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Procedia - Social and Behavioral Sciences 67 (2012) 322 – 334

Procedia
Social and Behavioral Sciences

The 3rd International Conference on e-Learning
ICEL 2011, 23-24 November 2011, Bandung, Indonesia

UPSI Learning Management System (MyGuru2) in the Cloud Computing Environment

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Abstract

UPSI Learning Management System or MyGuru2 is an e-learning portal that offers a robust set of teaching and learning tools, functions and features. It enables lecturers to create and upload learning resources and activities for learner's access and at the same time allow them to track and monitor their learning activities. Currently the system is used in hybrid technology method and be part of university's integrated management system which applies the concept of data centralization and single sign-on. MyGuru2 consists of four main features such as subject information that contains outcome based education (OBE), assessment that contains auto and manual grading system and collaborative tools that includes forum, file sharing, online survey and web conferencing. The other feature is an administrative tool that enables lecturers to manage and revise their subject to meet the changing needs of students. With the increasing number of students, especially in distance learning (PJJ) which entirely dependent on the MyGuru2 as the medium of communication and learning, system infrastructure need to be upgraded to accommodate the increasing access and usage as well as service delivery. We propose cloud computing as a solution where MyGuru2 will be put on convenient, ondem and network access to a shared pool of configurable computing resources that can be maintained and provisioned with minimal management effort. The project will present the issues and challenges of the current MyGuru2 system and how cloud computing manage to overcome the problem in the meantime provide high availability and usability. We also study how it affects students to communicate and share materials with their lecturers and classmates compared to the current practice.

Selection and peer-review under responsibility of i-Learn Centre, Universiti Teknologi MARA, Malaysia

Keywords: Learning Management System; Distance Learning; Cloud Computing

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1. Introduction

The University Integrated Management System or Sistem Maklumat Bersepadu Universiti for Universities (SMBU) is an innovative web-based application developed by skilled programmers & developers of ICT Centre, UPSI, with involvement from the management of the university, faculty administrators, education experts, financial managers, human resource managers, and technology experts of Universiti Pendidikan Sultan Idris.The main objective of this proposal is to provide a cost effective and robust application by implementing SMBU based on open-source solution. The implementation will be performed by experienced project team with thorough knowledge and understanding of the related process flows and operations. An achievable implementation time frame with structured activities and high emphasis on quality and quick results will be put into practice to ensure the development process runs smoothly without interrupting the existing system. The SMBU integrates all the comprehensive modules, accessible through the web which has single sign-on feature. The main modules are MyUPSI Portal, MyFIS, MySIS, MyGuru2 and MyHRA. Integration of the system fulfills 3 main objective which to ensure efficient data management and retrieval, to ensure data reliability and integrity and enable data mining for knowledge discovery (Wan Maseri, 2004). SMBU fulfills management needs and has proven to increase the efficiency of the organization as a whole since it was implemented in 2008. UPSI continues to embed the latest technology into the business including teaching & learning management. The E-learning portal is integrated into the SMBU. All the teaching and learning processes are carried out via MyGuru2. It is a platform with various functions and features designed to support an outstanding teaching and learning process. It allows the lecturers to create the content of teaching resources and upload them to the internet themselves. Meanwhile they can also monitor their students' activities. MyGuru2 is a fully open source system in terms of component, operating system, development application and database. MyGuru2 is compatible with all browsers because one of the main reasons for using the Web is compatibility with all users (Alessi & Trollip, 2001). The Web is emerging as a viable teaching and learning platform for learner-centered instruction at the same time that there is a call for incorporating learner-centered approaches in education (Roberts, 2004).

2. About The Project

Realizing the importance of ICT in teaching and learning, UPSI has set a policy of e-learning which require lecturers and students to use learning management system as a medium of information sharing.Therefore, the ICT Centre were given the responsibility to make this happen by kicking-off the project of University Learning Management System referred as MyGuru2.The vision of MyGuru2 is to offer robust set of teaching and learning tools, functions and features. Besides that, MyGuru2 enables lecturers to upload learning materials and create activities for learner's learning progress. MyGuru2 consists of four main features such as subject information and assessment that contains auto and manual grading system while collaborative tools includes forum, file sharing and online survey. The other feature is an administrative tool that enables lecturers to manage and revise their subject to meet the changing needs of students. The main advantage of MyGuru2 like other LMS is includes a self-paced 24/7 learning for students (Rosenberg, 2001). Besides, each tool is designed to ensure its user friendliness.

2.1. The Users

MyGuru2 is mandatory to all lecturers and students. Currently, there are 20116 students and 506 lecturers in UPSI actively using MyGuru2 with the total of 3409 courses. Table 1 shows the number of hits to MyGuru2 system from January to May 2011.

Table 1. MyGuru2 hits in 2011

Month	Student	Lecturer
January	54044	2286
February	54261	1438
March	165737	3456
April	392199	7675
May	356916	7817

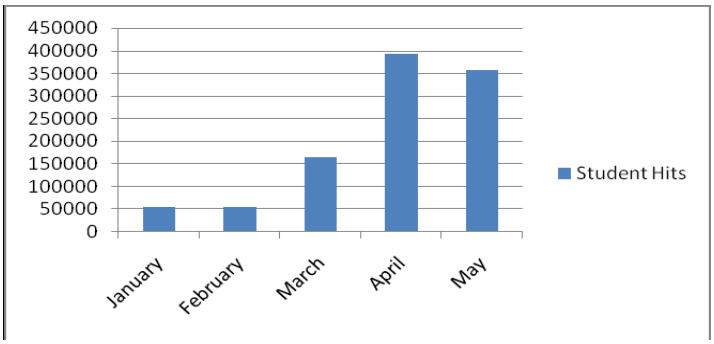

Fig. 1. MyGuru2 hits by month in 2011

2.2. Technical Specification

2.2.1. Database

MySQL 5.0 is selected because of these features:

Scalability and flexibility - MySQL database server provides scalability, supporting the capacity to handle embedded applications with a footprint of only 1MB to run massive data and hold terabytes of information.

High performance and availability - A unique storage-engine architecture allows database professionals to configure MySQL database server specifically for particular applications.

Robust transactional support - MySQL offers one of the most powerful transactional database engines on the market. Features include complete ACID (atomic, consistent, isolated, durable) transaction

support, unlimited row-level locking, distributed transaction capability, and multi-version transaction support.

Web and data warehouse strength - MySQL is the de-facto standards for high-traffic web sites because of its high-performance query engine, tremendous fast data insert capability, and strong support for specialized web functions.

Strong data protection – MySQL offers exceptional security features that ensure absolute data protection.

Manageability - MySQL offers exceptional quick-start capability with average time from software download to installation completion is less than fifteen minutes.

Low total cost of ownership - By migrating current database-drive applications to MySQL, UPSI enjoys cost saving in licensing and database maintenance.

2.2.2. Application

MyGuru2 uses PHP as the development platform based on these factors:

- Works Great with HTML - PHP and HTML are interchangeable within the page. While PHP might add some new features to our application, its basic appearances are still created with HTML.
- Interactive Features - PHP allows us to interact with our users in ways that HTML alone can't.
- Easy to Learn - By learning just a few simple functions, we are able to do a lot of things with our application.

2.2.3. Operating System

For the server and back-end solution, we are using Red Hat Enterprise Linux for operating system.

2.2.4. Web Server

Apache is used as the web server for this project based on these advantages:
Supports a wide variety of operating systems. Can be customized for the needs of MyGuru2. The installation of Apache became easier by using XAMPP which is also open source.

2.2.5. Design Specification

- Open source integrations. Linux, MySQL, Apache, XAMPP
- Uses industry standard open protocols. HTTP, Extensible Markup Language (XML)
- Modern technology design. Java, JavaScript, Dynamic HTML, WEBEQ, Zapatec Tree,
- MediaWiki, TinyMCE, Oracle Call Interface (OCI).
- Horizontal scalability. Load balancer to distribute workload into 3 different servers with cluster technology for the database.
- Browser based client interface.
- Administration console to manage accounts and servers.

2.3. Overview of Hardware/Software of System

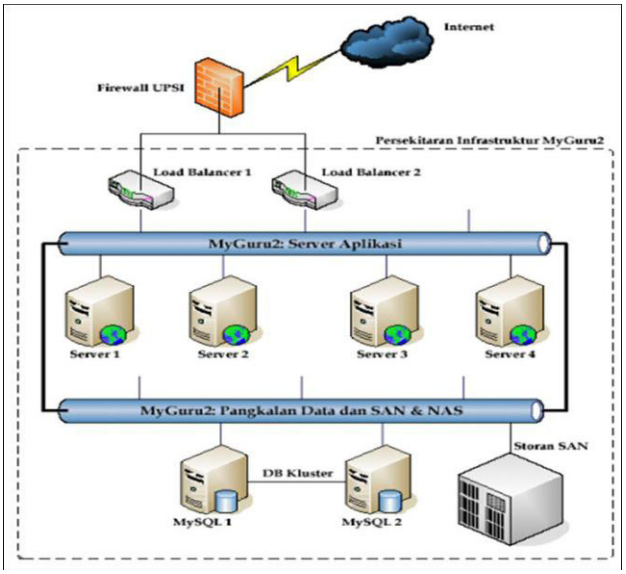

Fig. 2. MyGuru2 Infrastructure

As depicted in Fig.2, MyGuru2 infrastructure consists of:

- Blade Chassis : Sun Blade 6000 Modulor System
- Blade Server : 6 x Sun Blade X6250 Server Module
- Load Balancer : Big IP (f5) 3600 Series

Generally the server consists:

- Red Hat Enterprise Linux - Significantly improves performance, price/performance, scalability, and reliability and made possible with MyGuru2 server architectures.
- Hyperic - provides a popular open source IT Operations computer system and network monitoring application software.
- XAMPP – Free and open source cross-platform web server package, consisting mainly of the Apache HTTP Server, MySQL database, and interpreters for scripts written in the PHP and Perl programming languages. XAMPP have been tested and works well with :
- Oracle Call Interface (OCI), provide interface between MyGuru2 and University Student Information System (MySIS) for data synchronization.
- WEBEQ, Java open source toolkit that uses MathML to build dynamic web pages that allows the usage of mathematical and scientific symbols seamlessly.
- The Zapatec Tree - versatile way to display information. Use the DHTML tree as a menu, a site map, or a way to display your data. Our DHTML tree works with many different browsers. Also an open source software.
- TinyMCE - released as open source software under the LGPL by Moxiecode Systems AB. It has the ability to convert HTML text area fields or other HTML elements to editor instances.
- Mediawiki - web-based and open source wiki software application to create wiki application.

2.4. Innovation

The following is a list of innovations made in MyGuru2 to become a robust and powerful system:

- Platform for e-learning – MyGuru2 transforms the way of learning and teaching from conventional to electronic. Indirectly it optimizes lecturers and students time where the process of learning and teaching can be done continuously 24x7.
- Allows collaborative learning – MyGuru2 encourages collaboration between lecturers and students via bulletin board, course material, online assessment, assignment etc. At the same time, students can contribute as content provider which promotes the concept of sharing and collaborative learning.
- Social Networking – virtual sharing with RSS and other social network like twitter, Facebook etc.
- Web Based Learning - Internet access in multiple platform
- Mobile Learning – MyGuru2 is proven able to work with mobile devices such as iPad, iPhone and other smartphones.
- Data Integration – As a component of University Integrated Management System (UIMS), MyGuru2 is fully integrated with other systems in the university and accessible via single sign on. The diagram below shows the overview of integrated system in UPSI.
- E-portfolio – allows students to manage their portfolio and collect their learning evidences digitally.
- Learning Evaluation – Online evaluation of the academic staff at the end of the semester.
- University Evaluation – Evaluates UPSI's infrastructures and program via final semester student's opinion / polls.
- Practicum survey – Evaluates industrial training quality via student opinion / polls.
- Green IT – using Sun Solaris thin clients to minimize hardware and energy consumption.
- Outcome Based Education - Creation of a curriculum framework that outlines specific, measurable outcomes including soft skills, bloom taxonomy and others.
- Cloud Computing – MyGuru2 application and its content is accessible anywhere in the world in a secured server and storage.
- In 2011, MyGuru2 takes another step ahead by providing the services in cloud 24 by 7 to all PJJ
- (Distance Learning) students.
- Secured Socket Layer (SSL), providing MyGuru2 with reliable end-to-end secure services. So
- MyGuru2 are not anymore HTTP but HTTPS.

2.5. Deployment of MyGuru2

MyGuru2 users are the UPSI teachers and lecturers, also few others agency who have interested in using MyGuru2 as their e-learning platform. Based on the data obtained in June 2011 shows numbers of active users in MyGuru2 is 23442 (Refer **Table 2**), and 6809 of them are off-campus student (PJJ).

These are among the factors;

a) MyGuru2 as the medium of learning and teaching has been made obligatory by Pusat Program Luar (PPL). Students are able to access the notes, learning material and latest announcement from the lecturer via MyGuru2
b) MyGuru2 is the main communication channel between lecturers and students with the usage of forums, personal messages and web conferencing
c) Quizzes and tests are conducted via myGuru2
d) Virtual Classes (via Web Conferencing) are accessible via MyGuru2

Table 2. Active MyGuru Users Statistics

Group	Number of users
Lecturer	576
Administation Staff	1544
Fulltime student	14303
Off Campus Student (PJJ)	6809
Sekolah Khir Johari (Project with school)	90
JPN (Project with JPN)	120
TOTAL	**23442**

Statistics of active PJJ users is shows in Table 3, since registration on Mac 17, 2011, access to MyGuru2 increases 5 times compared to normal usage by in-campus students. This shows that PJJ students rely on the portal for their learning session and activities

Table 3. Active MyGuru Users Comparison

Month	**Full Time hits**	**PJJ hits**
January	54044	-
February	54261	-
March	66544	99193
April	89898	302031
May	67897	289019

This paper will review the usage of MyGuru2 among off-campus student and suggest few solutions to problems and limitation faced by UPSI in implementing e-learning as whole.

3. Methodology

A survey has been done to the off-campus students on April 5th till 15th 2011 related to MyGuru2. The questionnaire is created through Google Docs and being published in MyGuru2 main screen. There 4694 students or 69% of off-campus students participates as respondents in this survey.The result of the respective survey is generated by Spreadsheet Google Docs.

At the same time, the survey is also conducted via phone calls to the off-campus students. The number of respondents is 7. Data obtained via the system such as MyGuru2 usage by hour, by students and by courses are also being made as a base of this research.

4. Analysis

4.1. Internet Service Providers used

We've given option based on current ISP selection trend which includes TM Streamyx, Celcom Broadband, DIGI Broadband, Maxis Brondband, YES Broadband and P1 Broadband. 2135 students or 45% chose TM Streamyx, 1414 students or 30% chose Celcom Broadband and the rest chose the other ISPs. Refer Fig 3**.**

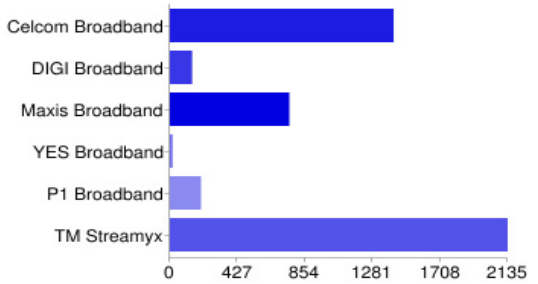

Fig. 3. ISP used by off-campus students to access MyGuru2

4.2. MyGuru2 accessing interval

Accessing interval is the time needed from the login page to the main page displayed fully. Students are given with options including less than 20 seconds(fastest), less than 40 seconds, less than 1 minute, less than 2 minutes, and more than 2 minutes(slowest). Refer Fig 4**.**

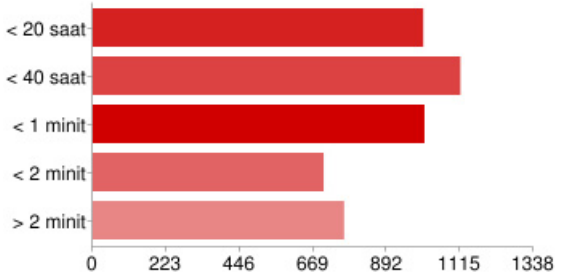

Fig. 4. MyGuru2 accessing interval for off-campus students

Fig 4 depicts 1003 students or 21% able to access MyGuru2 at the fastest interval time with less than 20 seconds while 1116 students or 24% able to access in less than 40 seconds. If less than 40 seconds is considered as an ample time to access a web site, 45% of distance learning students can access MyGuru2 at a fast and comfort condition. 763 students or 16% only able to access the system at an interval time of more than 2 minutes which is considered as slow to access a web site. 56% from the fast access are using TM Streamyx as shown in Table 4. 52% of slow access recorded used Celcom Broadband. Refer Table 5.

Table 4**.** Users with less than 20 seconds interval with their respective ISPs

ISP	**Number**	**Percentage**
TM StreamyxTM	562	56.0%
Celcom Broadband	232	23.2%
Maxis Broadband	137	13.8%
P1	49	5.0%
Digi Broadband	21	1.7%
YES	3	0.3%
TOTAL	**1003**	**100%**

Table 5. Users with more than 2 minutes interval with their respective ISPs

ISP	**Number**	**Percentage**
TM StreamyxTM	402	52.0%
Celcom Broadband	153	19.8%
Maxis Broadband	152	19.6%
P1	42	5.4%
Digi Broadband	21	2.7%
YES	2	0%
TOTAL	**772**	**100%**

4.3. Frequency of Distance learning students login to MyGuru2 system

This question is to analyze the frequency of login by Distance Learning Students in a period of one week time. 7 options are given to chosen as the answer which includes less than once, once, twice, trice, four to six times, seven times and more than seven times. Refer Fig 5.

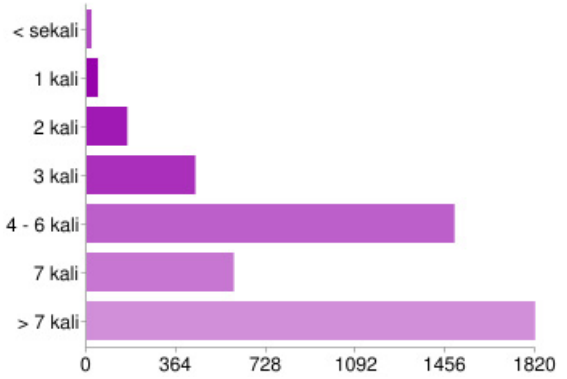

Fig. 5. Frequency of Distance learning students login to MyGuru2 system

The bar chart in Fig 5 proves that 84% or majority of the distance learning students surfs MyGuru2 at least four times a week. The non-active users who log in stand between less than once to twice only recorded 5% from total students. The high dependency towards the system makes majority students to surf it more frequently.

4.4. Communication medium

Students can choose more than one type of communication medium to communicate between lecturers in this survey. Options given include MyGuru2 Forum, E-mail, Short Message Service (SMS), telephone conversation and web conferencing. Fig 6 proves that the distance learning students chose the MyGuru2 Forum as the preferred communication medium with the vote off 3469 or 78% using it, 2112 or (47%) students chose the e-mail service provided by the UPS ICT Center. This is because the MyGuru2 comprehends other information needed by the students to communicate such as lecturer's name, group mate's name, notes, latest announcements and many more.

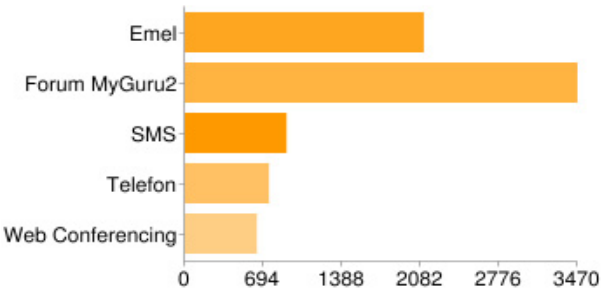

Fig. 6. Communication medium between distance learning students and lecturers

4.5. Frequencies of connection problems (Unable to log in to MyGuru2 system)

This section is almost similar to section 4.2 that is access period except that it focuses directly on the accessibility to MyGuru2. This survey leads us to a number of 565 or 12% of the students did not came across any connection problem in using MyGuru2. 1775 students or 38% from the total happen to face around twice connection problem out of 10 login tries. 1310 or 28% students faced 3-4 times of connection problem meanwhile 640 or 14% students faced 4-5 times connection problems and the rest faced more than half of their tries to login to MyGuru2.

108 students or 2% from the total faced connection problem almost every time they login. Analysis found that 80.5% of these students are using Celcom Broadband and Maxis Broadband.

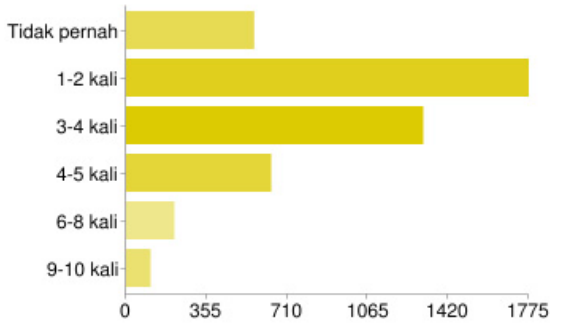

Fig. 7. Frequency of connection problems.

Table 3.3. Users faced 9-10 times connection problems out of 10 login tries to MyGuru2 and their

ISP	**Number**	**Percentage**
TM StreamyxTM	57	52.7%
Celcom Broadband	30	27.8%
Maxis Broadband	11	10.2%
P1	7	6.5%
Digi Broadband	2	1.9%
YES	1	0.9%
TOTAL	**108**	**100%**

4.6. MyGuru2 usage by Distance Learning Students in 24 hours

Our analysis found that the usage is high between 8pm to 10pm. Fig 8 shows the access to the system at time on 31st March 2011. 8pm to 9pm recorded the access of 1013 users and from 9pm to 10pm it reaches to 1250. The situation differs with the absence of the distance learning students where the highest hit recorded was between 12pm to 3pm. This is because as the distance learning students are full time teachers, they are only free after their work hour.

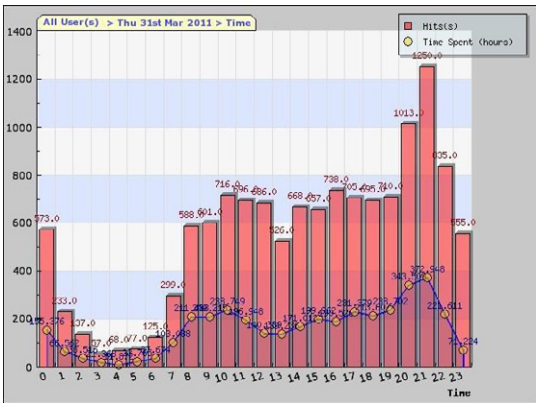

Fig. 8. Access to the system in 24 hours.

5. Result And Discussions

Based on the analysis done, we found that the awareness of the students to use the more stable internet connection is high with 45% using TM™ Streamyx™ compared to other broadband service providers. Streamyx™ proved to be the most stable and fast connection base on the analysis made which proves that 56% of fast connection to MyGuru2 is by that particular ISP.

Besides TM™ Streamyx™, students also prefer to use Maxis and Celcom Broadband. But, these two ISPs are also proven to be slow in surfing MyGuru2 where 52% of the slow connection access to MyGuru2 is from Celcom Broadband and 80.5% of the connection problems in login to MyGuru2 where 9-10 tries out of 10 failed are from Maxis and Celcom Broadband.

Analysis also reveals that the percentage of students took time more than 2 minutes to access MyGuru2 is significant though with its less percentage of 16%. The percentage of frequent connection problem to MyGuru2 with 4 out of 10 login tries is also significant with 913 number of students or 19%. As MyGuru2's dependency by distance learning student is quite high, these numbers are quite big and should be reduced.

With the constant increase of number of distance learning students that is believed to be reaching 12000 in future, current MyGuru2 infrastructure expected to be insufficient to handle the request from users or at least to maintain the current performance. Diagram 4.1 shows the current MyGuru2 system's infrastructure.

New server or hardware purchase to boost the performance of the system will consume a huge amount of expenses and with a limited scalability. Alternatively, we suggest in using Cloud Computing for MyGuru2 system. Via cloud computing, MyGuru2 will be operating from a cloud network and operate in an environment called on-demand networking which can be scaled accordingly. This network can access to any form of computer source such as in server form, storage, application or software.

5.1. Why cloud environment?

UPSI has decided to move to the cloud computing environment because:

- Incremental Scalability. Cloud environments allow users to access additional computer resources on-demand in response to increased application loads.

- Agility. As a shared resource, the cloud provides flexible, automated management to distribute the computing resources among the cloud's users.
- Reliability and Fault-Tolerance. Cloud environments take advantage of the built-in redundancy of the large numbers of servers that make them up by enabling high levels of availability and reliability for applications that can take advantage of this.
- Service-oriented. The cloud is a natural home for service-oriented applications, which need a way to easily scale as services get incorporated into other applications.
- Utility-based. Users only pay for the services they use, either by subscription or transaction-based models.
- Shared. By enabling IT resources to be consolidated, multiple users share a common infrastructure, allowing costs to be more effectively managed without sacrificing the security of each user's data.
- SLA-driven. Clouds are managed dynamically based on service-level agreements that define policies like delivery parameters, costs, and other factors.
- APIs. Because clouds virtualized resources as a service they must have an application programming interface (API).

6. Conclusions

The practice of MyGuru2 for distance learning students opened a new chapter in system development in UPSI ICT Center. We are now more aligned towards the requirement and access to the internal systems thus in a different pattern showed by the full time students. We are confident that the usage of MyGuru2 system by the distance learning students will be in the encouraging mode as it is the main communication medium between them and their lecturers besides accessing to their course materials, announcements, latest news and online tests. We are suggesting the usage of cloud computing which is proven to be more manageable as UPSI need not to spend to upgrade the infrastructure to support the increasing number of users as it can be given to the cloud service provider itself.

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