USES OF SIMULATION IN THE DESIGN
OF LARGE SCALE INFORMATION SYSTEMS

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ABSTRACT

The Business Information System we will describe is a combination of four different concepts:

  1. Information Retrieval - fixed inquiry response.
  2. Data Processing - mechanization of clerical activity.
  3. Management Information Processing - response to semi-structured inquiry with minor scientific processing.
  4. Scientific Processing - one-shot or low repetition mathematically oriented processing.

As shown in Figure 1, current plans call for each of the systems to be implemented by 9 computer complexes, each of which is composed of one or more central processors. A message switching communications processor is used to tie these computers into a unified system.

Our uses of simulation are concerned with the evaluation of preliminary and detail designs of the aforementioned system. The simulations fall into five major classes:

  1. Internal processes
  2. Communications networks
  3. Manual and man/machine studies
  4. Computer complex simulations
  5. Total system simulations

The material presented discusses not only the approaches adopted, but also compares and evaluates alternative approaches which are available. The objective is to provide a set of guidelines which may be helpful to others.

Internal Process Simulations

Internal process studies are currently performed in two ways, one of which is discrete simulation. Discrete simulation is used in those areas where a high degree of accuracy is required or where little is known about the details of the process. The two major areas of study are operating or control software/hardware and data base management software/hardware, which includes file accessing, record protection and retrieval data extraction.

The control system simulations are being carried on at a fairly detailed level utilizing both GPSS and SIMSCRIPT. To date these simulations have been confined to studies of physical I/O control programs, job queuing procedures, and interrupt handling.

The second way in which internal process studies are being conducted is through the use of a version of a continuous simulation technique called SCERT - Systems and Computers Evaluation and Review Technique. Studies have concentrated on the operational feasibility of the system design and the hardware required to support the system. The use of SCERT as a second criteria - time being the first - to measure the effectiveness with which the design effort is proceeding is outlined.

Communications Network Simulations

Work in this area has consisted of the development of a large - about 1000 blocks - GPSS/360 model which is being used to simulate a communications network from the point of man/machine interface to a main processor. The model is also used to determine the systems performance of network components whose characteristics have been determined by using analytical methods, e.g., queuing theory. The model's use in the area of reliability (availability) studies is discussed.

Manual and Man/Machine Studies

Generalized demand-server models have been constructed using the GPSS/360 and SIMSCRIPT 1.5 programming languages. The primary use of these models has been to determine quantitatively the work force impact resulting from computerizing processes which heretofore were performed manually. The use of these models in performing cost effectiveness studies will be discussed in detail. Experiments are also being made to ascertain if these models, in conjunction with data maintained in the centralized data base and forecasting algorithms, can be used to estimate staffing requirements in telephone company business offices. The results of these experiments are reported.

Computer Complex Simulations

These simulations are concerned with hardware selection and system reliability. Most work in this area has utilized a version of SCERT, SCERT V, which utilizes discrete simulation of equipment units, processes, and transactions.

Total System Simulations

This work is currently aimed at determining the effects of job transfer between essentially dedicated computer complexes. The GPSS models of this operation are currently very macro, and are mainly used for problem definition. Analytical techniques are then applied to these areas.

Other topics covered in the paper include the following:

1. Sensitivity analysis experiments conducted with the models as an aid to data identification for data gathering efforts.

2. Behavioral aspects involved in applying management science techniques. The consultant-clinet relationship is explored and actual problems encountered are discussed.
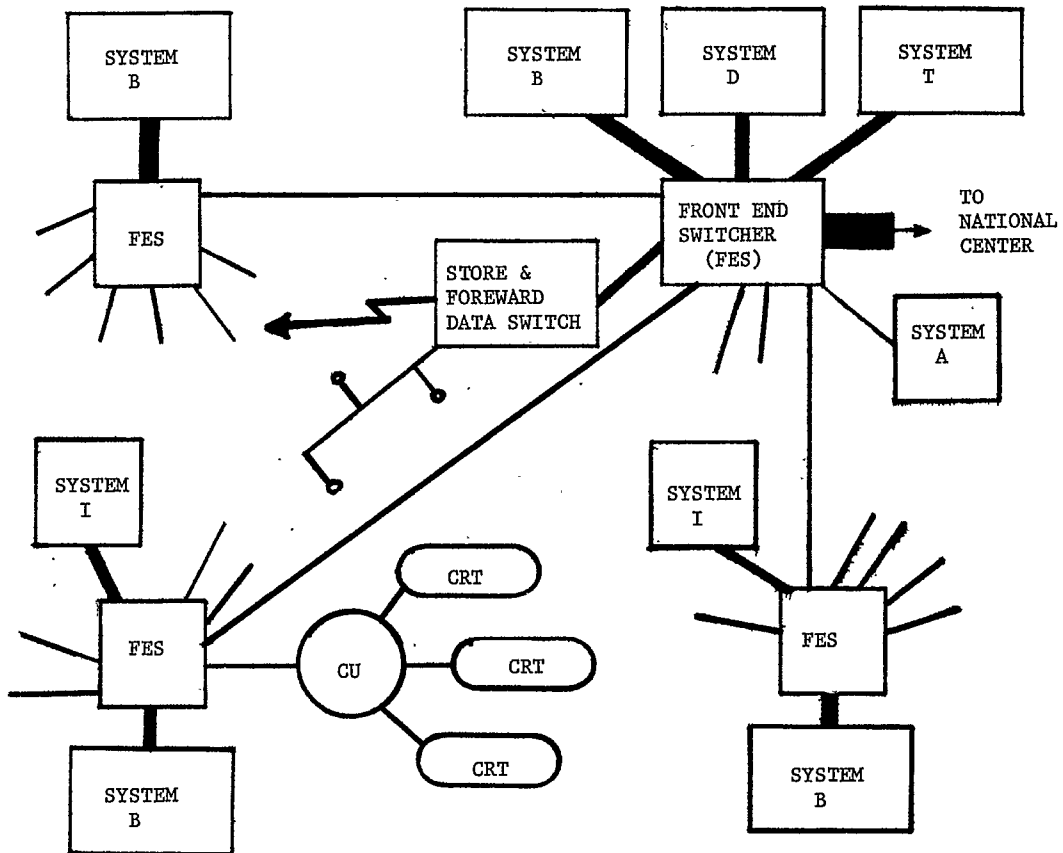
BUSINESS INFORMATION SYSTEM

FIGURE 1