

REVIEW OF CLOUD TESTING, TYPES, CHALLENGES AND FUTURE SCOPE

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ABSTRACT

Cloud Computing is currently the new way of using Computing Resources likewise Computers, Data Bases, Infrastructure etc. Cloud computing also changes the way of organizing and maintain the Computing Services and Technologies. It also enables the Infrastructure to be treated as Services. These Cloud services improves scalability, reliability and agility. Cloud testing means testing the cloud based applications that use Hardware, Software and Infrastructure for making the test cases. By using Cloud Computing solutions for testing, organizations can reduce their delivery time, development cost without negative impact for time critical applications. Cloud testing is also on demand service. The main challenge is the initial setup cost of migration testing which is very high. So, modification cannot be done easily. Cloud testing is vulnerable to the security issues and test results may not be accurate due to different performance on different systems provided over the internet.

Keywords: cloud computing, cloud testing, testing cloud services, Cloud Testing Challenges

I. INTRODUCTION

Cloud computing received significant attention recently as it changes the way computation and services to customers, For example, it changes the way of providing and managing computing resources, such as CPUs, databases, and storage systems. Today, leading players, such as Amazon, Google, IBM, Microsoft, Dropbox and Salesforce.com offer their cloud infrastructure for services.

Cloud Computing comes as a great deal of relief to businesses with lots of benefits. Some can be of immediate and some can be of long time, from reductions in cost of without the ownership to location independence. But it is not possible to enjoy these benefits without the expense of anything so here comes a few concerns; Security, privacy, availability, performance and integrity. Appropriate testing must be at the top priority of any Cloud solution to ensure the delivery of a safe, integrated solution which guarantees the needs of the business it is indented to serve.

Cloud computing the buzzword is the single largest trend in computing infrastructure today. It is a much more generalized term in which little or no centralized infrastructure exists. Sets of loosely coupled data centers work together achieving high utilization levels to perform a common task, presenting GUI interfaces to users through Virtualization or thin clients via the 'Cloud'.

II. UNDERSTANDING CLOUD TESTING

Cloud computing is the next stage of the Internet evolution. A typical cloud must have several distinct properties: elasticity and scalability, multi-tenancy, self-managed function capabilities, service billing and metering functions, connectivity interfaces and technologies. In addition, a cloud supports large scale user accesses at distributed locations over the Internet, offers on-demand application services at anytime, and provides both virtual and/or physical appliances for customers. There are three types of clouds: a) private clouds, which are internal clouds based on a private network behind a firewall; b) public clouds, which are the clouds with public accessible services over the Internet; and c) hybrid clouds, which are made of different types of clouds, including public and private clouds.

2.1 What is Cloud Testing?

According to Wikipedia, "cloud testing is a form of software testing in which Web applications that leverage Cloud computing environments ("cloud") seek to simulate real-world user traffic as a means of load testing and stress testing web sites. The ability and costs to simulate Web traffic for software testing purposes has been an inhibitor to overall Web reliability."

"Testing in the cloud leverages cloud computing environments and seeks to simulate real-world user traffic as a means of load or stress testing Web sites. (By Nivedan Prakash)

"Cloud testing is the answer to the less-than realistic performance test that originates within the infrastructure of one of our clients. When we use cloud testing, we take advantage of hardware and bandwidth that more closely mimics our observed, real world conditions. Essentially, we execute the test in cloud-based infrastructure and bandwidth." (R V Ramanan, President – Global Delivery and Chief Software Architect, Hexaware Technologies)

2.2 Why is Cloud Testing Important?

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

- 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.
- 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.

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

2.3 Forms of Cloud-Based Software Testing

There are four different forms of cloud-based software testing. Each of them has different focuses and objectives:

- Testing a SaaS in a cloud – It assures the quality of a SaaS in a cloud based on its functional and non-functional service requirements.
- Testing of a cloud – It validates the quality of a cloud from an external view based on the provided cloud specified capabilities and service features. Cloud and SaaS vendors as well as end users are interested in carrying on this type of testing.
- Testing inside a cloud - It checks the quality of a cloud from an internal view based on the internal infrastructures of a cloud and specified cloud capabilities. Only cloud vendors can perform this type of testing since they have accesses to internal infrastructures and connections between its internal SaaS(s) and automatic capabilities, security, management and monitor.
- Testing over clouds – It tests cloud-based service applications over clouds, including private, public, and hybrid clouds based on system level application service requirements and specifications. This usually is performed by the cloud-based application system providers.

III. CHALLENGES IN CLOUD TESTING

There are a number of issues and challenges in testing clouds and cloud-based software.

3.1 On-demand test environment construction

How to set up a testing environment systematically (or automatically) for on-demand testing services in a cloud? Although the current cloud technologies support automatic provision of required computing resources for each SaaS (or application) in a cloud, there are no supporting solutions to assist engineers to set up a required test environment in a cloud using a cost-effective way. It is necessary to provide an on-demand test environment for TaaS customers. To do this, TaaS vendors need to provide a systematic solution to establish a required test environment based on the user's selection. In addition, engineers also found that there is a lack of cost-effective solutions for them to easily leverage their cloud based applications (or SaaS) in a cloud with the existing test tools because most of them are not cloud-enabled.

3.2 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 our recent literature survey on this subject, most existing papers focus on scalability evaluation metrics and frameworks for parallel and distributed systems. Since these systems are set up with preconfigured system resources and infrastructures, performance testing and scalability evaluation are usually conducted in a static and pre-fixed system environment (such as a test lab.), so the existing evaluation metrics, frameworks, and solutions did not consider the special features in cloud testing, such as dynamic scalability, scalable testing environments, SLA-based requirements, and cost-models.

3.3 Testing security and measurement in clouds

Security testing has becoming a hot research subject with many open questions in current software testing community. Since security becomes a major concern inside clouds and security services become a necessary part in modern SaaS and cloud technology, engineers must deal the issues and challenges in security validation and quality assurance for SaaS and clouds.

3.4 Integration testing in clouds

Although we have seen numerous published research papers addressing software integration testing issues and strategies, not much research results have been applied in the real engineering practice. One of the major reasons is the existing software and components are developed without enabling technology and solution to support and facilitate systematic software integration. In a cloud infrastructure, engineers must deal with integration of different SaaS and applications in/over clouds in a black-box view based on their provided APIs and connectivity protocols.

3.5 Regression testing issues and challenges

Supporting on-demand software validation in clouds must address the regression testing issues and challenges caused by software changes and bug-fixing. However, most existing research in software regression testing pays most attention to re-test a specific software version in a preconfigured test environment. The multi-tenancy feature of clouds may cause the difficulty to apply the existing research work in cloud testing, specially for on-demand software regression testing service whenever software changes. In addition, we also lack of dynamic software validation methods and solutions to address the dynamic features of SaaS and clouds, for example automatic provisioned/de-provisioned features.

IV. EXISTING RESEARCH WORK

There are many published papers discussed grid-based and cloud-based software infrastructure, design, management, technologies, and standards. However, there is a very few of articles discussing cloud testing and cloud-based application testing. Although there are a number of vendors offering cloud testing services to support cloud-based applications, there is a lack of clear understanding about cloud testing in terms of concepts, issues, challenges, and needs. This section briefly reviews the published papers relating to software testing as service and cloud testing.

4.1 Cloud testing environment and tools

Liviu Ciortea et al. in [3] introduce Cloud9; a cloud based testing service that promises to make high quality testing fast, cheap, and practical. Cloud9 is the first parallel symbolic execution engine to run on large shared- clusters of computers, and its test harness uses the aggregate memory and CPU resources based on compute utilities like Amazon EC2. The paper reports their initial prototype results. In addition, some initial cloud-based test experiments are reported.

V. CONCLUSION AND FUTURE SCOPE

Cloud testing is becoming a hot research topic in cloud computing and software engineering community. As the advance of cloud technology and testing as services, more research work must be done to address the open issues and challenges in cloud testing and TaaS. More innovative testing techniques and solutions, and QoS standards are needed to support on-demand testing services in a scalable cloud infrastructure. This paper provides a comprehensive review cloud testing by discussing the related concepts, issues, and challenges. 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.

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