Experience and Lessons from Software Configuration Management for PMAS

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1. Introduction

Plant Monitoring and Annunciator System (PMAS) for Shin-kori and Shin-wolsong nuclear power plants 1 and 2 is the first localization of a large scale I&C system in nuclear power plant construction project. The PMAS is composed of Plant Computer System (PCS), Plant Data Acquisition System (PDAS) and Plant Annunciator System (PAS). The function of the PCS is to perform plant status monitoring and application programs running. The PDAS performs I/O signal acquisition, processing and data communication for the PCS, and the PAS performs the annunciation of plant alarm through annunciator window. The PCS and the PDAS/PAS are developed by different organizations, and they are integrated at the staging area. After the testing at the staging area, the PMAS is delivered to the site.

The software configuration management has been executed respectively by each developing organization of the PCS and the PDAS/PAS before integration, and the software codes of the PCS and the PDAS/PAS are merged to unified software configuration environment at the time of integration.

2. Software Configuration Management

The PCS is composed of system server, data server and application server which have the redundant and distributed system architecture. In addition there are operator display stations, engineering workstation, maintenance workstation, network switches, storage devices and printers, and the PCS interfaces with the external systems. Hence, the large volume of software is needed to operate the PCS. For the success of the project, the Software Configuration Management (SCM) is applied to the whole period of software development.

2.1. Software Configuration Management Plan for PCS

The activities of software configuration management are defined in software configuration management plan which complies with the IEEE standard [1].

2.1.1. SCM Management

The SCM organization is composed of supervisor, system administrator and engineers. The supervisor is responsible for the implementation of adequate measures to manage and control the software configuration, the system administrator is responsible for performing ongoing backup of work in progress for the system periodically, and the engineers are responsible to develop source code and prepare the related document.

The configuration control plan for the PCS is based on the principle of a single, controlled source archive. Each engineer is responsible for developing the single source of archive and the system administrator maintains the single controlled archive. Configuration control of externally developed software begins upon receipt of the software from the external supplier.

2.1.2. SCM Activities

Configuration identification is applied to all software, both code and associated documentation. Associated documentation along with the actual produced software makes up the configuration item. All computer files for modules are identified by a unique module name.

The goal of software configuration control is the preservation of the integrity of the deliverable software in the controlled system environment through such means as: 1) prevention of accidental or unauthorized modification or deletion of a module, 2) prevention of simultaneous modifications to a module, 3) coordination of changes to the system.

2.1.3. SCM Schedules

Major milestones or baselines are planned according to project schedule.

2.1.4. SCM Resources

The software configuration management is performed primarily by Perforce software [2] which is a computer program to manage the changes in developing software. The operating system of Perforce server is based on Microsoft Windows 2000, and the operating systems of Perforce clients are based on UNIX and Linux. Perforce provides a protection scheme to prevent unauthorized or inadvertent access to the archive.

2.1.5. SCM Plan Maintenance

This plan will be updated as deemed necessary by the agreement between engineer including system administrator and supervisor. Changes to the plan will be documented and approved to the same level as the original issue of the document and transmitted to each engineer for the SCM effectiveness.

2.2. Execution of Software Configuration Management

2.2.1. Configuration Items

The configuration items of concept phase and requirements phase are design requirement documents and design specification documents. The design requirement documents are prepared by internal and external designers. The design specification documents contain the performance requirement for the PMAS.

The configuration items of software design phase are software requirement specification documents. These documents are prepared by software developers.

The configuration items of software implementation phase are software codes, input data files and database file. The software codes and input data files are prepared by software developers, and the database file prepared by database engineer.

The configuration items of test phase for the PCS are test procedures, test reports and the software. The test procedures and reports are prepared by test engineer.

After test phase for the PCS, the integration is performed. At this phase, the software codes of the PCS, the PDAS and the PAS are merged to unified software configuration environment. During integration test phase, integration test procedure, integration test reports and the software are configuration items.

2.2.2. Implementation

Configuration control environment was set up in early stage of software development. All internal and external documents were controlled by Engineering Database System which manages the engineering resources and work products. The software codes, input data files and the database file were controlled by Perforce software.

During configuration control of software, the following troubles were occurred.

1) The controlled account could not maintain the latest software always because software developers were reluctant to put their software into configuration control environment.

2) A unified software configuration control environment for the PCS, the PDAS and the PAS could not control the PDAS/PAS software properly due to the different practice of configuration control.

3. Conclusions

The software configuration management for the PMAS has been executed satisfactorily although there were some troubles.

For the better software configuration management, the following are needed.

1) Software developer's correct understanding to configuration control is much more important than configuration control system setup.

2) System administrator's role is very important, and appropriate authority must be given.

3) The practices of configuration control between different developers should be consistent.

REFERENCES

[1] IEEE Std. 828-1998, IEEE Standard for Software Configuration Management Plans.
[2] Perforce Software(www.perforce.com), Perforce Technical Documentation.