White
PAPER

Testing the Cloud: Test Triangle's view on Cloud Testing

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The cloud computing refers to a shared computing paradigm, wherein same resources can be used by different business and personal applications. Several features such as high bandwidth, technology virtualization and storage have made cloud a very popular technology today.

In cloud testing, software testing is migrated towards the cloud. It can reduce testing cost by removing upfront capital expenditure. There are also certain non-cost benefits such as utility, on-demand flexibility, reduced time-to-market and high collaboration between teams. The cloud testing is based on the concepts of cloud and Software as a Service (SaaS).

There are several cost & effort benefits of cloud testing - but a comprehensive view is needed to achieve quality - Most of the company misses that but at test triangle a comprehensive view is adopted to achieve high quality.

360 Degree Quality View

The cloud computing is developed to fulfill sporadic types of business needs. The cloud data centers offer a flexible environment where consumer applications run. The cloud data centers have servers, storage and networking features. The cloud carrier handles the data communication and interconnection between the data users and cloud data centers.
The NIST definition of cloud computing defines three delivery models:

Software as a Service (SaaS): The consumer uses an application, but does not control the operating system, hardware or network infrastructure on which it's running.

Platform as a Service (PaaS): The consumer uses a hosting environment for their applications. The consumer controls the applications that run in the environment (and possibly has some control over the hosting environment), but does not control the operating system, hardware or network infrastructure on which they are running. The platform is typically an application framework.

Infrastructure as a Service (IaaS): The consumer uses "fundamental computing resources" such as processing power, storage, networking components or middleware. The consumer can control the operating system, storage, deployed applications and possibly networking components such as firewalls and load balancers, but not the cloud infrastructure beneath them.

(This definition is from the latest draft of the NIST Working Definition of Cloud Computing published by the U.S. Government's National Institute of Standards and Technology)

Recently, a new cloud delivery model is proposed, which is based on cloud testing:

TaaS: Testing as a Service (TaaS): Testing as a Service is an outsourcing model wherein the cloud-based platform is used for delivering automated testing services. It provides test labs which include the test application, test tools, load, and functional test scripts, application monitoring, and chargeback facility for metering the usage. TaaS services reduce the testing time and cost. The cloud TaaS offers several benefits such as center of excellence, governance, infrastructure facility, licensing and standardization.

The testing services help the business organizations in maximizing software testing ROI. It offers a virtual test infrastructure set-up, which doesn't require any investment. It s based on a pay-per-usage model, which is a lot cheaper than other pricing methods. Further, Cloud TaaS offers scalability and flexibility, which reduces the testing time and complexity.

In cloud services, the user experience depends on the cloud service provider and the network carrier. Both are critical in determining the user experience with the application. The network carrier manages different features such as bandwidth, reachability and other key performance indicators (KPIs). Similarly, the cloud provider manages the utilization, switching, scaling, and storage of the services. The primary KPIs affecting the Quality of Service (QoS) are web download time, data delivery time and service delivery. All the details about the cloud services are discussed in SLA documents. These documents are designed by the cloud service providers to the cloud consumers.

Actor	Definition
Cloud User	An organization or an individual that uses the cloud services.
Cloud Consumer	An organization or person that buys cloud services from a service
Cloud Provider	An organization that provides a cloud service
Cloud Carrier	A service provider that provides connectivity between user and the cloud or within the cloud

Future trends in Big Data Testing

- he research report from IBM posits that on an average, IT departments utilize only up to 50% of their whole IT infrastructure in development and up to 90% of the available test infrastructure remains idle.

- The Aberdeen Group conducted a study to find that an average business suffers from occasional infrastructure downtime which adds up to 8 days a year.

- The SaaS application require periodic review for different parameters such as performance and security

Different types of Testing for Cloud-based Solution

In this technology, a virtual environment is created to simulate real-world traffic. There are various types of functional and non-functional testing that should be carried out for an effective SaaS application. Here's the list of the different testing types that you can perform to test SaaS applications:

Functional Testing

The functional testing is a quality assurance practice wherein all the features and functionalities of a system are tested. The cloud-based functional testing has several benefits such as remote access to any platform, simulation of real-world user scenarios, and parallel test running.

System Testing

The system testing is performed to analyze the system behavior against some standard requirements. It is important to test whether system components are working together in alignment. System testing is conducted with respect to Functional Requirement Specification (FRS) and System Requirement Specification (SRS) to test the behavior of the system.

Integration Testing

Integration cloud testing examines whether the cloud solution will work with the current infrastructure. The cloud solution should not negatively impact the existing systems of the organization. The business requirements and cloud solution should also be evaluated to analyze that the cloud solution will meet the business requirements. In this methodology, software modules are tested as a group. The test analyzes if the cloud computing system matches with the overall business strategy of the organization. Cloud integration requires several organization changes such as connecting source and target, extracting data and publishing the data to the cloud system.

The cloud-based tool should comply with the continuous testing pipeline and support the design, maintenance, and management of the test integration. However, no cloud vendor would be able to meet all the requirements. Open APIs, easy integration and support can sort this problem.

User Acceptance Testing

The user acceptance testing is used to analyze if the cloud solution can meet the business requirements. The testing insights are important in user acceptance testing. The production analytics provide crucial information regarding faulty user flows. The cloud-based functional labs are able to capture production data and provide visibility for the test quality.

There are certain challenges in cloud-based functional testing such as it does not offer high security especially for sensitive data and slow down the test execution due to the load time for virtual machines. It has hidden complexities and is not stable.

Non-functional Testing

The non-functional testing is conducted to identify if the system is meeting the performance requirements.

Business Requirement Testing

In the business requirement testing, comprehensive requirements should be gathered before the selection of the cloud testing solution. The business requirements can be gathered from reviews and workshops.

Cloud Security Testing

The cloud security testing is integral to the overall cloud implementation. Security testing assures that the data is stored and migrated in a safe and secure manner. In the cloud environment, network security is an important issue. The security systems or mechanisms are evaluated on their performance, accuracy, and effectiveness.

Cloud Scalability and Performance Testing

One of the most lucrative benefits of the cloud system is its scalability. Therefore, scalability testing is integral to cloud deployment. The cloud solutions should always be scalable on demand. The scalability and performance testing helps in accurately evaluating cloud performance. The performance testing aims to identify the bottlenecks, threshold, and limitations of the cloud. It can evaluate response time and load-bearing capacity. In performance testing, the capacity, responsiveness, scalability, and throughput of an organization are evaluated.

Cloud Load Testing

Load testing examines the application response time in case of heavy user traffic. The stress testing evaluates that the website or application meets certain performance standards. With the cloud, load testing can become more efficient in handling large-scale projects. The cloud test yield more realistic test results. When automated machines are used for performance testing, they are inside the organization's firewall. Therefore, it cannot test the entire delivery chain. It means that these tests do not reveal information about all the performance issues. With the cloud, the test cases can be loaded from outside the organization's firewall, which may reveal actual performance issues. These tests can reveal results regarding the impact of third-party components, content delivery networks and analytical servers.

Best practices of Testing SaaS-based applications

A comprehensive testing strategy is imperative for optimum quality assurance. Adopting best practices can result in high test results:

- Begin by identifying the testing goals and test requirements

- Design a test plan and strategy

- Conduct load and stress testing based on different factors such as maximum load and response time

- The Cloud applications should be tested with more powerful platforms to analyze whether additional resources can increase the performance of the service

- Analyze the common testing practices in other business units and competing business organizations. It will provide a platform for the testing efforts.

These best practices would surely gear up cloud application testing efforts. However, there are some critical challenges in SaaS application testing, which can delay and implement inferior quality assurance practices.

Software Testing Type	Testing Emphasis	SaaS oriented testing
Functional testing	GUI based functionality	Testing cloud based service functions
Integration testing	Testing cloud connections	Testing cloud component and service integration in the cloud
Security testing	Data, process and function security	User customized testing for the cloud
API testing	API testing and service protocols	Cloud API and connectivity testing in the cloud
Compatibility testing	Validate client interfaces and compatibility with different browsers and platforms	Testing compatibility inside the cloud

Table 1: Different Testing techniques

Common challenges in Cloud application testing

• Numerous access rights, which makes access control and security very challenging

• The cloud applications cannot authenticate the integration of backend components with the application interface

• Numerous updates and small time duration of validating application quality

• No standardization for cloud providers

• Security challenges in the data transmission in a company's network and cloud application

Overcoming SaaS Application Testing Challenges

Following guidelines should be followed to overcome the SaaS testing challenges:

• Initiating the performance testing activities in the pre-production environment to identify the compatibility and data transfer issues

• Adopting strong encryption methods to control the privacy and security issues in data transportation

• Designing performance benchmarks to assure that the testing goals met in a timely manner

• Focus on the areas which have a higher impact on the application performance

• Creating Test libraries for complete test coverage of SaaS application

Benefits of Cloud Testing

Several business organizations are adopting the dynamic and fast growing services of cloud-based solutions. The cloud services have several unique features such as low cost, on-demand services, resource pooling, eliminating capital expenditure and reducing the testing time, which makes it a rewarding option for the business enterprises.

1.   Developing a Quick Test environment(s)

In the present dynamic environment, it is challenging for the business enterprises to set up testing infrastructure for a short period of time. The cloud services make it easier for the business organizations to design a virtual testing environment which can fulfill the project requirements in a limited timeframe. The replicated test environment can be simulated to identify the functional and non-functional issues in the system.

2. Cost-effective solution

With the help of cloud environment, the companies can set up the testing environment in accordance to their need. Once testing is completed, the testing infrastructure can be decommissioned, which can help the companies saving money. It will help the companies in saving cost and completing the work at a lower price as there is no cost associated with setting up the entire infrastructure in advance.

3. Customized Hardware resources

With the cloud environment, the companies can easily customize the production scenario according to the testing needs. The product is needed to be verified in different production environment for multiple browsers, different operating systems and software versions, which can be easily conducted in the cloud environment.

4. Reducing the carbon footprint

Carbon emission is a growing concern for the global community. Therefore, it is important to reduce the carbon footprint with the computing resources. Shared computing or green computing is a method of reducing the carbon emission with shared resources. With the cloud services, the companies can become more environment-friendly. It can also increase the efficiency of resource utilization.

About Test Triangle

Originally founded in 2012, Test Triangle has become a leader in IT consultancy services providing services in application testing, DevOps, RPA, Custom software development, mobile app development, Atlassian consultancy, niche IT staff augmentation and training in advanced technologies. Test Triangle is headquartered in Ireland; but it also has branch offices in London, United Kingdom, and Hyderabad, India. We have exponentially grown to become a team of 200+ members providing services in different verticals such as Banking & Finance, Utilities, Pharma, Retail, IT & Education etc.

Test Triangle's R&D department has created a propriety platform, Test Outsourcing Dashboard [TOD] which can be used to manage software testing lifecycle using collaboration tools like email, live chat, video conferencing. We have also launched a self- service testing platform (the premium version will be released as SaaS solution), which can provide a project overview and real-time updates of the software development lifecycle.

Over the years, we have established the reputation of being a 'trusted partner in IT consulting'. Test triangle is an agile software company, which constantly strives to exceed the expectations of its clients. We adopt the software testing and software application lifecycle to meet the customer's demand in an efficient and reliable manner. With a global workforce, we have proved ourselves in delivering tight-deadline projects.

We are proud to declare ourselves a client of Enterprise Ireland and European commission.

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