CRITICAL EVALUATION ON SOFTWARE DEVELOPMENT PROCESS MODELS WITH RESPECT TO MOBILE SOFTWARE DEVELOPMENT

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ABSTRACT

Desktop computing is different from mobile computing, however, mostly mobile software developers or designers are using desktop development strategies for mobile software developments. To compete with the fast growing mobile technologies, we need faster and appropriate development strategies. As to initiate the development of a specific process model for mobile application development, first it is necessary to study the existing process models' strengths and weaknesses. A comparative analysis was performed using methods like life-cycle coverage project management support, type of guidelines, fitness-for-purpose and empirical study as the analytical tools. The comparative analysis is performed using the method's life-cycle coverage project management support, type of guidance, fitness-for-purpose and empirical evidence as the analytical tools. The results shows that MSD methods covers different phases of the software development life-cycle and most of existing do not offer adequate support for mobile project management. Yet, many methods still attempt to strive for universal solutions as contrasting to MSD and the empirical verification is still very imperfect. In this paper, we study on the current available process models and then identified the irrelevancies in the existing models pertaining to mobile software development. Finally, based on the findings, we suggested some important properties to be considered in the new mobile software development process model.

KEYWORDS

Mobile Software Development (MSD), Software process models, Linear, Itterative, Incremental.

1 INTRODUCTION

Mobile phones are becoming the ultimate business devices that communicate and network among the business partners. "Demand for mobile applications is flourishing, mobile applications downloads are expected to exceed 21.6 billion

worldwide by 2013" [1]. Looking at the speed of the mobile phone penetration in the world, the current speed of mobile software development cannot compete with the emerging mobile phone trend. The quicker the software can be developed, the better competitive advantage a company will derive, provided it meets the demand.

Existing software development approaches will be difficult to apply in a mobile development context. First, mobile system user interfaces (UI) present a new standard for human-computer interaction sequences (e.g., touch screen, quick response (QR) code scanning, voice recognition, retina screen.) that have not explored earlier in research and did not established UI guidelines. Second, the different mobile platforms (such as iOS, Android, Blackberry, Symbian and Windows mobile), differing hardware makers for platforms (e.g. Apple versions, Samsung versions, Blackberry versions, Google versions) and mobile phone and tablet platforms (e.g. Apple iPad models and Samsung Galaxy models) have demanded the producers to make same application tailored for each different devices. Third, the originality of mobile development platform makes both exclusive opening and challenges.

Many of the issues which were considered as mobile computing issues in the past are not issues today. However, process models, programming paradigms, and development platforms are the major concerns. Identifying the appropriate process model, programming paradigm and language selection are key important areas to be considered in the case of Mobile Software Development (MSD). Along with those constraints, mobile software should able to operate properly on different currently available mobile environment and future environments. Current mobile software developments and deployment environments are to be observed, and suitable properties for a MSD process model need to be adopted.

The purpose of this paper is to suggest a set of specific properties for mobile software development process model. This paper is organized in few sections. Section 2 identifies the available process model, start from the general linear model then specific iterative and incremental model and finally to hybrid model. Section 3 describes the literature of MSD researches and explained the irrelevancies of the researches toward mobile software development. In Section 4, we justify the need for a specific process model for MSD by

giving some factors such as time-to-market, innovation, risk, multiple platform and programming paradigm. Finally, we suggest a set of properties for MSD in Section 4.

2 LITERATURE OF CURRENT PROCESS MODELS

From the very beginning of the software development era, the developer and consultants wants to incorporate quality into software has gained acceptance of various process models. Even though developers use many different type of software process model, however, each of these models has its strength and weaknesses.

A typical software process model comprises of four generic phases: requirements engineering, design and implementation, testing and evolution [2]. All software development projects have to involve the four phases in their development life cycle for successful completion. There are many software development life cycle models is been suggested but basically based on this typical four phases which expressed in different term and terminologies. In this section, we identified four different types of life cycle models, they are linear model, iterative model, incremental model and hybrid or customized model.

A linear model is the earliest software development model which states the phases in a linear or sequence order. Each of the phases should be complete before proceed to the next phase. Waterfall model is the most common process model among linear model. Secondly, the iterative model is a model where the developing team will repeat the same task until they (the client and the developer) satisfied with the outcome [3]. Spiral model is an example of iterative process model. Next, the incremental model is emphasis on evolutionary development, where each increment will deliver a deliverable. Each increment will have a complete set of development life cycle. This process will continue until all customer requirements are satisfied [17]. In increment and iterative models, the phases are interleaved. Prototyping [2] and agile methods [18][19] can be adopted in order to accommodate with the requirements changes and rapid delivery. Finally, the hybrid model or customized model, hybrid models means collaborating two or more models to generate a new model, for example, Rapid Application Development (RAD), and a combination of Waterfall, Spiral, prototyping and Join Application Design (JAD) makes James Martins RAD model [4].

Therefore, each of the software development process models aimed to improve the productivity in their own domain. Most of the process models that we discussed above are depending on the external factors such as time, costs and functions. As the result, every software development project requires different type of processes to ensure the quality and reliability. Moreover, the unique requirements and constraints of such multifaceted computing environments are differing from conventional computing systems thus brought new challenges to software development [5].

The review explained that the particularity of each model in the development process will achieve quality product. In MSD the factors such as marketing, software platform, and trend will add complexity in selecting a process model. Hence, mobile software too needs a specific process model to ensure the sustainability of mobile software in the world.

3 IRRELEVANCIES OF PROCESS MODELS TO MSD

Separate software engineering principles and process model is suggested to secure the availability, integrity, time to market and other mobile development issues by considering development aspects from the very beginning and throughout software development life cycle. Mobile software development process is the process of designing, building, and testing mobile software so that it becomes useful for users. Mobile software development process model includes software development processes and mobile software development (MSD) methods.

Mobile software development related research is not a new research area. The research was started early as early eighties and nineties. The researches were conducted in many areas in MSD (e.g., [6], [7], [8], [13], [14],[15]). For example, Satyanarayanan in [6] was critically analyzed the issues and challenges in the mobile development. He also points out the differences and specialty. Besides, he also mentioned the constraints in designing mobile software. Although the work of Satyanarayanan [6] on mobile software development seems to be very promising, however, the description that he provides in his paper is does not apply anymore, in which there are more advance tools and techniques are now available.

Another researcher was investigating a common architecture for MSD called application framework [7]. This framework supports the agile

software development and paves a path to support on common framework for various mobile platforms by using Platform Independent Model (PIM) in Model Driven Development (MDD). Even though this work leads to a common framework for various mobile platforms and to reduce MSD time, however, it seems to be lacking in employing common process model.

There is also other research work conducted which similar to our research topic where they came out with an integrated process [8]. In their work, the authors use market and business models to explain about the process. According to the authors, current MSD processes are too technical and product-oriented, where they claim that is not suitable for global competitiveness. Hence, they argued that technical and product-oriented is not only factoring for MSD but it also must include business model into it. Based on some empirical research conducted with some final year mobile computing students, the author concluded that the factors mentioned by Zeidler, C [8] and the team is suitable only for the business-oriented type of application. But, mobile applications are covering various domains such as communication, games and entertainment. Therefore, the proposed processes are less suitable to generalize the overall MSD.

In conclusion, from the literatures conducted by the various researchers, actually, there is no specific or precise process model for MSD. Therefore, we plan to narrow down our research scope to very specific to the technical aspect of the MSD. As for the start, we are doing a critical analysis on process models for optimal utilization in mobile software development.

4 WHY NEED A SEPARATE PROCESS MODEL FOR MOBILE SOFTWARE DEVELOPMENT

On the basis of our review, we have assessed the appropriateness of current process models with respect to five critical application development requirements.

4.1 Time To Market

Having a software development project can be considered is very long process. Therefore using existing process models will be suitable but in the case of MSD these process models will reduce time to market. This will lead to a big loss to the organization where time is crucial. For example, by using a RAD approach for developing a normal software application will take at least three month [9] but we can consider it is very slow process for MSD. According to an empirical

study conducted with five mobile software development organizations, it is found that mobile software needs to be developed within a month. Hence, RAD is not suitable for MSD.

4.2 Innovation

"Innovation is the specific instrument of entrepreneurship, the act that endows resources with a new capacity to create wealth." – Peter Drucker [16]. In this industry if innovation is not been emphasize, then the penetration to market will be impossible. For example, if the design of the mobile application is not up to the current trend, the sales of the product will be reduced. In which, this will lead to the failure of the product. Hence, innovation is the key factor for success for mobile software. The more innovative the products are, the more competitive in the market. Current process models are not emphasizing on innovation but on accuracy, reliability and deliverability. Even though those factors are important, however, there are some other factors that should also be considered. The factors such as attractiveness, usability, simplicity and cognitive are also equally contribute to the success of mobile software. Therefore, these factors should be included when constructing a process model for mobile software development.

4.3 Risk

Everywhere there are risks but in software development it is very significant. Risk is the catastrophic event that makes a software development project to fail. The risk will cause a lot of side effect to the project. Some of the effects are schedule-slip, budget-slip, product goes sour and features out of trend. For example, the overwhelming demand of iPhone, Android and Blackberry applications, thus, the demand for mobile system developers increased. Therefore even a moderate mobile developer is in demand by the enterprise leaders. [10] By using inexperience developers in this type of demanding projects will escort to the quality and schedule related risk such as schedule-slip and increase of defect rate.

4.4 Multiple platform

Traditionally, the software development is targeted on a single type of business. The application is solely used in financial and accounting management, where it was used as a desktop application. Moreover, traditionally, there were not much platform available, the only most widely used is Windows, Unix, Linux and Mac. Since it was only limited platforms, the developers have no issues of choosing a single development process model for all

kind of system development. Whereas, in mobile computing there are different type of devices (e.g. Smartphone, Tablet PC and Personal Digital Assistant (PDA)) with various platforms (e.g. iOS, Android, Bada, Blackberry, Palm OS, Symbian etc.). The usage of multiple platforms makes the developers to go through huge difficulties to identify and select a suitable process model for their development.

4.5 Programming paradigm

A paradigm defines the fundamental approach of a design solution for a problem. Selecting a most favorable paradigm will increase the precision and performance of the solution.

In programming, there are many paradigms is been suggested and it keeps evolving in order to suit the requirements of software development of the respective times. Mostly, procedural, structural and object-oriented features are common when we use languages like Java, C#, C++, Objective C etc.

Concepts such as inheritance, creating objects, recursion, concatenating strings, thread synchronization and global variables, results redundancy, memory leaks, stack overflow, low execution speed and takes more memory. These features are not relatively suitable for mobile computing as they have limited resources [11].

5 PROPOSED PROPERTIES OF A MSD

The factors such as managing many different devices, inconsistent standards and protocols, managing various APIs and versions, resource constraints of mobile devices, managing for different operating environment versions, usage of appropriate development tools, inappropriate methodologies and security for web services [12] are some of the major issues should be considered in developing a specific mobile development process model. Hence, the mobile software development much more complex than the typical software development processes. Although current process models and methodologies provide some detail and clear guidelines to follow, however, there are some deficiencies in these processes.

The MSD process model should able to deal with the issues mentioned earlier: time to market, innovation, risk, multiple platform, and programming paradigm. The following are some of the suggested properties that a MSD process model should have:

- track the activities that happen during the process. Since mobile software development

has to be developed fast to avoid outdating. It should have good audit trail capabilities and configuration management capabilities.

- accept the comments given by the teams or externals and should able to work according to the convenience and the future tasks of the developers. As the number of people working on one mobile software development, developers have discovered that they can do so much more if the top level management listens to the given comments. A good configuration management process can help to manage these comments.
- provide feedback and rational for the feedback. It will make the team to understand what should be done for the following and can make plans for rectifying the existing issues.
- clearly explain the activities and provide the detail guide to perform those activities.
- allow for different protocols and networks used in the deployment and testing
- give alternative in any undesirable circumstances. (e.g., time slip – provide frequent monitoring functionality such as time-boxing function).
- provide milestones and check point to verify the consistency and accuracy of the project.
- access risk and it mitigation plans.
- provide innovative ideas or path to investigate the current trends.
- address speed development (maximum 3 months)

The suggested properties can be included in the four main phases or as additional interleave activities in the current process models.

6 CONCLUSION

Software development process is an important concept that disciplines all activities that happen during the making of a product. Moreover most developers in this domain have a strong support in the respective literature. Generally, all software development process models have the same nature that the ultimate objective is produces an application that meets the customer's requirements, within the given time and budget. Most of the software development process consist of requirements engineering, design and

implementation, testing and evolution, but describe in different terminologies depending to the product nature. When it comes to MSD, we should carefully examine each of the phases in the life cycle to suit MSD process model. Some of the imperative process models have been critically analyzed with respect to mobile software development and abstract principles appeared to dominate the current development method and also developers' minds. Based on the above, new ideas were put forward. To be exact, it was recommended that emerging MSD need to clarify the applicability and should explain the boundaries to those parts of the mobile software development life-cycle and are not a part of the selected area. Additionally it was recommended that importance should rather be emphasized on method specialization than generalization. Importance should be also emphasizing on allowing developers to utilize the suggestions. This requires placing the focus in MSD on empirically validated situation-specific solutions.

Suitable properties for the technical aspect of the MSD that should be included in a mobile software development model have been proposed. This type of properties in a process model will help faster and appropriate mobile software development. Further work is still on going to strengthen the suggested properties and to create the most suitable MSD process model.

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