

Characterization of tests focused on validation of software project

*Jose Calvo-Manzano Villalón¹, Gonzalo Cuevas Agustin¹, José de Jesús Jiménez Puello²,
Tomás San Feliu Gilabert¹*

*¹Department Languages and Informatics Systems and Software Engineering
Polytechnic University of Madrid, UPM, Madrid, Spain
jcalvo@fi.upm.es, gcuevas@fi.upm.es, tsanfe@fi.upm.es*

*²Department of Computer Science, University of Panama, UP, Panama, Panama
jjimpue@hotmail.com*

Abstract

In this paper, a method is applied to identify and characterize what software testing should be applied to a software project for technological validation. The method was applied to a Web project and resulted in a characterization of the tests to which a project must be subjected to verify its functional and non-functional requirements. The characterization determined which tests should be applied to the project. Furthermore, the results of the characterization define a test plan that presents the validation tests for a specific project, and the problem of applying specific and appropriate tests to the project is thus resolved.

1 Introduction

It is necessary that every organization that is dedicated to software development set a series of control mechanisms to for determining your that each product meets the standards, processes and quality standards to and thereby ensure that your product it is free of errors, as a guarantee before entering the national and international competitive market. One of the processes that ensure this competitiveness is validation.

Thus, the whole entire software development process is linked to the validation process through the implementation of a series of activities or processes, usually called tests, which ensure that the software meets its specification. The main concern of validation focuses on product requirements. If implementation of the requirements is not are not implemented according to the actual needs of the user and the real environment where the same, in fact, the software will run, you can not it is not possible to meet the customer requirements. This leads to therefore, many projects to be defective due to because the system functionality expected so do not satisfy the needs of users in the workplace [2]. For [8], validation is intrinsically linked to the activity of software testing, which is the necessary support to ensure product quality. The One paper [5] shows that each product presents requirements and different validation activities and that, so it is necessary, a process is thus needed to identify the appropriate activities of product validation activities. That is, that every software product is to apply a specific or individualized series of validation tests should be applied to every software product. In that sense, [9] indicates that projects software development fails, due to inadequate software testing, to specifically poor or unplanned tests or poor, indicating that the project is not methodologically checked which further leads to affect failures due to the absence or lack of training of users, who are unaware of the purpose of the tests. Similarly, refers [6], no testing that the lack of testing and quality standards, as due to the absence of consistency, are precursors of interruptions happen that occur in organizations due to software bugs, that which can be expensive. While Furthermore, [10] indicates that there is a lack in terms of the type of project and software testing tool that would implement the project specific tools and therefore create an adequate proof relationship.

All this overall situation is expressed by [1], which states that there is no clear definition of the types of tests to that can be applied to the a specific type of project, used by each that each organization, applies and by [3], which indicate that one of the biggest problems in the test software is whether the appropriate according to the types of test have been conducted appropriate tests.

Therefore, it is critical that organizations produce evidence of software development or testing that is are defined by based on the technological projects that they develop, apply because as the tests required by a demands a particular project and the must reduce the impact of failures or errors of omission or ignorance must be reduced the tests required by a project. Therefore, we ask the following questions: ¿How to can we determine what software testing to should be applied to a project? ¿Characterize the project will provide evidence a for specific validation testing project? ¿The characterization allows for defining of a test plan for a software project?

The answers to these questions will try to answer. We will attempt to answer these questions raised by the application of applying a method focused designed to characterize for the technological characterization of software testing for a software development project by technology.

The article is divided into the following sections: 1. Introduction 2. Related Work 3. Method for characterizing software Test 4. Conclusion 5. Bibliography.

2 Related work

[4] Characterizes software testing approaches based on models that determine the tests, techniques, tools, quality characteristics, and other features required. [12] Establishes a characterization scheme for the selection of V & V techniques for modeling and simulation projects. This characterization

scheme selects techniques according to the project and provides a catalog of applications as a repository of information that will allow selection of the technique specified for the project. [11] Provides a characterization scheme for selection from a catalog that provides the information needed to select the best technique tests for a project.

2.1 Importance and benefits of Characterization

Characterization tests are important as a means to identify and establish the characteristics or attributes that identify a project in regard to software testing. Through such a characterization, it is possible to determine which software tests are appropriate for a software project or product. Characterization tests make it possible to identify the software development group or test set required to accurately test strategies related to the project. The characterization seeks to establish which tests are appropriate for a project according to the implemented technology.

Also presents benefits or advantages in addressing problems such as the lack of methodologies, methods or similar studies in the area of software testing. Moreover, the difficulty of characterization will depend on how the attributes are identified and organized and how these attributes are considered to select studies that support the characterization. The benefits gained by applying the characterization are mainly (Figure 1):

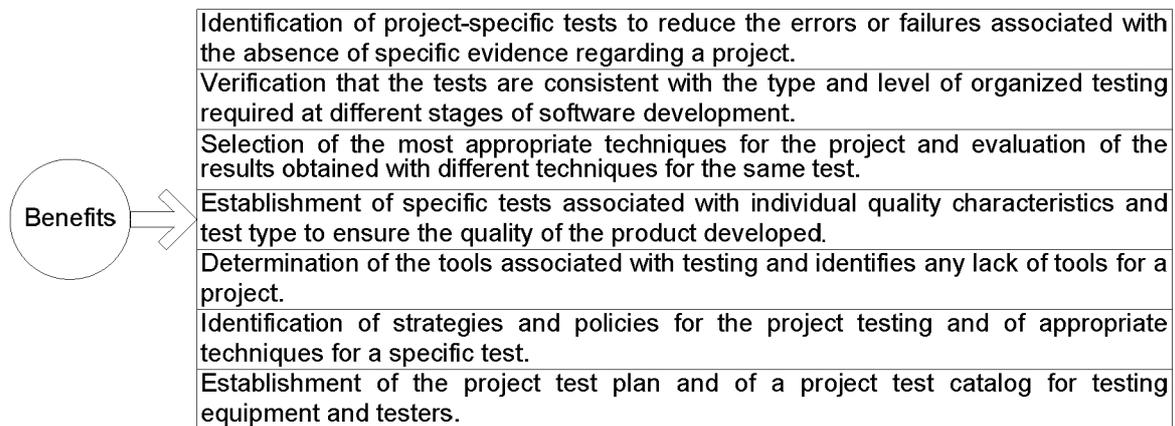


Figure 1. Benefits of the characterization.

3 Method of characterizing software testing

The method presented is adapted from the method applied in [4]. The proposed method allows for the characterization of software testing for given software project through the six steps described below (Figure 2):

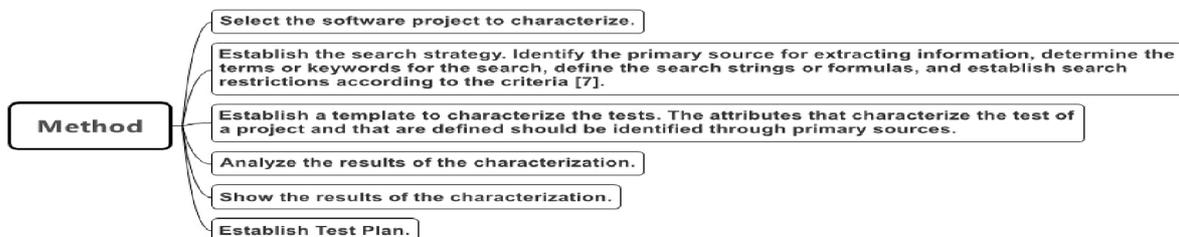


Figure 2. Method of characterizing.

3.1 Select the Software Project to Characterize

The project is aimed at developing Web applications. A validation test for a Web project is characterized.

3.2 Establish the search strategy

- Identify the primary source for the extraction of information: primary sources selected search are: IEEE Xplore, ACM Digital Library, Springer Link y Science Direct Avoid
- The search terms are: Web Application Testing, Web Application Testing Tool, Web Application Level Testing, Non functional Web testing, functional Web testing y funcional Web testing tool. Definir las cadenas o fórmulas de búsqueda y establecer las restricciones de la búsqueda. Defining search strings or formulas and set search restrictions.
- The search strings or formulas:IEEE Xplorer: (((((((("Document Title":Testing Web Applications) OR "Document Title":Web Application Testing) OR "Document Title":Web Application Testing Tool) OR "Document Title":Web Application Level Testing) OR "Document Title":Web non functional testing) OR "Document Title":Web functional testing) OR "Document Title":functional testing tool for web applications) NOT "Document Title":web services), ACM: Web Application Testing , Web Application Testing Tool, Web Application Level Testing, Web non functional testing, Web functional testing, Functional web testing tool, Springer link:(Web and applications and testing or web and applications and testing and tool or web and applications and level)' published between '1 Jan 1990' and '11 Feb 2013' with no filters and (web and non and functional and testing or web and functional and testing or web and functional and testing)' published between '1 Jan 1990' and '11 Feb 2013' with no filters, Science Direct: TITLE(Web Application Testing) or TITLE(Web Application Testing Tool OR Web Application Level Testing OR Web non functional testing OR Web functional testing OR web applications functional testing tool)[All Sources(Computer Science)] y Web Application Testing Tool OR Web Application Level Testing OR Web non functional testing OR Web functional testing OR web applications functional testing tool.
- The search constraint is limited from the years 1990 to 2013 only for Web applications and does not include Web services and Web 2.0.

3.3 Characterize Template

The characterization template is the tool that is used to organize the attributes that identify the tests to be applied to a project: Author, Title (name of article), Test type (functional or non functional test), Test level; Quality features. Specific test, Technique, tool.

3.4 Analyze the Results.

The obtained data are analyzed by searching the different sources of information and identifying the attributes set in the template. The table 1 establishes the results of the search for Web applications.

Digital Library	Search Results	Select Paper
IEEE Xplore	183	17
ACM Dgital Library	201	7
Springer Link	14	3
Science Direct	13	4

Table 1. Search Results.

4 Results

The results obtained through this characterization make it possible to determine and identify which software testing should be applied to Web application projects. Moreover, the characterization facilitates the establishment of a test plan that is appropriate for the project. The results suggest which tests should be applied for Web projects and which require more intensive application to reduce or eliminate errors or failures. The results of the characterization are described below:

The test types were organized into functional and non-functional tests (Figure 3). Functional tests represent 71% of the tests, whereas 29% are non-functional. This result indicates that there is an increased interest in functional testing because it verifies the correct operation of the project.

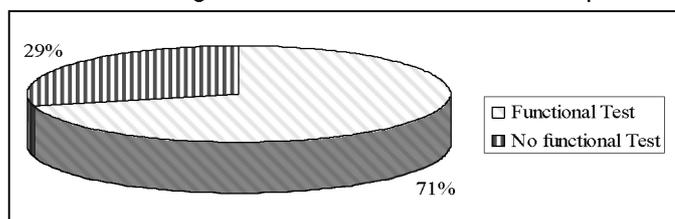


Figure 3. Type of Test.

Regarding the test level (Figure. 4), 87% were for the system level, and 13% were for the acceptance level. Integration testing and unit testing were not considered. These results show that most of the tests focus on the system level.

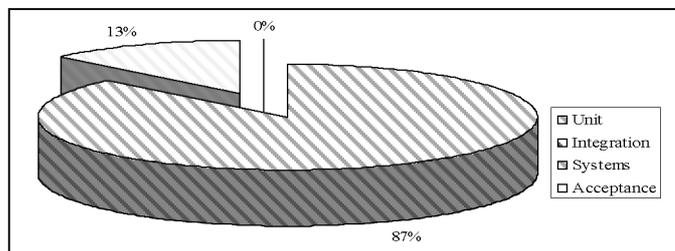


Figure 4. Test Level.

The quality characteristics (Figure. 5) indicate that the tests are oriented as follows: 71% toward functionality, 26% toward efficiency and 3% toward usability. These results show that functional tests have priority in Web projects.

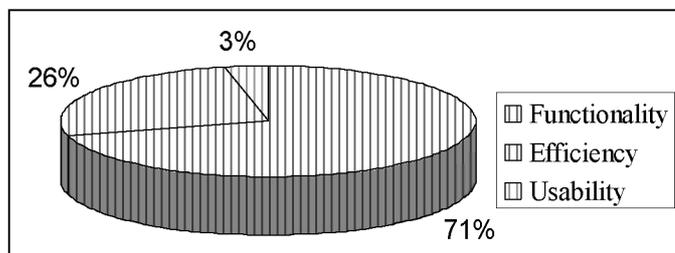


Figure 5. Quality Characteristics.

Specific tests (Figure 6) show that the security tests have a demand of 30% since the Web security is vital, functional 20%, performance 19%, 10% acceptance and 3% other tests. However, testing graphical interface and browser compatibility as well as security and acceptance is part of the cate-

gory of functional tests. Similarly, load testing and stress fall within the category of performance testing. Database testing represents a different entity from a web project and therefore has been considered separately.

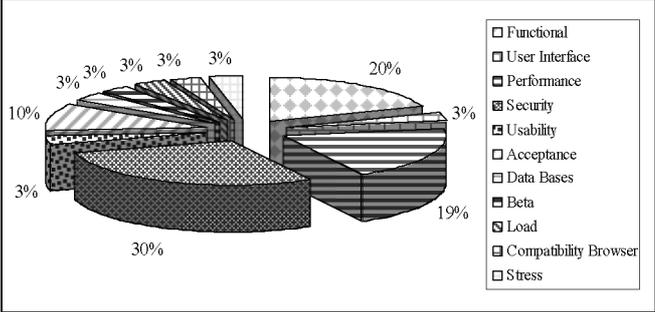


Figure 6. Specific Tests.

The results show that 67% of the tests represent the tools and that 33% represent techniques (Figure 7).

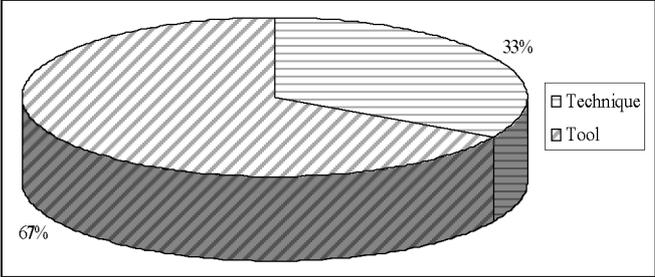


Figure 7. Technique and Tool.

The test plan is the result of the characterization testing. The plan summarizes the tests to be applied to the Web project. The plan (Table 2) is organized according to the type of test. But it does not make any reference to the techniques or the tools, that are, in many cases, experimental.

Table 2. Test Plan.

Test Type: Functional
Test Level: Unit, Systems, Acceptance
Quality Characteristics: Functionality, security
Specifics Test: Functionality, security, user interface, browser compatibility, database, beta, acceptance
Techniques:
Tool:

5 Conclusions

A method to characterize software validation testing has been adapted and applied. The method is a feasible and effective way to determine the tests to which a project should be subjected. The method identifies the type of tests, test levels, quality characteristics and specific tests for a project. It also allows the identification of techniques and testing tools.

It has been determined that there is increased interest in the application of functional testing for Web projects where safety testing has greater importance. The test level is systems, and

the quality characteristic is functionality. The review shows the lack of unit testing and integration testing.

The review presented difficulties due to the lack of related studies validating Web applications, as there are few studies on the characterization of software testing to provide insight into what aspects have been of software testing have been characterized. This lack may be because the main motivation for researchers is to develop methods or techniques that eliminate or reduce errors or failures when applied to the validation of Web applications.

The characterization has facilitated the establishment of a test plan that allows testers or test equipment to develop validation tests with confidence for a Web project.

6 Literature

1. A. Causevic, D. Sundmark and S. Punnekkat, "An Industrial Survey on Contemporary Aspects of Software Testing," *Software Testing, Verification and Validation (ICST), 2010 Third International Conference on* , vol., no., pp.393,401, 6-10 April 2010.
2. F. Davis and V, Venkatesh, "Toward preprototype user acceptance testing of new information systems: implications for software project management," *Engineering Management, IEEE Transactions on*, vol.51, no.1, pp.31, 46, Feb. 2004.
3. Desai and S. Shah, "Knowledge Management and Software Testing", *International Conference and Workshop on Emerging Trends in Technology (ICWET 2011) – TCET, Mumbai, India*, pp. 767-770, 2011
4. A. Dias Neto, R. Subramanyan, M. Vieira, and G. Travassos, "Characterization of Model-based Software Testing Approaches", *Technical Report ES-713/07, PESC/COPPE/UF RJ and SIEMENS CORPORATE RESEARCH*. 2007.
5. A. Farooq, and R. Dumke, "Research Directions in Verification & Validation Process Improvement", *ACM SIGSOFT Softw. Eng. Notes* vol., no., 32, 4, Article 3, July 2007.
6. P. Iyengar, and F. Karamouzis, "Offshore Application Testing Drives Greater Business Value." *Gartner Research*, pp. 1. August 17, 2007
7. B. Kitchenham, "Procedures for Performing Systematic Review", *Joint Technical Report Software Engineering Group, Department of Computer Science Keele University, United King and Empirical Software Engineering, National ICT Australia Ltd, Australia*, 2004.
8. O. Hyejin, C., Byoungju, H. Hyuksoo and E. Wong, "Optimizing Test Process Action Plans by Blending Testing Maturity Model and Design of Experiments," *Quality Software, QSIC '08. The Eighth International Conference on* , vol., no., pp.57,66, 12-13 Aug. 2008.
9. R. Quillen, "Why Some Software Development Projects Fail and What You Can Do About It", *Quillen Infrastructure Technologies*, 2011. http://www.quillenit.com.au/docs/Why_Software_Development_Projects_Fail.pdf
10. S. Uspenskiy, "A survey and classification of software testing tools", *Master's thesis. Department: Information technology, Lappeenranta University of Technology*, 2010.
11. S. Vegas and V. Basil, "A Characterisation Schema for Software Testing Techniques". *Empirical Softw. Engg. Vol.*, 10, pp., 437-466, October 2005.
12. Z. Wang, "Characterization Approach to Selecting Verification and Validation Techniques for Simulation Projects. *Proceedings of the Winter Simulation Conference*, C. Laroque, J. Himmelspach, R. Pasupathy, O. Rose, and A. M. Uhrmacher, eds., pp.,392: 1-392:2, 2012.