
Senf

May 09, 2020

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CHAPTER 1

1.5.0 - 2020-05-09

- tests: fix tests in case HOME is overridden #12
- uri2fsn: Handle a subset of legacy UNC file URIs on Windows #14
- expanduser: Ignore HOME env var on Windows like Python 3.8 #15

CHAPTER 2

1.4.1 - 2019-12-26

- `fsn2uri()`: Fix handling of surrogates with PyPy3 on Windows

CHAPTER 3

1.4.0 - 2019-11-17

- Python 3.3 support removed
- Added type annotations

CHAPTER 4

1.3.4 - 2018-01-23

- `fsn2bytes()` and `bytes2fsn()` now default to “utf-8” for the Windows path encoding instead of having no default.

CHAPTER 5

1.3.3 - 2018-01-03

- Restore WinXP support
- Fix some warnings with Python 3.6

CHAPTER 6

1.3.2 - 2017-11-05

- Tests: Fix some errors with newer pytest and make the test suite work on native Windows.

CHAPTER 7

1.3.1 - 2017-07-29

- Fixed missing normalization with `path2fsn()` on Linux + Python 3

CHAPTER 8

1.3.0 - 2017-07-28

- New `supports_ansi_escape_codes()`
- New `fsn2norm()` (+ all API now returns normalized fsnative)
- `fsn2uri()`: various fixes

CHAPTER 9

1.2.2 - 2016-12-18

- `uri2fsn`: improve error handling on unescaped URIs #4

CHAPTER 10

1.2.1 - 2016-12-07

- `isinstance(path, fsnative)` now checks the value as well. If True passing the instance to *path2fsn* will never fail.

CHAPTER 11

1.2.0 - 2016-12-06

- *fsnative*: safeguard against containing null bytes. All operations converting to *fsnative* will now fail if the result would contain null bytes. This means passing *fsnative* to functions like `open()` is now always safe.

CHAPTER 12

1.1.0 - 2016-12-05

- `print_()`: Don't ignore `flush` in Windows redirect mode
- `argv`: Forwards changes to `sys.argv #2`
- `environ`: Forwards changes to `os.environ #2`
- `environ`: Handle case insensitive env vars on Windows
- `fsn2text()`: Add a `strict` mode
- `fsn2uri()`: Always return `text`
- `fsn2bytes()`: Merge surrogate pairs under Python 3 + Windows
- `fsn2bytes()`: Support `utf-16-be` under Python 2.7/3.3

CHAPTER 13

1.0.1 - 2016-10-25

- Python 2.6 support removed
- `print_()`: allow `None` for `end`, `sep` and `file` arguments
- `print_()`: always output utf-8 when redirected on Windows

CHAPTER 14

1.0.0 - 2016-09-09

- First stable release

CHAPTER 15

0.4.0 - 2016-09-07

- Support paths with surrogates under Windows

CHAPTER 16

0.3.0 - 2016-09-03

- Support `__fspath__` in `path2fsn()`. See [PEP 519](#) for details.
- Rename `fsn2uri_ascii` to `fsn2uri()`, remove the later.
- Fix `fsn2uri()` output on Windows for certain unicode ranges.
- Add `expandvars()`

CHAPTER 17

0.2.0 - 2016-08-25

- `input_()`: Add Windows Unicode support

CHAPTER 18

0.1.0 - 2016-08-22

- Initial release

CHAPTER 19

Tutorial

There are various ways to create `fsnative` instances:

```
# create from unicode text
>>> senf.fsnative(u"foo")
'foo'

# create from some serialized format
>>> senf.bytes2fsn(b"foo", "utf-8")
'foo'

# create from an URI
>>> senf.uri2fsn("file:///foo")
'/foo'

# create from some Python path-like
>>> senf.path2fsn(b"foo")
'foo'
```

You can mix and match the `fsnative` type with ASCII str on all Python versions and platforms:

```
>>> senf.fsnative(u"foo") + "bar"
'foobar'
>>> senf.fsnative(u"foo").endswith("foo")
True
>>> "File: %s" % senf.fsnative(u"foo")
'File: foo'
```

Now that we have a *fsnative*, what can we do with it?

```
>>> path = senf.fsnative(u"/foo")

# We can print it
>>> senf.print_(path)
/foo
```

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```
# We can convert it to text for our favorite GUI toolkit
>>> senf.fsn2text(path)
'/foo'

# We can convert it to an ASCII only URI
>>> senf.fsn2uri(path)
'file:///foo'

# We can serialize the path so we can save it somewhere
>>> senf.fsn2bytes(path, "utf-8")
b'/foo'
```

The functions in the `stdlib` usually return the same type as was passed in. If we pass in a *fsnative* to `os.listdir`, we get one back as well.

```
>>> files = os.listdir(senf.fsnative(u"."))
>>> isinstance(files[0], senf.fsnative)
True
```

In some cases the `stdlib` functions don't take arguments and always return the same type. For those cases Senf provide alternative implementations.

```
>>> isinstance(senf.getcwd(), senf.fsnative)
True
```

A similar problem arises with `stdlib` collections. Senf provides alternatives for `sys.argv` and `os.environ`.

```
>>> isinstance(senf.argv[0], senf.fsnative)
True
>>> isinstance(senf.environ["PATH"], senf.fsnative)
True
```

Also for `os.environ` related functions.

```
>>> isinstance(senf.getenv("HOME"), fsnative)
True
>>> isinstance(senf.expanduser("~"), fsnative)
True
```

If you work with files a lot your unit tests will probably need temporary files. Senf provides wrappers for `tempfile` functions which always return a *fsnative*.

```
>>> senf.mkdtemp()
'/tmp/tmp26Daqo'
>>> isinstance(_, senf.fsnative)
True
```

20.1 Fsnative Related

Helper functions for working with the *fsnative* type

<i>fsnative()</i>	Virtual path type and constructor
<i>path2fsn()</i>	Convert <i>pathlike</i> to <i>fsnative</i>
<i>fsn2text()</i>	Convert <i>fsnative</i> to <i>text</i>
<i>text2fsn()</i>	Convert <i>text</i> to <i>fsnative</i>
<i>fsn2bytes()</i>	Convert <i>fsnative</i> to <i>bytes</i>
<i>bytes2fsn()</i>	Convert <i>bytes</i> to <i>fsnative</i>
<i>uri2fsn()</i>	Convert URI to <i>fsnative</i>
<i>fsn2uri()</i>	Convert <i>fsnative</i> to ASCII URI
<i>fsn2norm()</i>	Normalize <i>fsnative</i>

20.2 Stdlib Replacements

Alternative implementations or wrappers of stdlib functions and constants. In some cases their default is changed to return an *fsnative* path (`mkdtemp()` with default arguments) or Unicode support for Windows is added (`sys.argv`)

<code>environ</code>	<code>os.environ</code> replacement
<code>argv</code>	<code>sys.argv</code> replacement
<code>sep</code>	<code>os.sep</code> replacement
<code>pathsep</code>	<code>os.pathsep</code> replacement
<code>curdir</code>	<code>os.curdir</code> replacement
<code>pardir</code>	<code>os.pardir</code> replacement
<code>altsep</code>	<code>os.altsep</code> replacement
<code>extsep</code>	<code>os.extsep</code> replacement
<code>devnull</code>	<code>os.devnull</code> replacement
<code>defpath</code>	<code>os.defpath</code> replacement
<code>getcwd()</code>	<code>os.getcwd</code> replacement
<code>getenv()</code>	<code>os.getenv</code> replacement
<code>putenv()</code>	<code>os.putenv</code> replacement
<code>unsetenv()</code>	<code>os.unsetenv</code> replacement
<code>print_()</code>	<code>print()</code> replacement
<code>input_()</code>	<code>input()</code> replacement
<code>expanduser()</code>	<code>os.path.expanduser()</code> replacement
<code>expandvars()</code>	<code>os.path.expandvars()</code> replacement
<code>gettempdir()</code>	<code>tempfile.gettempdir()</code> replacement
<code>gettempprefix()</code>	<code>tempfile.gettempprefix()</code> replacement
<code>mkstemp()</code>	<code>tempfile.mkstemp()</code> replacement
<code>mkdtemp()</code>	<code>tempfile.mkdtemp()</code> replacement

20.3 Misc Functions

<code>supports_ansi_escape_codes()</code>	if the output file supports ANSI codes
---	--

20.4 Package Related

<code>senf.version</code>	Version tuple
<code>senf.version_string</code>	Version string

```
senf.version = (1, 5, 0)
```

The version tuple (major, minor, micro)

Type `Tuple[int, int, int]`

```
senf.version_string = '1.5.0'
```

A version string

Type `str`

```
class senf.fsnative(text=u'')
```

Parameters `text` (`text`) – The text to convert to a path

Returns The new path.

Return type `fsnative`

Raises `TypeError` – In case something other than `text` has been passed

This type is a virtual base class for the real path type. Instantiating it returns an instance of the real path type and it overrides instance and subclass checks so that `isinstance` and `issubclass` checks work:

```
isinstance(fsnative(u"foo"), fsnative) == True
issubclass(type(fsnative(u"foo")), fsnative) == True
```

The real returned type is:

- **Python 2 + Windows:** `unicode`, with surrogates, without null
- **Python 2 + Unix:** `str`, without null
- **Python 3 + Windows:** `str`, with surrogates, without null
- **Python 3 + Unix:** `str`, with surrogates, without null, without code points not encodable with the locale encoding

Constructing a `fsnative` can't fail.

Passing a `fsnative` to `open()` will never lead to `ValueError` or `TypeError`.

Any operation on `fsnative` can also use the `str` type, as long as the `str` only contains ASCII and no NULL.

`senf.path2fsn(path)`

Parameters `path` (`pathlike`) – The path to convert

Returns `fsnative`

Raises

- `TypeError` – In case the type can't be converted to a `fsnative`
- `ValueError` – In case conversion fails

Returns a `fsnative` path for a `pathlike`.

`senf.fsn2text(path, strict=False)`

Parameters

- `path` (`fsnative`) – The path to convert
- `strict` (`bool`) – Fail in case the conversion is not reversible

Returns `text`

Raises

- `TypeError` – In case no `fsnative` has been passed
- `ValueError` – In case `strict` was `True` and the conversion failed

Converts a `fsnative` path to `text`.

Can be used to pass a path to some unicode API, like for example a GUI toolkit.

If `strict` is `True` the conversion will fail in case it is not reversible. This can be useful for converting program arguments that are supposed to be text and erroring out in case they are not.

Encoding with a Unicode encoding will always succeed with the result.

`senf.text2fsn(text)`

Parameters `text` (`text`) – The text to convert

Returns `fsnative`

Raises `TypeError` – In case no `text` has been passed

Takes `text` and converts it to a `fsnative`.

This operation is not reversible and can't fail.

`senf.fsn2bytes(path, encoding='utf-8')`

Parameters

- **path** (`fsnative`) – The path to convert
- **encoding** (`str`) – encoding used for Windows

Returns `bytes`

Raises

- `TypeError` – If no `fsnative` path is passed
- `ValueError` – If encoding fails or the encoding is invalid

Converts a `fsnative` path to `bytes`.

The passed `encoding` is only used on platforms where paths are not associated with an encoding (Windows for example).

For Windows paths, lone surrogates will be encoded like normal code points and surrogate pairs will be merged before encoding. In case of `utf-8` or `utf-16-le` this is equal to the [WTF-8](#) and [WTF-16 encoding](#).

`senf.bytes2fsn(data, encoding='utf-8')`

Parameters

- **data** (`bytes`) – The data to convert
- **encoding** (`str`) – encoding used for Windows

Returns `fsnative`

Raises

- `TypeError` – If no `bytes` path is passed
- `ValueError` – If decoding fails or the encoding is invalid

Turns `bytes` to a `fsnative` path.

The passed `encoding` is only used on platforms where paths are not associated with an encoding (Windows for example).

For Windows paths `WTF-8` is accepted if `utf-8` is used and `WTF-16` accepted if `utf-16-le` is used.

`senf.uri2fsn(uri)`

Parameters **uri** (`text` or `str`) – A file URI

Returns `fsnative`

Raises

- `TypeError` – In case an invalid type is passed
- `ValueError` – In case the URI isn't a valid file URI

Takes a file URI and returns a `fsnative` path

`senf.fsn2uri(path)`

Parameters **path** (`fsnative`) – The path to convert to an URI

Returns An ASCII only URI

Return type *text*

Raises

- *TypeError* – If no *fsnative* was passed
- *ValueError* – If the path can't be converted

Takes a *fsnative* path and returns a file URI.

On Windows non-ASCII characters will be encoded using utf-8 and then percent encoded.

`senf.fsn2norm(path)`

Parameters *path* (*fsnative*) – The path to normalize

Returns *fsnative*

Normalizes an fsnative path.

The same underlying path can have multiple representations as fsnative (due to surrogate pairs and variable length encodings). When concatenating fsnative the result might be different than concatenating the serialized form and then deserializing it.

This returns the normalized form i.e. the form which `os.listdir()` would return. This is useful when you alter fsnative but require that the same underlying path always maps to the same fsnative value.

All functions like *bytes2fsn()*, *fsnative()*, *text2fsn()* and *path2fsn()* always return a normalized path, independent of their input.

`senf.envIRON = {}`

Like `os.envIRON` but contains unicode keys and values under Windows + Python 2.

Any changes made will be forwarded to `os.envIRON`.

Type Dict[*fsnative*, *fsnative*]

`senf.argv = []`

Like `sys.argv` but contains unicode under Windows + Python 2

Type List[*fsnative*]

`senf.sep = '/'`

Like `os.sep` but a *fsnative*

Type *fsnative*

`senf.pathsep = ':'`

Like `os.pathsep` but a *fsnative*

Type *fsnative*

`senf.curdir = '.'`

Like `os.curdir` but a *fsnative*

Type *fsnative*

`senf.pardir = '..'`

Like `os.pardir` but a *fsnative*

Type *fsnative*

`senf.altsep = None`

Like `os.altsep` but a *fsnative* or `None`

Type *fsnative* or `None`

`senf.extsep = '.'`

Like `os.extsep` but a *fsnative*

Type *fsnative*

`senf.devnull = '/dev/null'`

Like `os.devnull` but a *fsnative*

Type *fsnative*

`senf.defpath = ':/bin:/usr/bin'`

Like `os.defpath` but a *fsnative*

Type *fsnative*

`senf.getcwd()`

Like `os.getcwd` but returns a *fsnative* path

Returns *fsnative*

`senf.getenv(key, value=None)`

Like `os.getenv` but returns unicode under Windows + Python 2

Parameters

- **key** (*pathlike*) – The env var to get
- **value** (*object*) – The value to return if the env var does not exist

Returns The env var or the passed value if it doesn't exist

Return type *fsnative* or *object*

`senf.putenv(key, value)`

Like `os.putenv` but takes unicode under Windows + Python 2

Parameters

- **key** (*pathlike*) – The env var to get
- **value** (*pathlike*) – The value to set

Raises *ValueError*

`senf.unsetenv(key)`

Like `os.unsetenv` but takes unicode under Windows + Python 2

Parameters **key** (*pathlike*) – The env var to unset

`senf.print_(*objects, sep=None, end=None, file=None, flush=False)`

Parameters

- **objects** (*object*) – zero or more objects to print
- **sep** (*str*) – Object separator to use, defaults to " "
- **end** (*str*) – Trailing string to use, defaults to "\n". If end is "\n" then `os.linesep` is used.
- **file** (*object*) – A file-like object, defaults to `sys.stdout`
- **flush** (*bool*) – If the file stream should be flushed

Raises *EnvironmentError*

Like `print()`, but:

- Supports printing filenames under Unix + Python 3 and Windows + Python 2

- Emulates ANSI escape sequence support under Windows
- Never fails due to encoding/decoding errors. Tries hard to get everything on screen as is, but will fall back to “?” if all fails.

This does not conflict with `colorama`, but will not use it on Windows.

`senf.input_(prompt=None)`

Parameters `prompt` (*object*) – Prints the passed object to stdout without adding a trailing new-line

Returns *fsnative*

Raises `EnvironmentError`

Like `input()` but returns a *fsnative* and allows printing filenames as prompt to stdout.

Use `fsn2text()` on the result if you just want to deal with text.

`senf.expanduser(path)`

Parameters `path` (*pathlike*) – A path to expand

Returns *fsnative*

Like `os.path.expanduser()` but supports unicode home directories under Windows + Python 2 and always returns a *fsnative*.

`senf.expandvars(path)`

Parameters `path` (*pathlike*) – A path to expand

Returns *fsnative*

Like `os.path.expandvars()` but supports unicode under Windows + Python 2 and always returns a *fsnative*.

`senf.gettempdir()`

Returns *fsnative*

Like `tempfile.gettempdir()`, but always returns a *fsnative* path

`senf.gettempprefix()`

Returns *fsnative*

Like `tempfile.gettempprefix()`, but always returns a *fsnative* path

`senf.mkstemp(suffix=None, prefix=None, dir=None, text=False)`

Parameters

- **suffix** (*pathlike* or `None`) – suffix or `None` to use the default
- **prefix** (*pathlike* or `None`) – prefix or `None` to use the default
- **dir** (*pathlike* or `None`) – temp dir or `None` to use the default
- **text** (*bool*) – if the file should be opened in text mode

Returns A tuple containing the file descriptor and the file path

Return type `Tuple[int, fsnative]`

Raises `EnvironmentError`

Like `tempfile.mkstemp()` but always returns a *fsnative* path.

`senf.mkdtemp(suffix=None, prefix=None, dir=None)`

Parameters

- **suffix** (*pathlike* or `None`) – suffix or `None` to use the default
- **prefix** (*pathlike* or `None`) – prefix or `None` to use the default
- **dir** (*pathlike* or `None`) – temp dir or `None` to use the default

Returns A path to a directory

Return type *fsnative*

Raises `EnvironmentError`

Like `tempfile.mkstemp()` but always returns a *fsnative* path.

`senf.supports_ansi_escape_codes(fd)`

Returns whether the output device is capable of interpreting ANSI escape codes when `print_()` is used.

Parameters `fd` (*int*) – file descriptor (e.g. `sys.stdout.fileno()`)

Returns `bool`

20.5 Documentation Types

These types only exist for documentation purposes and represent different types depending on the Python version and platform used.

class `senf.text`

Represents `unicode` under Python 2 and `str` under Python 3. Does not include `surrogates`.

class `senf.bytes`

Represents `str` under Python 2 and `bytes` under Python 3.

class `senf.pathlike`

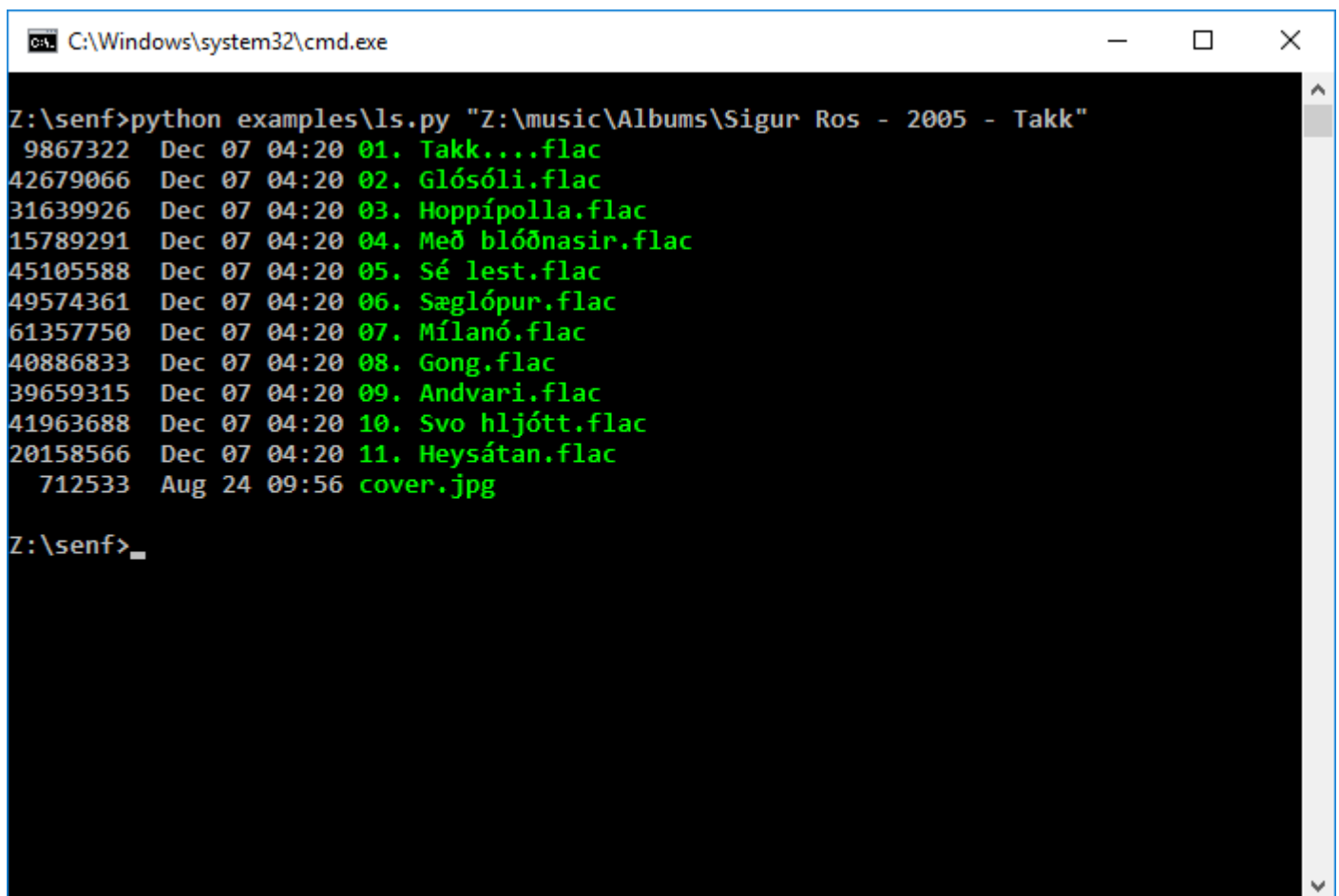
Anything the Python stdlib allows as a path. In addition to *fsnative* this allows

- *bytes* encoded with the default file system encoding (usually `mbcs`) on Windows.
- *bytes* under Python 3 + Unix.
- `unicode` under Python 2 + Unix if it can be encoded with the default file system encoding.
- (Python 3.6+) Instances where its type implements the `__fspath__` protocol. See [PEP 519](#) for details.

CHAPTER 21

Examples

See <https://github.com/quodlibet/senf/tree/master/examples> for a few example programs.



```
C:\Windows\system32\cmd.exe

Z:\senf>python examples\ls.py "Z:\music\Albums\Sigur Ros - 2005 - Takk"
 9867322 Dec 07 04:20 01. Takk....flac
42679066 Dec 07 04:20 02. Glósóli.flac
31639926 Dec 07 04:20 03. Hoppípolla.flac
15789291 Dec 07 04:20 04. Með blóðnasir.flac
45105588 Dec 07 04:20 05. Sé lest.flac
49574361 Dec 07 04:20 06. Sæglópur.flac
61357750 Dec 07 04:20 07. Mílanó.flac
40886833 Dec 07 04:20 08. Gong.flac
39659315 Dec 07 04:20 09. Andvari.flac
41963688 Dec 07 04:20 10. Svo hljótt.flac
20158566 Dec 07 04:20 11. Heysáttan.flac
 712533 Aug 24 09:56 cover.jpg

Z:\senf>
```

```
C:\Windows\system32\cmd.exe

Z:\senf>python examples\ansi.py

b b B B b b b b c c c c d d d d a a d d q q z z o o e e
f f f f Y Y h h l l i i k k k k l l l l m m n n n n o o
m m m m p p R R z z z z s s s s t t t t u u u u v v v v
Y Y Y y Z Z z z z z s s s s z z z z p p p p l l l l i i i i
O O O o U U u u u u u u u u u u u u u u u u u u u u u u
G G g g k k o o o o o o o o o o o o o o o o o o o o o o
p p N N n n A A a a a a e e e e e e e e e e e e e e e e
i i i i i i i i o o o o o o o o o o o o o o o o o o o o o
s s s s t t t t z z z z h h h h h h h h h h h h h h h h
O O O o O O o o o o o o o o o o o o o o o o o o o o o
Z Z Z z z z z z z z z z z z z z z z z z z z z z z z z
R R r r y y e e o o o o b b c c c c d d d d e e e e e e
z z z z z z z z g g g g g g g g g g g g g g g g g g g g
k k w w w w w w w w w w w w w w w w w w w w w w w w
r R R R s s s s s s s s s s s s s s s s s s s s s s s s
Z z z z z z z z z z z z z z z z z z z z z z z z z z z
```

Z:\senf>

Frequently Asked Questions

Are there any existing users of Senf? It is currently used in [Quod Libet](#) and [mutagen](#).

Why not use bytes for paths on Python 3 + Unix? Downsides of using str: str can not be pickled as it depends on the locale encoding. You have to use something like [fsn2bytes](#) first, or you have to make sure that the encoding doesn't change across program invocations.

Upsides of using str: str has more support in the stdlib (pathlib for example) and it can be used in combination with the string literal `"foo"`. The later makes `some_fsnative + "foo"` work for all Python versions and platforms as long as it contains ASCII only.

Why the weird “foo2bar” function naming? As the real types depend on the platform anything like “decode”/“encode” is confusing. So you end up with “a_to_b” or “a_from_b”. And imo having things always go one direction, being fast to parse visually and not being too long makes this a good choice. But ymmv.

How can it be that [fsnative\(\)](#) can't fail, even with an ASCII encoding? It falls back to utf-8 if encoding fails. Raising there would make everything complicated and there is no good way to handle that error case anyway.

Why not replace `sys.stdout` instead of providing a new [print\(\)](#)? No monkey patching. Allows us to do our own error handling so print will never fail. Printing some question marks is better than a stack trace if the target is a user.

Senf introduces a new platform native string type called [fsnative](#). It adds functions to convert text, bytes and paths to and from that new type and helper functions to integrate it nicely with the Python stdlib.

Senf supports Python 2.7, 3.3+, works with PyPy, works on Linux, Windows, macOS, is MIT licensed, and only depends on the stdlib. It does not monkey patch anything in the stdlib.

```
pip install senf
```

<https://github.com/quodlibet/senf>

CHAPTER 23

Why?

OS strings are used in many different places across the Python stdlib. They are used for filesystem paths, for environment variables (`os.environ`), for program arguments (`sys.argv` and `subprocess`), for printing to the console (`sys.stdout`, `sys.stderr`) and more.

The problem with them is that they come in many shapes and forms and handling them has changed significantly between Python 2 and Python 3.

A valid platform native string is either *bytes*, *unicode*, *str* + surrogates (either through the `surrogatepass` or the `surrogateescape` error handler) or anything implementing the `__fspath__` protocol. The values of those types depend on the Python version, the platform and the environment the program was started in. Ideally we don't want to care about any of those details.

For example, assume you want to check the extension of a file name:

```
import os
from senf import path2fsn

def has_extension(filename, ext):
    root, filename_ext = os.path.splitext(path2fsn(filename))
    return filename_ext == path2fsn(ext)
```

This will just work everywhere. `path2fsn()` will convert anything which is considered a valid path by Python to a *fsnative* and then we can just compare by value. Note that Python stdlib functions will always return the same type which was passed in, so `os.path.splitext()` will return two *fsnative* values.

Or you want to send a filename over some binary interface:

```
from senf import fsnative, fsn2bytes, bytes2fsn

def send(filename):
    assert isinstance(filename, fsnative)
```

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```
data = fsn2bytes(filename, "utf-8")
return data

def receive(data):
    filename = bytes2fsn(data, "utf-8")
    return filename
```

fsn2bytes() converts the path to binary (“utf-8” is used on Windows, or “wtf-8” to be exact) and the receiving end re-creates the filename with *bytes2fsn()*.

Another example is printing filenames and text to a console:

```
import os
from senf import print_, argv

for filename in os.listdir(argv[1]):
    print_(u"File: ", filename)
```

Senf provides its own print function which can output platform strings as is and mix them with text. No more encoding/decoding errors.

In addition, **Senf** emulates ANSI escape sequence handling when using the Windows console and extends Python 2 under Windows with Unicode support for `sys.argv` and `os.environ`.

CHAPTER 24

Who?

Senf is used by the following software:

- [Quod Libet](#) - A multi platform music player
- [mutagen](#) - A Python multimedia tagging library

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