

Access times for DVD drives are similar to CD drives. However, when the DVD disks rotate at the same speed, the data transfer rates are much higher because of the higher density of pits.

DVD-RAM

A rewritable version of DVD devices, known as DVD-RAM, has also been developed. It provides a large storage capacity. Its only disadvantages are the higher price and the relatively slow writing speed. To ensure that the data have been recorded correctly on the disk, a process known as write verification is performed. This is done by the DVD-RAM drive, which reads the stored contents and checks them against the original data. A detailed discussion of optical disk technology can be found in Reference [11].

5.9.3 MAGNETIC TAPE SYSTEMS

Magnetic tapes are suited for off-line storage of large amounts of data. They are typically used for hard disk backup purposes and for archival storage. Magnetic-tape recording uses the same principle as used in magnetic-disk recording. The main difference is that the magnetic film is deposited on a very thin 0.5- or 0.25-inch wide plastic tape. Seven or 9 bits (corresponding to one character) are recorded in parallel across the width of the tape, perpendicular to the direction of motion. A separate read/write head is provided for each bit position on the tape, so that all bits of a character can be read or written in parallel. One of the character bits is used as a parity bit.

Data on the tape are organized in the form of records separated by gaps, as shown in Figure 5.33. Tape motion is stopped only when a record gap is underneath the read/write heads. The record gaps are long enough to allow the tape to attain its normal speed before the beginning of the next record is reached. If a coding scheme such as that in Figure 5.29c is used for recording data on the tape, record gaps are identified as areas where there is no change in magnetization. This allows record gaps to be detected independently of the recorded data. To help users organize large amounts of data, a group of related records is called a file. The beginning of a file is identified by a file mark, as shown in Figure 5.33. The file mark is a special single- or multiple-character

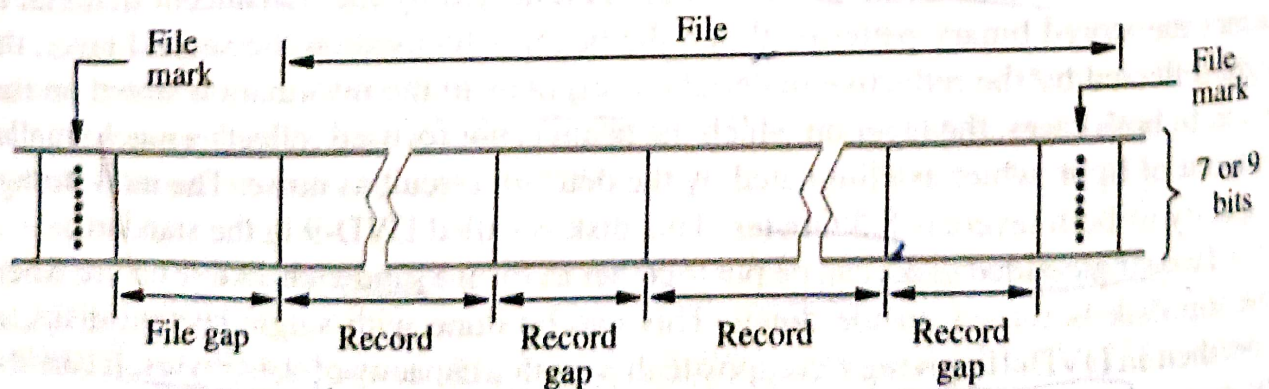


Figure 5.33 Organization of data on magnetic tape.

record, usually preceded by a gap longer than the interrecord gap. The first record following a file mark can be used as a header or identifier for this file. This allows the user to search a tape containing a large number of files for a particular file.

The controller of a magnetic tape drive enables the execution of a number of control commands in addition to read and write commands. Control commands include the following operations:

- Rewind tape ✓
- Rewind and unload tape ✓
- Erase tape ✓
- Write tape mark ✓
- Forward space one record ✓
- Backspace one record ✓
- Forward space one file ✓
- Backspace one file ✓

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The tape mark referred to in the operation "Write tape mark" is similar to a file mark except that it is used for identifying the beginning of the tape. The end of the tape is sometimes identified by the EOT (end of tape) character (see Appendix E).

Two methods of formatting and using tapes are available. In the first method, the records are variable in length. This allows efficient use of the tape, but it does not permit updating or overwriting of records in place. The second method is to use fixed-length records. In this case, it is possible to update records in place. Although this may seem to be a significant advantage, in practice it has turned out to be of little importance. The most common uses of tapes are backing up information on magnetic disks and archival storage of data. In these applications, a tape is written from the beginning to the end so that the size of the records is irrelevant.

Cartridge Tape System

Tape systems have been developed for backup of on-line disk storage. One such system uses an 8-mm video format tape housed in a cassette. These units are called cartridge tapes. They have capacities in the range of 2 to 5 gigabytes and handle data transfers at the rate of a few hundred kilobytes per second. Reading and writing is done by a helical scan system operating across the tape, similar to that used in video cassette tape drives. Bit densities of tens of millions of bits per square inch are achievable. Multiple-cartridge systems are available that automate the loading and unloading of cassettes so that tens of gigabytes of on-line storage can be backed up unattended.