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Research on Cloud Testing Based on Ontology and Multi-Agent Framework

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Abstract— Cloud computing is a solution to problems of Modern day Software companies that needs fast, secure and scalable IT infrastructure, which helps organizations to focus on their core business rather than worrying about the investment and maintenance of their IT infrastructure. Software Testing is a challenging activity for every software engineering projects and it is one of the five main technical activity areas of the software engineering lifecycle that continuously poses essential challenges. This paper puts forward an ontology and multi-Agent testing framework to solve the problems of software cloud testing such as poor scalability, compatibility and other problems.

Keywords— Cloud, software testing, ontology, multi agent

I. INTRODUCTION

Software testing is an important phase of the development process of any software projects which needs expensive infrastructure and resources that to insure the application quality which include the application's performance, reliability, speed, security and functionality. The growing complexity of all business applications, need from the organizations to build and maintain in-house testing facilities that imitate real-time environments which is somehow difficult. The solution of that difficult is cloud testing which emerged as a fresh approach to testing where cloud computing environments are simulate real-world user traffic by significantly decreasing costs[1].

Testing a Cloud refers to the verification and validation of applications [2], environments and infrastructure that are available on demand by conforming these to the expectations of the cloud computing business model [3]. Limited test budget, meeting deadlines, High costs per test, large number of test cases and little reuse of tests and geographical distribution of users are several problems are challenged to Cloud testing. Cloud testing aiming to ensure service of high quality delivery and avoiding data outages requires testing inside datacenter or outside the datacenter or in both [4].

Multi-agent systems (MAS) represent another distributed computing based on multiple interacting agents with intelligent behaviour used to solve problems by using a decentralized approach where several cooperating agents. One key feature of software agents is the intelligence that can be embodied into them according to some collective artificial intelligence approach that needs cooperation among several agents that can run on a parallel or distributed computer to achieve the needed high performance for solving large complex problems keeping execution time low [5]. By Integration between of Cloud computing systems and multi-agents, several benefits can be obtained and several common problems can be identified. Cloud computing can offer a very reliable, predictable, powerful, and scalable computing infrastructure for the execution of multi-agent systems implementing complex agent-based applications.

As a summary, efficient use of the infrastructure at reduced costs is main focus of research in Cloud computing, intelligent aspects of agents in developing complex applications are a good companion to propose a framework and ontology for testing complex system that what our paper like to propose.

II. BACKGROUND.

A. *Cloud Deployment Model*

There are four types of cloud deployment namely public cloud, private cloud, hybrid cloud, and community cloud [6] illustrated in Fig.1.

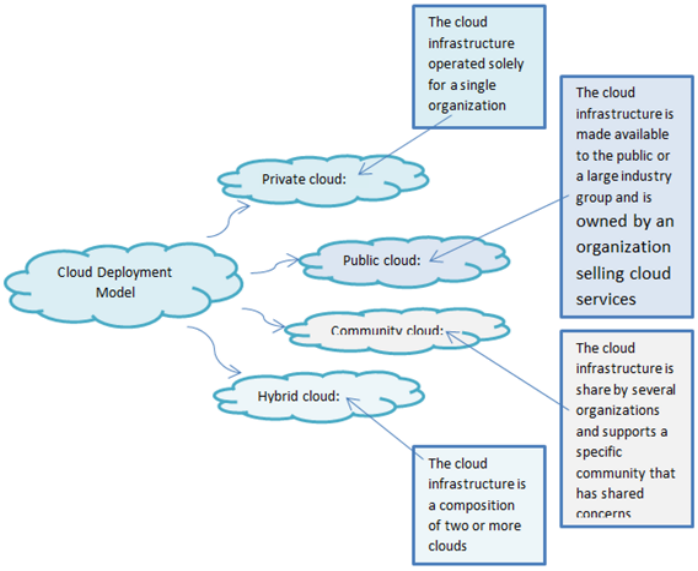

Fig. 1 Cloud Deployment Model

B. *Cloud Testing Techniques*

It refers to the verification and validation of applications, environments and infrastructure that is available on demand. This ensures that applications, environments and infrastructure conform to the expectations of the cloud computing business model. For example, mobile and web applications are tested in multiple operating systems, multiple browser platforms and versions and different types of hardware to understand its performance in real-time various cloud testing techniques [7] shown in Fig.2.

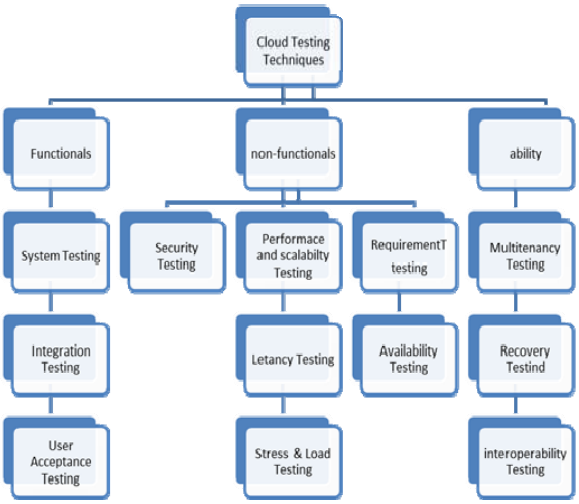

Fig. 2 Cloud Testing Techniques

C. *Cloud Testing Types*

Fig. 3 show the various types of testing performed in cloud [8] [9].

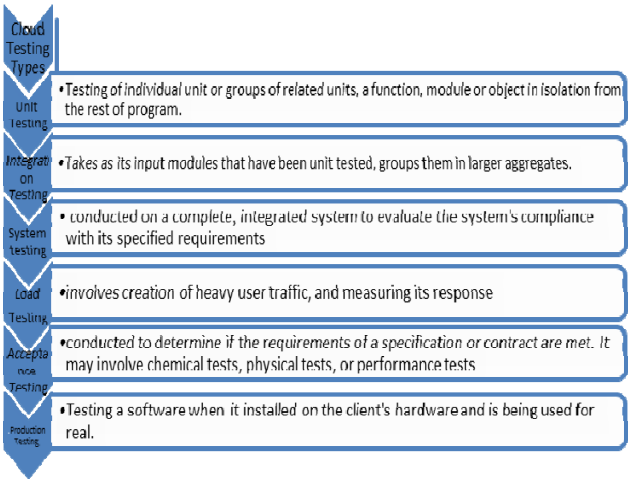

Fig. 3 Cloud Testing Types

C. Types of Cloud

The resources of the cloud, are often ”borrowed” by the enterprise. There are three acknowledged types of cloud service offerings [10].:

1- Software-as-a-Service: These are full-service applications accessed from anywhere on the Internet. These services are implemented through the use of distributed data centers.
2- Platform-as-a-Service: These are distributed development platforms used to create applications, web pages, and services that run in cloud environments.
3- Infrastructure-as-a-Service: companies offer the building blocks of cloud services that are available through a number of cloud hosting services such as Amazon’s Elastic Computing Cloud (EC2). They include a virtualization layer, database, web, and application servers, firewalls, server load balancers, WAN optimizers, routers, and switches

Fig. 4 illustrates the three type of cloud [10].

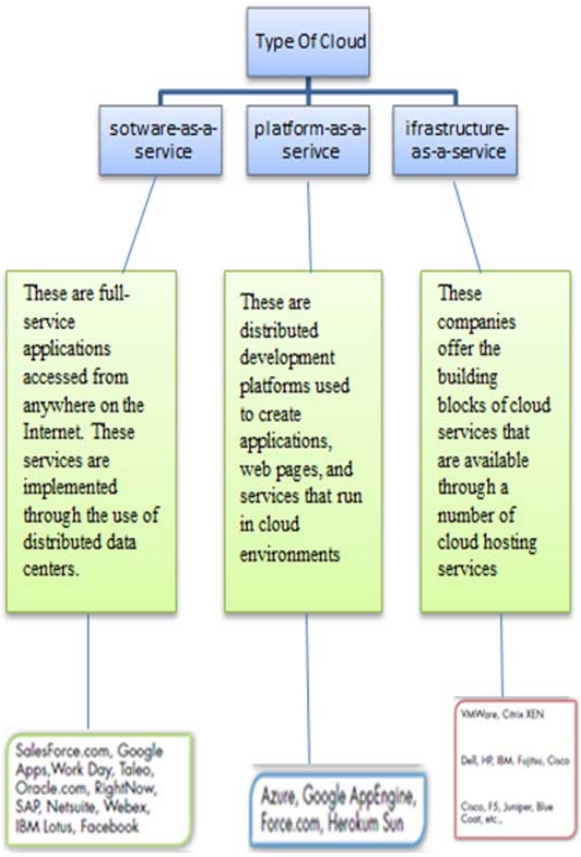

Fig. 4 Type of Cloud

E. Testing Rank

The below Fig. 5 indicates that testing and application development rank second (57%) as the most likely workload to be put into the cloud after Web sites (61%) [11].

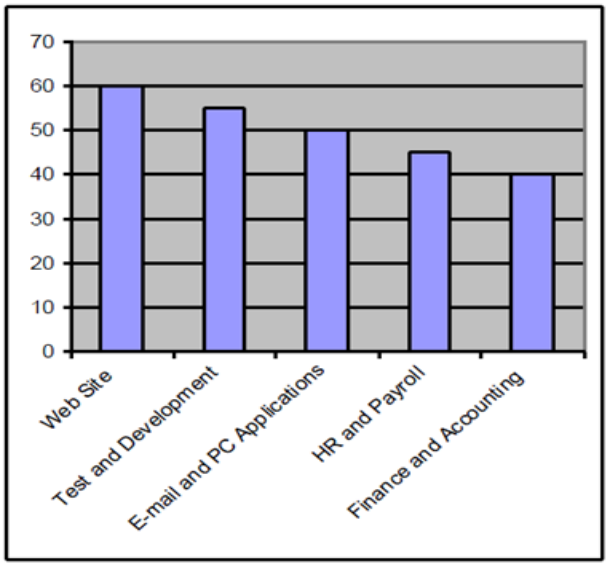

Fig. 5 TOP Applications in Cloud

F. Cloud Testing Problems

The main problems facing the cloud testing [6] are illustrated in Fig.6

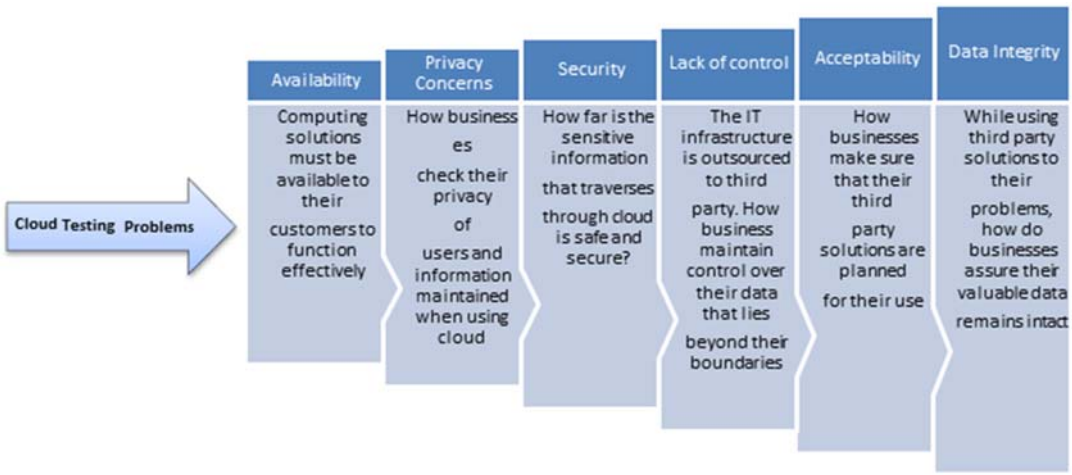

Fig.6 cloud testing problems

G. V Transferring Of Testing Into Cloud [14]

Before performing testing in the cloud we must consider how testing process should be included transferred into the cloud [12]. Software testing is a process of assessing the product quality base on analysis and execution. Fig. 7 illustrate the process of software testing.

Fig. 7 Software testing process

When this testing process is shifted into the cloud, the necessary requirements that are involved in the traditional testing process needs to be transferred into new cloud environment. Such requirements include:-

- Test cases
- Test plans
- Testing techniques
- Types of testing
- Test requirements
- Types of tools used for testing process.

Therefore, a controlled and correct process needs to be followed to achieve success while transferring testing process into cloud. Transferring software testing to the cloud requires understanding types of risks that are associated while transferring process. The aim of testing should define the risks associated with cloud computing, mainly security because security is main drawback in cloud computing. Simply defining test cases and executing that test case are not good

When the defined test case not able to define the good design quality attributes, it is tough to execute those test cases in a cloud environment. Whenever the test cases that do not have good quality attributes it must need reengineering because cloud computing may not support those test cases in testing process

III. PROPOSED FRAMEWORK AND ONTOLOGY

A .*Cloud Testing Framework*

To accomplish the testing task, the framework Fig. 8 accomplishes of the following multi agents that is hierarchical architecture in different layers and Knowledge Agent layer:

- Analysis Agent
- Controller Agent
- Recorder Agent
- Replayer Agent
- Monitor Agent

Every agent play a role, center machine is a role of Controller Agent, Script Builder is a role of Recorder Agent, Load generator is a role of Replayer Agent, monitor is a role of Monitor Agent, and Data Analyzer is a role of Analysis Agent.

To complete the testing process, Agents (based on BDI [13] (Belief, Desire, Intension (model) by the different roles are communication and collaboration. through the communication and collaboration model, agents address the test group of user among the various tasks to improve test automation.

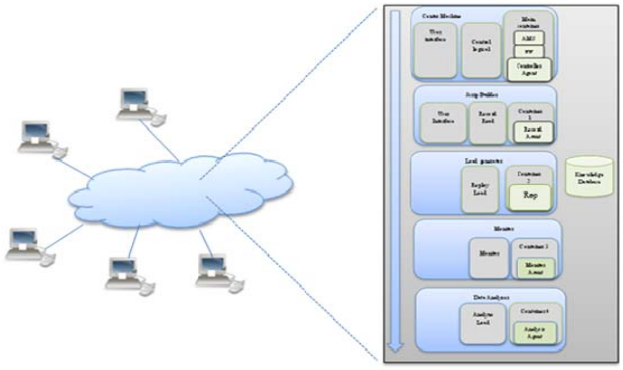

Fig. 8 cloud testing framework

according to testing requirements ,BDI model using multi-Agent test ,through use case knowledge base, describe the different roles of each Agent to achieve different objectives; Then, the Agent with the provisions of the definition of an approach to the design of each Agent, Agent state according

to their own belief, desire and intention of the state, Implementation of a series of operations, without affecting the target to complete the same to communicate with other Agent and collaboration; Ultimately test automation.

To accomplish testing process, the testing framework used five roles and functions of Agent. To define a common base class Agent we use BDl mode, base class is inherit to the role of Agent, and completed their corresponding functions. Such as: core part of the test platform is a Controller Agent that central machine , the demand for access to user testing, coordinate the operation of the test system.

B Ontology-Based MA Model

In general, ontologies are a main part of the semantic web technology and facilitate the knowledge representation of real-world concepts. Ontologies are formal models of a specific application domain, and primarily used to facilitate the exchange and partitioning of knowledge. More precisely, anontology is a data model that represents a set of concepts within a domain and their relationships [14].

Our proposal ontology consist of MAS (Multi-Agent System), each its roles composed the same type of composition, Fig. 9 outlines the approach we propose.

Agent may be used in any systems; ontology is a semantic to solve the problem, so we need a public ontology to represent knowledge in the test field. To get knowledge interaction each agent needs to achieve local knowledge base and testing in the field of semantic consistency between the shared ontology conversions; agents play effective communicates and collaborates with each other.

According to different building MAS (Multi-Agent System) Agent is the basic unit, each MAS Agent roles is composed by the same kind of composition. MAS have a different function in each of the corresponding local knowledge base to provide the same functionality of the agent role of collaboration between MAS, to achieve semantic consistency between the conversion and to achieve the field of communication and collaboration between the agents in different functional areas, the center plane agent field testing different functional areas of shared ontology.

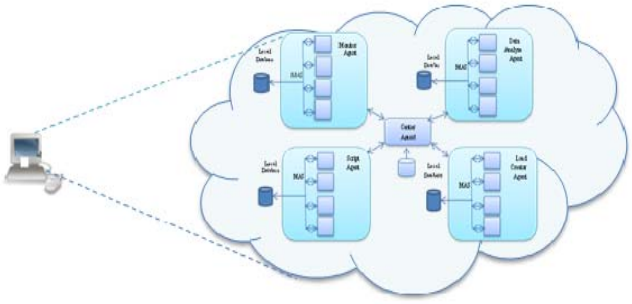

Fig. 9 Ontology-Based Multi-Agent Interaction

IV. CONCLUSIONS

The integration between Clouds, multi Agents and testing can be convenient for all. This paper proposes a framework and ontology of testing based on high-performance multi agent services on Clouds. All agents were designed by BDI and then proposing a multi-Agent based automated testing framework and ontology technology to communications collaboration between agents. This is a good solution to the current framework testing tool for poor, weak extension, to meet the needs of the shortcomings and to improve the scalability and flexibility..

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