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Cloud Testing Tools and Its Challenges: A Comparative Study

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Abstract

Cloud computing has emerged as a new technology across organization and cooperates that impacts several different research fields, including software testing. To provide a cloud service and sharing resources successfully, the cloud must be tested before it comes into offering services. Testing the applications has their own testing tools and testing methodologies. In this paper we provide an overview regarding cloud computing trends, types, challenges, tools and the comparison of tools for cloud testing.

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Keywords: Software Testing; SOASTA; Functional Testing; Performance Testing; Service Oriented Architecture; Cloud Testing

1. Introduction

Traditional approaches to software testing have become costly in terms of effort, cost and overheads. Hence testing practices have shifted gears to strategies that would benefit the organizations in terms of business and profits. Leading companies such as IBM, Microsoft, Google, and Amazon have a vested interest in the biz word "CLOUD". As computations, storage and customer interactions have already started migrating to cloud environment, software testing is also getting migrated to Cloud. Testing new software requires costly server, storage and network devices only for a limited time. These computing resources are not used after testing, thus incurring extra cost on budget. To ensure a reliable service, providers have to test their services on all platforms.

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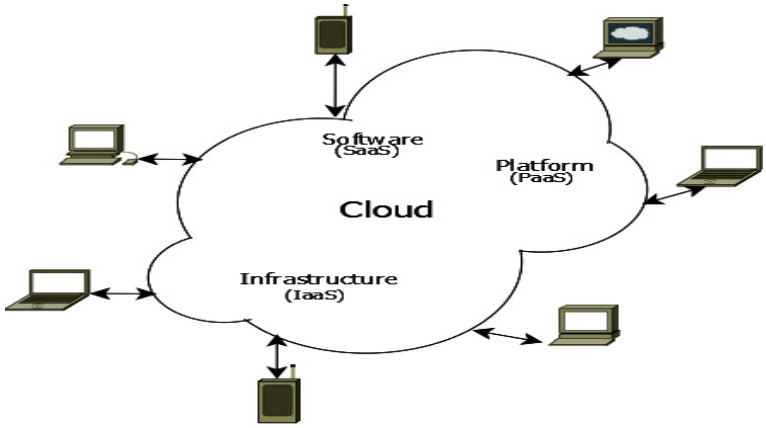

Fig.1. Types of Cloud Services

Cloud testing is a form of evaluation methodology in which the applications to be tested uses cloud as a computing environment and its infrastructure to simulate real world traffic by using existing cloud computing technologies. Cloud testing basically aligns with the concepts of cloud and Software as a service (SaaS). Cloud testing provides the ability to test cloud by using cloud infrastructure such as hardware, network bandwidth, and workload that more closely simulate real world conditions and parameters. In simple words, verification and validation of applications, environments and infrastructure.

Testing a cloud includes availability, security, performance, interoperability, disaster recovery and multitenancy testing. Cloud testing are challenged by several problems such as limited budget, meeting deadlines, High cost per test, large number of test cases, little reuse of tests and geographical distributions of users. The aim of cloud testing is to ensures high quality service delivery and avoiding data outages requires testing inside data centre or outside the data centre or in both places

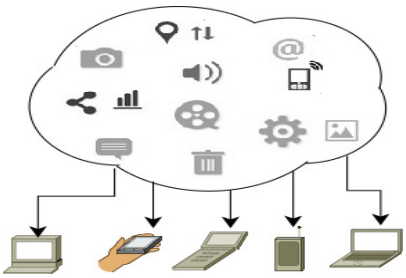

Fig.2. Cloud Testing

2. Cloud Testing Types

In this section we briefly describe various Cloud platform testing dimensions applicable in general

2.1. Elasticity and Scalability Testing

Elasticity and Scalability Testing one of the major characteristics of Cloud is its support for auto-elasticity. i.e. resource demand can be satisfied on-the-go elastically. Hence vertical and horizontal scalability need to be tested. Vertical scalability means that, replacing current resource with a more powerful resource should satisfy the increasing demand. On the other hand, horizontal scalability means that adding more resources of same type should

increase the performance of the platform as per the requirements. Similarly, resources should be provisioned in a seamless manner whenever the requirements arise. We should also test if load balancing works properly with changes in demand. Finally, elastic load testing need to be performed for various possible user scenarios. [1]

2.2. Security Testing

Cloud platforms and applications are exposed to several security vulnerabilities. One important security concern is traversal vulnerability. It means that one tenant (could be an intruder) is able to traverse from one Virtual Machine (VM) client environment to other client environments being managed by the same hypervisor. This vulnerability might allow a customer to access the virtual instances of other customer's applications. So adequate testing is required to make sure that the platform is not vulnerable to such situations. With multi-tenant environments, penetration testing is very important to simulate a malicious user and to test for all vulnerabilities such as SQL injection, Cross-Site scripting (XSS) etc. We need to test with a malicious user who has valid credentials to the Platform under test as a tenant and that user's ability to penetrate the system and view the information of other tenants. Other security areas to be tested include checking for the capability of appropriate role-based access control, identity federation management, and appropriate data management. [1]

2.3. Performance Testing

With the unique characteristics of Cloud environments, we need to perform the accuracy of various data present in the Cloud, latency and throughput. Further, elastic load testing and multi-tenant performance testing are other key items to be considered. Finally, high availability and failover testing are required to test the behavior of the platform and applications under resilience scenarios.

2.4. Live Upgrade Testing

This is closely related to understanding the performance of the system when an upgrade of the software/platform happens and to understand its capability to continue its business services to users even when the upgrade is going on. We need to make sure that business continuity is there even when software/hardware maintenance/upgrade is performed.

2.5. Stress Testing

Stress Test is used to determine ability of application to maintain a certain level of effectiveness beyond breaking point. It is essential for any application to work even under excessive stress and maintain stability. Stress testing assures this by creating peak loads using simulators. But the cost of creating such scenarios is enormous. Instead of investing capital in building on-premise testing environments, cloud testing offers an affordable and scalable alternative.

2.6. Functional Testing

Functional testing of both internet and non-internet applications can be performed using cloud testing. The process of verification against specifications or system requirements is carried out in the cloud instead of on-site software testing.

2.7. Compatibility Testing

Using cloud environment, instances of different Operating Systems can be created on demand, making compatibility testing effortless. [2]

2.8. Browser Performance

To verify application's support for various browser types and performance in each type can be accomplished with ease. Various tools enable automated website testing from the cloud.

2.9. Latency Testing

Cloud testing is utilized to measure the latency between the action and the corresponding response for any application after deploying it on cloud.

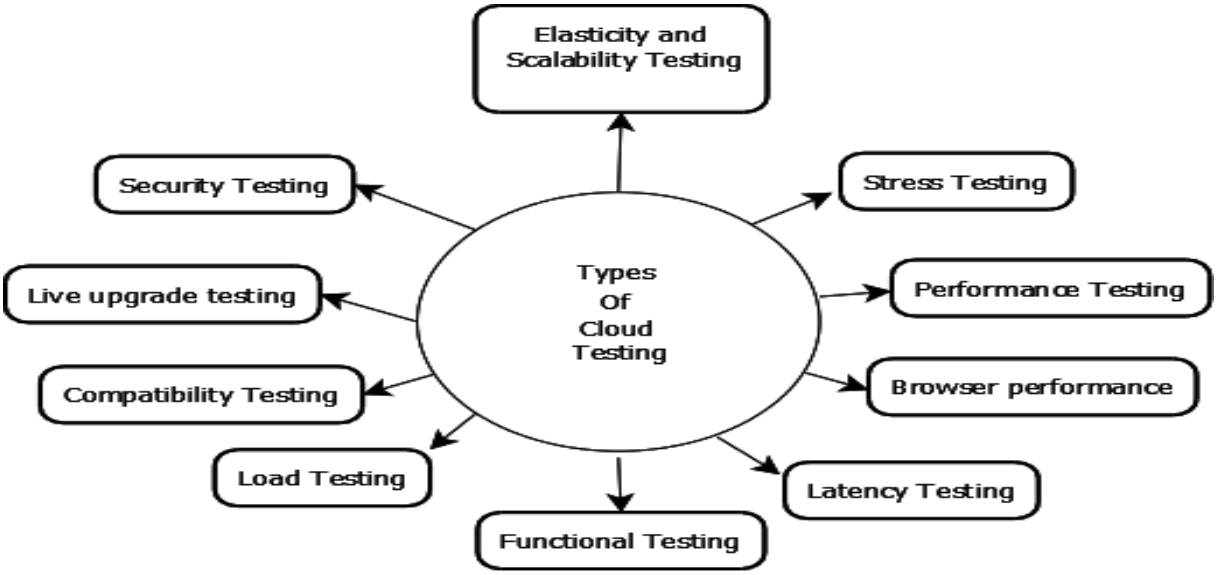

Fig.3. Types of Cloud Testing

3. Testing Tools

Various tools are available to test cloud based systems at various layers including hardware interface, platform interface, storage system and application system.

3.1. SOASTA

SOASTA is motivated by the necessity to test in production, rather than in a laboratory environment. Today's web applications usually follow agile practices with frequent builds and high change rates. Load testing with legacy tools in the laboratory can be significantly different from testing in the production environment in terms of scale, configuration, user profiles and network environment. Running tests against production websites thus can achieve higher degree of accuracy and confidence, compared with lab practices. [3] SOASTA CloudTest is a production performance testing tool for Web applications. It can simulate thousands of virtual. Public cloud infrastructure service. The worker nodes can be distributed across public and private clouds to cooperate in a large load testing. [7]

Test results from distributed test agents are integrated for analysis. Memory-based analytic techniques are implemented to handle, in real-time, the huge data produced by large-scale testing. Provisioning data are displayed via analytic dashboard on a synchronized time-line. Through an Ajax based web UI, testers can operate and supervise the whole process including launching hundreds of load generation servers, creating and running test agents geographically distributed, and analyzing test results.

3.2. ITKO LISA

ITKO's LISA product suite is designed to improve the effectiveness of application development teams, especially those involved in custom applications, SOA, and cloud computing. [6] iTKO LISA aims to provide a cloud-based environment and virtual services for composite application development, verification and validation. It claims to reduce software delivery timeline by 30% or more using its innovative approach to support continuous integration for development and testing. Central to LISA architecture is its virtualization technology. For unavailable or inaccessible resources, LISA provides virtualized services by simulating the target system's dynamic behaviour so that they can respond as live systems. In this way, it breaks Dependence constraints of system integration and supports continuous testing. [3]

3.3. Load Runner

HP LoadRunner is an automated performance and test automation product from Hewlett-Packard for application load testing: examining system behavior and performance, while generating actual load. HP acquired LoadRunner as part of its acquisition of Mercury Interactive in November 2006. A software testing tool, HP LoadRunner works by creating virtual users who take the place of real users' operating client software, such as Internet Explorer, sending requests using the HTTP protocol to IIS or Apache web servers.[10] HP LoadRunner can simulate thousands of concurrent users to put the application through the rigors of real-life user loads, while collecting information from key infrastructure components (Web servers, database servers etc.) The results can then be analyzed in detail to explore the reasons for particular behaviour. HP LoadRunner supports various protocol bundles for load testing: .NET Record/Replay, Database, DCOM, GUI Virtual Users, Java Record/Replay, Network, Oracle E-Business, Remote Access, Remote Desktop, Rich Internet Applications, SAP, SOA, Web 2.0, Web and Multimedia and Wireless.

HP LoadRunner can be run standalone geared towards one or two persons using each controller or as part of HP Performance Centre (which pools together several controllers, all load generators, adding a web site, a schedulers and more to facilitate sharing of the LoadRunner resources among many persons.[6][9]

3.4. Blitz

Blitz is a load-testing tool from the cloud to the cloud. Blitz customers tend to be application and website developers who use the service throughout the iterative build process of mobile applications, websites, and APIs Blitz provides developers with several capabilities throughout the build process [6]:

- Load testing for Web apps and APIs to test scalability
- Integration with PaaS providers, continuous integration tools, and browsers
- Scales testing up to 50,000 simultaneous virtual users on a pay-per-test model
- Cloud-based, no client to install. However, this means it is unable to test applications behind firewalls or otherwise protected from the Internet.

3.5. Blaze Meter

Blaze Meter's Load Testing Platform for Developers is designed for professional use, is equipped with a self-service, on-demand platform and advanced scripting capabilities leveraging JMeter and Selenium (Web Driver). Blaze Meter can run multiple load tests that easily simulate load of up to 1,000,000 concurrent users from both the public cloud or inside the corporate firewall, enabling its customers to quickly locate and fix performance bottlenecks.[6]

You can create proprietary test scripts and load scenarios using a graphical web environment. Blaze Meter offers web-based test management, archiving, repository, cloud-based monitoring, rich scripting language, and supports HTTP/S, web-services, XML, TCP, SQL, Login (Flash, images, streaming) and more. Blaze Meter enables you to write load test-scripts using JMeter and user-experience test-scripts using Selenium .Blaze Meter will generate a load based on the JMeter script. The Selenium script is used during the load to automate the launch of real browsers to measure the real end-user experience. The load and monitoring is using a pre-configured distributed load testing environment. The environment is ready to use and available at all times. Table1. Shows the comparison of testing tools on cloud we have discussed the pros and cons of the tools with pricing.

Tool	Pros	Cons	Pricing
Soasta	A complete environment to setup tests Add test users locations seamless A good coverage around the globe A comprehensive real-time interface to metrics Drill down analysis on web requests A Lite (Free) version is available with a limit of 100 concurrent users	Requires some setup: you have to spin up a VM to load the test environment	"CloudTest is sold based on server hours, including support. With no limits on the number of testers or software access, you select Plans based on how many test server hours you'll run. Plans are available for coverage of a few tests each month up to thousands of tests each year"
LoadStorm	Scalable up to 300,000 users A testing data centre in Sydney, Australia Supports automatic crawling (Spider) No scripting language is involved Nothing to install	Currently they only cover Virginia, California, Oregon, Ireland, Sydney, Tokyo, Singapore, Sao Paulo No built-in feature to collect server performance metrics	Monthly plans – Starting Free (100 users, 25 users per test) up to "Call Us" On-Demand (Per hour) – Starting $39 (1,000 users per test) to "Call" (10,000+ users
Blitz	Capacity planning tools, Optimization, Performance monitoring are out-of-the-box Nothing to install/setup, all cloud-based Simulate up to 5,000 concurrent virtual users It has a chrome/Firefox plugin to monitor app performance on develop environment Integrated with Google Analytics Performance Monitoring Alerts (Email, Twitter, SMS, Pager Duty)	Only 8 test locations around the globe (Australia, Brazil, California Ireland, Japan, Oregon, Singapore, Virginia) Relatively less sophisticated interface (compared to Soasta)	Works with "Credits" 1 credit = 1 minute and 1,000 users credits = $40 credits = $135 300 Credits = $240
Blaze Meter	JMeter compliant Easy to use test creation interface Nice interface for test results You can export test results Compare two test runs Has a server in Australia (yes, we're load-testing apps in Oz) Test scheduling Integrated with Google Analytics VPN is supported Chrome extension to record JMeter	Available only in limited geographical areas, cover's(Brazil, Tokyo, Oregon and Virginia USA, Singapore, California, Australia and Ireland)	Monthly plans – Starting $199 (1,000 users, 20 hours) up to "Call Us" On-Demand (Per hour) – Starting $19 (1,000 users, 1 server) to $299 (40,000 users, 40 servers)

	scripts and upload it to BlazeMeter It has a free version that can simulate up to 50 concurrent users		

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[3]http://loadstorm.com/load-testing-cost/
[4]https://www.blitz.io/pricing#/subscriptions
[5] http://blazemeter.com/pricing

Table1. Comparison of Testing Tools

4. Testing Challenges

4.1. Constructing Environment For On Demand Testing

For an on demand testing service, what are the steps to be taken to create a testing environment which is systematic or automatic? Even though the present technologies in cloud support instinctive delivery of needed computing resources for every Software as a Service (SaaS) or for an application in the cloud, for setting up the needed test domain in a cloud there are no carrying solutions to assist engineers using a beneficial way. [5]

4.2. Testing Security Measures

In present software testing society security testing is been converting to a profound topic with lot of open queries. Meanwhile security turn into a most important requirement within the clouds and security services converted into a compulsory measure in present Software as a Service (SaaS) and cloud technology, the problems and challenges in security validation and quality assurance for SaaS and clouds need to be accord by the engineers .[5]

4.3. Integration Testing

Even though we saw various research articles describing software integration testing problems and schemes, not plentiful research outcomes are been put in in the real engineering system. The main causes is the present software and mechanisms are created without permitting technology and solution to help and assist organized software integration. In a cloud organization, engineers needed to be deal with combination of various SaaS and applications inside and outside clouds in a black-box sight depending on the offered APIs and connectivity protocols.

4.4. Regression Testing

The regression testing problems and challenges caused by software modifications and bug-fixing must be addressed the by on-demand software validation in clouds. Yet, maximum current exploration in software regression testing grants most consideration to re-test a particular software version in a preconfigured test environment. The multi-tenancy characteristic of clouds might origin the trouble to put on the present explorated work in cloud testing, particularly for on-demand software regression testing service each and every time software is modified.[5] In further, we also lack of dynamic software validation methods and solutions to address the dynamic features of SaaS and clouds

Conclusion

In upcoming years cloud computing is emerging in IT industry the real opportunity to cut cost of test environment in public private and hybrid environments or community clouds lies in both their management and maintenance before deploying the cloud its essential that cloud application is thoroughly tested. In this paper we

have discussed different cloud testing techniques and commercial tools available in the market. Though we are in starting stage of cloud testing we have identified some of the challenges through the analysis based on research papers. Based on the challenges we are planning to build a new testing framework in future to test a cloud.

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