Chapter 7
Software Quality Measurement: State of the Art

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ABSTRACT

Software measurement helps to quantify the quality and the effectiveness of software to find areas of improvement and to provide information needed to make appropriate decisions. In the recent studies, software metrics are widely used for quality assessment. These metrics are divided into two categories: syntactic and semantic. A literature review shows that syntactic ones are widely discussed and are generally used to measure software internal attributes like complexity. It also shows a lack of studies that focus on measuring external attributes like using internal ones. This chapter presents a thorough analysis of most quality measurement concepts. Moreover, it makes a comparative study of object-oriented syntactic metrics to identify their effectiveness for quality assessment and in which phase of the development process these metrics may be used. As reliability is an external attribute, it cannot be measured directly. In this chapter, the authors discuss how reliability can be measured using its correlation with syntactic metrics.

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INTRODUCTION

Quality is crucial mainly in delicate systems. Poor quality could cause economical and financial loss and it may cause catastrophic situations in organizations using software products. For example, on January 15, 1990, a fault in the software of switching systems has engendered severe perturbations in a long-distance network as well as the shutdown of a number of local phone series (Lyu, 1996). Moreover, on April 19, 2006, the software system of Transportation Security Administration (TSA), U.S. Department of Homeland Security, indicated an image of suspicious device which is a part of routine testing, rather than indicating that a test was underway. Hence, to search the suspicious device, the security area was evacuated for two hours which cause more than 120 flight delays (Wong, 2009). Generally, software quality is represented by different attributes which may be internal i.e size, complexity and cohesion (Helali, 2015) or external i.e reliability, maintainability and portability (Saini et al. 2014).

According to Al-Qutaish (Al-Qutaish. 2010), these attributes are organized in a structured manner by various quality models including McCall’s, FURPS, Boehm’s and ISO 25010 that replaced the ISO 9126. Among these attributes, reliability was identified as the only common factor of cited models (Farooq et al., 2012).

In the context of quality measurement, numerous models, techniques and metrics have been proposed. For example, different semantic metrics suites are proposed in object oriented (OO) paradigm to measure different dimensions of software quality (Stein et al., 2004; Etzkorn and Delugach, 2000; Mili et al., 2014). Before the emergence of semantic metrics, an important number of syntactic metrics has also been proposed and used for internal software attributes measurement i.e cohesion and complexity (Chidamber and Kemerer 1994; Li 1998). However, little works have investigated the relationship of these metrics with external ones like reliability in order to estimate it. For example Vipin Kumar et al. (Vipin Kumar et al., 2011) proposed a tool called ANTLER based on the C++ programs as input to compute the optimal value of syntactic metrics and to deduce its influence on reliability. They used some OO syntactic metrics to identify which aspects constitute the reliability of the software. Other empirical studies are presented to show the impact of OO properties on quality attributes like maintainability (Abreu and Melo, 1996).

In brief, this chapter aims at presenting the fundamentals of software quality measurement including quality models, techniques and metrics. Moreover, our intention is to present a qualitative approach to measure software reliability as an important software dependability attribute using OO syntactic metrics. This approach will investigate the relationship of these metrics with reliability in order to measure it.

This chapter is structured into five major sections; the authors will present basic elements of software quality including quality attributes and models in section 1.
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