A SIMULATOR FOR EVALUATION OF INFORMATION SYSTEMS

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ABSTRACT

A simulation package has been developed to enable a user to evaluate the effectiveness of different types of file structures in the development of Information Systems. The simulator provides a tool to estimate response time for specific types of data structures and files and evaluate the effect of different maintenance procedures. The model provides a tool for the analyst to evaluate the feasibility of different approaches for data collection and analysis. It enables the analyst to develop information systems which are compatible with operations research models.

I. INTRODUCTION

There is a need to be able to accurately predict the type of response or performance that can be expected from a Management Information System prior to its implementation. The poor performance of many Management Information Systems has proven that the computer can be overwhelmed with data. Management Information Systems normally maintain many different relationships; these relationships are maintained between files of information as well as within files. The input/output requirements are frequently the bottleneck in the operation. It is frequently difficult to assess the effect of each operating environment on the performance of the system. This difficulty has been emphasized for at least one data management package by the author (4) of the package, "program run times are impossible to predict due to the heavily data dependent nature of the technique employed". The authors of this study have studied similar systems in the past. These types of systems are frequently used by large manufacturers and are commonly referred to as bill of material processors (5).

The approach taken in this study has been to develop a simple model that approximately imitates the desired system. This pilot model is then used to collect critical data; this data can be converted into meaningful statistics for different computer configurations. Vital parameters of the model can be changed and the results monitored. The data that is processed by the system can be controlled to reflect the effect of different operating environments.

A pilot model has been written in Fortran; it provides the user the capability to collect critical data such as the number of logical and physical input/output functions completed. The model is segmented so that it can be treated as a process (3,4). The idea is that the total model is a complete process or potentially several different processes. This enables the user to tailor his own pilot model (4).

The pilot model developed for this experiment supports three different types of file processing; sequential, indexed, and directly addressable (3). It utilizes a variety of different techniques to maintain different relationships between and within the files; the techniques most often used are chaining and indirect addressing (3).

II. STUDY ENVIRONMENT AND CONDITIONS

The type of data management system selected for a limited analysis was a system commonly referred to as the bill of material processor (5). The primary function of this data management package is to store hierarchical structures which represent an entity and each subassembly or piece part required to construct the entity. The relationship of the elements in the structure may be expressed in terms of a "master" and "subordinate" relationship. These relationships must be retained while they are stored; in other words, one must be able to reconstruct the relationships without manual intervention.

The analysis conducted in this experiment examined the effects of varying two conditions; first, the effect of different loading sequences and secondly, the effect of different blocking factors.

The term blocking factor is used to refer to the number of logical records or pieces of contiguous data retrieved in one read. After the conditions for the study had been established then the functions to be performed during the study were selected. The functions that were selected represent the type of activity that occurs frequently in a manufacturing organization; the creation of the data base, the retrieval of all the immediate subordinates for a specified element, and the retrieval of all immediate masters for a specified element. The creation of the file and the retrievals were simulated as a single process. The timer on the computer was used to isolate specific activities. The total time to create the file was broken down into two separate functions--the activity essential to maintain group (chained) relationships and the activity required to enforce the hierarchical relationship.

III. CONCLUSIONS

The data was collected with the intent to perform an analysis of variance to establish if there were significant differences in performance based on the order of the data at creation and the different blocking factors. It was apparent that these factors do have a significant influence on the amount of I/O that must be performed. Additional data should be collected and the proper analysis performed.

The authors found that the order of the data at the time the file is created heavily influences the reads and writes to maintain hierarchical relationships. The effect of increasing the blocking past some limit appears to have a diminishing return. The results should be formally analyzed, however, perhaps even more important is the apprach used to collect the data for evaluation. The concept of simulating the system under a fixed environment and collecting data for evaluation appears to be a plausible approach for designers and users of data management systems.

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