

Taking Software Testing to the Cloud-Benefits and Guidelines

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Abstract: Software testing is always a challenging activity for tester due to the rapid changing technology and testing methodology such as big data, mobile platform, agility, automation testing tools, internet of things and cloud computing. Cloud computing has been gaining momentum and popularity over this past few years and it impacts several different research areas which include software testing. As it continues to mature, cloud computing has opened up new opportunity and changes the way of how the software is tested. Many organizations started to invest heavily in this technology as they gain confidence and trust, knowing that cloud computing will bring more rewards to the organization. Hence, there is no doubt that testing in the cloud will become the new trend and might overtake conventional testing in the future. In this study, we will address the benefits of testing in the cloud and guidelines on how to leverage the cloud in software testing more effectively.

Key words: Software testing, cloud computing, testing in the cloud, conventional testing, organizations, momentum

INTRODUCTION

According to NIST (Mell and Grance, 2011), definition of cloud computing is the utilization of a network of remote servers hosted in the internet to access a shared pool of resources such as storage, servers, applications, services and network which can be provisioned with minimum management effort or service provider interaction.

In this study, the term “testing in the cloud” is referring to software testing activities where testing is conducted by leveraging resources hosted on cloud under the cloud infrastructure to conduct testing such as functional, performance, security, compatibility, etc.

As technology innovation goes on, software testing will need to catch up with the latest digital trends which is cloud computing. Since, it's introduction, cloud has significantly changed the way on how conventional testing is performed, especially on environment management and creates more complex testing challenges to testers. Despite the challenges, there are positive impacts and advantages of testing in the cloud.

WHY TESTING IN THE CLOUD?

There are many reasons to use cloud computing in software testing as it offers new solutions and could overcome some of the challenges and limitations encountered in conventional software testing.

Time saving: In the fast-paced, agile development cycle, time is crucial. Testing in the cloud helps to shorten testing process as the infrastructure will be provided by cloud providers, e.g., types of configuration, service, application, technology, servers and storage, networking and bandwidth. The activities of setting testing environment, configuration and maintenance can be done in minutes compare to conventional testing method which typically takes days or weeks (Katherine and Alagarsamy, 2012). Time can be saved when testing involve a combination of scenarios where test need to be done on different software, infrastructure, browsers, etc.

Cost effective: Conventional testing requires expensive infrastructures and resources that will only be used in testing phases. After testing end, the infrastructures will become obsolete or sit idle, needing regular updates and maintenance and thus incurred extra cost on budget. With testing in the cloud, testers can save cost on hardware management, software licensing, support and maintenance cost, etc. Survey show that utilizing standardized testing processing and tools can yield a 10-20% in cost reduction and a 5-10% increase of revenue from test automation cloud deployment (Sathe and Kulkarni, 2013).

Pay-per-use is another aspect of reducing cost of cloud computing because most system do not make equal of computation, storage and network bandwidth, some

are CPU-bound, others network-bound, etc. and may drench one resource while underutilizing others (Astri, 2015).

Scalability: Big data is a rapid growing technology and it continues to grow significantly over the years. Big data is being increasingly applied to various critical operations as it move to production from proof-of-concept (CenturyLink, 2015). Therefore, testers should be equipped with big data testing knowledge and tools. Cloud presents a compelling solution to this bundle of big data challenges. Big data analytics is often associated with cloud computing because the analysis of large data sets in real-time requires a platform like Hadoop to store large data sets across a distributed cluster and MapReduce to coordinate, combine and process data from multiple sources.

Scalability is crucial in software testing, especially performance test as testing might often requires distribute testing environment to simulate load or stress test with millions of requests. Through testing in the cloud, the infrastructure can be scale up or down on demand based on requirements. Testers tend to have more control to execute the test, perform analyses on system performance to look for stress area and bottleneck in the midst of testing. Besides that, geographically distributed load which is similar to the real life scenarios can be simulate easily using cloud.

ACCESSIBILITY

Agile approach which is totally different from traditional testing process, stresses on frequent and efficient delivery of software through incremental releases and iterations, concentrates more on teamwork and getting feedback from stakeholders (Capgemini, 2010).

During the agile development, testers are most likely come from different team and location (Negi, 2015). With testing in the cloud, data integrity can be achieved where tester can access the test data and environment share in remote location, anytime and anywhere through the internet.

Guidelines for testing in the cloud: To make testing in the cloud simple, we have listed out best practices to adhere to before, during and after testing activity.

Know the cloud:

- Understand what the cloud can do and the limitations of the cloud
- Assess tester, process and technology for cloud readiness and identify area for improvement
- Define the objective of testing in the cloud

Table 1: Assessment criteria and requirements (Schlauderer and Overhage, 2015)

Criteria/Property	Requirement
Service obligations	
Performance	Service and data availability
accountability	Efficiency and effectiveness of service
Costing	Quotation
Contract violation	Cases on breach of contract
and settlement	Procedures after termination of contract
	Return of data after completion of contract
Trustworthiness	
Transparency	Location of data center
	Service provider financial status
	Ownership structure and rights
Personnel policy	Control access to client's data
	Adherence letters
	Employed trained employees
Rights of control	Options to conduct audit and on-site inspections
	Certified sub-contractors
	Publication of audit results
Service management	
Service controlling	Information security, business continuity and security incident management
Measurement	Continuous monitoring of service quality
Technology	
Compatibility	Service and data portability
	Interoperability
Elasticity	Ability to scale based on demand
Modularity	Customizable solutions
Accessibility	Compatible on browsers and devices
Security	
Security architecture	Data center, network, server and platform security
Data security	Access control
	Multi-client capability
	Encryption of data
	Data backup and restore
	Secure erase data

Planning and design:

- Define the type of test strategies
- Identify risk, budget and duration of the testing
- Understand the requirements, especially, performance test. For example, the throughput level, capacity, latency and ability to operate in lower mode level (Hussain and Abdulsalam, 2014). The quality of cloud-based solution can be determined by the capability of meeting or exceeding performance requirements (Suffian *et al.*, 2014)

Select cloud service vendor:

- Identify service required such as Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS) or Infrastructure-as-a-Service (IAAS) and type of cloud (public, hybrid, private)
- Study cloud architecture design
- Choose reputable cloud service vendor, e.g., Amazon, SOASTA, HP and Microsoft and understand their SLA
- Evaluate the suitability of a cloud vendor according to the criteria stated in Table 1

Table 2: Automation testing tools

Testing types	Testing tools
Web	Selenium, Watir, Windmill, Ranorex Studio, SoapUI, Sahi, Tellurium, iMacros, SOAtest
GUI	Squish, Ranorex, test complete, test studio, egg plant
Unit	NUnit, xUnit, PyUnit/unittest, JUnit, TestNG, PHPUnit, Symfony Lime, Test::Unit, RSpec

Table 3: Automated testing cloud services

Testing types	Services
Cross-browser mobile and selenium testing	Sauce labs
Cross-browser selenium testing	TestingBot Gridlastic
Continuous integration and unit testing	CircleCI Tddium CloudBees
Email testing automation	Mailosaur

Setup infrastructure:

- Setup the test environment according to the test strategy
- Select appropriate version of testing/automation tools, applications, software, hardware, bandwidth, etc., according to the requirements (Table 2 and 3)

Test execution:

- Pilot testing as early as possible to gain confidence
- Record, apply test data and run test by invoking testing tools and services
- Optimize the utilization of infrastructure
- Monitor duration and utilization of the infrastructure to avoid over-usage
- Use cost calculator to avoid over-spend
- Stop the instances after testing

Analyze test result and reporting:

- Perform real time monitoring, validation and measurement to understand performance related issue
- Export and download test result from instance
- Evaluate the ROI of the cloud service by comparing the usage against the cost

CONCLUSION

Besides all the advantages identified in this study, there are still few concern or challenges face in cloud computing such as unexpected downtime, security and privacy issue, availability, compliance issue and limited control over infrastructure. However, we can't deny that the pros still surpasses the cons, especially when could computing still have plenty of room for improvement and maturing.

As most of the organizations and applications are moving onto the cloud, it is to believe that cloud will be here to stay for a long time. Therefore, testers must be equipped and update themselves with cloud computing knowledge and realized the advantages of leveraging cloud to apply it in testing field. Transition from

conventional testing to testing in the cloud may not be easy, thus, testers must broaden their horizons and embrace the cloud, accept it as a challenge and opportunity to grow. It is also tester's responsibility to mitigate potential issues and risk, explore more services and tools offered by cloud to make software testing even more efficient, effective and optimized in the future.

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