Designing a workgroup multifunction printer

Productivity, cost of operation, and balanced deployment are critical to small/medium businesses and to large corporations alike. Workgroup printing is a well-established method of managing these issues, and Xerox has utilized its document management and printing expertise to scale workgroup solutions to fit organizations of virtually any size. So far, however, a solution that extends workgroup economies to scanning and color copying has remained elusive, especially when ease of use and smooth operation over the network are taken into account.

Color printing has proven its worth in business, and its adoption has increased the demand for scanning and color copying. Building these functions into a multifunction product built on a shared color printer is a viable and desirable alternative to uncontrolled proliferation of scanners and color copiers. Although color desktop MFPs are becoming more prevalent, Xerox saw a hole in the market and an opportunity to create a more robust solution with better workgroup features, and sought to build a world-class design suitable to join its WorkCentre® product line.

Potential synergies with the engine in Xerox’s Phaser® 8400 solid ink printer were very strong; in its decade-plus history, solid ink color printing had established itself as a viable contender to inkjet and laser printing. The critical speeds — time to first print and pages per minute — were right for workgroup applications, and the company’s solid ink printers had demonstrated their reliability, low maintenance, high-quality output, and ease of use. The technology had improved dramatically over the years, both in resolution and speed, from an initial 300 dpi and 4 pages per minute to the current 2400 FinePrint™ resolution and 24 ppm.

Xerox was also attuned to customer input, which showed an increasing interest in technologies with low environmental impact, workplace cleanliness and convenience, and a minimal waste stream. By replacing cartridges, powders, toners, inks, multiple drums, and the like with solid inks, the Phaser 8400 engine had the potential to extend the benefits it had already conferred on departmental printing to a workgroup multifunction device. Users, however, were accustomed to other technologies in MFPs; Xerox’s hope was that they would quickly grasp the benefits of solid ink technology and that it would precisely match their concerns for operational simplicity and environmental friendliness.
Design Goals

Printing
A WorkCentre-class MFP would first and foremost have to be a rugged, reliable printer, capable of consistent color pages at the engine’s full, rated speed, day in and day out. Nominal maintenance, simple consumables reloading, low environmental impact, and minimal amounts of products introduced into the waste stream were essential criteria. Duplex printing was also a basic requirement, as were optional multiple paper trays and expandability. Letter-sized paper with legal capability was deemed sufficient for workgroup applications; most organizations have access to larger-format printers in graphic arts departments or through external suppliers. Time to first page and continuous print speed would have to be appropriate for workgroup tasks.

Scanning
With duplex printing a basic capability, this new product would require duplex scanning to minimize paper handling and to ensure user success with complex, double-sided documents. Resolution, color accuracy, and speed would have to be best in class, and document routing back to the user’s computer would have to be foolproof. The scanner would also need to handle legal-sized documents.

Copying
Color copying was specified to meet high user expectations, with all of the features they had come to expect in departmental copiers and WorkCentre-class products, such as edge erase and gutter erase. Color accuracy was essential, as were convenience features such as interrupting long print runs for copies, with automatic resumption of the print job. Duplex copying and collation were essential as well. The MFP would have to be capable of sophisticated tasks, such as combining reduction, auto centering, two-sided copying, and collation, for example, to turn single-sided documents into convenient booklets.

Intelligence
The new MFP would require a significant amount of onboard intelligence and a substantial amount of memory and disk storage. A large hard disk would allow collation, storage of scanned images, and many more convenience features, and a fast processor would ensure maximum efficiency in all operations. A simple user interface with a logical control layout was a basic requirement, and a fast processor would allow the designers to use an ergonomically sound mix of dedicated buttons and a large screen with navigation controls. Users would receive feedback of option selections via colored indicator lights and onscreen information. Users would also have the option to view concise help files onscreen or print detailed documentation stored on the hard disk.

Integration
The integration challenge was twofold: physical and operational. The MFP had to look the part — a handsome, substantial piece of office equipment that would fit into any décor, and the individual features had to work easily and harmoniously with one another, with easy access to media, document loader, platen, and paper. The product would also have to be customer-installable, with built-in calibration and alignment capabilities. Furthermore, it would have to meet and exceed international standards for workplace safety, electrical and thermal loads, and, for customers who required it, the device would have to meet Department of Defense criteria for handling of secure documents.
Implementation

Xerox had a very capable engine in its Phaser 8400 solid ink color printer. It had the requisite speed, simplicity of operation, and high color quality necessary to power a workgroup MFP. It’s a letter-sized engine with legal capability; it became the heart of the WorkCentre C2424. Solid ink technology is well regarded for high-quality output, convenience, and low maintenance, and consumables can be added on the fly, even while long print jobs are in progress.

Unlike other technologies, solid ink requires no powders, liquids, tanks, or cartridges. As the ink is consumed, there are no “empties” to dispose of or recycle. Workgroup areas and workers stay clean because there is nothing to spill or leak. Pages printed with solid ink have a distinctive look and feel, a semi-gloss sheen produced by the process that fixes the ink to the page with pressure.

Unlike inkjet printers, solid ink printers do not lose resolution to wicking and can print on any kind of paper, and do not require coated papers, labels, or special transparency materials, greatly increasing the MFP’s flexibility in diverse workgroup situations. Likewise, fixing the ink by pressure has significant advantages over laser technologies, which use heat to fuse the toners to the page. The Phaser 8400’s short, direct paper path and single drum are inherently more reliable than multi-drum and multi-pass technologies found in laser printers.

Engines and Drivers

As a workgroup printer, the Phaser 8400 has a head start on being the foundation of a workgroup color MFP. Its print driver uses the same “beacon” technology found in other Phaser printers to connect with client machines over the network. The full driver is stored on the device’s hard disk, and a new user needs only to run a small program. The client and MFP find one another on the network; it’s not even necessary to know the MFP’s IP address, although the address is readily available from the status panel.

Installation is equally simple if you know the machine’s IP address. Entering it into the client’s browser brings up a Web page hosted by the WorkCentre C2424. From there, each user can download and install the driver software. Any user can have access to the printer’s status, including full monitoring of jobs in progress, in the queue, usage profiles, or job accounting, unless the administrator turns off or password-protects the feature.

While the beacon technology, Web page-based printer management, and downloadable drivers were perfected on workgroup printers such as the Phaser 8400, the WorkCentre C2424 expands on the theme by including all of the necessary scanner drivers as well.

Simple Setup

Since the WorkCentre C2424 is designed to be user-installed, it is delivered to the customer in manageable packages. The duplexing print engine is in one box, while the document feeder/scanner is in another. Optional items, such as the rolling base or additional paper trays, are boxed separately. Each portion is easy to handle, sets up quickly, and locks securely in place without tools. A single cable connects the upper and lower portions of the DADF (duplexing automatic document feeder) and a single cable connects the combined assembly to the print engine. The optional base is wide and stable, with large, lockable wheels set at the extreme corners for stability when rolling the MFP to a different work site.

Xerox engineers gave considerable thought to desktop stability, too. Although the Phaser 8400 print engine is a solid, weighty underpinning for the WorkCentre C2424, the DADF hinges back to expose the platen, and the platen itself hinges back to expose the filler tray for the solid ink. The DADF snaps into a strong internal metal backbone that is essentially part of the print engine, connecting it to the base of the machine. Concealed by the outer housing, the backbone gives the WorkCentre C2424 an all-of-a-piece solidity that is unmatched by MFPs with stand-and-shelf construction or an add-on scanner/document feeder. Although the weight of the print engine is more than sufficient to keep the unit stable, the designers added short, sturdy legs that swivel out from the back of the MFP, increasing its front-to-back footprint and making it impervious to the most violent or foolhardy treatment by users.

The WorkCentre C2424’s integration goes far beyond the physical, however. The machine is designed for superior workflow when working locally with the device as well as when working remotely from client machines. With an unusual amount of onboard intelligence, the internal software drives a large, easy-to-read LCD, which displays clear instructions and selected options. The display is flanked by “cascades” of buttons and LED indicators that group options logically. Rather than forcing the user to drill down through onscreen menus, the cascades expose the most popular and often-used options and provide full mode and status information to the user. The user is also apprised of the overall mode — copy, scan, print, or setup — with lighted pushbuttons. Further options are selected from the navigation buttons below the LCD screen. The menus are hierarchical and logical, allowing the user to drill down to the necessary depth, but executing all operations in the minimum number of selections. And finally, a conventional 10-key pad is available for numeric input.
Web Savvy
The WorkCentre C2424's built-in Web server is the heart of its communication with the workgroup it serves. By entering its IP address, any user (or authorized user, where access needs to be controlled) can see the machine's current status, retrieve job accounting records, manage saved and protected print jobs, print documentation and color samples, retrieve scans, view and set properties, and run local and remote diagnostics. While much of the capability was pioneered in the Phaser 8400, the WorkCentre C2424 incorporates features developed in the WorkCentre line's CentreWare software, and the two are seamlessly blended into a coherent, user-friendly whole.

The Web server offers over 50 pages within six major tabs, allowing users and administrators to drill down quickly to the area they need, to set or adjust options, or to retrieve information. Additional links within the pages connect to Xerox corporate resources for service, support, ordering supplies, and even tips and suggestions for the most effective use of the product. A comprehensive index, with nearly 200 entries, provides direct access to all features, even the most esoteric settings and protocols.

Copying
Copying convenience is as good as that of any dedicated office copier, and better than many, thanks to the color capability, automatic duplexing, collation, and minimal document handling. It also includes high-end features such as book copying, edge erase, gutter erase, and scaling. These high-end features, developed for Xerox office copiers, are easily accessed from the LCD panel and navigation buttons on the control panel. The user simply selects the desired amount of erasure, for example, in tenth of an inch increments. Other high-end Xerox features, such as auto-sizing, are built in.

Sophisticated features such as booklet copying harness the WorkCentre C2424’s onboard intelligence by combining reduction, rotation, auto centering, collation, and two-sided printing. It can make booklets from single-sided or double-sided source pages.

The WorkCentre C2424’s capacious memory and hard disk facilitate job interruption and resumption: convenience copies can be made while lengthy print jobs are in progress.
Smart Scanning

If a workgroup MFP is to fulfill its mission and fully justify itself through elimination of individual scanners, it must refine the scanning workflow to the point where it rivals or even better the performance of dedicated scanners. Of the many challenges that the engineers faced, this was the most difficult, and perhaps the most notable for its success.

The scanning engine was designed to be full duplex, but in one pass, to simplify and speed double-sided document handling, both for scans and for copying. One side of the document is scanned by a fixed head as the page is moved from the input tray to the platen while the other side is scanned simultaneously by a moving head under the platen.

First, the DADF minimizes document handling. The single-pass design yields an effective 20 sides per minute for double-sided material, while the 10 page-per-minute full-quality rate for single-sided material still matches or beats a hand-fed scanner because it eliminates handling the platen cover, document positioning, and recollation of multipage documents. The 600 by 600 dpi maximum scan resolution is sufficient for all but the most exacting graphic arts applications. It also handles legal-sized pages at full resolution. If the application requires less resolution, scanning speed increases to 20 pages per minute at 300 by 300 dpi.

The hardware, however, is just the tip of the iceberg. The WorkCentre C2424 offers unprecedented flexibility in getting scanned documents to go where you want. With four different document-handling implementations, it adapts to the way users want to work, rather than limiting them in any way.

The Xerox Scan Utility uses the same beacon technology that facilitates printer driver installation. Each PC emits an identification beacon, which the WorkCentre C2424 reads. Users simply load their documents into the DADF and press Scan. The C2424 then lists all of the PCs in alphabetical order. The user selects the desired PC and presses Start. The documents are scanned to the selected PC, where the Xerox Scan Utility automatically opens, displaying thumbnails of the images. At the PC, the user can then select each image by its thumbnail for archiving, editing, or inclusion in a document. By pushing the documents out to the users’ PCs, scanning becomes as simple as copying.

The WorkCentre C2424 also performs a vital role in turning printed materials into editable documents. The optional ScanSoft PaperPort Pro 9.0 and OmniPage Pro 12.0 software facilitates easy document and image acquisition, as well as comprehensive, best-in-class OCR. The documents can then be organized and stored as images or edited with Word, Excel, and other common tools.

Users can also define up to 50 mailboxes, which are stored on the WorkCentre C2424’s 40GB hard disk. These mailboxes can be public or password-protected. To retrieve documents, users simply log into the WorkCentre C2424’s Web page, click on the Scans tab, and choose whether they want to retrieve the scanned document as a JPEG, BMP, GIF, TIFF, or PDF. The support of these popular file formats allows users to maximize resolution and image quality or to minimize file size, as required, while being compatible with virtually all graphical editing products and presentation software. Users of the PDF format will especially appreciate the WorkCentre C2424’s ability to batch multiple pages into a single PDF document. The Scans page features a thumbnail of the scanned document, its automatically assigned filename, and the date and time that it was created. They can then delete the scanned images from the hard disk.

Finally, the scanner can be operated in TWAIN mode, as an imaging resource that appears in the client software’s menu selections, and the driver will start the user’s application of choice to receive the scanned images. It performs as though it were dedicated to a single PC, and users can just “pull” the scans into their applications.

Sophistication and Security

The tight integration with the underlying Phaser 8400 engine, its management system, and roomy hard disk makes the WorkCentre C2424 a truly integrated MFP, a one-stop tool for all of the graphical aspects of preparing sophisticated presentations. The solid ink engine remains a superior choice because the inks are water- and smear-proof and don’t bleed into paper or other media, thereby retaining all of the resolution produced by the print engine. The engine also leaves a highly finished surface on the page, which gives the documents a distinctive, high-quality look and feel. Solid ink technology is also a superior solution for transparency and overlay material, again because of the finished surface and because the ink transmits light.

Another capability that the WorkCentre C2424 inherits from the Phaser 8400 is DOD-compliant secure printing. Since the transfer drum is scraped clean on each revolution, there is no latent image in the print engine, and the secure erase function overwrites the disk image in accordance with DOD standards.

Conclusion

The WorkCentre C2424 sets a new standard for workgroup MFP performance, features, low maintenance, and low acquisition/operating cost. The seamless integration of double-sided color copying, scanning, and printing elevates workgroup-produced business documents to a level that rivals professionally printed presentations, booklets and brochures.
High Performance Solid Ink Technology

For More Information
To request printer information and a print sample, go to: www.xerox.com/office/ or call (877) 362-6567.

About the Author
Bill Machrone is a technology analyst and writer who concentrates on personal computer technologies, office and productivity technologies, and personal productivity and entertainment devices. He is the former editor-in-chief and publisher of PC Magazine, and created PC Labs and the benchmark testing and comparison reviews that helped millions of readers through the process of selecting products that best met their needs. He has been a columnist in PC Magazine for 21 years and is a five-time winner of the Computer Press Association’s awards for best magazine, best comparison review, and best columnist.

As Vice President, Technology for Ziff Davis Publishing, he founded its corporate testing facility, ZD Labs, was the first executive producer of ZDTV (later TechTV), and launched several publications, including Corporate Computing, Yahoo! Internet Life, and Ziff Davis Internet Magazine. More recently, he was the cofounder of Extremetech.com, the highly successful technology site. He works from his home office in New Jersey.