The Document Life Cycle: A White Paper

Prepared for The Association for Information and Image Management

(AIIM International)

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Executive Summary

The concept of a document life cycle is well established in records management theory and practice. From creation or receipt through destruction or permanent preservation, documents are subject to changing requirements for timely retrieval, convenient distribution, and reliable, cost-effective storage.

The document life cycle is divided, by frequency of reference, into active and inactive (less active) stages.

The active stage is concerned with the timely availability of information to support an organization's business operations. The storage medium selected for the active stage must permit convenient retrieval of documents for reference, editing, or distribution.

The inactive stage is principally concerned with retention of information. The storage medium selected for the inactive stage must provide cost-effective, reliable retention of documents, often for long periods of time.

Available document storage media have distinctive strengths and limitations.

Paper is familiar and convenient for reference copies, but paper documents can require large amounts of storage space and paper files can be difficult to organize and maintain.

Electronic formats provide excellent retrieval functionality for the active stage of the document life cycle, but they are poorly suited to retention of information for long periods of time. In particular, the continued utility of electronic documents is adversely affected by the limited stability of computer storage media and the dependence of computer-processible information on specific hardware and software configurations.

With its superior stability, compatibility, and compactness, micrographics is very well suited to long, even permanent retention of documents. Micrographics technology also provides good functionality for the active stage of the document life cycle.

Paper, micrographics, and electronic media can and must coexist in document management applications. These media are less competitors than allies. It is not the task of document management to prefer one storage medium over the others, but to match media to specific application requirements.

A mixed-media approach combines the distinctive advantages of paper, micrographics, and electronic formats to satisfy specific life cycle requirements that cannot be satisfied by a single document management methodology or technology. Micrographics, in particular, has a solid track record of integration with other document formats. When combined with paper or electronic media, it can deliver very effective solutions to document management problems.

Technology is a means to an end, not an end in itself. The objective of document management should always be a proper business solution.

Introduction

In biology, a life cycle denotes the continuous sequence of changes that an organism undergoes from birth to death. The phrase is also applicable to certain inanimate objects-such as business machines, automobiles, and other manufactured products-that undergo changes throughout defined life spans. As such products age, they are subject to wear and tear that necessitates periodic repair or replacement of specific components until they are removed from service. Life cycle concepts similarly apply to complex entities, such as computer systems, telecommunication networks, and office buildings. A mainframe-based computer program developed in the 1970s, for example, may have been modified repeatedly throughout the 1980s to address changing application requirements or improve efficiency, before ultimately being replaced in the l990s by a client/server implementation .

The concept of a document life cycle is well established in records management theory and practice. In corporations, government agencies, and other organizations, the life spans of documents are defined by record retention policies and procedures. Such policies and procedures are based on legal, fiscal, administrative, or other requirements. From creation or receipt through destruction or permanent preservation, documents are subject to changing requirements for timely retrieval, convenient distribution, and reliable, cost-effective storage

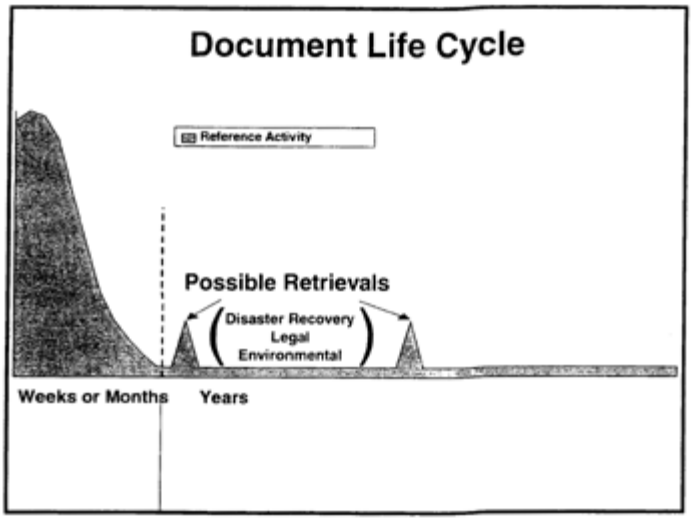

Figure 1

Illustrating the most significant feature of the document life cycle, Figure 1 depicts the widely observed relationship between the age of a document and its reference activity. Most documents are referenced frequently for a relatively brief period of time following their creation or receipt. Reference activity diminishes as documents age. When, and if, reference activity falls to zero, the document can be discarded. This life cycle applies to documents in paper, microfilm, or electronic formats. It is also valid for other types of recorded information such as computer databases, scientific and medical imagery, audio recordings and video recordings.

Retention periods defined by corporations, government agencies, or other organizations are essentially estimates of life cycle duration for specific types of documents. Certain documents, such as notes of telephone calls and junk mail, have short life cycles; they are often discarded after an initial reading. Others, such as routine office correspondence, are filed for a brief period then discarded, usually within several years of creation or receipt. Many transaction-oriented documents, such as purchase orders and insurance claims, are referenced frequently for several weeks or months following creation or receipt, but only occasionally after the matters to which they pertain are resolved. Total retention periods for such documents may range from six to 10 years to satisfy legal or auditing requirements.

Certain documents are retained for much longer periods. Their retention parameters may be determined by the life cycles of objects to which the documents pertain. Engineering drawings of manufacturing facilities or equipment, for example, are retained as long as the facilities or equipment remain in service. Documents that relate to pharmaceutical products are retained as long as the products are marketed and often longer as continuing proof of safety or efficacy. Finally, some documents have continuing administrative or research value that warrants permanent retention, either by business offices or cultural agencies. Government and corporate archives, for example, preserve documents for their historical significance without regard to reference activity. Where classified information about persons or government activities is involved, such archival documents may be made available for reference for several decades.

Media Requirements

The document life cycle is divided, by frequency of reference, into active and inactive (less active) stages. Each stage has distinct functional and media requirements. The active stage of the document life cycle is concerned with the timely availability of information to support an organization's business operations. The storage medium selected for the active stage must permit convenient retrieval of documents for reference, editing, or distribution.

By contrast, the inactive stage of the document life cycle is principally concerned with retention of information. The storage medium selected for the inactive stage must provide cost-effective, reliable retention of documents, often for long periods of time. It must support the continued retrievability of documents over the designated retention period. It must provide physical and chemical stability compatible with retention requirements. It must satisfy all legal requirements to which documents may be subject.

Documents can be stored in paper, micrographic, or computer-processible (electronic) formats. Broadly defined, the paper format encompasses engineering drawings on vellum or mylar. The micrographics format includes microfilm, microfiche, aperture cards, or other microforms produced by source document cameras or COM recorders. The electronic format includes digitized images generated by document scanners as well as character-coded data or text produced by word processing software, E-mail systems, or other computer programs. These document storage formats have distinctive attributes that can satisfy specific life cycle requirements. The following sections consider the most important advantages and limitations of each format.

PAPER

Paper plays an important role in the life cycle of documents, if only because most documents originate in paper form. While an increasing quantity of information is captured at its source in electronic formats, a significant percentage of the world's documents exist solely in paper. Until recently, paper was the only medium available for document creation, and the worldwide installed base of filing cabinets and other record storage facilities contains trillions of handwritten, typewritten, and printed pages. Even documents created in electronic formats by word processors are usually printed on paper for reference, distribution, or filing. Many E-mail messages are likewise printed and filed. For decades, data base management systems and other computer programs have generated printed reports, many of them voluminous. In any case, these computerized approaches to document creation are typically limited to documents generated internally; documents from external sources are usually received in paper form.

Among its advantages for the active stage of the document life cycle, paper is a familiar, convenient, and versatile reference medium. Paper documents can contain textual and/or graphic information. Paper is available in sizes, colors, and textures appropriate to a broad range of document management requirements. Brief messages can be handwritten on small notepads, while very large sheets can contain detailed engineering drawings, maps, or charts. For emphasis, information can be written or printed in colors, large sizes, or distinctive styles.

Where appropriate, preprinted forms and letterheads can combine static and dynamic information within a page. Annotations or signatures can be added to paper documents at any time.

Paper documents are portable in reasonable quantities. They are easily reproduced by photocopiers for distribution, but manual routing is the most common distribution method for both originals and copies. Electronic routing of paper documents through facsimile technology is possible but typically involves some manual procedures.

Because paper documents contain human-readable, eye-legible information, they require no special hardware or software for reference. This is an advantage for both the active and inactive stages of the document life cycle. Paper documents created today should prove usable for the foreseeable future, just as books and manuscripts created centuries ago are readable today. In file cabinets, cartons, or other storage containers, most paper documents will remain stable for decades. For archival records, American National Standards specify the characteristics of permanent papers. As a further advantage, the legal acceptability of properly authenticated paper documents is well established for both record keeping requirements and admissibility in evidence.

Despite these strengths, paper has several limitations for the active and inactive stages of the document life cycle. Paper documents are subject to wear and tear through frequent or careless use. In large quantities, paper documents require considerable amounts of storage space, which may be unavailable or prohibitively expensive in an office setting. Large quantities of paper documents can be stored economically in record centers or other warehouse-type facilities, but such arrangements are not appropriate for documents that must be immediately and continuously available for active reference. Record center storage is best suited to the inactive stage of the document life cycle. Compared to other storage options, it will usually prove most economical for paper documents that are retained less than 10 years. Beyond that time, the accumulated cost of record center storage may exceed the cost of converting paper documents to microfilm or electronic images for more compact storage.

As a significant problem for the active stage of the document life cycle, paper files can be difficult to organize for effective retrieval. The development and implementation of subject filing systems are particularly challenging tasks. Subject headings must be identified and arranged in alphabetical or hierarchical sequence. Cross references must be created for documents that treat more than one subject. Alternatively, such documents must be duplicated for filing under multiple headings -- a technique that increases the bulk of files.

File organization aside, paper documents are difficult to control. They are often removed from filing areas for reference purposes. Unless extra copies are filed, documents in use are unavailable to others. Users may not return documents to filing areas when reference is completed. File integrity is further compromised by misfiling. Finally, paper documents may be lost or stolen. Due to space constraints, it is usually impractical to store additional paper copies of important documents for backup.

MICROGRAPHICS

Micrographics technology provides effective solutions for both the active and inactive stages of the document life cycle. Micrographics' value for active records management applications is widely recognized. Certain micrographics products were developed specifically for applications involving frequently referenced documents. Self-threading cartridges, for example, simplify loading and viewing of 16mm microfilm, the most common micrographics

medium for office documents. Since the 1960s, microfilm jacket systems have miniaturized files, such as insurance claims and student records, that are subject to updating through periodic interfiling of new documents. Because the jacketed files are compact, they are easy to handle. Aperture cards similarly facilitate the handling, reproduction, and distribution of engineering drawings, maps, and other large documents. Compared to paper printouts, computer-output microfilm (COM) technology speeds and simplifies the production, distribution, and handling of accounting reports, tabular listings, and other computer-generated documents.

For the most demanding document management applications, computer-assisted retrieval (CAR) systems use computer data bases to index microfilm images for rapid retrieval. The data base is searched to determine the existence and microfilm locations of document images that satisfy retrieval specifications. Usually, the document images are recorded on 16mm, blip-encoded microfilm loaded into self threading cartridges. In a traditional CAR system, retrieved microfilm images are displayed on reader/printers equipped with blip-counting accessories. Alternatively, reader/scanners can digitize microfilm images for distribution over computer networks to desktop display stations. Such document management configurations combine photographic and electronic imaging technologies. At a more complex level, microfilm jukeboxes with integrated scanning mechanisms provide fully automated image retrieval, digitization, and distribution capabilities.

By definition, micrographics technology miniaturizes information. It offers compact, economical, reliable storage for both active and inactive stages of the document life cycle. When compared to paper filing methods, micrographics can reduce storage space requirements by 95 percent or more. A six-drawer cabinet for 16mm microfilm, for example, can store as many pages as 350 four-drawer cabinets filled with paper documents. The space-saving potential of micrographics is on a par with electronic document storage formats.

Compact storage is particularly important where large quantities of documents must be retained for long periods of time. Micrographics technology has a well deserved reputation for efficiency and effectiveness in such situations. Since the early twentieth century, it has satisfied the long-term storage requirements of corporations, government agencies, and other organizations. Compared to paper and electronic media, microfilm offers superior physical and chemical stability for archival retention of documents. For the polyester-based silver gelatin microfilm used in source document cameras, computer-output microfilmers, and certain duplicators, American National Standards estimate a stable life exceeding 500 years when the film is properly processed and stored in a controlled environment. The lifetime estimate exceeds 100 years for acetate-based silver gelatin microfilms when properly processed and stored. Diazo and vesicular films, which are used for microfilm duplication rather than original recording, have lifetime estimates of 100 years in controlled storage environments.

Microfilm images, like paper documents, contain human-readable information. While such images require magnification for eye-legible display or printing, micrographics equipment requirements are straightforward. Appropriate display and printing devices have been widely available for decades. Compared to documents stored in electronic formats, micrographics implementations have minimal hardware and software dependencies. With its long history of standardization, micrographics technology offers exceptional compatibility and interchangeability of recorded information among the products of different vendors. Micrographics users can exchange documents worldwide with confidence that the documents will be viewable and printable by available equipment. Similarly, users can have a high degree of confidence that micrographic images created today will be compatible with display

and printing equipment introduced in the future.

As with paper documents, the legal status of microfilm images is well established for both recordkeeping requirements and admissibility in evidence. Among pertinent statutory provisions, the Uniform Photographic Copies of Business and Public Records as Evidence Act (UPA), as well as the Federal Rules of Evidence (FRE) and Uniform Rules of Evidence (URE), specifically mention microfilm as an acceptable medium for document reproduction.

Because microfilm is easily and economically duplicated, it is often the preferred medium for vital records protection and other document backup operations. Microfilm's compactness and unmatched stability are valuable attributes in such situations.

ELECTRONIC FORMATS

Electronic formats, as defined above, encompass digitized document images and character-coded textual documents. Together, these computer-processible document formats offer superior reference functionality for the active stage of the document life cycle. They are particularly well suited to applications requiring rapid retrieval of documents, remote access to documents, or controlled document routing through a prescribed workflow.

Systems that store documents in electronic formats rely on computer-based indexing methods to satisfy complex retrieval requirements. As with the CAR systems described above, computer-based indexing permits rapid identification of needed documents. Often, electronic document storage can be integrated with existing computer applications. An insurance company that maintains a data base of summary information about policies or claims, for example, can link electronic documents, in image or text formats, to specific data base records. Following retrieval of summary information, users have the option of examining complete documents online. Full-text indexing can provide additional retrieval flexibility.

Depending on the application, electronic documents may be stored on hard disk drives or in optical disk autochangers for rapid, fully automated access. Once retrieved, they can be transmitted to users' desktops over local or wide area computer networks. The retrieved documents can be displayed, printed, or routed to other users. Because users do not take exclusive possession of electronic documents to reference them, simultaneous access is possible, and contention for documents is eliminated. Compared to paper filing systems, file maintenance and file integrity problems are minimized. Because electronic documents are not removed from files for reference purposes, tracking, sorting, and refiling operations are eliminated. Electronic documents are unaffected by reference activity. Unlike paper records, they cannot be damaged by use, stolen, or misplaced. While individual storage media may be damaged, lost, or stolen, backup copies can ensure the continued availability of electronic documents.

Like micrographics, electronic document formats greatly reduce storage space requirements when compared to an equivalent quantity of paper documents. One gigabyte of magnetic or optical disk storage can contain over half a million double spaced, typewritten pages stored as character-coded text or as many as 30,000 of the same pages stored as digitized images. Hard disk arrays and optical disk autochangers can store the contents of hundreds or even thousands of file cabinets in a small area.

While electronic document formats offer important advantages for the active stage of the document life cycle, they have significant limitations for document retention, the principal concern of the inactive stage. As previously noted, electronic documents are usually recorded

on magnetic disks or optical disks. Magnetic tapes are also a possibility, but their serial access limitations usually relegate them to a backup role for documents that will be referenced frequently. Because the information they contain is vulnerable to damage through hardware malfunctions, hard disk drives cannot be considered stable storage media. Electronic documents or other information recorded on hard drives must be copied onto optical disks or magnetic tapes for offline storage. The stability of such storage copies is an obvious concern in applications where documents must be retained for long periods of time. While American National Standards define the stability characteristics of paper and microfilm, lifetime estimates and optimal storage conditions for computer media have not been defined by national or international standards. Optical disks and magnetic tapes are sometimes described by their manufacturers as archival media, but they do not offer the permanence implied in that description. On the contrary, scientific studies indicate that optical and magnetic media are vulnerable to significant time-dependent degradation that will eventually render them unsuitable for accurate retrieval of recorded information. Based on accelerated aging tests, several manufacturers of optical disks claim stable life spans as long as 100 years for certain products. For most optical disks and magnetic tapes, however, the anticipated life span is 30 years or less.

Stability characteristics aside, optical disks and magnetic tapes are designed for use with specific hardware and software components that usually have shorter service lives than the media themselves. While a given optical disk or magnetic tape may retain playback stability for several decades, there is no historical precedent for computer storage devices remaining in use for that length of time. Many optical disk drives and magnetic tape units are engineered for a maximum service life of 10 years, and the frequency of repair and high maintenance costs associated with aging equipment will typically necessitate replacement before that time. The availability of new models with improved cost-performance characteristics, coupled with changing application requirements, also encourages replacement at relatively short intervals-within five years or less in many cases.

To maintain competitiveness, manufacturers of computer storage devices introduce new models with improved capabilities at regular intervals. To preserve the utility of previously recorded information, new optical disk drives and magnetic tape units may offer backward compatibility with older media for reading purposes; that is, they can retrieve information from media recorded by predecessor models in a given manufacturer' s product line. While such backward compatibility is customary, there is no guarantee that it will be continued in all future products. On the contrary, the history of computer storage devices suggests that, at best~ backward compatibility provides a bridge between two or three generations of equipment. Eventually, support for older media and recording formats will be phased out. As an added constraint, backward compatibility does nothing to address retrievability problems associated with discontinued optical or magnetic storage products.

Further complicating long-term retention, electronic documents and their associated index data are designed for retrieval or other processing by specific application programs. Even more than hardware components, software may be updated or otherwise changed in a manner that can render previously recorded information unusable. New releases of a given vendor's application programs may not be able to read electronic documents or index data produced by earlier versions. In addition, a user may switch to an incompatible electronic document management system of another vendor, thereby rendering an existing collection of electronic documents unreadable. Such a switch may be forced by circumstances beyond the user's control, should a vendor discontinue a given product line or go out of business, for example.

Records management complications posed by limited stability of computer storage media and

the dependence of electronic documents on specific hardware and software configurations for continued utility are widely acknowledged. Retrievability of electronic documents can be extended indefinitely by periodically converting them to new media or formats. The transfer interval is determined by a given medium's claimed stability period or by the service life of compatible hardware and software components, whichever is shorter. Because computer-based systems are routinely upgraded or replaced at relatively short intervals to take advantage of improved technology embodied in new products, the stability of particular storage media and the continued availability of compatible equipment and software have little significance for record retention practices. An electronic document storage and retrieval system installed today is likely to be replaced or significantly upgraded within five or six years. Before media stability has elapsed or specific hardware or software components are discontinued, electronic document images and their associated data base records will have been converted to media and formats required by a replacement system.

This argument assumes that information from existing optical or magnetic media can be conveniently and reliably transferred to the replacement system, that the required media transfers and format conversions can be incorporated into an organization's work routines, and that the cost of such media transfers and format conversions is not prohibitive. Given the large quantity of documents encountered in many records management applications, the time, effort, and cost required to accomplish the periodic conversion of electronic documents to new media or formats must not be trivialized.

The simplest scenario, recopying of electronic documents onto new media without format conversion, involves computer time, operator interventions, and the purchase of replacement media. Assuming an average data transfer rate of 700 kilobytes per second, a collection of one million electronic document images occupying 30 gigabytes of optical disk storage will require 12 hours to recopy onto new media. Replacement media will cost about $1,500. Recopying with document format conversion, a much more complicated task, involves greater effort and higher costs. When performed by a service bureau, typical conversion costs for electronic document images will range from five to 10 cents per page, plus a set-up fee of $10,000 to $15,000 for customized programming and file preparation. Thus, format conversion for a collection of one million document images will cost $50,000 to $100,000 plus the set-up fee and the cost of replacement media. If such conversions will be performed at five-year intervals to maintain the utility of electronic documents through successive system replacements, cumulative conversion costs can exceed half a million dollars for documents with a 50-year retention period.

In fact, such costs are likely to be even higher, because format conversion requirements are typically pyramidal. As an organization's backfile of documents recorded on optical disks or magnetic media grows, successive conversions will involve greater volumes of information and will require more time to complete. Many users consequently prefer human-readable paper or micrographic formats for the inactive stage of the document life cycle. Such formats do not require periodic recopying or conversions for long-term retention.

When properly authenticated, electronic documents are admissible as evidence in trials or other legal proceedings. Electronic documents may also satisfy legally mandated recordkeeping requirements specified in laws and government regulations, but they do not enjoy the broad acceptance of paper or microfilm for that purpose. Many U.S. government agencies, for example, maintain documents in electronic formats to satisfy reference requirements during the active stage of the document life cycle, but the National Archives and Records Administration, which has ultimate retention authority over such agencies, requires paper or microfilm for storage of permanent documents. U.S. government agencies that

implement electronic document management systems must also retain paper copies of permanent records or microfilm them. Similarly, many state archives, which have retention authority over state and local government records, require paper or microfilm for documents that will be retained longer than a specified period of time, typically 10 years.

MIXED-MEDIA SOLUTIONS

New technologies do not invariably supplant older document management methodologies. Micrographics and electronic formats offer alternatives to paper, but they have not completely replaced it. As the preceding discussion indicates, paper, micrographics, and electronic formats each have significant strengths for document management, but no single medium offers the best solution for all phases of the document life cycle.

Paper is familiar and convenient for reference copies, but paper documents can require large amounts of storage space and paper files can be difficult to organize and maintain. Electronic formats provide excellent retrieval functionality for the active stage of the document life cycle, but they are poorly suited to retention of information for long periods of time. In particular, the continued utility of electronic documents is adversely affected by the limited stability of computer storage media and the dependence of computer-processible information on specific hardware and software configurations. With its superior stability, compatibility, and compactness, micrographics is very well suited to long, even permanent retention of documents. Micrographics technology also provides good functionality for the active stage of the document life cycle, but users may prefer a completely computerized system for active reference, particularly in applications that have a workflow component.

Rather than competing with one another, paper, micrographics, and electronic formats can and must coexist in document management applications. A mixed-media approach combines the distinctive advantages of paper, micrographics, and electronic formats to more effectively address the active and inactive stages of the document life cycle. In mixed media implementations, document formats complement and supplement each other, the strengths of one format addressing the limitations of the others.

Micrographics, in particular, has a solid track record of integration with other document formats. Document management systems that combine paper with micrographics are commonplace. For over half a century, office documents have been maintained in paper form to satisfy active reference and interfiling requirements, after which they are microfilmed for compact, reliable long-term storage. Similar scientific and business libraries may prefer paper copies for reading and routing the latest issues of professional journals or other serial publications, but they often purchase microfilm or microfiche versions of annual volumes to save shelf space and eliminate binding costs. In COM applications, microfiche reports may be supplemented by one or two paper copies to facilitate annotations or other functional requirements that micrographics cannot easily accommodate.

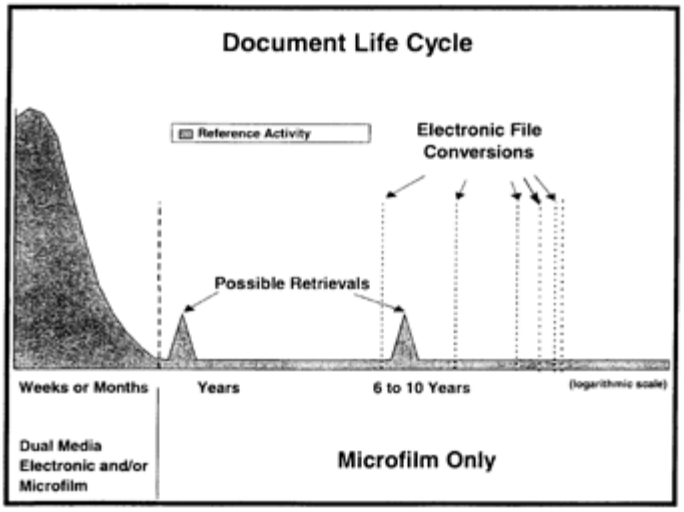

Figure 2

In computer-based document management implementations, micrographics can complement or supplement electronic document formats, delivering exceptional value in areas where electronic formats lack appropriate functionality. As depicted in Figure 2, documents can be stored for different purposes in both electronic and micrographic formats. The electronic versions offer convenient reference and distribution for the most active stage of the document life cycle, which may span several weeks or months, depending on the application. Micrographics provides reliable storage copies for less active stages, which may span years, decades, or- the case of permanent records-centuries. If the electronic versions are recorded on rewritable media, they can be deleted when retrieval activity diminishes, leaving the micrographic versions to satisfy continuing reference requirements. The rewritable electronic media can be reused for new documents. That approach conserves computer storage space, just as microfilming of paper documents conserves office space. Because micrographics technology can easily accommodate users' reference requirements, the dual media approach does not compromise retrieval functionality during less active stages of the document life cycle.

Such dual-media configurations can be implemented in several ways:

Documents can be converted to electronic formats and microfilmed in separate operations, either in-house or by a service bureau.

Integrated scanner/cameras can digitize documents and record them on microfilm in a single operation.

Documents can be microfilmed and the resulting images scanned for input to an electronic document storage system. Micrographic scanners are available for roll microfilm, microfiche, and aperture cards.

Finally, COM technology can produce micrographic storage copies from computer-processible text or electronic document images.

In many electronic document management implementations, numerous older records exist on microfilm Though less active than newer documents, such microfilm images often contain useful information that must be conveniently accessible. To avoid costly conversion of

microfilm backfiles to electronic formats, a computer data base can serve as an index to document images recorded on either microfilm or electronic media. In such hybrid implementations, retrieval workstations can include display and printing components for both document formats: high-resolution video monitors and laser printers for electronic document images and reader/printers for microfilm. Alternatively, reader/scanners, as described above, can convert microfilm images to electronic formats for display, printing, distribution, or storage on computer-processible media.

For completely automated media handling, sophisticated hybrid systems can combine hard disk arrays or optical disk autochangers for storage of electronic documents with specially designed microfilm jukeboxes. In such implementations, microfilm cartridges that contain images identified by a data base search are retrieved and mounted in a scanning mechanism for transmission to desktop retrieval stations for display or printing. Since the electronic documents and micrographic images can be displayed and printed on the same devices, the document format and storage media are transparent and irrelevant to the requester.

Conclusion

The well-established concept of a document life cycle recognizes the varying importance of convenient reference and reliable, cost-effective retention at different stages in the life of a document. As discussed above, no single storage medium can satisfy all life cycle requirements for every document management application. Paper, micrographics, and electronic formats each have distinctive strengths and limitations.

It is not the task of document management to prefer one storage medium over the others, but to match media to specific application requirements. Fortunately, the strengths of one storage medium often complement the limitations of another. Paper, micrographics, and electronic media are less competitors than allies. By combining paper, micrographics, and electronic formats to address specific life cycle requirements, mixed-media implementations can deliver useful solutions to document management problems that cannot be successfully addressed by a single methodology or technology. It is important to remember that technology is a means to an end, not an end in itself. The objective of document management should always be a proper business solution.