Study on Predigest Frame and Schedule Schema Model Based on CMM Software Process Improvement

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Abstract: Based on CMM principle and method, a kind of predigesting software process improvement frame for the particular characteristic in Chinese enterprises software developing is brought forward. The project sanction and project track which are two core flows in the predigest frame are discussed in detail. At the same time the issue of software development schedule schema what is fewer involved in CMM model is studied. A sort of model to be developed collaterally for several phases is brought out and is described by math method. At last each phase inside of the model is optimized. As a result of this every factor that affects the developing efficiency of the whole project is disassembled to the idiographic parameter of adjusted model in each phase. So the efficiency of the holistic project is improved.

Key Words: CMM, Software Process, Frame, Schedule Schema, Phase Model

1. Introduction

Software process delineates the whole action of software engineering in the exploiting and evolving course of transforming the user request into an executable system. It is a set of tools, methods and practice used to produce software production. It mainly studies how to organize and manage the developing action, men and the resources efficiently in the course of software development. The software capability of an enterprise lies on its software process capability. What is process capability? It just means that the per se course of exploiting and producing a software is transparent, standard and operation compelled organization. In order to efficiently define and

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manage the software process better during the process of software developing. Software Capability Maturity Model was brought out by Software Engineering Institute in Carnegie Mellon University in 1991. CMM mainly evaluates the software process capability of a software development research organization. It accentuates the continual improvement and control of the software process action. CMM has been regarded in the software enterprise in China. But at the same time the Chinese software enterprise has to digest and ameliorate when fetches in CMM standard because of the complexity of CMM itself and the characteristic of Chinese software enterprise. Based on the principle and method of CMM a utility frame suits for Chinese software enterprise is brought out by predigesting CMM rationally in this paper. This frame grades software process as four layers: Project Management Layer, Logic Schema Layer, Core Layer and Process organizational Layer. Project management and organize management are combined by the two core, one is Project Administer (PA) and the other is Organize Administer (OA), that accomplish project confirm and project track the two core workflows.

CMM mainly evaluates the model of software developing process. It involves little about the plan and control of software developing schedule while they are one of the main content in software enterprise managing the process. Based on parallel model in parallel compute area, parallel exploiting model in the software project schedule plan process is built in this paper and stated by math method. Each phase inside of schedule plan optimized, three subphases time model in a phase is brought out. So schedule control in a phase can be achieved by the method of controlling the idiographic parameter of the three subphases. Hence, the efficiency of the whole project is improved.

2. Predigest Frame Based on CMM Software Process Ameliorating

2.1 Predigest Frame of Software Process Ameliorating

It is necessary to understand and master when CMM standard is enforced in China. Some proper reduce and amelioration to CMM should be made according to the characteristic of the enterprise itself. Based on CMM principle and method CMM is studied and ameliorated to the question of standardization during the course of software development in Chinese software enterprise. And an actualized frame structure suits for the software enterprise in China is brought out. In this frame structure software process is divided into four relatively special layers: Project
Management Layer, Logic Schema Layer, Core Layer and Process organizational Layer. It is showed by fig.1.

![Fig.1 Practical Frame based on CMM](image)

- **Project Management Layer**
  Project Management Layer is the project engineering sponsor and the project plan frame constitutor. It mainly includes four aspects. The first is Request management (RM). It is the constitutor of corresponding and communicating software project request between software user and realization user. It controls system software request and holds consistency of system software with software request, product and action. Request management constitutes Request management frame for Logic Schema Layer. The second is Software Project Plan (SPP). It offers a suitable base and constitutes an executive plan for software engineering operating and software project management. And it constitutes project plan frame for Logic Schema Layer. The forth is Software project track oversee (SPTO). It is monitor and examinant of project plan. It tails and examines the complexion of software according to tailing and examining the document of project plan. It corrects warp and adjusts phase plan according to actual project evolving.

- **Frame Core Layer**
  Frame Core Layer is connective hinge layer of Project Management Layer and Process Organizational Layer. It mainly includes three aspects. The first is process database. It is concourse for enterprise software process information. It includes project plan information, executing plan information, actually executed data, project evaluating information, quality controlled information and software process statistical
information. The second is Organize administer (OA). It is another core entity. It transforms organize process capability into actual process capability and put the data and quality note produced in the process into process database. OA leads document management group and communicates with the high decision-maker. The third is Document management group (DMG). Correspondence and communication of each group is depended on DMG and OA.

1. Process organizational Layer

Process organizational Layer mainly takes charge of project actualizing, project resource distributing and project overseeing. It includes four groups. The first is Finance Group (FG). It mainly takes charge of project finance collocating and project’s ID providing and managing. The second group is Systems engineering group (SEG). It includes manpower resource group, manpower training group and project cadre sustain group. It affords the whole sustain and restriction from enterprise’s view. The third is Software engineering group. It is a team of project exploitation and maintenance. It executes project’s request-analysis, design, coding and testing. The forth is Software relation group (SRG). It is a sort of team delegate of software engineering project. It sustains but doesn’t directly take charge of exploiting and maintaining software and executes software quality control and software configure management.

2.2 The Main Workflow of Predigest Frame

In the predigest frame based on CMM each project must apply login to Project Administer (PA). PA presides over project startup request to Organize Administer (OA) to gain confirm. All the related groups must take part in the review to the goal of project management layer, then distribute resource to the sanctified project and gain the only ID. Project is tracked and oversaw by ID. Frame takes charge of building a kind of mechanism to deal with the original communicative question between the delivery group and the sustain group. Frame can obtain the protocol and promise to client request when project is starting. And it also takes charge of maintaining authorized projects’ information database of all software projects, affords the standard and gist of tracking and overseeing project schedule. There are two parts in the core workflow of predigest frame. One is project sanction and the other is project track.

⑴Project Sanction

Project sanction mainly alternates between PA and OA to realize project confirm. From PA to OA is the only channel of project sanction. Project sanction is divided into
four phases: project request, PA validation, OA review and project sanction. Its workflow is showed by fig.2.

Project request begins with the applying for Project Information Request (PIR) to PA of project plan man in project management layer. Project information request includes supposing ingather project, client order letter, decision-making suggest and the needing information of project starting document. PA validates after receiving PIR application. Validated content includes if PIR has proper starter signing, if the content of PIR is full and if append document is completing. If PIR doesn’t accord with the validate request, PA brings suggest which is then returned to applicant. And PIR is reapplied after modifying. If PA validation passed through OA review is submitted and at the same time document management group is also submitted. Then put the tidied information into process database. OA takes charge of the communication and correspond of Systems engineering group (SEG) in software process organizational layer after OA accepting PIR. At the same time OA and Finance Group (FG) correspond and validate the condition of commerce bargain item and client order letter. All the influenced group must be solved assort with each other in two weeks. OA also takes charge of collecting and reviewing PIR application and feedbacks the review idea to project management layer. Project is restarted after PIR modifying. If the review of project request is passed through by OA then it is submitted to FG and received a only ID. The project ID is informed to all the influenced groups and persons by OA. The design of project ID shows that the project has been authorized.

(2) Project Track

Project track oversees and reviews the examined and approved project. And it
controls each standard in the process of project actualizing according to the document content of PIR project plan. Project track is taken charge by OA. Its workflow is showed by fig.3.

- **Examine and approve result**
  - **Modify**
  - **OA**
  - **DMG**
  - **FG**
  - **SEG**
  - **SRG**

**Fig.3 Project track workflow**

OA gathers the information of monthly project report compiled by document management group and compares the gathered result with project PIR to gain track analysis record. The analysis report mainly includes the project that the actual load exceeds project plan or project schedule exceeds prescriptive time. Its content includes project name, project ID, user name, project begin and end time, project evaluation load, actual load and actual using time. OA notes high decision-maker track analysis report. Decision-maker gives review and modification idea and brings forward alteration to project estimation, plan and schedule by OA to PA. At the same time OA sends modifying idea to FG, software quality ensure group, manpower resource and training group and cadre sustain group. Request plan of PIR is modified after PA receiving track analysis report and the note all the involved groups. Working schedule and content are regulated according to the modified plan.

Each project must have starting request conform to the suggestion and be authorized by high manager. Frame must assure the effect between process organizational layer and management layer should be controlled and corresponded efficiently by the core entity of PA and OA. OA reports the actual executing status to high manager and each involved group according to formerly schemed project plan monthly and regulates project executing plan based on track analysis report.

In the predigest frame based on CMM the most important step is establishing software project plan. There isn’t much describe about software developing schedule.
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of software project plan in CMM. Software developing schedule plan and control is one of important content in project management of a software enterprise. So schedule plan model in software project developing is studied in this paper based on parallel plan model of parallel compute area.

3. Parallel Phase Schedule Plan Model of Software Developing

What is software project parallel phase developing? It means that during the course of software project developing, software project process is divided into a series of comparatively independent phases according to some division mechanism. Every resource of project team is comparative independent in a certain phase. The member works not only independently but also synergic. There is much complex relation just as parallel, cooperation and cross between the tasks. And there is order, iterative and helix etc. multiform deductive model. They can’t enter the next phase until all the members have finished the task in a phase. Otherwise the members have finished work firstly have to wait for those have not finished. Mathematics method is used to describe parallel phase model of software project as follows and parallel phase inside optimize is adopted.

3.1 Description to Parallel Phase Model

The idea of building parallel phase model is as follow: the optimization schedule plan is not to pursue in the original phase of model designed, but depending on part optimizing to seek the optimization approximately solution of collectivity project schedule based on balancing project stability.

Step 1: If $T_o$ is time expending in project dividing phase and the time of the $i$ phase need is $T_i$, so the total time of project primary estimated is

$$M_o = T_o + \sum_{i=1}^{n} T_i$$

(1)

Step 2: At the initialization phase 0 of project, project does not start. It should vista from the first phase to number $n$ phase and give the concrete task decompose $W_i$.

Step 3: In number $i$ phase ($i=1, 2, .. n-1$) the task of this phase is finished and at the same time it should vista the phases from number $i+1$ to number $n$. If the alteration in this phase can be regulated in the leaving phases from number $i+1$ to number $n$ and can be adjusted up to time, well then according to the working time of attaining this
phase finished-sign $T$, the best achievable concrete task decompose $W_{i+1}$ in number $i+1$ phase is given and the plan finishing time $T_{i,k}$ from number $i + 1$ to number $n$ phase is regulated. $T_{i,k}$ denotes regulation of the next $k$ phase in number $i$ phase ($k=i+1,...,n$). Hence, the total time of project regulating is

$$M_i = T_0 + \sum_{k=i}^{n} T_{i,k}$$

(2)

If there is any fatal and unable adjusting problem there, that means the influence producing in number $i$ phase cannot regulate in the next phase, then phases have to be divided again. Let $T_0$ is

$$T_0 = M_{i+1} + T_k$$

(3)

Then return to step 1.

Step 4: In the last phase $n$, unite all the phases’ time and draw a conclusion that the project final schedule time is

$$M_o = T_0 + \sum_{i=1}^{n} T_i'.$$

(4)

Here $T_i'$ denotes each phase’s actual time.

3.2 Analysis of Phase inside Parallel Optimize

Each phase inside need optimizing to short phase time and therefore project developing schedule approach the furthest optimizing roundly. There are three subphases inside each phase: manage-temper subphase, work executing subphase and information communicating subphase. Each phase time schedule can be controlled by the regulation to the time of schedule parameter in the three subphases.

(1) Manage-tempering Subphase

The consumption of member task management is involved in this phase, for example task allocating, synchronization grouping, resource distributing and relational plan setting etc. The need time in manage-tempering subphase is

$$T_s = t_s(n).$$

(5)

(2) Work Executing Subphase

The member in the phase can finish part task of this phase. Part here means that the task information and resource the member need can be gained straight. The time need
The \( \omega \) denotes a working load and it processes information software project. Because there is difference among information carriers the computing mode of the \( \omega \) is different while it can be sum up to project efficient production. The \( f_t \) is average time of processing unit information in this phase for the member. In different phase \( f_t \) and \( \omega \) may be different.

Supposing in the \( i \) phase the total workload finished by these \( n \) members is: \( W = \sum w_i \), and it can be divided into \( n \) absolute work task. Supposing the absolute work-running time of these \( n \) members is a random variable having average value \( w_i f_t \) and standard warps \( s f_t \). There \( \omega \) and \( \sigma \) denote the imbalance of granule-degree and load. The minimum \( \sigma \) represents a parallel working phase. If \( \sigma = 0 \) it shows that workload \( W \) in this phase is distributed averagely to each member. Because \( n \) members finish work independently in phase the Max value can be denotes approximately as formula (6) according to Kruckal and Weiss studied result [2].

(3) Information Communicating Phase:

Information communicating phase indicates that the necessary information communicating between members in order to assort with each other. For example to finish task A need the result of task B the concrete developing work mustn’t be done when they is commuting information. In information communicating phase the need time of commuting information is

\[
T_c = a w f_t (n) .
\]  

Here \( a w f_t \) denotes information length and \( a \) is communicate-operation ratio of phase. It measures information traffic need by each member when he finishes task. \( t_f (n) \) denotes each unit information communicating time among \( n \) members.

In summary the total time of \( n \) members finish the task of this phase is:

\[
T_i = T_w + T_c + T_e = t_f (n) + (w + s \sqrt{2 \log_2 n}) f_t + a w f_t (n) \]  

In parallel phase model project is divided into several phases based on the form of phase end. In each concrete phase member load \( \sigma \) , information communicating \( t_c \) and parallel management cost \( t_e \) are considered. Software project team
developing efficiency is improved by adjust some concrete parameter of project phase model. Each subphase parameter representative direction is considered according to the objective of different phase. These parameters are adjusted properly to short the finishing time in this phase and finally the developing efficiency of the whole project is improved.

4. Conclusion

CMM model is predigested and a sort of utility frame suitable for Chinese software enterprise software process improvement is brought out. Two core workflows of the frame are discussed, one is project sanction and the other is project track. Project schedule schema model is studied specially which is usually little discussed. Based on parallel model in parallel computing area project developing parallel phase model is brought out and this model is described by mathematics method. By Phase inside optimize the factor affecting team’s developing efficiency is decomposed to adjusting concrete parameter inside phase. Predigest frame model and project schedule schema model brought forward in this paper have biggish utility value to Chinese software enterprise in project developing and managing.

References

Biography

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