A Model of Managing Knowledge for Software Maintenance As a Service (SMaaS) in a Private Cloud Computing Environment

RUSLI ABDULLAH
Information System Department,
Faculty of Computer Science & IT,
University Putra Malaysia, 43400 UPM,
Serdang, Selangor,
MALAYSIA
rusli@fsktm.upm.edu.my

NAGHMEH MAHMOODIAN
Information System Department,
Faculty of Computer Science & IT,
University Putra Malaysia, 43400 UPM,
Serdang, Selangor,
MALAYSIA
naghmeh.ma@gmail.com

Abstract: Software Maintenance (SM) community of practice (CoP) is including the system maintainer as a service provider and the users as its service recipient. Based on this scenario, they are working together or work collaboratively in order to optimize the capabilities of the software, which we called it as SM as a service (SMaaS) process. In this context, The CoP can make use knowledge management system (KMS) as a tool in managing the SM knowledge as a best practice and lesson learnt. SM is the process of identifying and delivering the software as a product based on service level agreement (SLA) that has been made between service provider and the users. The paper will discuss the model on how the SM is offering its service of processes through knowledge life cycle which starting from knowledge acquisition, knowledge storing, knowledge dissemination, and knowledge application in order to avoid any shortcoming fault or failure especially during the software development (SD) in a private cloud computing environment. Therefore, by using the KMS model in managing knowledge of SM, CoP can utilize the SM knowledge in the KMS and it will reduces the mistake or errors, so that they can also maintain a good service besides in enhancing the return of investment (ROI) as well as the quality of software to the particular users.

Key-Words: Software Maintenance, Collaboration, Knowledge Management, Service Level Agreement, Cloud Computing

1 Introduction

Software Maintenance (SM) community of practice (CoP) is including the system maintainer as a service provider and the users as its service recipient. Based on this scenario, they are working together or work collaboratively in order to optimize the capabilities of the software, which we called it as SM as a service (SMaaS) process. In this context, The CoP can make use knowledge management system (KMS) as a tool in managing the SM knowledge as a best practice and lesson learnt. SM is the process of identifying and delivering the software as a product based on service level agreement (SLA) that has been made between service provider and the users [13]. The paper will discuss the model on how the SM is offering its service of processes through knowledge life cycle which starting from knowledge acquisition, knowledge storing, knowledge dissemination, and knowledge application in order to avoid any shortcoming fault or failure especially during the software development (SD) in a private cloud computing environment. Therefore, by using the KMS model in managing knowledge of SM, CoP can utilize the SM knowledge in the KMS and it will reduces the mistake or errors, so that they can also maintain a good service besides in enhancing the return of investment (ROI) as well as the quality of software to the particular users.

2 Literature Review

Knowledge management system (KMS) is a tool for managing knowledge which is involved knowledge acquisition, knowledge storage, knowledge dissemination, and knowledge application [4]. The knowledge of the CoP can be divided into two types of knowledge called tacit and explicit knowledge [3]. Fig. 1 is showing the KM life cycle process. In this context, KMS can also be used in different knowledge environment such as Software Engineering [4,5], Software Testing [3,6], Software Maintenance Knowledge [7,8] and many others.

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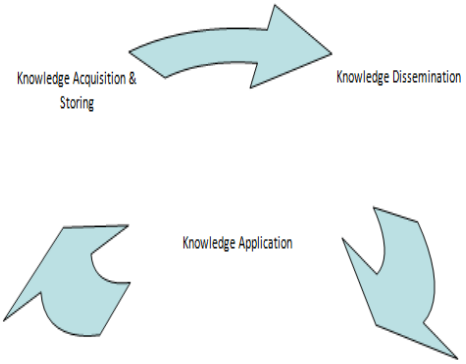

Fig. 1: KM Life Cycle Process

In the context of managing knowledge of SM which is consists of knowledge of maintenance activities of processes, it will be managed or categorized according to the knowledge structure of software maintenance (SM) process based on its type of SM as well as configuration management environment Mean while, according to Kaner [9,10], SM is also related to an investigation conducted to provide stakeholders with information about the quality of the product or service under its maintainability. So that, by handling the SM process, the product that will be delivered to the stakeholders as main users significantly will become in a good quality of condition which according with their requirement. The Fig. 2 is showing on CoP such as Software Maintainer, Developer, and the User are working collaboratively in SM as a service (SMaaS) and shared their knowledge as much as possible into a specific system.

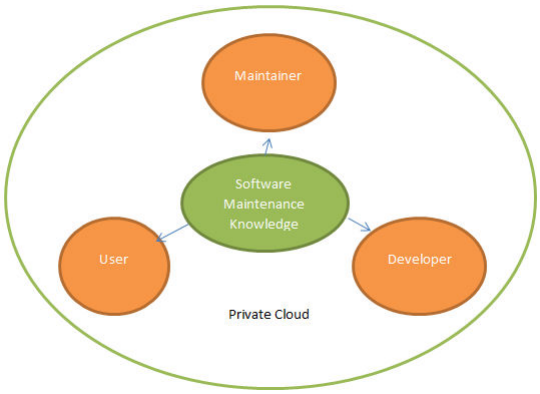

Fig. 2: CoP in SMaaS Environment

SM process normally involved corrective and adaptive maintenance. Corrective maintenance is a maintenance process that will maintain the functionality of the product as in a shortcoming of current problem of the software, while the adaptive maintenance is the maintenance process which is involving the software based on the changes of the environment such as rules and regulations. This inventory will be starting by requirements which are consists of functional, non-functional requirement, and followed by any structure of software a product. Fig. 3 is showing the corrective and adaptive maintenance by indicating internal and external structure of the software as a product.

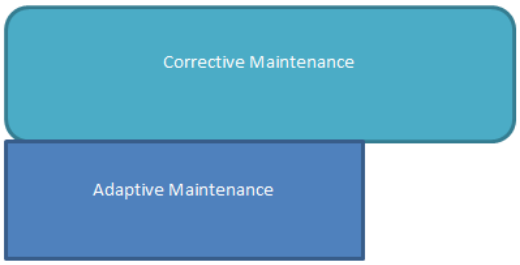

Fig. 3: Types of Software Maintenance

Besides that, in order to ensure the CoP will be informing about the latest knowledge with regards to SM that was deposited and used by certain members of the CoP in the KMS, there are two kinds of technologies can be implemented for this environment. These are included push and pull technology mechanisms in term of soft and hard information about the utilization of the specific knowledge of relevant CoP in SM environment

3 Methodology

In order to formulate the model of KMS in managing knowledge of SM as a service (SMaaS) process environment, there are few steps that has been indicated as shown in Fig. 4.

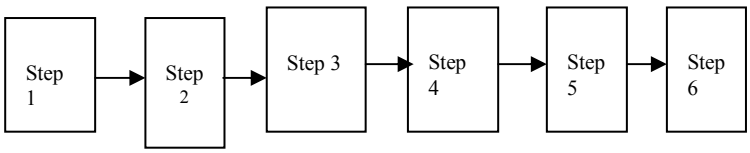

Fig. 4: Steps in KMS model in SMaaS formulation

Step 1: Performing Review of the literature. This is involving the process of reviewing the KM, Software Maintenance (SM) process, and how the KM as system can be used to manage of the SM in a CoP in order to achieve their mission statement.

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Step 2: Conduct the preliminary survey. This is the process of conducting the preliminary survey for getting input for the model of KMS in SM as a service (SMaaS). For this purposes, the survey has been done by using a questionnaire to those who are involved in the project of SM such as software maintainer, developer, and users, so that they can verify the proposed input such as usability, maintainability, and security that supported from the literature as well as may have additional requirement of any missing variability or functions of KM as a system in providing the knowledge of SM process to the CoP.

Step 3: Formulate the model. This is the process involving the composition of the attributes and elements based on the previous steps into a specific format or manner.

Step 4: Translate the form of model into system components. This is the process to architectural design the model into its component-based system with regards on KMS together with SM process.

Step 5: Evaluation. This is the process of evaluation that involved another round of questionnaire called post-survey in order not only to verify and validate the model but also a part to enhancing of a comprehensive system model specification.

Step 6: Conclusion. This is the process of summarizing the finding of pre and post survey that has been done on in producing the KMS model for managing knowledge of SM process environment.

4 A Model Of Software Maintenance As A Service In KMS Environment

The overall model of KMS in managing knowledge a CoP in software testing, it can be proposed as shown as in Fig. 5. Besides that, the model KMS can be divided into three main components or layers. These are including the SM CoP layer, KMS Functionality in SM layer, and KMS architecture layer.

These layers will be interacting to each other in order to ensure it will perform based on the particular purpose of CoP in maintaining the services especially related to knowledge structure of best practise and lesson learnt in SM.

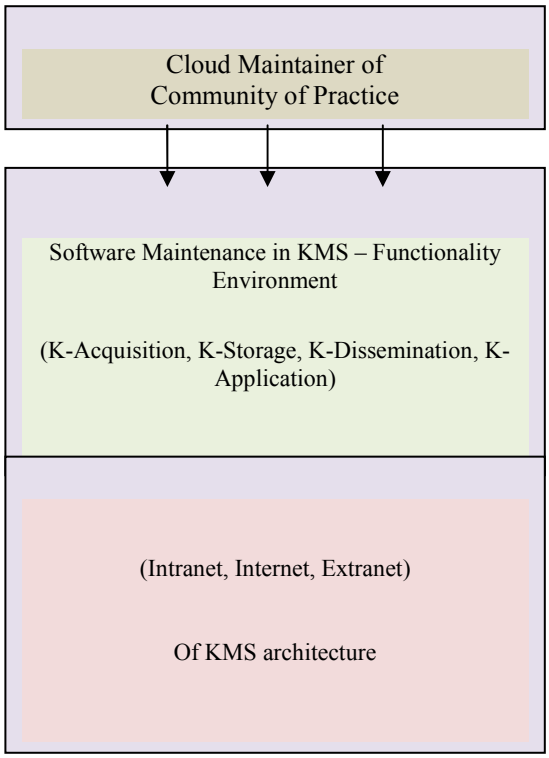

Fig. 5: A Model in SMaaS in Cloud Computing Environment

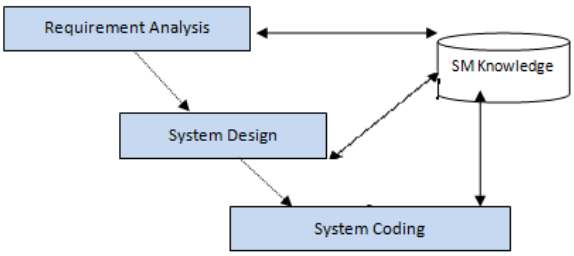

Fig. 6: Knowledge Structure in SMaaS

Fig. 6 show also a diagram of SM process in terms of knowledge structure in software development in cloud computing that is starting from the requirement analysis in producing system specification for system development activities, which are consists of system design and system coding and then up to system verification and validation of a product for delivering to the specified to the users

5 Result And Discussion

The KMS model development in the context of software testing has been gone through the steps as mentioned in the methodology section. Based on this, there is a significant result shown that the KMS

model should accommodated the following features or components, in order to become relevant to serve the CoP in software maintenance environment.

5.1 KMS of Software Maintenance Capabilities in Cloud Computing Environment

KM system Capabilities of its Environment that can be implemented based on the following aspects such as Conceptual modelling, KM system Functionality and Its Architecture, KM system Operational having the similarity agreement. Fig. 7 show the level of agreement on particular knowledge of software maintenance community about the knowledge that need to be included in the KMS for future purposes. While, Fig. 8 show the level of important of Knowledge Type that the explicit knowledge is more concern agreement on particular knowledge of software testing community about the knowledge that need to be included in the KMS for future purposes. While, Figure 9 show the level of important of Knowledge Type that the explicit knowledge is more concern than tacit knowledge a KMS of Software Maintenance Environment.

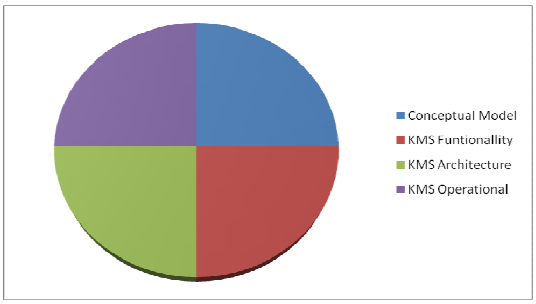

Fig. 7: KMS of SMaaS Capabilities in Cloud Computing Environment

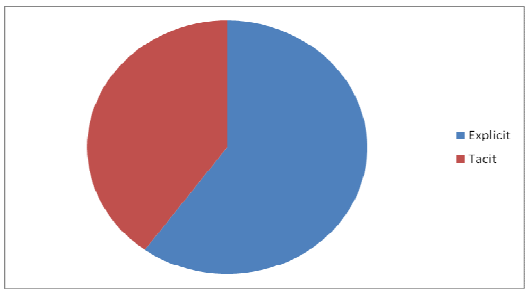

Fig. 8: The Important of Knowledge Type in a KMS of SMaaS Environment

5.2 Knowledge Structure of Software Maintenance

Based on the Knowledge Structure of Software Maintenance in terms of Importance for Reliability and Availability, respondents are agreed that the average of Knowledge Structure of Software Maintenance in managing the knowledge, the CoP has agreed that Reliability – 100%, and Availability – 80%. This is shown that reliability is more concern in the SM environment.

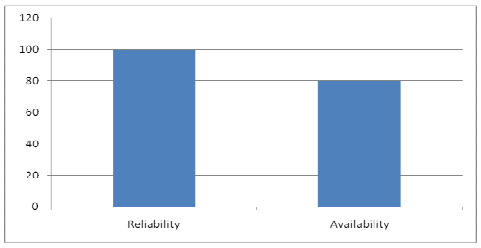

Fig. 9: The Aggreement of Important for Knowledge Structure

6 CONCLUSION AND FUTURE WORK

As a conclusion, the paper has shown that the KMS model is very important feature for the CoP in providing the knowledge of software maintenance as a service (SMaaS) in cloud computing environment. The KMS model can be implemented by using two components which are involved KMS functionality and its related architecture through network computer capabilities weather it was directly or remotely. The finding is also shown that the CoP can getting the collection of processes in a SMaaS that has contribute a significant effect to them in acquiring, storing, disseminating and applying the knowledge of SM for the future purposes. Besides that, in order to ensure KMS in SM that can be done smoothly, the administrator should be considered the most related issues like performance, learn ability, reliability, availability and security in a good manners so, that CoP can access and use of the particular knowledge at anywhere and at anytime.

For future work, it is good to be considered on how KMS can be accessed and used by CoP in SMaaS together service level agreement (SLA) that may be using any devices especially through mobile computing since this project is only considered for accessing in a KMS as common devices (client server based environment through desktop technology) only.

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