STUDY OF VARIOUS TECHNIQUES AND CHALLENGES OF CLOUD TESTING

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ABSTRACT

Cloud computing is the next stage of Internet evolution. To successfully provide cloud services and sharing of resources, the cloud must be tested before came into service. Cloud testing refers to testing of resources such as hardware, software, etc. that are available on demand. Cloud testing typically involves monitoring and reporting on real-world user traffic conditions as well as load balance and stress testing for a range of simulated usage conditions. In this article, a detailed study of various techniques and challenges of cloud testing has been carried out. The objective of this paper is to provide better understanding of cloud testing techniques and its challenges in the cloud computing environment.

Keywords- Cloud Computing, Cloud Testing Techniques, SOASTA Cloud Test, Service Level Agreements (SLAs).

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INTRODUCTION

CLOUD COMPUTING

Cloud computing refers to the delivery of computing resources over the Internet. Instead of keeping data on your own hard drive or updating applications for your needs, you use a service over the Internet, at another location, to store your information or use its applications.

Cloud Computing to put it simply, means "Internet Computing." The Internet is commonly visualized as clouds. Hence the term "Cloud Computing" for computation done through the Internet. With Cloud Computing user can access database resources via the Internet from anywhere, for as long as they need, without worrying about any maintenance or management of actual resources. Besides, databases in cloud are very dynamic and scalable.
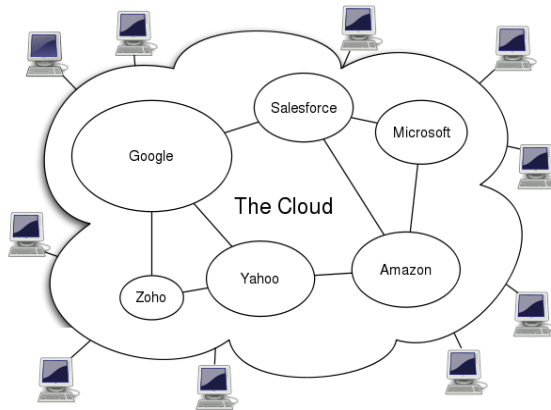

Fig. 1- Cloud Computing

Some examples are:

A. Google — It has a private cloud that offers online productivity software including email access, document applications, text translations, maps, social networking etc.

B. Microsoft — It provides online service that allows the tools which are required for business purpose are moved into the cloud, and Microsoft currently makes its office applications available in a cloud which includes online storage, file sharing, website design and hosting..

C. Salesforce.com — It allows us to deliver revolutionary customer service from anywhere, anytime on any device.

DEFINITION

"Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and

services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models."

WHY CLOUD COMPUTING?

1. ***Explosive growth in applications:*** Web 2.0 social networking, YouTube, Facebook, biomedical informatics, space exploration, and business analytics

2. ***Extreme scale content generation:*** e-science and e-business data deluge

3. ***Extraordinary rate of digital content consumption:*** digital gluttony: Apple iPhone, iPad, Amazon Kindle

4. ***Exponential growth in compute capabilities:*** multi-core, storage, bandwidth, virtual machines (virtualization)

5. ***Very short cycle of obsolescence in technologies:*** Windows Vista to Windows 7; Java versions; C to C#; Python

6. ***Newer architectures:*** web services, persistence models, distributed file systems/repositories (Google, Hadoop), multi-core, wireless and mobile [1].

CLOUD TESTING

Cloud testing is a subset of software testing is used to test cloud-based Web applications. Cloud testing also verifies and validates specific cloud functions, including redundancy and performance scalability.

Cloud computing poses some challenges, such as manageability, reliability and security. Generally, organizations document a test strategy prior to actual cloud testing.

Key cloud testing elements include:

1. Identifying relevant testing types

2. Understanding cloud characteristics and conducting a risk/challenge analysis

3. Setting up a cloud testing environment

4. Simulating real-world challenges by selecting the right testing strategy

CLOUD TESTING BENEFITS

i. ***Location independent access*** – The use of thin clients or virtualization significantly reduces hardware requirements, making it possible to test the services anywhere.

2. ***Reduced cost of ownership*** – Using service provided by existing Cloud deployments removes the need to install and support hardware. The use of Cloud solutions makes it possible to centralize all IT components. Any maintenance steps will need to be executed only once, centrally, and they will be mirrored on all end user instances.

i. ***Green IT*** – The reduced requirement for hardware, implementations and location dependence enables businesses to reduce the carbon footprint of its IT infrastructure.

Why is Cloud Testing Important?

Comparing with current software testing, cloud-based testing has several unique advantages listed below.

1. Reduce costs by leveraging with computing resources in clouds – This refers to effectively using virtualized resources and shared cloud infrastructure to eliminate required computer resources and licensed software costs in a test laboratory.

2. Take the advantage of on-demand test services (by a third-party) to conduct large-scale and effective real-time online validation for internet based software in clouds.

3. Easily leverage scalable cloud system infrastructure to test and evaluate system (SaaS/ Cloud/Application) performance and scalability.

4. Reduce its capital and licensing expenses.

5. Reduce operating and labour costs.

6. Shorten its development and testing setup time.

7. Improve product quality and reduce the detected defects [2].

Types of Testing-There are basic Three types of testing.

1. **Functional Testing –** Functional testing has to be performed to make sure that offering provides the services that the user is paying for. Functional tests ensure that the business requirements are being met.

1. *System Verification Testing –* This makes sure that the various modules function correctly with one another, thus making sure that their behavior is as expected.

2. *User Acceptance Testing -* Testing is done to verify the current provided cloud solution from the vendor meets the business needs of the organization.

3. *Interoperability Testing* – Verify moving application from one cloud to alternate cloud provider should have the flexibility to run successfully. Basically there should not be any issue if business/user is migrating from one infrastructure to another one.

2. **Non-Functional Testing –** These tests mainly focus on the web application based tests ensuring that they meet the desired requirements.

1. *Availability Testing-* Cloud offering should be available 24*7 for the enterprise or end user. It's the key responsibilities of the provider to maintain as per Service Level Agreements (SLAs).

2. *Security Testing-* Ensure that all sensitive and important information which are going to be stored in the cloud will be highly secure in nature. As privacy also a key area in cloud from the user point of view, its important to verify the privacy of the application users and associated information when maintained in cloud.

3. *Performance Testing-* Testing technique that measures the system performances in cloud- Verify the network latency and response time. Load balancing, peak request count by hosting subscription in different data centres across the globe. Adding to these, traditional load and stress testing are required to validate business scenarios in the cloud model in terms of varying dynamic load and stress on the application.

4. *Disaster Recovery Testing* – Verify that the time its takes to recover from disaster in different scenario as per SLA. Also verify is there any data loss in this process and time takes to report failure.

5. *Multi tenancy Testing-* The concept of multi tenancy is to provide solution/offering from a single instance to multiple tenants. Cloud offering should be validated when more than one client is using the same instance in terms of security and Data.

6. *Scalability Testing -* **Test** to make sure that offering has the capability to provide scale up or scale down facilities as per the need [3].

DIFFERENT TYPES OF CLOUD TESTING WITH THEIR AIM[4].

S.N.	Types of Testing	Aim

1	**System Integration Testing & User Acceptance Testing**	To ensure the developed cloud solution meets the functional requirements.
2	**Interoperability Testing & Compatibility Testing**	To ensure meeting the business requirements specific to cloud computing
3	**Performance Testing & Load Testing**	To ensure meeting the business requirements specific to cloud computing
4	**Stress Testing & Recovery Testing**	To ensure data recovery from crashes, hardware failures in a cloud environment.
5	**Security Testing**	To ensure meeting the Application/Data security requirement.

Table 1: Cloud Testing Techniques and their Aim

FACTS OF CLOUD TESTING

1. **Testing a SaaZS or non-SaaS in a cloud-** It makes sure the quality of a SaaS or non-SaaS based on its non-functional and functional service requirements. Also, this includes testing at different test such as security testing.

2. **Testing Within a Cloud –** It surveys the quality of a cloud based on cloud capabilities and the internal infrastructures of a cloud. This type of testing is done on all models of cloud i.e. private, public and hybrid clouds. Since only cloud vendors have access to internal infrastructure, they can do this kind of testing.

3. **Testing of a cloud –** Cloud environments should be tested. Also to support delivery of services, cloud environments availability, performance, scalability and security should be measured.

4. **Testing over clouds –** This type of test is performed by application providers. It tests service application over clouds i.e. private, public, and hybrid clouds based on application service requirements.

Cloud Testing Tools – Different tools used in various kinds testing performed in cloud are mentioned.

TOOLS FOR PERFORMANCE TESTING IN THE CLOUD:

1. SOASTA Cloud Test
2. LoadStorm
3. CloudTestGo
4. AppPerfect
5. Jmeter
6. Cloudslueth
7. CloudTestGo
8. AppPerfect

Cloud Security Testing Tools :

1. Nessus
2. Wireshark
3. Nmap

Cloud Testing Challenges

Challenge Category	Challenges
Service Challenge	• Service Availability • Service Assurance • Service Efficiency
Security Challenge	• Confidential Data Security • Meeting Security Requirements

Layered Testing Challenge	- Three layers testing Protocol - Communication between Layers
Lack of Universal Standard and Infrastructure	- Limited Technology configuration - Limited Servers and Storage Infrastructure - Networks interconnectivity - Virtualization level
Guidance, Knowledge and Staff Expertise	- Obtaining Guidance - Expertise Teaching Staff - Acquiring Direct Knowledge
Procuring Cloud Service on-Demand Basis	- Define Specific Quantity and Costs - Dependency on Remote Installed Applications - Increasing Expenditure on Encrypted Data
Other's Challenges	- Planning of Test Environment - Ensuring Data Portability - Proper Utilization of Cloud Resources

Table 2: Challenges in Cloud Testing

1. **Privacy**:-A privacy issue is a very difficult job and necessary to achieve in cloud environment as data may be moved to data center's which are located in many different countries and locations So an approach must be developed by customers and service providers to ensure the data is collected, stored, Accessed and managed in conformity of applicable privacy laws.

2. **Security Issues: -** Security in cloud testing is the most important issues. Fundamentally the nature of cloud computing means the data of one consumer is often stored alongside

the data of another. To some extent that challenge is being met through encryption, which is often used to segregate data-at-rest, but this is not a cure-all and a thorough evaluation of the encryption systems used should always be undertaken.

3. **Reliability, Availability, Scalability and Performance testing**:-Although many published papers discuss system performance testing and scalability evaluation in the past two decades, most of them address issues and solutions in conventional distributed software or web-based software systems. According to the recent literature survey on this subject, most existing papers focus on scalability evaluation metrics and frameworks for parallel and distributed systems [5].

KEYS TO SUCCESSFUL TESTING

1. Understanding the platform provider's elasticity model / dynamic configuration method.
2. Staying abreast of provider's evolving monitoring services and Service Level Agreements (SLAs).
3. Potentially engaging the service provider as an on-going operations partner if producing commercial off-the-shelf (COTS) Software.
4. Being willing to be used as a case study by the cloud service provider. The latter may lead to cost reductions.

CONCLUSION

Cloud Computing has today become one of those "big bangs" in the industry. Most organizations are now leaning to adopting the cloud because of its **flexibility, scalability and reduced costs**. Using the testing is immensely helping organizations to acquire the required tools, software licenses, infrastructures at a very low cost without having to set it up themselves and then worry about its maximum utilization. This paper has give the better understanding of cloud computing and Cloud testing techniques, testing benefits, Why cloud testing important, different types of testing and their aim and cloud testing challenges.

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