Cloud Market Cogitation and Techniques to Averting SQL Injection for University Cloud

Mr. Patil Pratap Ramgonda  
Department of Computer Science  
Shivaji University, Kolhapur  
pratap23patil@gmail.com

Dr. Mudholkar R. R.  
Department of Electronics  
Shivaji University, Kolhapur  
rrm_eln@unishivaji.ac.in

Abstract

Cloud Computing is playing a game changer role in field of Information Technology which is not only impacting the way computing services are and will be delivered but also the way in which user will use IT.

Cloud computing is a significant alternative in today’s educational perspective. The technology gives the students and teachers the opportunity to quickly access various application platforms and resources through the web pages on-demand. Unfortunately, not all educational institutions often have an ability to take full advantages of the newest information technology. Cloud Computing can help in solving this problem by making available the latest technologies to the students and helping the educational institutions to support the better process of teaching and learning.

Universities may soon be building and managing their own data centers. This model would let Universities maintain more control over the applications and data stores that contain sensitive, private information about patrons. In this paper we discuss problems faced with Universities IT and development efforts to overcome these problems. This paper also contributes in finding the ways to defend SQL Injection Attacks. The paper also contributes to analyzing the current spending on IT worldwide and then suggesting the ways on how Cloud Computing can help in reducing the cost. The paper also, focuses on the growth of Cloud Computing Market.

Keywords

1. Introduction
The 21st century, will be the ‘Century of the Mind,’ where education will undergo a paradigm shift. Nowhere will this change be more marked or visible than in India, a country with a deep and enduring heritage of learning, which goes many centuries, to universities such as Nalanda and Takshila. Our IT industry, barely 40-years-old, which is now renowned for its expertise and technical talent, has become the country's spearhead in the international markets, enabling it to play catch up with the industrialized world. Today, technology, implying computers and communications, cutting-edge tools, and delivery methodologies such as cloud computing, are being used to equip students and professionals with relevant IT knowledge and skills that are critical to the growth of this burgeoning sector. We are actually operating in the cloud following examples will give clear idea,

- Social media like Facebook, Twitter and LinkedIn
- Media services like YouTube and Flickr
- Online e-mail like Gmail and Hotmail
- VoIP services like Skype and Google Voice
- Content distribution services like Bit Torrent
- Personal finance tools like Mint

The aim of the paper is to analyze possibilities of the cloud computing technology that can help educational institutions to support a process of teaching and learning. To achieve this aim, the following research tasks are fulfilled:

✓ Analysis of worldwide IT spending in different Sector like Computer Hardware, Enterprise Software, IT Services, Telecom Equipment, Telecom Services.
✓ Key Benefits and Concerns of Cloud Computing
✓ The exploration of cloud computing possibilities for the education organizations.
✓ The detection of the risks that the educational institutions can get.
2. Defining the Cloud

There are a number of circulating definitions for cloud, but the National Institute of Standards and Technology (NIST) definition is a generally accepted standard: “Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (such as networks, servers, storage, applications and services) that can rapidly provisioned and released with minimal management effort for service provider interaction” [1]. As can be seen in Table 1, the cloud can take on various forms as follows, [2]

Table 1. Variants of Cloud Computing

<table>
<thead>
<tr>
<th>Level</th>
<th>Label Description</th>
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<tbody>
<tr>
<td>User Level</td>
<td>SaaS “Software as a Service”</td>
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<tr>
<td></td>
<td>Companies host applications in the cloud that many users access through Internet connections. The service being sold or offered is a complete end-user application.</td>
</tr>
<tr>
<td>Developer</td>
<td>PaaS “Platform as a Service”</td>
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<td></td>
<td>Developers can design, build and test applications that run on the cloud provider's infrastructure and then deliver those applications to end-users from provider's servers.</td>
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<tr>
<td>IT Level</td>
<td>IaaS “Infrastructure as a Service”</td>
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<td></td>
<td>System administrators obtain general processing, storage, database management and other resources and applications through the network and pay only for gets used.</td>
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</table>

The cloud in cloud computing provides the means through which everything from computing power to computing infrastructure, applications, business processes to personal collaboration can be delivered to you as a service wherever and whenever you need. It is offered in different forms as follows,[3]

2.1. Private Cloud

The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise.

2.2. Community Cloud

The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on premise or off premise.

2.3. Public Cloud

The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

2.4. Hybrid Cloud

The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load-balancing between clouds).

3. Why Cloud Computing?

The Gartner's forecast overall global IT spending growth worldwide from 2010 - 2015 as in Figure 1. From which we get the idea that how many billion dollars we are spending on IT Infrastructure.

![Figure 1: IT Spending by Sector, Worldwide, 2010-2015](Image)

Gartner's growth forecast for overall IT spending in U.S. dollar terms has been revised downward from 4.6% to 3.7% for 2012. We expect all four major technology sectors, computing hardware, enterprise software, IT services, and telecommunications equipment and services to experience slower IT spending growth in the coming year than previously forecast. The computing hardware sector will see the sharpest slowdown in 2012, as the impact of hard-disc drive (HDD) supply constraints on HDD and PC shipments in the first half of the year compound the cautious environment for hardware spending.
4. Cloud Market Cogitation

We have analyzed the cloud computing market for different parameter.

4.1. Cloud Computing Market in India
Enterprise Cloud penetration in India will surge to 46% by 2016 [6].

4.2. Cloud Computing Market Size
The cloud computing market will rise from $40.7 billion this year to more than $241 billion in 2020, with a year-to-year growth of over 20 percent.

4.3. Traditional Workloads to Cloud Data Centers
A workload can be defined as the amount of processing a server undertakes to execute an application and support a number of users interacting with the application. The year 2014 is expected to be a pivotal year—when workloads processed in cloud data centers (51 percent) will exceed those processed in traditional data centers (49 percent) for the first time. Continuing that trend, we expect cloud-processed workloads to dominate at 57 percent by 2015 Figure 4.

4.4. Cloud Computing Market Distribution in Industry Sector
The survey received a good response from CIOs across the industrial landscape. IT/ITeS CIOs were the highest in number, followed by manufacturing and financial services. Education Sector contains 4% of total Cloud Computing Market [5].
4.5. Key Benefits of Cloud Computing

‘Cost Savings’ is the most important benefit of Cloud Computing. We also look forward to the ability to scale better, switch from CapEx to OpEx, and benefit from easier maintenance – available from the Cloud vendor [5].

4.6. Key Concerns of Cloud Computing

Security continues to be the biggest concern for CIOs when looking at Cloud adoption. 66% of CIOs are apprehensive about security on the Cloud. Privacy Concerns come next, with 45% of CIOs pegging this as their area of concern. Another significant concern for CIOs is the over-dependence on vendors and whether that would lead to vendor lock-in – 33% of CIOs responded in the affirmative to this area of concern. Integration with existing systems (hardware and software) also Figures high in the trepidations of CIOs (30%) with regard to Cloud Computing [5].
study inevitably obtains a greater efficiency, see Figure 8.

5.2. Cloud Computing Implementation
In Figure 9 cloud superintendent is composed by university representative, government representative and service provider representative, its responsibility should be the management daily operation, provides the high grade service and the high security, the formulation agreement, the coordinated all quarters' benefit and carries on sanction on the illegal user and the contrary operation.

First, user requested to the Internet transmission, and between cloud platform and Internet continuous revision key, in order to protect the platform. Simultaneously the cloud platform defines an access rule to its user, the user transmits own status to the platform, the platform basis rule production user permissions statement.

6. University Life Cycle
University Life Cycle is dedicated to a single objective to provide the best possible solution for management of University.

Responsibilities carried out by University Life Cycle are as follows,

- Management Information system.
- Examination Management
- Payroll Management System.
- Stores & Inventory Management.
- Strong Security Administration.
- Admission Process
- Library Management.
- Unique Time Table Management.
- Hostel Management.
- Transport Management with Bus Stops and timings for the bus to pickup and Drop.
- Comprehensive Building setup system.
- Allotment of rooms to the students.
- General SMS & Email to students & staff.
7. Using Cloud in University
The aim is to develop a Private Cloud Environment as shown in Figure 11 which would eventually host all the University Department's Computing. It will allow the entire Department for greater information and resource sharing and promote more standardization and consolidation in the University IT resources.

![University Cloud Diagram]

Figure 11: University Cloud

By Consolidating all University IT under a single cloud infrastructure will not only help in reducing cost and operational benefits but more "green" environmentally IT Operations. Every day that goes by, research and educational needs of universities’ change with developing technology. All the software and hardware of universities’ must be renewed in accordance with the changes. For example, there are office applications, programming language, and multimedia developing courses in Computer Education & Instructional Technology department of education faculty. Also every year, the new versions of applications were used for courses with respect to the needs of industry. As a natural result of this progress, new software cause new hardware costs. Students frequently use both the software and development platforms during the training. The large majority of university budgets are devoted to meet these needs. In addition, students and researchers do not study together and don’t use potential of collaboration-based research due to the varied location of university campuses. However, the issues such as setup, configure, and transport the new software tools would cause to loss of the researchers’ workforce, and researchers don’t focus their basic tasks. There is a new IT approaches for managing effectively the technological needs of universities such as delivery of software, providing of development platform, storage of data, and computing. Cloud Computing can be said as a new approach to solution for all the problems mentioned. Students will have access to all software anytime, anywhere and any technological devices connected internet by suggested cloud structure. Also, students will have access to development platform, and develop their applications, and store on university infrastructure. In this way, lecturers will focus their basic tasks and not lose their workforce. With suggested cloud structure, universities can open their technology infrastructures to businesses and industries for research advancements and develop university-industry collaboration.

The advantages of the University Cloud are studied in the non functional, economic and technological areas.

7.1. Non- Functional Aspects
- **Elasticity**
  It is an essential core feature of cloud systems and circumscribes the capability of the underlying infrastructure to adapt to changes potentially non functional requirements like size of data supported by an application, number of concurrent users etc.
- **Reliability**
  Reliability denotes the capability the capability to ensure constant operation of the system without disruption. It is considered as main features to exploit cloud capabilities.
- **Quality of Service**
  Quality of service support is a relevant capability that is essential in many cases where specific requirements have to be met by the outsourced services and /or resources.
- **Availability**
  With increasing concurrent access, availability is particularly achieved through replication of data/ services and distributing them across different resources to achieve load-balancing

7.2. Economic Aspects
- **Cost Reduction**
  Cloud system can adapt to changing consumer behaviour and reduce cost for infrastructure
maintenance and acquisition. Upfront cost to run the system on the cloud is very lower.

- **Pay Per Use**
  Pay per use strongly relates to quality of service support, where specific requirements to be met by the system and hence to be paid for can be specified.

- **Improved Time To Market**
  Universities can focus on meeting their objectives instead of spending time on infrastructure which is not their core competency.

- **Going Green**
  Clouds principally allow reducing the consumption of unused resources (down-scaling). Users of cloud computing are more likely to significantly reduce the carbon footprint.

### 7.3. Technical Aspects

- **Ease of Use**
  Through hiding the complexity of the infrastructure (including management, configuration etc.) Cloud can make it easier for the user to develop new applications, as well as reduces the overhead for controlling the system.

- **Location Independence**
  Services can be accessed independent of the physical location of the user and the resource.

- **Multi-tenancy**
  It is a highly essential issue in cloud systems, where the location of code and / or data is principally unknown and the same resource may be assigned to multiple users (potentially at the same time).

- **Data Management**
  As size of data may change at any time, data management addresses both horizontal and vertical aspects of scalability. User need not worry about the database backups.

- **Programming Enhancement**
  Developers can focus on the business instead of worrying about issues like scalability.

### 8. SQL Injection Proof SaaS

With improved performance of database server's most of the web applications use RDBMS (Relational Database management Systems). And the web applications allow its valid users to either store/edit/view the data stored in RDBMS through the interface coded by the application programmers. Traditionally programmers have been trained in terms of writing code to implement the intended functionality but they are not aware of the security aspects in many ways. Thus now we have insecure interface to the most valuable data stored in RDBMS because of the vulnerability in the web application called 'SQL Injection'.

This paper focuses on educating the security professionals with the risks associated with this situation and tries to give brief understanding of various kinds of attacks that attacker ay launch and outline of various strategies that can be evaluated and adopted to protect the valuable information assets.

Like other web-based systems, cloud applications are prone to most of the common web attacks ranging from: Cross-Site Scripting (XSS), Injection Flaws, Information Leakage and Improper Error Handling, Broken Authentication and Session Management, Failure to Restrict URL Access, Improper Data Validation, Insecure Communications, and Malicious File Execution. While most of these are common vulnerabilities found in web applications, a SQL Injection is one of the highest possibilities in a SaaS application.

SQL injection is an attack technique which can be used by the attacker to exploit the web application; as a result the attacker may gain unauthorized access to a database or to retrieve information directly from the database. Attacker can exploit SQL injection vulnerabilities remotely without any database or application authentication. SQL injection attacks are straightforward in nature – an attacker just passes malicious string as an input to an application for stealing confidential information [7]. Techniques to averting SQL Injection (SQLI) are as follows,

#### 8.1. Validate Input

The vast majority of SQL Injection checks can be prevented by properly validating user input for both type and format.

#### 8.2. Parameterized Queries

SQL Injection arises from an attacker's manipulation of query data to modify query logic. The best method of preventing SQL Injection attacks is thereby to separate the logic of a query from its data. This will prevent commands inserted from user input from being executed.
8.3. Proposed Design of SQL Injection
In this security model only store procedure can access database information. So that the Database architecture is free from public interactions, which simply not only hide database architecture from hacker but also provide complete protection against the SQL Injection. If hackers don’t know the Database architecture they are not able to access the Database information through SQL Injection.

![Diagram of Proposed Model of Security against the SQL Injection](image)

8.4. Encrypt Data
Never store data in plain text format. Rather, encrypt data, and at least salt and hash passwords, so that if attackers do manage to dump your database, they’ll extract fewer pieces of high-value information.

8.5. Distrust Users
"All input is evil." That’s one essential Web application security mantra, according to Microsoft. What it means is that in an ideal scenario, Web application developers would only allow the inputs that they expect to receive, and would block all others.

9. Conclusion
Cloud Computing can really help in reducing the huge spending on IT infrastructure. The Market analysis of Cloud Computing clearly gives the idea that it will bring a great change in IT Infrastructure Management in the years to come. The cloud computing market will rise from $40.7 billion this year to more than $241 billion in 2020, with a year-to-year growth of over 20 percent. Especially, in India the Enterprise Cloud penetration will surge to 46% by 2016. Education Sector contains 4% of total Cloud Computing Market.

Cloud Computing can dramatically improve the quality of Education for all students in the University. Use of Cloud Computing in universities has many benefits such as accessing the file storages, e-mails, databases, educational resources, research applications and tools anywhere for faculty, administrators, staff, students and other users in university, on demand. Furthermore, cloud computing reduces universities’ IT complexity and cost. The Universities will be situated in a place but can be virtually accessed using Cloud services.

Security is the main concern of Cloud Computing. Cloud applications are prone to most of the Common web attacks and a SQL Injection is one of the highest possibilities in a SaaS application. SQL Injection attacks can be avoided using the proposed design.

10. References