# WSGI and python 3

Armin Ronacher
http://lucumr.pocoo.org/ // armin.ronacher@active-4.com // http://twitter.com/mitsuhiko

## About Me

- using Python since version 2.2
- WSGI believer :)
- Part of the Pocoo Team: *Jinja, Werkzeug, Sphinx, Zine, Flask*

## “Why are you so pessimistic?!”

- Because I care
- Knowing what’s broken makes fixing possible
- On the bright side: Python is doing really good

# Why Python 3?

GUILLON
Whisky
Single Malt de la Montagne de Reims
Distillé et mis en bouteille par SAS GW - Distillerie Guillon
51150 Louvois
FRANCE

## What is WSGI?

# WSGI is PEP 333

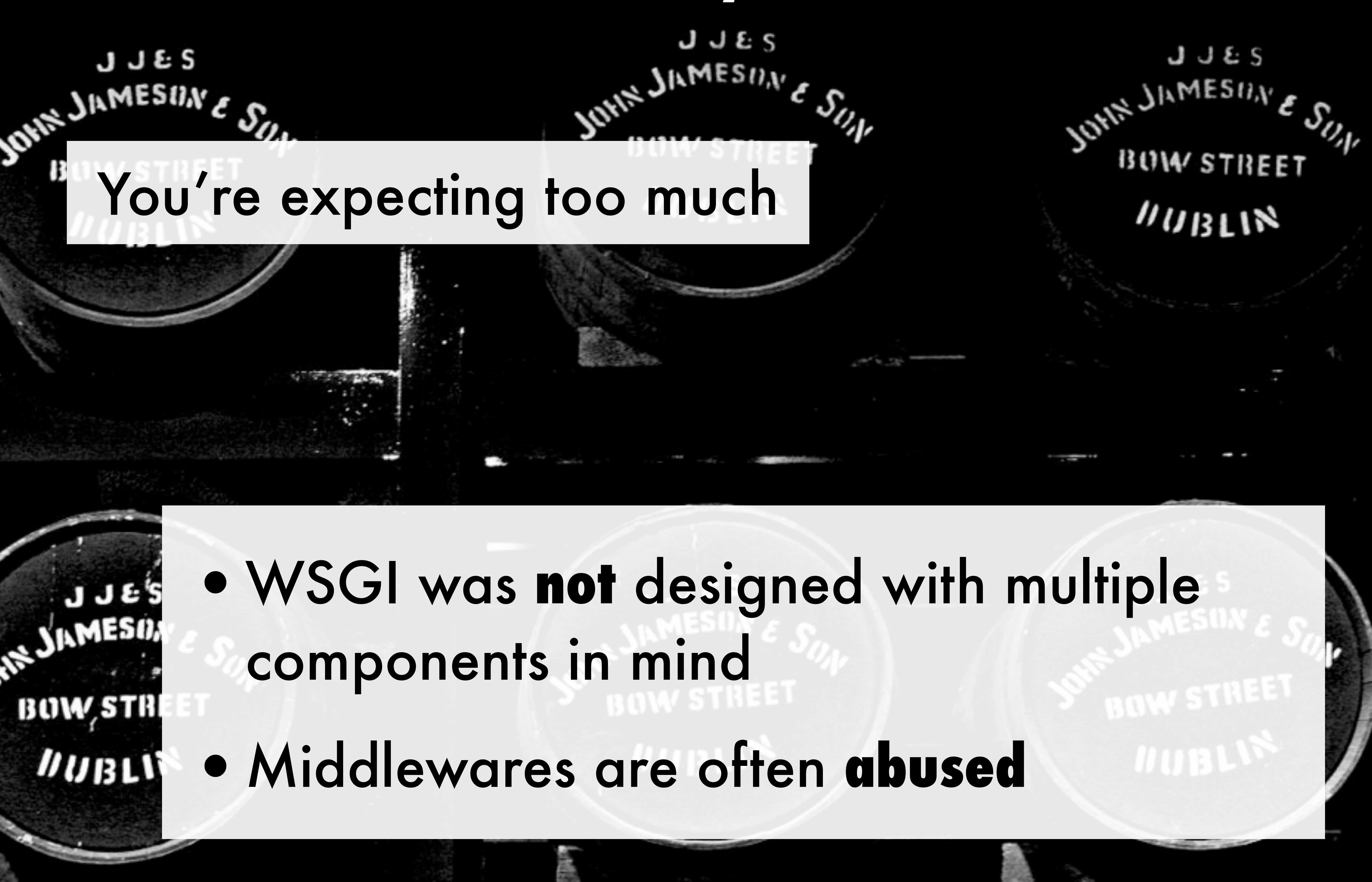
Last Update: 2004

**Frameworks**: Django, pylons, web.py, TurboGears 2, Flask, ...

**Lower-Level**: WebOb, Paste, Werkzeug

**Servers**: mod_wsgi, CherrPy, Paste, flup, ...

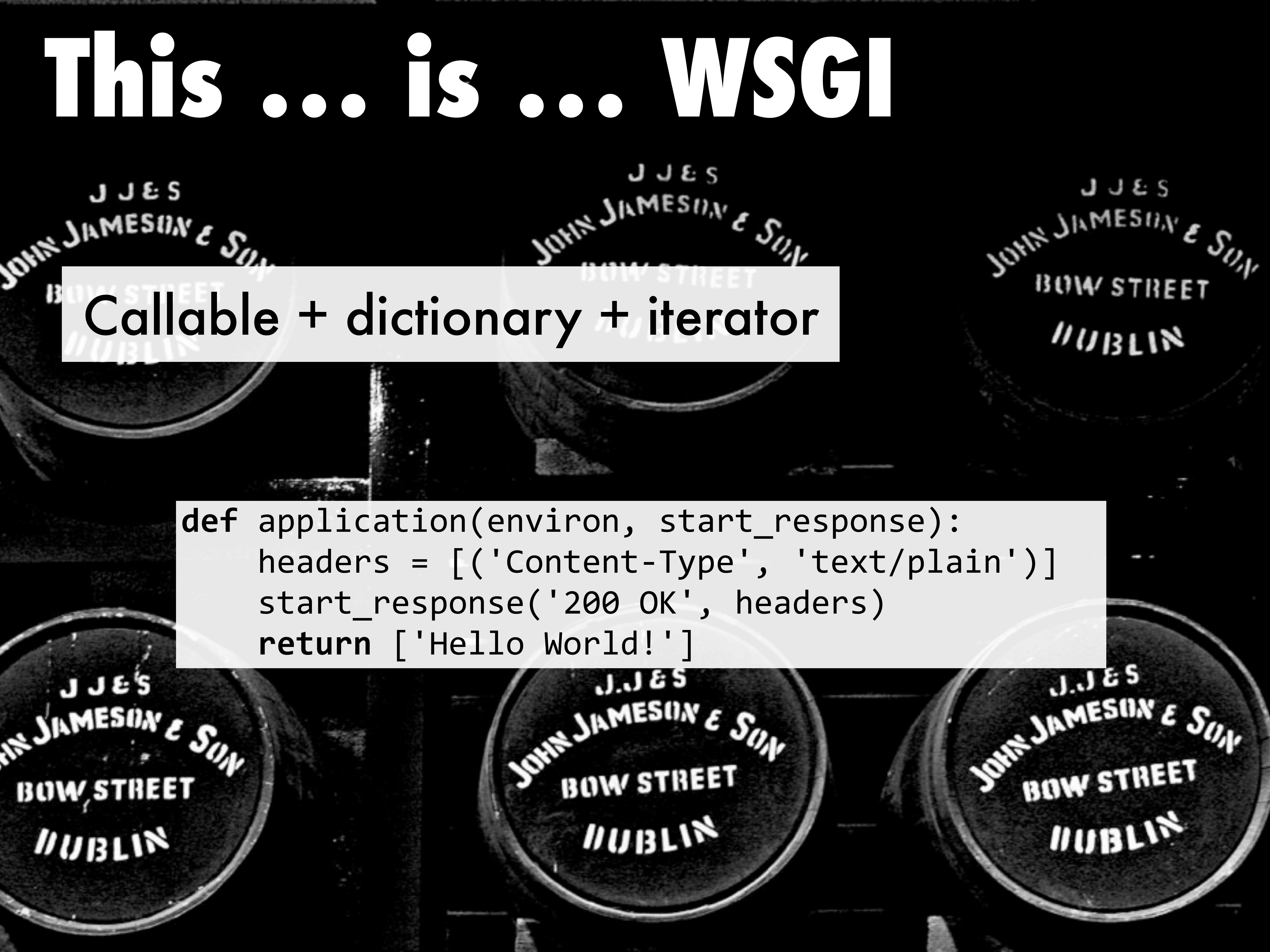
# **WSGI is** Gateway Interface



You're expecting too much

- WSGI was **not** designed with multiple components in mind
- Middlewares are often **abused**

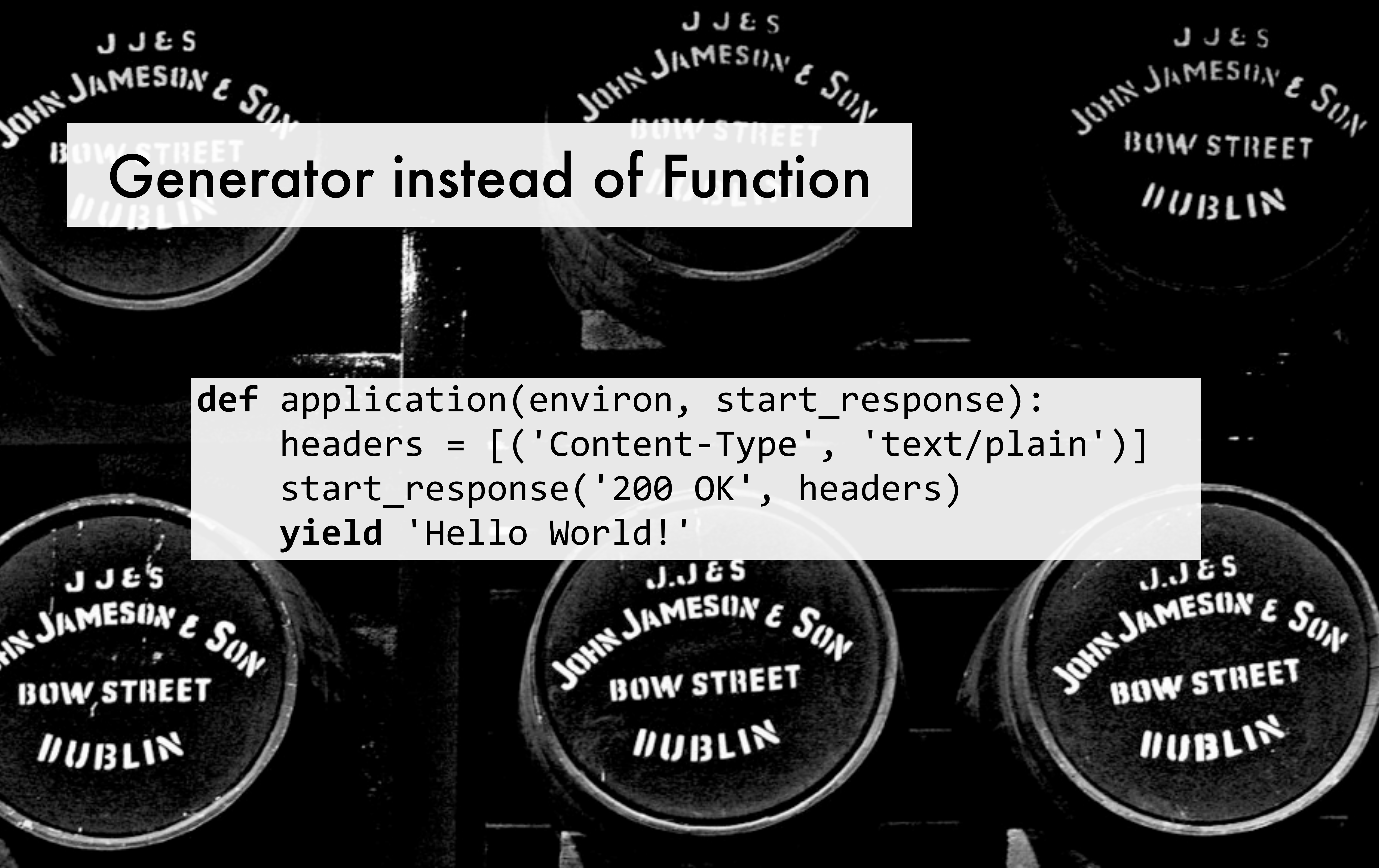
# This ... is ... WSGI



Callable + dictionary + iterator

```
def application(environ, start_response):
    headers = [('Content-Type', 'text/plain')]
    start_response('200 OK', headers)
    return ['Hello World!']
```

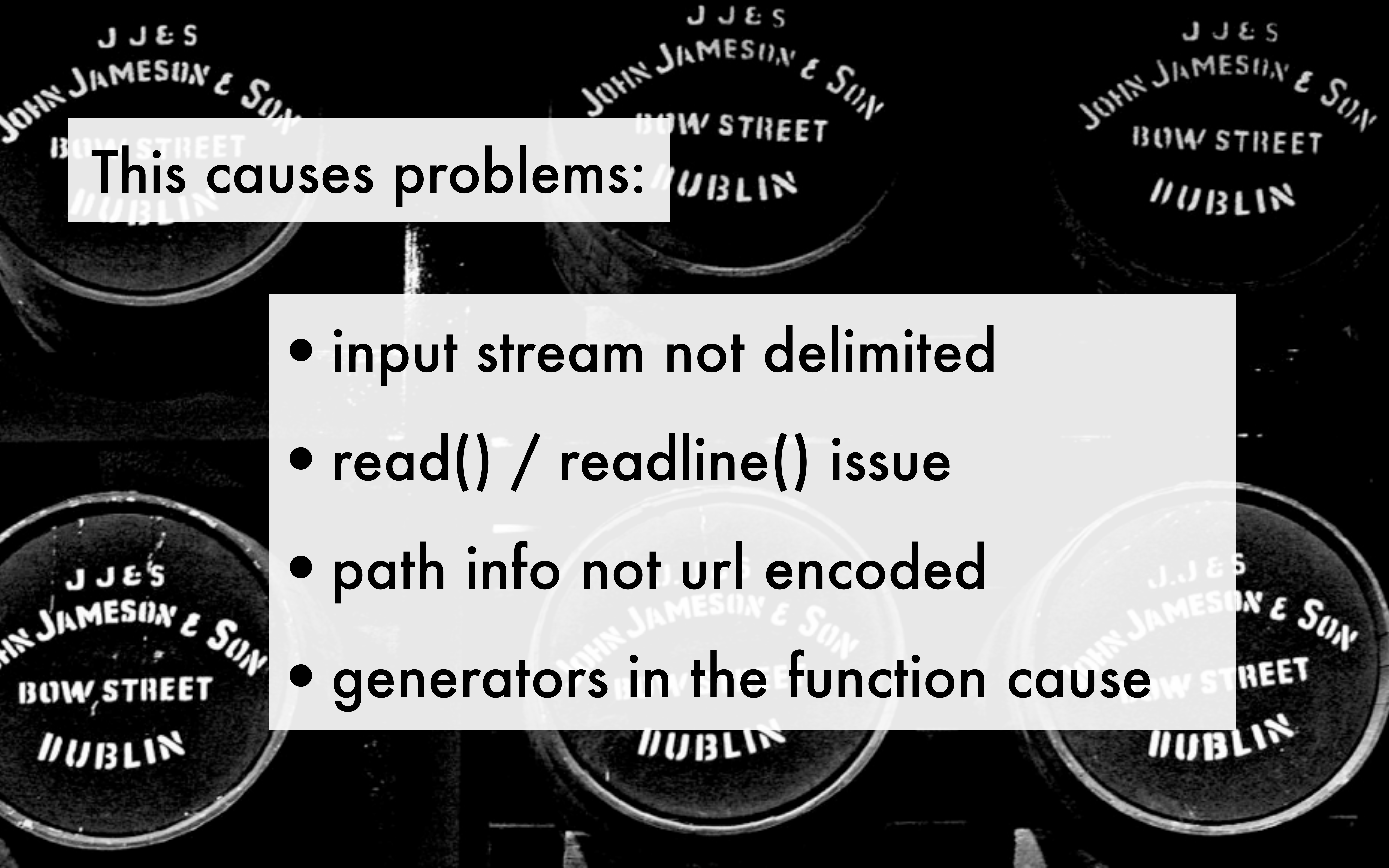
# Is *this* WSGI?



Generator instead of Function

```
def application(environ, start_response):
    headers = [('Content-Type', 'text/plain')]
    start_response('200 OK', headers)
    yield 'Hello World!'
```

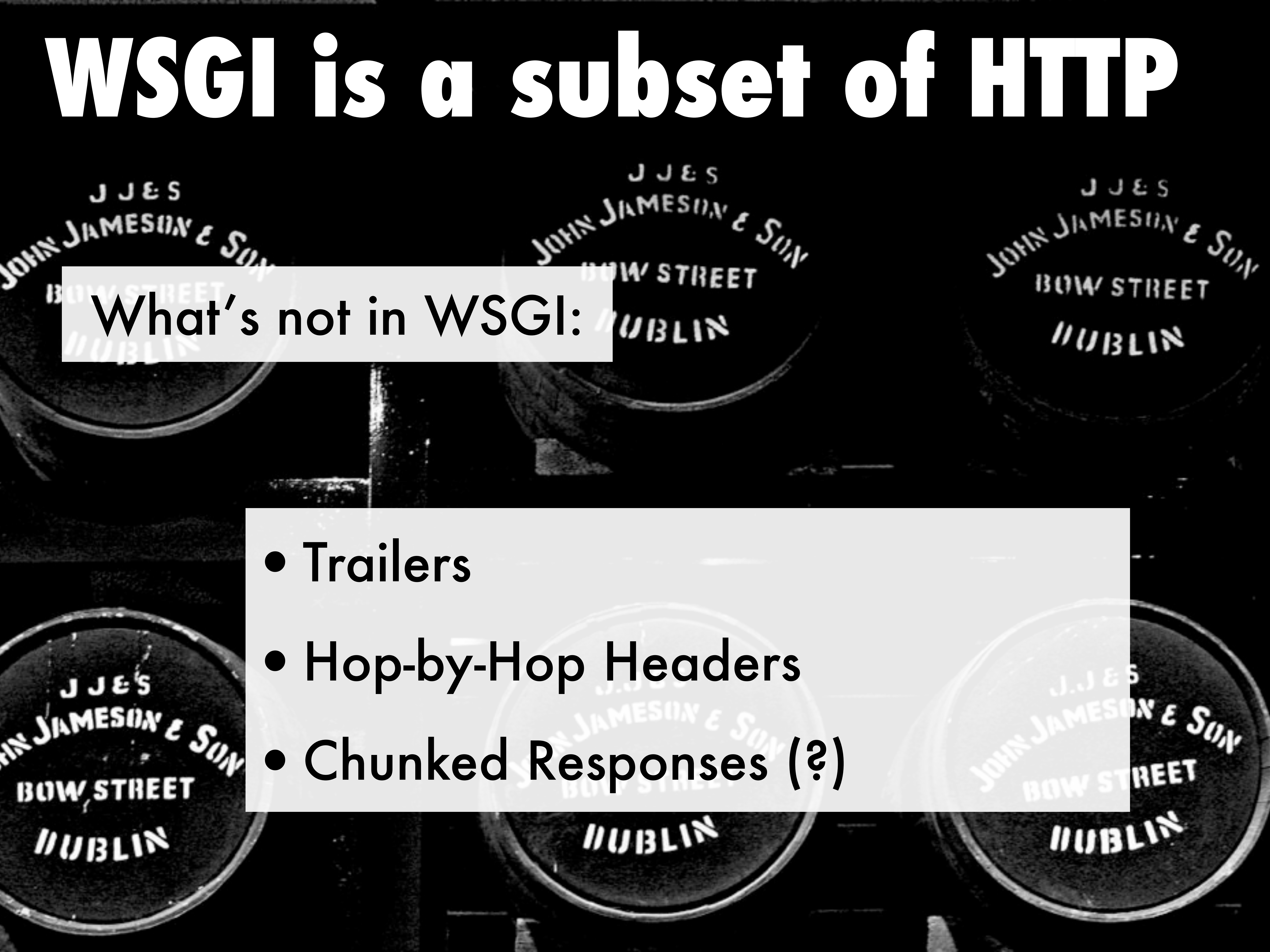
# WSGI is slightly flawed



This causes problems:

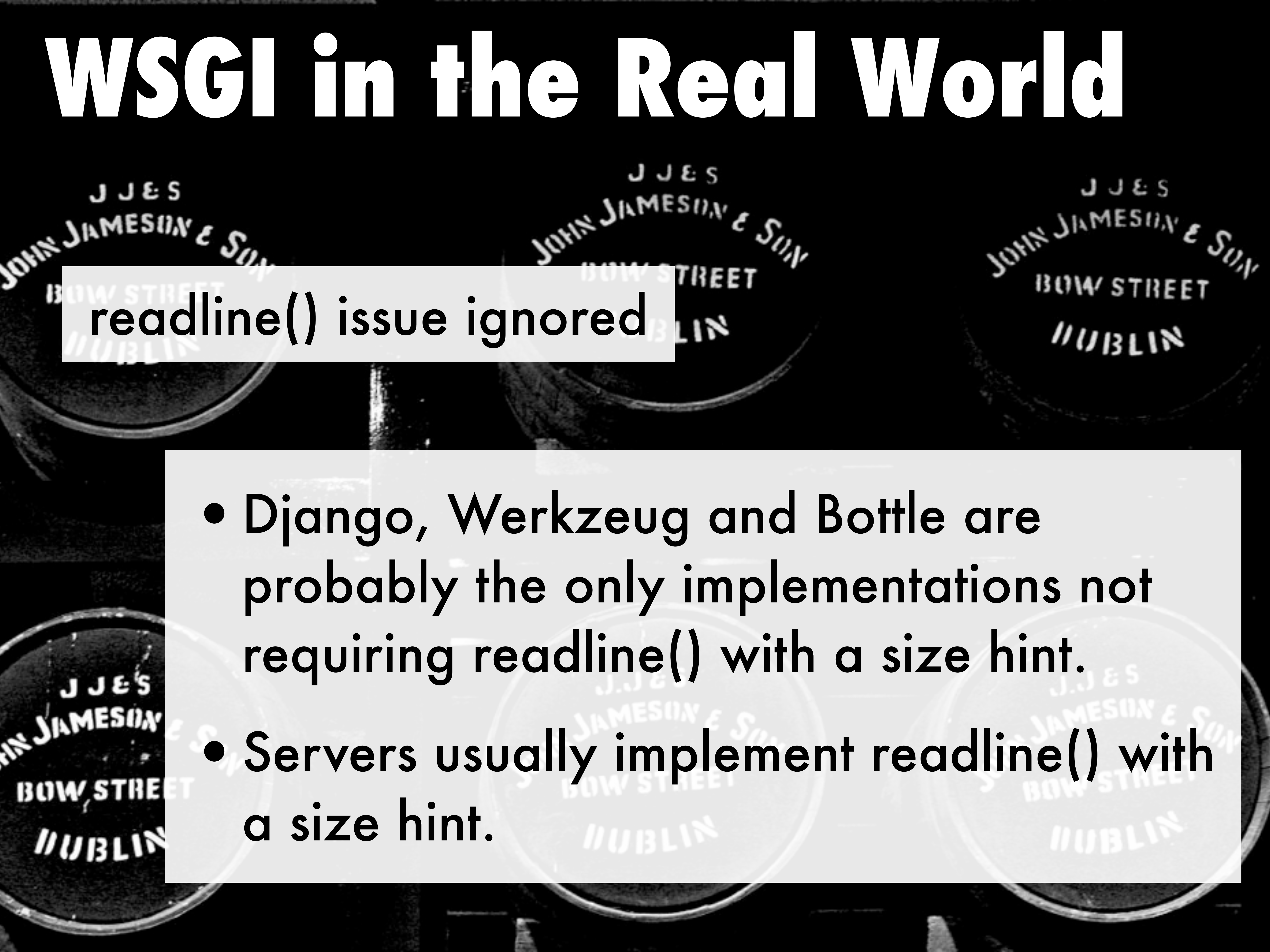
- input stream not delimited
- read() / readline() issue
- path info not url encoded
- generators in the function cause

# WSGI is a subset of HTTP



What’s not in WSGI:

- Trailers
- Hop-by-Hop Headers
- Chunked Responses (?)

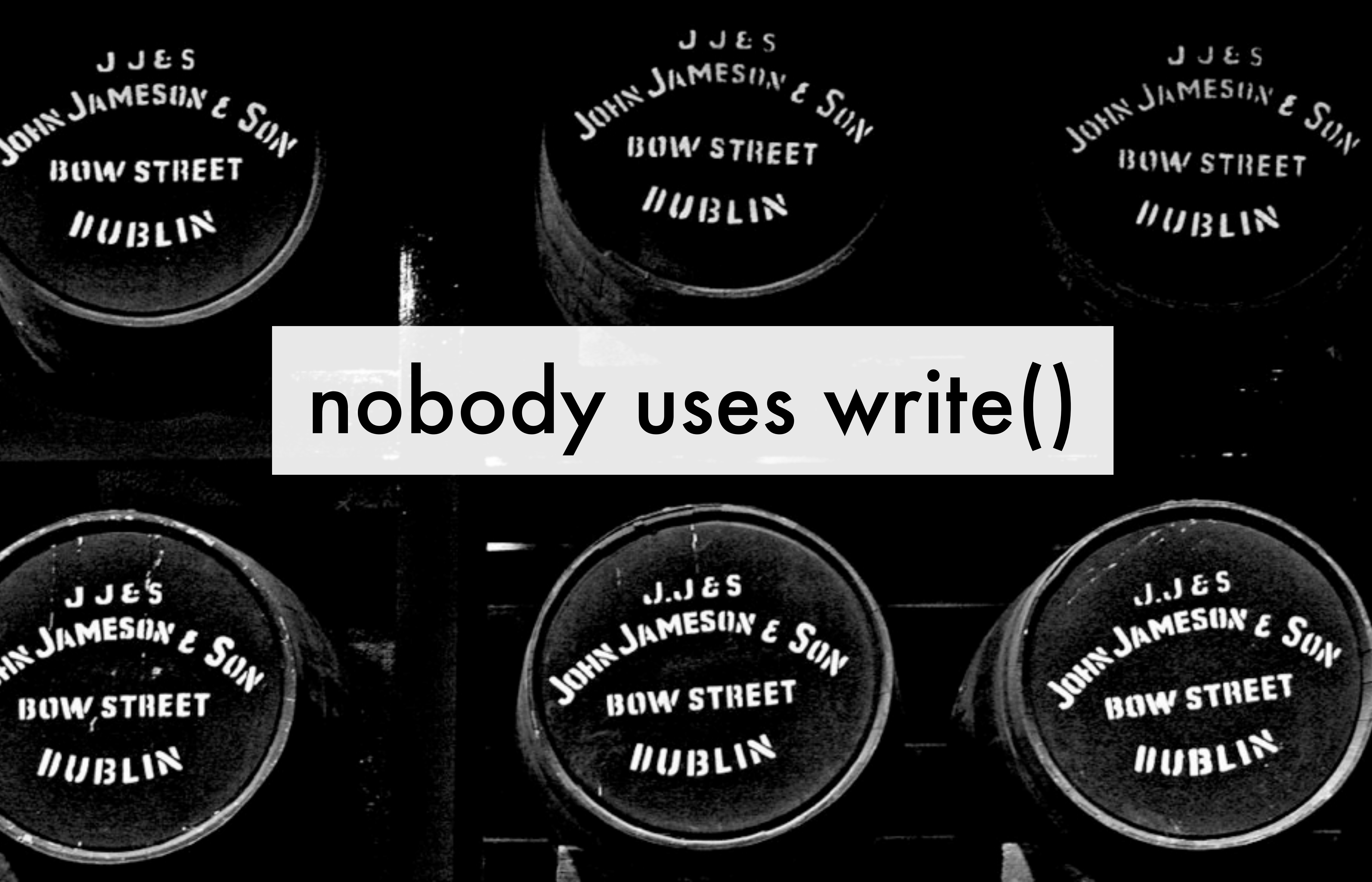


## WSGI in the Real World

readline() issue ignored

- Django, Werkzeug and Bottle are probably the only implementations not requiring readline() with a size hint.
- Servers usually implement readline() with a size hint.

# WSGI in the Real World

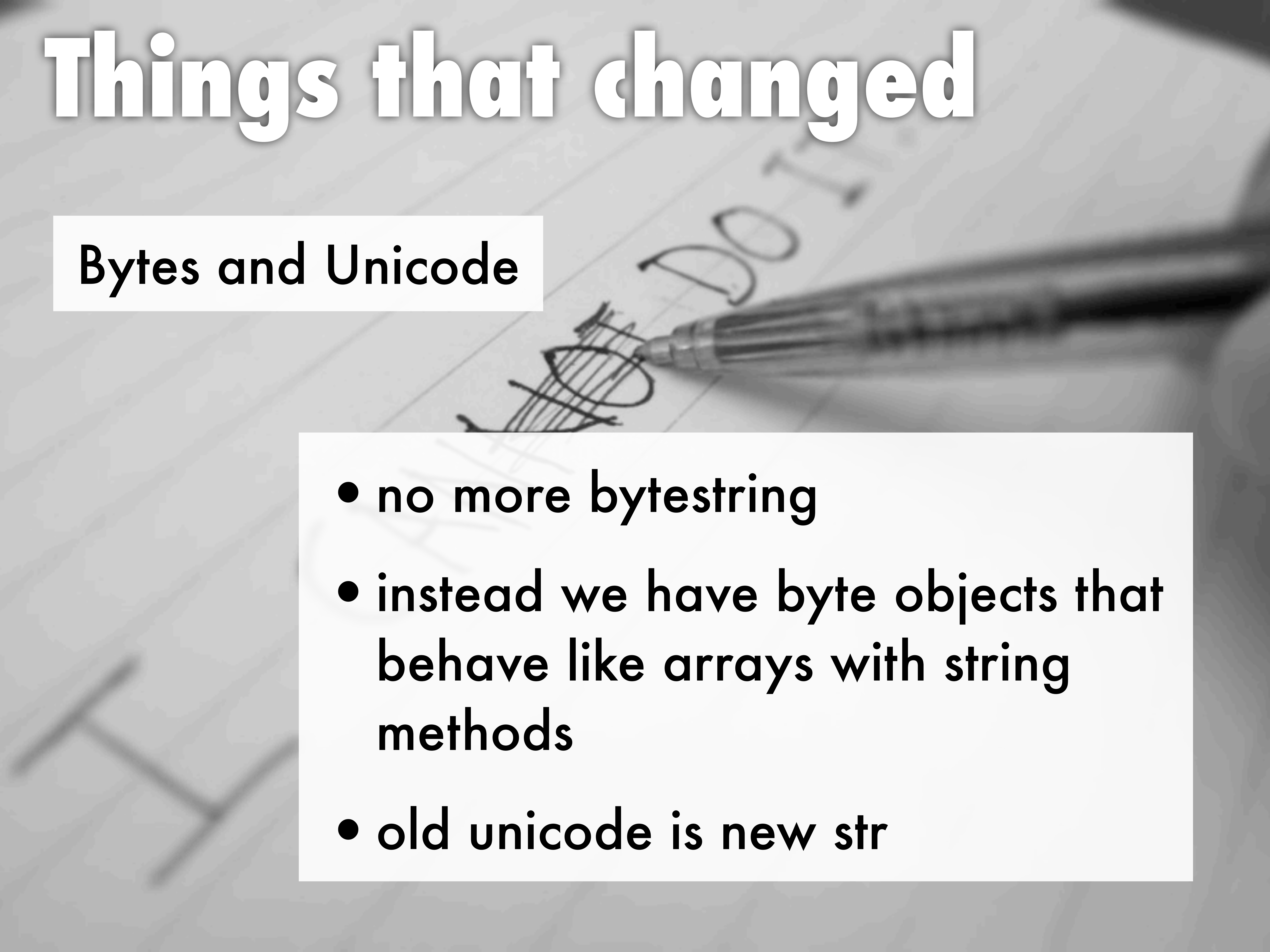


nobody uses write()

*WSGI relevant*

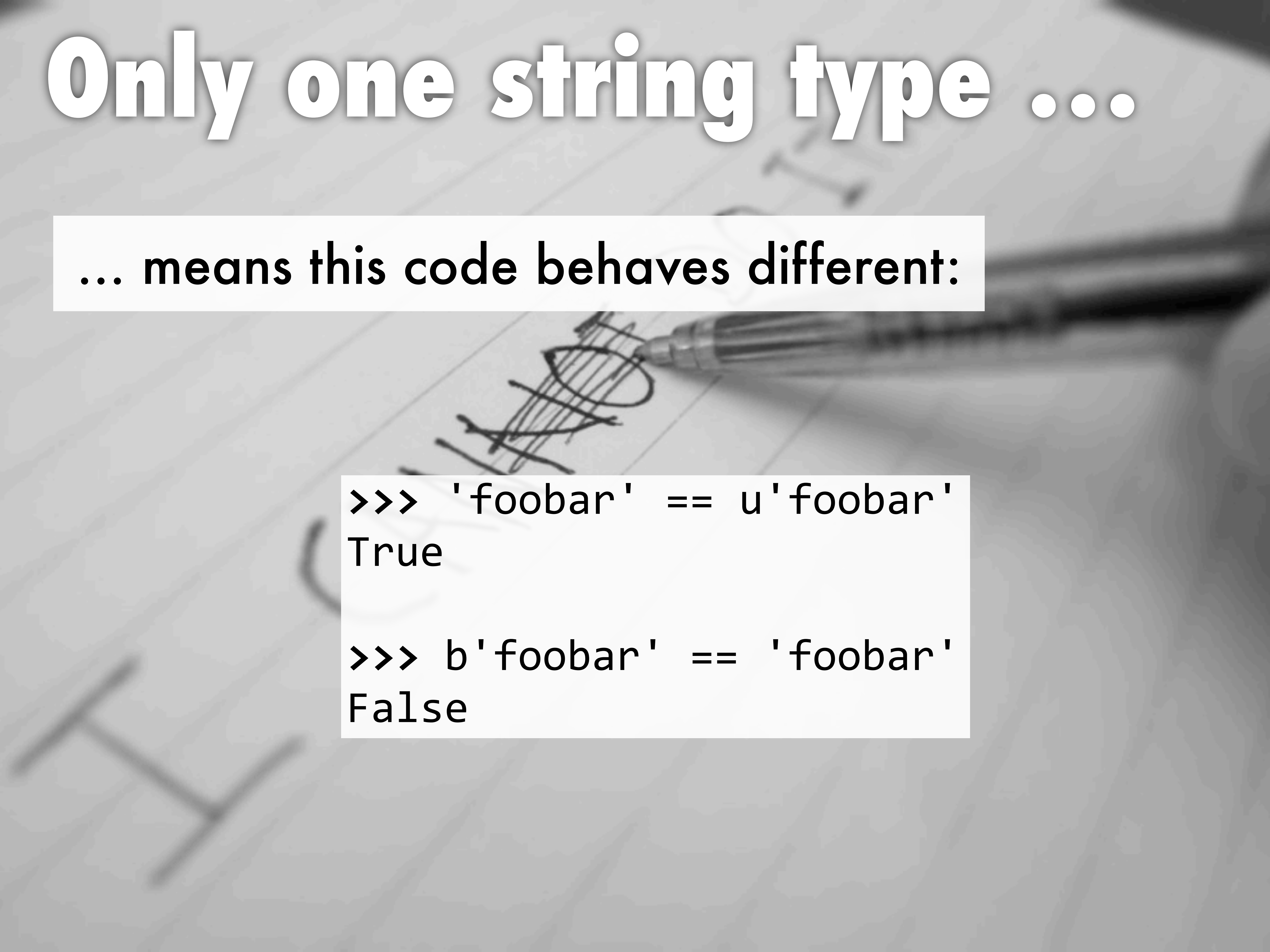
## Language Changes

# Things that changed



## Bytes and Unicode

- no more bytestring
- instead we have byte objects that behave like arrays with string methods
- old unicode is new str

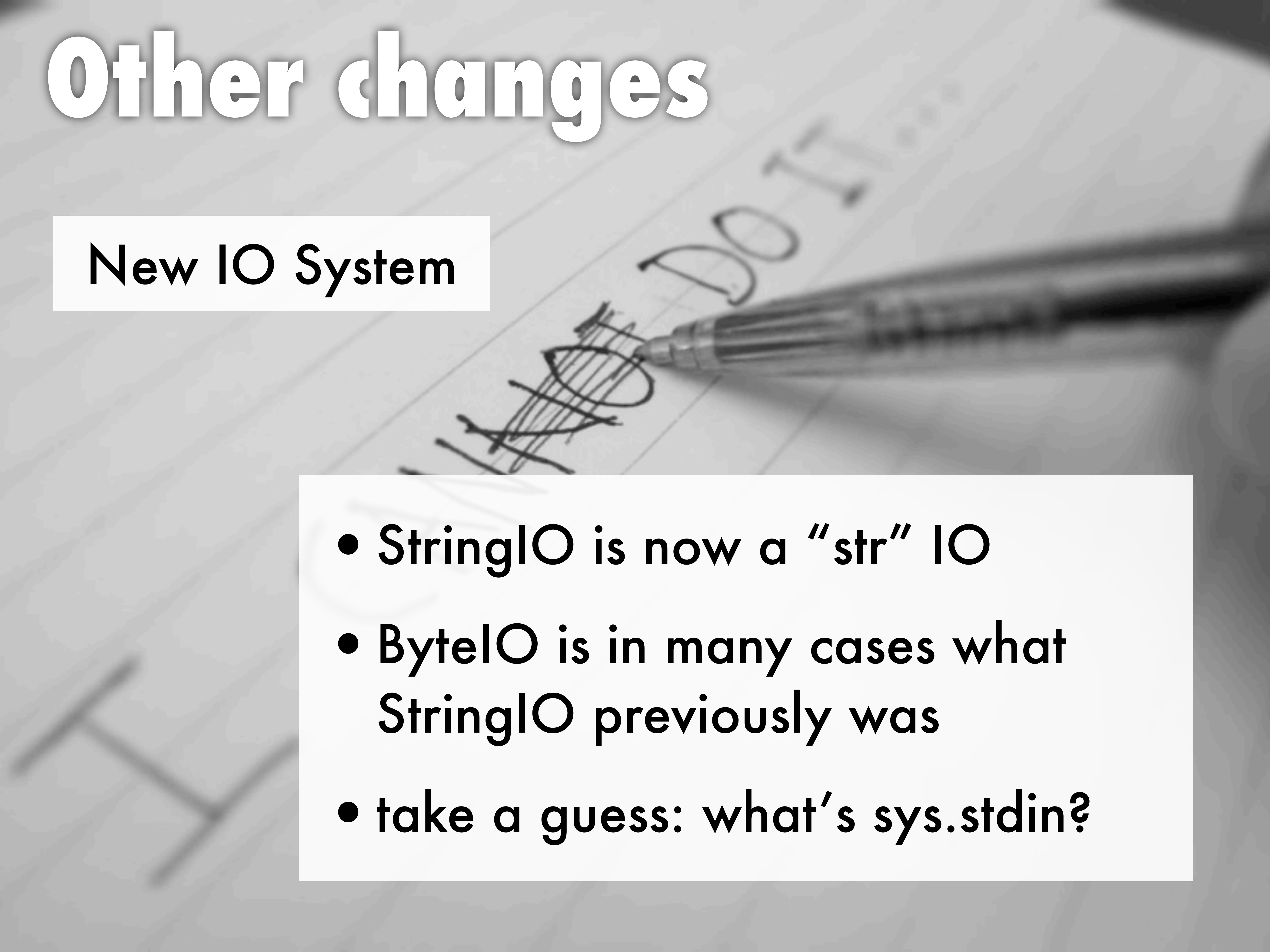


# Only one string type ...

... means this code behaves different:

```
>>> 'foobar' == u'foobar'
True

>>> b'foobar' == 'foobar'
False
```

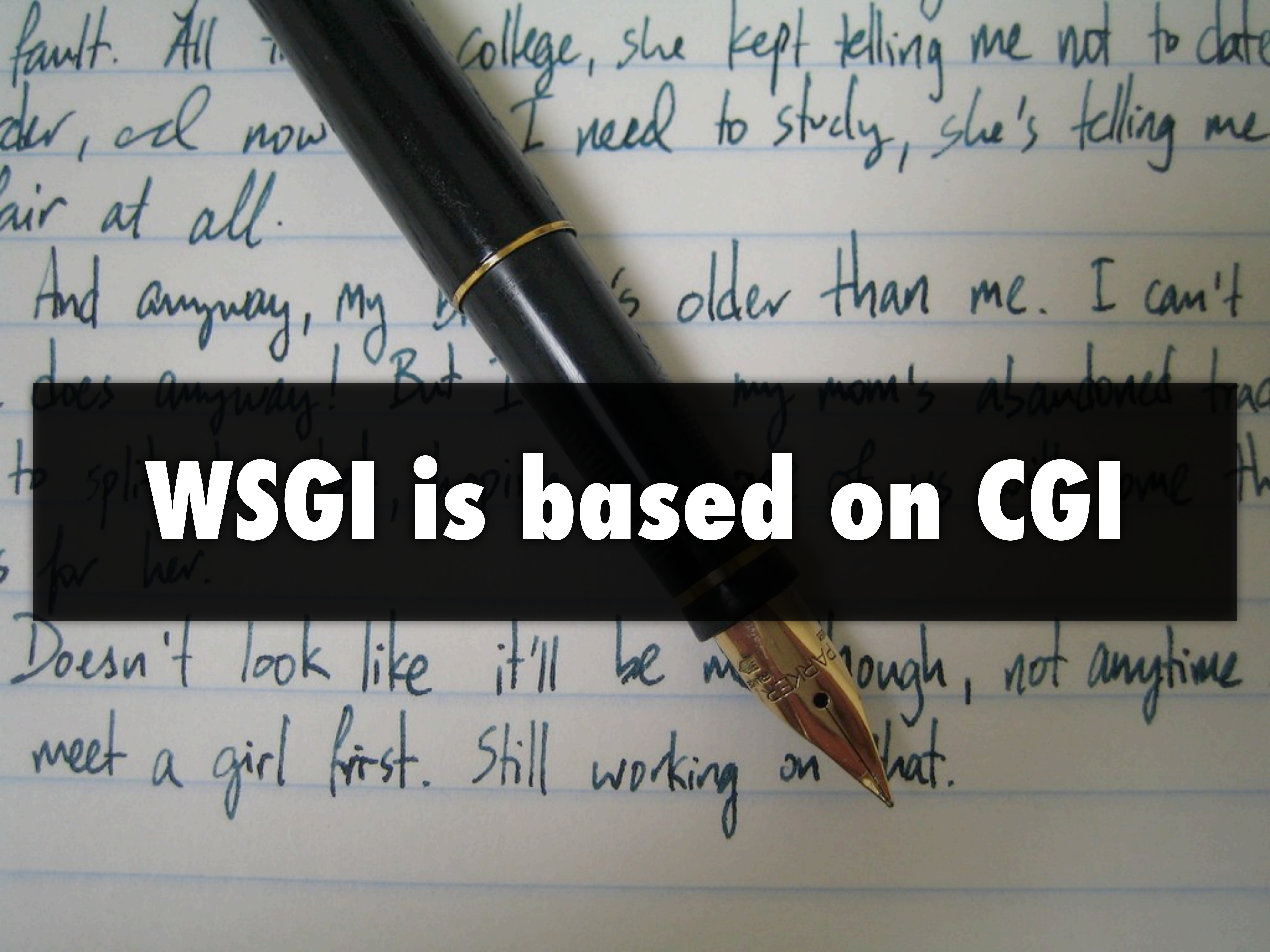


# Other changes

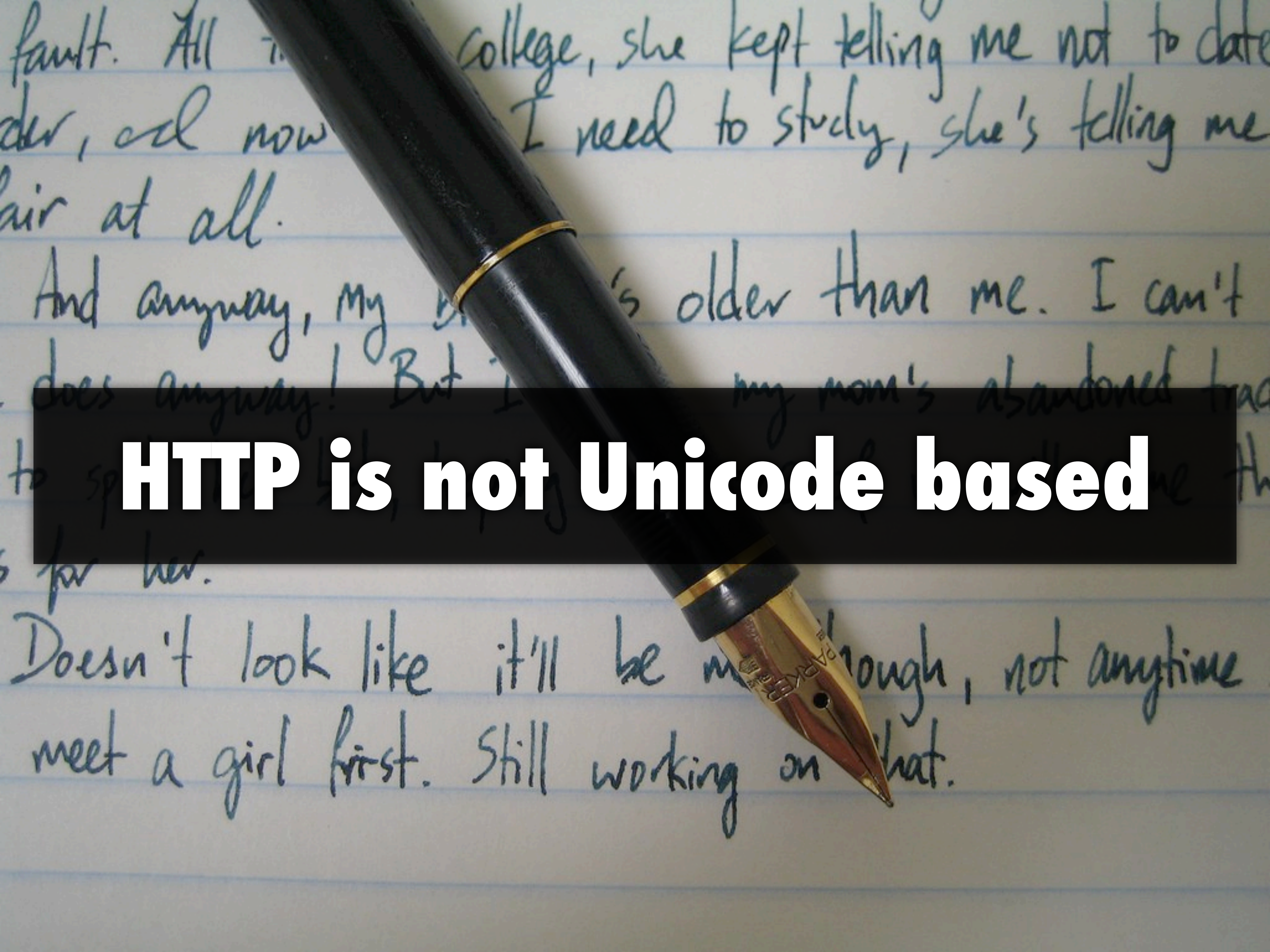
New IO System

- StringIO is now a “str” IO
- ByteIO is in many cases what StringIO previously was
- take a guess: what’s sys.stdin?

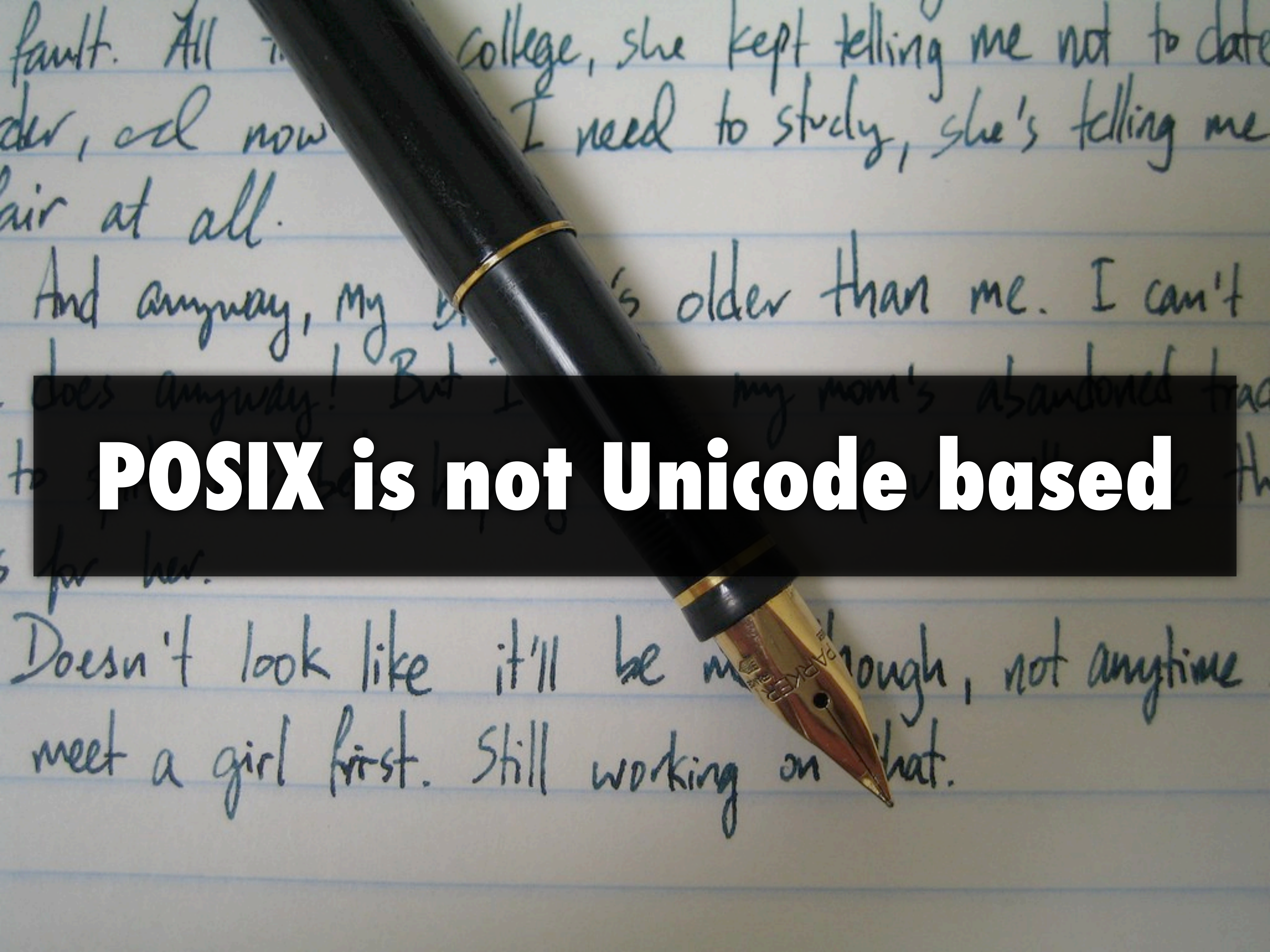
FACTS!



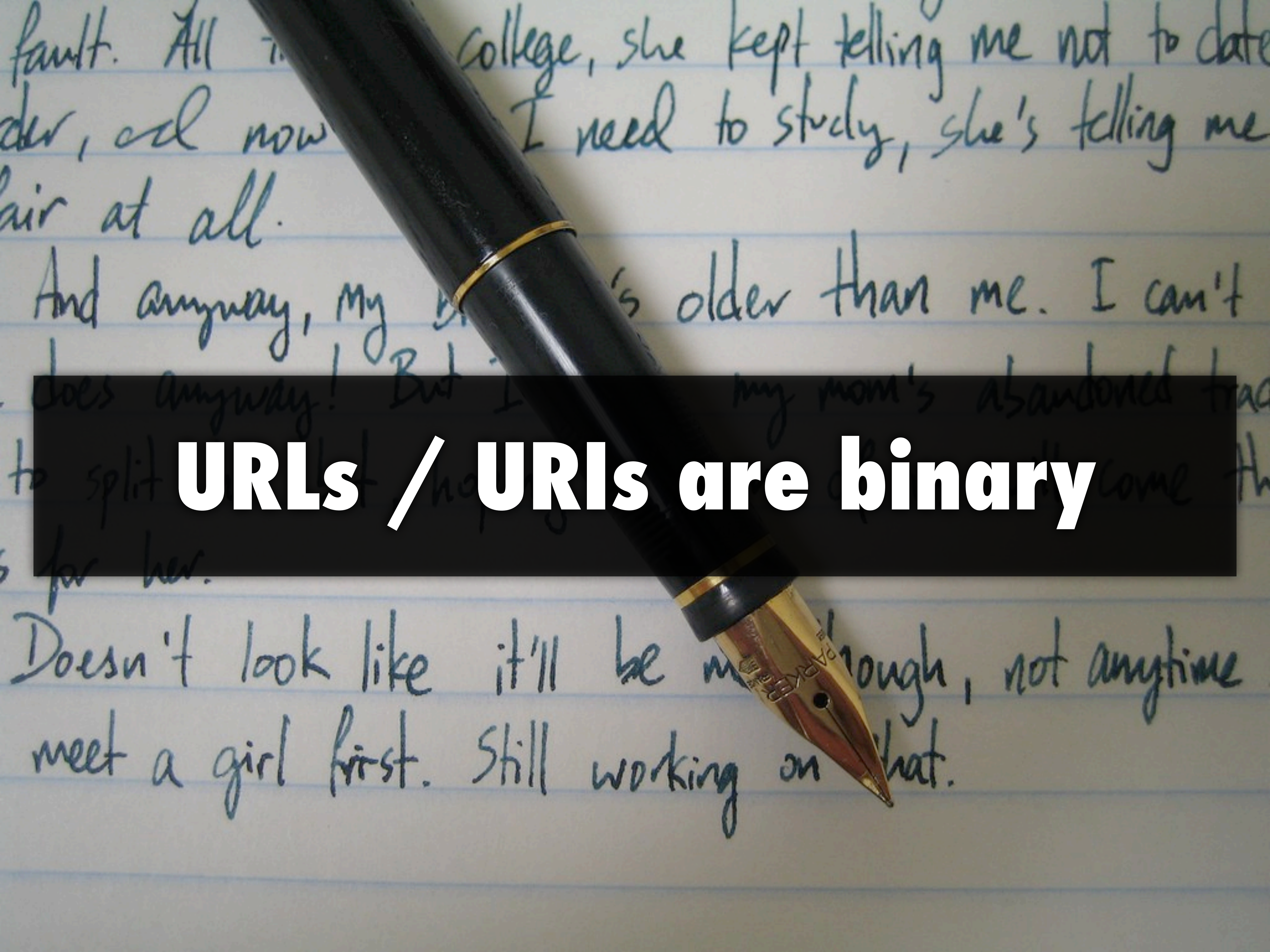
## WSGI is based on CGI



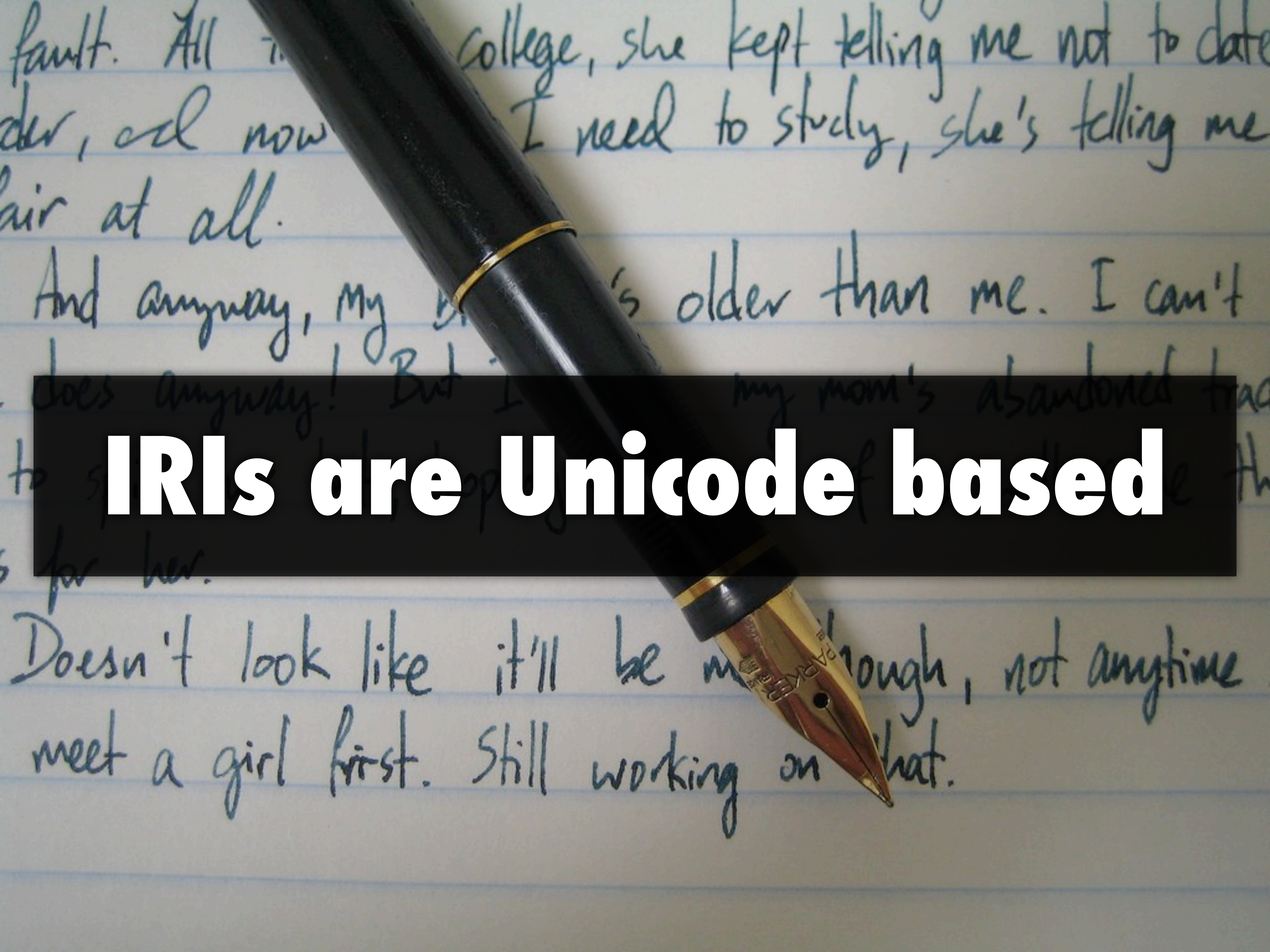
## HTTP is not Unicode based



## POSIX is not Unicode based

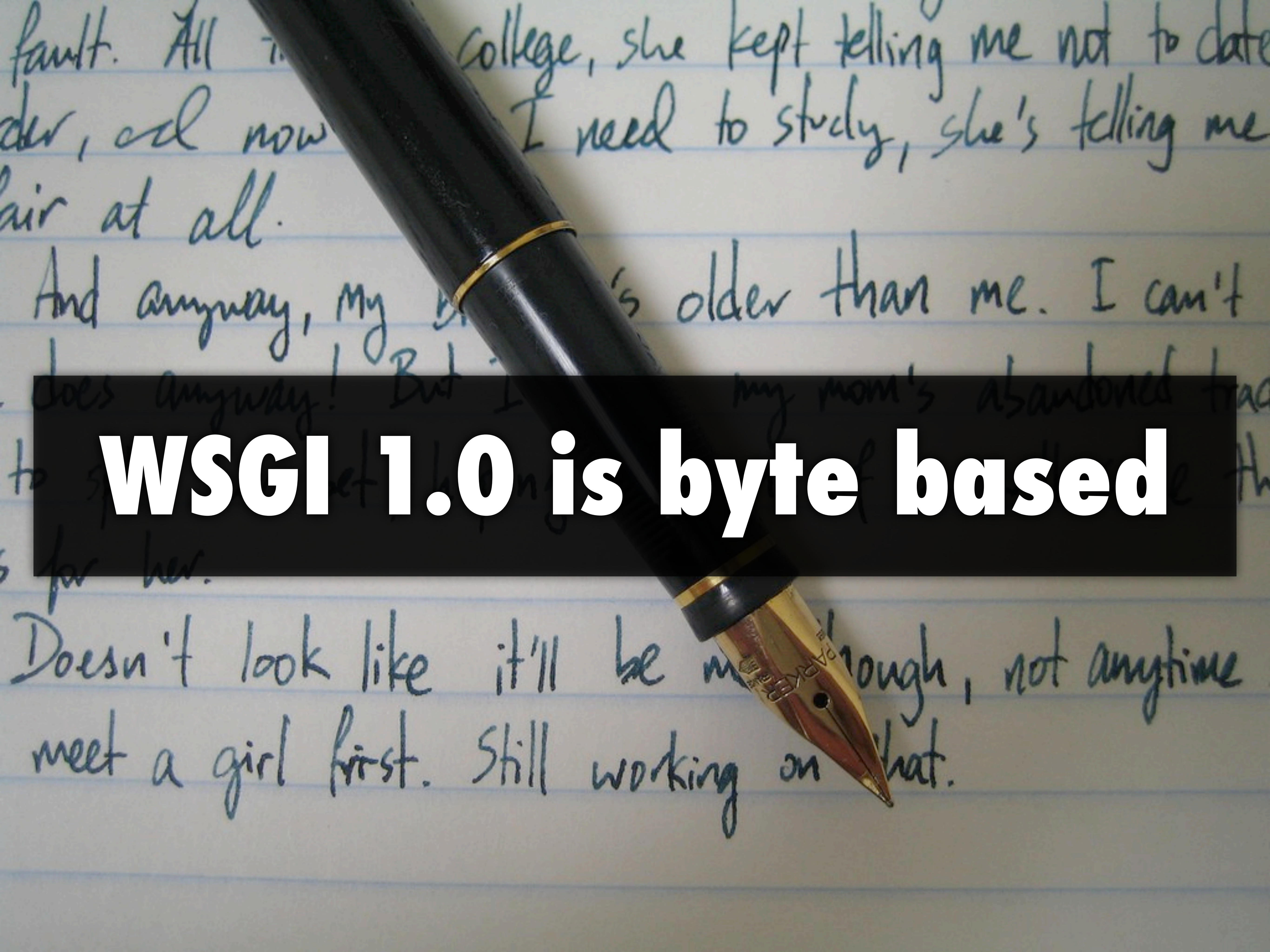


## URLs / URIs are binary



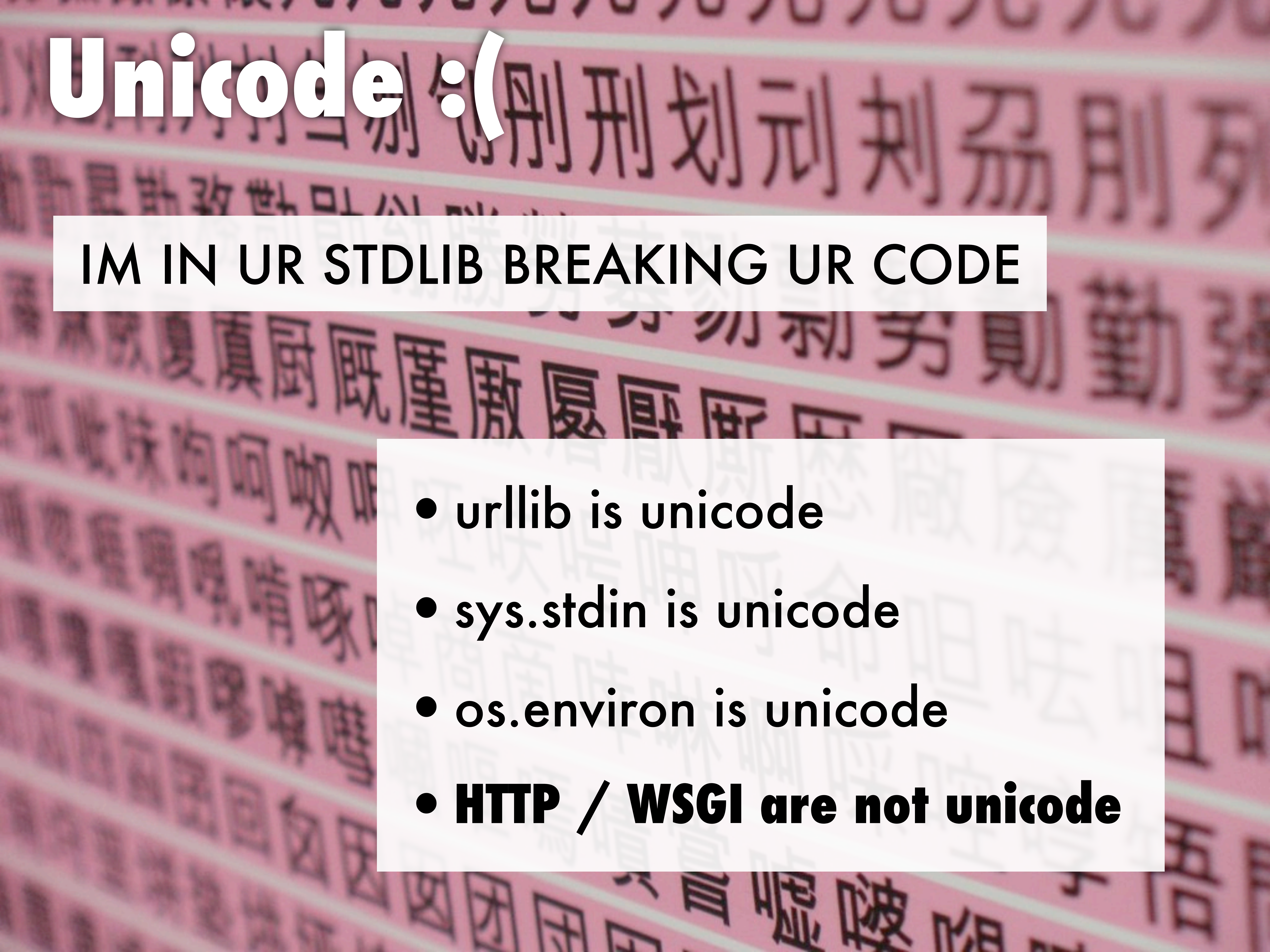
fault. All [illegible] college, she kept telling me not to date
older, and now [illegible] I need to study, she's telling me
fair at all.
And anyway, my [illegible]'s older than me. I can't
does anyway! But I [illegible] my mom's abandoned trac
to [illegible] th
for her.
Doesn't look like it'll be m[illegible]ough, not anytime
meet a girl first. Still working on [illegible]hat.

## IRIs are Unicode based



## WSGI 1.0 is byte based

## Problems ahead

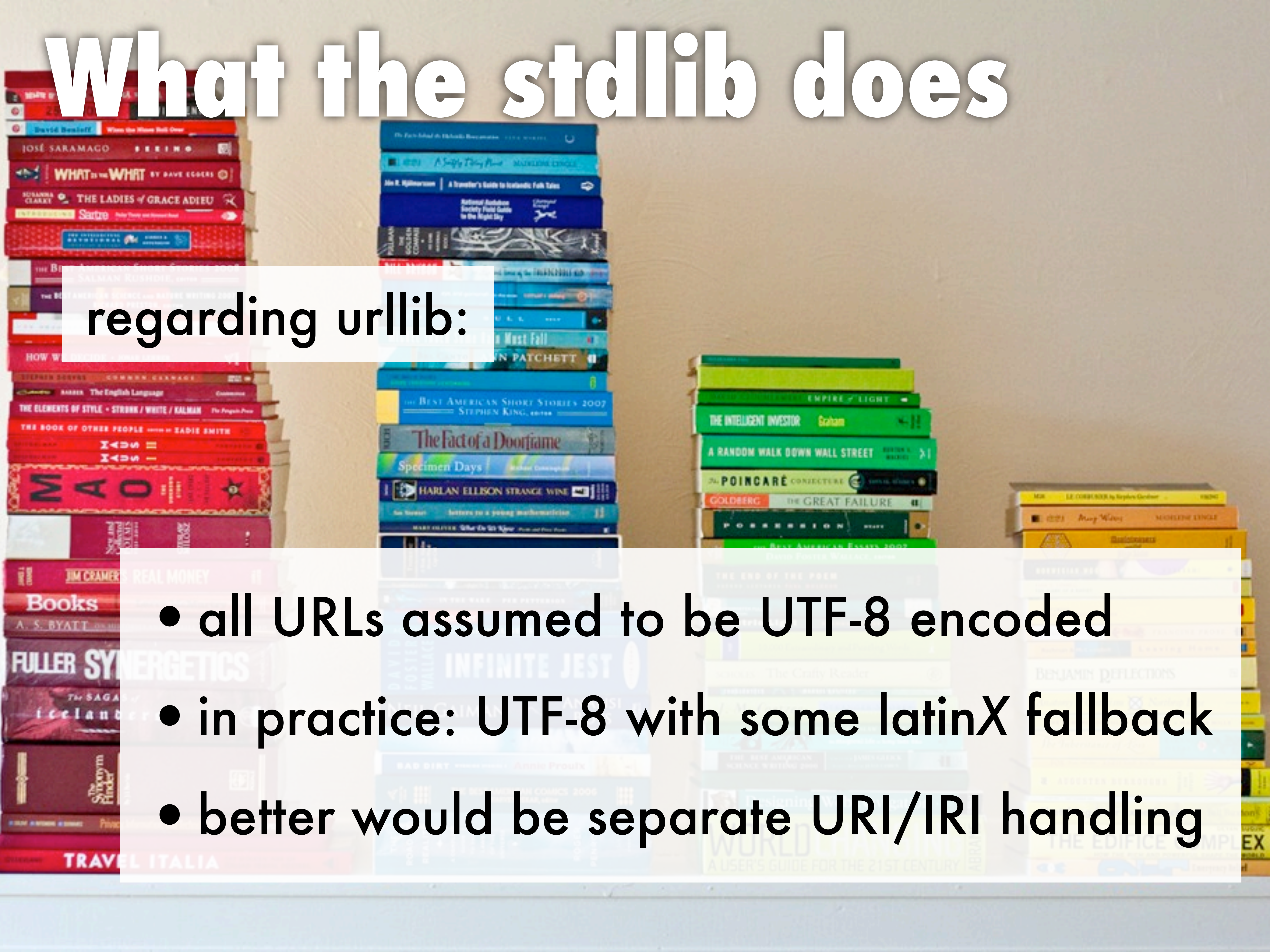


## Unicode :(

IM IN UR STDLIB BREAKING UR CODE

- urllib is unicode
- sys.stdin is unicode
- os.environ is unicode
- **HTTP / WSGI are not unicode**

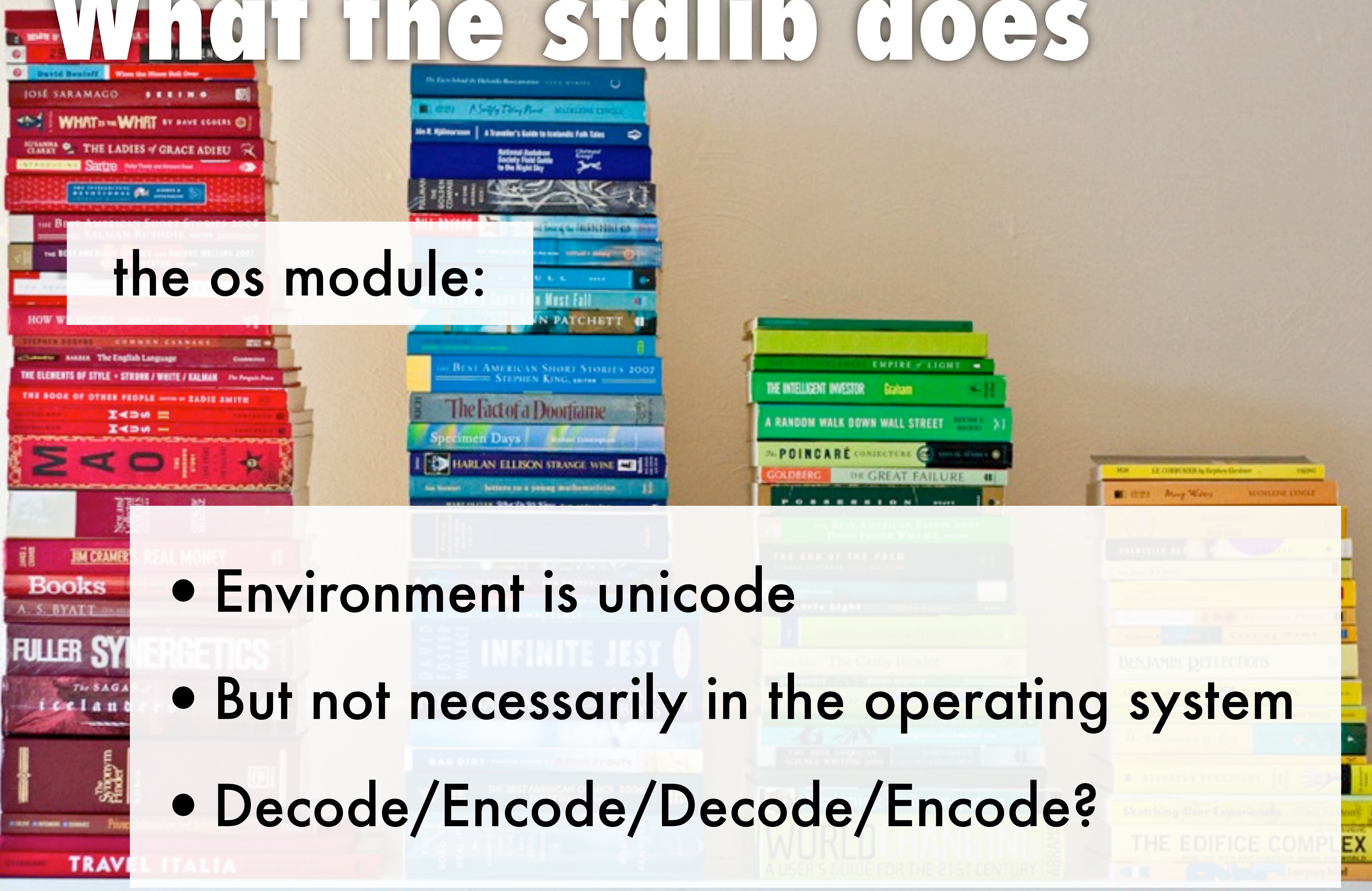
# What the stdlib does



regarding urllib:

- all URLs assumed to be UTF-8 encoded
- in practice: UTF-8 with some latinX fallback
- better would be separate URI/IRI handling

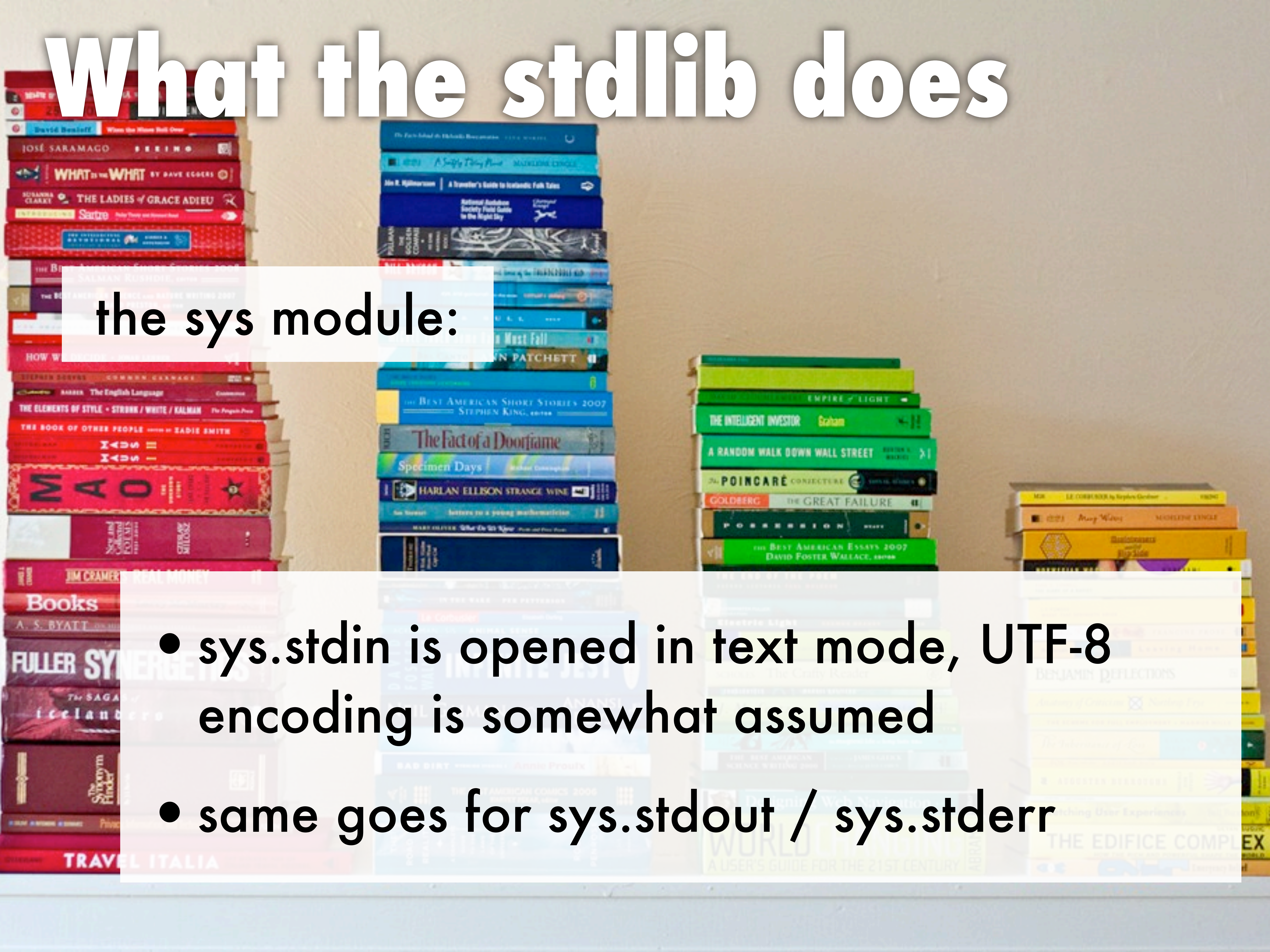
# What the stdlib does



the os module:

- Environment is unicode
- But not necessarily in the operating system
- Decode/Encode/Decode/Encode?

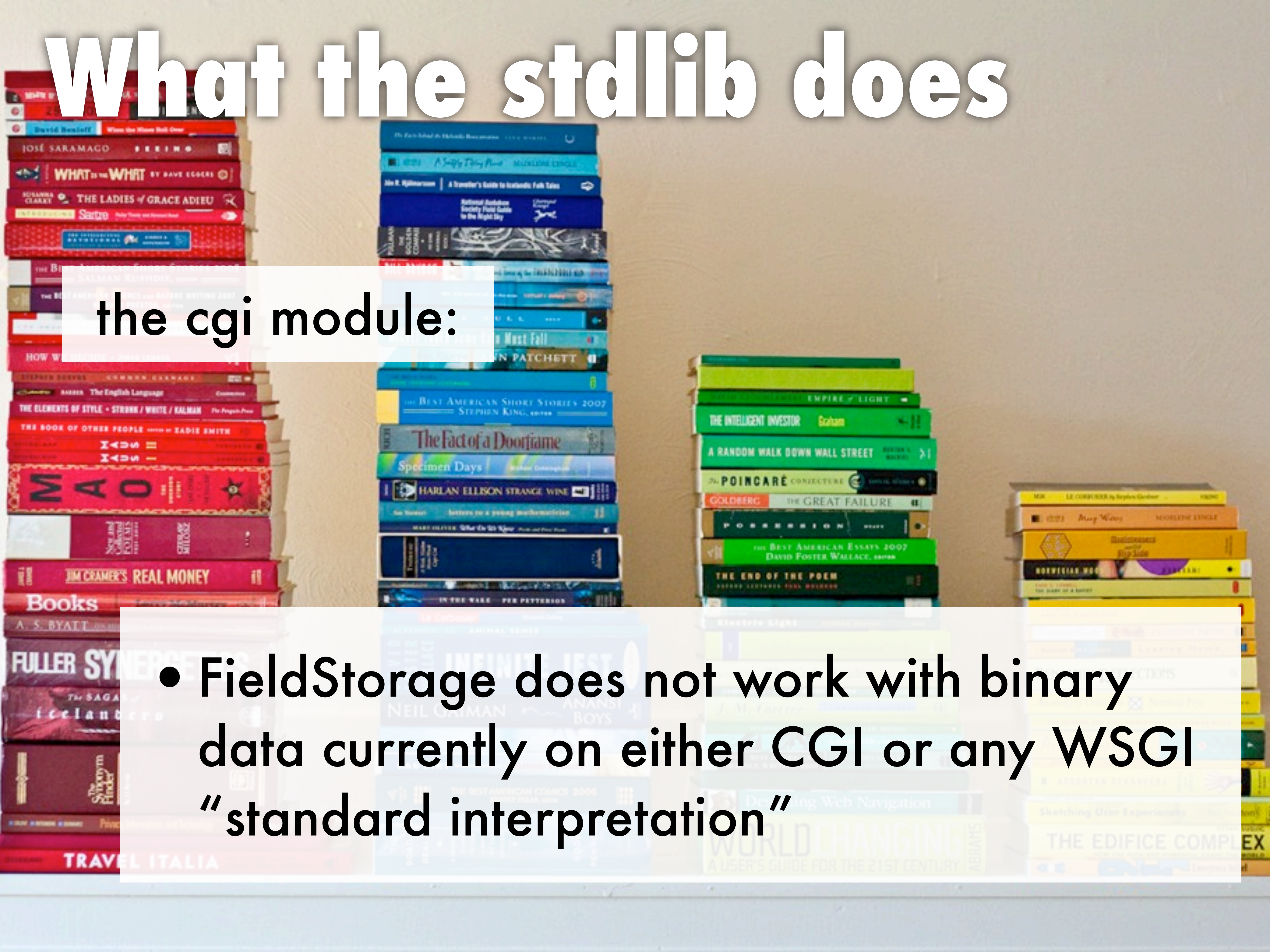
# What the stdlib does



the sys module:

- sys.stdin is opened in text mode, UTF-8 encoding is somewhat assumed
- same goes for sys.stdout / sys.stderr

# What the stdlib does

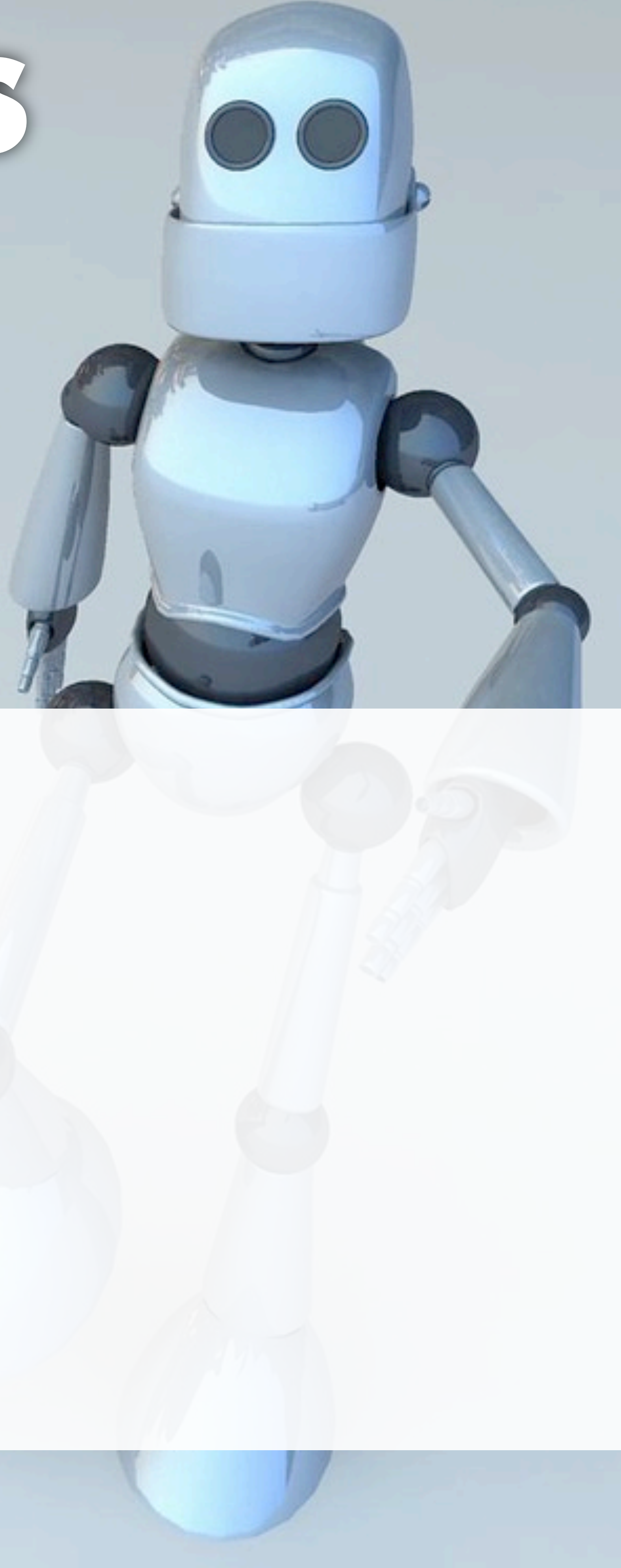


the cgi module:

- FieldStorage does not work with binary data currently on either CGI or any WSGI "standard interpretation"

## Weird Specification / General Inconsistencies

# Non-ASCII things

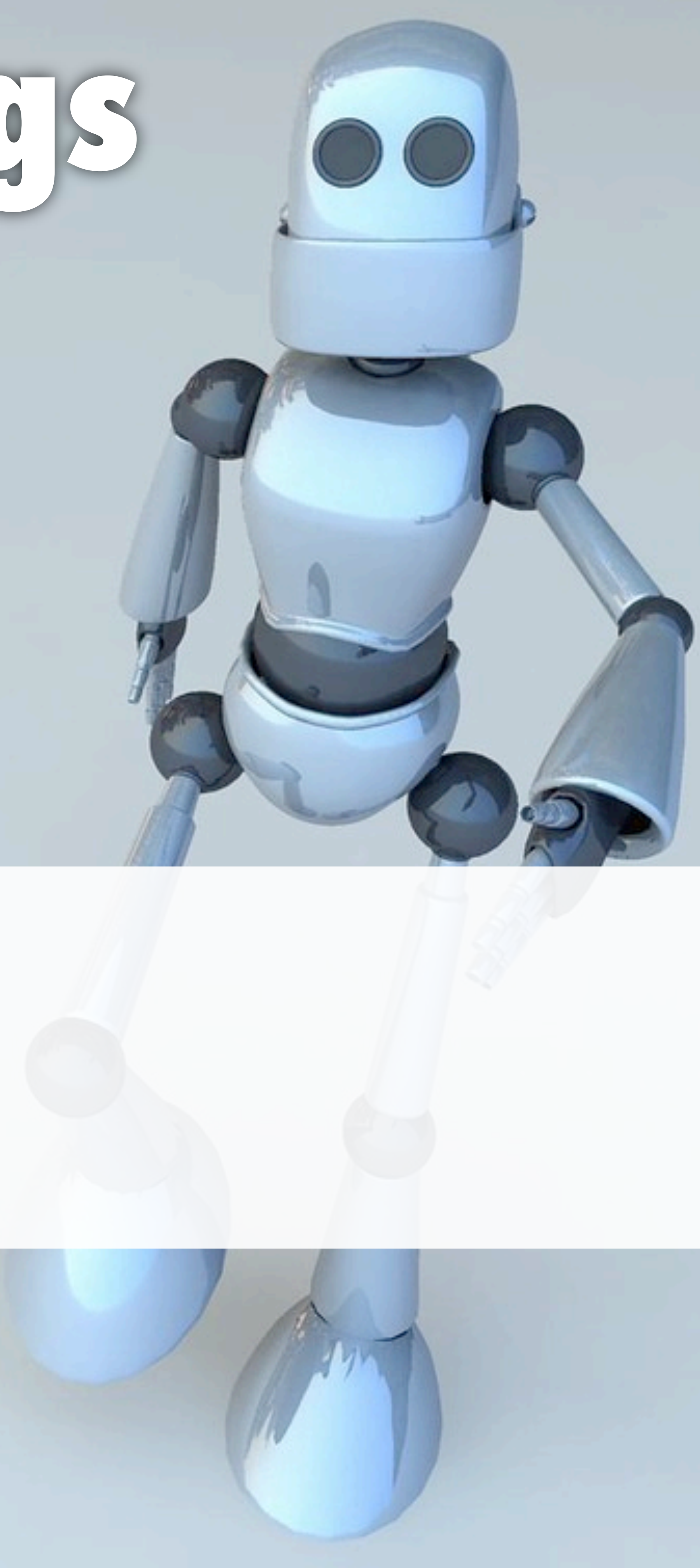


in the environ:

- HTTP_COOKIE
- SERVER_SOFTWARE
- PATH_INFO
- SCRIPT_NAME

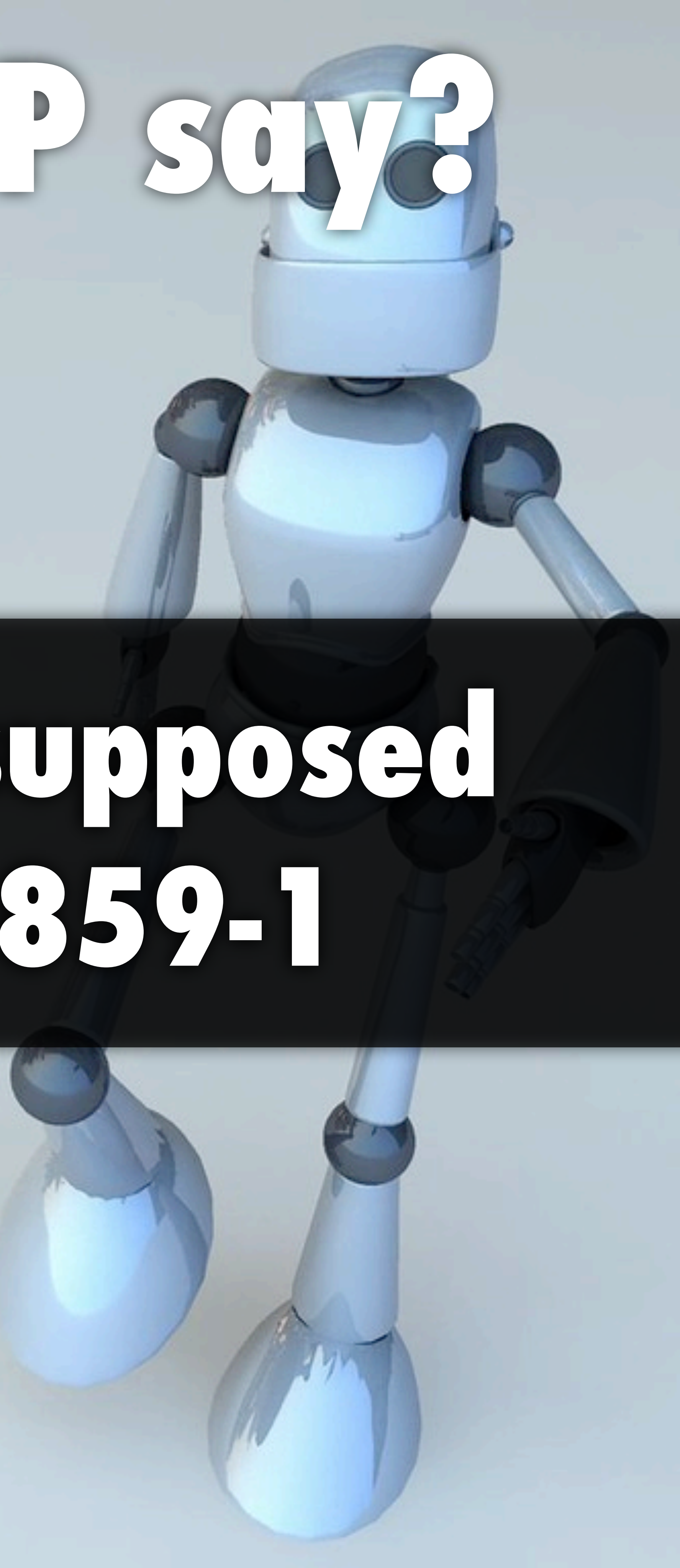
# Non-ASCII things

in the headers:



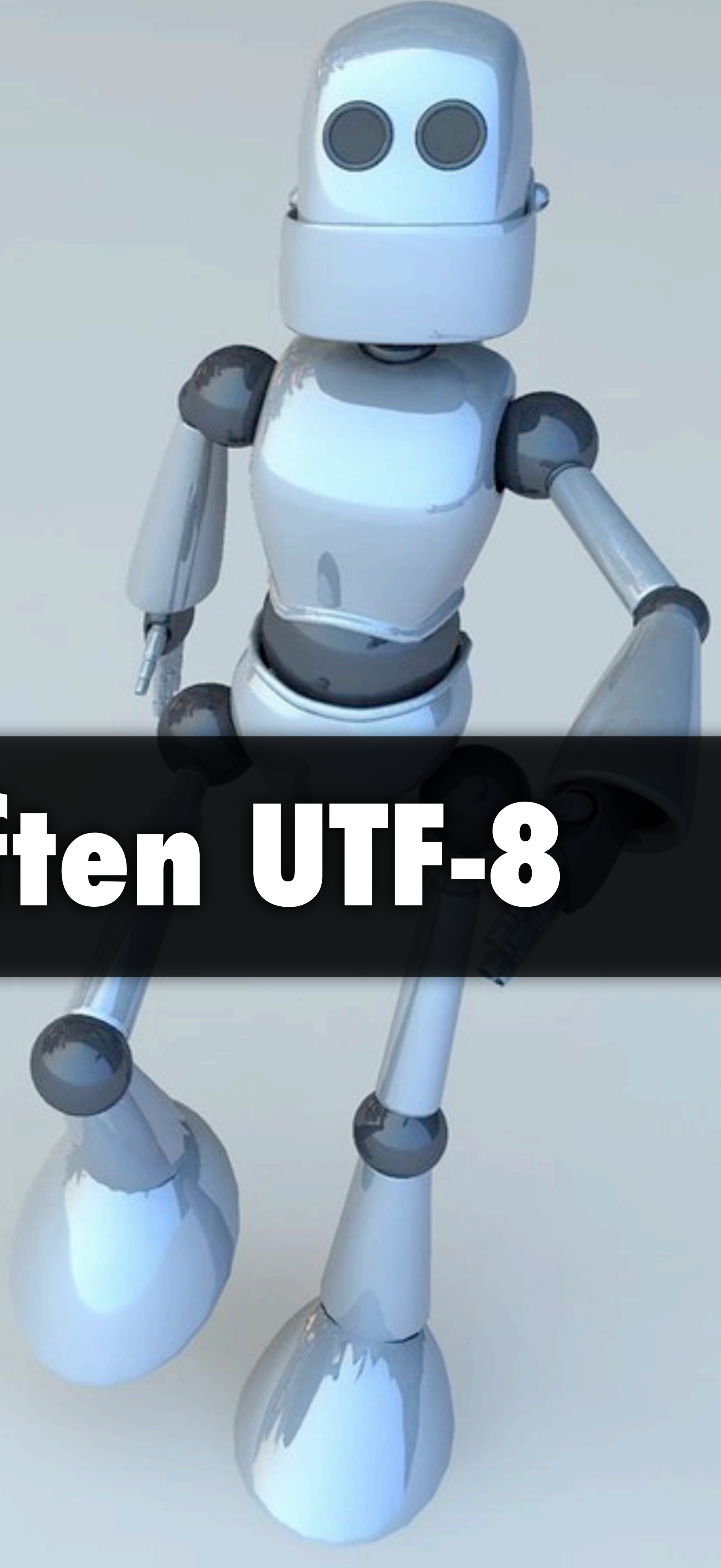
- Set-Cookie
- Server

## What does HTTP say?



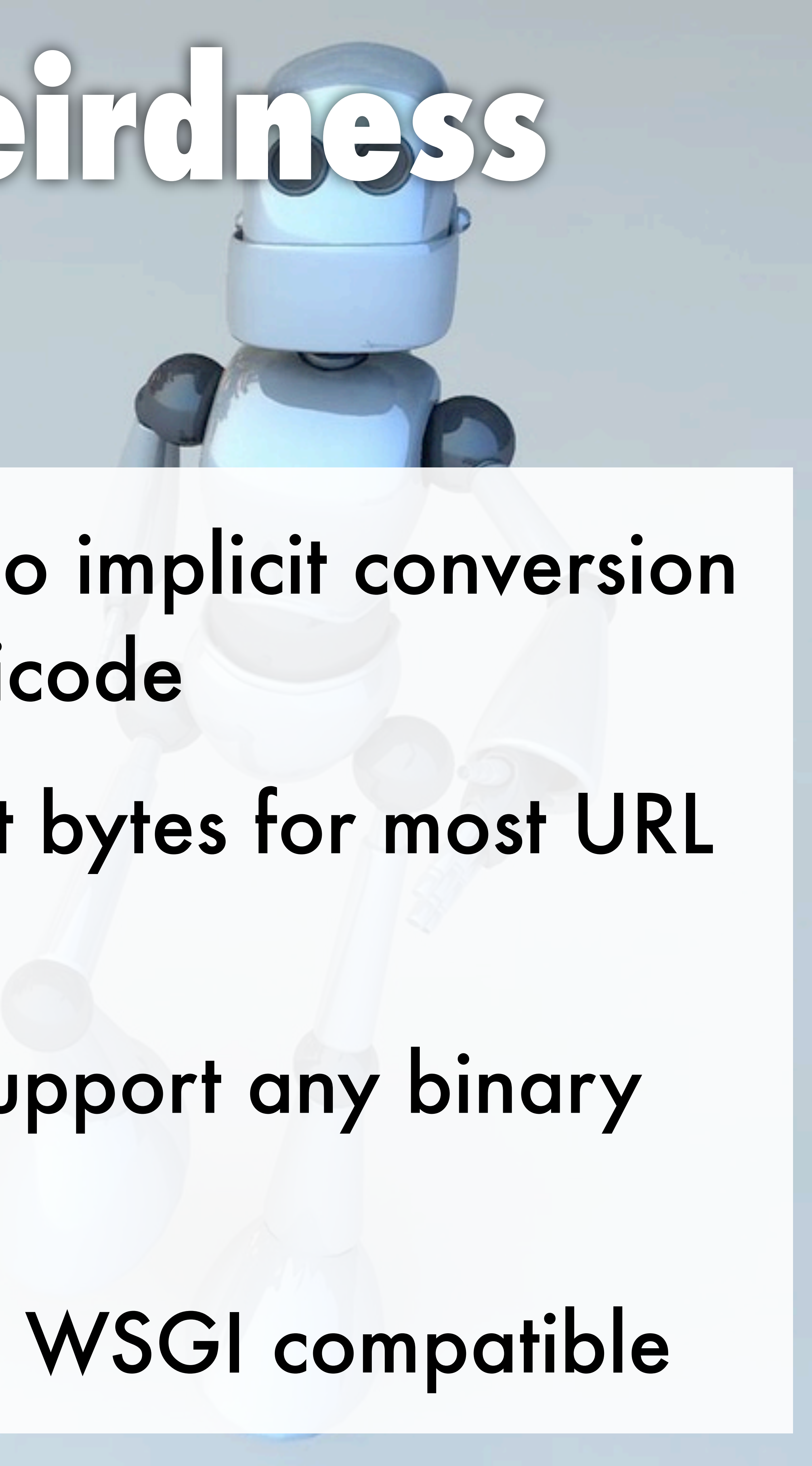
headers are supposed
to be ISO-8859-1

## In practice?



cookies are often UTF-8

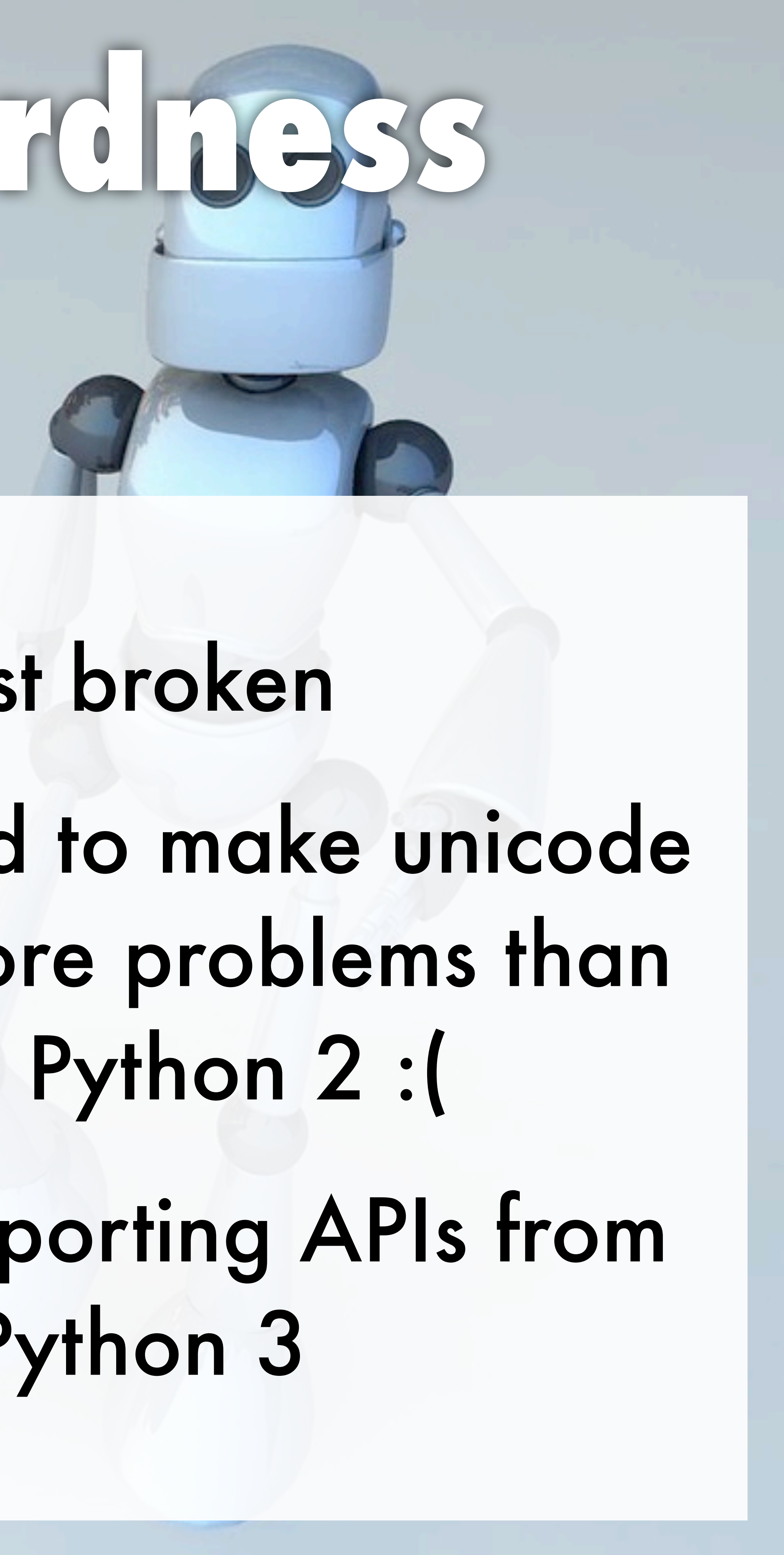
# Checklist of Weirdness



the status:

1. only one string type, no implicit conversion between bytes and unicode
2. stdlib does not support bytes for most URL operations (!?)
3. cgi module does not support any binary data at the moment
4. CGI no longer directly WSGI compatible

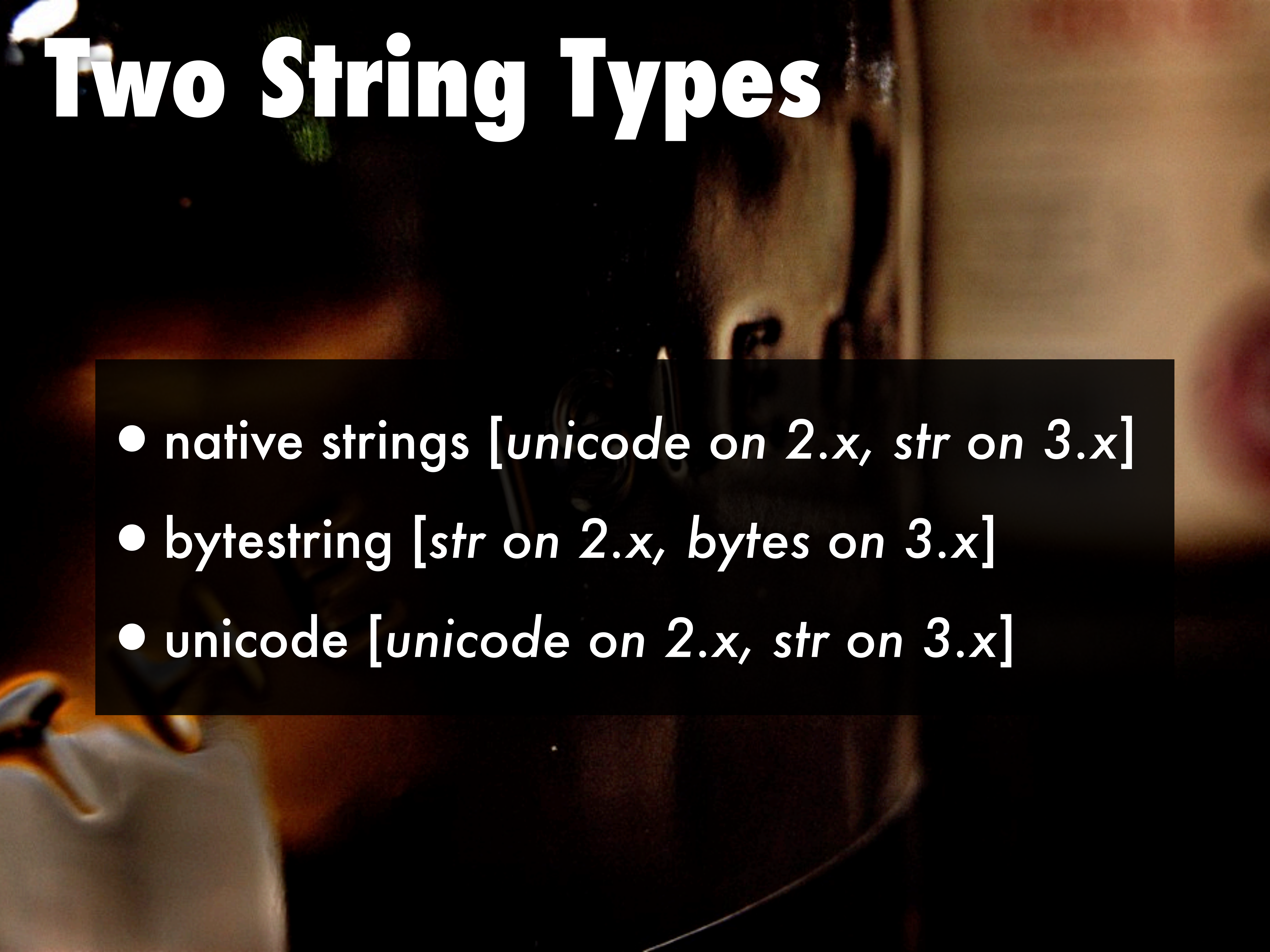
## Checklist of Weirdness



the status:

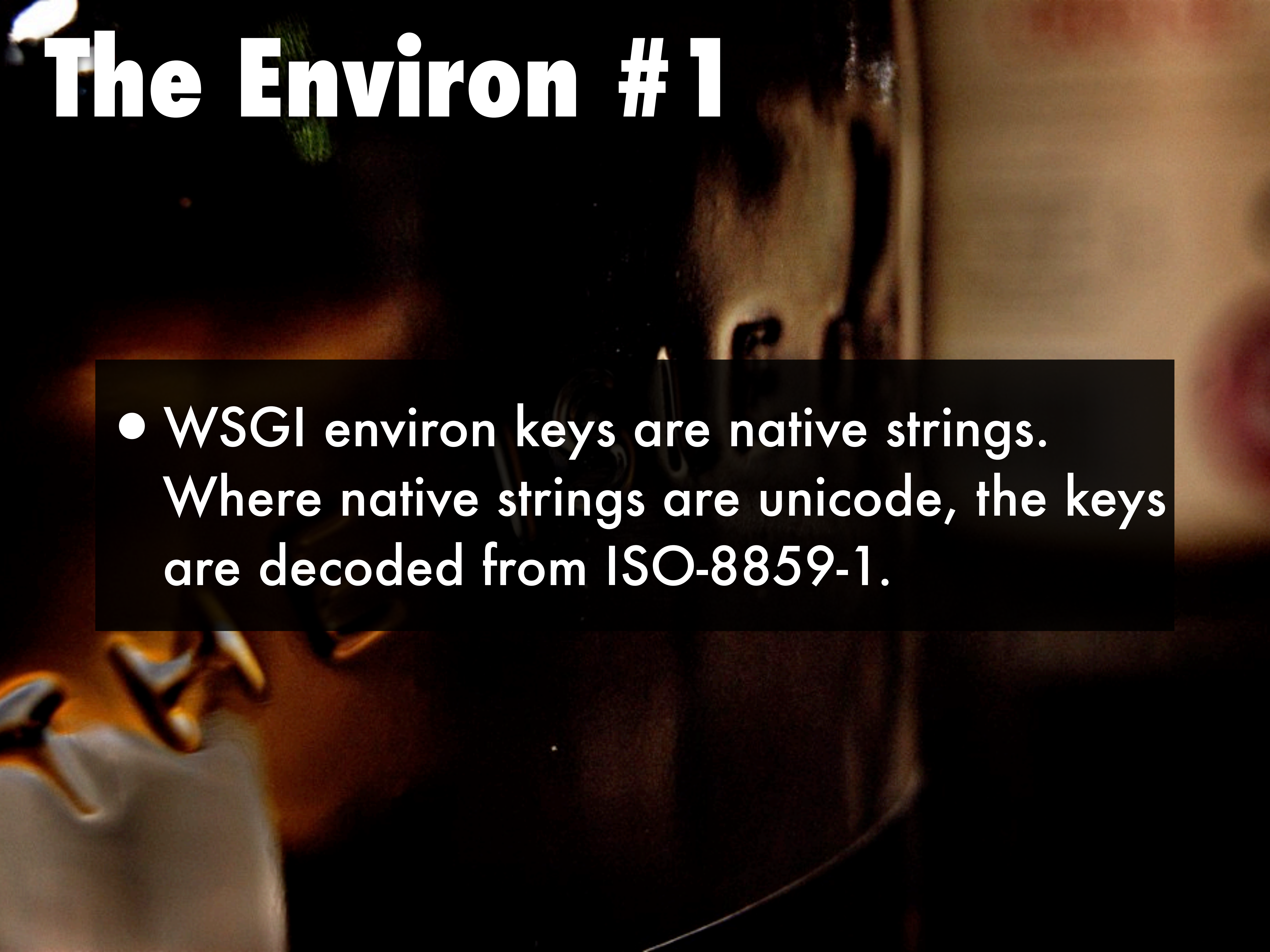
5. wsgiref on Python 3 is just broken
6. Python 3 that is supposed to make unicode easier is causing a lot more problems than unicode environments on Python 2 :(
7. 2to3 breaks unicode supporting APIs from Python 2 on the way to Python 3

## What would Graham do?



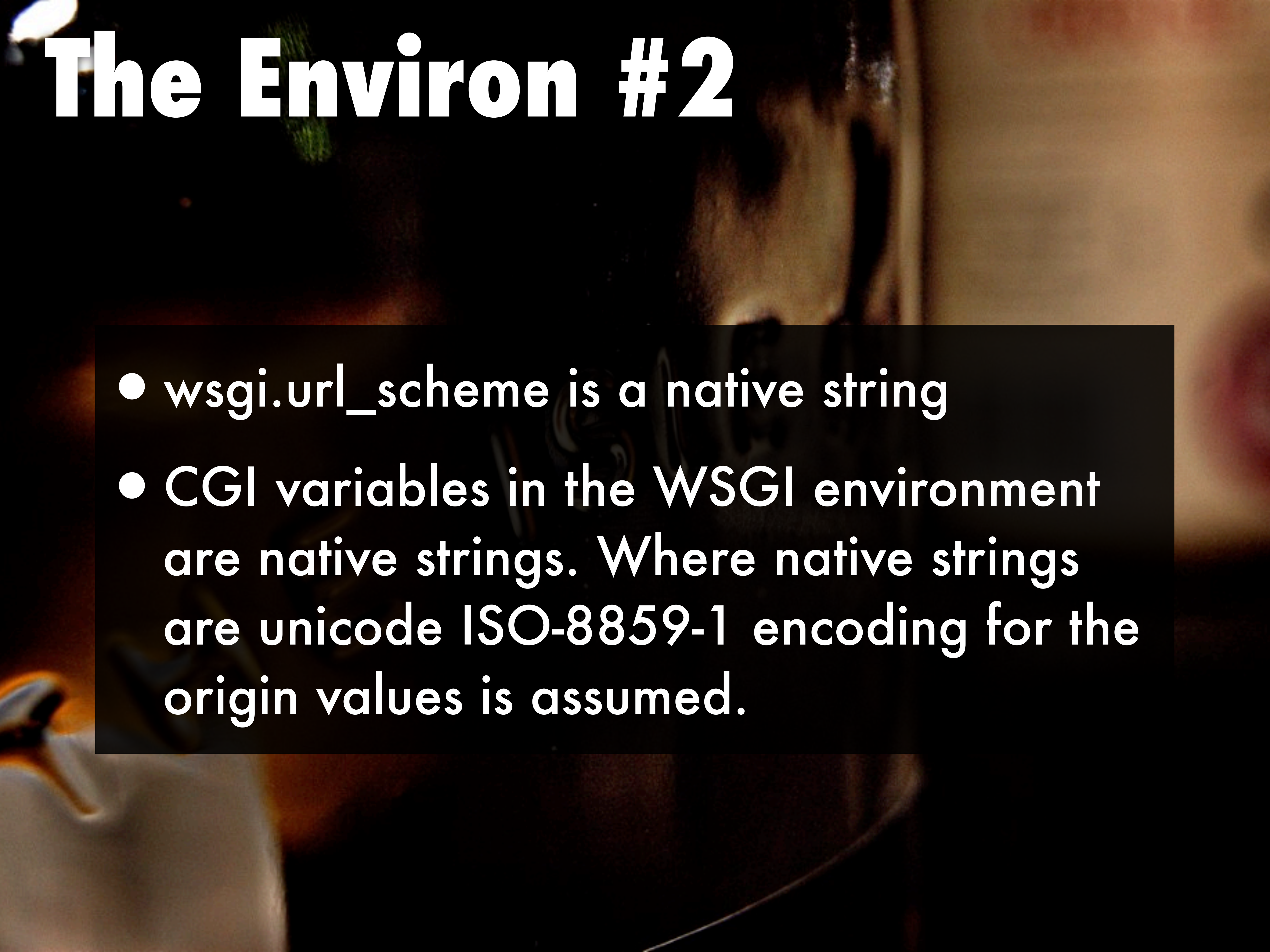
## Two String Types

- native strings [*unicode on 2.x, str on 3.x*]
- bytestring [*str on 2.x, bytes on 3.x*]
- unicode [*unicode on 2.x, str on 3.x*]



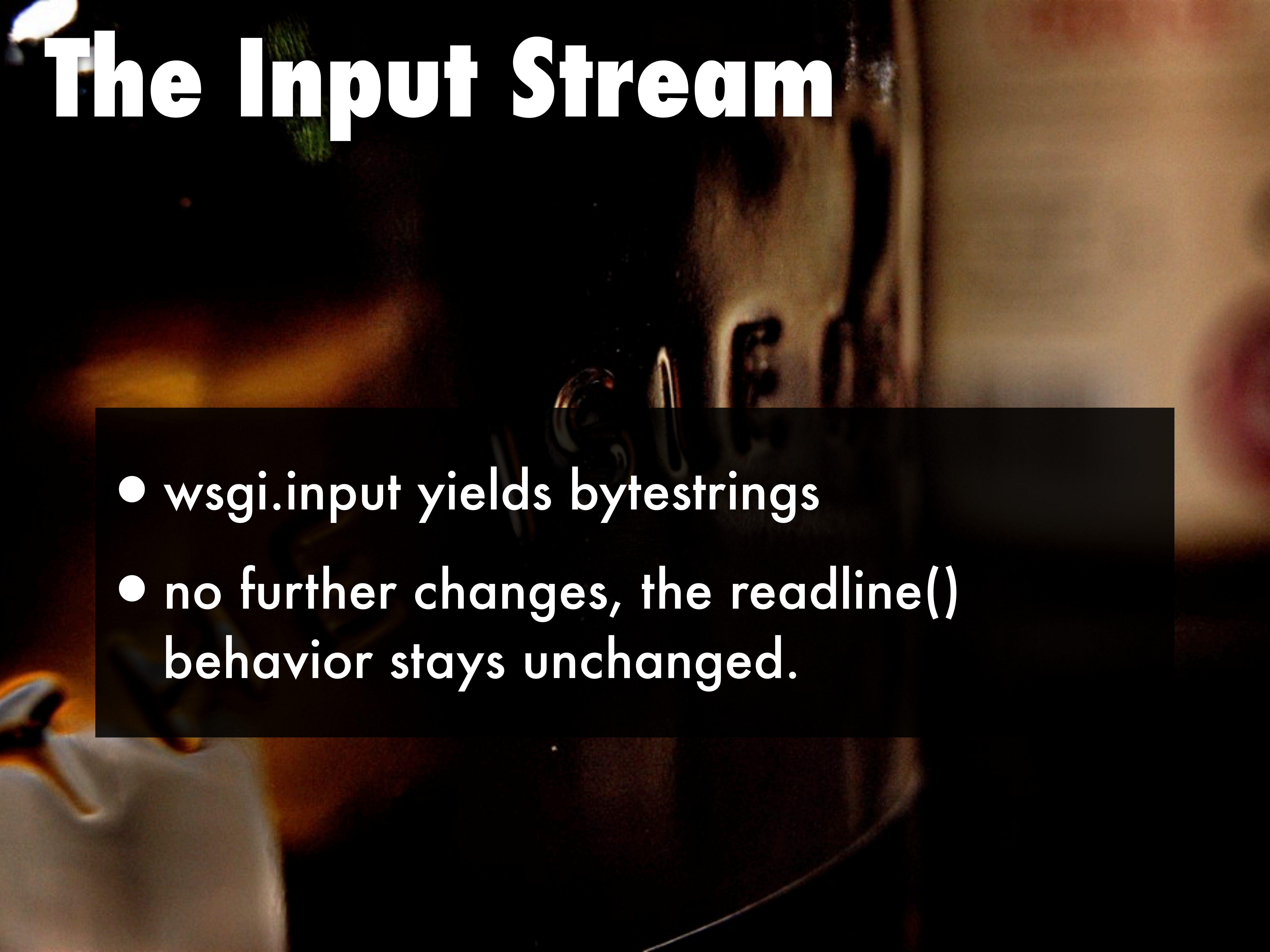
## The Environ #1

- WSGI environ keys are native strings. Where native strings are unicode, the keys are decoded from ISO-8859-1.



## The Environ #2

- wsgi.url_scheme is a native string
- CGI variables in the WSGI environment are native strings. Where native strings are unicode ISO-8859-1 encoding for the origin values is assumed.

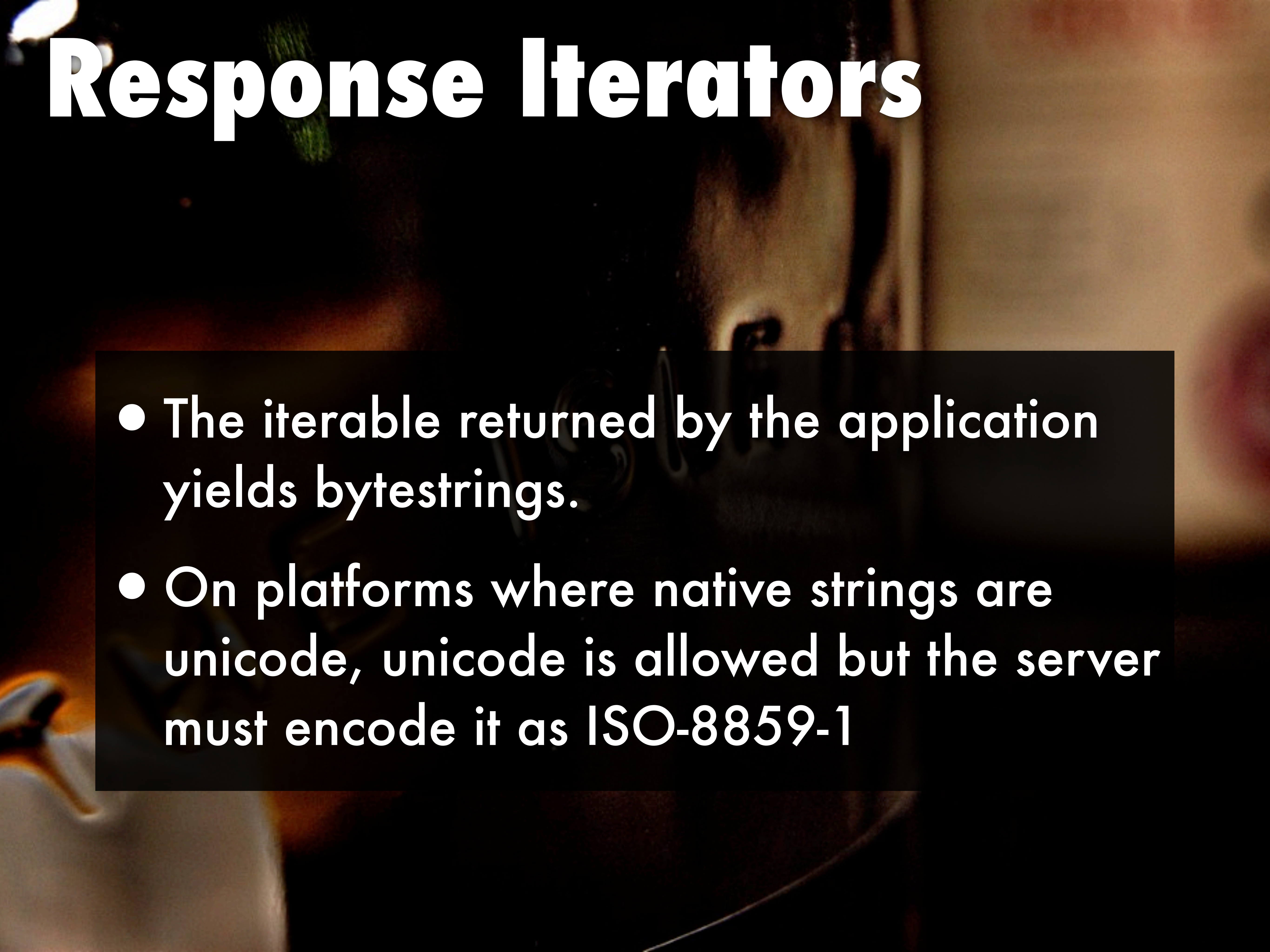


## The Input Stream

- wsgi.input yields bytestrings
- no further changes, the readline() behavior stays unchanged.

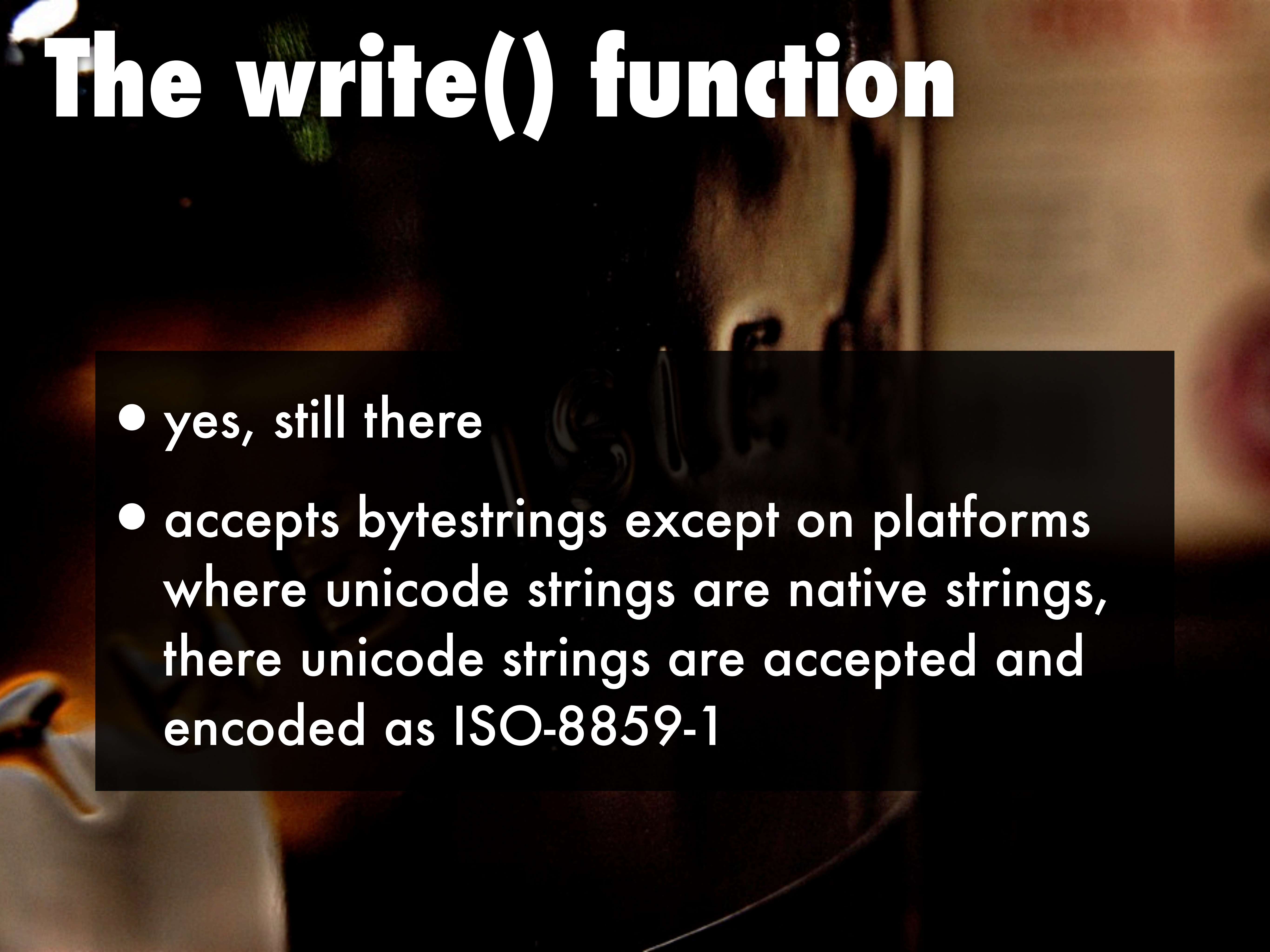
# Response Headers

- status strings and headers are bytestrings.
- On platform where native strings are unicode, native strings are supported but the server encodes them as ISO-8859-1



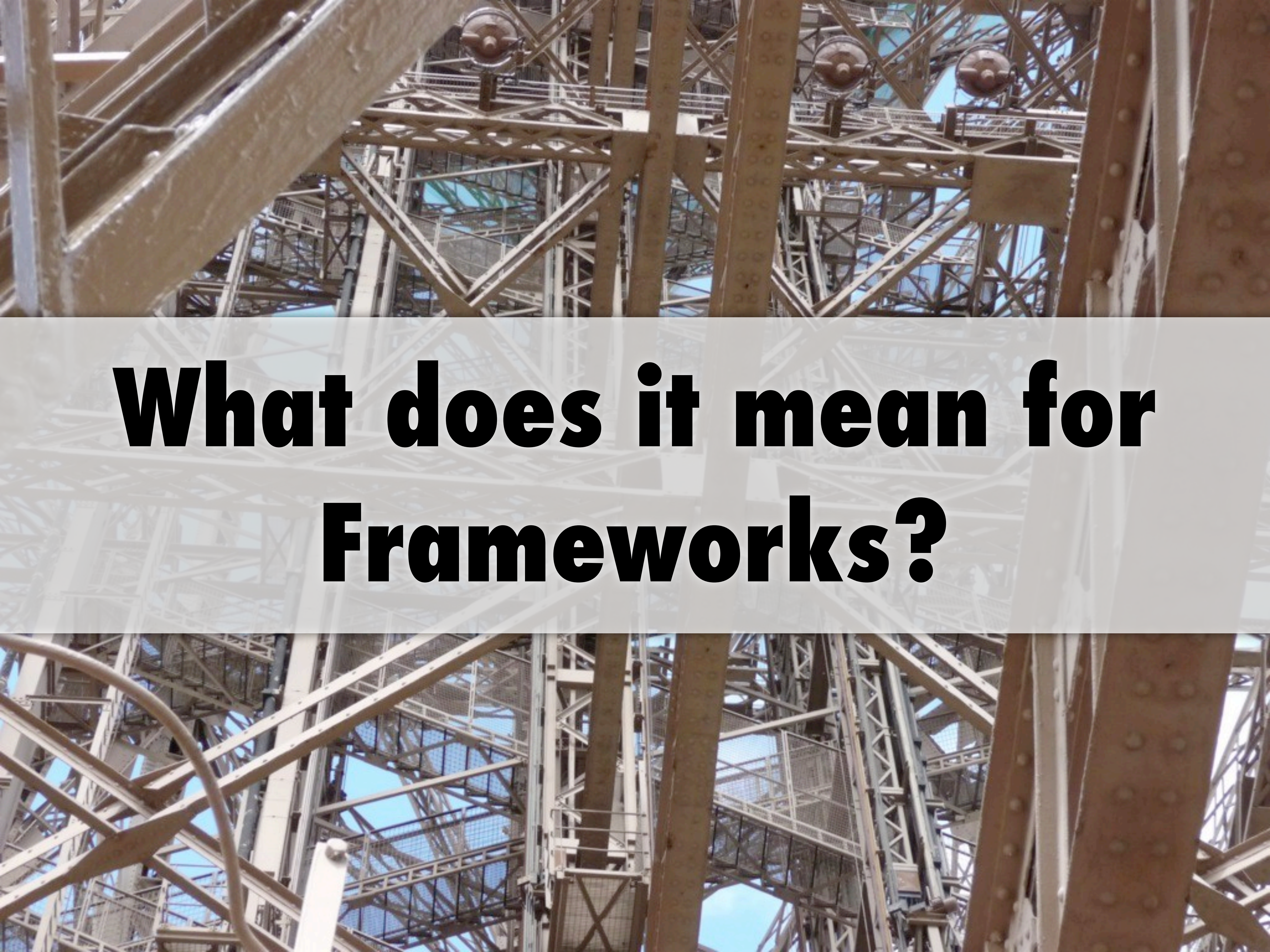
## Response Iterators

- The iterable returned by the application yields bytestrings.
- On platforms where native strings are unicode, unicode is allowed but the server must encode it as ISO-8859-1



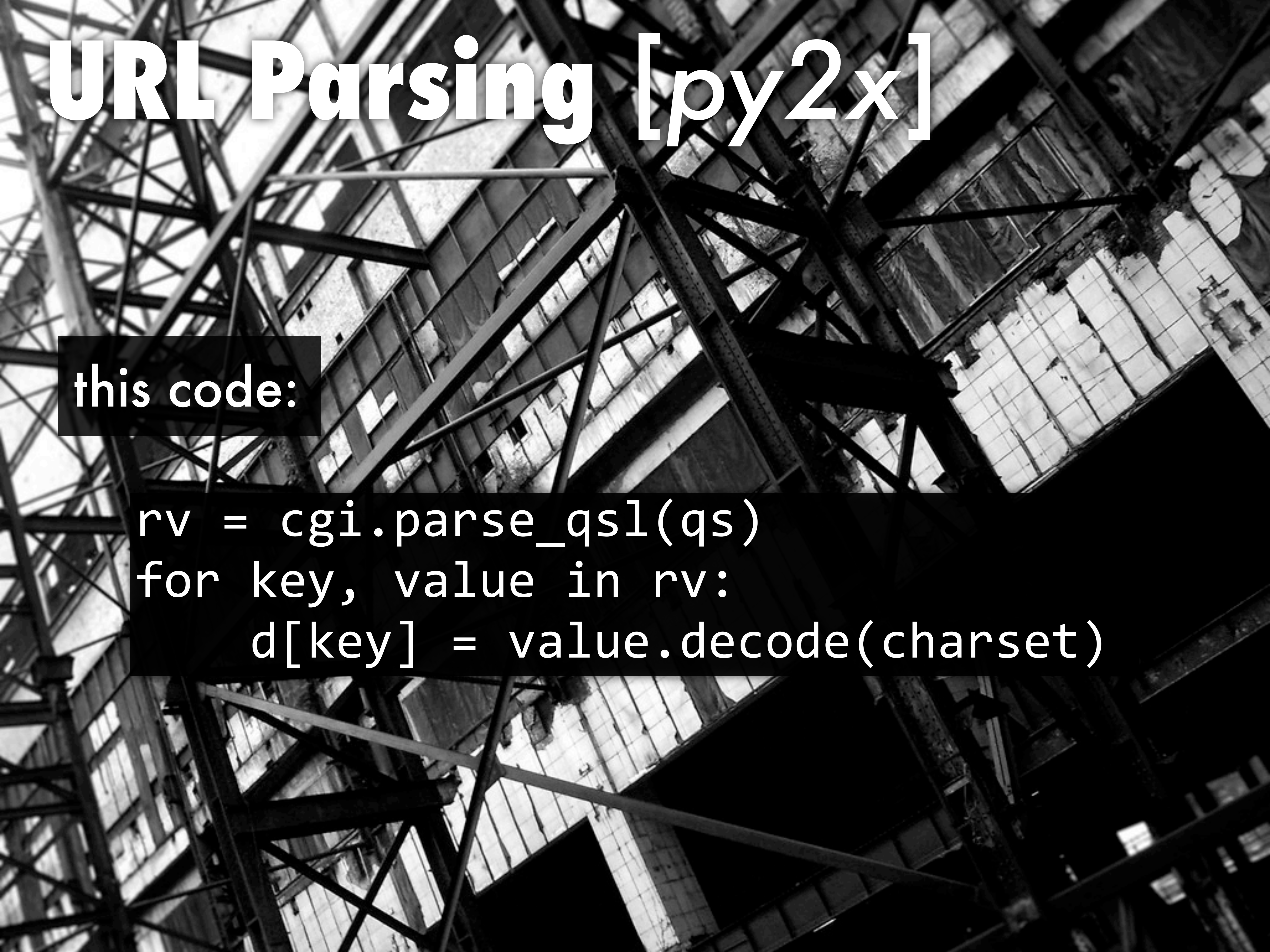
## The write() function

- yes, still there
- accepts bytestrings except on platforms where unicode strings are native strings, there unicode strings are accepted and encoded as ISO-8859-1



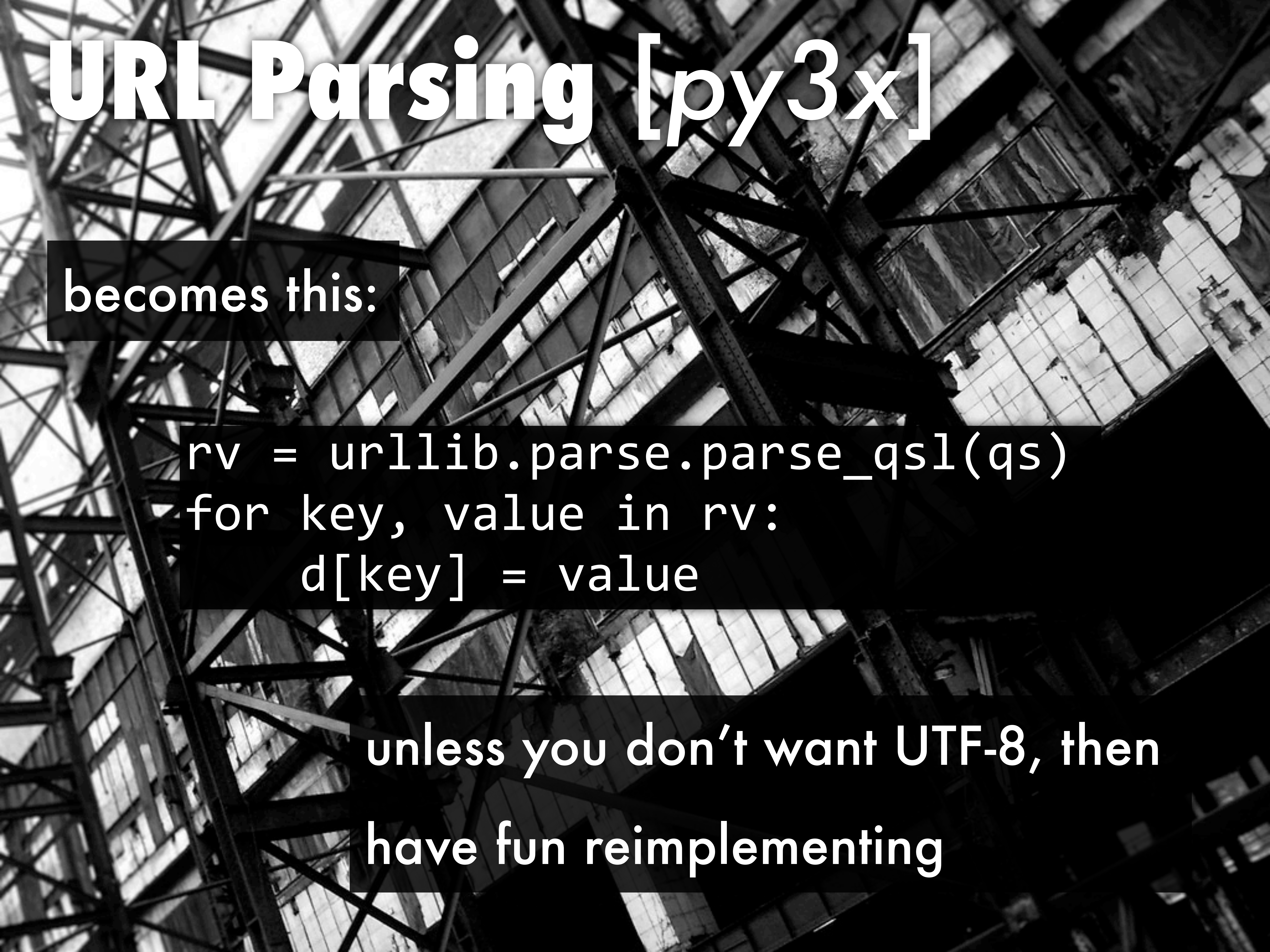
## What does it mean for Frameworks?

# URL Parsing [*py2x*]



this code:

```
rv = cgi.parse_qsl(qs)
for key, value in rv:
    d[key] = value.decode(charset)
```



## URL Parsing [*py3x*]

becomes this:

```
rv = urllib.parse.parse_qsl(qs)
for key, value in rv:
    d[key] = value
```

unless you don’t want UTF-8, then have fun reimplementing

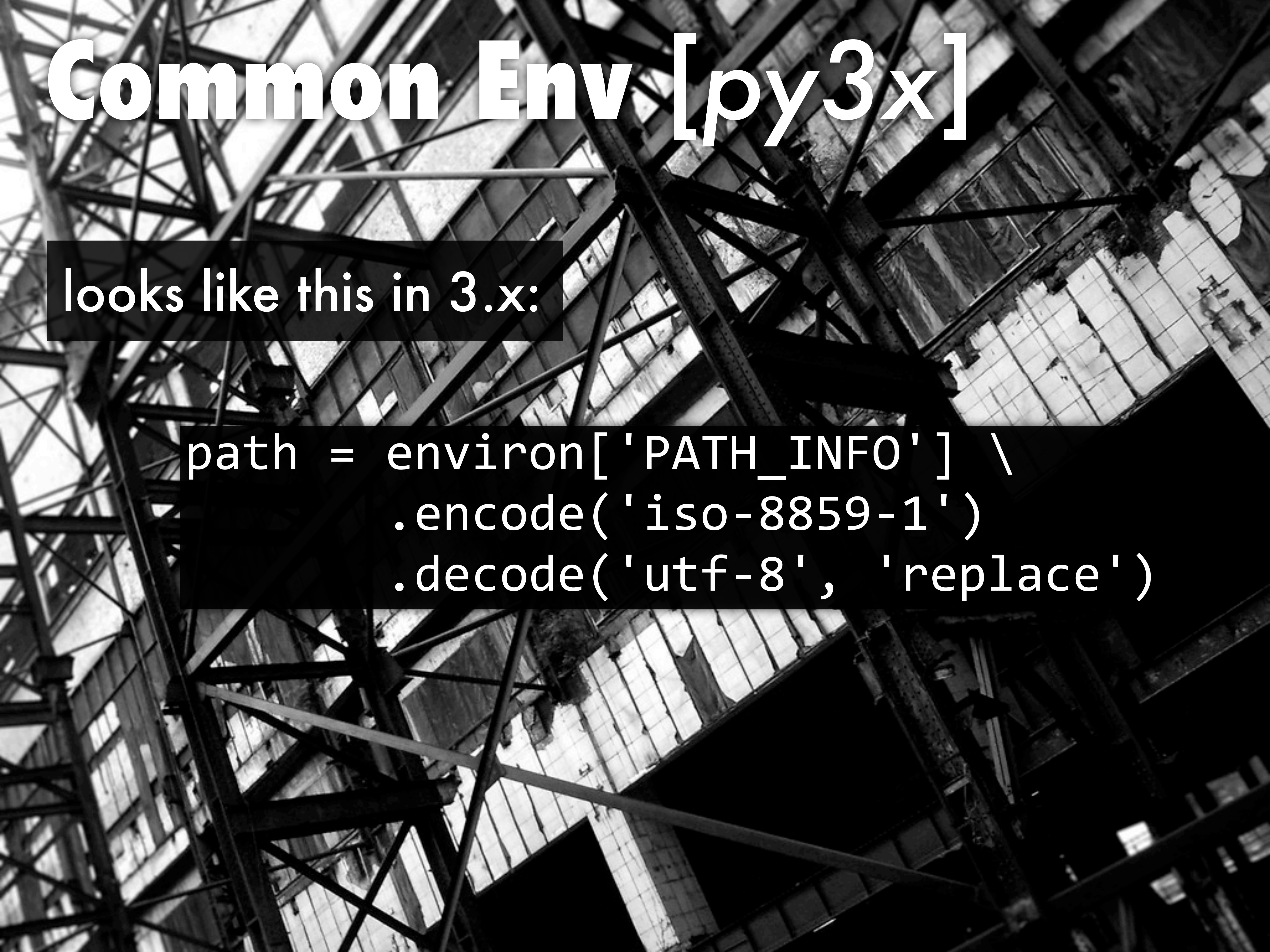
## Form Parsing

roll your own. cgi.FieldStorage was broken in 2.x regarding WSGI anyways. Steal from Werkzeug/Django

## Common Env [py2x]

this handy code:

```
path = environ['PATH_INFO'] \
         .decode('utf-8', 'replace')
```



## Common Env [py3x]

looks like this in 3.x:

```
path = environ['PATH_INFO'] \
         .encode('iso-8859-1')
         .decode('utf-8', 'replace')
```

## Middlewares in [*py*2x]

this common pattern:

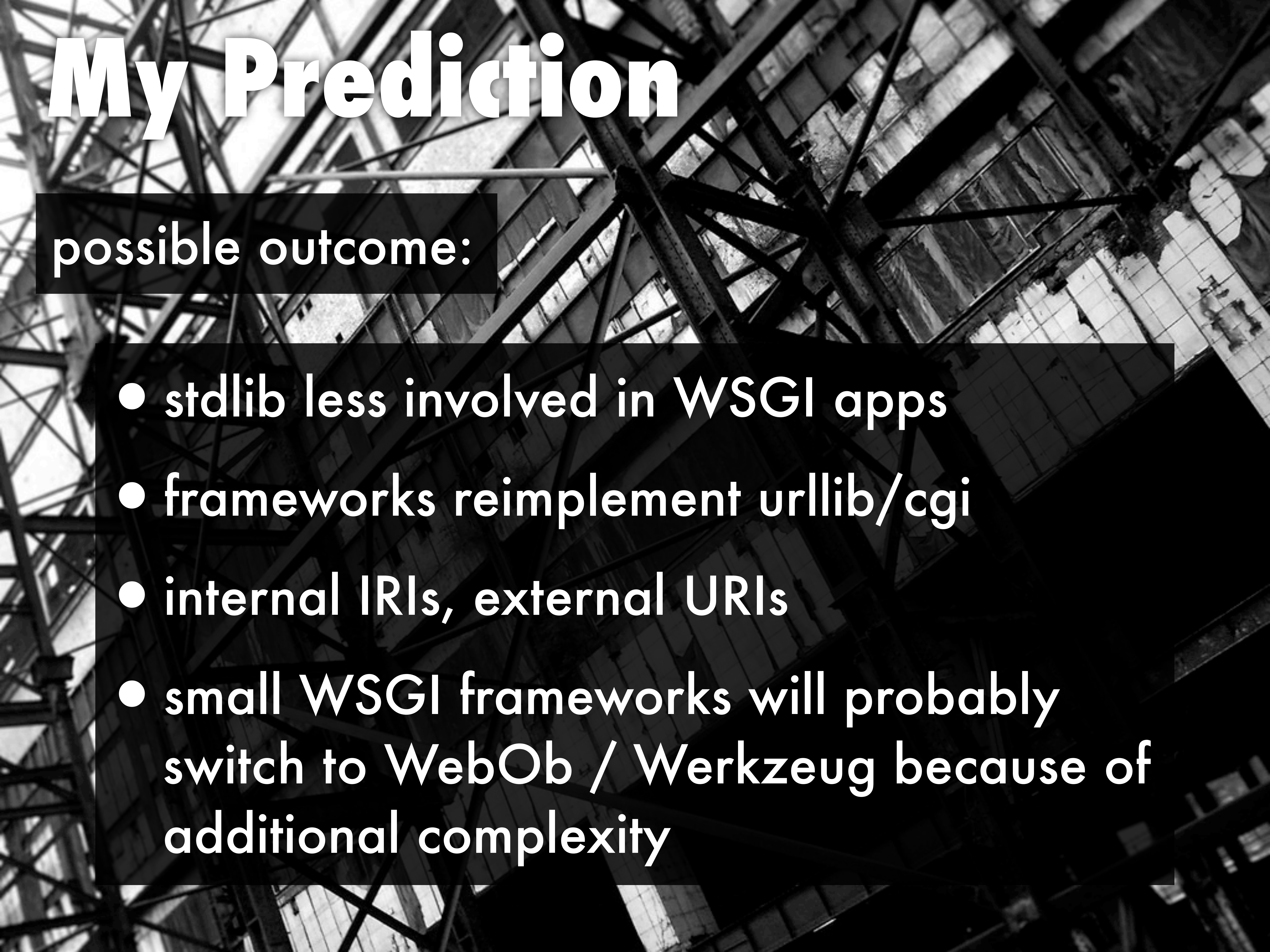
```
def middleware(app):
  def new_app(environ, start_response):
    is_html = []
    def new_start_response(status, headers,
                           exc_info=None):
      if any(k.lower() == 'content-type' and
             v.split(';')[0].strip() == 'text/html'):
        is_html.append(True)
      return start_response(status, headers, exc_info)
    rv = app(environ, new_start_response)
    ...
  return new_app
```

# Middlewares in [*py3x*]

becomes this:

```
def to_bytes(x):
  return x.encode('iso-8859-1') if isinstance(x, str) else x

def middleware(app):
  def new_app(environ, start_response):
    is_html = []
    def new_start_response(status, headers,
                           exc_info=None):
      if any(to_bytes(k.lower()) == b'content-type' and
             to_bytes(v).split(b';')[0].strip() == b'text/html'):
        is_html.append(True)
      return start_response(status, headers, exc_info)
    rv = app(environ, new_start_response)
    ...
  return new_app
```

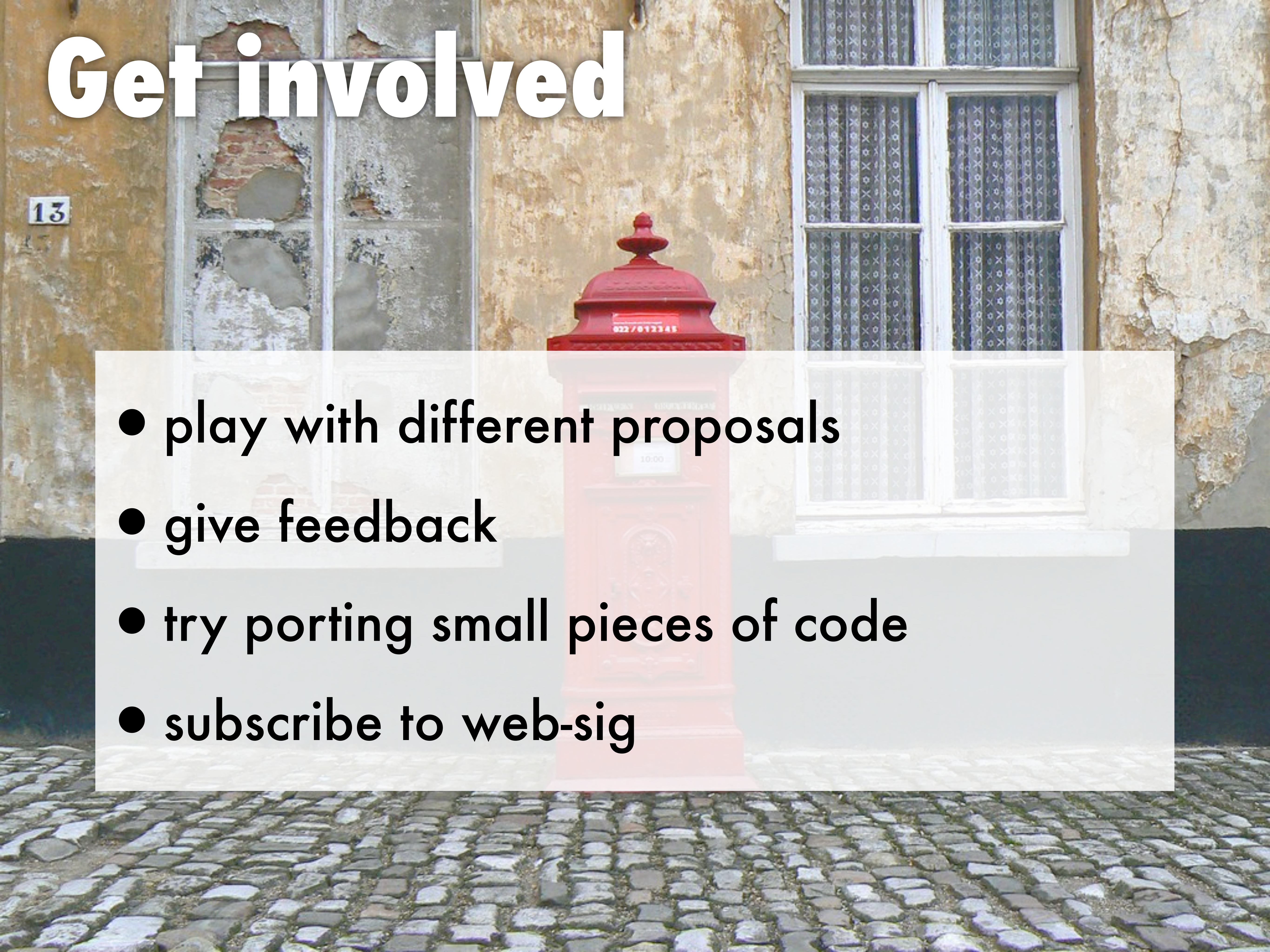


## My Prediction

possible outcome:

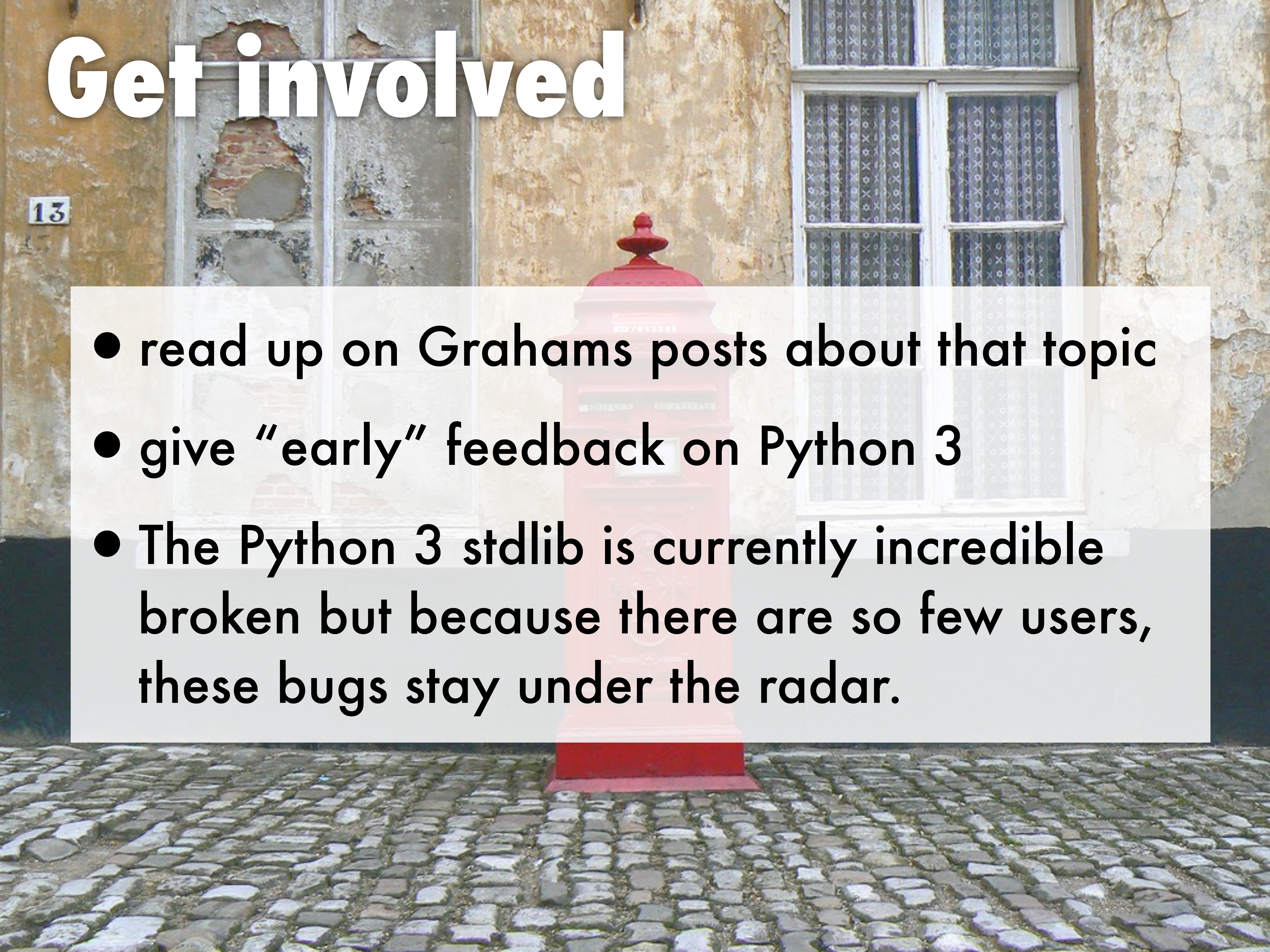
- stdlib less involved in WSGI apps
- frameworks reimplement urllib/cgi
- internal IRIs, external URIs
- small WSGI frameworks will probably switch to WebOb / Werkzeug because of additional complexity

## *My very own* **Pony Request**



## Get involved

- play with different proposals
- give feedback
- try porting small pieces of code
- subscribe to web-sig



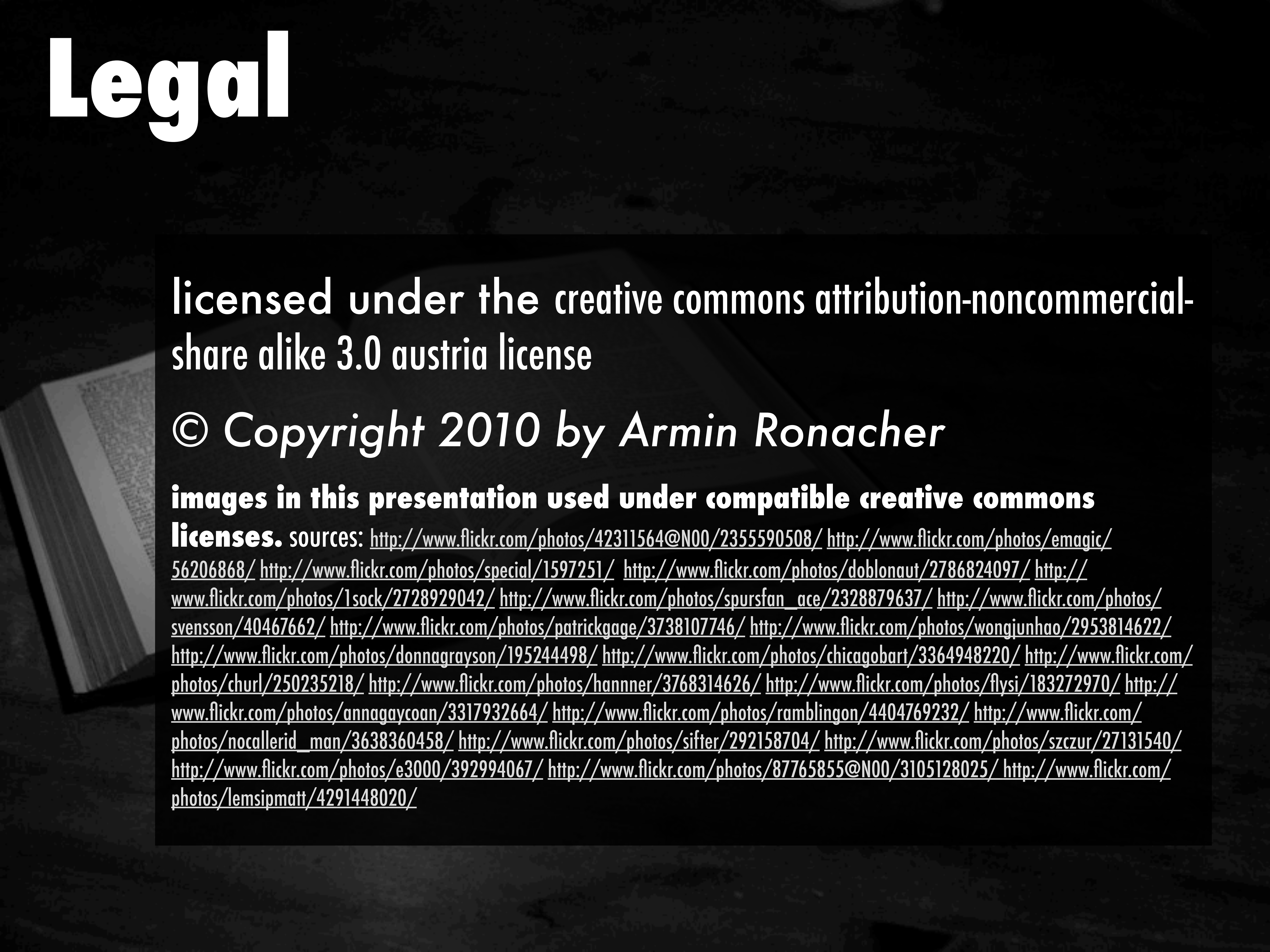
## Get involved

- read up on Grahams posts about that topic
- give “early” feedback on Python 3
- The Python 3 stdlib is currently incredible broken but because there are so few users, these bugs stay under the radar.

*Remember:*

## 2.7 is the last 2.x release

## Questions?



## Legal