# Software Technology for High-speed Color Printer

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This article introduces the host-side printer driver and utility software technologies that enable high-speed color printer functions.

One can broadly divide high-speed color printer software into two categories: high-end software which focuses on printers for high image quality, high speed, high volume printing, and low-end software providing easy, low-cost color printing.

Elements of technology that are required in common of all high-speed color printers include: ease of use, intuitive color settings, the capability to share printers via a network, and printer/consumable monitoring and management.

## Driver Technologies for Color Printers

Each color printer is configured according to one of two broad concepts. High-end color printers are provided with high function Page Description Language (PDL) capabilities, while with low-end color printers, the printer-side is limited to the print engine function alone, with print data creation and management being assigned to the host.
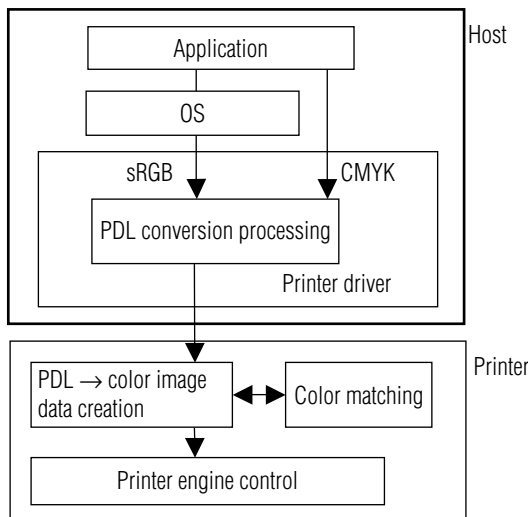


**Fig. 1   High-End Color Page Printer Configuration**

### (1) Driver Technologies for High-End Color Page Printers

Fig. 1 shows a high-end color page printer configuration that includes PDL. Most printer drivers convert operating system (OS) plotting commands to PDL. Settings provided on print screens are generally sent to printers, and the printers perform the printing processes including color matching.

OSs generally support the sRGB color space, and printer drivers send color data to the printer with no modification. Printers that adopt PostScript ®[*1] languages as the PDL can also process CMYK data on the printer side. Additionally, with an application that supports PostScript ® language, the user can send CMYK data directly to the printer. With "ink simulation" functions installed on printers, user can simulate commercial printing inks.

### (2) Driver Technologies for Low-End Color Page Printers

Fig. 2 shows the configuration of a low-end color page printer. This is a simple configuration with the printer receiving color image data and then printing it without modification. The host printer driver performs the processing up to and including generation of color image data for printing through the printer engine. Color matching is performed during the process of converting OS plotting commands to color image data.

Since the generated color image data size can be quite large, sending data to the printer without any intervention would take considerable time, resulting in low performance. To avoid this, data is compressed. Because the processing load for this function falls on the driver of a high-function color page printer, it is well recognized that if the processing power of the host-side PC is low, performance will deteriorate. For that reason, recommended PC specifications have been set as follows:

- CPU: Clock speed 700 MHz or higher
- Free Hard Disk Space: 500 MB or greater
- Memory size : 128 MB or greater

Most of the commercially available PC's today, even low-end models, satisfy these requirements, so they provide an engine speed adequate for the necessary performance.

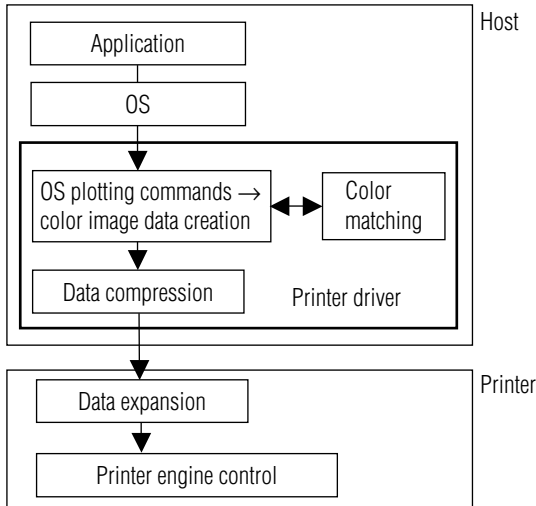*1)  PostScript is a registered trademark of Adobe Systems Inc.

**Fig. 2   Low-End Color Page Printer Configuration**

### (3) Driver Operability

The internal data processing performed by drivers varies considerably between high-end color page printers and low-end color page printers.   However, we can provide functionalities that are essentially the same when seen  of through the eyes of the user.  By making the print screens and settings essentially similar, we enable the user to use the high-end printer driver without being aware of the difference in its configuration compared to a low-end printer driver.

## Management Software Technologies in a Network Environment

Because of cost considerations, most color printers are connected and administered through networks as shared printers.   Generally in such an environment, printers are operated by administrators the same as other network devices such as routers and servers.   This chapter discusses software technologies involved in operating color network printers.

### (1) Software Configuration

Fig. 3 shows an example of a configuration using a Web application.  In the event of a Web application, software runs in association with Web servers.   This provides the advantage that operations management software does not need to be installed on each PC. It is installed on one PC on the network and then all other PC's can access printer functions through browser software.    Additionally,  accumulated  data  can  be centralized.  In the past it was common for such software to be installed on each PC, but that approach had drawbacks from the standpoint of installation work, maintenance and data all having to be distributed.  As a result, management software configured as described above has now become the mainstream.
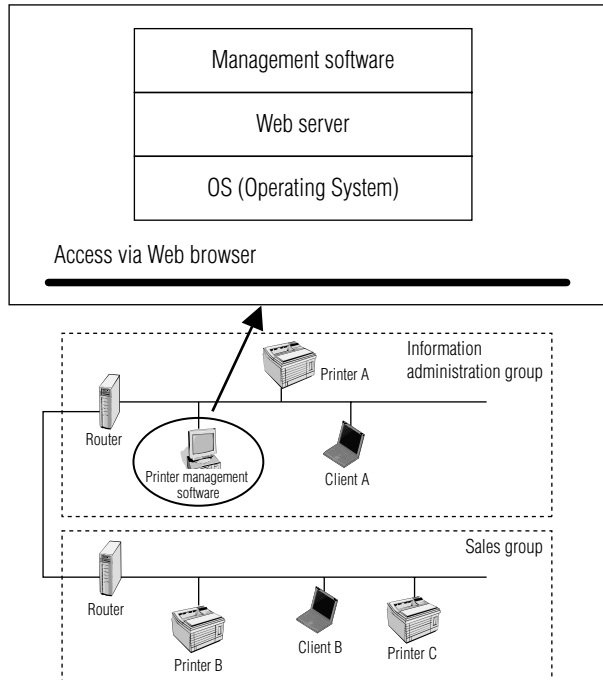


**Fig. 3   Management Software Configuration Diagram**

### (2) Management Indices

The market requirements for measurement indices to manage and operate printers are the following:
- Printer status information (such as print ready, print disabled)
- Printer failure information (detailed failure information)
- Page number information (number of pages printed since start of operation, current page count, etc.)
- Printer model and location information (such as product name or physical location of printer)
- Page number information by user (such as number of pages printed by division or by user, and current page count)

Such information can help administrators to interpret operational status and failure information.   Additionally, recognizing the number of printed pages may help to identify unnecessary printer locations to optimize printer deployment.     Users can also use the management software to locate other nearby printers and to determine whether those printers are available.

### (3) Information Acquisition Methods

The following are two general methods of acquiring information.
1) Periodically acquiring information from printers (Polling method)
2) Capturing information issued by printers periodically or upon occurrence of events, (Event-driven method)

In either method, SNMP (Simple Network Management Protocol) is usually used.   In the case of 1), since information is obtained at specific intervals, SNMP would be  sure  to  update  information  regularly.     However, because   the   number   of   packets   transferred   is

proportionate to the number of managed printers, network traffic may increase. In the case of 2), since no unnecessary packets are sent, the affect on network traffic is smaller than for 1), although updated information is not regularly obtained. Therefore, it is necessary to choose a method for the network management software according to the desired management index measurements.

**(4) Future View**

This section discusses the relationship of printing to recent environmental changes that have accompanied growth of the Internet. Since most companies connect to the Internet, there is increasing demand to integrate management software with external maintenance services through the Internet. Information obtained from printer management software can be sent directly to external maintenance services to provide fast, timely maintenance services. Because the notification has to go through firewalls on the Internet, available protocols are limited.

Fig. 4 shows an example of software configuration in an Internet environment. Printer management software accumulates printer operational status information within the company, and notifies a designated maintenance service company via e-mail of any failure when detected. The maintenance service company processes the e-mail and provides appropriate service. Using e-mail, the communication of information can be done through any firewall.
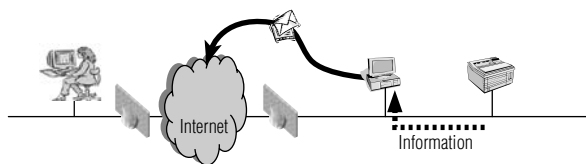


**Fig. 4   Management Software in an Internet Environment**

## Installation Technologies for "Easy to Use" Drivers

This chapter discusses technical trends in installing printer drivers in client PC's.

It is easy for experts in PC configuration to install printer drivers on various OSs, but it is often difficult for beginners. The following steps show the general method for installing a printer driver in a network environment, right up to the point where printing can be done.

(The case of a Windows ® *2) environment)

1. Select the Start menu.
2. Select Settings→Printers or Control Panel→Printers.
3. Select Add a Printer.
4. Install the printer driver following the instructions provided by the wizard.
5. Install network communication software (port).
6. Configure network communication software (port).

As shown above, many steps must be correctly performed to allow access to a network printer.

As a result, it is becoming more common to use a method that consolidates these steps and provides guidance to users within one "wizard." Fig. 5 shows an example of a wizard for installing a network printer driver. When a user launches the install wizard, all necessary installation and configuration is performed. Additionally because of the wizard format, explanations for each of the screen items can be provided through the GUI (Graphical User Interface) allowing even PC beginners to perform the operation easily and effectively.



**Fig. 5   Installation Wizard for a Network Printer Driver**

Demand for installation step standardization and wizard-type installation methods to simplify installation will probably continue to increase.

## Software Technologies for Color Adjustment

Color printers are used in wide range of fields, from design businesses to general offices. For that reason, they must be able to adjust colors as required by their use.

**(1) Design Business Usage**

Generally, color adjustment is performed using an ICC (International Color Consortium) profile.

ICM (Image Color Matching) must be supported for a Windows ® environment, and ColorSync ® *3) must be supported for a Macintosh ® *3) environment. To coordinate the appearance of colors between monitors and print out, there is an increasing need for adjusting colors based on monitor ICC profiles. Fig. 6 shows a driver GUI to allow coordinated color adjustment from monitor display to output device by selecting profiles for the monitor and output device.

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**Fig. 6  Color adjustment GUI using an ICC profile**

**(2) Applications in Office Usage**

The software used in office applications must have the ability to adjust graphic, text, and logo colors using Windows ® Office applications.  Technically, a man-machine interface is needed.  For example, there could be a way to show a sample printed image, allowing a user to adjust it while viewing the image.  A GUI for adjustment software is shown in Fig. 7.  A user can print the adjusted result, make further fine adjustments, and then output the desired colors.



**Fig. 7   Color adjustment GUI for graphics data**

**Conclusion**

We have discussed high-speed color printer controllers from the standpoint of software.  At Oki Data, we will continue to work on improving the coloring, networking, and management functionalities essential to high-speed color printers.  We will also work on developing software that is operationally intuitive enough for average business users and that allows system administrators to monitor and control printers easily and securely.

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