

What's New In Python 3.8

Editor: Raymond Hettinger

This article explains the new features in Python 3.8, compared to 3.7. For full details, see the [.ref: changelog <changelog>](#).

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 47); [backlink](#)

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Unknown directive type "testsetup".

```
.. testsetup::

    from datetime import date
    from math import cos, radians
    from unicodedata import normalize
    import re
    import math
```

Summary -- Release highlights

New Features

Assignment expressions

There is new syntax `:=` that assigns values to variables as part of a larger expression. It is affectionately known as "the walrus operator" due to its resemblance to [the eyes and tusks of a walrus](#).

In this example, the assignment expression helps avoid calling `.func().len()` twice:

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```
if (n := len(a)) > 10:
    print(f"List is too long ({n} elements, expected <= 10)")
```

A similar benefit arises during regular expression matching where match objects are needed twice, once to test whether a match occurred and another to extract a subgroup:

```
discount = 0.0
if (mo := re.search(r'(\d+)% discount', advertisement)):
    discount = float(mo.group(1)) / 100.0
```

The operator is also useful with while-loops that compute a value to test loop termination and then need that same value again in the body of the loop:

```
# Loop over fixed length blocks
while (block := f.read(256)) != '':
    process(block)
```

Another motivating use case arises in list comprehensions where a value computed in a filtering condition is also needed in the expression body:

```
[clean_name.title() for name in names
 if (clean_name := normalize('NFC', name)) in allowed_names]
```

Try to limit use of the walrus operator to clean cases that reduce complexity and improve readability.

See [PEP 572](#) for a full description.

(Contributed by Emily Morehouse in [.issue: 35224](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 115); [backlink](#)

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Positional-only parameters

There is a new function parameter syntax `/` to indicate that some function parameters must be specified positionally and cannot be used as keyword arguments. This is the same notation shown by `help()` for C functions annotated with Larry Hastings' [Argument Clinic](#) tool.

In the following example, parameters `a` and `b` are positional-only, while `c` or `d` can be positional or keyword, and `e` or `f` are required to be keywords:

```
def f(a, b, /, c, d, *, e, f):
    print(a, b, c, d, e, f)
```

The following is a valid call:

```
f(10, 20, 30, d=40, e=50, f=60)
```

However, these are invalid calls:

```
f(10, b=20, c=30, d=40, e=50, f=60)  # b cannot be a keyword argument
f(10, 20, 30, 40, 50, f=60)          # e must be a keyword argument
```

One use case for this notation is that it allows pure Python functions to fully emulate behaviors of existing C coded functions. For example, the built-in `:func:`divmod`` function does not accept keyword arguments:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 143); [backlink](#)

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```
def divmod(a, b, /):
    "Emulate the built in divmod() function"
    return (a // b, a % b)
```

Another use case is to preclude keyword arguments when the parameter name is not helpful. For example, the builtin `:func:`len`` function has the signature `len(obj, /)`. This precludes awkward calls such as:

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```
len(obj='hello')  # The "obj" keyword argument impairs readability
```

A further benefit of marking a parameter as positional-only is that it allows the parameter name to be changed in the future without risk of breaking client code. For example, in the `:mod:`statistics`` module, the parameter name `dist` may be changed in the future. This was made possible with the following function specification:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 157); [backlink](#)

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```
def quantiles(dist, /, *, n=4, method='exclusive')
    ...
```

Since the parameters to the left of `/` are not exposed as possible keywords, the parameters names remain available for use in `**kwargs`:

```
>>> def f(a, b, /, **kwargs):
...     print(a, b, kwargs)
...
>>> f(10, 20, a=1, b=2, c=3)          # a and b are used in two ways
10 20 {'a': 1, 'b': 2, 'c': 3}
```

This greatly simplifies the implementation of functions and methods that need to accept arbitrary keyword arguments. For example, here is an excerpt from code in the `:mod:`collections`` module:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-

main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 175); [backlink](#)

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```
class Counter(dict):  
    def __init__(self, iterable=None, /, **kwds):  
        # Note "iterable" is a possible keyword argument
```

See [PEP 570](#) for a full description.

(Contributed by Pablo Galindo in [:issue:36540](#).)

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Parallel filesystem cache for compiled bytecode files

The new `:envvar:PYTHONPYCACHEPREFIX` setting (also available as `:option:-X pycache_prefix`) configures the implicit bytecode cache to use a separate parallel filesystem tree, rather than the default `__pycache__` subdirectories within each source directory.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 194); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 194); [backlink](#)

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The location of the cache is reported in `:data:sys.pycache_prefix` (`:const:None` indicates the default location in `__pycache__` subdirectories).

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(Contributed by Carl Meyer in [:issue:33499](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 204); [backlink](#)

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Debug build uses the same ABI as release build

Python now uses the same ABI whether it's built in release or debug mode. On Unix, when Python is built in debug mode, it is now possible to load C extensions built in release mode and C extensions built using the stable ABI.

Release builds and [:ref: debug builds <debug-build>](#) are now ABI compatible: defining the `Py_DEBUG` macro no longer implies the `Py_TRACE_REFS` macro, which introduces the only ABI incompatibility. The `Py_TRACE_REFS` macro, which adds the `:func:sys.getobjects` function and the `:envvar:PYTHONDUMPREFS` environment variable, can be set using the new `:option:./configure --with-trace-refs <--with-trace-refs>` build option. (Contributed by Victor Stinner in [:issue:36465](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 214); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 214); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 214); [backlink](#)

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On Unix, C extensions are no longer linked to libpython except on Android and Cygwin. It is now possible for a statically linked Python to load a C extension built using a shared library Python. (Contributed by Victor Stinner in [:issue:21536](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 222); [backlink](#)

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On Unix, when Python is built in debug mode, import now also looks for C extensions compiled in release mode and for C extensions compiled with the stable ABI. (Contributed by Victor Stinner in [:issue:36722](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 229); [backlink](#)

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To embed Python into an application, a new `--embed` option must be passed to `python3-config --libs --embed` to get `-lpython3.8` (link the application to libpython). To support both 3.8 and older, try `python3-config --libs --embed` first and fallback to `python3-config --libs` (without `--embed`) if the previous command fails.

Add a `pkg-config python-3.8-embed` module to embed Python into an application: `pkg-config python-3.8-embed --libs` includes `-lpython3.8`. To support both 3.8 and older, try `pkg-config python-X.Y-embed --libs` first and fallback to `pkg-config python-X.Y --libs` (without `--embed`) if the previous command fails (replace `X.Y` with the Python version).

On the other hand, `pkg-config python3.8 --libs` no longer contains `-lpython3.8`. C extensions must not be linked to libpython (except on Android and Cygwin, whose cases are handled by the script); this change is backward incompatible on purpose. (Contributed by Victor Stinner in [:issue:36721](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 246); [backlink](#)

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f-strings support = for self-documenting expressions and debugging

Added an `=` specifier to [term: f-string](#)'s. An f-string such as `f'{expr=}'` will expand to the text of the expression, an equal sign, then the representation of the evaluated expression. For example:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 256); [backlink](#)

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```
>>> user = 'eric_idle'
>>> member_since = date(1975, 7, 31)
>>> f'{user=} {member_since=}'
"user='eric_idle' member_since=datetime.date(1975, 7, 31)"
```

The usual `ref` f-string format specifiers `<f-strings>` allow more control over how the result of the expression is displayed:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 265); [backlink](#)

Unknown interpreted text role "ref".

```
>>> delta = date.today() - member_since
>>> f'{user=!s} {delta.days=:,d}'
'user=eric_idle delta.days=16,075'
```

The `=` specifier will display the whole expression so that calculations can be shown:

```
>>> print(f'{theta=} {cos(radians(theta))=:.3f}')
theta=30 cos(radians(theta))=0.866
```

(Contributed by Eric V. Smith and Larry Hastings in `issue:36817`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 278); [backlink](#)

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PEP 578: Python Runtime Audit Hooks

The PEP adds an Audit Hook and Verified Open Hook. Both are available from Python and native code, allowing applications and frameworks written in pure Python code to take advantage of extra notifications, while also allowing embedders or system administrators to deploy builds of Python where auditing is always enabled.

See [PEP 578](#) for full details.

PEP 587: Python Initialization Configuration

The [PEP 587](#) adds a new C API to configure the Python Initialization providing finer control on the whole configuration and better error reporting.

New structures:

- `:ctype:PyConfig`

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Unknown interpreted text role "ctype".

- `:ctype:PyPreConfig`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 302); [backlink](#)

Unknown interpreted text role "ctype".

- `:ctype:PyStatus`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 303); [backlink](#)

Unknown interpreted text role "ctype".

- `:ctype:PyWideStringList`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 304); [backlink](#)

Unknown interpreted text role "ctype".

New functions:

- `:c:func:PyConfig_Clear`

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[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyConfig_InitIsolatedConfig`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 309);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyConfig_InitPythonConfig`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 310);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyConfig_Read`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 311);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyConfig_SetArgv`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 312);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyConfig_SetBytesArgv`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 313);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyConfig_SetBytesString`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 314);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyConfig_SetString`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 315);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyPreConfig_InitIsolatedConfig``

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 316);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyPreConfig_InitPythonConfig``

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 317);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyStatus_Error``

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 318);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyStatus_Exception``

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 319);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyStatus_Exit``

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 320);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyStatus_IsError``

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 321);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyStatus_IsExit``

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 322);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyStatus_NoMemory``

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 323);
[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:PyStatus_Ok``

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 324); [backlink](#)

Unknown interpreted text role "c:func".

- :c:func:`PyWideStringList_Append`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 325); [backlink](#)

Unknown interpreted text role "c:func".

- :c:func:`PyWideStringList_Insert`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 326); [backlink](#)

Unknown interpreted text role "c:func".

- :c:func:`Py_BytesMain`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 327); [backlink](#)

Unknown interpreted text role "c:func".

- :c:func:`Py_ExitStatusException`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 328); [backlink](#)

Unknown interpreted text role "c:func".

- :c:func:`Py_InitializeFromConfig`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 329); [backlink](#)

Unknown interpreted text role "c:func".

- :c:func:`Py_PreInitialize`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 330); [backlink](#)

Unknown interpreted text role "c:func".

- :c:func:`Py_PreInitializeFromArgs`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 331); [backlink](#)

Unknown interpreted text role "c:func".

- :c:func:`Py_PreInitializeFromBytesArgs`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 332);

[backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:'Py_RunMain'`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 333); [backlink](#)

Unknown interpreted text role "c:func".

This PEP also adds `_PyRuntimeState.preconfig` (`:c:type:'PyPreConfig'` type) and `PyInterpreterState.config` (`:c:type:'PyConfig'` type) fields to these internal structures. `PyInterpreterState.config` becomes the new reference configuration, replacing global configuration variables and other private variables.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 335); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 335); [backlink](#)

Unknown interpreted text role "c:type".

See [ref: Python Initialization Configuration <init-config>](#) for the documentation.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 341); [backlink](#)

Unknown interpreted text role "ref".

See [PEP 587](#) for a full description.

(Contributed by Victor Stinner in [:issue:'36763'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 346); [backlink](#)

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PEP 590: Vectorcall: a fast calling protocol for CPython

[ref: vectorcall](#) is added to the Python/C API. It is meant to formalize existing optimizations which were already done for various classes. Any [ref: static type <static-types>](#) implementing a callable can use this protocol.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 352); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 352); [backlink](#)

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This is currently provisional. The aim is to make it fully public in Python 3.9.

See [PEP 590](#) for a full description.

(Contributed by Jeroen Demeyer, Mark Shannon and Petr Viktorin in [:issue:'36974'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 363); [backlink](#)

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Pickle protocol 5 with out-of-band data buffers

When `mod:'pickle'` is used to transfer large data between Python processes in order to take advantage of multi-core or multi-machine processing, it is important to optimize the transfer by reducing memory copies, and possibly by applying custom techniques such as data-dependent compression.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 369); [backlink](#)

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The `mod:'pickle'` protocol 5 introduces support for out-of-band buffers where PEP 3118-compatible data can be transmitted separately from the main pickle stream, at the discretion of the communication layer.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 374); [backlink](#)

Unknown interpreted text role "mod".

See [PEP 574](#) for a full description.

(Contributed by Antoine Pitrou in [issue:'36785'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 380); [backlink](#)

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Other Language Changes

- A `:keyword:'continue'` statement was illegal in the `:keyword:'finally'` clause due to a problem with the implementation. In Python 3.8 this restriction was lifted. (Contributed by Serhiy Storchaka in [issue:'32489'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 386); [backlink](#)

Unknown interpreted text role "keyword".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 386); [backlink](#)

Unknown interpreted text role "keyword".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 386); [backlink](#)

Unknown interpreted text role "issue".

- The `:class:'bool'`, `:class:'int'`, and `:class:'fractions.Fraction'` types now have an `:meth:'~int.as_integer_ratio'` method like that found in `:class:'float'` and `:class:'decimal.Decimal'`. This minor API extension makes it possible to write `numerator, denominator = x.as_integer_ratio()` and have it work across multiple numeric types. (Contributed by Lisa Roach in [issue:'33073'](#) and Raymond Hettinger in [issue:'37819'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 391); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 391); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 391); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 391); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 391); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 391); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 391); [backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 391); [backlink](#)

Unknown interpreted text role "issue".

- Constructors of `:class:`int``, `:class:`float`` and `:class:`complex`` will now use the `:meth:`~object.__index__`` special method, if available and the corresponding method `:meth:`~object.__int__``, `:meth:`~object.__float__`` or `:meth:`~object.__complex__`` is not available. (Contributed by Serhiy Storchaka in [issue`20092`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 399); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 399); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 399); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 399); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 399); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 399); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 399); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 399); [backlink](#)

Unknown interpreted text role "issue".

- Added support of `\N{name}` escapes in `mod:regular expressions <re>`:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 405); [backlink](#)

Unknown interpreted text role "mod".

```
>>> notice = 'Copyright © 2019'
>>> copyright_year_pattern = re.compile(r'\N{copyright sign}\s*(\d{4})')
>>> int(copyright_year_pattern.search(notice).group(1))
2019
```

(Contributed by Jonathan Eunice and Serhiy Storchaka in `:issue:30688`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 412); [backlink](#)

Unknown interpreted text role "issue".

- Dict and dictviews are now iterable in reversed insertion order using `:func:reversed`. (Contributed by Rémi Lapeyre in `:issue:33462`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 414); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 414); [backlink](#)

Unknown interpreted text role "issue".

- The syntax allowed for keyword names in function calls was further restricted. In particular, `f((keyword)=arg)` is no longer allowed. It was never intended to permit more than a bare name on the left-hand side of a keyword argument assignment term. (Contributed by Benjamin Peterson in `:issue:34641`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 417); [backlink](#)

Unknown interpreted text role "issue".

- Generalized iterable unpacking in `:keyword:`yield`` and `:keyword:`return`` statements no longer requires enclosing parentheses. This brings the *yield* and *return* syntax into better agreement with normal assignment syntax:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 423); [backlink](#)

Unknown interpreted text role "keyword".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 423); [backlink](#)

Unknown interpreted text role "keyword".

```
>>> def parse(family):
    lastname, *members = family.split()
    return lastname.upper(), *members

>>> parse('simpsons homer marge bart lisa maggie')
('SIMPSONS', 'homer', 'marge', 'bart', 'lisa', 'maggie')
```

(Contributed by David Cuthbert and Jordan Chapman in [:issue:`32117`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 435); [backlink](#)

Unknown interpreted text role "issue".

- When a comma is missed in code such as `[(10, 20) (30, 40)]`, the compiler displays a `:exc:`SyntaxWarning`` with a helpful suggestion. This improves on just having a `:exc:`TypeError`` indicating that the first tuple was not callable. (Contributed by Serhiy Storchaka in [:issue:`15248`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 437); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 437); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 437); [backlink](#)

Unknown interpreted text role "issue".

- Arithmetic operations between subclasses of `:class:`datetime.date`` or `:class:`datetime.datetime`` and `:class:`datetime.timedelta`` objects now return an instance of the subclass, rather than the base class. This also affects the return type of operations whose implementation (directly or indirectly) uses `:class:`datetime.timedelta`` arithmetic, such as `:meth:`~datetime.datetime.astimezone``. (Contributed by Paul Ganssle in [:issue:`32417`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 443); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 443); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 443); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 443); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 443); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 443); [backlink](#)

Unknown interpreted text role "issue".

- When the Python interpreter is interrupted by Ctrl-C (SIGINT) and the resulting `.exc:KeyboardInterrupt` exception is not caught, the Python process now exits via a SIGINT signal or with the correct exit code such that the calling process can detect that it died due to a Ctrl-C. Shells on POSIX and Windows use this to properly terminate scripts in interactive sessions. (Contributed by Google via Gregory P. Smith in `.issue:1054041`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 451); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 451); [backlink](#)

Unknown interpreted text role "issue".

- Some advanced styles of programming require updating the `.class:types.CodeType` object for an existing function. Since code objects are immutable, a new code object needs to be created, one that is modeled on the existing code object. With 19 parameters, this was somewhat tedious. Now, the new `replace()` method makes it possible to create a clone with a few altered parameters.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 458); [backlink](#)

Unknown interpreted text role "class".

Here's an example that alters the `.func:statistics.mean` function to prevent the `data` parameter from being used as a keyword argument:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-

resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 465);
[backlink](#)

Unknown interpreted text role "func".

```
>>> from statistics import mean
>>> mean(data=[10, 20, 90])
40
>>> mean.__code__ = mean.__code__.replace(co_posonlyargcount=1)
>>> mean(data=[10, 20, 90])
Traceback (most recent call last):
...
TypeError: mean() got some positional-only arguments passed as keyword arguments: 'data'
```

(Contributed by Victor Stinner in [issue:37032](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 477);
[backlink](#)

Unknown interpreted text role "issue".

- For integers, the three-argument form of the `func:pow` function now permits the exponent to be negative in the case where the base is relatively prime to the modulus. It then computes a modular inverse to the base when the exponent is -1 , and a suitable power of that inverse for other negative exponents. For example, to compute the [modular multiplicative inverse](#) of 38 modulo 137, write:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 479);
[backlink](#)

Unknown interpreted text role "func".

```
>>> pow(38, -1, 137)
119
>>> 119 * 38 % 137
1
```

Modular inverses arise in the solution of [linear Diophantine equations](#). For example, to find integer solutions for $4258x + 147y = 369$, first rewrite as $4258x \equiv 369 \pmod{147}$ then solve:

```
>>> x = 369 * pow(4258, -1, 147) % 147
>>> y = (4258 * x - 369) // -147
>>> 4258 * x + 147 * y
369
```

(Contributed by Mark Dickinson in [issue:36027](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 503);
[backlink](#)

Unknown interpreted text role "issue".

- Dict comprehensions have been synced-up with dict literals so that the key is computed first and the value second:

```
>>> # Dict comprehension
>>> cast = {input('role? '): input('actor? ') for i in range(2)}
role? King Arthur
actor? Chapman
role? Black Knight
actor? Cleese

>>> # Dict literal
>>> cast = {input('role? '): input('actor? ')}
role? Sir Robin
actor? Eric Idle
```

The guaranteed execution order is helpful with assignment expressions because variables assigned in the key expression will be available in the value expression:

```
>>> names = ['Martin von Löwis', 'Łukasz Langa', 'Walter Dörwald']
>>> {(n := normalize('NFC', name)).casefold(): n for name in names}
{'martin von löwis': 'Martin von Löwis',
```



```
'lukasz langa': 'Łukasz Langa',  
'walter dörwald': 'Walter Dörwald'}
```

(Contributed by Jörn Heissler in [issue:35224](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 530); [backlink](#)

Unknown interpreted text role "issue".

- The `meth:object.__reduce__` method can now return a tuple from two to six elements long. Formerly, five was the limit. The new, optional sixth element is a callable with a `(obj, state)` signature. This allows the direct control over the state-updating behavior of a specific object. If not `None`, this callable will have priority over the object's `meth:~.__setstate__` method. (Contributed by Pierre Glaser and Olivier Grisel in [issue:35900](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 532); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 532); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 532); [backlink](#)

Unknown interpreted text role "issue".

New Modules

- The new `mod:importlib.metadata` module provides (provisional) support for reading metadata from third-party packages. For example, it can extract an installed package's version number, list of entry points, and more:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 543); [backlink](#)

Unknown interpreted text role "mod".

```
>>> # Note following example requires that the popular "requests"  
>>> # package has been installed.  
>>>  
>>> from importlib.metadata import version, requires, files  
>>> version('requests')  
'2.22.0'  
>>> list(requires('requests'))  
['chardet (<3.1.0,>=3.0.2)']  
>>> list(files('requests'))[:5]  
[PackagePath('requests-2.22.0.dist-info/INSTALLER'),  
 PackagePath('requests-2.22.0.dist-info/LICENSE'),  
 PackagePath('requests-2.22.0.dist-info/METADATA'),  
 PackagePath('requests-2.22.0.dist-info/RECORD'),  
 PackagePath('requests-2.22.0.dist-info/WHEEL')]
```

(Contributed by Barry Warsaw and Jason R. Coombs in [issue:34632](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 562); [backlink](#)

Unknown interpreted text role "issue".

Improved Modules

ast

AST nodes now have `end_lineno` and `end_col_offset` attributes, which give the precise location of the end of the node. (This only applies to nodes that have `lineno` and `col_offset` attributes.)

New function `:func:`ast.get_source_segment`` returns the source code for a specific AST node.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 575); [backlink](#)

Unknown interpreted text role "func".

(Contributed by Ivan Levkivskiy in [:issue:`33416`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 578); [backlink](#)

Unknown interpreted text role "issue".

The `:func:`ast.parse`` function has some new flags:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 580); [backlink](#)

Unknown interpreted text role "func".

- `type_comments=True` causes it to return the text of [PEP 484](#) and [PEP 526](#) type comments associated with certain AST nodes;
- `mode='func_type'` can be used to parse [PEP 484](#) "signature type comments" (returned for function definition AST nodes);
- `feature_version=(3, N)` allows specifying an earlier Python 3 version. For example, `feature_version=(3, 4)` will treat `:keyword:`async`` and `:keyword:`await`` as non-reserved words.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 588); [backlink](#)

Unknown interpreted text role "keyword".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 588); [backlink](#)

Unknown interpreted text role "keyword".

(Contributed by Guido van Rossum in [:issue:`35766`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 592); [backlink](#)

Unknown interpreted text role "issue".

asyncio

`:func:`asyncio.run`` has graduated from the provisional to stable API. This function can be used to execute a `:term:`coroutine`` and return the result while automatically managing the event loop. For example:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 598); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 598); [backlink](#)

Unknown interpreted text role "term".

```
import asyncio

async def main():
    await asyncio.sleep(0)
    return 42

asyncio.run(main())
```

This is *roughly* equivalent to:

```
import asyncio

async def main():
    await asyncio.sleep(0)
    return 42

loop = asyncio.new_event_loop()
asyncio.set_event_loop(loop)
try:
    loop.run_until_complete(main())
finally:
    asyncio.set_event_loop(None)
    loop.close()
```

The actual implementation is significantly more complex. Thus, `func: asyncio.run` should be the preferred way of running asyncio programs.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 627); [backlink](#)

Unknown interpreted text role "func".

(Contributed by Yury Selivanov in `issue:32314`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 630); [backlink](#)

Unknown interpreted text role "issue".

Running `python -m asyncio` launches a natively async REPL. This allows rapid experimentation with code that has a top-level `keyword: await`. There is no longer a need to directly call `asyncio.run()` which would spawn a new event loop on every invocation:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 632); [backlink](#)

Unknown interpreted text role "keyword".

System Message: WARNING/2 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 637)

Cannot analyze code. No Pygments lexer found for "none".

```
.. code-block:: none

$ python -m asyncio
asyncio REPL 3.8.0
Use "await" directly instead of "asyncio.run()".
Type "help", "copyright", "credits" or "license" for more information.
>>> import asyncio
>>> await asyncio.sleep(10, result='hello')
hello
```

(Contributed by Yury Selivanov in `issue:37028`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 647); [backlink](#)

Unknown interpreted text role "issue".

The exception `class: 'asyncio.CancelledError'` now inherits from `class: 'BaseException'` rather than `class: 'Exception'` and no longer inherits from `class: 'concurrent.futures.CancelledError'`. (Contributed by Yury Selivanov in [issue: '32528'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 649); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 649); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 649); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 649); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 649); [backlink](#)

Unknown interpreted text role "issue".

On Windows, the default event loop is now `class: '~asyncio.ProactorEventLoop'`. (Contributed by Victor Stinner in [issue: '34687'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 654); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 654); [backlink](#)

Unknown interpreted text role "issue".

`class: '~asyncio.ProactorEventLoop'` now also supports UDP. (Contributed by Adam Meily and Andrew Svetlov in [issue: '29883'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 657); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 657); [backlink](#)

Unknown interpreted text role "issue".

`class: '~asyncio.ProactorEventLoop'` can now be interrupted by `exc: 'KeyboardInterrupt'` ("CTRL+C"). (Contributed by Vladimir Matveev in [issue: '23057'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 660); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 660); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 660); [backlink](#)

Unknown interpreted text role "issue".

Added `meth:'asyncio.Task.get_coro'` for getting the wrapped coroutine within an `class:'asyncio.Task'`. (Contributed by Alex Grönholm in [issue:'36999'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 664); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 664); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 664); [backlink](#)

Unknown interpreted text role "issue".

Asyncio tasks can now be named, either by passing the `name` keyword argument to `func:'asyncio.create_task'` or the `meth:'~asyncio.loop.create_task'` event loop method, or by calling the `meth:'~asyncio.Task.set_name'` method on the task object. The task name is visible in the `repr()` output of `class:'asyncio.Task'` and can also be retrieved using the `meth:'~asyncio.Task.get_name'` method. (Contributed by Alex Grönholm in [issue:'34270'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 668); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 668); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 668); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 668); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 668); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 668); [backlink](#)

Unknown interpreted text role "issue".

Added support for [Happy Eyeballs](#) to `func:'asyncio.loop.create_connection'`. To specify the behavior, two new parameters have been added: `happy_eyeballs_delay` and `interleave`. The Happy Eyeballs algorithm improves responsiveness in applications that support IPv4 and IPv6 by attempting to simultaneously connect using both. (Contributed by twisteroid ambassador in [issue:'33530'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-

main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 676); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 676); [backlink](#)

Unknown interpreted text role "issue".

builtins

The `:func:`compile`` built-in has been improved to accept the `ast.PyCF_ALLOW_TOP_LEVEL_AWAIT` flag. With this new flag passed, `:func:`compile`` will allow top-level `await`, `async for` and `async with` constructs that are usually considered invalid syntax. Asynchronous code object marked with the `CO_COROUTINE` flag may then be returned. (Contributed by Matthias Bussonnier in [issue:`34616`](#))

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 688); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 688); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 688); [backlink](#)

Unknown interpreted text role "issue".

collections

The `:meth:`~collections.somenamedtuple._asdict`` method for `:func:`collections.namedtuple`` now returns a `:class:`dict`` instead of a `:class:`collections.OrderedDict``. This works because regular dicts have guaranteed ordering since Python 3.7. If the extra features of `:class:`OrderedDict`` are required, the suggested remediation is to cast the result to the desired type:

`OrderedDict(nt._asdict())`. (Contributed by Raymond Hettinger in [issue:`35864`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 699); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 699); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 699); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 699); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 699); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 699); [backlink](#)

Unknown interpreted text role "issue".

cProfile

The `:class:`cProfile.Profile`` class can now be used as a context manager. Profile a block of code by running:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 711); [backlink](#)

Unknown interpreted text role "class".

```
import cProfile

with cProfile.Profile() as profiler:
    # code to be profiled
    ...
```

(Contributed by Scott Sanderson in [:issue:`29235`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 720); [backlink](#)

Unknown interpreted text role "issue".

csv

The `:class:`csv.DictReader`` now returns instances of `:class:`dict`` instead of a `:class:`collections.OrderedDict``. The tool is now faster and uses less memory while still preserving the field order. (Contributed by Michael Selik in [:issue:`34003`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 726); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 726); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 726); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 726); [backlink](#)

Unknown interpreted text role "issue".

curses

Added a new variable holding structured version information for the underlying ncurses library: `:data:`~curses.ncurses_version``. (Contributed by Serhiy Storchaka in [:issue:`31680`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 735); [backlink](#)

Unknown interpreted text role "data".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 735); [backlink](#)

Unknown interpreted text role "issue".

ctypes

On Windows, `:class:`~ctypes.CDLL`` and subclasses now accept a `winmode` parameter to specify flags for the underlying

LoadLibraryEx call. The default flags are set to only load DLL dependencies from trusted locations, including the path where the DLL is stored (if a full or partial path is used to load the initial DLL) and paths added by `:func:`~os.add_dll_directory``. (Contributed by Steve Dower in [issue`36085`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 743); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 743); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 743); [backlink](#)

Unknown interpreted text role "issue".

datetime

Added new alternate constructors `:meth:`datetime.date.fromisocalendar`` and `:meth:`datetime.datetime.fromisocalendar``, which construct `:class:`date`` and `:class:`datetime`` objects respectively from ISO year, week number, and weekday; these are the inverse of each class's `isocalendar` method. (Contributed by Paul Ganssle in [issue`36004`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 754); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 754); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 754); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 754); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 754); [backlink](#)

Unknown interpreted text role "issue".

functools

`:func:`functools.lru_cache`` can now be used as a straight decorator rather than as a function returning a decorator. So both of these are now supported:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 764); [backlink](#)

Unknown interpreted text role "func".

```
@lru_cache
def f(x):
    ...

@lru_cache(maxsize=256)
def f(x):
    ...
```


(Contributed by Raymond Hettinger in [issue:36772](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 775); [backlink](#)

Unknown interpreted text role "issue".

Added a new `:func:`functools.cached_property`` decorator, for computed properties cached for the life of the instance.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 777); [backlink](#)

Unknown interpreted text role "func".

```
import functools
import statistics

class Dataset:
    def __init__(self, sequence_of_numbers):
        self.data = sequence_of_numbers

    @functools.cached_property
    def variance(self):
        return statistics.variance(self.data)
```

(Contributed by Carl Meyer in [issue:21145](#))

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 791); [backlink](#)

Unknown interpreted text role "issue".

Added a new `:func:`functools.singledispatchmethod`` decorator that converts methods into `:term:`generic functions`` `<generic function>` using `:term:`single dispatch``:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 794); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 794); [backlink](#)

Unknown interpreted text role "term".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 794); [backlink](#)

Unknown interpreted text role "term".

```
from functools import singledispatchmethod
from contextlib import suppress

class TaskManager:

    def __init__(self, tasks):
        self.tasks = list(tasks)

    @singledispatchmethod
    def discard(self, value):
        with suppress(ValueError):
            self.tasks.remove(value)

    @discard.register(list)
    def _ (self, tasks):
        targets = set(tasks)
        self.tasks = [x for x in self.tasks if x not in targets]
```

(Contributed by Ethan Smith in [issue:32380](#))

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-

main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 816); [backlink](#)

Unknown interpreted text role "issue".

gc

`:func:`~gc.get_objects`` can now receive an optional *generation* parameter indicating a generation to get objects from. (Contributed by Pablo Galindo in [:issue:`36016`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 821); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 821); [backlink](#)

Unknown interpreted text role "issue".

gettext

Added `:func:`~gettext.pgettext`` and its variants. (Contributed by Franz Glasner, Éric Araujo, and Cheryl Sabella in [:issue:`2504`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 829); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 829); [backlink](#)

Unknown interpreted text role "issue".

gzip

Added the *mtime* parameter to `:func:`gzip.compress`` for reproducible output. (Contributed by Guo Ci Teo in [:issue:`34898`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 836); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 836); [backlink](#)

Unknown interpreted text role "issue".

A `:exc:`~gzip.BadGzipFile`` exception is now raised instead of `:exc:`OSError`` for certain types of invalid or corrupt gzip files. (Contributed by Filip Gruszczyński, Michele Orrù, and Zackery Spytz in [:issue:`6584`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 839); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 839); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 839); [backlink](#)

Unknown interpreted text role "issue".

IDLE and idlelib

Output over N lines (50 by default) is squeezed down to a button. N can be changed in the PyShell section of the General page of the Settings dialog. Fewer, but possibly extra long, lines can be squeezed by right clicking on the output. Squeezed output can be expanded in place by double-clicking the button or into the clipboard or a separate window by right-clicking the button. (Contributed by Tal Einat in [:issue:'1529353'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 848); [backlink](#)

Unknown interpreted text role "issue".

Add "Run Customized" to the Run menu to run a module with customized settings. Any command line arguments entered are added to sys.argv. They also re-appear in the box for the next customized run. One can also suppress the normal Shell main module restart. (Contributed by Cheryl Sabella, Terry Jan Reedy, and others in [:issue:'5680'](#) and [:issue:'37627'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 855); [backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 855); [backlink](#)

Unknown interpreted text role "issue".

Added optional line numbers for IDLE editor windows. Windows open without line numbers unless set otherwise in the General tab of the configuration dialog. Line numbers for an existing window are shown and hidden in the Options menu. (Contributed by Tal Einat and Saimadhav Heblikar in [:issue:'17535'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 861); [backlink](#)

Unknown interpreted text role "issue".

OS native encoding is now used for converting between Python strings and Tcl objects. This allows IDLE to work with emoji and other non-BMP characters. These characters can be displayed or copied and pasted to or from the clipboard. Converting strings from Tcl to Python and back now never fails. (Many people worked on this for eight years but the problem was finally solved by Serhiy Storchaka in [:issue:'13153'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 867); [backlink](#)

Unknown interpreted text role "issue".

New in 3.8.1:

Add option to toggle cursor blink off. (Contributed by Zackery Spytz in [:issue:'4603'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 876); [backlink](#)

Unknown interpreted text role "issue".

Escape key now closes IDLE completion windows. (Contributed by Johnny Najera in [:issue:'38944'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 879); [backlink](#)

Unknown interpreted text role "issue".

The changes above have been backported to 3.7 maintenance releases.

Add keywords to module name completion list. (Contributed by Terry J. Reedy in [:issue:'37765'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 884); [backlink](#)

Unknown interpreted text role "issue".

inspect

The `:func:`inspect.getdoc`` function can now find docstrings for `__slots__` if that attribute is a `:class:`dict`` where the values are docstrings. This provides documentation options similar to what we already have for `:func:`property``, `:func:`classmethod``, and `:func:`staticmethod``:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 890); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 890); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 890); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 890); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 890); [backlink](#)

Unknown interpreted text role "func".

```
class AudioClip:
    __slots__ = {'bit_rate': 'expressed in kilohertz to one decimal place',
                 'duration': 'in seconds, rounded up to an integer'}
    def __init__(self, bit_rate, duration):
        self.bit_rate = round(bit_rate / 1000.0, 1)
        self.duration = ceil(duration)
```

(Contributed by Raymond Hettinger in [issue`36326`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 902); [backlink](#)

Unknown interpreted text role "issue".

io

In development mode (`:option:`-X` env`) and in `:ref:`debug build <debug-build>`, the `:class:`io.IOBase`` finalizer now logs the exception if the `close()` method fails. The exception is ignored silently by default in release build. (Contributed by Victor Stinner in [issue`18748`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 908); [backlink](#)

Unknown interpreted text role "option".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 908); [backlink](#)

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 908); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 908); [backlink](#)

Unknown interpreted text role "issue".

itertools

The `:func:`itertools.accumulate`` function added an option *initial* keyword argument to specify an initial value:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 917); [backlink](#)

Unknown interpreted text role "func".

```
>>> from itertools import accumulate
>>> list(accumulate([10, 5, 30, 15], initial=1000))
[1000, 1010, 1015, 1045, 1060]
```

(Contributed by Lisa Roach in [:issue:`34659`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 924); [backlink](#)

Unknown interpreted text role "issue".

json.tool

Add option `--json-lines` to parse every input line as a separate JSON object. (Contributed by Weipeng Hong in [:issue:`31553`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 930); [backlink](#)

Unknown interpreted text role "issue".

logging

Added a *force* keyword argument to `:func:`logging.basicConfig()``. When set to true, any existing handlers attached to the root logger are removed and closed before carrying out the configuration specified by the other arguments.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 937); [backlink](#)

Unknown interpreted text role "func".

This solves a long-standing problem. Once a logger or *basicConfig()* had been called, subsequent calls to *basicConfig()* were silently ignored. This made it difficult to update, experiment with, or teach the various logging configuration options using the interactive prompt or a Jupyter notebook.

(Suggested by Raymond Hettinger, implemented by Dong-hee Na, and reviewed by Vinay Sajip in [:issue:`33897`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 948); [backlink](#)

Unknown interpreted text role "issue".

math

Added new function `:func:`math.dist`` for computing Euclidean distance between two points. (Contributed by Raymond Hettinger in [:issue:`33089`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 955); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 955); [backlink](#)

Unknown interpreted text role "issue".

Expanded the `:func:`math.hypot`` function to handle multiple dimensions. Formerly, it only supported the 2-D case. (Contributed by Raymond Hettinger in [:issue:`33089`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 958); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 958); [backlink](#)

Unknown interpreted text role "issue".

Added new function, `:func:`math.prod``, as analogous function to `:func:`sum`` that returns the product of a 'start' value (default: 1) times an iterable of numbers:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 962); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 962); [backlink](#)

Unknown interpreted text role "func".

```
>>> prior = 0.8
>>> likelihoods = [0.625, 0.84, 0.30]
>>> math.prod(likelihoods, start=prior)
0.126
```

(Contributed by Pablo Galindo in [:issue:`35606`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 971); [backlink](#)

Unknown interpreted text role "issue".

Added two new combinatoric functions `:func:`math.perm`` and `:func:`math.comb``:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 973); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 973); [backlink](#)

Unknown interpreted text role "func".

```
>>> math.perm(10, 3)    # Permutations of 10 things taken 3 at a time
720
>>> math.comb(10, 3)    # Combinations of 10 things taken 3 at a time
120
```

(Contributed by Yash Aggarwal, Keller Fuchs, Serhiy Storchaka, and Raymond Hettinger in [:issue:`37128`](#), [:issue:`37178`](#), and [:issue:`35431`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 980); [backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 980); [backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 980); [backlink](#)

Unknown interpreted text role "issue".

Added a new function `:func:`math.isqrt`` for computing accurate integer square roots without conversion to floating point. The new function supports arbitrarily large integers. It is faster than `floor(sqrt(n))` but slower than `:func:`math.sqrt``:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 983); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 983); [backlink](#)

Unknown interpreted text role "func".

```
>>> r = 650320427
>>> s = r ** 2
>>> isqrt(s - 1)          # correct
650320426
>>> floor(sqrt(s - 1))    # incorrect
650320427
```

(Contributed by Mark Dickinson in [:issue:`36887`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 995); [backlink](#)

Unknown interpreted text role "issue".

The function `:func:`math.factorial`` no longer accepts arguments that are not int-like. (Contributed by Pablo Galindo in [:issue:`33083`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 997); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 997); [backlink](#)

Unknown interpreted text role "issue".

mmap

The `:class:`mmap.mmap`` class now has an `:meth:`~mmap.mmap.madvise`` method to access the `madvise()` system call. (Contributed by Zackery Spytz in [:issue:`32941`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1004); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1004); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1004); [backlink](#)

Unknown interpreted text role "issue".

multiprocessing

Added new `:mod:'multiprocessing.shared_memory'` module. (Contributed by Davin Potts in [:issue:'35813'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1012); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1012); [backlink](#)

Unknown interpreted text role "issue".

On macOS, the `spawn` start method is now used by default. (Contributed by Victor Stinner in [:issue:'33725'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1015); [backlink](#)

Unknown interpreted text role "issue".

os

Added new function `:func:'~os.add_dll_directory'` on Windows for providing additional search paths for native dependencies when importing extension modules or loading DLLs using `:mod:'ctypes'`. (Contributed by Steve Dower in [:issue:'36085'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1022); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1022); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1022); [backlink](#)

Unknown interpreted text role "issue".

A new `:func:'os.memfd_create'` function was added to wrap the `memfd_create()` syscall. (Contributed by Zackery Spytz and Christian Heimes in [:issue:'26836'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1027); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1027); [backlink](#)

Unknown interpreted text role "issue".

On Windows, much of the manual logic for handling reparse points (including symlinks and directory junctions) has been delegated to the operating system. Specifically, `:func:'os.stat'` will now traverse anything supported by the operating system, while `:func:'os.lstat'` will only open reparse points that identify as "name surrogates" while others are opened as for `:func:'os.stat'`. In all cases, `:attr:'stat_result.st_mode'` will only have `S_IFLNK` set for symbolic links and not other kinds of reparse points. To identify other kinds of reparse point, check the new `:attr:'stat_result.st_reparse_tag'` attribute.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1031); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1031); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1031); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1031); [backlink](#)

Unknown interpreted text role "attr".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1031); [backlink](#)

Unknown interpreted text role "attr".

On Windows, `func.os.readlink` is now able to read directory junctions. Note that `func~os.path.islink` will return `False` for directory junctions, and so code that checks `islink` first will continue to treat junctions as directories, while code that handles errors from `func.os.readlink` may now treat junctions as links.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1040); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1040); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1040); [backlink](#)

Unknown interpreted text role "func".

(Contributed by Steve Dower in [issue:37834](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1046); [backlink](#)

Unknown interpreted text role "issue".

os.path

`mod.os.path` functions that return a boolean result like `func~os.path.exists`, `func~os.path.lexists`, `func~os.path.isdir`, `func~os.path.isfile`, `func~os.path.islink`, and `func~os.path.ismount` now return `False` instead of raising `exc.ValueError` or its subclasses `exc.UnicodeEncodeError` and `exc.UnicodeDecodeError` for paths that contain characters or bytes unrepresentable at the OS level. (Contributed by Serhiy Storchaka in [issue:33721](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-

main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1052); [backlink](#)

Unknown interpreted text role "issue".

:func:`~os.path.expanduser` on Windows now prefers the :envvar:`USERPROFILE` environment variable and does not use :envvar:`HOME`, which is not normally set for regular user accounts. (Contributed by Anthony Sottile in :issue:`36264`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1060); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1060); [backlink](#)

Unknown interpreted text role "envvar".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1060); [backlink](#)

Unknown interpreted text role "envvar".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1060); [backlink](#)

Unknown interpreted text role "issue".

`:func:`~os.path.isdir`` on Windows no longer returns `True` for a link to a non-existent directory.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1065); [backlink](#)

Unknown interpreted text role "func".

`:func:`~os.path.realpath`` on Windows now resolves reparse points, including symlinks and directory junctions.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1068); [backlink](#)

Unknown interpreted text role "func".

(Contributed by Steve Dower in `:issue:`37834``.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1071); [backlink](#)

Unknown interpreted text role "issue".

pathlib

`:mod:`pathlib.Path`` methods that return a boolean result like `:meth:`~pathlib.Path.exists()``, `:meth:`~pathlib.Path.is_dir()``, `:meth:`~pathlib.Path.is_file()``, `:meth:`~pathlib.Path.is_mount()``, `:meth:`~pathlib.Path.is_symlink()``, `:meth:`~pathlib.Path.is_block_device()``, `:meth:`~pathlib.Path.is_char_device()``, `:meth:`~pathlib.Path.is_fifo()``, `:meth:`~pathlib.Path.is_socket()`` now return `False` instead of raising `:exc:`ValueError`` or its subclass `:exc:`UnicodeEncodeError`` for paths that contain characters unrepresentable at the OS level. (Contributed by Serhiy Storchaka in `:issue:`33721``.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1077); [backlink](#)

Unknown interpreted text role "issue".

Added `:meth:`pathlib.Path.link_to()`` which creates a hard link pointing to a path. (Contributed by Joannah Nanjeyye in [issue:`26978`](#))

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1087); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1087); [backlink](#)

Unknown interpreted text role "issue".

pickle

`:mod:`pickle`` extensions subclassing the C-optimized `:class:`~pickle.Pickler`` can now override the pickling logic of functions and classes by defining the special `:meth:`~pickle.Pickler.reducer_override`` method. (Contributed by Pierre Glaser and Olivier Grisel in [issue:`35900`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1095); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1095); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1095); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1095); [backlink](#)

Unknown interpreted text role "issue".

plistlib

Added new `:class:`plistlib.UID`` and enabled support for reading and writing NSKeyedArchiver-encoded binary plists. (Contributed by Jon Janzen in [:issue:`26707`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1104); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1104); [backlink](#)

Unknown interpreted text role "issue".

pprint

The `:mod:`pprint`` module added a `sort_dicts` parameter to several functions. By default, those functions continue to sort dictionaries before rendering or printing. However, if `sort_dicts` is set to false, the dictionaries retain the order that keys were inserted. This can be useful for comparison to JSON inputs during debugging.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1112); [backlink](#)

Unknown interpreted text role "mod".

In addition, there is a convenience new function, `:func:`pprint.pp`` that is like `:func:`pprint.pprint`` but with `sort_dicts` defaulting to False:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1118); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1118); [backlink](#)

Unknown interpreted text role "func".

```
>>> from pprint import pprint, pp
>>> d = dict(source='input.txt', operation='filter', destination='output.txt')
>>> pp(d, width=40)                                # Original order
{'source': 'input.txt',
 'operation': 'filter',
 'destination': 'output.txt'}
>>> pprint(d, width=40)                             # Keys sorted alphabetically
{'destination': 'output.txt',
 'operation': 'filter',
 'source': 'input.txt'}
```

(Contributed by Rémi Lapeyre in [:issue:`30670`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1132); [backlink](#)

Unknown interpreted text role "issue".

py_compile

`:func:`py_compile.compile`` now supports silent mode. (Contributed by Joannah Nanjeyye in [:issue:`22640`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1138); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1138); [backlink](#)

Unknown interpreted text role "issue".

shlex

The new `:func:`shlex.join`` function acts as the inverse of `:func:`shlex.split``. (Contributed by Bo Bayles in [issue:`32102`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1145); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1145); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1145); [backlink](#)

Unknown interpreted text role "issue".

shutil

`:func:`shutil.copytree`` now accepts a new `dirs_exist_ok` keyword argument. (Contributed by Josh Bronson in [issue:`20849`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1152); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1152); [backlink](#)

Unknown interpreted text role "issue".

`:func:`shutil.make_archive`` now defaults to the modern pax (POSIX.1-2001) format for new archives to improve portability and standards conformance, inherited from the corresponding change to the `:mod:`tarfile`` module. (Contributed by C.A.M. Gerlach in [issue:`30661`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1155); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1155); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1155); [backlink](#)

Unknown interpreted text role "issue".

`:func:`shutil.rmtree`` on Windows now removes directory junctions without recursively removing their contents first. (Contributed by Steve Dower in [issue:`37834`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1160); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1160); [backlink](#)

Unknown interpreted text role "issue".

socket

Added `.meth:~socket.create_server()` and `.meth:~socket.has_dualstack_ipv6()` convenience functions to automate the necessary tasks usually involved when creating a server socket, including accepting both IPv4 and IPv6 connections on the same socket. (Contributed by Giampaolo Rodolà in [issue:17561](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1168); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1168); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1168); [backlink](#)

Unknown interpreted text role "issue".

The `.func:socket.if_nameindex()`, `.func:socket.if_nametoindex()`, and `.func:socket.if_indextoname()` functions have been implemented on Windows. (Contributed by Zackery Spytz in [issue:37007](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1173); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1173); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1173); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1173); [backlink](#)

Unknown interpreted text role "issue".

ssl

Added `.attr:~ssl.SSLContext.post_handshake_auth` to enable and `.meth:~ssl.SSLSocket.verify_client_post_handshake` to initiate TLS 1.3 post-handshake authentication. (Contributed by Christian Heimes in [issue:34670](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1181); [backlink](#)

Unknown interpreted text role "attr".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1181); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1181); [backlink](#)

Unknown interpreted text role "issue".

statistics

Added `:func:`statistics.fmean`` as a faster, floating point variant of `:func:`statistics.mean()``. (Contributed by Raymond Hettinger and Steven D'Aprano in [:issue:`35904`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1190); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1190); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1190); [backlink](#)

Unknown interpreted text role "issue".

Added `:func:`statistics.geometric_mean()`` (Contributed by Raymond Hettinger in [:issue:`27181`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1194); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1194); [backlink](#)

Unknown interpreted text role "issue".

Added `:func:`statistics.multimode`` that returns a list of the most common values. (Contributed by Raymond Hettinger in [:issue:`35892`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1197); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1197); [backlink](#)

Unknown interpreted text role "issue".

Added `:func:`statistics.quantiles`` that divides data or a distribution in to equiprobable intervals (e.g. quartiles, deciles, or percentiles). (Contributed by Raymond Hettinger in [:issue:`36546`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1200); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1200); [backlink](#)

Unknown interpreted text role "issue".

Added `:class:`statistics.NormalDist``, a tool for creating and manipulating normal distributions of a random variable. (Contributed by Raymond Hettinger in [:issue:`36018`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1204); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1204); [backlink](#)

Unknown interpreted text role "issue".

```
>>> temperature_feb = NormalDist.from_samples([4, 12, -3, 2, 7, 14])
>>> temperature_feb.mean
6.0
>>> temperature_feb.stdev
6.356099432828281

>>> temperature_feb.cdf(3)          # Chance of being under 3 degrees
0.3184678262814532
>>> # Relative chance of being 7 degrees versus 10 degrees
>>> temperature_feb.pdf(7) / temperature_feb.pdf(10)
1.2039930378537762

>>> el_niño = NormalDist(4, 2.5)
>>> temperature_feb += el_niño      # Add in a climate effect
>>> temperature_feb
NormalDist(mu=10.0, sigma=6.830080526611674)

>>> temperature_feb * (9/5) + 32    # Convert to Fahrenheit
NormalDist(mu=50.0, sigma=12.294144947901014)
>>> temperature_feb.samples(3)      # Generate random samples
[7.672102882379219, 12.000027119750287, 4.647488369766392]
```

sys

Add new `:func:'sys.unraisablehook'` function which can be overridden to control how "unraisable exceptions" are handled. It is called when an exception has occurred but there is no way for Python to handle it. For example, when a destructor raises an exception or during garbage collection (`:func:'gc.collect'`). (Contributed by Victor Stinner in `:issue:'36829'`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1236); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1236); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1236); [backlink](#)

Unknown interpreted text role "issue".

tarfile

The `:mod:'tarfile'` module now defaults to the modern pax (POSIX.1-2001) format for new archives, instead of the previous GNU-specific one. This improves cross-platform portability with a consistent encoding (UTF-8) in a standardized and extensible format, and offers several other benefits. (Contributed by C.A.M. Gerlach in `:issue:'36268'`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1247); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1247); [backlink](#)

Unknown interpreted text role "issue".

threading

Add a new `:func:`threading.excepthook`` function which handles uncaught `:meth:`threading.Thread.run`` exception. It can be overridden to control how uncaught `:meth:`threading.Thread.run`` exceptions are handled. (Contributed by Victor Stinner in [:issue:`1230540`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1257); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1257); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1257); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1257); [backlink](#)

Unknown interpreted text role "issue".

Add a new `:func:`threading.get_native_id`` function and a `:data:`~threading.Thread.native_id`` attribute to the `:class:`threading.Thread`` class. These return the native integral Thread ID of the current thread assigned by the kernel. This feature is only available on certain platforms, see `:func:`get_native_id` <threading.get_native_id>` for more information. (Contributed by Jake Tesler in [:issue:`36084`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1262); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1262); [backlink](#)

Unknown interpreted text role "data".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1262); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1262); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1262); [backlink](#)

Unknown interpreted text role "issue".

tokenize

The `:mod:`tokenize`` module now implicitly emits a `NEWLINE` token when provided with input that does not have a trailing new line. This behavior now matches what the C tokenizer does internally. (Contributed by Ammar Askar in [:issue:`33899`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1274); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1274); [backlink](#)

Unknown interpreted text role "issue".

tkinter

Added methods `:meth:`~tkinter.Spinbox.selection_from``, `:meth:`~tkinter.Spinbox.selection_present``, `:meth:`~tkinter.Spinbox.selection_range`` and `:meth:`~tkinter.Spinbox.selection_to`` in the `:class:`tkinter.Spinbox`` class. (Contributed by Juliette Monsel in [issue:`34829`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1283); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1283); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1283); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1283); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1283); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1283); [backlink](#)

Unknown interpreted text role "issue".

Added method `:meth:`~tkinter.Canvas.moveto`` in the `:class:`tkinter.Canvas`` class. (Contributed by Juliette Monsel in [issue:`23831`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1290); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1290); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1290); [backlink](#)

Unknown interpreted text role "issue".

The `:class:`tkinter.PhotoImage`` class now has `:meth:`~tkinter.PhotoImage.transparency_get`` and `:meth:`~tkinter.PhotoImage.transparency_set`` methods. (Contributed by Zackery Spytz in [issue:`25451`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1294); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1294); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1294); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1294); [backlink](#)

Unknown interpreted text role "issue".

time

Added new clock `:data:~time.CLOCK_UPTIME_RAW` for macOS 10.12. (Contributed by Joannah Nanjeyye in `:issue:35702``.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1303); [backlink](#)

Unknown interpreted text role "data".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1303); [backlink](#)

Unknown interpreted text role "issue".

typing

The `:mod:typing`` module incorporates several new features:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1310); [backlink](#)

Unknown interpreted text role "mod".

- A dictionary type with per-key types. See [PEP 589](#) and `:class:typing.TypedDict``. TypedDict uses only string keys. By default, every key is required to be present. Specify `"total=False"` to allow keys to be optional:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1312); [backlink](#)

Unknown interpreted text role "class".

```
class Location(TypedDict, total=False):
    lat_long: tuple
    grid_square: str
    xy_coordinate: tuple
```

- Literal types. See [PEP 586](#) and `:class:typing.Literal``. Literal types indicate that a parameter or return value is constrained to one or more specific literal values:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1322); [backlink](#)

Unknown interpreted text role "class".

```
def get_status(port: int) -> Literal['connected', 'disconnected']:
    ...
```

- "Final" variables, functions, methods and classes. See [PEP 591](#), `:class:typing.Final`` and `:func:typing.final``. The final qualifier instructs a static type checker to restrict subclassing, overriding, or reassignment:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1329); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1329); [backlink](#)

Unknown interpreted text role "func".

pi: Final[float] = 3.1415926536

- Protocol definitions. See [PEP 544](#), `:class:`typing.Protocol`` and `:func:`typing.runtime_checkable``. Simple ABCs like `:class:`typing.SupportsInt`` are now `Protocol` subclasses.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1336); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1336); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1336); [backlink](#)

Unknown interpreted text role "class".

- New protocol class `:class:`typing.SupportsIndex``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1340); [backlink](#)

Unknown interpreted text role "class".

- New functions `:func:`typing.get_origin`` and `:func:`typing.get_args``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1342); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1342); [backlink](#)

Unknown interpreted text role "func".

unicodedata

The `:mod:`unicodedata`` module has been upgraded to use the [Unicode 12.1.0](#) release.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1348); [backlink](#)

Unknown interpreted text role "mod".

New function `:func:~unicodedata.is_normalized` can be used to verify a string is in a specific normal form, often much faster than by actually normalizing the string. (Contributed by Max Belanger, David Euresti, and Greg Price in [:issue:'32285'](#) and [:issue:'37966'](#)).

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1351); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1351); [backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1351); [backlink](#)

Unknown interpreted text role "issue".

unittest

Added `:class:~unittest.mock.AsyncMock` to support an asynchronous version of `:class:~unittest.mock.Mock`. Appropriate new assert functions for testing have been added as well. (Contributed by Lisa Roach in [:issue:'26467'](#)).

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1360); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1360); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1360); [backlink](#)

Unknown interpreted text role "issue".

Added `:func:~unittest.addModuleCleanup()` and `:meth:~unittest.TestCase.addClassCleanup()` to unittest to support cleanups for `:func:~unittest.setUpModule()` and `:meth:~unittest.TestCase.setUpClass()`. (Contributed by Lisa Roach in [:issue:'24412'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1365); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1365); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1365); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1365); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1365); [backlink](#)

Unknown interpreted text role "issue".

Several mock assert functions now also print a list of actual calls upon failure. (Contributed by Petter Strandmark in [issue:35047](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1371); [backlink](#)

Unknown interpreted text role "issue".

`mod:unittest` module gained support for coroutines to be used as test cases with `class:unittest.IsolatedAsyncioTestCase`. (Contributed by Andrew Svetlov in [issue:32972](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1374); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1374); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1374); [backlink](#)

Unknown interpreted text role "issue".

Example:

```
import unittest

class TestRequest(unittest.IsolatedAsyncioTestCase):

    async def asyncSetUp(self):
        self.connection = await AsyncConnection()

    async def test_get(self):
        response = await self.connection.get("https://example.com")
        self.assertEqual(response.status_code, 200)

    async def asyncTearDown(self):
        await self.connection.close()

if __name__ == "__main__":
    unittest.main()
```

venv

`mod:venv` now includes an `Activate.ps1` script on all platforms for activating virtual environments under PowerShell Core 6.1. (Contributed by Brett Cannon in [issue:32718](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1403); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1403); [backlink](#)

Unknown interpreted text role "issue".

weakref

The proxy objects returned by `func:weakref.proxy` now support the matrix multiplication operators `@` and `@=` in addition to the other numeric operators. (Contributed by Mark Dickinson in [issue:36669](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1411); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1411); [backlink](#)

Unknown interpreted text role "issue".

xml

As mitigation against DTD and external entity retrieval, the `:mod:`xml.dom.minidom`` and `:mod:`xml.sax`` modules no longer process external entities by default. (Contributed by Christian Heimes in [:issue:`17239`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1419); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1419); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1419); [backlink](#)

Unknown interpreted text role "issue".

The `.find*()` methods in the `:mod:`xml.etree.ElementTree`` module support wildcard searches like `{*}tag` which ignores the namespace and `{namespace}*` which returns all tags in the given namespace. (Contributed by Stefan Behnel in [:issue:`28238`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1424); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1424); [backlink](#)

Unknown interpreted text role "issue".

The `:mod:`xml.etree.ElementTree`` module provides a new function `:func:`xml.etree.ElementTree.canonicalize()`` that implements C14N 2.0. (Contributed by Stefan Behnel in [:issue:`13611`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1429); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1429); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1429); [backlink](#)

Unknown interpreted text role "issue".

The target object of `:class:`xml.etree.ElementTree.XMLParser`` can receive namespace declaration events through the new callback methods `start_ns()` and `end_ns()`. Additionally, the `:class:`xml.etree.ElementTree.TreeBuilder`` target can be configured to process events about comments and processing instructions to include them in the generated tree. (Contributed by Stefan Behnel in [:issue:`36676`](#) and [:issue:`36673`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-

main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1433); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1433); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1433); [backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1433); [backlink](#)

Unknown interpreted text role "issue".

xmlrpc

`:class:`xmlrpc.client.ServerProxy`` now supports an optional `headers` keyword argument for a sequence of HTTP headers to be sent with each request. Among other things, this makes it possible to upgrade from default basic authentication to faster session authentication. (Contributed by Cédric Krier in [issue`35153`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1445); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1445); [backlink](#)

Unknown interpreted text role "issue".

Optimizations

- The `:mod:`subprocess`` module can now use the `:func:`os.posix_spawn`` function in some cases for better performance. Currently, it is only used on macOS and Linux (using glibc 2.24 or newer) if all these conditions are met:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1455); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1455); [backlink](#)

Unknown interpreted text role "func".

- `close_fds` is false;
- `preexec_fn`, `pass_fds`, `cwd` and `start_new_session` parameters are not set;
- the `executable` path contains a directory.

(Contributed by Joannah Nanjey and Victor Stinner in [issue`35537`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1464); [backlink](#)

Unknown interpreted text role "issue".

- `:func:`shutil.copyfile``, `:func:`shutil.copy``, `:func:`shutil.copy2``, `:func:`shutil.copytree`` and `:func:`shutil.move`` use platform-specific "fast-copy" syscalls on Linux and macOS in order to copy the file more efficiently. "fast-copy" means that the copying

operation occurs within the kernel, avoiding the use of userspace buffers in Python as in `"outfd.write(infd.read())"`. On Windows `:func:'shutil.copyfile'` uses a bigger default buffer size (1 MiB instead of 16 KiB) and a `:func:'memoryview'`-based variant of `:func:'shutil.copyfileobj'` is used. The speedup for copying a 512 MiB file within the same partition is about +26% on Linux, +50% on macOS and +40% on Windows. Also, much less CPU cycles are consumed. See `ref'shutil-platform-dependent-efficient-copy-operations'` section. (Contributed by Giampaolo Rodolà in `:issue:'33671'`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1466);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1466);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1466);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1466);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1466);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1466);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1466);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1466);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1466);
[backlink](#)

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1466);
[backlink](#)

Unknown interpreted text role "issue".

- `:func:`shutil.copytree`` uses `:func:`os.scandir`` function and all copy functions depending from it use cached `:func:`os.stat`` values. The speedup for copying a directory with 8000 files is around +9% on Linux, +20% on Windows and +30% on a Windows SMB share. Also the number of `:func:`os.stat`` syscalls is reduced by 38% making `:func:`shutil.copytree`` especially faster on network filesystems. (Contributed by Giampaolo Rodolà in [:issue:`33695`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1482);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1482);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1482);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1482);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1482);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1482);
[backlink](#)

Unknown interpreted text role "issue".

- The default protocol in the `:mod:`pickle`` module is now Protocol 4, first introduced in Python 3.4. It offers better performance and smaller size compared to Protocol 3 available since Python 3.0.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1489);
[backlink](#)

Unknown interpreted text role "mod".

- Removed one `Py_ssize_t` member from `PyGC_Head`. All GC tracked objects (e.g. tuple, list, dict) size is reduced 4 or 8 bytes. (Contributed by Inada Naoki in [:issue:`33597`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1493);
[backlink](#)

Unknown interpreted text role "issue".

- `:class:`uuid.UUID`` now uses `__slots__` to reduce its memory footprint. (Contributed by Wouter Bolsterlee and Tal Einat in [:issue:`30977`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1497); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1497); [backlink](#)

Unknown interpreted text role "issue".

- Improved performance of `:func:`operator.itemgetter`` by 33%. Optimized argument handling and added a fast path for the common case of a single non-negative integer index into a tuple (which is the typical use case in the standard library). (Contributed by Raymond Hettinger in [issue:35664](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1500); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1500); [backlink](#)

Unknown interpreted text role "issue".

- Sped-up field lookups in `:func:`collections.namedtuple``. They are now more than two times faster, making them the fastest form of instance variable lookup in Python. (Contributed by Raymond Hettinger, Pablo Galindo, and Joe Jevnik, Serhiy Storchaka in [issue:32492](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1506); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1506); [backlink](#)

Unknown interpreted text role "issue".

- The `:class:`list`` constructor does not overallocate the internal item buffer if the input iterable has a known length (the input implements `__len__`). This makes the created list 12% smaller on average. (Contributed by Raymond Hettinger and Pablo Galindo in [issue:33234](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1511); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1511); [backlink](#)

Unknown interpreted text role "issue".

- Doubled the speed of class variable writes. When a non-dunder attribute was updated, there was an unnecessary call to update slots. (Contributed by Stefan Behnel, Pablo Galindo Salgado, Raymond Hettinger, Neil Schemenauer, and Serhiy Storchaka in [issue:36012](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-

resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1516);
[backlink](#)

Unknown interpreted text role "issue".

- Reduced an overhead of converting arguments passed to many builtin functions and methods. This sped up calling some simple builtin functions and methods up to 20--50%. (Contributed by Serhiy Storchaka in [:issue:'23867'](#), [:issue:'35582'](#) and [:issue:'36127'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1521);
[backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1521);
[backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1521);
[backlink](#)

Unknown interpreted text role "issue".

- `LOAD_GLOBAL` instruction now uses new "per opcode cache" mechanism. It is about 40% faster now. (Contributed by Yury Selivanov and Inada Naoki in [:issue:'26219'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1526);
[backlink](#)

Unknown interpreted text role "issue".

Build and C API Changes

- Default `:data:'sys.abiflags'` became an empty string; the `m` flag for `pymalloc` became useless (builds with and without `pymalloc` are ABI compatible) and so has been removed. (Contributed by Victor Stinner in [:issue:'36707'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1534);
[backlink](#)

Unknown interpreted text role "data".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1534);
[backlink](#)

Unknown interpreted text role "issue".

Example of changes:

- Only `python3.8` program is installed, `python3.8m` program is gone.
- Only `python3.8-config` script is installed, `python3.8m-config` script is gone.
- The `m` flag has been removed from the suffix of dynamic library filenames: extension modules in the standard library as well as those produced and installed by third-party packages, like those downloaded from PyPI. On Linux, for example, the Python 3.7 suffix `.cpython-37m-x86_64-linux-gnu.so` became `.cpython-38-x86_64-linux-gnu.so` in Python 3.8.
- The header files have been reorganized to better separate the different kinds of APIs:
 - `Include/*.h` should be the portable public stable C API.
 - `Include/cpython/*.h` should be the unstable C API specific to CPython; public API, with some private API prefixed by `_Py` or `_PY`.

- `Include/internal/*.h` is the private internal C API very specific to CPython. This API comes with no backward compatibility warranty and should not be used outside CPython. It is only exposed for very specific needs like debuggers and profiles which has to access to CPython internals without calling functions. This API is now installed by `make install`.

(Contributed by Victor Stinner in [:issue:'35134'](#) and [:issue:'35081'](#), work initiated by Eric Snow in Python 3.7.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1562); [backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1562); [backlink](#)

Unknown interpreted text role "issue".

- Some macros have been converted to static inline functions: parameter types and return type are well defined, they don't have issues specific to macros, variables have a local scopes. Examples:

- `:c:func:'Py_INCREF'`, `:c:func:'Py_DECREF'`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1569); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1569); [backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:'Py_XINCRF'`, `:c:func:'Py_XDECREF'`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1570); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1570); [backlink](#)

Unknown interpreted text role "c:func".

- `:c:func:'PyObject_INIT'`, `:c:func:'PyObject_INIT_VAR'`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1571); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1571); [backlink](#)

Unknown interpreted text role "c:func".

- Private functions: `:c:func:'_PyObject_GC_TRACK'`, `:c:func:'_PyObject_GC_UNTRACK'`, `:c:func:'_Py_Dealloc'`

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1572); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1572); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1572); [backlink](#)

Unknown interpreted text role "c:func".

(Contributed by Victor Stinner in :issue:`35059`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1575); [backlink](#)

Unknown interpreted text role "issue".

- The `c:func:PyByteArray_Init` and `c:func:PyByteArray_Fini` functions have been removed. They did nothing since Python 2.7.4 and Python 3.2.0, were excluded from the limited API (stable ABI), and were not documented. (Contributed by Victor Stinner in :issue:`35713`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1577); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1577); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1577); [backlink](#)

Unknown interpreted text role "issue".

- The result of `c:func:PyExceptionClass_Name` is now of type `const char *` rather of `char *`. (Contributed by Serhiy Storchaka in :issue:`33818`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1582); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1582); [backlink](#)

Unknown interpreted text role "issue".

- The duality of `Modules/Setup.dist` and `Modules/Setup` has been removed. Previously, when updating the CPython source tree, one had to manually copy `Modules/Setup.dist` (inside the source tree) to `Modules/Setup` (inside the build

tree) in order to reflect any changes upstream. This was of a small benefit to packagers at the expense of a frequent annoyance to developers following CPython development, as forgetting to copy the file could produce build failures.

Now the build system always reads from `Modules/Setup` inside the source tree. People who want to customize that file are encouraged to maintain their changes in a git fork of CPython or as patch files, as they would do for any other change to the source tree.

(Contributed by Antoine Pitrou in [issue:32430](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1599); [backlink](#)

Unknown interpreted text role "issue".

- Functions that convert Python number to C integer like `:c:func:PyLong_AsLong` and argument parsing functions like `:c:func:PyArg_ParseTuple` with integer converting format units like `'i'` will now use the `:meth:~object.__index__` special method instead of `:meth:~object.__int__`, if available. The deprecation warning will be emitted for objects with the `__int__()` method but without the `__index__()` method (like `:class:~decimal.Decimal` and `:class:~fractions.Fraction`). `:c:func:PyNumber_Check` will now return 1 for objects implementing `__index__()`. `:c:func:PyNumber_Long`, `:c:func:PyNumber_Float` and `:c:func:PyFloat_AsDouble` also now use the `__index__()` method if available. (Contributed by Serhiy Storchaka in [issue:36048](#) and [issue:20092](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1601); [backlink](#)

Unknown interpreted text role "issue".

- Heap-allocated type objects will now increase their reference count in `c:func:PyObject_Init` (and its parallel macro `PyObject_INIT`) instead of in `c:func:PyType_GenericAlloc`. Types that modify instance allocation or deallocation may need to be adjusted. (Contributed by Eddie Elizondo in [issue:35810](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1615); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1615); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1615); [backlink](#)

Unknown interpreted text role "issue".

- The new function `c:func:PyCode_NewWithPosOnlyArgs` allows to create code objects like `c:func:PyCode_New`, but with an extra *posonlyargcount* parameter for indicating the number of positional-only arguments. (Contributed by Pablo Galindo in [issue:37221](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1621); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1621);

[backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1621);
[backlink](#)

Unknown interpreted text role "issue".

- `c:func:Py_SetPath` now sets `:data:sys.executable` to the program full path (`c:func:Py_GetProgramFullPath`) rather than to the program name (`c:func:Py_GetProgramName`). (Contributed by Victor Stinner in `:issue:38234`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1626);
[backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1626);
[backlink](#)

Unknown interpreted text role "data".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1626);
[backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1626);
[backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1626);
[backlink](#)

Unknown interpreted text role "issue".

Deprecated

- The distutils `bdist_wininst` command is now deprecated, use `bdist_wheel` (wheel packages) instead. (Contributed by Victor Stinner in `:issue:37481`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1635);
[backlink](#)

Unknown interpreted text role "issue".

- Deprecated methods `getchildren()` and `getiterator()` in the `mod:~xml.etree.ElementTree` module now emit a `:exc:DeprecationWarning` instead of `:exc:PendingDeprecationWarning`. They will be removed in Python 3.9. (Contributed by Serhiy Storchaka in `:issue:29209`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1639);
[backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1639); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1639); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1639); [backlink](#)

Unknown interpreted text role "issue".

- Passing an object that is not an instance of `:class:`concurrent.futures.ThreadPoolExecutor`` to `:meth:`loop.set_default_executor()` <`asyncio.loop.set_default_executor`> is deprecated and will be prohibited in Python 3.9. (Contributed by Elvis Pranskevichus in [issue`34075`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1645); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1645); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1645); [backlink](#)

Unknown interpreted text role "issue".

- The `:meth:`__getitem__`` methods of `:class:`xml.dom.pulldom.DOMEventStream``, `:class:`wsgiref.util.FileWrapper`` and `:class:`fileinput.FileInput`` have been deprecated.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1651); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1651); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1651); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1651); [backlink](#)

Unknown interpreted text role "class".

Implementations of these methods have been ignoring their *index* parameter, and returning the next item instead. (Contributed by Berker Peksag in [:issue:'9372'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1655); [backlink](#)

Unknown interpreted text role "issue".

- The `:class:'typing.NamedTuple'` class has deprecated the `_field_types` attribute in favor of the `__annotations__` attribute which has the same information. (Contributed by Raymond Hettinger in [:issue:'36320'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1659); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1659); [backlink](#)

Unknown interpreted text role "issue".

- `:mod:'ast'` classes `Num`, `Str`, `Bytes`, `NameConstant` and `Ellipsis` are considered deprecated and will be removed in future Python versions. `:class:'~ast.Constant'` should be used instead. (Contributed by Serhiy Storchaka in [:issue:'32892'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1663); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1663); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1663); [backlink](#)

Unknown interpreted text role "issue".

- `:class:'ast.NodeVisitor'` methods `visit_Num()`, `visit_Str()`, `visit_Bytes()`, `visit_NameConstant()` and `visit_Ellipsis()` are deprecated now and will not be called in future Python versions. Add the `:meth:'~ast.NodeVisitor.visit_Constant'` method to handle all constant nodes. (Contributed by Serhiy Storchaka in [:issue:'36917'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1668); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1668); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1668); [backlink](#)

Unknown interpreted text role "issue".

- The `:func:`asyncio.coroutine`` `:term:`decorator`` is deprecated and will be removed in version 3.10. Instead of `@asyncio.coroutine`, use `:keyword:`async def`` instead. (Contributed by Andrew Svetlov in [issue`36921`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1675); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1675); [backlink](#)

Unknown interpreted text role "term".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1675); [backlink](#)

Unknown interpreted text role "keyword".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1675); [backlink](#)

Unknown interpreted text role "issue".

- In `:mod:`asyncio``, the explicit passing of a *loop* argument has been deprecated and will be removed in version 3.10 for the following: `:func:`asyncio.sleep``, `:func:`asyncio.gather``, `:func:`asyncio.shield``, `:func:`asyncio.wait_for``, `:func:`asyncio.wait``, `:func:`asyncio.as_completed``, `:class:`asyncio.Task``, `:class:`asyncio.Lock``, `:class:`asyncio.Event``, `:class:`asyncio.Condition``, `:class:`asyncio.Semaphore``, `:class:`asyncio.BoundedSemaphore``, `:class:`asyncio.Queue``, `:func:`asyncio.create_subprocess_exec``, and `:func:`asyncio.create_subprocess_shell``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-

resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1680); [backlink](#)

Unknown interpreted text role "func".

- The explicit passing of coroutine objects to `:func:`asyncio.wait`` has been deprecated and will be removed in version 3.11. (Contributed by Yury Selivanov in [issue:34790](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1690); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1690); [backlink](#)

Unknown interpreted text role "issue".

- The following functions and methods are deprecated in the `:mod:`gettext`` module: `:func:`~gettext.lgettext``, `:func:`~gettext.ldgettext``, `:func:`~gettext.lngettext`` and `:func:`~gettext.lngettext``. They return encoded bytes, and it's possible that you will get unexpected Unicode-related exceptions if there are encoding problems with the translated strings. It's much better to use alternatives which return Unicode strings in Python 3. These functions have been broken for a long time.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1694); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1694); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1694); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1694); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1694); [backlink](#)

Unknown interpreted text role "func".

Function `:func:`~gettext.bind_textdomain_codeset``, methods `:meth:`~gettext.NullTranslations.output_charset`` and `:meth:`~gettext.NullTranslations.set_output_charset``, and the `codeset` parameter of functions `:func:`~gettext.translation`` and `:func:`~gettext.install`` are also deprecated, since they are only used for the `l*gettext()` functions. (Contributed by Serhiy Storchaka in [issue:33710](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1702); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1702); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1702); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1702); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1702); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1702); [backlink](#)

Unknown interpreted text role "issue".

- The `meth:~threading.Thread.isAlive()` method of `:class:~threading.Thread` has been deprecated. (Contributed by Dong-hee Na in [issue:~35283](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1710); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1710); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1710); [backlink](#)

Unknown interpreted text role "issue".

- Many builtin and extension functions that take integer arguments will now emit a deprecation warning for `:class:~decimal.Decimal`'s, `:class:~fractions.Fraction`'s and any other objects that can be converted to integers only with a loss (e.g. that have the `meth:~object.__int__` method but do not have the `meth:~object.__index__` method). In future version they will be errors. (Contributed by Serhiy Storchaka in [issue:~36048](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1714); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1714); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1714); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1714); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1714); [backlink](#)

Unknown interpreted text role "issue".

- Deprecated passing the following arguments as keyword arguments:
 - `func` in `:func:`functools.partialmethod``, `:func:`weakref.finalize``, `:meth:`profile.Profile.runcall``, `:meth:`cProfile.Profile.runcall``, `:meth:`bdb.Bdb.runcall``, `:meth:`trace.Trace.runfunc`` and `:func:`curses.wrapper``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1724); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1724); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1724); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1724); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1724); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1724); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1724); [backlink](#)

Unknown interpreted text role "func".

- *function* in `:meth:`unittest.TestCase.addCleanup``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1728); [backlink](#)

Unknown interpreted text role "meth".

- *fn* in the `:meth:`~concurrent.futures.Executor.submit`` method of `:class:`concurrent.futures.ThreadPoolExecutor`` and `:class:`concurrent.futures.ProcessPoolExecutor``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1729); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1729); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1729); [backlink](#)

Unknown interpreted text role "class".

- *callback* in `:meth:`contextlib.ExitStack.callback``, `:meth:`contextlib.AsyncExitStack.callback`` and `:meth:`contextlib.AsyncExitStack.push_async_callback``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1732); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1732); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1732); [backlink](#)

Unknown interpreted text role "meth".

- *c* and *typeid* in the `:meth:`~multiprocessing.managers.Server.create`` method of `:class:`multiprocessing.managers.Server`` and `:class:`multiprocessing.managers.SharedMemoryServer``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1735); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1735); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1735); [backlink](#)

Unknown interpreted text role "class".

- `obj` in `:func:`weakref.finalize``.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1738); [backlink](#)

Unknown interpreted text role "func".

In future releases of Python, they will be `:ref:positional-only <positional-only_parameter>`. (Contributed by Serhiy Storchaka in `:issue:36492``.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1740); [backlink](#)

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1740); [backlink](#)

Unknown interpreted text role "issue".

API and Feature Removals

The following features and APIs have been removed from Python 3.8:

- Starting with Python 3.3, importing ABCs from `:mod:`collections`` was deprecated, and importing should be done from `:mod:`collections.abc``. Being able to import from `collections` was marked for removal in 3.8, but has been delayed to 3.9. (See `:issue:36952``.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1750); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1750); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1750); [backlink](#)

Unknown interpreted text role "issue".

- The `:mod:`macpath`` module, deprecated in Python 3.7, has been removed. (Contributed by Victor Stinner in `:issue:35471``.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1755);

[backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1755);
[backlink](#)

Unknown interpreted text role "issue".

- The function `:func:`platform.popen`` has been removed, after having been deprecated since Python 3.3: use `:func:`os.popen`` instead. (Contributed by Victor Stinner in [issue`35345`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1758);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1758);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1758);
[backlink](#)

Unknown interpreted text role "issue".

- The function `:func:`time.clock`` has been removed, after having been deprecated since Python 3.3: use `:func:`time.perf_counter`` or `:func:`time.process_time`` instead, depending on your requirements, to have well-defined behavior. (Contributed by Matthias Bussonnier in [issue`36895`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1762);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1762);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1762);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1762);
[backlink](#)

Unknown interpreted text role "issue".

- The `pyenv` script has been removed in favor of `python3.8 -m venv` to help eliminate confusion as to what Python interpreter the `pyenv` script is tied to. (Contributed by Brett Cannon in [issue`25427`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1768);
[backlink](#)

Unknown interpreted text role "issue".

- `parse_qs`, `parse_qsl`, and `escape` are removed from the `mod:`cgi`` module. They are deprecated in Python 3.2 or older. They should be imported from the `urllib.parse` and `html` modules instead.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1772);
[backlink](#)

Unknown interpreted text role "mod".

- `filemode` function is removed from the `mod:`tarfile`` module. It is not documented and deprecated since Python 3.3.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1776);
[backlink](#)

Unknown interpreted text role "mod".

- The `class:`~xml.etree.ElementTree.XMLParser`` constructor no longer accepts the `html` argument. It never had an effect and was deprecated in Python 3.4. All other parameters are now `ref:`keyword-only <keyword-only_parameter>``. (Contributed by Serhiy Storchaka in [:issue:`29209`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1779);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1779);
[backlink](#)

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1779);
[backlink](#)

Unknown interpreted text role "issue".

- Removed the `doctype()` method of `class:`~xml.etree.ElementTree.XMLParser``. (Contributed by Serhiy Storchaka in [:issue:`29209`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1784);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1784);
[backlink](#)

Unknown interpreted text role "issue".

- "unicode_internal" codec is removed. (Contributed by Inada Naoki in [:issue:`36297`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1787);
[backlink](#)

Unknown interpreted text role "issue".

- The `Cache` and `Statement` objects of the `mod:`sqlite3`` module are not exposed to the user. (Contributed by Aviv Palivoda

in `:issue:'30262'`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1790); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1790); [backlink](#)

Unknown interpreted text role "issue".

- The `bufsize` keyword argument of `:func:'fileinput.input'` and `:func:'fileinput.FileInput'` which was ignored and deprecated since Python 3.6 has been removed. `:issue:'36952'` (Contributed by Matthias Bussonnier.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1794); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1794); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1794); [backlink](#)

Unknown interpreted text role "issue".

- The functions `:func:'sys.set_coroutine_wrapper'` and `:func:'sys.get_coroutine_wrapper'` deprecated in Python 3.7 have been removed; `:issue:'36933'` (Contributed by Matthias Bussonnier.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1798); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1798); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1798); [backlink](#)

Unknown interpreted text role "issue".

Porting to Python 3.8

This section lists previously described changes and other bugfixes that may require changes to your code.

Changes in Python behavior

- Yield expressions (both `yield` and `yield from` clauses) are now disallowed in comprehensions and generator expressions (aside from the iterable expression in the leftmost `:keyword:'!for'` clause). (Contributed by Serhiy Storchaka in `:issue:'10544'`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1813); [backlink](#)

Unknown interpreted text role "keyword".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1813); [backlink](#)

Unknown interpreted text role "issue".

- The compiler now produces a `:exc:'SyntaxWarning'` when identity checks (`is` and `is not`) are used with certain types of literals (e.g. strings, numbers). These can often work by accident in CPython, but are not guaranteed by the language spec. The warning advises users to use equality tests (`==` and `!=`) instead. (Contributed by Serhiy Storchaka in [issue:'34850'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1818); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1818); [backlink](#)

Unknown interpreted text role "issue".

- The CPython interpreter can swallow exceptions in some circumstances. In Python 3.8 this happens in fewer cases. In particular, exceptions raised when getting the attribute from the type dictionary are no longer ignored. (Contributed by Serhiy Storchaka in [issue:'35459'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1825); [backlink](#)

Unknown interpreted text role "issue".

- Removed `__str__` implementations from builtin types `:class:'bool'`, `:class:'int'`, `:class:'float'`, `:class:'complex'` and few classes from the standard library. They now inherit `__str__()` from `:class:'object'`. As result, defining the `__repr__()` method in the subclass of these classes will affect their string representation. (Contributed by Serhiy Storchaka in [issue:'36793'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1830); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1830); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1830); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1830); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1830); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1830); [backlink](#)

Unknown interpreted text role "issue".

- On AIX, `attr:'sys.platform'` doesn't contain the major version anymore. It is always 'aix', instead of 'aix3' .. 'aix7'. Since older Python versions include the version number, so it is recommended to always use `sys.platform.startswith('aix')`. (Contributed by M. Felt in [issue:36588](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1837); [backlink](#)

Unknown interpreted text role "attr".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1837); [backlink](#)

Unknown interpreted text role "issue".

- `:c:func:'PyEval_AcquireLock'` and `:c:func:'PyEval_AcquireThread'` now terminate the current thread if called while the interpreter is finalizing, making them consistent with `:c:func:'PyEval_RestoreThread'`, `:c:func:'Py_END_ALLOW_THREADS'`, and `:c:func:'PyGILState_Ensure'`. If this behavior is not desired, guard the call by checking `:c:func:'_Py_IsFinalizing'` or `:c:func:'sys.is_finalizing'`. (Contributed by Joannah Nanjeyye in [issue:36475](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1843); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1843); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1843); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1843); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1843); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1843); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1843); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1843); [backlink](#)

Unknown interpreted text role "issue".

Changes in the Python API

- The `:func:`os.getcwd`` function now uses the UTF-8 encoding on Windows, rather than the ANSI code page: see [PEP 529](#) for the rationale. The function is no longer deprecated on Windows. (Contributed by Victor Stinner in [issue:`37412`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1855); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1855); [backlink](#)

Unknown interpreted text role "issue".

- `:class:`subprocess.Popen`` can now use `:func:`os.posix_spawn`` in some cases for better performance. On Windows Subsystem for Linux and QEMU User Emulation, the `:class:`Popen`` constructor using `:func:`os.posix_spawn`` no longer raises an exception on errors like "missing program". Instead the child process fails with a non-zero `:attr:`~Popen.returncode``. (Contributed by Joanna Nanjey and Victor Stinner in [issue:`35537`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1860); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1860); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1860); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1860); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1860); [backlink](#)

Unknown interpreted text role "attr".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1860); [backlink](#)

Unknown interpreted text role "issue".

- The `preexec_fn` argument of `*:class:'subprocess.Popen'` is no longer compatible with subinterpreters. The use of the parameter in a subinterpreter now raises `:exc:'RuntimeError'`. (Contributed by Eric Snow in [:issue:'34651'](#), modified by Christian Heimes in [:issue:'37951'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1867); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1867); [backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1867); [backlink](#)

Unknown interpreted text role "issue".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1867); [backlink](#)

Unknown interpreted text role "issue".

- The `:meth:'imap.IMAP4.logout'` method no longer silently ignores arbitrary exceptions. (Contributed by Victor Stinner in [:issue:'36348'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1873); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1873); [backlink](#)

Unknown interpreted text role "issue".

- The function `:func:'platform.popen'` has been removed, after having been deprecated since Python 3.3: use `:func:'os.popen'` instead. (Contributed by Victor Stinner in [:issue:'35345'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1877); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1877); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1877); [backlink](#)

Unknown interpreted text role "issue".

- The `func:statistics.mode` function no longer raises an exception when given multimodal data. Instead, it returns the first mode encountered in the input data. (Contributed by Raymond Hettinger in [issue:35892](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1881); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1881); [backlink](#)

Unknown interpreted text role "issue".

- The `meth:~tkinter.ttk.Treeview.selection` method of the `class:~tkinter.ttk.Treeview` class no longer takes arguments. Using it with arguments for changing the selection was deprecated in Python 3.6. Use specialized methods like `meth:~tkinter.ttk.Treeview.selection_set` for changing the selection. (Contributed by Serhiy Storchaka in [issue:31508](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1886); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1886); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1886); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1886); [backlink](#)

Unknown interpreted text role "issue".

- The `meth:xml.dom.minidom.writexml`, `meth:xml.dom.minidom.toxml` and `meth:xml.dom.minidom.toprettyxml` methods of `mod:xml.dom.minidom`, and the `meth:xml.etree.ElementTree.write` method of `mod:xml.etree.ElementTree`, now preserve the attribute order specified by the user. (Contributed by Diego Rojas and Raymond Hettinger in [issue:34160](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1892); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1892); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1892); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1892); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1892); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1892); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1892); [backlink](#)

Unknown interpreted text role "issue".

- A `:mod:`dbm.dumb`` database opened with flags `'r'` is now read-only. `:func:`dbm.dumb.open`` with flags `'r'` and `'w'` no longer creates a database if it does not exist. (Contributed by Serhiy Storchaka in [issue:32749](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1897); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1897); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1897); [backlink](#)

Unknown interpreted text role "issue".

- The `doctype()` method defined in a subclass of `:class:`~xml.etree.ElementTree.XMLParser`` will no longer be called and will emit a `:exc:`RuntimeWarning`` instead of a `:exc:`DeprecationWarning``. Define the `:meth:`doctype()` `<xml.etree.ElementTree.TreeBuilder.doctype>` method on a target for handling an XML doctype declaration. (Contributed by Serhiy Storchaka in [issue:29209](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1902);

[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1902);
[backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1902);
[backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1902);
[backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1902);
[backlink](#)

Unknown interpreted text role "issue".

- A `:exc:`RuntimeError`` is now raised when the custom metaclass doesn't provide the `__classcell__` entry in the namespace passed to `type.__new__`. A `:exc:`DeprecationWarning`` was emitted in Python 3.6--3.7. (Contributed by Serhiy Storchaka in [:issue:`23722`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1909);
[backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1909);
[backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1909);
[backlink](#)

Unknown interpreted text role "issue".

- The `:class:`cProfile.Profile`` class can now be used as a context manager. (Contributed by Scott Sanderson in [:issue:`29235`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1914);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1914);
[backlink](#)

Unknown interpreted text role "issue".

- `:func:`shutil.copyfile``, `:func:`shutil.copy``, `:func:`shutil.copy2``, `:func:`shutil.copytree`` and `:func:`shutil.move`` use platform-specific

"fast-copy" syscalls (see [ref:shutil-platform-dependent-efficient-copy-operations](#) section).

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1917);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1917);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1917);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1917);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1917);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1917);
[backlink](#)

Unknown interpreted text role "ref".

- [:func:shutil.copyfile](#) default buffer size on Windows was changed from 16 KiB to 1 MiB.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1922);
[backlink](#)

Unknown interpreted text role "func".

- The `PyGC_Head` struct has changed completely. All code that touched the struct member should be rewritten. (See [:issue:33597](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1925);
[backlink](#)

Unknown interpreted text role "issue".

- The `:xtype:PyInterpreterState` struct has been moved into the "internal" header files (specifically `Include/internal/pycore_pystate.h`). An opaque `PyInterpreterState` is still available as part of the public API (and stable ABI). The docs indicate that none of the struct's fields are public, so we hope no one has been using them. However, if you do rely on one or more of those private fields and have no alternative then please open a BPO issue. We'll work on helping you adjust (possibly including adding accessor functions to the public API). (See [:issue:35886](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1928);
[backlink](#)

Unknown interpreted text role "c:type".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1928); [backlink](#)

Unknown interpreted text role "issue".

- The `meth:`mmap.flush()` `<mmap.mmap.flush>` method now returns `None` on success and raises an exception on error under all platforms. Previously, its behavior was platform-dependent: a nonzero value was returned on success; zero was returned on error under Windows. A zero value was returned on success; an exception was raised on error under Unix. (Contributed by Berker Peksag in [issue:`2122`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1938); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1938); [backlink](#)

Unknown interpreted text role "issue".

- `mod:`xml.dom.minidom`` and `mod:`xml.sax`` modules no longer process external entities by default. (Contributed by Christian Heimes in [issue:`17239`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1945); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1945); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1945); [backlink](#)

Unknown interpreted text role "issue".

- Deleting a key from a read-only `mod:`dbm`` database (`mod:`dbm.dumb``, `mod:`dbm.gnu`` or `mod:`dbm.ndbm``) raises `attr:'error'` (`:exc:`dbm.dumb.error``, `:exc:`dbm.gnu.error`` or `:exc:`dbm.ndbm.error``) instead of `:exc:`KeyError``. (Contributed by Xiang Zhang in [issue:`33106`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1949); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1949); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1949);

[backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1949);
[backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1949);
[backlink](#)

Unknown interpreted text role "attr".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1949);
[backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1949);
[backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1949);
[backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1949);
[backlink](#)

Unknown interpreted text role "exc".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1949);
[backlink](#)

Unknown interpreted text role "issue".

- Simplified AST for literals. All constants will be represented as `:class:`ast.Constant`` instances. Instantiating old classes `Num`, `Str`, `Bytes`, `NameConstant` and `Ellipsis` will return an instance of `Constant`. (Contributed by Serhiy Storchaka in [:issue:`32892`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1954);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1954);
[backlink](#)

Unknown interpreted text role "issue".

- `:func:`~os.path.expanduser`` on Windows now prefers the `:envvar:`USERPROFILE`` environment variable and does not use `:envvar:`HOME``, which is not normally set for regular user accounts. (Contributed by Anthony Sottile in [:issue:`36264`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1960); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1960); [backlink](#)

Unknown interpreted text role "envvar".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1960); [backlink](#)

Unknown interpreted text role "envvar".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1960); [backlink](#)

Unknown interpreted text role "issue".

- The exception `:class:`asyncio.CancelledError`` now inherits from `:class:`BaseException`` rather than `:class:`Exception`` and no longer inherits from `:class:`concurrent.futures.CancelledError``. (Contributed by Yury Selivanov in [:issue:`32528`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1965); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1965); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1965); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1965); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1965); [backlink](#)

Unknown interpreted text role "issue".

- The function `:func:`asyncio.wait_for`` now correctly waits for cancellation when using an instance of `:class:`asyncio.Task``. Previously, upon reaching *timeout*, it was cancelled and immediately returned. (Contributed by Elvis Pranskevichus in [:issue:`32751`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1970); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1970); [backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1970); [backlink](#)

Unknown interpreted text role "issue".

- The function `:func:`asyncio.BaseTransport.get_extra_info`` now returns a safe to use socket object when 'socket' is passed to the `name` parameter. (Contributed by Yuri Selivanov in [:issue:`37027`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1975); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1975); [backlink](#)

Unknown interpreted text role "issue".

- `:class:`asyncio.BufferedProtocol`` has graduated to the stable API.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1979); [backlink](#)

Unknown interpreted text role "class".

- DLL dependencies for extension modules and DLLs loaded with `:mod:`ctypes`` on Windows are now resolved more securely. Only the system paths, the directory containing the DLL or PYD file, and directories added with `:func:`~os.add_dll_directory`` are searched for load-time dependencies. Specifically, `:envvar:`PATH`` and the current working directory are no longer used, and modifications to these will no longer have any effect on normal DLL resolution. If your application relies on these mechanisms, you should check for `:func:`~os.add_dll_directory`` and if it exists, use it to add your DLLs directory while loading your library. Note that Windows 7 users will need to ensure that Windows Update KB2533623 has been installed (this is also verified by the installer). (Contributed by Steve Dower in [:issue:`36085`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1983); [backlink](#)

Unknown interpreted text role "mod".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1983); [backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1983); [backlink](#)

Unknown interpreted text role "envvar".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-

resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1983);
[backlink](#)

Unknown interpreted text role "func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1983);
[backlink](#)

Unknown interpreted text role "issue".

- The header files and functions related to pgen have been removed after its replacement by a pure Python implementation. (Contributed by Pablo Galindo in [issue:36623](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 1996);
[backlink](#)

Unknown interpreted text role "issue".

- `:class:'types.CodeType'` has a new parameter in the second position of the constructor (*posonlyargcount*) to support positional-only arguments defined in [PEP 570](#). The first argument (*argcount*) now represents the total number of positional arguments (including positional-only arguments). The new `replace()` method of `:class:'types.CodeType'` can be used to make the code future-proof.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2000);
[backlink](#)

Unknown interpreted text role "class".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2000);
[backlink](#)

Unknown interpreted text role "class".

Changes in the C API

- The `:ctype:'PyCompilerFlags'` structure got a new `cf_feature_version` field. It should be initialized to `PY_MINOR_VERSION`. The field is ignored by default, and is used if and only if `PYCF_ONLY_AST` flag is set in `cf_flags`. (Contributed by Guido van Rossum in [issue:35766](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2011);
[backlink](#)

Unknown interpreted text role "c:type".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2011);
[backlink](#)

Unknown interpreted text role "issue".

- The `:cfunc:'PyEval_ReInitThreads'` function has been removed from the C API. It should not be called explicitly: use `:cfunc:'PyOS_AfterFork_Child'` instead. (Contributed by Victor Stinner in [issue:36728](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2017);
[backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-

resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2017);
[backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2017);
[backlink](#)

Unknown interpreted text role "issue".

- On Unix, C extensions are no longer linked to libpython except on Android and Cygwin. When Python is embedded, libpython must not be loaded with `RTLD_LOCAL`, but `RTLD_GLOBAL` instead. Previously, using `RTLD_LOCAL`, it was already not possible to load C extensions which were not linked to libpython, like C extensions of the standard library built by the `*shared*` section of `Modules/Setup`. (Contributed by Victor Stinner in [issue:21536](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2022);
[backlink](#)

Unknown interpreted text role "issue".

- Use of # variants of formats in parsing or building value (e.g. `:c:func:PyArg_ParseTuple`, `:c:func:Py_BuildValue`, `:c:func:PyObject_CallFunction`, etc.) without `PY_SSIZE_T_CLEAN` defined raises `DeprecationWarning` now. It will be removed in 3.10 or 4.0. Read [ref:arg-parsing](#) for detail. (Contributed by Inada Naoki in [issue:36381](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2030);
[backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2030);
[backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2030);
[backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2030);
[backlink](#)

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2030);
[backlink](#)

Unknown interpreted text role "issue".

- Instances of heap-allocated types (such as those created with `:c:func:PyType_FromSpec`) hold a reference to their type object. Increasing the reference count of these type objects has been moved from `:c:func:PyType_GenericAlloc` to the more low-level functions, `:c:func:PyObject_Init` and `:c:func:PyObject_INIT`. This makes types created through `:c:func:PyType_FromSpec` behave like other classes in managed code.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2036);
[backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2036); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2036); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2036); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2036); [backlink](#)

Unknown interpreted text role "c:func".

:ref: Statically allocated types `<static-types>` are not affected.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2044); [backlink](#)

Unknown interpreted text role "ref".

For the vast majority of cases, there should be no side effect. However, types that manually increase the reference count after allocating an instance (perhaps to work around the bug) may now become immortal. To avoid this, these classes need to call `Py_DECREF` on the type object during instance deallocation.

To correctly port these types into 3.8, please apply the following changes:

- Remove `:c:macro:'Py_INCREF'` on the type object after allocating an instance - if any. This may happen after calling `:c:func:'PyObject_New'`, `:c:func:'PyObject_NewVar'`, `:c:func:'PyObject_GC_New'`, `:c:func:'PyObject_GC_NewVar'`, or any other custom allocator that uses `:c:func:'PyObject_Init'` or `:c:func:'PyObject_INIT'`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2055); [backlink](#)

Unknown interpreted text role "c:macro".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2055); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2055); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line

2055); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2055); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2055); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2055); [backlink](#)

Unknown interpreted text role "c:func".

Example:

```
static foo_struct *
foo_new(PyObject *type) {
    foo_struct *foo = PyObject_GC_New(foo_struct, (PyTypeObject *) type);
    if (foo == NULL)
        return NULL;
#ifdef PY_VERSION_HEX < 0x03080000
    // Workaround for Python issue 35810; no longer necessary in Python 3.8
    PY_INCREF(type)
#endif
    return foo;
}
```

- Ensure that all custom `tp_dealloc` functions of heap-allocated types decrease the type's reference count.

Example:

```
static void
foo_dealloc(foo_struct *instance) {
    PyObject *type = Py_TYPE(instance);
    PyObject_GC_Del(instance);
#ifdef PY_VERSION_HEX >= 0x03080000
    // This was not needed before Python 3.8 (Python issue 35810)
    Py_DECREF(type);
#endif
}
```

(Contributed by Eddie Elizondo in [issue:35810](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2095); [backlink](#)

Unknown interpreted text role "issue".

- The `Py_DEPRECATED(3.8)` macro has been implemented for MSVC. The macro now must be placed before the symbol name.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2097); [backlink](#)

Unknown interpreted text role "c:macro".

Example:

```
Py_DEPRECATED(3.8) PyAPI_FUNC(int) Py_OldFunction(void);
```

(Contributed by Zackery Spytz in [issue:33407](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2106); [backlink](#)

Unknown interpreted text role "issue".

- The interpreter does not pretend to support binary compatibility of extension types across feature releases, anymore. A `:c:type: 'PyTypeObject'` exported by a third-party extension module is supposed to have all the slots expected in the current Python version, including `:c:member: ~PyTypeObject.tp_finalize'` (`:const: 'Py_TPFLAGS_HAVE_FINALIZE'` is not checked anymore before reading `:c:member: ~PyTypeObject.tp_finalize'`).

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2108); [backlink](#)

Unknown interpreted text role "c:type".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2108); [backlink](#)

Unknown interpreted text role "c:member".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2108); [backlink](#)

Unknown interpreted text role "const".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2108); [backlink](#)

Unknown interpreted text role "c:member".

(Contributed by Antoine Pitrou in [:issue: `32388`](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2115); [backlink](#)

Unknown interpreted text role "issue".

- The functions `:c:func: 'PyNode_AddChild'` and `:c:func: 'PyParser_AddToken'` now accept two additional `int` arguments `end_lineno` and `end_col_offset`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2117); [backlink](#)

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2117); [backlink](#)

Unknown interpreted text role "c:func".

- The `:file: 'libpython38.a'` file to allow MinGW tools to link directly against `:file: 'python38.dll'` is no longer included in the regular Windows distribution. If you require this file, it may be generated with the `gendef` and `dlltool` tools, which are part of the MinGW binutils package:

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2120);

[backlink](#)

Unknown interpreted text role "file".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2120);
[backlink](#)

Unknown interpreted text role "file".

```
gendef - python38.dll > tmp.def  
dlltool --dllname python38.dll --def tmp.def --output-lib libpython38.a
```

The location of an installed `:file:'pythonXY.dll'` will depend on the installation options and the version and language of Windows. See `:ref'using-on-windows'` for more information. The resulting library should be placed in the same directory as `:file:'pythonXY.lib'`, which is generally the `:file:'libs'` directory under your Python installation.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2130);
[backlink](#)

Unknown interpreted text role "file".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2130);
[backlink](#)

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2130);
[backlink](#)

Unknown interpreted text role "file".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2130);
[backlink](#)

Unknown interpreted text role "file".

(Contributed by Steve Dower in `:issue:'37351'`.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2136);
[backlink](#)

Unknown interpreted text role "issue".

CPython bytecode changes

- The interpreter loop has been simplified by moving the logic of unrolling the stack of blocks into the compiler. The compiler emits now explicit instructions for adjusting the stack of values and calling the cleaning-up code for `:keyword:'break'`, `:keyword:'continue'` and `:keyword:'return'`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2142);
[backlink](#)

Unknown interpreted text role "keyword".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2142);
[backlink](#)

Unknown interpreted text role "keyword".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2142); [backlink](#)

Unknown interpreted text role "keyword".

Removed opcodes :opcode:`BREAK_LOOP`, :opcode:`CONTINUE_LOOP`, :opcode:`SETUP_LOOP` and :opcode:`SETUP_EXCEPT`. Added new opcodes :opcode:`ROT_FOUR`, :opcode:`BEGIN_FINALLY`, :opcode:`CALL_FINALLY` and :opcode:`POP_FINALLY`. Changed the behavior of :opcode:`END_FINALLY` and :opcode:`WITH_CLEANUP_START`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2148); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2148); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2148); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2148); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2148); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2148); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2148); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2148); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2148); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2148); [backlink](#)

Unknown interpreted text role "opcode".

(Contributed by Mark Shannon, Antoine Pitrou and Serhiy Storchaka in [issue:17611](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2154); [backlink](#)

Unknown interpreted text role "issue".

- Added new opcode `:opcode:'END_ASYNC_FOR'` for handling exceptions raised when awaiting a next item in an `:keyword:'async for'` loop. (Contributed by Serhiy Storchaka in [issue:33041](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2157); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2157); [backlink](#)

Unknown interpreted text role "keyword".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2157); [backlink](#)

Unknown interpreted text role "issue".

- The `:opcode:'MAP_ADD'` now expects the value as the first element in the stack and the key as the second element. This change was made so the key is always evaluated before the value in dictionary comprehensions, as proposed by [PEP 572](#). (Contributed by Jörn Heissler in [issue:35224](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2161); [backlink](#)

Unknown interpreted text role "opcode".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2161); [backlink](#)

Unknown interpreted text role "issue".

Demos and Tools

Added a benchmark script for timing various ways to access variables: `Tools/scripts/var_access_benchmark.py`. (Contributed by Raymond Hettinger in [issue:35884](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2170); [backlink](#)

Unknown interpreted text role "issue".

Here's a summary of performance improvements since Python 3.3:

System Message: WARNING/2 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2176)

Cannot analyze code. No Pygments lexer found for "none".

```
.. code-block:: none
```

Python version	3.3	3.4	3.5	3.6	3.7	3.8
-----	---	---	---	---	---	---
Variable and attribute read access:						
read_local	4.0	7.1	7.1	5.4	5.1	3.9
read_nonlocal	5.3	7.1	8.1	5.8	5.4	4.4
read_global	13.3	15.5	19.0	14.3	13.6	7.6
read_builtin	20.0	21.1	21.6	18.5	19.0	7.5
read_classvar_from_class	20.5	25.6	26.5	20.7	19.5	18.4
read_classvar_from_instance	18.5	22.8	23.5	18.8	17.1	16.4
read_instancevar	26.8	32.4	33.1	28.0	26.3	25.4
read_instancevar_slots	23.7	27.8	31.3	20.8	20.8	20.2
read_namedtuple	68.5	73.8	57.5	45.0	46.8	18.4
read_boundmethod	29.8	37.6	37.9	29.6	26.9	27.7
Variable and attribute write access:						
write_local	4.6	8.7	9.3	5.5	5.3	4.3
write_nonlocal	7.3	10.5	11.1	5.6	5.5	4.7
write_global	15.9	19.7	21.2	18.0	18.0	15.8
write_classvar	81.9	92.9	96.0	104.6	102.1	39.2
write_instancevar	36.4	44.6	45.8	40.0	38.9	35.5
write_instancevar_slots	28.7	35.6	36.1	27.3	26.6	25.7
Data structure read access:						
read_list	19.2	24.2	24.5	20.8	20.8	19.0
read_deque	19.9	24.7	25.5	20.2	20.6	19.8
read_dict	19.7	24.3	25.7	22.3	23.0	21.0
read_strdict	17.9	22.6	24.3	19.5	21.2	18.9
Data structure write access:						
write_list	21.2	27.1	28.5	22.5	21.6	20.0
write_deque	23.8	28.7	30.1	22.7	21.8	23.5
write_dict	25.9	31.4	33.3	29.3	29.2	24.7
write_strdict	22.9	28.4	29.9	27.5	25.2	23.1
Stack (or queue) operations:						
list_append_pop	144.2	93.4	112.7	75.4	74.2	50.8
deque_append_pop	30.4	43.5	57.0	49.4	49.2	42.5
deque_append_popleft	30.8	43.7	57.3	49.7	49.7	42.8
Timing loop:						
loop_overhead	0.3	0.5	0.6	0.4	0.3	0.3

The benchmarks were measured on an [Intel® Core™ i7-4960HQ processor](#) running the macOS 64-bit builds found at [python.org](#). The benchmark script displays timings in nanoseconds.

Notable changes in Python 3.8.1

Due to significant security concerns, the `reuse_address` parameter of `meth:'asyncio.loop.create_datagram_endpoint'` is no longer supported. This is because of the behavior of the socket option `SO_REUSEADDR` in UDP. For more details, see the documentation for `loop.create_datagram_endpoint()`. (Contributed by Kyle Stanley, Antoine Pitrou, and Yury Selivanov in [issue:'37228'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2232); [backlink](#)

Unknown interpreted text role "meth".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2232); [backlink](#)

Unknown interpreted text role "issue".

Notable changes in Python 3.8.8

Earlier Python versions allowed using both `;` and `&` as query parameter separators in `func:'urllib.parse.parse_qs'` and `func:'urllib.parse.parse_qs'`. Due to security concerns, and to conform with newer W3C recommendations, this has been changed to allow only a single separator key, with `&` as the default. This change also affects `func:'cgi.parse'` and `func:'cgi.parse_multipart'` as they use the affected functions internally. For more details, please see their respective documentation. (Contributed by Adam Goldschmidt, Senthil Kumaran and Ken Jin in [issue:'42967'](#).)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2242); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2242); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2242); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2242); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2242); [backlink](#)

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Notable changes in Python 3.8.12

Starting with Python 3.8.12 the `mod:'ipaddress'` module no longer accepts any leading zeros in IPv4 address strings. Leading zeros are ambiguous and interpreted as octal notation by some libraries. For example the legacy function `func:'socket.inet_aton'` treats leading zeros as octal notation. glibc implementation of modern `func:'~socket.inet_pton'` does not accept any leading zeros.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2255); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2255); [backlink](#)

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2255); [backlink](#)

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(Originally contributed by Christian Heimes in `issue:'36384'`, and backported to 3.8 by Achraf Merzouki.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\cpython-main\Doc\whatsnew\ (cpython-main) (Doc) (whatsnew) 3.8.rst, line 2262); [backlink](#)

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