

CLOUDSIS: An Application of Cloud Computing for Smart School Management System

Ahmad Waqas¹, Hafiz Abid Mahmood Malik², Mostafa Karbasi², Naeem A. Nawaz¹, Abdul Waheed Mahessar³

¹Department of Computer Science, Sukkur IBA University, Pakistan

²Department of Computer Science, International Islamic University Malaysia

³Institute of Information and Communication Technology, University of Sindh, Jamshoro

ahmad.waqas@iba-suk.edu.pk, hafiz.abid@live.iium.edu.my, mostafa.karbasi@live.iium.edu.my, nanawaz@uqu.edu.sa, waheed.mahessar@usindh.edu.pk

Abstract: Cloud computing has been emerged as cost-effective solution. Schools have to maintain information regarding students, admin staff, teachers, finances and community. They also need to immediately communicate between their branches for sharing of these information and resources that may be in remote and less technological developed or metropolitan areas. Traditional school information systems do not support efficient sharing of information between school branches, students, teachers and parents with cost-effectiveness. In this paper, we propose a Cloud-based School Information System (SIS) to manage and infer school related information and an architecture to associate school head office with its branches.

Keywords: Cloud Computing; Distributed MIS; ICT; Management Information System; School Information System; Campus Management System

I. INTRODUCTION

Advancement in information technology reveals new horizons for managing, storing and manipulating information. Cloud computing, nowadays, is a well-known cost effective platform to utilize computing resources for storage and sharing information among users and organization [1]. Cloud has many benefits over traditional information systems that include less administrative burden, save cost, collaboration, and data security. Cloud-based information systems are referred to as next-generation information system to manage and infer information. Traditional academic management systems are very common and have been widely used by academic institutions and schools for managing information. These systems contribute and provide enormous assistance in numerous means that includes student management, course selection, course discussions, assignment announcements and submissions, online testing and grading etc. [2] [3].

This paper describes the requirements specification and a cloud-based framework to manage multiple school branches whether online or offline. The purpose of proposed architecture is to design a generalized low-cost solution for an education system that is applicable on chain of schools. It supports administrative staff by generating quick summaries for decision making and facilitate end-user and middle-user so that they can communicate in automated way.

A. Cloud Computing Fundamentals

“Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of

configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction” [4][5][6]. The cloud ensures five features that include “on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service”. A pool of resources (Cloud Services SaaS, PaaS, and IaaS) is maintained that is available for cloud users. To deliver the requested resource timely with accuracy, access to broad network is required. CSP charge cloud users for cloud services using the “measured service” phenomena. The cloud users have provision to scale the cloud service that are deployed using one of the deployment models that are Private, Community, Public and Hybrid Clouds [2]. Figure 2 depicts the overview of cloud computing fundamentals.

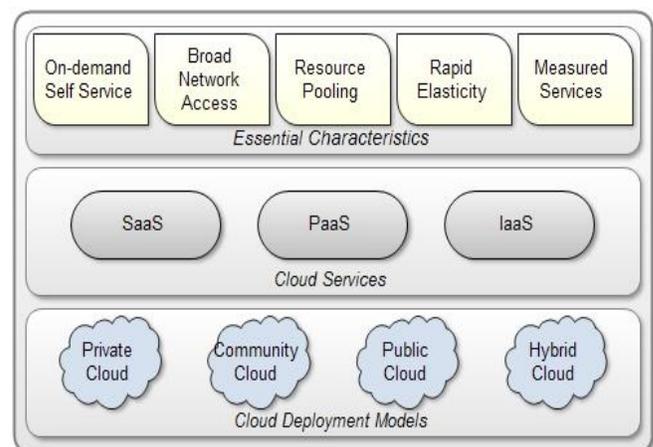


Figure 1. Cloud Computing Fundamentals

II. RELATED WORK

With the advancement in information technology and hype of cloud computing, organizations are rapidly adopting cloud-based systems. It has provided efficient solutions for many practical implications for example, health and patient data management system [7][8], laboratory information management system (LIMS), educational management systems, data storage and sharing and last but not least business industry for testing and simulation.

A. Traditional School Information Systems

In a traditional School Information System (SIS), users of IT services over cloud are Board of Directors (BOD), Managers, Admin Staff, Teachers, Students and Parents as illustrated in Figure 2 [9]. The BOD uses IT services to draft new policies, rules and regulations based on the information provided by the SIS and to infer decisions. The managers use IT Services to implement policies and overlook the performance of system in compliance with mission and vision of the school. Teachers and students are facilitated with IT services over cloud to improve the learning and efficient communication. It helps in many ways for example, online testing, assignments submission, announcements, the history of student learning and attitude, examination results and discussion forums. Parents use IT services to keep themselves updated regarding the performance of their children and efficient communication medium with teachers and staff.

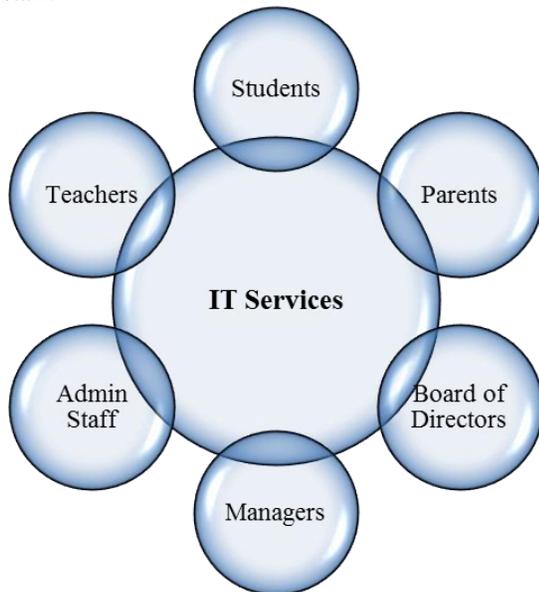


Figure 2. Beneficiaries of IT Services in a Typical School Environment

Various principles and guidelines for classroom management systems especially for secondary school teachers are discussed by Emmer et al. [10]. The book highlights various plans for teachers to implement and use, for smoothly running a classroom and maintaining the school

system. Whereas the role of ICT and its effect in schools, has been addressed by Hoque et al., by emphasizing the involvement and participation of parents in some sort of academic decision making in case of Maldives [11]. Similarly, Hutchings, N. implements a Learning Management System (LMS) called Moodle, in secondary schools, elaborating the principles and process for successful implementation. Whereas a model for web based school management system is discussed by Martins et al., highlighting various issues regarding the adaptation of online course management system by students [12].

B. Cloud Computing in Education System

In a typical education environment specially schools, cloud computing is a low cost, efficient and convenient solution to organize, manage and share information between multiple branches globally [13]. Cloud computing has a great potential to facilitate the education management system like it has been providing solutions for other complex system such as health, laboratory and inventory management systems. Many researchers contributed to applications of cloud computing in education system specially schools. T. Ercana [14] reviewed the cloud computing infrastructure with respect to education system for the effective use of cloud computing in educational institutes. Whereas D. Chandra et al. [15] gives the cost benefit analysis of cloud computing in educational systems. Similarly, S. Noor et al. [16] proposed an education system based on cloud computing for Bangladesh. They discussed the cloud services with respect to education system and analyzed the impact of cloud computing in education based on data portability, reporting, economic feasibility and distance learning. Bo Wang et al. [17] presented the usage of cloud computing in education informatization. They discussed the present-day status of informatization and the imbalanced distribution of education resources in china. They concluded that the use of cloud computing can solve the problem of this unequal educational resources distribution. Weber [18], in his book, discussed the best practices that need to be followed in educational cloud computing. M. Alabbadi [19] discussed the use of cloud computing in education and learning, and proposed Education and Learning as a Service (ELaaS) model for delivering education through cloud computing. S. Fatimah discussed the impact and potential benefits for education system in Malaysia [20].

III. SCHOOL INFORMATION SYSTEM (SIS)

A School Information System (SIS) is a computerized system for schools to organize, manipulate and manage information related to school that may be beneficial to infer decisions. It involves many process and actors, and has a great impact on society and business. It turns into more complex system when school has branches geographically especially in remote areas where the technology has not implemented. The actors involved in distributed school information system can be categorized into three different layers. First layer or top level includes Board of Directors (BOD) and School Head Office (Manager). Second layer or middle level contains Zone Manger (Field Education

Officer), School Branch (Principal and Staff) and In-charges who own different responsibilities. The third layer or beneficiaries includes Students and Community [9]. Figure 3 describes the layers and levels of actors involved in SIS.

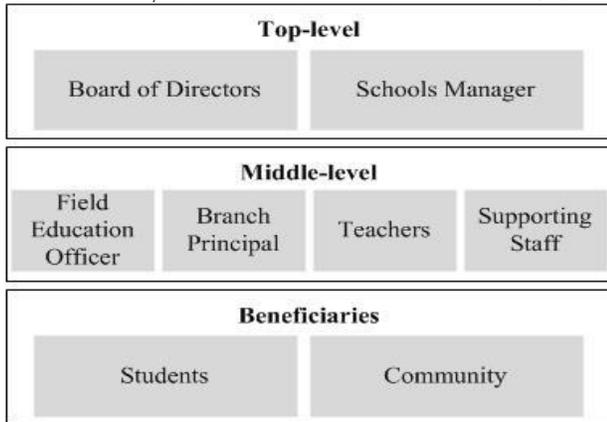


Figure 3. Levels of Actors in SIS

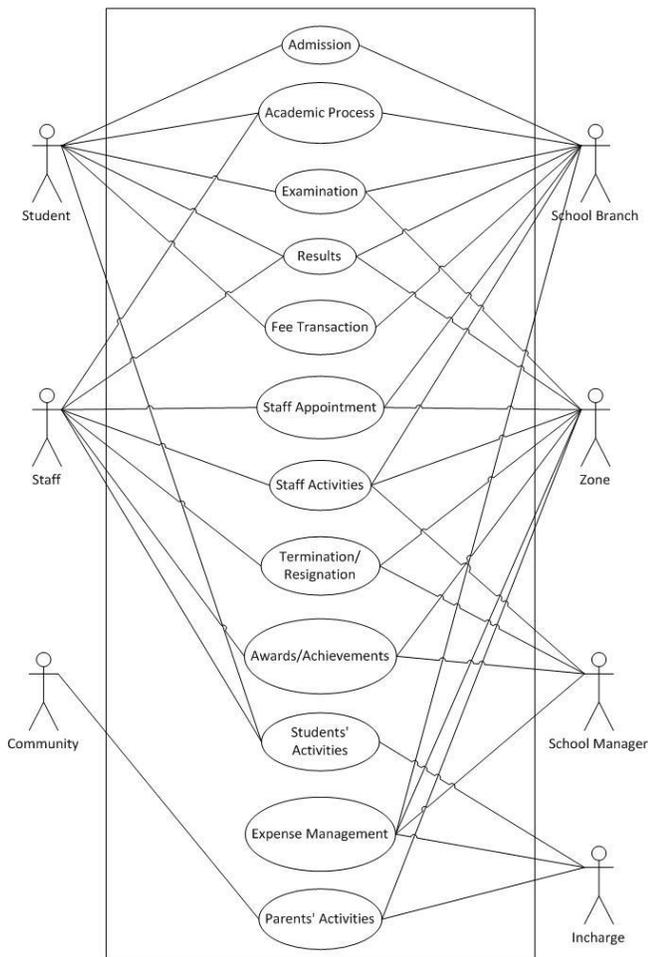


Figure 4. Primary Use Case Diagram [9]

There are many processes involved in School Information System associated with these actors. This involves Student Admission, Academic Process,

Examination, Results, Finances (Fee, Salaries, and Expenses etc.), Staff Appointment, Staff Activities, Staff Resignation/Termination, Awards and Achievements, Student's Activities and Parents (Community) Activities. Figure 4 depicts the use-case diagram of school information system.

IV. THE CLOUD SIS

We propose a simple cloud-based School Information System to connect branches of schools round the globe including rural, remote areas branches and metropolitan area branches. The connection and communication problem arises between remote areas and metropolitan areas with the head office for sharing of resources including information. This is because of lack of IT services deployment in such areas. We have designed a cloud-based application to manage school information including branches on cloud. The information system is to be controlled and managed centrally and all branches of school can use that information. Fig. 5 depicts the architecture of cloud-based School Information System. The application software has to be deployed in public or private cloud that will act as server application. The client application will be installed in the client computers at school branches. The branches may be in remote rural areas or in more developed metropolitan areas. To connect the branches of remote areas, we propose to use the exiting communication technology that may be public internet or cellular data network. This will reduce the deployment cost and will give the maximum connectivity and ease-of-use to utilize features of system. The only problem that may arise is the security issues in public internet and cellular data networks. To connect the head office and metropolitan branches with cloud, we propose to use the virtual private network (VPN) for speedy access with security.

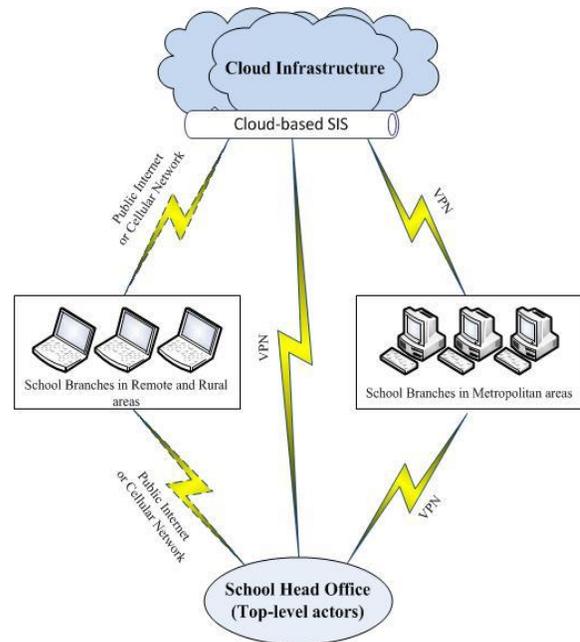


Figure 5. Architecture for Cloud-based SIS

This may happen that a student has to shift from one branch to another branch because of his personal or family issues or some managerial issues of school. In traditional SIS, the new branch is not able to know the history and previous data of that student including his deficiencies and special needs. It is also difficult for new branch to track his learning curve and attitude. The Cloud-based SIS proposes a centralized system that will enable all branches to access the information of all students when they are transferred from one branch to another. It will enable management and teachers to better understand the personality and learning habits of student including his academic, co-curricular activities and behavior. It also gives the complete history of other attributes including finances and parent meetings. This will definitely help school branch and teachers for better understanding of student and making effective teaching plans for that student. The same can happen with staff members when they are transferred from one branch to another to keep track of his or her history information.

V. SIGNIFICANCE OF CLOUD SIS

There are a number of potential advantages of Cloud-based SIS in this implementation. For instance,

- Cost-effective: With the ease of cloud computing technology, Schools and branches can get the services provided by millions of servers in the cloud but pay a little, then higher efficiency, lower cost can be achieved.
- Better information sharing: Through the cloud model, the School branch, Head office and Parents can work together for better learning processes.
- Maintenance cost reduction: The user terminal architecture is unlimited in cloud computing model, therefore, no need to upgrade the school hardware, while the daily maintenance of the server is also provided by the cloud service provider.

VI. CONCLUSION AND FUTURE WORKS

Cloud-based SIS is cloud computing solution for schools to connect with their branches both in remote and metropolitan areas using exiting communication infrastructure and hardware. It uses the public internet or cellular data network to provide connectivity between cloud and remote branches and VPN for connectivity between metropolitan area branches, head office and cloud. It is limited to share information between school branches that are under the same management. In future, we will connect the schools under different management so that whenever a student changes his school, the new school will get the history information about his learning habits, attitude, skills and finances.

REFERENCES

- [1] A. Waqas, Z. M. Yusof, and A. Shah, "A security-based survey and classification of Cloud Architectures, State of Art and Future Directions," in *2nd International Conference on Advanced Computer Science Applications and Technologies*, 2013, pp. 284–289.
- [2] P. S. A. Dutta, R. Roy, "Course management system adoption and usage: A process theoretic perspective," *Comput. Human Behav.*, vol. 29, no. 6, pp. 2535–2545, 2013.
- [3] H. M. Jarrahi, "A structural analysis of how course management systems are used in practice," *Behav. Inf. Technol.*, vol. 29, no. 3, pp. 257–275, 2010.
- [4] P. Mell and T. Grance, "The NIST Definition of Cloud Computing (Draft) Recommendations of the National Institute of Standards and Technology," in *NIST Special Publication 800-145 (Draft)*, U.S. Department of Commerce, Gaithersburg, MD, USA., 2011.
- [5] A. Waqas, Z. M. Yusof, A. Shah, and M. A. Khan, "ReSA : Architecture for Resources Sharing Between Clouds," in *Conference on Information Assurance and Cyber Security (CIACS2014)*, 2014, pp. 23–28.
- [6] A. Waqas, Z. M. Yusof, A. Shah, and N. Mahmood, "Sharing of Attacks Information across Clouds for Improving Security: A Conceptual Framework," in *IEEE 2014 International Conference on Computer, Communication, and Control Technology (I4CT 2014)*, 2014, pp. 255–260.
- [7] C. He, X. Jin, Z. Zhao, and T. Xiang, "A cloud computing solution for Hospital Information System," in *2010 IEEE International Conference on Intelligent Computing and Intelligent Systems*, 2010, pp. 517–520.
- [8] N. Mahmood, A. Shah, A. Waqas, Z. Bhatti, A. Abubakar, and H. A. M. Malik, "RFID Based Smart Hospital Management System: A Conceptual Framework," in *2014 International Conference on Information and Communication Technology for Muslim World*, 2014, pp. 1–6.
- [9] A. Waqas, Z. Bhatti, H. Abid, M. Malik, and G. Muhammad, "SIS : A Framework for Distributed Information Management System for School Branches," *Am. J. Syst. Softw.*, vol. 2, no. 1, pp. 1–8, 2014.
- [10] C. M. E. Edmund T. Emmer, *Classroom management for middle and high school teachers*. 2012.
- [11] K. E. Hoque, R. Sukor, A. Samad, and S. Siraj, "The Role of ICT in School Management of Maldives," *New Educ. Rev.*, p. 270, 2012.
- [12] L. and K. Martins, "A model of business school students' acceptance of a web-based course management system," *Acad. Manag. Learn. Educ.*, vol. 3, no. 1, pp. 7–26, 2004.
- [13] N. Sultan, "Cloud computing for education: A new dawn?," *Int. J. Inf. Manage.*, vol. 30, no. 2, pp. 109–116, Apr. 2010.
- [14] T. Ercan, "Effective use of cloud computing in educational institutions," *Procedia Soc. Behav. Sci.*, vol. 2, no. 2, pp. 938–942, Jan. 2010.
- [15] D. G. Chandra, "Cost Benefit Analysis of Cloud Computing in Education Deka," in *2012 International Conference on Computing, Communication and Applications*, 2012, pp. 1–6.
- [16] S. Al Noor, G. Mustafa, S. A. Chowdhury, Z. Hossain, and F. T. Jaigirdar, "A Proposed Architecture of Cloud Computing for Education System in Bangladesh and the Impact on Current Education System," *Int. J. Comput. Sci. Netw. Secur.*, vol. 10, no. 10, pp. 7–13, 2010.
- [17] B. Wang, "The application of cloud computing in education informatization," in *2011 International Conference on Computer Science and Service System*, 2011, pp. 2673–2676.
- [18] A. S. Weber, "Cloud Computing in Education," in *Ubiquitous and Mobile Learning in the Digital Age*, D. G. Sampson, P. Isaias, D. Ifenthaler, and J. M. Spector, Eds. New York, NY: Springer New York, 2013, pp. 19–36.
- [19] M. M. Alabbadi, "Cloud Computing for Education and Learning : Education and Learning as a Service (ELaaS);" in *14th International Conference on Interactive Collaborative Learning*, 2011, no. September, pp. 589–594.
- [20] S. Fatimah and A. Razak, "Cloud Computing in Malaysia Universities," in *2009 Conference on Innovative Technologies in Intelligent Systems and Industrial Applications*, 2009, no. July, pp. 101–106.