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SOFTWARE DEFECTS IDENTIFICATION, PREVENTIONS AND AMPLIFICATION IN SDLC PHASES

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ABSTRACT

The present paper finds that to detect and cure software defects is one of the best band esteemed quality activity which saves time, cost and man power. It also delivers qualited and more user friendly software product to customers.

KEYWORDS
SDLC – Software Development Life Cycle.

INTRODUCATION

In software development area there is no any such software development company which develop 100% error free software. What is Software error? Occurrence of the technical difficulty in software is the error. But when any customer complaints about software then we can conclude about error. Software error is error -resulting from bad code in some program involved in producing the erroneous result[1]. To maintain software error of defects it is necessary to concentrate over phases of SDLC "Software defect" has many interchangeable names: software bug, error, fault, failure, crash and anomaly. The institute for electrical and electronic engineering (IEEE), the standards body regulating even the software profession, defines a software bug as a programming error that causes software to malfunction. IEEE sees defect as a product anomaly when software does not conform to customer expectation and specification. A crash is an extreme case of a software defect that stops the software from further working.

SOME SOURCES OF DEFECTS

Software defects can arise from misinterpreting customer requirements, poor programming habits, wrong programming logic, poor testing and even untested software implementation scenarios. For example, a customer specifying a blue background to a website and the developer producing a white background is a defect. Even though the website runs fine, it does not meet customer requirements.

DEFECTS IN SDLC

Defects can occur at any phase in the software development life cycle (SDLC). The SDLC phases are requirements analysis, systems design, program design, program implementation, program testing, system testing and maintenance. Thus since defects can occur at any phase, the defect life cycle involves quality assurance at every phase. Configuration management enables defects to be recorded and tracked to removal. Thus tools for configuration management and defect tracking will be required in the defect life cycle quality assurance.

1. Customers don't know what they want

Due to the Technical concern behind the concept software development the customer who developes software can't have any clear idea about the problem. If software developer identifies problem from customer then customer can take care about the clear understanding about problem. Enlist all the task that to be completed by software developer. List of all the task/functions are finalised here.

2. Requirements change during the course of the project

The second most common problem with software projects is that the requirements defined in the first phase change as the project progresses. This may occur because as development progresses and prototypes are developed, customers are able to more clearly see problems with the original plan and make necessary course corrections; it may also occur because changes in the external environment require reshaping of the original business problem and hence necessitates a different solution than the one originally proposed. Good project managers are aware of these possibilities and typically already have backup plans in place to deal with these changes.

To solve this problem, you should:

- Have a clearly defined process for receiving, analyzing and incorporating change requests, and make your customer aware of his/her entry point into this process.
- Set milestones for each development phase beyond which certain changes are not permissible -- for example, disallowing major changes once a module reaches 75 percent completion.
- Ensure that change requests (and approvals) are clearly communicated to all stakeholders, together with their rationale, and that the master project plan is updated accordingly.

3. Customers doesn't follow principles

The analysis in each phase may be extended due to some long activities. Due to the assurance by developer to the customer about quality developer tries to develop Quality software. Customer can't understand this difficulty and ask for final product again and again.

To solve this problem, you should:

- Convert the software requirements specification into a project plan, detailing tasks and resources needed at each stage and modeling best-case, middle-case and worst-case scenarios.
- Ensure that the project plan takes account of available resource constraints and keeps sufficient time for testing and quality inspection.
- Enter into a conversation about deadlines with your customer, using the figures in your draft plan as supporting evidence for your statements. Assuming that your plan is reasonable, it's quite likely that the ensuing negotiation will be both productive and result in a favorable outcome for both parties.

4. Communication gap between customer and Developer

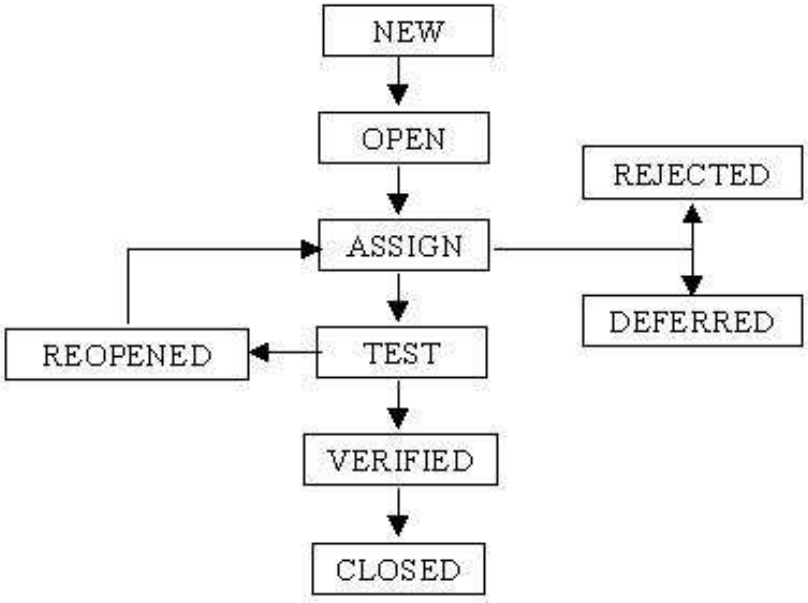
Often, customers and engineers fail to communicate clearly with each other because they come from different worlds and do not understand technical terms in the same way. This can lead to confusion and severe miscommunication, and an important task of a project manager, especially during the requirements analysis phase, is to ensure that both parties have a precise understanding of the deliverable and the tasks needed to achieve it.

To solve this problem, you should:

- Take notes at every meeting and disseminate these throughout the project team.
- Be consistent in your use of words. Make yourself a glossary of the terms that you're going to use right at the start, ensure all stakeholders have a copy, and stick to them consistently.

BEHAVIOR OF SOFTWARE DEFECTS

Basili and Boehm assembled a list of ten rules of thumb which main purpose was to highlight pitfalls in software engineering. Seven of these rules are directly related to how defects impact the project [Boehm and Basili, 2001]. First, it is 100 times more expensive to correct a defect after delivery than during the requirements or design phase. Second, 40 to 50 percent of the effort in the project is spent on rework which could have been avoided. Third, 20 percent of the defects results in 80 percent of the rework and 80 percent of the defects come from 20 percent of the modules while half of modules are almost free of defects. Developing high dependability software are often 50 percent more expensive than low dependability software, and 90 percent of the downtime comes from 10 percent of the defects. However, investing the 50 percent extra is well worth it if the software is to be maintained. Last, 40 to 50 percent of software contains defects which are nontrivial. The results described by Boehm and Basili in [Boehm and Basili, 2001] gives an impression of how software defects influence the total costs of software projects.



DESCRIPTION OF VARIOUS STAGES

1. New: When the bug is posted for the first time, its state will be "NEW". This means that the bug is not yet approved.
2. Open: After a tester has posted a bug, the lead of the tester approves that the bug is genuine and he changes the state as "OPEN".
3. Assign: Once the lead changes the state as "OPEN", he assigns the bug to corresponding developer or developer team. The state of the bug now is changed to "ASSIGN".
4. Test: Once the developer fixes the bug, he has to assign the bug to the testing team for next round of testing. Before he releases the software with bug fixed, he changes the state of bug to "TEST". It specifies that the bug has been fixed and is released to testing team.
5. Deferred: The bug, changed to deferred state means the bug is expected to be fixed in next releases. The reasons for changing the bug to this state have many factors. Some of them are priority of the bug may be low, lack of time for the release or the bug may not have major effect on the software.
6. Rejected: If the developer feels that the bug is not genuine, he rejects the bug. Then the state of the bug is changed to "REJECTED".
7. Duplicate: If the bug is repeated twice or the two bugs mention the same concept of the bug, then one bug status is changed to "DUPLICATE".
8. Verified: Once the bug is fixed and the status is changed to "TEST", the tester tests the bug. If the bug is not present in the software, he approves that the bug is fixed and changes the status to "VERIFIED".
9. Reopened: If the bug still exists even after the bug is fixed by the developer, the tester changes the status to "REOPENED". The bug traverses the life cycle once again.
10. Closed: Once the bug is fixed, it is tested by the tester. If the tester feels that the bug no longer exists in the software, he changes the status of the bug to "CLOSED". This state means that the bug is fixed, tested and approved.
While defect prevention is much more effective and efficient in reducing the number of defects, most organization conducts defect discovery and removal. Discovering and removing defects is an expensive and inefficient process. It is much more efficient for an organization to conduct activities that prevent defects.

BUG LIFE CYCLE IMPLEMENTATION GUIDELINES

- Make sure the entire team understands what each bug status exactly means. Also, make sure the bug life cycle is documented.
- Ensure that each individual clearly understands his/her responsibility as regards each bug.
- Ensure that enough detail is entered in each status change. For example, do not simply DROP a bug but provide a reason for doing so.
- If a bug tracking tool is being used, avoid entertaining any 'bug related requests' without an appropriate change in the status of the bug in the tool. Do not let anybody take shortcuts. Or else, you will never be able to get up-to-date bug metrics for analysis.

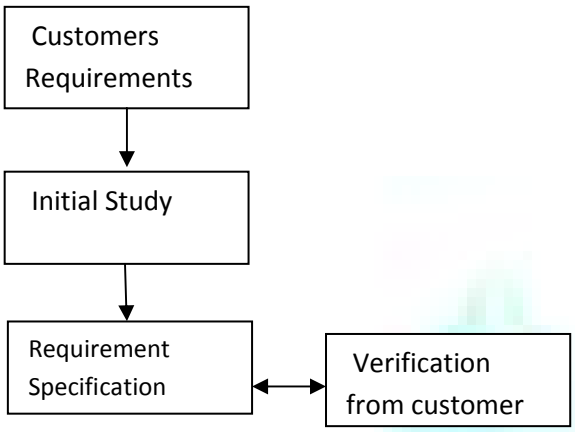
TECHNIQUES FOR SOFTWARE DEFECT PREVENTION AND IDENTIFICATION

A quality process should produce close to zero-defect software that meets the user requirements. In this article, we will go through step-by-step, the various practices/techniques that can help you prevent defects in your software, and how to catch them if they already exist.

TO KNOW CUSTOMER REQUIRMRNTS

When a customer provides you a requirement, it's not that you start working on it there and then (Figure 1, below). You first need to understand clearly what the customer wants. Once you have gone through the requirement, put down what you have understood. Then, get your understanding confirmed from the customer. Doubts, if any, in the requirement specification, must be clarified at this stage. Do not procrastinate or hesitate in asking your queries. If customers are many try to understand all the customers and collect common data or unambiguous data from that collection.

FIG. 1: REQUIREMENT WORKFLOW FOR CLARIFICATION



While working in development process there are many defects creeping in due to misinterpretation of the requirement specification. Fixing such defects at a later stage can prove costly. So, it is very important that you get your understanding verified from the customer.

PEER REVIEW

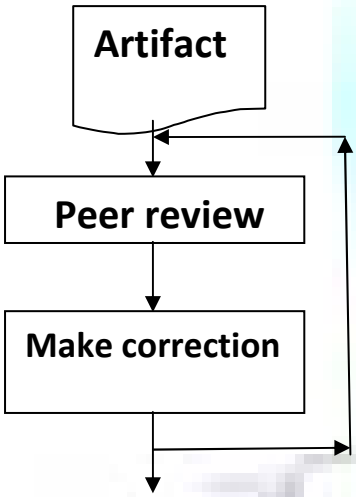
Software project development is one of the Team work activity .Functioning as a team is a skill. Delivering a high quality product is no responsibility of an individual. It's the entire team who is responsible for it. If the product fails, each team member is responsible for it.

Review is an important part of team work. Peer Review refers to participation of team members in the development and assessment of task/activity performed by an individual.

In this process, illustrated in Figure 2 below, a team member requests an artifact to be reviewed. The other team members then provide their review comments which may include corrections, suggestions and doubts on the artifact.

The artifact is then updated based on the review comments. This process is repeated till the artifact is up to satisfaction of all the team members. Of course, in case of any conflict it is the Project Leader who makes the final judgment.

FIGURE 2: HUNTING FOR ARTIFACTS



REVIEWS IN DIFFERENT SOFTWARE DEVELOPMENT STAGES

a. Requirement Specification Review. As we discussed in the last point, understanding the customer requirement is very important. So, while you prepare the Requirement Specification, get it reviewed by your team members. Ten people in a team may have ten interpretations of the specification. Discuss it out within your team, and then pass your understanding to the customer for verification.

b. Design Review. Once the requirement specification gets finalized, we move on to the design phase. In the design stage, you would now think about how to approach the problem.

As you will agree, review at this stage is vital. Selection of a wrong strategy can put the entire system in a miserable state. Reviews performed at this stage will help you in:

*Analyzing various strategies to solve the problem.

* Analyzing feasibility of each strategy.

* Knowing advantages/disadvantages of each strategy.

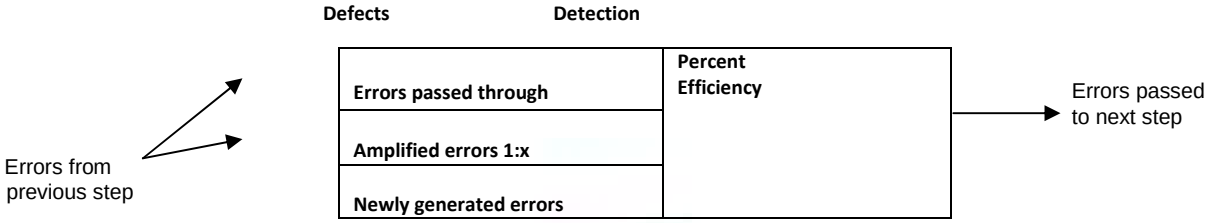
c. Code Review. Code Review involves examining the source code to find defects. While working on development of system software tools, I have been a witness to how code review can really help you find defects.

It is good to let someone in your team walk through you code, and do the review. All the members must review the code changes with respect to other modules and give their feedback in case some side-effect is suspected.

Many defects such as memory leaks, wrong passing of arguments, unreachable code, lack of readability, high complexity and maintainability issues can be identified via code review. Finding defects at the coding stage, and fixing them there and then, would prove to be less expensive than finding them in the testing stage.

A defect amplification model [IBM81] can be used to illustrate the generation and detection of errors during the design and code generation actions of a software process.

DEFECTS DETECTION



DEVELOPMENT STEP

Figure 2.4 illustrates hypothetical example of defect amplification for a software development process in which no reviews are conducted. As shown in the figure each test step is assumed to uncover and correct fifty percent of all incoming errors without introducing new errors (an optimistic assumption). Ten preliminary design errors are amplified to 94 errors before testing commences. Twelve latent defects are released to the field. Figure 2.5 considers the same conditions except that design and code reviews are conducted as part of each development step. In this case, ten initial preliminary design errors are amplified to 24 errors before testing commences.

Only three latent defects exist. By recalling the relative cost associated with the discovery and correction of errors, overall costs (with and without review for our hypothetical example) can be established.

To conduct reviews a developer must expend time and effort and the development organization must spend money. However, the results of the preceding or previous, example leave little doubt that we have encountered a “Pay now or pay much more lately” syndrome.

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