Integrated Campus Management System using Cloud Computing – A Case Study of Guru Nanak Dev University

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ABSTRACT

Cloud computing has become a momentous technological trend in recent years, and many experts presage that cloud computing could reshape information technology (IT) processes and its current marketplace. These Cloud based Campuses integrated with traditional educational set-ups would help in procuring various solutions helpful not only for students but also for University administration. In this paper, a model for Integrated Campus Management System using Cloud Computing has been proposed for Guru Nanak Dev University's Main Campus and well as its Satellite Campuses.

Keywords: Cloud computing, IaaS, SaaS, PaaS, CMS, GNDU, VPN

1. INTRODUCTION

Recent advances in computing, multimedia, and communication technology procure an opportunity to build a self growing, unit sharing virtual environment for teaching and learning. At present, it is common to access content across the Internet independently without reference to the underlying hosting infrastructure. This infrastructure consists of data centres that are monitored and maintained around the clock by content providers. Cloud computing is an extension of this paradigm where the competencies of applications are exposed as services. These services empower the development of scalable web application in which dynamically scalable and often virtualized resources are provided as a service over the Internet.[1]

2. CLOUD COMPUTING

Cloud computing is the conveyance of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a utility over a network (typically the Internet).[2] At the foundation of cloud computing is the broader concept of infrastructure convergence and shared services. This type of data centre environment allows enterprises to get their applications up and running faster, with facile manageability and less maintenance, and enables IT to more rapidly adjust IT resource to meet fluctuating and unpredictable business demand.[3][4] The intelligent infrastructure provided by Cloud computing helps create smart environments like smart data

centers, pervasive computing, automation, virtualization and intelligent networks; they already penetrate many spaces of our daily life.[5]Cloud computing providers offer their services according to three fundamental models: Infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) where IaaS is the most basic and each higher model abstracts from the details of the lower models.
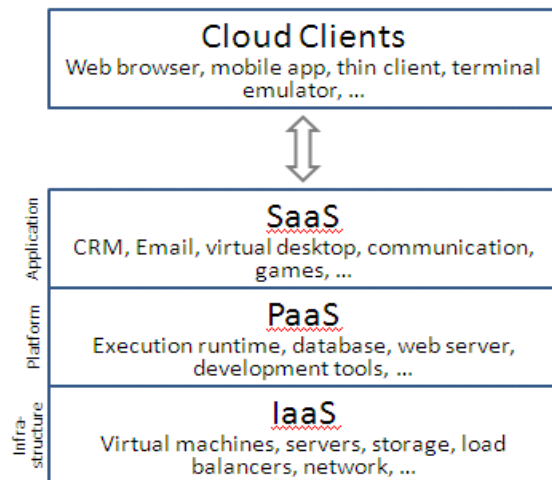

Figure 1: Cloud Service model

There are three types of cloud computing: (a) public cloud, (b) private cloud, and (c) hybrid cloud. [6]
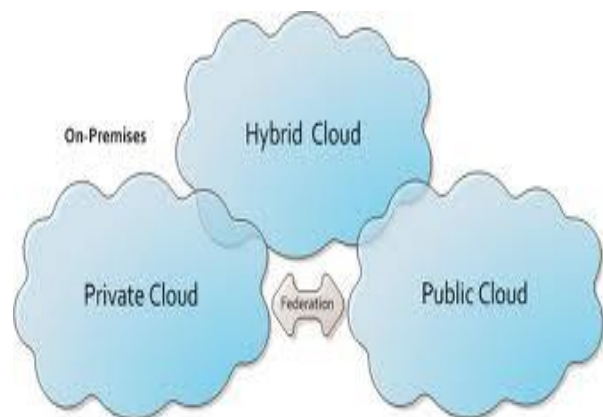

Figure 2: Types of Cloud

3. CAMPUS MANAGEMENT SYSTEM USING CLOUD COMPUTING

Educational establishments continue to seek opportunities to rationalize the way they manage their resources. Educational institutions can take advantage of cloud applications to provide

students and teachers with free or low-cost alternatives to expensive, proprietary productivity tools.[1] Campus Management can be divided into different spheres controlling different aspects within campus. A number of pillars have been defined in the Campus framework, namely the C-Learning, C-Social, C-Green, C-Health, C-Management, and C Governance aspect of the campus which briefly covers the following aspects:

1) C-Learning: abets the students and faculty in their task of acquiring knowledge. This includes providing means in the preparation and delivery of contents for the students to learn , and access to contents from any corner and at anytime.[5]

2) C-Social: concentrates on social networking and communities within the campus, hence enabling informal social interactions between people. In this arena, there are three main areas of concern: campus's core curriculum, extra curriculum, and general social activities.[5]

3) C-Management: encompasses more physical aspects of a campus, such as smart building management, student access and control, security and surveillance, as well as emergency response.[5]

4) C-Green: covers aspects of green ICT and sustainability, smart energy harvesting, and resource management[5]

5) C-Governance: takes care of the organizational aspects of the campus, providing process management, change management and adaptability, and administration aspects.[5]

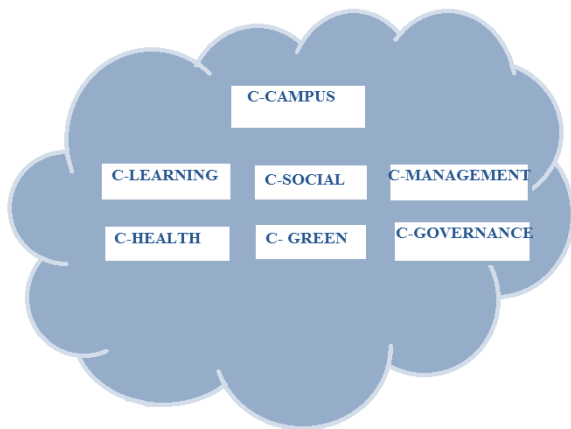6) C-Health: finally provides preventive healthcare, remote healthcare and monitoring and epidemic alert systems.[5]

Figure 3: Pillars of C-campus

4. IMPLEMENTATION OF CLOUD COMPUTING ON GURU NANAK DEV UNIVERSITY

Guru Nanak Dev University, one of the premier Universities of India has five Satellite campus throughout Punjab besides Main Campus at Amritsar. The University caters the need for Knowledge Management of almost 10000 students each year at Undergraduate, Postgraduate and Doctorate level.

Implementation of Campus management system would enable the teachers, students as well as other employees to use a variety of devices, including PCs, laptops, smart phones etc to access programs, share and application development platforms

over the internet via services provided by Cloud Computing providers. Implementation of cloud computing on Guru Nanak Dev University (GNDU) is the proposed model. This hypothetical model given for GNDU includes the various satellite campuses of GNDU with the control in the hands of GNDU (Main campus), Amritsar. Architecture of Implementation of Integrated Campus Management System using Cloud Campus on GNDU can be described by 3 layers as shown in figure 4:
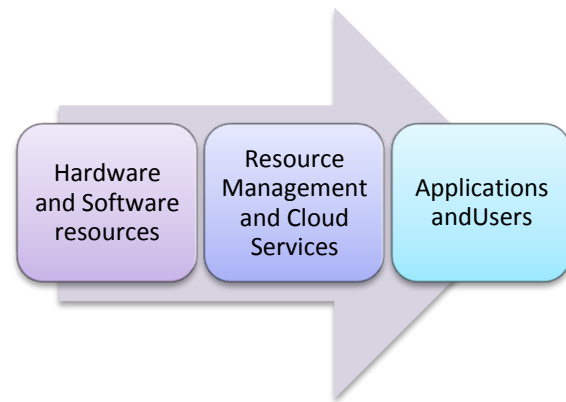

Figure 4: Architecture of Implementation of Integrated Campus Management System

1. Hardware and Software Resource layer: Hardware and Software Resource is the bottom most layer in the cloud service where it wields the essential computing things like physical memory and CPU for the total system and operating systems.

2. Resource management and Cloud services: This layer plays an important role in loose coupling of software and hardware resources and provides Cloud Services namely IAAS, PAAS, and SAAS. These service layers help cloud customers to use the variegated forms of cloud resources for their products like software resource, hardware resource, and infrastructure resource.

3. Applications and Users layer: application layer mainly consists of content creation, content delivery, education platform and education management and their interaction with users. Here we have cleaved Application layer into various managements to be used within GNDU:

1. Campus Management
2. Department Management
3. Admission Management
4. Student Management
5. Staff Management
6. Library Management
7. Laboratory Management
8. Examination Management
9. Hostel Management
10. Transport Management
11. Canteen Management
12. WEB Module
13. Accounts Management
14. Inventory Management
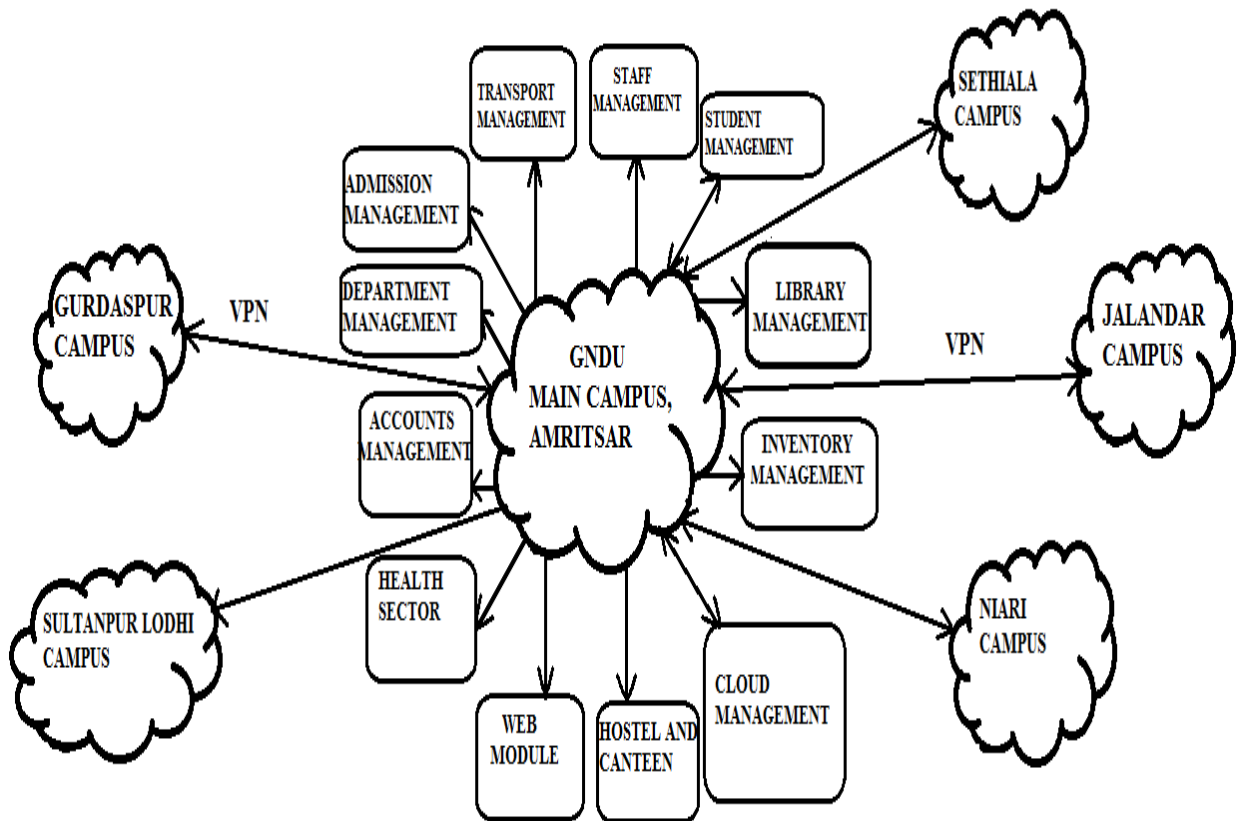15. Health Sector Management
16. Cloud Management

Figure 5: Proposed model of cloud implemented on GNDU

Now let us explain all these sectors controlling various aspects:

1. Campus Management: This module include controlling other campuses of GNDU (Jalandhar campus, Gurdaspur Campus, Sethiala Campus, Sultanpur Lodhi and Niari Campus). These are connected to the Main Campus GNDU via VPN(Virtual Private Networks) over Internet.

2. Department Management: This fragment controls various departments belonging to various faculties like Engineering, sciences, Life sciences, Commerce, Management, Humanities administration of their internal and external affairs.

3. Admission Management: This manages the new admissions of students in various departments at all campuses.

4. Student Management: Student Management means management of all student details like name, address, corresponding department, attendance, marks, records, etc

5. Staff Management: Staff Management is similar to student management it manages the staff either teaching or non teaching, staff application, personal details and recruitment process.

6. Library Management: Library Management controls the main and departmental libraries, number of books, various Transactions done on various dates and times, OPAC – Online Public Access Catalogue, etc

7. Laboratory Management: This portion includes controls of all the Laboratories of different Departments, their equipments, etc

8. Examination Management: Manages the examination dates, exam fees, etc

9. Hostel Management: This would manages the Hostel which can be either girls, boys or staff hostels, and Controls inventory, Daily Expense, Student Mess Bill, Student Attendance, date of joining, withdrawal etc.

10. Transport Management: This part would deals with Vehicle Details, Fuel Details, Employee Details – License Expiry Date, User Details – Staff, Student Stages and Route Allocation and even the GPS tracking of the transport vehicles.

11. Canteen Management: This would help the central authority to manage the canteen rents, products, their nutrition contents and keep a check on other unfair practices of the canteen contractors.

12. WEB Module: This is an important module which would help to interact with parent/others online. Some of the special features are: View student status. Student Application form, Exam application form, Student Result.

13. Accounts Management: Accounts would be managed by the account department at Main campus only that deals with fees structure of students, date of submission, pays of staff, Budget, Asset, Income & Expenditure, Balance Sheet, Budget Analysis, etc

14. Inventory Management: This module is used to take care the Inventory of Materials of the institution like Vendor Details, Material Details, Purchase Request ,Purchase Order, Goods Receipt / Issues and more …

15. Health Sector Management: Health Sector Management means managing the various dispensaries of all campuses and doctors related information, etc

16. Cloud Management: This is the most important and centralized part of cloud that manages the cloud and

its related issues like security of cloud, storage servers.

5. CONCLUSION

Cloud computing will certainly decimate the effort required at the various campus for setting up, updating and maintaining hardware and software. These will also intelligible the user interface, allowing students to access various manuscripts, e-journals/ simulations software, presentations/ seminars through a browser interface. In addition, updating of equipment and software at main campus will become easy because of centralization; and University would be competent to extend its growth in all fields of excellence over other Universities on the posterior of advancing technology trends in this region.

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