

ABSTRACT

Software Transition Project Retrospectives and the Application of SEL Effort Estimation Model and Boehm's Constructive Cost Model to Complex Software Transition Projects

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The Multimission Image Processing Subsystem (MIPS) at the Jet Propulsion Laboratory (JPL) has managed transitions of application software sets from one operating system and hardware platform to multiple operating systems and hardware platforms. As a part of these transitions, cost estimates were generated from the personal experiences of in-house developers and managers to calculate the total effort required for such projects. Productivity measures have been collected for two such transitions, one very large and the other relatively small in terms of source lines of code. These estimates used a cost estimation model similar to the Software Engineering Laboratory (SEL) Effort Estimation Model. Experiences in transitioning software within JPL MIPS have uncovered a high incidence of interface complexity. Interfaces, both internal and external to individual software applications, have contributed to software transition project complexity, and thus to scheduling difficulties and larger than anticipated design work on software to be ported.

As an exercise in reviewing our process for cost estimation for such software transition/implementation projects, cost models that include reuse adjustments are examined to determine their adequacy in tracking costs for such projects. Two specific cost models to be examined include the SEL Effort Estimation Model based on the November 1993 Cost and Schedule Estimation Study Report, and Barry Boehm's Constructive Cost Model (COCOMO).

In preparation for an examination of these two cost estimation models, metrics collected over the life of these two software projects at JPL MIPS will be presented. An examination of the total source lines of code will be reviewed for the two software transition projects. An explanation of original cost estimates for both projects will be presented, with a general discussion of the source language and general application software characteristics. A detailed discussion of various unplanned, unanticipated software design and interface-related development hurdles will be reviewed for both projects. Specifically, application software interfaces with other application software, with dedicated special

purpose hardware, with display functions and with databases were a subset of all interfaces which presented a significant level to project complexity. This discussion will be part of a lessons learned review in the transitioning of software from *one* operating system and hardware platform to another with an emphasis on software set complexity. Finally, original cost estimates will be compared with measured productivity and schedule results for both projects.

After this quantitative and qualitative review of these projects, the SEL Effort Estimation Model, as published in November 1993, will be reviewed in terms of its ability to improve upon the original estimates based on personal experience. Specifically, the Subjective Evaluation Form (SEF) and other effort modifiers that are a part of this cost model will be examined to see how well they reflect the influence of software interface complexity. Special consideration will be given to the ability of the reuse factors in the equations to appropriately gauge the efficiencies in transitioning software, versus authoring new code. A SEL Effort Estimate model estimate will be generated for both JPL MIPS projects, and estimate results will be compared with original estimates and project actuals.

Secondly, Boehm's COCOMO will be reviewed for its inclusion of interface complexity in cost estimates. The model's use of Software Development Modes and Module Complexity Ratings will be explored for its ability to incorporate reuse and software interface complexity. A COCOMO model estimate will be generated for both JPL MIPS projects, and estimate results will be compared with original estimates and project actuals.

As a conclusion, the general magnitude of the impact of application software set interfaces will be summarized, along with the ability of these two models to track such complexity in a software project. Possible modifications to the SEL SEF and the COCOMO Mode and Complexity tables will be explored with the aim of providing a set of models to estimate software transition projects.