



Conserve O Gram

October 2010

Number 22/5

Digital Storage Media

Introduction

This *Conserve O Gram* provides an overview of digital storage media and general guidelines for its appropriate use and care. See the resources section for further information on this rapidly-changing technology.

Note: While digital storage media facilitates storage of, and easy access to electronic data, it does not provide long-term archival storage.

Using Digital Storage Media

Advantages:

- Space saving and portable; volumes of data can be stored on a single piece of media.
- Data can be located, accessed, and modified quickly.

Disadvantages:

- Hardware and software obsolescence can render data irretrievable.
- Media can fail suddenly or unpredictably.

Care and Storage

Even when kept in ideal conditions, all types of media **can** and **do** fail without warning. To help improve data longevity:

- Store in a cool, dry and dark location.
- Avoid unnecessary moving or handling.
- Check and activate (load) storage media regularly.
- Keep clean using dry, lint-free cotton or microfiber cloths.

Backup and Migration

Perform routine backups of all data regardless of the type of digital storage media used.

- Back up data regularly to multiple locations.
- Keep updated backups of varying media in several off-site locations to reduce the risk of data loss due to accidents or disasters.
- Make backups using varied media (such as different disks purchased from different sources) in case of unforeseeable manufacturing weaknesses or defects.

Digital storage technology evolves quickly. Developing and implementing a strategy to systematically migrate digital data to the most appropriate storage media is vital. Failure to do so can render data difficult or impossible to retrieve because of hardware or software obsolescence. Floppy disks were commonplace at one time but have now all but disappeared; PCs sold today rarely include the drives necessary to read them.

Produce hard copies on archival paper or microforms of important data wherever possible. This prevents data loss due to obsolescence or unexpected media failure. Archival paper can endure centuries, while the lifespan of digital formats is limited to years, or decades at best.

Media Types

There are three types of digital storage media. Refer to Table 1 for more detailed information.

Flash Memory Media

Data is stored in memory chips that are modified electronically. A lack of moving parts or sensitive external surfaces make this type less vulnerable to physical damage, but not impervious. Sudden failures can and do occur, particularly when media is subjected to physical or environmental stress.

Common forms:

USB flash drives: Also known as “thumb drives,” they are extremely portable and compatible with virtually all PCs (connected via USB port).

Memory cards: Used most often in digital cameras or other devices for convenient, temporary storage of data intended for later transfer to a PC or other device.

External solid-state disk (SSD) drives: Offers the large storage capacity of a magnetic hard disk drives but are more durable due to lack of moving parts that can fail or be damaged.

Writable Optical Media

Data is written to writable optical media by a laser which alters light-sensitive dyes within the disk. Once data is written to a disk, it usually cannot be modified. Re-writable (erasable) disks are available, but their more complex composition may render them less reliable than non-erasable disks.

Because of the materials used in their construction, writable optical disks are particularly sensitive to environmental conditions. The dye layer where data is recorded or the metallic layer that reflects laser light can be easily dam-

aged by exposure to light, high humidity or heat. Even disks stored in optimal (cool, dry, dark) conditions have failed in as little as two years.

Note: Laboratory testing has shown that **disks** manufactured **using** a certain type of dye (Phthalocyanine) and a reflective layer containing **gold (or a gold alloy) are more resistant to premature failure**. For more information, consult the resources and references sections below.

The surfaces of writable optical media are sensitive to mishandling.

- Do not touch the writable (bottom) side of the disk or the label (top) side of the disks unnecessarily.
- Always handle the disk by grasping the outside or inside edges.
- Use only pens or markers with solvent-free, permanent ink to label the disk.

Common forms:

Writable CDs (CD-R): Largely eclipsed by the use of writable DVDs.

Writable DVDs (DVD-R, DVD+R): Offer much larger storage capacity than writable CDs at virtually no extra cost.

Writable Blu-ray disks (BD-R): Use a more precise type of laser (blue in color) to store much greater amounts of data on a disk. The disk surface is also more resistant to scratching than that of most CD or DVD media.

Magnetic Media

Data is stored by altering the magnetic polarity on disks or tape. To record the data, the disk or tape must be rotated or otherwise moved. Because this type of media requires moving

parts, it is prone to mechanical failure and damage due to mishandling. However, it offers the greatest storage capacity relative to cost.

Common forms:

External hard disk drives: Similar to disk drives used for storage inside of most PCs, but mounted inside a portable metal or plastic case. Connect to a PC through a cable (usually USB).

Floppy & ZIP disks: Both are obsolete. Data currently stored on such media should be migrated to newer formats.

Tape cartridges: These cartridges contain spooled magnetic tape. Used almost exclusively by IT professionals for critical backups of computer systems.

References

Byers, Fred R. "Care and Handling of CDs and DVDs: A Guide for Librarians and Archivists," Council on Library and Information Resources and National Institute of Standards and Technology, 2003

Canadian Conservation Institute. Longevity of Recordable CDS and DVDS. CCI Notes 19/1. www.cci-icc.gc.ca

Tyson, Jeff. "How Removable Storage Works," HowStuffWorks.com, <http://computer.howstuffworks.com/removable-storage.htm>

Kingston Technology Company, "Tips for Caring for Your Flash Memory," www.kingston.com/flash/digitalmedia_care.asp

Resources

Delkin Archival Gold Media (CCD, DVD, and Blu-ray)
www.delkin.com/shop or other retailers

MAM-A Gold Archive Media (CD, DVD, and Blu-ray)
www.MAM-A-Store.com or other retailers

Delkin Archival Gold CD/DVD-Safe Pens (Solvent-Free)
www.Delkin.com or other retailers

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	Flash Memory Media			Writable Optical Media			Magnetic Media		
	USB flash drives	Memory cards	External solid-state disk (SSD) drives	Writable CDs (CD-R)	Writable DVDs (DVD-R, DVD+R)	Blu-ray disks (BD-R)	External hard disk drives	ZIP & floppy disks	Tape cartridges
Compatible with...	Any PC manufactured since about 2002	Digital cameras, camcorders, etc., and PCs with card readers	Any PC manufactured since about 2002	PC with a CD recorder drive and software	PC with a DVD recorder drive and software	PC with a Blu-ray recorder drive and software	Any PC manufactured since about 2002	Any PC with proper drive (ZIP or floppy)	PC or server with a compatible tape drive
Best for...	Transfer and storage of frequently used or modified files	Temporary storage of files produced on portable devices	Backups or easily-accessible storage for many/large files	Static, infrequently accessed backups	Static, infrequently accessed backups	Static, infrequently accessed backups	Large backups or easily-accessible storage for many/large files	Nothing; outdated and unreliable	IT professionals to perform backups
Capacity	1 to 256 GB (Gigabytes)	1 to 64 GB (Gigabytes)	32 GB to 512 GB (Gigabytes)	700 MB (Megabytes)	4.7 to 8.5 GB (Gigabytes)	25 to 50 GB (Gigabytes)	80 GB to 4 TB (Terabytes)	1.44 to 750 MB (Megabytes)	10s to 100s of GB (Gigabytes)
Longevity	Limited, but may last up to several years; manufacturing quality & user handling are key factors	Limited, but may last several years; type, quality of manufacture & user handling are key factors	Limited; high quality drives may last up to several years of heavy use	Limited; may last decades in ideal conditions, but testing has revealed as few as two years	Limited; may last decades in ideal conditions, but haven't been tested	Limited; may be greater than CD/DVD but haven't been tested	Limited; may last years but depends on usage and handling	Limited; sudden failures are common	Limited; variable by type; intended for relatively long-term storage
Advantages	<ul style="list-style-type: none"> - Very portable - Inexpensive - Fast - Reusable - Data easily modified 	<ul style="list-style-type: none"> - Very portable - Inexpensive - Fast - Convenient for temporary storage 	<ul style="list-style-type: none"> - High capacity - More reliable/durable than magnetic disk drives 	<ul style="list-style-type: none"> - Inexpensive - Most PCs can both read & write CDs 	<ul style="list-style-type: none"> - Inexpensive - Much greater capacity than writable CDs 	<ul style="list-style-type: none"> - Much greater capacity than CD or DVD; surface is also more durable 	<ul style="list-style-type: none"> - Very high capacity - Inexpensive relative to storage capacity 	<ul style="list-style-type: none"> - Inexpensive 	<ul style="list-style-type: none"> - Extremely high capacity
Dis-advantages	<ul style="list-style-type: none"> - Portability predisposes to damage or loss - May be unreliable (no testing has been done) 	<ul style="list-style-type: none"> - Portability predisposes to damage or loss 	<ul style="list-style-type: none"> - Less portable - More expensive than magnetic disk drives 	<ul style="list-style-type: none"> - Easily scratched or damaged - Relatively limited capacity 	<ul style="list-style-type: none"> - Easily scratched or damaged 	<ul style="list-style-type: none"> - New and not yet widely adopted - Relatively expensive 	<ul style="list-style-type: none"> - Moving parts make vulnerable to mechanical failure 	<ul style="list-style-type: none"> - Obsolete - Limited capacity - Unreliable 	<ul style="list-style-type: none"> - Expensive - Require expertise to use properly
Do...	<ul style="list-style-type: none"> - Unplug from PC when not in use - Cover/protect USB connector 	<ul style="list-style-type: none"> - Use provided storage containers/sleeves 	<ul style="list-style-type: none"> - Unplug from PC when not needed for extended periods 	<ul style="list-style-type: none"> - Keep in a cool, dry environment out of sunlight - Store vertically in protective sleeves or cases 	<ul style="list-style-type: none"> - Keep in a cool, dry environment out of sunlight - Store vertically in protective sleeves or cases 	<ul style="list-style-type: none"> - Keep in a cool, dry environment out of sunlight - Store vertically in protective sleeves or cases 	<ul style="list-style-type: none"> - Unplug from PC when not needed for extended periods 	<ul style="list-style-type: none"> - Remove from PC when not in use - Store in cases/sleeves 	<ul style="list-style-type: none"> - Use for professional backups of many PCs or servers
Don't...	<ul style="list-style-type: none"> - Leave in a pocket or purse for extended periods - Expose to moisture, contaminants, or extreme temperatures 	<ul style="list-style-type: none"> - Use for long-term storage of files - Expose to moisture, contaminants, or extreme temperatures 	<ul style="list-style-type: none"> - Expose to moisture, contaminants, or extreme temperatures 	<ul style="list-style-type: none"> - Touch the top or bottom surfaces - Label with stickers or solvent-based ink 	<ul style="list-style-type: none"> - Touch the top or bottom surfaces - Label with stickers or solvent-based ink 	<ul style="list-style-type: none"> - Label with stickers or solvent-based ink 	<ul style="list-style-type: none"> - Move while on - Expose to moisture, contaminants, or extreme temperatures 	<ul style="list-style-type: none"> - Expose to moisture, contaminants, or extreme temperatures 	<ul style="list-style-type: none"> - Expose to moisture, contaminants, or extreme temperatures