD EDUCATION

The education system often prioritizes grades and numbers, neglecting practical knowledge and critical thinking for success in the competitive world. However, investing in costly hardware configurations for laboratories can be costly. Cloud computing services offer a cost-effective solution by offering pay-as-you-go access to the latest technology without high upfront costs or concerns about technological obsolescence. Additionally, cloud services can be used for content management systems, allowing access from anywhere, anytime, and on any device, eliminating the need for institutes to invest in their own infrastructure.

The diagram bellow illustrates how the educational institution is utilizing a range of services from the education cloud to deliver high-quality education.

V. *IMPLEMENTATION* OD CLOUD COMPUTING EDUCATION SECTOR

The diagram bellow demonstrates institution is harnessing a variety of educational cloud services to deliver high-quality education [7] [8].

Education cloud has the potential to benefit various individuals within the educational sector, including students, staff, and academicians. Each user is provided with their own unique credentials to access the specific cloud services they require. By utilizing the SAAS aspect of Education cloud, teaching staff can efficiently manage attendance records, administer online quizzes, and perform other tasks using the appropriate software packages. Additionally, by adopting PAAS, educational institutes can easily organize practical sessions whenever necessary, such as for the development of projects like mobile apps or web apps [10]. Furthermore, by implementing IAAS, staff members are able to upload study materials and other relevant content onto the Education cloud, which can then be accessed by students [11].

VI. CLOUD COMPUTING ECONOMICS

In this section, we will discuss the economic models of cloud computing and provide some observation.

- When considering the long-term viability of hosting a service in the cloud, the detailed economic models made possible by cloud computing allow for more flexible tradeoff decisions [12]. Specifically, the elasticity provided by clouds helps to shift and manage risk.
- Additionally, while the costs of hardware resources are consistently decreasing, they do so at different rates. For instance, computing and storage expenses are declining at a faster pace compared to WAN costs [13]. Cloud Computing has the ability to accurately monitor these changes and potentially pass on the benefits to customers more efficiently than constructing and managing their own datacenter. This ultimately leads to a better alignment of expenses with actual resource usage [14].
- When considering the migration of an existing service to the cloud, it is important to analyze the anticipated average and maximum utilization of resources, particularly if the application experiences unpredictable spikes in resource demand. It is also crucial to take into account the practical limitations of purchased equipment in terms of real-world utilization [15], as well as the operational costs that can vary depending on the specific type of cloud environment under consideration.

VII. CLOUD COMPUTING CHALLENGES

A. Costing Model:

When considering moving to the cloud, cloud consumers need to carefully evaluate the tradeoffs between computation, communication, and integration. While the cost of infrastructure can be significantly reduced, there is an increase in the cost of data communication [16], such as transferring data to and from the public and community clouds. Additionally, the cost per unit of computing resource used is likely to be higher. This is especially true in hybrid cloud deployments where data is distributed among multiple public, private, and community clouds. It is important to note that on-demand computing is most beneficial for CPU-intensive tasks [17].

B. Charching Model:

The introduction of elastic resource pools has made cost analysis more complex compared to traditional data centers, which typically calculate costs based on static computing consumption [17]. Additionally, the unit of cost analysis has shifted from the underlying physical server to the instantiated virtual machine. For SaaS cloud providers, implementing multitenancy within their offerings can incur significant

costs. These costs include redesigning and redeveloping software originally designed for single-tenancy, providing new features for customization, enhancing performance and security for concurrent user access, and addressing complexities resulting from these changes. As a result, SaaS providers must carefully consider the trade-off between offering multitenancy and the cost savings it brings, such as reduced overhead through amortization and fewer on-site software licenses. Therefore, having a strategic and viable charging model is crucial for the profitability and sustainability of SaaS cloud providers.

C. Service Level Agreement (SLA):

Cloud computing holds the promise of boosting efficiency, cutting costs, and providing convenience to universities and educational sectors. Nevertheless, it is imperative to acknowledge that there exist particular constraints related to this technology Cloud consumers must ensure the quality, availability, reliability, and performance of the computing resources they use in the cloud. This requires obtaining guarantees from providers through Service Level Agreements (SLAs). Defining SLA specifications is crucial, striking a balance between expressiveness and complexity to meet consumer expectations while being easily evaluated and enforced by the cloud's resource allocation mechanism. Different types of cloud offerings (IaaS, PaaS, and SaaS) require different SLA meta specifications, posing implementation challenges for providers. Additionally, advanced SLA mechanisms should incorporate user feedback and customization features to improve the evaluation framework [18].

VIII. BENEFITS OF CLOUD COMPUTING

The emergence of educational cloud technology has led to the development of new web applications like Lecture Tools and SlideShare. These platforms enable educators to conduct their work directly within web browsers, eliminating the need to store and transport their materials on physical hard drives. This transition offers numerous advantages, including:

- Ability to access files from anywhere.
- Relieve yourself from concerns about acquiring extra software licenses.
- Simplify content sharing.
- Accomplish tasks effortlessly without dealing with software complications.
- Strengthening support for teaching and learning.
- Software available for free or pay-as-you-go basis.
- Round-the-clock access to infrastructure and content.
- Promote environmental conservation through the use of sustainable, green technologies.
- Enhance student's familiarity with emerging IT technologies through greater exposure.
- Decreased the cost to update infrastructure.

IX. SECURITY ISSUES

The primary reason for the widespread acceptance of cloud computing is its strong economic advantages. Cloud providers are able to construct cost-effective, large-scale datacenters by leveraging their expertise in efficiently managing and allocating computational resources. This scalability allows providers to generate higher revenue while reducing costs and users. By adopting an on-demand approach to computing, providers can optimize resource utilization through statistical multiplexing, while users can avoid unnecessary expenses by dynamically scaling their resources as needed.

In cloud computing, the consolidation of important and sensitive data in one location poses a potential vulnerability to hacking. Safeguarding data is a significant security concern, particularly for educational institutions who may feel more confident in the security of their data if it is stored within their own premises. The transfer of data to a third-party provider for hosting in a remote data center, beyond the institution's control and potentially unknown in terms of location, introduces risks. To address this, some cloud providers now offer contractual guarantees that personal data will only be stored in specific countries. It has been suggested that relying on a single cloud provider for services creates a single point of failure, and it would be advisable to engage multiple providers to minimize risk. Additionally, another security issue arises from unsolicited advertising, where cloud providers may target users with unwanted emails or advertisements.

X. CONCLUSION

This study examines the concept of cloud computing and its implications in the education sector. It focuses on how cloud computing can improve efficiency, enable access to data and information anytime and anywhere, and facilitate data sharing among cloud users. The paper also highlights the advantages of cloud computing in enhancing the quality of education for students, faculty members, and educational institutions through the utilization of advanced technology.

REFERENCES

[1] Sh. Ahmed and H. Mehta, “On Applying Big Data and Cloud Computing for Quality Improvement in Higher Education”, in Int'l Conf. on Advances in Big Data Analytics, pp. 50-54, jul 2015.

[2] N. Gosavi, S. shinde, and B. Dhakulkar, “Use Of Cloud Computing Library And Information Science Field”, International Journal of Digital Library Services, vol. 2, no. 3, july-september 2012.

[3] U. Bora and M. Ahmed, “E-Learning using Cloud Computing”, International Journal of Science and Modern Engineering, vol. 1, no. 2, Jan 2013.

[4] K. Modi, “Cloud Computing – concepts, architecture and challenges”, International Conference on Computing, Electronics and Electrical Technologies (ICCEET), Nagercoil, India, Mar 2012.

[5] A. Kale and R. Mente, “Impact of Cloud Computing on Education Sustem”, International Journal of Electronics, Electrical and Computational System, vol. 6, no. 11, Nov 2017.

[6] M. Jawarneh, et al., "The Impact of Virtual Reality Technology on Jordan's Learning Environment and Medical Informatics among Physicians," International Journal of Computer Games Technology, vol. 2023, Article no. 1678226, 2023, doi: 10.1155/2023/16782

[7] Q. Zhang, L. Cheng, and R. Boutaba, “Cloud Computing: State-of-the-art and Research Challenges”, Journal of Internet Services and Applications, May 2010.

[8] T. Desai, R. Patel, and P. Patel, “Cloud Computing in Education Sector”, International Journal for Innovative Research in Science & Technology, vol. 2, no. 10, Mar 2016.

[9] Mutaz AB Al-Tarawneh, and Saif E. Alnawayseh “Performance assessment of context-aware online learning for task offloading in vehicular edge computing systems”, International Journal of Advanced Computer Science and Applications, volume 12, issue 4, Pages 304 – 320, 2021.

[10] Ghazal, T. M., Hasan, M. K., Abdullah, S. N. H., Abubakkar, K. A., & Afifi, M. A. M. (2022f). IoMT-enabled fusion-based model to predict posture for smart healthcare systems. Computers, Materials and Continua, 71, 2579–2597.

[11] Saif. E. A. Alnawayseh and Mayyadah Alma’aitah, " Crosstalk reduction technique for GPS transmission lines in 5G smart phones", International Journal of Engineering Trends and Technology (IJETT), Vol 69(6)),2021.

[12] M. Salahat, et al., "Personality assessment based on natural stream of thoughts empowered with machine learning," Computers, Materials & Continua, vol. 76, no.1, pp. 1–17, 2023.

[13] T. Desai, R. Patel, and P. Patel, “Cloud Computing in Education Sector”, International Journal for Innovative Research in Science & Technology, vol. 2, no. 10, Mar 2016.

[14] S. Mathew, “Implementation of Cloud Computing in Education – A Revolution”, International Journal of Computer Theory and Engineering, vol. 4, no. 3, Jun 2012.

[15] Alkeem, E.A., Shehada, D., Yeun, C.Y. et al, "New secure healthcare system using cloud of things", Cluster Comput 20, 2211–2229,2017.

[16] Dina Shehada, Chan Yeob Yeun, M. Jamal Zemerly, Mahmoud Al-Qutayri, Yousof Al-Hammadi, Jiankun Hu,"A new adaptive trust and reputation model for Mobile Agent Systems",Journal of Network and Computer Applications,Volume 124,2018,Pages 33-43.

[17] Heba Abunahla, Dina Shehada, Chan Yeob Yeun, Baker Mohammad, Maguy Abi Jaoude, "Novel secret key generation techniques using memristor devices", AIP Advances, February 2016.

[18] E. Rehman, et al., “Using blockchain to ensure trust between donor agencies and ngos in under-developed countries,” Computers, vol. 10, no. 8, p. 98, Aug. 2021. Multidisciplinary Digital Publishing Institute.