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SIMULATION MODEL COST DATABASE

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ABSTRACT

Simulation-based acquisition (SBA) is a robust, collaborative use of modeling and simulation (M&S) technologies that are integrated across acquisition phases and programs. Our research goal is to quantitatively show the benefits from M&S in SBA. To that end, we should consider costs arisen from the use of M&S in SBA, e.g., development costs related with M&S. This paper presents a simulation model cost database where simulation models developed, their development costs, and sizes are stored in. Based on these data, our database with a model query processor would be able to estimate development costs of models to be developed at the very early stage of, or before, an acquisition program.

1 INTRODUCTION

In SBA, M&S technologies make design alternatives analyzed within risk-free environments, so that substantial amounts of time, cost, and risk can be reduced across acquisition phases and programs (Criscimagna 2001). However, the benefits from M&S in SBA are intuitive, so that they should be quantified to clearly determine them (DoD 1998). In order to quantify them at the very early stage of, or before, an acquisition of a system, we should estimate development cost of simulation models to be developed in a 'rough order of magnitude' manner (Lee and Kim 2015). Unless the development cost exceeds 'quantified' benefits from M&S, SBA would be well worth considering for the acquisition, in terms of cost saving.

In this paper, we propose a simulation model cost database (SMCDB), which could be used as part of qualitative evaluation of the benefits from M&S in SBA. Simulation models developed through an acquisition program are stored in SMCDB, together with their development costs. These data are then used to estimate development costs of simulation models to be developed. To this end, sizes of models developed are measured by SMCDB using multiple measurement methods, and then used in the development cost estimation. A prototype of SMCDB has been just developed.

2 SIMULATION MODEL COST DB

Figure 1 shows some screenshots of our SMCDB prototype. Once a model, e.g., one shown in the left of Figure 1, has been developed through part of an acquisition program, the model and its development costs, in terms of multiple factors, e.g., development expense, development time, human resources, and so on, are inputted through the user interface (UI) of SMCDB, shown in the middle of Figure 1. Simultaneously, a *model preprocessor* of SMCDB computes its sizes using multiple 'model size measurement methods,' e.g., a functional size measurement method (ISO/IEC 2011), Lee and Kim's method (2015), and so on, and then stores the sizes, together with the model and costs, into SMCDB. Factors of the costs can be freely added or modified through UI, e.g., we may separate direct cost and indirect cost. Also, model size measurement methods can be also added or modified by creating or rewriting plug-ins for SMCDB. We can review size-to-cost (or cost-to-size) graphs, as well as tables, for models stored in SMCDB through

UI shown in the right of Figure 1. Through the graphs and tables, we would, if we have stored large enough models in SMCDB, be able to find some 'relations' between costs and sizes.

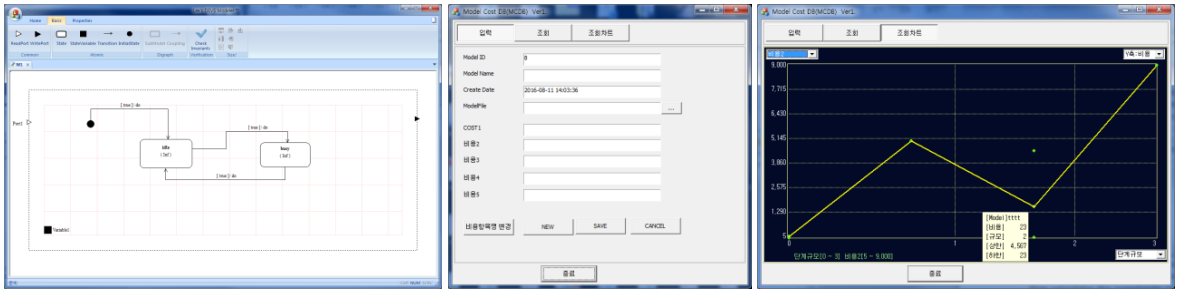

Figure 1: Screenshots of our SMCDB prototype.

3 MODEL COST ESTIMATION

Once we have stored large enough models in SMCDB, we could use the 'statistics' to estimate development costs of a model to be developed. This could be done based on estimated sizes of the model inputted by the user. By using the cost-size relations come out through SMCDB, a *model query processor* of SMCDB could estimate the costs of the model, in terms of multiple factors. To estimate the cost, various analysis methods, such as regression analysis, cluster analysis, and so on, can be used. The processor may be further developed to accept 'conceptual descriptions' of the model as input; it may then search SMCDB for 'similar,' in terms of behavior or structure, models, and use them to estimate the costs and sizes of the model.

Another benefit of SMCDB is that it could be used to figure out which of the model size measurement sizes would be more 'practical.' That is, SMCDB could be used to evaluate the effectiveness of the model size measurement methods. Note that the effectiveness, however, would vary with acquisition phases and programs.

4 CONCLUSIONS AND FUTURE WORK

This paper presented SMCDB where models developed, their development costs, and sizes are stored in. A model query processor of SMCDB could estimate development costs of models to be developed, based on these data. A SMCDB prototype has been just developed. A new version of the model query processor that uses conceptual descriptions of models to be developed to estimate their development costs will be investigated. Also, we will perform factor analyses on various data stored in SMCDB to infer which factors are likely to influence development costs the most.

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