SIMULATION OF MASS STORAGE SYSTEMS OPERATING IN A LARGE
DATA PROCESSING FACILITY

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We are studying the kind of data processing facility that we will need in
the near future to meet the expected workload and to obtain the desired
operational benefits, including cost benefits. The most recent studies in this
area have centered on facilities built around mass storage systems. A mass
storage system, as we use the term, is capable of providing storage for up to
$1 \times 10^{12}$ bits of data and access to any part of this data within a few
seconds. This quantity of data is equivalent to about one year of the data
flow into our facility.

The configuration in which such a mass storage system might operate is
shown in Figure 1. The mass storage system is shown here providing storage
for data between the input processor and the intermediate processor, which
is a UNIVAC 1108 complex. The mass storage simulation program simulates
the behavior of such a mass storage system operating on-line with the
UNIVAC 1108.

The simulation program was written to aid system designers in the
design of a new data processing facility. The simulation accomplishes this by
providing a tool to measure the overall effect on the facility of on-line mass
storage systems and by providing a means for measuring and comparing the
performance of competing mass storage systems.

Table 1 shows how well the simulation performed. Four different cases
were simulated for a 1-hr period of production processing. Each case
required only $2\frac{1}{2}$ min to simulate. In the first case, magnetic tape was used
to input data to the UNIVAC 1108; this is the present mode of operation of
the UNIVAC 1108. The second and third cases were mass storage systems,
and the fourth case was an idealized situation which put an upper bound on
the amount of production that can be processed in the 1-hr period. A large
difference in throughput between mass storage system 1 and mass storage
system 2 is probably explained by the figures in the last column, which
show the amount of data available within milliseconds to the UNIVAC 1108. Mass storage systems have the characteristic of providing millisecond access to that subset of the total data which is mounted in the reading device. Mass storage system 2 had very little data available within milliseconds and had to spend too much time performing time-consuming "fetch" operations to retrieve additional data.

These results show that competing systems can be compared by the use of the simulation program and that the simulation program can be used as a design tool by system designers. Future plans for the simulation include (1) making it easier for designers to use, (2) simulation of other mass storage systems and comparisons of them to those discussed here, and (3) enlargement of the scope of the simulation to include a larger part of the operations of the facility, such as the on-line input of data from the input processor.

Figure 1—On-line mass storage system block diagram.

Table 1—Results of 1-hr simulation of Univac 1108 processing.

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>JOBS COMPLETED</th>
<th>DATA AVAILABLE IN MILLISECONDS (REELS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAPE (EXISTING)</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>MS #1</td>
<td>32</td>
<td>50</td>
</tr>
<tr>
<td>MS #2</td>
<td>2</td>
<td>0.1</td>
</tr>
<tr>
<td>IDEAL</td>
<td>38</td>
<td>∞</td>
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