Reprint: Digital Workflow: Managing the Process Electronically

Beebe, Linda; Meyers, Barbara

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Between the invention of the printing press and that of the computer, developments in printing and publishing technology occurred in small increments over long periods of time. In those intervening centuries, the process of preparing manuscripts for publication remained fairly static. In the last half-century, however, the pace of change in printing and publishing technology has become dynamic. Now changes in technology come about in a matter of years, sometimes even months. And with those changes, the steps in the process of publication may now be controlled, tracked, and subsumed into one continuous electronic system often called digital workflow.

Scholarly publishing encompasses six major functions:

- Content Development
- Publisher Enhancements
- Manufacturing
- Distribution
- Marketing
- Archiving

Over the years publishers have incorporated discrete automation applications for these major functions. Now scholarly publishers can create a workflow linking all the steps in a completely digital process.

This white paper presents a snapshot of current technologies used throughout publishing and printing. Over the past 30 years, computers have changed procedures for preparing publications dramatically. First, photocomposition replaced hot type, but layout artists still pasted up pages, often using decorative tapes and markers to create illustrations. Gradually, the industry moved to creating pages in the computer; printers worked from sheets of resin-coated paper or even film generated by imagesetters. With the advent of desktop publishing programs, publishers began supplying disks to printers; however, advertising and many illustrations remained separate, often on hard copy. Today publishers can prepare fully integrated digital files containing all content (illustrations, text, and advertising) that printers can receive.

The 1990s brought rapid developments in printing technologies, publishing software, computer applications, and the Internet, that facilitate the flow of information from author to reader. These new technologies present several options for scholarly publishers and their partners engaged in the manufacture, storage, preservation, and retrieval of information. Implementing a digital workflow can result in streamlined processes, increased quality, and potential for lowering internal cost structure.

"Electronic peer-review systems . . . give the appearance of reducing bias"

At the same time, development of new digital technologies can be investment intensive. New costs include maintenance, replacement of obsolescent equipment and software, and hiring and retaining a highly skilled technical staff to support the digital workflow.

Process

Content Development

Today authors commonly use word processing programs to create their work. In fact, many researchers work in a totally electronic environment, so they synthesize their data and present their results graphically in digital form. Consequently, preparing their written reports in a digital format is a natural extension. Sophisticated programs, such as LaTeX, which accommodate scientific formulas and equations, have become an everyday part of writing in the lives of many scientific and technical authors.

Authors supply copy to publishers physically on disk or electronically via e-mail, FTP, or URL. Current methods of transmitting data electronically include private ISDN (Integrated Services Digital Network), xDSL (Digital Subscriber Lines), cable modems, services such as Wam!Net, and T1 lines.

Electronic Submission

Definition

With electronic submissions, authors submit manuscripts in electronic form either on disk or via the Internet (e-mail, FTP, or HTTP).

Process

Many publishers have set forth author guidelines for electronic submission of manuscripts. These guidelines usually include a template for the author to use in preparing a manuscript. Most templates are straightforward focusing on stylistic conventions of point size and type style. In fact, MS Word is the most prevalent format used. Some guidelines contain requirements for specialized software, such as LaTeX, so that composition of complex mathematics and equations can be subsequently dealt with easily in a digital production workflow.

Publishers may specify which technical formats they will accept electronically. In addition to LaTeX, common formats are Troff, GIF (Graphic Interchange Format), RTF (Rich Text Format), or MIF (Maker Interchange Format). A few publishers even expect authors to use SGML in compliance with their DTDs (Document Type Definitions). For some publications, such as IEEE's Transactions, publishers accept manuscripts only on disk unless the author has obtained prior approval for another format from the editor.

Common Problems

Authors frequently do not follow templates; their submissions must be converted from one word processing program to another. This is not a daunting task, but disk conversion still costs a publisher time and money in creating an all-electronic process.

FTP submissions are not always straightforward. Naming conventions may be complex. Also, a number of steps are required to transfer a manuscript to a publisher's FTP site. Successful transfer depends on the authors skill and the reliability of the site.

Publisher Enhancements

The arrival of author-prepared electronic copy in a variety of formats is now a daily occurrence for most publishers. Until recently, many publishers could accept manuscripts in only a single word processing format because their internal systems could accommodate only one kind of software. Now, software conversion programs make it possible for them to accept manuscripts in nearly every word processing format.

Peer Review

The first level of publisher enhancement is the process of peer review: filtering for quality, significance, and originality. Manuscript tracking software allows for the automated management of the peer review process. Electronic peer-review systems offer several benefits to publishers:

- Enhanced quality of reviews
- Increased efficiency
- Valuable statistics and information

An additional benefit might be that they give the appearance of reducing bias because they are systematized. Referee databases provide editorial staff with access to a larger universe of reviewers, an increased knowledge of their expertise, and a track record of their performance.

The primary outcome of a computerized review system is a bank of accepted manuscripts in digital form ready for editing. A valuable ancillary outcome is the information created as a result of the process. Publishers can gather statistics such as:

- Average time for review
- Number of submissions
- Number of manuscripts accepted, rejected, accepted with revision
- Number of reviews per referee
- Performance by individual referee including turnaround time, quality of reviews, and consistency with other referees, who are usually assigned by editors and/or Peer Review Board

Peer Review

Definition

In electronic peer review, the entire process from receipt of manuscript through transmittal to reviewers to final decision is accomplished digitally. Individual participants (editors, reviewers, authors) may print out a submission to read, but all transmittals are delivered electronically.

Process

Electronic peer review begins with a digital copy of the author's manuscript. Referees are selected from a computerized database, the manuscript is transmitted electronically, and the reviewers' forms and comments are returned electronically. Once the editor makes a decision using the digital files, that decision and any comments are transmitted to the author electronically.

Electronic peer review has evolved from home-grown tracking systems created by editors to sophisticated in-house systems developed by large publishers. A third option now available is off-the-shelf software such as Editorial Assistant, Global Editor, Manuscript Central, and PaperPath. These proprietary and packaged software programs can be used purely as a tracking system if the publisher has not completely automated the peer-review process. They can also be linked to production-tracking systems to help create a completely digital workflow.

Common Problems

Manuscript tracking systems are expensive to develop internally and not inexpensive to purchase. The systems commercially available all have unique strengths and weaknesses. A common weakness is the limited capacity for customization to an individual publication's editorial-office procedures.

Editing

Although the level of editing varies from publication to publication, in general there are two types of editing. Substantive editing primarily addresses content issues, and it may include major rewrites or reorganization. Copyediting deals mainly with such issues as style, format, consistency, grammar, and punctuation.

"SGML and XML add value by assuring that the content can be used in different media"

Electronic, or onscreen, copyediting facilitates inserting text changes and provides audit trails to authors during their proofing and correcting stages. If one has the proper electronic tools available, appropriate training and experience, online editing can be much faster than pen and ink editing. The publisher gains a great deal from electronic copyediting in that data can be quickly transmitted and retrieved to outside copyeditors via e-mail or FTP. Clearing manuscripts is easier because authors receive a clean proof generated from their disk, and the cleared manuscript is in digital form, ready for page composition. If files are coded consistently and thoroughly, composition charges typically are reduced. Authors' alterations decline, and there is greater consistency in applying house style if macros or pre-edits are used.

Electronic Copyediting

Definitions

1. Copyediting accomplished using a computer rather than pen and paper; often called onscreen editing.
2. Computer programs that prepare a manuscript for editing by making standardized style and format changes.

Process

If the author did not use the publisher's template or preferred word processing program, the editor first converts the disk. Some publishers still use Xywrite or WordPerfect; however, the standard appears to be MS Word for Windows. Many publishers and printers have created special macros to systematize the application of house style and to insert coding. The editor then completes the editing by making changes directly in the file. When the author receives the edited manuscript, it may be a clean proof or a "redlined" one in which all substantive changes are shown in color or different font styles.

Instead of using publisher-created macros to pre-edit the manuscript, some use a computer program such as PowerEditor Pro from Librosystems or 1stedit from Carden Jennings Publishing. These editing programs may make basic grammar changes, such as correcting wrong usages of which/that or while/although. They can correct spellings and fix punctuation problems. They may correct the order of elements in references. And they can be set up to insert house style preferences such as abbreviations, special terms, and heading formats. Some composition houses also have their own proprietary pre-edit programs, such as the Sheridan PRISM System offered at The Sheridan Press.

Coding

At some point in the process, the text is marked up for typesetting, and the document may be tagged for SGML, XML, or HTML. The typesetting codes enhance the appearance of the document by instructing the compositor to set it in the publication style. SGML and XML add even greater value by assuring that the content can be reused in different media.

Publishers vary widely in when they tag documents for SGML. Some insert codes as the first step in the process. Some apply the coding to copyedited material. And some insert the coding as one of the last steps before files are loaded for electronic products. For example, the University of Chicago Press converts to SGML before any copyediting is done for its journals, because SGML applied early in the process supports complex content in a variety of ways including multiple presentations and data collections. They find that even major restructuring in SGML is no more difficult than maintaining a style in MS Word (Evan Owens, personal communication, August 1999).

On the other hand, the American Chemical Society generates SGML from their Xyvision typesetting files, in part because they use Xyvision consistently for their many journals. They are re-engineering their journal production and moving to a relational database management system, which will serve as their core repository rather than SGML (Lorrin Garson, personal communication, August 1999).

Coding

Definition The act of tagging elements in a document to describe their structure, content, or desired appearance.

Process Previously, coding told the typesetter how to treat elements such as titles or subheads typographically. Today markup languages such as SGML (Standard Generalized Markup Language) or XML (Extensible Markup Language) are applied to describe the content and structure of a document. SGML is a complex language with a prescribed vocabulary and syntax. Because it separates content from appearance, an SGML document can be displayed in many different media. The coder defines each element, such as title, footnote, subhead, and so forth by inserting tags within angle brackets. Then the document is "parsed" to verify that the coding meets the rules. SGML files, which are written in plain ASCII, are platform-independent.

Publications may be fully coded in SGML according to the publication's DTD (Document Type Definition), which provides a blueprint for all of the content and structure, or SGML may be applied only to part of the document. For example, some publishers code only their headers and footers in SGML and present the text in PDF.

HTML (HyperText Markup Language) is used to prepare a document for display on the World Wide Web. A simplified variation of SGML, it does not require a DTD and contains a small set of fixed codes. Because the range is so limited, it is generally used only for Internet transmission and not for archiving.

Implementing SGML can be complicated, and HTML has significant limitations. In response to these problems, the World Wide Web Consortium (W3C) created XML as a new standard for electronic delivery of content. Well-formed XML does not require a DTD and has less rigorous rules than SGML.

Manufacturing

Composition and Prepress

Using coded and edited files, the compositor or printer integrates text, black and white art, and color images. Several platforms and programs may be used depending on the project. There are traditional typesetting systems such as Miles, Penta, and Xyvision; and there are desktop programs such as QuarkXPress, PageMaker, or FrameMaker. Acquiring usable digital art is still one of the more challenging technical aspects of the composition process.

Digital Art

Definition Illustrations that are delivered as digital files. Examples include advertisements, charts, graphs, technical illustrations, and photographs.

Process Artwork is constructed as a digital file, generally in one of three ways:

- Using computer illustration software
- Scanning photographs or other hard copy
- Working in all-digital environments in scientific laboratories

Software most commonly used to create digital art includes Adobe Illustrator, Adobe Photoshop, and Macromedia Freehand. Scanned art is generally captured in a standard desktop publishing program such as Adobe Photoshop and saved as EPS (Encapsulated PostScript) or TIFF (Tagged Image File Format) formats. The images from scientific experiments also are saved in Adobe Photoshop.

The digital image is then imported into the page layout composition program to complete the page design. The entire publication can then be processed in the digital workflow.

For advertising, several common file types are used. Vector files, such as QuarkXpress and Adobe PageMaker, require time-intensive output. PDF is used primarily for black-and-white advertisements; however, developers are creating PDF/X as a standard for exchanging color ads. TIFF/IT is the most common raster file format used for CMYK (Cyan, Magenta, Yellow, Black) color ads. Screened bitmap files are also used, although changing the files is cumbersome.

Digital pages are transferred to a digital proofer, which outputs a reproduction of the page. The use of digital proofing has significantly changed the production cycle because it allows for reiteration of the approval step as often as needed until the document is exactly as it should be (George, in Kirby, 1999).

Digital Proofing

Definition Proofs created directly from electronic page layouts to enable full digital workflows with no film. Digital proofs, sometimes called soft proofs, are also used in the composition cycle.

Process Digital pages are transferred to a digital proofer, which reproduces the page using imaging software to interpret the binary data in the file. Digital proofers include:

- Desktop inkjet printers
- Desktop laser printers
- Dye-sublimation printers
- Thermal laser halftone dot proofing devices
- Full-flat large format proofing devices

The development of digital proofing equipment that produces a halftone dot significantly advanced digital workflow. The halftone dots permit accurate calibrations and checking ink trap, which previously had been accomplished with analog proofs made from film. Until halftone dots were available, many publishers were hesitant to trust digital proofs.

The large format proofer enables printers to produce an entire imposed signature and later fold it down to represent the pages of a book or journal. This process replicates the traditional blueline, except that no film is used.

High-end color digital proofers are becoming fairly common. It is important to use International Color Consortium color profiles for calibration, so that all applications are using a standard color language to interpret the colors.

DuPont Digital WaterProof, Fuji FirstProof, Iris proofers, Kodak Approval, and Polaroid Polaproof are among the most

common proofs for high-resolution digital proofing of four-color work. For black and white materials, there are inkjets and a variety of laser proofs. Digital bluelines that show full color replace conventional Dylux proofs.

Prepress production processes begin with preflight checking that entails opening each file to ensure that all parts of a manuscript will reproduce properly. A preflight checklist must be examined and approved before a publication is released for printing and distribution.

Preflight

Definition Process of completely checking digital files against an extensive checklist of items to ensure correctness before releasing publication to printing.

Checklist The items examined during preflight include fonts, graphics, text and page construction, margins and folios, proper file-building techniques, color, and proofing issues.

Process Preflighting files is absolutely necessary to ensure quality control and an effective digital workflow. Preflighting takes place at the end of the composition process and again before plates are produced.

As suppliers receive files from customers, they run them through preflighting checks to assure that they are usable. Three types of checks detect file errors. Those are application file preflights, which are most time intensive; PostScript file preflights, which require special analysis software; and PDF file preflights, which also require special software. Examples of software used include Acquired Knowledge Download Mechanic, Enfocus PitStop, Extensis PreflightPro, and Markzware Flightcheck.

Following preflight, some additional steps are required to prepare the publication for online distribution. The document may be rendered in HTML for viewing on the Web. If PDF files were not used for plate output, they will be created at this stage so the reader can print the publication from the Web files.

PDF

Definition PDF or Portable Document Format is an Adobe format derived from their PostScript language. An object-oriented file format that is platform independent, it combines the strength of PostScript with some of the flexibility of application files.

Process Developed in the early 1990s, PDF made it possible to create an electronic file that could be sent to many different computers that did not use the same operating systems or applications. Adobe added features that made PDF usable for high-end graphic applications, as well as desktop, office, and Web processes.

Once a document has been created in PostScript, it is "distilled" into PDF using Adobe Acrobat Distiller or PDFWriter, which creates low-resolution PDFs from common software programs. It is also possible to generate PDFs directly from application files such as Adobe InDesign.

In the Adobe 4.0 version, users have three options when preparing a file for printing:

1. *ScreenOptimized*. Used for documents distributed electronically and printed only on low resolution printers. All colors are converted to RGB (Red, Green, Blue), and images are reduced to 72 dpi to minimize downloading times.
2. *PrintOptimized*. Used for content proofing. Output is 300 dpi; color settings are maintained. This option can be used for digital printing when color accuracy is not essential.
3. *PressOptimized*. Used for output to imagesetter or platesetter with resolutions of 1200 dpi or greater. The PressOptimized option offers a full range of controls including embedded fonts, halftones, overprints, spot colors, and other settings.

Purposes PDF is used throughout the production process for such purposes as:

- Submission of digital art
- Medium for film or plate output
- Proofing mechanism
- Display of electronic files in page format
- Archiving

For example, PDF files can serve as e-page proofs sent to the author and editor instead of traditional laser proofs. Recipients can print them out and fax back corrections, or they can use Adobe Acrobat to make revisions directly in the PDF proof file.

In the last stage of page composition, PDFs can substitute for traditional PostScript for film or plate output. The same files distilled for film or plate can be distilled again for low-resolution Internet-compatible PDFs.

Benefits PDF offers a number of benefits in the digital workflow:

- Because it is independent, it can be read on different platforms.
- Edits can be made at any stage.
- PDF files are much smaller than PostScript files, so they use less space and transmit more quickly.
- Because the distiller process for creating a PDF is essentially a RIP (Raster Image Process), it is also verification that the file will be processed correctly. Some call this a "pre-RIP."

- PDF offers a one-file solution for both print and online.
- Anyone can view Web documents in PDF using a free reader.

Printing

Once the printer has verified that the files are accurate and complete, they are ready to make a plate to use on the press. In a less fully digitized environment, the preflighted disk is used to create signature impositions, which are sent to an imagesetter to produce film.

Disk to Film

Definition Film derived from an imagesetter controlled by computers. This process is digital from page composition to imagesetting, and it may have been digital from the authors creation through the content shaping and polishing to page composition. The digital workflow is truncated, however. Instead of going all the way through platesetting and printing, it terminates with film.

Process First, the compositor creates pages using one of the various page composition programs. All of the necessary graphic elements are integrated or gathered and sent to the printer with the composition files. Page files are preflighted to determine if they will yield good high-resolution PostScript.

Fonts and graphics are embedded, and Post-Script files or PDFs are created. They are then preflighted for data integrity. Next they are imposed using imposition software to create signature templates. That is, the pages are put in the correct order for printing, folding, and binding. These imposition signatures generally contain four, eight, or sixteen pages; however, signatures vary depending on the printing press. The signatures are then sent to the imagesetter, which generates plate-ready film in the correct page order and position for printing.

In a more fully digitized workflow, the printer produces a plate directly from the files. Getting to press with a computer to plate process can be faster than it is with film.

Computer to Plate

Definition Computer to Plate (CTP) is the process by which lithographic printing plates are imaged directly from digital files.

Process The CTP process starts with the preparation of files during the page creation stage and finishes with digitally imaged plates.

Preparing Files Postscript files of each page are digitally arranged in the order they will appear on the plate during a process called imposition. Specialized software, such as ImposeIt from IPTech or PREPS from ScenicSoft, or vendor-specific imposition software is used. Then the files are RIPed (Raster Image Processed), and color trapping may occur. Once the files are imposed, trapped, and RIPed, they are ready for imaging.

Imaging Feeding can occur manually or automatically. Generally, automatic plate feeding is used in visible light platesetters, which must be run in a darkroom environment. Thermal plates, which can be handle under normal light conditions, allow more flexibility for manual or automatic feed. Two types of technology may be used during this process: internal drum or external drum. In internal drum systems, laser signals are sent to a spinning mirror, which reflects light onto a stationary plate to expose it. In external systems, the drum holding the plate rotates while a stationary bank of laser diodes expose the plate.

Processing The plate must be processed after exposure. Chemicals are applied to the plate during this final step and the plate comes out of the processor ready for the printing press.

But many publishers and printers must still contend with film, either because it is supplied for advertising or because they are using archived film. A process called copydot scanning can help them move from film to computer to plate production.

Copydot Film Scanning

Definition A process that scans film, digitizes the data, and creates a bitmap file ready for the RIP.

Process Using copydot scanners, printers scan color-separated halftone film to create digital files that can be integrated into a totally digital workflow. Although the digital file is another generation, the material has been scanned at a high resolution such as 4800 dpi; consequently, little or no data is lost. Copydot scanning can help publishers move from film, supplied or archived, into computer to plate production.

Copydot scanning is an interpretive process that requires expensive specialized equipment to create a third generation file of a second generation image (film). Copydot scanners and software vary in quality; consequently, quality variations may occur in the outcome, depending on the equipment used.

Computer to press is the most dramatic printing advance to date in the quest for an all-digital workflow that culminates in putting real ink on paper. The process eliminates a separate platesetting device, and relies on highly specialized printing technology called Direct Image (DI) presses.

Computer to Press

Definition Computer to Press is a lithographic printing process in which plates are imaged directly from digital files while the plates are positioned on the plate unit of the printing press.

The Press This process requires a specialized offset printing press called a Direct Image (DI) press that incorporates imaging heads, printing plates, and a common impression cylinder. Alonso (1998) described the Direct Image presses as machines that combine traditional offset technology with "on-press imaging functionality." The press uses real printing ink, rather than toner. The plate relies on waterless technology, and the ink pools inside the recessed image area in a process similar to gravure.

DI presses are one of three types of digital presses. The other two include digital photocopiers and printers that accommodate variable data.

Process All proofing and file preparation are completed prior to the imaging process. Bitmapped files are sent to and queued up at the presscomputer station. Clean plates are automatically fed into position, and the plate cylinder begins to spin while a bank of laser diodes image the plate. Once the plate is imaged and cleaned, sheets are run through the press to complete the makeready. When color and registration have been fine-tuned, the job is ready to run. Basically, digital files created by the publisher are used to image the printing plates while the plates are hanging on the press.

The combination of digital files and digital presses has made print-on-demand economical. Being able to print very short runs cost-effectively alleviates several problems related to distribution and warehousing and can reduce costs, particularly for non-serial publications.

Distribution

Automation has enhanced all the steps in the distribution of publications both in print and electronic form. Bar codes are printed on cartons and skid labels so that the distribution center can process inventory with the wave of a sensor wand. UPC (Universal Product Codes) bar codes are also printed on individual publications to facilitate processing for wholesalers, retailers, and librarians. Automated manifest systems track shipments so that distributors can keep customers informed about delivery.

Integrated distribution and fulfillment systems incorporate inventory control, customer databases, order processing and tracking, accounts receivable, sales histories, and so forth. From order entry, these systems automatically deduct from perpetual inventory, update accounts receivable, and feed into all sales history programs. With e-commerce systems linked to publisher's Web sites, the process is even further automated because the customer in effect accomplishes the order entry. For electronic publications, the publisher maintains digital files for access directly by end users or for transfer by telecommunications or magnetic tape to an aggregator for further distribution as part of a larger database.

Marketing

Marketing professionals have long regarded the computer as a valuable workhorse. They have relied on databases to handle a myriad of tasks such as maintaining customer files and profiles, creating labels and mailing lists, tracking promotion results, and reporting unit and dollar sales. Professional marketers equate the development of database marketing in the 1980s with the new advertising medium television offered in the 1950s (SRA, 1999). Now a flourishing and accepted strategy, database marketing is likely to become the basis for most effective marketing programs in the new century.

Swanson Russell Associates (SRA, 1999) outlined steps in the database marketing process, which can be summarized as follows:

- Identify current and prospective customers.
- Store in a database of customer names along with contact information.
- Enhance the name and contact data with additional information such as demographics, prior purchases, and survey responses.
- Analyze the data to identify similarities in purchase behavior patterns among groups of customers and prospects based on timing, frequency, and volume statistics.
- Develop effective communication avenues with current customers through loyalty and frequent buyer incentives, relationship building, cross-selling, and customer service programs, and with prospective customers through product trials, image building, or customer referral programs.
- Analyze marketing program results based on the response tracking made possible by the database.

Using a digital workflow, a publisher can produce customized marketing materials such as brochures targeted to specific audience segments. Catalogs can be offered in different languages, and advertisements changed for special offers in different venues.

Marketing research professionals, long-time users of computer resources for data entry, tabulation, and compilation, have now added online research to the traditional mail survey, in-person or telephone interview, and on-site focus session. There are two major ways of conducting surveys electronically: e-mail and Web-based. Both are in their infancy, but the larger market research firms are attempting to develop their effectiveness and reliability. In both, responses are transferred electronically to the research firm in another example of a completely digital workflow.

"Incorporating a total digital workflow can make a major difference in reducing time to market"

Archiving

An all-digital workflow produces files ready for proper archival storage and retrieval. Standard coding in a platform-independent medium assures that the publication can be used in the future. Files can then be transferred from one

medium to another as technology advances or be included in a larger database as part of a publishers knowledge management activities. SGML or XML are the preferred languages for material to be archived because they are platform-independent; consequently, the material can be transferred to any media in the future.

Although some publishers have attempted to use HTML documents for archiving, Kasdorf (1998) noted that publishers should "save their richest file, the one preserving the most distinctions." He suggested saving composition files rather than HTML if SGML is not available.

In addition, publishers may code and archive supplemental data sets including graphic elements. This practice is particularly useful for creating journal databases.

Differences Between Analog And Digital

The differences introduced with a digital workflow transform the publishing process and even the products significantly. The more fully they integrate a digital workflow, the more changes publishers will see. The process changes, schedules are compressed, and quality improves. Ultimately, the publisher may achieve financial rewards as well.

Process

If the process is completely digital from start to finish, some components of the old analog workflow for printing disappear. One of them is film, which can be eliminated by going directly from computer to plate. Some products, particularly those produced in short runs, may be printed on digital presses that eliminate plates as well. Because there is no film, there also is no blueline; instead publishers see digital proofs on plain paper at several points in the process including the stage immediately before printing.

Schedules

Steep competition, rising costs, and consumer demands have pressured publishers to reduce the lapsed time for production schedules, and it is unlikely these pressures will subside. In fact, they probably will intensify. Incorporating a total digital workflow can make a major difference in reducing time to market.

At the front end, changing from a totally paper-based traditional mail system for manuscript submission and peer review can eliminate a month or more, just because of the transmittal time. Further, there is some indication that reviewers respond more quickly when they receive requests electronically and can send their reviews the same way. During production, digital transmission can save several days of going back and forth between author and publisher and publisher and supplier.

Throughout the process, the speed of communications can help compress schedules so that publications are completed more rapidly. The following are just three examples.

- **Submission and Peer Review**
  In the traditional process, packages were put in the mail approximately 10 times for an average manuscript. Estimating three days per mailing, just sending the manuscript back and forth requires a minimum of 30 days.
  In the digital workflow, manuscripts are submitted via e-mail, FTP, or HTTP; all reviews are sent electronically; and transmission time is very short.
- **Author Clearance**
  In a paper exchange, express shipping of manuscripts and proofs requires two days back and forth for each round. In the digital workflow, edited copy and proofs are sent electronically to arrive in minutes.
- **File Transmission and Proofing**
  In the usual 1990s process, files were sent by express shipping or courier; because they must go back and forth several times, just the transportation took days. In the fully digital workflow, files are sent over high-speed, wide-band lines, and the process takes hours at most.

There may also be time savings in production. Using computer to plate technology and implementing digital proofing can hasten the approval process.

Most of these efficiencies reduce the time to market. Reductions in the length of time required to process each step in production also reduce labor and overhead. The minutes shaved each time a file is processed may seem minuscule until one realizes that each page goes through three or four passes with back-ups at each stage.

Quality

Improvements in quality begin with the creative process. When graphic artists developed materials mechanically, each concept required so much time that it was prohibitively expensive to develop more than a few. Electronic design allows artists to experiment cost effectively so they can create a better quality product. Once that design is in production, they can easily alter colors and graphic elements to achieve optimal results.

With computer to plate technology, the quality is improved because the plate is closer to the original image, as there are fewer generations in processing. There is minimal dot gain or distortion, which can occur with photo-mechanical exposure of plates. The color registration is better. And because the technology is stable, machines will produce identical plates from the same file no matter how many times they are burned. This stability is particularly important for publishers who do distributed printing, sending files to various regional plants for printing and dissemination.

Need for Precision

In the old workflow in which the composed document was photographed to produce film, it was not so important how we got to a document that was ready to print. The compositor could take shortcuts, and as long as the camera-ready looked correct, it didn't matter. Then when publishers started providing disks to printers, the printers often cleaned up sloppy files, so the publisher might not have realized that there were problems in the files. The digital workflow is not WYSIWYG. Someone will have to open each file and check that all elements are correct. Is it in CMYK? Are the crops and traps correct? Is the bleed accurate? Any lack of precision will affect the quality of the final product.

Options For Implementation

Completely In-House

A very large publisher with considerable resources may choose to take on all the tasks involved in carrying out a digital workflow. That is, they will maintain in-house all the equipment and supports for all of the tasks in each step of the process from submission of content to delivery of finished publication. In practice, few publishers follow this route. The exceptions are generally newspaper or very large catalog publishers.

Completely Outsourced

At the opposite end of the spectrum is the publisher who outsources every phase from peer review to archiving. Nearly any aspect of the publishing process can be outsourced successfully if appropriate study, negotiations, and follow-through are accomplished. When the publisher has completed a careful analysis, they can then identify and create relationships with potential partners (Beebe & Meyers, 1998). Outsourcing all or any part of the process can save the publisher the cash outlay for acquiring the equipment and many of the associated costs of staffing and training. Further, outsourcing exposes publishers to different ideas and opinions.

Type your comment here.

"No matter how skilled staff are, additional training may be necessary

When looking at outsourcing, publishers should remember the digital workflow process changes the services that may be available to them. For example, the printer who stored film for the publisher may now be offering rental space for data warehouses.

Joint Publisher-Supplier Operation

Probably the most common arrangement is some blend of publisher and supplier responsibilities. The division of labor between the two varies widely. Some publishers do all of the content preparation and prepress work internally and send files to a supplier when they are ready to go to plate. Others carry out only the peer review and project management aspects and ask their suppliers to complete all editing, coding, and other preparation for printing.

In all cases, clear communications systems are essential. When the workflow is divided between the publisher and the supplier, there must be an unmistakable demarcation between where the in-house work ends and the supplier takes over. And if there are multiple suppliers, defining the work responsibility for each is very important. The publisher will have to develop a transmission system to get all the benefits of speed that digital workflows offer, and they may need to upgrade their computer networks.

Publishers who carry out any aspects of digital workflow internally will need to assure that there is close coordination between their data processing unit and editorial and production units. Programmers tend to view procedures from a computing vantage, whereas the people using the system seek user-friendly interfaces. Establishing a rapport that enables staff to link these two is essential to successful implementation.

Phase-In for All

For most publishers, implementing digital workflow has been evolutionary, often as a result of the need to replace other tools. Unfortunately, this evolution often occurs without planning or setting objectives. Too often publishers overlook the need to integrate the development and production of publications with all of the metadata surrounding their creation, plus information from marketing and distribution.

Publishing as it has developed to date is generally computer-assisted rather than fully digital. The goal for publishers will be to progress as systematically as possible from being computer-assisted to completing all phases of publishing digitally — moving the author's concept through the entire process from peer review to content polishing to manufacturing to distribution.

Suppliers, too, are generally phasing in digital equipment, transferring from legacy systems and building what they hope will be integrated systems out of what may currently be a collection of upgrades. In addition, they must maintain equipment to meet the varying needs of their clients. As supplier and publisher phase in digital workflows, they must maintain clear lines of communication so that they can achieve a successful partnership.

Training and tolerance for initial errors are important. No matter how skilled staff are, additional training may be necessary to implement a digital workflow, in-house or in cooperation with a supplier. There are bound to be mistakes as everyone learns.

Outcomes of Digital Workflow

Content as Asset

Publishers have long thought of content as king; however, translating that concept into treating content as a tangible asset stored in bits and bytes is a leap for many publishers. What used to be the "morgue" now should be what Rubin (in Seybold, 1998) described as a "content centric repository." Publishers can create large databases, housed in their own computers or in space rented from suppliers, that include all of their digital content. That content may be portrayed in text, images, video, or audio.

If publishers develop or acquire the necessary content management tools, their data repository or data warehouse can be their greatest asset. They can then:

- Reduce production and distribution costs.
- Reduce time to market.

- Enter new markets with fewer barriers.
- Produce multiple versions and new products from existing content.
- Customize content for special audiences or individual cases.
- Track and recognize the scope and potential of their content assets.
- Eliminate the potential for conflicting information because changing a data element once in the database changes the element wherever it occurs.
- Maintain a consistent image throughout the company.
- Develop new partnerships.
- Improve profit margins.

Issues

Although treating content as a key asset can lead to greatly enhanced profit margins, the process is not a simple one. There are several issues to be considered. Among the most important ones are establishing and maintaining the data warehouse and managing intellectual property rights.

The Data Warehouse

One of the outcomes of a digital workflow is digitized files ready to be archived in a data warehouse; however, establishing the warehouse requires considerable work and planning.

A database design that suits the company's requirements for current products and planned growth is the first step. Standardization is an essential ingredient in all stages of the digital workflow, and it is particularly important in building a content warehouse.

Metadata must be tagged in a consistent manner so that content can be identified and retrieved to develop new products. Indexes must be carefully devised. Among the types of metadata the European Commissions Open Information Interchange (1998) has identified are the following:

- Author, publisher, publication date
- Any related intellectual property ownership
- Searchable keywords
- Classification codes

Other metadata might include details about the production process and the type of data in the document.

These large, complex databases require sophisticated management tools. Calabretto and Bozzi (1998) in discussing the BAMBI (Better Access to Manuscripts and Browsing of Images) project, described the use of HyTime (Hypermedia/Time-Based Structured Language). HyTime, they noted, addresses problems such as locating data, describing links, and structuring contents. Indexing and file maintenance tools are essential. In addition, server and storage technology are critical factors for all databases. Publishers who decide to maintain their own data warehouse must be prepared to invest in adequate servers and systems.

Rights Management

Rights management grows ever more complex when information may be reused in many different forms. Erickson (1996) noted that the fundamental purpose of attribution is "associating the people behind creative works with their content, wherever it may be found and however it may be used."

Overall, the industry must put in place control mechanisms that will manage the intricacies of tracking legitimate usage. Hill (1999) identified four key requirements for such a system:

- Persistent identification or association of identifiers with digital content
- Global resolution for identifiers
- Information management standards
- Trusted certification authority

These needs fostered cooperation among publishers through the Association of American Publishers to create the Digital Object Identifier (DOI). The DOI was developed to provide a means to identify any piece of content, however small. The system uses persistent identifiers to assure that each piece of content will have a unique permanent name that will not change no matter how the content is delivered. Since introducing the DOI in October 1997, the parties have formed the International DOI Foundation (IDF). Members of IDF and other proponents see DOI as an essential component in viable e-commerce because it protects intellectual property rights.

> *"Publishers can spread their fixed costs over more revenue streams and therefore be more competitive"*

Individual publishers must also establish rights tracking systems. When publishers pull content for reprints or for other derivative products, they must have all of the information pertaining to ownership and royalties as well as the original bibliographic facts. All should be included in the metadata about the content. Once the metadata schematic has been developed and the procedures put in place, the digital files should produce cost savings in rights management.

Derivative Products

Reprints

With digital files, reprints are easier to produce and promote. (For example, The Sheridan Press uses a Heidelberg Quickmaster Press for fast production of reprints.) The rapid turnaround time for production makes it possible to reduce costs in other areas, for instance, substituting ground shipment for express delivery. In addition, the publisher can offer "e-prints" in HTML or another Web standard so that buyers can post the content on their Web site.

New Products

Any time publishers can transform the content used for one product into another, they have reduced their costs. For example, publishers can easily produce publications assembled from content originally published in a variety of other publications. The most common is the still-popular "reader", which is generally a collection of articles first published in one or several journals. However, many other kinds of products, such as manuals, training packages, and industry reports, as well as catalogs and annual reports, are possible.

Customization

Digital warehouses permit publishers to offer customized products. Essentially, the publisher can offer a menu of materials in different content areas for the customer to select and request in very short runs, which are economically viable because of the digital technology. For example, a fully automated system for printing coursepacks on demand may be quite profitable.

Economics of Digital Workflow

Publisher-Specific Impacts

Initially, costs may increase because of the need to add equipment, software, and training. In addition to dealing with their own plant expenses, publishers must recognize that their suppliers have incurred substantial costs to install digital equipment. Further, the suppliers must operate both a film and digital workflow to meet the needs of their clients. Overall, however, publishers should see substantial improvements in efficiencies and productivity, in part because a digital workflow significantly reduces redundant tasks.

Publisher Expenses

Costs of new equipment and software can be expected to continue to decline. The general computer trend has been that speed doubles and prices go down every 6 to 12 months. On the other hand, maintenance and recurring upgrades are costly. To remain competitive, publishers will need to look at all aspects of digital technologies and determine which they should incorporate into their own internal workflows and which they need to rely on suppliers to deliver.

Revenue Potential

When their digital workflow process results in a data warehouse that can generate derivative products easily, publishers can develop new streams of revenue from new products and from value-added services. Mackie-Mason and Riveros (1997) noted that bundling journal components in a variety of packages enables publishers to obtain revenue from users who value the same content differently. Using different pricing schemes, publishers can spread their fixed costs over more revenue streams and therefore be more competitive in the marketplace. The use of a digital workflow makes it cost effective for publishers to expand on the concept of selective dissemination of information by providing new products that are related to subject area, geography, source, and other specialty areas.

Industry-Wide Impacts

Will the outcomes of a digital workflow change the overall economics of scholarly publishing? As the costs of publishing have risen and library resources have declined, many have asked whether our current system is economically viable. Summerfield (revised, 1998) reviewed many of these issues in a study of Columbia University electronic publishing projects funded by the Andrew W. Mellon Foundation. Among the issues she noted are these:

- Scholarly communications in print have high fixed and low marginal costs.
- With declining marginal costs and average prices, there is sub-optimal output and consumption.
- Electronic publishing has an uncertain cost profile.

Summerfield suggested that digital technologies have the potential to change the sub-optimal characteristics of scholarly publishing.

Economic factors, such as continuing reductions in library budgets, shifts in the value of various currencies, and increased costs in subscriptions, in part stimulated the push for electronic journals. Despite suggestions that new technology will free authors to produce electronic journals without the help of publishers, the demise of publishers is unlikely.

MacKie-Mason and Riveros (1997) pointed out that the business of publishing adds significant value to authorship. Among the services they listed are copyediting, proofing, typesetting and layout, printing, binding, distribution (print and electronic), billing, and maintenance. All of these services are enhanced by digital workflow. The use of digital technologies throughout the publishing process should ultimately reduce costs and perhaps mitigate the economic issues in the development and dissemination of scholarly information.

Some questions for future resolution:

- How will the industry account for its information assets?
- Can the content in bits be valued as a dollar asset?
- What protocols will be applied?
- What kind of shelf life can we expect for digitized information? Will it be longer than print information because it can be reassembled for other purposes? Or will it be shorter?

The very processes by which we account for publishing activities may change in the future. In a print-based system, publishers invest in paper, ink, and binding and obtain copies that are stored in warehouses until they are sold or recycled. Each has a dollar value that is represented on the publisher's balance sheet. In a totally digital system, the publisher invests in preparation of the content and its maintenance in bits and bytes. There is no tangible product on the shelf even if the product the customer orders is a print volume (which is printed on demand). In fact, accounting systems traditionally have treated the elements in this process as assets that diminish in value quite rapidly. There is no precedent for setting a dollar value on content in electronic form. Over time, these practices may change.

Sociology of Digital Workflow

Experts in the printing industry predict that a digital workflow will result in increased quality and savings in time and dollars. But little has been written about the potential sociological impacts, both positive and negative. How will digital workflows change human relationships in the publishing process?

The one area in which we can expect little change is how authors and readers develop and use content. As Kling & Covi (1995) noted, scholars are likely to continue shifting back and forth between their paper notes, electronic versions, and printed drafts as they compose their contributions to the literature. And their readers will use electronic means for searching and retrieval, but will print pages for actual reading. Both authors and readers will participate in and benefit from the digital workflow, but digitization will not bring about truly major changes in their regular practices.

Changing Roles

There is no question that roles are changing. Where they once submitted a hard copy manuscript, sometimes filled with misspellings and hand-written corrections, then waited for the publisher to produce clean typeset pages, authors are now active partners in the production process. They submit material in electronic form, sometimes crafted within publisher templates, and a few even code SGML in compliance with the publisher's DTD. Many publishers require that the authors correct files for editorial changes and submit them ready for imaging.

At the other end of the process, publishers are also relying more and more on their suppliers as the technology grows more complex. Many publishers, particularly smaller ones who find it difficult to maintain the equipment and staff knowledge needed to keep up with the rapid changes in technology, have shifted work they previously accomplished in-house to their suppliers.

With advances in technology and the changes in roles, publishers have even greater need to clarify and promote the added value they bring to the process. The enhancements and benefits publishers provide are significant; they include gathering and selecting content, adding imprimatur, helping authors polish and revise their content, editing, indexing, proofreading, overseeing production, publicizing and distributing content, protecting the authors attribution, and archiving.

Changes in Business

For publishers and printers the onset of each new technological advance means a definite change in their business routines. The need for even greater quality control and staff training seems to be ever increasing. Communication among all the individuals involved in transferring information from author to reader will become more critical. As always, proper planning will serve as the cornerstone for success, and the lack of planning will have more dire consequences.

The increased interaction throughout the process suggests that the increased publisher reliance on suppliers will not wane in the near term. Instead it is likely that ever-stronger alliances and partnerships will be forged.

Looking Toward the Future

We have entered into an era of dynamic change. Following Gutenberg's invention, improvements advanced at a relatively slow pace for the first few hundred years. Then after computerized photocomposition began to replace hot metal in the late 1960s, progress grew each year at a much faster pace. Changes in publishing and printing technology continue unabated today. This evolution will continue past our lifetimes as all aspects of publishing — the transfer of information from author to reader — proceed through an evolving digital environment.

> *"Technology alone will not determine the future"*

If technology were the only determining factor, we could envision a future in which communications from author to reader are continually improved. In that future, authors have the ability to create more comprehensive and more dynamic reports of their work. Publishers continue to enhance each individual work and expand their overall offerings while they reduce the cost of production. Compositors and printers expand upon their technical areas of expertise to support an ever-growing component of information transfer. Librarians and their patrons are assured of archived information that is well preserved and accessible with whatever current technology they are using.

The scholarly-communication process as a whole can be more accurate, more efficient, more effective, and more rapid as it builds on the publishing and printing technologies from centuries past. And the individual reader can be free to select

information in whatever format may be desired — paper, disk, online, or something not yet invented.

But technology alone will not determine the future. Relationships, economics, and patterns of behavior are equally important. Changes in these four factors will occur at varying speeds and will have different impacts on the process at different times. Everyone involved in the publishing process needs to recognize the impact of these factors and not simply assume that technology alone will inherently generate a prosperous future for us all.

Linda Beebe is Senior Director of the American Psychological Association's PsycINFO, an online abstract database of psychological literature from 1887 to the present. She was formerly the president of Parachute Publishing Services, which provides project and program management and support for all publication phases from content development through promotion, distribution and evaluation. Also the former director of the NASW Press, a division of the National Association of Social Workers, she has worked for and consulted with professional and trade associations, consumer groups, colleges and universities, and others to develop and deliver communications in print and electronic media. Together she and Barbara Meyers have 55 years experience in scholarly publishing and are well known for their active participation in a number of industry groups such as AAP/PSP, CBE, NFAIS, and SSP. You may contact her by e-mail at lbeebe@sprynet.com.

Barbara Meyers is president of Meyers Consulting Services (MCS), which provides expertise in management, marketing, planning, and research to professional societies, publishers, and commercial firms. Formerly she worked for the American Chemical Society, the National Academy of Sciences, and the Chamber of Commerce of the U.S. She was one of the founders of the Society for Scholarly Publishing and was President of the Council of Biology Editors from 1997 through 1998. Together she and Linda Beebe have 55 years experience in scholarly publishing and are well known for their active participation in a number of industry groups such as AAP/PSP, CBE, NFAIS, and SSP. You may contact her by e-mail at mcsone@erols.com.

References

Alonso, M.R. (1998). The total package. *Package Printing & Converting Presidents Report: Digital Prepress,*August 1998.

Beebe, L. & Meyers, B. (1998). *Outsourcing: Planning for Strategic Partnerships. A White Paper Prepared by The Sheridan Press.*Hanover, PA: The Sheridan Press.

Calabretto, S. & Bozzi, A. (1998). The philological workstation BAMBI (Better Access to Manuscripts and Browsing of Images). *Journal of Digital Information,*1(3). Available: http://jodi.tamu.edu/Articles/v01/i03/Calabretto/.(Note: This journal is currently free; however, the reader must register before obtaining access to content.)

Cray, D. (1998). Driving the digital route. *In-Plant Graphics,* November 1998. [Editor's note: link removed August 2001 as it is no longer available.]

Erickson, J.S. (1996). Rights management through enhanced attribution. *Internet Society Proceedings*. Available: http://www.isoc.org/isoc/whatis/conferences/inet/96/proceedings/b3/b3_4.htm.

Hill, K. (1999). A perspective: The role of identifiers in managing and protecting intellectual property in the digital age. *Proceedings of the IEEE.* 87:7. [doi: 10.1109/5.771074]

Kasdorf, W. (1998). *An Introduction to SGML and XML for Book and Journal Publishers: An Overview of the Issues.*Ann Arbor, MI: Impressions Book and Journal Services, Inc. Available: http://www.impressions.com.

Kirby, G. A. (1999). Knowledge is power: An in-depth look at CTP. *MagazineTech 98 Conference Seminar Summary*.

Kling, R. & Covi, L. (1995). Electronic journals and legitimate media in the systems of scholarly communication. *The Information Society,*11, 261-271. Available: http://www.indiana.edu/~tisj/readers/abstracts/11/11-4%20Kling.html.

MacKie-Mason, J. K. & Riveros, J. F. (1997). Economics and electronic access to scholarly information. [Revised May 10,

1997.] Available: http://hdl.handle.net/2027.42/57548.

Meyers, B. & Beebe, L. (1999). *The Future of the Print Journal. A White Paper Prepared for The Sheridan Press.*Hanover, PA: The Sheridan Press.

Open Information Interchange. (1998). OII guide to metadata.

Seybold San Francisco/Publishing 98. Publishing Systems Conference. XML for print. *Seybold Seminars Online,*September 3, 1998. [formerly http://www.mobiltape.com/ShowSum.tpl?command=search&db=MT.txt&eqCategoryTypedatarq=Technology&cart=99667332622280o&searchTitle=Technology&ShowNamesum

SRA. (1999). Database marketing — An overview.

Summerfield, M. (1997). Issues in the economics of scholarly communication: A white paper supporting the Andrew W. Mellon Foundation-funded projects. The Online Books Evaluation Project & Columbia International Affairs Online. [Revised March 1998.] [formerly http://www.columbia.edu/cu/libraries/digital/texts/econpap.html].

Additional Reading

Greenlaw, D., Cosimini, G., Scott, F., and Warmus, J. (1998). Analyzing digital ad formats: Flawless file preparation for CTP. *MagazineTech 98 Conference Seminar Summary*.

A Brief Glossary

BMP: The standard bitmapped graphic used in Windows; files end in the .bmp suffix.

CSS: Cascading Style Sheets. A style sheet language developed by W3C to style HTML documents for the Web.

DTD: Document Type Definition. The blueprint for any publication tagged in a mark-up language such as SGML, XML, or HyTime.

EPS: Encapsulated PostScript. A format particularly useful for providing text, such as tables and math, in a graphic. Used for vector-based and object-based graphics.

GIF: Graphic Interchange Format. Used for image files on the World Wide Web.

GUI: Graphical User Interface. The interactive screen display that includes icons, windows, and point-and-click capability.

HTML: HyperText Mark-up Language. A derivative of SGML, used to transmit text across the Internet to any computer.

HyTime: Hypermedia/Time-based Structured Language. An international standard that is an extension of SGML, HyTime defines the structure of multimedia materials. Its DTD includes elements called architectural forms or meta elements.

JPEG: Joint Photographic Experts Group. A "lossy" technique that compresses color image files to about 5 percent of their normal size by "losing" detail.

MathML: A markup language developed to make it easier to put mathematical and scientific representations in World Wide Web pages. Based on XML, MathML was released as an official W3C recommendation in April 1998.

Metadata: Data about data. In data warehouses, metadata describe the details of creation, development, ownership, prior publication, rights, and so forth.

PCX: Graphics format that was the standard pre-Windows. PCX is an efficient file format for bitmapped graphics.

PDF: Portable Document Format. An Adobe format for online publishing that is a derivative of PostScript; delivers searchable files that are platform-independent.

PNG: Portable Network Graphics. A format that delivers "lossless" compression.

RIP: Raster Image Processor. RIP translates PostScript language into bitmap data (0s and 1s); in turn the imagesetter processes this information to tell the laser how to image the next level of material, which may be paper, film, or plate.

SGML: Standard Generalized Markup Language. A platform-independent coding scheme used to define the structure of a publication.

TIFF: Tagged Image File Format. A format used to store graphics in a bitmapped image.

Vector: Another method of representing images. With Vector, mathematical formulas are used to define all the shapes in an image; consequently, they look the same however they are scaled, in contrast to bitmapped images that may become ragged with size changes.

VXML: Voice Extensible Mark-Up Language. A technology developed by AT&T, Lucent, and Motorola to make it easier to create interactive voice applications for the World Wide Web.

WMF: Windows Metafile Format. A graphics format used to exchange graphics information between Windows applications; can hold both bitmapped and vector images.

: World Wide Web Consortium. An industry consortium established to promote standards for the evolution of the W and interoperability between products. CERN (the high energy particle physics laboratory in Geneva) and DARPA (the U.S. Defense Advanced Research Projects Agency) established W3C. The consortium is hosted jointly by the MIT Laboratory for Computer Science in the U.S. and INRIA in Europe.

XML: Extensible Markup Language. A coding scheme with user-defined tags that combines the flexibility of SGML and the easier use of HTML. Because it is extensible, it can be used in more ways than HMTL.

XSL: Extensible Style Sheet Language. A standard W3C is developing to style XML documents and to transform XML data into HTML/CSS documents on the Web. It is template-based so that the editor can attach style information to elements.

Check http://www.zdwebopedia.comor http://www.whatis.com or http://www.ask.com as sources for other definitions.

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