

The DVD in Libraries

Introduction

The CD (Compact Disc) is over fifteen years old, an eternity for things digital. The DVD, popularly known as the Digital Video Disc, is designed to replace CDs. It is not possible to say what DVD stands for because by DVD committee decree, DVD does not stand for anything, not even Digital Versatile Disc.

Improvements to the CD have been technically possible for a long time and have been under development since before CD's became available. The impetus for making the change now is movies, replacing videotape. A DVD can be stamped out for less than one US dollar. It replaces videotapes that cost more than twice as much per copy. CDs were created for music; DVDs were created for video.

The DVD is already available in stores as a videodisc. For libraries and PC users the DVD is just like the CD, and it is more. The DVD comes in a ROM (Read Only Memory) version, a WORM (Write Once Read Many) version, and a RW (Re-Writable) version. Each of the versions stores a different volume of data: DVD ROM: up to 17 GigaBytes, about 25 times as much as a CD, DVD WORM: 7.9 GigaBytes, about 10 times as much as a CD, and DVD RW: about 5.2 GigaBytes.

The DVD establishes new, higher standards for digital recording of audio and video. The DVD also imposes these new, higher standards on the PC, merging the PC with TV and VCR's. The DVD makes high quality Internet TV broadcasts and videotelephony part of the next increase in Internet local loop bandwidth.

Microsoft released Windows 98 on June 25, 1998. Windows 98 fully supports the DVD, to the extent that DVD standards have been completed. This support will be available worldwide and will be identical everywhere.

The DVD provides an opportunity for members of the library community to observe the introduction of a new computing technology. The speed (and finality) of the introduction should be faster than for any product that preceded the DVD. Most of the issues surrounding the DVD are the same issues that surrounded the CD. While the CD took 15 years to get to its present level of acceptance, the DVD may complete the cycle in as little as one year.

2. Advantages, Promises

For computers, the DVD is a transparent replacement for the CD but with a much larger storage capacity.

More important than the physical media, the DVD audio and video file formats will establish the standards for TV, PCs, and audio recordings for at least the next 15 years. Even better, because so much material will be produced in the DVD file formats, there will be many conversion routines to convert the material to the formats that will be developed in the following decades.

DVD Audio and Video Format Advances:

- * 5 channel theater quality surround sound (vs 2 channel stereo sound for CDs)
- * 96 kilohertz sampling (vs 44 kilohertz sampling for CDs)
- * 24 bit audio (vs 16 bit audio for CDs)
- * 720 lines of horizontal video resolution (vs about 600 for laser discs)
- * 8 audio language tracks
- * 32 subtitle tracks
- * 135 minutes of video on each of two top layers and slightly less on each of two bottom layers
- * Run time editing that allows the transparent skipping of R rated segments. This allows the recording of all rated versions of a movie on the same disc.
- * The ability to play HDTV
- * The ability to record much more than 9 hours of high quality audio if video is not required.

Document Imaging

Document imaging, a subdivision of document management, is the discipline that is funding the development of tools and techniques for the scanning of black and white documents. Other than accommodating the spines of bound books, document imaging is very similar to the activities of digital libraries.

While DVDs were not created for document scanning, they are useful for storing digital documents. DVDs can store from six to twenty-five times as many documents as a CD, depending on the DVD configuration.

DVD readers cost twice as much as CD readers today. DVD writers and blank media cost twenty-five times as much as CD writers and blank media in the second quarter of 1998. Even at these prices, some commercial document imaging installations were using DVDs. The DVD writers and media costs should drop considerably in the third quarter of 1998 when the first supplier begins to get more competition. DVD and CD costs should be about the same for disc media, readers, and writers in about two to three years.

DVDs will provide an excellent medium for offsite backup. Storing digital library backups at more than one site (spatial diversity) reduces the need for impenetrable storage vaults. The DVD capacity, up to 10 times the capacity of a write-once CD, will allow the use of multiple backup sites, with all of the materials duplicated at each site for an insignificant cost. What is destroyed at one site can easily be recovered from any one of multiple other sites. DVDs are also very inexpensive to store because they take up so little room.

In addition to the support in Microsoft Windows 98 the DVD is supported in Microsoft Windows NT 5.0, planned for release in the fourth quarter of 1999 or shortly thereafter. While these releases may be delayed, it is very unlikely that DVD support will not be in the final versions.

DVDs will force all PCs and PC 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 added to the documents stored in libraries and will be added to the documents of record that enter document management systems.

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, digital libraries, and document management.

The DVD provides a common, high quality format for digital audio and video. The DVD also imposes these standards on PCs. At the same time, competition is putting in place very low cost, high bandwidth Internet connections. These converging trends suggest that audio and video files stored in digital libraries will very quickly become a large percentage of the materials accessed.

DVD's Future Development / Problems

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. This is a DVD reader with a blue laser that can read DVD ROMs containing 40 GigaBytes or about one half million scanned pages (or 2,500 books).

However, neither the DVD file formats nor the DVD media will be the standard for more than a few decades. When libraries plan for a longer period, the emphasis should be on converting the files to a new file format on a new type of media. Raster scanned files are most amenable to this conversion.

Like writeable archival CD's, writeable archival DVD's will probably be guaranteed to last for 100 years. They may or may not actually last that long.

The bits on any media actually fade away slowly. The perfection of digital files is maintained by an error correcting code (ECC) which can overcome the effect of the accumulating bad bits. The ECC makes it possible to reconstruct a perfect copy of the original digital file. Eventually, enough bad bits collect to overwhelm the ECC. When the bad bits overwhelm the error correcting code, the files are lost.

The raw error rate, the actual level of bad bits, can be read from archived discs to see how many bad bits have accumulated, and how close the bad bits are to overwhelming the error correcting code. Well before the error correcting code's ability is threatened, the DVD's can be recopied, preserving a perfect copy of the files. Eventually, a permanent media will appear. A possibility for permanent media is at Norsam.com. Papers on this subject can be found at ArchiveBuilders.com.

The DVD is not the final format or the final media.

To stay up to date, current developments are posted at <http://www.VideoDiscovery.com/vdyweb/dvd/dvdfaq.html> by Jim Taylor, who wrote the book: DVD Demystified: The Guidebook for DVD-Video and DVD-ROM

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DVD's Place in the Storage World

A CD has a capacity of 650 MegaBytes. Using the industry standard of 50 KiloBytes per scanned page with a 300 dpi resolution and a bit depth of 1, a CD can store about ten thousand scanned 8 1/2 by 11 inch pages (Equivalent to the A4 metric size.) along with indexing overhead and possibly a 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. Making similar assumptions, one CD could store the contents of approximately 50 books. Using the PhotoCD standard, a DVD WORM could store 1,000 color images of 24 bit pixels and a resolution of 3,072 x 2,048 pixels.

DVDs come in two sizes, the mini-CD size of 80 millimeters (mm) (about 3 1/2 inches) in diameter, and the standard CD size of 120 mm (just over 4 inches) in diameter. This section only describes the standard size DVDs. These 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. 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).

DVDs come in ROM (Read Only Memory), WORM (Write Once Read Many), and RW (Read Write) 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 is a format that is rewritable (like magneto optical or phase change discs). RW discs have not been commonly available in a standard format for CDs.

DVD ROMs can have one, two, three, or four readable layers. The top layer of each side of a disc can store 4.7 GigaBytes of documents, or about eighty thousand scanned pages and associated indexes, eight times the ten thousand scanned pages a CD can store. The top layer is translucent (see-through) so that the lower layer can be read. The translucency reduces the amount of data that can be read from the lower layer. The lower layer can store 3.8 GigaBytes of documents, or about sixty thousand scanned pages. A four layer DVD ROM can store 17 GigaBytes of documents, or about two hundred and eighty thousand pages per four layer DVD ROM. For estimating purposes, this can be rounded to a working figure of about one quarter million pages, or 1,250 books. 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, video, or software DVDs are published.

There are competing standards for the DVD WORM. The lowest capacity DVD WORM proposed can store 3.95 GigaBytes per layer. DVD WORMs can have two sides, but only one layer per side. DVD WORMs with two sides can store 7.9 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 thousand pages (fifty thousand pages per side), 5 hundred books, or about the same capacity as 10 CDs.

There are competing standards for the DVD RW. The lowest capacity DVD RW proposed can store 2.6 GigaBytes per layer, or about forty thousand pages (2 hundred books) per layer. DVD RWs can have two sides, but only one layer per side. DVD RWs with two sides can store 5.2 GigaBytes, or about eighty thousand pages (4 hundred books) per double sided DVD RW disc.

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.

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. No one can afford to stay with 8 inch or 5 1/4 inch floppy disks. Everyone must convert to the current floppy size because it is too expensive to use something that no one else uses.

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 thousand pages are scanned. Disc flipping does not become necessary with DVDs unless more than about fifty 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.

DVDs will take over and replace CDs. 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. For computers, the difference is already only about 1 hundred US dollars. With the two technologies at about the same price, and with DVDs handling many more types of material, the DVD will displace the CD. Similar progressions have taken place in the multiple generations of floppy disks and in the multiple generations of hard disks.

Appendix: Summary

DVD ROM (Read Only Memory)

Maximum of two layers per side.

Top layer: 4.7 GigaBytes

Bottom layer: 3.7 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): 3.8 GigaBytes

Double sided (one layer per side): 7.6 GigaBytes

DVD RW (Read Write, Rewritable)

Maximum of one layer per side.

Single sided (one layer): 2.6 GigaBytes

Double sided (one layer per side): 5.2 GigaBytes

Updated

Updated from the June 15, 1998 issue of DigiNews, Volume 2, Issue 3, the web-based, quarterly newsletter of RLG (Research Libraries Group).

Updates and More Detailed Descriptions

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.

Comments

Please let us know how you like this paper, or if you had any questions. What would you like to see in the future? For more, and the most recent version of this article, please visit our web site at www.ArchiveBuilders.com.

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Bio

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 seventeen years experience in document imaging and is a Sr. Systems Engineer at Archive Builders.

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Steve Gilheany is a Sr. Systems Engineer at Archive Builders. He has worked in digital document management and document imaging for eighteen years.

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.

In addition, he has nine years of experience in data center operations and database and computer communications systems design, programming, testing, and software configuration management. He has an MLS Specialization in Information Science and an MBA with a concentration in Computer and Information Systems from UCLA, a California Adult Education teaching credential, and a BA in Computer Science from the University of Wisconsin at Madison. His industry certifications include: the CDIA (Certified Document Imaging System Architect) and the AIIM Master, and AIIM Laureate, of Information Technologies (from AIIM International, the Association of Information and Image Management, www.AIIM.org), and the CRM (Certified Records Manager) (from the ICRM, the Institute of Certified Records Managers, an affiliate of ARMA International, the Association of Records Managers and Administrators, www.ARMA.org).

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