

Windows Color Architecture

Part 2

Michael Stokes

Color Architect

Windows Printing and Imaging

Microsoft Corporation

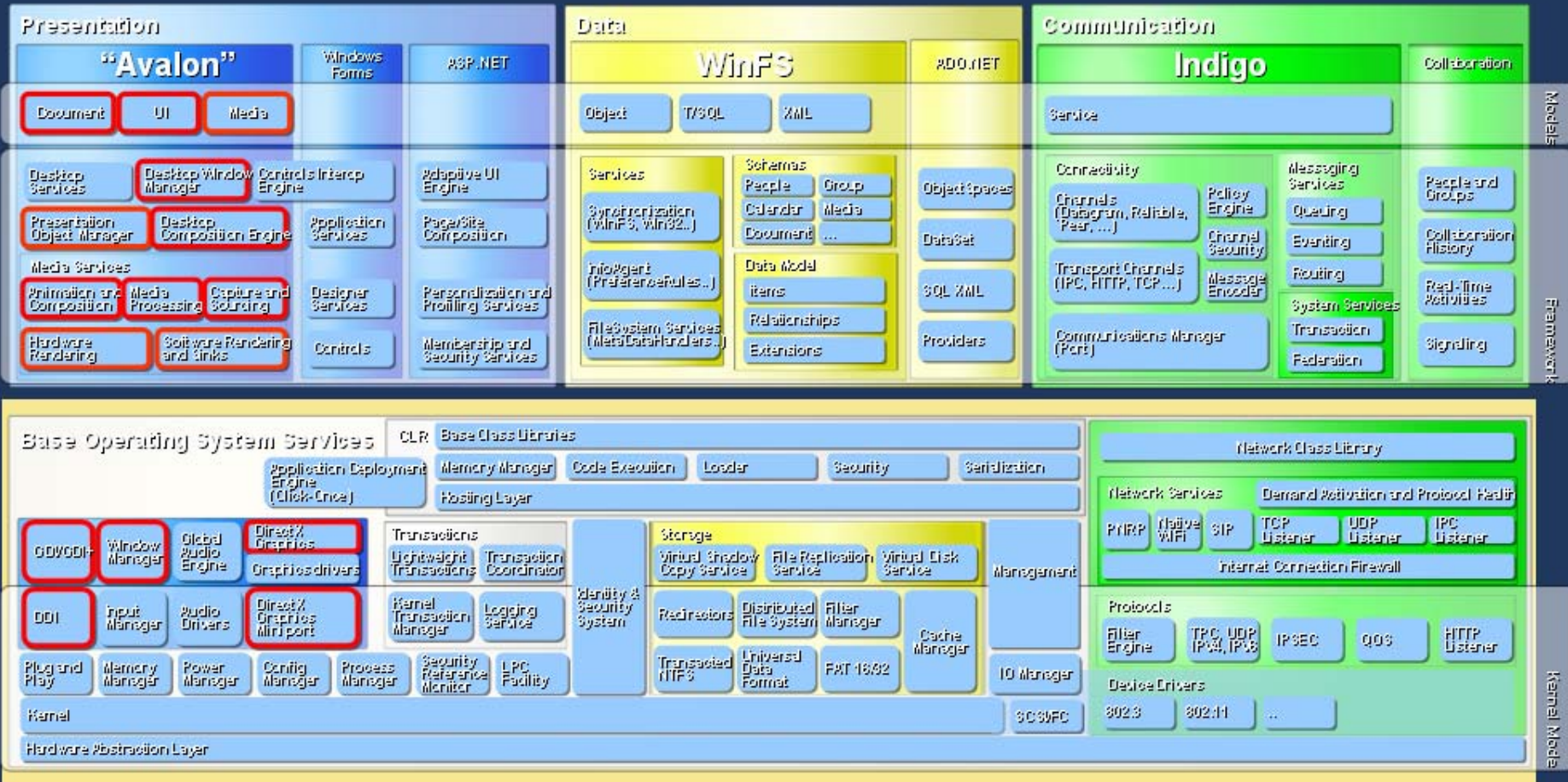
Session Outline

- Windows Color System Architecture
- User Experience
- How to optimize your devices for “Longhorn” Color

Session Goals

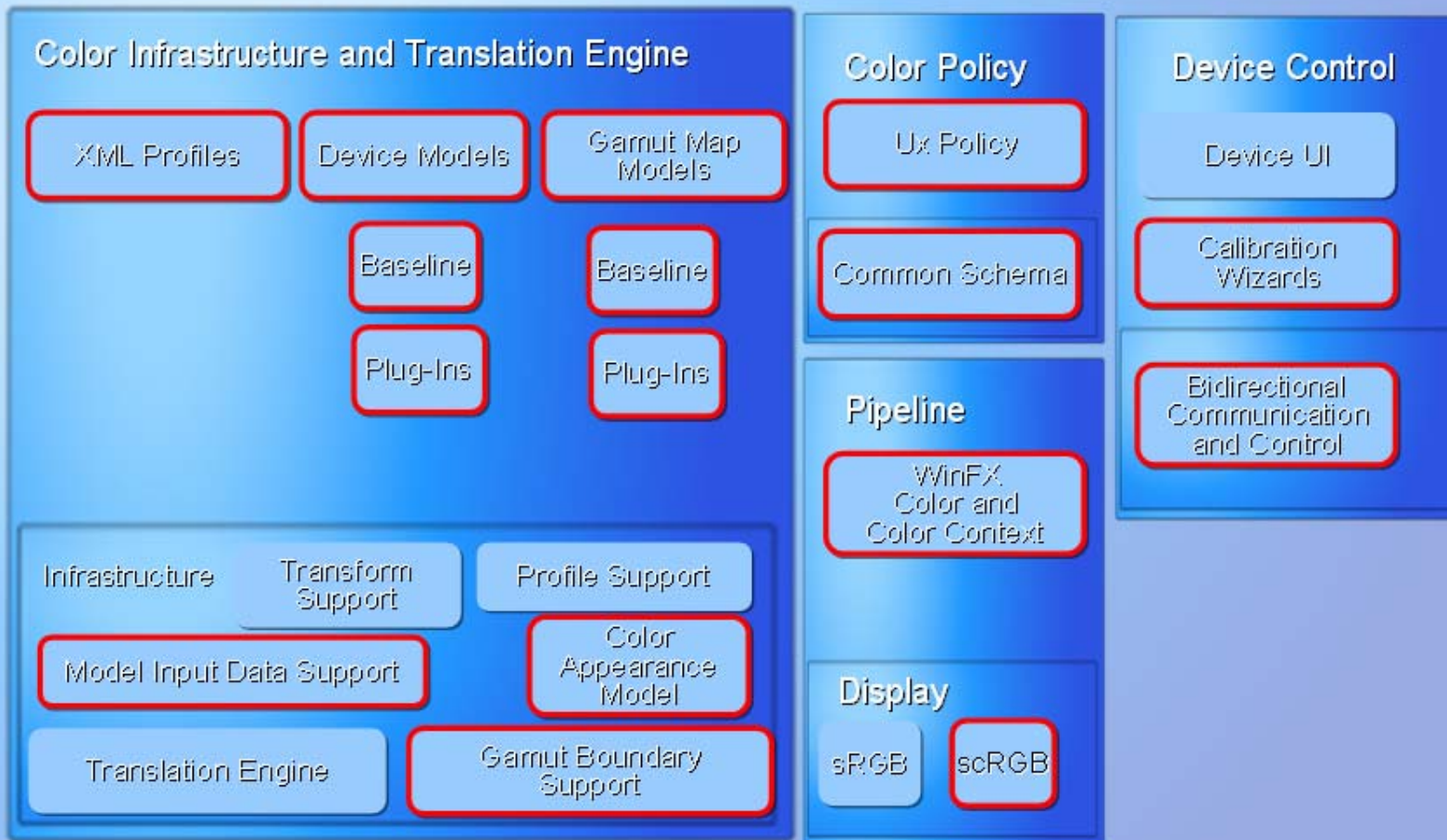
- Attendees should leave this session with the following
 - An understanding of the design details of the Windows Color System
 - An understanding of how to take best advantage of enhanced capabilities and opportunities for innovation enabled by the Windows Color System
 - Pointers on where to look for new information about the WCS as it becomes available during the “Longhorn” development cycle

WinFX Architecture



“Longhorn” Color Architecture

“Longhorn” Color Architecture



Architectural Overview

- Color Infrastructure and Translation Engine (CITE)
- Color Processing Pipeline
- Device Control
- Color Policy Infrastructure

Slide 6

VM9

Architectural Overview

Vicki Milton, 03/31/04

VM10

Main three components as the focus of this slide -- lose the sub bullets

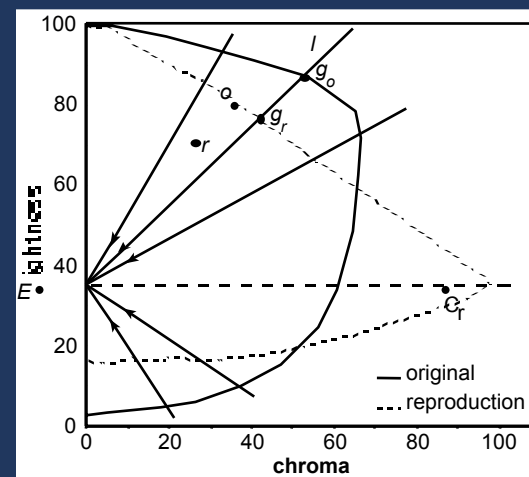
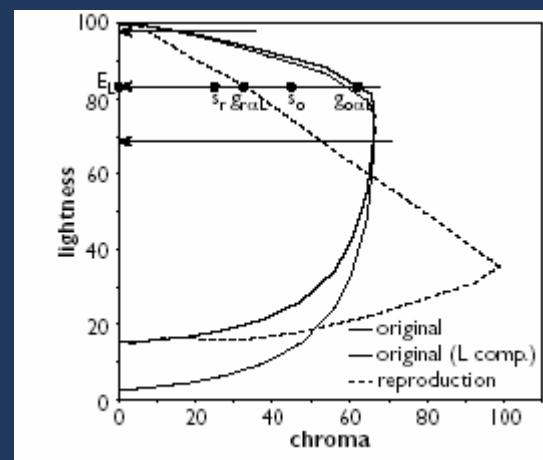
Vicki Milton, 03/31/04

Color Infrastructure And Translation Engine (CITE)

- Infrastructure
 - Legacy ICC profiles
 - “Longhorn” (LH) XML-based Device Model Profiles (DMP)
- Color Translation Engine (CTE)
 - Legacy ICM2 CMM
 - LH CTE
 - Core System Services
 - Single Color Appearance Model
 - High, wide, and deep color processing pipeline
 - Baseline Device Models
 - CRT – 3x4 matrix + Gamma/Offset/Gain for each primary
 - LCD – 3x4 matrix + tone curve for each primary
 - Scanners/Cameras – 3rd order polynomial for each channel
 - RGB Printers – 3 dimensional LUT
 - CMYK Printers – multi-dimensional LUT
 - Baseline Gamut Mapping Models
 - Pictorial
 - Colorimetric
 - Saturation

Baseline Gamut Mapping Models Based On CIE TC8-03

- Colorimetric
 - Lightness or luminance clipping
- Pictorial/Perceptual
 - Sigmoidal Gaussian with Clipping at the Knee
- Saturation is under investigation



Color Processing Pipeline

- Pipeline
 - 8 and 16 bpc sRGB with alpha
 - 16 and 32 bpc scRGB with alpha
 - All color compositing and transparency calculations occur in 32 bpc floating point scRGB
 - Enables support of lossless capture to display to printing of AdobeRGB
 - Enables no-compromise processing of Camera RAW data
 - Multi-channel for non-display pipeline
 - 8 and 16 bpc CMYK with alpha
 - 8 and 16 bpc n-Channel Color with alpha

Slide 9

- VM7** Change title to something more specific
Vicki Milton, 03/31/04
- VM8** focus slide on the plug in architecture
Vicki Milton, 03/31/04
- VM12** scrgb gives lossless processing of high dynamic range...
Vicki Milton, 03/31/04
- VM13** scRGB is a floating bit implementation
Vicki Milton, 03/31/04

Plug-In Architecture

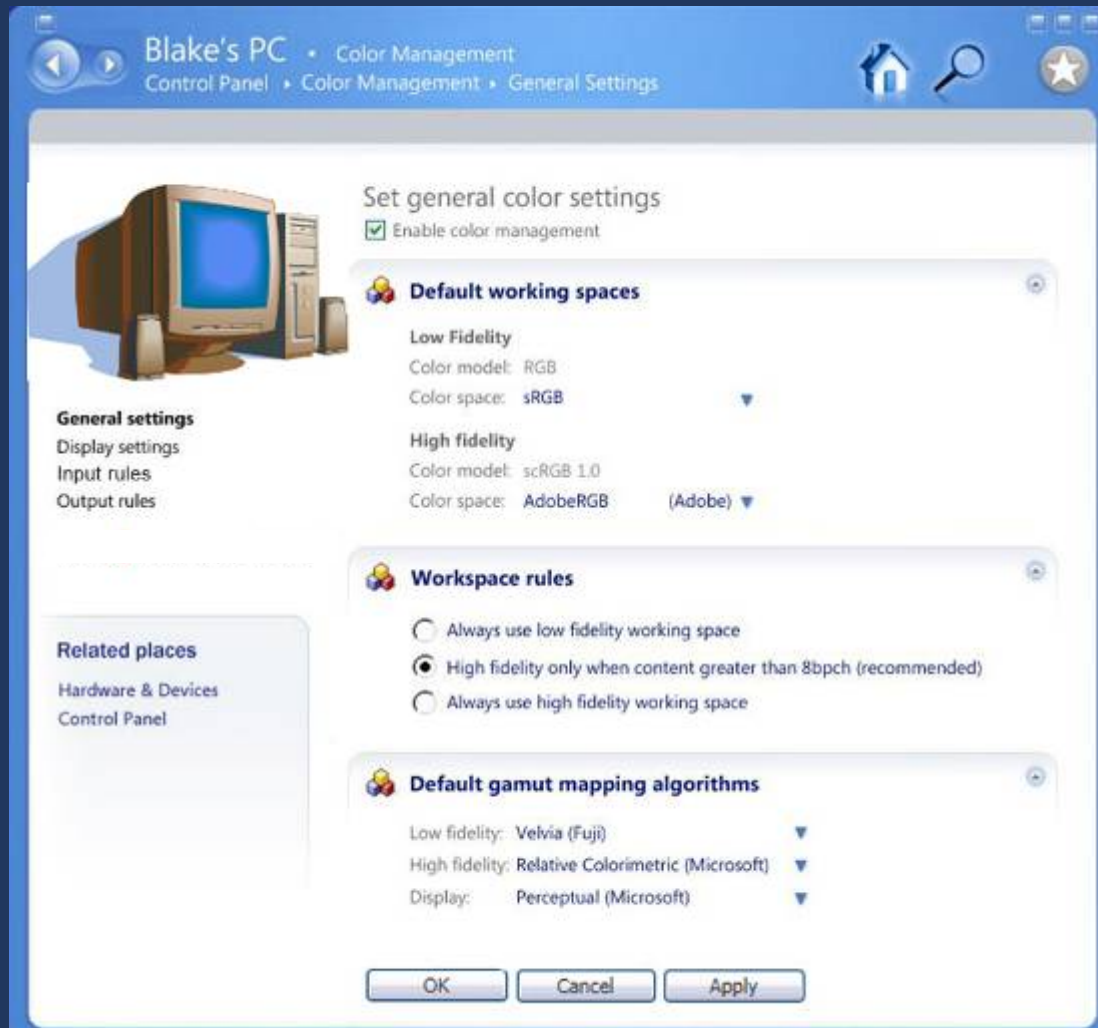
- Based on “Longhorn”/“Avalon” Imaging codecs and effects Plug-In Architecture
 - Managed code only
 - “Longhorn” only
- Device Models are pluggable
- Gamut Mapping Models are pluggable

Device Control Infrastructure

- Bidirectional communication and control of color information between system and device drivers
- Goal is to coordinate color management policy with optimize device capabilities and behavior
- Display
 - VESA DDC/CI
- Capture (scanners, cameras and video capture devices)
 - WIA, MTP/WPD APIs
 - scope being decided for DSCs, requirements requested
- Printer
 - Microsoft XML PrintTicket / PrintCapabilities in NextGen Print Path
 - Web Services for Devices (WSD)

Color User Experience

General Color Policy Settings (UI Prototype: Will Change!)



Slide 13

VM14 request button change.

Vicki Milton, 03/31/04

VM18 reduce screenshots to cover only:

default policy

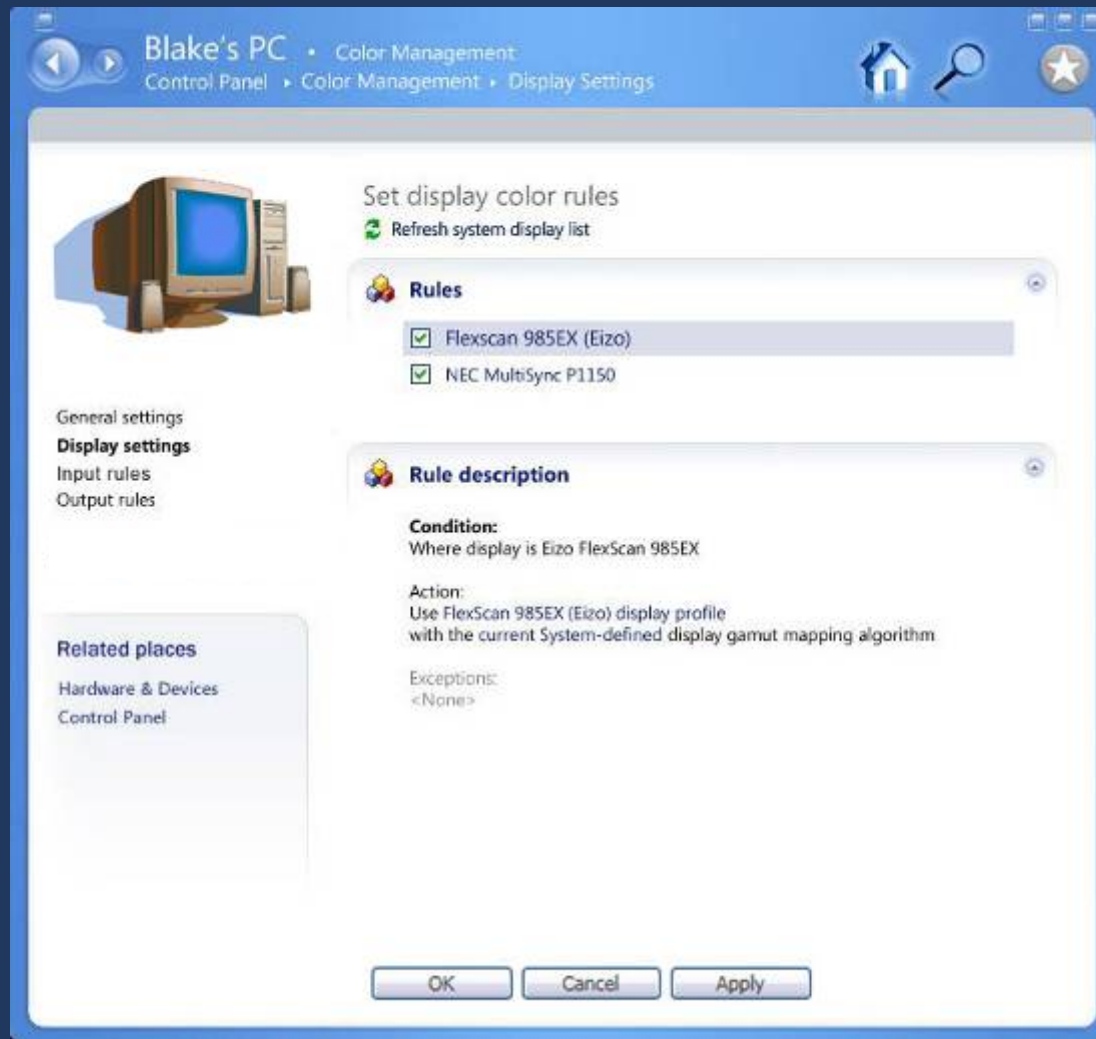
Vicki Milton, 03/31/04

VM19 reduce screen shots to only 3 of them. To express general policy, defaults, device specific setting

Consider moving these to MBourgoi's talk or to split between the two talks. Do not duplicate

Vicki Milton, 03/31/04

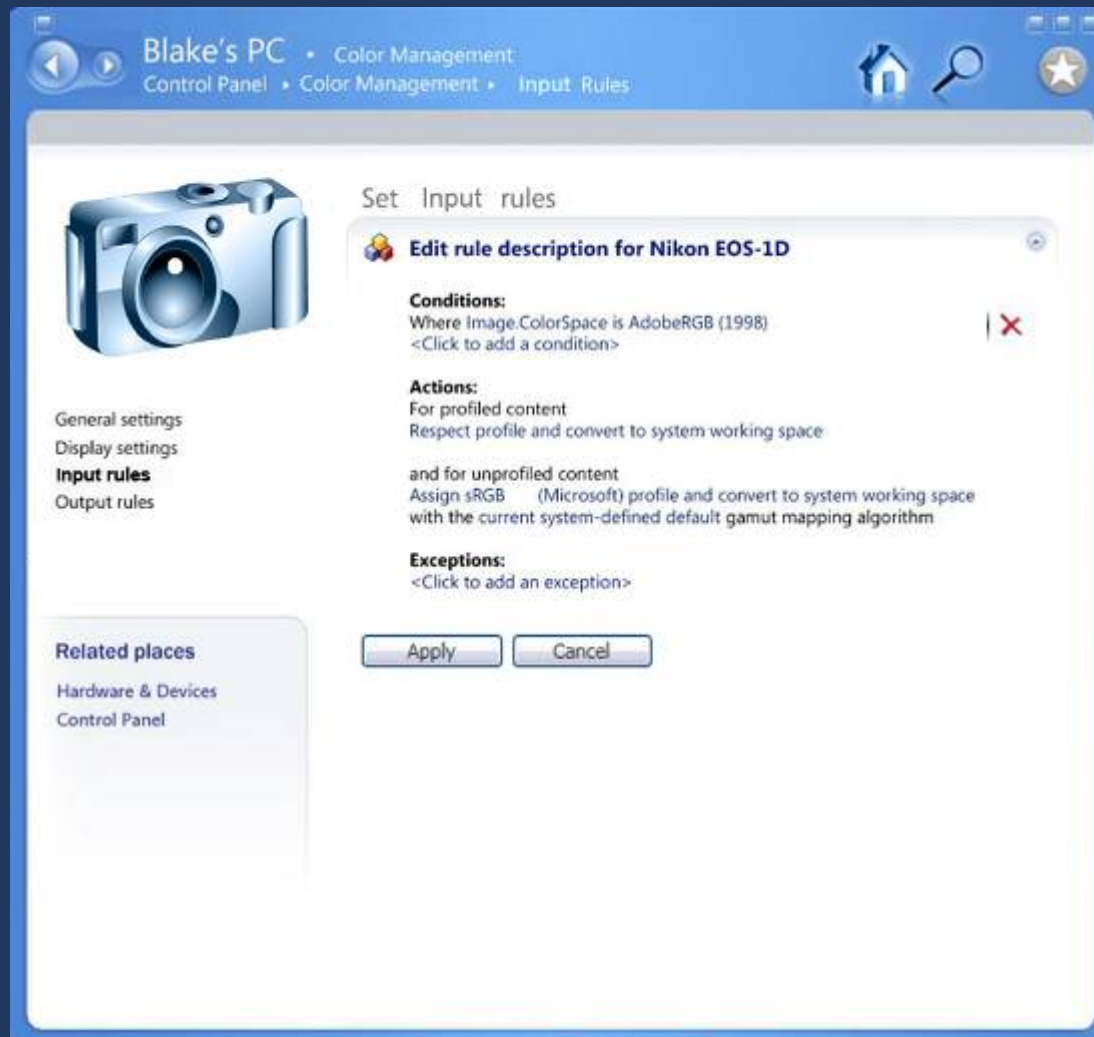
Display Color Policy Settings (UI Prototype: Will Change!)



VM15

request button change
Vicki Milton, 03/31/04

Input Color Policy Settings (UI Prototype: Will Change!)



VM16

change buttons

Vicki Milton, 03/31/04

Calibration Wizards

- Simplify and improve end user experience
 - Communicate results to device or generate LH XML profile based on results
 - Types
 - Visual
 - Built upon Windows Media Center visual video color calibration wizards
 - Closed Loop – under investigation
 - Built upon visual calibration
 - Camera captures display + Printer output display + Scanner captures print
 - Cross validate results and resolve problems
 - Instrument-based
 - LH to enable advanced solutions by exposing WinFX APIs

WinFX Color API Overview

WinFX API Color Support

- “Longhorn” API color constructors

- sRGB constructor example

```
Color col1 = Color.FromRGB(0x00, 0x7f, 0xff);  
Color col2 = new Color();  
Color col2 = MS_Avalon.Windows.Media.Colors.AliceBlue;
```

- scRGB-base constructor example

```
Color col1 = Color.FromScRGB(0.2f, 0.0f, 0.5f, 1.0f);
```

- Color Profile constructor example

```
Color.FromProfile(filename)  
float[] cmykValue = new float[4];  
cmykValue[0] = 0.0f;  
cmykValue[1] = 0.5f;  
cmykValue[2] = 0.5f;  
cmykValue[3] = 0.5f;  
Color col3 = Color.FromValues(cmykValue, "CMYKProfile.icc");
```

- Named color support still under investigation

- LAPI Color Context Class

- All colors have a context in order to be meaningful

- Describes color definition relative to how we perceive colors

How To Optimize Devices For “Longhorn” Color

- Check on WinColor and Designed for Windows Logo Requirements
 - Choose which best suits your device business
 - sRGB, ICC, LH XML color profile or scRGB
 - Display – support DDC/CI, brighter and wider gamuts
 - Capture – under investigation (WIA, MTP)
 - Printer – support bidirectional communication and NextGen Print Path, PrintTicket / PrintCapabilities
- LDK
- More information will become available as “Longhorn” progresses

Call To Action

- Give us feedback!
 - Your comments, criticism, opinions matter to us! – We want to get this right!
 - Tell us what we are missing to satisfy your needs
 - Come to our “Ask The Experts” session: Windows Color Architecture AW04031
 - <mailto:mcolor@microsoft.com>
- Understand the “Avalon” presentation subsystem
- Understand “Longhorn” Print Architecture
 - Identify strategic devices to exploit the NextGen Print Path
 - Identify extension scenarios
- Investigate adoption of NextGen Print Path technologies
 - Dual Mode Driver
 - “Avalon” presentation subsystem
- Investigate DDC/CI drivers for displays
- Prepare to develop NGPP drivers and RIPs starting later this year
- Try writing an “Avalon”-based application that prints and displays managed color!
- Review Documentation
- Plan to attend upcoming conferences for more details

References

- Email
 - [Mscolor @ microsoft.com](mailto:Mscolor@microsoft.com)
- Image Color Matching (ICM) documentation
 - http://msdn.microsoft.com/library/default.asp?url=/library/en-us/icm/icmstart_5i91.asp
- Print Schema
 - SDK for Print Schema User Manual and Keywords
 - LDK for PT/PC interfaces:
Reference\Printer Driver and Spooler Component Interfaces\Printer Driver Functions and Structures\Unidrv and Pscript Interfaces\Methods for Job Ticket Providers and Consumers
- “Longhorn” SDK
 - <http://longhorn.msdn.microsoft.com>
- Related Sessions
 - Windows Color Architecture – Part 1
 - “Longhorn” Printing Architecture
 - “Longhorn” NextGen Print Path
 - “Longhorn” Printing: Processing the Payload
 - Web Services for Devices
 - Web Services for Printing and Imaging Devices Part 1 & 2
 - Ask the Experts – Windows Color Architecture
 - Ask the Experts – “Longhorn” Printing
 - Ask the Experts – Web Services for Printing and Imaging Devices

References

Continued

- Web Resources

- MSDN Developer Community Chats:

- Printer Drivers -- Ask the Experts Online

- http://msdn.microsoft.com/chats/windows/windows_102402.asp

- Windows Drivers: Printer Drivers

- http://msdn.microsoft.com/chats/windows/windows_101602.asp

- Windows Drivers Printing and Networking

- http://msdn.microsoft.com/chats/windows/windows_022002.asp

- WHDC

- Image Color Management (ICM) Driver Support

- <http://www.microsoft.com/whdc/hwdev/tech/color/default.mspx>

- Printing - Architecture and Driver Support

- <http://www.microsoft.com/whdc/device/print/default.mspx>

- Still Imaging / WIA Technologies

- <http://www.microsoft.com/whdc/device/stillimage/default.mspx>

Question & Answer