Digital Media Storage

Summary

State and local governments use computers to create, capture, or maintain public records. To be accountable to the citizens of Minnesota, government agencies are required by law to keep records documenting their activities. Many of these records, because they will be of long-term or enduring value, must remain accessible over time. Some will be needed to continue critical government operations, some to document programs, and some to provide legal evidence. While the law does not require that the records be kept permanently, the approved retention schedule may dictate that they are kept for an extended period of time (10+ years). For practical reasons, you may want to remove the records that you do not refer to frequently from an online system to a lower-cost off-line storage facility until their disposal date. To ensure timely access to automated information, users must be able to identify and retrieve records online, near-line, or off-line. If stored off-line, records of enduring value will require special maintenance due to the basic instability of the media as well as system conversions that may jeopardize their long-term safety.

Legal Framework

For more information on the legal framework to consider when considering storage options for your records, refer to the Legal Framework chapter of these guidelines and the Minnesota State Archives’ Preserving and Disposing of Government Records. Keep in mind the legal requirements you may have for providing access to records over time.

Key Concepts

As you discuss and develop a plan for digital storage, you will need to consider:

- Storage Options
- Planning and Maintaining Digital Media Storage
- Storage Environment Guidelines
- File Storage with a Third-Party
- Storage Facility Details

Storage Options

As part of a records management plan for electronic records, you will need to determine where and how your records will be stored. This decision will be based on the likelihood of access of those resources versus the overall cost in maintaining them. Your general options for storage include online, near-line, and offline. Records that are accessed most should be stored online; records accessed the least off-line. After it is determined where the records will be stored you will need to determine how to provide various users with access. This will depend on the records themselves as well as the type of media chosen.

Make sure to select appropriate media and systems for maintaining your records for the required period of time. Regardless of your choice, files may need to be refreshed (transferred to new media) or migrated (to a different format) possibly within a pre-determined period of time. For more information about the types of digital media please review the Digital Media section of these guidelines. Online, near-line, and offline storage are described below.

Online Storage
Online storage allows immediate access to records to anyone on the system’s network. Properly designed storage will provide access to appropriate users only. Online storage maintains the greatest functionality but requires more expensive network storage.

Examples of online storage include:

- **Storage Area Networks (SAN)**. SANs allow access to remote drives with the same convenience of internal hard drives. A SAN is a networked system.
- **Just a Bunch of Disks (JBOD)**. JBOD is a collection of disks that are set up to look like one large disk to users. If one disk goes bad, only the information on that disk is lost; the information on the others is still readable. This is sometimes used to store backup files.
- **Redundant Array of Inexpensive/Independent Disks (RAID)**. RAID uses a group of disks to back up data on a daily basis. There are many different configurations of RAID arrays with their own features. RAID is frequently used, but depending on the size of your institution, may or may not be cost effective. Although RAID is used to backup local files, it is not intended to be used as a main backup method.
- **Cloud Computing**. More recently, online storage also refers to files that can be accessed online via the Internet. With cloud computing files are stored by a third-party and accessed through a web service. This technology continues to be explored. It may not be appropriate for confidential files or vital records that need to have 24 hour access. As with any outside provider, questions need to be asked about their policies and procedures for storing, preserving, and providing access to records.

Near-line Storage
Near-line storage is storage in a system that is not a direct part of your network, but that can be accessed through your network (e.g., an optical media jukebox). Access to these files is done with an automated process that selects the correct disk/tape from a disk/tape library and makes it accessible. This option maintains a moderate amount of functionality. While the storage space is cheaper than online storage, near-line storage requires extra time to manipulate both the files and
media of choice to access the records. Near-line storage is often used for backups as large quantities of data can be managed quickly.

**Offline Storage**

Files that cannot be accessed immediately are said to be stored offline (e.g., files not accessible through your network such as on removable media like external hard drives or magnetic tape). Older records or records that do not need to be accessed frequently are often stored online. This option trades functionality for stability. There is a focus on data accuracy, protection, and security due to the long-term storage necessity. The longer records need to be maintained the more important preservation methods, back-up procedures, storage conditions, handling procedures, and security become. Offline storage can be stored in-house, off-site, or outsourced.

Examples of offline storage include:

- Removable magnetic or optical media (tape, DVD). For integrity purposes, read-only media is preferred.
- Flash media (solid state media has no moving parts)
- External hard drives (with moving parts)
Planning and Maintaining Digital Media Storage

Even when properly cared for, all digital media and hardware have limited life expectancy. Media life spans are dependent on a number of factors, including manufacturing quality, age and condition before recording, handling and maintenance, frequency of access, and storage conditions. Hardware and software may be supplanted by rapid advances in technology. Therefore, storage of digital media demands greater planning and attention than the traditional formats such as paper or microfilm. The suggestions in this chapter provide basic information on the design and management of a digital storage facility. For more information on choosing and caring for digital media, refer to the Digital Media chapter of these guidelines.

Record Maintenance

For records of long-term or enduring value stored on electronic media, agencies should consider the following:

Access: Maintain your records in a usable format and keep up-to-date materials needed to access them, including indexes and other documentation, until they are scheduled for disposal. In instances where you maintain non-confidential public records permanently in your agency, you will need to create a plan that provides easy access to those records upon request.

Backups: Maintain backup copies of records and all materials required to access them in an off-site, preferably geographically different, location that does not share the same disaster threat. Create policies and procedures for backing up records.

Labeling: Develop procedures for labeling storage media. Each external label should carry information unique to the medium it identifies. At minimum, it should display the name of the organizational unit responsible for the data, the system title, the file title, the disposition date or permanent status of the record, and its security classification, if applicable. Larger storage systems (such as an external hard drive) should have at the minimum a printed inventory of the files it contains.

Inventories: Develop procedures to maintain an accurate and up-to-date inventory of records stored off-line. If using tapes or other portable media, a useful inventory will contain the following information about each item: item ID; file title(s); system title; dates covered by file(s); date moved off-line; the recording density; type of internal labels; volume serial number, if applicable; number of tracks; character code/software dependency; information about block size; and the number of the item if part of a multi-item set. Where applicable, it will also give the number of records for each set of data, the format of the record, and logical record length.

Storage Environment Guidelines
Each type of storage location has specific requirements to function properly and protect your digital records. Requirements for online, near-line, and offline storage environments are discussed below.

**Online**
All types of online storage for a local network depend on computer equipment and servers. Networked computer equipment is generally housed in a ‘server room’.

Some requirements for a well designed server room include:

- **Location and Accessibility.** If possible, centrally locate your server room. This will make it easier to connect computers to the network. A server room should be easily accessible to authorized personnel to facilitate monitoring and maintenance when needed. Security systems should be in place to keep unauthorized personnel out and monitor who accesses the room.

- **Size.** If designing a networked system, make sure the space you dedicate to the server has enough room to allow for growth over time. Using a space to its capacity at the outset will be detrimental in the future.

- **Storage.** Depending on the size and number of your servers, you can store them on wall mounted racks or on floor racks. These racks separate the individual servers and keep them from touching each other, which could cause overheating and other physical damage.

- **Temperature.** To keep equipment from overheating and being damaged, the server room should be temperature controlled, and set at about 65-75 degrees. It is a good idea to have separate temperature controls for the server room; relying on central air conditioning that cools an entire building is not a good idea, as temperatures can fluctuate drastically throughout the building.

- **Power.** Make sure there is an appropriate amount of power being delivered to the server room. Make sure that more power is available for expansion as needed. If the amount of power is not adequate, the servers will overheat and fail.

- **Cable Management.** Many cables will be attached to the servers. It is important to make sure these cables are well organized. Make sure cables are not twisted, bent, resting on the floor, or under any pressure. Damaging the cables will damage the network connections and possibly the data on the servers. Labeling cables is also a good idea.

- **Environment.** Keep the server room clean; dust can damage the servers. Protect the servers from water damage (sprinklers, leaky pipes). Keep magnets away, since magnets can damage digital data on magnetic storage media.
Documentation. Overtime, hardware and software updates will need to be performed on the servers. Keep a running log of all updates. This can help problem solve technology issues that may arise in the future.

Near-line
Near-line storage equipment requires the same general storage requirements as online storage equipment. The physical media the records are stored on will also have their own care and handling procedures. Please review the ‘Care and Handling’ section in the Digital Media chapter of these guidelines to understand the care and handling of the media itself.

Offline
Offline storage consists of removable media including magnetic tape, optical disks, or external hard drives housed in a storage facility. For care and handling of the removable media itself review the ‘Care and Handling’ section of the Digital Media chapter of these guidelines. The desirable qualities of a storage facility for this media include:

- **Adequate floor space.** You will need to consider:
  - The current volume of media you need to store.
  - The projected volume of media you will need to store in the future based upon your records retention requirements.

- **Security.** Allow only approved people access to the storage facility. You will want to consider, among other things:
  - A controlled auditable entrance (e.g., security code keypad, smart-card swipe).
  - An alarm system that sounds if an unauthorized person attempts to enter the storage facility.

- **Convenient location.** Consider how often you will need to access the records in your offline storage facility to help determine how conveniently located your storage facility needs to be.

- **Adjustable Lighting.** Your storage facility will need to have adequate lighting available for people using the facility.

- **Ventilation.** Good ventilation will help prevent dampness, mold, and pest infiltration.

- **Temperature and humidity control.** Proper temperature and humidity are essential for preserving the electronic records on digital media. Temperatures and humidity levels that are above or below the recommended range can deteriorate electronic (and paper) records. Above all, you should strive for a consistent environment, without sudden or drastic changes in temperature or relative humidity. A good temperature and humidity requirement for storage facilities is as follows: Temperature between 60 and 69 F. Relative humidity between 35-45%.
- **Clean air quality.** The air in the storage facility should be free from pollutants (e.g., strong cleaning solution fumes). Dust can also be particularly damaging to digital media.

- **Damage prevention.** Protect your storage facility from:
  - Pest infestation (e.g., mice, cockroaches, silverfish)
  - Fire, smoke, and sprinkler damage
  - Water damage, either from leaky pipes and leaky foundations, or from trapped moisture in walls, floors, and ceilings.
  - Damage from magnets, since magnets can damage digital data on magnetic storage media and thereby damage your electronic records.

**File Storage with a Third Party**

You may also consider using a third-party storage facility that can store, access, and deliver records to you. Third-party services include management of offsite storage facilities as well as cloud computing technologies, both of which are contracted out. Cost-benefit analysis should be done to determine if working with a third party will be beneficial to your institution. Be certain that the third-party policies, procedures, and facility can meet your operational needs and legal requirements.

**Storage Facility Details**

In addition to the above requirements, if you use a storage facility, you will need to:

- **Establish a policy.** Your storage facility and procedures policy should mesh with your overall records management strategy. Address both operational and legal requirements to ensure that you store and handle your records in accordance with state laws, while also meeting your operational needs.

- **Evaluate the physical storage space.** Storing your electronic records in a space designed for that purpose will help you maintain your records as long as legally and operationally necessary.

- **Develop access procedures.** Procedures for access and use of the storage facility must detail who physically and electronically may access the facility, retrieve records, add records, and dispose of records.

Determine your needs, priorities, and budget for the following components of a storage facility:

- **Storage Aids.** Appropriate storage aids for the media may include shelving, file cabinets, and storage boxes. You may also need special cleaning supplies (e.g., lint-free dusting cloths, cotton gloves for handling sensitive media).
• **Facility map.** Consider creating a map of the storage facility so that you know which digital media are stored in each area.

• **Access and use training.** Provide instruction and training for staff members who will be submitting items for storage, accessing stored records, and retrieving records. Established guidelines and training will enable you to provide service, stay organized, and protect your records.

• **Circulation control.** Develop a circulation log or other method for tracking facility access and records circulation. For a reliable circulation control system, you will need to develop an indexing system that accounts for all the digital media stored in the facility. A central authority should manage the index’s content. Options include a paper list, card file, or database. You should be able to look at the circulation control index and determine the exact status of each stored media (e.g., if checked out, with whom and when due; if disposed of, when destroyed or disposed of; date of final disposition).

• **Acceptance system.** Develop a process that allows agency members to place records into the facility. Items submitted for storage should have, at minimum, the:
  - Name of the record series
  - Security classification; open or restricted
  - Record series inclusive dates
  - Unique locator number or identifier
  - Name of the agency and/or department submitting the item
  - Records disposal date

• **Special consideration for vital records.** Your vital records should have the best storage facility you can devise and afford. Be certain that your facility map shows the location of digital media containing your vital records; so that you can locate them immediately should a disaster occur. An off-site storage location for back-up copies is best.

• **On-going maintenance schedule.** Establish an ongoing system for maintaining the storage facility, including:
  - Regular cleaning, using chemicals that will not leave harmful residue or fumes
  - Procedures for checking deterioration of physical storage media (e.g., warped compact disks, cracked disks, moldy boxes)
  - Procedures for checking deterioration of electronic content (e.g., unreadable disks, inaccurately read records, missing or scrambled information on records)
  - On-going maintenance program (e.g., reading samples, spinning tapes to tighten them)
  - Regular maintenance of storage facility equipment (e.g., furnaces, air conditioners, dehumidifiers)

• **Disaster recovery (Continuity of Operation) plan.** As part of your records management policy, include a disaster recovery plan that provides a series of detailed actions (including who is responsible for executing each step of the disaster plan) if a disaster should occur at the storage facility. Include the response procedures for multiple types of disasters (e.g.,
flood, fire, smoke, or explosion). The goal of the plan should be to have the facility operational and the greatest number of records recovered in the least amount of time. Train staff members and practice the disaster recovery plan. For more information on disaster recovery, refer to the Disaster Preparedness guidelines\(^2\) on the Minnesota State Archives’ web site.

Key Issues to Consider

Now that you are familiar with some of the basic concepts of storage facilities, you can use the questions below to discuss how those concepts relate to your agency. Pay special attention to the questions posed by the legal framework, including the need for public accessibility and protection of not-public records as set forth in the Minnesota Government Data Practices Act (MGDPA). Consider your current and future activities and records to help determine your requirements for a storage facility. The answers to these questions will guide your development of a storage facility that meets your agency’s needs and legal requirements.

Discussion Questions

- What are our goals for storage and access? How do we prioritize these goals? How does this prioritization affect our budget?

- Are there other government agencies that are able to share resources? Collaborations?

- How long do we need to retain our records according to applicable retention schedules?

- Will we be storing an increasing volume of electronic records over time?

- How frequently will the records need to be accessed? How strictly must access to the records be monitored? Will the public access our records directly, or will we access records on behalf of the public? How will we protect not-public records as defined under the MGDPA?

- What are our needs for floor space, storage aids, location, and security systems?

- Will the storage area be located in our daily work space or in a separate location? What are the cost differences of our options?

- Are we considering a third-party storage facility? How will we be sure that the third-party can meet all of our legal and operational requirements?

- Who is responsible for enforcing the storage system policy and procedures? Who will maintain the map and index?

How will we accept and process records into the storage facility?

Annotated List of Resources


This guide discusses the physical characteristics of various optical media, as well as methods for their proper care and handling to ensure longest possible use in any given environment. A useful glossary is included.


Developed for Minnesota government agencies, this overview of the basic principles of records management includes chapters on defining a government record, taking inventory of your records, developing records retention schedules, preserving archival records, disposing of records, and setting up a records storage area. A list of resources for more information is included, as well as information about applicable state law regarding electronic records management. Originally published by the Minnesota Department of Administration in July 2000, the guide was updated jointly by the Minnesota Historical Society and the Minnesota Government Records and Information Network (MNGRIN) in 2008.


Also available as a downloadable file, the information on these web pages summarizes the basic concepts of disaster preparedness, including disaster prevention, disaster planning, disaster recovery, and disaster preparedness resources.

Includes explanation of cloud computing including the benefits and concerns of the technology.


An introduction to cloud computing including its current use in government and challenges with implementing it.

*The PC Technology Guide*
http://www.pctechguide.com/pc-data-storage

This site is a comprehensive resource on all aspects of the personal computer. Topics include hardware, software, computer use, and digital media.

*COOL (Conservation OnLine): Electronic Storage Media*

These pages are part of the Conservation OnLine, Resources for Conservation Professionals web site operated by the Foundation of the American Institute for Conservation. This web page is a collection of materials from other sources about electronic conservation, including resources on disaster recovery, electronic media, electronic formats, and storage environments.