THE USE OF SIMULATION IN THE DESIGN OF INFORMATION SYSTEMS

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Summary

This paper describes the application of simulation to the design and analysis of information systems. The philosophy of such models is described in detail. Then the actual application of the technique is discussed.

Philosophy

The basic success factor behind simulation modeling is complete understanding of the complex environments which are modeled. The analysis of a railroad model causes the analyst to familiarize himself with railroads. The study of an air defense strategy forces the student to acquaint himself with military technology. However, the modeler of information systems is faced with twice the tasks of other analysts since he must be an information systems specialist as well as a specialist as well as a specialist in the particular environment in which the information system must serve.

This infers that there should be a detailed interaction between the simulation expert and the information analyst. In fact, the project described in this paper heavily relied on simulation analysis as an integral design tool.

Environment

This project was to design an information system which satisfied the following constraints:

1. The system must be a generalized information software package which would permit the use of simplified application programmer interfaces.
2. The system must operate in an "MVT" type of environment. That is, core should be dynamically available to all applications which contend for service on a priority basis.
3. The system must operate independently from any existing operating system although it must be designed so as not to cause any changes with respect to the application programmer's view of his operating environment.
4. The system must permit backgroung batch processing so that both teleprocessing and non-teleprocessing applications must proceed concurrently.
5. The system must allow for many different applications to run on one large computer concurrently. (This particular system was designed for multiprogramming, not multiprocessing.
6. The system must facilitate hierarchial file structures and must permit multi-level indexing.

The full impact of the above constraints on the simulation model will now be discussed.

Model Assumptions

First of all, since this system is a generalized information interface, there is no one particular set of application programs which are to be run under the model. Therefore, it is necessary to design the simulation model such that it can and will be tested under a large variety of input. This implies the "exogenous event" concept of SIMSCRIPT. Since GPSS/360 was chosen, this meant that the program must rely on the JOBTAPE feature for detailed loading of the system. The major reason for the choice of GPSS was the fact that the model was needed in a short period of time and that GPSS easily affords the fastest turnaround from a development standpoint.

Secondly, since the simulation model was to be a design tool, it became necessary to consider the multitude of modeling changes that would be necessary. A modularly constructed model using a FORTRAN or PL/I list processor or SIMSCRIPT does not permit changes but again GPSS seems to be the most easily modifiable environment.

Thirdly, the scope of the model must accurately represent the system design. That is, the model must be of sufficient detail to represent such crucial aspects as data transmission and storage arrangements. However, it was not necessary to model the system on an instructional basis as is common in "micro" modeling.

Fourthly, since there is no one measurement of system performance, many output features are desireable. Again the excellent output features of GPSS facilitated this aspect.

Since the model was written in GPSS, it is hoped that the reader will be familar with basic GPSS terminology. Also since the model and the information system are considered proprietary products of Advanced Information Development, Inc., only general concepts and achievements will be discussed in the paper.

The Model

In general, core was treated as a storage and different dynamic transactions required different ammounts of core. The basic strategy was that of a priority level within which there was a first come first serve strategy. However, the intial system implementation also treated

demmands on a facility by using a "circular" priority scheme. That is, certain termporarily resident transactions were checked until a successful match was found. This checking would continue after the match. The system also incorporated a priority update technique which would automatically increase the transaction priority once a certain limit had been reached by some attribute of the transaction. In this particular case, both time in the system and number of similar transactions (or similar teleprocessing inputs) were tested.

One particularly interesting use of this simulation model was the study of various random access methods such as ISAM (IBM's indexed sequential access method.) The various access methods were modeled and then tests were run under ideal conditions and under extreme conditions such as CPU failure or garbled data transmission. The outcome of this particular effort was the implementation of a new access method which not only proved to be safer than those currently available but also proved to be much more efficient.

One of the hoped for uses of this model is as a marketing device for the information package. That is, given a characteristic input, the model can accurately demonstrate the performance of the system. Once the prospective system user is convinced of the system effectiveness, the model can then be used by him as a guide to configuration selection.

It is hoped that this model will eventually evolve into a generalized information systems model which can be used to evalauate a variety of systems. However, the actual use of the model by designers of the information system discussed more than paid for its creation. Needless to say, the model was validated at an early stage of development and is constantly being adjusted to represent new changes in the system.

In summary, a simulation model of an information system can be a useful tool during the design and implementation of any package of programs. However, the usefulness of the model extends further than that of a design tool since it can also be used as a marketing device as well as a decision assister.