# Founding and Growing Adobe Systems, Inc.

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***Abstract*—Founded in 1982, Adobe Systems heralded several of the technological innovations necessary to precipitate the emergence of desktop publishing as well as many features of modern office computing, digital media, and graphic arts. In this paper, Adobe founders Charles Geschke and John Warnock cover their professional history, the conception of Adobe Systems, and its growth. They also explain the technology behind the advances in computer printing, electronic file transfer, and digital art and photography. Adobe, its products, and its engineers played a key role in these developments, which enabled desktop publishing and the publishing revolution.**

**Adobe Systems** was founded on December 2, 1982, by Charles Geschke and John Warnock.

While working at Xerox Palo Alto Research Center (PARC), they were both contributing to and participating in the design of the "office of the future." During this time, they were becoming increasingly frustrated with Xerox management's lack of appreciation and understanding of what the researchers at PARC had developed.

To understand this frustration, one must understand what PARC was, where it came from, and Warnock and Geschke's educations and backgrounds. (Note this paper builds on an earlier article by John Warnock, "The Origins of PostScript," that appeared in the first IEEE Annals special issue on the history of desktop publishing.)[1]

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## ARPA COMMUNITY AND XEROX PARC

The roots of our creation and development of Adobe Systems lie in the research community supported and shaped by the Advanced Research Projects Agency (ARPA) and by Xerox's research laboratory, the PARC.

In 1958, Neil McElroy, under the U.S. President Dwight D. Eisenhower, established ARPA within the Department of Defense.[2] The Information Processing Technology Office (IPTO) branch of ARPA was started by J. C. R. Licklider in 1962.

This ARPA office gave large grants to Centers of Excellence in computer science, artificial intelligence, and computer networking spread across the country, including the Massachusetts Institute of Technology (MIT), Harvard University, Carnegie Mellon University, the University of Illinois, the University of Utah, Stanford University, Stanford Research Institute, the University of California at Berkeley, Bolt Beranek & Newman, Rand Corporation, and more. Taken together, the grants allowed these centers to investigate and share all aspects of computer science and advanced computer technologies in an unclassified setting. These ARPA Centers for Excellence produced students and researchers who formed a self-conscious community and became some of the best computer scientists in the country. (In 1970, ARPA was changed to Defense Advanced Research Projects Agency and its focus changed to defense- and military-oriented research.)

Between 1965 and 1969, John Warnock worked on his doctorate at the University of Utah under David Evans and Ivan Sutherland, working under a Utah ARPA contract studying man–machine communication. The Utah ARPA project mostly pursued computer graphics. Warnock's earlier work started with IBM in 1963. In 1969, Warnock was one of the principals in starting Computime Canada, a company in Vancouver, British Columbia. Its goal was to provide time-sharing computer services in the Vancouver area. Because of an economic downturn in 1970–1971, Computime ran out of money and shut down. After Computime, Warnock worked for Computer Sciences Corporation and Evans & Sutherland Computer Corporation.

During the same period, Charles (Chuck) Geschke studied programming languages and pursued his doctorate at Carnegie Mellon University under William Wulf, also under an ARPA contract. After finishing his degree, Chuck joined the newly opened Xerox PARC in 1972.

These early experiences were useful for what Warnock and Geschke were about to do.

In 1969, Robert (Bob) Taylor, who had been head of the ARPA IPTO office, moved to Utah to join David Evan's ARPA project. In 1970, Taylor then moved to California to start and help build Xerox PARC, which was established as two labs in a shared building. Because Bob Taylor knew all the exceptional students and researchers who were part of the ARPA community, he recruited many of them to join him at PARC. Taylor and PARC amassed the best, the most talented group of computer scientists we have ever encountered, before or since.[3]

## INTRODUCTIONS TO PARC

Like other research laboratories of the computer industry, PARC recruited from the graduate programs supported by ARPA. Carnegie Mellon University was no exception, and in 1972, Bob Taylor and Jerome "Jerry" Elkind, who lead PARC's Computer Systems Laboratory (CSL), encouraged Chuck Geschke as he was finishing his dissertation to consider coming to PARC. Two other recent Carnegie computer science PhDs who had gone to PARC—Edward McCreight and James Mitchell—added their further encouragement.

Geschke soon joined PARC, where his first role was driving the completion of the CSL's locally designed and produced clone of a PDP-10 called MAXC. The Digital Equipment Corporation (DEC) PDP-10 and its time-sharing operating system Tenex were the predominant systems used by the ARPA community and connected by the fledgling ARPA network. With Taylor as a personal mentor, Geschke soon hired a young gifted programmer named Edward Taft to help on the MAXC effort. Years later, Taft would make seminal contributions to software development at Adobe Systems.

Once MAXC was operational, Geschke moved on to a multiresearcher effort within CSL to develop a new modular programming language called Mesa, which would become prominent within PARC. By 1977, Geschke was taking on larger managerial roles within PARC, spearheading the enormous Futures Day Meeting in that year, during which PARC's development of the graphical, networked, personal computer Alto, and innovative software for it was presented to the Xerox leadership. Following the success of the Alto's corporate debut, Geschke was offered the chance to create a new Imaging Sciences Laboratory at PARC with the objective of developing ways to use computers and laser printers to print everything that a printing press could, moving beyond text into graphics, photography, color, and the like.

As Geschke moved to build out his new Imaging Sciences Laboratory, PARC researcher William Newman (who previously was a post-doc at Utah) told Geschke, "You really ought to talk to John Warnock." Geschke had known Warnock by reputation and had heard him give a talk as part of their mutual participation in the ARPA community. At the time, Warnock was working near PARC for the Utah-based Evans & Sutherland. Geschke telephoned Warnock about the opportunity to join his new lab at PARC, and the two agreed to meet for lunch. During lunch, Geschke was struck by their connections and the many things they had in common.

When Warnock joined Geschke's Imaging Sciences Laboratory at PARC in August 1978, he was amazed by what PARC had developed. Each member of management, each scientist, and their assistants had their own personal Alto computer. Remember that the IBM PC was not introduced until 1982. These Altos were all equipped with interactive screens, a mouse, and a 2.5-MB hard drive. All the Altos could communicate with each other over an Ethernet network. In addition, the network was connected to both file servers and high-speed laser printers—both black and white and color and both invented at PARC.

Each Alto was supported by a variety of applications: a full-blown text editor called Bravo, a fully functional email package called Laurel that looked exactly like today's email systems, a bit-mapped graphics drawing package called Mark-up, a drawing package called Draw, and an electronic design package called SIL. In addition to these fundamental tools, many programming languages and research platforms existed at PARC. For both of Warnock and Geschke, being at PARC was like having a wide window into the future of the personal computer and its place in our society, but even that window was evolving and changing.

Geschke's Imaging Sciences Laboratory was focused on the intersection of laser printing and computing, not only allowing computers to produce anything on a laser printer that could be done with a printing press, but also allowing such printing to take place while using a variety of displays, computers, and laser printers.

Warnock's role in the lab was to create a graphics model that was device independent and that would work across multiple display types that had multiple resolutions. This graphics model also had to apply to laser printers with similar variations of resolution and color.

This graphics model included all types of geometric shapes consisting of straight lines and curves, text of all kinds in any size and orientation, and images in both black and white and color. Both images and any kind of shading could be put into any shape.[4]

To research such a model, Martin Newell, Doug Wyatt, and Warnock implemented an interpretive programming language they called JaM (John and Martin) based on a language that Warnock had originally helped design and build when he worked at Evans & Sutherland. The JaM language would eventually evolve into Adobe's PostScript.[5]

## STEVE JOBS VISITS PARC

In December 1979, Steve Jobs allowed Xerox to invest in Apple prior to Apple's initial public offering only on the condition that he could see what was happening at PARC. All reports about his visit indicate that he was "blown away" by the Alto's GUI and capabilities. He too saw in the Alto a window into the future of computing. (See Newsweek for a popular account of this incident[6] and a Stanford webpage for a more critical account.[7])

After Steve's visits to PARC, Apple hired several PARC researchers. Tom Malloy (who would later serve key roles at Adobe) and Larry Tesler joined Apple to work on its Lisa computer. Bob Belville left PARC to start work on the Macintosh, which soon seemed to us to be Apple's version of the Xerox Alto. Steve's visit to PARC and his changing of Apple's direction toward the graphically oriented computing pioneered at PARC turned out to be critical to Adobe's future success.

## XEROX IMPLEMENTS THE "OFFICE OF THE FUTURE"

Around the time that the Imaging Sciences Laboratory began at PARC, Xerox made the decision to develop a commercial workstation product for the office, building on the Alto and on some more powerful versions of it that had recently been completed. This implementation of the office of the future would be known as the Xerox Star.

As the Star effort progressed, Geschke received a phone call from one of its leaders: "We need to print," he was told, "and we do not know how to do that." Geschke threw his lab into "crash mode." They would quickly set out to create a standard printing protocol for Xerox, including the Star, that would handle graphics, color, and variety in laser printers and displays.

For the better part of the next year, Geschke and Warnock collaborated with Bob Sproull, Butler Lampson, Brian Reid, and Jerry Mendelson to create this new Xerox printer protocol, eventually named Interpress. The Interpress project took place almost entirely using email on Altos, with members of the team in Palo Alto, Los Angeles, Philadelphia, and Pittsburgh.[8]

The reaction of Xerox to Interpress was the defining moment in the story of Adobe Systems. After two years trying to sell to Xerox management the Interpress standard printing protocol that we and four others had developed, our sales job was successful. But in its infinite wisdom, management said we could not publish the protocol until Xerox shipped its first printer that supported Interpress, which was expected to take seven years. For us, that was the straw that broke the camel's back.

We had become close friends and partners over the four years we had worked together at PARC, and like all engineers, we wanted our work to be used.

Warnock recalled it this way in his recent oral history with the Computer History Museum:

> *I went into Chuck's office and said, "Well, I need to fly back to Salt Lake and talk to Dave Evans." I flew back to Salt Lake, and I said, "Here's what we want to do." He said, "Let me introduce you to Bill Hambrecht," a venture investor who had worked closely with Evans & Sutherland.*
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> *I said to Dave Evans, "Well, one thing is I reimplemented the Design System at PARC, but it is Evans & Sutherland's Design System. If we need to start this company, I want to license it from you because that's where the original work was done." So we gave him a portion of the company stock to license the Design System. We contacted Bill Hambrecht. Bill said, "If you can put out of business all of the financial printers, I will invest anything into you as a revenge investment." He said, "How much money do you need? Where are you going to start up?"*

## ENTERING A NEW ECOSYSTEM

In the fall of 1982, the Hambrecht & Quist investment bank agreed to an initial funding of $2.5 million over two years. That initial funding would be split in half, with the second half contingent on milestones achieved during the first year. We resigned from Xerox in November and started Adobe Systems on December 2, 1982, naming it for the creek in Los Altos that ran behind our homes.

Our fledgling business plan outlined that we were going to build systems that would automate the publishing process. The company would develop and provide high-end document production systems: workstations and laser printers able to produce high-quality printed pages by using the PostScript framework for both document production and printer drivers. We learned about the current publishing industry by attending the Seybold Seminars that were then held in Los Angeles.[9]

The IBM PC had just been announced and was totally inadequate for our needs. Viable computer systems available at that time for our planned system were made by Sun Microsystems, Apollo Computers, and DEC. Laser printers were available, but they cost more than $13 000 (something like $33 000 in today's currency).

In the beginning, our friends at DEC, Forrest Baskett and Sam Fuller, lent us a Xerox laser printer, and we leased a DEC VAX computer that we used in time-sharing mode. We hired two senior computer scientists (Bill Paxton and Doug Brotz) and two electronics designers (Tom Boynton and Dan Putnam) from PARC, along with a few other employees. With this team, we started to build PostScript. The electronics engineers were hired to architect controller boards for printers. This was necessary because of the size of the page buffers and the execution memory that PostScript required.

## WHY POSTSCRIPT?

A major technical decision at Adobe was to pick a direction to go in solving the laser printing problem. Most printing protocols in the past and at the time (including Interpress) were declarative in nature. They consisted of a catalog of capabilities that along with parameters and input provided a page's content (much as HTML provides a catalog of capabilities for building a website). PostScript is a full programing language with a complete set of controls, mathematics, graphics, and system operators (much as JavaScript when combined with Canvas provides a programming language to build websites).

Warnock and Geschke decided that a full programming language would provide a much more flexible and extensible solution as a device-independent printing protocol.

In the implementation process, the engineers only assumed that the ultimate output was to a raster imaging device. No assumptions were made about the device's resolution or the depth or number of components in an individual pixel. These assumptions were bound when the target device was known. These assumptions and the implementations allowed the majority of the PostScript implementation to drive any resolution machine, black and white or color. The implementation was not appropriate for vector displays or plotters.

The PostScript Interpreter renders arbitrary graphical shapes, broken down into line segment outlines that are possibly self-intersecting. This includes font outlines as well as general graphics. The heart of the graphics engine is a process called the Reducer, which employs a plane sweep algorithm to break down arbitrary shapes into a series of nonoverlapping trapezoids that are then rendered onto the output raster. Originally, the Reducer used floating-point arithmetic for all segment endpoints and intersection points. A test program of Warnock's, we called the Death Star, showed that, under certain circumstances, the Reducer algorithm could blow up. At PARC, Lyle Ramshaw had demonstrated that seemingly identical line segments with coordinates that were defined with floating-point numbers could show anomalous behavior, such as braiding around one another. Doug Brotz managed to reengineer the Reducer using only exact integer representations. The Reducer was bug-free from that point on. Jerome Coonen of Apple helped with a fast implementation of this new arithmetic.

In parallel, we started building a new representation for text character outlines utilizing cubic Bézier curves.

To succeed in publishing, you need to have a font library. We would describe the shape of letters and characters in different fonts geometrically, rather than by scanning them and creating sets of bitmaps. Other font libraries were being built at the time, but they were based on quadratic curves that were not as flexible or efficient as the cubic curves.

As we developed PostScript, we also started to document and test all aspects of the implementation. We made progress quickly, and after about six months, we printed our first pages on a 300 dpi laser printer using PostScript. The first page was a black, 1-in square at the lower left corner of the page. (Warnock, Geschke, Brotz, Taft, and Paxton received the ACM Software System Award in recognition of the PostScript Interpreter.)

## GORDON BELL CALLS

Shortly after the start of Adobe, Gordon Bell—the famed DEC computer architect and Geschke's former professor at Carnegie Mellon—called and asked to come visit the new firm to learn more about it.

After hearing our plans, Gordon told us that DEC was having difficulty in designing a printer protocol for new laser printers that were coming on the market and that he would be interested in buying our printer software for his needs. The other aspects of our business plan did not interest him much.

## STEVE JOBS CALLS

In May 1983, about a month after Gordon Bell's visit, Steve Jobs called and mentioned that Bob Belville had told him we were doing "good stuff." We invited him over to see our progress. Steve had a dilemma. His Macintosh design was very much like the Alto at PARC but was much cheaper to build, and it was small. At the time, the Macintosh, which had not yet been released, only had a dot-matrix printer. Steve realized that any serious business environment would not accept low-quality dot-matrix printers. He planned to use the new lower cost "engine" produced by Canon for an Apple-produced desktop laser printer with the Macintosh.

His dilemma was that he did not have a printing protocol to use with the Macintosh or the printer.

After Steve had seen what we had done, negotiations between Apple and Adobe began. Initially, Steve offered to buy our company for $5 million. We declined. We were too early in our development to know what we had.

We communicated the substance of these meetings with our Board Chairman Q. T. Wiles. Q. T. listened and pointed out that our business plan was only useful for raising money, but when someone offers you money for something else, that is what your business will become.

Instead of buying Adobe, Apple gave us an advance of $1.5 million on royalties and invested $1 million to buy 20% of the company.

Our engineers and Apple's engineers started designing a control board for use on the newly released Canon laser printer. This activity was the beginning of the Apple LaserWriter.[10]

With the initial business plan laid aside in favor of a focus on licensing PostScript to computer makers and laser printer producers, the licensing business took off. Gordon Bell's DEC was in fact another early customer.

In parallel with the development of the Apple LaserWriter, Adobe needed to overcome two major hurdles in order to enter the high-end professional printing and publishing markets around the world. Success in this market required high-resolution typesetting equipment that supported PostScript and access to a typeface library of high-quality and well-known fonts.

A critical ingredient to Adobe's success in creating the digital publishing marketplace was finding a solution to providing digital typography. Designers and publishers had a passion for using a broad array of typefaces. Unfortunately, conventional wisdom at PARC in the 1970s held that in order to guarantee quality typography on a 300-dpi laser printer, one must manually create hand-tuned bitmaps for every typeface and for each character's point size. Clearly, this approach was not tenable in a world of thousands of typefaces, hundreds of different resolutions, and an unlimited choice of point sizes and orientations.

Adobe's solution was, and is, to use a mathematical representation of the outline of each character in a font that they can be rendered at any resolution and at any orientation. We define the shape of every character geometrically. With much creative effort and experimentation, we were able to come up with a solution that produced high-quality typography on medium (300 dpi) devices.

The basic idea behind the solution is to slightly distort the character's curves and lines to align consistently with the raster grid. This slight distortion produced high-quality bitmaps with a standard straightforward scan conversion algorithm. (For a more detailed description of the outline representation and the rendering algorithms, see an earlier publication.)[11]

Early on, Adobe licensed the International Typeface Corporation (ITC) library of typefaces. This library, while extensive, did not have the reputation that would gain Adobe access to the professional publishing market.

Jonathan Seybold, a leading publishing consultant, advised Adobe to contact Allied Linotype, a 100-year-old printing company originally founded in the United States with roots in metal typesetting. Linotype was the owner of a world-class type library. Linotype President Wolfgang Kummer licensed its highly respected typeface library, including the treasured Times and Helvetica typefaces, to Adobe and agreed to codevelop the first PostScript typesetter (the Linotype 100) with us.

This was a real coup for Adobe, which became the first company to obtain a full license to Linotype's famed Mergenthaler Type Library. In January 1985, when the Apple LaserWriter was introduced, a memorable photo was published of Wolfgang Kummer, John Warnock, and Chuck Geschke smiling at the announcement of their desktop publishing partnership in New York (see Figure 1).

## DESKTOP PUBLISHING ARRIVES

Although PostScript printers were announced in late 1984 by Alabama-Based Quality Micro Systems, Apple's January 1985 announcement of the LaserWriter had much more impact, and it dramatically enhanced Adobe's visibility. This announcement, when coupled with the Linotype 100 and Aldus' PageMaker software, enabled the beginning of desktop publishing.

A few months later, Steve Jobs was forced out of Apple, at which point he founded NeXT Corporation. NeXT also quickly licensed PostScript.

**Figure 1.** John Warnock and Charles Geschke of Adobe Systems and Wolfgang Kummer of the Linotype-Hell Company at a joint press reception. (Courtesy of the author.)

After printer, manufacturers saw the flexibility and quality that PostScript delivered, our success in licensing PostScript to other printer manufacturers accelerated. Eventually, we licensed PostScript to a long list of printer providers including IBM. The announcement of the IBM license was a major influence on Hewlett-Packard's licensing of PostScript.

Adobe went into a sustained period of hypergrowth: revenues were $16 million in 1986, $39 million in 1987, $83 million in 1988, and so on. PostScript had become a standard across the world of computer printing.

Adobe's growth was essentially driven by partnerships with large computer makers and printer vendors who were relying on PostScript to become the standard for computer printing. By betting on PostScript, these corporations helped Adobe make PostScript a global standard. This growing relationship with major international corporations enabled Adobe's early IPO in 1986.

## POSTSCRIPT IN THE PROFESSIONAL PUBLISHING MARKETPLACE

PostScript's impact on commercial printing and publishing has been no less revolutionary than in computer printing and desktop publishing. Typesetting was traditionally a closed industry in which each vendor protected its technical secrets and would allow only its own trademarked typefaces to be used on their equipment. Once a customer bought into a vendor's system, they were locked in for a long time and were able to change only at a significant expense. Adobe and PostScript changed this dependence on a single vendor. PostScript-enabled software, laser printers, and printing equipment let users choose from a variety of typefaces without sacrificing printing quality.

Following PostScript's rise to an industry standard and our licensing of Mergenthaler Linotype and ITC typefaces, the remaining major type libraries including Agfa, Monotype, and Berthold announced that they would convert their significant libraries to support PostScript as well. In addition, under the direction of Adobe's Director of Typography Sumner Stone, the Adobe Type Library was launched in 1986, including new typefaces created for Adobe by a group of designers that included Robert Slimbach, David Lemon, and Carol Twombly.

The next frontier for Adobe to explore was typefaces for Asian languages, especially Japanese, as Japan was a world leader in the design, manufacture, and marketing of laser printers. Adobe's Vice President of Sales Steve MacDonald, along with Sumner Stone and Chuck Geschke, began the process of exploring how PostScript could be introduced to the Japanese market.

Prior to World War II, the Japanese printing market was dominated by a company headquartered in Tokyo and founded by two individuals: Shaken and Morisawa. As Japan prepared to enter the war, the two partners found that they were in violent disagreement over the direction that their country was headed. They decided that they could no longer maintain their partnership. They divided the company into two corporations; Shaken would remain in Tokyo and Morisawa would relocate to Osaka. After the war ended, Shaken's company prospered and became the market leader in the Japanese printing and publishing industry. Morisawa continued but was a distant second.

We decided to approach Shaken first to see if we could get them to design a PostScript image setter for the Japanese market and provide Adobe with a license to their industry-leading library of Japanese typefaces. Shaken's widow was running the company in 1987. We met with her on a couple of occasions but made no progress in developing a relationship.

In frustration, we approached Morisawa, which was much more receptive. We signed an agreement to help them develop a PostScript image setter for the Japanese market, and we were able to license their entire library of Japanese typefaces.

Today, Morisawa is the largest type foundry in Japan, and Shaken is a distant second.

## ENTER GRAPHIC ARTS

The invention and implementation of PostScript printers enabled the possibility of high-quality graphic arts to be created on low-cost computers. Until that time, most graphic arts material was created by hand using art boards, technical pens, press-on letters, X-Acto knives, and art paste-ups. The camera-ready copy was then photographed and etched onto printing plates. This was a manual, time-consuming, expensive, and error-prone process.

Although the design of PostScript allowed it to render high-quality color artwork and photographs, there were no software applications that could produce such material for printing with PostScript. The only existing applications were those to produce high-quality text documents. The original graphics application draw on the Macintosh was a simple black and white bitmapped drawing application that did not produce high-quality output. However, this and other applications had introduced people to the idea of making drawings on a computer.

With the appropriate applications, PostScript—and thereby Adobe—had the potential to revolutionize the way the world's graphic art was produced, as it had revolutionized the computer printing of text. A key challenge was that, due to the discipline's manual practices, most graphic artists were not computer users.

For the computing revolution to move from text to graphic arts, graphic artists would have to learn how to use computers, keyboards, and a computer mouse as well as understand file systems, and navigate operating systems and communication networks. For people who were mostly unfamiliar with computers, this was a steep learning curve.

Adobe started this process of getting graphic artists to use computers by first releasing PostScript fonts and font families for sale through retail channels (computer stores) in 1985 and 1986. The attraction of having greater and more affordable access to a greatly expanded library of typefaces brought some graphic artists into computer use.

Because John Warnock's wife, Marva, was a graphic artist, he was familiar with the production problems facing graphic artists. In fact, while he was at PARC, Marva would give him graphic problems she encountered, and he would produce artwork on the laser printers at PARC. Unlike fine artists who are driven by freedom and inspiration, graphic artists produce highly precise and controlled artwork. Therefore, any new computer graphics program Adobe would make had to be able to produce this precise and controlled artwork.

In 1987, we released Adobe Illustrator, the first advanced drawing application. The driving principle behind Illustrator was to give the user a precise control over the creation of a piece of artwork. Mike Schuster, an incredibly talented programmer, was responsible for all the first implementations. Like the typeface packages before it, Illustrator was distributed through computer stores.

In 1989, we made a huge gamble on the future of computing, believing that the pace of change in computer technology would continue at breakneck speed. In particular, we bet that future computers would make the editing and printing of digital photography a major activity in graphic arts. At the time, this was indeed a gamble. Apple computers had 512-kB memories. The largest hard drive you could buy was 20 MB. The situation on the PC was worse. There were no storage cards. There were two primitive digital cameras. There were no low-priced scanners. In short, there were almost no sources of digital images and digital photographs.

Nevertheless, Tom and John Knoll, two employees at Industrial Light and Magic, which was at the forefront of computer graphics, had begun to think about digital photography on personal computers. They had implemented a photo-editing program on a 512-kB Macintosh. They called it Photoshop. The single most impressive thing about the implementation was the memory management architecture and that the implementation would adapt as machines became more powerful and more memory became available. They had done a good job of thinking into the future.

We decided to license Photoshop from the Knoll brothers. John Warnock told our board and the rest of the company, "We are going to sell maybe 200 to 250 copies of this a year until the world changes, but if we put our faith in this, there will eventually be a large market for it." We have not disclosed the terms of that licensing agreement with Tom and John Knoll, but it was royalty based and was good for both parties.

In 2005, we acquired Photoshop from the Knoll brothers. Illustrator, Photoshop, and products from other vendors enabled the shift in the graphics arts industry to become computer based.

## ADOBE SOFTWARE ARCHITECTURE

All of Adobe's first applications (Illustrator, Photoshop, and some other minor applications) were developed for the Apple Macintosh. As desktop publishing expanded, we started to see demand for these applications on PCs. Because PCs were increasing their memory capacity, it became practical to move the applications, but we did not take this challenge lightly.

Instead of staffing independent teams to rewrite applications, we built low-level interfaces on each platform that would expose interfaces common to the applications (no matter the platform) but differently to the individual operating systems. We called this Common Core technology.

Since the main code base of each application did not directly communicate with the operating system, and instead communicated with the Common Core, transporting the applications was much easier. By doing this, we preserved consistency in code bases and user interfaces across operating systems and machine types.

## ENTER THE INTERNET: MAKING PDF AND ACROBAT

By 1990, the use of local area and wide area networks was becoming increasingly popular. At this time, computer users began transmitting PostScript files over these networks, not for rendering by printers, but as a way to electronically send and receive documents. We believed that there were two significant risks in this.

This main problem was that these PostScript files might not contain all the resources needed to print them. When printed by a recipient, the resulting document could contain errors or have an appearance at odds with the sender's output. The documents could look different, and not for the better.

The second problem is that a PostScript file is a computer program. PostScript is both a printing protocol and a complete programming language. In principle, any program that can be run by a digital computer could be written in PostScript. Sending PostScript files for document exchange was thus exchanging executable programs over networks. From a computer security point of view, it is not a good idea to send computer programs over a network.

In thinking about these risks, John Warnock was reminded of an idea that he had used years earlier to make the public announcement of Apple's LaserWriter. The public announcement for the LaserWriter was to take place at the annual Apple shareholder's meeting on January 23, 1985. For Steve Jobs' demonstration of the LaserWriter, Warnock had hand-coded a PostScript file that would generate an elaborate IRS tax form on the LaserWriter that was largely indistinguishable from the IRS's printed form.

Warnock believed the same approach that he had used to make the tax form print quickly for the Apple LaserWriter demo might solve both the appearance and computer security problems, and he decided to spread the idea throughout Adobe in an August 1990 memo called "The Camelot Project."

The basic idea in the memo was to redefine all the graphics output operators to write their input parameters and the operator name to an output file and to include all the font information and other context information. The resulting file would not have loops, procedures, conditional statements, or computational expressions. Instead, the file would contain resources and a linear stream of graphics commands that would faithfully produce the document. Because each page would stand alone, it would be possible to print any subcollection of pages from the document without executing all preceding pages, which is not possible with a general PostScript program. This process would produce an entity we would call the Portable Document Format, or a PDF file. This was the beginning of Acrobat.

A main design goal of Acrobat was to build a robust file architecture that would not only accommodate printed pages, but would accommodate animations, videos, sound, and all kinds of media that one would like to communicate. We gave this task to some of our most talented managers, designers, and programmers: Bob Wulff, Doug Brotz, Peter Hibbard, and Richard Cohn. Without the contributions of this early talented group and many others, PDF would not be as stable and flexible as it is today.

We announced Acrobat in June 1993, and over the next few years, we were surprised by the product's slow growth. It was only when the growth of the Web started to explode that Acrobat was appreciated and its use grew. It is our suspicion that Acrobat is one of the most used computer programs in the world, and it continues to be an essential part of Adobe's present-day success.

## ADOBE CULTURE

Since 2000, Adobe and its suite of application have continued to grow. As of this writing, and for many years, Adobe has consistently ranked among the world's largest software companies in terms of profitability and market value.

Today, Adobe has more than 20 000 employees and a market value that has exceeded Xerox, Hewlett-Packard, General Electric, General Motors, and IBM. Being an initial player in the evolution of the graphic arts, photography, printing, publishing industries, and the Internet has been quite a journey. It has required perseverance, imagination, invention, education, and a vision of what the future holds.

Chuck Geschke summarized it this way in his recent oral history:

> *When John and I started the company, our goal was to build a company that we would like to work at because we figured if we liked to work there, the kind of people we wanted to hire would be attracted to it as well. We also decided though that we didn't want to write up a big book of rules of behavior and all that kind of stuff.*
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> *We said, "Look, if you're going to work for Adobe, you have to be aware of the fact that there are several constituencies on which we depend: our employees, our management team, our customers, our vendors, our business partners, and the communities in which we work. Those constituencies are all mildly in conflict because what's good for one is probably not as good for the others. Your job is to balance that effectively so that everybody feels like they're getting a good deal or at least a fair deal."*
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> *The way we enforced it is that the simple rule was, at Adobe you treat every one of the members of those constituencies the same way you would want to be treated. That's the Adobe way. Every culture on Earth has that—it's the Golden Rule.*

Ultimately, the extraordinary talent and vision of the Adobe employees has made Adobe's contributions to society possible.

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