Software Development Models - A Survey

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Abstract— Software engineering is the field of engineering that deals with the development and maintenance of software. For the development of software an efficient process required called process model, which build high quality software and deliver it as per customer needs. There are numerous process models are available for the development of software, for example, waterfall model, spiral model, rational unified model, agile approaches etc. Agile approaches such as expert programming (XP), scrum, crystal, and kanban are very popular nowadays, which changed the total scene of the software development; this is due to the customer centric nature of agile approaches. In this paper, we provide a survey of different software development models.

Keywords: Software engineering, Software development, Process model, Agile approach

I. INTRODUCTION

Software process model is a framework includes various activities performed for the development of software. For the development of software developer's change these framework activities according to the current needs in such a way that the ultimate principle of process model does not changed. A software development process model consists of five phases, namely, requirement gathering and analysis, design, implementation, testing, and deployment and maintenance [1]. There are various process models are available for the development of software and these models are differ from each other on the basis of time and importance given to different activities of software development phases.

This research paper is further organized as follows, in section 2 we describe various process models available, and in section 3 we conclude our research work.

II. SOFTWARE PROCESS MODELS

A software process model is an abstraction of activities and processes which are utilized for the development of software. It basically follows the software development lifecycle activities, which consists of requirement gathering and analysis, design, coding, testing, and deployment and maintains [2]. The goal of software development model is to develop a software / mobile app that fulfil customer requirements and time to market. In general, software process models are divided into two categories- traditional models and modern software development models [3]. Traditional software development models includes- waterfall model, spiral model, rational unified model, rapid application development model, v-shaped model, and incremental model and modern development models includes- agile software development, and DevOps software development. The description of different software development models are as follows.

A. Waterfall Model

Waterfall approach is one of the oldest approaches for software development and it is widely used by most of the software developers for the traditional software (desktop software) development. Waterfall Model is based on the linear sequential flow philosophy. As the name suggests 'Waterfall' Model, in which flow of activities is like a waterfall, means that developer can move to the next phase only if the prior phase is done. In waterfall approach there is no way to change the requirements if once the requirement phase is completed, this is the main drawback of it [4]. Waterfall philosophy is shown in figure- 1.1.

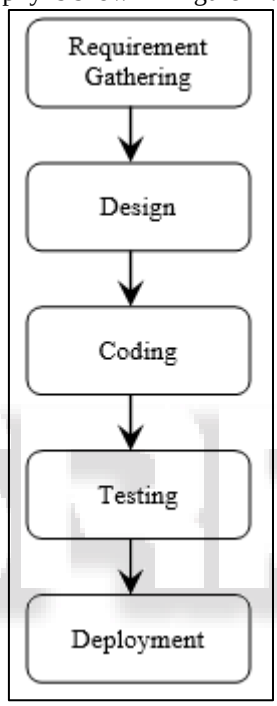

Fig. 1.1: Waterfall Software Development Model

B. Spiral Model

The spiral model was originally suggested by Barry Boehm for the development of software in 1988. Spiral model as shown in figure 1.2 [3] uses a cyclic approach to create the software. Each succession incorporates 4 phases namely, requirements gathering, risk analysis, prototyping or development and customer evaluation. These all 4 project activities are iterated. The development of software is upgraded to a stage when an iteration succession is done. Spiral model was developed mainly to offer a substitute of the models those based on heavy documentation work and codedriven development, for example waterfall model, which were actually appeared to be far too regulable and not capable to control the intrinsic risk in the development of software [5].

C. Rational Unified Process

Rational Unified Process (RUP) is an iterative technique for software development. It offers a regimented technique to allocating responsibilities inside a software development organization. The main aim of RUP is to make sure the construction of high quality product that fulfills the desires of

its end users, that fits according to expected financial and scheduled plan [6] [7].

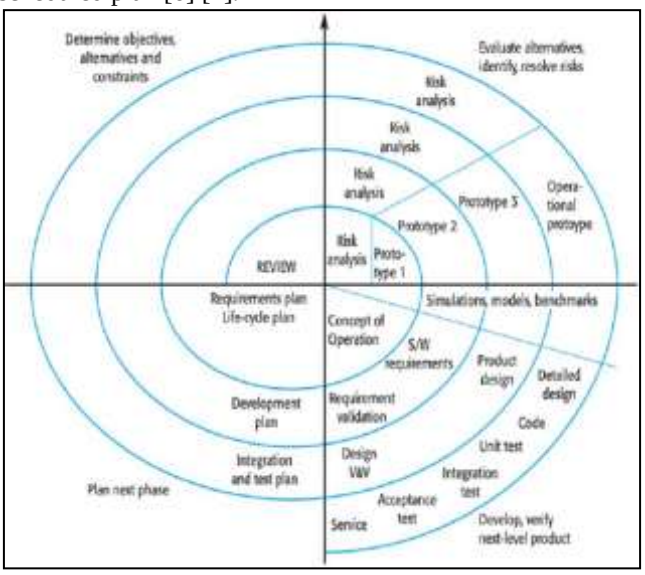

Fig. 1.2: Spiral Model for Software Development

RUP is structured around two ideas- phases and workflows. It consists of 4 phases (Inception, Elaboration, Construction, and Transition phase) and 9 workflows (business modeling, requirements, analysis & design, implementation, test, deployment, project management, configuration and change management, and environment workflow). The architecture of RUP is shown in figure- 1.3 [8] [9].

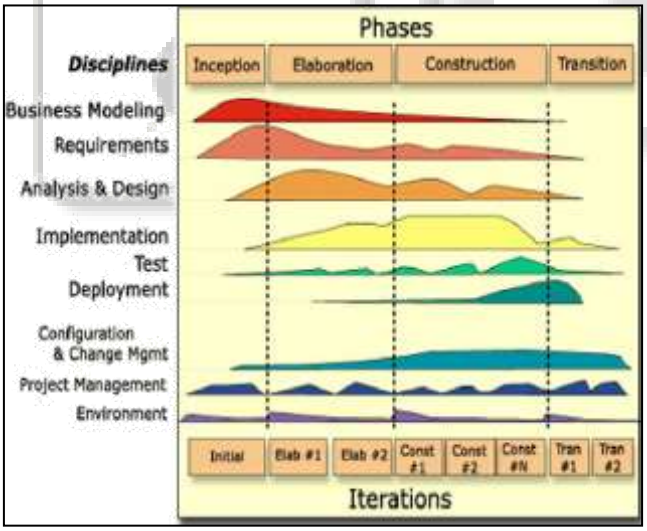

Fig. 1.3: Architecture of RUP

D. Rapid Application Development model

Rapid Application Development (RAD) model is based on incremental approach. In RAD model the software modules or utilities are build in parallel fashion like mini projects.

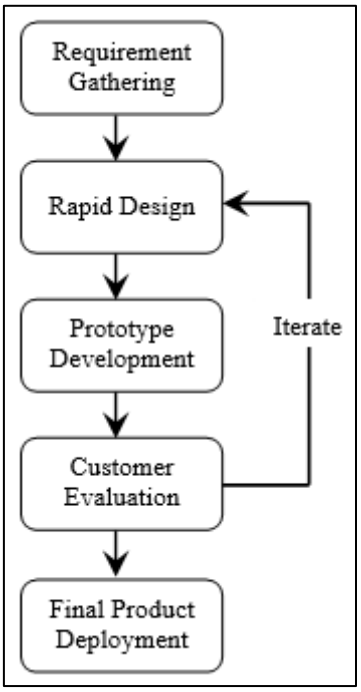

Fig. 1.4: RAD Model

The developed artifacts are time boxed, hand over to customer and later put together into a working product. By using RAD model developers quickly deliver something to customer to view, use and to give feedback about the delivered module, as this fits according to his or her needs or not. Figure- 1.4 shows the different phases of RAD model [10].

E. Agile Software Development

The word agile derived from agility, which implies that, the software facilities can support to variations and adaptations to increase the business profits and production [11]. Agile software development is rely twelve principles called agile manifesto and this manifesto move around the four values (individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan) [12]. Agile is an iterative and incremental strategy for the development of software, which utilizes small development cycles. Agile software development is flexible and adaptive set of process, which are fully customer oriented [13]. Agile is not just a single method, it is a set of different processes that follow the agile manifesto. These all approaches are individually known as agile methodology. Following are the famous agile methodologies [11].

- Extreme Programming (XP)
- Scrum
- Dynamic Systems Development Method (DSDM)
- Crystal Methods (Crystal Clear)
- Lean Development (LD)
- Adaptive Software Development (ASD)
- Kanban
- Agile Modeling
- Feature-Driven Development (FDD)
- Agile Unified Process (AUP)

All the above agile methodologies follow the agile manifesto and these methods differing from each other on the basis of time and importance given to different activities of software development phases. Nowadays agile XP, scrum and kanban is most famous in software industries.

F. DevOps Software Development

IT industries are introducing agile approaches in process to speed up the software development process and to increase the quality of their product. DevOps is employed as an umbrella term to express their efforts in software development [14]. DevOps is group of practices and principles, utilized to improve software development lifecycle by means of providing connections among development and operations teams to decrease the release rounds and enhance the software deliveries [15].

III. CONCLUSION

Software development process model is very crucial for developing quality software. In this paper we have provided a survey of different software development approaches. Traditional software development models like waterfall, spiral etc. is not suitable for the development of software that needs changes in between the development or at the end of development, and this is one of the causes for organizations to moves towards the agile development. In software development, agile is most popular approach due to its customer oriented and flexible nature. In agile development customer requirements are invited at any time of development, it supports short development cycles and believes in providing working software after each cycle. DevOps is a new concept introduced in software development that boost up the efficiency by means of improved customer feedback rounds and decreased overhead.

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