

DeviceN and Spot Color proofing with ICC Profiles

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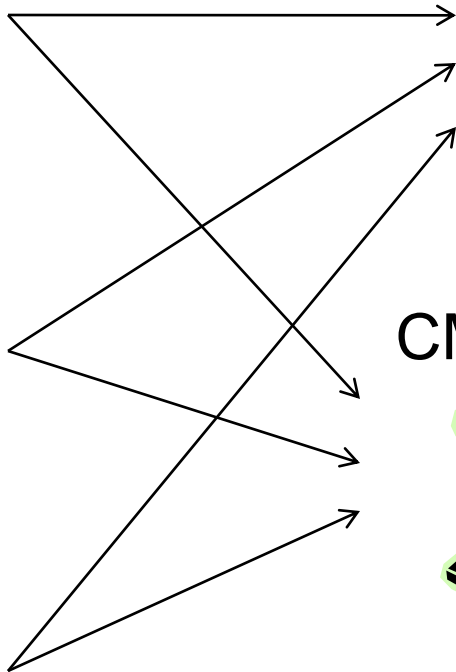
Background

- **Spot color printing involves the usage of any ink other than the standard CMYK colorants.**
- **DeviceN color printing is the printing of a spot color with any additional colorants.**
- **Examples:**
 - Hexachrome CMYKOG
 - Printing with Pantone or Toyo Inks
 - Common to use spot colors in logos and products

Note that CcMmYK not really DeviceN due to the way that this is usually implemented in embedded environment.

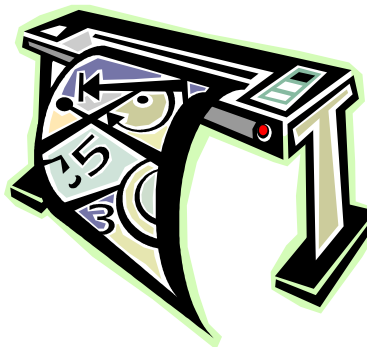
Goal is to achieve accurate proofing

Documents with spot
and/or DeviceN colors



Final press
using specialized
inks specified in
document

CMYK Proofing



RGB Proofing



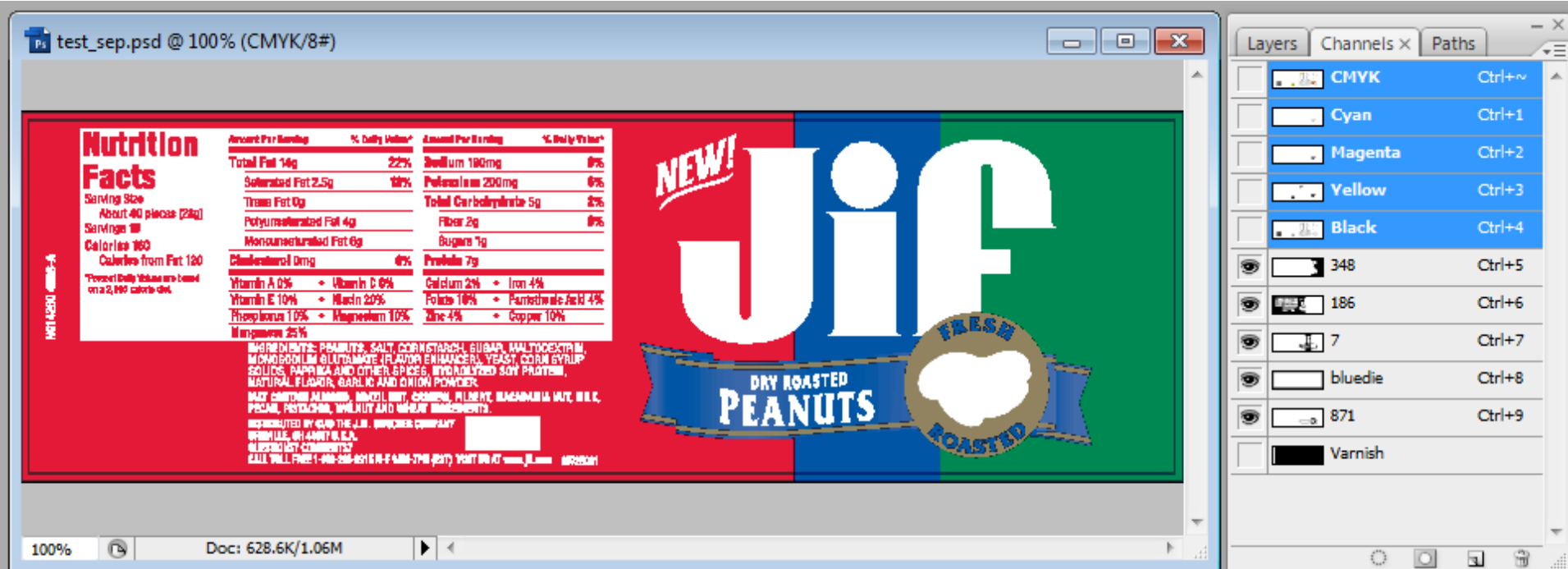
Outline

- **Solid non-mixed spot colors**
- **Tint varying spot colors**
- **DeviceN colors**
- **Document DeviceN color and ICC capabilities**
- **Overcoming document limitations**

Label Print Example



Label Print Example. Spot Colors Only.



Typical Label Spot Color

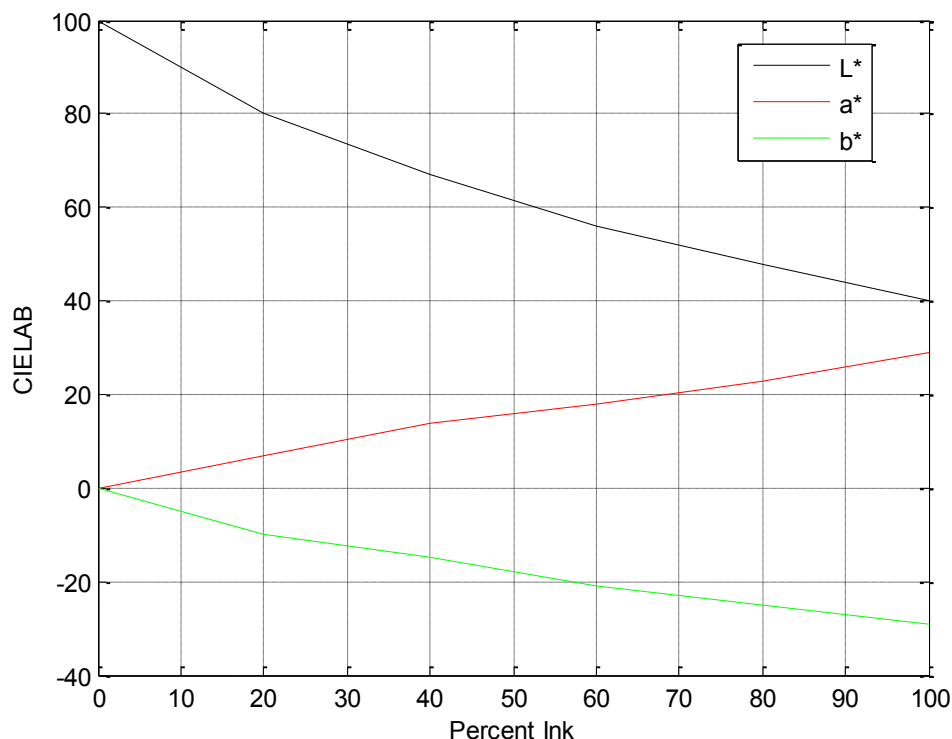
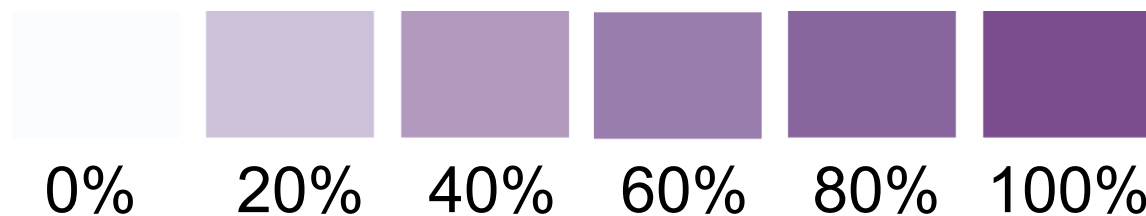
- **Usually 100% colorant.**
- **Typically no real ink mixing.**
- **Named Color ICC profile meets needs for application.**
- **Essentially a look-up-table mapping colorant names to CIELAB values or device values.**

Named Color ICC Profile

	Required	Optional
Pantone Uncoated Yellow	CIELAB	Device Value
Toyo Red	CIELAB	Device Value
Pantone Coated Green	CIELAB	Device Value
.		
.		
.		
Toyo Coated Blue	CIELAB	Device Value

If device values not supplied, CMM should map table CIELAB values to device values for a given destination profile and rendering intent.

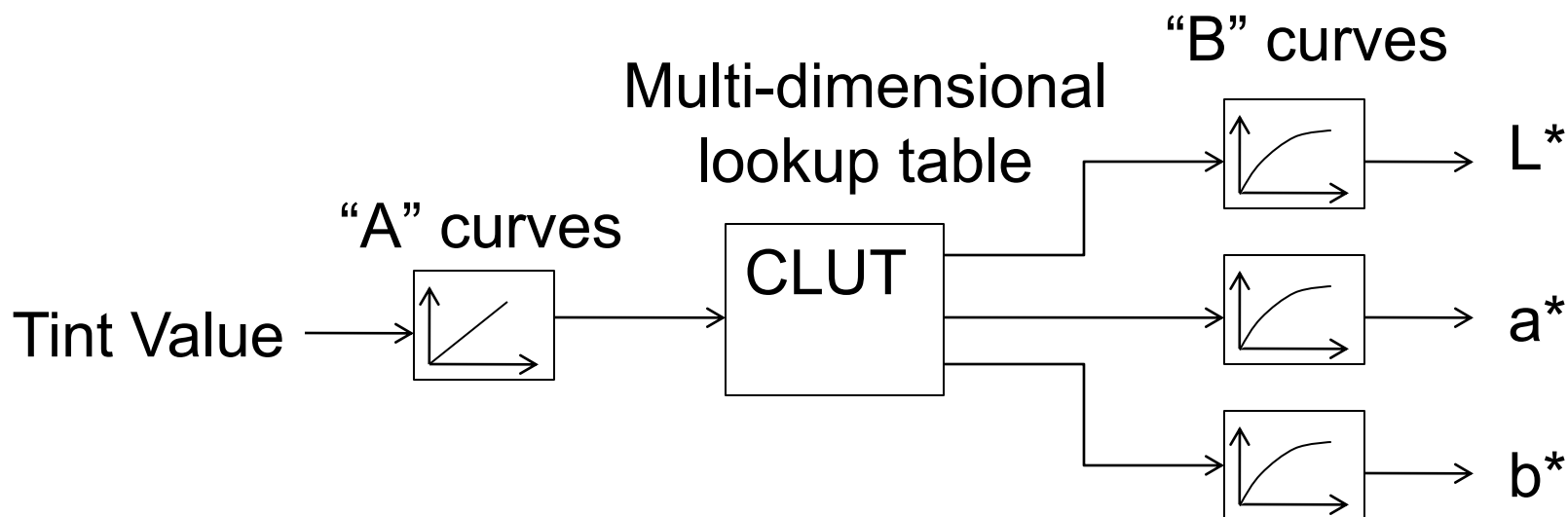
Spot Colors With Varying Tint



lutAtoBtype can be used today to handle this (Sec. 10.10 in ICC Spec).

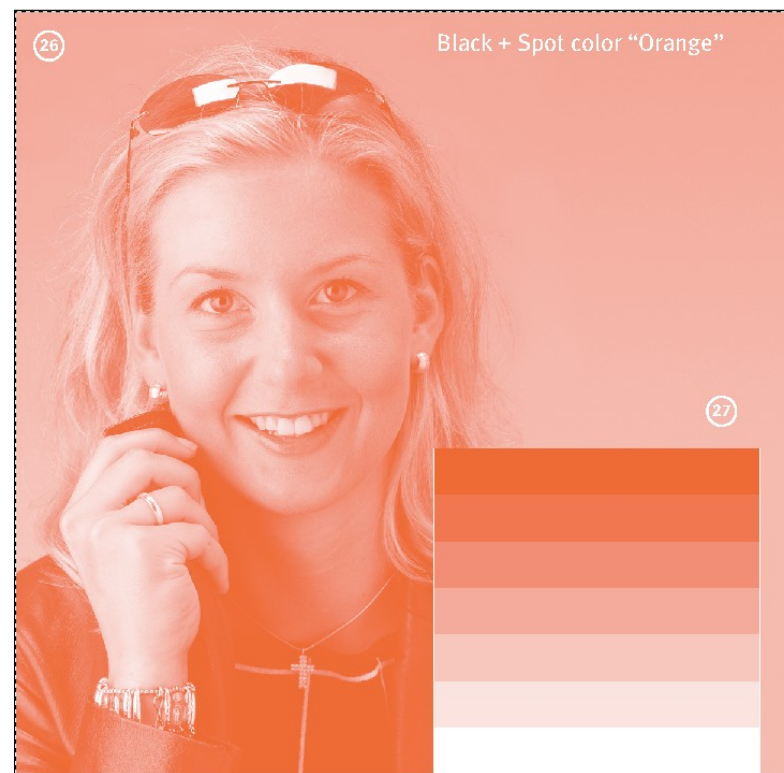
Using CLUT to map 1 ink To 3 values and B curves to apply monotonic curve

Spot Colors With Varying Tint



Data color space field in header would need to be "GRAY"

Spot Color Overprinting



Spot Color Overprinting



Comments:

Characterization dependent upon ink print order.

XPS format requires ICC profile for DeviceN color.

PDF and PS do not directly enable ICC support for DeviceN.

Indirect support possible with some RIP engines.

ICC support for DeviceN (xCLR)

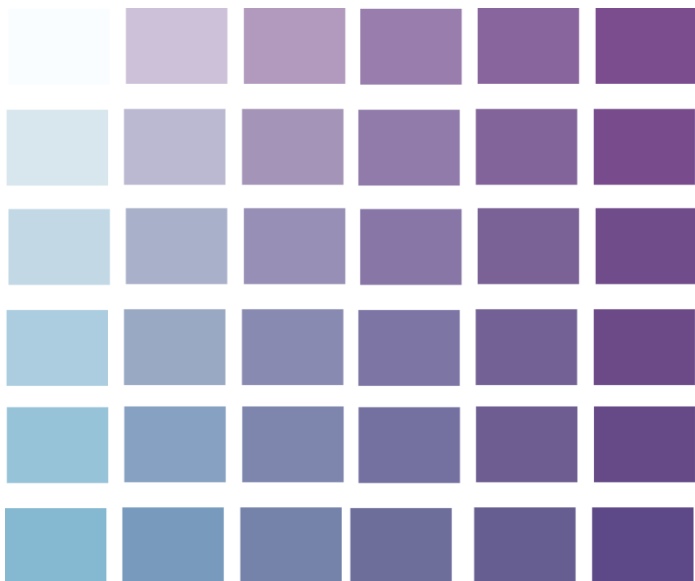
Color Space	Signature	Hex Encoding
2colourData	'2CLR'	32434C52h
3colourData	'3CLR'	33434C52h
4colourData	'4CLR'	34434C52h
5colourData	'5CLR'	35434C52h
6colourData	'6CLR'	36434C52h
7colourData	'7CLR'	37434C52h
8colourData	'8CLR'	38434C52h
9colourData	'9CLR'	39434C52h
10colourData	'A CLR'	41434C52h
11colourData	'B CLR'	42434C52h
12colourData	'C CLR'	43434C52h
13colourData	'D CLR'	44434C52h
14colourData	'E CLR'	45434C52h
15colourData	'F CLR'	46434C52h

Input type N-Component
LUT-based input profiles

Required Tags:

profileDescriptionTag
copyrightTag
mediaWhitePointTag
AtoB0Tag

DeviceN input profile creation quite easy



artifex_blue_purple

ProfileHeader

Size: 792(0x318) bytes

Suggested CMM: NULL

Version: 3.40

Type of Profile: InputClass

Data Color Space: MCH2Data/2colorData

PCS Color Space: LabData

Creation Date: 0/0/0 00:00:00

Primary Platform: Macintosh

Flags: EmbeddedProfileFalse | UseAnywhere

Attributes: Reflective | Glossy

Rendering Intent: Perceptual

Illuminant: X=0.9642, Y=1.0000, Z=0.8249

Creator: NULL

Profile ID: 00000000 00000000 00000000 00000000

Validate Profile

Profile Tags

Tag ID	Tag Type	Offset	Size
profileDescriptionTag	textDescriptionType	204	116
copyrightTag	textType	320	40
mediaWhitePointTag	XYZ Type	360	20
mediaBlackPointTag	XYZ Type	380	20
colorantTableTag	colorantTableType	400	96
AToB0Tag	lut16Type	496	296

1. Print samples
2. Measure CIELAB values
3. Pack into MLUT AtoB0Tag

DeviceN Output Profiles

Output type N-Component LUT-based output profile more difficult to create due to inversion of measurement data.

Required Tags:

profileDescriptionTag

copyrightTag

mediaWhitePointTag

AtoB0Tag, AtoB1Tag, AtoB2Tag, BtoA0Tag, BtoA1Tag, B2A2Tag

colorantTableTag

DeviceN color definition in PostScript

1997 PostScript Level 3 specified DeviceN color space.

[**/DeviceN** *names alternativeSpace tintTransform*]

names: List of colorant names. (e.g. orange, pantoneblue, cyan)

alternativeSpace: Alternate color space to which the DeviceN color values should be mapped if output device does not natively display with colorants in names list. Gray, RGB, CMYK or a CIE based color space.

tintTransform: Functional mapping to map DeviceN value to alternate color space.

PSL3 architectural limit defined to 250 colorants in DeviceN color space.

No embedded source ICC profiles in PS.

DeviceN color definition in PDF

PDF 1.3 specified DeviceN color space.

[**/DeviceN** *names alternativeSpace tintTransform attributes*]

names: List of colorant names. (e.g. orange, pantoneblue, cyan)

alternativeSpace: Alternate color space to which the DeviceN color values should be mapped if output device does not natively display with colorants in names list. Gray, RGB, CMYK or a CIE based color space.

tintTransform: Functional mapping to map DeviceN value to alternate color space.

Attributes: Mixing hints.

Acrobat limited to 32 colorants in DeviceN color

ICC color in PDF

Source PDF ICC profiles limited to 1, 3, and 4 colorants (PDF 1.4)

Alternate spaces are gray, RGB and CMYK.

One *could* possibly use a 3CLR or 4CLR profile in embedded in an ICC profile as a source profile and still meet the specification.

Note that PDF/X output Intent dictionary specifies an Output Rendering Intent which contains an ICC profile entry. This output profile can be xCLR type.

DeviceN color definition in XPS and OpenXPS

Recently released as an ECMA specification.

ALL colors defined by ICC profiles ICC.1:2001-04. May use profiles conforming to ISO 15076-1.

Limited to maximum of 8 colorants.

Syntax:

Color = "ContextColor ProfileURI AlphaFloat, ChanFloat₀ , ... ,ChanFloat_{N-1}

Use of xCLR source profiles in PDF and PS with Ghostscript.



1. DeviceN ICC profiles.
One for each DeviceN
color space of interest.
Can be created by
measurement or from
a mixing model.

2. Preload into
graphics library

Graphics Library

4. When DeviceN color
space encountered, check
DeviceN ICC profiles

```
[/DeviceN  
[ /Orange /Green /Blue ]  
/DeviceCMYK  
tintTransform  
]
```

3. Load and parse document to render

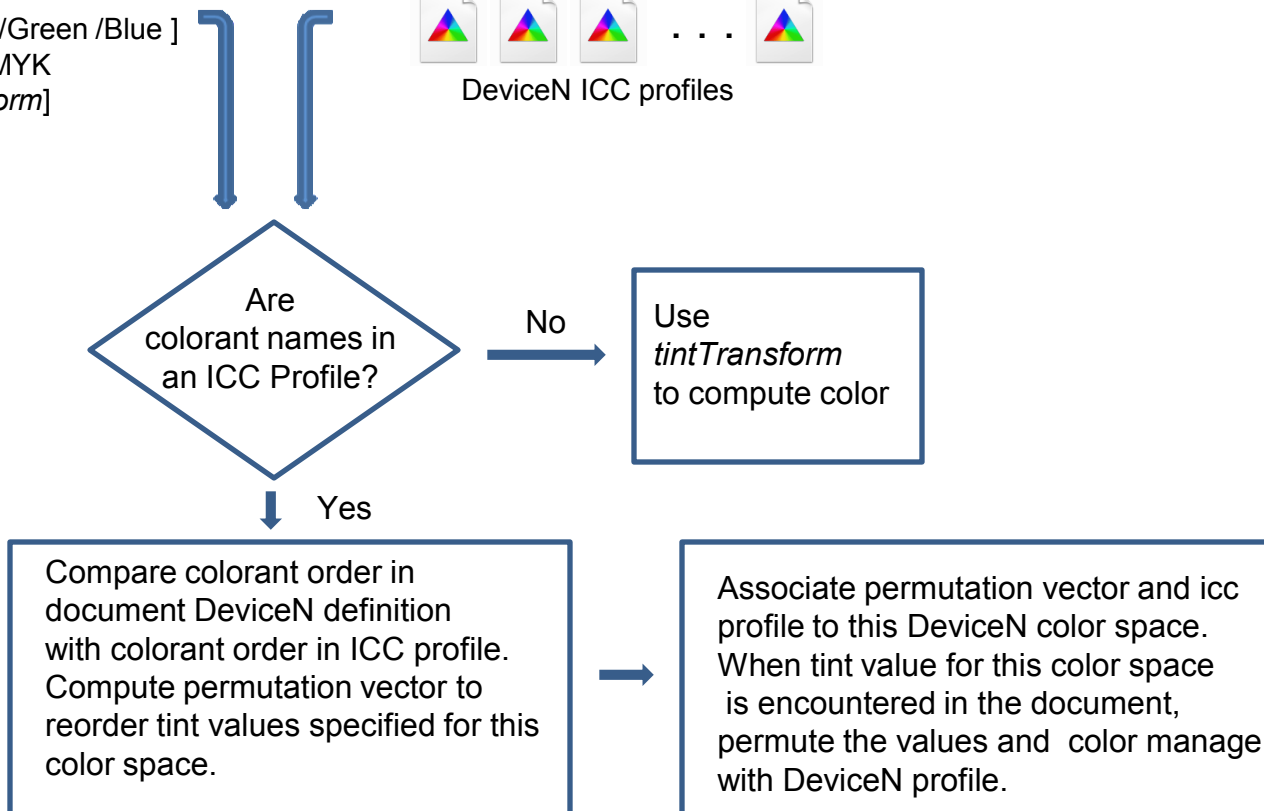
Document with a DeviceN
color space

Use of xCLR source profiles in PDF and PS with Ghostscript.

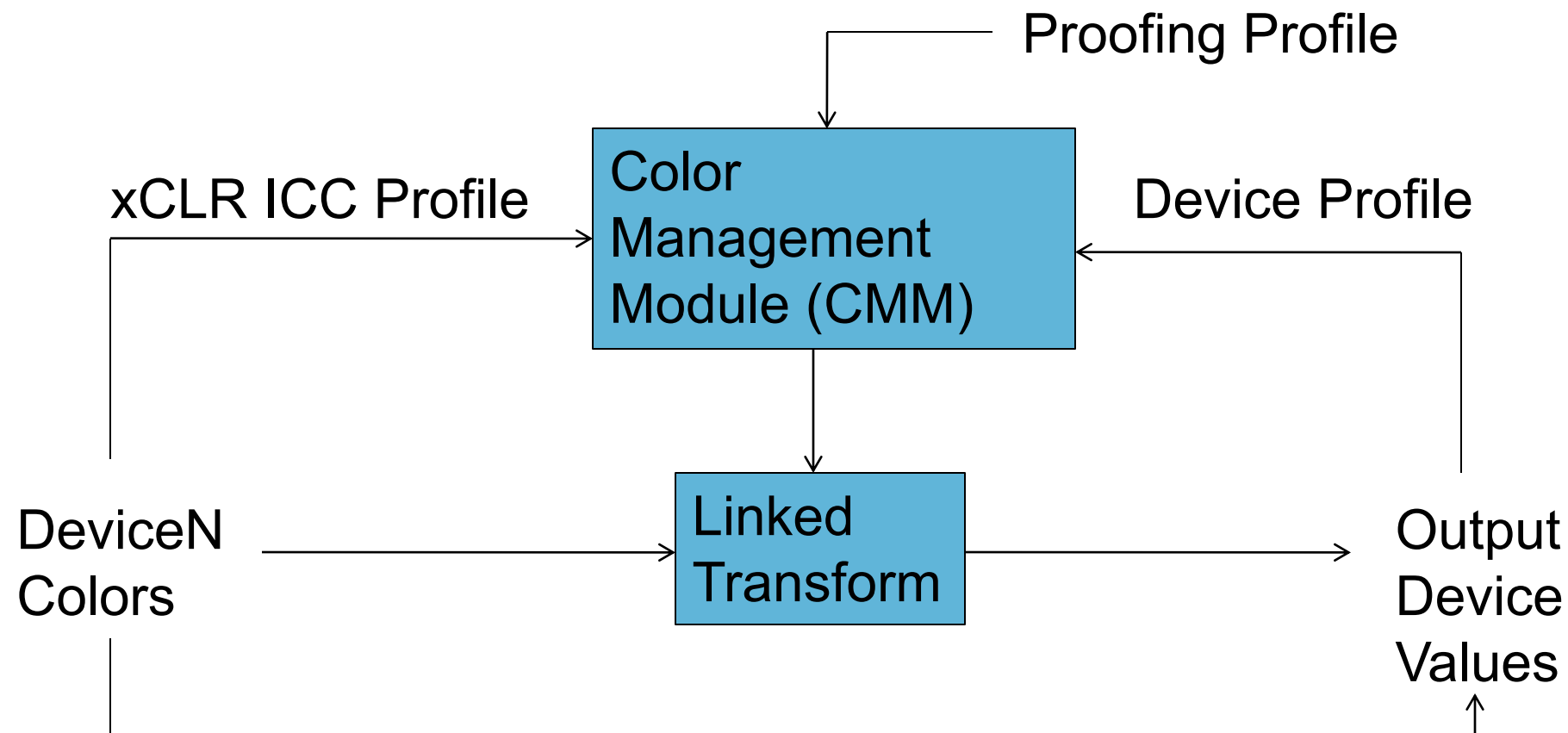
[/DeviceN
[/Orange /Green /Blue]
/DeviceCMYK
tintTransform]



DeviceN ICC profiles



Proofing with xCLR Profiles



Thank you for your attention!

Questions/Comments?

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