processors have empowered people to communicate their thoughts more logically and more professionally. It is no exaggeration to suggest that what Gutenberg's printing press did for society as a whole, word processors have since done for individuals. Even more revolutionary is the way information is created and stored in electronic files that can be converted to a variety of printed and online formats.

On the other hand, many—often incompatible—systems have been developed in the short history of word processing. Paper documents hundreds of years old and stone tablets very much older can still be read, albeit sometimes with difficulty. Yet how many word-processed documents written during the last 30 years have become inaccessible simply because the systems that produced them have now become obsolete? How many more will be lost by the difficulties of maintaining information in electronic form? Word-processed information seems far more convenient and robust than information committed to paper, but librarians designing the digital libraries of the future and others still have questions over the durability of electronic information.

FURTHER READING

Biermann, Alan. *Great Ideas in Computer Science: A Gentle Introduction*. Cambridge, Mass.: MIT Press, 1996.

Goldfarb, Charles. *The SGML Handbook*. Oxford: Clarendon Press, 1990.

Kinkoph, Sherry. *How to Use Microsoft Word 2000*. Indianapolis, Ind.: Sams, 1999.

Myers, Brad. "A Brief History of Human–Computer Interaction Technology." *ACM Interactions*, Vol. 5, No. 2. Mar. 1998, p. 44.

Parker, Roger C. *Desktop Publishing and Design for Dummies*. Foster City, Calif.: IDG Books, 1995.

Romano, Frank. *Digital Media: Publishing Technologies for the 21st Century*. Torrance, Calif: Micro Publishing Press, 1996.

Rothenberg, Jeff. "Ensuring the Longevity of Digital Documents." *Scientific American*, Jan. 1995, p. 24.

—*Chris Woodford*

Workflow Software

Workflow software is the generic term used to refer to integrated systems capable of encompassing all phases of office work. Instead of employees exchanging paper files, workflow systems allow them to exchange electronic files. All transactions are monitored through all stages, so that the state of a certain work unit can be assessed immediately. Installing these systems at corporations is not an automatic process, and therefore workflow systems require an associated activity called *business process reengineering* (BPR).

In every office, work is organized in a pipeline. One office worker receives a document, processes it, and sends it to the next worker in the line. Much time is lost, not in the actual processing of the document, but in the physical exchange of paper. Also, in many cases it is uncertain which phase the document has reached. Workflow software automatizes the exchange process, making office workers more productive. The workflow software industry has now become a multibillion dollar business.

Workflow analysts distinguish between material, information, and human processes. The purpose of workflow systems is to make information processes faster and to provide tools (e.g., videoconferencing, meetings calendar) for the human processes in a business.

Three types of workflow are usually distinguished: image-based, form-based, and coordination-based systems. *Image-based workflow processes* are optimized by transferring documents to a digital file and moving them through the organization. Many banks, for example, do not move paper checks across their branches but rather, a digital image of the check. *Form-based workflow systems* make entering data into forms more efficient by avoiding paper. Forms are displayed on screens and are filled in, for example, at hospitals or car rental agencies. *Coordination-based workflow systems* try to facilitate collaboration of several persons through the various stages of a task.

Typically, a business process reengineer has to go through three steps in order to reorganize the information processing at a business. First, all the persons involved in the process are interviewed and a map of the interactions between them and of the transaction flow is created. This is actually a difficult task, because the structure of a company is rarely documented, it just "exists." Next, the processes are broken down into meaningful, manageable pieces that can be analyzed individually. Finally, a new information processing graph is sought, which can fulfill the same task more efficiently, that is, in less time and with less work. For

all these steps of the evaluation process, special software can be used to assist the evaluator in determining the old and new workflow structures.

At this point, the business engineer has to assess the technological options available and design a new integrated system, capable of implementing the new workflow. There are many commercial packages that can be selected for this task.

The Workflow Management Coalition is a nonprofit organization of software vendors and users interested in developing standards for the interoperability of workflow systems. In this way, different companies could connect their systems together to avoid having to go back to paper at the company's boundary.

FURTHER READING

Dogac, Asuman, ed. *Workflow Management Systems and Interoperability*. Berlin: Springer-Verlag, 1998.

Schäl, Thomas. *Workflow Management Systems for Process Organisations*. Berlin: Springer-Verlag, 1998.

—Raúl Rojas

World Intellectual Property Organization

The World Intellectual Property Organization (WIPO) is an intergovernmental organization within the United Nations system that is responsible for the promotion of the protection of intellectual property throughout the world. In early 2000, more than 170 countries were members of WIPO.

WIPO is dedicated to helping to ensure that the rights of creators and owners of intellectual property are protected worldwide and that inventors and authors are recognized and rewarded for their ingenuity. There are two main forms of intellectual property: industrial property, chiefly in inventions, trademarks, industrial designs, and appellations of origin; and copyright, chiefly in literary, musical, artistic, photographic, and audiovisual works. WIPO carries out many tasks related to the protection of both forms of intellectual property.

The need for international protection of intellectual property first became evident when foreign exhibitors refused to attend the International Exhibition of Inventions in Vienna in 1873 because they were afraid their ideas would be stolen and exploited commercially in other countries. Ten years later, the Paris Convention for the Protection of Industrial Property was convened to develop the first major international treaty designed to help people obtain protection for their intellectual creations in countries other than their own. The treaty addressed industrial property rights, known as inventions (patents), trademarks, and industrial designs. In 1886, international copyright protection was addressed by the Berne Convention for the Protection of Literary and Artistic Works.

Both the Paris and the Berne Conventions established international bureaus to carry out their activities, and in 1893, these two organizations combined into the United International Bureaux for the Protection of Intellectual Property, the predecessor to WIPO. In 1960, the organization moved to Geneva to be closer to the United Nations, and in 1970, underwent a series of structural reforms to become WIPO, which became an agency of the United Nations in 1974.

Today, WIPO administers a total of 21 international treaties that define international intellectual property law or simplify the international protection process by providing for a single registration or filing that has effect in all countries that are parties to the treaty. WIPO also provides assistance to developing countries in establishing effective intellectual property protection systems by training officials dealing with intellectual property and assisting them in establishing effective administrative procedures.

Copyright is the legal mechanism by which most **software** developers protect their right to control the distribution and use of the software they have developed; therefore, WIPO's efforts to ensure consistency in definition and enforcement of copyright law among its members is of great significance to the international software industry.

With the great expansion of the **Internet** for commercial and personal use in the 1990s, the need arose to ensure that intellectual property law provided adequate protection for software and information distributed electronically. WIPO drafted the World Intellectual Property Organization Copyright Treaty (WCT) to ensure that copyrighted works remain protected when transmitted online and that there are prohibitions in