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# FILE INTEGRITY IN A DISC-BASED MULTI-ACCESS SYSTEM\*

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## INTRODUCTION

The operating system that is used on the Titan computer at Cambridge University includes procedures for the organization and maintenance of file storage. About 10,000 files, belonging to some 700 users, are held on a magnetic disc that has a total capacity of 128 million characters. For the past 4 1/2 years this system has been used on a scheduled 20-hour day to provide job-shop and multiple-access facilities to a total user population of about 1500 persons. The file management software is described here in some detail. An overview of the system will be found in reference [1], and further details will be found in references [2] and [3]. Under the heading of file management we include these procedures which are concerned with file identification, file privacy, space allocation and file integrity. In this context a file may be any ordered string of data and it is of no interest to the file management software to know what that data represents. In practice each file is held as a string of blocks (one block can accommodate 4096 characters). A quite distinct set of data handling routines provide the user with convenient means of processing the contents of a file. The file management software consists of complete programs that operate under supervisor control in the manner normally associated with other users of the system. One of these programs, the File Master, receives special recognition

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from the supervisor and it is around this program that the file management system revolves. The File Master contains five main functional parts.

1. Routines that service calls made by the supervisor itself.
2. Routines that service enquiries and demands that come direct from a user program.
3. Routines that provide special functions for the other programs in the set of file management software.
4. A routine that is entered at the start of day and after a system failure.
5. Routines that investigate or alter a user's entitlement to perform a requested activity.

The special status of the File Master stems from two facts.

1. The supervisor knows about and relies upon the File Master to provide it with certain services.
2. The File Master uses information on disc to decide what disc accesses the supervisor should allow and determines which area of the disc it should access.

The File Master program is set in operation before any other program is allowed to run and it does not terminate itself until the operating system closes itself down. The program is activated whenever its services are requested and each activation services just one request; a queue of outstanding requests is held by the supervisor. The File Master is the only program that has direct access to the disc and it has certain other special privileges that allow it to communicate with the supervisor in order to obtain a few specialized services.

There is a substantial number of distinct programs in the total set of file management software and they fall into the following five categories.

- A. Programs that use magnetic tape as additional file storage space and as an insurance against loss of filed data.
- B. Programs that provide the user with convenient facilities connected with file management, such as printing a list of file titles.
- C. Programs that provide the installation management with necessary statistics and allows him to exercise necessary control over the use of various file system resources and functions.
- D. Programs that facilitate inspection and maintenance of the file system data base both on disc and magnetic tape.