Ghostscript and MuPDF Status
OpenPrinting Summit April 2016

Michael Vrhel, Ph.D.

Artifex Software Inc.

San Rafael CA

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Outline

ghostscript®

Ghostscript overview

What is new with Ghostscript

MuPDF overview

What is new with MuPDF

MuPDF vs Ghostscript

MuJS, GSView

The Basics

Ghostscript is a document conversion and rendering engine.

Written in C ANSI 1989 standard (ANS X3.159-1989)

Essential component of the Linux printing pipeline.

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Source and documentation available at www.ghostscript.com

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Graphical Overview

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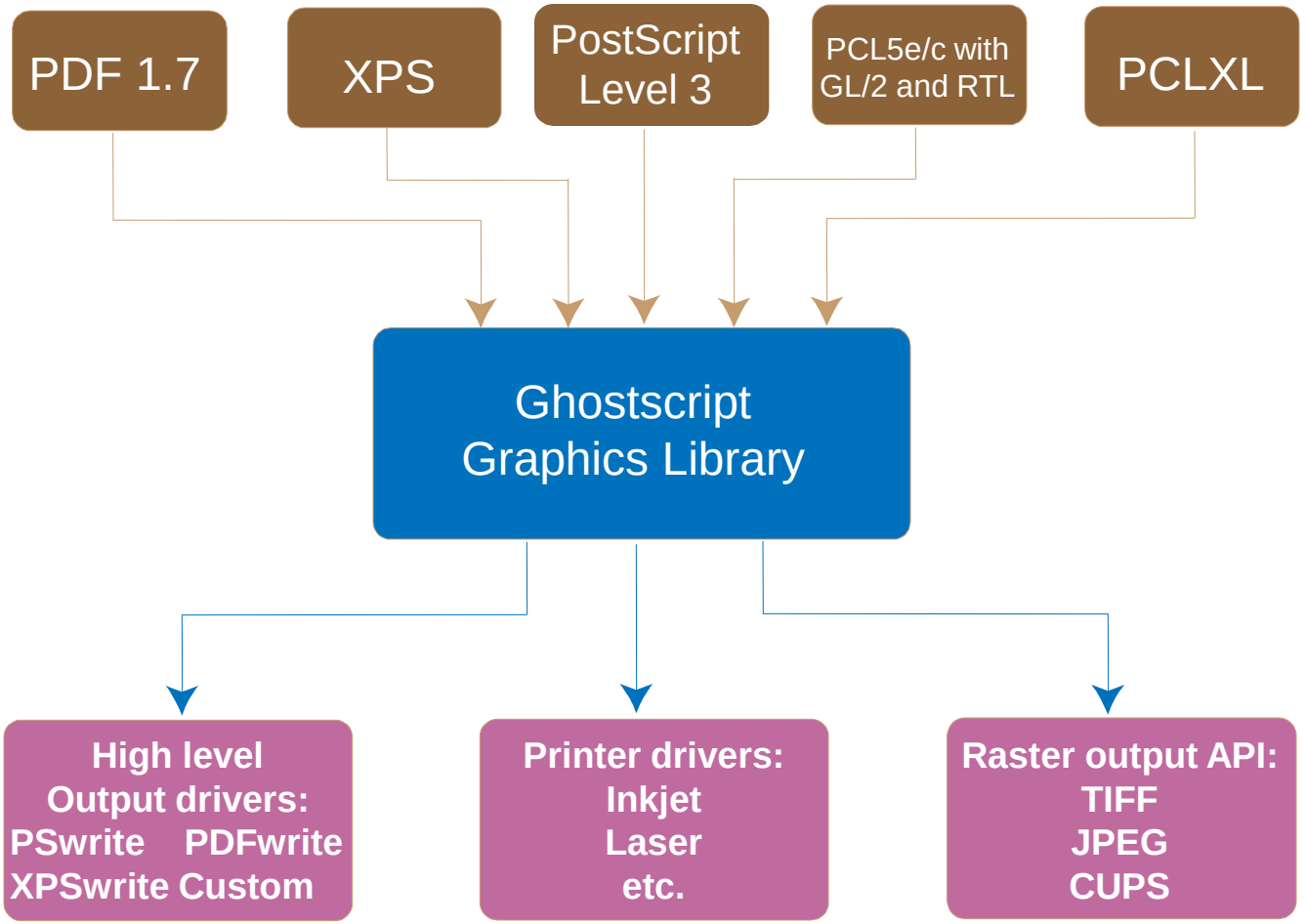

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Devices

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Understanding devices is a major key to understanding Ghostscript.

Devices can have high-level functionality. e.g. pdfwrite can handle text, images, patterns, shading, fills, strokes and transparency directly.

Graphics library has “default” operations. e.g. text turns into bitmaps, images decomposed into rectangles.

In embedded environments, calls into hardware can be made.

Raster devices require the graphics library to do all the rendering.

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Relevant Changes to GS since last meeting….

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A substantial revision of the build system and GhostPDL directory structure (9.18)

GhostPCL and GhostXPS "products" are now built by the
Ghostscript build system "proper" rather than having their own builds (9.18)

New method of internally inserting devices into the device chain developed.
Allows easier implementation of “filter” devices (9.18)

Implementation of "-dFirstPage"/"-dLastPage" with all input languages (9.18)

Relevant Changes to GS since last meeting….

New custom PJL equivalents for pdfmark and setdistillerparams.
Added to allow pdfwrite configuration for PDF/A output from GhostPCL (9.19)
See: ghostpdl/doc/VectorDevices.htm#PXL_IN

Metadata pdfmark implemented. Allows user to specify an XMP stream
to be written to the Catalog of the PDF file. (9.19)
See: ghostpdl/doc/VectorDevices.htm#Extensions

Experimental, rudimentary raster trapping added to Ghostscript (9.19)
See: ghostpdl/doc/Devices.htm#TIFF_trapping

The halftone threshold array generation tools (toolbin/halftone) improved
Allow folding the transfer function into the threshold array.
Support for minimum dot size and shape with stochastic arrays. (9.19)

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Relevant Changes to GS since last meeting….

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Optimization of generation of ICC profiles from PS CIE color spaces (9.19)

-dUsePDFX3Profile with -dNumRenderingThreads (9.19)

Introduction of gproof device for use with MuPDF/GSView (9.19)

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What is MuPDF?

MuPDF

- **A Core Set of Libraries Focused on PDF**
  Entirely written in C, very portable, small ROM footprint
  Windows/Linux/MacOS/iOS/Android/BB10/QNX/others

- **Example Tools:**
  Simple viewers for Linux/Android/MacOS/iOS/Windows/WinRT.
  Command line tools:
  - Rendering PDF pages
  - Creating PDF pages
  - Merging PDF content
  - Extracting pages
  - Decompressing content streams
  - Extracting resources
  - Repairing files

- **Licensing.** Dual AGPL/Proprietary licensed. Artifex owns the copyright.

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Features of MuPDF

MuPDF

Other input formats:

XPS/OXPS

CBZ/JPEG/PNG/TIFF/EPUB (version 2 DRM-free)

Device interface

Separates interpretation from rendering

Allows display lists

Includes PWG raster device

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Features of MuPDF

MuPDF

Clever memory management

Caching of objects (both raw and decoded)
Memory scavenging (throw objects away just in time)

Multi-core/threading support

Not tied to any one threading implementation
All we need is locks

Interpretation happens on one thread, rendering can happen on many.
Thumbnails rendered in the background.
Banded rendering of pages.
Resources decoded on one thread can be used by others.

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Features of MuPDF

MuPDF

Form filling

Ability to save files back with data in them.

JavaScript support

Not tied to any one JavaScript implementation

Thin veneer to Googles 'v8' engine supplied

MuJS is our own small JavaScript library (http://www.mujs.com/)

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Features of MuPDF

MuPDF

Reflow View

Pages extracted to HTML (text and images).

Rudimentary layout detection (tables, indents, etc.)

Digital Signatures

Verify signatures

Sign documents

Re-sign documents after form filling

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Relevant Changes to MuPDF since last meeting….

MµPDF

Significant EPUB improvements (1.8)

- User style sheets
- GIF Image
- Table of Contents
- CJK text

Bare bones OpenGL-based desktop viewer added (1.8)

64-bit file support (1.8)

Ghostscript proofing mode (1.8)

Output Mono & Color PCL content (1.8)

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Relevant Changes to MuPDF since last meeting….

MuPDF

New low-level Java interface for desktop and Android (1.9)

Bidirectional layout for Arabic and Hebrew scripts (1.9)

“create” command line for creating PDF files from scratch (1.9)
- Reads content stream from text file
- Includes font and image resource embedding

“draw” command line improvements (1.9)
- multi-threaded operation
- low-memory mode

“run” command line (1.9)
- Runs JavaScript scripts with MuPDF bindings
- Supports ECMAScript 5 in strict mode
- Provides access to most of the MuPDF library
- “run” by itself provides an interactive prompt

Simple JavaScript Draw Example

```
var doc, page, pixmap

var doc = new mupdf.Document("pdfref17.pdf")
print(doc, doc.countPages())
var page = doc.loadPage(1144)
print(page, page.bound())
var pixmap = page.toPixmap(mupdf.Identity, mupdf.DeviceRGB)
pixmap.saveAsPNG("out.png", false)

pixmap = new mupdf.Pixmap(mupdf.DeviceRGB, page.bound())
pixmap.clear(255)
var device = new mupdf.DrawDevice(pixmap)
page.run(device, mupdf.Identity)
pixmap.saveAsPNG("out2.png", false)
```

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Simple JavaScript Draw Example

MuPDF

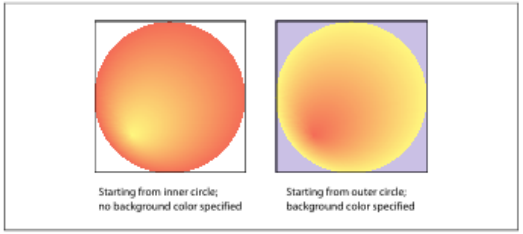

PLATE 12 *Radial shadings depicting a sphere ("Type 3 (Radial) Shadings," page 313)*

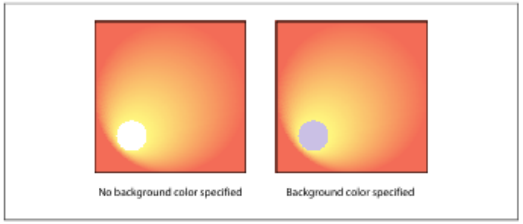

PLATE 13 *Radial shadings with extension ("Type 3 (Radial) Shadings," page 313)*

PLATE 14 *Radial shading effect ("Type 3 (Radial) Shadings," page 313)*

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Simple JavaScript PDF Creation Example

MuPDF

```
var pdf = new mupdf.PDFDocument()
var trailer = pdf.getTrailer()
var root = trailer.Root
var pages = root.Pages

var contents = pdf.addStream("0.5 0.5 1 rg 10 10 m 90 10 l 90 90 l h f")

var page = pdf.addObject({ Type: 'Page', MediaBox: [0, 0, 500, 500],
        Rotate: 0, Contents: contents, Resources: null, Parent: pages})

pages.Count = 1
pages.Kids = [ page ]

trailer.Info = { Author: "(JavaScript)", Title: "(Example)“ }
print(trailer)

pdf.save("out.pdf")
```

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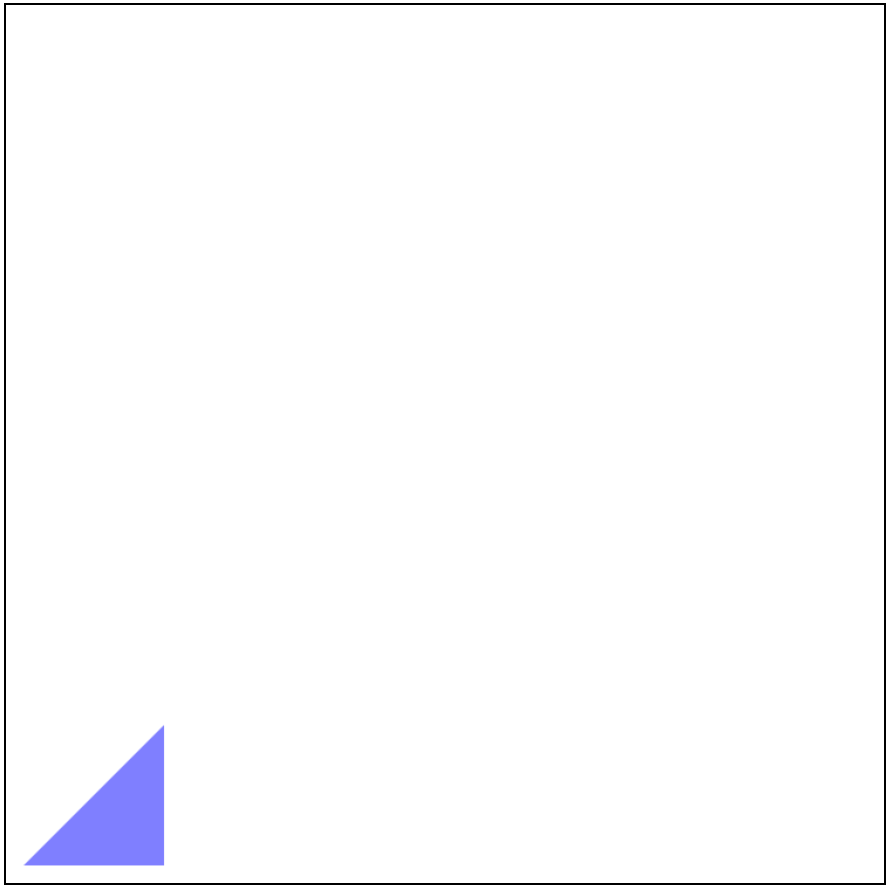
Simple JavaScript PDF Creation Example

MµPDF



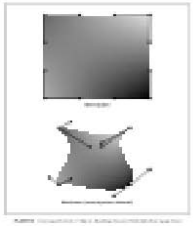
Simple JavaScript Create Example With Resources


```
var pdf = new mupdf.PDFDocument()
 var trailer = pdf.getTrailer()
 var root = trailer.Root
 var pages = root.Pages

 var courier = pdf.addSimpleFont(new mupdf.Font(“courier.ttf"))
 var arial = pdf.addSimpleFont(new mupdf.Font(“arial.ttf"))
 var lena = pdf.addImage(new mupdf.Image("Lena.png"))

 var subdoc = new mupdf.Document("pdfref17.pdf")
 var subpage = subdoc.loadPage(1145)
 var pixmap = subpage.toPixmap([0.2,0,0,0.2,0,0], mupdf.DeviceGray)
 var thumb = pdf.addImage(new mupdf.Image(pixmap))
```

Simple JavaScript Create Example With Resources Continued


```
var contents = new mupdf.Buffer()
contents.writeLine("0.5 0.5 1 rg")
contents.writeLine("10 10 m 90 10 l 90 90 l h f")
contents.writeLine("0 g")
contents.writeLine("BT /Ar 16 Tf 10 30 TD (Hello, world!) Tj ET")
contents.writeLine("BT /Co 16 Tf 10 10 TD (Goodbye, cruel world!) Tj ET")
contents.writeLine("q 150 0 0 150 100 100 cm /Im0 Do Q")
contents.writeLine("q 150 0 0 150 100 250 cm /Im1 Do Q")

var resources = pdf.addObject({ Font: { Co: courier, Ar: arial },
                                XObject: { Im0:   lena, Im1: thumb }})

var page = pdf.addPage([0,0,500,500], 0, contents, resources)
pdf.insertPage(-1, page)

trailer.Info = { Author: "(JavaScript)", Title: "(Example)“ }

pdf.save("out.pdf")
```

Simple JavaScript Create Example With Resources Continued



Hello, world!

Goodbye, cruel world!

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Ghostscript or MuPDF?

MuPDF

http://twiki.ghostscript.com/do/view/Ghostscript/GhostscriptOrMuPDF

For most printing applications - use Ghostscript.

Postscript
PCL
Spot colors
Extreme level of color management control
Massive range of output devices

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Ghostscript or MuPDF?

MµPDF

For screen use or embedded devices - use MuPDF.

Fast
- PDF Parser in C.
- AA Rendering designed in from the ground up.

Small
- Much smaller ROM footprint.

Simple
- No complex garbage collector to maintain
- Small set of dependent libraries
- Simpler to port

Interactive features
- More suitable for building viewers
- Searching
- Zooming
- Form filling
- Transitions

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MuJS

Lightweight implementation of the JavaScript language in a library

MuJS implements ECMAScript 5

Written in portable C

Runs on all flavors of Linux and Windows, on mobile devices (such as Android and iOS), embedded microprocessors (such as the Beagle board and Raspberry Pi), etc.

The source contains around 10'000 lines of C.

Under Linux, the compiled library takes 180kB if optimized for size, and 260kB if optimized for speed.

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GSView

gsview®

A user friendly viewer for Postscript, PDF, XPS, EPUB[1], CBZ, JPEG, and PNG

GSView leverages the viewing capabilities of MuPDF, along with the conversion capabilities of Ghostscript to provide fast and high quality on-screen experience, and high quality export and conversion features.

GSView includes form filling, annotation display and print proofing

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GSView

Conversion to SVG, PCL-XL, XPS, Text, HTML, XML, Postscript, Image formats, PDF/X PDF/A, Linearized PDF

Specification of ICC Output intent for PDF/X formats

Copy of text / images from GSView into other applications

Vector extraction of page regions

Current work on PDF creation, adding of annotations, page merging from multiple PDFs, adding text, graphic and image content to existing PDFs

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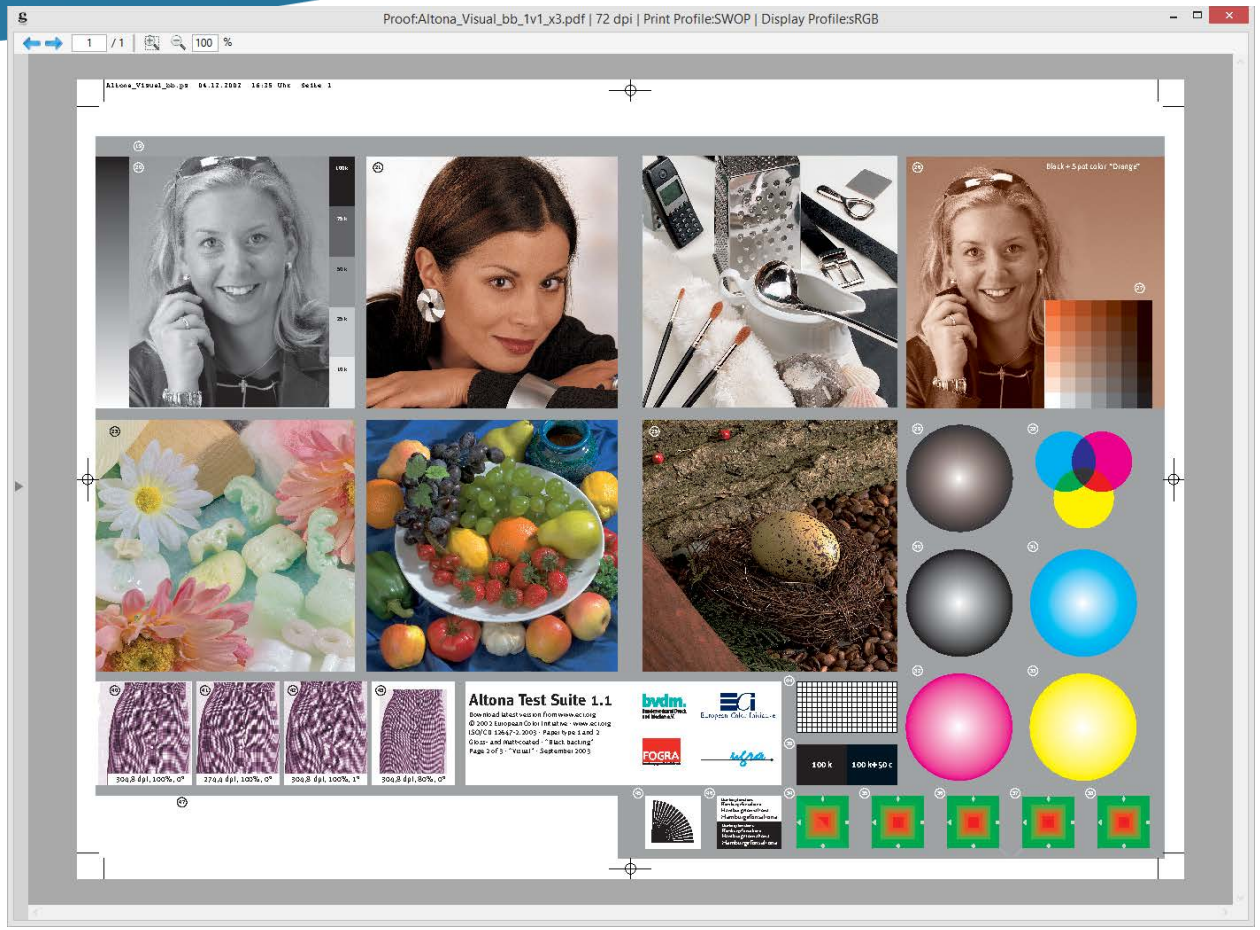
GSView gproof example

gsview®



Altona Visual Test file rendered with SWOP CMYK and sRGB

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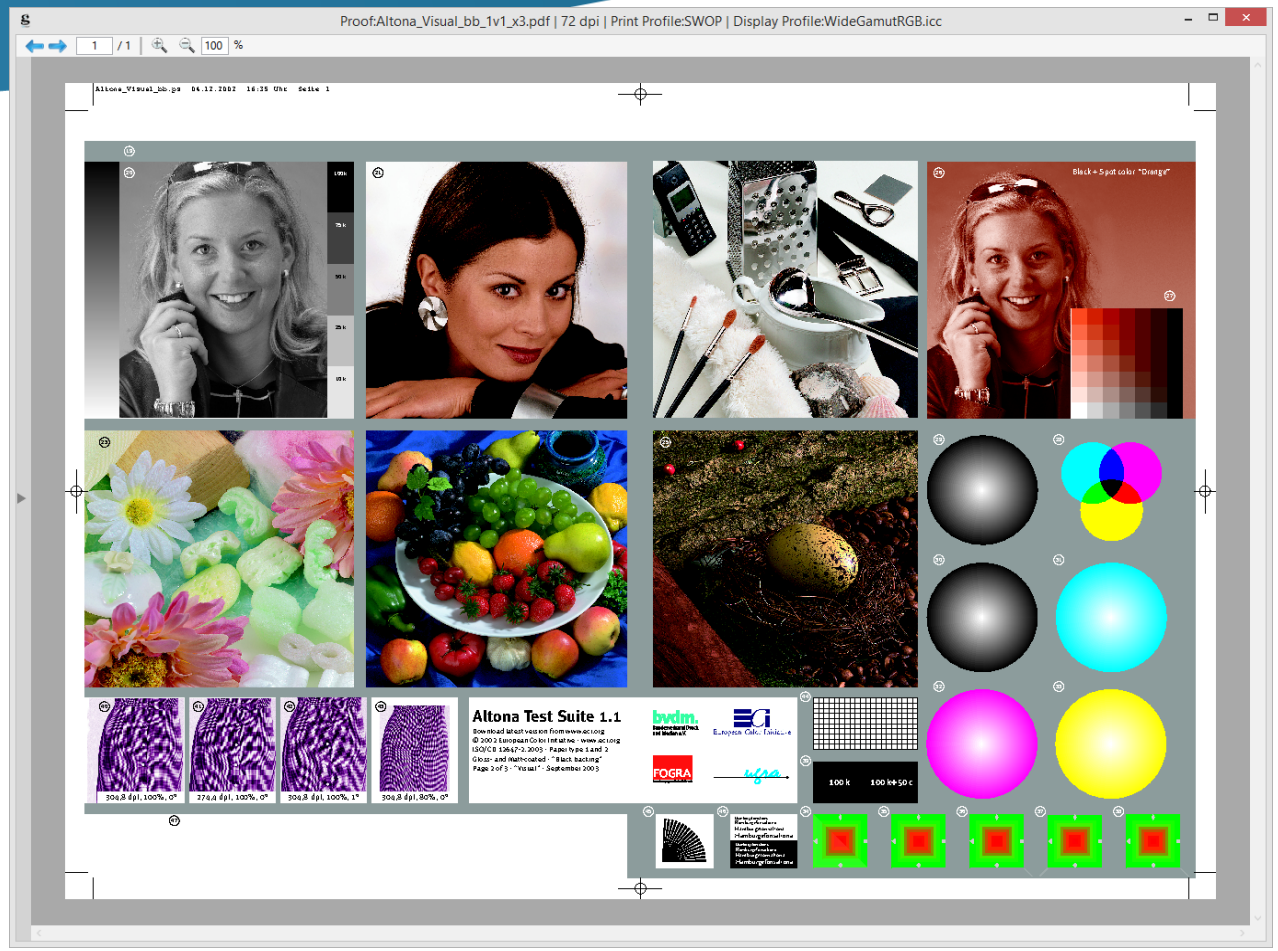
GSView gproof example

gsview®



Altona Visual Test file rendered with SWOP CMYK and Wide Gamut RGB

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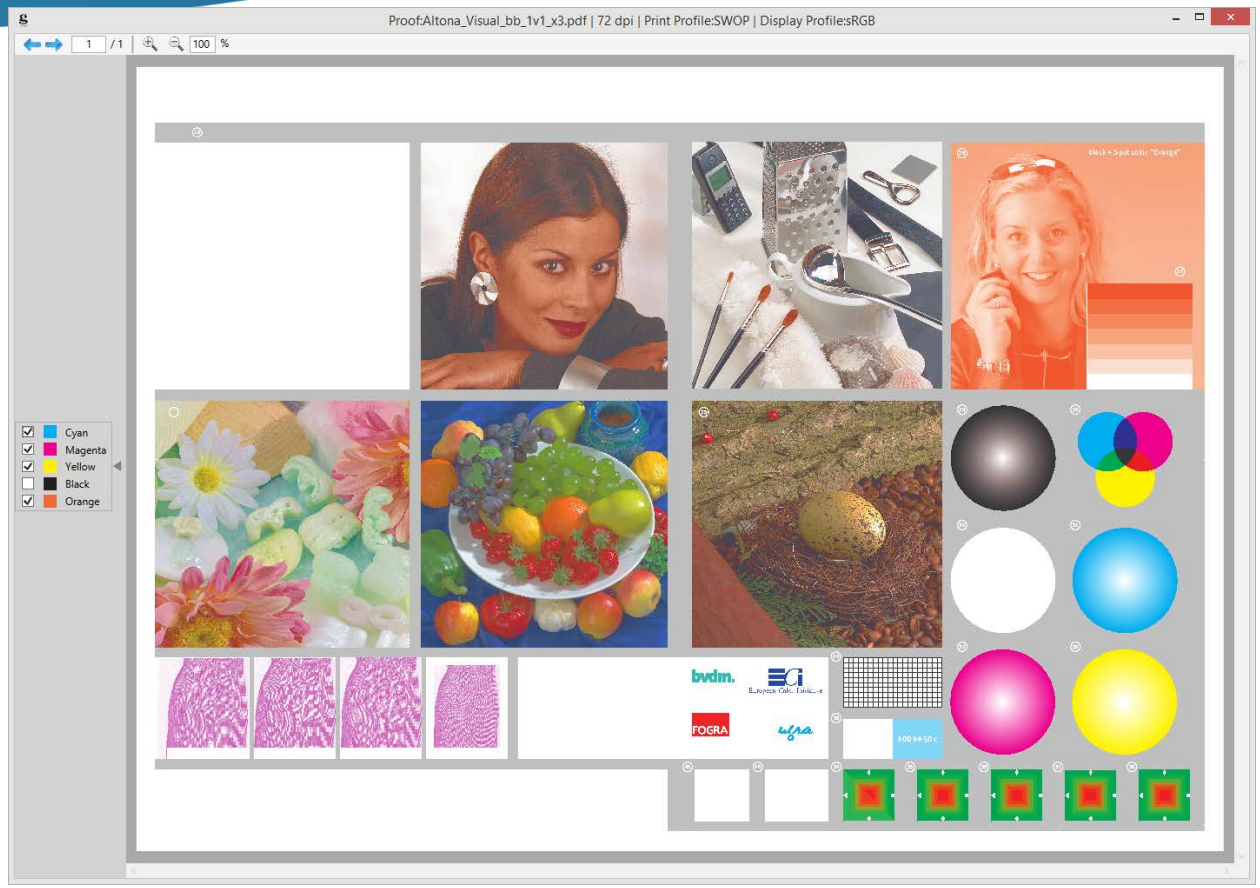
GSView gproof example

gsview®



Altona Visual File without black separation

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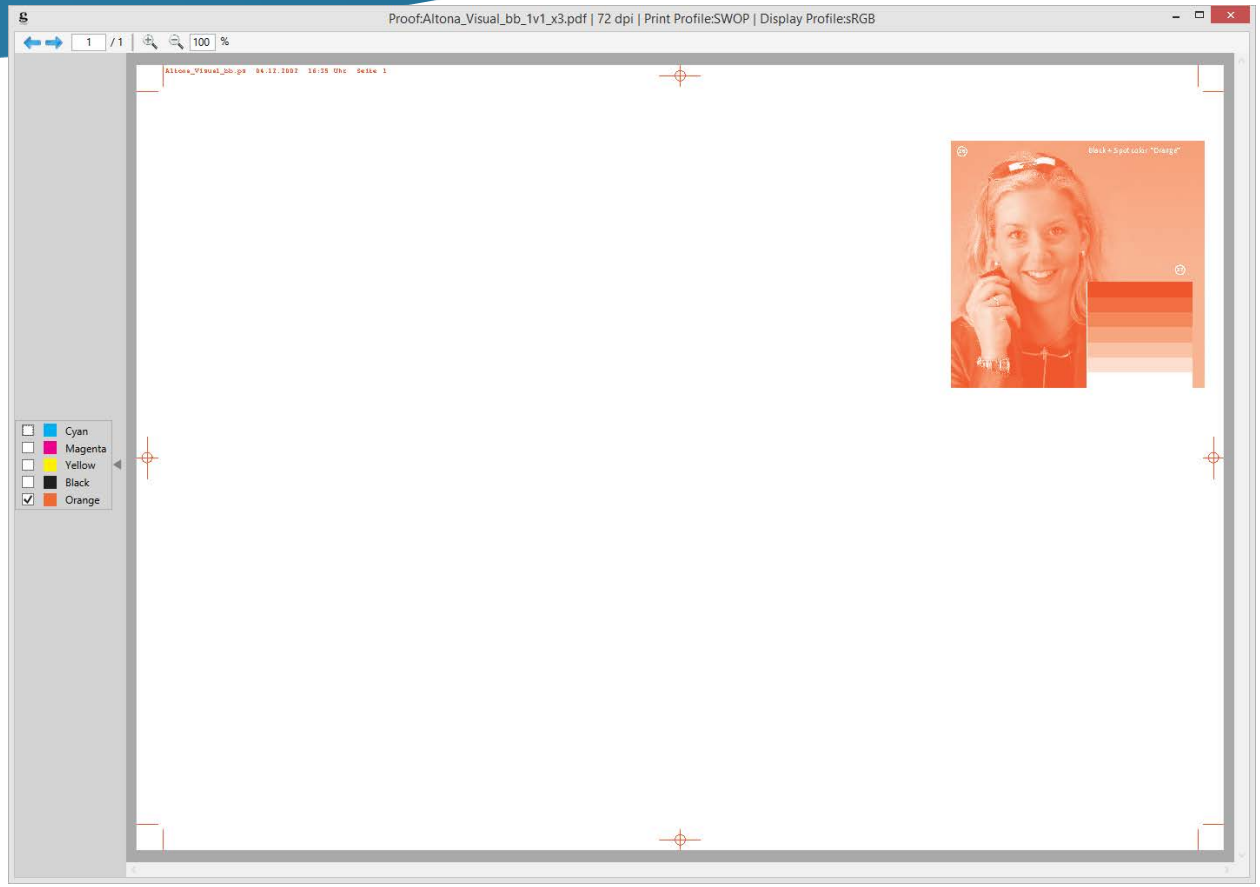
GSView gproof example

gsview®



Altona Visual File with only the orange separation

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Bug Tracking

ghostscript® MµPDF gsview®

http://bugs.ghostscript.com/

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More Information

Repositories located at
git://git.ghostscript.com

MuPDF and Ghostscript discussions on IRC freenode #ghostscript channel

Additional information at www.mupdf.com www.ghostscript.com www.mujs.com