

# Computer Technology in Libraries

## Introduction

The DVD presents an unparalleled opportunity for members of the library community to observe a paradigm shift in the computer world. On June 25, 1998, Microsoft introduced Windows 98. Windows 98 supports the DVD. The instantaneous nature of a paradigm shift should be apparent, as PC's without a DVD drive become unsellable. DVD drives have almost reached the price level of CD drives already, and DVD drives will read CD's. The only thing holding back DVD drives had been a need for special drivers in Windows 95. These drivers are included in Windows 98, and in Windows NT 5.0 due later in 1999.

Government actions may impact Windows 98. However, Microsoft's recent activation of web pages reviewing the Year 2000 (Y2K) features of its existing products will encourage early adoption of Windows 98, Office 98, and Windows NT 5.0 which are now implicitly Y2K compliant.

Microsoft's PCnn specifications, starting with PC97, have given Microsoft a level of control over PC hardware that may even exceed Apple's control over the components of a Macintosh computer. PC99 requires that PCs have a DVD drive and an IEEE 1394 port for connecting hard drives and other high speed peripherals such as video cameras, surround sound speakers, and television sets.

CD's have not changed in 15 years, and DVDs should last a similar length of time. There is even a blue light special (DVD's currently use orange lasers, and CDs use red lasers) that is projected to increase DVD capacity to 40 GBytes in about a decade.

## New Formats

The DVD will establish completely new (but compatible) video and audio formats. The consistency, ubiquity, and longevity of these formats will simplify the design of digital library contents. DVD's can also be used to record the HDTV format. While there are many extensions to the DVD formats, such as HDTV, that will continue to evolve, the basic audio and video formats will arrive with Windows 98.

Many attempts have been made to extend CD's, including high density CD's. This is why there are so many stories of CD incompatibilities. The DVD will have a few problems, but with the entire video rental industry, music industry, and software distribution industry, poised to adopt DVD's, there are many forces and even more financial resources working to resolve incompatibilities.

## TV/PC Coming Soon

The DVD will force PC's to support high quality television. As the transistors on the support chips on the PC motherboards migrate onto the microprocessor chip itself, the cost of the PC will drop considerably. As some point the only difference between a TV and a PC will be the

microprocessor chip, and it will be cheaper to make all PC's and TV's identical to gain the economies of scale. The same chip will contain both television and PC circuits, with considerable chip real estate left over. It is probably a greater effort to design the single chip to include a DVD player than it is to provide PC and TV capabilities on the chip.

The merging of all functions onto one chip will be spurred on as voice recognition eliminates the keyboard and as eye tracking (a part of the video telephone) replaces mice.

## Behind the Scenes

The carrier frequency of fiber optics is 230 THz. Our fastest wavelength division multiplexers modulate it at 320 Gbits per second, leaving room for an increase of almost 1 thousand times in transmission speed on the fibers we now are burying. These future speed increases promise continued free Internet delivery of ever increasing volumes of information, including DVD quality audio and video.

Even today, at 320 Gbits per second, a single fiber can carry over 200 thousand video phone calls or 5 million voice only phone calls.

Internet switches now operate in the tens of Gigabits per second. Switches that operate at over a Terabit per second have been designed and are planned for the near future.

When current local loop barriers to the Internet finally fall, 1 Gbit/second into the home will be less expensive than 56 Kilobit modems are today.

## The Cost of Storage and Other Moot Points

The ever falling cost of computing has rendered many considerations moot. Examples are the use of lower case type, which began to appear around 1970, the use of bit mapped displays, which began to appear around 1980, and color printing which began to appear around 1990.

The cost of magnetic disk storage continues to drop at about 40 percent per year and is projected to do so for the foreseeable future. For any given collection, the cost of storage will eventually be less than ten percent of the implementation cost of a digital library.

Few users need to access a page in less than the 10 milliseconds currently offered by magnetic disks. Few users need more than the 100 pages per seconds that can be easily provided by a single magnetic disk drive. And the speed can be multiplied by dozens, hundreds, or even thousands of disks in disk arrays.

## Magnetic Disk VS Jukebox

For many applications, the cost of magnetic disk storage is less than the cost of an empty jukebox. When the cost of filling the jukebox with drives and disc is added, fewer applications favor the jukebox. Finally, the special drivers to manage the jukebox, along with support personnel training and driver installation, reduce the number of applications that favor jukeboxes.

Microsoft has indicated a desire to incorporate jukebox drivers into Windows NT, perhaps as early as the introduction of Windows NT 5.0. This transition should be evaluated and costed for prospective jukebox installations.

Optical discs, in particular DVD's are an excellent backup mechanism for a digital library, but they can be stored on a shelf.

## IEEE 1394

See also PC 97, PC 98, and PC 99

See also SAN (System/Storage Area Network)

Currently, when designing a magnetic disk system, the level and perfectly uniform surface of magnetic disk capacity becomes filled with stair steps. RAID arrays must have at least three disks. One of the disks cannot be used for data. The RAID array requires a SCSI cable which requires a SCSI card which requires SCSI slot in the computer. The RAID array requires a separate disk tower, or an expensive server that incorporates a disk tower. The disk tower must be close to the server because the SCSI cable cannot be more than 18 feet long, and this includes cable that is within the tower. If you want to go farther, then you need differential SCSI which needs a different terminator, a different SCSI card, and a different disk or disk tower interface. Each consideration constrains the digital library design and adds to the cost.

IEEE 1394 allows the connection of over 100 magnetic disk drives to a PC with a single fiber optic connector. The 1394 connector is about the size of a telephone wire connector. The chain of disks can be up to 10 km long under some conditions. Additional disk can be added as needed. Using a fabric configuration, planned extensions can connect up to 16 million disk drives with a single connector.

## MTR (Mean Time to Repair)

Circulation systems must stay up, but must digital libraries be restored in 4 hours. Allowing 1 or even 2 days for restoration can cut the cost of a system by a factor of 5 or even 10. A mirrored site in another region can solve many of these problems, especially with the acceptance of a 1 or 2 day restoration time if both sites go down.

As storage costs continue to drop, information will be mirrored at more and more sites and MTR will become a moot point.

## Buy What You Need Now, No More

Grants work exactly the opposite of computer cost reductions. If you buy extra capacity now for use in three years, the hardware will be out of date when you begin actually using it. Disk space will be 4 times less expensive and the processors will be twice as fast. The operating system will work much better with the features on the newer hardware.

Scalability means software will run on new hardware without being rewritten. Scalability does not mean that old hardware can be renovated.

### DVD Physical Size

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.

### The DVD is Not the Final Format

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

### 1,000 Year Media

See Norsam.com

### Data formats: 10 years vs forever

PDF, see [www.Adobe.com](http://www.Adobe.com)

### National Archives conversion to magnetic tape.

The United States National Archives removes all digital data from incoming media and copies it to magnetic tape. The Archives then plans to copy the data on the tape to the then current standard media in 10 years. If you use what everyone else uses, then there will be conversion software.

Watch the bits, not the media. Digital seals can guarantee the integrity of your records. Digital seals can be used in references to preserve the author's intent.

### Summary

Most areas of library technology are changing fast. There are many benefits to library patrons in the rapidly falling prices. With good planning, these benefits can be delivered.

### Updates and More Detailed Descriptions

When using the information in this article, please check the website [www.ArchiveBuilders.com](http://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

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Please send your comments via email to [SteveGilheany@ArchiveBuilders.com](mailto:SteveGilheany@ArchiveBuilders.com). Tel: +1 310-937-7000. Fax: +1 310-937-7001. Also, please let us know where you saw this article.

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### Note to Editors

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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 seventeen 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](http://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](http://www.ARMA.org)).

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