Dependability and Trustworthiness Analysis for Component Based Software Development

Sahil Khan, Shambhu Kumar Jha, Sunil Kumar Khatri

Abstract: ***Component based software development refers to the development of software by reusing components that fulfils the users requirements and achieves desired results. It has been in practice for a long time as it saves time and improves efficiency. Reusing components not only saves time but also provides efficient way of accomplishing task and contributes in optimal software development environment. This study analyzes the dependability and trustworthiness for the component-based software development which studies and provides with analysis of how reliable and dependable are the components and how much can this technique be trusted for developing software's. The components that are used in developing software's determine the success of the particular software and may work differently in different environment, hence it is important to analyze and study how much these software components are reliable, dependable and if they can be trusted with the large-scale projects that make use of component-based software development approach.***

Keywords: Component-based software development,reusability, dependability, trustworthiness, component reliability, software development environment

I. INTRODUCTION

Component based software development (Jha & Soni, July 2015) has been in use for a long time and it helps in improving efficiency by reducing the time taken in development of a software. It refers to the different components of various functionalities in a software system compiled together to build a specific software. The approach refers to the process of reusing a component in different application and to build new software's. The approach has been adopted as there are various advantages to this approach and with lots of advantages, also comes few disadvantages (Jha & Mishra, April 2015).An individual component might be a separate function all together that has been carried and utilized in a software system to build a bigger and more wide application with the use of various components. Alogin system can also be considered as a component which has been integrated into a software system with many other components. Although this practice saves up a lot of time and drastically improves the efficiency, we need to be sure if these components can be trusted and are dependable enough to carry out a bigger development task (Jianguo Chen, 2009). When developing a big software in a bigger software development environment, it is of utmost importance to check and test all the components and their functionalities before building into a software which may take a lot of time and even more time than creating a new component from scratch. Hence, in large scale development, people often build components of their own. However, if there was a way to know if the components can be trusted and are dependable to be utilized and integrated in large scale software development without the need for thorough testing, it would save up a lot of time and increase efficiency drastically as well as bringing down the cost to a great extend which is very important in development of that stature. This research analysis talks about the dependability and trustworthiness of these components and how much can they be relied upon when developing in a big software development environment and provides a complete analysis report of the component based software development.

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***** Correspondence Author

Sahil Khan*, Amity Institute of Information Technology, Amity University Campus, Sector 125, Noida (Uttar Pradesh), India
Shambhu Kumar Jha, Amity Institute of Information Technology, Amity University Campus, Sector 125, Noida (Uttar Pradesh), India
Sunil Kumar Khatri, Amity Institute of Information Technology, Amity University Campus, Sector 125, Noida (Uttar Pradesh), India

II. LITERATURE REVIEW

Chahal (Kuljit Kaur Chahal, 2008)proposed a Metrics Based Approach to Evaluate design of Software Components. In the approach they evaluated and studied in the internal design of a software component along with its relationship with the external part of the components as it was thought that the complexity involved in the internal system of component can help estimating the efforts related to the evolution of component. The CK-Metric (Chidamber, 1994) and Abreu's MOOD Metric (Abreu, 1995) was applied to a model software component and found out that the internal software component lacks in quality and the component was made using the object-orientedmethodology and it may require more efforts to make any change or extension to it. Gui (Gui, 2006) researched on Component reusability and cohesion measures in object-oriented system and provided a new measure of cohesion which was developed to assess the reusability of a component of java which was taken from search engine. He also stated how the measure differs from other established metrics in various aspects. It was concluded that the measure proposed was successful and reliable in predicting and analyzing the reusability of the java component (R. van Ommering, 2000).

III. METHODOLOGY ADOPTED

A. Analyzing Dependability and Trustworthiness

Components are very crucial in the development stage of any software. A lot is dependent on the quality and reliability of the component (Luka Lednicki Ana Petričić, 2009).

They may not always work as expected in a certain environment and often work differently in different situations. Therefore, it is very important to analyze and know the best component for each requirement. We take into consideration few characteristic qualities of the component and provide a rating to it based various factor that are needed while development for a specific use (Kharb L, 2008). The rating can be done for each purpose to analyze the best component available for the work.For this analysis, pair of three components was considered and compared by providing the rating, based on the requirement and characteristics to find out the best component to be used in this case. The characteristics based on which ratings are given are Accuracy, Compliance, Fault Tolerance, Testabilityand Security.Total 6 components, COMP_A1,COMP_A2,COMP_B1,COMP_B2,COMP_C1, COMP_C2 are considered, where COMP_A1 is to be compared to COMP_A2, COMP_B1 with COMP_B2 and so on. The component has been rated with the following characteristics for the reasons mentioned below. Each characteristic many sub parameters which were analyzed to create these five characteristics along with the weightage of the component user to for added accuracy.

1. Accuracy is the characteristic that determines how accurate the component is in terms of the purpose of its use and if it fits into the requirement for the software development. The accuracy can be judged by matching all the requirements of the software with the specifications of the component and rating it on the scale for the same.

2. Compliance characteristic refers to how much does the component complies with the standards and requirements of the software system and if it meets the standard set for the software development process and can be incorporated in the same.

3. Fault-Tolerance is to measure the robustness of a component which is to determine how much a component can handle if it fails at any stage or produces warnings and if it can handle the task despite having failures in the process and to what extent. It is an important characteristic to be rated upon and has multiple parameters attached to it based on which a general rating is provided.

4. Testability is also an important aspect of rating as each component's testability is of importance in development environment. Testability defines the degree to which a software can be tested and incase the testability is high in a component, it is much easier to find problems and faults within the component and if it is low, its harder. Based on this criterion of testability, the rating is provided on a scale considering various forms of testing and extended parameters.

5. Security characteristic defines how much secure is the component to various attacks and faults. The security is essential part of any software component and each component is designed keeping in mind some security enhancements. To keep it in check, the developers rate the component on the security characteristic as well bearing in mind the various attacks and concerns related to security within software environment. The components were put through test with the developers on the given parameters and were tested in due time to test their reliability and rate on the following. The factors were many which were reduced to the following 5 parameters listed in the paper and the research was concluded based on the following data compiled. The developers included working people with ample of experience and in the field of development who have worked in a component-based software development environment. The batch also included few less experienced people but with enough to have a perspective and knowledge to make the data as flexible as possible and as accurate. The Data was calculated from different working people to keep in mind the different factors that may affect the selection of components which we are discussed further in the paper. The selection of components by different developers and testing the reliability from a different perspective is an important factor and that's how the data result is achieved.

B. Selection of Components

In Component based software development there is always lack of trust and confusion amongst selecting the right component for the development. There are various factors of selecting a component as different components have different requirements and usage but what makes component more reliable is complete information regarding that component and its past usage and full disclosure of its properties (May, 2002).

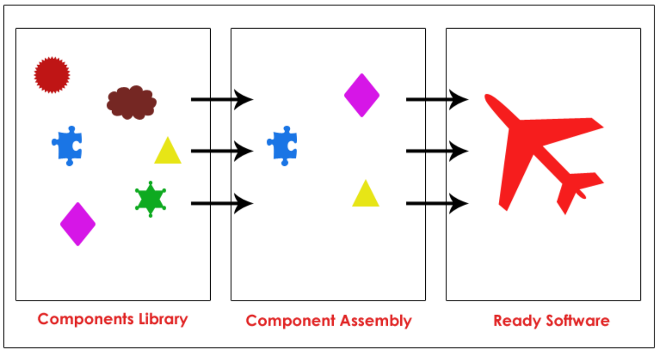

Fig 1. Component Selection in CBSD

As can be seen from Fig.1 The components that are best suited for the requirement and fulfils the dependability and trustworthiness rating test are selected from the vast library of components and taken into the component assembly where they are built together along with other components to create a new software. The best and most suitable components can be tracked and analyzed based on several criteria and tests and fitted into the assembly for building (Ali, 2002). These are generally most dependable and can be trusted as they meet the criteria completely and fulfils all the necessary requirements that are need to be met for the development.

IV. RESULT

The Methodology discussed has been worked out and the calculated results are below which shows the data conducted through survey from various reputed people who have been in the field of development and has been involved in component-based software development. For more accurate measurement of the data provided, we also take into consideration the weightage of each person based on their experience and expertise on a scale of 1-5 and calculated it as an additional factor in their data to assess the final outcome.

COMPONENTS	Accuracy	Compliance	Fault Tolerance	Testability	Security
COMP_A1	4.6	4.4	4.1	4.7	4.4
COMP_A2	2.7	2.9	3	3.4	3
COMP_B1	2.6	2.8	2.9	2.8	3.1
COMP_B2	4.3	4.1	4.3	4.2	4.4
COMP_C1	4.6	4.4	4.4	4.5	4.3
COMP_C2	3.1	2.8	3.1	2.5	3.2

Table 1. Rating for components by 5 developers

With the usage of these components by multiple users in the data is analyzed and compiled in a graph as follows.

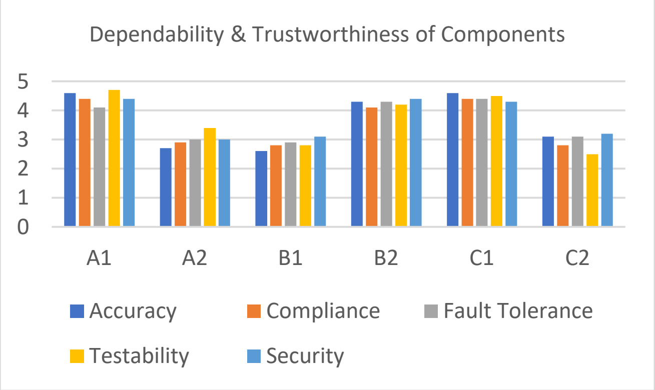

Fig 2. Result of Analysis for Components

Based on the above data, we can conclude that amongst the components, COMP_A1 is a better choice than COMP_A2. COMP_B2 is a better choice than COMP_B1 and COMP_C1 is a better choice than COMP_C2. Hence if we need to build a dependable and trustworthy software, Components COMP_A1, COMP_B2, COMP_C1 will be the right choice for the development.

V. CONCLUSION

After analyzing the Dependability and Trustworthiness in the component-based software system, it can be concluded that the component should be used after cautious selection of components based on their capabilities and factors. Each component has a different capability and may perform differently in different applications. The data compiled was based on different working people with different experience for which the weightage was provided and the result was achieved since different components perform differently in various environments and may not work as expected in the given environment. However, the component with the most reusability will prove to be more dependable and trustworthiness as the component has a proven record which makes it a better choice however it will still need to be checked through the factors and analyzed if it fits the requirement. On proper selection of components based on the functional requirement of the system and the operating environment, the component is proven to be dependable as well as trustworthiness.

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