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An Assessment Process for Software Reuse

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Introduction

There have been a number of papers written on how to achieve software reuse through various techniques, tools and methods as well as reuse management. This paper discuses the advantages of conducting an initial reuse assessment prior to starting a reuse program. An initial reuse assessment can assist an organization in planning its reuse strategy based on their current infrastructure, reuse goals, and availability and quality of existing reusable assets.

This approach is based on the belief that there are critical success factors for adopting software reuse as a policy. Each organization is unique in that they have different cultures and maturity with software processes and thus each organization should have a reuse plan specifically designed for their purposes. Therefore an organization should undertake an initial reuse assessment as the first step in planning to adopt reuse.

The initial reuse assessment discussed in this paper has two objectives. First, to assess an organization's current management practices, policies, and culture, and it's maturity with software development practices in order to develop an implementation strategy for a reuse program. Second, to assess the current reuse opportunities in the organization to maximize the reuse of existing software artifacts.

Initial Reuse Assessment

The assessment is performed through the use of a questionnaire, interviews and code reviews. Several people in the organization are involved in the reuse assessment including senior management, maintenance programmers, project leaders, and software developers. The assessment is performed by someone external to the organization who is familiar with the software reuse process and the software environment of the organization which is being assessed. The external assessor uses the questionnaire to interview members of the organization. After the completion of the questionnaire and interviews, the assessor reviews the condition of the software artifacts (e.g. code modules, documentation). The assessment process should be completed over 2 days, one day for interviews and the second day for code reviews. Of course this time frame depnds on the cooperation of the people within the organization.

The results of the assessment are analyzed against the reuse assessment indicators described in this paper to determine the organization's reuse potential.

Assessment Questionnaire

The assessment questionnaire was developed based on a set of reuse assessment indicators grouped into 5 categories:

* management

* domain

* organizational structure and diversity

* current systems

* process

These assessment indicators are based on the attributes of successful reuse programs, reuse adoption strategies, evaluation questionnaires for organizational reengineering, and criteria for identifying reusable components (references available on request). A copy of the questionnaire can be found on http://seweb.dit.csiro.au/.

Reuse Assessment Indicators

A summary of the type of information being sought for the reuse assessment indicators is summarized below by category.

A. Management

a. Motivation for reuse.

b. Commitment to reuse.

c. Understanding of the reuse process requirements (e.g., people, tools, methods, training).

d. Long/short-term IT strategy.

B. Domain

a. Domain knowledge.

b. Number of applications that have been developed in domain.

C. Organizational Structure and Diversity

People

a. Knowledge of domain.

b. Knowledge and practice of software engineering principles.

c. Staff employment type (% contractors, employees).

Culture

a. Communication between work groups/projects/divisions.

b. Team dedication and morale.

c. Reward structure.

Business

a. Own and maintain software developed/vendor owned and maintained

b. Use COTS

c. Legal rights to software.

d. Type of business/software.

D. Current Systems Technology

a. Maintainability:

-- Understandability.

-- Condition (e.g., quality and usefulness).

b. Documentation condition.

c. Life expectancy.

d. Software architecture (e.g. interfaces).

e. Availability of reusable artifacts and reuse management.

f. Maintenance history.

E. Process

a. Ability to adopt new technology.

b. How technology transfer is performed.

c. Tools in use.

d. Performs assessment to an improvement model (e.g., CMM, SPICE), to include such things as:

-- Methods practiced.

-- Quality assurance.

-- Configuration management.

-- Metrics.

-- Process improvement.

Assessment Evaluation

The assessment results would group organizations into one of the following four types:

1. *High reuse potential:* existing software artifacts which meet useful and quality requirements and the organization has mature software engineering processes.
2. *High-Low reuse potential:* existing software artifacts which meet useful and quality requirements but the organization has immature software processes.
3. *Low-High reuse potential:* limited existing software artifacts which met useful and quality requirements and the organization has mature software engineering processes.
4. *Low reuse potential:* limited existing software artifacts which meet useful and quality requirements and the organization has immature software engineering processes.

In addition to the existence and condition of reusable artifacts, other contributing factors are current technology in use, organizational infrastructure, and the IT strategy of the organization.

In addition to the four assessment groupings, other conditions may occur such as when an organization has reusable artifacts which are not in the format (e.g., language) in which new applications are being developed. In this case the organization may consider reengineering the code for use in the future system or reverse engineering the code for the documentation to assist in both reuse and the reengineering activity. The result of the assessment will provide valuable information to organization to determine a starting point for a reengineering project.

In the above cases, the assumption is made that when an organization has a reuse assessment performed it eants to asopt a reuse program. The assessment will determine both the commitment the organization has to making reuse happen and its understanding of what is required to establish and maintain a reuse program. If the organization does not

have management commitment to reuse (and a reuse champion), and good channels of communication, then reuse will not be efective regardless of the reuse capability.

The above four assessment groups can assist an organization in determining the level and quality of their documentation of software artifacts and software integration.

Documentation: One of the principles of software reuse is that reusable artifacts must be documented and classified according to quality standards and guidelines. Software that is documented (and locatable) is easier to understand and thus maintain. Documented software artifacts also serve as a record of corporate knowledge which is useful for documenting the business rules and training new staff.

Software Integration: Existing reusable artifacts can be used in the migration to new technology by the use of defined software interfaces to COTS, or through the use of object wrappers or bindings. Both approaches to software integration provide reduced software development and allow for an incremental implementation of reuse.

Advantages of Reuse Adoption Assessment

There are several advantages to performing an initial reuse assessment at the initiation of a reuse program starting with existing software artifacts. The strongest advantage is coming to understand an organization's reuse goals, processes, people, opportunities and challenges. Armed with this knowledge, there is a better ability to create an integrated solution to the problem of achieving levels of reuse that are aligned with overall objectives of the organization. Additionally, an understanding of the organization's reuse potential through code reviews plays an important part for the following reasons:

It allows the organization to initiate a reuse program starting with existing software components which provides a familiar point of reference that may reduce uncertainty, and help to create a feeling of ownership. This may make it easier to justify a major initiative that starts with the existing software (i.e. recoup the software development costs).

2. It will determine if there are large, readily identifiable sections of code that are reusable as is. Incremental adoption can use them to promote acceptance.

3. Very often working with existing software may involve significant problems. The quality of source code can be uneven and documentation inadequate, especially in the case where software was not designed for reuse. The code analysis provides the opportunity to determine the reusability of the software artifacts before a reuse program has been initiated.