

ACCESS AND ORGANIZATION OF SECONDARY MEMORY DEVICES

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by

INJA CHUN

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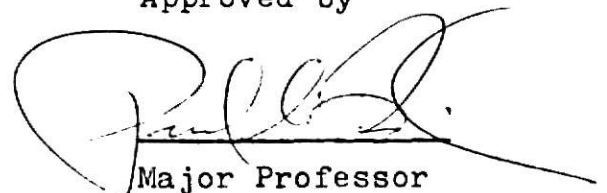
Department of Computer Science

KANSAS STATE UNIVERSITY

Manhattan, Kansas

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Approved by



Major Professor

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## Table of Contents

### Chapter

I.	Introduction -----	1
II.	Multiple Nature of Secondary Storage -----	1
	Magnetic tape -----	3
	Disk -----	9
	Drum -----	15
III.	Overview of Data Management -----	16
IV.	Comparison of Common File Organizations and Access Method -----	22
	Sequential file organization -----	23
	Indexed sequential file organization ---	25
	Direct or random file organization -----	32
	Partitioned file organization -----	35
V.	Files, Directory Hierarchies -----	37
	Limitations of file system -----	41
VI.	Segmented & Paged Virtual Memory vs. File System -----	45
	References -----	50

## I. INTRODUCTION

This report discusses data storage and access techniques of the general purpose file systems on secondary memory devices. In addition, the idea of segmentation is introduced as an example to show the limitations of file systems.

Various types of computer systems that use operating system techniques (software/hardware composites) are:

- (1) real-time control systems: reservation, telephone switching, process control;
- (2) data-base systems: management information, credit reporting;
- (3) general purpose programming systems: batch, multi-programming, time sharing;
- (4) other computer networks.

Throughout the sections of this report, the discussion of file systems are based upon general purpose programming systems.

## II. MULTIPLE NATURE OF SECONDARY STORAGE

A file is an organized collection of related information usually kept in peripheral storage devices such as magnetic tape, disk or drum. The portion of the file system storage which is immediately accessible to the file system, i.e. disk and drums, is called the on-line storage system. Devices which are removable from the storage complex, such as tapes and disk packs, which are used as an extension of on-line facilities, are called the file backup storage system.

Table 1. Parameters of Storage Devices with  
Typical Values in year 1965 (25, pp122)

<u>Device</u>	<u>Typical Values</u>
<b>Magnetic core Storage :</b>	
Capacity	0.065 - 8
Access Time	0.25 - 4 msec
Cycle Time	0.5 - 8 msec
Bandwidth (flow rate)	8 - 64
<b>Magnetic Drum :</b>	
Capacity	6 - 32
Access Time	8 msec
Bandwidth (flow rate)	1 - 8
<b>Magnetic Disk :</b>	
Capacity	20 - 2,000
Access Time to a Cylinder (seek)	80 msec (average)
Rotational Delay	10 msec (average)
Capacity of One Cylinder	0.2 - 1
Bandwidth (flow rate)	2.4
<b>Magnetic Tape :</b>	
Capacity (one reel)	100 - 500
Start-Stop Time	3 - 10 msec
Flow Rate	0.15 - 2.5

Note: All capacity in millions of bits; all flow rate in  
millions of bits per second

Among the different types of secondary memory devices, the choice of storage should depend on the cost of information per unit and access time per unit of information. Generally cost increases as access time decreases. Therefore in selecting a storage medium for each application, consideration should be given to the logical organization of data, frequency of use, desired access time and so on. For example, little-used information should be put on devices with longer access time to allow more frequently used files on faster devices; files which need to be accessed directly should be put on directly accessible devices (i.e. disk, drum, but not tape).

The subsequent discussions will be on physical and functional characteristics of the most common auxiliary storage devices: tape, disk and drum.

#### MAGNETIC TAPES

The most common magnetic tape consists of a reel of  $\frac{1}{2}$ -inch-wide,  $1\frac{1}{2}$  mils (0.0015 inch) thick, and 2400 feet long tape. Magnetic tape has a magnetic surface on which data can be stored by selective magnetization. There are two methods of recording the binary data on the tape. The older method, still in use, records the binary digits with a net magnetic field and binary zeros by the absence of magnetic field. An additional non-data parity bit is also recorded to make the number of 1-bits in a column either even (even parity) or odd (odd parity); this bit is used to check the validity of data by the hardware when the tape is read. The newer method is to