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THE FUTURE OF POSTSCRIPT LANGUAGE TECHNOLOGY FROM ADOBE SYSTEMS

New applications and an expanded role for Adobe's industry-standard technology for communicating visual information

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POSTSCRIPT®
Software From Adobe

Since its introduction in 1985, technology developed at Adobe has had a profound impact on computer printing and publishing. It has solved crucial problems for software developers and hardware manufacturers, has brought 500 years of printing and publishing techniques to computer users, and has given users the power to communicate visual information more clearly and elegantly than ever before possible.

Adobe envisions new applications and an expanded role for its PostScript technology in the 1990s. The company plans to continue introducing technology that solves fundamental computing problems; makes computers more powerful communication devices; and removes obstacles preventing users of different types of computers, operating systems, applications and output devices from exchanging, displaying and printing files easily.

The future direction of PostScript technology and the problems it can help solve are closely related to the problems it solved when it first appeared.

HOW POSTSCRIPT® SOFTWARE CHANGED THE PRINTING AND PUBLISHING INDUSTRY

The key elements of Adobe's technology are the PostScript language and the PostScript interpreter, a software program that interprets page descriptions in the PostScript language. When they were introduced in 1985, there were no effective page-description standards, popular typefaces were used only with specific typesetting equipment, producing high-quality visual materials was restricted to specialists, and the cost of producing most high-quality documents was prohibitive.

In its brief history, the PostScript language and the many corporations and individuals working with PostScript products have changed all that. The PostScript language has become the industry-standard page description language, the major type libraries are available in the Adobe Type 1 format, and the cost of producing high-quality printed material has dropped substantially. As a result, the PostScript language is becoming a part of the basic fabric of the printing, publishing and computing industries.

PostScript devices helped change the electronic printing and publishing landscape because they were the first desktop printers that could print high-quality text and graphics on the same page; and the first that could quickly build and print smooth, sharp type at any size—something most experts thought was simply impossible. As devices that enabled users to accomplish both those publishing tasks, PostScript printers became one of the indispensable enabling technologies behind the desktop publishing revolution.

Acceptance of the PostScript language as a standard also benefitted software developers and hardware manufacturers. Instead of having to write dozens of printer drivers to support dozens of printing devices with different protocols, developers could suddenly write a single driver that supported every PostScript device. Hardware manufacturers, in turn, could introduce products incorporating PostScript software—the most advanced imaging technology available—and be guaranteed the devices would be compatible with thousands of applications that support PostScript devices.

Adobe technology also helped establish the clear advantages of open computing, an approach to designing and integrating systems that gives users the freedom to combine the hardware and application software they need to perform a specific task, with the assurance that they will be compatible. The PostScript language and PostScript

software also give users the freedom to print a document on any PostScript output device—regardless of the computer or PostScript-supporting application used to create it—without having to re-format it. That capability of creating "device-independent" documents lets users create a document once, on the system best suited to the task, then output the document on any output device that meets their needs for throughput, resolution, finishing features and quality.

POSTSCRIPT TECHNOLOGY TODAY

PostScript software technology has become an industry standard for electronic printing and publishing because PostScript output devices are extremely cost-effective tools for designing and producing printed materials. The standard was established in partnership with major computer equipment and peripheral vendors, which are shipping more than 200 PostScript output devices, and with leading application software companies, which have included support for PostScript devices in more than 5,000 products. More computer products support the PostScript language than support any other electronic imaging model.

Adobe has continued to revise and extend the PostScript language since its introduction in 1985. In mid-1990, the company announced PostScript Level 2, the next generation of the language. PostScript Level 2 delivers improved performance, adds new features and functionality, and is easier for software developers to use. It also incorporates previously announced extensions to the language for color, composite fonts (large character sets) and the Display PostScript® system.

While the principal application for the PostScript language to date has been as a page description language, it is in fact a general computer language with far wider application. Because the language is *device independent, platform independent, operating system independent* and *resolution independent*, it is ideally suited to serve as a **universal language for communication** among computer systems and output devices as well as for displaying and printing visual information on the widest possible range of devices.

Adobe believes the future of the PostScript language lies in expanding its role as an industry-standard printing and display language and as a universal language for computer communication. The company envisions the language developing in several ways in the 1990s, with it serving as:

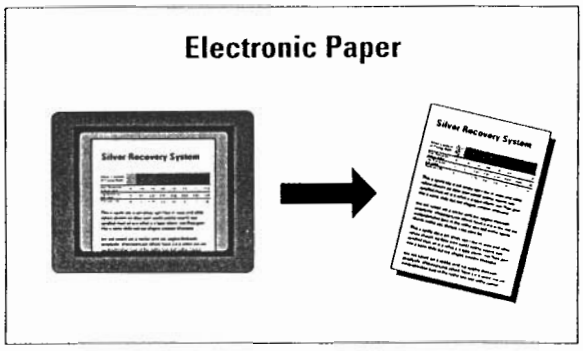
- A form of **Electronic Paper**
- An editable document interchange format
- A multimedia carrier
- An interactive document format

THE ELECTRONIC PAPER OF THE FUTURE

Predictions of a "paperless office" have never come true because there is currently no viable electronic alternative to paper. Such an alternative needs to be easier to distribute than paper and at least as easy to view and reproduce.

To make Electronic Paper feasible, the computer industry needs a device-independent format for a self-contained document that can be transmitted via network from computer to computer and location to location. Also necessary is a software program, or interpreter, that can read such a format and display or print the document on any device. Like a paper document, Electronic Paper documents will exist only in a "final form," not revisable or editable by people who receive them.

Adobe is developing both the format and the interpreter for Electronic Paper. PostScript language files today are already very close to having the features of the Electronic Paper



The goal of Adobe's Electronic Paper is to enable users to view documents on any device containing a PostScript reader and to print them on any raster output device.

format, but do not incorporate all the information, such as font outlines, needed to view and print them. Adobe believes it is the responsibility of the printer driver program to insert font information into a document, thereby taking a major step toward making a document self-contained. Future versions of printer drivers Adobe is developing will be capable of doing just that. Once a document becomes self-contained by incorporating all the underlying information describing its appearance, users will be able to view it on any device containing a PostScript "reader," or interpreter, and print it on any printer.

The PostScript language interpreter, which has already shipped on over a million devices, has the capability of being a reader of PostScript language files. Once the interpreter is slightly modified to be a reader, and development on the format is completed, Adobe plans to introduce them together as a turnkey, device-independent solution for viewing and printing formatted documents.

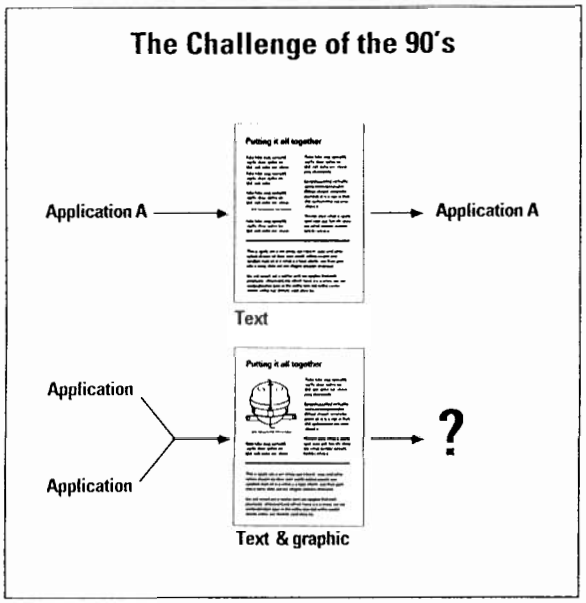
Another technology currently under development at Adobe that will help make Electronic Paper a reality is a chip that will be able to rasterize type, or create bitmapped characters from outlines, at more than 1,000 characters per second. (Current technologies rasterize at about 125 characters per second.)

The ability to create text at that speed will enable viewers to see a page in its original physical size and orientation, to scroll around the page, and to zoom in on sections of the document—all with a natural, fluid motion. The document will be rendered as if the display were a window on the page. The effect is like that of a newspaper viewed through a square window cut out of a piece of cardboard and placed over the paper. Moving the paper underneath the cardboard enables the viewer to see different areas of the paper through the window. PostScript software, by constructing an ideal representation of a page (that is, a resolution-independent representation) then modifying it for viewing or printing on a specific device, is capable of enabling users to view documents in precisely this way—a way that turns a PostScript file into an Electronic Paper document.

POSTSCRIPT LANGUAGE FILES AS AN EDITABLE DOCUMENT INTERCHANGE FORMAT—INTERCHANGE POSTSCRIPT (IPS)

A long-standing problem for users is the difficulty of combining several types of documents from several sources into one compound document. Imagine, for instance, that you're putting together a marketing plan for a new product and you need to combine several pieces of information: text describing the plan, a spreadsheet table showing projected revenues at various price points, a map illustrating projected sales by region, and photos of packaging.

All those pieces exist as computer files, but were created in different applications running on different computing platforms controlled by different operating systems. No technology currently available can serve as a common *interchange format* that will allow you to



Adobe is preparing a solution to a long-standing problem — How to enable users to combine and edit documents from several applications, regardless of the application, operating system or platform used to create the document.

import all those files, complete with formatting, into an application on your computer so you can edit them and create a single compound document.

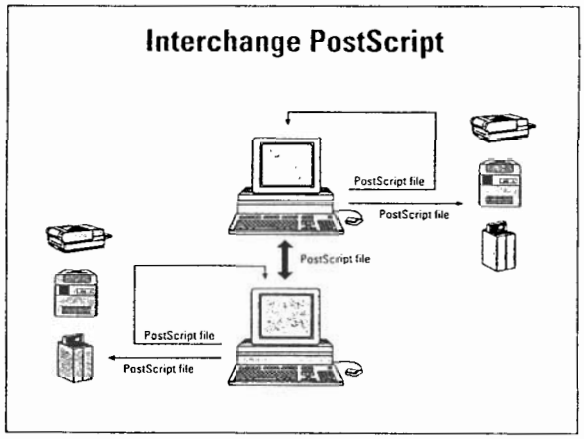
The need for this capability—the capability to exchange editable documents—is growing because today's typical corporate computing environment is made up of a variety of systems from a variety of manufacturers, and documents created on one system in one application are often impossible to view, edit and print on another system.

Current technology does permit users to import formatted files into applications other than the one used to create them, but such files are rarely editable. For today's users to exchange formatted, editable documents, they must have the same application, the same version of that application, and the same operating system. They often do not, especially if they work for different organizations.

Adobe's concept of Electronic Paper, described in the preceding section, is an intermediate stage along the way towards the ultimate goal—an editable document interchange format that contains both the final form and an editable form of a document.

Document-centric vs. operating-system-centric approaches. Several companies, including Microsoft, GO, and Patriot Partners are trying to solve the problem of exchanging formatted, editable documents by developing next-generation operating systems that handle a wide variety of applications. The drawback to such an approach is that it requires all users who want to exchange editable information to have the same operating system. The continuing proliferation of operating systems and computing platforms makes that level of uniformity unlikely.

Adobe believes the answer lies in creating self-sufficient documents that users can exchange, view, edit and print, regardless of the operating system or applications residing



Documents in the Interchange PostScript format can be viewed and edited on any platform with a PostScript interpreter, exchanged among platforms, and printed on any PostScript output device.

on their computer. This *document-centric* approach contrasts with the *operating-system-centric* approach being pursued by Microsoft and others.

In the document-centric approach, the document—not the application or the operating system—contains all the information needed to perform operations on itself. The document becomes the *artifact* of the application and is capable of being exchanged among applications and platforms.

In order for documents to serve as a self-sufficient medium of exchange, they must contain all necessary underlying semantic information. A spreadsheet, for example, contains numbers in columns and rows as well as formulas—not visible in the printed version of the spreadsheet—that generate those numbers. Similarly, an Adobe Illustrator® 3.0 document consists of objects composed of curves, lines, colors, groups and other elements. The document generates those objects as printed output and contains underlying, device-independent information describing them. An Illustrator document thus comprises not only what appears in its printed form, but also all the semantic information that generates that output.

The capability to create documents that include a final form and all the information necessary to edit the document gives the PostScript language, as evidenced in Illustrator 3.0, the potential to serve as the enabling technology for a document-centric solution.

Interchange PostScript. Adobe is currently working on extending the concepts in Illustrator 3.0 to make them the foundation for a universal editable file format for entirely self-sufficient documents.

The name for the format is *Interchange PostScript,* or IPS. IPS will be a file format that can be created by any application program and understood by any other program. Adobe's plan is to write a specification for IPS which it will make available free to application software vendors so that they may incorporate support for it into their products.

To return to the example, you could write your marketing plan easily if all the applications whose files you need to import supported the IPS format. The people creating those files would simply save them in the IPS format, and you could bring them into your application with all their formatting intact. You could then edit them as necessary and combine them into a single document.

Approaches for Exchanging Formatted, Editable Documents

Approach	Advantages	Disadvantages
Operating-system centric (O/S)	No need for O/S-independent file format	Everyone needs same O/S and same version of O/S
	No need for O/S-independent file format reader	Same O/S must run on all platforms, PC, Mac, UNIX, mainframes
Document-centric	Documents can be viewed on any platform with a file format reader and printed on any device	Application developers must support the format as an option for saving files
		Adobe and its partners must solve technical problems related to device-independent viewing and editing of documents containing text, graphics and photographs

This table briefly summarizes the advantages and disadvantages of the two approaches.

The PostScript language is the logical choice to become the technology behind such an interchange format because it can describe any kind of text, line art or scanned image that can be stored in a computer. In addition, it's already an industry-wide standard in electronic printing and publishing.

In devising a solution to the problem of displaying, as well as printing, documents in a device-independent manner, Adobe is solving the other half of the problem it solved in 1985, when PostScript software began enabling users to print documents on any PostScript device. Once the display solution is in place, users will truly be able to print and view anywhere with PostScript technology.

THE POSTSCRIPT LANGUAGE AS A CARRIER OF MULTI-MEDIA INFORMATION

Multi-media computing is a developing technology that promises to increase the power of the computer to educate and communicate. In multi-media computing, programs combine text, images, color, sound and full-motion video to communicate more effectively than would be possible without such a combination of tools.

The PostScript language is currently structured to be able to carry information about text, graphical shapes and sampled images. But its structure can be extended to carry other types of visual and audio information. Extended in those ways, it can become part of the foundation for multi-media computing and can help that technology realize its potential.

The definition of a document in the document-centric approach applies not only to paper documents and electronic files, but also to other self-contained carriers of visual information, such as a commercial television newscast. A "document" in the PostScript language is therefore an electronic file containing any or all of the following elements: text, line art, scanned or sampled images (photographs), sound and full-motion video. A newscast thus qualifies as a document being exchanged between different systems. Because they can be transformed into a series of digital images, video programs such as newscasts can be carried and enhanced by the PostScript language.

Using that capability, PostScript technology could facilitate advances in mass communication, such as a newspaper distribution system where newspaper companies send subscribers electronic versions of their paper to be read on a television screen. An existing video editing system called Video F/X enables a PostScript file to be divided into multiple pages, where each page represents a video frame. Building on that system, Adobe could use PostScript software to make the text on a television screen smoother and more readable, thereby making even newspaper-size print easy to read. Such an improvement makes it more feasible for newspapers to be delivered and read in electronic form.

The PostScript language can already carry audio information, as demonstrated by applications for NeXT computers, which allow users to add voice messages to documents. Many other companies are working on multi-media applications that will produce new kinds of complex files. Adobe's goal is not to build a standard product, but to establish a methodology for document interchange.

POSTSCRIPT LANGUAGE FILES AS INTERACTIVE DOCUMENTS

An interactive document is one that contains information instructing the user how to interact with the document's contents. It can guide you in finding information it contains and in customizing itself to suit your purposes. For example, an interactive document can guide the user in creating a training

presentation that incorporates several types of files, including text, graphics, line art and even full-motion video. Simpler interactive documents that link related information and allow users to define the relationships between pieces of information include address books, sales organizers and product documentation.

One existing format for such documents is the HyperCard language from Apple. A drawback to HyperCard documents is that are device-dependent, working only on the Apple Macintosh.

The PostScript language is more powerful than the HyperCard language and is capable of carrying information on making a document interactive. It is possible to build interactive documents using the PostScript language that can be viewed and printed on any device that contains PostScript software.

Adobe is currently exploring means to take advantage of the potential of the PostScript language as a format for interactive documents.

ADOBE'S STRATEGY

Adobe's approach to extending the PostScript language in the 90s will be to develop products that take advantage of the capabilities and potential inherent in the language. The company will also continue to enhance the enabling technology that underlies Adobe products, such as device-independent color in PostScript Level 2 and the file interchange capabilities of its Encapsulated PostScript file format. Adobe will also continue to work with OEMs, ISVs and users to find the best solutions for the industry as a whole.

The PostScript language has already become an industry standard and a proven solution to the long-standing problem of integrating high-quality text and images in computer-generated documents. Extending the functionality of the language into new areas will require substantial research and development, but the payoff can also be substantial. Adobe is prepared to undertake that research, since there are no limitations inherent in the language to prevent it from serving as the foundation for Electronic Paper, an editable interchange format, multi-media carrier and interactive document. If Adobe succeeds, the whole industry benefits, and users will find that computers have moved a giant step closer to becoming the communication tools they want them to be.

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