OPI White Paper
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Executive Summary

This document covers a category of applications known in the printing and publishing industries as “OPI servers.” With an estimated installed base of about 10,000 sites, this is a distinct and important category of productivity solutions for publishing.

The installed base of OPI servers to date just scratches the surface of the total market potential. Estimates developed for this document indicate that the incremental market opportunity for 1995 is about 20,000 sites worldwide. Over the next five years, as more of the worldwide publishing industry moves away from proprietary systems and OPI products decrease their prices and increase their feature set, the total number of installations is expected to expand to more than 200,000 sites worldwide. In hardware alone, the OPI market represents an opportunity of close to a billion dollars.

“OPI” literally means Open Prepress Interface, a name given to a specification developed in 1989 by Aldus Corporation. The goal of the specification was to establish a structure for linking existing high-end color systems to desktop publishing systems.

Today, OPI has assumed a much broader role than the narrow focus of the original Aldus specification. OPI now refers to a general image-swapping procedure for page layout. Low-resolution image files—called “proxies,” “previews,” or “FPOs”—are used for page design. Subsequently, at print time, the low-resolution images are replaced by corresponding high-resolution files needed to obtain quality reproduction on press.

Image swapping then opened the door to what has become a second important function of OPI—managing high-resolution output with print services. Print services physically separate layout from output: the output can be in a different room, a different department, or miles away. It also enables layout and output to be scheduled independently.

The two components—print services and image swapping—are bound tightly in the informal understanding of the term OPI. An “OPI server” has become synonymous with a client/server solution that offers this mix of functionality. Virtually all of these OPI products target Macintosh clients. The most successful, Color Central from Adobe™ Systems, is identified primarily with a Mac OS server application. However, Color Central is available for Windows NT servers and their competitors support Macintosh clients from UNIX® and NetWare servers as well. The Mac OS applications have succeeded on the basis of ease-of-use and total system economics, but are challenged by what the industry views as “industrial strength” server technology.
Recently, a variety of additional services have been added to the OPI framework, including links to ISDN, relational databases, and server-based image manipulation systems. It is clear that OPI provides the foundation for a family of client/server prepress applications that serve the printing and publishing industry as a way to automate production, and transform what traditionally has been an artisan activity into a manufacturing activity.

Content review
This document provides a comprehensive overview of OPI.

- Chapter 2 covers the basic OPI functions in detail. An explanation of how it works and why it works is provided along with details about the future development directions for OPI products.
- Chapter 3 addresses the supply side of the OPI market. Profiles of the major developers and their products are provided.
- Chapter 4 addresses the demand side of the OPI market. The chapter begins with an overview of the market demand for OPI products reported for each major market segment. Concluding the chapter is a series of OPI user profiles.

This document concludes with a glossary of terms that are relevant to the discussion of OPI.
The story is told how Mr. Morita of Sony hosted a mid-1960’s gathering of industry mavens to sneak preview the Walkman technology. First he explained the concept, a small portable radio/tape player with great stereo sound. Then he ushered the group into an R&D lab where they saw a device with hundreds of wires occupying most of a work bench. One reporter asked the obvious, how could Sony expect a person to carry around so much stuff? According to the story, Morita replied, “First we make it work, then we make it small.”

Similarly, as we look back on almost a decade of desktop publishing innovation—on the giant steps represented by PostScript™, PageMaker, XPress, Illustrator, Freehand, and Photoshop—the experience can be viewed as the prototyping stage. The industry made it work; now it has to make it work well, by adding the pieces of technology that concatenate and coordinate the applications and keep track of the work.

Taken together, this new class of technology will transform the prepress activity from an artisan model to a group activity oriented around and organized by server hardware and client/server software. Accordingly, the new model is called client/server prepress. The model applies equally well to newspapers, magazines, ad agencies, service bureaus, or any setting where people work as a group to design and/or output publications.

Eventually, these server-based applications may become as sophisticated as the software used to manage manufacturing, where the groupware itself provides the principle for organizing the workflow. In the first few generations of development, however, client/server applications for publishing have focused on solving big obvious problems.

OPI servers
To date, the most successful and widespread application in the client/server category is what the industry calls an OPI server. Understanding this application type is mandatory, both to be an informed participant in the industry, and also to develop a sense of the trajectory of the entire client/server technology set. Yet one encounters rampant fuzziness and misconception, due perhaps in part to the name alone. “OPI” — Open Prepress Interface—communicates almost nothing about the nature of the application. Therefore, a full review of the OPI foundations is germane to understanding the client/server picture.
The name aside, what an OPI package does is provide two kinds of functionality: print spooling and image swapping. The first function liberates the printing workstation from direct interface to the marking device. The second function insures that the file sizes transmitted by the printing workstation are small and manageable. Both of these topics are covered at length in the sections that follow, but first we take a small detour to review the printing process on the desktop.

**What happens when you click Print**

The reason that there is a place for OPI at all is that, when printing, the workstation and the marking device are only loosely bound together. Here is what happens when you click Print:

**Step 1**

The data structure is translated into some common graphics language, PostScript being the high-end graphics language standard.

This translation is done on the workstation, and for high-end publishing programs, the translation is done by the layout application itself. When you click Print in XPress, for example, it is XPress itself that converts the layout from XPress internal format to PostScript.

**Step 2**

The graphics language data is translated into a bit map, if monochrome, or four bit maps (CYM&K), if color.

This translation is done by an application called a raster image processor, or RIP. The RIP may be resident in the ROM of the dedicated computer inside of the marking device—resident in the ROM of a printer controller board in a LaserWriter, for example—in which case it is called a “hardware RIP.” On the other hand, the RIP may be resident on a standard computer on the network, in which case it is called a “software RIP.”

**Step 3**

The bit maps are communicated to the imager, which deposits pigment on paper, if a printer, or exposes film, if an imagesetter.

An important note here is that in the case of a software RIP, this communication is managed by a printer driver, yet another application resident on the same computer as the RIP.

Figure 2a reviews this process schematically for one of the most common combinations in high-end publishing.

**OPI function 1: Print serving**

The very first client/server functionality in desktop prepress was print serving. Print servers were a response to two significant problems. First, big files take a long time to RIP and image, and with ordinary imaging, the user is locked out of any other work while waiting for the print job to finish. Second, if additional users want to print while a first is printing, they all wait.
What the print server does is to intervene at the end of step 1 in the printing cycle. Using the Figure 2a situation as an example, the layout station is disconnected from the RIP and connected instead to the print server. When the user on the layout station clicks Print, XPress generates a PostScript file that is sent to the print server. The print server queues the PostScript files and outputs them in order to the RIP. In this fashion, a three-step process is converted to a four-step process, but the new step is one that offers pooling possibilities. Because of the additional step, the first person to print does not have to wait for the job to be imaged to recover use of the workstation, the second does not have to wait for the first to finish before beginning to transmit, the third does not have to wait for the second, and so on.

This means the print server offers a productivity gain because people do not have to wait to recover the use of their computers. They communicate indirectly with the imager, through the intermediation of the print server. The print server cannot make the imaging faster, but it does gather and dispatch the imaging jobs.

Figure 2b shows the print server in the middle of the client/server printing sequence. As long as it performs its primary function, a number of secondary functions can be added. None of these are important enough to generate demand for the product; only the relief from waiting on print dialog boxes can do that. However, these other functions incrementally improve the efficiency of the group prepress activity. Typically, they include:

- Providing queues for and connections to several imagers at once
- Providing different resolution queues to the same imager
- Providing different paper type queues to the same imager
- Providing queue management—access privileges, queue priorities, reports, special handling

The different product offerings for print servers all provide a basic service and compete on the scope and functionality of these additional services. For example, the marketing literature for one product will claim it can manage a large number of printers, and the literature for a second might emphasize the reliability and speed in managing a group of print queues. A UNIX or Windows NT product will excel in the areas where multitasking facilitates simultaneous attention to the users at their workstations and to the imagers on the network. A Mac OS product will excel in the ease of installation and setup with the additional advantage of creating a customized workflow with AppleScript.

As with any program, the basic features fulfill 90% of the need, and the more exotic features are rarely used. For example, the full power of multitasking is rarely necessary, and the extra cost of a UNIX server is rarely reflected in extra value or productivity.

In the Mac OS environment, it would have been rather easy for Apple to supply a more robust print server as a companion to AppleShare. But they did not, opening the door to what was then a small company, Compumation, to dominate this product niche with its application Print Central, which sold several thousand copies before Compumation was acquired by Aldus, which was subsequently acquired by Adobe. Now an Adobe product, Print Central continues to be market-share leader in the Mac OS market for print server applications.
OPI function 2: Image swapping

Although the print serving function may be the most commonly accessed service of an OPI server, it is the image swapping function that attracts the most attention in product reviews and marketing literature. In brief, image swapping enables a page designer to work with a small screen-resolution picture file during page design and then rely on the intervention of the OPI server to swap it out for the high-resolution, color-separated file necessary to render the picture in print. The full details of this process are the focus of this section.

Picture files get large fast; it comes with the territory. In a typical U.S. magazine, for example, a file for printing a one inch by one inch color picture would be 283K. A two-inch by two-inch color picture would be 1.1 MB. The cover of Esquire magazine is 25 MB. It gets worse. Many Asian and European magazines use higher line screens (150 vs. 133, or even 175 vs. 133 lines per inch). IdN magazine in Hong Kong routinely publishes the complete file sizes for all their contents. The IdN cover is 42 MB. A recent 4-page piece comparing flat bed scanner output was 215 MB. Table 2a provides a formula for determining image file sizes.

It comes as no surprise that these kinds of file sizes can cause big problems at print time. Simply transmitting a 215 MB file in real Ethernet conditions is a 20- to 30-minute exercise, during which time the sending and receiving computers are virtually immobilized and the network is compromised. In a production environment such as a service bureau or a print shop, repetitive transmission of big files (from the scanner to the design station, from the design station to the imagesetter) can cause major efficiency losses throughout the day. In a newspaper, where most of the imagesetting is concentrated in a small time window before going to press, this problem can make the whole desktop model unworkable.

The solution to these problems is image swapping, managed by the OPI server. Here’s how it works: First, the page layout is done with a preview image instead of the high-resolution image. Due to color component reduction, resolution reduction, and compression, the preview file is dramatically reduced in size compared to the original file. In the example in Table 2b, the preview sizes are 1% to 3% of the full resolution size, depending on the type of publication.

| Table 2b Comparison of high resolution and preview file sizes, showing components of total reduction for an 8-inch by 10-inch final printed size file (all figures in Megabytes) |

<table>
<thead>
<tr>
<th></th>
<th>High-res file size</th>
<th>Preview file size</th>
<th>Total reduction (high-res less preview file size)</th>
<th>RGB vs. CYMK</th>
<th>Screen res vs. printing res</th>
<th>Compressed vs. uncompressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newspaper</td>
<td>9.2</td>
<td>0.2</td>
<td>9.0</td>
<td>2.3</td>
<td>2</td>
<td>4.7</td>
</tr>
<tr>
<td>Magazine</td>
<td>22.6</td>
<td>0.2</td>
<td>22.4</td>
<td>5.7</td>
<td>12</td>
<td>4.7</td>
</tr>
<tr>
<td>Book</td>
<td>39.2</td>
<td>0.2</td>
<td>39.0</td>
<td>9.8</td>
<td>24.5</td>
<td>4.7</td>
</tr>
</tbody>
</table>

Table 2a Determining image file sizes

The size of a picture file, in bytes, is determined this way. First, determine the bytes in one color plane, with the formula: bytes in one color plane = pixel count across the top x pixel count along the side. Second, determine the bytes in all of the color planes: multiply by one for monochrome, 3 for RGB, and 4 for CYMK.

Example:

A monochrome image 5 pixels wide by 5 pixels high has 25 pixels in total. Because it is monochrome, each pixel is represented by a single number representing one out of a possible 256 grey levels. 256 is the number of levels that can be represented by eight bits, or one byte, of digital information. Hence, 5 pixels wide by 5 high is 25 bytes.

Different perspectives on this size relationship are available. For example, the pixel count across the top of a picture plane is the width times the resolution that has been set manually in the scanning or image preparation stages, the basis for which is the relationship, set resolution = lines per inch in screening x quality factor. The quality factor between 1.5 and 2 is usually selected. The rule-of-thumb is, use 2. Therefore, in U.S. magazines that print at 133 lines per inch photo screening, the size of a one inch by one inch color photo (4 color planes) is given by total size for one square inch on paper = 4 x (133 x 2) x (133 x 2) = 283,024 bytes, or 283K.
Second, the form of the sample file has a special structure that meshes appropriately with the layout program. The genesis of this form, and perhaps the genesis of the entire OPI swapping routine, was serendipitous. It is based on a solution that was developed originally to enable designers to visualize the PostScript illustrations they placed in XPress or PageMaker layouts. Since XPress and PageMaker cannot render PostScript to the screen, a special system was developed, which works like this:

- Illustration programs include the option of saving a PICT preview in the resource fork of the file; the corresponding PostScript information is in the data fork of the illustration. The PICT preview is a 72 dpi rendering of the PostScript data, which may be compressed using QuickTime (JPEG) compression.
- When the Illustrator file, for example, is “placed” in the layout, the PICT preview is opened by the layout program and the user positions and crops it.
- At print time, when the layout program converts from its own data structure to the PostScript data structure, the preview from the resource fork is deleted and replaced by the content of the data fork—PostScript code that defines the illustration. Finally, the illustration is rendered at full resolution in the RIP. This procedure is shown in Figure 2c.

A major innovation was made by Tim Gill at Quark in 1988. He was seeking a procedure to handle data that XPress users would receive from high-end scanners. This data was already separated into components for each of the process colors—cyan, yellow, magenta, and black. Tim’s innovation was the Encapsulated PostScript—Desktop Color Separation (EPS-DCS) format.

A picture saved in EPS-DCS format consists of five files. Four of the files are EPS files with data for each of the separations. The fifth file is like an illustration in that it has a low-resolution preview saved as PICT in the resource fork. When a designer selects the fifth file from the “Get Picture . . .” dialog in XPress, the PICT is opened into the picture box and used for cropping, rotating, and scaling. At print time, instead of substituting PostScript code, as in the illustration case, XPress substitutes the appropriate high-resolution file into the print stream.

This procedure gave rise to a workflow system that is still used widely as an alternative to OPI servers. The EPS-DCS files are saved on a server. At the layout station, the EPS-DCS preview is opened and placed. When the document is complete, it is saved to the server in a folder with all of the full separation files. Finally, the layout program is opened on the server and prints the layout from the server.

This is a system that works well in an environment that can follow meticulous file management protocols and can control the file formats precisely. It breaks down at the slightest glitch in workflow management and where there is no control over the incoming picture file formats.

The final step in the evolution of OPI image swapping came when an unknown computer engineer realized that the XPress DCS image swapping system provided the structure for other kinds of image swapping. The preview file did not have to be a DCS file, it could be any EPS file with a PICT preview at the right address in the resource fork. One could put a PostScript message in the data fork, and XPress would interpret that as PostScript code and include it in the print file. One need only intercept the print file prior to delivery to the RIP, and replace the message with a PostScript bit map call that would trigger the RIP to use the correct high-resolution file.
What should be the right software to carry out the procedure, to intercept this message and replace it with the right call? The print server, of course, which was already managing the delivery of the PostScript layout file to the RIP. Thus was born the modern OPI server, in function, if not in name. Schematically, the full OPI swapping procedure is shown in Figure 2d.

Where did the name come from? Ironically, it came from Aldus, whose PageMaker encountered the same difficulties as XPress. At about the same time that Quark was inventing the EPS-DCS file format, Aldus was independently developing an image swapping procedure based on TIFF files, and published a specification for the model using the name “Open Prepress Interface.” Whereas the EPS approach built on the structure inherent in the illustration solution, the Aldus specification required special support that was incorporated subsequently into both PageMaker and XPress.

Today, one finds a mixture of the two approaches. The leading OPI server products use the EPS approach, and most vendors offer EPS as at least one of the options. Several vendors support the TIFF specification. The name OPI is applied to both. Most users have found that the EPS approach is the most efficient, both for previews and separated files.

There are two more parts of the technology set that complete the image swapping function. First, there has to be some way to generate the preview file, and each of the OPI vendors focus on this element as an area of intense competition. Brand A claims its preview module is X times faster than Brand B’s. Brand B claims its preview module is better because it can handle a wider variety of original file formats than Brand A.

Typically, the functionality is similar in each solution: The user saves a CYMK file to a particular folder. That triggers a routine that creates a preview file and puts it in a different folder. One of the virtues of this procedure is that it supports a division of labor in the group prepress activity. The scanner department only needs to know about the folder where it leaves the completed scans. The layout department only needs to know about the folder where it finds the previews. This division of labor has given rise to a way of working in many catalog and magazine situations in which the scanning and output is done at a service bureau, and the preview files are accessed via modem by editorial staff who never see the high-resolution data.

The final part of the swapping technology is the mechanism by which the server software finds the high-resolution files at print time. One solution is an ordered search through folders on and off the server. The other solution is to keep track of everything with a special database.

In the desktop applications set, the image swapping functionality has a special elegance due to its simplicity and impact. It makes everything work better—the layout team, the scanning team, the network performance, and the printing performance. It opens the door to geographical separation in prepress and organizational innovation. By binding it closely to the print server in the creation of the OPI server, the developers have created a product that has immediate payback and widespread appeal.
Extending OPI with additional services

Another virtue of OPI servers is that they have proven to be the kernel of an ever-widening circle of client/server functionality. The first category of services is additional procedures for the print files. Just as the OPI server can swap image files before it passes the PostScript file off to the RIP, it can also carry out additional manipulations of the PostScript files, both before and after they are printed. Here are three examples:

• **Trap the file**
  The OPI server can call in a trapping program, such as Trapper from Island Graphics or TrapWise from Adobe, to adjust the PostScript graphics to improve printing output.

• **Impose the file**
  The server can impose the pages in a file using an application like Impostrip from Ultimate Technologies or PressWise from Adobe. In this service, a series of pages are reordered, reoriented, and then laid out automatically into a meta-page that is output on a single piece of imagesetter film. Without digital imposition, this step has to be done manually by the printer in order to create the multi-page plates used in printing signatures.

• **Archive the file**
  Once printed, the server can dispatch a file to an archive, passing along all relevant statistics about the printing process (date, time, place, fonts, pictures, illustrations, and so on).

  Adobe and Agfa have recently developed a novel structure for these and other service options in their applications called OPEN and Mainstream, respectively. These applications let the user construct virtual production lines. For example: trap, then swap, then print, then archive; or swap, then impose, then print.

  With OPEN, each of these production lines is given a name which subsequently appears in the Chooser. This way, the Chooser mechanism, which was originally designed for selecting printers, then extended to selecting print queues, has been further extended to selecting multifunction queues. The user “prints” to whatever virtual production line is appropriate for each job.

Extending OPI with database production management

To the extent that a prepress facility might be run like a manufacturing plant, it would be relevant to use software that imitates manufacturing software. This approach is in an embryonic stage of development, but the results to date are very promising. Typically, it is based on a standard client/server database engine that is specialized by the vendor to the prepress task. The database manages page elements, pages in development, and the archive of printed pages. It can also manage production scheduling, production reporting, and cost reporting. This approach seems to be especially valuable for catalog houses that need to link flexible items like product numbers, pictures, and prices to inflexible structures like page layouts.

  The names in this field are CatTrax from Digital Color Solutions (DCS), ImageFlow from Cascade Systems, and InterSep IMS from Archetype, developed for Mac OS servers, UNIX servers, and NetWare servers, respectively. Each of these products have OPI techniques incorporated into a broader solution that includes a database.
Extending OPI with client/server image manipulation
The final area of extension is with client/server image manipulation. No comprehensive application has appeared in this area, but there are paths to the future in the way some advanced users are working with scripts in Apple’s PhotoFlash and in the structure of Live Picture from HSC Software and PhotoMatic from Daystar Digital. In the former case, a user can write a script with AppleScript that will cause PhotoFlash to manipulate in a set fashion any picture that is saved to a particular folder. For example, PhotoFlash might do routine sharpening or might apply a particular plug-in filter. These scripts can be set up to run on a server.

In the Live Picture case, an abstract structure is in place, but not the client/server connections. Live Picture enables a user to retouch a single preview and/or combine multiple previews into a new composition. Once composed, the new image is “rendered” by applying to high-resolution data the steps that were applied to the preview data. Today, there is no automatic server-based imaging, but it is likely to come to market soon, especially as Kodak rolls out plans for joining the PhotoCD and Live Picture formats.

Summary
OPI servers are the first client/server prepress applications to attract widespread support and generate revenue from both application and server sales. As explained in this chapter, the OPI Server combines the features of a print server with high-resolution image swapping. These two functions add significantly to the efficiency of groups of people working together on a network to develop publications, ads, and other material that is ultimately printed. In particular, without image swapping, a network will be brought to a crawl when large image files have to move down to page layout workstations and then back to the output device.

OPI is just the first in what will be a series of client/server application areas for desktop publishing and prepress at the professional level. Taken together, this application opens the way for organizations to compete on the basis of efficiency as well as creativity.
The Supply Side of the OPI Market

OPI developers and vendors

A recent trade magazine listed a bewildering array of more than thirty OPI vendors. Many of these products use their own terminology and publicize a barrage of claims and counter-claims leaving the user community confused. The purpose of this chapter is to provide the basic facts about the developers and vendors that constitute the supply side of the OPI market.

The basic facts

One company, one product, and one platform dominate the market

The company is Adobe Systems, the product is Color Central, and the platform is the Mac OS. The installed base for Color Central is around 6,000 units worldwide. Though competition on the Mac OS platform is just now appearing in the form of Printdesk from the Danish company Nine Bits, and 4-Sight OPI from the UK company 4-Sight, Color Central has enjoyed a long run without significant competition in the Mac OS market.

1994 was a big year for Color Central. Early in the year, the original developer, Compumation, was acquired by Aldus Corporation, who subsequently merged with Adobe Systems. At mid-year, a Windows NT version was published that distinguished itself with processing power and speed. At year-end, the Mac OS version continued as the flagship product among what is now the Adobe prepress product line.

There are at least three other significant developers: one each for the UNIX, NetWare, and DOS platforms

- Helios, a German company, is the major supplier of UNIX OPI solutions. Their product is called EtherShare OPI.
- Archetype, a Massachusetts company, is the major supplier of NetWare OPI solutions. Their product is called InterSep OPI.
- CoOperative Printing Solutions, Inc. (COPS), a Georgia company, is the major supplier of DOS OPI solutions. Their product is called PServe XPRS.

Each of these developers recognizes the predominance of Macintosh workstations in publishing. Accordingly, their server products are designed to work most effectively with Macintosh clients.
There appear to be a great number of OPI products in the market because many prepress vendors license products from the major developers.

For example, EtherShare OPI is sold by Agfa, PServer XPRS is included in EFI’s Fiery RIP, and Linotype-Hell distributes 4-Sight OPI under the name LinoPrint. It is this multiplicity of OPI vendors that confuses the market about the source of the software and the various features of the products.

OPI products are licensed for two reasons. First, virtually all of the imagesetter vendors have an OPI solution, or two, on their price list. In many cases, this is an add-on item when selling the imagesetter that can generate additional income without additional sales energy. Furthermore, many high-end customers prefer to have a single service organization, whether it is to support their imagesetter, their RIP, or their OPI/print server hardware and software.

Second, many systems integrators like to add features to the base OPI product to give it a special identity. For example, the Cascade Systems product ImageFlow is an enhanced version of the Helios OPI server that can be integrated with a Cascade imaging project management database.

Why the Mac OS platform dominates in OPI environments

In the view of many prepress “experts,” a UNIX, Novell, or Windows NT product should be preferred to the Mac OS one. They point to printing bottlenecks in the Mac OS, as well as limits on open files that constrain the number of people who can work simultaneously on the server. Most significantly, I/O limitations and TIFF file formats combine to make the generation of a TIFF preview almost palpably slow. With these drawbacks, it is quite easy to illustrate speed and power shortcomings on a Mac OS platform, especially compared to a UNIX or Windows NT server platform.

Thus, it seems paradoxical that Mac OS OPI server products outsell the competition by a large margin. There is a tendency among the industry mavens to chalk it up to irrational personal attachment to Macintosh computers. In reality, however, the sales statistics reflect thoughtful decision making about the economics of running a prepress operation.

The calculation starts with the total cost of setting up an OPI server. Table 3a shows the cost comparison for typical server/product mixes. The Mac OS platform is the economical solution, purely on an acquisition cost basis.

Table 3a Cost comparisons for acquisition and installation of OPI solutions for a 10-workstation Macintosh publishing workgroup

<table>
<thead>
<tr>
<th></th>
<th>Mac OS</th>
<th>NetWare</th>
<th>UNIX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware + OS</td>
<td>$ 6,500</td>
<td>$ 8,000</td>
<td>$12,000</td>
</tr>
<tr>
<td>OPI Software</td>
<td>4,000</td>
<td>11,500</td>
<td>11,000</td>
</tr>
<tr>
<td>Installation</td>
<td>400</td>
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<td>1,700*</td>
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<tr>
<td>Total</td>
<td>$10,900</td>
<td>$29,000</td>
<td>$24,700</td>
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</table>

* Figures based on dealer quotes.
The second aspect is installation, training, and support. Publishers and prepress sites report that they install and configure Mac OS OPI products themselves, train new users in a couple of hours, and handle support functions within the scope of their support structure for the Macintosh layout stations and scanning stations. In contrast, the installation cost of the NetWare and UNIX systems run $2,000 to $10,000. NetWare installation requires the intervention of a Certified NetWare Engineer. Support contracts, where available, are in the range of $1,000 to $3,000 per month. Where support contracts are unavailable, the custom is to hire dedicated network administrators for Novell or UNIX sites, who draw salaries of $35,000 and above. What this adds up to is a total cost advantage significantly weighed toward the Mac OS solution.

In addition to cost, the Mac OS solution offers a reliability benefit. Should there be a server crash, the server software can be loaded onto one of the Macintosh workstations, and operations continue while repairs are made. In the NetWare, Windows NT, or UNIX cases, users either have to buy a back-up server, mirrored servers, or absorb lost revenue when they have to shut down production to fix the server.

The situations where the economic balance swings toward the NetWare, Windows NT, or UNIX solutions are those sites that have already made a decision in favor of a different network operating system. This is particularly common in very large publishing sites such as metropolitan newspapers or book publishers. Typically, these sites have a mixed operating environment, and there is network support staff in place. These sites can absorb the extra complexity without difficulty.

**Product profiles**

This section profiles the major Mac OS–based OPI products and their competitors, as follows:

- **Mac OS**
  - Color Central, from Adobe Systems
  - PrintDesk OPI, from Nine Bits
  - 4-Sight OPI, from 4-Sight
  - CatTrax, from DCS
- **UNIX**—EtherShare OPI, from Helios
- **NetWare**—InterSep OPI, from Archetype
- **DOS**—PServe XPRS, from COPS

Each product consists of a client application, a sampler application, and a server application. The basic functionality of the client application is to control the flow of information when the user at the client workstation clicks the Print button. The client applications are designed to function as if they were extensions of the operating system. The user does not have to open the client application; it runs in the background. For Mac OS clients, the interface to the client is either in the form of a custom array of icons in the Chooser dialog box or a custom array of printer alternatives in the Print dialog box. When the Print button is clicked, the application generates a PostScript file, and the client transmits it over the network to the server. The screen clears quickly, and the user can go on to the next task.
The sampler application creates preview files from high-resolution files. Designed to function as automatically as possible, the sampler application typically involves three folders or directories, as shown in Figure 3a. The sampler is triggered when a high-resolution file is saved to the drop folder, which can be on any workstation or server in most cases. The sampler application opens the file, samples the image down to a low-resolution version, saves the low-resolution image in either EPS or TIFF preview format, and writes it to a low-resolution placing folder. Finally, the sampler moves the high-resolution file from the original drop folder to a storage location.

The server application is the engine of the OPI solution. Its primary function is to mediate between and carry out the functions of the “queues” and the “devices.” Both of these terms have specialized meanings in the OPI context, which are abstracted from natural English usage. Queues are groupings of PostScript spool files that are resident on the OPI server. The user at a client workstation selects a queue in the Chooser or Printer dialog, which will receive printed jobs. Queues are set up by the system administrator. Typically these queues are configured by the type of output, for example, black and white proofs, transparencies, 1200 dpi negatives, 1200 dpi positives.

The OPI server manages the direction of a spool file from a queue, usually on a first-in-first-out basis, and delivers it to a device. “Device” is another abstract concept, in this case rooted in the notion of an output device. In its simplest form, delivering to a device means passing a spool file to a PostScript output device—for example, printer, RIP, and so on. In more complex forms, delivering to a device means carrying out the OPI image swapping—and perhaps other processing such as color correction, imposition, and trapping—before passing the file to the output device. In some cases, the procedure abstracts completely from the physical output device. For example, a “device” can be a procedure that instructs the server to dial a number, manage a connection, and transmit a PostScript spool file to a remote output device or even to a queue on a remote OPI server.

Queues and devices can be related in three ways. The easiest is conventional to all Macintosh users, one Chooser icon relates to one output peripheral. But a single queue can also be related by the OPI server application to several different devices. For example, there may be several different laser printers that can produce black and white proofs. The administrator maps the black and white proofs queue to all of the available laser printers. The application watches each of the laser printers and dispatches from a single queue as the various printers become available.

In the third option, several queues can connect to the same output device. This feature is important for imagesetting. Especially in small shops, operators switch the output mode on a single imagesetter from positive (“paper”) to negative (“film”) and from high resolution (2400 dpi) to low resolution (1200 dpi) to match the requirements for a particular print job. To handle this scenario, different queues are set up by the administrator to match the output profile. The server dispatches from one of these queues to a single output peripheral only when its operating parameters match the queue profile.

It is the subtleties of queue and device operation and overall system performance, rather than product price, that differentiate the various OPI products.
Like many successful products, Color Central has succeeded because its developers have been close to the key market segment, in this case service bureaus, and continually responsive to their needs. Their first step was a service bureau telecommunications and management package called Bureau Master that was developed in 1987 to help with their own service bureau business. This product was refined into a Mac OS print server, Print Central, that shipped first in 1991. Image-swapping capabilities were added in 1992, completing the first version of Color Central. To keep product development and distribution growing with the industry, the developers were acquired by Aldus in 1994. The subsequent merger of Aldus and Adobe opened the door to another jump in PostScript sophistication and integration that will bear fruit as new services and capabilities in 1995.

Ease of use is a guiding principle in the Color Central package. This is best exemplified in the user interface for setting up and managing devices and queues, reproduced in Figure 3b. The queue icons are on the left. The names below each icon appear as print queues in the Chooser, the numbers on the icon represent the number of jobs currently in the queue. The devices are on the right. The lines indicate the current relationships of queues and devices. In this example, two different output queues map to the same AGFA ProSet imagesetter. They both call for setting the output resolution to 2400 dpi. The upper of the two is a queue whose PostScript file will be augmented so that all half-tones are 150 lpi (lines per inch). The lower of the two is a queue whose PostScript file will be adjusted to 120 lpi half-tones. Conversely, the “Laser Proof Q,” is mapped to two device icons. This means that the oldest PostScript spool file still in the queue will be sent to the first available of the two laser printers named “BLP Elite” and “Personal LaserWriter.”

Double clicking a queue icon opens a window showing the jobs in that queue. These jobs can be reordered or deleted directly from this window.

The print services in Color Central provide a wide variety of administrative support for the prepress activity. As a security measure, Color Central limits queue access to an authorized list. Queues can be manipulated by the system administrator. Additionally, job logs are provided, and printing errors are saved for special handling and reporting.

Color Central has led the way in pushing the envelope of services that are provided within a device definition. In addition to color correction, and lines per inch settings, Color Central can invoke different screening algorithms, including stochastic screens. Also, in the case where a color printer is selected as the output device, Color Central can recombine files that have been separated in the EPS-DCS format into a color composite. Additionally, the list of high-resolution file types is continually extended. Currently, Color Central will accept TIFF, EPS, DCS, Photoshop, Scitex CT, and PhotoCD.
The Color Central developers have also innovated in the sampler area. The preview file creation can be linked to automatic cataloging by popular Mac OS image database applications such as Adobe Fetch, Im-space Kudo, and Canto Cumulus. Layout designers can search and select from the image database, and then drag the Color Central preview from the database into an XPress or PageMaker layout.

Adobe also provides special services to segments of the OPI market as add-on components to the basic package. For example, the Scitex APR ProPak allows Color Central to recognize and replace the placement files generated in proprietary Scitex systems. They have also announced a Remote Connections ProPak that will support remote clients in WAN configurations.

The rapid migration of Color Central to Aldus and then Adobe opens the door to unique levels of product integration, most immediately with their own trapping and imposition products, TrapWise and PressWise.

Printdesk with OPI Extension, a Mac OS OPI server
Nine Bits, Frederiksberg, Denmark

Nine Bits
Allégade 8H
2000 Frederiksberg, Denmark

Suggested Retail Price
Printdesk OPI: $3,900
OPP extension: $590
Font Library: $150

Telephone: (011) 45 31 23 18 14
Fax: (011) 45 31 21 27 97
AppleLink: DK0124
Internet: ninemb@unidhp.uni-c.dk

 localized Versions
English, German, French, Danish

The developers of Printdesk also started in the trenches of the service bureau industry, and their first applications responded to the reality they confronted in their own service bureau. Over several years, they developed a series of applications aimed at improving service bureau productivity and eventually turned to the print server problem. Their product Printdesk has been available in Scandinavian countries and the UK since October 1994, and they are beginning to address the market opportunities in France, Germany, and the U.S.

Their print server, Printdesk, has the usual base structure: A variety of queues are defined by the system administrator and linked to output devices; the users print to the queues on the server, which manages the dispatch to final output.

To differentiate their product, Nine Bits has focused on printing productivity. Their primary target is the total time involved in the full print cycle. They have developed a special communication layer—the asynchronous network manager (ANM)—on top of the Apple Printer Access Protocol (PAP). Table 3b, reproduced from Nine Bits promotional literature, displays the range of efficiency gains that this offers.
Table 3b  Printing time comparisons for single A4 page
(Times in minutes : seconds)

<table>
<thead>
<tr>
<th>Image size and format</th>
<th>No print server</th>
<th>Printdesk</th>
<th>Competitor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Screen free</td>
<td>Total print time</td>
<td>Screen free</td>
</tr>
<tr>
<td>27 MB TIFF</td>
<td>15:16</td>
<td>17:37</td>
<td>0:30</td>
</tr>
<tr>
<td>34 MB EPS</td>
<td>37:20</td>
<td>39:43</td>
<td>0:30</td>
</tr>
<tr>
<td>30 MB EPS-DCS</td>
<td>8:00</td>
<td>9:55</td>
<td>0:30</td>
</tr>
</tbody>
</table>

Source: Nine Bits sales information. Output to Linotronic 630 with RIP 50; printer resolution, 2438 dpi; screen ruling, 150 lpi; standard Ethernet connection.

A second productivity target is efficient use of imagesetter film, for which they offer an extension for optimal page positioning called PrintOptions/OPP. This extension rotates a page image, or positions two of them side by side, wherever possible, to get more usable output from the same amount of raw material film.

The third area of specialization is in font management. Instead of loading all the printer fonts on each printer and imagesetter, the system administrator can use a Printdesk extension called Font Library, to create a font database on the server. Printdesk draws appropriate fonts on a job-by-job basis and includes them in the data stream it sends to the output device.

Finally, Nine Bits has provided for user extensibility through support for AppleScript.

4-Sight OPI, a new Mac OS OPI server
4-Sight (International) Ltd., Bournemouth, UK

4-Sight (International) Ltd.  Suggested Retail Price: $3,995
Guild House  Localized Versions: English only
64-68 Norwich Avenue West
Bournemouth, Dorset, UK BH2 6AW
Telephone: (011) 44 (202) 764 401
Fax: (011) 44 (202) 761 666
AppleLink: FOURSIGHT

Though 4-Sight OPI is the latest competitor to enter the Mac OS OPI server market, the same product was originally available from its development collaborator, Linotype-Hell, who markets the product under the name LinoPrint. The developer has established a position as a leading supplier of ISDN communications software for the graphic arts industry. Moving into the area of OPI servers, their goal is to build successfully on their reputation for reliability in production environments.

4-Sight OPI has two features that distinguish it significantly from competitors. At the user interface level on the client workstation, queue selection is through the Print dialog box, not the Chooser. In addition to selecting the output queue, the user enters a name and password at print time. These are used for access security and for tracking. The server also uses the sender identity to return a message on production completion.

Building on its telecommunications background, 4-Sight has included special support for WAN configurations. They follow the standard queue/device duality but they have added two categories of devices designed for connectivity. The first is simply a drop folder for complete PostScript files, which includes all fonts and all high-resolution files.
The user can manipulate the contents of the drop folder with custom scripts or third party applications. The second is what they call a “broadcast bin.” It is designed to support the architecture pictured in Figure 3c.

When a PostScript spool file is written to a broadcast bin, routing information is included with it. When a file arrives, it triggers a routine that interprets the routing information, activates the ISDN connection, and dispatches the file automatically. This functionality makes 4-Sight OPI a natural add-on to 4-Sight’s ISDN products.

4-Sight has also targeted printing speed as a key feature. To this end they include a font database in the server software together with a database of printer preparation files.

4-Sight has chosen a strong marketing partner in the U.S., CE Software, publishers of QuickMail. The U.S. company is called 4-Sight LC and is responsible for the distribution, marketing, and sales of both the ISDN and OPI products.

CatTrax, an OPI product as part of a catalog publishing system

DCS Corporation, Atlanta, Georgia

Price Range: $80,000 to $120,000
Localized Versions: English only

DCS Corporation
500 Northpark Town Center 625
1100 Abernathy Drive
Atlanta, Georgia 30328

Telephone: (404) 986-6072
Fax: (404) 986-6176

CatTrax is a good deal more than an OPI server. It includes a Mac OS database application for managing catalog components and a collection of Mac OS utilities, including those that directly manage print serving and image swapping. It requires that retouchers and layout artists change their working style. In total, it is a complete approach to catalog production that includes both the workflow design and the software to support the workflow. It is priced about 10 to 20 times higher than the price of other solutions mentioned here. It is included here to illustrate the leverage that OPI exerts on the entire prepress production cycle, and also to illustrate the directions of development in productivity software for publishing.

In CatTrax, the production process is enveloped by a 4D database application that enables a catalog publisher to work efficiently with its service bureau partner. Everything is maintained on-line, in hard-disk arrays that can total tens of gigabytes at the cataloger and hundreds of gigabytes at the service bureau. The two businesses are connected by ISDN or switch 56 links. When any new high-resolution images are scanned at the service bureau, preview files are immediately generated, and both are acquired into the database tracking system. A copy of the preview is telecommunicated to the catalog publisher’s site. Special applications keep the two databases synchronized. All images are placed into layouts from the database, using proprietary extensions to XPress. At print time, the pages are transmitted from the catalog publisher to the service bureau server. Each individual page is rendered as a separate EPS document and acquired by the database. A page assembly routine at the service bureau pulls the EPS pages and the high-resolution images and integrates all the components into a print stream to the RIP. All of the steps are tracked and recorded in the database, and there are a variety of database reports to manage the process. Since everyone works inside the CatTrax environment, even individual productivity performance can be tracked and assessed.
In a catalog production system, the opportunity for big productivity increases are managing the reuse of catalog components from one edition to the next, called “pick-ups” in the trade. Pick-ups may make up as much as 70% of a new catalog edition. The components include text descriptions and prices, as well as pictures. CatTrax maintains all of these elements in its databases. For many of the product shots, CatTrax also maintains an inventory of corresponding silhouettes, drop shadows, and “ghosts” that can be used with the same speed as the base image to facilitate the construction of graphic effects common to consumer catalogs. As an indication of the productivity gains achieved with CatTrax, a California cataloger recently put together a complete 64-page project, from the beginning of layout to final film in three days.

CatTrax was developed by a service bureau to help with their own work. It has been installed in a small number of other sites in the U.S. Though it is designed for catalogers and their service bureaus, DCS hopes to specialize it still further for magazine publishers.

EtherShare and EtherShare OPI, a UNIX solution for file sharing and OPI services

Helios Software GmbH, Hannover, Germany

HELIOS Software GmbH
Lavesstr. 80
D-30159 Hannover, Germany
Telephone: (011) 49 511 36482-0
Fax: (011) 49 511 36482-69
AppleLink: helios.de
Internet: info@helios.de or www.helios.de

Suggested Retail Price
EtherShare: $3,900
EtherShare OPI: $7,150

Localized Versions
EtherShare—German, English, French
Norwegian, Korean, Japanese
EtherShare OPI—English

Helios Software is probably the Macintosh community’s best friend in the UNIX world. For several years, the Helios flagship product, EtherShare, has enabled UNIX computers from Sun, IBM, and other companies to provide file services to Macintosh clients. EtherShare is fully compliant with the AppleTalk Filing Protocol (AFP). A client Macintosh can access an EtherShare server via the Chooser in the same manner as an AppleShare server. With many happy customers in large publishing sites, EtherShare has gained a reputation as robust file server for Macintosh networks.

The structure of the Helios solution is different than Mac OS solutions. Since Helios provides the print services within the file server application, their OPI solution (print services + image swapping) is differentiated because the customer benefits from the full scope of their UNIX file services.

These file services include, notably, a network router. As a result, Helios OPI sites are often characterized by a network architecture, portrayed in Figure 3d, that separates output, scanning and retouching, and layout onto three different network segments that share the OPI/file server and communicate through the router.

Another advanced feature of the Helios solution is its support for servers with multiple CPUs. In this environment, tasks can be balanced among the available CPUs including OPI sampling and rasterization in a software RIP.

Helios supports both TIFF and EPS preview file conventions, and applies the full set of OPI image operators to high-resolution files before dispatching to the RIP. Like Nine Bits and 4-Sight, Helios includes a font database as part of the server software. Helios also provides a link to a Canto Cumulus image database that automatically catalogs preview files.
Archetype has been an active prepress developer since 1985. It has developed layout, database, and OPI server solutions for a variety of OS environments, including DOS, Windows, Windows NT, UNIX, AIX, NextStep, and NetWare.

Archetype offers two distinct OPI solutions. The first, InterSep OPI, is for UNIX and Windows NT environments. It is a solution that only provides the image-swapping portion of an OPI solution. The user must obtain the print services from a different application, usually from a UNIX file server application. Among its competitive features, InterSep OPI supports the full range of OPI image manipulation comments, and offers support for “nested” OPI manipulations that involve EPS files within EPS files.

InterSep IMS is an innovative product. It is a combination of an image-swapping manager and a database that does image management. Print services are performed by the Novell NetWare system under which IMS runs. IMS can support both Mac OS and Windows clients.

The primary function of IMS is to manage the location of previews and high-resolution files so they can be mobilized rapidly. Typically, users at the client workstations use the database to locate thumbnails, either by browsing or by a structured search. The server image-swapping routines use the database to find the high-resolution files, regardless of the volume or medium on which they are stored. However, since it is a full B-Trieve database, its utility is extensible to address other production problems. For example, identifiers for SKU and product ID can be entered to support the “pick-up” functionality crucial for catalog preparation.

COPS was the first company to fill the print server void for the Macintosh community. From the start they have concentrated on software that runs on Microsoft OS platforms but provides services compliant with AppleTalk Filing Protocol (AFP).
The workflow for COPS OPI is unique among OPI vendors. They offer two samplers, one of which is a Photoshop plug-in. The high-resolution files are saved to any Apple AFP-compliant server, including the one they sell as a complete hardware and software solution called EasyServer, based on a DOS platform. However, the high-resolution files are not saved to the print server.

The print server and image-swapping routines are resident on a dedicated print server that has PServe XPRS installed. At print time, these routines draw the high-resolution file from the file server via an Ethernet connection, and include it in the print stream. COPS provides basic print services. It supports 8 queues that are mapped to any PostScript output device. It provides job log accounting and error recovery.

Though this structure seems awkward compared to other solutions, it grew naturally out of the COPS base product PServe, a PostScript print server for Macintosh and/or PC clients that runs on a DOS platform. PServe provides print services but not file services. It is compatible with environments that have no dedicated file server.

Other OPI products

Though this paper does not attempt to be all inclusive, two other vendors should be mentioned. Though they have not grown to the prominence of those profiled, each is doing innovative work in the development of client/server imaging systems.

- **Information Presentation Technologies, Inc. (IPT)** is the developer of a product set analogous to the combination of an AppleShare file server and Color Central, called GetThePicture. GetThePicture runs on a UNIX computer and supports Macintosh clients. They also offer an image database extension.

  Information Presentation Technologies, Inc.
  555 Chorro Street, Suite A
  San Luis Obispo, CA 93405
  Telephone: (805) 541-3000
  Fax: (805) 541-3037
  Internet: info@iptech.com
  AppleLink: D0263

- **Cascade Systems Inc.** is the developer of a client/server production management and control system, called ImageFlow, based on UNIX servers with Macintosh and Windows clients. Cascade is also an OEM vendor of the Helios OPI solution.

  Cascade Systems Inc.
  One Corporate Drive
  Andover, MA 01810
  Telephone: (508) 794-8000
  Fax: (508) 794-0005
The Demand Side of the OPI Market

*Market size, composition, and user profiles*

This chapter addresses the demand side of the market for OPI solutions and covers three main issues. The first issue is qualitative—what types of businesses make up the market for OPI and why do they buy OPI? The second issue is quantitative—what is the market size today, and over the next five years? The third issue is user experience—what are profiles of typical users?

**The ROI of OPI**

The purchase of an OPI solution is a business investment. Accordingly, the purchase decision is based on return on investment (ROI) considerations. In larger sites, or in prepress groups within broader organizations, the purchase may have to be justified with a formal ROI calculation.

As noted in the previous chapter, the size of the investment in an OPI solution can range from $10,000 to $30,000. The return on this investment comes from at least six sources.

- First, as depicted dramatically in Table 3b, OPI permits more productive work from the same number of design workstations. This benefit is most significant in settings where layout workstations are the bottleneck in the workflow. Notable examples are newspapers and those service bureaus that provide output services. The effect is so strong, however, that some advertising agencies and graphic design shops cost-justify an OPI solution even though they only have color printers and not imagesetters.

- Second, in some situations, OPI solutions enable prepress organizations to get more output out of the same number of printers and imagesetters. This return is most available to prepress sites that are not able to organize the output function effectively. With OPI, they are able to queue up jobs and leave the scheduling and load balancing to the server software. In sites that do not have 24 hour staff, OPI servers offer the means to queue up jobs to run in the evening or overnight. This return accrues to sites where printing is the bottleneck.

- Third, in large sites, OPI is the basis for job specialization. It separates scanning from layout and both scanning and layout from output. Each of the three functions can be a separate department, as in Four Lakes Colorgraphics, which is profiled later in this chapter. This benefit is reflected in more work from the same number of staff.

- Fourth, when combined with database structures as exemplified by CatTrax in the previous chapter, OPI contributes to the direct automation of a myriad of prepress tasks.
• Fifth, OPI reporting functions, the job logs and error reporting, are the feedback loop in a production flow. They enable managers to monitor and measure productivity. They are the key to keeping control of the business.

• Sixth, for prepress service providers, OPI can cement customer relations and capture new customers. The prepress site scans and samples, and then delivers the preview via mail, messenger, or telecommunication services. The customer completes the layout and delivers it back to the prepress site. In effect, the OPI solution integrates the workflow of the outside customer with the prepress service provider.

The first four of these sources relate to improving output from a given number of workstations and output devices. Their impact is greatest where there is more work available than the business can handle. Typically, in these businesses, the OPI solutions cost-justify themselves in a few months. In fact, it is this high level of return on investment that explains the rather high price of OPI software, compared to other prepress software applications.

The last two sources of return apply also to businesses that do not face capacity limitations. The fifth reason, OPI reporting functions, is important, but if this is a key purchase consideration, it is more economical to start with a print server solution, which offers the same reporting features. An upgrade can provide OPI services at a later date.

The sixth reason reflects a trend in the prepress business. Newspapers are beginning to use OPI in a WAN configuration to lock in the business of real estate, automobile, department stores and other advertisers that use many pictures in their ads. Service bureaus, trade shops, and reproduction houses are using the same techniques to lock in the business of magazines and catalog publishers.

The market size
This section presents a quantitative perspective on the demand side of the OPI market. It is based on a market segment study summarized in Table 4a. The conclusion of the study is very positive about the future for OPI solutions.

The estimation technique used to size the OPI market for the United States focuses on market segmentation. Eleven major segments were identified. The size of each segment, in sites, was estimated from a variety of sources, including government census data, trade organization data, and trade magazine data, as well as from special studies conducted in the past for Apple Computer.

Within each segment, the determinants of demand are similar. The main variables are the size of the site, the degree of penetration of the (PostScript) DTP model, and the requirement for high-resolution imaging, especially for color. Taking these factors into account, the demand potential for 1995 was estimated on a segment by segment basis, drawing heavily on industry expertise. A low-to-high range estimate was used, instead of a point estimate, in order to reflect the uncertainties inherent in the estimation technique.

Table 4a presents the results of the estimation. The first column is the number of sites. The second column is the low end of the range for 1995 potential demand for OPI solutions on a segment-by-segment basis. The third column is the high end of the range. The fourth and fifth columns show each segment’s share of the total market potential at each end of the demand range.
**Table 4a OPI server market potential for the United States in 1995**

<table>
<thead>
<tr>
<th>Segment</th>
<th>1995 potential</th>
<th>Segment share</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total sites</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Printers, including screen printers</td>
<td>60000</td>
<td>3000</td>
<td>9000</td>
</tr>
<tr>
<td>Service bureaus and trade shops</td>
<td>6000</td>
<td>4800</td>
<td>5400</td>
</tr>
<tr>
<td>In-plant, government &amp; education</td>
<td>12000</td>
<td>1200</td>
<td>2400</td>
</tr>
<tr>
<td>Daily newspapers</td>
<td>1500</td>
<td>800</td>
<td>1000</td>
</tr>
<tr>
<td>Weekly newspapers and shoppers</td>
<td>11500</td>
<td>600</td>
<td>1200</td>
</tr>
<tr>
<td>Catalog publishers</td>
<td>13000</td>
<td>300</td>
<td>800</td>
</tr>
<tr>
<td>Advertising agencies</td>
<td>7500</td>
<td>200</td>
<td>500</td>
</tr>
<tr>
<td>Periodical publishers</td>
<td>11000</td>
<td>200</td>
<td>800</td>
</tr>
<tr>
<td>Book publishers</td>
<td>3000</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>Graphic design studios</td>
<td>29000</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>154500</td>
<td>11400</td>
<td>21700</td>
</tr>
</tbody>
</table>

**OPI market potential 1995–2000**

The market potential for 1995 is defined as a willingness to buy an OPI solution in 1995, at the current prices for hardware and software. The estimation procedure is based on U.S. data, which is more complete than data for other geographies. As reported in the previous section, the forecast market potential range for the U.S. in 1995 is 11,400 to 21,700 sites. To arrive at a worldwide estimate for 1995, the technique is to apply standard multipliers for installed PostScript solutions in publishing, which range from 2 to 3. Applying the more conservative multiplier, the worldwide market potential may be in the range of 23,000 to 43,000 sites.

Market potential is not the same as sales potential; the difference is installed base. A survey of vendors conducted for this study puts the installed base of OPI servers in the range of 9,000 to 11,000, worldwide. After subtracting the installed base, the conclusion is that there is an unfulfilled potential of no less than 12,000 sites for 1995, with an upper bound of 32,000 sites.

The U.S. data provide additional information on where OPI sales could come from in 1995. The largest potential segment is printers, including screen printers, and prepress service bureaus. These two segments make up about 65% of the OPI market potential for 1995. Other important segments are daily newspapers and “in-plant” prepress and printing sites in business, government, and education, making up a total of 15% of the market potential. The remaining 20% is spread among publishers, designers, and ad agencies, where the penetration of OPI will remain quite small as long as the OPI solution price stays at current levels.
Moving farther into the future, the market outlook over a five-year horizon can be described as buoyant, if not astonishing. Five trends are pushing this market toward very rapid growth over the period following 1995:

- The cost of OPI solutions should decline by at least 50% over the next five years
- Color printing for proofing should expand in editorial, design, and advertising sites
- The printing segment will completely convert to the digital publishing paradigm in page preparation
- Digital cameras will push the problem of high-resolution data management back to the photographers, ad agencies and graphic designers and create problems that OPI solves
- Client/server image retouching and composition—exemplified by the Live Picture technology that Kodak has recently embraced—will become a significant part of digital prepress.

Taken together, these factors will push the U.S. demand potential into the range of 90,000 to 120,000 sites by the turn of the century.

Internationally, identical forces will be at work. An additional surge will come in Asia, as Japanese printing and publishing moves down from CEPS to DTP and much of Chinese and Indian technology moves up to DTP from metal type. By the end of the decade, the worldwide multiplier will be in the range of 3 to 4. This translates into a total market potential in the range of 270,000 to 480,000 sites.

The data portrays a remarkable growth potential, in excess of 50% per year on a compound basis. Putting a dollar amount on the total, using even a conservative range of $3,500 to $5,000 per site for hardware and software, the conclusion here is that OPI represents a market potential of $1 billion to $2.5 billion over the next five years.

**User profiles**

This section profiles a number of OPI users chosen to represent the spectrum of major publishing market segments. Profiles include a service bureau, a printer, a newspaper, and a catalog printer. They illustrate a variety of OPI workflow problems and solutions. To be complete, the section concludes with a profile of a service bureau that has carefully evaluated and rejected OPI software, for now.

**Four Lakes Colorgraphics, Madison, Wisconsin**

**OPI in a large prepress color service bureau**

Four Lakes Colorgraphics is a large trade shop in the U.S. Midwest. They provide layout and output services, but the value they provide customers is in their color scanning, retouching, and color separation expertise. Their OPI solution is 3 PowerPC-based servers running Adobe Color Central. They have 30 workstations, 3 large scanners, 5 imagesetters, and a variety of printers and proofers.

As shown in Figure 4a, OPI is the hub of activity at Four Lakes Colorgraphics. It permits them to divide the workforce into three main groups—scanning and retouching, layout, and system administration. The workflow begins in the scanning department, where material is scanned, retouched, and separated. The OPI previews are created in the scanning department and then both the high-resolution file and the OPI preview file are written to the enterprise file server.
The layout designers pull the previews from the file servers. It is notable that the designers can be in-house or at a customer site. In the latter case, the preview is dispatched by express mail or messenger. Once the design is complete, it is routed to the OPI server either directly, in the case of their own layouts, or via their layout department, in the case of layouts from customers.

The remote users are not on line yet. Files are transferred on floppy or cartridge. Four Lakes not only provides color quality control but also archives the color files to tape for possible reuse.

One of the interesting features of this operation is that Color Central is used on a Mac OS server together with an expensive custom fiber network and file server, called MediaNet from Sonic solutions. Color Central is valued for its intuitive interface, ease-of-use, and for the ease in training a new operator. Four Lakes finds that one server can keep two or three imagesetters going full time.

Four Lakes uses three OPI servers to manage the workflow to five imagesetters, two color proofers, a color printer, and two laser printers. Two of the servers are dedicated primarily to imagesetting. Providing in effect “mirrored OPI services,” each of these two servers is wired to all the imagesetters, and each user sees two different queues for this same imagesetter in the Chooser. At print time, the user decides which OPI server to print to depending on the current output load. The third OPI server is dedicated to proof printing and to low-resolution output to the laser printers or the color printer. This configuration is illustrated in Figure 4b.

In summary, Four Lakes Colorgraphics is representative of perhaps the largest group of current OPI users—namely, trade shops that provide service to the public. Four Lakes uses OPI technology as the basis for the way they organize their workforce as well as for managing output more efficiently.

Harrisonburg Electronic PrePress, Harrisonburg, Virginia
The prepress operation at R.R. Donnelley & Sons Co. book printing plant

The purpose of Harrisonburg Electronic PrePress is to provide quality assurance for book publishers that are the customers of this Donnelley division. The scope of their activities is similar to a service bureau, except that their volume is more extreme. Their imagesetters output 60,000 book pages per month, in support of a printing plant that produces 100,000,000 books per year, mostly trade books.

Their equipment includes 12 Macintosh workstations, 2 Windows workstations, and two Sparc workstations. There are 2 imagesetters that can output 16-page imposed flats, one that outputs an 8-page flat, two capstan-drive imagesetters and an Apple LaserWriter Pro. OPI is managed by Color Central running on a PowerPC-based server—a single OPI server outputting 60,000 book pages per month!

In this operation, almost all the layout is done by the client. The plant provides scanning services, primarily for black and white output, since there is little color printing in the plant. The steps in this workflow are shown in Figure 4c.
Figure 4c  Diagram of the workflow at Harrisonburg/R.R. Donnelley

1. Client sends art to plant
2. Plant scans and preps the files (cropping, scaling, tonal adjustment, etc.)
3. Plant runs sampler on high-resolution files to create OPI previews
4. Plant sends previews to client
5. Client does layout
6. Client sends layouts to plant
7. Plant preflights the layouts
8. PostScript files are saved with OPI comments
9. Plant imposes layouts using Impostrip
10. Plant prints imposed signature to OPI server
11. Server substitutes high-resolution files for previews and outputs to imagesetter
Step 7, preflighting, is a workflow procedure that has become more common in prepress environments. It involves reviewing font availability and other aspects of the job that could lead to PostScript errors when the page is processed at the RIP. Harrisonburg does this manually. Several vendors are bringing products to market to facilitate the preflight step, some in conjunction with OPI server solutions.

Step 9, imposition, is emphasized at Harrisonburg because most of their work is book printing. In this step, 8 or 16 individual PostScript pages are stripped electronically into a superpage which is output onto a single piece of film, called a flat. As illustrated in Figure 4d, imposition involves correct page order, rotation, and spacing. This is another step that has been selected by OPI developers to absorb into the OPI envelope in future versions of their applications.

To summarize, Harrisonburg PrePress uses OPI for output management in a high-volume situation. Print services are their primary interest, but the ability to handle picture replacement means the same software can handle their full scope of printing requirements.

The Arkansas Democrat, Little Rock, Arkansas
Largest daily newspaper in Arkansas

The Arkansas Democrat is one of the first large U.S. dailies to have full editorial pagination. The layouts are done in XPress, using copy drawn from a standard newspaper editorial database and preview images from their Cascade OPI system. Cascade is an OEM vendor of the Helios system that runs on a UNIX server.

A newspaper has a picture problem that is different from other prepress operations. In a service bureau or a print shop, the images that come through the door have already been selected for publication. In contrast, a newspaper is inundated with vastly more photos than it uses. Each day, 300 to 400 photos arrive via a digital service provided by the Associated Press. Staff photographers on assignment shoot 400 to 800 frames a day. Several dozen photos arrive attached to press releases or wedding notifications. In addition, the newspaper maintains an image archive with more than 100,000 photos.

This multitude of images creates a special workflow management problem. The OPI system cannot keep up with the full load of images and the full load of printing simultaneously. The solution at the Arkansas Democrat, illustrated in Figure 4e, is to filter all sources of photos before loading them to the OPI server. The rule is that only the pictures selected for publication are passed to the OPI server. This is still many pictures, since on average the paper prints 100 black and white and 30 color pictures a day.

As part of their structured approach to printing productivity, the imaging side of the newspaper operation, consisting of photo workstations, OPI server, and imagesetters, is isolated from the rest of the editorial network, on a separate Ethernet segment.

In summary, the Arkansas Democrat uses OPI as an essential part of their digital pagination solution. It allows the newspaper to separate layout from image preparation and management, and permits the paginators to keep up with the dynamic demands of newspaper deadlines.
Figure 4e  Image-flow schematic for the Arkansas Democrat

Wire photos
Sent from the field as individual files in digital form

Assignment photos
Developed from film and evaluated; the best are selected

Archive photos

Press release and wedding photos

Wire photo server

Film processor
Film scanner

Flat bed scanner

Photo editors
make selections and send high-resolution photos to OPI server.

OPI server

Imagesetter

1 Preview

Layout file server

2 Page layouts with previews

3 Page layouts with high-resolution files

OPI White Paper
Southwest Color, Van Nuys, California
The impact of client/server imaging at a prepress giant

With 15 years in the trade, Southwest Color is a prepress giant. It is included in this group of profiles to document a high-end solution in the range of client/server imaging systems. Southwest Color uses the CatTrax system from DCS.

Southwest Color is a trade shop business with work that includes magazines, ads, and posters, but they specialize in catalog production. At any time they are working on five or six catalogs, mostly for regular customers. This work load had grown to the point where last year they employed up to 100 people, working three shifts.

Today they employ 60 people, and they attribute 95% of their staff reduction to the efficiency gains achieved with the CatTrax system. The biggest single savings has been in managing pick-ups, the images in a new catalog that are repeated from a previous catalog. Before CatTrax, searching through magnetic tape to find pick-ups was full-time work for 10 people. Today it is all handled by the CatTrax database.

Additionally, their production cycle has been shortened dramatically. Prior to CatTrax, it took one to two weeks for Southwest Color to produce complete film for a catalog. Today, the total time has been reduced to three days, which includes two days to build complete pages and one day for checking and corrections.

Another remarkable aspect of Southwest Color is the scale of operations. They have 120 gigabytes of on-line storage. They operate with 6 Mac OS servers, 20 manned Macintosh workstations, 10 automated Macintosh workstations, and 8 imagesetters.

It is notable that these efficiency gains come from implementing CatTrax at the hub site. The Southwest Color customers have not yet acquired the client database system that completes the CatTrax architecture.

To summarize, Southwest Color shows two things: First, OPI server technology is a foundation for more comprehensive solutions to specific vertical market problems; and second, the opportunities for efficiency gains with these specialized systems are very impressive.

Desktop Prepress International, San Francisco, California
The exception that proves the rule

Desktop Prepress International (DPI) is one of the premier color service bureaus on the U.S. West Coast. One of their largest customers is MacWorld Magazine. DPI has 6 imagesetters, 30 Macintosh workstations, 2 large drum scanners, and a variety of other equipment. DPI is included here to illustrate the point that OPI is not for everyone.

The workflow at DPI is determined by a strategic choice regarding the business design. DPI does not provide layout design services and they consciously avoid division of labor. There are two parts to the organization, the scanning department and the output department. In the output department, each job is assigned to a highly-trained, well-paid specialist who is responsible from start to finish.

The nine steps in DPI job processing are illustrated in Figure 4f. They emphasize the role of the skilled professional as the focus of both productivity and quality assurance.

Why no OPI? Two reasons. First, in this workflow situation, image swapping does not offer productivity improvements because the bottlenecks in the operation are the imagesetters or staff, not the workstations. When capacity opens up, because a new imagesetter is acquired or the staff increases, the owner buys additional workstations.
**Figure 41 Image-flow schematic at Desktop Prepress**

1. Client sends art to DPI

2. Scanning Department scans and preps the files (cropping, scaling, tonal adjustment, etc.) and saves them in DCS format

3. DCS preview delivered to client

4. Client does layout and delivers it to DPI

5. Job assigned to an output manager, who moves high-resolution via “sneakernet” from scanning department to an output workstation

6. Output manager links the high-resolution to file, preflights, selects an imagesetter, and prints directly to imagesetter

7. If there are PostScript problems, output manager resolves them and re-sends the job

8. If job prints successfully, output manager processes film, and carries out film check

9. If film check ok, job delivered to customer
Second, the print serving function contradicts the quality control scheme at DPI, which is based on the delegation of full responsibility for each job to a single output manager. Since there is no print server, the output manager selects the output device that is available and appropriate on a job-by-job basis, he then pays close attention as the job prints. The owner believes the extra attention is reflected in faster response to printing errors and faster completion of the film processing and job check.

In summary, DPI demonstrates that the alternative to OPI in a color service bureau is comprehensive and continual attention to staff development and quality control.

Summary and conclusion

OPI solutions have achieved prominence in professional publishing because they provide a productivity gain and expand market opportunities. The customers are satisfied, and many have reorganized their production flow to take full advantage of task separation and specialization.

The sales to date have only scratched the surface of the potential demand, which will expand dramatically throughout the remainder of the decade as this publishing production paradigm spreads, and with it the OPI workflow solution.
Glossary

**AFP**  AFP is an acronym for “AppleTalk Filing Protocol,” a protocol originated and maintained by Apple Computer that allows users to share data and applications that reside on a file server.

**APR and Scitex APR**  APR is an acronym for “automatic picture replacement.” Scitex APR is a technology that is very similar to the image swapping part of OPI. In Scitex APR, two files are generated, a high-resolution and a preview. As in OPI, the preview file is placed in a desktop layout program. The difference is in the location of the swapping. In the Scitex model, the swapping is part of the rasterization in their software RIP. The high-resolution file does not travel from a server to a RIP.

Perhaps confusing things a little, some OPI solutions advertise support for Scitex APR. This means that the OPI software recognizes an APR preview file and can swap it out for the APR high-resolution file, but on the server, where the OPI solution swaps out any other low-resolution for high-resolution.

**Cameo**  Cameo is another word for a preview. Cameo is usually used in connection with an image, seldom in connection with a file. The term is often used to indicate the size of an image: a cameo is larger than a thumbnail but smaller than a high resolution file.

**CEPS**  CEPS is an acronym for “Computer-aided Electronic Publishing Systems.” The CEPS systems comprise a generation of page layout software developed in the mid-80s by high-end vendors such as Scitex, Hell, and Dai Nippon. They are closed, expensive, proprietary systems that provide a variety of features only recently approached by DTP systems.

**Cumulus**  An image database application published by Canto Software GmbH that can be linked to OPI sampler routines. The user can search on file characteristics. Hits are displayed in a window with thumbnail versions of the files. Cumulus is used in OPI sites to catalog preview and high-resolution files. It is used by layout designers as a handy way to find images. Cumulus is available in a client/server version.

**CMYK**  CMYK is an acronym for “cyan, magenta, yellow, black.” Cyan, magenta, yellow, and black are the pigment primaries used in creating printed images which reflect into the eyes of the viewer. A CMYK file is one which contains four versions of the same image, each one carrying the intensity data, or separation, for one of the reflective color components.

**DCS**  The initials DCS stand for “Desktop Color Separation.” This is an open format invented by Quark to integrate images already separated as CMYK files into a layout. In the DCS format there are five files, four separation files in EPS format, and a fifth file that usually has a preview image in the resource fork and may have a composite color file in the data fork. DCS has become especially important in prepress activities because it prints faster than alternative formats.
DTP  DTP is an acronym for “desktop publishing.” Coined in 1985 to characterize a system made up of a 512K Macintosh, PageMaker, and a LaserWriter, early usage had a pejorative connotation of low quality, relative to a CEPS system. In the 90s, the quality differential has disappeared and the term DTP has come to indicate an open solution, usually based on core products from Quark, Inc., Adobe Systems, and Apple Computer.

EPS  EPS is an acronym for “Encapsulated PostScript.” EPS is a file format for a file that contains a sequence of PostScript code, PostScript commands, comments, and data values. The Mac OS version of the EPS format provides for the resource fork to include a PICT thumbnail and PICT preview of the image that will be generated when printed by the PostScript information, which is carried in the data fork of the file.

Fetch An image database application published by Adobe Systems that can be linked to OPI sampler routines. The user can search on file characteristics. Hits are displayed in a window with thumbnail versions of the files. Fetch is used in OPI sites to catalog preview and high-resolution files. It is used by layout designers as a handy way to find images.

FPO  FPO is an acronym for “for position only.” This term is synonymous with preview or proxy and it is used in conjunction with files and images.

Imagesetter  An imagesetter is a marking device that marks with light, usually a laser, or film. It can mark either on positive media (called “velox” or “paper” in the trade), or on negative media (called “film” in the trade). The name comes from the fact that it can mark out images with half-tone dots, as well as text.

Imposition  Imposition is a term that DTP has inherited from a hand process in which the film for two, four, eight, and sometimes 16 individual pages are stripped into a larger frame, called a flat, from which plates are exposed. The imposed plate is used for printing a signature on press. The order and the orientation of the pages, as well as the spacing, is critical, so that when the signature is folded and then trimmed, the reading order is preserved and all the pages are upright.

In digital imposition, a sequence of code blocks representing PostScript pages are combined together in the proper order, and spacing and rotation operators are inserted, so that an imagesetter can output a full flat.

Digital imposition can come before or after OPI image swapping, and imposition applications can be managed by OPI server solutions.

Kudo  An image database application published by Imspace Systems that can be linked to OPI sampler routines. The user can search on file characteristics. Hits are displayed in windows with thumbnail versions of the files. Kudo is used in OPI sites to catalog preview and high-resolution files. It is used by layout designers as a handy way to find images.

Live Picture  Live Picture, published by HSC Software, is an application used for the composition and retouching of images. The steps in manipulation are determined while working on preview images and then subsequently applied automatically to the high resolution image. At this writing, there is no client/server version of the application, but it is expected, at which point the technique will fall within the umbrella of the generalized use of the OPI term.

OPI  OPI is an acronym for “Open Prepress Interface,” a specification for image swapping procedures published by Aldus Corporation in 1989. The term has been generalized to refer to a group of products and a style of work in prepress environments. In its most general form, OPI refers to a client/server solution that involves image swapping and print services.
**PhotoCD**  The property of Eastman Kodak, PhotoCD is a proprietary file format for storing digital photos. PhotoCD uses a color space related to broadcast video formats, which has to be translated into RGB for display on a computer monitor or CMYK for output with page separations. Many desktop applications can read and manipulate PhotoCD data, only those licensed by Kodak can write in the PhotoCD format.

**Preview**  “Preview” is used to describe either a file or an image that is used in place of a full resolution copy of the same object. In an OPI system, the preview file is created by the sampler application. The preview image, in a preview file, is usually sized to be the same dimensions as the high-resolution image it represents but with the resolution reduced to a screen resolution of 72 dpi.

**Proxy**  Proxy is another term for preview or FPO.

**RGB**  RGB is an acronym for “red, green, blue.” Red, green, and blue are the primaries used when an image is projected, on computer monitors television sets. An RGB file is one which contains three versions of the same image, each one carrying the intensity data for one of the transmissive color components.

**RIP**  RIP is an acronym for “raster image processor.” A RIP is a computer program that converts lines of code and data values, generally in PostScript form, into a bit map that will be rendered on film by an imagesetter or film recorder or on paper by a printer. A RIP that runs on a host computer is called a “software RIP.” a RIP that runs on a dedicated computer integral to an imager, such as a printer controller, is called a “hardware RIP.”

**Sampler**  The sampler is a component of an OPI solution. Input to the sampler is a high resolution file, output is the same high resolution file and a low resolution preview file.

**Scitex CT**  CT is an acronym that stands for “contone,” or continuous tone. Scitex CT is an image file format originated by Scitex Corporation, who maintains the specification. It is an open format. More often than not, CT files are ones which originate on a Scitex system.

**TIFF**  TIFF is an acronym that stands for “tag image file format.” TIFF is an image file format originated by Aldus Corporation, the specification for which is not maintained by Adobe Systems. A TIFF file can be monotone or color, and the color data can be in a variety of formats, including RGB or CMYK.

**Trapping**  Trapping a file is adjusting the PostScript data structure to make the eventual print job more congenial to misalignments or misregistration on the press. Trapping involves complex and sometimes time consuming calculations. The traps, or image adjustments where two colors abut one another, can be computed at layout time, but it has been more successful to compute them just prior to the time a file is RIPed. Therefore, there are special applications for trapping that are invoked after page layout is complete. In principle, trapping is a step that can be managed by generalized OPI solutions.