

# Application of CMMI in Software Product Development Process

**Abstract.** Using CMMI architecture can bring scientific management to project management. However, at present how to use CMMI software development in software management process. Based on the advanced CMMI architecture concept, this paper extracts formation process character of the specified type project products. It establishes software models, initiates standardized project. It research, develop, inspect, audit and implement relevant content of the procedure. It decomposes the actual project problem and translates into software implementation process. Ultimately it achieves centralized management to multiple projects.

**Streszczenie.** W artykule zaprezentowano zastosowanie architektury CMMI (Capability Maturity Model Integration) do oprogramowania problemów projektowych. (Zastosowanie architektury CMMI do oprogramowania problemów projektowych)

**Keywords:** CMMI, software product, develop process

**Słowa kluczowe:** CMMI, oprogramowanie.

## Introduction

CMMI is the abbreviation of Capability Maturity Model Integration. CMMI certification is established by the American Software Engineering Institute. It is a specific software product quality management and quality assurance standards. From a technical level, software engineering starts at a series of modelling task. The final result of these tasks is software project complete requirements stipulation and full design denotation. Software model can effectively guide the act of development personnel. When it needs design and construct a system, a detailed software model tells developers how to coordinate and cooperate with colleagues. Software models include organization, function, behaviour and various other parties. So developers can focus on a particular aspect of the software model to enhance understanding or guiding operations. An ideal software model should be well-defined software model, which describes a certain type software project development activities of all the important details to the software, and must have operable. Software model activity that built by software design and software define is called software modelling. In recent years, many software companies have implemented CMMI management model, which shows that our business has improved software development methods in order to achieve with the world connection. Software modelling approach based on CMMI could improve the project management and enable complete the project with high-quality, low cost, according to the period.

The system introduces advanced CMMI concepts to the project feature extraction and modelling. It built the model with the project scope, cost, quality, resources, and integration and other aspects and feature implementation. The current traditional manual project management emphasizes "How to do Project". From a single project management approach, it convert to "how to run the project," the large centralized unified computer management. From the management level and strategic level, it manages, organizes, decide to the project.

## System Analysis

With the software rapid development today, software product is the developmental trend of software development models. Development model around with the engineering project is simple, efficient, client. It also brings disadvantages: a lot of duplication labour, lack of accumulation, difficult to maintain, quality control problems and the lack of a unified brand.

Software product advantages: Module repetition and high reuse, it will help promote product market and after service maintenance. It will bring market responsive and quality easy to control. Therefore software product needs the appropriate quality control support system.

In various stages of software products formation and application, it includes requirements, design, test, release, applications and so on. It provides technical support to ensure flow implementation throughout the organization.

## System architecture

This system's architecture is as fig 1:

In all stages of software development, system controls electronic process through the quality. It has achieved the unified management to code libraries and document libraries. It associates these information and get all kinds quality analysis data. It is propitious to the assessment of product quality, and promptly takes appropriate measures. System roles include the following. It includes configuration management engineer (BM), requirement change personnel (CCB), developer (DEV), manager (MANGR), research and development product manager (PM), testers (QA), test team leader (QA-LD), filing person, distribution, executors, testing people (these three roles is for task assignment, implementation and testing in task management), after-sale technical support (PSO), system administrator (SA), reviewer.

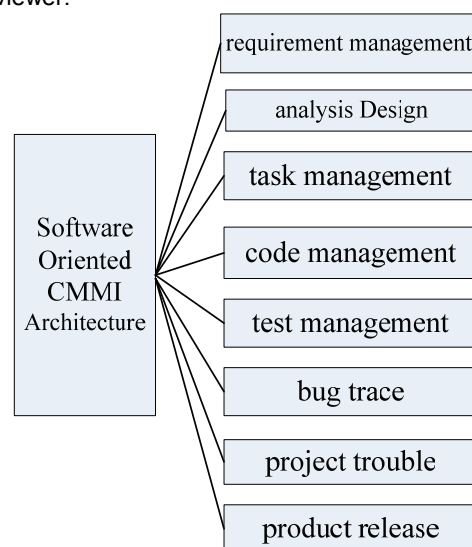


Fig.1. System Architecture

## System Implementation

System implementation includes requirement management, analysis and design, task management, code management, test management, bug trace, project trouble and project release. The material realization is as the following.

## Requirement management

Requirement management includes two types: one is requirement analysis management. The other is the requirement change management.

Requirement management involves the following role. It includes after-sale technical support personnel, requirement changes personnel, research and development product managers, developers, testers, configuration management engineer. When the after-sale technical support engineer at the scene found the system functional design need to make changes, the above role carried out a series of related operations.

Requirements analysis management definitude product need implement function based on product research at the software development initial stages. This is meet requirement which need implement function at the development initial stages.

In the actual software product development process, requirement makes changes because of various reasons at more time. This system's focus is implement requirement vary management. After product release and on-line, the project spot after-sales technical support engineer brings out new requirements traceability management. Its basic features include: reporting requirements, processing requirement, publishing requirements, distribution need, the relevant personnel reporting date according to the needs, other conditions combination involving of products, check the requirements which meet the requirements and so on other functions.

Requirements management flows are as follows: After-sales technical support engineer declare requirement → Requirement alter personnel judge the requirement whether reasonable → If the requirement is reasonable, it refuses requirement. If the requirement is reasonable, requirement alter personnel needs to determine whether requirement is immediate deal with. → If requirement do not need an immediate treatment, the requirement alter personnel needs lay aside requirement, and activate requirements at the appropriate time. If requirement need immediate treatment, the requirement alter personnel deal with requirement. → Requirement alter personnel issues requirement → Research and development product manager allocate requirement. → Developer performs task → Testers inspect task → Testers alter function state → Testers turns off task → Configuration management engineers issues requirement. → After-sale technical support engineer closes requirement.

## Analysis and Design

Analysis and design related different roles. It includes research and development product manager, test manager, test team leader, project manager, test personnel.

Analysis and design includes development plans, develop test plans, functional point maintenance and other functions.

Research & Develop product development manager formulate the development plan and modify the development plan (modify plan completion date, modify plan contains function point) according to the project progress. Test manager/test team leader develop appropriate test plans under the development plan.

System development test plan developed a support platform for the functional control and management. It can

intuitively see all function state under any plan. It also provides a convenient search function and makes relevant information more effective communication

Functional point maintenance means of research and development product manager entry function point, research and development product manager and test manager designate function point, project manager assigned function points, task management and tester modify function point state, developers and testers view function point details, developers and testers statistics function point.

The specific process of development test plan are as follows: Development manager formulates development plans → According to requirement management, development manager needs to decompose function point, and add the need to achieve function point in planning cycle. → Test manager adds the test plan. → When it arrives at development/test plan to complete. → It judges the function point which contained by plan whether it has been achieved → If it has been achieved, it complete the development test plan. If it has not achieved, there are two methods to deal with it. The first method is development manager to modify the development plan completion time, the test manager modify the test plan complete tie, it again re-develop/test plan to complete according judgment. The second method is that development manager built next development plan and make the delay and un-complete function point add to the new plan.

The specific procedure of functional point maintenance is as the follows. The research and development product manager make product development function point information input into the system. Research and development product manager, test manager make the product/subsystem/ module assigned to the project manager. Project manager make the module corresponding function point, as the task assigned to specific developers and testers. After it assign task management and function, the test personnel update function point status of the according to actual situation in a fixed period.

## Task Management

Task management involves the role as the following. It includes task executor, task identifier and task allocate person. When task executor receives task, task executor, task identifier and task allocate person do a series of related operations.

Task management features include the following .Executor performs tasks, identifier checks out tasks and identifier modifies function point status and identifier close tasks.

The specific process of task management is as the following. Distribution person assigns tasks → Executor revert to task identifier. → Identifier determines whether who is a responsible person. → If it is not is a responsible person, the identifier transmit tasks to other people; If it is a responsible person, identifier inspects tasks. → Identifier determine whether the task is complete, identifier alters functional status → Identifier closes task.

## Code Management

Code management involves roles as the following. It includes developers and configuration management engineer.

Software code stored in the CVS library and its storage form is products/subsystems/modules/ files. The basic process of source management is as the following. Configuration management engineer set the compiler environment. → Configuration management engineers input subsystem and module information. → The developer set the compile environment. → The developer input file

information. →The developers modify the code and submit to the CVS library. →The developers submit compiled result and configuration management engineer compile code.

If conditions permit, the code can be reused in code management. Through code reuse, it can make the existing code, algorithms, methods, ideas, technologies, etc use to the current project.

For a project within the same type project, it can be directly reused. For different projects, it needs modify the code and then reuse. In code reuse, it needs collect the specific function code in the project and compile to volume and provide reference for other projects. It can reduce the subsequent development of the system and the development work with the same function code. So not only it can improve efficiency but also it can save cost.. Code use includes two forms, namely the binary code reuse and code reuse. The former is implemented by creating and using objects. The latter is achieved through inheritance. To achieve code reuse, it must do the following things: a unified coding standard, employee with code reuse awareness, employee with coding level, the high level code library of business and employee group. General code with the following two stages: the first stage is using the previous code, on one side the developers of each project team in the development can directly can be directly used to extract the code from business or personal code library; the other side, reference code library code and ideas can modify and use, it writes the code for the current project. The second stage is extracting the code to prepare for reuse. Each project members concluded their algorithm, classes, methods, functions, etc which used in the development process. It can reference in other project code and classify according to the purpose and function.

### **Test Management**

Test management involves the roles is tester. It applies for testing personnel to maintain test data. In a fixed cycle, testers update the test product features point status according to the actual situation. Test Management module provides view test data to update, test progress details, test schedule and statistics and so on functions for the research and develop personnel.

### **Bug Trace**

Bug trace involves the role as the following. It includes document person, tester and developer. It used when document person found bug, the corresponding developers and testers carried out a series of related operations. The tasks include: developers, testers default settings, testers new add bug, developers deal with bug, developers and testers append reversion, the test personnel deal with bug, testers re-open bug, testers remove the bug, the developer and testers query bug, tester statistics bug.

The specific process of Bug tracking is as the following. Developers and testers adding bug. →Developers judge whether he is the responsible people →Developers judge if the bug is exists. →Developers modify bug →Developers reply bug to testers→ Testers determine whether he is responsible testers. → Tester determine whether there is bug. →Tester bug reply the developers →Testers close bug →Tester determine whether there is bug. →Testers again open bug.

### **Project Trouble**

Project trouble task involves four roles. It includes after-sale technical support person, test team leader, testers and developers. It applies when after-sale technical support person find project trouble in engineering implementation. After-sale technical support person, test team leader, testers and developers do a series of related operations.

Project trouble include: After-sale technical support person supported declaration task. The test team leader confirmed the task. The test personnel diagnosed faults. AIR & D solves bug. After-sale technical support person dealt with trouble. After-sale technical support person reopened trouble. After-sale technical support person deleted fault. After-sale technical support person and tester searched and statistics trouble.

The main flow of project trouble is as the following. After-sale technical support person declared trouble → s After-sale technical support person judge whether it is trouble. →If it is not trouble, after-sale technical support person delete trouble and troubleshooting is end. If it is trouble, the test team leader judge whether it is trouble. →If it is not trouble, the test team leader write back to after-sale technical support, person. If it is trouble, the test team leader distributes trouble to the tester.→ The team leader tester diagnoses trouble. → AIR & D solves bug. →After-sale technical support person deal with trouble and determine whether the trouble is resolved →If it is not resolved, the after-sale technical support response trouble to the test team leader. If it is resolved, after-sale technical support person close trouble. →After-sale technical support person check whether the fault is resolved. → If it is not resolved, the after-sale technical support person re-opens trouble, enter into the test group and determine whether it is the trouble, re-execute the corresponding process. If it is resolved, the trouble processing is completed.

### **Product Release**

Product release's role who is involved is configuration management engineers. Configuration management engineer do a series of related operations for the release product version. Product release tasks include: add release plan, edit the release plan, perfect release plan, new configuration item, modify the configuration item, search the released product information and download the released product configuration items (such as documentation package, install package, code package, etc.) .

Configuration management engineer formulates release plans. The relevant test personnel to release information to configuration management engineer. It includes the releasing engineering failures and bug description, the achieved engineering requirements, the updated operating documents, the released DB alteration. When configuration management engineer performs publishing plan, it need to select the release project scene. After the after-sales technical support person of each project site receives the notice inform, he downloads release package according to release illuminate address and online after test. After-sale technical support person feedback on-line case to the system, and update at any moment until the line's state is normal. Project managers, configuration management engineers, tester traces issue situation according to after-sale technical support feedback information.

### **Conclusions**

Since there is different projects type, there is different management mode and flow. So the key of this research is how we can use CMMI idea to exactly abstract and model different project flow. The preliminary research work becomes extremely important. This system has the following characteristics:

(1)It is the powerful function, simple operation, Web-friendly interface system.

(2)It has automatic email reminder mechanism. After it successful implements the operation, the system automatically sends a E-mail to the relevant personnel.

(3)It has flexible customization and various statistical reports. It can help relevant personnel analyze its process, identify need and upgrade area.

(4)It has comprehensive online help system.

(5)It applies single point centralized authentication, combines domain user and system users.

(1)It has multi-product, different role purview control and flexible configuration permissions.

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