

Adoption of Agile Methodology for Mobile Application Development

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Abstract--In last few years, mobile telecommunication industry has grown very rapidly. Mobile industry has become highly competitive, dynamic and uncertain environment. Mobile application development require integration with existing enterprise computing systems such as databases, legacy applications, security features, testing environments and Web services. Software developers are looking for more flexible methods that can adjust to dynamic situations and provide valuable software in short duration and within low budget. Software project therefore requires iterative developmental models to cope with uncertain and fast changing user requirements. The agile methodologies are accepting changes are at any stage in software development and provide a structure through prototyping. This article provides a detailed review and analysis on the adoption of agile practices for mobile application development.

Keywords: Agile Methodologies, Mobile application Development, testing environments, adoption of agile practices

I. INTRODUCTION

In recent years the number of active smart phone users has rapidly increased worldwide. This leads to the rise in the competition the mobile phone market. This has increased the demand of suitable mobile software for high quantity of Internet-connected mobile devices. In order to thrive in this highly competitive market, the process of mobile software development needs to be standardized. This can be accomplished through the application of software process models and development methodologies. Mobile applications nowadays interact with other systems, use network and hardware resources more profoundly and apply various collaboration tools. This makes mobile applications more complex over the years. Agile methodologies provide techniques that facilitate communication between the developer and the customer, and undergo develop-deliver-feedback cycles, to have more specific view of the customer requirements.

Agile software development methodology helps teams to build the right product and redesign their release to optimize its value throughout the development cycle. Agile methodologies are suitable to apply when client's requirements dynamically changing or when the deadlines and budgets are tight. This paper is an attempt to review and analyze the literature on use of the

agile methodologies for the development of mobile software development.

II. AGILE SOFTWARE DEVELOPMENT

The Manifesto was published by a team of software developers which gives a set of values and principles for development methodologies like Extreme Programming, SCRUM, DSDM and Feature-Driven Development. Agile methodology focuses more on the human aspects of software engineering than the viewpoint of processes. Agile methods focus on individuals and interactions than processes and tools, delivery of working software is more important than documentation, customer collaboration is valued than over negotiation and flexibility is preferred than plan based methodologies.

It gives four core values for enabling high-performance, efficiency and outputs:

1. Individuals and their interactions
2. Delivering working software
3. Customer collaboration
4. Responding to rapid changes.

These core values are further supported by 12 principles which underlie the Agile Manifesto that

Includes the following:

1. Customer Satisfaction through early and frequent delivery software elements
2. Scope for changes at every stage in the project lifecycle
3. Short delivery cycle
4. Collaboration between customer and developers
5. Motivation among individuals
6. Face to face communication
7. Working software-Primary measure of progress
8. Promoting sustainable development pace
9. Continuous focus on technical excellence and good design
10. Simplicity
11. Self-Organization to obtain best results

12. Self-improvement.

III. MOBILE APPLICATION DEVELOPMENT

Mobile Application Development is the process of developing for small low-power handheld devices which are either pre-installed on phones or downloaded by users from app stores and other software distribution platforms. The mobile application market is undergoing a rapid growth and demand from users for a wide variety of mobile applications. Day by day there is a significant increase in number of projects for mobile application development services as with performance of mobile platforms.

Mobile applications development processes needs some additional requirements than that of traditional software applications including interface with other applications, handling device movements, cross platform compatibility, varying hardware complexities, security risks, privacy, small user interfaces, testing complexity, power consumption, 24/7 support and mobile phone screen size. The constant development in mobile technology also brings changes to the implementation of mobile applications, since the products must also be updated to fit in the new environments like changing screen sizes or new versions of the operating systems.

The mobile software development teams are facing the problems of the different environment for development and technical requirements with frequent changes in user's needs and expectations.

During this age of constantly changing environments and rapidly changing market the agile processes are considered to be most suitable for development life cycle. Agile techniques are benefited from governing customer satisfaction by frequent and short delivery of prototyping cycles. These methodologies have scope for changes during project development, communication between customer and developers, need for continuous technical excellence, good design and simplicity.

Challenges in Mobile Application Development

One of the major challenges faced by mobile software development in a technology landscape that it is highly fragmented and highly evolving. Mobile applications require lot of customizations to run on various platforms and the firm stream of new hardware, OS versions and browsers.

In reply to this the mobile industry has started using fast evolving cross-platform and cross-device frameworks, libraries of reusable components and other tools designed to simplify multi-platform development of mobile solutions. Still the basic requirements remain same that are to code less and bring about more solutions, to reuse the components across multiple platforms and consider developing from scratch as a last alternative. Any available tool

or framework should be able to work to accommodate the current and future requirements and not be restricted for any particular platform or technology.

IV. LITERATURE REVIEW

One of the pioneering studies in the area of agile methodologies has been conducted by Abrahamsson et al. in 2004. The authors recommended that agile development methodology is a natural fit for mobile application development environment and proposed a new approach referred as Mobile D. The study puts focus on various challenges and characteristics of the mobile application development. It introduces a market-enabled software development approach to meet the volatile demands of the users. A new application framework was introduced that is "Architecture Line" to guide the development of future mobile applications.

A. Mobile-D

This approach is a combination of Rational Unified Process RUP, extreme programming and Crystal methods. Mobile-D comprised of five phases which are as follows: Explore, Initialize, Productionize, Stabilize, System Test and Fix. Mobile applications have to run on multiple different platforms, so reusability of components has to be achieved. Mobile-D currently develops "single-systems with reuse" which is also called as "clone and own" process.

Mobile-D has already been implemented for development projects and has benefited in the earlier detection and restore of technical issues, low defect density in the final product and a constant progress in development cycles. Abrahamsson et al. have verified the characteristics of agile technologies to make them a best fit mobile software development. The various issues includes, highly volatile environment, small development teams, exclusive needs of customer, object oriented development environment, small handheld devices and short development cycles.

B. RaPiD7

Dooms et al. has proposed a method called 'RaPiD7' (Rapid Production of Documentation) that helps to improve the documentation work without scarifying with the quantity. RaPiD7 gives a three-layer structure that is as follows:

- Project Layer Describes how human interaction and joint decision-making is planned for software projects.
- Case Layer Describes how the selected cases such as documents are to be created in consecutive workshops.

- Workshop Layer Describes how the actual action is carried out in form of facilitated workshop, using seven steps of method.

The workshops are planned in detail with the phases which are Preparation Phase, Kick-off Phase, Idea gathering Phase, Analysis Phase and decision making techniques are used in the workshops. The decisions are noted at desired level and the workshop results are verified and the next steps are agreed on in closing phase.

RaPiD7 approach embraces two very agile practices: Whole Team & Do the Simplest Thing That Will Work. RaPiD7 improves the traditional approach for specification work by offering a way to plan the human interaction in the early phases of software projects and by providing means to make decisions and to document authoring jointly with a built-in quality assurance.

C. Hybrid Methodology

Rahimian and Ramsin have presented a hybrid Agile and risk-based methodology that is suitable for mobile application development designed from Methodology Engineering techniques.

This process is concerned with designing suitable methodologies for different development environments. It is based on a combination between agile methodologies, Adaptive Software Development (ASD) and New Product Development (NPD).

Hybrid engineering methodology is based on software product line support, architecture-based development, reusability, inclusion of review and learning sessions. This methodology has been developed as a top-down, iterative-incremental model. It also includes prioritization of user's requirements, selection and application of the appropriate design approaches, enhancement and reformation of the methodologies built so far. Hybrid Engineering Methodology Phases are as follows: Idea generation, project initiation, analysis, design, implementation, Test, Commercialization.

Hybrid Engineering Methodology for mobile development methodology has four iterations. In the first iteration, the method is detailed by incorporating commonly found in agile practices. With the considerations of market situations, the second iteration includes tricks for New Product Development, which is concerned with introducing a new product or service in the market. In the third iteration, Adaptive Software Development (ASD) ideas were integrated into the development strategies then in the final iteration a prototype is created and released for the user.

Hybrid development methodology is still at a high-level and no specific stages are identified.

D. MASAM

Jeong et al. has suggested the Mobile Application Software Agile Methodology (MASAM).

It is based on Extreme Programming (XP), Agile Unified Process, RUP and the Software and Systems Process Engineering Metamodel (SPEM). It is GUI based architecture-centered model that uses business domain knowledge.

MASAM model comprised of four phases: the Preparation Phase defines outline and first idea about the product, assigns roles and responsibilities, the Embodiment Phase focuses on understanding user's requirements and defining the architecture of the software product, the Product Developing Phase, and uses iterative Extreme Programming development steps. The development is carried out through Pair Programming, continuous Integration, iterative testing activities and then, the Commercialization focus on product launching and product selling activities. It is suggested to use the MASAM model for small companies that are focused on the development of mobile software applications.

E. Scrum and Lean Six Sigma (SLeSS)

Cunha et al. proposed this combination of an agile approach that integrates Scrum and Lean Six Sigma (LSS) that emphasizes on project management and process improvement activities respectively.

The implementation of SLeSS helps in the easy adaptation to changes in requirement at any phase of the project, delivers software versions rapidly and shortening the development lifecycle.

Scrum is used for project management and software development that is suitable for complex projects. Whereas Lean Six Sigma (LSS) is used for defining and improving products and processes with a focus on reduction of defects and failures, on variation and waste elimination,

1. Scrum in SLeSS:

Scrum is broadly used in software development and it is also suited to mobile software development. The implementation of SLeSS approach assumes an incremental methodology by first implementing the Scrum alone and after its settlement Lean Six Sigma should be executed as a quality framework. Initially, training team was chosen in the Deployment phase aiming that the customization development would not suffer from changes in time and quality. Later, the scrum was introduced to relative experienced team, with well-defined scope and known risk activities and process improvement. The development team and customer identify the problems in the sprint which are then prioritized and solved by the team members.

2. Lean Six Sigma (LSS):

Once Scrum is established in the organization Lean Six Sigma is applied as a quality framework as a development technique. The

model is represented by DMAIC phases which are identified as Define, Measure, Analyze, Improve and Control)

The SLeSS approach has been used in real embedded software customization development process for mobile projects. The application of SLeSS helps in obtaining better adaptation to changes in user's requirements, the realization of the deadlines and delivering more software versions rapidly. It achieves high productivity, maintaining in process quality and reduction in budget. This approach provides improvement in development and management processes, initiating their statistical control and to meet the customer expectations.

V. SUITABILITY OF AGILE METHODOLOGIES TO MOBILE APPLICATION DEVELOPMENT

VI.

Agile methodologies are found to be the best fit for mobile application development

It has been suggested through many literatures that agile practices can solve the mobile application development issues more efficiently.

1. Agile approaches are well suited for the experimental and revision nature of mobile applications. Mobile apps are in the hands of consumers who post comments and ratings on the app stores frequently. Mobile apps themselves require the process of refining and meeting user's expectations.

2. Agile practices offer high reliability and leads to continued use of applications for users. Agile mythology with its iterative testing cycles and continuous customer feedbacks during each sprints, enables application developers to provide more quality assurance.

3. Sprints offer mobile app the update model. For any new version of an app, in most cases, it shows up as an update in the app stores. This makes it possible to form a nice pace of sprints and version releases to end users.

4. Agile enables mobile app development to be responsive to technology changes such as versions of mobile operating systems, framework enhancements and new feature updates.

5. Agile methods allow developers to make trial with various options in subsequent sprints and adjust the design of the application in such a way that the user experience is quick, smooth and seamless.

With numerous agile practices like Extreme Programming that includes refactoring of application, simple design, test-first development, and continuous integration, a team can rapidly respond to all types of changes. Incorporating appropriate agile practices can help teams implement efficient and well-tested mobile applications across all the platforms and technical environments.

VII. SYNCHRONIZING DEVELOPMENT WITH TESTING

The main challenge in the mobile industry is the strange speed required to bring applications to the market. Day by day the average lifetime of a mobile device is now about one year and mobile software is even less. Software release cycles are shorten to a few weeks requiring agile software methodologies that enable development teams to gather and define customer requirements, release software functionality, consume stakeholder's feedback and make changes in extremely compacted timeframes.

This challenging environment also requires a new approach to software testing. Instead of waiting until development of a mobile app is complete, testing is to be performed in development stage to detect and correct flaws as early in the project lifecycle as possible. Mobile software developers are using innovative tools and testing methodologies with management frameworks to reduce overall time and cost of the projects.

Agile methodology integrates testing into the development process Testing therefore is an essential part of the software development and keenly participates throughout the implementation process. This helps the combined team to easily meet the project's definite objectives for business domain, software usability, quality assurance and timeframes.

VIII. CONCLUSION

As the mobile industry is rapidly growing there is considerable increase in mobile development projects. Study of published literature confirms that agile practices are a good fit for the development of mobile applications. An appropriate agile methodology could be selected and customized according to customer requirements for mobile projects. Based upon project's complexity and team size different approaches could be chosen. Study evaluates how the adoption of various agile approaches like scrum, lean, XP improves the development of mobile applications and can be used in order to provide more process improvements within an organization. The decision about adoption of one methodology depends on the knowledge of the team members regarding a particular methodology, team size and on the

organization of the team. To succeed with agile practices team members must have thorough understanding of the agile principles and the organization must establish quantifiable goals.

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