Optical discs and milestones

How do you differentiate between CD and DVD formats, such as DVD-ROM discs with different DVD-R or DVD + R discs? Does the DVD drive you just bought can read all kinds of discs? Which format should be best suited for your work?

How do you differentiate between CD and DVD formats, such as DVD-ROM discs with different DVD-R or DVD + R discs? Does the DVD drive you just bought can read all kinds of discs? Which format should be best suited for your work?

The following article gives you an overview of the ways in which optical disc format and structure of each format are developed.Although not yet covered all but the article refers to the most common formats and many 'secret' information about the familiar disk for a long time.

CD (COMPACT DISC)

Appeared more than 12 years ago (October 1982), today the CD is very popular and its future is still very bright, even though the DVD has appeared. The first format of CD is audio CD. In 1984, the standard CD-ROM was released, allowing the application and data to run on the computer. Since then, many extended formats have appeared such as CD-ROM XA, CD-I, Enhanced CD and Video CD. These formats are physically like audio CD discs but contain other format data such as text, images, video . They are manufactured for specialized use for a specific device such as computer, game machine.

CDs are cooperative products of Philips and Sony. Philips studies lasers and Sony studies digital music. But before that, there are 3 inventions that are considered the foundation for the CD:

• Pulse Code Modulation (PCM): digital audio encoding mechanism developed by CD by Alec Reeves in 1937 in London, England.

• Error Correction Code: Error correction mechanism invented by Irving Reed in 1960.

• Laser: invented by Arthur Schawlow and Charles Townes in 1958.

There are 3 main CD formats:

• Audio CD is the original CD format and all other CD formats are based on this format. Audio CDs can also be used for CD-Graphics or CD-Text and CD-Extra (add PC data in addition to audio data).

• CD-ROM based audio CD for storing PC data (applications and games).

• CD-ROM XA is the multimedia format of CD-ROM, basically CD-I, Video CD and Photo CD. CD-I Bridge

format allows CD-ROM and X-CD-ROM to play on CD-I.

Table 1

SOME TECHNICAL CHARACTERISTICS OF AUDIO CD

Parameter

Value

Note

Disc diameter

12cm

There are also 8cm forms

Thickness

1.2mm

Face

1 face

Only use 1 face

Pit length *

1 to 3 microns

Pit depth *

0.15 micron

Reading speed

1.2 to 1.4 m / s (CLV)

Wavelength

780nm

Red laser

Music time

74 minutes

Can expand to 80 minutes

Track number

Up to 99 tracks

Add 99 indexes to each track

Number of channels

2

Stereo

** See the section for creating a CD*

AUDIO CD (COMPACT DISC DIGITAL AUDIO - CD DA)

Digital CD for stereo recording, launched by Philips and Sony in 1982. (Plastic disc and cassette tape recording analog audio format). Audio CD has 3 extended formats: CD-Graphics, CD-Text and CD Extra. See table 1.

CD-GRAPHICS (CD-G)

This format adds 6 signal channels in audio CD format to accommodate more simple graphics and text files, which can be displayed while playing music.There is also an application of CD-G which is Karaoke (CD-G Karaoke) to play on portable CD players, users need a TV to display images and lyrics.See table 2.

Table 2

CD-G SPECIALIZED REGULATIONS

Regime

Horizontal (line)

Vertical (column)

Color

Line-graphics

288

24

2

TV-graphics (CD-G)

288

192

16

Extended-TV-graphics (CD-EG)

288

192

CD-TEXT

Also add 6 signal channels in audio CD format. Readers that support CD-Text can display up to 21 lines with 40 graphic symbols and numbers. The specifications of this format are applied to JPEG encoded images. CD-Text is an audio CD format that adds album information, music title, artist name .

ENHANCED CD (CD-EXTRA)

It also comes from audio CD, but CD-Extra has 2 disk areas (the disc has multiple regions originating from the CD-R format, allowing data to be written repeatedly).Each zone has 3 parts: lead-in, data area and lead-out.

Zone 1 (audio)

Lead-in

Audio data (98 tracks)

Lead-out

Zone 2 (data)

Lead-in

Data (CD-ROM format track)

Lead-out

Zone 1 can contain 98 tracks of audio data in a format like audio CD.Zone 2 contains data in the CD-ROM format XA and requires a file structure, certain folders use ISO 9660 file system (if readable on a Mac, HFS file system must be used), including : autorun.inf file;CDPLUS directory;folder PICTURES;and DATA optional folder.

HDCD (HIGH DEFINITION / HIGH DENSITY COMPATIBLE DIGITAL)

This is also an extension of the Pacific Microsonics audio CD developed. This standard restricts additional information to the track to get this information channel in addition to the audio channel. HDCD format for audio sampling at 20-bit (audio CD is 16-bit) should sound more vivid and natural. Audio CD players can play HDCD discs, but a dedicated HDCD reader will sound better.

CD-ROM (COMPACT DISC - READ ONLY MEMORY)

THE DISCIPLES OF DISC

There are many different ways to burn:
• CLV (Constant Linear Velocity): In this mode, the disc rotates at a fixed speed, depending on where the track is being recorded on the disc surface. When recording in this mode, the bit density on the track will be uniform, so the outer tracks will contain more data than the inner tracks and take full advantage of the disk space. In fact,

the rotation speed is not completely different from track to track and the data in the buffer will support this speed change.
• Z-CLV (Zoned-CLV): Face segmentation burns multiple areas, namely 24 regions for DVD-RAM discs and the speed will change when moving from one region to another.
• CAV (Constant Angular Velocity): the disc rotates at a fixed speed. Since the length of the inner track is shorter than the outer track, the data bit density recorded on the internal tracks will be thicker than the outside.
• Z-CAV (Zoned CAV): To make good use of disk space, this mode splits the disk into multiple regions and has a fixed speed for each region, the same tracks still have the most data density.
• Partial CAV (P-CAV or CAV / CLV) divides the disk into 2 regions, the inner area uses the mechanism of recording CLV and the outer region uses the mechanism of recording CAV.

Audio signals are the first to be 'digitized', followed by data.In 1984, Philips and Sony introduced the standard CD-ROM format.This standard is suitable for optical drives used on PCs.Physically, the CD-ROM is like the audio CD format, but the data contains two different formats.While audio CDs can only be read at a single speed, the CD-ROM can read at speeds up to 56X.The CD-ROM has a more complex error detection and correction mechanism than audio CDs (adding a separate identification and error correction layer), which is understandable because if the audio CD has an error, the sound will not sound seamless, As for CD-ROM, the data is wrong is difficult to accept.

Format CD-ROM other than audio CD in 2 important points:

• Data on CD-ROM is divided by sectors, including user data and other data for control and error correction.

• Data on CD-ROM is stored as file. Therefore all CD-ROMs need a file format so that the PC can access data easily and quickly.

When the first CD-ROMs appeared, the main applications were often encyclopedias and large text databases. Later, graphic images, audio and video are also saved to CD-ROM. CD-ROM is also used to store software and is a solution for storing large-sized digital files.

CD-ROM XA (EXTENDED ARCHITECTURE)

This is an improved format developed by Philips, Sony and Microsoft in 1988 to synchronize text, audio and video more accurately. The sectors in Mode 2 can contain both audio and data interleaved so it can be read simultaneously. CD-ROM XA uses the standard 256-color image format, ADPCM audio encoding standard (Adaptive Delta Pulse Code Modulation). Physical architecture Mode 2 of CD-ROM XA also has two additional formats: Mode 2 Form 1 and Mode 2 Form 2. XA Mode 2 Form 1 has the same mechanism to detect and fix errors like Mode 1 disks but yes Higher compatibility. XA Mode 2 Form 2 also removes a bug fix data layer to have more room for data. In fact, this format is not widely used and has not really attracted manufacturers to follow. There are 3 basic CD formats based on the physical architecture of CD-ROM XA: Photo CD, Video CD and CD Extra. Currently, only 2 popular formats are Video CD and CD Extra.

Needless to say, the most common CD-ROMs use Mode 1 and ISO 9660 / Joliet file system for Windows and other OS platforms. Windows can also read the XA Mode 2 file structure, but Mode 1 is still used for more purposes. The CD-ROMs for Macs using Mode 1 and HFS (Hierarchical File Structure) are less common. There is also the Hybrid CD-ROM format containing both ISO 9660 and HFS file systems for both platforms to read,

executable files (.exe) have 2 separate versions for 2 operating systems but multilateral files general use.

Table 3

COMPARISON BETWEEN VCD AND SVCD FORMAT

Parameter

Video CD v 2.0

SVCD

Length

74 minutes

35 to over 70 minutes

Transfer rate

150 KBps (1X speed)

300 KBps (2X speed)

Video

MPEG-1
1.15 Mbps (Constant Bit Rate)

MPEG-2
Average 2.6 Mbps (Variable Bit Rate)

Resolution

352 x 240 (NTSC)
352 x 280 (PAL / SECAM)

480 x 480 (NTSC)
480 x 576 (PAL / SECAM)

Audio

MPEG-1 stereo
(can use audio CD)

2 stereo MPEG-1 lines
(can use audio 5.1)

Image

MPEG-1

MPEG-2

Interactive

Menu, track list,
fast forward / backward

More interactive functions

Subtitle

Fixed, unchanged

Class interface
(Can choose 1 of 4 subtitle channels)

CD-I Bridge

CD-I Bridge is a standard developed by Philips and Sony to be read on CD-I readers and other readers as CD-ROM drive for PC. This format is also based on the standard of CD-ROM XA but the main applications are contained in the CDI directory. CD-I Bridge formats include:

• CD-Interactive (CD-I) multimedia format, currently almost no longer. CD-I uses Mode 2 Form 1 and 2. Each sector contains audio and video.

• Photo CD introduced by Kodak in 1990, containing images formatted according to a certain resolution, including sub-formats: Photo CD Master (2048x3072); Pro Photo CD master (4096x6144); Photo CD Porfolio

(512x768 or 1024x1536); Photo CD Catalog (512x768); and Print Photo CD (2048x3072).

• Video CD can hold up to 74 minutes of MPEG-1 video for VHS quality video and CD audio quality, developed by Matsushita, Philips, Sony and JVC. VCD has a resolution of 352x240 at 30fps (NTSC) or 352x280 at 25fps (Pal / Secam). You need to distinguish Video CD with Video CD (CDV). Video CD format combines audio CD and analog video.

• Super Video CD (SVCD) contains higher quality MPEG-2 videos developed by Philips for the Chinese market (initially). This format has many technical details similar to DVD-Video, but has a shorter movie saving time. To store a movie in this format, we need to have between 2 and 3 discs, giving the image quality nearly the same as DVD-Video. You need to have a reader that supports SVCD format to read SVCD disc.

Two Video CD and Super Video CD formats are currently used pretty much in Asia. Each format has its own directory and file structure. See table 3.

CD-Recordable (CD-R) and other CD formats

CD-R

CD-R is not uncommon but you may not know the format of WORM and CD-WO. In fact, all three formats are a one-time disk format and the same function. Distinguish between names of this format due to development. For example, the disk-making technique of WORM format is read only once and is produced in a separate technique - DMM (Direct Metal Mastering) or DRAW (Direct Read After Write) technique, so called WORM.

As for CD-R format, there are many different manufacturing techniques, the most popular is the dyeing method because of the lowest cost. This method uses two chemicals cyanine and phthalocyanine as dyes. This dye is sandwiched between gold and clear plastic (polycarbonate). When interacting with a laser, the heated dye is heated to create pits on the CD-R. It is these two dyes that determine the 'network number' of the CD-R disc. The life of phthalocyanine is the determining factor for CD-R life. Just a small change in the composition of this substance can cause disk errors. Secondly, the light sensitivity of two phthalocyanine dyes and cyanine may affect the stability of the disc, since these two substances are organic so it is susceptible to blue light and ultraviolet rays.

CD-R is a multi-session disk format that can write data multiple times, each session containing separate lead-in, data and lead-out areas (like CD-ROM Extra). There are 2 types of CD-R:

• Data CD-R to store data. This format disk can record audio encoded PCM.

• Audio CD-R is used for recording in a new standard against counterfeiting, cost more expensive than CD-R data disc.

CD-RW or CD-E (CD-Rewritable or CD-Erasable)

There is the same capacity as the CD-R but the CD-RW disc has a lower reflectivity than the CD-ROM and CD-R, and requires the CD-ROM drive to support MultiRead to read. CD-RW discs can be recorded 1,000 times. The difference between CD-RW and CD-R: CD-RW is that it uses the UDF (Universal Disc Format) format similar to the file system on a hard drive. We can use packet-writing records such as copying data on the hard drive. The CD-RW disk before use should be formatted. CD-RW uses phase change technology to interfere with

the reflection on the disc surface.

HC-R (High Capacity Recordable)

Philips upgraded the capacity for the CD-R disc with the new standard HC-R with the aim of expanding the capacity of the CD-R disc. HC-R discs have a capacity of up to 850MB, recorded once.

DDCD (Double Density CD)

This is the latest CD format released by Philips and Sony (2000).DDCD is a 12cm or 8cm disk, which is about 1331MB (double the size of the CD).DDCD has a read-only, write-once and multiple-version version.This format is mainly used to store data, not for audio.

AUDIO CD vs DISC CARBON

Audio CD (also called CD-DA, Compact Disc Digital Audio, appeared in 1982) can contain 74 minutes of hi-fi stereo music.Audio is digitized from analog sound, sampling at 44,056 times per second (16-bit).Calculated, every second of hi-fi quality stereo music, it takes up to 1.5 million bits of storage.These bits are stored under small grooves starting from the center of the spiral disk slowly out to the outer rings of the disc.The Audio CD gradually replaced the disc in the early 80s of the 20th century. The coal disc used a small needle, vibrating on the coal disc groove;CD audio discs use reflective laser on the disc surface.Audio CD discs as well as other types of CDs (CD-ROM, CD-R) read data from the inside out, while the coal disc reads from outside to inside.Because the data of the audio CD disc in binary form should be very clear;also with coal discs, analog sound is often affected by the tip of the needle that touches the disc groove or has a small bang.Moreover, the CD can adjust the volume level wider than the coal disc.However, today, in addition to the above defects of the coal disc, music listeners still see the sound of 'dry' and unrealized CD discs with charcoal discs.(There are also later disc formats for better sound quality, like SACD, DVD-audio, XRCD .).To avoid disk read errors, the simplest is to add the recognition bits and fix parity errors (1 = even, 0 = odd) after the data bits (8 data bits have 4 bits) fixes).More complex, people use other error correction algorithms such as data interleaving like word guessing games, hiding data (for bits that cannot be read by 0, this time no sound) To ignore the error, EFM coding technique (Eight to Fourteen Modulation - considered the most effective way to correct errors).You can refer to the audio CD at http://www.ee.washington.edu/conselec/CE/kuhn/cdaudio/95x6.htm.

DVD (DIGITAL VERSATILE DISC)

Picture 1 of Optical discs and milestones

Figure 1: Hybrid SACD

Like CDs, DVDs contain data on small grooves on the disk surface in a spiral from inside to outside and also apply pit and land to record reflection signals that define bit status (0 or 1).However, DVDs differ from CDs in that they record tracks with a smaller size (0.74 micron wide compared to 1.6 micrograms of CD) and require special lasers (red lasers, while CDs use infrared lasers) so the The normal CD-ROM reader is not readable.At the same time, DVD has other debugging and module methods, these technologies allow DVD to contain 7 times more data than CD.

At first, the DVD stands for Digital Video Disc but now corrects it to Digital Versatile Disc (from Versatile - versatile - to DVD format that is suitable for containing audio, video and data). This is a disk format with the same physical size with a CD but much higher capacity, from 4.7GB to 17.1GB, and is a very popular data storage, audio, video, and game today. Currently DVD is widely used with the following 4 types of applications:

• DVD-Video first appeared in the US in 1997 and achieved a lot of success in the film industry because of its superior image quality and sound quality.

• DVD-ROM gradually replaces CD-ROM in the computer field because of its high storage capacity.Developers of game consoles also use DVD-ROM to store games.

Picture 2 of Optical discs and milestones

Figure 2: Hybrid DVD

• DVD-Audio appeared in 2000 also became popular but the growth rate was slow. This format for surround sound, higher quality.

•Burnable DVD formats include: DVD-R, DVD + R, DVD-RW, DVD + RW, DVD-RAM are now very popular for storing data.And with DVD format, we have 2

'The world' is quite separate from fierce competition.It is a DVD Forum that supports DVD-ROM, DVD-R, DVD-RW, DVD-RAM and HD-DVD formats.The second organization is DVD + RW Alliance that supports formats: DVD + R, DVD + RW, DVD + R DL.

In addition to the above DVD formats, there are a number of other formats such as:

Picture 3 of Optical discs and milestones

Figure 3: DVD Plus

Hybrid SACD is developed by Philips and Sony, combining SACD layer (similar to DVD layer construction) and CD layer.Both layers are on one side of the disc.Hence the data is read depending on the laser.Infrared laser reads the CD layer and red laser beam reads SACD layer (Figure 1).

Hybrid DVD was created by DVD Forum with the aim of combining audio DVD and audio CD, similar to

Hybrid SACD (Figure 2).

DVD Plus is a disc with 2 sides, one side CD format, the other side DVD format (almost similar to Hybrid DVD). The first version of the DVD Plus is 1.8mm thick but is now reduced to 1.5mm. The DVD Forum is no longer developing this format (Figure 3).

Single-layer DVD disc and 2-layer disc

Picture 4 of Optical discs and milestones

Like CD, DVD has 3 areas: lead-in, data storage area, lead-out and go inside and out.But with 2-layer disk, the partition structure is different.

Parallel structure: layer 0 and layer 1 all have the same lead-in area, the middle data area and the outer lead-out area.

Lead-out

ß Data ß
(layer 1)

Middle area

Lead-in

ah Data
(layer 0)

Middle area

Inverted structure: layer 0 starts at the bottom of the disk and layer 1 starts at the layer 0. The structure has only one lead-in area (above layer 0) and lead-out (above layer 1).) and there are 2 middle areas.DVD-Video uses this structure to avoid moving from one layer to another as a stand-alone movie (often used in DVD-9 and DVD + R DL formats).

Identifier zone (Burst