BENEFITS OF CLOUD COMPUTING AND SOFTWARE TESTING CHALLENGES

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ABSTRACT

Today Software companies needs fast, secure and scalable IT infrastructure, in order to catch up with their ever growing needs of business. But, the challenge lies in setting up this setup in their own premises. The Software Companies have to spend huge amount of money towards the growing needs of the IT infrastructure, personnel and the expertise to manage. As a result the focus will be shifted from their core business towards handling this burden. Here comes the Cloud computing, a solution which helps organizations to focus on their core business rather than worrying about the investment and maintenance of their IT infrastructure. Software testing plays an importance role to minimize the risk of failure of any developed application. Software testing requires some platforms through which the cycle of the testing get complete. These platforms or setup or we can say environment involves a big amount of cost of whole testing. This paper focuses on the challenges faced by companies in moving to a cloud environment, with respect to security, reliability, and manageability, which the organizations should focus on only through rigorous testing. The paper starts explaining the benefits of cloud computing and move towards the testing challenges faced by testers.

Keywords: Software Testing, Cloud Computing, Cloud Testing, Testing Challenges.

INTRODUCTION

In very simple definition provided by Wikipedia, Cloud computing is Internet-based computing, whereby shared resources, software, and information are provided to computers and other devices on demand, like the electricity grid. The cloud is often characterized by self-service interfaces that let customers acquire resources when needed and as long as they are needed. Cloud is also the concept behind an approach to building IT services that takes advantage of the growing power of servers and virtualization technologies.

In recent 10 years, Internet has been developing very quickly. The cost of storage, the power consumed by computer and hardware is increasing. The storage space in data center can’t meet our needs and the system and service of original internet can’t solve above questions, so we need new solutions. At the same time, large enterprises have to study data source fully to support its business. The collection and analysis must be built on a new platform. Why we need cloud computing? It is to utilize the vacant resources of computer, increase the economic efficiency through improving utilization rate, and decrease the equipment energy consumption [1].

A recent study has shown that 66% of the surveyed companies will be considering Cloud Based solutions for the future. Also 63% in Financial Services, 62% in Manufacturing are currently using Cloud based solutions. Majority of the companies surveyed has provided that they now have a streamlined administration, Increased agility/scalability, Sustainability, better performance, improved security, control of data and last but not the least lower costs [2].
The resources of the cloud, while owned and maintained by a Cloud Service Provider (CSP), are often borrowed by the enterprise. There are three acknowledged types of service offerings:

- **Software-as-a-Service (SaaS)** – This kind of cloud computing transfer programs to millions of users through browser. In the user’s views, this can save some cost on servers and software. In the provider’s views, they only need to maintain one program, this can also save cost. Examples include Salesforce.com, Google Apps, SAP, Taleo, WebEx, and Facebook. These are full-service applications accessed from anywhere on the Internet. These services are implemented through the use of distributed data centers.

- **Platform-as-a-Service (PaaS)** – Platform as a service, another SaaS, this kind of cloud computing providing development environment as a service. We can use the middleman’s equipment to develop our own program and transfer it to the users through internet and servers. Examples include Windows Azure, Google AppEngine, Force.com, Heroku, and Sun/Oracle [3]. These are distributed development platforms used to create applications, web pages, and services that run in cloud environments.

- **Infrastructure-as-a-Service (IaaS)** – as offered by VMware, Citrix, Dell, HP, IBM, Cisco, F5, Juniper, and others. These companies offer the building blocks of cloud services that are available through a number of cloud hosting services such as Amazon’s Elastic Computing Cloud (EC2). They include a virtualization layer, database, web, and application servers, firewalls, server load balancers, WAN optimizers, routers, and switches.

Software testing is a process used to check and comment on the, completeness, correctness, and quality of developed computer software. It includes a set of activities conducted with the intent of finding errors in software so that it could be corrected before the product is released to the end users [1]. Software testing can be classified into two types in terms of operation basis:

- Functional testing and
- Non-functional testing
Functional testing is the type in which we check or test the functionality of the software. It refers to activities that verify a specific action or function of the code. Functional testing tends to check that particular feature should work properly as per given requirement. We can perform functional testing at Requirement basis and business Process basis. In Requirement basis type of testing the requirements are prioritized depending on the risk criteria and accordingly the tests are prioritized. The business Process basis functional testing performed against the business requirement of the software given by the client.

Non-functional testing is the type in which we check the features other than functional testing. Non-functional testing involves testing the product’s quality factors. Non-functional testing is concerned with the non-functional requirements and is designed to evaluate the readiness of a system according to several criteria not covered by functional testing. It enables the measurement and comparison of the testing of non-functional attributes of software systems. Non-functional testing is also performed at all levels like functional testing [3].

![Functional and Non-Functional Testing](image)

**Figure – 2: Functional and Non-Functional Testing**

**BENEFITS, LIMITATIONS AND CHALLENGES OF CLOUD**

We need to analyze before judging the perceptibility of cloud, many of the computing variables are available in market, why then Cloud has niche market hold. In business and technical terms below are few pointers suggesting the benefits, the limitations and the challenges faced by the Cloud computing. Ironically the benefits or the strengths are also mentioned as weaknesses somewhere but they are relative to the facilities provided by the vendors and the infrastructure in support.

Adequate availability of Services makes organizations suspicious of the Cloud computing. Ironically existing products in the market for cloud computing are quite reliable and have set high standards today [2]. In the Berkeley View of Cloud Computing Google Search is effectively the dial tone of the Internet. If people went to Google for search and it was not available, they would think the Internet was down. Users expect similar availability from new services, which is hard to do [3].
While many companies are approaching cloud computing with cautious optimism, testing appears to be one area where they are willing to be more adventurous. There are several factors that account for this openness toward testing in the cloud:

- **Testing is a periodic activity and requires new environments to be set up for each project.** Test labs in companies typically sit idle for longer periods, consuming capital, power and space. Approximately 50% to 70% of the technology infrastructure earmarked for testing is underutilized, according to both anecdotal and published reports.

- **Testing is considered an important but non-business-critical activity.** Moving testing to the cloud is seen as a safe bet because it doesn’t include sensitive corporate data and has minimal impact on the organization’s business-as-usual activities.

- **Applications are increasingly becoming dynamic, complex, distributed and component-based, creating a multiplicity of new challenges for testing teams.** For instance, mobile and Web applications must be tested for multiple operating systems and updates, multiple browser platforms and versions, different types of hardware and a large number of concurrent users to understand their performance in real-time. The conventional approach of manually creating in-house testing environments that fully mirror these complexities and multiplicities consumes huge capital and resources.

Cloud’s on-demand provisioning addresses these issues with one click. Moreover, the effort and resources saved in the development and testing area can be redeployed for core business pursuits. Recent research from Fujitsu (see Figure-3) suggests that testing and application development rank second (57%) as the most likely workload to be put into the cloud after Websites (61%).

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**Table – 1: Benefits Vs Limitations Vs Challenges of Cloud Computing**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Limitations</th>
<th>Challenges</th>
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<tbody>
<tr>
<td>• Speed to Value</td>
<td>• Availability of a Service</td>
<td>• Data Governance</td>
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<tr>
<td>• Flexibility</td>
<td>• Data Lock-In</td>
<td>• Manageability</td>
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<tr>
<td>• Cost Reduction</td>
<td>• Data Confidentiality and Auditability</td>
<td>• Reliability and Availability</td>
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<td>• CapEx Avoidance</td>
<td>• Data Transfer Bottlenecks</td>
<td>• Virtualization Security</td>
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<tr>
<td>• Greener IT</td>
<td>• Performance Unpredictability</td>
<td>• Monitoring</td>
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<tr>
<td>• Highly Automated</td>
<td>• Scalable Storage</td>
<td>• Latency</td>
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<tr>
<td>• More Mobility</td>
<td>• Bugs in Large-Scale Distributed Systems</td>
<td>• Connectivity</td>
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<tr>
<td>• Allows IT to Shift Focus</td>
<td>• Scaling Quickly</td>
<td>• Regulatory compliance</td>
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<tr>
<td>• Scalability</td>
<td>• Reputation Fate Sharing</td>
<td>• Privacy, Legal</td>
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<tr>
<td>• Easy Implementation</td>
<td>• Software Licensing</td>
<td>• Open source, Open standards</td>
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<td>• Sustainability and siting</td>
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**SOFTWARE TESTING AND THE CLOUD**

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OPERATIONAL CHALLENGES

Despite the bright upside, cloud-based testing has its limitations, too. Organizations must contend with a different set of challenges in their quest to reap cloud’s benefits [2].

- **Lack of standards:** Presently, there are no universal/standard solutions to integrate public cloud resources with user companies’ internal data center resources. Public cloud providers have their own architecture, operating models and pricing mechanisms and offer very little interoperability. This poses a big challenge for companies when they need to switch vendors [3].

- **Security in the public cloud:** Security in the public cloud is still a major concern, and encryption techniques currently available today are considered insufficient. Procedures are being developed to improve security and performance in the public cloud. For instance, service providers are developing virtual private clouds and client partitions. The main cause for concern is that the data may be stored in a remote location beyond an organization’s legal and regulatory jurisdiction.

- **SLAs:** Terms and conditions of cloud service are sometimes hard to understand, misleading and biased toward the vendor. Such areas include clauses governing data integrity, data preservation, data location and transfer, according to a study by The Center for Commercial Law Studies at Queen Mary, University of London 2010. Companies would do well to be diligent and proactive in sorting through these issues with their vendors.

- **Infrastructure:** Some cloud providers offer only limited types of configurations, technology, servers and storage, networking and bandwidth, making it difficult to create real-time test environments.

- **Usage:** Improper usage of cloud-based test environments can increase costs. Even though some vendors offer pay-as-you-go cloud based testing services, this approach can be expensive or out of sync with requirements, particularly if user estimates are too conservative or wildly overblown. Companies that apply pay-as-they-go approaches must first perfect their cost models or apply process-driven estimates rather than utilizing projections that are unsupported by data [3].

- **Planning:** Testing teams should rigorously plan their test environments, from utilization periods through disassembly. They should also be aware of the associated expenses, such as cost of encrypting data, before putting testing in a cloud environment, since these requirements will consume additional CPU and memory. It’s important to monitor utilization of cloud resources to avoid over-usage and over-payment.

- **Performance:** As public clouds are shared by numerous users, there may be cases where a company might have to wait for the required bandwidth. There may also be cases where a service provider may
suddenly announce disruption of service due to a maintenance window or network outage. Some of these issues can be resolved by working closely and proactively with the service provider.

CONCLUSION

Cloud Applications for business are still in their early stages. The benefits are already realized by many IT majors worldwide thanks to cloud providers like Amazon [5], Netmagic and others who are offering public as well as private cloud [6] and its impact cannot be ignored by businesses striving to overcome the constraints of their current IT hardware whilst struggling to justify the cost of investing in major upgrades. Testing of cloud components and systems requires a variety of techniques – some standard and some new. The very thing that makes cloud computing so attractive, virtualization, poses an interesting challenge for network and application testing. Virtualization of the test tools themselves provides the key to testing the cloud.

Only a few advantages and a few testing challenges of the cloud computing solutions have been identified in this paper. In future, as we are getting more matured architecture for cloud computing, and more and more testing on the cloud applications there is every possibility of more testing challenges which can be explored by researchers.

REFERENCES


