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 damaged 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**


**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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The George Washington University

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The series is distributed to all NPS units and is available to non-NPS institutions and interested individuals on line at <http://www.nps.gov/history/museum/publications/conserveogram/cons_toc.html>. For further information and guidance concerning any of the topics or procedures addressed in the series, contact NPS Park Museum Management Program, 1849 C Street NW (2265), Washington, DC 20240; (202) 354-2000.
<table>
<thead>
<tr>
<th>Flash Memory Media</th>
<th>External solid-state disk (SSD) drives</th>
<th>Writable CDs (CD-R)</th>
<th>Writable DVDs (DVD-R, DVD+R)</th>
<th>Blu-ray disks (BD-R)</th>
<th>External hard disk drives</th>
<th>ZIP &amp; floppy disks</th>
<th>Tape cartridges</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB flash drives</td>
<td>Digital storage media</td>
<td>Any PC manufactured since about 2002</td>
<td>PC with a CD recorder drive and software</td>
<td>PC with a Blu-ray recorder drive and software</td>
<td>Any PC manufactured since about 2002</td>
<td>PC or server with a compatible tape drive</td>
<td></td>
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<td>Memory cards</td>
<td>Digital cameras, camcorders, etc., and PCs with card readers</td>
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<td>Best for…</td>
<td>Transfer and storage of frequently used or modified files</td>
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<tr>
<td>Capacity</td>
<td>1 to 256 GB (Gigabytes)</td>
<td>1 to 64 GB (Gigabytes)</td>
<td>32 GB to 512 GB (Gigabytes)</td>
<td>700 MB (Megabytes)</td>
<td>4.7 to 8.5 GB (Gigabytes)</td>
<td>25 to 50 GB (Gigabytes)</td>
<td>80 GB to 4 TB (Terabytes)</td>
</tr>
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<td>Longevity</td>
<td>Limited, but may last up to several years; manufacturing quality &amp; user handling are key factors</td>
<td>Limited, but may last up to several years; manufacturing quality &amp; user handling are key factors</td>
<td>Limited; high quality drives may last up to several years of heavy use</td>
<td>Limited; may last decades in ideal conditions, but testing has revealed as few as two years</td>
<td>Limited; may last decades in ideal conditions, but haven’t been tested</td>
<td>Limited; may last decades in ideal conditions, but haven’t been tested</td>
<td>Limited; may last years but depends on usage and handling</td>
</tr>
<tr>
<td>Advantages</td>
<td>- Very portable</td>
<td>- High capacity</td>
<td>- Inexpensive</td>
<td>- Inexpensive</td>
<td>- Much greater capacity than CD or DVD; surface is also more durable</td>
<td>- Very high capacity</td>
<td>- Inexpensive</td>
</tr>
<tr>
<td>- Inexpensive</td>
<td>- More reliable/ durable than magnetic disk drives</td>
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<td>- Most PCs can both read &amp; write CDs</td>
<td>- Much greater capacity than writable CDs</td>
<td>- Inexpensive relative to storage capacity</td>
<td>- Inexpensive</td>
<td></td>
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<tr>
<td>- Fast</td>
<td>- Convenient for temporary storage</td>
<td>- Less portable</td>
<td>- Easily scratched or damaged</td>
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<td>- New and not yet widely adopted</td>
<td>- Moving parts make vulnerable to mechanical failure</td>
<td>- Extremely high capacity</td>
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<td>- Reusable</td>
<td>- Data easily modified</td>
<td>- More expensive than magnetic disk drives</td>
<td>- Relatively limited capacity</td>
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<td>- Relatively expensive</td>
<td>- Obsolete</td>
<td>- Expensive</td>
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<td>- Portability predisposes to damage or loss</td>
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<td>- Keep in a cool, dry environment out of sunlight</td>
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<td>- Unplug from PC when not in use</td>
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<td>- Use for professional backups of many PCs or servers</td>
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<td>Disadvantages</td>
<td>- Portability predisposes to damage or loss</td>
<td>- Easily scratched or damaged</td>
<td>- Keep in a cool, dry environment out of sunlight</td>
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<td>- Store vertically in protective sleeves or cases</td>
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<td>- Use for long-term storage of files</td>
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### Do…
- Unplug from PC when not in use
- Cover/protect USB connector
- Use provided storage containers/sleeves
- Use for long-term storage of files
- Expose to moisture, contaminants, or extreme temperatures
- Keep in a cool, dry environment out of sunlight
- Store vertically in protective sleeves or cases
- Touch the top or bottom surfaces
- Label with stickers or solvent-based ink
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- Touch the top or bottom surfaces
- Label with stickers or solvent-based ink
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- Move while on
- Expose to moisture, contaminants, or extreme temperatures
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### Don’t…
- Leave in a pocket or purse for extended periods
- Expose to moisture, contaminants, or extreme temperatures
- Use for long-term storage of files
- Expose to moisture, contaminants, or extreme temperatures
- Touch the top or bottom surfaces
- Label with stickers or solvent-based ink
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