

# Toward a Cloud based Framework for Facilitating Software Development and Testing Tasks

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**Abstract**—The cloud computing model enables efficient access to dynamic computing resources. As the growing of cloud computing related technologies, more and more software organizations and companies are considering the benefits to the software development and testing tasks. In this paper, a cloud based development and testing framework is introduced. Based on the advantages of different cloud computing models and technologies, the framework aims to integrate and provide corresponding tools to facilitate software development and testing tasks.

## I. INTRODUCTION

The cloud computing model enables efficient access to dynamic computing resources. As the growing of cloud computing related technologies, more and more software organizations and companies are considering the benefits to the software development and testing tasks. Generally, IaaS model provides fundamental computing resources, including processing, storage, networks, and so on [1]. Software developers can control the computing resources and perform related development, deployment and testing tasks. For software development and testing tasks, IaaS brings the benefits of avoiding extra capital expenditure on hardware resources. However, environment configuration, application deployment, and resource management still bring certain burdens on software developers. PaaS provides software developers with the capability to develop software applications based on specific environment supported by the underlying cloud infrastructure. The environment comprises specific programming language runtime, framework, library, database, and so on for the implementation and deployment tasks [2]. However, several development and testing tasks, including project management, software artifacts management, verification and validation are not considered in current PaaS model. SaaS provides users with the capability to use particular software applications running on particular cloud infrastructure [3]. It helps to mask the underlying complexities and provides users with simple access method (e.g., browsers) to use services. Nowadays, more and more software companies and organizations offer SaaS as a new software delivering and business model. Meanwhile, software development and testing services (e.g., cloud based IDE) are emerging recently [4]. However, if services are not well integrated and aligned with the software development process, it could cause additional management efforts.

In this paper, a cloud based development and testing framework is introduced. Based on the advantages of different cloud computing models and technologies, the framework aims to integrate and provide corresponding tools to facilitate software development and testing tasks. A case study which describes the usage scenario of the framework is also introduced in this paper.

## II. DESIGN OF THE FRAMEWORK

The development and testing framework is built based on several cloud technologies to support particular software activities. Cloud technologies include scalable and reliable storage, virtualization, and big data infrastructure and analytics. Firstly, storage is used to preserve all the software artifacts acquired, generated and used throughout the development and testing tasks. Secondly, virtualization technology is used for the construction, deployment, monitoring and maintenance of virtualized resources. Finally, big data infrastructure and analytics are used to gather and analyze all the quantitative data, which can be insightful reference for strategy and decision making. As shown in Fig 1, the framework comprises several components, including Resource Manager, Process Manager, Artifact Manager, CASE Tools, Automation Engine, Evaluation Module and Platform Portal. Descriptions of components are stated as the following.

- **Resource Manager:** According to resource requirement of task, Resource Manager cooperates with the underlying

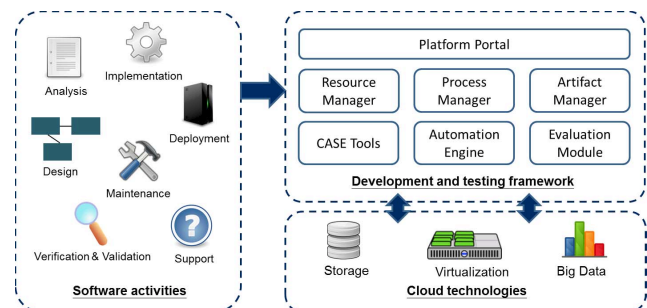


Fig. 1. Architecture of the cloud based software development and testing framework

virtualization technology to create, deploy and manage necessary resources for specific development and testing tasks. When task is finished, related resources can be released for other tasks. It facilitates the efficiency of resource usage throughout the software development life cycle.

- **Process Manager:** Process Manager maintains process of development and testing tasks. Steps, associated resources and related software artifacts are described in process document and managed by Process Manager. It provides corresponding process information for Automation Engine to perform specific development and testing tasks.
- **Artifact Manager:** Artifact Manager helps to preserve and manage all the software artifacts. It cooperates with the underlying storage to handle various artifacts in different formats and generated in different tasks. In addition, because the development and testing tasks are performed through the framework, the traceability of software artifacts can be strongly maintained by Artifact Manager.
- **CASE Tools:** More and more CASE Tools are used in the software development projects. For instance, project management system, issue tracking system, static/dynamic analysis tools, continuous integration system, test case management system and so on can be used to facilitate the development and testing tasks. In the framework, CASE Tools are packaged as virtualized resources. Based on the requirement of particular task, CASE Tools can be constructed, deployed and operated efficiently.
- **Automation Engine:** Automation is one of the key factor for facilitating development and testing tasks. Based on the descriptions of process steps, associated resources and related artifacts, Automation Engine is responsible for execution of particular development and testing tasks.
- **Evaluation Module:** Evaluation Module cooperates with the underlying big data technologies to gather, analyze and evaluate all the software activities happened in the framework. Continuous data gathering, analysis and evaluation can generate insightful information for software

development projects.

- **Platform Portal:** Platform Portal is the interface for software developers to perform development and testing tasks based on the cloud based framework.

### III. CASE STUDY: AUTOMATIC WEB TESTING

Automatic web testing is used as a scenario to elaborate the feasibility of the cloud based development and testing framework. As shown in Fig 2, the automatic web testing task is achieved by test case management system, continuous integration system (Jenkins) [5], web browser automation (Selenium) [6] and test target.

In the beginning, Jenkins (as Automation Engine) retrieves test case from test case management system (as Process Manager). Test steps, necessary test environment and related test scripts are described in the test case. Based on the requirement of test environment, Jenkins requests virtualization platform (as Resource Manager) to define, create and configure virtual machines to different roles (e.g., Selenium Hub, Selenium Node or Test Target) in the automatic web testing task. When the test environment construction and deployment are finished, Jenkins can launch the testing tasks performed by Selenium (as CASE Tool). After the completion of test execution, summary and statistics of test run will be generated and preserved (by Artifact Manager). Further analysis and evaluation can be performed to generate more insightful reference for software development projects. Meanwhile, resources (virtual machines for Selenium Hub, Selenium Node and Test Target) can be released for other tasks.

### IV. CONCLUSION

In this paper, a cloud based development and testing framework is introduced. Based on the advantages of different cloud computing models and technologies, the framework aims to integrate and provide corresponding tools to facilitate software development and testing tasks. In the future work, the framework prototype will be designed and implemented. More scenarios can be practiced to examine the feasibility and the benefits of the cloud based development and testing framework.

### ACKNOWLEDGMENT

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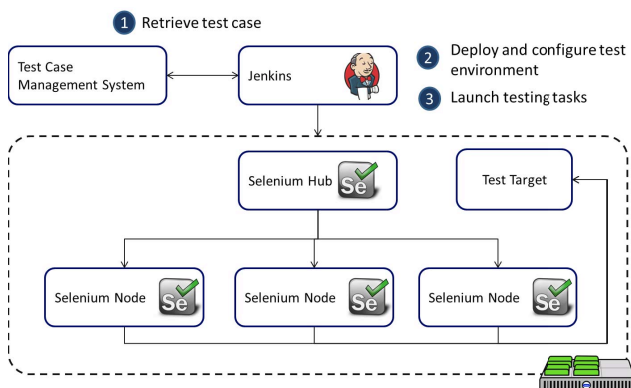


Fig. 2. Automatic web testing based on cloud environment