DVD Does Not Stand For Digital Video Disc (Records Management)

DVD Does Not Stand For Digital Video Disc

(And Other Terms Useful for Discussing DVD Applications)

The DVD

The CD (Compact Disc) is over fifteen years old, an eternity for things digital. The DVD is designed to replace CDs. By DVD committee decree (by vote of the committee that controls the trademark 'DVD', the DVD Forum. [http://www.DVDForum.org]), DVD stands for Digital Versatile Disc.

Improvements to the CD have been technically possible for a long time. The impetus for making the change now is movies, replacing videotape. A DVD can be stamped out for less than a dollar. It replaces videotapes that cost more than twice as much per copy. CDs were for music; DVDs are for video.

DVDs in Document Management

While DVDs were not created for document management, they are useful for storing digital documents. DVDs can store from eight to thirty-two times as many documents as a CD, depending on the DVD configuration. DVD readers cost about twice as much as CD readers today. DVD writers cost about twenty-five times as much as CD writers today. DVD and CD costs should be about the same for disc media, readers, and writers in about two to three years.

Configurations

A CD has a capacity of 650 MegaBytes. Using the industry standard of 50 KiloBytes per scanned page, a CD can store about ten thousand scanned pages along with indexing overhead and possibly a software document viewer. (Ten thousand pages is about the number of pages stored in a standard four drawer file cabinet, or in four standard records storage cartons, or on eight linear feet of open shelving, or on four one hundred foot rolls of sixteen millimeter microfilm.)

DVDs come in two sizes, the mini-CD size of 80 millimeters (mm) (about 3 1/8 inches) in diameter, and the standard CD size of 120 mm (just over 4 3/4 inches) in diameter. The full size DVDs look just like standard CDs.

DVDs have two useable sides. Each side can have two layers for a total of four layers per disc.

Turning Over Two-Sided DVDs

Currently, there are no DVD drives that have two heads, so DVDs that have information recorded on two sides must be turned over. This process is as difficult as inserting a different DVD, so the main reason to have two sided DVDs is to reduce the number of DVDs that have to be physically managed, not to increase the amount of information 'under-head' in the DVD disc reader. Two headed DVD drives are technically possible, and may eliminate the need to turn DVDs over (disc flipping).

DVD Types

DVDs come in ROM (Read Only Memory), WORM (Write Once Read Many), RW (Read Write), and RAM (Random Access Memory) versions. ROM is the format in which music and software CDs are sold. WORM is the format in which document management systems write documents to CDs. RW and RAM formats are rewriteable (like magneto optical or phase change discs).

DVD ROM (Read Only Memory)

DVD ROMs can have one, two, three, or four readable layers. Each layer of each side of a two layer disc can store 4.27 GigaBytes of documents, or about eighty thousand scanned pages and associated indexes, eight times the ten thousand scanned pages a CD can store. A four layer DVD ROM can store 17 GigaBytes of documents, or about three hundred and twenty thousand pages per four layer DVD ROM. For estimating purposes, this can be rounded to a working figure of about one quarter million pages per DVD ROM. DVD ROMs can only be used in document management if you plan to publish one thousand or more copies of your scanned documents; the way music or software is published.

DVD WORM (Write Once Read Many)

DVD WORMs can store 4.7 GigaBytes per layer. DVD WORMs can have two sides, but only one layer per side. DVD WORMs with two sides can store 9.4 GigaBytes per double-sided DVD WORM disc. For estimating purposes, the capacity of a double-sided DVD can be rounded to a working figure of about one hundred sixty thousand pages (eighty thousand pages per side) or about the same capacity as 16 CDs.

Double Sided DVD WORMs

Double sided DVD WORM media is currently rare in the US. Before planning to use double sided WORM media, it is important to check on the reliability of the supply of the media.

DVD RW (Read Write) and DVD RAM (Random Access Memory)

DVD RWs and RAMs can store 4.7 GigaBytes per layer, or about eighty thousand pages per layer. DVD RWs and RAMs can have two sides, but only one layer per side. DVD RWs and RAMs with two sides can store 9.4 GigaBytes, or about one hundred sixty thousand pages per double sided DVD RW or RAM disc.

Compatibility

DVD readers can read CD ROMs. This means that DVD readers are backward compatible for music and software CDs. DVD readers can read some, but not all, CD WORMs. To avoid incompatibilities in the document management environment, it is best to plan to convert all CD WORMs to DVD WORMs before the last CD reader is decommissioned at a given document management site.

When to Convert from CD to DVD?

It is recommended that the planned migration of data from CD to DVD occur when DVDs are less expensive than CDs.

Colors

CD lasers are red. DVD lasers are orange. This difference in color is why DVD readers cannot read some CD WORM discs. There is also a blue light special under development, a DVD reader with a blue laser that can read DVD ROMs containing a projected 64 GigaBytes or about one million scanned pages. It is projected that double sided DVD WORMS using blue lasers will hold 32 GigaBytes or about one half million scanned pages.

Spatial Diversity

Storing digital document management system backups at more than one site (spatial diversity) reduces the need for impenetrable storage vaults. What is destroyed at one site can easily be recovered from any one of multiple other sites. DVDs are so inexpensive that many entire databases can be duplicated several times at an insignificant cost (7 sites recommended). DVDs are also very inexpensive to store because they take up so little room.

Support

DVD readers are fully supported in Microsoft Windows 98 and in Microsoft Windows 2000.

DVD's Effect on PCs

DVDs will force all PCs and networks to support theater quality video and audio. Video and audio documents will be fully supported in digital form. These digital video and audio documents will be the documents of record that enter the document management system.

PCs with DVDs will become TVs with VCR functions. TVs with VCR functions will become PCs with DVDs. This will greatly expand the reach of computing, document management, and Microsoft.

The TV set-top boxes that promise the ability to zap commercials in live broadcasts are based on magnetic disk drives and the video technology that DVDs have brought to PCs.

When Are CDs Good Enough?

For many applications CDs are already so inexpensive that the increased efficiency of DVDs

provide little or no advantage. In these cases, the switch to DVD will come when the world switches to DVDs.

This enforced switch is similar to the transition to 3 1/2 inch floppies. Few people could afford to stay with 8 inch or 5 1/4 inch floppy disks because it was too expensive to use something that no one else used.

Where the DVD is Essential

For some applications DVDs are essential. For example, in a legal case, where the discovered documents are scanned and placed on a single disc, disc swapping is necessary with CDs if more than about ten thousand pages are scanned. With a DVD, disc swapping does not become necessary unless more than about one hundred and sixty thousand pages are scanned. Disc flipping does not become necessary with DVDs unless more than about eighty thousand pages are scanned. Disc swapping and disc flipping are important considerations because the disc containing the documents is frequently placed in a notebook computer and used in court by a lawyer.

Many cases have more than ten thousand pages of discovered documents, but almost all cases have less than one hundred and sixty thousand pages of discovered documents. Therefore, the discovered document search application is feasible without disc swapping for almost all cases with DVDs, but is only feasible for some cases, or requires additional structuring of indexes, with CDs. The additional index structuring for CDs is necessary to group related documents on the same CD to reduce CD swapping. With DVDs, the additional index structuring is used to group related documents on the same side of a DVD when more than eighty thousand pages are scanned.

Will DVDs Take Over?

Yes. That is the plan, and in the near future, the technology will allow DVD discs and drives to be manufactured for about the same prices as CD discs and drives. With the two technologies at about the same price, and with DVDs handling many more types of material, the DVD will displace the CD. This has been the case with the multiple generations of floppy disks and the multiple generations of hard disks.

Can You Still Buy PCs with CD Drives?

It is already almost impossible to buy consumer PCs with a CD readers. Most of the PC vendors have switched their products to DVD drives. PC buyers know that the difference between the price of a CD drive and a DVD drive (which will read CDs) is now less than the cost of installing a DVD drive in the future.

DVD Drives in Business Systems

DVDs are not being purchased for many business systems. This will provide considerable opportunity for upgrades when all software comes on a DVD and includes a video based tutorial on how to use the software. Everyone is willing to sit through a well made video. Few people are willing to read a computer manual for software.

To Stay Up-to-Date

Current DVD developments are posted at [http://www.DVDdemystified.com/dvdfaq.html] by Jim Taylor, who wrote the book: DVD Demystified: The Guidebook for DVD-Video and DVD-ROM.

Appendix: Summary

DVD ROM (Read Only Memory)

Maximum of two layers per side.

Top layer: 4.27 GigaBytes
Bottom layer: 4.27 GigaBytes

Single sided (two layers): 8.5 GigaBytes
Double sided (two layers per side): 17 GigaBytes

DVD WORM (Write Once, Read Many)

Maximum of one layer per side.

Single sided (one layer): 4.7 GigaBytes
Double sided (one layer per side): 9.4 GigaBytes

DVD RW (Read Write, Rewriteable) and RAM (Random Access Memory)

Maximum of one layer per side.

Single sided (one layer): 4.7 GigaBytes
Double sided (one layer per side): 9.4 GigaBytes

Scanned Page Size (Industry Standard Estimates)

Bytes per 8 1/2 by 11 inch letter size page (compressed): 50 KiloBytes

Compressed pages per GigaByte: 20,000

DVD Formats and Capacities

Disc Type	Acronym	Media Type	Side A Top Layer	Side A Bottom Layer	Side B Top Layer	Side B Bottom Layer	Total Storage Capacity
120 mm (4 3/4 inch) DVD	DVD-R** (SS)	DVD Recordable	4.70 GigaBytes	Not Available	Not Available	Not Available	4.70 GigaBytes
	DVD-R** (DS)	DVD Recordable	4.70 GigaBytes	Not Available	4.70 GigaBytes	Not Available	9.40 GigaBytes
	ROM (DS/DL)	Read Only Memory	4.27 GigaBytes	4.27 GigaBytes	4.27 GigaBytes	4.27 GigaBytes	17.08 GigaBytes
	RW & RAM	ReWriteable Random Access Memory	4.70 GigaBytes	Not Available	4.70 GigaBytes	Not Available	9.40 GigaBytes
80 mm (3 1/8 inch) DVD	DVD-R** (DS)	DVD Recordable	1.46 GigaBytes	Not Available	1.46 GigaBytes	Not Available	2.92 GigaBytes
	ROM (DS/DL)	Read Only Memory	1.33 GigaBytes	1.33 GigaBytes	1.33 GigaBytes	1.33 GigaBytes	5.32 GigaBytes
	RW & RAM	ReWriteable Random Access Memory	1.46 GigaBytes	Not Available	1.46 GigaBytes	Not Available	2.92 GigaBytes
HD-DVD Future: ~2006 120 mm	DVD-R** (DS)	DVD Recordable	16+ GigaBytes	Not Available	16+ GigaBytes	Not Available	32+ GigaBytes
	ROM (DS/DL)	Read Only Memory	16+ GigaBytes	16+ GigaBytes	16+ GigaBytes	16+ GigaBytes	64+ GigaBytes
120 mm CD	All (SS/SL)	All (SS/SL only)	682* MegaBytes	Not Available	Not Available	Not Available	682* MegaBytes
80 mm CD	All (SS/SL)	All (SS/SL only)	194 MegaBytes	Not Available	Not Available	Not Available	194 MegaBytes

SS (Single Sided), DS (Double Sided), SL (Single Layer), DL (Double Layer), SS/SL (Single Sided / Single Layer), DS/DL (Double Sided / Double Layer), DS/SL (Double Sided / Single Layer per side), DS/ML (Double Sided / Mixed Layer; one side 1 layer, other side 2 layer), HD (High Density); Top Layer (Layer 1), Bottom Layer (Layer 0)

* CD capacities have always been advertised as 650 MegaBytes using the older computer based MegaByte (1,048,576 Bytes) size. Using the new commercial standard units of 1 Million Bytes per MegaByte, a CD holds 682 MegaBytes. DVD capacities, however, are always stated in the new, smaller, commercial units.

** DVD-R (Recordable) and CD-R are the equivalent of WORM (Write Once, Read Many) The DVD-R capacity listed above, of 4.7 GigaBytes per side, is for discs and DVD writers that conform to the new DVD-R standard (DVD-R 2.0). The new DVD-R discs and writers are available now. The older (DVD-R 1.0) capacity of DVD-R discs is 3.95 GigaBytes per side for a total of 7.9 GigaBytes for a two sided disc.

DVD Does Not Stand For Digital Video Disc (Records Management)

Disk Capacity Estimates

All disc capacities stated in pages include a conservative allowance for indexing and full text file overhead. All disc capacities stated in pages use conservatively rounded numbers to facilitate conservative estimation by administrative staff members.

Capacities Given in Commercial Units

All capacities are given in commercial units: e.g.: 1 GigaByte = 1 Billion Bytes; 1 MegaByte = 1 Million Bytes (The computer unit for MegaByte is 1,048,576 Bytes).

Estimating Your Storage Needs

When you calculate the amount of storage you will need on a given CD or DVD (using the table above), be sure that the units you are using for the size (amount) of data you plan to record are given in commercial rather than computer units. If you are not sure that the size (amount) of your data is given in commercial units, then add 10 (ten) percent to the size (amount) of data you plan to record. In all cases, you should leave yourself some headroom (of at least 5 percent) for last minute changes. (This can be reduced as you gain experience.) If, in addition to the normal headroom allowance, you are also uncertain of the (data size) units used, it is best to allow a total of 15 percent for headroom.

DVD 16X

CD drives read at up to 40X speed. Music CDs are listened to at 1X. Listening to music at 2X or at an X other than 1X does not make sense, except for Alvin and the Chipmunks.

CD and DVD Xs do not always mean that the entire CD or DVD will be read at X times the normal speed. This is because CDs and DVDs are meant to be read at a Constant Linear Velocity (CLV), which means that a CD or DVD rotates faster when reading the shorter inner tracks. Some high speed readers do not increase their rotational speed when reading the inner tracks. The rotational speed on these readers is a Constant Angular Velocity (CAV) (one rotation sweeps out an angle of 360 degrees).

For disc speed estimates, a good rule of thumb is to reduce the X speed by 25 percent. A 16X DVD drive would transfer an entire DVD movie at 12X fast forward speed and would therefore read about 4 GigaBytes in about 1 / 6 hour or 10 minutes at a data rate of about 25 GigaBytes per hour. Restoring a 250 GigaByte database with 10 of the 16X DVD readers would require about 1 hour. In a short time the DVD drives should approach the CD drive cost of 50 US dollars each, so that 10 of the DVD drives would cost about 500 US dollars. Restoring a 2.5 TeraByte database with 10 of the 16X DVD drives would require 10 hours. A 10 TeraByte database would require 4 times as many drives (40) to restore the database in the same time (10 hours). When restoring files, some time is required to create catalog entries. For large files this is less of a problem.

Two Layers per Side on DVD ROM (Read Only Memory) (Capacity Calculation)

For a DVD with a two layer side, to reduce inter-layer crosstalk, the minimum pit length of both layers is increased from .40 um to .44 um. This results in longer (and therefore fewer) pits for more effective reading of the data. (4.27 GigaBytes per layer rather than 4.7 GigaBytes per layer)

DVD Multimedia

Video DVDs provide: 6 channel (theater quality surround sound) (5.1, Dolby AC-3), 96 KHz audio sampling, 24 bit audio samples, 8 language tracks, 32 subtitle tracks, and about 135 minutes (long enough to accommodate 94% of all movies) of high quality video (720 horizontal pixels) on each of 4 DVD layers.

DVDs support runtime editing so that all ratings of a movie can be recorded on the same DVD; 'R' rated scenes can be skipped, without interruption, as the DVD is played. The file format is ISO 13346 UDF (Universal Disc Format), which harmonizes all CD recording standards including ISO 9660. A future technology, 3rd generation blue lasers [sort of a blue light special, as blue light has a wavelength about half that of red light], should yield a 64^{+} GigaByte DVD ROM for HDTV.

See also
[http://www.DVDdemystified.com/dvdfaq.html]

DVD Audio

DVDs can be used to record audio only, with no video. In addition, DVD audio includes various still images. DVD audio is different than the audio that is used as part of DVD video.

The DVD audio standard provides for up to 6 channels, a sampling rate of 48, 96, or 192 KHz, and a sample size of 16, 20, or 24 bits. With 24 bit samples taken at a 192 KHz rate, this provides a 96 KHz frequency response and a 144 dB dynamic range. DVD audio can also provide for a lossless audio compression of about 2 to 1 which would have a playing time of 120 to 140 minutes for two-channel 192 KHz / 24 bit recordings for a single layer. Each DVD disc can have up to 4 layers, 2 layers per side.

DVD audio includes various still image modes for synchronized lyrics, navigation, etc. DVD audio allows up to 16 still graphics per track (or slightly more, depending on the compression ratio) and a set of limited transitions.

The audio used in DVD video can also be used without the video. This produces a stereo, DVD quality, play time of over 55 hours at 192 Kilobits per second (compressed) for a single layer and over 200 hours for a 4 layer DVD disc. Lower quality sound can be recorded as computer files on a DVD for much longer play times. At a compressed audio rate of 16 Kilobits per second (in the low range of telephony quality), this is 9 million seconds, 150 thousand minutes, 2,500 hours, 100 days, 15 weeks, or 3 months of audio on a 4 layer DVD disc. (Each of the 24 T-1 telephony voice channels carries 64 Kilobits per second: 8 thousand 8 bit audio (sound or volume) samples per second.) See also AES (Audio Engineering Society) [http://www.AES.org]

Bit Fade and Copying

Like all storage and communications media, CD and DVD discs have the property that bits stored on them fade. Every day, some of the stored bits fade away. CDs and DVDs have an error correcting code (ECC) that can correct (replace) the lost bits. Eventually, there are too many lost bits to be corrected. This is the basis for the estimated lifetimes of CD and DVD media.

Rather than an estimate, MS59 provides a means of directly counting the number of bad bits (the raw error rate) on a given CD or DVD. [ANSI/AIIM (Association for Information and Image Management [AIIM.org]/American National Standards Institute [ANSI.org]) MS59-1996 media error monitoring and reporting standard, which complements the ANSI X3.131, media error hardware interface]. This gives a disc-by-disc reading on when to copy the data on the disc, and indicates exactly which discs will actually last (protect the data for) the disc's projected lifetime (up to 100 years).

Until commercial, end user implementations of MS59 are available for checking discs, many users are following a practice of copying CDs and DVDs every five years, regardless of the nominal warranty period.

Spelling

Optical disc is spelled with a 'c' as in music disc. Magnetic disk is spelled with a 'k' as in harrow disk.

Sidebar: Thousands of Seconds (KiloSeconds)

Why is it so hard to figure out how long it will take to process one thousand documents if each document takes fifty seconds to process? (The answer is fifty thousand seconds.) But, how many hours, minutes, and seconds is that? Blame the Babylonians! The Babylonians used 60 as a base rather than 10 (as we do) because 60 is divisible by so many numbers. Minutes that have 60 seconds and hours that have 60 minutes are easy to divide into halves, thirds, quarters, fifths, sixths, tenths, and twelfths, fifteenths, thirtieths, and sixtieths. But, those same sixty second minutes and sixty minute hours make it impossible to figure out how many hours, minutes, and seconds there are in fifty thousand seconds. The Babylonians did it to us long before computers gave us binary, octal, and hexadecimal arithmetic.

Note to Readers

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When using the information in this article, please check the website www.ArchiveBuilders.com for updates. The version number of this article is just before the page number below. The website also has articles that provide more details on some of the terms and concepts in this article.

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Note to Editors

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Steve Gilheany, BA in Computer Science, MBA, MLS Specialization in Information Science, CDIA (Certified Document Imaging System Architect), AIIM Maser, and AIIM Laureate, of Information Technologies, CRM (Certified Records Manager, ARMA) has twenty years experience in document imaging and is a Sr. Systems Engineer at Archive Builders.

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His experience in the application of document management and document imaging in industry includes: aerospace, banking, manufacturing, natural resources, petroleum refining, transportation, energy, federal, state, and local government, civil engineering, utilities, entertainment, commercial records centers, archives, non-profit development, education, and administrative, engineering, production, legal, and medical records management. At the same time, he has worked in product management for hypertext, for windows based user interface systems, for computer displays, for engineering drawing, letter size, microform, and color scanning, and for xerographic, photographic, newspaper, engineering drawing, and color printing.

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