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THE GUIDING PRINCIPLES FOR HANDLING OF REUSABLE SOFTWARE COMPONENTS

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ABSTRACT

Handling of reusable software components will be a step towards creating a discipline in the field of reusable software components. The concept of handling emerges from the idea that the reusable components should be used, transacted, stimulated, and retrieved by adhering to proper guidelines and standards. As the guidelines and standards are followed while handling with the other entities, the software components should also be dealt with the same way. If the guidelines and standards are not followed while handling the software components, there won't be any regularity on the components. Therefore, the study has provided with the standards and guidelines for handling of reusable software components. It would affect the quality of reusable software components. Consequently, the quality of software products composed from these components will be affected. Also, the lack of handling will have a negative impact on the whole market of reusable components. The study also stated the process and the elements involved in the process of handling of reusable software components.

KEYWORDS: Acquisition, management, usage, retrieval, transacting.

I. INTRODUCTION

Handling of reusable software components refers to the usage, methods of transacting, process of acquiring and retrieving components. That is, handling defines how the reusable components should be dealt with while being reused, transacted, acquired, and retrieved [2] [8]. The idea is the reusable components should be dealt in a right way. The inspiration for handling of components is aroused by looking into the handling of hardware/other entities. In the way the other entities being handled, it convinced that the concept of handling should be introduced into the area of reusable software components. It advocates that the components should be acquired or retrieved in the form of a package containing the complete information about the usage, documentation, modifications, policies and methods of transaction etc.

The concept has its significance in the fact that a large number of software components are stimulated into the market arena with the purpose of being reused. To maintain discipline among the usage of reusable components it is required that they should be dealt in a standard way. A standard handling method can lead to regularize and controlling reusable components. The software industry can be benefitted from the reuse of software components but only if they are handled in a standard manner. The novelty of this study lies in the institutionalization of this concept. The purpose of handling is to provide safety to reusable software components. Handling leads to preventing the components from damage and unauthorized use [7].

Handling of reusable software components emphasizes on the safety and usage of components. It is a pioneering effort in the development of reusable software systems. It can lead the way for software industry to explain that how and why handling should be induced in development lifecycle of reusable components. It is the responsibility of component provider to ensure necessary guidelines for handling reusable components. A provider refers to the one who has made the component available for reuse by others. A provider is the one that has actually designed, coded, implemented, tested, and maintain the reusable components [10].

The guidelines should be in the form of a document that should travel along with the component while transacting. It can be said that the component handling also refers to one kind of extension of component documentation. It is a written illustration that moves along with software component. It tells for its users that how it works, or how to operate it, or how it can be used in different scenarios. Different types of documentations may include: usage report, transaction report, acquisition report, and retrieval report [2].

II. STANDARDS AND GUIDELINES FOR HANDLING

There are no specific standards and guidelines present, that guides one for handling of reusable software components. Though there exist standards and guidelines that fall under other categories of standards such as quality assurance, configuration management, and safety standards [10]. The standards under these separate categories of standards are being used accordingly as and when required by the individuals or the organizations to suite their requirements. But the lack of a specific standard and guideline regarding the handling of reusable software components affects the uniformity in handling of components. This lack in uniformity in handling components has its effects on the reuse market arena.

The individuals and the organizations are taking the standards and guidelines as they feel right for them. The study emphasized on the need of standards and guidelines for handling components. In that course of action, it analyses the different categories of standards and figures out some of the guidelines that should be followed while handling the reusable components. These guidelines are [8]:

- The handling of reusable software components should be done in a centralized manner.
- The classification scheme should be implemented, so that there should be an effective storage, searching, and retrieval mechanism be put in place.
- There should be a form of consistency when acquiring software components from providers.
- There should be a form of consistency when providing software components to the retrievers.
- Uniform naming conventions should be implemented on reusable components upon their acquisition.
- Uniform packaging system for reusable components should be implemented while acquiring and delivering reusable components.
- The quality aspects of reusable software components should be considered while acquisition of components. Consequently, the quality components will be delivered and that in turn, will increase the reliability of the component.
- Quality assessment of components should be conducted at regular time intervals for detecting any kind of damage and providing repair to the components.
- A log containing the complete access record of reusable components should be maintained.

The above mentioned guidelines are stated after analyzing the IEEE standard for configuration management in systems and software engineering [3], IEEE standard for software quality assurance processes [4], IEEE recommended practice for software acquisition [2], IEEE standard for software safety plans [1], NATO standard for management of a reusable software component library [8], NASA standard for software safety [10], and NASA software catalog for 2015-2016 [7].

III. PROCESS OF HANDLING

The process of handling reusable components broadly covers the four aspects such as the usage, the management, the acquisition, and the retrieval of reusable components. That is, it explains how the reusable components are to be handled while usage, management, acquisition, and the retrieval of components [2] [8]. The manifestation of details of these aspects is presented in this section. These details are:

A. Acquisition

The term acquisition, here, refers to the supply or storage of reusable components to a specific place called repository. The reusable components are supplied or provided by the original developer or provider of the component. The term acquisition here should not be mixed with the term acquirer as mentioned in the processes of part ‘B’, ‘C’, and ‘D’ of this section [2]. This section explains the process of acquisition of reusable components by the repository. The steps of acquisition are illustrated as follows [2]:

- The lifecycle of acquisition process starts with the inception of idea of supplying the reusable component to the repository by the provider.
- The provider will identify the suitable repositories for reusable software components.

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- The provider then reaches out to potential repositories of reusable software components and while doing so, it should keep in mind the requirements for components as well.
- It then works out on the performance, terms & conditions, and requirements of acquisition by different repositories.
- On reaching a state of agreement, it finalizes the selection of repository for supplying the reusable software components.
- The repository will now identify the requirement for the reusable component, i.e., it will determine whether there is a need for the component to be acquired.
- If there remains the requirement for acquisition of component, then the repository may validate it for its conformance to quality, standards, and established practices.
- On being confident about the component the repository will give its consent for acquisition of reusable components by extending a contract with the provider.
- After selecting a repository for supplying its components, the original developer or provider will sign a contract with the repository.
- It will then supply the reusable component to the repository as per the conditions mentioned in the contract.
- It is the responsibility of both the parties that they should adhere to the conditions of signed contract.
- The lifecycle of acquisition process ends with the supply of reusable software components to the repository.

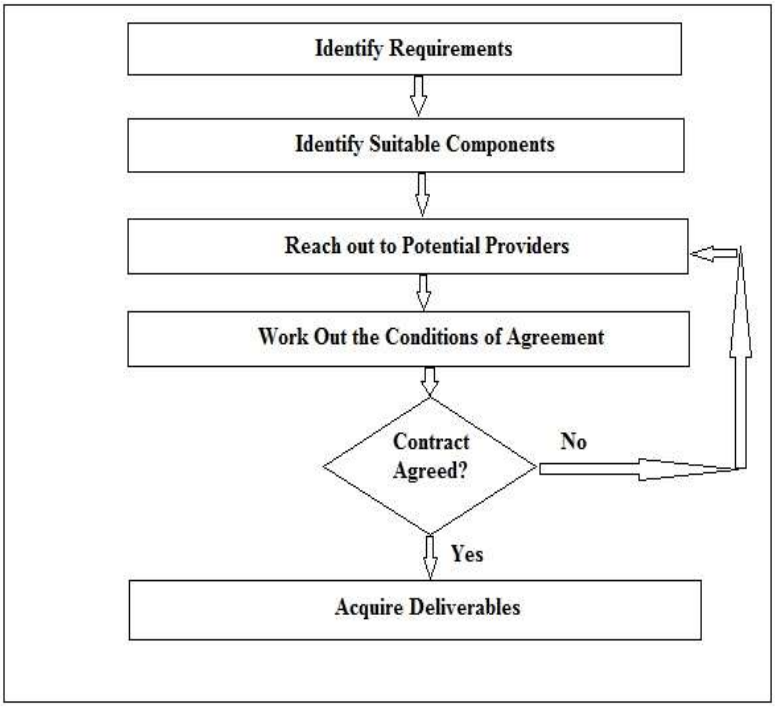

Figure 1: Process of Acquisition

The figure 1 explains the process of acquisition of reusable software components. It states the acquisition process from the viewpoint of repository. That is, the repository will first identify the requirements for reusable component to be acquired. In certain, it determines the need for a component to be acquired. After that, it identifies a set of reusable components that suites the requirements. The repository will then reach out to the potential providers of the identified reusable software components. The potential providers may be the original developers of the component or the supplier of the component. The repository will work out on the conditions about the acquisition of the reusable component with the provider of the component. The terms and conditions for acquisition refer to the costs, maintenance, services, legal aspects, proprietary issues etc. This is observed as a phase of negotiation, where both the parties negotiate to attain a position of benefit. When both the parties agree upon the conditions of acquisition, they sign a contract and the components are acquired. In case the consensus is not reached between the two parties, on terms and conditions of acquisition of reusable components, the repository may approach to other potential providers.

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B. Management

The management process refers to the management of reusable software components while they are stored in the repository. This process starts right after the component is stored into the repository and ends when the component is either retrieved by the acquirer or the component is no more available for reuse. The steps of management process are illustrated as follows [8]:

- The repository will maintain a complete list of the reusable software components stored in it.
- It is required to classify the reusable components, as per the classification scheme implemented in repository, for better storage, search, management, and retrieval of components.
- It may conduct qualitative and quantitative analyses of reusable components on the basis of predefined standard criteria and then it may rank them accordingly.
- This ranking will be helpful for the acquirers, in deciding, which components will suite their requirements most.
- It is required to conduct quality assessment of components at regular time intervals in order to assess the present quality state of the component and to identify any damage to the components.
- The repository will have to make complete documentation about the reusable components.
- The documentation may contain each information about the components such as details about the reusable components, details of provider, details of acquirer (if retrieved), details about modifications, contract details etc.

C. Retrieval

The process of retrieval state that the reusable software components are retrieved by the acquirers or retrievers as and when required, from the repository. The term acquirer and retriever are used interchangeably. A repository may implement different retrieval techniques in order to make the retrieval process effective and better. The process of reusable software component retrieval is conducted by the acquirer. The manifestations of details of this process are [2]:

- The process of retrieval starts when the acquirer feels about the need of reusable software component.
- The acquirer starts identifying its requirements for the components.
- It then identifies a number of possible reusable components that matches its requirements.
- The acquirer works on the providers regarding their performance, terms and conditions, and other support & maintenance for reusable components.
- It weighs the proposals of different providers.
- If there is a state of agreement between the provider and the acquirer or the retriever, the contract may be signed between them.
- After the contract is signed and other formalities are completed, the provider may give an access to the reusable software component to the acquirer.
- On retrieving the concerned reusable component, the process of retrieval ends.

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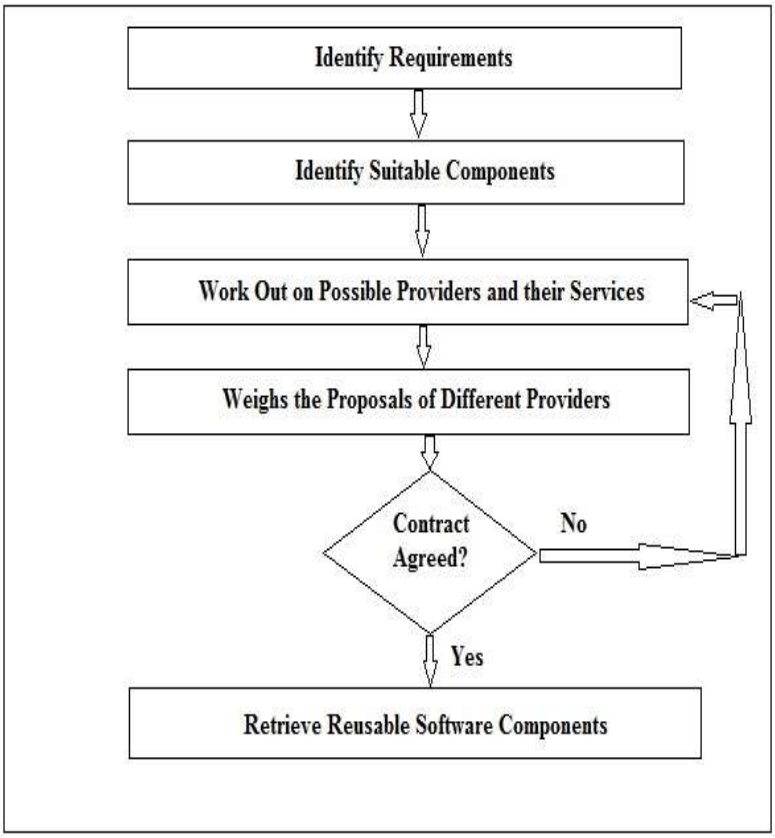

Figure 2: Process of Retrieval

The figure 2 explains the process of retrieval of reusable software components by the potential reusers. The retrieval process has been stated from the viewpoint of the reuser. In its first step, the reuser will work out on the requirements. That is, it will identify what requirements are needed there in a component to be retrieved. After the requirements are identified, a set of components that matches those requirements is identified. On identification of suitable components, the reuser can then work on the services provided and the performance of the potential providers of these components. After working out on the services and performance of different component providers, the reuser then weighs the proposals of different providers and tries to match the best with its requirements. Once, it reaches the agreement to the conditions of potential provider, a contract is signed. If the contract is signed, the access is provided to the reuser to retrieve the reusable component from the repository. Otherwise, in case of non agreement to the conditions, the reuser [8] may then look out for other potential providers and their services.

D. Usage

The usage of reusable components refers to agreed terms and conditions between the provider and the acquirer of reusable components. It states that the component should be reused based on those terms. The provider is the one that offers a component for reuse, whereas an acquirer is the one that takes over the reusable component to fulfill its requirements. A provider and an acquirer may be an individual or an organization. It is a professional as well as a legal obligation for an acquirer to stick to the agreed terms and conditions of agreement for the exchange of reusable components. The agreement, in certain, contains the do's and don'ts about the component. The terms and conditions can be finalized by a mutual understanding between both the parties. Also the provider should take care that the reusable components should be reused as per the terms of the agreement. The process for this has been illustrated as follows [2] [10]:

- Once the acquirer has selected the reusable component, it should fill out the agreement form designed specifically for the usage of components.
- If the component is open source component, it can be downloaded directly without any usage agreement.
- Otherwise, it is required to fill out the usage agreement.

- The acquirer will have to sign the agreement form designed by the provider in order to get an access to the component.
- The acquirer will have to maintain a usage report for the component and also it will have to intimate that report to the provider at regular time intervals, provided, it is mentioned by the provider. This can be one of the methods; the provider can prevent the violations of component usage.
- An automated configuration tracking system can also be put in place to track the violations.
- Also the components can be packaged in such a way, that it should prevent the components from being used otherwise than stated.
- There may be such situations where the acquirer will be required to make modifications into the reusable components in order to fit it into its project. In such a case, the acquirer is required to intimate and to take permissions from the provider to make modifications.
- Such permissions should be granted through extended agreement between both parties.
- The provider can drag the acquirer in the court of law, if it finds any violations of the signed agreement.

The process of handling reusable software components covers both the view points of software component reuse, i.e., development for reuse and development with reuse. From the process of handling, it can be seen clearly that when the reusable software components are supplied or stored to a repository, they address the purpose of development for reuse whereas when the reusable software components are retrieved from the repository by the acquirer, they address the purpose of development through reuse.

IV. CONCLUSIONS

Handling is an important issue for the reusable software components. Though handling is not considered effectively, but it can be vital in preventing damage and theft of the software components. The study presented the guidelines for handling of reusable software components. The guidelines have been prepared after reviewing the standards for other different activities, but are in concern with software components handling. It stated the process of components handling which has four parts such as the acquisition, the management, the retrieval, and the usage. It provided the complete details about the handling processes of software components. These processes stated about the activities to be undertaken, how these activities will be performed, and who will be responsible for these activities. The study also emphasized that the software components should be packaged in such a format that it should be accessible by the intended users only. Also the software component package should contain the necessary relative information about the component.

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