ColorSync Software: Overview (6/95)

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TOPIC ---

This article provides an overview of the ColorSync software.

DISCUSSION ---

ColorSync is an extension to QuickDraw. It facilitates color conversion from the color space (method of mathematically describing a color) of one device to the color space of another device. It does this while maintaining consistent visual representation. In simple terms, ColorSync displays and prints the same image that it scanned.

The Major Difficulties in Reproducing Color

The physics of color presents a technical barrier, since delivering colored light is very different from delivering colored ink. Colors are described in device-dependent terms:

- RGB (Red, Green, Blue) for monitors and most scanners
- CMYK (Cyan, Magenta, Yellow, and Black) for most printers

Device-dependent descriptions cause the same blend on one monitor to display a very different color on a different monitor. While it is possible to map an RGB value to a CMYK value for a given pair of devices, this is not a practical solution because changing the devices changes the mapping, and therefore the result.

Different devices (scanner, monitor, printer) have different capabilities in delivering color. A color possible on one device is not possible on another. Every device produces a different range of colors, or color gamut. The scanner, display, and printer each have a different color gamut. Colors that all three devices can produce present no problem. But colors that only one or two devices can generate require color matching.

The perceived color given by a specific value of RGB for an individual monitor can vary. Any RGB to CMYK mapping is not accurate over time. The solution for this problem is commonly called calibration.

Colorsync Architecture

ColorSync is a system extension that provides color matching capabilities to the existing QuickDraw graphics model. It provides three important features:

System-Level Support for Color Matching

All applications and peripherals can take advantage of it. All applications and imaging peripherals use the same scheme for color matching.

Support for Existing Applications

Some existing applications get color-matched printing without waiting for revised applications. ColorSync provides some new calls that enable applications to match to the display as well. This completes the entire picture -- matched input, display, and output.

Opportunities for Third Parties to Add Value

ColorSync uses the Component Manager, which lets third-party developers add value to the color-matching system. This was developed in conjunction with QuickTime to link a series of Apple or third-party color management resources and utilities.

How Colorsync Solves Color Matching Problems

Device-Independent Color

ColorSync was developed to solve the problems related to device-dependent color such as RGB and CMYK. ColorSync attempts to consistently represent colors (visually very similar or identical) across the three color gamuts. ColorSync uses device profiles to determine what colors a device can display, print, or scan (device color gamut).

ColorSync translates the colors that the originating device created for an image into a device-independent, and human perception-based color space, CIE XYZ. From the CIE-XYZ color space, ColorSync then translates the image into the color space of the destination device.

ColorSync uses the Apple Color High-Resolution RGB monitor as the default system profile or space. If you have a different monitor, you should use the ColorSync profile for that monitor in order for ColorSync to work properly. The ColorSync profile creates a device-independent color definition while maintaining compatibility with QuickDraw, which is RGB-based. You can select any monitor that has a profile installed.

Applications

There are three levels of ColorSync application support:

SUPPORT LEVEL	DESCRIPTION
Printing Fidelity	Making the standard Macintosh call, DrawPicture, enables matching the source image to the printer. Applications that support this call provide printing functionality without revision.
Display Fidelity	ColorSync can correct for the display if the source is a scanner or a different monitor. The ColorPicker shows two gamuts, and you can choose those available on the monitor and printer or other display.
Preview Function	ColorSync lets applications offer a preview function that indicates those colors not possible on a particular device. Users can check documents before printing.

Device Profiles and Drivers

ColorSync allows characterizations of each device in terms of the CIE XYZ color space. These characterizations are called profiles. This allows making comparisons between any pair of ColorSync devices in terms of the common space.

Color Matching with ColorSync CMMs (Color Matching Methods)

CMMs give the best possible match when the exact match is not available. ColorSync uses the device profiles to determine if a device can display or print a certain color. If a color is outside the color gamut of a device, ColorSync determines a best-match color within that device’s gamut. It uses a simple look-up table or an algorithmic calculation to do this. The table look-up method is much faster than the algorithmic method.

The algorithmic method gives better color matching, and offers four options:

OPTION	DESCRIPTION
Perceptual	This maintains perceptual differences. Colors are interpreted relative to the destination device's white point. This option is usually best for photographic scanned images.
Colorimetric	This maintains individual colors at the expense of their relative values. It is usually best for spot colors.
Saturation	This maintains the levels of color saturation. It sacrifices contrast to maintain color saturation. It is usually best for computer-generated graphics.
Faster Matching	This offers a good compromise between photographs and computer-generated images, and takes less time.

ColorSync attempts to provide a base level of color matching with the smallest possible memory footprint (about 70K). Some print jobs require higher quality color matching. More sophisticated color management schemes can replace ColorSync's color matching method and hook into ColorSync via the Component Manager. This process lets other color management products integrate into the system software via ColorSync.

ColorSync still translates the image's colors into the device-independent color space. However, ColorSync then calls the substituted color matching method to translate the image into the color space of the destination device.

Color Calibration

The ColorSync Color Management extensions support the calibration systems available from third-party developers (such as SuperMac, Radius, and Raster Ops). You can periodically update the profile to compensate for differences from the standard profile.

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