

File system implementation

11.1 File-System Structure

11.2 File-System implementation

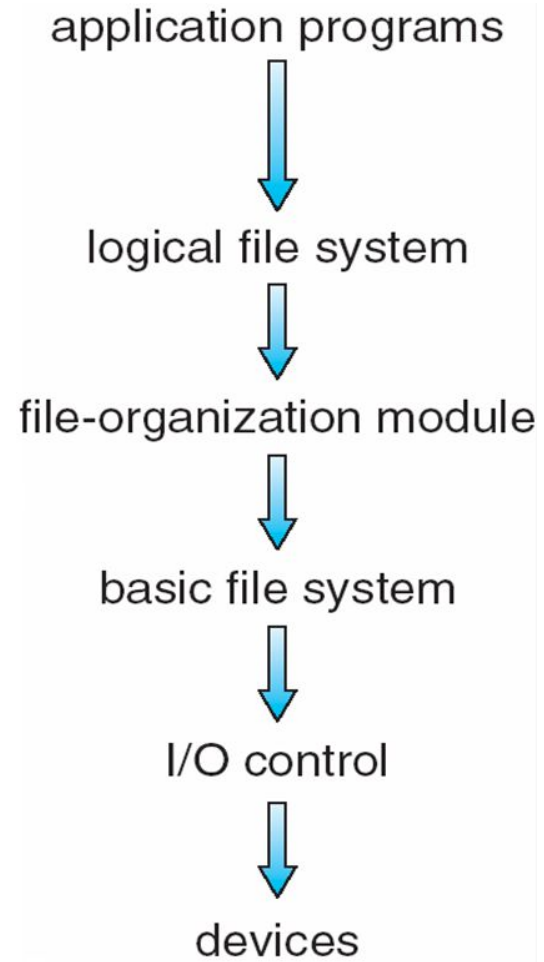
11.1 File-System Structure

- Disks provide the bulk of secondary storage on which a file system is maintained. They have two characteristics that make them a convenient medium for storing multiple files:
- **A disk can be rewritten in place**; it is possible to read a block from the disk, modify the block, and write it back into the same place.
- **A disk can access directly any given block of information** it contains. Thus, it is simple to access any file either sequentially or randomly, and switching from one file to another requires only moving the read-write heads and waiting for the disk to rotate.
- Rather than transferring a byte at a time, to improve I/O efficiency, I/O transfers between memory and disk are performed in units of **blocks**. **Each block has one or more sectors**.
- Depending on the disk drive, sectors vary from 32 bytes to 4,096 bytes; usually, they are 512 bytes.

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- The file system itself is generally composed of many different levels. The structure shown in Figure 11.1 is an example of a layered design.
- Each level in the design uses the features of lower levels to create new features for use by higher levels.
- The lowest level, the *I/O control*, consists of **device drivers** and interrupt handlers to transfer information between the main memory and the disk system.
- A device driver can be thought of as a translator. Its input consists of high-level commands such as "retrieve block 123." Its output consists of low level, hardware-specific instructions that are used by the hardware controller, which interfaces the I/O device to the rest of the system.
- The **basic file system** needs only to issue generic commands to the appropriate device driver to read and write physical blocks on the disk. Each physical block is identified by its numeric disk address (for example, drive 1, cylinder 73, track 2, sector 10).
- **The file-organization module** knows about files and their logical blocks, as well as physical blocks. By knowing the type of file allocation used and the location of the file, the file-organization module can translate logical block addresses to physical block addresses for the basic file system to transfer.

Layered File System



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- Finally, the logical file system manages metadata information. Metadata includes all of the file-system structure except the actual *data* (or contents of the files). The logical file system manages the directory structure to provide the file organization module with the information the latter needs, given a symbolic file name.
- It maintains file structure via file-control blocks. A **file-control block** (FCB) contains information about the file, including ownership, permissions, and location of the file contents.
- Application programs :makes use of all features mentioned above.