

# TaaS: An Evolution of Testing Services using Cloud Computing

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**ABSTRACT**— *The concept of Cloud Computing has brought about phenomenal changes in the way how the services are delivered to enterprise and consumers. Initially Cloud provided SaaS, IaaS and PaaS to attain Software, Infrastructure and Platform as a service respectively but now TaaS (Testing-as-a-Service) is emerging as another prominent service provided by Cloud Computing. Testing with cloud provides flexible, scalable and pay-per-use mechanism. Testing-as-a-Service enables enterprise and consumers to save the cost of complicated maintenance and upgrade effort. It provides a very high range of Permutations and Combinations to test the product and examine its performance. In this paper we have explained the term TaaS along with the brief introduction to major Cloud Testing Service Providers that would help one in understanding the various Testing Services available in a better way.*

**Index Terms**— *Testing-as-a-Service (TaaS); Cloud Computing; Cloud Testing; Performance Testing; Load Testing.*

## I. INTRODUCTION

The term TaaS is Software Testing done using Cloud Computing. It is not testing ‘The Cloud’ and it is not just about testing the applications deployed in cloud.

Cloud Computing is a marketing term to give computation, software, data access and storage services over the network. User does not have to know the physical location, configuration about the system which is delivering the service. Five important characteristics of cloud are: (a) On-demand access, (b) Scalability and Elasticity, (c) Cost Reduction, (d) Minimum management effort, and (e) Device or location independence. Common Characteristics of cloud are: Massive Scale, Homogeneity, Virtualization, Low cost Software, Service Orientation, Advanced Security, and Geographic Distribution. Four Deployment models: (i) Public Cloud, (ii) Private Cloud, (iii) Hybrid Cloud, and (iv) Community Cloud. Three service Models are: (a) Software-as-a-Service (SaaS): itself will be hosted in Cloud, (b) Infrastructure-as-a-Service (IaaS): Utilizing Infrastructure services of the Cloud, and (c) Platform-as-a-Service (PaaS): Utilizing platform services of the Cloud [1]. This gives quite brief understanding of cloud.

Testing Services with the help of Cloud is gaining popularity primarily because enterprise seeks to reduce costs, speed time to benefit and improve quality of the applications.

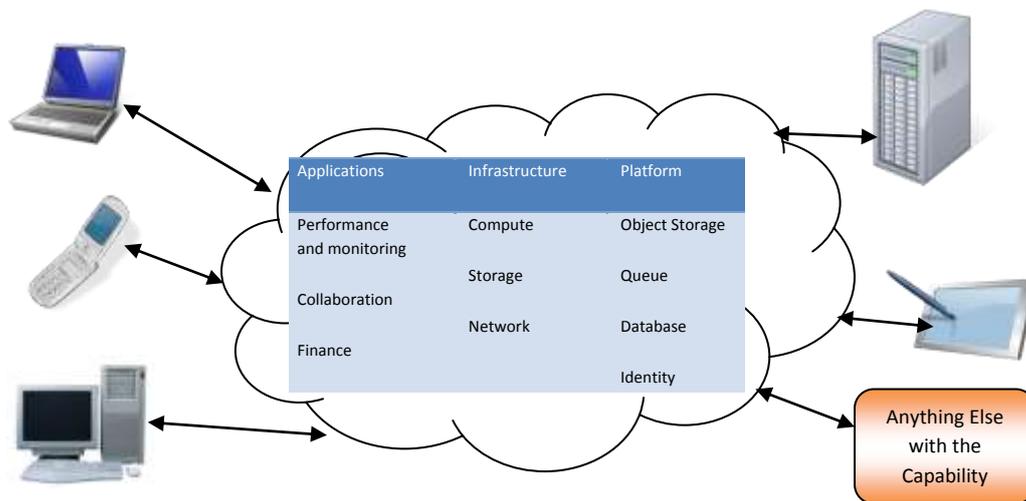


Figure 1: Cloud Computing- Pictorial

## II. CLOUD TESTING TYPES

### Functional

Testing Features and Functionality is part of Functional testing, but the important aspect added is Multi-tenancy. Multi-Tenancy [5] is embraced by most of the applications deployed in cloud.

#### A. Load / Performance

Very important as we require checking Response time, max load and other performance numbers. Another thing to look for Performance testing is SLA's, whether SLA's are delivered as promised.

#### B. Compliance

An important property coming through with cloud deployment as your application may not be restricted to usage to one location. You would want your application to be accessed and used in many geographical location and they have their own compliance standard in terms of data handling, location, retention etc.

#### C. Latency

With dependency of cloud over internet, Latency is introduced. This is a cloud testing type for testing to be done over the cloud as well as testing to be done for an application deployed in cloud. Your application could face latent latency issues because of the communication problem, or the database could be a separate machine or a separate service or any mechanism of accessing the Relational database or IOs that requires Latency test.

#### D. Endurance

Endurance really becomes important because most of the applications deployed in cloud are expected to run theoretically with 100% availability. You would not want your application to breakdown or face some issues when they are demanded for.

## III. TEST USING CLOUD TESTING

Same way as Software Testing, the fundamentals do not change. There is no fundamental change required in the STLC. The knowledge of Quality Attributes, Test Planning, Test case writing, Requirement Traceability, Coverage Analysis, etc. all applies to TaaS. What changes is How we test, Where we test and with more options.

#### IV. TAAS SERVICE CLASSIFICATION

The services provided by Testing as a Service can be classified as under:

1. TaaS Management:
  - a. Account Management
  - b. Control Management
  - c. Access Control
  - d. Billing & Pricing
2. Test Environment Management:
  - a. Testware/Test Tool Deployment
  - b. Environment Configuration
  - c. Test Tool Controller
  - d. Testware Management
  - e. Resource Allocation
3. Test Management:
  - a. Project Management
  - b. Service Control
  - c. Test Repository
  - d. Project Reporting
4. On-Demand Testing:
  - a. Test Scheduling
  - b. Test Running
  - c. Test Recording
  - d. Test Tracking
  - e. Bug Reporting
5. Test Simulation:
  - a. Traffic Simulation
  - b. User Simulation
  - c. Connectivity Simulation
  - d. Control Configuration
6. Performance & Scalability Testing:
  - a. Performance & Scalability evaluation
  - b. Performance & Scalability Modeling
  - c. Simulation Control

#### V. ROAD MAP FOR TESTING AS A SERVICE (TAAS)

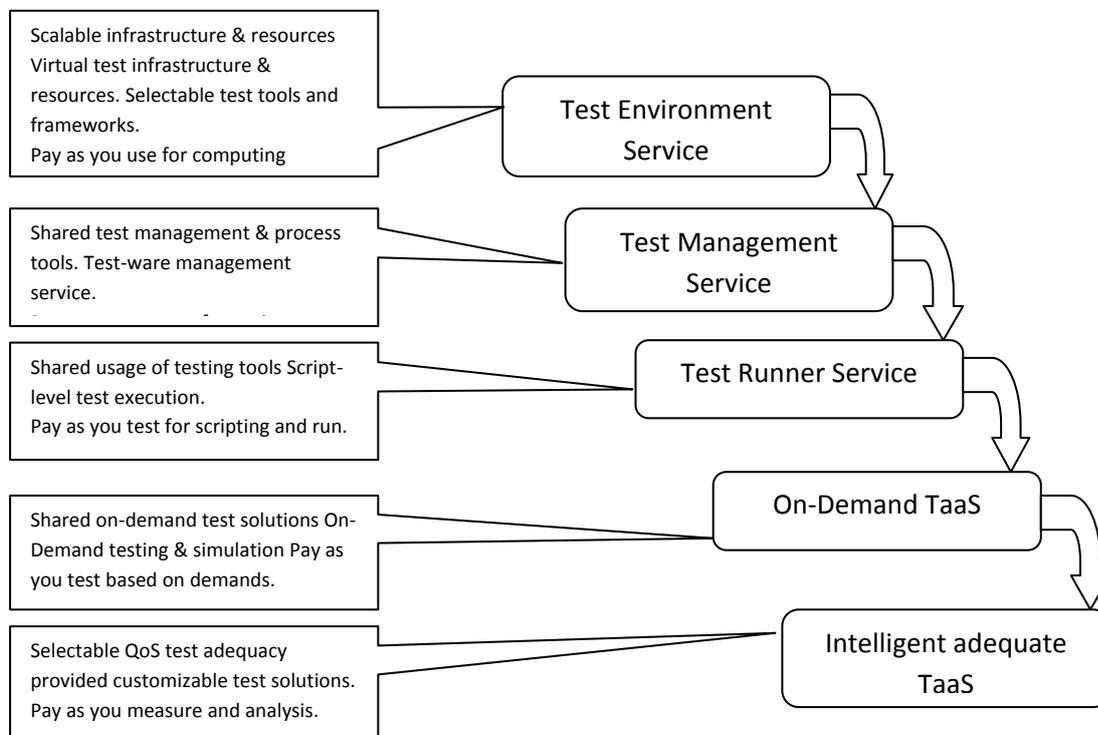


Figure 2: Road Map for TaaS

## VI. PERFORMANCE TESTING

Performance testing is in general, testing performed to determine how a system performs in terms of responsiveness and stability under a particular workload. Performance Testing is used to evaluate following qualities in a system: Reliability, Scalability & Interoperability [2]. The major type of Performance Testing includes:

- Load: Modeling the expected usage by simulating multiple users accessing the programs service concurrently.
- Stress: Determining the stability of a given system testing beyond normal operational capacity.
- Reliability: Determines how long the application can sustain optimum performance levels under expected loads.
- Scalability: Determines how long the application can scale up, be it user load supported, no. of transactions, data volume etc.
- Interoperability: It is a property referring to the ability of diverse system and organizations to work together (inter-operate).
- Volume: Testing a software application for a certain data volume.

## VII. TRADITIONAL PERFORMANCE TESTING APPROACH AND WHERE DOES CLOUD FITS IN?

In Traditional Performance Testing Scenario there was the Application to be tested located at some Lab with a Load Controller and then the Load Generators located at various remote locations, but there was always a limitation of the no. of Load Generators and no of locations.

Here the Cloud fits in. There can be many Load Generator servers (can be Virtual Machines also) located at different places in different clouds and these Load Generators can be much more in no as compared to the independent Load Generators in Traditional Approach. In Traditional Approach there was a maximum of say 50-to-250 Load Generators across a Globe but with the help of Cloud, we are able to generate a load of 500,000 users, 100,000+ load generating consumers. [8, 9, 10, 11]

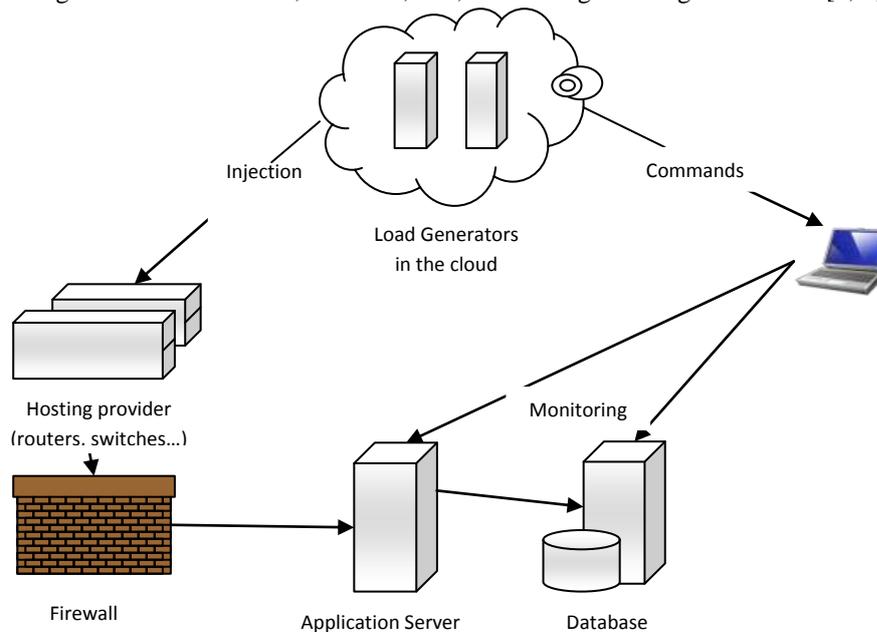


Figure 3: Cloud Testing Methodology

## VIII. WHY WE USE CLOUD FOR LOAD TESTING

The cloud brings substantial benefit to load testing, whether the testing is carried out by a large corporation with an in-house performance center or by a start-up.

- More Flexibility: multiple generators, multiple resource generators, etc.
- More Savings: you pay when you use.
- More Realistic: you can test more realistic scenarios with load being input from different part of the globe.

- d. No Limits: you can progressively test heavier and heavier loads (the power available is almost limitless) to find the real limits of your systems capabilities.

### IX. MAJOR CLOUD BASED SERVICE PROVIDERS

Many testing technology tool vendors are available who provide access to cost-efficient pricing mechanisms. Some of the Vendors are:[8,9,10,11]

- |                 |                                  |
|-----------------|----------------------------------|
| 1. NEOTYS       | 9. Load Impact                   |
| 2. App Perfect  | 10. Load Storm                   |
| 3. Gomez        | 11. HP-Beta                      |
| 4. Acutest      | 12. Sauce Labs                   |
| 5. Platform Lab | 13. PushToTest                   |
| 6. Soasta       | 14. Amazon Elastic Compute Cloud |
| 7. Keynote      | 15. Google App Engine            |
| 8. Browser Mob  | 16. Go Grid                      |

#### Load-Storm:

Load-Storm is a cloud load testing tool that generates traffic for you. [8]

#### Cost per Load Test. (up to 60-minutes duration)

Maximum Concurrent Users	Cost
1,000	\$39.90
5,000	\$199.50
10,000	\$399.00
100,000	\$3,990.00

Table 1: Load storm cost list

SOASTA.Inc:

Soasta provides services to test websites and web applications. It is the leading provider of cloud based testing services and created the industries' first browser based website testing product. "There was no way we could ever have simulated 500,000 users against our site in an internal test Lab." said Christopher Roe, CTO, Qtrax. "By Cloud Testing we were able to identify connection issues immediately and fix the site prior to production." [6]

Gomez:

Test from where your end-users are located by selecting from over 100,000+ load generating consumers-grade desktops. 500+ combinations of browsers, operating systems and screen resolutions plus more than 5000 supported mobile devices. [10]

Acutest: [11]

SAP performance testing.

Cloud Load testing

Stress Testing cloud services.

Load Testing CRM and ERP implementations.

### X. BENEFITS WITH CLOUD TESTING

"As-a-service" testing is gaining popularity in removing upfront investment that reduces both risk and cost, benefits with TaaS are: [5, 13]

1. Reduction in capital expenditure.
2. Resources (Hardware, Software, licenses, tools etc.)
  - a. Assured availability and unlimited supply (theoretically)
  - b. Optimal utilization
  - c. Multiple options available without requiring long term commitment.
3. Pay-per-use model saves costs.
4. Fast and Flexible deployment and provisioning.
5. Scalability and Elasticity.
6. Ideal for virtual teams and/or geographically dispersed teams.
7. Easy to indulge Testing-as-a-Service Model.

### **XI. CHALLENGES WITH CLOUD TESTING**

Before adopting testing from the cloud, important considerations must be factored into the decision: [3]

1. Cloud Computing and in turn Cloud Testing is evolving.
2. Dependency on internet [connectivity, latency, bandwidth and availability]
3. Business Acceptability.
4. Data Integrity.
5. Lack of Standards.
6. Security (in public Cloud).
7. Lack of control/high dependency.
8. Privacy Concerns.

### **XII. LIMITATIONS**

1. “The cloud [test environment] doesn’t reflect production environments- applications run on specific [physical] servers, specific virtualization technology, specific networking and bandwidth, and that are hard to replicate”. Forrester Research Inc. [12]
2. Moving from existing business to Cloud or planning new business on the Cloud, there are various challenges are: [5]
  - a. Data Integrity
  - b. Privacy
  - c. Security
  - d. Availability
3. Capacity Limitation: Ability to increase throughput is not going to improve by migrating to the cloud. Issues with Constraint systems or legacy systems limit the capacity of the cloud which can be solved only by virtual legacy systems that costs very high.
4. The initial setup cost for migrating to cloud is very high as it involves modifying some of the test cases to suit cloud environment. This makes the decision of migrating crucial.

### XIII. CONCLUSION

Testing Services using cloud is becoming popular primarily because enterprise seeks to reduce costs, speed time to benefit and improve quality of the application. ‘Testing-as-a-Service’ provides organizations an option to set up a virtual test lab without any upfront investment in Lab Infrastructure, Automation tools Licenses, and skilled Resources. The pay-per-usage pricing models are great in controlling IT budget and maximizing ROI. This benefit of cloud computing solution cannot be ignored by the enterprise and the consumers around the globe because still the business is striving to overcome the constraint of the current IT Hardware while struggling to justify the cost of investing in major upgrades. Today’s fast moving online world demands the companies to have the right performance testing solution. Creating a poor customer experience can be catastrophic.

A lot is discussed about Cloud Testing in many articles, papers and over the Internet but to a person or enterprise it is very necessary for him to understand the Cloud testing basics and also what Cloud testing Services are available today and what Testing Service he needs or should choose. This paper explains the basics of the Cloud Testing along with the introduction to the major Cloud Testing Service Providers. It also explains the Cloud testing methodology with the issues and challenges faced by the TaaS. And thus, this paper acts as an Initial reference to Cloud Testing explaining the true power of Cloud Computing.

### FUTURE WORK

Although cloud computing is doing phenomenal job at present. It has taken traditional testing mechanism to a new level. But, in spite of all these outstanding qualities, cloud still faces few limitations, one of which is the Network Bandwidth. Bandwidth, as we all know is not very flexible. Lower bandwidth areas face network bottlenecks which in turn decreases the overall throughput of the whole cloud system. Thus, in future the testing algorithms as well as the mechanisms must be modified in such a way that the efficiency remains uncompromised and the bandwidth usage reduces considerably. This approach would lead us to avail the services of Cloud Computing to its maximum potential.

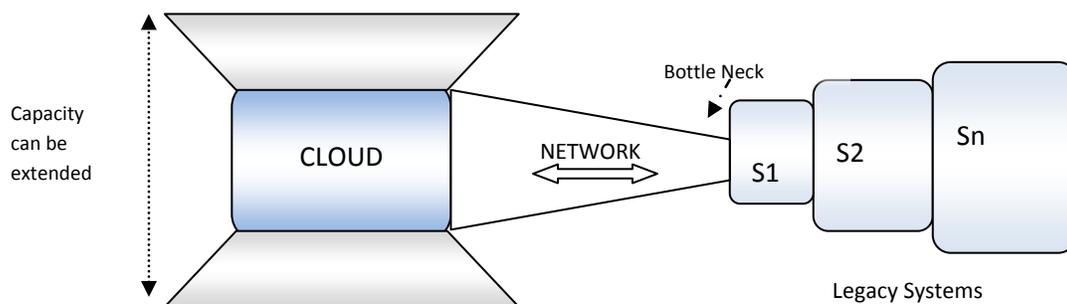


Figure 4: Showing bottleneck in network

## REFERENCES

- [1] K. Priyadarshini, B. Balasubramanian, S. Karthik, “*Cloud Testing as a Service*” (IJAEST) INTERNATIONAL JOURNAL OF ADVANCED ENGINEERING SCIENCES AND TECHNOLOGIES Vol No. 6, Issue No. 2, 173 – 177
- [2] Jerry Gao, Xiaoying Bai, and Wei-Tek Tsai, “*Cloud Testing- Issues, Challenges, Needs and Practice*” An International Journal (SEIJ), Vol. 1, No. 1, SEPTEMBER 2011
- [3] Somenath Nag, “*Business Case for Cloud Based Testing*” White Paper Blue Star Infotech.
- [4] AppLabs, “*Testing the Cloud*”, App\_WhitePaper\_Testing\_the\_Cloud\_1v00.  
Last Updated 10, March 2009.
- [5] Neha Mehrotra, Infosys, “*Cloud Testing vs. Testing a Cloud*”  
10<sup>th</sup> Annual International Software Testing Conference 2010.
- [6] SOASTA, “*Cloud Test Strategy and Approach*”.  
Cloud Test Methodology White Paper Series.
- [7] Cognizant, “*Taking Testing to the Cloud*”.  
Cognizant Reports, March 2011.
- [8] Load-Storm: Load Storm Cloud Testing Services,  
Url:<http://www.loadstorm.com>
- [9] SOASTA,Inc, Soasta,Inc Cloud Testing Services,  
Url:<http://www.soasta.com>
- [10] Gomez , Gomez Cloud Testing Services,  
Url: <http://www.gomez.com/website-performance-test/>
- [11] Acutest, Acutest Cloud Testing Services,  
Url: <http://www.acutest.co.uk>
- [12] James Staten, “*Understanding Virtualization and Cloud in Enterprise*”, Forrester Research.
- [13] Paul Ashwood, “*Why Your IT Organization Should Move from Traditional application Testing to Testing-as-a-Service (TaaS)*”, HP Enterprises.