

# **A Research Framework for Empirical Software Engineering Collaboration and Its Application in a Software Development Project**

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## **Abstract**

To demonstrate and verify empirical software engineering methods, a new research framework was developed in response to government policy in Japan. This framework was adapted to a government software development project, which is currently in detailed design. This application demonstrates use of the framework in a real software development project.

This paper describes the background and current status of the research framework and the software development project. It also makes observations based on this application about generalized conditions needed to support empirical software engineering data sharing between industry and academia, and introduces the concept of a "macro-measurement tool."

## **Initial Assumptions**

To firmly support empirical software engineering research based on measurement, Industry and Academia (I&A) must share field data and knowledge and also exchange feedback about accomplishments.

Up until now such collaboration has been difficult to realize in Japan, as the industry side has limited access to academic institutions being buried in daily business issues, and the academic side also has limited opportunity for access to the real software development field.

To overcome these limitations, we consider it necessary to realize a new research framework supported by government policy. [1][2]

## **The Background**

Under the government political leadership, two new software engineering research frameworks for collaboration between I&A were realized by two ministries, MEXT (Ministry of Education, Culture, Sports, Science and Technology) and METI (Ministry of

Economy, Trade and Industry). They were EASE (Empirical Approach to Software Engineering) project and SEC (Software Engineering Center) Japan. Each project has connections with both academia and industry, and both promote collaboration between I&A. With the commonality of interests, the two projects decided to work in collaboration.

The EASE project is an I&A collaboration research project and it established a small research laboratory at a conveniently located place. Some post-doctoral researchers from local universities and software development persons from the software industry were gathered here for software engineering investigation. This research team developed a software project measurement platform named EPM (Empirical Project Monitor). EPM was distributed to industry in free manner as a communication measure between I&A. This started the I&A collaboration activity of sharing software development field-data.

EPM measurement targets include product and process data from ongoing projects, mainly from configuration management tools such as CVS, bug tracking tools such as GNATS and mail management tools such as mailman.

EPM was distributed to several software companies and adopted to real development projects, with some collaboration research projects started sharing real field data. [3][4][5]

SEC is a new investigation and research organization gathering many software engineering professionals organized into several task forces to publish various practical working reference models, engineering standards and white papers. In this activity SEC gathered and analyzed data from over 1,000 real benchmark projects and published the results as a software development data white paper.

This spring, the EASE project passed over 2 years since its beginning and SEC passed a half year. Together, the projects started a new project in collaboration manner to adopt their accomplishment to a real software development project and to feedback its outcome to target projects. The target project is named ASDP (Advanced Software Development Project).

#### Features of the Advanced Software Development Project

As a target of ASDP, a middle scale development project was selected under METI leadership. It is an experimental "Probe Information Platform" development project.

This project is in the field of ITS (Intelligent Transport System). It will develop an experimental probe information platform, using a special collaborate research organization organized by seven companies including an automobile manufacturer, an automobile component manufacturer and five major IT vendors. This organization is supported by each private company but the probe system development and experimental expense are supported by government budget. The experimental period is two years with two stages of development and experiment are scheduled.

Software will be developed by the IT vendors of this organization through multi-vendor wide area distributed development. Each IT vendor in this organization competes with each other in the ITS field, so the development project makes a clear distinction between collaboration areas and competition areas. In collaboration areas, information is shared by each vendor and in competition areas information is confidential.

Development software for this project is mainly application programs on Linux servers, coded in C/C++ with access to RDB. Some personal computer programs for displaying results also are included.

The probe information platform is mainly constituted by a data collecting part, data processing part and display part. The data collecting part collects transportation data from probe cars such as taxi, bus and other cars. The data processing part constructs useful information such as traffic jam information from collected data. As an experimental system, several processing methods will be tried in parallel and combined. The display part also will have various approaches.

#### Current Status of the Advanced Software Development Project

At present, ASDP is in the detailed design process. At the end of the basic design process, ASDP arrived at the following accomplishments.

1) Developed a measurement framework for a real software development project and for sharing data between I&A.

As shown in Table 1, ASDP reached a consensus between I&A on data collection items, data collection methods including data form, and data collection tools including EPM and its rules of operation.

As shown in Table 2, ASDP also agreed to basic data analyzing examples.

2) Data collection and data sharing between I&A at the end of basic design process as follows.

Project context data. Basic design review recodes. Basic design documents. Mails between each company which include basic documents as attachments. Bench mark

project data until basic design process includes project attribution, project schedule data and track records produced by the end of basic design process.

### 3) Data analysis by shared data

Quality evaluation of basic design review.

Retrieve similar project from past benchmark data collection.

### Observations concerning I&A collaboration projects

As a government project, ASDP has various generalized features, such as multi-vendor wide area distributed development by major IT vendors and a development organization which reflects the Japanese software industry's hierarchical structure. So we believe that observation points of this project have considerable generality.

In this kind of multi vendor development structure, generally the development process at each IT vendor is in a black box except for the system integration test process at the ending part of the development process. For the project owner, the government, and PM (project manager), the majority of the development process is a black box, where we can only catch a glimpse of quality at the inter-vendor integration test.

In the case of ASDP this situation is conquered. Under the thoughtful preparation and agreement between all parties concerned in the project, it becomes possible to measure the whole process from the view point of software engineering and share data between I&A. At present, the development process is only partially complete but it is meaningful to realize that there has been whole process measurement and I&A data-share.

In particular, the major factors which allow ASDP to realize measurement and data-sharing are as follows.

#### 1) The fundamental I&A collaboration research framework developed by government budget.

EASE project:: Established small I&A collaboration laboratory and developed practical software engineering data measurement platform, then distributed it to software industry and shared collected data as a medium of this platform.

SEC:: Organized various taskforces with wide gathered professionals and investigated and published software engineering standards, guidelines and data white papers.

Collaboration between EASE project and SEC.

Government leadership overcoming barriers between ministries.

#### 2) Concept and equipment of measurement platform: EPM

Real-time process and product data collection from ongoing software project.

Utilize popular open-source software engineering tools, such as CVS, GNATS and Mailman.

Newly developed light weight glue-ware type measurement platform.

Loosely coupled software tool interface, flexible platform structure. Familiarity with existing software development environment.

Automatic software engineering data collection method less work for software development field. Light weight operation method.

3) Thoughtful measurement plan and execution.

Careful discussion with software development group and agreement based project process.

Presentation measurements usefulness to development group.

Acquiring understanding to measurement and analyzing concept from development group.

Feedback plan of measurement and analyze result to development project.

Construct win- win relationship between all related group.

Equip physical environment

Equip data collecting server suitable to multi-vender wide area distributed development.

Secret data room, neutrality data analyze organization adapt to collaborate and compete structure.

4) Total framework coordination

Special coordinator.

Powerful readership and support of government.

Fig.1 illustrates those factors in a hierarchical manner. Considering such measurement issues as software tool and its operation issue, those 1) and 2) are positioned as “macro measurement tools” and 3) and 4) are its management and operation.

As a result of this ASDP activity, the “macro measurement tools” have been developed and shown to be effective in a real project environment.

## References

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5) EASE project <http://www.empirical.jp/English/index.html>