

TECHNICAL INFORMATION

FILE SYSTEM FORMATS

The file format defines how a computer names and organizes files for storage and how it manages data exchange. There are three primary file system formats to choose from when creating a BD/DVD/CD.

Universal Disk Format (UDF): Developed by the Optical Storage Technologies Association, UDF is the predominant file system for BD/DVD/CD. It offers compatibility across most popular authoring applications, hardware platforms, and computer operating systems.

ISO 9660: Published by the International Organization of Standardization, this file system format was created for DVD-ROM and CD. ISO 9660 is a standard file system that can be read on most popular operating systems. While ISO 9660 supports operating systems that follow the Unix specification, it does not recognize certain features found on Mac file systems, such as long file names or icon options. Joliet, an extension to ISO 9660 created by Microsoft, allows for Unicode file character names and file names up to 64 characters.

Mac OS Extended (HFS+): The file system native to Macintosh is best used when media is only shared among Apple computers.

Another popular format is a hybrid disc, which includes two partitions: one for Mac and one for Windows.

OPTICAL DISC WRITING METHODS

	DAO	SAO	IR	MBR	RO	PW
CD	X	X				X
DVD	X		X	X	X	
BD-R				X		X
BD-RE		X				X

Disc at Once (DAO). The entire disc is recorded in one session and data cannot be added after the recording is finished. DAO on DVDs differs from DAO on CD-R since the lead-in and lead-out areas are written sequentially.

Session at Once (SAO). SAO provides more control than DAO and PW since data can be written in multiple sessions. Additionally, SAO gives optimized disc capacity by foregoing gaps between tracks.

Incremental Recording (IR). Data may be added in multiple sessions but the minimum recording size during a single session is 32KB. Capacities and write speeds are decreased due to the overhead of combined lead-in/out areas and data. A disc must be finalized before it can be played back on a drive other than the recording drive.

Multi-Border Recording (MBR). Using MBR, IR discs that have not been finalized can be read by more than

one player. MBR inserts a very short boundary zone around an IR recording session so a compatible player or DVD-ROM drive does not attempt to play beyond the border of the recorded area.

Restricted Overwriting (RO). New data segments can be randomly inserted anywhere within the boundary of a recorded disc. However, data can only be added to an area of the disc that has already been recorded over and from the point where the last session ended.

Packet Writing (PW). Drag-and-drop writing that is very useful for data backup. Buffer underruns are rare when using PW because data is written in “packets”, a few kilobytes at a time. PW is a CPU-hungry process since it constantly checks the available space on the disc.

Technical note on Buffer Underruns: The recording of a disc is a system-intensive application, and the rewritable drive needs a constant stream of data. A buffer underrun occurs when the stream of data to the rewritable drive is not fast enough to keep the rewritable drive’s buffer full, causing the an error in the recording process. If this problem occurs often, turn down the recording speed.

AVAILABLE CAPACITY ON AN OPTICAL DISC

Optical discs are manufactured in two physical sizes: 4.7” (12cm) and 3.1” (8cm); both are .47” (1.2cm) thick. DVD and BD are:

- Single-sided
- Single layer (SL) or dual layer (DL). DL discs usually hold twice as much data as SL discs.

While an optical disc is listed with a maximum capacity (i.e. 4.7GB, 25GB, 100GB, etc.), the amount of data that it can hold is dependent upon many factors including the amount of audio on a recording, the type of compression used on the file(s), etc. For example, a dual layer BD-R can store just over four hours of HD video using MPEG2 (AVCHD) or up to 20 hours of broadcast quality standard definition video.

When media companies reference the amount of data that a disc can hold, they represent the total amount in terms of gigabytes (GB), or a billion bytes (1000 x 1000 x 1000 bytes). This number, though, is not the way in which a computer addresses the data; to a computer the value is binary and larger than a billion bytes – 1,073,741,824 (1024 x 1024 x 1024 bytes).

COMPRESSION STANDARDS

Most BD and DVD are compressed using an MPEG codec (Moving Picture Expert Group), a compression standard recognized by the ISO. “MPEG video” in commercial discs actually consists of three finalized standards: MPEG1, MPEG2, and MPEG4. The latter was finalized in 1998 for Very Low Bitrate Audio-Visual Coding.

HD Video, with full-motion video and multi-channel sound (multi-lingual soundtracks, surround sound, etc.), requires a great deal of data. MPEG2 compression allows you to fit a full-length feature film in HD plus bonus material, on just one disc. MPEG4 (H.264) and VC-1 are two other HD video compression standards that can match the best possible MPEG2 quality at up to half the data rate.

Bit rates for HD compression:

- MPEG2 = 21Mbps/s
- MPEG4 (H.264) = 8Mbps/s
- VC-1 (WMV9) = 8Mbps/s