Abstract—We have recognized the recent problems of manual based chaotic Configuration Management (CM) in many Information Technology (IT) divisions, which include aspects like naming convention & correct placement of work products in CM directives, automated configurable item identification, baseline report creation, change management and status accounting. Choosing and using an appropriate CM tool is a crucial aspect in this area to avoid such problems. So, the aim is to formulate a new model and to implement the proposed model as a single CM tool solution for preventing the problems as mentioned above. The method is to propose a model based solution by integrating a new front end interface with Subversion (SVN) in the back end which preserves stringent access restriction ultimately resulting in CM work products as per Capability Maturity Model Integrated (CMMI) guidelines. In this new concept, employees other than CM specialists no longer need to toil exclusively with the CM tool and its standards but can reap the benefits of collaboration with automated CMMI process areas instead.

Index Terms—Capability maturity model integrated (CMMI), software configuration management.

I. INTRODUCTION

During the prolonged global economic downturn, organizations are accentuating on initiatives that produce new operational efficiencies without hampering their overall productivity. Configuration Management (CM) is a process area that focuses on ensuring consistency between the functional and physical attributes of items that support a business service, and their requirements, design, and other related information. Thus, proper attention to CM is one of the vital facts for organizations to achieve the above objective. A proposed amalgamation of CM with guidance of Capability Maturity Model Integrated (CMMI) will enable many Information Technology (IT) organizations to create an automated software configuration management system that will help them work more effectively and efficiently to prevent these CM related problems. In this concept, employees other than CM specialists no longer need to toil exclusively with the configuration management tool and its standards but can reap the benefits of collaboration with automated CMMI process areas instead.

II. CHALLENGES IN SOFTWARE CONFIGURATION MANAGEMENT AREA

In today’s frequent discussion of globalization, configuration management needs to play an important role in Information Technology (IT) industry in making effective collaboration happen across geographically distributed stakeholders who develop software packages through parallel releases. Under these circumstances potential problems generally faced by the IT industry in configuration management process area are described below.

1) We have observed that naming conventions for the documents, code and data are not rigorously followed. Life cycle based standard configuration item list is not available for most of the projects and applications. (part of CMMI requirement under SP 1.1 & SP 1.2)

2) Standard folder structures for the projects and applications are not defined. So projects normally use their own ad hoc structures to maintain the work products. (part of CMMI requirement under SP 1.1.2)

3) Imposing access restrictions to different project and application folders is not possible in a CM tool like Clearcase. So anybody who has been given access in the parent level project or application folder can access all folders for that particular project or application. There is no role based access approach criterion. (part of CMMI requirement under SP 1.2)

4) Majority of industry does not admit Sharepoint as a CM tool. Clearcase has also few restrictions like access criteria as mentioned above. Now, industry accepts Subversion (SVN) as a better open source tool than Concurrent Version System (CVS) as in [1]. Hence, a mandated approach with only SVN as CM tool is sufficient.

5) There is no collaborative approach available with the different CMMI process areas and the configuration management process area. This collaboration is vital as the CM process has a significant role to maintain all direct and indirect evidence to achieve CMMI maturity. (Control configuration item and establish configuration management records are part of CMMI requirement under SP 2.2 & SP 3.1)

6) The baseline reports for different milestones and change impact report need to be automatic for easy reference as these are not available for projects and applications. (part of CMMI requirement under SP 1.3 & SP 2.1)

7) We have observed that CM Audit [2] reveals most of the defects occur owing to chaotic configuration management. So they require some in-built automation

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to remove the recurring CM process defects as well. (CM Audit is part of CMMI requirement under SP 3.2)

8) We have also observed that CM training cost for all members of the project and application is very high owing to frequent changes in project teams. It is quite impossible to effectively train the whole organisation in every tiny detail of the CM area. CM Audit findings in projects also regularly reveal low effectiveness of the CM trainings. There is no standardization of CM directives and baseline criteria as well. So an automated process is deemed necessary which would enable all members to maintain the configuration management process [3].

III. CONFIGURATION MANAGEMENT REQUIREMENTS FROM CMMI PERSPECTIVE

Configuration Management is a support process area at maturity level 2. The purpose of this process area is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits, as in [4].

Following are the specific goals defined for configuration management process area under CMMI as in [5].
1) Identify Configuration Items (SP 1.1)
2) Establish a Configuration Management System (SP 1.2)
3) Create or Release Baselines (SP 1.3)
4) Track Change Requests (SP 2.1)
5) Control Configuration Items (SP 2.2)
6) Establish Configuration Management Records (SP 3.1)
7) Perform Configuration Audits (SP 3.2)

IV. SOLUTION WITH PROCESS MANAGEMENT TOOL

In Fig. 1, we have outlined the vision, i.e., to devise a tool utilizing the collaborative approach. Users of the tool interface with a front end that is in line with the CM directives and CMMI guidelines. We integrate this front end tool with the open source CM tool in the backend. Through stringent access management features inbuilt in the tool, we can preserve CM guidelines. Finally, different reports allow us to harvest the benefits of proper implementation of CMMI guidelines of CM process area.

In Fig. 2, we propose Front End and CM tool integration model in project and application perspective. We will display links to the different work products corresponding to CMMI in the "Front End." These work products will be grouped as per the different project lifecycle methodologies. No one except the CM team will have administrative access directly to SVN in the back end; the rest of the project team members will have access to the work products only through the front end of the tool.

The tool will have facilities to draw up reports like configurable item List, CM audit report, change Impact and baseline reports directly from the front end.

The project team will be able to check out the different work products directly from the front end, update them, and check them back in. They will also be able to add or remove work products (with proper approvals) from there. The team will not be concerned about what goes on in the back end in SVN. Access rights for each work product will be granted as per a predefined RACI (Responsible, Accountable, Consulted and Informed) matrix in keeping with CMMI standards. However, this model will allow software engineers to work either directly on SVN or through Eclipse for amending or developing code files. The CM head and CM team will have admin rights over the repositories in the backend and will take baselines on the repositories on the agreed milestones.

Here we have explained each division of the model with elaborations of the proposed features of the Front End tool.

A. Interfacing
1) Tool service team will configure each new project in the Front end with the appropriate life cycle model defined by project and quality management team.
2) All work products will be visible based on CMMI guideline (direct and indirect evidences for all process areas).

3) Projects will be able to tailor the work products which are not applicable as per scope of the project. The front end shall have features to exclude the tailored items. This work product list will be considered as the Configurable Item list, except the Non Configurable Items, which can be generated as a report.
4) All work product access rights will be role based (edit, review and approve). The work product status will be shown on the front end screen with the document.
5) All work products must have check in, check out, download, upload and edit options based on individual user roles. There will be features for users to add multiple documents as well as to delete existing documents.
6) The tool will have features to display all standard templates and guidelines with hyperlinks to the documents under each CMMI process area.

B. Integrating
1) Industry identifies SVN as CM tool for its many advantages and a dedicated service group will maintain this central SVN server for the organisation. The project repositories will reside in this server. On the front end, configuration manager will define address path (folder and sub folder path of CM tool) till root level of a particular project and application.
2) By default, tools team will define the address path of CM tool till sub folder level for each work product. Document naming convention will also be mandated from the front end and it will be reflected in the CM tool when user selects, creates and uploads a new document. The document ultimately will be placed on the SVN back end by the tool.
3) If users check out any existing work product from the front end, then it will be checked out from SVN itself. After check in, a new version will be created as per the philosophy followed in CM tool. The tool will have the facility for mail triggers to concerned stakeholders when any work product is amended through front end.
4) There would be different views for the work products like CMMI view, Role wise view etc.

C. Preserving
1) Only CM group will have admin rights for creating baseline and branches to maintain releases in SVN.
2) Only CM team will govern access rights. Any other problems which cannot be resolved by CM team can directly implemented by helpdesk as requested.

D. Harvesting
1) The reporting section will house reports like configuration Item list, baseline report etc. Any baseline and milestone report can be generated by using the label of SVN which will fetch data from the backend and produce output. Other configuration management reports are part of configuration item list which will be available in the front end.
2) For any change request, the impacted list of work product with changes can be shown based on a report output.

As SVN is an open source tool, the code base for it is freely available. Thus it will be easy to build the necessary plugins to connect the front end solution with SVN to implement the proposed model as a single CM Tool Solution.

V. Benefits
1) We can develop well-defined automated CM directives like standard document naming conventions, folder structure and in built automated work product maintenance. We will also be able to generate CMMI guided automated CI list from the report section.
2) We can define role based (RACI) access for each work product. Hence proper review and approval process can be implemented as per CMMI guideline.
3) The training cost for the CM area will be less because majority of the team members do not need to be concerned about CM directives maintained at the backend. We will have just a one-time investment for the tool and minimum training requirement. This tool and concept can be reused by any other IT division.
4) We can generate a collaborative approach with all CMMI process area with CM philosophy. We can manage all direct and indirect evidence automatically along with all versions with little manual intervention.
5) We can automate CM status accounting including baseline reports.
6) We can easily identify the impacted artifacts for a change request through in built reports.
7) Above all, we can achieve more stringent CM process hence lesser defects in that process area.

VI. Future Roadmap
We can enhance this tool interface for baselining and release management activities from the front end. Software Engineers can also handle code with an eclipse plug in. The estimate for building the front end, integration with SVN and supporting helpdesk will be crucial. We must consider security aspects during development of the tool. This tool can be shared with other IT division for reuse.

VII. Conclusion
This is a new model that promotes collaboration and integration of CM process areas with CMMI guideline. We can automate various elements of the CM process like directives, change management, status accounting. The front end interface will help to follow the CMMI processes easily and automation of configuration management at the backend will ensure fewer errors. We can develop the front end interface with minimum cost and reuse it for many other IT divisions as well. Currently managing Configuration Management with CMMI process compliance for every project is a challenge which we can resolve very easily through this collaborative model. Security aspects and release management integration would be a challenge to incorporate and require further thought. However, the benefits of this approach far outweigh the challenges.

REFERENCES
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