Pycairo

Jun 20, 2019

Contents

Installation:

- Python 2: `pip2 install pycairo`
- Python 3: `pip3 install pycairo`

Installing Pycairo requires pkg-config and cairo including its headers. Here are some examples on how to install those for some platforms:

- Ubuntu/Debian: `sudo apt install libcairo2-dev pkg-config python3-dev`
- macOS/Homebrew: `brew install cairo pkg-config`
- Arch Linux: `sudo pacman -S cairo pkgconf`
- Fedora: `sudo dnf install cairo-devel pkg-config python3-devel`
- openSUSE: `sudo zypper install cairo-devel pkg-config python3-devel`

To verify that the installation works run the following Python code:

```
import cairo
```

CHAPTER 1

Changelog

Since version 1.11.0 Pycairo uses Semantic Versioning i.e. the newest version is the latest stable one.

1.1 1.18.1 - 2019-04-19

- meson: install .egg-info to platlib
- meson: fix configure error with meson 0.50 re absolute paths #pr-145
- PyPy: don't use PyOS_FSPath() with PyPy3.6, it's missing: https://bitbucket.org/pypy/pypy/issues/2961
- Docs fixes #pr-134 (Matteo Italia)

1.2 1.18.0 - 2018-11-04

Build:

- Dropped Python 3.3 support
- meson build requires meson >=0.47 (was >=0.46)
- Fix various build warnings with GCC8
- meson: Don't link against libpython on non-Windows systems #pr-120
- meson: Improve support for Visual Studio builds #pr-121 (Chun-wei Fan)
- setup.py: Support specifying custom `--pkgconfigdir` #pr-127 (Michał Górny)

Fixes:

- docs: Remove a broken link #pr-124 (Nik Nyby)
- typing: Add missing annotations for __enter__/__exit__ #pr-126

New API: Some are only available when building with newer cairo versions, see the linked API docs for details.

- *CAIRO_VERSION*, *CAIRO_VERSION_STRING*, *CAIRO_VERSION_MAJOR*, *CAIRO_VERSION_MINOR*, *CAIRO_VERSION_MICRO*
- *Status.TAG_ERROR*, *Status.FREETYPE_ERROR*, *Status.PNG_ERROR*, *Status.WIN32_GDI_ERROR*
- *SVGUnit*, *PDFMetadata*, *PDFOutlineFlags*
- *FontOptions.set_variations()*, *FontOptions.get_variations()*
- *Context.tag_begin()*, *Context.tag_end()*, *TAG_DEST*, *TAG_LINK*
- *PDFSurface.set_page_label()*, *PDFSurface.set_metadata()*, *PDFSurface.set_thumbnail_size()*, *PDFSurface.add_outline()*, *PDF_OUTLINE_ROOT*
- *SVGSurface.set_document_unit()*, *SVGSurface.get_document_unit()*
- *MIME_TYPE_CCITT_FAX*, *MIME_TYPE_CCITT_FAX_PARAMS*, *MIME_TYPE_EPS*, *MIME_TYPE_EPS_PARAMS*, *MIME_TYPE_JBIG2*, *MIME_TYPE_JBIG2_GLOBAL*, *MIME_TYPE_JBIG2_GLOBAL_ID*

1.3 1.17.1 - 2018-07-07

- Meson support (>=0.46). #114

1.4 1.17.0 - 2018-04-15

- *cairo.Surface* and *cairo.Device* can now be used as context managers. #103
- Fix a leak when a cairo error was raised.
- Fix a leak when a mapped surface was GCed instead of unmapped.
- Make it possible to use the C API with Python 3 outside of the compilation unit doing the import by defining `PYCAIRO_NO_IMPORT`. #110
- Implement PEP 561 (added a py.typed marker)

1.5 1.16.3 - 2018-02-27

- Ship Python type annotation stubs. They are currently supported by mypy and PyCharm. #99 #pr-101

1.6 1.16.2 - 2018-02-10

- setup.py: Some fixes for Debian pybuild quirks. #98

1.7 1.16.1 - 2018-02-06

- setup.py: correctly install pkgconfig into /usr/lib* again. To make JHBuild on Fedora work the following patch is needed: https://bugzilla.gnome.org/show_bug.cgi?id=793216

1.8 1.16.0 - 2018-02-05

- Add a `get_include()` function which returns the compiler include path needed for interfacing with the Pycairo C API #92
- Note for packagers: The default header installation path has changed, but a compat header is installed to the old location to prevent breakage in case anyone has hardcoded the old path instead of using pkg-config. Just in case anyone is wondering why there are two header files now.

1.9 1.15.6 - 2018-01-30

- Experimental PyPy and PyPy3 support #90

1.10 1.15.5 - 2018-01-29

- Support Unicode paths under Windows with cairo 1.15.10+ #pr-87
- Don't include the pkg-config file when building a wheel #83

1.11 1.15.4 - 2017-11-08

Fixes:

- Fix some enum conversation errors with (unused) large and negative values. #pr-81

Tests:

- Fix a rare test error #pr-80 (Sergei Trofimovich)

1.12 1.15.3 - 2017-09-17

Fixes:

- setup.py: Install pkgconfig file into /usr/share/pkgconfig to work around JHBuild on Fedora not picking it up.
- Fix tests on big endian machines. #75
- Support building with MSVC #pr-72 (Chun-wei Fan)

Tests:

- Test MSVC builds on appveyor

1.13 1.15.2 - 2017-09-03

Fixes:

- setup.py: Install pkgconfig file to the same library prefix that Python uses. (/usr/lib64 instead of /usr/lib under Fedora for example) #70 #pr-71 (Sander Sweers)

1.14 1.15.1 - 2017-08-19

Fixes:

- Improved support for Python filesystem paths including `os.PathLike`. See *pathlike* for details.
- Various minor fixes

Changes:

- Expose *cairo.Path*

Tests:

- Improved test coverage from ~70% to ~90%

1.15 1.15.0 - 2017-07-24

New Features:

- Add *Surface.map_to_image()* and *Surface.unmap_image()* #51
- Add *RasterSourcePattern* #48
- Add *Glyph* #53
- Add *Rectangle* #54
- Add *TextCluster* #61
- Add *ScaledFont.text_to_glyphs()* and *ScaledFont.glyph_extents()*
- Add *Context.show_text_glyphs()*
- Add *TextExtents* #62

Changes:

- Pycairo instances wrapping the same underlying cairo object now hash and compare equally e.g. `context.get_target() == context.get_target()`
- Functions which returned a cairo error with *Status.NO_MEMORY* no longer raise `MemoryError`, but a subclass of *Error* and `MemoryError`. Similarly errors with *Status.READ_ERROR* and *Status.WRITE_ERROR* no longer raise `IOError`, but a subclass of *Error* and `IOError`. #55
- Some functions which previously returned a tuple now return a tuple subclass like *Rectangle*, *Glyph*, *TextCluster* and *TextExtents*

1.16 1.14.1 - 2017-07-24

Fixes:

- Fix a crash with *Surface.get_device()* #57

1.17 1.14.0 - 2017-07-12

General:

- Requires at least cairo 1.13.1 (The snapshop in Ubuntu 14.04)

Tests:

- Optional Hypothesis tests.

New Features:

- Add *Surface.set_device_scale()* and *Surface.get_device_scale()*. #pr-44 (Sander Sweers)
- Add *Device* #pr-45
- Add *Surface.get_device()* #pr-45
- Add *ScriptDevice* and *ScriptMode* #pr-46
- Add *ScriptSurface* #17
- Add *Status.JBIG2_GLOBAL_MISSING*
- Add *Format.stride_for_width()*
- Add *TextClusterFlags* and *SurfaceObserverMode*
- Add *Gradient.get_color_stops_rgba()*
- Add *TeeSurface*
- Add *MeshPattern*

1.18 1.13.4 - 2017-07-12

Fixes:

- Fix a rare crash with *get_data()* under Python 3 (1.13.3 regression).

1.19 1.13.3 - 2017-06-01

Fixes:

- Fix ImageSurface leaking in case *get_data()* is used under Python 3. #41

Documentation:

- Add Pillow to ImageSurface example. #pr-40 (Stuart Axon)
- Describe Freetype-py intergration. #25 #pr-43 (Hin-Tak Leung)

1.20 1.13.2 - 2017-05-21

Fixes:

- Fix pip failing to install pycairo in some cases. #39

Testing:

- Added continuous testing for Windows using MSYS2 and appveyor. #19

1.21 1.13.1 - 2017-05-07

Fixes:

- setup.py install: Fix generated pkg-config file if `--home` or `--user` is specified. #34
- Fix a build error on macOS Sierra. #pr-36 (Nicolas P. Rougier)
- examples: Fix snippet examples when .pyc files are present. #35

Documentation:

- Add Pyglet integration example. #pr-33 (Stuart Axon)

1.22 1.13.0 - 2017-05-03

New Features:

- The buffer returned by *ImageSurface.get_data()* under Python 2 now implements the character buffer interface to make it work with pygame.image.frombuffer(). #pr-29
- All C enum types now have their own corresponding Python enum type: *Antialias*, *Content*, *Extend*, *FillRule*, *Filter*, *FontSlant*, *FontWeight*, *Format*, *HintMetrics*, *HintStyle*, *LineCap*, *LineJoin*, *Operator*, *PDFVersion*, *PSLevel*, *PathDataType*, *RegionOverlap*, *SVGVersion*, *Status*, *SubpixelOrder*. #26

  All relevant constants are now an alias to attributes of those types e.g. *ANTIALIAS_DEFAULT* is the same as *Antialias.DEFAULT*.

  All functions returning enum values now return instances of the new types e.g. *Context.get_antialias()* returns a *Antialias*.

  Error.status is now a *Status*.
- All included examples now work with Python 2 & 3
- All included examples using GTK+ have been ported to GTK+ 3/PyGObject 3

Fixes:

- Fix the signature of the *ImageSurface* buffer interface for Python 2 (int -> Py_ssize_t)
- setup.py: Ensure "-fno-strict-aliasing" is used with Python 2.

Testing:

- Added travis-ci tests for flake8 and sphinx. #pr-30, #pr-32
- The test suite now has optional tests for numpy and pygame integration.

1.23 1.12.0 - 2017-04-18

General:

- Require cairo 1.12.0
- Use C90 and enforce it on travis-ci. #5, #fdo-22940

Constants:

- Add various new cairo.OPERATOR_*, cairo.ANTIALIAS_* and cairo.FORMAT_* constants. #1

- Add *HAS_MIME_SURFACE* and cairo.MIME_TYPE_*. #7, #fdo-58771
- Add cairo.PDF_VERSION_*. #pr-16
- Add cairo.SVG_VERSION_*

Error:

- Add a *Error.status* attribute exposing cairo.STATUS_*
- Add *CairoError* alias for *Error* for cairocffi compatibility

Matrix:

- Expose matrix components as read/write properties. e.g. *Matrix.xx*
- Fix type checking of the multiplication operator under Python 3. #8, #fdo-89162 (Lawrence D'Oliveiro)

Surface:

- Add *Surface.set_mime_data()*. #7, #fdo-58771
- Add *Surface.get_mime_data()*. #7, #fdo-58771
- Add *Surface.supports_mime_type()*. #7, #fdo-58771
- Add *Surface.create_for_rectangle()*. #pr-13
- Add *Surface.create_similar_image()*. #pr-15
- Add *Surface.has_show_text_glyphs()*
- Fix crash when the surface wrapper gets deallocated before the surface object. #11

Context:

- Add *Context.in_clip()*. #pr-14

PDFSurface:

- Add *PDFSurface.restrict_to_version()*. #pr-16
- Add *PDFSurface.get_versions()*. #pr-16
- Add *PDFSurface.version_to_string()*. #pr-16

SVGSurface:

- Add *SVGSurface.restrict_to_version()*
- Add *SVGSurface.get_versions()*
- Add *SVGSurface.version_to_string()*

XCBSurface:

- Add *XCBSurface.set_size()*

PSSurface:

- Add *PSSurface.get_levels()*
- Add *PSSurface.level_to_string()*

Pattern:

- Add *Pattern.set_filter()*
- Add *Pattern.get_filter()*

RecordingSurface:

- Add *RecordingSurface.get_extents()*

***FontOptions*:**

- Implement __eq__ and __ne__
- Add *FontOptions.copy()*
- Add *FontOptions.hash()*
- Add *FontOptions.equal()*
- Add *FontOptions.merge()*

***ScaledFont*:**

- Add *ScaledFont.get_ctm()*
- Add *ScaledFont.get_font_matrix()*
- Add *ScaledFont.get_font_options()*

1.24 1.11.1 - 2017-04-12

This release fixes an ABI breakage. I missed that the original pycairo master had already broken ABI compared to 1.10.0.

1.25 1.11.0 - 2017-04-09

This version is based on the Python 2 version of pycairo 1.10.0 and is API/ABI compatible with both py2cairo 1.10.0 and py3cairo 1.10.0.

General Changes:

- Requires cairo 1.10.2+
- Switch to semantic versioning
- Switch build system to distutils/setup.py (xpyb integration can be enabled with passing `--enable-xpyb` to setup.py build)
- Moved to GitHub: https://github.com/pygobject/pycairo

New Features:

- Python 3 support (API/ABI compatible with py3cairo 1.10.0) including support for *cairo.Error*, *cairo.ImageSurface.get_data()* and *cairo.ImageSurface.create_for_data()*, which were missing in py3cairo.
- *cairo.RecordingSurface* (#fdo-36854, Torsten Landschoff)
- *cairo.Region*, *cairo.RectangleInt* and cairo.REGION_OVERLAP_* (#fdo-44336, Bug Fly)

Bug Fixes:

- Fix crash when read()/write() methods of file objects passed to pycairo raise exceptions.
- Fix possible value truncation of handles passed to Win32Surface and Win32PrintingSurface on 64bit Windows. #fdo-57493

1.26 1.10.0 - 2011-05-01

General Changes: py2cairo 1.10.0 requires cairo 1.10.0 (or later).

New Constants: cairo.FORMAT_RGB16_565

Bug Fixes:

- context.get_source().get_surface() fails #fdo-33013
- Add support for './waf configure –libdir=XXX' #fdo-30230

Documentation Changes:

- Upgrade to using Sphinx 1.0.7.
- Include html documentation in the pycairo archive file.

Build Changes:

- Update waf to 1.6.3
- Remove setup.py

Other Changes:

- Improve/simplify unicode filename support.
- Improve/simplify unicode text support.

1.27 1.8.10 - 2010-05-20

General Changes: Pycairo 1.8.10 requires cairo 1.8.10 (or later).

New Classes/Types:

- Win32PrintingSurface
- XCBSurface - add XCB support using xpyb

Bug Fixes:

- Fix for libtool 2.2 (#fdo-27974).
- Mingw32 and pypy fixes (#fdo-25203).

Other Changes: Tests updated.

The Win32PrintingSurface and XCBSurface changes mean that pycairo 1.8.10 is not binary compatible with pycairo 1.8.8. So modules that use the pycairo C API (like pygtk) will need to be recompiled to use pycairo 1.8.10.

1.28 1.8.8 - 2009-08-26

General Changes:

- Pycairo 1.8.8 requires cairo 1.8.8 (or later).
- Move from CVS to git.
- Add support for the waf build tool.

Updated Methods:

- The PDF/PS/SVGSurface constructors now accept None as a filename.

1.29 1.8.6 - 2009-06-25

General Changes: Pycairo 1.8.6 requires cairo 1.8.6 (or later)

Bug Fixes:

- ImageSurface.create_from_png _read_func fix
- ToyFontFace type fix
- #fdo-19221: restore cairo.Matrix '*' operator to the way it originally worked.

Other Changes: Documentation completed.

1.30 1.8.4 - 2009-03-19

General Changes: Pycairo 1.8.4 requires cairo 1.8.4 (or later) and Python 2.6

Bug Fixes:

- 20674: Add get/set_extend for Gradient Patterns

New Classes: cairo.ToyFontFace

New Methods:

Pattern.get_extend
Pattern.set_extend
ToyFontFace.get_family
ToyFontFace.get_slant
ToyFontFace.get_weight

Deleted Methods:

SurfacePattern.get_extend
SurfacePattern.set_extend

Other Changes: Threading for surfaces with stream functions has been reenabled. Documentation updates.

1.31 1.8.2 - 2009-01-15

Pycairo 1.8.0 resulted in crashes for some applications using threads. So upgrading to 1.8.2 is recommended for threaded applications.

Bug Fixes:

- #fdo-19287: Threading support results in crashes in cairo.ImageSurface

New Methods: Context.set_scaled_font

API Changes: Matrix multiplication:

```
old code: matrix3 = matrix1 * matrix2
new equivalent code: matrix3 = matrix1.multiply(matrix2)
matrix3 = matrix1 * matrix2
is now equivalent to matrix3 = matrix2.multiply(matrix1)
which is consistent with standard matrix multiplication.
```

1.32 1.8.0 - 2008-12-15

General Changes: Pycairo 1.8.0 requires cairo 1.8.0 (or later). Add documentation (available separately)

Bug Fixes:

- #fdo-18101: Add support for threading
- #fdo-18947: cairo.SurfacePattern should INCREF the used surface

New Methods:

ScaledFont.get_scale_matrix
Surface.mark_dirty_rectangle
Surface.set_fallback_resolution

New Constants:

cairo.EXTEND_PAD
cairo.HAS_IMAGE_SURFACE
cairo.HAS_USER_FONT

API Changes:

- Surface.mark_dirty: no longer accepts keyword arguments with default values.
- PycairoPattern_FromPattern (C API): has a new 'base' argument - to fix #fdo-18947.

Other Changes: Allow unknown cairo Pattern/Surface types to use the pycairo base Pattern/Surface type.

1.33 1.6.4 - 2008-08-18

General changes:

Pycairo 1.6.4 requires cairo 1.6.4 (or later). requires Python 2.5 (or later).

Bug fixes: #fdo-16112: Fix win32 'python setup.py ...' build – use double quotes

New Methods:

Context.has_current_point
Context.path_extents
ImageSurface.format_stride_for_width
PSSurface.get_eps
PSSurface.set_eps
PSSurface.ps_level_to_string
PSSurface.restrict_to_level
Surface.copy_page
Surface.show_page

New Constants: cairo.PS_LEVEL_2, cairo.PS_LEVEL_3

Other changes: test/pygame-test1.py, test/pygame-test2.py : pygame tests

examples/cairo_snippets/snippets/ellipse.py : Update so line-width is a constant width in device-space not user-space

1.34 1.4.12 - 2007-12-13

General changes: Pycairo 1.4.12 requires cairo 1.4.12 (or later). requires Python 2.4 (or later).

Bug fixes:

- #fdo-10006: update autogen.sh to support automake >= 1.10
- #fdo-13460: use python-config to get python includes

Other changes:

- allow cairo.Context to be subclassed
- create a 'doc' subdirectory and start a FAQ file

1.35 1.4.0 - 2007-03-14

General changes: Pycairo 1.4.0 requires cairo 1.4.0 (or later).

New methods:

Context.clip_extents
Context.copy_clip_rectangles
Context.get_dash
Context.get_dash_count
Context.get_scaled_font
Context.glyph_extents
Context.glyph_path
Context.show_glyphs
LinearGradient.get_linear_points
RadialGradient.get_radial_circles
SolidPattern.get_rgba
SurfacePattern.get_surface

Deleted methods: ImageSurface.create_for_array Remove Numeric Python support, since Numeric has been made obsolete by numpy, and numpy data can be read using ImageSurface.create_for_data.

Other changes: the module cairo.gtk has been removed (pygtk 2.7.0 onwards has cairo support built in).

1.36 1.2.6 - 2006-11-27

- Pycairo 1.2.6 requires cairo 1.2.6 (or later).
- mingw32 compiler fixes (Cedric Gustin)
- setup.py improvements (Cedric Gustin)

- ImageSurface.get_data() new method added ImageSurface.get_data_as_rgba() method removed

1.37 1.2.2 - 2006-08-21

- Pycairo requires cairo 1.2.2 (or later).
- setup.py has been updated to allow installation by executing $ python setup.py install
- examples/cairo_snippets/snippets/gradient_mask.py A new example to demonstrate pattern masks.
- The cairo.svg module has been removed because:
  1) Cairo does not include SVG parsing, so this module does not belong in pycairo.
  2) libsvg-cairo (the underlying C library) is unmaintained.

1.38 1.2.0 - 2006-07-03

General changes: Pycairo has been updated to work with cairo 1.2.0.

New methods:

Surface.set_fallback_resolution
Surface_get_content
ImageSurface_get_format
Image_surface_get_stride

Deleted methods:

PDFSurface.set_dpi, PSSurface.set_dpi, SVGSurface.set_dpi

- replaced by Surface.set_fallback_resolution

Other changes: cairo.FORMAT_RGB16_565 added

1.39 1.1.6 - 2006-05-29

General changes: Pycairo has been updated to work with cairo 1.1.6.

New objects: SVGSurface

New methods:

Context.get_group_target
Context.new_sub_path
Context.pop_group
Context.pop_group_to_source
Context.push_group
Context.push_group_with_content
FontOptions.get_antialias
FontOptions.get_hint_metrics
FontOptions.get_hint_style
FontOptions.get_subpixel_order
FontOptions.set_antialias

FontOptions.set_hint_metrics
FontOptions.set_hint_style
FontOptions.set_subpixel_order
PDFSurface.set_size
PSSurface.dsc_begin_page_setup
PSSurface.dsc_begin_setup
PSSurface.dsc_comment
PSSurface.set_size
ScaledFont.get_font_face
ScaledFont.text_extents
Surface.get_device_offset
XlibSurface.get_depth

Updated methods: PDFSurface()/PSSurface() - can now write to file-like objects (like StringIO).

surface.write_to_png() and ImageSurface.create_from_png() can now write to file-like objects (like StringIO).

select_font_face, show_text, text_extents and text_path now accept unicode objects.

Other changes: misc bug fixes.

New examples:

examples/cairo_snippets/snippets_svg.py
examples/cairo_snippets/snippets/ellipse.py
examples/cairo_snippets/snippets/group.py
examples/svg/svgconvert.py

1.40 1.0.2 - 2005-10-11

General changes: Pycairo has been updated to work with cairo 1.0.2.

New cairo functions supported: cairo.ImageSurface.create_for_data()

Updated functions: ctx.set_source_rgba (r, g, b, a=1.0) now supports a default alpha argument

Other changes: cairo.Matrix now supports the Python sequence protocol, so you can do: xx, yx, xy, yy, x0, y0 = matrix

1.41 1.0.0 - 2005-08-31

General changes: Pycairo has been updated to work with cairo 1.0.0.

New cairo functions supported:

cairo.cairo_version()
cairo.cairo_version_string()
PSSurface.set_dpi()

Patterns are now implemented in a class hierarchy, the new constructors are:

cairo.SolidPattern (r, g, b, a=1.0)
cairo.SurfacePattern (surface)
cairo.LinearGradient (x0, y0, x1, y1)

cairo.RadialGradient (cx0, cy0, radius0, cx1, cy1, radius1)

Updated functions: Surface.write_to_png() now accepts a file object as well as a filename

Updated examples: The gtk examples now work with pygtk >= 2.7.0 without requiring the cairo.gtk module

Bug Fixes: fix "initializer element is not constant" compiler warnings

1.42 0.9.0 - 2005-08-10

General changes: Pycairo has been updated to work with cairo 0.9.0.

New cairo functions supported:

cairo_get_antialias
cairo_set_antialias
cairo_surface_mark_dirty_rectangle
cairo_surface_flush

Bug Fixes:

- double buffering now works with the cairo.gtk module

1.43 0.6.0 - 2005-08-01

This version has many changes which update Pycairo to the new cairo API. The change list is not duplicated here, instead see the cairo/NEWS file for full details of all these API changes.

Pycairo method names that were different from the underlying cairo function names have been changed to make Pycairo more closely follow cairo and so enable the cairo documentation to be used for writing Pycairo programs. NOTES has been updated to list the differences between the C API and the Pycairo API.

Context.copy_path() has been implemented, it returns a Path instance which supports the iterator protocol.

Python 2.3 is now required.

New examples: examples/warpedtext.py: shows usage of the Path iterator

examples/cairo_snippets/: shows many of the 'cairo-demo/cairo_snippets' examples

examples/gtk/png_view.py: example using cairo.ImageSurface.create_from_png()

General changes: Pycairo has been updated to work with cairo 0.6.0, including using cairo's new error handling scheme.

New features: cairo.CONTENT_COLOR, cairo.ALPHA, cairo.COLOR_ALPHA have been added for working with surfaces.

A new class cairo.FontOptions has been added.

cairo.ImageSurface.create_from_png() now accepts a filename string or a file object

New wrapper functions have been added for cairo_get_font_options, cairo_set_font_options and cairo_surface_get_font_options.

1.44 0.5.1 - 2005-06-22

New features:

- new class cairo.Win32Surface (Niki Spahiev)
- cairo.HAS_WIN32_SURFACE, cairo.HAS_PS_SURFACE etc are defined to give access to the values from cairo-features.h

Fixes:

- fix cairo_mask, cairo_mask_surface and cairo_stroke_preserve wrappers
- compile properly against GTK+ 2.7 (Gustavo Carneiro)
- other small fixes, including fixes for gcc 4.0 warnings

1.45 0.4.0 - 2005-03-10

New cairo bindings:

cairo_font_extents

Bindings removed:

cairo_font_set_transform
cairo_font_current_transform

New examples: gtk/hangman.py

Other: Changed version numbering to correspond directly with the Cairo version Pycairo was developed to work with. So, for example, Pycairo version 0.4.0 represents the Pycairo version that has been developed and tested with Cairo 0.4.0.

1.46 0.1.4 - 2005-01-14

The Pycairo license has changed so that it is now dual-licensed under the LGPL and the MPL, the same as Cairo itself. For details see the COPYING file as well as COPYING-LGPL-2.1 and COPYING-MPL-1.1.

New cairo bindings:

cairo_pdf_surface_create
cairo_set_target_pdf

New libsvg-cairo bindings:

svg_cairo_parse
svg_cairo_parse_buffer
svg_cairo_render
svg_cairo_get_size

Other:

- Added –without-pygtk configure option.
- Renamed the Pycairo API _new() functions to _wrap() to allow _new() to
- be used for python __new__ functions.

- New examples: svg2png.py and svgview.py.

1.47 0.1.3 - 2004-11-24

After the recent server compromise we discarded all unsigned snapshots. That left us without a pycairo snapshot.

Additionally, there were no tags in the source repository so I couldn't recreate the 0.1.2 snapshot, so here's a new 0.1.3 snapshot.

I apologize if I botched the version number or left something significant out of this announcement—I'm not the one who will usually be doing pycairo maintenance.

New bindings:

current_path
current_path_flat
current_font_extents

Changes: fill_extents,stroke_extents: Remove unnecessary args and change from a method to an attribute.

Other: Added two new examples: context-subclass.py and warpedtext.py

CHAPTER 2

An Introduction to Cairo with Python

Cairo is a library for drawing vector graphics. Vector graphics are interesting because they don't lose clarity when resized or transformed.

Pycairo is a set of bindings for cairo. It provides the cairo module which can be used to call cairo commands from Python.

2.1 Integration with other Libraries

2.1.1 NumPy & ImageSurface

Creating an ImageSurface from a NumPy array:

```
import numpy
import cairo

width, height = 255, 255
data = numpy.ndarray(shape=(height, width), dtype=numpy.uint32)
surface = cairo.ImageSurface.create_for_data(
    data, cairo.FORMAT_ARGB32, width, height)
```

Creating a NumPy array from an ImageSurface:

```
import numpy
import cairo

width, height = 255, 255
surface = cairo.ImageSurface(cairo.FORMAT_ARGB32, width, height)
buf = surface.get_data()
data = numpy.ndarray(shape=(width, height),
                     dtype=numpy.uint32,
                     buffer=buf)
```

2.1.2 Pygame & ImageSurface

Creating a pygame.image from an ImageSurface:

```
import pygame
import cairo

width, height = 255, 255
surface = cairo.ImageSurface(cairo.FORMAT_ARGB32, width, height)
buf = surface.get_data()
image = pygame.image.frombuffer(buf, (width, height), "ARGB")
```

2.1.3 Pyglet & ImageSurface as Texture

Creating a pyglet.Texture from an ImageSurface

```
import ctypes
import cairo

from pyglet import app, clock, gl, image, window

# create data shared by ImageSurface and Texture
width, height = 400, 400

surface_data = (ctypes.c_ubyte * (width * height * 4))()
surface = cairo.ImageSurface.create_for_data (surface_data, cairo.FORMAT_ARGB32,
width, height, width * 4);
texture = image.Texture.create_for_size(gl.GL_TEXTURE_2D, width, height, gl.GL_
↪RGBA)
```

Draw pyglet.Texture bound to ImageSurface

```
window = window.Window(width=width, height=height)

@window.event
def on_draw():
    window.clear()

    # Draw texture backed by ImageSurface
    gl.glEnable(gl.GL_TEXTURE_2D)

    gl.glBindTexture(gl.GL_TEXTURE_2D, texture.id)
    gl.glTexImage2D(gl.GL_TEXTURE_2D, 0, gl.GL_RGBA, width, height, 0, gl.GL_BGRA,
    gl.GL_UNSIGNED_BYTE,
    surface_data)

    gl.glBegin(gl.GL_QUADS)
    gl.glTexCoord2f(0.0, 1.0)
    gl.glVertex2i(0, 0)
    gl.glTexCoord2f(1.0, 1.0)
    gl.glVertex2i(width, 0)
    gl.glTexCoord2f(1.0, 0.0)
    gl.glVertex2i(width, height)
    gl.glTexCoord2f(0.0, 0.0)
    gl.glVertex2i(0, height)
    gl.glEnd()
```

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```
# call clock.schedule_update here to update the ImageSurface every frame
app.run()
```

2.1.4 Pillow (PIL) & Cairo

Creating an ImageSurface from a PIL Image:

```
import PIL.Image as Image

def from_pil(im, alpha=1.0, format=cairo.FORMAT_ARGB32):
    """
    :param im: Pillow Image
    :param alpha: 0..1 alpha to add to non-alpha images
    :param format: Pixel format for output surface
    """
    assert format in (cairo.FORMAT_RGB24, cairo.FORMAT_ARGB32), "Unsupported␣
↪pixel format: %s" % format
    if 'A' not in im.getbands():
        im.putalpha(int(alpha * 256.))
    arr = bytearray(im.tobytes('raw', 'BGRa'))
    surface = cairo.ImageSurface.create_for_data(arr, format, im.width, im.height)
    return surface


filename = 'test.jpeg'

# Open image to an ARGB32 ImageSurface
im = Image.open(filename)
surface1 = from_pil(im)

# Open image to an RGB24 ImageSurface
im = Image.open(filename)
surface2 = from_pil(im, format=cairo.FORMAT_RGB24)

# Open image to an ARGB32 ImageSurface, 50% opacity
im = Image.open(filename)
surface3 = from_pil(im, alpha=0.5, format=cairo.FORMAT_ARGB32)
```

2.1.5 Freetype-py & Cairo

See https://github.com/rougier/freetype-py/tree/master/examples for examples. Most of the `*-cairo.py` examples illustrate conversion from FreeType bitmaps to Cairo surfaces; the two examples, `glyph-vector-cairo.py` and `glyph-vector-2-cairo.py`, illustrate conversion from FreeType glyph contours to Cairo paths.

2.2 Examples

The Git repository and release tarball contain various examples showing various features of cairo and integration with pygame and GTK+ in the "examples" directory:

https://github.com/pygobject/pycairo/tree/master/examples

2.3 Understanding How to use Cairo

The best way to understand how to use cairo is to imagine that you are an artist using a paintbrush to draw out a shape on canvas.

To begin, you can choose a few characteristics of your brush. You can choose the thickness of your brush and the colour you want to paint with. You can also choose the shape of your brush tip - You can choose either a circle or a square.

Once you have chosen your brush, you are ready to start painting. You have to be quite precise when describing what you want to appear.

Firstly, decide where you want to place your brush on the canvas. You do this by supplying an x & y coordinate. Next you define how you want your brush stroke to look - an arc, a straight line etc. Finally you define the point where you want your stoke to end, again by supplying an x & y coordinate. Triangles and squares are very easy to do!

More complex graphics are generated using variations of the above theme with a few additions such as Fills (colouring in), transformations (zooming in, moving) etc. Using the Python interface to cairo

Nearly all the work revolves around using the *cairo.Context* (or `cairo_t` in the cairo C API). This is the object that you send your drawing commands to. There are a few options available to initialize this object in different ways.

2.4 Initializing the cairo.Context Object

- One Very Important thing to realize is there is a difference between the coordinates you are describing your graphics on and the coordinates you will be displaying your graphic on.

  (Ex - When giving a presentation you draw on your transparent acetate before hand, and then display it on your overhead projector - cairo calls the transparent acetate the user space coordinates and the projected image the device space coordinates)

  On initializing the cairo context object, we tell it how to transform our description to how it should be displayed. To do this we supply a transformation matrix. Modifying the transformation matrix can lead to some very interesting results.

- One of cairo's most powerful features is that it can output graphics in many different formats (it can use multiple back ends). For printing, we can have cairo translate our graphics into Postscript to be sent off to the printer. For on screen display, we can have cairo translate our graphics into something glitz can understand for hardware accelerated rendering! It has many more important and useful target back ends. On initializing the *cairo.Context*, we set its target back end, supplying a few details (such as colour depth and size), as in the example below.

2.5 Example

```
#!/usr/bin/env python

import math
import cairo

WIDTH, HEIGHT = 256, 256

surface = cairo.ImageSurface(cairo.FORMAT_ARGB32, WIDTH, HEIGHT)
ctx = cairo.Context(surface)
```

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```
ctx.scale(WIDTH, HEIGHT)  # Normalizing the canvas

pat = cairo.LinearGradient(0.0, 0.0, 0.0, 1.0)
pat.add_color_stop_rgba(1, 0.7, 0, 0, 0.5)  # First stop, 50% opacity
pat.add_color_stop_rgba(0, 0.9, 0.7, 0.2, 1)  # Last stop, 100% opacity

ctx.rectangle(0, 0, 1, 1)  # Rectangle(x0, y0, x1, y1)
ctx.set_source(pat)
ctx.fill()

ctx.translate(0.1, 0.1)  # Changing the current transformation matrix

ctx.move_to(0, 0)
# Arc(cx, cy, radius, start_angle, stop_angle)
ctx.arc(0.2, 0.1, 0.1, -math.pi / 2, 0)
ctx.line_to(0.5, 0.1)  # Line to (x,y)
# Curve(x1, y1, x2, y2, x3, y3)
ctx.curve_to(0.5, 0.2, 0.5, 0.4, 0.2, 0.8)
ctx.close_path()

ctx.set_source_rgb(0.3, 0.2, 0.5)  # Solid color
ctx.set_line_width(0.02)
ctx.stroke()

surface.write_to_png("example.png")  # Output to PNG
```

CHAPTER 3

API Reference

3.1 Module Functions and Constants

3.1.1 Module Functions

cairo.**cairo_version**()

Returns the encoded version

Return type int

Returns the version of the underlying C cairo library, encoded in a single integer.

cairo.**cairo_version_string**()

Returns the encoded version

Return type str

Returns the version of the underlying C cairo library as a human-readable string of the form "X.Y.Z".

cairo.**get_include**()

Returns a path to the directory containing the C header files

Return type str

Gives the include path which should be passed to the compiler.

New in version 1.16.0.

3.1.2 Module Constants

cairo.**version**
the pycairo version, as a string

cairo.**version_info**
the pycairo version, as a tuple

cairo.**CAIRO_VERSION**
The version of cairo available at compile-time in the same format as returned by *cairo_version()*

New in version 1.18.0.

cairo.**CAIRO_VERSION_STRING**
A human-readable string literal containing the version of cairo available at compile-time, in the form of "X.Y.Z".

New in version 1.18.0.

cairo.**CAIRO_VERSION_MAJOR**
The major component of the version of cairo available at compile-time.

New in version 1.18.0.

cairo.**CAIRO_VERSION_MINOR**
The minor component of the version of cairo available at compile-time.

New in version 1.18.0.

cairo.**CAIRO_VERSION_MICRO**
The micro component of the version of cairo available at compile-time.

New in version 1.18.0.

cairo.HAS

1 if the feature is present in the underlying C cairo library, 0 otherwise.

cairo.**HAS_ATSUI_FONT**
cairo.**HAS_FT_FONT**
cairo.**HAS_GLITZ_SURFACE**
cairo.**HAS_IMAGE_SURFACE**
cairo.**HAS_PDF_SURFACE**
cairo.**HAS_PNG_FUNCTIONS**
cairo.**HAS_PS_SURFACE**
cairo.**HAS_RECORDING_SURFACE**
cairo.**HAS_SVG_SURFACE**
cairo.**HAS_USER_FONT**
cairo.**HAS_QUARTZ_SURFACE**
cairo.**HAS_WIN32_FONT**
cairo.**HAS_WIN32_SURFACE**
cairo.**HAS_XCB_SURFACE**
cairo.**HAS_XLIB_SURFACE**

cairo.**HAS_MIME_SURFACE**
New in version 1.12.0.

cairo.**HAS_SCRIPT_SURFACE**
New in version 1.12.0.

cairo.**HAS_TEE_SURFACE**
New in version 1.15.3.

cairo.TAG

cairo.**TAG_DEST = "cairo.dest"**
Create a destination for a hyperlink. Destination tag attributes are detailed at Destinations.

New in version 1.18.0: Only available with cairo 1.15.10+

cairo.**TAG_LINK = "Link"**
Create hyperlink. Link tag attributes are detailed at Links.

New in version 1.18.0: Only available with cairo 1.15.10+

cairo.MIME_TYPE

cairo.**MIME_TYPE_JP2 = "image/jp2"**
The Joint Photographic Experts Group (JPEG) 2000 image coding standard (ISO/IEC 15444-1).

New in version 1.12.0.

cairo.**MIME_TYPE_JPEG = "image/jpeg"**
The Joint Photographic Experts Group (JPEG) image coding standard (ISO/IEC 10918-1).

New in version 1.12.0.

cairo.**MIME_TYPE_PNG = "image/png"**
The Portable Network Graphics image file format (ISO/IEC 15948).

New in version 1.12.0.

cairo.**MIME_TYPE_URI = "text/x-uri"**
URI for an image file (unofficial MIME type).

New in version 1.12.0.

cairo.**MIME_TYPE_UNIQUE_ID = "application/x-cairo.uuid"**
Unique identifier for a surface (cairo specific MIME type). All surfaces with the same unique identifier will only be embedded once.

New in version 1.12.0.

cairo.**MIME_TYPE_CCITT_FAX = "image/g3fax"**
Group 3 or Group 4 CCITT facsimile encoding (International Telecommunication Union, Recommendations T.4 and T.6.)

New in version 1.18.0: Only available with cairo 1.15.10+

cairo.**MIME_TYPE_CCITT_FAX_PARAMS = "application/x-cairo.ccitt.params"**
Decode parameters for Group 3 or Group 4 CCITT facsimile encoding. See CCITT Fax Images.

New in version 1.18.0: Only available with cairo 1.15.10+

cairo.**MIME_TYPE_EPS = "application/postscript"**
Encapsulated PostScript file. Encapsulated PostScript File Format Specification

New in version 1.18.0: Only available with cairo 1.15.10+

cairo.**MIME_TYPE_EPS_PARAMS = "application/x-cairo.eps.params"**
Embedding parameters Encapsulated PostScript data. See Embedding EPS files.

New in version 1.18.0: Only available with cairo 1.15.10+

cairo.**MIME_TYPE_JBIG2 = "application/x-cairo.jbig2"**
Joint Bi-level Image Experts Group image coding standard (ISO/IEC 11544).

New in version 1.18.0.

cairo.**MIME_TYPE_JBIG2_GLOBAL = "application/x-cairo.jbig2-global"**
Joint Bi-level Image Experts Group image coding standard (ISO/IEC 11544) global segment.

New in version 1.18.0.

cairo.**MIME_TYPE_JBIG2_GLOBAL_ID = "application/x-cairo.jbig2-global-id"**
An unique identifier shared by a JBIG2 global segment and all JBIG2 images that depend on the global segment.

New in version 1.18.0.

Other Constants

cairo.**PDF_OUTLINE_ROOT = 0**
The root outline item in *PDFSurface.add_outline()*

New in version 1.18.0: Only available with cairo 1.15.10+

3.1.3 Other Classes and Functions

class cairo.**text**
This type only exists for documentation purposes. It represents `str`/`unicode` under Python 2 and `str` under Python 3.

class cairo.**pathlike**
This type only exists for documentation purposes.

On Unix it is equal to what Python allows as a filesystem path. On Windows with cairo <=1.15.8 only ANSI paths are supported. With cairo >=1.15.10 all paths are supported as long as they don't contain surrogates.

Many functions taking a path also allow passing in an already open Python file object. This can be used to support all Python filesystem paths independent of the underlying platform or cairo version.

New in version 1.15.1: Older versions only supported a subset of `str` paths

3.2 Enums

Before Pycairo 1.13 most of the enum values defined here where only available as constants on the module level. See *Legacy Constants*.

class cairo.**Antialias**
Specifies the type of antialiasing to do when rendering text or shapes.

New in version 1.13.

DEFAULT
Use the default antialiasing for the subsystem and target device

NONE
Use a bilevel alpha mask

GRAY
Perform single-color antialiasing (using shades of gray for black text on a white background, for example).

SUBPIXEL
Perform antialiasing by taking advantage of the order of subpixel elements on devices such as LCD panels.

FAST
Hint that the backend should perform some antialiasing but prefer speed over quality.

GOOD
The backend should balance quality against performance.

BEST
Hint that the backend should render at the highest quality, sacrificing speed if necessary.

class cairo.**Content**
These constants are used to describe the content that a *Surface* will contain, whether color information, alpha information (translucence vs. opacity), or both.

New in version 1.13.

COLOR
The surface will hold color content only.

ALPHA
The surface will hold alpha content only.

COLOR_ALPHA
The surface will hold color and alpha content.

class cairo.**Extend**
These constants are used to describe how *Pattern* color/alpha will be determined for areas "outside" the pattern's natural area, (for example, outside the surface bounds or outside the gradient geometry).

The default extend mode is *NONE* for *SurfacePattern* and *PAD* for *Gradient* patterns.

New in version 1.13.

NONE
pixels outside of the source pattern are fully transparent

REPEAT
the pattern is tiled by repeating

REFLECT
the pattern is tiled by reflecting at the edges (Implemented for surface patterns since 1.6)

PAD
pixels outside of the pattern copy the closest pixel from the source (Since 1.2; but only implemented for surface patterns since 1.6)

class cairo.**FillRule**
These constants are used to select how paths are filled. For both fill rules, whether or not a point is included in the fill is determined by taking a ray from that point to infinity and looking at intersections with the path. The ray can be in any direction, as long as it doesn't pass through the end point of a segment or have a tricky intersection such as intersecting tangent to the path. (Note that filling is not actually implemented in this way. This is just a description of the rule that is applied.)

The default fill rule is *WINDING*.

New in version 1.13.

WINDING
If the path crosses the ray from left-to-right, counts +1. If the path crosses the ray from right to left, counts -1. (Left and right are determined from the perspective of looking along the ray from the starting point.) If the total count is non-zero, the point will be filled.

EVEN_ODD
Counts the total number of intersections, without regard to the orientation of the contour. If the total number of intersections is odd, the point will be filled.

class cairo.**Filter**
These constants are used to indicate what filtering should be applied when reading pixel values from patterns. See *Pattern.set_filter()* for indicating the desired filter to be used with a particular pattern.

New in version 1.13.

FAST
A high-performance filter, with quality similar *FILTER_NEAREST*

GOOD
A reasonable-performance filter, with quality similar to *FILTER_BILINEAR*

BEST
The highest-quality available, performance may not be suitable for interactive use.

NEAREST
Nearest-neighbor filtering

BILINEAR
Linear interpolation in two dimensions

GAUSSIAN
This filter value is currently unimplemented, and should not be used in current code.

class cairo.**FontSlant**
These constants specify variants of a *FontFace* based on their slant.

New in version 1.13.

NORMAL
Upright font style

ITALIC
Italic font style

OBLIQUE
Oblique font style

class cairo.**FontWeight**
These constants specify variants of a *FontFace* based on their weight.

New in version 1.13.

NORMAL
Normal font weight

BOLD
Bold font weight

class cairo.**Format**
These constants are used to identify the memory format of *ImageSurface* data.

New entries may be added in future versions.

New in version 1.13.

stride_for_width(*width*)

Parameters **width** (*int*) – the desired width of an *ImageSurface* to be created.

Returns the appropriate stride to use given the desired format and width, or -1 if either the format is invalid or the width too large.

Return type int

This method provides a stride value that will respect all alignment requirements of the accelerated image-rendering code within cairo. Typical usage will be of the form:

```
format = cairo.Format.RGB24
stride = format.stride_for_width(width)
surface = cairo.ImageSurface.create_for_data(
    data, format, width, height, stride)
```

Also available under *cairo.ImageSurface.format_stride_for_width()*.

New in version 1.14.

INVALID
no such format exists or is supported.

ARGB32
each pixel is a 32-bit quantity, with alpha in the upper 8 bits, then red, then green, then blue. The 32-bit quantities are stored native-endian. Pre-multiplied alpha is used. (That is, 50% transparent red is 0x80800000, not 0x80ff0000.)

RGB24
each pixel is a 32-bit quantity, with the upper 8 bits unused. Red, Green, and Blue are stored in the remaining 24 bits in that order.

A8
each pixel is a 8-bit quantity holding an alpha value.

A1
each pixel is a 1-bit quantity holding an alpha value. Pixels are packed together into 32-bit quantities. The ordering of the bits matches the endianess of the platform. On a big-endian machine, the first pixel is in the uppermost bit, on a little-endian machine the first pixel is in the least-significant bit.

RGB16_565
each pixel is a 16-bit quantity with red in the upper 5 bits, then green in the middle 6 bits, and blue in the lower 5 bits.

RGB30
like *RGB24* but with 10bpc.

class cairo.**HintMetrics**
These constants specify whether to hint font metrics; hinting font metrics means quantizing them so that they are integer values in device space. Doing this improves the consistency of letter and line spacing, however it also means that text will be laid out differently at different zoom factors.

New in version 1.13.

DEFAULT
Hint metrics in the default manner for the font backend and target device

OFF
Do not hint font metrics

ON
Hint font metrics

class cairo.**HintStyle**
These constants specify the type of hinting to do on font outlines. Hinting is the process of fitting outlines to the pixel grid in order to improve the appearance of the result. Since hinting outlines involves distorting them, it also reduces the faithfulness to the original outline shapes. Not all of the outline hinting styles are supported by all font backends.

New entries may be added in future versions.

New in version 1.13.

DEFAULT
Use the default hint style for font backend and target device

NONE
Do not hint outlines

SLIGHT
Hint outlines slightly to improve contrast while retaining good fidelity to the original shapes.

MEDIUM
Hint outlines with medium strength giving a compromise between fidelity to the original shapes and contrast

FULL
Hint outlines to maximize contrast

class cairo.**LineCap**
These constants specify how to render the endpoints of the path when stroking.

The default line cap style is *BUTT*

New in version 1.13.

BUTT
start(stop) the line exactly at the start(end) point

ROUND
use a round ending, the center of the circle is the end point

SQUARE
use squared ending, the center of the square is the end point

class cairo.**LineJoin**
These constants specify how to render the junction of two lines when stroking.

The default line join style is *MITER*

New in version 1.13.

MITER
use a sharp (angled) corner, see *Context.set_miter_limit()*

ROUND
use a rounded join, the center of the circle is the joint point

BEVEL
use a cut-off join, the join is cut off at half the line width from the joint point

class cairo.**Operator**
These constants are used to set the compositing operator for all cairo drawing operations.

The default operator is *OVER*.

The operators marked as *unbounded* modify their destination even outside of the mask layer (that is, their effect is not bound by the mask layer). However, their effect can still be limited by way of clipping.

To keep things simple, the operator descriptions here document the behavior for when both source and destination are either fully transparent or fully opaque. The actual implementation works for translucent layers too.

For a more detailed explanation of the effects of each operator, including the mathematical definitions, see https://cairographics.org/operators.

New in version 1.13.

CLEAR
clear destination layer (bounded)

SOURCE
replace destination layer (bounded)

OVER
draw source layer on top of destination layer (bounded)

IN
draw source where there was destination content (unbounded)

OUT
draw source where there was no destination content (unbounded)

ATOP
draw source on top of destination content and only there

DEST
ignore the source

DEST_OVER
draw destination on top of source

DEST_IN
leave destination only where there was source content (unbounded)

DEST_OUT
leave destination only where there was no source content

DEST_ATOP
leave destination on top of source content and only there (unbounded)

XOR
source and destination are shown where there is only one of them

ADD
source and destination layers are accumulated

SATURATE
like over, but assuming source and dest are disjoint geometries

MULTIPLY
source and destination layers are multiplied. This causes the result to be at least as dark as the darker inputs.

SCREEN
source and destination are complemented and multiplied. This causes the result to be at least as light as the lighter inputs.

OVERLAY
multiplies or screens, depending on the lightness of the destination color.

DARKEN
replaces the destination with the source if it is darker, otherwise keeps the source.

LIGHTEN
replaces the destination with the source if it is lighter, otherwise keeps the source.

COLOR_DODGE
brightens the destination color to reflect the source color.

COLOR_BURN
darkens the destination color to reflect the source color.

HARD_LIGHT
Multiplies or screens, dependent on source color.

SOFT_LIGHT
Darkens or lightens, dependent on source color.

DIFFERENCE
Takes the difference of the source and destination color.

EXCLUSION
Produces an effect similar to difference, but with lower contrast.

HSL_HUE
Creates a color with the hue of the source and the saturation and luminosity of the target.

HSL_SATURATION
Creates a color with the saturation of the source and the hue and luminosity of the target. Painting with this mode onto a gray area produces no change.

HSL_COLOR
Creates a color with the hue and saturation of the source and the luminosity of the target. This preserves the gray levels of the target and is useful for coloring monochrome images or tinting color images.

HSL_LUMINOSITY
Creates a color with the luminosity of the source and the hue and saturation of the target. This produces an inverse effect to *HSL_COLOR*

class cairo.**PathDataType**
These constants are used to describe the type of one portion of a path when represented as a *Path*.

New in version 1.13.

MOVE_TO
A move-to operation

LINE_TO
A line-to operation

CURVE_TO
A curve-to operation

CLOSE_PATH
A close-path operation

class cairo.**PSLevel**
These constants are used to describe the language level of the PostScript Language Reference that a generated PostScript file will conform to. Note: the constants are only defined when cairo has been compiled with PS support enabled.

New in version 1.13.

LEVEL_2
The language level 2 of the PostScript specification.

LEVEL_3
The language level 3 of the PostScript specification.

class cairo.**PDFVersion**
These constants are used to describe the version number of the PDF specification that a generated PDF file will conform to.

New in version 1.13.

VERSION_1_4
The version 1.4 of the PDF specification.

VERSION_1_5
The version 1.5 of the PDF specification.

class cairo.**SVGVersion**
These constants are used to describe the version number of the SVG specification that a generated SVG file will conform to.

New in version 1.13.

VERSION_1_1
The version 1.1 of the SVG specification.

VERSION_1_2
The version 1.2 of the SVG specification.

class cairo.**SubpixelOrder**
The subpixel order specifies the order of color elements within each pixel on the display device when rendering with an antialiasing mode of *Antialias.SUBPIXEL*.

New in version 1.13.

DEFAULT
Use the default subpixel order for for the target device

RGB
Subpixel elements are arranged horizontally with red at the left

BGR
Subpixel elements are arranged horizontally with blue at the left

VRGB
Subpixel elements are arranged vertically with red at the top

VBGR
Subpixel elements are arranged vertically with blue at the top

class cairo.**RegionOverlap**
New in version 1.13.

IN
The contents are entirely inside the region.

OUT
The contents are entirely outside the region.

PART
The contents are partially inside and partially outside the region.

class cairo.**Status**
New in version 1.13.

SUCCESS
NO_MEMORY
INVALID_RESTORE
INVALID_POP_GROUP
NO_CURRENT_POINT
INVALID_MATRIX
INVALID_STATUS
NULL_POINTER
INVALID_STRING

INVALID_PATH_DATA
READ_ERROR
WRITE_ERROR
SURFACE_FINISHED
SURFACE_TYPE_MISMATCH
PATTERN_TYPE_MISMATCH
INVALID_CONTENT
INVALID_FORMAT
INVALID_VISUAL
FILE_NOT_FOUND
INVALID_DASH
INVALID_DSC_COMMENT
INVALID_INDEX
CLIP_NOT_REPRESENTABLE
TEMP_FILE_ERROR
INVALID_STRIDE
FONT_TYPE_MISMATCH
USER_FONT_IMMUTABLE
USER_FONT_ERROR
NEGATIVE_COUNT
INVALID_CLUSTERS
INVALID_SLANT
INVALID_WEIGHT
INVALID_SIZE
USER_FONT_NOT_IMPLEMENTED
DEVICE_TYPE_MISMATCH
DEVICE_ERROR
INVALID_MESH_CONSTRUCTION
DEVICE_FINISHED
LAST_STATUS

JBIG2_GLOBAL_MISSING
New in version 1.14.

TAG_ERROR
New in version 1.18.0: Only available with cairo 1.15.10+

FREETYPE_ERROR
New in version 1.18.0: Only available with cairo 1.15.10+

WIN32_GDI_ERROR
New in version 1.18.0: Only available with cairo 1.15.10+

PNG_ERROR
New in version 1.18.0: Only available with cairo 1.15.10+

class cairo.**ScriptMode**
A set of script output variants.

New in version 1.14.

ASCII
the output will be in readable text (default)

BINARY
the output will use byte codes.

class cairo.**TextClusterFlags**
Specifies properties of a text cluster mapping.

New in version 1.14.

BACKWARD
The clusters in the cluster array map to glyphs in the glyph array from end to start.

class cairo.**SurfaceObserverMode**
Whether operations should be recorded.

New in version 1.14.

NORMAL
no recording is done

RECORD_OPERATIONS
operations are recorded

class cairo.**PDFOutlineFlags**
PDFOutlineFlags is used by the *PDFSurface.add_outline()* method to specify the attributes of an outline item. These flags may be bitwise-or'd to produce any combination of flags.

New in version 1.18.0: Only available with cairo 1.15.10+

OPEN
The outline item defaults to open in the PDF viewer

BOLD
The outline item is displayed by the viewer in bold text

ITALIC
The outline item is displayed by the viewer in italic text

class cairo.**SVGUnit**
SVGUnit is used to describe the units valid for coordinates and lengths in the SVG specification.

See also:

- https://www.w3.org/TR/SVG/coords.htmlUnits
- https://www.w3.org/TR/SVG/types.htmlDataTypeLength
- https://www.w3.org/TR/css-values-3/lengths

New in version 1.18.0: Only available with cairo 1.15.10+

USER
User unit, a value in the current coordinate system. If used in the root element for the initial coordinate systems it corresponds to pixels.

EM
The size of the element's font.

EX
The x-height of the element's font.

PX
Pixels (1px = 1/96th of 1in).

IN
Inches (1in = 2.54cm = 96px)

CM
Centimeters (1cm = 96px/2.54).

MM
Millimeters (1mm = 1/10th of 1cm).

PT
Points (1pt = 1/72th of 1in).

PC
Picas (1pc = 1/6th of 1in).

PERCENT
Percent, a value that is some fraction of another reference value.

class cairo.**PDFMetadata**
PDFMetadata is used by the *PDFSurface.set_metadata()* method to specify the metadata to set.

New in version 1.18.0: Only available with cairo 1.15.10+

TITLE
The document title

AUTHOR
The document author

SUBJECT
The document subject

KEYWORDS
The document keywords

CREATOR
The document creator

CREATE_DATE
The document creation date

MOD_DATE
The document modification date

3.3 Cairo Context

3.3.1 class Context()

Context is the main object used when drawing with cairo. To draw with cairo, you create a *Context*, set the target surface, and drawing options for the *Context*, create shapes with functions like *Context.move_to()* and *Context.line_to()*, and then draw shapes with *Context.stroke()* or *Context.fill()*.

Contexts can be pushed to a stack via *Context.save()*. They may then safely be changed, without losing the current state. Use *Context.restore()* to restore to the saved state.

class cairo.**Context**(*target*)

Parameters **target** – target *Surface* for the context

Returns a newly allocated *Context*

Raises *MemoryError* in case of no memory

Creates a new *Context* with all graphics state parameters set to default values and with *target* as a target surface. The target surface should be constructed with a backend-specific function such as *ImageSurface* (or any other cairo backend surface create variant).

append_path(*path*)

Parameters **path** – *Path* to be appended

Append the *path* onto the current path. The *path* may be either the return value from one of *Context.copy_path()* or *Context.copy_path_flat()* or it may be constructed manually (in C).

arc (*xc*, *yc*, *radius*, *angle1*, *angle2*)

Parameters

- **xc** (*float*) – X position of the center of the arc
- **yc** (*float*) – Y position of the center of the arc
- **radius** (*float*) – the radius of the arc
- **angle1** (*float*) – the start angle, in radians
- **angle2** (*float*) – the end angle, in radians

Adds a circular arc of the given *radius* to the current path. The arc is centered at (*xc, yc*), begins at *angle1* and proceeds in the direction of increasing angles to end at *angle2*. If *angle2* is less than *angle1* it will be progressively increased by 2*PI until it is greater than *angle1*.

If there is a current point, an initial line segment will be added to the path to connect the current point to the beginning of the arc. If this initial line is undesired, it can be avoided by calling *Context.new_sub_path()* before calling *Context.arc()*.

Angles are measured in radians. An angle of 0.0 is in the direction of the positive X axis (in user space). An angle of PI/2.0 radians (90 degrees) is in the direction of the positive Y axis (in user space). Angles increase in the direction from the positive X axis toward the positive Y axis. So with the default transformation matrix, angles increase in a clockwise direction.

To convert from degrees to radians, use `degrees * (math.pi / 180)`.

This function gives the arc in the direction of increasing angles; see *Context.arc_negative()* to get the arc in the direction of decreasing angles.

The arc is circular in user space. To achieve an elliptical arc, you can scale the current transformation matrix by different amounts in the X and Y directions. For example, to draw an ellipse in the box given by *x, y, width, height*:

```
ctx.save()
ctx.translate(x + width / 2., y + height / 2.)
ctx.scale(width / 2., height / 2.)
ctx.arc(0., 0., 1., 0., 2 * math.pi)
ctx.restore()
```

arc_negative (*xc*, *yc*, *radius*, *angle1*, *angle2*)

Parameters

- **xc** (*float*) – X position of the center of the arc
- **yc** (*float*) – Y position of the center of the arc
- **radius** (*float*) – the radius of the arc
- **angle1** (*float*) – the start angle, in radians
- **angle2** (*float*) – the end angle, in radians

Adds a circular arc of the given *radius* to the current path. The arc is centered at (*xc, yc*), begins at *angle1* and proceeds in the direction of decreasing angles to end at *angle2*. If *angle2* is greater than *angle1* it will be progressively decreased by 2*PI until it is less than *angle1*.

See *Context.arc()* for more details. This function differs only in the direction of the arc between the two angles.

clip()
Establishes a new clip region by intersecting the current clip region with the current path as it would be filled by *Context.fill()* and according to the current *fill rule* (see *Context.set_fill_rule()*).

After *clip()*, the current path will be cleared from the *Context*.

The current clip region affects all drawing operations by effectively masking out any changes to the surface that are outside the current clip region.

Calling *clip()* can only make the clip region smaller, never larger. But the current clip is part of the graphics state, so a temporary restriction of the clip region can be achieved by calling *clip()* within a *Context.save()*/*Context.restore()* pair. The only other means of increasing the size of the clip region is *Context.reset_clip()*.

clip_extents()

Returns (x1, y1, x2, y2), all float

Return type tuple

- *x1*: left of the resulting extents
- *y1*: top of the resulting extents
- *x2*: right of the resulting extents
- *y2*: bottom of the resulting extents

Computes a bounding box in user coordinates covering the area inside the current clip.

New in version 1.4.

clip_preserve()
Establishes a new clip region by intersecting the current clip region with the current path as it would be filled by *Context.fill()* and according to the current *fill rule* (see *Context.set_fill_rule()*).

Unlike *Context.clip()*, *clip_preserve()* preserves the path within the *Context*.

The current clip region affects all drawing operations by effectively masking out any changes to the surface that are outside the current clip region.

Calling *clip_preserve()* can only make the clip region smaller, never larger. But the current clip is part of the graphics state, so a temporary restriction of the clip region can be achieved by calling *clip_preserve()* within a *Context.save()*/*Context.restore()* pair. The only other means of increasing the size of the clip region is *Context.reset_clip()*.

close_path()
Adds a line segment to the path from the current point to the beginning of the current sub-path, (the most recent point passed to *Context.move_to()*), and closes this sub-path. After this call the current point will be at the joined endpoint of the sub-path.

The behavior of *close_path()* is distinct from simply calling *Context.line_to()* with the equivalent coordinate in the case of stroking. When a closed sub-path is stroked, there are no caps on the ends of the sub-path. Instead, there is a line join connecting the final and initial segments of the sub-path.

If there is no current point before the call to *close_path()*, this function will have no effect.

Note: As of cairo version 1.2.4 any call to *close_path()* will place an explicit MOVE_TO element into the path immediately after the CLOSE_PATH element, (which can be seen in *Context.copy_path()* for example). This can simplify path processing in some cases as it may not be necessary to save the "last

move_to point" during processing as the MOVE_TO immediately after the CLOSE_PATH will provide that point.

copy_clip_rectangle_list()

Returns the current clip region as a list of rectangles in user coordinates. Returns a list of *Rectangle*

Return type list

New in version 1.4.

copy_page()

Emits the current page for backends that support multiple pages, but doesn't clear it, so, the contents of the current page will be retained for the next page too. Use *Context.show_page()* if you want to get an empty page after the emission.

This is a convenience function that simply calls *Surface.copy_page()* on *Context's* target.

copy_path()

Returns *Path*

Raises *MemoryError* in case of no memory

Creates a copy of the current path and returns it to the user as a *Path*.

copy_path_flat()

Returns *Path*

Raises *MemoryError* in case of no memory

Gets a flattened copy of the current path and returns it to the user as a *Path*.

This function is like *Context.copy_path()* except that any curves in the path will be approximated with piecewise-linear approximations, (accurate to within the current tolerance value). That is, the result is guaranteed to not have any elements of type CAIRO_PATH_CURVE_TO which will instead be replaced by a series of CAIRO_PATH_LINE_TO elements.

curve_to(*x1*, *y1*, *x2*, *y2*, *x3*, *y3*)

Parameters

- **x1** (*float*) – the X coordinate of the first control point
- **y1** (*float*) – the Y coordinate of the first control point
- **x2** (*float*) – the X coordinate of the second control point
- **y2** (*float*) – the Y coordinate of the second control point
- **x3** (*float*) – the X coordinate of the end of the curve
- **y3** (*float*) – the Y coordinate of the end of the curve

Adds a cubic Bézier spline to the path from the current point to position *(x3, y3)* in user-space coordinates, using *(x1, y1)* and *(x2, y2)* as the control points. After this call the current point will be *(x3, y3)*.

If there is no current point before the call to *curve_to()* this function will behave as if preceded by a call to `ctx.move_to(x1, y1)`.

device_to_user(*x*, *y*)

Parameters

- **x** (*float*) – X value of coordinate

- **y** (*float*) – Y value of coordinate

Returns (x, y), both float

Return type tuple

Transform a coordinate from device space to user space by multiplying the given point by the inverse of the current transformation matrix (CTM).

device_to_user_distance(*dx*, *dy*)

Parameters

- **dx** (*float*) – X component of a distance vector
- **dy** (*float*) – Y component of a distance vector

Returns (dx, dy), both float

Return type tuple

Transform a distance vector from device space to user space. This function is similar to *Context.device_to_user()* except that the translation components of the inverse CTM will be ignored when transforming *(dx,dy)*.

fill()

A drawing operator that fills the current path according to the current *fill rule*, (each sub-path is implicitly closed before being filled). After *fill()*, the current path will be cleared from the *Context*. See *Context.set_fill_rule()* and *Context.fill_preserve()*.

fill_extents()

Returns (x1, y1, x2, y2), all float

Return type tuple

- *x1*: left of the resulting extents
- *y1*: top of the resulting extents
- *x2*: right of the resulting extents
- *y2*: bottom of the resulting extents

Computes a bounding box in user coordinates covering the area that would be affected, (the "inked" area), by a *Context.fill()* operation given the current path and fill parameters. If the current path is empty, returns an empty rectangle (0,0,0,0). Surface dimensions and clipping are not taken into account.

Contrast with *Context.path_extents()*, which is similar, but returns non-zero extents for some paths with no inked area, (such as a simple line segment).

Note that *fill_extents()* must necessarily do more work to compute the precise inked areas in light of the fill rule, so *Context.path_extents()* may be more desirable for sake of performance if the non-inked path extents are desired.

See *Context.fill()*, *Context.set_fill_rule()* and *Context.fill_preserve()*.

fill_preserve()

A drawing operator that fills the current path according to the current *fill rule*, (each sub-path is implicitly closed before being filled). Unlike *Context.fill()*, *fill_preserve()* preserves the path within the *Context*.

See *Context.set_fill_rule()* and *Context.fill()*.

font_extents()

Returns (ascent, descent, height, max_x_advance, max_y_advance), all float

Return type tuple

Gets the font extents for the currently selected font.

get_antialias()

Returns the current antialias mode, as set by *Context.set_antialias()*.

Return type *cairo.Antialias*

get_current_point()

Returns (x, y), both float

Return type tuple

- *x*: X coordinate of the current point
- *y*: Y coordinate of the current point

Gets the current point of the current path, which is conceptually the final point reached by the path so far.

The current point is returned in the user-space coordinate system. If there is no defined current point or if *Context* is in an error status, *x* and *y* will both be set to 0.0. It is possible to check this in advance with *Context.has_current_point()*.

Most path construction functions alter the current point. See the following for details on how they affect the current point: *Context.new_path()*, *Context.new_sub_path()*, *Context.append_path()*, *Context.close_path()*, *Context.move_to()*, *Context.line_to()*, *Context.curve_to()*, *Context.rel_move_to()*, *Context.rel_line_to()*, *Context.rel_curve_to()*, *Context.arc()*, *Context.arc_negative()*, *Context.rectangle()*, *Context.text_path()*, *Context.glyph_path()*, *Context.stroke_to_path()*.

Some functions use and alter the current point but do not otherwise change current path: *Context.show_text()*.

Some functions unset the current path and as a result, current point: *Context.fill()*, *Context.stroke()*.

get_dash()

Returns (dashes, offset)

Return type tuple

- *dashes*: return value as a tuple for the dash array
- *offset*: return value as float for the current dash offset

Gets the current dash array.

New in version 1.4.

get_dash_count()

Returns the length of the dash array, or 0 if no dash array set.

Return type int

See also *Context.set_dash()* and *Context.get_dash()*.

New in version 1.4.

get_fill_rule()

Returns the current fill rule, as set by *Context.set_fill_rule()*.

Return type *cairo.FillRule*

get_font_face()

Returns the current *FontFace* for the *Context*.

get_font_matrix()

Returns the current *Matrix* for the *Context*.

See *Context.set_font_matrix()*.

get_font_options()

Returns the current *FontOptions* for the *Context*.

Retrieves font rendering options set via *Context.set_font_options()*. Note that the returned options do not include any options derived from the underlying surface; they are literally the options passed to *Context.set_font_options()*.

get_group_target()

Returns the target *Surface*.

Gets the current destination *Surface* for the *Context*. This is either the original target surface as passed to *Context* or the target surface for the current group as started by the most recent call to *Context.push_group()* or *Context.push_group_with_content()*.

New in version 1.2.

get_line_cap()

Returns the current line cap style, as set by *Context.set_line_cap()*.

Return type *cairo.LineCap*

get_line_join()

Returns the current line join style, as set by *Context.set_line_join()*.

Return type *cairo.LineJoin*

get_line_width()

Returns the current line width

Return type float

This function returns the current line width value exactly as set by *Context.set_line_width()*. Note that the value is unchanged even if the CTM has changed between the calls to *Context.set_line_width()* and *get_line_width()*.

get_matrix()

Returns the current transformation *Matrix* (CTM)

get_miter_limit()

Returns the current miter limit, as set by *Context.set_miter_limit()*.

Return type float

get_operator()

Returns the current compositing operator for a *Context*.

Return type *cairo.Operator*

get_scaled_font()

Returns the current *ScaledFont* for a *Context*.

New in version 1.4.

get_source()

Returns the current source *Pattern* for a *Context*.

get_target()

Returns the target *Surface* for the *Context*

get_tolerance()

Returns the current tolerance value, as set by *Context.set_tolerance()*

Return type float

glyph_extents(*glyphs*)

Parameters **glyphs** – glyphs, a sequence of *Glyph*

Return type *TextExtents*

Gets the extents for an array of glyphs. The extents describe a user-space rectangle that encloses the "inked" portion of the glyphs, (as they would be drawn by *Context.show_glyphs()*). Additionally, the x_advance and y_advance values indicate the amount by which the current point would be advanced by *Context.show_glyphs()*.

Note that whitespace glyphs do not contribute to the size of the rectangle (extents.width and extents.height).

glyph_path(*glyphs*)

Parameters **glyphs** – glyphs to show, a sequence of *Glyph*

Adds closed paths for the glyphs to the current path. The generated path if filled, achieves an effect similar to that of *Context.show_glyphs()*.

has_current_point()

returns: True iff a current point is defined on the current path. See *Context.get_current_point()* for details on the current point.

New in version 1.6.

identity_matrix()

Resets the current transformation *Matrix* (CTM) by setting it equal to the identity matrix. That is, the user-space and device-space axes will be aligned and one user-space unit will transform to one device-space unit.

in_fill(*x*, *y*)

Parameters

- **x** (*float*) – X coordinate of the point to test
- **y** (*float*) – Y coordinate of the point to test

Returns True iff the point is inside the area that would be affected by a *Context.fill()* operation given the current path and filling parameters. Surface dimensions and clipping are not taken into account.

See *Context.fill()*, *Context.set_fill_rule()* and *Context.fill_preserve()*.

in_stroke(*x*, *y*)

Parameters

- **x** (*float*) – X coordinate of the point to test
- **y** (*float*) – Y coordinate of the point to test

Returns True iff the point is inside the area that would be affected by a *Context.stroke()* operation given the current path and stroking parameters. Surface dimensions and clipping are not taken into account.

See *Context.stroke()*, *Context.set_line_width()*, *Context.set_line_join()*, *Context.set_line_cap()*, *Context.set_dash()*, and *Context.stroke_preserve()*.

line_to(*x*, *y*)

Parameters

- **x** (*float*) – the X coordinate of the end of the new line
- **y** (*float*) – the Y coordinate of the end of the new line

Adds a line to the path from the current point to position *(x, y)* in user-space coordinates. After this call the current point will be *(x, y)*.

If there is no current point before the call to *line_to()* this function will behave as `ctx.move_to(x, y)`.

mask(*pattern*)

Parameters **pattern** – a *Pattern*

A drawing operator that paints the current source using the alpha channel of *pattern* as a mask. (Opaque areas of *pattern* are painted with the source, transparent areas are not painted.)

mask_surface(*surface*, *x=0.0*, *y=0.0*)

Parameters

- **surface** – a *Surface*
- **x** (*float*) – X coordinate at which to place the origin of *surface*
- **y** (*float*) – Y coordinate at which to place the origin of *surface*

A drawing operator that paints the current source using the alpha channel of *surface* as a mask. (Opaque areas of *surface* are painted with the source, transparent areas are not painted.)

move_to(*x*, *y*)

Parameters

- **x** (*float*) – the X coordinate of the new position
- **y** (*float*) – the Y coordinate of the new position

Begin a new sub-path. After this call the current point will be *(x, y)*.

new_path()
Clears the current path. After this call there will be no path and no current point.

new_sub_path()
Begin a new sub-path. Note that the existing path is not affected. After this call there will be no current point.

In many cases, this call is not needed since new sub-paths are frequently started with *Context.move_to()*.

A call to *new_sub_path()* is particularly useful when beginning a new sub-path with one of the *Context.arc()* calls. This makes things easier as it is no longer necessary to manually compute the arc's initial coordinates for a call to *Context.move_to()*.

New in version 1.6.

paint()
A drawing operator that paints the current source everywhere within the current clip region.

paint_with_alpha(*alpha*)

Parameters **alpha** (*float*) – alpha value, between 0 (transparent) and 1 (opaque)

A drawing operator that paints the current source everywhere within the current clip region using a mask of constant alpha value *alpha*. The effect is similar to *Context.paint()*, but the drawing is faded out using the alpha value.

path_extents()

Returns (x1, y1, x2, y2), all float

Return type tuple

- *x1*: left of the resulting extents
- *y1*: top of the resulting extents
- *x2*: right of the resulting extents
- *y2*: bottom of the resulting extents

Computes a bounding box in user-space coordinates covering the points on the current path. If the current path is empty, returns an empty rectangle (0, 0, 0, 0). Stroke parameters, fill rule, surface dimensions and clipping are not taken into account.

Contrast with *Context.fill_extents()* and *Context.stroke_extents()* which return the extents of only the area that would be "inked" by the corresponding drawing operations.

The result of *path_extents()* is defined as equivalent to the limit of *Context.stroke_extents()* with cairo.LINE_CAP_ROUND as the line width approaches 0.0, (but never reaching the empty-rectangle returned by *Context.stroke_extents()* for a line width of 0.0).

Specifically, this means that zero-area sub-paths such as *Context.move_to()*; *Context.line_to()* segments, (even degenerate cases where the coordinates to both calls are identical), will be considered as contributing to the extents. However, a lone *Context.move_to()* will not contribute to the results of *Context.path_extents()*.

New in version 1.6.

pop_group()

Returns a newly created *SurfacePattern* containing the results of all drawing operations performed to the group.

Terminates the redirection begun by a call to *Context.push_group()* or *Context.push_group_with_content()* and returns a new pattern containing the results of all drawing operations performed to the group.

The *pop_group()* function calls *Context.restore()*, (balancing a call to *Context.save()* by the *Context.push_group()* function), so that any changes to the graphics state will not be visible outside the group.

New in version 1.2.

pop_group_to_source()
Terminates the redirection begun by a call to *Context.push_group()* or *Context.push_group_with_content()* and installs the resulting pattern as the source *Pattern* in the given *Context*.

The behavior of this function is equivalent to the sequence of operations:

```
group = cairo_pop_group()
ctx.set_source(group)
```

but is more convenient as their is no need for a variable to store the short-lived pointer to the pattern.

The *Context.pop_group()* function calls *Context.restore()*, (balancing a call to *Context.save()* by the *Context.push_group()* function), so that any changes to the graphics state will not be visible outside the group.

New in version 1.2.

push_group()
Temporarily redirects drawing to an intermediate surface known as a group. The redirection lasts until the group is completed by a call to *Context.pop_group()* or *Context.pop_group_to_source()*. These calls provide the result of any drawing to the group as a pattern, (either as an explicit object, or set as the source pattern).

This group functionality can be convenient for performing intermediate compositing. One common use of a group is to render objects as opaque within the group, (so that they occlude each other), and then blend the result with translucence onto the destination.

Groups can be nested arbitrarily deep by making balanced calls to *Context.push_group()*/*Context.pop_group()*. Each call pushes/pops the new target group onto/from a stack.

The *push_group()* function calls *Context.save()* so that any changes to the graphics state will not be visible outside the group, (the pop_group functions call *Context.restore()*).

By default the intermediate group will have a *cairo.Content* type of *cairo.Content.COLOR_ALPHA*. Other content types can be chosen for the group by using *Context.push_group_with_content()* instead.

As an example, here is how one might fill and stroke a path with translucence, but without any portion of the fill being visible under the stroke:

```
ctx.push_group()
ctx.set_source(fill_pattern)
ctx.fill_preserve()
ctx.set_source(stroke_pattern)
ctx.stroke()
ctx.pop_group_to_source()
ctx.paint_with_alpha(alpha)
```

New in version 1.2.

push_group_with_content(*content*)

Parameters **content** (cairo.Content) – a content indicating the type of group that will be created

Temporarily redirects drawing to an intermediate surface known as a group. The redirection lasts until the group is completed by a call to *Context.pop_group()* or *Context.pop_group_to_source()*. These calls provide the result of any drawing to the group as a pattern, (either as an explicit object, or set as the source pattern).

The group will have a content type of *content*. The ability to control this content type is the only distinction between this function and `Context.push_group()` which you should see for a more detailed description of group rendering.

New in version 1.2.

rectangle(*x*, *y*, *width*, *height*)

Parameters

- **x** (*float*) – the X coordinate of the top left corner of the rectangle
- **y** (*float*) – the Y coordinate to the top left corner of the rectangle
- **width** (*float*) – the width of the rectangle
- **height** (*float*) – the height of the rectangle

Adds a closed sub-path rectangle of the given size to the current path at position *(x, y)* in user-space coordinates.

This function is logically equivalent to:

```
ctx.move_to(x, y)
ctx.rel_line_to(width, 0)
ctx.rel_line_to(0, height)
ctx.rel_line_to(-width, 0)
ctx.close_path()
```

rel_curve_to(*dx1*, *dy1*, *dx2*, *dy2*, *dx3*, *dy4*)

Parameters

- **dx1** (*float*) – the X offset to the first control point
- **dy1** (*float*) – the Y offset to the first control point
- **dx2** (*float*) – the X offset to the second control point
- **dy2** (*float*) – the Y offset to the second control point
- **dx3** (*float*) – the X offset to the end of the curve
- **dy3** (*float*) – the Y offset to the end of the curve

Raises *cairo.Error* if called with no current point.

Relative-coordinate version of `Context.curve_to()`. All offsets are relative to the current point. Adds a cubic Bézier spline to the path from the current point to a point offset from the current point by *(dx3, dy3)*, using points offset by *(dx1, dy1)* and *(dx2, dy2)* as the control points. After this call the current point will be offset by *(dx3, dy3)*.

Given a current point of (x, y), `ctx.rel_curve_to(dx1, dy1, dx2, dy2, dx3, dy3)` is logically equivalent to `ctx.curve_to(x+dx1, y+dy1, x+dx2, y+dy2, x+dx3, y+dy3)`.

rel_line_to(*dx*, *dy*)

Parameters

- **dx** (*float*) – the X offset to the end of the new line
- **dy** (*float*) – the Y offset to the end of the new line

Raises *cairo.Error* if called with no current point.

Relative-coordinate version of *Context.line_to()*. Adds a line to the path from the current point to a point that is offset from the current point by *(dx, dy)* in user space. After this call the current point will be offset by *(dx, dy)*.

Given a current point of (x, y), `ctx.rel_line_to(dx, dy)` is logically equivalent to `ctx.line_to(x + dx, y + dy)`.

rel_move_to(*dx*, *dy*)

Parameters

- **dx** (*float*) – the X offset
- **dy** (*float*) – the Y offset

Raises *cairo.Error* if called with no current point.

Begin a new sub-path. After this call the current point will offset by *(dx, dy)*.

Given a current point of (x, y), `ctx.rel_move_to(dx, dy)` is logically equivalent to `ctx.(x + dx, y + dy)`.

reset_clip()

Reset the current clip region to its original, unrestricted state. That is, set the clip region to an infinitely large shape containing the target surface. Equivalently, if infinity is too hard to grasp, one can imagine the clip region being reset to the exact bounds of the target surface.

Note that code meant to be reusable should not call *reset_clip()* as it will cause results unexpected by higher-level code which calls *clip()*. Consider using *save()* and *restore()* around *clip()* as a more robust means of temporarily restricting the clip region.

restore()

Restores *Context* to the state saved by a preceding call to *save()* and removes that state from the stack of saved states.

rotate(*angle*)

Parameters **angle** (*float*) – angle (in radians) by which the user-space axes will be rotated

Modifies the current transformation matrix (CTM) by rotating the user-space axes by *angle* radians. The rotation of the axes takes places after any existing transformation of user space. The rotation direction for positive angles is from the positive X axis toward the positive Y axis.

save()

Makes a copy of the current state of *Context* and saves it on an internal stack of saved states. When *restore()* is called, *Context* will be restored to the saved state. Multiple calls to *save()* and *restore()* can be nested; each call to *restore()* restores the state from the matching paired *save()*.

scale(*sx*, *sy*)

Parameters

- **sx** (*float*) – scale factor for the X dimension
- **sy** (*float*) – scale factor for the Y dimension

Modifies the current transformation matrix (CTM) by scaling the X and Y user-space axes by *sx* and *sy* respectively. The scaling of the axes takes place after any existing transformation of user space.

select_font_face(*family*[, *slant*[, *weight*]])

Parameters

- **family** (*text*) – a font family name

- **slant** (cairo.FontSlant) – the font slant of the font, defaults to *cairo.FontSlant.NORMAL*.
- **weight** (cairo.FontWeight) – the font weight of the font, defaults to *cairo.FontWeight.NORMAL*.

Note: The *select_font_face()* function call is part of what the cairo designers call the "toy" text API. It is convenient for short demos and simple programs, but it is not expected to be adequate for serious text-using applications.

Selects a family and style of font from a simplified description as a family name, slant and weight. Cairo provides no operation to list available family names on the system (this is a "toy", remember), but the standard CSS2 generic family names, ("serif", "sans-serif", "cursive", "fantasy", "monospace"), are likely to work as expected.

For "real" font selection, see the font-backend-specific font_face_create functions for the font backend you are using. (For example, if you are using the freetype-based cairo-ft font backend, see cairo_ft_font_face_create_for_ft_face() or cairo_ft_font_face_create_for_pattern().) The resulting font face could then be used with cairo_scaled_font_create() and cairo_set_scaled_font().

Similarly, when using the "real" font support, you can call directly into the underlying font system, (such as fontconfig or freetype), for operations such as listing available fonts, etc.

It is expected that most applications will need to use a more comprehensive font handling and text layout library, (for example, pango), in conjunction with cairo.

If text is drawn without a call to *select_font_face()*, (nor *set_font_face()* nor *set_scaled_font()*), the default family is platform-specific, but is essentially "sans-serif". Default slant is *cairo.FontSlant.NORMAL*, and default weight is *cairo.FontWeight.NORMAL*.

This function is equivalent to a call to *ToyFontFace* followed by *set_font_face()*.

set_antialias(*antialias*)

Parameters **antialias** (cairo.Antialias) – the new antialias mode

Set the antialiasing mode of the rasterizer used for drawing shapes. This value is a hint, and a particular backend may or may not support a particular value. At the current time, no backend supports *cairo.Antialias.SUBPIXEL* when drawing shapes.

Note that this option does not affect text rendering, instead see *FontOptions.set_antialias()*.

set_dash(*dashes*[, *offset=0*])

Parameters

- **dashes** – a sequence specifying alternate lengths of on and off stroke portions as float.
- **offset** (*int*) – an offset into the dash pattern at which the stroke should start, defaults to 0.

Raises *cairo.Error* if any value in *dashes* is negative, or if all values are 0.

Sets the dash pattern to be used by *stroke()*. A dash pattern is specified by *dashes* - a sequence of positive values. Each value provides the length of alternate "on" and "off" portions of the stroke. The *offset* specifies an offset into the pattern at which the stroke begins.

Each "on" segment will have caps applied as if the segment were a separate sub-path. In particular, it is valid to use an "on" length of 0.0 with *cairo.LineCap.ROUND* or *cairo.LineCap.SQUARE* in order to distributed dots or squares along a path.

Note: The length values are in user-space units as evaluated at the time of stroking. This is not necessarily the same as the user space at the time of *set_dash()*.

If the number of dashes is 0 dashing is disabled.

If the number of dashes is 1 a symmetric pattern is assumed with alternating on and off portions of the size specified by the single value in *dashes*.

set_fill_rule(*fill_rule*)

Parameters **fill_rule** (cairo.FillRule) – a fill rule to set the within the cairo context. The fill rule is used to determine which regions are inside or outside a complex (potentially self-intersecting) path. The current fill rule affects both *fill()* and *clip()*.

The default fill rule is *cairo.FillRule.WINDING*.

set_font_face(*font_face*)

Parameters **font_face** – a *FontFace*, or None to restore to the default *FontFace*

Replaces the current *FontFace* object in the *Context* with *font_face*.

set_font_matrix(*matrix*)

Parameters **matrix** – a *Matrix* describing a transform to be applied to the current font.

Sets the current font matrix to *matrix*. The font matrix gives a transformation from the design space of the font (in this space, the em-square is 1 unit by 1 unit) to user space. Normally, a simple scale is used (see *set_font_size()*), but a more complex font matrix can be used to shear the font or stretch it unequally along the two axes

set_font_options(*options*)

Parameters **options** – *FontOptions* to use

Sets a set of custom font rendering options for the *Context*. Rendering options are derived by merging these options with the options derived from underlying surface; if the value in *options* has a default value (like *cairo.Antialias.DEFAULT*), then the value from the surface is used.

set_font_size(*size*)

Parameters **size** (*float*) – the new font size, in user space units

Sets the current font matrix to a scale by a factor of *size*, replacing any font matrix previously set with *set_font_size()* or *set_font_matrix()*. This results in a font size of *size* user space units. (More precisely, this matrix will result in the font's em-square being a *size* by *size* square in user space.)

If text is drawn without a call to *set_font_size()*, (nor *set_font_matrix()* nor *set_scaled_font()*), the default font size is 10.0.

set_line_cap(*line_cap*)

Parameters **line_cap** (cairo.LineCap) – a line cap style

Sets the current line cap style within the *Context*.

As with the other stroke parameters, the current line cap style is examined by *stroke()*, *stroke_extents()*, and *stroke_to_path()*, but does not have any effect during path construction.

The default line cap style is *cairo.LineCap.BUTT*.

set_line_join(*line_join*)

Parameters **line_join** (cairo.LineJoin) – a line join style

Sets the current line join style within the *Context*.

As with the other stroke parameters, the current line join style is examined by *stroke()*, *stroke_extents()*, and *stroke_to_path()*, but does not have any effect during path construction.

The default line join style is *cairo.LineJoin.MITER*.

set_line_width(*width*)

Parameters **width** (*float*) – a line width

Sets the current line width within the *Context*. The line width value specifies the diameter of a pen that is circular in user space, (though device-space pen may be an ellipse in general due to scaling/shear/rotation of the CTM).

Note: When the description above refers to user space and CTM it refers to the user space and CTM in effect at the time of the stroking operation, not the user space and CTM in effect at the time of the call to *set_line_width()*. The simplest usage makes both of these spaces identical. That is, if there is no change to the CTM between a call to *set_line_width()* and the stroking operation, then one can just pass user-space values to *set_line_width()* and ignore this note.

As with the other stroke parameters, the current line width is examined by *stroke()*, *stroke_extents()*, and *stroke_to_path()*, but does not have any effect during path construction.

The default line width value is 2.0.

set_matrix(*matrix*)

Parameters **matrix** – a transformation *Matrix* from user space to device space.

Modifies the current transformation matrix (CTM) by setting it equal to *matrix*.

set_miter_limit(*limit*)

Parameters **limit** – miter limit to set

Sets the current miter limit within the *Context*.

If the current line join style is set to *cairo.LineJoin.MITER* (see *set_line_join()*), the miter limit is used to determine whether the lines should be joined with a bevel instead of a miter. Cairo divides the length of the miter by the line width. If the result is greater than the miter limit, the style is converted to a bevel.

As with the other stroke parameters, the current line miter limit is examined by *stroke()*, *stroke_extents()*, and *stroke_to_path()*, but does not have any effect during path construction.

The default miter limit value is 10.0, which will convert joins with interior angles less than 11 degrees to bevels instead of miters. For reference, a miter limit of 2.0 makes the miter cutoff at 60 degrees, and a miter limit of 1.414 makes the cutoff at 90 degrees.

A miter limit for a desired angle can be computed as:

```
miter limit = 1/math.sin(angle/2)
```

set_operator(*op*)

Parameters **op** (*cairo.Operator*) – the compositing operator to set for use in all drawing operations.

The default operator is *cairo.Operator.OVER*.

set_scaled_font(*scaled_font*)

Parameters **scaled_font** – a *ScaledFont*

Replaces the current font face, font matrix, and font options in the *Context* with those of the *ScaledFont*. Except for some translation, the current CTM of the *Context* should be the same as that of the *ScaledFont*, which can be accessed using *ScaledFont.get_ctm()*.

New in version 1.2.

set_source(*source*)

Parameters **source** – a *Pattern* to be used as the source for subsequent drawing operations.

Sets the source pattern within *Context* to *source*. This pattern will then be used for any subsequent drawing operation until a new source pattern is set.

Note: The pattern's transformation matrix will be locked to the user space in effect at the time of *set_source()*. This means that further modifications of the current transformation matrix will not affect the source pattern. See *Pattern.set_matrix()*.

The default source pattern is a solid pattern that is opaque black, (that is, it is equivalent to `set_source_rgb(0.0, 0.0, 0.0)`.

set_source_rgb(*red*, *green*, *blue*)

Parameters

- **red** (*float*) – red component of color
- **green** (*float*) – green component of color
- **blue** (*float*) – blue component of color

Sets the source pattern within *Context* to an opaque color. This opaque color will then be used for any subsequent drawing operation until a new source pattern is set.

The color components are floating point numbers in the range 0 to 1. If the values passed in are outside that range, they will be clamped.

The default source pattern is opaque black, (that is, it is equivalent to `set_source_rgb(0.0, 0.0, 0.0)`.

set_source_rgba(*red*, *green*, *blue*[, *alpha=1.0*])

Parameters

- **red** (*float*) – red component of color
- **green** (*float*) – green component of color
- **blue** (*float*) – blue component of color
- **alpha** (*float*) – alpha component of color

Sets the source pattern within *Context* to a translucent color. This color will then be used for any subsequent drawing operation until a new source pattern is set.

The color and alpha components are floating point numbers in the range 0 to 1. If the values passed in are outside that range, they will be clamped.

The default source pattern is opaque black, (that is, it is equivalent to `set_source_rgba(0.0, 0.0, 0.0, 1.0)`.

set_source_surface(*surface*[, *x=0.0*[, *y=0.0*]])

Parameters

- **surface** – a *Surface* to be used to set the source pattern
- **x** (*float*) – User-space X coordinate for surface origin

- **y** (*float*) – User-space Y coordinate for surface origin

This is a convenience function for creating a pattern from a *Surface* and setting it as the source in *Context* with *set_source()*.

The *x* and *y* parameters give the user-space coordinate at which the surface origin should appear. (The surface origin is its upper-left corner before any transformation has been applied.) The *x* and *y* patterns are negated and then set as translation values in the pattern matrix.

Other than the initial translation pattern matrix, as described above, all other pattern attributes, (such as its extend mode), are set to the default values as in *SurfacePattern*. The resulting pattern can be queried with *get_source()* so that these attributes can be modified if desired, (eg. to create a repeating pattern with *Pattern.set_extend()*).

set_tolerance(*tolerance*)

Parameters **tolerance** (*float*) – the tolerance, in device units (typically pixels)

Sets the tolerance used when converting paths into trapezoids. Curved segments of the path will be subdivided until the maximum deviation between the original path and the polygonal approximation is less than *tolerance*. The default value is 0.1. A larger value will give better performance, a smaller value, better appearance. (Reducing the value from the default value of 0.1 is unlikely to improve appearance significantly.) The accuracy of paths within Cairo is limited by the precision of its internal arithmetic, and the prescribed *tolerance* is restricted to the smallest representable internal value.

show_glyphs(*glyphs*)

Parameters **glyphs** – glyphs to show as a sequence of *Glyph*

A drawing operator that generates the shape from an array of glyphs, rendered according to the current font face, font size (font matrix), and font options.

show_page()

Emits and clears the current page for backends that support multiple pages. Use *copy_page()* if you don't want to clear the page.

This is a convenience function that simply calls `ctx.get_target() . show_page()`

show_text(*text*)

Parameters **text** (*text*) – text

A drawing operator that generates the shape from a string of text, rendered according to the current font_face, font_size (font_matrix), and font_options.

This function first computes a set of glyphs for the string of text. The first glyph is placed so that its origin is at the current point. The origin of each subsequent glyph is offset from that of the previous glyph by the advance values of the previous glyph.

After this call the current point is moved to the origin of where the next glyph would be placed in this same progression. That is, the current point will be at the origin of the final glyph offset by its advance values. This allows for easy display of a single logical string with multiple calls to *show_text()*.

Note: The *show_text()* function call is part of what the cairo designers call the "toy" text API. It is convenient for short demos and simple programs, but it is not expected to be adequate for serious text-using applications. See *show_glyphs()* for the "real" text display API in cairo.

stroke()

A drawing operator that strokes the current path according to the current line width, line join, line cap, and dash settings. After *stroke()*, the current path will be cleared from the cairo context. See *set_line_width()*, *set_line_join()*, *set_line_cap()*, *set_dash()*, and *stroke_preserve()*.

Note: Degenerate segments and sub-paths are treated specially and provide a useful result. These can result in two different situations:

1. Zero-length "on" segments set in *set_dash()*. If the cap style is *cairo.LineCap.ROUND* or *cairo.LineCap.SQUARE* then these segments will be drawn as circular dots or squares respectively. In the case of *cairo.LineCap.SQUARE*, the orientation of the squares is determined by the direction of the underlying path.

2. A sub-path created by *move_to()* followed by either a *close_path()* or one or more calls to *line_to()* to the same coordinate as the *move_to()*. If the cap style is *cairo.LineCap.ROUND* then these sub-paths will be drawn as circular dots. Note that in the case of *cairo.LineCap.SQUARE* a degenerate sub-path will not be drawn at all, (since the correct orientation is indeterminate).

In no case will a cap style of *cairo.LineCap.BUTT* cause anything to be drawn in the case of either degenerate segments or sub-paths.

stroke_extents()

Returns (x1, y1, x2, y2), all float

Return type tuple

- *x1*: left of the resulting extents
- *y1*: top of the resulting extents
- *x2*: right of the resulting extents
- *y2*: bottom of the resulting extents

Computes a bounding box in user coordinates covering the area that would be affected, (the "inked" area), by a *stroke()* operation given the current path and stroke parameters. If the current path is empty, returns an empty rectangle (0, 0, 0, 0). Surface dimensions and clipping are not taken into account.

Note that if the line width is set to exactly zero, then *stroke_extents()* will return an empty rectangle. Contrast with *path_extents()* which can be used to compute the non-empty bounds as the line width approaches zero.

Note that *stroke_extents()* must necessarily do more work to compute the precise inked areas in light of the stroke parameters, so *path_extents()* may be more desirable for sake of performance if non-inked path extents are desired.

See *stroke()*, *set_line_width()*, *set_line_join()*, *set_line_cap()*, *set_dash()*, and *stroke_preserve()*.

stroke_preserve()

A drawing operator that strokes the current path according to the current line width, line join, line cap, and dash settings. Unlike *stroke()*, *stroke_preserve()* preserves the path within the cairo context.

See *set_line_width()*, *set_line_join()*, *set_line_cap()*, *set_dash()*, and *stroke_preserve()*.

text_extents(*text*)

Parameters **text** (text) – text to get extents for

Return type *TextExtents*

Gets the extents for a string of text. The extents describe a user-space rectangle that encloses the "inked" portion of the text, (as it would be drawn by *Context.show_text()*). Additionally, the x_advance and y_advance values indicate the amount by which the current point would be advanced by *Context.show_text()*.

Note that whitespace characters do not directly contribute to the size of the rectangle (extents.width and extents.height). They do contribute indirectly by changing the position of non-whitespace characters. In particular, trailing whitespace characters are likely to not affect the size of the rectangle, though they will affect the x_advance and y_advance values.

text_path(*text*)

Parameters **text** (text) – text

Adds closed paths for text to the current path. The generated path if filled, achieves an effect similar to that of *Context.show_text()*.

Text conversion and positioning is done similar to *Context.show_text()*.

Like *Context.show_text()*, After this call the current point is moved to the origin of where the next glyph would be placed in this same progression. That is, the current point will be at the origin of the final glyph offset by its advance values. This allows for chaining multiple calls to to *Context.text_path()* without having to set current point in between.

Note: The *text_path()* function call is part of what the cairo designers call the "toy" text API. It is convenient for short demos and simple programs, but it is not expected to be adequate for serious text-using applications. See *Context.glyph_path()* for the "real" text path API in cairo.

transform(*matrix*)

Parameters **matrix** – a transformation *Matrix* to be applied to the user-space axes

Modifies the current transformation matrix (CTM) by applying *matrix* as an additional transformation. The new transformation of user space takes place after any existing transformation.

translate(*tx*, *ty*)

Parameters

- **tx** (*float*) – amount to translate in the X direction
- **ty** (*float*) – amount to translate in the Y direction

Modifies the current transformation matrix (CTM) by translating the user-space origin by *(tx, ty)*. This offset is interpreted as a user-space coordinate according to the CTM in place before the new call to *translate()*. In other words, the translation of the user-space origin takes place after any existing transformation.

user_to_device(*x*, *y*)

Parameters

- **x** (*float*) – X value of coordinate
- **y** (*float*) – Y value of coordinate

Returns (x, y), both float

Return type tuple

- *x*: X value of coordinate
- *y*: Y value of coordinate

Transform a coordinate from user space to device space by multiplying the given point by the current transformation matrix (CTM).

user_to_device_distance(*dx*, *dy*)

Parameters

- **dx** (*float*) – X value of a distance vector
- **dy** (*float*) – Y value of a distance vector

Returns (dx, dy), both float

Return type tuple

- *dx*: X value of a distance vector
- *dy*: Y value of a distance vector

Transform a distance vector from user space to device space. This function is similar to *Context.user_to_device()* except that the translation components of the CTM will be ignored when transforming *(dx,dy)*.

in_clip(*x*, *y*)

param float x X coordinate of the point to test

param float y Y coordinate of the point to test

returns `True` if the point is inside, or `False` if outside.

rtype bool

Tests whether the given point is inside the area that would be visible through the current clip, i.e. the area that would be filled by a *paint()* operation.

See *clip()*, and *clip_preserve()*.

New in version 1.12.0.

show_text_glyphs(*utf8*, *glyphs*, *clusters*, *cluster_flags*)

Parameters

- **utf8** (*text*) – a string of text
- **glyphs** (*list*) – list of glyphs to show
- **clusters** (*list*) – list of cluster mapping information
- **cluster_flags** (TextClusterFlags) – cluster mapping flags

Raises ***Error*** –

New in version 1.15.

This operation has rendering effects similar to *Context.show_glyphs()* but, if the target surface supports it, uses the provided text and cluster mapping to embed the text for the glyphs shown in the output. If the target does not support the extended attributes, this function acts like the basic *Context.show_glyphs()* as if it had been passed `glyphs` .

The mapping between utf8 and glyphs is provided by a list of clusters. Each cluster covers a number of text bytes and glyphs, and neighboring clusters cover neighboring areas of utf8 and glyphs . The clusters should collectively cover utf8 and glyphs in entirety.

The first cluster always covers bytes from the beginning of utf8 . If `cluster_flags` do not have the *TextClusterFlags.BACKWARD* set, the first cluster also covers the beginning of glyphs , otherwise it covers the end of the glyphs array and following clusters move backward.

See *TextCluster* for constraints on valid clusters.

stroke_to_path()

Note: This function is not implemented in cairo, but still mentioned in the documentation.

tag_begin(*tag_name*, *attributes*)

Parameters

- **tag_name** (text) – tag name
- **attributes** (text) – tag attributes

Marks the beginning of the tag_name structure. Call *tag_end()* with the same tag_name to mark the end of the structure.

The attributes string is of the form "key1=value2 key2=value2 . . . ". Values may be boolean (true/false or 1/0), integer, float, string, or an array.

String values are enclosed in single quotes ('). Single quotes and backslashes inside the string should be escaped with a backslash.

Boolean values may be set to true by only specifying the key. eg the attribute string "key" is the equivalent to "key=true".

Arrays are enclosed in '[]'. eg "rect=[1.2 4.3 2.0 3.0]".

If no attributes are required, attributes can be an empty string.

See Tags and Links Description for the list of tags and attributes.

Invalid nesting of tags or invalid attributes will cause the context to shutdown with a status of *Status.TAG_ERROR*.

See *tag_end()*.

New in version 1.18.0: Only available with cairo 1.15.10+

tag_end(*tag_name*)

Parameters **tag_name** (text) – tag name

Marks the end of the tag_name structure.

Invalid nesting of tags will cause the context to shutdown with a status of *Status.TAG_ERROR*.

See *tag_begin()*.

New in version 1.18.0: Only available with cairo 1.15.10+

3.4 Exceptions

When a cairo function or method call fails an cairo.Error exception, or a subclass thereof, is raised.

3.4.1 cairo.Error()

exception cairo.**Error**

This exception is raised when a cairo object returns an error status.

status

Type *cairo.Status*

exception cairo.**CairoError**

An alias for *Error*

New in version 1.12.0.

exception cairo.**MemoryError**

Bases *Error*, MemoryError

New in version 1.15: Prior to 1.15 `MemoryError` was raised instead of this type.

exception cairo.**IOError**

Bases *Error*, IOError

New in version 1.15: Prior to 1.15 `IOError` was raised instead of this type.

3.5 Matrix

3.5.1 class Matrix()

Matrix is used throughout cairo to convert between different coordinate spaces. A *Matrix* holds an affine transformation, such as a scale, rotation, shear, or a combination of these. The transformation of a point (x,y) is given by:

```
x_new = xx * x + xy * y + x0
y_new = yx * x + yy * y + y0
```

The current transformation matrix of a *Context*, represented as a *Matrix*, defines the transformation from user-space coordinates to device-space coordinates.

Some standard Python operators can be used with matrices:

To read the values from a *Matrix*:

```
xx, yx, xy, yy, x0, y0 = matrix
```

To multiply two matrices:

```
matrix3 = matrix1.multiply(matrix2)
# or equivalently
matrix3 = matrix1 * matrix2
```

To compare two matrices:

```
matrix1 == matrix2
matrix1 != matrix2
```

For more information on matrix transformation see https://www.cairographics.org/cookbook/matrix_transform/

class cairo.**Matrix**(*xx = 1.0*, *yx = 0.0*, *xy = 0.0*, *yy = 1.0*, *x0 = 0.0*, *y0 = 0.0*)

Parameters

- **xx** (*float*) – xx component of the affine transformation
- **yx** (*float*) – yx component of the affine transformation
- **xy** (*float*) – xy component of the affine transformation
- **yy** (*float*) – yy component of the affine transformation
- **x0** (*float*) – X translation component of the affine transformation
- **y0** (*float*) – Y translation component of the affine transformation

Create a new *Matrix* with the affine transformation given by *xx, yx, xy, yy, x0, y0*. The transformation is given by:

```
x_new = xx * x + xy * y + x0
y_new = yx * x + yy * y + y0
```

To create a new identity matrix:

```
matrix = cairo.Matrix()
```

To create a matrix with a transformation which translates by tx and ty in the X and Y dimensions, respectively:

```
matrix = cairo.Matrix(x0=tx, y0=ty)
```

To create a matrix with a transformation that scales by sx and sy in the X and Y dimensions, respectively:

```
matrix = cairo.Matrix(xx=sy, yy=sy)
```

classmethod init_rotate(*radians*)

Parameters **radians** (*float*) – angle of rotation, in radians. The direction of rotation is defined such that positive angles rotate in the direction from the positive X axis toward the positive Y axis. With the default axis orientation of cairo, positive angles rotate in a clockwise direction.

Returns a new *Matrix* set to a transformation that rotates by *radians*.

invert()

Returns If *Matrix* has an inverse, modifies *Matrix* to be the inverse matrix and returns *None*

Raises *cairo.Error* if the *Matrix* as no inverse

Changes *Matrix* to be the inverse of it's original value. Not all transformation matrices have inverses; if the matrix collapses points together (it is *degenerate*), then it has no inverse and this function will fail.

multiply(*matrix2*)

Parameters **matrix2** (cairo.Matrix) – a second matrix

Returns a new *Matrix*

Multiplies the affine transformations in *Matrix* and *matrix2* together. The effect of the resulting transformation is to first apply the transformation in *Matrix* to the coordinates and then apply the transformation in *matrix2* to the coordinates.

It is allowable for result to be identical to either *Matrix* or *matrix2*.

rotate(*radians*)

Parameters **radians** (*float*) – angle of rotation, in radians. The direction of rotation is defined such that positive angles rotate in the direction from the positive X axis toward the positive Y axis. With the default axis orientation of cairo, positive angles rotate in a clockwise direction.

Initialize *Matrix* to a transformation that rotates by *radians*.

scale(*sx*, *sy*)

Parameters

- **sx** (*float*) – scale factor in the X direction
- **sy** (*float*) – scale factor in the Y direction

Applies scaling by *sx, sy* to the transformation in *Matrix*. The effect of the new transformation is to first scale the coordinates by *sx* and *sy*, then apply the original transformation to the coordinates.

transform_distance(*dx*, *dy*)

Parameters

- **dx** (*float*) – X component of a distance vector.
- **dy** (*float*) – Y component of a distance vector.

Returns the transformed distance vector (dx,dy), both float

Return type tuple

Transforms the distance vector *(dx,dy)* by *Matrix*. This is similar to *transform_point()* except that the translation components of the transformation are ignored. The calculation of the returned vector is as follows:

```
dx2 = dx1 * a + dy1 * c
dy2 = dx1 * b + dy1 * d
```

Affine transformations are position invariant, so the same vector always transforms to the same vector. If *(x1,y1)* transforms to *(x2,y2)* then *(x1+dx1,y1+dy1)* will transform to *(x1+dx2,y1+dy2)* for all values of *x1* and *x2*.

transform_point(*x*, *y*)

Parameters

- **x** (*float*) – X position.
- **y** (*float*) – Y position.

Returns the transformed point (x,y), both float

Return type tuple

Transforms the point *(x, y)* by *Matrix*.

translate(*tx*, *ty*)

Parameters

- **tx** (*float*) – amount to translate in the X direction
- **ty** (*float*) – amount to translate in the Y direction

Applies a transformation by *tx, ty* to the transformation in *Matrix*. The effect of the new transformation is to first translate the coordinates by *tx* and *ty*, then apply the original transformation to the coordinates.

xx

float: xx component of the affine transformation

New in version 1.12.0.

yx

float: yx component of the affine transformation

New in version 1.12.0.

xy

float: xy component of the affine transformation

New in version 1.12.0.

yy

float: yy component of the affine transformation

New in version 1.12.0.

x0

`float`: X translation component of the affine transformation

New in version 1.12.0.

y0

`float`: Y translation component of the affine transformation

New in version 1.12.0.

3.6 Paths

3.6.1 class Path()

class cairo.**Path**

Path cannot be instantiated directly, it is created by calling *Context.copy_path()* and *Context.copy_path_flat()*.

str(path) lists the path elements.

See *path attributes*

Path is an iterator.

See examples/warpedtext.py for example usage.

3.7 Patterns

Patterns are the paint with which cairo draws. The primary use of patterns is as the source for all cairo drawing operations, although they can also be used as masks, that is, as the brush too.

A cairo *Pattern* is created by using one of the *PatternType* constructors listed below, or implicitly through *Context.set_source_<type>()* methods.

3.7.1 class Pattern()

Pattern is the abstract base class from which all the other pattern classes derive. It cannot be instantiated directly.

class cairo.**Pattern**

get_extend()

Returns the current extend strategy used for drawing the *Pattern*.

Return type *cairo.Extend*

Gets the current extend mode for the *Pattern*. See *cairo.Extend* attributes for details on the semantics of each extend strategy.

get_matrix()

Returns a new *Matrix* which stores a copy of the *Pattern's* transformation matrix

get_filter()

Returns the current filter used for resizing the pattern.

Return type *cairo.Filter*

New in version 1.12.0: Used to be a method of *SurfacePattern* before

set_filter(*filter*)

Parameters **filter** (cairo.Filter) – a filter describing the filter to use for resizing the pattern

Note that you might want to control filtering even when you do not have an explicit *Pattern* object, (for example when using *Context.set_source_surface()*). In these cases, it is convenient to use *Context.get_source()* to get access to the pattern that cairo creates implicitly. For example:

```
context.set_source_surface(image, x, y)
surfacepattern.set_filter(context.get_source(), cairo.FILTER_NEAREST)
```

New in version 1.12.0: Used to be a method of *SurfacePattern* before

set_extend(*extend*)

Parameters **extend** (cairo.Extend) – an extend describing how the area outside of the *Pattern* will be drawn

Sets the mode to be used for drawing outside the area of a *Pattern*.

The default extend mode is *cairo.Extend.NONE* for *SurfacePattern* and *cairo.Extend.PAD* for *Gradient* Patterns.

set_matrix(*matrix*)

Parameters **matrix** – a *Matrix*

Sets the *Pattern's* transformation matrix to *matrix*. This matrix is a transformation from user space to pattern space.

When a *Pattern* is first created it always has the identity matrix for its transformation matrix, which means that pattern space is initially identical to user space.

Important: Please note that the direction of this transformation matrix is from user space to pattern space. This means that if you imagine the flow from a *Pattern* to user space (and on to device space), then coordinates in that flow will be transformed by the inverse of the *Pattern* matrix.

For example, if you want to make a *Pattern* appear twice as large as it does by default the correct code to use is:

```
matrix = cairo.Matrix(xx=0.5,yy=0.5)
pattern.set_matrix(matrix)
```

Meanwhile, using values of 2.0 rather than 0.5 in the code above would cause the *Pattern* to appear at half of its default size.

Also, please note the discussion of the user-space locking semantics of *Context.set_source*.

3.7.2 class SolidPattern(Pattern)

class cairo.**SolidPattern**(*red*, *green*, *blue*, *alpha=1.0*)

Parameters

- **red** (*float*) – red component of the color
- **green** (*float*) – green component of the color

- **blue** (*float*) – blue component of the color
- **alpha** (*float*) – alpha component of the color

Returns a new *SolidPattern*

Raises *MemoryError* in case of no memory

Creates a new *SolidPattern* corresponding to a translucent color. The color components are floating point numbers in the range 0 to 1. If the values passed in are outside that range, they will be clamped.

get_rgba()

Returns (red, green, blue, alpha) a tuple of float

Gets the solid color for a *SolidPattern*.

New in version 1.4.

3.7.3 class SurfacePattern(Pattern)

class cairo.**SurfacePattern**(*surface*)

Parameters **surface** – a cairo *Surface*

Returns a newly created *SurfacePattern* for the given surface.

Raises *MemoryError* in case of no memory.

get_surface()

Returns the *Surface* of the *SurfacePattern*.

New in version 1.4.

3.7.4 class Gradient(Pattern)

Gradient is an abstract base class from which other *Pattern* classes derive. It cannot be instantiated directly.

class cairo.**Gradient**

add_color_stop_rgb(*offset*, *red*, *green*, *blue*)

Parameters

- **offset** (*float*) – an offset in the range [0.0 .. 1.0]
- **red** (*float*) – red component of color
- **green** (*float*) – green component of color
- **blue** (*float*) – blue component of color

Adds an opaque color stop to a *Gradient* pattern. The offset specifies the location along the gradient's control vector. For example, a *LinearGradient's* control vector is from (x0,y0) to (x1,y1) while a *RadialGradient's* control vector is from any point on the start circle to the corresponding point on the end circle.

The color is specified in the same way as in *Context.set_source_rgb()*.

If two (or more) stops are specified with identical offset values, they will be sorted according to the order in which the stops are added, (stops added earlier will compare less than stops added later). This can be useful for reliably making sharp color transitions instead of the typical blend.

add_color_stop_rgba(*offset*, *red*, *green*, *blue*, *alpha*)

Parameters

- **offset** (*float*) – an offset in the range [0.0 .. 1.0]
- **red** (*float*) – red component of color
- **green** (*float*) – green component of color
- **blue** (*float*) – blue component of color
- **alpha** (*float*) – alpha component of color

Adds an opaque color stop to a *Gradient* pattern. The offset specifies the location along the gradient's control vector. For example, a *LinearGradient's* control vector is from (x0,y0) to (x1,y1) while a *RadialGradient's* control vector is from any point on the start circle to the corresponding point on the end circle.

The color is specified in the same way as in *Context.set_source_rgb()*.

If two (or more) stops are specified with identical offset values, they will be sorted according to the order in which the stops are added, (stops added earlier will compare less than stops added later). This can be useful for reliably making sharp color transitions instead of the typical blend.

get_color_stops_rgba()

Returns a list of (offset, red, green, blue, alpha) tuples of float

Return type list

Gets the color and offset information for all color stops specified in the given gradient pattern.

New in version 1.14.

3.7.5 class LinearGradient(Gradient)

class cairo.**LinearGradient**(*x0*, *y0*, *x1*, *y1*)

Parameters

- **x0** (*float*) – x coordinate of the start point
- **y0** (*float*) – y coordinate of the start point
- **x1** (*float*) – x coordinate of the end point
- **y1** (*float*) – y coordinate of the end point

Returns a new *LinearGradient*

Raises *MemoryError* in case of no memory

Create a new *LinearGradient* along the line defined by (x0, y0) and (x1, y1). Before using the *Gradient* pattern, a number of color stops should be defined using *Gradient.add_color_stop_rgb()* or *Gradient.add_color_stop_rgba()*

Note: The coordinates here are in pattern space. For a new *Pattern*, pattern space is identical to user space, but the relationship between the spaces can be changed with *Pattern.set_matrix()*

get_linear_points()

Returns

(x0, y0, x1, y1) - a tuple of float

- x0: return value for the x coordinate of the first point

- y0: return value for the y coordinate of the first point
- x1: return value for the x coordinate of the second point
- y1: return value for the y coordinate of the second point

Gets the gradient endpoints for a *LinearGradient*.

New in version 1.4.

3.7.6 class RadialGradient(`Gradient`)

class cairo.**RadialGradient**(*cx0*, *cy0*, *radius0*, *cx1*, *cy1*, *radius1*)

Parameters

- **cx0** (*float*) – x coordinate for the center of the start circle
- **cy0** (*float*) – y coordinate for the center of the start circle
- **radius0** (*float*) – radius of the start circle
- **cx1** (*float*) – x coordinate for the center of the end circle
- **cy1** (*float*) – y coordinate for the center of the end circle
- **radius1** (*float*) – radius of the end circle

Returns the newly created *RadialGradient*

Raises *MemoryError* in case of no memory

Creates a new *RadialGradient* pattern between the two circles defined by (cx0, cy0, radius0) and (cx1, cy1, radius1). Before using the gradient pattern, a number of color stops should be defined using *Gradient.add_color_stop_rgb()* or *Gradient.add_color_stop_rgba()*.

Note: The coordinates here are in pattern space. For a new pattern, pattern space is identical to user space, but the relationship between the spaces can be changed with *Pattern.set_matrix()*.

get_radial_circles()

Returns

(x0, y0, r0, x1, y1, r1) - a tuple of float

- x0: return value for the x coordinate of the center of the first circle
- y0: return value for the y coordinate of the center of the first circle
- r0: return value for the radius of the first circle
- x1: return value for the x coordinate of the center of the second circle
- y1: return value for the y coordinate of the center of the second circle
- r1: return value for the radius of the second circle

Gets the *Gradient* endpoint circles for a *RadialGradient*, each specified as a center coordinate and a radius.

New in version 1.4.

3.7.7 class MeshPattern(Pattern)

class cairo.**MeshPattern**

Raises *Error* –

Return type *MeshPattern*

New in version 1.14.

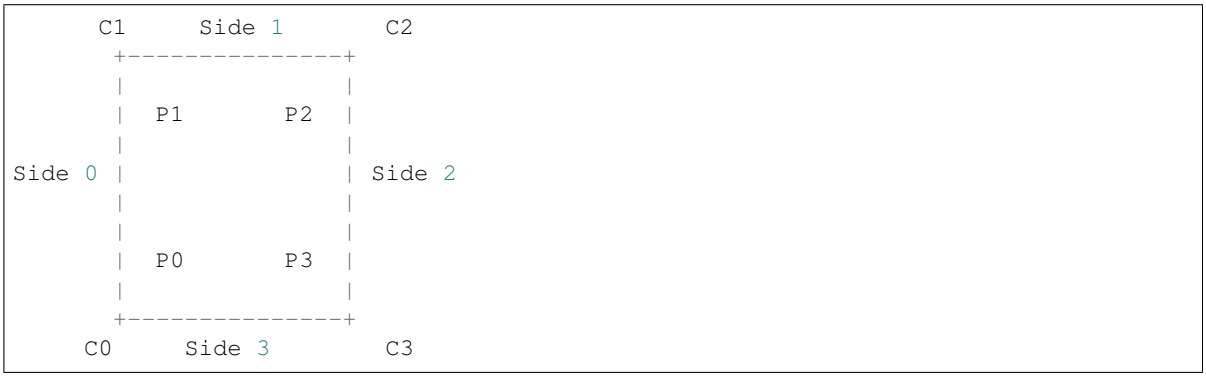
Create a new mesh pattern.

Mesh patterns are tensor-product patch meshes (type 7 shadings in PDF). Mesh patterns may also be used to create other types of shadings that are special cases of tensor-product patch meshes such as Coons patch meshes (type 6 shading in PDF) and Gouraud-shaded triangle meshes (type 4 and 5 shadings in PDF).

Mesh patterns consist of one or more tensor-product patches, which should be defined before using the mesh pattern. Using a mesh pattern with a partially defined patch as source or mask will put the context in an error status with a status of *cairo.Status.INVALID_MESH_CONSTRUCTION*.

A tensor-product patch is defined by 4 Bézier curves (side 0, 1, 2, 3) and by 4 additional control points (P0, P1, P2, P3) that provide further control over the patch and complete the definition of the tensor-product patch. The corner C0 is the first point of the patch.

Degenerate sides are permitted so straight lines may be used. A zero length line on one side may be used to create 3 sided patches.



Each patch is constructed by first calling *begin_patch()*, then *move_to()* to specify the first point in the patch (C0). Then the sides are specified with calls to *curve_to()* and *line_to()*.

The four additional control points (P0, P1, P2, P3) in a patch can be specified with *set_control_point()*.

At each corner of the patch (C0, C1, C2, C3) a color may be specified with *set_corner_color_rgb()* or *set_corner_color_rgba()*. Any corner whose color is not explicitly specified defaults to transparent black.

A Coons patch is a special case of the tensor-product patch where the control points are implicitly defined by the sides of the patch. The default value for any control point not specified is the implicit value for a Coons patch, i.e. if no control points are specified the patch is a Coons patch.

A triangle is a special case of the tensor-product patch where the control points are implicitly defined by the sides of the patch, all the sides are lines and one of them has length 0, i.e. if the patch is specified using just 3 lines, it is a triangle. If the corners connected by the 0-length side have the same color, the patch is a Gouraud-shaded triangle.

Patches may be oriented differently to the above diagram. For example the first point could be at the top left. The diagram only shows the relationship between the sides, corners and control points. Regardless of where the first point is located, when specifying colors, corner 0 will always be the first point, corner 1 the point between side 0 and side 1 etc.

Calling *end_patch()* completes the current patch. If less than 4 sides have been defined, the first missing side is defined as a line from the current point to the first point of the patch (C0) and the other sides are degenerate lines from C0 to C0. The corners between the added sides will all be coincident with C0 of the patch and their color will be set to be the same as the color of C0.

Additional patches may be added with additional calls to *begin_patch()*/*end_patch()*.

```
# Add a Coons patch
pattern = cairo.MeshPattern()
pattern.begin_patch()
pattern.move_to(0, 0)
pattern.curve_to(30, -30, 60, 30, 100, 0)
pattern.curve_to(60, 30, 130, 60, 100, 100)
pattern.curve_to(60, 70, 30, 130, 0, 100)
pattern.curve_to(30, 70, -30, 30, 0, 0)
pattern.set_corner_color_rgb(0, 1, 0, 0)
pattern.set_corner_color_rgb(1, 0, 1, 0)
pattern.set_corner_color_rgb(2, 0, 0, 1)
pattern.set_corner_color_rgb(3, 1, 1, 0)
pattern.end_patch()

# Add a Gouraud-shaded triangle
pattern = cairo.MeshPattern()
pattern.begin_patch()
pattern.move_to(100, 100)
pattern.line_to(130, 130)
pattern.line_to(130, 70)
pattern.set_corner_color_rgb(0, 1, 0, 0)
pattern.set_corner_color_rgb(1, 0, 1, 0)
pattern.set_corner_color_rgb(2, 0, 0, 1)
pattern.end_patch()
```

When two patches overlap, the last one that has been added is drawn over the first one.

When a patch folds over itself, points are sorted depending on their parameter coordinates inside the patch. The v coordinate ranges from 0 to 1 when moving from side 3 to side 1; the u coordinate ranges from 0 to 1 when going from side 0 to side

Points with higher v coordinate hide points with lower v coordinate. When two points have the same v coordinate, the one with higher u coordinate is above. This means that points nearer to side 1 are above points nearer to side 3; when this is not sufficient to decide which point is above (for example when both points belong to side 1 or side 3) points nearer to side 2 are above points nearer to side 0.

For a complete definition of tensor-product patches, see the PDF specification (ISO32000), which describes the parametrization in detail.

Note: The coordinates are always in pattern space. For a new pattern, pattern space is identical to user space, but the relationship between the spaces can be changed with *Pattern.set_matrix()*.

begin_patch()

Raises ***Error*** –

Begin a patch in a mesh pattern.

After calling this function, the patch shape should be defined with *move_to()*, *line_to()* and *curve_to()*.

After defining the patch, *end_patch()* must be called before using pattern as a source or mask.

curve_to(*x1*, *y1*, *x2*, *y2*, *x3*, *y3*)

Parameters

- **x1** (*float*) – the X coordinate of the first control point
- **y1** (*float*) – the Y coordinate of the first control point
- **x2** (*float*) – the X coordinate of the second control point
- **y2** (*float*) – the Y coordinate of the second control point
- **x3** (*float*) – the X coordinate of the end of the curve
- **y3** (*float*) – the Y coordinate of the end of the curve

Raises ***Error*** –

Adds a cubic Bézier spline to the current patch from the current point to position (x3 , y3) in pattern-space coordinates, using (x1 , y1) and (x2 , y2) as the control points.

If the current patch has no current point before the call to *curve_to()*, this function will behave as if preceded by a call to `pattern.move_to(x1, y1)`.

After this call the current point will be (x3 , y3).

end_patch()

Raises ***Error*** –

Indicates the end of the current patch in a mesh pattern.

If the current patch has less than 4 sides, it is closed with a straight line from the current point to the first point of the patch as if *line_to()* was used.

get_control_point(*patch_num*, *point_num*)

Parameters

- **patch_num** (*int*) – the patch number to return data for
- **point_num** (*int*) – he control point number to return data for

Returns a (x, y) tuple of float - coordinates of the control point

Return type tuple

Raises ***Error*** –

Gets the control point point_num of patch patch_num for a mesh pattern.

`patch_num` can range from 0 to n-1 where n is the number returned by *get_patch_count()*.

Valid values for `point_num` are from 0 to 3 and identify the control points as explained in *MeshPattern*.

get_corner_color_rgba(*patch_num*, *corner_num*)

Parameters

- **patch_num** (*int*) – the patch number to return data for
- **corner_num** (*int*) – the corner number to return data for

Returns a (red, green, blue, alpha) tuple of float

Return type tuple

Raises ***Error*** –

Gets the color information in corner `corner_num` of patch `patch_num` for a mesh pattern.

`patch_num` can range from 0 to n-1 where n is the number returned by *`get_patch_count()`*.

Valid values for `corner_num` are from 0 to 3 and identify the corners as explained in *`MeshPattern`*.

`get_patch_count`()

Returns number of patches

Return type int

Gets the number of patches specified in the given mesh pattern.

The number only includes patches which have been finished by calling *`end_patch()`*. For example it will be 0 during the definition of the first patch.

`get_path`(*patch_num*)

Parameters **`patch_num`** (*`int`*) – the patch number to return data for

Returns the path defining the patch

Return type *Path*

Raises ***`Error`*** –

Gets path defining the patch `patch_num` for a mesh pattern.

`patch_num` can range from 0 to n-1 where n is the number returned by *`get_patch_count()`*.

`line_to`(*x*, *y*)

Parameters

- **`x`** (*`float`*) – the X coordinate of the end of the new line
- **`y`** (*`float`*) – the Y coordinate of the end of the new line

Raises ***`Error`*** –

Adds a line to the current patch from the current point to position (x , y) in pattern-space coordinates.

If there is no current point before the call to *`line_to()`* this function will behave as `pattern.move_to(x ,y)`.

After this call the current point will be (x , y).

`move_to`(*x*, *y*)

Parameters

- **`x`** (*`float`*) – the X coordinate of the new position
- **`y`** (*`float`*) – the Y coordinate of the new position

Raises ***`Error`*** –

Define the first point of the current patch in a mesh pattern.

After this call the current point will be (x , y).

`set_control_point`(*point_num*, *x*, *y*)

Parameters

- **`point_num`** (*`int`*) – the control point to set the position for
- **`x`** (*`float`*) – the X coordinate of the control point
- **`y`** (*`float`*) – the Y coordinate of the control point

Raises *Error* –

Set an internal control point of the current patch.

Valid values for point_num are from 0 to 3 and identify the control points as explained in *MeshPattern*.

set_corner_color_rgb(*corner_num*, *red*, *green*, *blue*)

Parameters

- **corner_num** (*int*) – the corner to set the color for
- **red** (*float*) – red component of color
- **green** (*float*) – green component of color
- **blue** (*float*) – blue component of color

Raises *Error* –

Sets the color of a corner of the current patch in a mesh pattern.

The color is specified in the same way as in *Context.set_source_rgb()*.

Valid values for corner_num are from 0 to 3 and identify the corners as explained in *MeshPattern*.

set_corner_color_rgba(*corner_num*, *red*, *green*, *blue*, *alpha*)

Parameters

- **corner_num** (*int*) – the corner to set the color for
- **red** (*float*) – red component of color
- **green** (*float*) – green component of color
- **blue** (*float*) – blue component of color
- **alpha** (*float*) – alpha component of color

Raises *Error* –

Sets the color of a corner of the current patch in a mesh pattern.

The color is specified in the same way as in *Context.set_source_rgba()*.

Valid values for corner_num are from 0 to 3 and identify the corners as explained in *MeshPattern*.

3.7.8 class RasterSourcePattern(Pattern)

The raster source provides the ability to supply arbitrary pixel data whilst rendering. The pixels are queried at the time of rasterisation by means of user callback functions, allowing for the ultimate flexibility. For example, in handling compressed image sources, you may keep a MRU cache of decompressed images and decompress sources on the fly and discard old ones to conserve memory.

For the raster source to be effective, you must at least specify the acquire and release callbacks which are used to retrieve the pixel data for the region of interest and demark when it can be freed afterwards. Other callbacks are provided for when the pattern is copied temporarily during rasterisation, or more permanently as a snapshot in order to keep the pixel data available for printing.

class cairo.**RasterSourcePattern**(*content*, *width*, *height*)

Parameters

- **content** (Content) – content type for the pixel data that will be returned. Knowing the content type ahead of time is used for analysing the operation and picking the appropriate rendering path.

- **width** (*int*) – maximum size of the sample area
- **height** (*int*) – maximum size of the sample area

Raises ***Error*** –

Return type *RasterSourcePattern*

Creates a new user pattern for providing pixel data.

Use the setter functions to associate callbacks with the returned pattern.

New in version 1.15.

set_acquire(*acquire*, *release*)

Parameters

- **acquire** (callable) – acquire callback or None to unset it
- **release** (callable) – (optional) release callback or None

Raises ***Error*** –

Specifies the callbacks used to generate the image surface for a rendering operation (acquire) and the function used to cleanup that surface afterwards.

The acquire callback should create a surface (preferably an image surface created to match the target using *Surface.create_similar_image()*) that defines at least the region of interest specified by extents. The surface is allowed to be the entire sample area, but if it does contain a subsection of the sample area, the surface extents should be provided by setting the device offset (along with its width and height) using *Surface.set_device_offset()*.

acquire(*target*, *extents*)

Parameters

- **target** (Surface) – the rendering target surface
- **extents** (RectangleInt) – rectangular region of interest in pixels in sample space

Return type *Surface*

This function is called when a pattern is being rendered from. It should create a surface that provides the pixel data for the region of interest as defined by extents, though the surface itself does not have to be limited to that area. For convenience the surface should probably be of image type, created with *Surface.create_similar_image()* for the target (which enables the number of copies to be reduced during transfer to the device). Another option, might be to return a similar surface to the target for explicit handling by the application of a set of cached sources on the device. The region of sample data provided should be defined using *Surface.set_device_offset()* to specify the top-left corner of the sample data (along with width and height of the surface).

release(*surface*)

Parameters **surface** (Surface) – the surface created during acquire

This function is called when the pixel data is no longer being accessed by the pattern for the rendering operation.

New in version 1.15.

get_acquire()

Returns a (acquire, release) tuple of callables or None as set through *set_acquire()*

Queries the current acquire and release callbacks.

New in version 1.15.

3.8 Region

Region — Representing a pixel-aligned area

3.8.1 class Region()

Region is a simple graphical data type representing an area of integer-aligned rectangles. They are often used on raster surfaces to track areas of interest, such as change or clip areas.

class cairo.**Region**([*rectangle_int*|*rectangle_ints*])

Parameters **rectangle_int** (*RectangleInt* or [*RectangleInt*]) – a rectangle or a list of rectangle

Allocates a new empty region object or a region object with the containing rectangle(s).

New in version 1.11.0.

copy()

Returns A newly allocated *Region*.

Raises ***Error*** – if memory cannot be allocated.

Allocates a new *Region* object copying the area from original.

get_extents()

Returns The bounding rectangle of region

Return type *RectangleInt*

num_rectangles()

Returns The number of rectangles contained in region

Return type int

get_rectangle(*nth*)

Parameters **nth** (*int*) – a number indicating which rectangle should be returned

Returns The *nth* rectangle from the region

Return type *RectangleInt*

is_empty()

Returns Whether region is empty

Return type bool

contains_point(*x*, *y*)

Parameters

- **x** (*int*) – The x coordinate of a point
- **y** (*int*) – The y coordinate of a point

Returns Whether (x , y) is contained in the region

Return type bool

contains_rectangle(*rectangle*)

Parameters **rectangle** (RectangleInt) –

Returns region overlap

Return type *cairo.RegionOverlap*

Checks whether rectangle is inside, outside or partially contained in region

equal(*region*)

Parameters **region** (Region) –

Returns Whether both regions contained the same coverage

Return type bool

translate(*dx*, *dy*)

Parameters

- **dx** (*int*) – Amount to translate in the x direction
- **dy** (*int*) – Amount to translate in the y direction

Translates region by (dx , dy).

intersect(*other*)

Parameters **other** (*Region* or *RectangleInt*) –

Returns The intersection of the region and the passed region or rectangle

Return type *Region*

subtract(*other*)

Parameters **other** (*Region* or *RectangleInt*) –

Returns The result of the subtraction of the region and the passed region or rectangle

Return type *Region*

union(*other*)

Parameters **other** (*Region* or *RectangleInt*) –

Returns The union of the region and the passed region or rectangle

Return type *Region*

xor(*other*)

Parameters **other** (*Region* or *RectangleInt*) –

Returns The exclusive difference of the region and the passed region or rectangle

Return type *Region*

3.8.2 class RectangleInt()

RectangleInt is a data structure for holding a rectangle with integer coordinates.

class cairo.**RectangleInt**(*x=0*, *y=0*, *width=0*, *height=0*)

Parameters

- **x** (*int*) – X coordinate of the left side of the rectangle
- **y** (*int*) – Y coordinate of the the top side of the rectangle
- **width** (*int*) – width of the rectangle

- **height** (*int*) – height of the rectangle

Allocates a new *RectangleInt* object.

New in version 1.11.0.

x
int

y
int

width
int

height
int

3.9 Surfaces

cairo.Surface is the abstract type representing all different drawing targets that cairo can render to. The actual drawings are performed using a *Context*.

A cairo.Surface is created by using backend-specific constructors of the form cairo.<XXX>Surface().

3.9.1 class Surface()

class cairo.**Surface**

Surface is the abstract base class from which all the other surface classes derive. It cannot be instantiated directly.

Note: New in version 1.17.0: *cairo.Surface* can be used as a context manager:

```
# surface.finish() will be called on __exit__
with cairo.SVGSurface("example.svg", 200, 200) as surface:
    pass

# surface.unmap_image(image_surface) will be called on __exit__
with surface.map_to_image(None) as image_surface:
    pass
```

---

copy_page()

Emits the current page for backends that support multiple pages, but doesn't clear it, so that the contents of the current page will be retained for the next page. Use *show_page()* if you want to get an empty page after the emission.

Context.copy_page() is a convenience function for this.

New in version 1.6.

create_similar(*content*, *width*, *height*)

Parameters

- **content** (*cairo.Content*) – the content for the new surface
- **width** (*int*) – width of the new surface, (in device-space units)

- **height** – height of the new surface (in device-space units)

Returns a newly allocated *Surface*.

Create a *Surface* that is as compatible as possible with the existing surface. For example the new surface will have the same fallback resolution and *FontOptions*. Generally, the new surface will also use the same backend, unless that is not possible for some reason.

Initially the surface contents are all 0 (transparent if contents have transparency, black otherwise.)

finish()

This method finishes the *Surface* and drops all references to external resources. For example, for the Xlib backend it means that cairo will no longer access the drawable, which can be freed. After calling finish() the only valid operations on a *Surface* are flushing and finishing it. Further drawing to the surface will not affect the surface but will instead trigger a *cairo.Error* exception.

flush()

Do any pending drawing for the *Surface* and also restore any temporary modification's cairo has made to the *Surface's* state. This method must be called before switching from drawing on the *Surface* with cairo to drawing on it directly with native APIs. If the *Surface* doesn't support direct access, then this function does nothing.

get_content()

Returns The content type of *Surface*, which indicates whether the *Surface* contains color and/or alpha information.

Return type *cairo.Content*

New in version 1.2.

get_device_offset()

Returns

(x_offset, y_offset) a tuple of float

- x_offset: the offset in the X direction, in device units
- y_offset: the offset in the Y direction, in device units

This method returns the previous device offset set by *set_device_offset()*.

New in version 1.2.

get_fallback_resolution()

Returns

(x_pixels_per_inch, y_pixels_per_inch) a tuple of float

- x_pixels_per_inch: horizontal pixels per inch
- y_pixels_per_inch: vertical pixels per inch

This method returns the previous fallback resolution set by *set_fallback_resolution()*, or default fallback resolution if never set.

New in version 1.8.

get_font_options()

Returns a *FontOptions*

Retrieves the default font rendering options for the *Surface*. This allows display surfaces to report the correct subpixel order for rendering on them, print surfaces to disable hinting of metrics and so forth. The result can then be used with *ScaledFont*.

supports_mime_type(*mime_type*)

Parameters **mime_type** (*str*) – the mime type (*cairo.MIME_TYPE*)

Returns `True` if surface supports mime_type, `False` otherwise

Return type bool

Return whether surface supports `mime_type`.

New in version 1.12.0.

set_mime_data(*mime_type*, *data*)

Parameters

- **mime_type** (*str*) – the MIME type of the image data (*cairo.MIME_TYPE*)
- **data** (*bytes*) – the image data to attach to the surface

Attach an image in the format `mime_type` to *Surface*. To remove the data from a surface, call this function with same mime type and `None` for data.

The attached image (or filename) data can later be used by backends which support it (currently: PDF, PS, SVG and Win32 Printing surfaces) to emit this data instead of making a snapshot of the surface. This approach tends to be faster and requires less memory and disk space.

The recognized MIME types are listed under *cairo.MIME_TYPE*.

See corresponding backend surface docs for details about which MIME types it can handle. Caution: the associated MIME data will be discarded if you draw on the surface afterwards. Use this function with care.

New in version 1.12.0.

get_mime_data(*mime_type*)

Parameters **mime_type** (*str*) – the MIME type of the image data (*cairo.MIME_TYPE*)

Returns `bytes` or `None`

Return mime data previously attached to surface with *set_mime_data()* using the specified mime type. If no data has been attached with the given mime type, `None` is returned.

New in version 1.12.0.

mark_dirty()

Tells cairo that drawing has been done to *Surface* using means other than cairo, and that cairo should reread any cached areas. Note that you must call *flush()* before doing such drawing.

mark_dirty_rectangle(*x*, *y*, *width*, *height*)

Parameters

- **x** (*int*) – X coordinate of dirty rectangle
- **y** (*int*) – Y coordinate of dirty rectangle
- **width** (*int*) – width of dirty rectangle
- **height** (*int*) – height of dirty rectangle

Like *mark_dirty()*, but drawing has been done only to the specified rectangle, so that cairo can retain cached contents for other parts of the surface.

Any cached clip set on the *Surface* will be reset by this function, to make sure that future cairo calls have the clip set that they expect.

set_device_offset(*x_offset*, *y_offset*)

Parameters

- **x_offset** (*float*) – the offset in the X direction, in device units
- **y_offset** (*float*) – the offset in the Y direction, in device units

Sets an offset that is added to the device coordinates determined by the CTM when drawing to *Surface*. One use case for this function is when we want to create a *Surface* that redirects drawing for a portion of an onscreen surface to an offscreen surface in a way that is completely invisible to the user of the cairo API. Setting a transformation via *Context.translate()* isn't sufficient to do this, since functions like *Context.device_to_user()* will expose the hidden offset.

Note that the offset affects drawing to the surface as well as using the surface in a source pattern.

set_fallback_resolution(*x_pixels_per_inch*, *y_pixels_per_inch*)

Parameters

- **x_pixels_per_inch** (*float*) – horizontal setting for pixels per inch
- **y_pixels_per_inch** (*float*) – vertical setting for pixels per inch

Set the horizontal and vertical resolution for image fallbacks.

When certain operations aren't supported natively by a backend, cairo will fallback by rendering operations to an image and then overlaying that image onto the output. For backends that are natively vector-oriented, this function can be used to set the resolution used for these image fallbacks, (larger values will result in more detailed images, but also larger file sizes).

Some examples of natively vector-oriented backends are the ps, pdf, and svg backends.

For backends that are natively raster-oriented, image fallbacks are still possible, but they are always performed at the native device resolution. So this function has no effect on those backends.

Note: The fallback resolution only takes effect at the time of completing a page (with *Context.show_page()* or *Context.copy_page()*) so there is currently no way to have more than one fallback resolution in effect on a single page.

The default fallback resoultion is 300 pixels per inch in both dimensions.

New in version 1.2.

show_page()

Emits and clears the current page for backends that support multiple pages. Use *copy_page()* if you don't want to clear the page.

There is a convenience function for this that takes a *Context.show_page()*.

New in version 1.6.

write_to_png(*fobj*)

Parameters **fobj** (filename (*pathlike*), file or file-like object) – the file to write to

Raises *MemoryError* if memory could not be allocated for the operation

IOError if an I/O error occurs while attempting to write the file

Writes the contents of *Surface* to *fobj* as a PNG image.

create_for_rectangle(*x*, *y*, *width*, *height*)

Parameters

- **x** (*float*) – the x-origin of the sub-surface from the top-left of the target surface (in device-space units)

- **y** (*float*) – the y-origin of the sub-surface from the top-left of the target surface (in device-space units)
- **width** (*float*) – width of the sub-surface (in device-space units)
- **height** (*float*) – height of the sub-surface (in device-space units)

Returns a new surface

Return type *cairo.Surface*

Create a new surface that is a rectangle within the target surface. All operations drawn to this surface are then clipped and translated onto the target surface. Nothing drawn via this sub-surface outside of its bounds is drawn onto the target surface, making this a useful method for passing constrained child surfaces to library routines that draw directly onto the parent surface, i.e. with no further backend allocations, double buffering or copies.

Note: The semantics of subsurfaces have not been finalized yet unless the rectangle is in full device units, is contained within the extents of the target surface, and the target or subsurface's device transforms are not changed.

New in version 1.12.0.

create_similar_image(*format*, *width*, *height*)

Parameters

- **format** (`cairo.Format`) – the format for the new surface
- **width** (*int*) – width of the new surface, (in device-space units)
- **height** (*int*) – height of the new surface, (in device-space units)

Returns a new image surface

Return type *cairo.ImageSurface*

Create a new image surface that is as compatible as possible for uploading to and the use in conjunction with an existing surface. However, this surface can still be used like any normal image surface.

Initially the surface contents are all 0 (transparent if contents have transparency, black otherwise.)

New in version 1.12.0.

has_show_text_glyphs()

Returns `True` if surface supports *Context.show_text_glyphs()*, `False` otherwise

Return type bool

Returns whether the surface supports sophisticated *Context.show_text_glyphs()* operations. That is, whether it actually uses the provided text and cluster data to a *Context.show_text_glyphs()* call.

Note: Even if this function returns `False`, a *Context.show_text_glyphs()* operation targeted at surface will still succeed. It just will act like a *Context.show_glyphs()* operation. Users can use this function to avoid computing UTF-8 text and cluster mapping if the target surface does not use it.

New in version 1.12.0.

set_device_scale(*x_scale*, *y_scale*)

Parameters

- **x_scale** (*float*) – a scale factor in the X direction

- **y_scale** (*float*) – a scale factor in the Y direction

Sets a scale that is multiplied to the device coordinates determined by the CTM when drawing to surface . One common use for this is to render to very high resolution display devices at a scale factor, so that code that assumes 1 pixel will be a certain size will still work. Setting a transformation via *Context.translate()* isn't sufficient to do this, since functions like *Context.device_to_user()* will expose the hidden scale.

New in version 1.14.0.

get_device_scale()

Returns (x_scale,y_scale) a 2-tuple of float

This function returns the previous device offset set by *Surface.set_device_scale()*.

New in version 1.14.0.

get_device()

Returns the device or None if the surface does not have an associated device

Return type *Device*

This function returns the device for a surface.

New in version 1.14.0.

map_to_image(*extents*)

Parameters **extents** (RectangleInt) – limit the extraction to an rectangular region or None for the whole surface

Returns newly allocated image surface

Return type *ImageSurface*

Raises ***Error*** –

Returns an image surface that is the most efficient mechanism for modifying the backing store of the target surface.

Note, the use of the original surface as a target or source whilst it is mapped is undefined. The result of mapping the surface multiple times is undefined. Calling *Surface.finish()* on the resulting image surface results in undefined behavior. Changing the device transform of the image surface or of surface before the image surface is unmapped results in undefined behavior.

The caller must use *Surface.unmap_image()* to destroy this image surface.

New in version 1.15.0.

unmap_image(*image*)

Parameters **image** (ImageSurface) – the currently mapped image

Unmaps the image surface as returned from *Surface.map_to_image()*.

The content of the image will be uploaded to the target surface. Afterwards, the image is destroyed.

Using an image surface which wasn't returned by *Surface.map_to_image()* results in undefined behavior.

New in version 1.15.0.

3.9.2 class ImageSurface(Surface)

A *cairo.ImageSurface* provides the ability to render to memory buffers either allocated by cairo or by the calling code. The supported image formats are those defined in *cairo.Format*.

class cairo.**ImageSurface**(*format*, *width*, *height*)

Parameters

- **format** (cairo.Format) – format of pixels in the surface to create
- **width** – width of the surface, in pixels
- **height** – height of the surface, in pixels

Returns a new *ImageSurface*

Raises *MemoryError* in case of no memory

Creates an *ImageSurface* of the specified format and dimensions. Initially the surface contents are all 0. (Specifically, within each pixel, each color or alpha channel belonging to format will be 0. The contents of bits within a pixel, but not belonging to the given format are undefined).

classmethod create_for_data(*data*, *format*, *width*, *height*[, *stride*])

Parameters

- **data** – a writable Python buffer/memoryview object
- **format** (cairo.Format) – the format of pixels in the buffer
- **width** – the width of the image to be stored in the buffer
- **height** – the height of the image to be stored in the buffer
- **stride** – the number of bytes between the start of rows in the buffer as allocated. If not given the value from *cairo.Format.stride_for_width()* is used.

Returns a new *ImageSurface*

Raises *MemoryError* in case of no memory.

cairo.Error in case of invalid *stride* value.

Creates an *ImageSurface* for the provided pixel data. The initial contents of buffer will be used as the initial image contents; you must explicitly clear the buffer, using, for example, cairo_rectangle() and cairo_fill() if you want it cleared.

Note that the *stride* may be larger than width*bytes_per_pixel to provide proper alignment for each pixel and row. This alignment is required to allow high-performance rendering within cairo. The correct way to obtain a legal stride value is to call *cairo.Format.stride_for_width()* with the desired format and maximum image width value, and use the resulting stride value to allocate the data and to create the *ImageSurface*. See *cairo.Format.stride_for_width()* for example code.

classmethod create_from_png(*fobj*)

Parameters **fobj** – a *pathlike*, file, or file-like object of the PNG to load.

Returns a new *ImageSurface* initialized the contents to the given PNG file.

static format_stride_for_width(*format*, *width*)
See *cairo.Format.stride_for_width()*.

New in version 1.6.

get_data()

Returns a Python buffer object for the data of the *ImageSurface*, for direct inspection or modification. On Python 3 a memoryview object is returned.

New in version 1.2.

get_format()

Returns the format of the *ImageSurface*.

Return type *cairo.Format*

New in version 1.2.

get_height()

Returns the height of the *ImageSurface* in pixels.

get_stride()

Returns the stride of the *ImageSurface* in bytes. The stride is the distance in bytes from the beginning of one row of the image data to the beginning of the next row.

get_width()

Returns the width of the *ImageSurface* in pixels.

3.9.3 class PDFSurface(Surface)

The PDFSurface is used to render cairo graphics to Adobe PDF files and is a multi-page vector surface backend.

class cairo.**PDFSurface**(*fobj*, *width_in_points*, *height_in_points*)

Parameters

- **fobj** (None, *pathlike*, file or file-like object) – a filename or writable file object. None may be used to specify no output. This will generate a *PDFSurface* that may be queried and used as a source, without generating a temporary file.
- **width_in_points** (*float*) – width of the surface, in points (1 point == 1/72.0 inch)
- **height_in_points** (*float*) – height of the surface, in points (1 point == 1/72.0 inch)

Returns a new *PDFSurface* of the specified size in points to be written to *fobj*.

Raises *MemoryError* in case of no memory

New in version 1.2.

set_size()

Parameters

- **width_in_points** (*float*) – new surface width, in points (1 point == 1/72.0 inch)
- **height_in_points** (*float*) – new surface height, in points (1 point == 1/72.0 inch)

Changes the size of a *PDFSurface* for the current (and subsequent) pages.

This function should only be called before any drawing operations have been performed on the current page. The simplest way to do this is to call this function immediately after creating the surface or immediately after completing a page with either *Context.show_page()* or *Context.copy_page()*.

New in version 1.2.

restrict_to_version(*version*)

Parameters **version** – PDF version

Restricts the generated PDF file to version . See *get_versions()* for a list of available version values that can be used here.

This function should only be called before any drawing operations have been performed on the given surface. The simplest way to do this is to call this function immediately after creating the surface.

New in version 1.12.0.

static get_versions()

Returns supported version list

Return type list

Retrieve the list of supported versions. See *restrict_to_version()*.

New in version 1.12.0.

static version_to_string(*version*)

Parameters **version** – PDF version

Returns the string associated to the given version

Return type str

Raises **ValueError** – if version isn't valid

Get the string representation of the given version id. See *get_versions()* for a way to get the list of valid version ids.

New in version 1.12.0.

add_outline(*parent_id*, *utf8*, *link_attribs*, *flags*)

Parameters

- **parent_id** (*int*) – the id of the parent item or *PDF_OUTLINE_ROOT* if this is a top level item.
- **utf8** (text) – the name of the outline
- **link_attribs** (text) – the link attributes specifying where this outline links to
- **flags** (PDFOutlineFlags) – outline item flags

Returns the id for the added item.

Return type int

New in version 1.18.0: Only available with cairo 1.15.10+

set_metadata(*metadata*, *utf8*)

Parameters

- **metadata** (PDFMetadata) – The metadata item to set.
- **utf8** (text) – metadata value

Set document metadata. The *PDFMetadata.CREATE_DATE* and *PDFMetadata.MOD_DATE* values must be in ISO-8601 format: YYYY-MM-DDThh:mm:ss. An optional timezone of the form "[+/-]hh:mm" or "Z" for UTC time can be appended. All other metadata values can be any UTF-8 string.

New in version 1.18.0: Only available with cairo 1.15.10+

set_page_label(*utf8*)

Parameters **utf8** (text) – metadata value

Set page label for the current page.

New in version 1.18.0: Only available with cairo 1.15.10+

set_thumbnail_size(*width*, *height*)

Parameters

- **width** (*int*) – Thumbnail width.
- **height** (*int*) – Thumbnail height

Set the thumbnail image size for the current and all subsequent pages. Setting a width or height of 0 disables thumbnails for the current and subsequent pages.

New in version 1.18.0: Only available with cairo 1.15.10+

3.9.4 class PSSurface(Surface)

The *PSSurface* is used to render cairo graphics to Adobe PostScript files and is a multi-page vector surface backend.

class cairo.**PSSurface**(*fobj*, *width_in_points*, *height_in_points*)

Parameters

- **fobj** (None, *pathlike*, file or file-like object) – a filename or writable file object. None may be used to specify no output. This will generate a *PSSurface* that may be queried and used as a source, without generating a temporary file.
- **width_in_points** (*float*) – width of the surface, in points (1 point == 1/72.0 inch)
- **height_in_points** (*float*) – height of the surface, in points (1 point == 1/72.0 inch)

Returns a new *PDFSurface* of the specified size in points to be written to *fobj*.

Raises *MemoryError* in case of no memory

Note that the size of individual pages of the PostScript output can vary. See *set_size()*.

dsc_begin_page_setup()

This method indicates that subsequent calls to *dsc_comment()* should direct comments to the Page-Setup section of the PostScript output.

This method call is only needed for the first page of a surface. It should be called after any call to *dsc_begin_setup()* and before any drawing is performed to the surface.

See *dsc_comment()* for more details.

New in version 1.2.

dsc_begin_setup()

This function indicates that subsequent calls to *dsc_comment()* should direct comments to the Setup section of the PostScript output.

This function should be called at most once per surface, and must be called before any call to *dsc_begin_page_setup()* and before any drawing is performed to the surface.

See *dsc_comment()* for more details.

New in version 1.2.

dsc_comment(*comment*)

Parameters **comment** (*str*) – a comment string to be emitted into the PostScript output

Emit a comment into the PostScript output for the given surface.

The comment is expected to conform to the PostScript Language Document Structuring Conventions (DSC). Please see that manual for details on the available comments and their meanings. In particular, the %%IncludeFeature comment allows a device-independent means of controlling printer device features. So the PostScript Printer Description Files Specification will also be a useful reference.

The comment string must begin with a percent character (%) and the total length of the string (including any initial percent characters) must not exceed 255 characters. Violating either of these conditions will place *PSSurface* into an error state. But beyond these two conditions, this function will not enforce conformance of the comment with any particular specification.

The comment string should not have a trailing newline.

The DSC specifies different sections in which particular comments can appear. This function provides for comments to be emitted within three sections: the header, the Setup section, and the PageSetup section. Comments appearing in the first two sections apply to the entire document while comments in the BeginPageSetup section apply only to a single page.

For comments to appear in the header section, this function should be called after the surface is created, but before a call to *dsc_begin_setup()*.

For comments to appear in the Setup section, this function should be called after a call to *dsc_begin_setup()* but before a call to *dsc_begin_page_setup()*.

For comments to appear in the PageSetup section, this function should be called after a call to *dsc_begin_page_setup()*.

Note that it is only necessary to call *dsc_begin_page_setup()* for the first page of any surface. After a call to *Context.show_page()* or *Context.copy_page()* comments are unambiguously directed to the PageSetup section of the current page. But it doesn't hurt to call this function at the beginning of every page as that consistency may make the calling code simpler.

As a final note, cairo automatically generates several comments on its own. As such, applications must not manually generate any of the following comments:

Header section: %!PS-Adobe-3.0, %Creator, %CreationDate, %Pages, %BoundingBox, %DocumentData, %LanguageLevel, %EndComments.

Setup section: %BeginSetup, %EndSetup

PageSetup section: %BeginPageSetup, %PageBoundingBox, %EndPageSetup.

Other sections: %BeginProlog, %EndProlog, %Page, %Trailer, %EOF

Here is an example sequence showing how this function might be used:

```
surface = PSSurface (filename, width, height)
...
surface.dsc_comment (surface, "%%Title: My excellent document")
surface.dsc_comment (surface, "%%Copyright: Copyright (C) 2006 Cairo Lover")
...
surface.dsc_begin_setup (surface)
surface.dsc_comment (surface, "%%IncludeFeature: *MediaColor White")
...
surface.dsc_begin_page_setup (surface)
surface.dsc_comment (surface, "%%IncludeFeature: *PageSize A3")
surface.dsc_comment (surface, "%%IncludeFeature: *InputSlot LargeCapacity")
surface.dsc_comment (surface, "%%IncludeFeature: *MediaType Glossy")
surface.dsc_comment (surface, "%%IncludeFeature: *MediaColor Blue")
... draw to first page here ..
ctx.show_page (cr)
```

(continues on next page)

(continued from previous page)

```
...
surface.dsc_comment (surface, "%%IncludeFeature:  PageSize A5");
...
```

New in version 1.2.

get_eps()

Returns True iff the *PSSurface* will output Encapsulated PostScript.

New in version 1.6.

static level_to_string(*level*)

Parameters **level** (cairo.PSLevel) – a PS level

Returns the string associated to given level.

Return type str

Get the string representation of the given *level*. See *get_levels()* for a way to get the list of valid level ids.

Note: Prior to 1.12 this was available under *ps_level_to_string()*

New in version 1.12.0.

ps_level_to_string
Alias for *level_to_string()*

New in version 1.6.

restrict_to_level(*level*)

Parameters **level** (cairo.PSLevel) – a PS level

Restricts the generated PostSript file to *level*. See *get_levels()* for a list of available level values that can be used here.

This function should only be called before any drawing operations have been performed on the given surface. The simplest way to do this is to call this function immediately after creating the surface.

New in version 1.6.

set_eps(*eps*)

Parameters **eps** (*bool*) – True to output EPS format PostScript

If *eps* is True, the PostScript surface will output Encapsulated PostScript.

This function should only be called before any drawing operations have been performed on the current page. The simplest way to do this is to call this function immediately after creating the surface. An Encapsulated PostScript file should never contain more than one page.

New in version 1.6.

set_size(*width_in_points*, *height_in_points*)

Parameters

- **width_in_points** (*float*) – new surface width, in points (1 point == 1/72.0 inch)
- **height_in_points** (*float*) – new surface height, in points (1 point == 1/72.0 inch)

Changes the size of a PostScript surface for the current (and subsequent) pages.

This function should only be called before any drawing operations have been performed on the current page. The simplest way to do this is to call this function immediately after creating the surface or immediately after completing a page with either *Context.show_page()* or *Context.copy_page()*.

New in version 1.2.

static get_levels()

Returns supported level list

Return type list

Retrieve the list of supported levels. See *restrict_to_level()*.

New in version 1.12.0.

3.9.5 class RecordingSurface(Surface)

A *RecordingSurface* is a surface that records all drawing operations at the highest level of the surface backend interface, (that is, the level of paint, mask, stroke, fill, and show_text_glyphs). The recording surface can then be "replayed" against any target surface by using it as a source surface.

If you want to replay a surface so that the results in target will be identical to the results that would have been obtained if the original operations applied to the recording surface had instead been applied to the target surface, you can use code like this:

```
cr = cairo.Context(target)
cr.set_source_surface(recording_surface, 0.0, 0.0)
cr.paint()
```

A *RecordingSurface* is logically unbounded, i.e. it has no implicit constraint on the size of the drawing surface. However, in practice this is rarely useful as you wish to replay against a particular target surface with known bounds. For this case, it is more efficient to specify the target extents to the recording surface upon creation.

The recording phase of the recording surface is careful to snapshot all necessary objects (paths, patterns, etc.), in order to achieve accurate replay.

class cairo.**RecordingSurface**(*content*, *rectangle*)

Parameters

- **content** (cairo.Content) – the content for the new surface
- **rectangle** (cairo.Rectangle) – or None to record unbounded operations.

Returns a new *RecordingSurface*

Creates a *RecordingSurface* which can be used to record all drawing operations at the highest level (that is, the level of paint, mask, stroke, fill and show_text_glyphs). The *RecordingSurface* can then be "replayed" against any target surface by using it as a source to drawing operations.

The recording phase of the *RecordingSurface* is careful to snapshot all necessary objects (paths, patterns, etc.), in order to achieve accurate replay.

New in version 1.11.0.

ink_extents()

::rtype: (x0,y0,width,height) a 4-tuple of float

- x0: the x-coordinate of the top-left of the ink bounding box

- y0: the y-coordinate of the top-left of the ink bounding box
- width: the width of the ink bounding box
- height: the height of the ink bounding box

Measures the extents of the operations stored within the *RecordingSurface*. This is useful to compute the required size of an *ImageSurface* (or equivalent) into which to replay the full sequence of drawing operations.

New in version 1.11.0.

get_extents()

Returns a rectangle or `None` if the surface is unbounded.

Return type *Rectangle*

Get the extents of the recording-surface.

New in version 1.12.0.

3.9.6 class SVGSurface(Surface)

The *SVGSurface* is used to render cairo graphics to SVG files and is a multi-page vector surface backend

class cairo.**SVGSurface**(*fobj*, *width_in_points*, *height_in_points*)

Parameters

- **fobj** (None, *pathlike*, file or file-like object) – a filename or writable file object. None may be used to specify no output. This will generate a *SVGSurface* that may be queried and used as a source, without generating a temporary file.
- **width_in_points** (*float*) – width of the surface, in points (1 point == 1/72.0 inch)
- **height_in_points** (*float*) – height of the surface, in points (1 point == 1/72.0 inch)

Returns a new *SVGSurface* of the specified size in points to be written to *fobj*.

Raises *MemoryError* in case of no memory

restrict_to_version(*version*)

Parameters **version** – SVG version

Restricts the generated SVG file to version . See *get_versions()* for a list of available version values that can be used here.

This function should only be called before any drawing operations have been performed on the given surface. The simplest way to do this is to call this function immediately after creating the surface.

New in version 1.12.0.

static get_versions()

Returns supported version list

Return type list

Retrieve the list of supported versions. See *restrict_to_version()*.

New in version 1.12.0.

static version_to_string(*version*)

Parameters **version** – SVG version

Returns the string associated to the given version

Return type str

Raises **ValueError** – if version isn't valid

Get the string representation of the given version id. See *get_versions()* for a way to get the list of valid version ids.

New in version 1.12.0.

get_document_unit()

Returns the SVG unit of the SVG surface.

Return type *SVGUnit*

Get the unit of the SVG surface.

New in version 1.18.0: Only available with cairo 1.15.10+

set_document_unit(*unit*)

Parameters **unit** (SVGUnit) – SVG unit

Use the specified unit for the width and height of the generated SVG file. See *SVGUnit* for a list of available unit values that can be used here.

This function can be called at any time before generating the SVG file.

However to minimize the risk of ambiguities it's recommended to call it before any drawing operations have been performed on the given surface, to make it clearer what the unit used in the drawing operations is.

The simplest way to do this is to call this function immediately after creating the SVG surface.

Note if this function is never called, the default unit for SVG documents generated by cairo will be "pt". This is for historical reasons.

New in version 1.18.0: Only available with cairo 1.15.10+

3.9.7 class Win32Surface(Surface)

The Microsoft Windows surface is used to render cairo graphics to Microsoft Windows windows, bitmaps, and printing device contexts.

class cairo.**Win32Surface**(*hdc*)

Parameters **hdc** (*int*) – the DC to create a surface for

Returns the newly created surface

Creates a cairo surface that targets the given DC. The DC will be queried for its initial clip extents, and this will be used as the size of the cairo surface. The resulting surface will always be of format cairo.FORMAT_RGB24, see *cairo.Format*.

3.9.8 class Win32PrintingSurface(Surface)

The Win32PrintingSurface is a multi-page vector surface type.

class cairo.**Win32PrintingSurface**(*hdc*)

Parameters **hdc** (*int*) – the DC to create a surface for

Returns the newly created surface

Creates a cairo surface that targets the given DC. The DC will be queried for its initial clip extents, and this will be used as the size of the cairo surface. The DC should be a printing DC; antialiasing will be ignored, and GDI will be used as much as possible to draw to the surface.

The returned surface will be wrapped using the paginated surface to provide correct complex rendering behaviour; *cairo.Surface.show_page()* and associated methods must be used for correct output.

3.9.9 class XCBSurface(Surface)

The XCB surface is used to render cairo graphics to X Window System windows and pixmaps using the XCB library.

Note that the XCB surface automatically takes advantage of the X render extension if it is available.

class cairo.**XCBSurface**

Parameters

- **connection** – an XCB connection
- **drawable** – a X drawable
- **visualtype** – a X visualtype
- **width** – The surface width
- **height** – The surface height

Creates a cairo surface that targets the given drawable (pixmap or window).

Note: This methods works using xpyb.

---

set_size(*width*, *height*)

Parameters

- **width** – The width of the surface
- **height** – The height of the surface

Informs cairo of the new size of the X Drawable underlying the surface. For a surface created for a Window (rather than a Pixmap), this function must be called each time the size of the window changes. (For a subwindow, you are normally resizing the window yourself, but for a toplevel window, it is necessary to listen for ConfigureNotify events.)

A Pixmap can never change size, so it is never necessary to call this function on a surface created for a Pixmap.

3.9.10 class XlibSurface(Surface)

The XLib surface is used to render cairo graphics to X Window System windows and pixmaps using the XLib library.

Note that the XLib surface automatically takes advantage of X render extension if it is available.

class cairo.**XlibSurface**

Note: *XlibSurface* cannot be instantiated directly because Python interaction with Xlib would require open source Python bindings to Xlib which provided a C API. However, an *XlibSurface* instance can be returned from a function call when using pygtk http://www.pygtk.org/.

get_depth()

Returns the number of bits used to represent each pixel value.

New in version 1.2.

get_height()

Returns the height of the X Drawable underlying the surface in pixels.

New in version 1.2.

get_width()

Returns the width of the X Drawable underlying the surface in pixels.

New in version 1.2.

3.9.11 class ScriptSurface(Surface)

The script surface provides the ability to render to a native script that matches the cairo drawing model. The scripts can be replayed using tools under the util/cairo-script directory, or with cairo-perf-trace.

class cairo.**ScriptSurface**(*script*, *content*, *width*, *height*)

Parameters

- **script** (cairo.ScriptDevice) – the script (output device)
- **content** (cairo.Content) – the content of the surface
- **width** (*float*) – width in pixels
- **height** (*float*) – height in pixels

Return type *cairo.ScriptSurface*

Raises ***cairo.Error*** –

Create a new surface that will emit its rendering through `script`.

New in version 1.14.

classmethod create_for_target(*script*, *target*)

Parameters

- **script** (cairo.ScriptDevice) – the script (output device)
- **target** (cairo.Surface) – a target surface to wrap

Return type *cairo.ScriptSurface*

Raises ***cairo.Error*** –

Create a proxy surface that will render to `target` and record the operations to `device`.

New in version 1.14.

3.9.12 class TeeSurface(Surface)

This surface supports redirecting all its input to multiple surfaces.

class cairo.**TeeSurface**(*master*)

Parameters **master** (cairo.Surface) –

Return type *cairo.TeeSurface*

Raises ***cairo.Error*** –

New in version 1.14.

add(*target*)

Parameters **target** (cairo.Surface) –

Raises ***cairo.Error*** –

Add the surface

New in version 1.14.

remove(*target*)

Parameters **target** (cairo.Surface) –

Raises ***cairo.Error*** –

Remove the surface

New in version 1.14.

index(*index*)

Parameters **index** (*int*) –

Return type *cairo.Surface*

Raises ***cairo.Error*** –

Returns the surface at index `index`. The master surface is at index 0.

New in version 1.14.

3.10 Text

Cairo has two sets of text rendering capabilities:

- The functions with text in their name form cairo's toy text API. The toy API takes UTF-8 encoded text and is limited in its functionality to rendering simple left-to-right text with no advanced features. That means for example that most complex scripts like Hebrew, Arabic, and Indic scripts are out of question. No kerning or correct positioning of diacritical marks either. The font selection is pretty limited too and doesn't handle the case that the selected font does not cover the characters in the text. This set of functions are really that, a toy text API, for testing and demonstration purposes. Any serious application should avoid them.
- The functions with glyphs in their name form cairo's low-level text API. The low-level API relies on the user to convert text to a set of glyph indexes and positions. This is a very hard problem and is best handled by external libraries, like the pangocairo that is part of the Pango text layout and rendering library. Pango is available from http://www.pango.org/.

3.10.1 class FontFace()

A *cairo.FontFace* specifies all aspects of a font other than the size or font matrix (a font matrix is used to distort a font by sheering it or scaling it unequally in the two directions). A *FontFace* can be set on a *Context* by using *Context.set_font_face()* the size and font matrix are set with *Context.set_font_size()* and *Context.set_font_matrix()*.

There are various types of *FontFace*, depending on the font backend they use.

class cairo.**FontFace**

> **Note:** This class cannot be instantiated directly, it is returned by *Context.get_font_face()*.

3.10.2 class FreeTypeFontFace(FontFace)

FreeType Fonts - Font support for FreeType.

The FreeType font backend is primarily used to render text on GNU/Linux systems, but can be used on other platforms too.

> **Note:** FreeType Fonts are not implemented in pycairo because there is no open source Python bindings to FreeType (and fontconfig) that provides a C API. This a possible project idea for anyone interested in adding FreeType support to pycairo.

3.10.3 class ToyFontFace(FontFace)

The *cairo.ToyFontFace* class can be used instead of *Context.select_font_face()* to create a toy font independently of a context.

class cairo.**ToyFontFace**(*family*[, *slant*[, *weight*]])

Parameters

- **family** (text) – a font family name
- **slant** (cairo.FontSlant) – the font slant of the font, defaults to *cairo.FontSlant.NORMAL*.
- **weight** (cairo.FontWeight) – the font weight of the font, defaults to *cairo.FontWeight.NORMAL*.

Returns a new *ToyFontFace*

Creates a *ToyFontFace* from a triplet of family, slant, and weight. These font faces are used in implementation of the the "toy" font API.

If family is the zero-length string "", the platform-specific default family is assumed. The default family then can be queried using *get_family()*.

The *Context.select_font_face()* method uses this to create font faces. See that function for limitations of toy font faces.

New in version 1.8.4.

get_family()

Returns the family name of a toy font

Return type str

New in version 1.8.4.

get_slant()

Returns the font slant value

Return type *cairo.FontSlant*

New in version 1.8.4.

get_weight()

Returns the font weight value

Return type *cairo.FontWeight*

New in version 1.8.4.

3.10.4 class UserFontFace(FontFace)

The user-font feature allows the cairo user to provide drawings for glyphs in a font. This is most useful in implementing fonts in non-standard formats, like SVG fonts and Flash fonts, but can also be used by games and other application to draw "funky" fonts.

Note: UserFontFace support has not (yet) been added to pycairo. If you need this feature in pycairo register your interest by sending a message to the cairo mailing list, or by opening a pycairo bug report.

3.10.5 class ScaledFont()

A *ScaledFont* is a font scaled to a particular size and device resolution. A *ScaledFont* is most useful for low-level font usage where a library or application wants to cache a reference to a scaled font to speed up the computation of metrics.

There are various types of scaled fonts, depending on the font backend they use.

class cairo.**ScaledFont**(*font_face*, *font_matrix*, *ctm*, *options*)

Parameters

- **font_face** – a *FontFace* instance
- **font_matrix** – font space to user space transformation *Matrix* for the font. In the simplest case of a N point font, this matrix is just a scale by N, but it can also be used to shear the font or stretch it unequally along the two axes. See *Context.set_font_matrix()*.
- **ctm** – user to device transformation *Matrix* with which the font will be used.
- **options** – a *FontOptions* instance to use when getting metrics for the font and rendering with it.

Creates a *ScaledFont* object from a *FontFace* and matrices that describe the size of the font and the environment in which it will be used.

extents()

Returns (ascent, descent, height, max_x_advance, max_y_advance), a tuple of float values.

Gets the metrics for a *ScaledFont*.

get_ctm()

Returns the CTM

Return type *cairo.Matrix*

Returns the CTM with which scaled_font was created into ctm. Note that the translation offsets (x0, y0) of the CTM are ignored by `ScaledFont()`. So, the matrix this function returns always has 0, 0 as x0, y0.

New in version 1.12.0.

get_font_face()

Returns the `FontFace` that this *ScaledFont* was created for.

New in version 1.2.

get_font_matrix()

Returns the matrix

Return type *cairo.Matrix*

Returns the font matrix with which scaled_font was created.

New in version 1.12.0.

get_font_options()

Returns font options

Return type *cairo.FontOptions*

Returns the font options with which scaled_font was created.

New in version 1.12.0.

get_scale_matrix()

Returns the scale `Matrix`

The scale matrix is product of the font matrix and the ctm associated with the scaled font, and hence is the matrix mapping from font space to device space.

New in version 1.8.

glyph_extents(*glyphs*)

Parameters **glyphs** – glyphs, a sequence of `Glyph`

Return type *TextExtents*

New in version 1.15.

Gets the extents for a list of glyphs. The extents describe a user-space rectangle that encloses the "inked" portion of the glyphs, (as they would be drawn by `Context.show_glyphs()` if the cairo graphics state were set to the same font_face, font_matrix, ctm, and font_options as scaled_font). Additionally, the x_advance and y_advance values indicate the amount by which the current point would be advanced by cairo_show_glyphs().

Note that whitespace glyphs do not contribute to the size of the rectangle (extents.width and extents.height).

text_extents(*text*)

Parameters **text** (`text`) – text

Return type *TextExtents*

Gets the extents for a string of text. The extents describe a user-space rectangle that encloses the "inked" portion of the text drawn at the origin (0,0) (as it would be drawn by *Context.show_text()* if the cairo graphics state were set to the same font_face, font_matrix, ctm, and font_options as *ScaledFont*). Additionally, the x_advance and y_advance values indicate the amount by which the current point would be advanced by *Context.show_text()*.

Note that whitespace characters do not directly contribute to the size of the rectangle (width and height). They do contribute indirectly by changing the position of non-whitespace characters. In particular, trailing whitespace characters are likely to not affect the size of the rectangle, though they will affect the x_advance and y_advance values.

New in version 1.2.

text_to_glyphs (*x*, *y*, *utf8*[, *with_clusters=True*])

Parameters

- **x** (*float*) – X position to place first glyph
- **y** (*float*) – Y position to place first glyph
- **utf8** (*text*) – a string of text
- **with_clusters** (*bool*) – If False only the glyph list will computed and returned

Returns a tuple of ([*Glyph*], [*TextCluster*], *TextClusterFlags*)

Return type tuple

Raises ***Error*** –

New in version 1.15.

Converts UTF-8 text to a list of glyphs, with cluster mapping, that can be used to render later.

For details of how clusters, and cluster_flags map input UTF-8 text to the output glyphs see *Context.show_text_glyphs()*.

The output values can be readily passed to *Context.show_text_glyphs()* *Context.show_glyphs()*, or related functions, assuming that the exact same scaled font is used for the operation.

3.10.6 class FontOptions()

An opaque structure holding all options that are used when rendering fonts.

Individual features of a *FontOptions* can be set or accessed using functions named *FontOptions.set_<feature_name>* and *FontOptions.get_<feature_name>*, like *FontOptions.set_antialias()* and *FontOptions.get_antialias()*.

New features may be added to a *FontOptions* in the future. For this reason, *FontOptions.copy()*, *FontOptions.equal()*, *FontOptions.merge()*, and *FontOptions.hash()* should be used to copy, check for equality, merge, or compute a hash value of FontOptions objects.

class cairo.**FontOptions**

Returns a newly allocated *FontOptions*.

Allocates a new *FontOptions* object with all options initialized to default values.

Implements __eq__ and __ne__ using *equal()* since 1.12.0.

get_antialias()

Returns the antialias mode for the *FontOptions* object

Return type *cairo.Antialias*

get_hint_metrics()

Returns the hint metrics mode for the *FontOptions* object

Return type *cairo.HintMetrics*

get_hint_style()

Returns the hint style for the *FontOptions* object

Return type *cairo.HintStyle*

get_subpixel_order()

Returns the subpixel order for the *FontOptions* object

Return type *cairo.SubpixelOrder*

set_antialias(*antialias*)

Parameters **antialias** (cairo.Antialias) – the antialias mode

This specifies the type of antialiasing to do when rendering text.

set_hint_metrics(*hint_metrics*)

Parameters **hint_metrics** (cairo.HintMetrics) – the hint metrics mode

This controls whether metrics are quantized to integer values in device units.

set_hint_style(*hint_style*)

Parameters **hint_style** (cairo.HintStyle) – the hint style

This controls whether to fit font outlines to the pixel grid, and if so, whether to optimize for fidelity or contrast.

set_subpixel_order(*subpixel_order*)

Parameters **subpixel_order** (cairo.SubpixelOrder) – the subpixel order

The subpixel order specifies the order of color elements within each pixel on the display device when rendering with an antialiasing mode of *cairo.Antialias.SUBPIXEL*.

merge(*other*)

Parameters **other** (FontOptions) – another *FontOptions*

Merges non-default options from other into options , replacing existing values. This operation can be thought of as somewhat similar to compositing other onto options with the operation of *Operator.OVER*.

New in version 1.12.0.

copy()

Returns a new *FontOptions*

Returns a new font options object copying the option values from original.

New in version 1.12.0.

hash()

Returns the hash value for the font options object

Return type int

Compute a hash for the font options object; this value will be useful when storing an object containing a *FontOptions* in a hash table.

New in version 1.12.0.

equal(*other*)

param FontOptions other another *FontOptions*

returns True if all fields of the two font options objects match. Note that this function will return False if either object is in error.

rtype bool

Compares two font options objects for equality.

New in version 1.12.0.

set_variations(*variations*)

Parameters **variations** (str or None) – the new font variations, or None

Sets the OpenType font variations for the font options object. Font variations are specified as a string with a format that is similar to the CSS font-variation-settings. The string contains a comma-separated list of axis assignments, which each assignment consists of a 4-character axis name and a value, separated by whitespace and optional equals sign.

Examples:

- wght=200,wdth=140.5
- wght 200 , wdth 140.5

New in version 1.18.0: Only available with cairo 1.15.12+

get_variations()

Returns the font variations for the font options object. The returned string belongs to the options and must not be modified. It is valid until either the font options object is destroyed or the font variations in this object is modified with *set_variations()*.

Return type str

Gets the OpenType font variations for the font options object. See *set_variations()* for details about the string format.

New in version 1.18.0: Only available with cairo 1.15.12+

3.11 Devices

3.11.1 class Device()

class cairo.**Device**

A *Device* represents the driver interface for drawing operations to a *Surface*.

New in version 1.14.

Note: New in version 1.17.0: *cairo.Device* can be used as a context manager:

```
# device.finish() will be called on __exit__
with cairo.ScriptDevice(f) as device:
    pass
```

---

finish()

This function finishes the device and drops all references to external resources. All surfaces, fonts and

other objects created for this device will be finished, too. Further operations on the device will not affect the device but will instead trigger a *Status.DEVICE_FINISHED* error.

This function may acquire devices.

New in version 1.14.

flush()

Finish any pending operations for the device and also restore any temporary modifications cairo has made to the device's state. This function must be called before switching from using the device with Cairo to operating on it directly with native APIs. If the device doesn't support direct access, then this function does nothing.

This function may acquire devices.

New in version 1.14.

acquire()

Raises ***cairo.Error*** – If the device is in an error state and could not be acquired.

Acquires the device for the current thread. This function will block until no other thread has acquired the device.

If the does not raise, you successfully acquired the device. From now on your thread owns the device and no other thread will be able to acquire it until a matching call to *release()*. It is allowed to recursively acquire the device multiple times from the same thread.

After a successful call to *acquire()*, a matching call to *release()* is required.

Note: You must never acquire two different devices at the same time unless this is explicitly allowed. Otherwise the possibility of deadlocks exist. As various Cairo functions can acquire devices when called, these functions may also cause deadlocks when you call them with an acquired device. So you must not have a device acquired when calling them. These functions are marked in the documentation.

New in version 1.14.

release()

Releases a device previously acquired using *acquire()*. See that function for details.

New in version 1.14.

3.11.2 class ScriptDevice(Device)

class cairo.**ScriptDevice**(*fobj*)

Parameters **fobj** (*pathlike*, file or file-like object) – a filename or writable file object.

Creates a output device for emitting the script, used when creating the individual surfaces.

New in version 1.14.

set_mode(*mode*)

Parameters **mode** (cairo.ScriptMode) – the new mode

Change the output mode of the script

get_mode()

Returns the current output mode of the script

Return type *cairo.ScriptMode*

Queries the script for its current output mode.

write_comment(*comment*)

Parameters **comment** (text) – the string to emit

Emit a string verbatim into the script.

from_recording_surface(*recording_surface*)

Parameters **recording_surface** (cairo.RecordingSurface) – the recording surface to replay

Raises ***cairo.Error*** –

Converts the record operations in recording_surface into a script.

3.12 Glyph

3.12.1 class Glyph(tuple)

class cairo.**Glyph**(*index*, *x*, *y*)

Parameters

- **index** (*int*) – glyph index in the font. The exact interpretation of the glyph index depends on the font technology being used.
- **x** (*float*) – the offset in the X direction between the origin used for drawing or measuring the string and the origin of this glyph.
- **y** (*float*) – the offset in the Y direction between the origin used for drawing or measuring the string and the origin of this glyph.

Return type *Glyph*

New in version 1.15: In prior versions a (int, float, float) tuple was used instead of *Glyph*.

The *Glyph* holds information about a single glyph when drawing or measuring text. A font is (in simple terms) a collection of shapes used to draw text. A glyph is one of these shapes. There can be multiple glyphs for a single character (alternates to be used in different contexts, for example), or a glyph can be a ligature of multiple characters. Cairo doesn't expose any way of converting input text into glyphs, so in order to use the Cairo interfaces that take arrays of glyphs, you must directly access the appropriate underlying font system.

Note that the offsets given by x and y are not cumulative. When drawing or measuring text, each glyph is individually positioned with respect to the overall origin

index
int

x
float

y
float

3.13 Rectangle

3.13.1 class Rectangle(tuple)

class cairo.**Rectangle**(*x*, *y*, *width*, *height*)

Parameters

- **x** (*float*) – X coordinate of the left side of the rectangle
- **y** (*float*) – Y coordinate of the the top side of the rectangle
- **width** (*float*) – width of the rectangle
- **height** (*float*) – height of the rectangle

Return type *Rectangle*

New in version 1.15: In prior versions a (float, float, float, float) tuple was used instead of *Rectangle*.

A data structure for holding a rectangle.

x
float

y
float

width
float

height
float

3.14 Text Cluster

3.14.1 class TextCluster(tuple)

class cairo.**TextCluster**(*num_bytes*, *num_glyphs*)

Parameters

- **num_bytes** (*int*) – the number of bytes of UTF-8 text covered by cluster
- **num_glyphs** (*int*) – the number of glyphs covered by cluster

New in version 1.15.

The *TextCluster* structure holds information about a single text cluster. A text cluster is a minimal mapping of some glyphs corresponding to some UTF-8 text.

For a cluster to be valid, both num_bytes and num_glyphs should be non-negative, and at least one should be non-zero. Note that clusters with zero glyphs are not as well supported as normal clusters. For example, PDF rendering applications typically ignore those clusters when PDF text is being selected.

See *Context.show_text_glyphs()* for how clusters are used in advanced text operations.

num_bytes
int

num_glyphs
int

3.15 TextExtents

3.15.1 class TextExtents(tuple)

class cairo.**TextExtents**(*x_bearing*, *y_bearing*, *width*, *height*, *x_advance*, *y_advance*)

Parameters

- **x_bearing** (*float*) – the horizontal distance from the origin to the leftmost part of the glyphs as drawn. Positive if the glyphs lie entirely to the right of the origin.
- **y_bearing** (*float*) – the vertical distance from the origin to the topmost part of the glyphs as drawn. Positive only if the glyphs lie completely below the origin; will usually be negative.
- **width** (*float*) – width of the glyphs as drawn
- **height** (*float*) – height of the glyphs as drawn
- **x_advance** (*float*) – distance to advance in the X direction after drawing these glyphs
- **y_advance** (*float*) – distance to advance in the Y direction after drawing these glyphs. Will typically be zero except for vertical text layout as found in East-Asian languages.

Return type *TextExtents*

New in version 1.15: In prior versions a (float, float, float, float, float, float) tuple was used instead of *TextExtents*.

The *TextExtents* class stores the extents of a single glyph or a string of glyphs in user-space coordinates. Because text extents are in user-space coordinates, they are mostly, but not entirely, independent of the current transformation matrix. If you call `context.scale(2.0, 2.0)`, text will be drawn twice as big, but the reported text extents will not be doubled. They will change slightly due to hinting (so you can't assume that metrics are independent of the transformation matrix), but otherwise will remain unchanged.

x_bearing
float

y_bearing
float

width
float

height
float

x_advance
float

y_advance
float

3.16 Legacy Constants

These constants are aliases for enum attributes in newer versions of Pycairo. They might still be useful if you need to support Pycairo versions older than 1.13.

cairo.**ANTIALIAS_DEFAULT**
See *Antialias.DEFAULT*

cairo.**ANTIALIAS_NONE**
See *Antialias.NONE*

cairo.**ANTIALIAS_GRAY**
See *Antialias.GRAY*

cairo.**ANTIALIAS_SUBPIXEL**
See *Antialias.SUBPIXEL*

cairo.**ANTIALIAS_FAST**
See *Antialias.FAST*

New in version 1.12.0.

cairo.**ANTIALIAS_GOOD**
See *Antialias.GOOD*

New in version 1.12.0.

cairo.**ANTIALIAS_BEST**
See *Antialias.BEST*

New in version 1.12.0.

cairo.**CONTENT_COLOR**
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See *Content.ALPHA*

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See *Extend.NONE*

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cairo.**EXTEND_REFLECT**
See *Extend.REFLECT*

cairo.**EXTEND_PAD**
See *Extend.PAD*

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See *FillRule.WINDING*

cairo.**FILL_RULE_EVEN_ODD**
See *FillRule.EVEN_ODD*

cairo.**FILTER_FAST**
See *Filter.FAST*

cairo.**FILTER_GOOD**
See *Filter.GOOD*

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See *Filter.BEST*

cairo.**FILTER_NEAREST**
See *Filter.NEAREST*

cairo.**FILTER_BILINEAR**
See *Filter.BILINEAR*

cairo.**FILTER_GAUSSIAN**
See *Filter.GAUSSIAN*

cairo.**FONT_SLANT_NORMAL**
See *FontSlant.NORMAL*

cairo.**FONT_SLANT_ITALIC**
See *FontSlant.ITALIC*

cairo.**FONT_SLANT_OBLIQUE**
See *FontSlant.OBLIQUE*

cairo.**FONT_WEIGHT_NORMAL**
See *FontWeight.NORMAL*

cairo.**FONT_WEIGHT_BOLD**
See *FontWeight.BOLD*

cairo.**FORMAT_INVALID**
See *Format.INVALID*

New in version 1.12.0.

cairo.**FORMAT_ARGB32**
See *Format.ARGB32*

cairo.**FORMAT_RGB24**
See *Format.RGB24*

cairo.**FORMAT_A8**
See *Format.A8*

cairo.**FORMAT_A1**
See *Format.A1*

cairo.**FORMAT_RGB16_565**
See *Format.RGB16_565*

cairo.**FORMAT_RGB30**
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New in version 1.12.0.

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See *HintMetrics.DEFAULT*

cairo.**HINT_METRICS_OFF**
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cairo.**HINT_METRICS_ON**
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cairo.**HINT_STYLE_NONE**
See *HintStyle.NONE*

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See *HintStyle.SLIGHT*

cairo.**HINT_STYLE_MEDIUM**
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cairo.**HINT_STYLE_FULL**
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cairo.**OPERATOR_DEST**
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cairo.**OPERATOR_DEST_OVER**
See *Operator.DEST_OVER*

cairo.**OPERATOR_DEST_IN**
See *Operator.DEST_IN*

cairo.**OPERATOR_DEST_OUT**
See *Operator.DEST_OUT*

cairo.**OPERATOR_DEST_ATOP**
See *Operator.DEST_ATOP*

cairo.**OPERATOR_XOR**
See *Operator.XOR*

cairo.**OPERATOR_ADD**
See *Operator.ADD*

cairo.**OPERATOR_SATURATE**
See *Operator.SATURATE*

cairo.**OPERATOR_MULTIPLY**
See *Operator.MULTIPLY*

New in version 1.12.0.

cairo.**OPERATOR_SCREEN**
See *Operator.SCREEN*

New in version 1.12.0.

cairo.**OPERATOR_OVERLAY**
See *Operator.OVERLAY*

New in version 1.12.0.

cairo.**OPERATOR_DARKEN**
See *Operator.DARKEN*

New in version 1.12.0.

cairo.**OPERATOR_LIGHTEN**
See *Operator.LIGHTEN*

New in version 1.12.0.

cairo.**OPERATOR_COLOR_DODGE**
See *Operator.COLOR_DODGE*

New in version 1.12.0.

cairo.**OPERATOR_COLOR_BURN**
See *Operator.COLOR_BURN*

New in version 1.12.0.

cairo.**OPERATOR_HARD_LIGHT**
See *Operator.HARD_LIGHT*

New in version 1.12.0.

cairo.**OPERATOR_SOFT_LIGHT**
See *Operator.SOFT_LIGHT*

New in version 1.12.0.

cairo.**OPERATOR_DIFFERENCE**
See *Operator.DIFFERENCE*

New in version 1.12.0.

cairo.**OPERATOR_EXCLUSION**
See *Operator.EXCLUSION*

New in version 1.12.0.

cairo.**OPERATOR_HSL_HUE**
See *Operator.HSL_HUE*

New in version 1.12.0.

cairo.**OPERATOR_HSL_SATURATION**
See *Operator.HSL_SATURATION*

New in version 1.12.0.

cairo.**OPERATOR_HSL_COLOR**
See *Operator.HSL_COLOR*

New in version 1.12.0.

cairo.**OPERATOR_HSL_LUMINOSITY**
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New in version 1.12.0.

cairo.**PATH_MOVE_TO**
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cairo.**PATH_LINE_TO**
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See *PSLevel.LEVEL_2*

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New in version 1.12.0.

cairo.**PDF_VERSION_1_5**
See *PDFVersion.VERSION_1_5*

New in version 1.12.0.

cairo.**SVG_VERSION_1_1**
See *SVGVersion.VERSION_1_1*

New in version 1.12.0.

cairo.**SVG_VERSION_1_2**
See *SVGVersion.VERSION_1_2*

New in version 1.12.0.

cairo.**SUBPIXEL_ORDER_DEFAULT**
See *SubpixelOrder.DEFAULT*

cairo.**SUBPIXEL_ORDER_RGB**
See *SubpixelOrder.RGB*

cairo.**SUBPIXEL_ORDER_BGR**
See *SubpixelOrder.BGR*

cairo.**SUBPIXEL_ORDER_VRGB**
See *SubpixelOrder.VRGB*

cairo.**SUBPIXEL_ORDER_VBGR**
See *SubpixelOrder.VBGR*

cairo.**REGION_OVERLAP_IN**
See *RegionOverlap.IN*

New in version 1.11.

cairo.**REGION_OVERLAP_OUT**
See *RegionOverlap.OUT*

New in version 1.11.

cairo.**REGION_OVERLAP_PART**
See *RegionOverlap.PART*

New in version 1.11.

cairo.**STATUS_SUCCESS**
cairo.**STATUS_NO_MEMORY**
cairo.**STATUS_INVALID_RESTORE**
cairo.**STATUS_INVALID_POP_GROUP**
cairo.**STATUS_NO_CURRENT_POINT**
cairo.**STATUS_INVALID_MATRIX**
cairo.**STATUS_INVALID_STATUS**
cairo.**STATUS_NULL_POINTER**
cairo.**STATUS_INVALID_STRING**
cairo.**STATUS_INVALID_PATH_DATA**
cairo.**STATUS_READ_ERROR**
cairo.**STATUS_WRITE_ERROR**
cairo.**STATUS_SURFACE_FINISHED**
cairo.**STATUS_SURFACE_TYPE_MISMATCH**
cairo.**STATUS_PATTERN_TYPE_MISMATCH**
cairo.**STATUS_INVALID_CONTENT**
cairo.**STATUS_INVALID_FORMAT**
cairo.**STATUS_INVALID_VISUAL**
cairo.**STATUS_FILE_NOT_FOUND**
cairo.**STATUS_INVALID_DASH**
cairo.**STATUS_INVALID_DSC_COMMENT**
cairo.**STATUS_INVALID_INDEX**
cairo.**STATUS_CLIP_NOT_REPRESENTABLE**
cairo.**STATUS_TEMP_FILE_ERROR**
cairo.**STATUS_INVALID_STRIDE**
cairo.**STATUS_FONT_TYPE_MISMATCH**
cairo.**STATUS_USER_FONT_IMMUTABLE**
cairo.**STATUS_USER_FONT_ERROR**
cairo.**STATUS_NEGATIVE_COUNT**
cairo.**STATUS_INVALID_CLUSTERS**
cairo.**STATUS_INVALID_SLANT**
cairo.**STATUS_INVALID_WEIGHT**
cairo.**STATUS_INVALID_SIZE**
cairo.**STATUS_USER_FONT_NOT_IMPLEMENTED**
cairo.**STATUS_DEVICE_TYPE_MISMATCH**
cairo.**STATUS_DEVICE_ERROR**
cairo.**STATUS_INVALID_MESH_CONSTRUCTION**
cairo.**STATUS_DEVICE_FINISHED**
cairo.**STATUS_LAST_STATUS**
See *Status*

New in version 1.12.

CHAPTER 4

C API Reference

This manual documents the API used by C and C++ programmers who want to write extension modules that use pycairo.

4.1 Pycairo Compiler Flags

To compile a Python extension using Pycairo you need to know where Pycairo and cairo are located and what flags to pass to the compiler and linker.

1. Variant:

   Only available since version 1.16.0.

   While Pycairo installs a pkg-config file, in case of virtualenvs, installation to the user directory or when using wheels/eggs, pkg-config will not be able to locate the .pc file. The *get_include()* function should work in all cases, as long as Pycairo is in your Python search path.

   Compiler Flags:

   - `python -c "import cairo; print(cairo.get_include())"`
   - `pkg-config --cflags cairo`

   Linker Flags:

   - `pkg-config --libs cairo`

2. Variant:

   This works with older versions, but with the limitations mentioned above. Use it as a fallback if you want to support older versions or if your module does not require virtualenv/pip support.

   Compiler Flags:

   - `pkg-config --cflags pycairo` or `pkg-config --cflags py3cairo`

   Linker Flags:

- `pkg-config --libs pycairo` or `pkg-config --libs py3cairo`

4.2 To access the Pycairo C API under Python 2

Edit the client module file to add the following lines:

```
/* All function, type and macro definitions needed to use the Pycairo/C API
 * are included in your code by the following line
 */
#include "pycairo.h"

/* define a variable for the C API */
Pycairo_CAPI_t *Pycairo_CAPI;

/* import pycairo - add to the init<module> function */
Pycairo_IMPORT;
```

In case you want to use the API from another compilation unit:

```
#include <pycairo.h>

extern Pycairo_CAPI_t *Pycairo_CAPI;

...
```

4.3 To access the Pycairo C API under Python 3

Example showing how to import the pycairo API:

```
#include "py3cairo.h"

PyMODINIT_FUNC
PyInit_client(void)
{
  PyObject *m;

  m = PyModule_Create(&clientmodule);
  if (m == NULL)
      return NULL;
  if (import_cairo() < 0)
      return NULL;
  /* additional initialization can happen here */
  return m;
}
```

In case you want to use the API from another compilation unit:

```
#define PYCAIRO_NO_IMPORT
#include <py3cairo.h>

...
```

New in version 1.17.0: The `PYCAIRO_NO_IMPORT` macro is used since 1.17.0

4.4 Misc Functions

int **Pycairo_Check_Status**(*cairo_status_t status*)

Parameters

- **status** (cairo_status_t) –

Returns -1 in case of an error, otherwise 0. Sets an exception in case of an error.

Takes a status value and converts it to an exception if it represents an error status.

4.5 Cairo Context

PyObject **PycairoContext**

*cairo_t** **PycairoContext.ctx**
The wrapped *cairo_t*

PyTypeObject ***PycairoContext_Type**

cairo_t * **PycairoContext_GET**(*PycairoContext *obj*)

Parameters

- **obj** (PycairoContext) –

Returns *cairo_t* [transfer none]

Get the *cairo_t* object out of the *PycairoContext*.

PyObject * **PycairoContext_FromContext**(*cairo_t *ctx*, PyTypeObject *type*, PyObject *base*)

Parameters

- **ctx** (cairo_t) – a cairo_t to 'wrap' into a Python object. It is unreferenced if the PycairoContext creation fails, or if the cairo_t has an error status. [transfer full]
- **type** (*PyTypeObject*) – a pointer to the type to instantiate. It can be &PycairoContext_Type, or a PycairoContext_Type subtype. (cairo.Context or a cairo.Context subclass) [transfer none]
- **base** (*PyObject*) – the base object used to create the context, or NULL. it is referenced to keep it alive while the cairo_t is being used [transfer none]

Returns New reference or NULL on failure and sets an exception [transfer full]

Create a new PycairoContext from a *cairo_t*

4.6 Cairo Font Face

PyObject **PycairoFontFace**

*cairo_font_face_t** **PycairoFontFace.font_face**

The wrapped *cairo_font_face_t*

PyTypeObject ***PycairoFontFace_Type**

PyObject * **PycairoFontFace_FromFontFace** (*cairo_font_face_t *font_face*)

Parameters

- **font_face** (cairo_font_face_t) – a cairo_font_face_t to 'wrap' into a Python object. it is unreferenced if the PycairoFontFace creation fails [transfer full]

Returns New reference or NULL on failure and sets an exception [transfer full]

Create a new PycairoFontFace from a cairo_font_face_t

PycairoFontFace **PycairoToyFontFace**

PyTypeObject ***PycairoToyFontFace_Type**

4.7 Cairo Font Options

PyObject **PycairoFontOptions**

*cairo_font_options_t** **PycairoFontOptions.font_options**

PyTypeObject ***PycairoFontOptions_Type**

PyObject * **PycairoFontOptions_FromFontOptions** (*cairo_font_options_t *font_options*)

Parameters

- **font_options** (cairo_font_options_t) – a cairo_font_options_t to 'wrap' into a Python object. it is unreferenced if the PycairoFontOptions creation fails [transfer full]

Returns New reference or NULL on failure and sets an exception [transfer full]

Create a new PycairoFontOptions from a cairo_font_options_t

4.8 Cairo Matrix

PyObject **PycairoMatrix**

cairo_matrix_t **PycairoMatrix.matrix**

PyTypeObject ***PycairoMatrix_Type**

PyObject * **PycairoMatrix_FromMatrix** (const *cairo_matrix_t *matrix*)

Parameters

- **matrix** (cairo_matrix_t) – a cairo_matrix_t to 'wrap' into a Python object. the cairo_matrix_t values are copied. [transfer none]

Returns New reference or NULL on failure and sets an exception [transfer full]

Create a new PycairoMatrix from a cairo_matrix_t

4.9 Cairo Path

PyObject **PycairoPath**

*cairo_path_t** **PycairoPath.path**

PyTypeObject ***PycairoPath_Type**

PyObject * **PycairoPath_FromPath** (*cairo_path_t *path*)

Parameters

- **path** (cairo_path_t) – a cairo_path_t to 'wrap' into a Python object. path is unreferenced if the PycairoPath creation fails, or if path is in an error status. [transfer full]

Returns New reference or NULL on failure and sets an exception [transfer full]

Create a new PycairoPath from a cairo_path_t

4.10 Cairo Pattern

PyObject **PycairoPattern**

*cairo_pattern_t** **PycairoPattern.pattern**

PyTypeObject ***PycairoPattern_Type**

PycairoPattern **PycairoSolidPattern**

PyTypeObject ***PycairoSolidPattern_Type**

PycairoPattern **PycairoSurfacePattern**

PyTypeObject ***PycairoSurfacePattern_Type**

PycairoPattern **PycairoGradient**

PyTypeObject ***PycairoGradient_Type**

PycairoGradient **PycairoLinearGradient**

PyTypeObject ***PycairoLinearGradient_Type**

PycairoGradient **PycairoRadialGradient**

PyTypeObject ***PycairoRadialGradient_Type**

PyObject * **PycairoPattern_FromPattern** (*cairo_pattern_t *pattern*, PyObject *base*)

Parameters

- **pattern** (cairo_pattern_t) – a cairo_pattern_t to 'wrap' into a Python object. It is unreferenced if the PycairoPattern creation fails, or if the pattern has an error status. [transfer full]
- **base** (*PyObject*) – the base object used to create the pattern, or NULL. It is referenced to keep it alive while the cairo_pattern_t is being used. [transfer none]

Returns New reference or NULL on failure and sets an exception [transfer full]

Create a new PycairoSolidPattern, PycairoSurfacePattern, PycairoLinearGradient, or PycairoRadialGradient from a cairo_pattern_t.

4.11 Cairo Region

PyObject **PycairoRegion**

*cairo_region_t** **PycairoRegion.region**

PyTypeObject ***PycairoRegion_Type**

PyObject * **PycairoRegion_FromRegion**(*cairo_region_t *region*)

Parameters

- **region** (cairo_region_t) – a cairo_region_t to 'wrap' into a Python object. region is unreferenced if the PycairoRegion creation fails, or if region is in an error status.

Returns New reference or NULL on failure and sets an exception [transfer full]

Create a new PycairoRegion from a cairo_region_t

4.12 Cairo RectangleInt

PyObject **PycairoRectangleInt**

*cairo_rectangle_int_t** **PycairoRectangleInt.rectangle_int**

PyTypeObject ***PycairoRectangleInt_Type**

PyObject * **PycairoRectangleInt_FromRectangleInt**(const *cairo_rectangle_int_t *rectangle_int*)

Parameters

- **rectangle_int** (cairo_rectangle_int_t) – a cairo_rectangle_int_t to 'wrap' into a Python object. rectangle_int is unreferenced if the PycairoRectangleInt creation fails. [transfer none]

Returns New reference or NULL on failure and sets an exception [transfer full]

Create a new PycairoRectangleInt from a cairo_rectangle_int_t

4.13 Scaled Font

PyObject **PycairoScaledFont**

*cairo_scaled_font_t** **PycairoScaledFont.scaled_font**

PyTypeObject ***PycairoScaledFont_Type**

PyObject * **PycairoScaledFont_FromScaledFont**(*cairo_scaled_font_t *scaled_font*)

Parameters

- **scaled_font** (cairo_scaled_font_t) – a cairo_scaled_font_t to 'wrap' into a Python object. it is unreferenced if the PycairoScaledFont creation fails [transfer full]

Returns New reference or NULL on failure and sets an exception [transfer full]

Create a new PycairoScaledFont from a cairo_scaled_font_t

4.14 Cairo Surface

PyObject **PycairoSurface**

*cairo_surface_t** **PycairoSurface.surface**

PyTypeObject ***PycairoSurface_Type**

PycairoSurface **PycairoImageSurface**

PyTypeObject ***PycairoImageSurface_Type**

PycairoSurface **PycairoPDFSurface**

PyTypeObject ***PycairoPDFSurface_Type**

PycairoSurface **PycairoPSSurface**

PyTypeObject ***PycairoPSSurface_Type**

PycairoSurface **PycairoRecordingSurface**

PyTypeObject ***PycairoRecordingSurface_Type**

PycairoSurface **PycairoSVGSurface**

PyTypeObject ***PycairoSVGSurface_Type**

PycairoSurface **PycairoWin32Surface**

PyTypeObject ***PycairoWin32Surface_Type**

PycairoSurface **PycairoXCBSurface**

PyTypeObject ***PycairoXCBSurface_Type**

PycairoSurface **PycairoXlibSurface**

PyTypeObject ***PycairoXlibSurface_Type**

PyObject * **PycairoSurface_FromSurface**(*cairo_surface_t *surface*, PyObject *base*)

Parameters

- **surface** (cairo_surface_t) – a cairo_surface_t to 'wrap' into a Python object. It is unreferenced if the PycairoSurface creation fails, or if the cairo_surface_t has an error status. [transfer full]
- **base** (*PyObject*) – the base object used to create the surface, or NULL. It is referenced to keep it alive while the cairo_surface_t is being used. [transfer none]

Returns New reference or NULL on failure and sets an exception [transfer full]

Create a new PycairoImageSurface, PycairoPDFSurface, PycairoPSSurface, PycairoRecordingSurface, PycairoSVGSurface, PycairoWin32Surface, PycairoWin32PrintingSurface, PycairoXCBSurface, or PycairoXlibSurface from a cairo_surface_t.

4.15 Cairo Types

These are only listed here so they can be referenced in the documentation.

See https://www.cairographics.org/manual/ for details.

cairo_t

```
cairo_status_t
cairo_surface_t
cairo_scaled_font_t
cairo_rectangle_int_t
cairo_region_t
cairo_pattern_t
cairo_matrix_t
cairo_font_options_t
cairo_path_t
cairo_font_face_t
```

CHAPTER 5

Resources

This section is for listing various useful pycairo resources, feel free to contribute !

Windows Binary Packages (unofficial) Precompiled binaries for the Microsoft Windows platform can be obtained from the following sources:

Precompiled PyCairo for Python 2.x from Uri Shaked

Some Libraries/Modules Using pycairo

- Cairo Plot: a module to plot graphics
- matplotlib: a python 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms.
- PyCha: PYthon CHArts - a Python package for drawing charts
- PyGoocanvas: python bindings for GooCanvas which is a canvas widget for GTK+
- PyGTK: GTK+ for Python.
- rsvg: part of gnome-python-desktop, it provides Python bindings for librsvg

Some Applications Using pycairo

- A Shogiban for Gnushogi.
- gPodder: a podcatcher.
- Miro: Internet TV, HD video player.
- pycairo projects at Google Code.
- PyChess.
- Pyroute - OpenStreetMap.
- Shoebot - a pure Python graphics robot.

Tutorials

- Cairo Tutorial for Python (and other) Programmers: Generic introduction to cairo concepts oriented to python.

- Cairo Tutorial for PyGTK Programmers: Tutorial about how to use cairo for drawing in PyGTK.
- Writing a widget using cairo and PyGTK 2.8 Part 1, Part 2: A translation of the GNOME Journal tutorial by Davyd Madeley from C to Python.

Demos

- A Basic Cairo-clock in Python using XShape.
- A simple clock implemented in pygtk and cairo.

Recipies See the main Cairo Cookbook.

CHAPTER 6

Frequently Asked Questions

The paths in the installed pkg-config file are wrong. Why? Multiple reasons:

- This can happen if you install from a Python wheel. Since you can't pass a prefix to setup.py bdist_wheel you don't have control over the paths in the .pc file.
- When installing with pip: pip will sometimes create a wheel and cache it for future installations. In case the next installation is to a different prefix the .pc file contains the paths of the first installation.

If you can think of any way to improve this, please tell us :)

Pycairo is a Python module providing bindings for the cairo graphics library. It depends on **cairo >= 1.13.1** and works with **Python 2.7+** as well as **Python 3.5+**. Pycairo, including this documentation, is licensed under the **LGPLv2.1** as well as the **MPLv1.1**.

The Pycairo bindings are designed to match the cairo C API as closely as possible, and to deviate only in cases which are clearly better implemented in a more 'Pythonic' way.

```
pip install pycairo
```

Installing Pycairo requires cairo including its headers. For more info see "Getting Started".

```
import cairo

with cairo.SVGSurface("example.svg", 200, 200) as surface:
    context = cairo.Context(surface)
    x, y, x1, y1 = 0.1, 0.5, 0.4, 0.9
    x2, y2, x3, y3 = 0.6, 0.1, 0.9, 0.5
    context.scale(200, 200)
    context.set_line_width(0.04)
    context.move_to(x, y)
    context.curve_to(x1, y1, x2, y2, x3, y3)
    context.stroke()
    context.set_source_rgba(1, 0.2, 0.2, 0.6)
```

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```
    context.set_line_width(0.02)
    context.move_to(x, y)
    context.line_to(x1, y1)
    context.move_to(x2, y2)
    context.line_to(x3, y3)
    context.stroke()
```

Features of the Pycairo bindings:

- Provides an object oriented interface to cairo.
- Queries the error status of objects and translates them to exceptions.
- Provides a C API that can be used by other Python extensions.

If Pycairo is not what you need, have a look at cairocffi, which is an API compatible package using cffi or Qahirah, which is using ctypes and provides a more "pythonic" API with less focus on matching the cairo C API.

For more information visit https://pycairo.readthedocs.io

PyPI: https://pypi.org/project/pycairo

Tarballs: https://github.com/pygobject/pycairo/releases

Git repo: https://github.com/pygobject/pycairo

Bug tracker: https://github.com/pygobject/pycairo/issues

Mailing list: https://lists.cairographics.org/cgi-bin/mailman/listinfo/cairo

See the "*API Reference*" for further details.

To use the pycairo library:

```
import cairo
```

To build/install the library:

```
python2/3 setup.py build
python2/3 setup.py install
```

To run the tests:

```
python2/3 setup.py test
```

The Python 2 version supports xpyb integration which is disabled by default. To enable, build as follows:

```
python2 setup.py build --enable-xpyb
# and for running tests:
python2 setup.py test --enable-xpyb
```

For examples of pycairo code see the 'examples' directory that comes with the pycairo distribution.

For author information see the git history as well as the now deleted "ChangeLog" file in the git history.

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