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**Senf**  
*Release*

**May 22, 2017**



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# CHAPTER 1

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1.2.2 - 2016-12-18

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





## CHAPTER 2

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1.2.1 - 2016-12-07

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



## CHAPTER 3

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1.2.0 - 2016-12-06

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- *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 4

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1.1.0 - 2016-12-05

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- `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 5

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1.0.1 - 2016-10-25

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





## CHAPTER 6

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1.0.0 - 2016-09-09

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- First stable release



## CHAPTER 7

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0.4.0 - 2016-09-07

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- Support paths with surrogates under Windows



## CHAPTER 8

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0.3.0 - 2016-09-03

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- 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 9

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0.2.0 - 2016-08-25

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- `input_()`: Add Windows Unicode support





## CHAPTER 10

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0.1.0 - 2016-08-22

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- Initial release



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
```

```
# 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
```

## 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

## 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

## Package Related

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

---

`senf.version = (1, 2, 2)`

`Tuple[int, int, int]` – The version tuple (major, minor, micro)

`senf.version_string = '1.2.2'`

`str` – A version string

`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 then `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*)

**Parameters**

- `path` (*fsnative*) – The path to convert
- `encoding` (*str* or `None`) – `None` if you don't care about Windows

**Returns** *bytes*

### Raises

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

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). If you don't care about Windows you can pass `None`.

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)`

### Parameters

- **data** (`bytes`) – The data to convert
- **encoding** (`str` or `None`) – `None` if you don't care about Windows

**Returns** `fsnative`

### Raises

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

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). If you don't care about Windows you can pass `None`.

`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.environ = {}
    Dict[fsnative, fsnative] – Like os.environ but contains unicode keys and values under Windows + Python 2.

    Any changes made will be forwarded to os.environ.

senf.argv = []
    List[fsnative] – Like sys.argv but contains unicode keys and values under Windows + Python 2.

    Any changes made will be forwarded to sys.argv.

senf.sep = '/'
    fsnative – Like os.sep but a fsnative

senf.pathsep = ':'
    fsnative – Like os.pathsep but a fsnative

senf.curdir = '.'
    fsnative – Like os.curdir but a fsnative

senf.pardir = '..'
    fsnative – Like os.pardir but a fsnative

senf.altsep = None
    fsnative or None – Like os.altsep but a fsnative or None

senf.extsep = '.'
    fsnative – Like os.extsep but a fsnative

senf.devnull = '/dev/null'
    fsnative – Like os.devnull but a fsnative

senf.defpath = './bin:/usr/bin'
    fsnative – Like os.defpath but a 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.gettemprefix()`, 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.

## 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.



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## Frequently Asked Questions

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**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 14

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### 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)
    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 15

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Who?

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**Senf** is used by the following software:

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



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