SOFTWARE MAINTENANCE PROCESS MODEL AFTER DELIVERY WITH QUALIFIED OUTPUT

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Abstract-Software maintenance is one important phase in the software life cycle. Due to the problems that arise during the maintenance phase, the research focuses on software qualify after delivery. A new integrated model for maintenance process will be constructed and implemented to support the analysis activates during software maintenance. This includes improving software productivity and the output quality. Additionally, this will involve applying the normal software application which an important in theoretical and practical cases.

Keywords- Software Maintenance; Maintenance Process; Process Model; Qualified Output.

I. INTRODUCTION

The IEEE 1219-1998 software standards document defines software maintenance as "the modification of a software product after delivery to correct faults, to improve performance or other attributes, or to adapt the product to a modified environment." Software maintenance is the concluding part of the software development process or "life cycle." There are four types of software maintenance defined in IEEE 1219-1998: corrective, adaptive, perfective and emergency maintenance. Corrective maintenance fixes the bugs discovered after delivery while adaptive maintenance keeps the software program usable in a changed or changing environment. Changes to software to improve performance and maintainability are classified as perfective maintenance. Emergency maintenance is usually unscheduled maintenance to keep the system working properly at any time. The need for changes of certain part of software after delivery is here from the beginning of electronic calculations. Required software changes are an inescapable consequence of the nature of software and the changing environment in which it is used. Majority of today’s software systems always meet with rapidly changing requirements, which result from changing environment, as well as rapidly changing requirements of users of these systems. Maintenance is one of the most important and costly phases in the life-cycle of a software system. For example, there are studies showing that up to 90% of the total resources consumed over the lifetime of a system are allocated to maintenance tasks [1].

Traditionally we use the term “software maintenance” for naming the discipline concerned with changes related to software system after delivery. An appreciation of this discipline is important especially because the cost is now extremely high. Safety and cost of software maintenance mean that there is an urgent need to find ways of reducing or eliminating maintenance problems [2]. In this paper, we will discuss model of software maintenance process after delivery with qualified output and compared with other model.

II. RELATED WORK

Software maintenance process model is an abstract representation of the evolution of software to help analyze activities during software maintenance. Which use kind of maintenance model, should be aware of the characteristics of various models and, based on preservation of the environment to decide. The following analysis of several common models [3]. Quickly modify model that the maintenance process is a “fire fighting” approach, which is the temporary custom software maintenance method, software problem should be solved as soon as possible, shouldn’t analyze long-term effects on the implementation of changes [4].

Dr. Barry W. Boehm bases on economic models and principle, proposes maintenance process model. Boehm's theory is models and principles of economics can not only improve maintenance productivity, but also helps to understand the maintenance process [5].

IEEE Computer Society software engineering standards branch, issued a "IEEE Software Maintenance Standards" (IEEE 1219-1993), details the activities of management and implementation of the iterative process of software maintenance, software maintenance, including input, processing, control and output and so on [6].

Initially the model is put forward as a development model, because the software developers usually can't fully understand the requirements, can't build a perfect system, so it is suitable for maintenance. Made the basis of the model: the software life cycle of software changes implemented, is an iterative process, and to iteratively enhanced software system [7].
III. SOFTWARE MAINTENANCE PROCESS

Software maintenance process show in figure 1.

- Preparation. Adequate preparation is a good start to maintenance. Including the designation of maintenance personnel, establish smooth communication channels to facilitate the maintenance, training, preparation and approval of "software maintenance plan" and so on. Maintenance. Including the designation of maintenance personnel, establish smooth communication channels to facilitate the maintenance, training, preparation and approval of "software maintenance plan" and so on[8].

![Software maintenance process](image)

Figure 1. Software maintenance process

- Request. Software maintenance begins with a request to change the system, usually a request by the user, on-site maintenance engineers or developers to issue report card form.

- Need analysis. Responsible officer explain to human analysts, who analysis system change requests which means issues report card, including the issue positioning, issues related to the specific product and the corresponding change of scale, give a specific solution to issues related to documentation, test programs and strategies proposed and ultimately the formation of the problem analysis.

- Analysis review. The process is an important means to ensure maintenance of quality, can make early detection of problems and reduce the risk of maintenance problems later discovered. Analysts question the degree of difficulty according to the problem involves the size of the change and the problem-solving ability to grasp and other factors, to decide which assessment method.

- Implementation modify. According to one report to address personnel issues, problem analysis report and product manuals related to the modification of the product. It modifies the software, must first understand the program, help complete the requirements; also modify the program to understand the possible side effects, so that when changes in the program note; final report on the formation of a single software modifications.

- Test. Software is modified, the analytical report based on testers in the test program for testing. It’s easy to introduce new errors and change, therefore the regression test, reduce side effects caused by change.

- Verification. After testing software changes before submission system upgrade, to go through the validation phase, the reviewers question whether the correct solution for the assessment. Verify the initiator for the managers, the purpose is to ensure the quality of software maintenance, can refer to the analysis phase of the evaluation methods for assessment.

- Upgrade. Software verification is complete in internal company, need publishing to user, upgrade system. Upgrade process from developers, engineers and users together[8].

IV. SOFTWARE MAINTENANCE PROCESS MODEL

As defined by IEEE 1219-1998, software maintenance has seven phases, with each phase having input, process, control and output. The phases are problem identification, analysis, design, implementation, system test, acceptance test and delivery. Modification request (MR) constitutes the input to problem identification while validated MR is the final output of this first phase. The last phase of maintenance is delivery. Physical configuration Audit (PCA) plays an important part to make sure that the validated MR is fully achieved in the prior phases. Finally installation, training of users and version description document (VDD) is produced. Software maintenance process model is an abstract representation of the evolution of software to help analyze activities during software maintenance. Which use kind of maintenance model, should be aware of the characteristics of various models and, based on preservation of the environment to decide. The following analysis of several common models [3].

A. Quickly Modify Model

Quickly modify model that the maintenance process is a "fire fighting" approach, which is the temporary custom software maintenance method, software problem should be solved as soon as possible, shouldn’t analyze long-term effects on the implementation of changes. Usually don’t analyze the code to modify the structure of the ripple effect of the impact, even if the analysis is also very little written documentation. Quickly modify the model structure show in figure 2. In the right environment, this model is very effective. For example, if the system is developed and maintained by one person, this person...
is very familiar with the system, has the ability in the absence of detailed documentation in the case management system, whether changes can be made to determine how to modify and maintain work quickly and economic.

There are many customers in the business environment, this approach isn’t reliable, but there are still many institutions using this model is due to software maintenance are time and resource constraints. For example, customers request the correction of an error, but are not willing to wait for software companies to change the cumbersome process and risk analysis. If the software rely on quick changes with a long time, it will accumulate a lot of problems, the software will become increasingly difficult to maintain, maintenance costs will increase, it will lose use of rapid change in the initial stages of the model to get any advantage. To address this problem, using the strategy is to quickly modify the model, into another, more sophisticated models, rapid changes in external pressure as an emergency to change the way modifications are completed, according to the model requires some fine measures.

B. Boehm Model
Dr. Barry W. Boehm bases on economic models and principle, proposes maintenance process model. Boehm's theory is models and principles of economics can not only improve maintenance productivity, but also helps to understand the maintenance process. Model structure show in figure 3. Model maintenance process is divided into management decision-making to achieve change, software delivery and evaluation of four stages, expressed as a closed loop to maintain the process by promoting the maintenance management decision-making process. In management decision-making stage, use of specific strategies, and proposed a set of changes for cost-effective assessment to determine a set of approved changes and the implementation of changes to a dedicated budget.

From the functional point of view of production, the model reflects the economics of investment and the relationship between earnings, reflecting a typical phases:

- **Investment stage.** This is a low input of resources and low-income stage, corresponding to an emergency there is a strong requirement to modify and enhance new software product;
- **High-return stage.** Institutions through software products have been growing returns, the initial problem is resolved. At this stage, resources and efficiency to the document, the agency's rapid growth in the accumulation of benefits;
- **Effective reduction stage.** At a certain point in time, the accumulation of effective growth rate gradually slows down. At the peak of the effectiveness of the product, to change to become less and less economic stage. Boehm model focuses on the management decision making, according to the approved changes to the implementation of changes to maintenance activities in the balance between investment and benefits from the perspective of economic interest to drive the software maintenance process. Based on this process, the organization can develop a reasonable maintenance strategy, maintenance efficiency to meet the organization to make decisions.

C. IEEE Model
With the development of software industry, is increasingly recognized for the importance of software maintenance standards. Therefore, IEEE Computer Society software engineering standards branch, issued a "IEEE Software Maintenance Standards" (IEEE 1219-1993), details the activities of management and implementation of the iterative process of software maintenance, software maintenance, including input, processing, control and output and so on. The standard that should be in the planning of software development when the software maintenance plan. Model show in figure 4.

- **Classification and identification.** Software maintenance starts in by the user, developer or manager's request to modify the software, and
Software Maintenance Process Model After Delivery With Qualified Output

Software maintenance process begins after the delivery of software products to the end when the software products is retired. However, software maintenance issues on the software life cycle should be developed in stages to be considered throughout the software life cycle, software maintenance and software development are closely connected. Software maintenance problems in the software life cycle consider the later, maintenance costs will be greater, the difficulty will be greater, result in expensive software maintenance costs[9]. Therefore, you should consider an early stage of software development software maintenance. The thesis process model for software maintenance research, focusing on software after delivery to retire between...
the software maintenance activities. With the acceleration of information technology, software products increasing, more and more important software maintenance, maintenance problems has become increasingly evident. There are many different maintenance models.

Three representative ones are quick-fix which is an ad hoc, firefighting approach; iterative enhancement which is based on the iterative nature of 90 Software Maintenance: Concepts and Practice change to a system; and reuse-oriented which sees maintenance as an activity involving the reuse of program components. The most pragmatic approach is given by Osborne's model.

In this paper, researching the software maintenance process model, has important theoretical and practical significance to improve the software maintenance process, guide maintenance activities, improve the quality of software maintenance to ensure the normal application software.

REFERENCES