COLRv1 in Chromium & OSS

WEB ENGINES HACKFEST
A Coruña

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In this talk

- Color Fonts?
- How does the COLRv1 format work?
- New Use Cases on the web
- Open-Source COLRv1 stack and tools
- Preview: WIP Variable COLRv1
Color Fonts?
Lobster

Lobster

Lobster
Material Two Tone Icons  https://fonts.google.com/icons
Reem-Kufi Arabic font by Khaled Hosny
https://github.com/aliftype/reem-kufi
COLRv1 Format
COLRv1 glyphs are a directed acyclic graph of paint operations.

Rendering a COLRv1 glyph means:

Traverse the graph and execute the 2D graphics operation in each node.
PaintRadialGradient
Paint **Glyph**
PaintColrLayers
PaintColrGlyph

Paint **Composite**

Paint **Solid**
PaintLinearGradient
PaintRadialGradient
PaintSweepGradient

Paint **Transform**
PaintTranslate
PaintScale
PaintScaleAroundCenter
PaintScaleUniform
PaintScaleUniformAroundCenter
Paint **Rotate**
PaintRotateAroundCenter
Paint **Skew**
PaintSkewAroundCenter

PaintVarSolid
PaintVarLinearGradient
PaintVarRadialGradient
PaintVarSweepGradient

PaintVarTransform
PaintVarTranslate
PaintVarScale
PaintVarScaleAroundCenter
PaintVarScaleUniform
PaintVarScaleUniformAroundCenter
PaintVarRotate
PaintVarRotateAroundCenter
PaintVarSkew
PaintVarSkewAroundCenter

[https://github.com/googlefonts/colr-gradients-spec/#c-structures](https://github.com/googlefonts/colr-gradients-spec/#c-structures)
Transform & Compose: Layer reuse
New Web Use Cases
Overcome image replacement

12:25 PM

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\[<\text{img crossorigin="anonymous" src="/img/8d34dcc...w_1888-64.png" alt="😄" draggable="false" class="_2UdhN _3Ci02 i0jNr selectable-text copyable-text" data-plain-text="😄" style="visibility: visible;"/>}\]

\[</\text{span}>\]
COLRv1 in Chrome & OSS

Rasterisation
COLRv1 Color Gradient Vector Fonts in Chrome 98

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https://developer.chrome.com/blog/colrv1-fonts/
Hybrid Font Stack

Font Format Supported by Operating System?

System Font Rasteriser

Open Source Stack Rasteriser
  Skia & FreeType
Open-Source Foundations for COLRv1 in Chrome

Chrome’s Font Stack
- Loads and displays COLRv1 web fonts

Skia Graphics Library
- Traverses COLRv1 glyph graph, executes graphics operations

FreeType Library
- Understands COLRv1 & CPAL tables
FreeType 2.11.0
2021-07-19

Our new release brings an additional rendering module to create Signed Distance Fields (SDF) for glyphs; it also introduces an experimental interface to access ‘COLR’ v1 fonts.

As usual, there are many more fixes and features; please see here for more.
COLRv1
in Chrome & OSS

Font Production
Open-Source Foundations for COLRv1 Font Production

- nanoemoji
- fonttools
- picosvg
{SVG} → Font

Design tools tend to provide SVGs

SVGs are complex
  ● Simplify them first!

https://github.com/googlefonts/picosvg
  ● Exactly 1 <defs>
    ○ Contains only gradients
  ● Only groups and paths
  ● Only absolute coordinates
  ● Apply clip paths
  ● Strokes → paths
To Fontland!

https://github.com/googlefonts/nanoemoji

- `{svgs} → color font
  - COLR v0 or v1
    - Outlines in glyf, cff, or cff2
  - Depends on picosvg
  - Optional: OT-SVG output

- Tries to produce a compact font
Nanoemoji Demo

$ nanoemoji --family "Hercules Emoji" --color_format glyf_colr_1 svg/emoji_u1F6A8.svg
File "/opt/homebrew/Cellar/python@3.9/3.9.12/Frameworks/Python.framework/Versions/3.9/lib/python3.9/subprocess.py", line 528, in run
raise CalledProcessError(retcode, process.args,
(venv) → build git:(main) × cd ..
(venv) → buildfont git:(main) × nanoemoji --family "Hercules Emoji" --color_format glyf_colr_1 svg/emoji_u1F6A8.svg
I0613 09:23:26.051822 4372661632 nanoemoji.py:593] Proceeding with 1 config(s)
ninja: Entering directory `/Users/drott/dev/coruna_talk/buildfont/build'
I0613 09:23:28.491578 4337501568 __init__.py:44] Pre-processing glyphs
I0613 09:23:28.511209 4337501568 base.py:178] Running CubicToQuadraticFilt
Welcome to
COLRv1 in OSS

- Black Foundry Python based renderer
  - [https://github.com/BlackFoundryCom/black-renderer](https://github.com/BlackFoundryCom/black-renderer)
- FontGoggles
  - [https://fontgoggles.org/](https://fontgoggles.org/)
Variable COLRv1
Variable Color Fonts

Elements become variable:

- Shapes (glyph outlines)
- Gradient placement, color stop offsets
- Color value alphas
- Transforms (e.g., rotation angles)

Based on Bungee Font by DJR
https://djr.com/bungee
Wrapping up
Wrapping up

- Color Fonts and their use on the web
- COLRv1 Internals
- COLRv1 in open-source libraries for
  - Rasterisation
  - Font Production
- Variable COLRv1
Thank you!