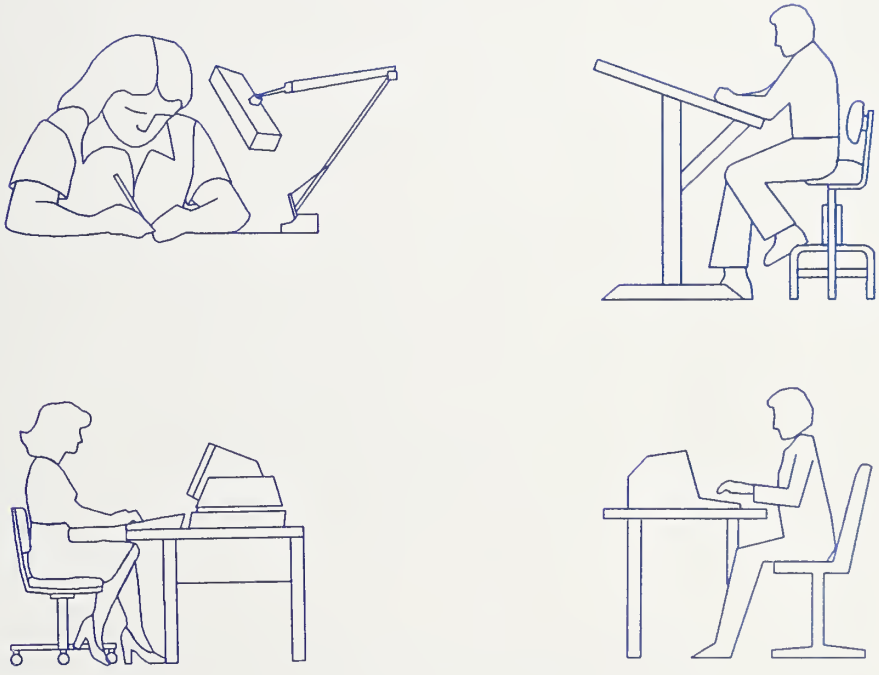
Computer Systems Technology

NIST Special Publication 500-164

Electronic Publishing: Guide to Selection

Lynne S. Rosenthal



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NOTE: As of 23 August 1988, the National Bureau of Standards (NBS) became the National Institute of Standards and Technology (NIST) when President Reagan signed into law the Omnibus Trade and Competitiveness Act.

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ABSTRACT

A primary challenge to Federal agencies and industry is the effective and consistent use and dissemination of information. Electronic publishing can help to meet this challenge by reducing the growing costs and increasing the efficiency and quality of producing documents.

Electronic publishing is the use of computer tools to create and combine different types of information and process them electronically rather than as pieces of paper to be assembled manually. As these tools have evolved, so has the number of publishing systems and potential applications. Managers and users must choose from literally hundreds of electronic publishing systems for the system that meets their organization's publishing needs.

The purpose of this report is to assist managers and users in making informed decisions on which systems are best for them. The report presents the technical and managerial choices and implications associated with selecting and using electronic publishing systems. A matrix of publishing capabilities and features is presented in the appendix to illustrate one method of comparing and selecting a publishing system.

KEYWORDS: composition; desktop publishing; electronic publishing; fonts; page layout; typography

Contents

I. Introduction

Electronic publishing has become an important technology in office automation and publication management. It can be used to improve the appearance and impact of documents while lowering publishing costs. However, the proliferation of publishing systems and potential applications makes it difficult for managers and users to make informed decisions on which systems are best for them.

Electronic publishing encompasses a broad range of technologies, computing services, and areas of expertise. By selecting the appropriate technologies and matching these with the appropriate applications, electronic publishing will improve productivity and reduce costs. The key to selecting the best publishing system begins by understanding your organization's publishing needs and goals along with an understanding as to how the different pieces of technology fit together in a publishing system.

The purpose of this report is to inform users and managers of the technical and management choices and implications associated with selecting and using publishing systems. The report defines electronic publishing, explores the advantages for using electronic publishing, presents selection criteria and concludes with a discussion of publishing issues.

The nature of this report requires citing vendors and commercial products. The presence or absence of a particular product or vendor does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the products identified are necessarily the best available.

II. General Discussion

A. Terminology

In general, publishing consists of the following processes (fig. 1):

- Creation: including the gathering, authoring, editing, and illustrating of information.
- Composition: including document design, page makeup, typesetting, and pagination.
- Reproduction: including printing as well as storage on electronic media such as magnetic tape or CD-ROM.
- Distribution: including handling of printed copies and electronic delivery systems.

Electronic publishing is the use of computer tools to perform these processes and produce documents. The tools are a result of the synthesis of word processing, graphics, electronic typesetting, software, information management, and communications services. The documents, which can range from simple letters or forms to in-depth technical manuals may contain text, tables, scientific notation, photographs, graphics, and/or line art.

Electronic publishing systems encompass a broad range of technologies ranging from personal computers to main frame computers, printing systems, scanners, storage devices, and software to integrate all these components. (Figure 2 shows the technologies that can be part of a publishing environment.) Text and graphics can be created on different input devices and output to one or several different types of output devices. Within a single publishing system any or all of these technologies may be used to produce and distribute documents.

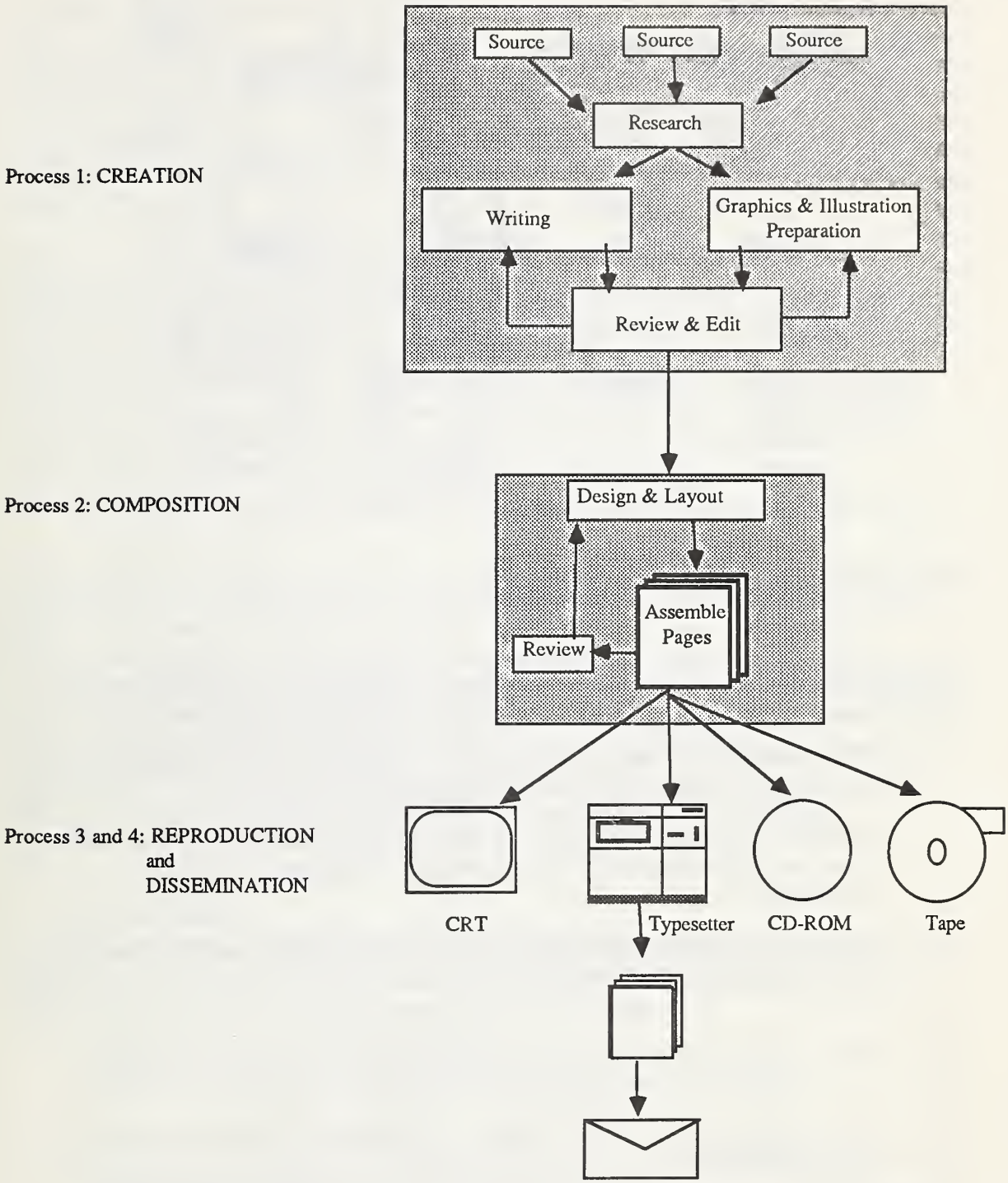

Figure 1. Publishing processes and workflow.

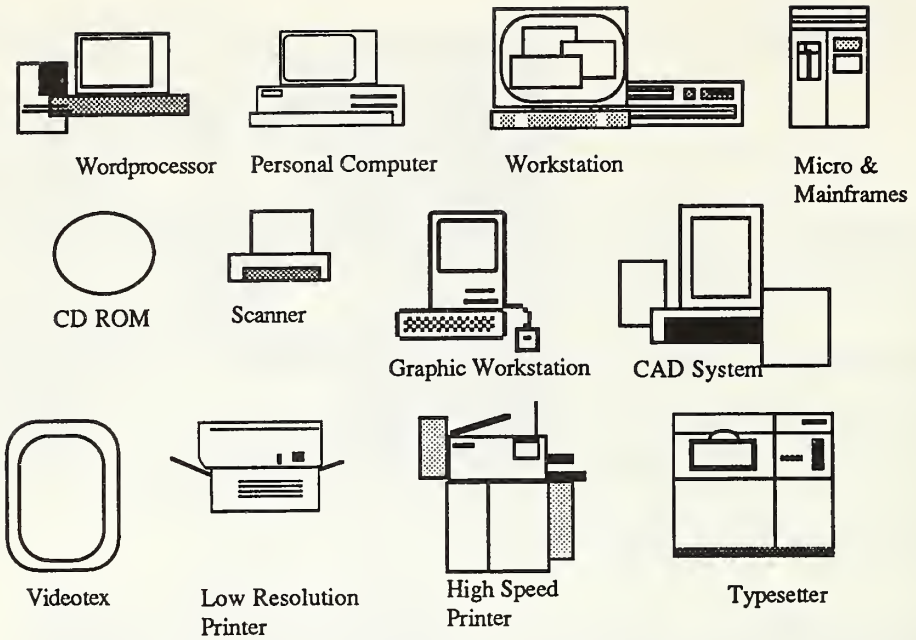

Figure 2. Examples of publishing technologies.

Underlying these publishing technologies are the infrastructures and services that are necessary to connect, integrate and manage the different publishing pieces.

- Communication systems (e.g., local and wide area networks, and private and public telephone networks) to provide connectivity.
- Database structures (e.g., information management systems and production management and tracking software) to manage information workflow.
- Document interchange formats (e.g., ODA[1], SGML[2] to integrate different types of information.

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1 Office Document Architecture and Interchange Format, ISO 8613:1988. ODA has been proposed as a Federal Information Processing Standard (FIPS).

2 Standard Generalized Markup Language, ISO 8879:1986 has been issued as FIPS PUB 152.

B. Historical Background

Before 1985, publishing was the purview of specialized practitioners in the publication, graphic arts, pre-press and/or printing organizations. For many, publishing a document meant providing these specialists with a prepared manuscript and then proofing document galleys and final pages prior to printing. There was little understanding or interest in the activities these specialists performed to produce high quality final products.

However, by 1985 technical advances in the form of workstations with increased computing performance, cheaper storage media, improved graphics displays, and new technology for reproducing images allowed for the introduction of desktop publishing (DTP). Capabilities that were once available only on specialized proprietary systems were now available on computing systems found in every office. Virtually every personal computer user could become a publisher. Authors of documents began to take an interest in the different aspects of publishing a document, performing many of the tasks themselves. Moreover, they began to look for methods of streamlining the publishing process to be more efficient and effective.

At first, most publishing products were categorized as either desktop publishing or professional publishing products. The distinction between the two categories was based on the number of users or publishers and the type of computer platform. Desktop publishing products were single-user software packages used to develop low to medium quality products such as newsletters, reports, and proposals for laser printer output. Professional publishing products were multiuser products that offered more sophisticated typographic and composition control for the production of large complex documents such as technical manuals, books, and newspapers. Figure 3 presents a generalization of the differences between these two publishing products.

C. Current Status

Today, the distinction between desktop publishing and professional publishing is disappearing as the products become more sophisticated in capabilities and/or available on a wider range of computer platforms. For example,

> Ventura 2.0 can be used in a multiuser environment, can handle large, complex documents, and can produce typeset quality documents.
>
> Interleaf Publisher, which was once only available on minicomputer networked workstations, is now available on the Apple Macintosh II and IBM PS/2 Model 80.

Additionally, other software applications, such as word processing packages, have embodied limited publishing capabilities in their newest software releases (e.g., WordPerfect 5.0, Word 4.0, and Wordstar 5). These word processors, sometimes known as word publishers, continue as authoring tools but may eliminate the need

Category	Desktop Publishing	Professional Publishing
Number of users	single user	multiple users
Document size	1-1000 pages	unlimited pages
Document complexity	simple to moderate complexity	high degree of complexity
Typographic	simple typography	high quality typography
Compositional richness	limited richness	full-featured high quality
Graphics capability	limited capability	full capability
Revision control	none	included in the system
cost	low cost	higher cost

Figure 3. Generalization of differences between desktop and professional publishing systems.

for a separate publishing package by enabling the author to produce near typeset quality final products. These new publishing products, including new versions of old favorites, are a result of increased user sophistication and demand for additional capabilities as well as continued advances in computing technology.

Since publishing activities may be performed by several people using different vendor systems it has become apparent that networking and integration is essential to the success of publishing. Consequently, emphasis is being placed on enabling users to exchange data between different computers and applications and to access a variety of input or output devices [20].

D. Benefits of Electronic Publishing

Electronic publishing can reduce the growing costs of producing documents and increase the efficiency and quality of final products. The benefits can be realized by organizations who do their own in-house publishing, use service bureaus, or are service bureaus. The benefits include:

- Cost savings due to a reduction in labor and production time, resulting in a faster turnaround time in getting information from the author to the reader.

  Document elements can be processed electronically eliminating the need to recreate information and correct errors from reentering the information.

  Use of outside service bureaus may be minimized or eliminated because the work can now be performed in-house.

- Improved quality of content, document design, and finished products, resulting in professional looking documents.

  Improved readability and clarity of visual relationships between information.

  Improved reader impact and impression.

  In-house control over the quality and appearance of the document.

- Improved efficiency in the document production process, resulting in a streamlined process and greater control over the process.

  Using information in electronic form eliminates redundancies by enabling users to share and reuse information.

  Improved document accessibility.

  Text and graphics can be merged electronically.

  Disseminate information in either printed or electronic forms.

  Ability to continually update and distribute current versions of a document.

  Flexibility in scheduling when work is performed.

- Increased security of information resulting in improved integrity and control over confidentiality of information.

III. Choosing a Publishing System

The guidelines presented in the following sections are intended to assist the reader in choosing an electronic publishing system. The guidance is intentionally general in nature since the answers are dependent upon many factors, including the type of application and user. This is not a checklist or a cookbook approach to evaluating electronic publishing, but rather a discussion of key issues that need to be addressed. This is not intended to be an exhaustive list of all possible issues but rather a starting point. It should be noted that a complete requirements analysis methodology is not included. The reader is referred to Section V, References for additional information on requirements analysis.

A. Examine and Analyze Organization Needs

To build a system, we need to think beyond the technology to how publishing works within the organization. As with the selection of any software application product, at least a minimal requirements analysis should be performed. Considerations should include: a determination of application requirements, a review of current and/or required hardware and software, and an evaluation of candidate publishing systems and alternatives. The benefits to be gained from electronic publishing should be compared to the benefits of not using electronic publishing as well as the benefits of implementing a partial system and using outside contractors to complete the job. Keep in mind that the benefits of electronic publishing are not achieved overnight. Electronic publishing may reduce costs and improve the quality of the document, but will take time to master and apply.

Each organization has different needs and publishes different types of publications. Each situation must be judged individually. It is necessary to examine existing production methods, production requirements, and management style. An organization needs to consider current needs as well as future needs. Since organizations publish different types of documents, a study of each major document type should be performed. The results of this analysis may call for either a single publishing solution or a combination of different publishing solutions.

B. Examine Current Publishing Methods

The goal of examining existing methods is to discover how current documents are being produced and determine how an electronic publishing system can improve upon existing methods. Moreover, an understanding of the current processes forms the basis for comparison with new system proposals. Areas to investigate include:

- Application: The type of publishing tools, personnel skills, and output media depend on the application.

  What are the types of publications, (e.g., manuals, reports, books, newsletters, newspapers, magazines, catalogs, presentations)?

  Who is the audience and what is the intended message (e.g., inform, sell)?

  What image do you want to leave in the reader's mind?

- Workflow: Improvements in efficiency can be achieved by understanding the processes that lead to the final published product and automating the process in the appropriate places.

  Who will be doing the work?

  Where do the documents originate?

  What are the steps or processes for producing the document and what are their purposes?

  Are there bottlenecks, redundant steps, duplication of effort?

- Current Systems: Since incompatibilities can exist between different hardware and software components of a system, it is essential to know the current inventory of hardware and software as well as the system configuration and connectivity.

  What software application programs are used to create information and what file formats are produced?

  Where are the systems located?

  Are systems networked together?

  Are information and/or peripherals shared through networking?

C. Examine Production Requirements

The goal of examining the production environment is to determine the characteristics and life cycle of the documents being produced.

- Document Attributes:

  What is the length of the document?

  Are the pages unique, one of a kind or a standard design?

  What mix of information comprises the document (e.g., text, graphics, raster images, tables, CAD illustrations)?

  How complex are the graphical elements (e.g., line art, charts, photographic halftones, 3-dimensional drawings, variable image rotation)?

  How many original designs will the document contain?

Is input being generated by multiple sources? by multiple people?

Where does the information originate?

What file format is the information in?

- Quality:

  What degree of typographic control and composition quality is required?

  What level of output quality is acceptable (laser output, typeset output)?

  How many fonts and what font sizes are needed?

  What level of typographic quality and control is required (e.g., minimal or extensive line and word spacing)?

  Is color required and if so, what type (e.g., one color, two colors, full color, named color)?

- Life Cycle:

  How often is the document produced?

  What is the turnaround time for producing the document?

  What are the document review and proofing procedures?

  How often will the document be revised?

  Is the document updated and reissued periodically?

  Will there be derivative products produced from the master document?

- Document Production:

  How many documents are being produced each month?

  Are several documents being produced at the same time?

  What is the printing volume of the document (e.g., 10 copies, 100 copies, 1000 copies, etc.)?

  Will the document be a collaborative effort involving several writers, editors, illustrators, etc.?

  Are the production tasks divided among several people and if so, across different organizational divisions?

  What are the storage requirements for maintaining and processing the document?

  Will documents be printed on demand?

- Organizational and Procedural Strategy:

  Will there be an organizational division responsible for producing all finished document?

  Will users prepare documents for publishing and/or publish their own documents?

  Is quality control an important issue?

IV. Electronic Publishing Issues

To select and effectively manage the publishing system, it is necessary to examine and understand the technological, managerial, and design issues related to publishing. The issues presented are general in nature, pertaining to general principles and directions. An explanation of each issue is followed by a discussion of some of the current and potential ways of dealing with the issue. The list of issues is not exhaustive, but contains many of the more salient concerns with respect to choosing and operating a publishing system.

A. Information Integration

Basic to electronic publishing is the ability to integrate different types of information into a single document. The information, whether it be character, graphic, tabular, or mathematical in nature, may be created on a variety of text and graphics systems. The different text formatters, graphics drawing packages, CAD systems, and scanner software, have their own conventions for representing data, formatting instructions, and organizing the structural relationships among its components. This variety of representations presents an obstacle to integration. The publishing system must be able to understand the different data formats and either manage the different formats or incorporate the information into its own internal data format.

Currently, we deal with incompatible data formats by using converters or filters to translate the information into a form understood by the publishing software. These converters may be an integral part of the publishing software or available separately by the vendor or third party vendors. However, this method of converting formats may be inadequate and uneconomical because:

- the appropriate conversion software is not available,
- the conversion software does not handle graphics,
- the conversion process may cause some loss of data and format information, or
- the conversion process may be cumbersome, requiring several conversions before the information is in the appropriate format.

One solution to overcoming the conversion problem is to provide an information interchange mechanism that is independent of any system, device, application, or data. Standards are such a mechanism. Using standards, information can be effectively shared among dissimilar systems and integrated together. Moreover, the quality and consistency of the information is assured. One standard, commonly referred to as ODA (references [1,8,11,16]), provides for the representation and encoding of text and graphic information so that it can be transferred between different systems irrespective of their manufacture [8]. As a proposed FIPS, ODA will be used by

Federal Government agencies when acquiring document/text processing systems. Moreover, each system acquired by Federal agencies shall include appropriate ODA translators [11].

Until implementations of ODA are readily available, conversion and import filters will continue to be the method of achieving information integration. To ensure a successful conversion, one in which your information is understood by the publishing system, you must:

1. consider the type of information you use and its data formats,
2. determine if conversion software or import filters are available from these formats to the publishing software, and
3. evaluate the effectiveness of the converter or filter (e.g., How easy is it to use? Is there any loss of content or formatting information?).

B. Document Printing

Once completed, the document is either printed, displayed, or stored electronically for future presentation. In order to print the document, it must be represented electronically in the language of the printer[3]. This language, referred to as a page description language (PDL) or printer command language (PCL), is used to describe to the printer how the finished page should appear. The most well known languages include PostScript, Interpress, and HP PCL. These printer languages are device specific. This means that the document can only be printed on output devices that understand the particular language.

Typically, the publishing software will automatically create the document in the printer language that was specified during installation. A problem arises if either:

1. the type of output device that will be used is unknown, or
2. the document will be printed on several different output devices, each with a different PDL or PCL.

These problems may occur when your organization supports several different output devices, uses a service bureau to print your documents, and/or prints on-demand. On-demand printing allows the document to be stored and interchanged for presentation (i.e., printing or display) at a later time and/or at other locations. The document printing could be distributed to the various sites that need the document. They, in turn, print only the number of copies and/or sections of the document that are needed. This would reduce the need to warehouse thousands of copies of a document and eliminate the problem of being temporarily out of print.

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[3] Printer is used generically to describe any output device, including laser printers, typesetters, and film recorders.

The most common method of solving this problem is to:

1. declare a single PDL or PCL as the only printer language that will be used, or
2. represent the document in several PDLs or PCLs.

Solution 1 requires that a specific class of output devices[4] be designated as the official or in-house standard device and the only device that will be used. Although solution 2 will allow an organization to support a variety of output devices, representing the document in several printer languages requires large amounts of storage and requires the document to be reformatted and repaginated for each device. Moreover, a document processed by one device may not be formatted correctly and may alter the font characteristics when processed by another device[5]. The differences may be in appearance, accuracy, and composition and are due to differences in the output device's font representation, resolution, and ability to handle graphics.

Currently, work is being conducted to produce a standard page description language, SPDL (references [10,14,16]). The SPDL[6] will be device-independent and enable a document represented in SPDL to be output to any display or printing device. It will be capable of representing all types of information, intermixed in any way, as well as black and white, multi-level monochrome, or full color documents. Moreover, the SPDL will neutralize any output device differences that may affect the quality of the document.

C. Document Quality

Electronic publishing systems have provided users with the technology to design and produce high quality, aesthetically pleasing documents. However, just having the technology does not guarantee quality results. Producing quality results requires knowledge and skills in areas such as page design, graphics arts, and typography. This is not to say the user is incapable of producing good-looking documents. But rather, the potential for producing low quality, aesthetically unsatisfactory documents exists. Moreover, since everyone has his or her own idea of what looks good,

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4 Class of output devices are all output devices that understand the same PDL or PCL.

5 Fonts may appear differently even when printing the document on devices that use the same PDL. This is due to the method of representing fonts and his or her metric information (i.e., the size of the font, number of characters to place on a line, and the character spacing and kerning [2]). For example, on the Apple Macintosh, fonts are assigned an ID number. Due to the limited number of ID's, the ID number may be shared by different fonts, causing conflicts [18]. Apple is addressing this problem.

6 Work on SPDL is being conducted by the International Organization for Standardization (ISO), the American National Standards Institute (ANSI), and the National Institute of Standards and Technology (NIST). It is estimated that SPDL products will be available by the late 1990's.

the same type of document may have several different looks, each reflecting the artistic taste of the producer (e.g., fig. 4). This inconsistency among documents prevents readers from differentiating documents by their format (e.g., fig. 5).

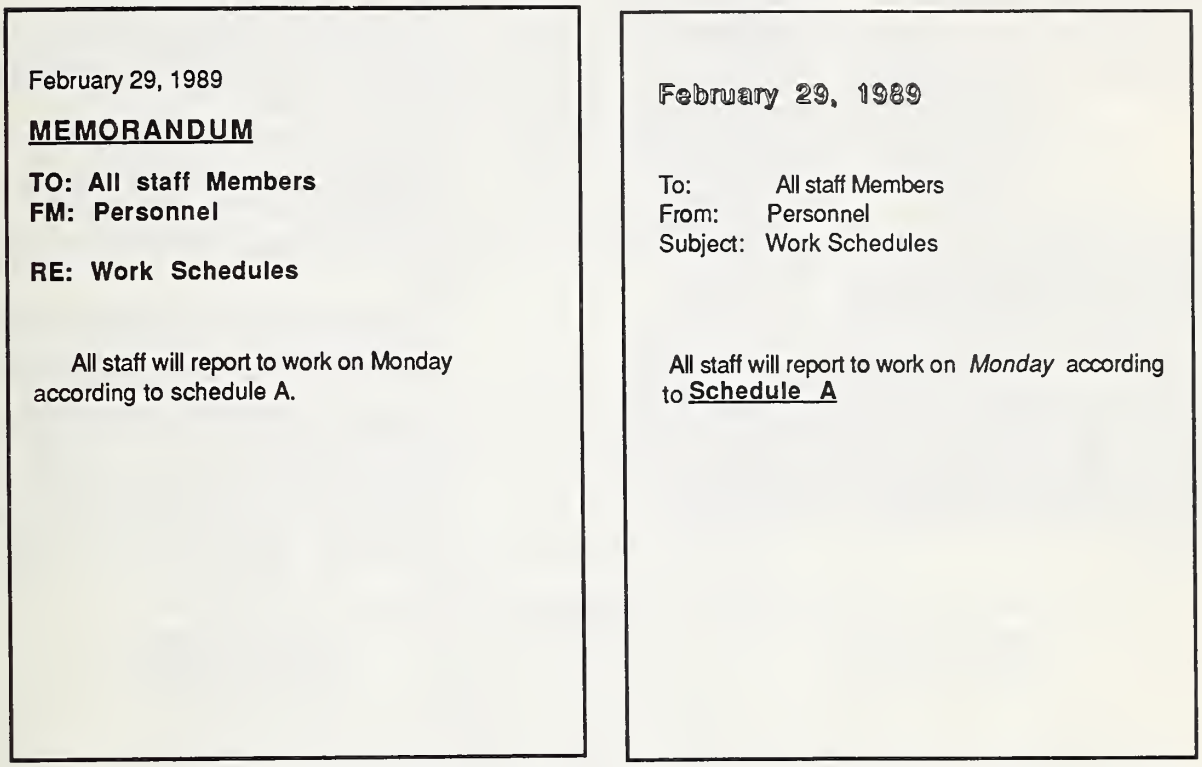
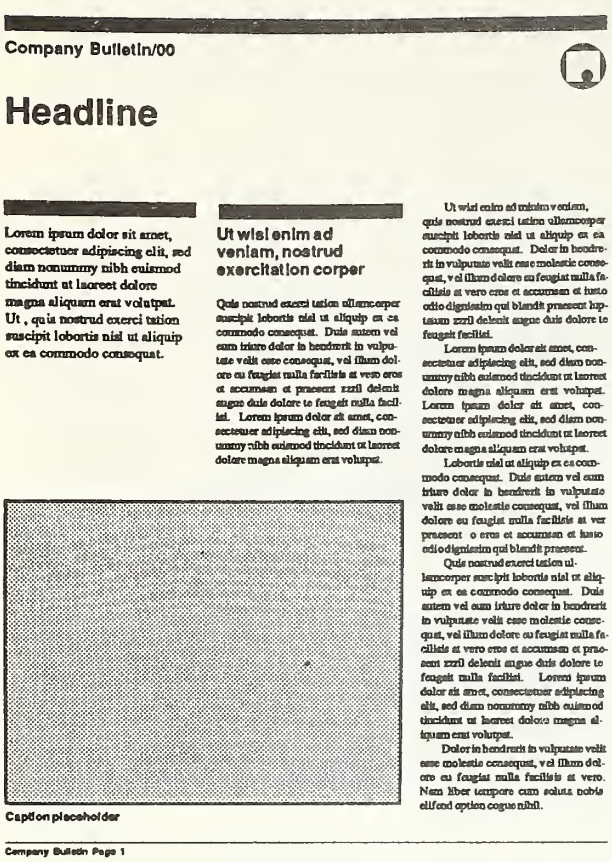
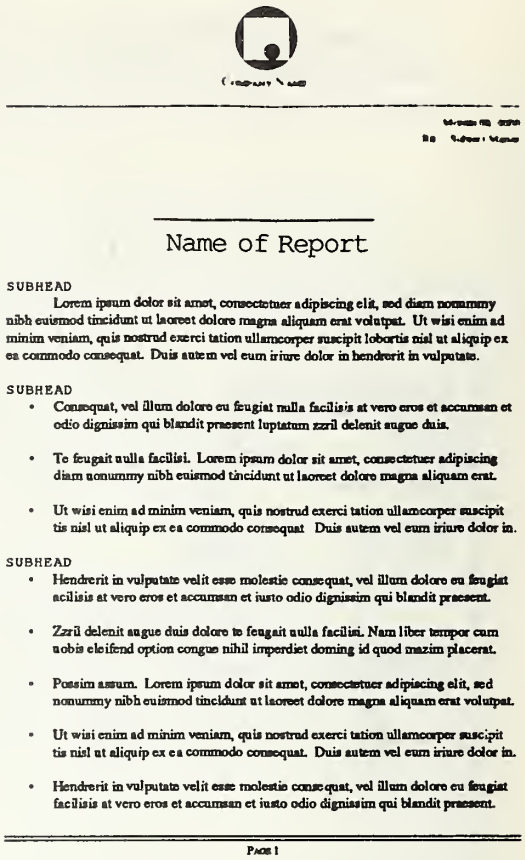


Figure 4. Examples of different document designs of the same document.



Company Bulletin
Document Style



Executive Report
Document Style

Figure 5. Examples of different document types with standardized publication styles. From the document format, the reader can easily recognize the company bulletin from the executive report.

One method to ensure document quality is to establish a publication style and require everyone to use it. Publication styles, often called templates or style sheets, are created for a class of documents (e.g., memoranda, technical manuals, executive summaries, product catalogs). The basic premise of a publication style is the separation of the document content from its layout and format. The author or artist creates the content and a document designer controls the design. Tags, markup, or styles represent the various elements of the document (e.g., paragraphs, headings, subheadings, bulleted items). Associated with each tag are formatting specifications such as:

> font and font sizes, margins, alignment, indentation, vertical spacing, tabs, columns, rules, boxes, pagination parameters, and graphic placement preferences.

The use of publication styles should be considered for documents that are:

- structured,
- reuse the same design,
- separate the design and editorial responsibilities, and/or
- require a consistent look.

The International and proposed Federal standard, Standard Generalized Markup Language, SGML (references [1,12,13,16]), is another method to ensure document quality. Although SGML is not a publication style, it can provide the same effect. SGML is more comprehensive than a publication style. It provides a syntax for describing the content and structural elements of a document through markup and the document type definition (i.e., a definition of all document elements and their relationships). Formatting specifications are associated with the markup when the document is processed by a publishing system or formatter.

D. Document Management

The publishing process is often divided among several people and across several departments. This distributed approach can make managing the production process difficult. Successful document management starts with a management plan. Taking into account all phases of the document development cycle, the plan should at least:

- define the workflow and job responsibilities,
- establish file naming and organization conventions so that information may be known and shared among contributors,
- specify revision methods and control, and
- specify the job tracking information that is desired and the method by which tracking will be accomplished.

Document management tools can aid in managing the process by:

- tracking the information workflow and status of projects,
- providing revision control and an audit trail of all changes and annotations, and/or
- providing file management capabilities including retrieval of documents by key words, dates, and other criteria, preview images at low resolution (to confirm identity), and file security and access control.

These tools may be part of the publishing software or a separate software utility. Most minicomputer-based publishing systems (e.g., Context, Interleaf, HyperScribe) have built-in document management tools. However, until recently, dedicated document management tools were unavailable for desktop systems. Typically, the document manager and contributors would track and manage documents either manually, using job tickets, status reports, and the like, or electronically, using database or

spreadsheet software. Today, document management tools are being included in desktop systems (e.g., IMSI PagePerfect) as well as being available from third party vendors (Odesta's ODMS/Matrix and New Riders Publisher's Desktop Manager).

The use of document management tools should be considered for publishing applications that:

- involve multiple people and/or multiple organizations,
- consist of several document pieces, and
- undergo extensive review and revision cycles.

E. System Capabilities and Features

As expected, each publishing system is designed to achieve different objectives and stress the power and importance of different capabilities and features. Consequently, each has its strengths and weaknesses and is appropriate for a variety of users and applications. Two factors that influence which capabilities and features are offered by the publishing system are where the content is created and how the system is oriented.

Content Creation: Not all publishing systems have the ability to create and manipulate content (e.g., text, graphics, tables, equations, raster images, etc.) within the publishing environment. Many publishing systems lack extensive writing or drawing tools such as word processors, draw and paint tools, and spell and grammar checkers. Although limited editing and graphics capabilities may be provided, content is generally imported from word processing and graphics applications. Legend, Context, Interleaf, and Scribe are examples of publishing systems with extensive writing/drawing tools, whereas, Pagemaker, Ventura, and Xerox 701 System provide limited writing/drawing ability.

System Orientation: Publishing systems may be layout oriented or document oriented. Layout oriented systems are most suitable for preparing short documents with unique designs, where flexibility and attention to graphic details are important. These systems allow the user to manually place and visually adjust the document elements and their design. In contrast, document oriented systems are most suitable for preparing long, structured documents, or multiple documents with the same design. These systems offer automatic capabilities for laying out the document according to a specified design and paginating the document with headers/footers, automatic page and paragraph numbering, footnotes, table of contents, indexes, etc.

Since many systems list the same capabilities and features, comparing the lists of one system to another may be futile in determining the best system. When comparing capabilities and features of publishing systems, not only is it important to find out if the system performs the function but also:

- how important is the function to your application,
- how well is the function performed,
- how is the function implemented,
- how powerful are the automatic functions,
- how much control does the user have,
- how easy is it to use, and
- will you be more productive with this function.

To conduct this comparison and evaluation, it may be helpful to construct a matrix listing the capabilities and functions and assign a weighted value to indicate the desirability, degree of user control, and ease of use. Appendix A provides a sample evaluation matrix.

F. System Configuration: Components

A publishing system is not a single technology or piece of hardware, but a synthesis of computers, input devices, output devices, and software. The system may consist of a personal computer, mouse, laser printer, and publishing software, or be a conglomeration of personal computers, workstations, minicomputers, CAD systems, scanners, laser printers, typesetters, CD-Rom devices, and software. Users have the ability to tie different types of computers together and/or purchase the system components from different vendors as their system needs evolve or as new products emerge. However, this freedom to mix and match systems and peripherals can create configuration problems such as incompatible hardware and/or software, non-working systems or systems that produce erroneous results.

The system integrator must configure the system so that the hardware and software work together. This is accomplished by:

- understanding the requirements, capabilities, and limitations of the hardware and software,
- acquiring all the appropriate components and required subcomponents such as a serial port, cables, mouse, graphics monitor, additional memory, fonts, printer toner, paper, etc. to set up the system,
- ensuring that the appropriate versions of software are used,
- acquiring the necessary device drivers and conversion software to support the different components, and
- installing, initializing, and tailoring the system.

With so many different components and possible configurations, the system integrator's job is not always an easy one. Depending upon the components selected and the vendor's commitment to promoting a heterogeneous publishing environment, the system configuration task may be as easy as following an automated menu-driven procedure or as complex as programming device drivers and translators, diagnosing and soldering cable pin connections, and reconfiguring existing system parameters. The user may wish to do the integration, hire a consultant or value-added retailer to do the work, or purchase a turnkey system in which all the components work together in a seamless manner (e.g., AST and Xerox publishing systems).

The key to this configuration confusion is to purchase products that adhere to or promote the use of international, national, or government standards as well as industry-standard hardware and software. Use of these products facilitate the use of off-the-shelf components and system extensibility as well as the ability to achieve a seamless integrated environment. These products, often called Fourth Wave systems, encompass application software programs, input and output devices, computer systems, networking, and information management and data exchange services. Examples of standards used in Fourth Wave systems are listed in figure 6.

Component	Standard
Operating System	POSIX DOS, VMS, UNIX Macintosh
Data Interchange and Data Formats	SGML, ODA/ODIF CGM,GKS, IGES, ASCII, TIFF, PCX WKS (Lotus 1-2-3)
Database Access	SQL
Data Communications	OSI, TCP/IP, SNA, DECNET
Network File Access	NFS, RFS
User Interface	XWindows, Microsoft Windows, GEM, Macintosh

Figure 6. Examples of Fourth Wave system standards.

G. System Components: Functionality

In addition to configuring the system components, the system integrator must ensure that the system will consist of all the appropriate and necessary components. In fact, the success of performing a publishing task and achieving the desired results depends upon this. For example, to include a black and white photograph in a document, not only is a grayscale scanner needed, but also:

- software to manipulate the pixels of the scanned image, in order to cleanup or enhance the image,
- publishing software that understands the format of the scanned image needed,
- a high resolution monitor that can distinguish the different levels of gray,
- sufficient memory in the computer system to store and process the image, and
- an output device with sufficient memory to represent the document with the embedded image and that can produce continuous tone output (e.g., phototypesetter).

Time and effort should be spent ensuring that the publishing system will perform the necessary functions. Start by reviewing each component's specifications and requirements and plan to configure the system accordingly. A demonstration of the components and system is helpful in knowing which components are necessary and how they work together. Moreover, a demonstration provides assurances that the desired results are attainable.

H. Networks

As stated earlier, publishing is a group activity. Rarely does the publishing environment consist of one individual. Rather, there are likely to be several authors, artists, editors, reviewers, and designers working together to publish a document. Through networking, the publishing processes and information can be distributed across a collection of computer systems and people. This improves productivity by allowing users to collaborate through electronic file sharing and mail capabilities as well as distributing the work among the different publishing systems.

However, networking the various computer systems may not solve all the connectivity needs. Issues such as information integration and file access and control must be addressed to successfully share and exchange information.

Information Integration: As discussed in section IV.A, each application program represents data in its own file format. Consequently, we can transfer the information between the different networked systems, but the information is useless in its present

form. It cannot be read, manipulated, edited, printed, etc. until it is converted into a format understood by application programs on the receiving system.

File Access and Control: In a networked environment, problems may arise when users have access to the same files and/or all files. For example, if two users try to edit the same file at the same time, an editing conflict occurs. A file locking capability is needed to prevent users from simultaneously accessing the same file and handling other problems of contention. Additionally, access controls should be imposed to limit user access to files (e.g., preventing a user from accessing a particular file or allowing a user to read a file, but not edit it).

The solution to these issues is found in both the networking and publishing software. Most publishing systems provide conversion software for importing information created by other software programs. Since desktop publishing systems were designed as single-user systems, most desktop publishing systems lack file access and control capabilities. However, many publishing vendors have network versions of their publishing software. These networked versions allow several users to invoke the publishing software at the same time and provide file locking and access controls. Moreover, the network software may also provide file locking and user access controls.

V. Summary

Electronic publishing offers a wide range of opportunities for effective and cost efficient production of documents and publications. It can reduce costs by eliminating or minimizing the need for outside vendors for copy preparation, typesetting, and composition. It can increase productivity by streamlining the workflow and providing greater control over the publishing processes. And, it can improve document quality by providing users with the tools necessary to create professional looking documents. However, these potential benefits can only be realized if the appropriate electronic publishing system is installed in the proper manner with the proper management.

Many factors must be considered in the selection and planning of an electronic publishing system. These factors encompass not only the equipment and publishing software, but also the structure of the organization, its needs, and the type of publications it will be producing. There are two major areas that require investigation: existing methods and publishing issues.

1. Existing Methods: The organization's current needs and methods for producing documents must be understood. This involves examining:

   the publishing procedures including the nature of the publications, workflow, and current systems in use,

   the production requirements including the document attributes, quality, and life cycle, and

   the organizational strategy including the policies and procedures for publishing documents.

Only by understanding these aspects of the current publishing environment can the manager or user know what is needed to improve the way publishing is currently performed.

2. Publishing Issues: The technological, managerial, and design issues related to publishing must be understood. This involves examining:

   information integration - the ability to combine different types of information from different systems,

   document printing - the ability to print or display the document on a variety of devices,

   document quality - the ability to produce high-quality, consistent-looking documents,

   document management - the ability to control and keep track of the document throughout its development cycle,

system capabilities and features - the ability to evaluate and select an electronic publishing system,

system configuration - the ability to create an integrated publishing environment with all the appropriate hardware and software components, and

networks - the ability to interchange documents or parts of documents among the document contributors and between systems.

Only by understanding these issues can a publishing system be selected and configured with the appropriate components as well as operated and managed in a consistent and productive manner.

In summary, a successful electronic publishing system is the result of a selection process supplemented by management direction and a defined structure for its implementation.

VI. References

[1] Adler, Sharon. "SGML and ODA: Two Standards for the Interchange of Documents." *TAG The SGML Newsletter.* Vol. 1, Issue 4.

[2] Barcroft, Taylor. "Accessing Large Font Libraries." *MacWeek Graphics Arts.* October 10, 1988.

[3] Barkley, John. *Personal Computer Networks.* NBS Special Publication 500-140. July 1986.

[4] Bloomfield, Craig. "Choosing a Page Composition Program That's Right for You." *PC Publishing.* April 1988.

[5] Doebler, Paul. "Who's the Boss?: Sorting Out Staffing and Workflow Issues." *EP&P* April 1988.

[6] Edwards, Stephen E. "Hyphenation and Justification: The Foundation." *The Seybold Report on Desktop Publishing.* April 4, 1988, Vol. 2. No. 8.

[7] Hansen, Rebecca. "Navigating the Murky Waters." *CG Magazine.* Spring 1988.

[8] Hunter, Roy, Per Kaijser, and Fran Nielsen. "An Overview of the Office Document Architecture (ODA) Standard." *Computer Communications,* Special Issue: Office Systems Standards. April 1989, Vol. 12. No. 2.

[9] Haugland, Henry. "Debunking the Myths of EP&P For the Serious Buyer." *EP&P.* March 1988.

[10] ISO JTC 1/SC 18/WG8 N715. *Text and Office Systems: Standard Page Description Language* (SPDL), 4th Working Draft. 1988.

[11] ISO 8613:1988 (E). *Information Processing Text and Office Systems: Office Document Architecture (ODA) and Interchange Format.*

[12] ISO 8879:1986. *Information Processing Text and Office Systems: Standard Generalized Markup Language (SGML).*

[13] Moline, Judi. *Document Interchange Standards: Description and Status of Major Document and Graphics Standards.* NISTIR 88-3851. September 1988.

[14] Polk, William Timothy. *PDLs: A Technology Assessment.* DRAFT NISTIR. October 1988.

[15] Rankin, Christine. "Making the Right Connections: LANs." *Datapro Reports on Electronic Publishing Systems*. September 1988, Vol. 3, No. 9.

[16] Rosenthal, Lynne. *Text and Graphics Standards in the CALS Publishing Environment.* Draft NISTIR. October 1988.

[17] Rosenthal, Lynne, Elizabeth Parker, Ted Landberg, and Shirley W. Watkins. *Guidance on Requirements Analysis for Office Automation Systems.* NBS Special Publication 500-147. March 1987.

[18] Rupprecht, Gene. "Working with a Service Bureau." *PC Publishing*. November 1988.

[19] Seybold, Jonathan W. "Publishing Joins the Mainstream." *The Seybold Report on Publishing Systems*. January 31, 1988, Vol. 17, No. 9.

[20] Seybold, Jonathan W. "Desktop Publishing 1988: A Conference Perspective." *Seybold Desktop Publishing Conference*. September 14, 1988.

[21] "The 1988 Guide to Desktop Publishing for PC-Compatible Systems." P*ersonal Computing.*

Appendix A: Evaluation Matrix

The sample evaluation matrix is not intended to be a comprehensive listing of all possible capabilities and features or an evaluation criteria. The objective of the example is to present one method of comparing capabilities and features. The reader is encouraged to modify this matrix or create his own to accommodate his application requirements and user preferences.

The capabilities and features listed in the matrix are divided into sections to assist in the evaluation. Each section focuses on a particular aspect of electronic publishing systems. The capabilities and features are evaluated against four criteria:

- importance level (IMPO): Is this capability or feature required to produce the type of documents the organization generates?
- ease of use (EASE): How easy is it for the user to implement this feature?
- user control (USER): How much control does the user have in adjusting or fine-tuning this capability/feature?
- performance indicator (PERF): How well is the overall performance of this capability/feature?

The rating values are derived from the requirement of the capability or feature to meet the specific needs of the organization. The values used in these examples are hypothetical, meant for illustration purposes only.

It is assumed that the reader has a general understanding of publishing terminology. Consequently, little if any explanation of the terminology is included with the matrix.

A. Example Matrix

The Bogus organization is producing long, structured documents that undergo multiple revisions and are the result of collaborative work. To meet this need, the Bogus organization has compared two publishing systems, A and B.

The evaluation process to select a publishing system for the Bogus organization produced the following matrix. The columns are divided in two, showing the evaluation scores for systems A and B, side by side. The matrix columns are defined by:

Column Id	Rating		Explanation
IMPO	0-3	0=nonessential 3=essential	indicates the weighted requirement of the feature to meet the specific needs of the organization
PRES?	X	X=present =not present	indicates that the feature is/is not present in the system
EASE	E,D	E=easy to use D=difficult to use	indicates the ease or difficulty of using the feature
USER	0-3	0=no control 3=high degree of control	indicates the amount of control the user has to adjust the feature to specifications
PERF	0-3	0=low performance 3=high performance	indicates the system's ability to perform the feature and meet user's expectations
SCORE	0 A,B, a,b	0=no preference A,B=strong preference a,b=weak preference	indicates the preferred product

IMPO	Features	PRES?		EASE		USER		PERF		SCORE
		A	B	A	B	A	B	A	B	
	User Interface									
2	icons	X	X	E	E	0	0	2	2	0
2	menus	X		E		0		2		A
3	keyboard shortcuts	X	X	E	E	1	1	3	3	0
	screen view:									
3	full page display	X	X	E	E	0	0	3	3	0
1	magnify	X	X	E	E	1	2	3	3	b
3	WYSIWYG	X	X	E	E	0	0	3	3	0
3	user defined macros	X		E			3		3	A
	Input Formats/Filters									
	Graphics:									
3	IGES	X		E			0		1	A
3	CGM	X	X	E	E	0	0	2	2	0
2	TIFF	X	X	E	E	0	0	2	2	0
0	PCX									
0	PICT									
3	Lotus WKS	X	X	E	E	0	0	2	1	A
	Text									
3	SGML	X	X	E	E	2	1	2	2	A
1	DCA	X	X	E	E	0	0	1	1	0
3	ASCII	X	X	E	E	0	0	3	3	0
	Output Formats/Filters									
	Page Description Lang.:									
3	Postscript	X		E			0		3	A
3	Interpress	X	X	E	E	0	0	3	3	0
3	PCL									
	Text Editing									
1	conventional text editor	X	X	E	E	0	0	1	1	0
3	copy	X	X	E	E	0	0	3	3	0
3	delete	X	X	E	E	0	0	3	3	0
3	paste	X	X	E	E	0	0	3	3	0
1	rotate		X		D		3		3	b
3	search/replace (text)	X	X	E	E	0	0	1	1	0
3	search/replace (typespecs)		X		E		0		3	ə
3	undo	X	X	E	E	0	0	3	3	0
	Graphics Editing									
2	copy	X	X	E	E	0	0	3	3	0
	draw tools:									
3	Arrowhead		X	E			0		3	B
2	Boxes	X	X	E	E	0	0	3	3	0
0	Circles	X	X	E	E	0	0	3	3	0
3	Lines	X	X	E	E	0	0	3	3	0

IMPO	Features	PRES?		EASE		USER		PERF		SCORE
		A	B	A	B	A	B	A	B	
2	paste	X	X	E	E	0	0	3	3	0
3	rotate	X	X	D	E	0	0	3	3	B
1	fill patterns	X	X	E	E	0	0	3	3	0
1	fill colors	X		E			0		3	a
1	line width	X	X	E	E	0	0	3	3	0
0	pixel editing		X		E		0		2	b
	Document Design									
2	interactive document design	X	X	E	E	0	0	2	2	0
3	structured documents	X	X	E	E	2	2	3	3	0
	page size:									
3	8.5 x 11	X	X	E	E	0	0	3	3	0
0	11 x 17	X	X	E	E	0	0	3	3	0
1	custom	X	X	E	E	1	2	3	2	a
3	templates	X		E			3		3	A
3	style sheets	X	X	E	E	3	3	3	3	0
1	irregular shaped text blocks									
1	irreg shaped graphics blks		X		E		2		2	b
	Composition									
1	character spacing	X		E			2		1	a
1	word spacing	X		E			2		1	a
1	kerning	X		E			2		1	a
	justification:									
3	justified	X	X	E	E	0	0	3	3	0
3	flush left	X	X	E	E	0	0	3	3	0
3	flush right	X	X	E	E	0	0	3	3	0
3	folio	X	X	E	E	0	0	3	3	0
	hyphenation:									
3	expandable dictionary	X		E			3		1	A
3	algorithm	X	X	E	E	0	0	1	1	0
2	characters before/after -		X		E		1		1	θ
2	consec. hyphenated lines		X		E		1		1	B
	tabular matter:									
3	automatic adjustment	X	X	E	E	0	0	2	1	A
3	across pages	X		E			0		2	A
	mathematical notation:									
3	adjust spacing		X		D		2		2	B
3	levels of super/subscripts	X	X	E	E	1	2	1	1	B
3	symbol character set	X	X	E	E	0	2	2	2	B

IMPO	Features	PRES?		EASE		USER		PERF		SCORE
		A	B	A	B	A	B	A	B	
	Pagination									
1	interactive	X	X	E	E	0	0	2	2	0
3	batch	X	X	E	E	0	0	2	2	0
2	user defined regions	X	X	E	E	1	2	2	2	B
3	vertical justification	X		E			2		3	A
3	multiple columns	X	X	E	E	2	2	3	3	0
2	widow/orphan control	X	X	E	E	3	2	3	3	0
3	page fidelity	X	X	E	E	2	2	3	3	0
	headers/footers:									
3	multiple	X	X	E	E	0	0	3	3	0
3	user positioning	X	X	E	E	2	2	2	2	0
	numbering/referencing:									
2	chapter	X	X	E	E	0	0	2	2	0
3	page	X	X	E	E	0	0	3	3	0
3	footnote	X	X	E	E	0	0	2	2	0
3	figure references	X	X	D	E	0	0	3	3	B
3	cross references	X	X	D	E	0	0	3	3	B
3	table of contents	X	X	E	E	0	0	3	3	0
3	index	X	X	E	E	0	0	3	3	0
	Document Management									
3	huge documents	X	X	E	E	0	0	3	3	0
3	merge document sections	X	X	E	E	3	3	3	3	0
3	retrieve section by reference	X	X	E	E	3	3	3	3	0
1	libraries of text	X	X	E	E	3	3	2	2	0
2	libraries of graphics	X	X	E	E	3	3	2	2	0
	version control:									0
3	multiple version	X		E			3		3	A
3	document status	X		E			3		3	A
3	file security	X	X	E	E	1	0	3	3	A
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A primary challenge to Federal agencies and industry is the effective and consistent use and dissemination of information. Electronic publishing can help to meet this challenge by reducing the growing costs and increasing the efficiency and quality of producing documents.

Electronic publishing is the use of computer tools to create and combine different types of information and process them electronically rather than as pieces of paper to be assembled manually. As these tools have evolved, so has the number of publishing systems and potential applications. Managers and users must choose from literally hundreds of electronic publishing systems for the system that meets their organization's publishing needs.

The purpose of this report is to assist managers and users in making informed decisions on which systems are best for them. The report presents the technical and managerial choices and implications associated with selecting and using electronic publishing systems. A matrix of publishing capabilities and features is presented in the appendix to illustrate one method of comparing and selecting a publishing system.

12. KEY WORDS *(Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)*

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