USING 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 evalu-
ates 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 operat-
ing 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 simula-
tions 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 Evalua-
tion and Review Technique. Studies have concen-
trated 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 the point of output.
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 effec-
tiveness 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 re-
quirements 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 deter-
mining 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:

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-client relationship is explored and actual problems encountered are discussed.

BUSINESS INFORMATION SYSTEM

FIGURE 1