

CLOUD COMPUTING ENVIRONMENT TESTING TECHNIQUES AND ITS CHALLENGES: AN OVERVIEW

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Abstract-

Cloud testing refers to testing of resources such as hardware, software, etc. that are available on demand. Even the testing hers can be viewed “as a service”. For cloud offerings it’s essential to make sure that the service (product) not only meets its functional requirements but also nonfunctional requirements. With the range of applications in the cloud it is now becoming essential to develop cloud testing strategy. The idea of cloud computing is based on a very fundamental principal of „reusability of IT capabilities!. The difference that cloud computing brings compared to traditional concepts of “grid computing”, “distributed computing”, “utility computing”, or “autonomic computing” is to broaden horizons across organizational boundaries. Applications such as e-mail, web conferencing, customer relationship management (CRM), all run in cloud.

I. Benefits of Cloud Testing:

The need for cloud testing is easily visible with the benefits, which are far too many. Below we attempt to discuss the most apparent benefits which explain why cloud is the need of the hour.

1.1 Dynamic availability of testing environment

The normal testing approach in any organization is to invest in the hardware/software infrastructure needed for the testing. Almost most of you will agree that the environment supplied to testing teams very rarely matches a customer environment on account of rapidly changing requirements, as a result of which it is very challenging for companies to keep up.

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Cloud is the answer to this problem whereby, user can easily replicate a customer environment and find defects early in the cycle.

1.2 Los cost

Another angle to the previous point is that when companies invest in the infrastructure, the usual it many of their servers are not utilized all the time. As a result, they may have to incur additional expenses on license renewal. Transitioning to cloud helps in this scenario as well, as users can commission appliances as and when they want, saving huge costs for an organization.

1.3 Easily customizable

With the usage of cloud, it's a rather easy task for organizations to emulate an end-user centric environment by customizing it as per use saving coast and time. Test teams can easily perform load and performance testing scenarios in various permutations and combinations like- different Oases, browsers, configurations, etc.

1.4 Scalability

One of the most attractive features of the cloud whereby the computing resources can be increased or decreased wherever, it is necessary. Extremely useful in situations where the business requirements keep altering frequently.

II. TESTING TYPES

Various types of testing required for a cloud setup which mainly categorize into three techniques: Functional, Non-Functional and Ability testing Techniques

2.1 Functional Testing

Functional cloud computing testing is performed for both remote ad local applications. Functional cloud testing is the testing of all the features and functions of a system which includes hardware and software.

2.1.1. System Testing

System testing techniques is used to prove the system behavior within its own boundaries. It is critical to prove that the system functions as it has been designed when the system components work together, inputs and outputs are as expected and the overall resulting system is a high quality cloud system

2.1.2. Integration Testing Integration cloud testing allows the business to verify the cloud solution will work within the current infrastructure and environments which ultimately proving that the implementation of a cloud solution does not detrimentally impact any existing systems. Finally, the business requirements must be verified and validated to prove that the end result of the Cloud solution will meet the documented needs of the business

2.1.3. User Acceptance Testing

User Acceptance Testing will be done to prove that delivered cloud solution meets business requirements so that the user accepts the developed cloud solution. User acceptance testing is done on both on-premise and off-premise. However, the onsite testing allows immediate control and monitoring of test progress

2.2. Non-Functional Testing

Non-functional testing is done to ensure that a web application meets the specified performance requirements. Non-functional testing technique is also known a performance testing technique. In cloud, the applications scalability scope is much wider than in conventional performance testing techniques

2.2.1. Business Requirements Testing

Before migrating their business to a cloud computing solution, the organizations and cooperates must carefully analyze and documents their business requirements clearly, precise and unambiguously. Business requirements are foundations for building a cloud computing solution. These business requirements can be achieved through reviews periodical customer meets and workshops.

2.2.2 Cloud Security Testing

Security testing which is an indispensable part of testing applications due to increase in security breaches in business. This can provide assurance that business critical words of gaining access to a system by using common tools and techniques used by hackers can very well guarantee the security of Cloud solution.

2.2.3 Cloud Scalability and Performance Testing

Cloud Scalability is another major area of concern where adequate amount of testing is needed. Cloud Computing solutions always claim to be scalable on demand. Local or Stress testing can be used to prove that he developed cloud solution can be scale as required with the help of software tools. Hence Cloud solution can be accurately measured and its capacity is verified. Cloud Performance testing techniques allow us to measure the cloud systems performance accurately. Performance testing with the load testing techniques allows getting accurate image of the solution's ability on the cloud.

A. Cloud Load and Stress Testing

Application stability is a major factor as the user count is expected to be increases. Load testing of an application involves creation of heavy user traffic ad measuring its response. There is also a need to tune the performance of any application to meet certain standard. Measure response times and isolate issues related to specific actions while system is subjected to increasing load form different locations and multi user operations. It is imperative to identify issues as system is tested to breaking points maximum expected capacity or often beyond the expected usage. Stress test it used to determine ability of application to maintain a certain level of effectiveness beyond breaking point or maximum expected capacity or beyond the expected usages

B. 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.

2.3.1. Compatibility and Interoperability Testing

Ability testing is done to ensure that the cloud environment system is used and created on demand which makes the compatibility testing must. A cloud application must capable to work and executed across multiple environments and various cloud platforms. Hence, it is very easy to migration of a cloud applications and platforms from one infrastructure to another infrastructure.

2.3.2 Disaster Recovery Testing

The cloud service provider has always prefers that his cloud services must be available all the time to end-us-errs but actually it is not achievable. There may be some be low. Cloud verification must be done to ensure the service is back online with minimum adverse effect on business

2.3.3 Multi-Tenancy Testing

Multi-tenancy testing ensures that the multiple clients' ad organizations using on-demand services activated at a given time. Cloud service should be customizable for each client and provide data and security level to avoid any access related issues.

III. TESTING CHALLENGES

Service Challenge:-

1. Service Availability
2. Service Assurance
3. Service Efficiency

Security Challenge:-

1. Confidential Data Security
2. Depending on customer data
3. Meeting Security Requirements

Layered Testing Challenge:-

1. Three layers testing Protocol
2. Communication between Layers

Lack of Universal Standard and Infrastructure:-

1. Limited Technology configuration
2. Limited Servers and Storage Infrastructure
3. Networks interconnectivity
4. Virtualization level

Guidance, Knowledge and Staff Expertise:-

1. Obtaining Guidance
2. Expertise Teaching Staff
3. Acquiring Direct Knowledge

Procuring Cloud Service on-Demand Basis:-

1. Define Specific Quantity and Costs
2. Dependency on Remote Installed Application
3. Increasing Expenditure on Encrypted Data

Other's Challenges:-

1. Planning of Test Environment
2. Accrediting Vendors which meets Standards
3. Ensuring Data Portability and Interoperability
4. Proper Utilization of Cloud Resources

3.1 Cloud Service Challenges

The fundamental challenge in cloud computing testing environment is the cloud service challenges. The first challenge in this category is service availability without experiencing undue delays because user organization is looking to adopt cloud services rather than maintain local installations. Cloud service must look and feel as local services rather than remote services. The second challenge is the cloud service assurance. The cloud services provider must assure timely delivery of cloud service and controls data communication connection between is service efficiency. It encompasses efficiency in all aspects from cost savings, space and power efficiency to efficient and scalable cloud service delivery using virtualization, high end serves and high speed interfaces.

3.2. Security Challenges

Since information travels through the Internet, testers have to perform security testing to make sure there is no data leakage when data is sent over the Internet. Security in the public cloud is still a major issue. The first challenge in this category is the security of the confidential data. There may come up the situation about the leakage of private information, internet suspending, and suddenly disruption of service due to a maintenance window. Show internet speed, virus attack. The second challenge is some test methods are depends upon the customer data. In order for effective testing to take place, some testing tasks depend highly on the actual customer or production data. In some case, the customers are prohibited from supplying confidential or production data to third parties. So the test data should be doubly scrutinized for testing in cloud, the third challenge is meeting security requirements. Cloud vendors may not be familiar with security requirements that are unique to government agencies such as continuous monitoring and maintaining an inventory of systems.

3.3. Layered Testing Challenges

The third major challenge category is the testing at multiple layers of the cloud environment. The first challenge in this is the layers testing Protocol. In this, the testing network connection, server performance, database and software application adds multiple layers to cloud testing. Testers have to test beyond what they can physically control in their environment.

3.4. Lack of Universal Standards and Limited Infrastructure

The fourth challenge category is the lack of standards and limited infrastructure in public cloud environments. The first challenge in this is the lack of universal standards. Presently, there are no proper universal standards solutions to integrate public cloud resources. Public cloud providers have their own architecture, operating models, pricing mechanisms and offer very little interoperability. This leads to a big challenge for companies when they need to switch vendors. The second challenge in this is the limited infrastructure. Some cloud providers offers only limited types of configurations, technology, servers, storage, networking and bandwidth which making it difficult to create real-time test environments.

3.5. Obtaining Guidance, Knowledge and Staff Expertise

The fifth challenge category is the obtaining guidance, knowledge and staff expertise. The first challenge in this is the Obtaining guidance for testing cloud service. Existing federal guidance for using cloud services is insufficient or incomplete. Agencies cited a number of areas where additional guidance is needed such as purchasing IT commodity and assessing information security management with security levels. The second challenge is the taking expertise teaching staff. Service provider may not have the necessary tools or resources such as expertise staff to implement cloud solutions. Teaching their staff an entirely new set of processes and tools such as monitoring performance in a cloud environment has been a challenge. A third challenge is the acquiring direct knowledge. Delivering cloud services without direct knowledge of the technologies and tools has been a challenge.

3.6. Procuring Cloud Services on On-Demand Basis

The six testing challenge category is the procuring cloud service on the on-demand basis. The first challenge in this is the delivering on-demand services with specific quantity and costs. The on-demand and scalable nature of cloud services can be difficult to define specific quantities and costs. These uncertainties make contracting and budgeting challenge because of the fluctuating costs associated with scalable and incremental cloud service procurements. The second challenge is the dependency on remote installed applications. Since applications are not installed locally in controlled environment. This makes it harder for testers to replicate the user environment. The third challenge is the increasing expenditure on encrypted data. Improper usage of cloud based test environments can increase costs.

3.7. Other's Challenge

The seventh testing challenge category contains some other's challenges related to testing a cloud computing environment. The first challenge in this is the planning of test environment and overcome cultural barrier. Testing team should rigorously plan their test environments from utilization periods through disassembly with the awareness of the associated expenses such as environments, since these requirements will consume additional CPU and memory. Organization culture may also act as an obstacle to implementing cloud computing solutions. The second challenge is the accrediting vendors which meets standards. Organization may not have a

mechanism for certifying that vendors meet standards for security because the risk and authorization management program had not yet reached initial operational capabilities. Third challenge is the ensuring data portability vendors in the future, agencies may attempt to avoid platforms or technologies that lock customers into a particular product. Forth challenge is the proper utilization of cloud resources. It is important to monitor utilization of cloud resources to avoid over usage and over-payment.

IV CONCLUSION AND FUTURE WORK

The growth of cloud computing created a demand for benchmarks that can measure the performance characteristics of cloud applications. Testing team should equip themselves with viable strategies to mitigate the risks and issues associated with cloud computing by converging additional capabilities available in the cloud computing environments. Only a few advantages and a few testing challenges of the cloud computing solutions have been identified in this paper. In future, as it is 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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