Need of Cloud based System for Higher and Technical Education in India

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ABSTRACT

The Indian Education sector has seen a tremendous rise in the field of higher education which has led to the demand for the automation of education sector at all the levels in order to cater to the need of information of various stakeholders. Due to burst in the field of communication technology every one expects the access of relevant information; in fast, accurate and anytime any where manner. All the educational organizations like college, institutes including statutory bodies like AICTE, DTE etc are already moving individually towards the adoption of IT to bring transparency and control. There is a need to bring and tie all the information system through a common platform without losing the control over their individual IT system.

The technological development in the abstraction and encapsulation of the IT resources has been successfully implemented with the help of cloud architecture. This technology not only caters to the various stakeholders; it also ensures the sharing, availability, security and reliability of information involved. It also provides all the benefits of outsourcing the IT maintenance services so as to concentrate only on the information and its presentation.

This paper proposes a cloud based system architecture for the applications used in higher education in India that makes information transparent and easily accessible. It also shows how the existing structure of IT in education can be adapted to make the information available between cloud based systems. This paper is organized into four main sections; firstly it gives the analysis of the existing IT system in education and its limitations, secondly it proposes a new architecture for the educational sector. Next it discusses the advantages of the proposed architecture and lastly it concludes the paper followed by the references.

1. INTRODUCTION

The IT industry has seen a remarkable shift from *application development to application deployment* due to the facility of multi-tier architecture and the support of the underlying networking hardware. This in turn has enabled the automation of many domains or sectors for the purpose of information availability and reliability to the stakeholders and ease in availability of information to others. All this is possible due to the introduction of cloud. Cloud architecture is a result of demand to outsource the IT services as well as to consume the desired services. This change is greatly transpired by the SOA (Service Oriented Architecture) model.

But at the same time, due to revolutionary and remarkable growth in mobile technology, the challenge in managing the information is even more as users have raised their expectation about the availability and accessibility of information. Hence there is need of strong backbone information system that can cater to the changing need of stakeholders and should be able to survive in this era of fast changing technology. Cloud based computing model provides the desired facility to deal with the information and its presentation as per the dynamic situation.

There is a large amount of data demanded by the Statutory bodies in order to track the educational sector. These statutory bodies have developed their own customized applications to maintain the desired data efficiently. The colleges or institutes have to provide the data to each of them in their 'desired' format which is an overhead to the colleges. This paper discusses the need to bring and tie all the information system through a common platform without losing the control over their individual IT system, so that data demanded by various statutory bodies in their desired format can be supplied successfully by the system.

2. EXISTING IT SYSTEM ARCHITECTURE

India being a geographically diverse and culturally rich country, the educational sector has progressed at various levels as shown in chart 1 having the information source from Ministry of HRD[3]. There is also an observation about varying degrees of application usage across India in the educational sector[4]. Most of the educational organizations make limited use of IT and IT enabled Services (ITeS) due to various limitations[1].

Year	Academic Year	Population (18-23 years)	Total Higher Education Enrollment based on SES*	Total GER** based on SES	Total Higher Education Enrollment based on Census Data	Total GER based on Census Data
	Base Year					
2006	2006-07	132243	13934	10.5	20666	15.6
	11th Plan					
2007	2007-08	135440	15034	11.1	22212	16.4
2008	2008-09	138318	16460	11.9	23929	17.3
2009	2009-10	141257	18222	12.9	25850	18.3
2010	2010-11	144259	20341	14.1	27986	19.4
2011	2011-12	144287	22365	15.5	29723	20.6

Source: Draft Report of Working Group on Higher Education for 11th Five-year Plan.
*Selected Education Statistics
**GER Gross Enrollment ratio

Chart-1 : Growth of higher education in India

As shown in the Fig 1, most of the colleges or institutes for higher education use IT System, hardware and software that is local to them, to serve their purpose of data storage, processing and reporting. Many freely available cloud computing applications are used to get benefits of information sharing and availability. Some organizations also store a part of the data on the cloud for more reliability and security, but mostly the data is in the form of flat file and not RDBMS. MIS reports from such data can not be exported in the format desired by statutory bodies to import data to their system.

Many colleges are also going the paperless admission route, where the entire process of application handling is managed though the web including the counseling and fee payments for courses / classes. If one looks across the higher education space, few of the technology implementations are Smart Card readers across the institutions, dynamic university websites & portals, student admission portals, faculty portals, student information systems for student life cycle, career/placement management, learning management system (LMS), document management systems etc. Most of these applications are not interactive with other systems or applications.

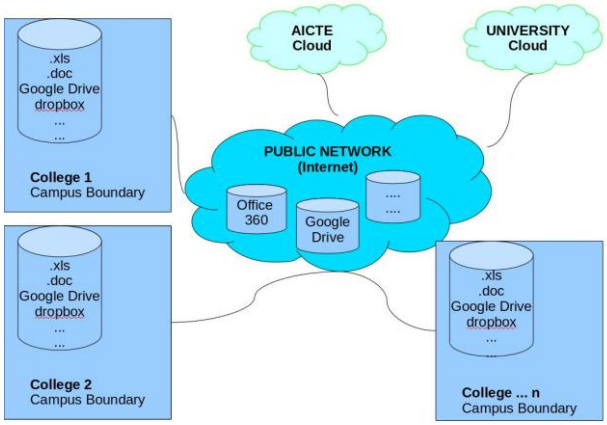

Fig 1 : Existing Architecture in Education

As given above in Fig 1, let us identify a few problems in the existing situation.

1. **Data is not protected**. A system may crash as per any given probability. This may happen due to virus, physical damage, accidental delete, accidental modification, tampering of data etc.
2. **Data security depends only on the operating system level security.** If any hacker or unauthorized user is able to crack the OS level security, they can easily get full access over the data. File or folder level security is available in a few operating systems through inbuilt feature or third party utility; but users generally do not make use of it because it is practically unmanageable for user to remember all these security details for individual files and folders in sharing such data.
3. **Lack of role based access.** As data is stored in flat file system, it is almost impossible to define role based access and sharing same copy of data with multiple users. This results in duplicity and inconsistency of data thereby making it difficult to track the latest & updated copy of data.
4. **Lack of homogeneity**. Due to lack of any predefined specification about the data and the type of file for storing the data, same data gets stored in different type of file. These decisions are taken spontaneously at the time of storing the data by individual. This becomes a major hurdle in exchanging the information because same data can be available in different file type in same or different machines. For example it is difficult to merge part of data in .doc with data available in .xls, .odt, .xlsx etc. Operating systems and file systems further create differences.
5. **Lack of standardization of information parameters**. The information parameter related to same entity stored by different persons and / or at different organizations varies in number of parameter(s), type of parameter(s) and / or sequence of parameters which makes the exchange of data difficult. There must be some open educational data standards which must be followed by all the higher educational organizations to allow exchange of data between systems.
6. **Non redundant file systems (non RAID storage device)**. Most of the data are stored in flat file system on standard PC. Such PCs do not have sufficient hardware to qualify as a server in order to ensure data reliability. Most of the colleges do not have a centralized file storage system and hence difficult to implement scheduled / automated back up policy, RAID or similar technology to protect the data against accidental loss.
7. **Scope of accessibility of data is limited**. As the data is stored in flat file systems, it is difficult to share a part of the data according to the need or role of the individual. Also such files are not accessible from intra or inter network always. Currently, users are equipped with hi tech devices such as tablet, PDA, smart phones etc where they expect that data should be reliably and securely accessible.

The above mentioned existing partially implemented cloud based system and its problems give an indication as to the need for improvement thereby centralizing the data to be used according to some data standards so that difficulty in exchanging the information among the systems can be taken care of.

3. PROPOSED CLOUD ARCHITECTURE

[2]In an interview by Sharon Lobo Feb 28, 2011 "There is a greater need for automation & process management in Indian educational institutes"; according to Raj Mruthyunjayappa, MD - APAC & Europe, Talisma Corporation, educational institutions in the country have identified the need for technology to bring in higher transparency, set governance standards, improve the interactive standards between faculty and student community, centralized view of academics among other needs. Various point solutions and comprehensive ERP applications can address all of these needs.

In order to address the need for a comprehensive application, this paper proposes the use of cloud based system based on certain data standards as shown in Fig 2. Here, the paper considers cloud based[5] system for the colleges where they can keep their individual data by making use of a data center or their own servers. College users interact with the application that is specific to the college needs. At the same time, the staff members of colleges (as users with roles and responsibility) interact with cloud based systems of statutory organizations. The statutory organizations demands and maintains student targeted data which may already exist on different clouds. At the same time, it is felt that a inter cloud communication ie communication between two or more clouds for system to system communication; is desirable to get various benefits.

The proposed system as given in Fig 2, will has to be developed in same way as traditional approach, the only condition is that all the systems should provide an interface to exchange the data in specific data standards format.

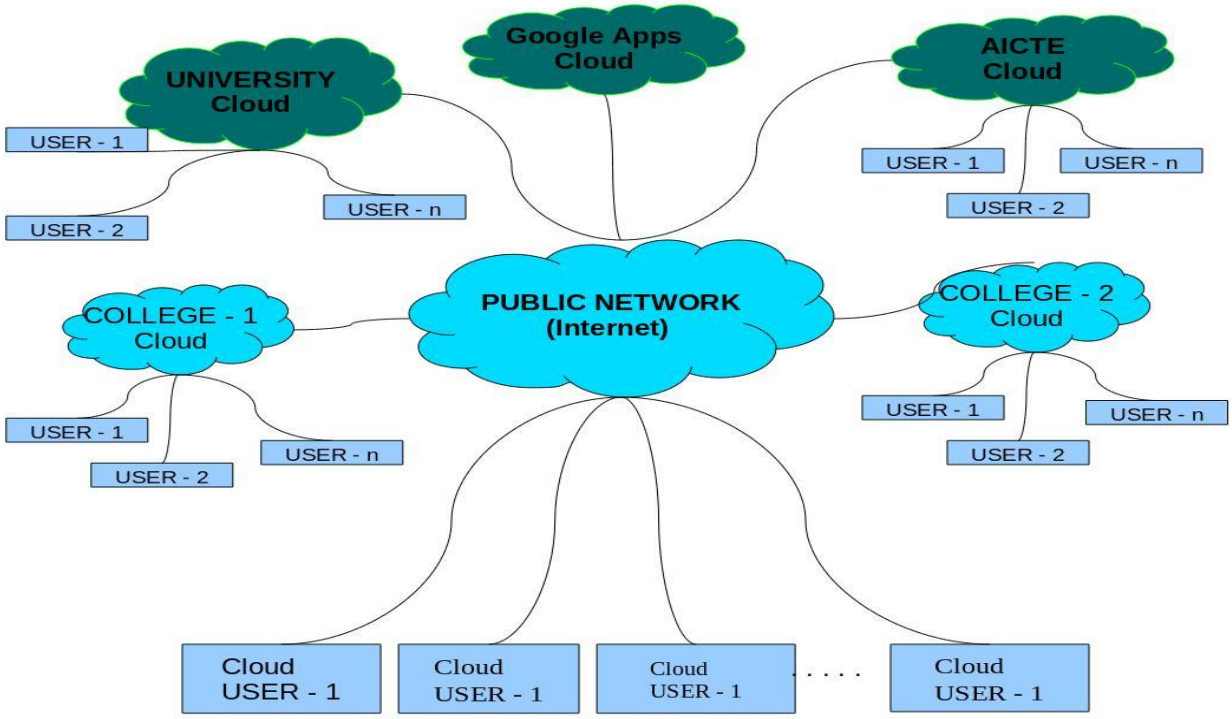

Fig 2 : Proposed Cloud Architecture

The proposed cloud based[7] system is to be developed by various researchers and technical staff; either for individual colleges or statutory bodies. It will allow the inter-networking of colleges or organizations as and when they will implement their cloud based system based on data standard. It will allow the inclusion and communication of ever growing network of educational organizations. This architecture will allow all stakeholders of educational organizations to access desired resources as per their needs and roles.

4. ADVANTAGES OF PROPOSED ARCHITECTURE

The benefits of proposed architecture can be realized by connecting all the stakeholders and the cloud based systems that are involved in the higher education in India. It is not a one time activity but needs to be developed over a period of time keeping the SOA[10] (service oriented architecture) principles in mind. The SOA[9] based system along with eduX will ensure that all new information systems coming under the ambit of cloud based education system will be able to communicate and exchange the necessary data smoothly; will comply with the open education data standards.

The proposed architecture as given in Fig 2, requires the facility of internet connection (mandatory for higher education institutes or colleges) to make the system applicable. In addition to taking care of the problems listed in section II, there are many advantages like :

1. **Proposed architecture works even on low bandwidth at access point**. Internet connectivity problems cannot be predicted and which affect the accessibility and availability of system. As shown in Fig 2, the exchange of information between two or more distinct systems that are on the cloud, will ensure the data transfer even in case of low bandwidth at end points from where user is accessing the system. This is because of the fact that the actual data transfer happens between data centers, which always has high bandwidth and strong connectivity.
2. **Reduces the network traffic**. Due to deployment of system in data centers, communication between systems and overall traffic on the network gets reduced drastically, because users need to only trigger or automate the transfer of information from one system to another.
3. **Fast and reliable storage and exchange of data.** As data centers are equipped with ultra modern and dedicated equipments which ensures the reliable and secure exchange of data. Dedicated and skilled manpower, ensures the high availability and management of data in redundant storage.
4. **Extensible to other upcoming devices like PDA, tablet, smart phone et**c. Proposed model will ensure the support of upcoming and future devices because of standard data exchange format for exchange of data for application development.
5. **Data adheres to single version of truth**. Due to centralization of data at organization level, the data that is communicated or shared to other system or statutory bodies will be exactly same as the source copy of data maintained by that organization. Hence, reports generated by all the systems will be same.

5. CONCLUSION

The growth of higher education in India has its own benefits and a tremendous demand for IT system development and support. To keep up with the pace, a cloud based system that takes care of the reliability and security aspect for a stakeholder is invaluable. The current systems or applications are existing as individuals. We need to bring them together to

make a more robust system that makes information exchange between various systems and statutory bodies simple, easy and fast. A cloud based system for the higher educational scenario in India ensures the maintainability, growth and compliance to the governing bodies and their norms and regulations.

The cloud based systems and an effective SOA provides for maximum flexibility to the system in terms of growth and expansion in relevant areas. Higher education related various stakeholders benefit in terms of easy, efficient and fast communication to the system. Reporting becomes efficient, effective and timely for analysis of the higher education in India.

6. REFERENCES

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