Constricting the Web

Offensive Python for Web Hackers

Yes, We are Weird

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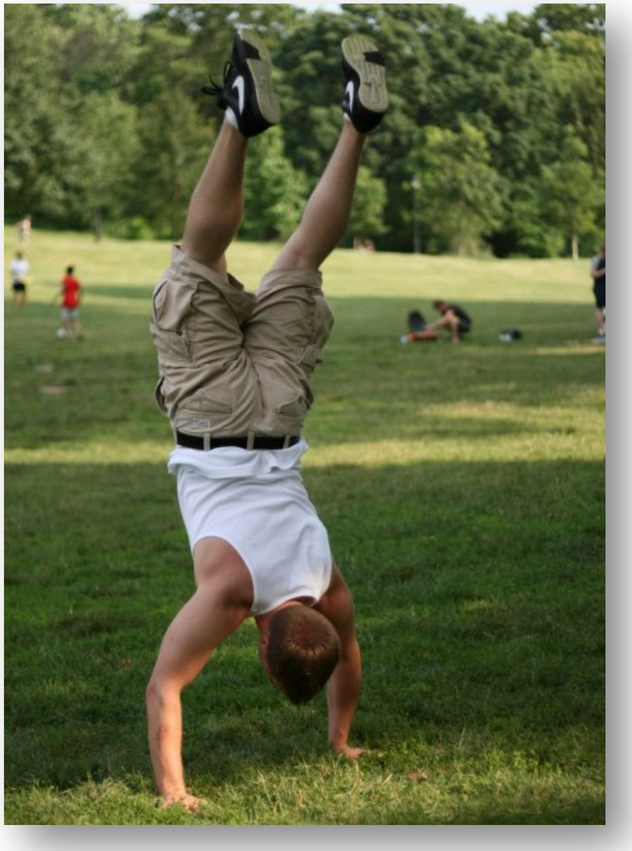
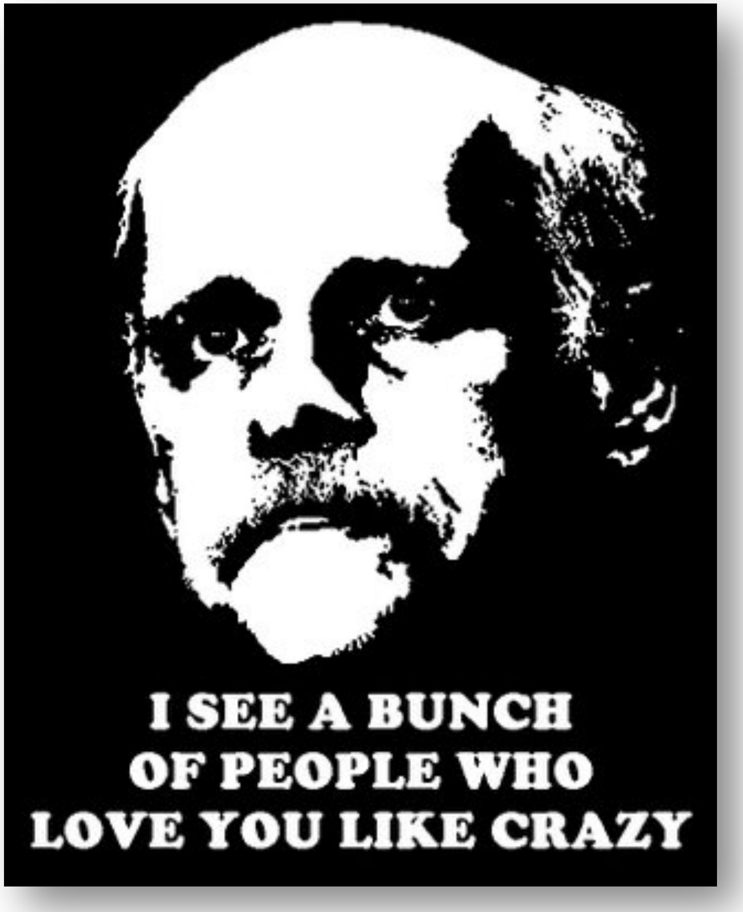


This is Important

- Reliance on tools can = Fail!
  - Many more people testing web apps
  - Vendors play catch-up
  - Success is on your shoulders
- Difficult cases
  - APIs and specialized data formats
  - Sequenced operations
  - Randomized data

An AppSec Intervention



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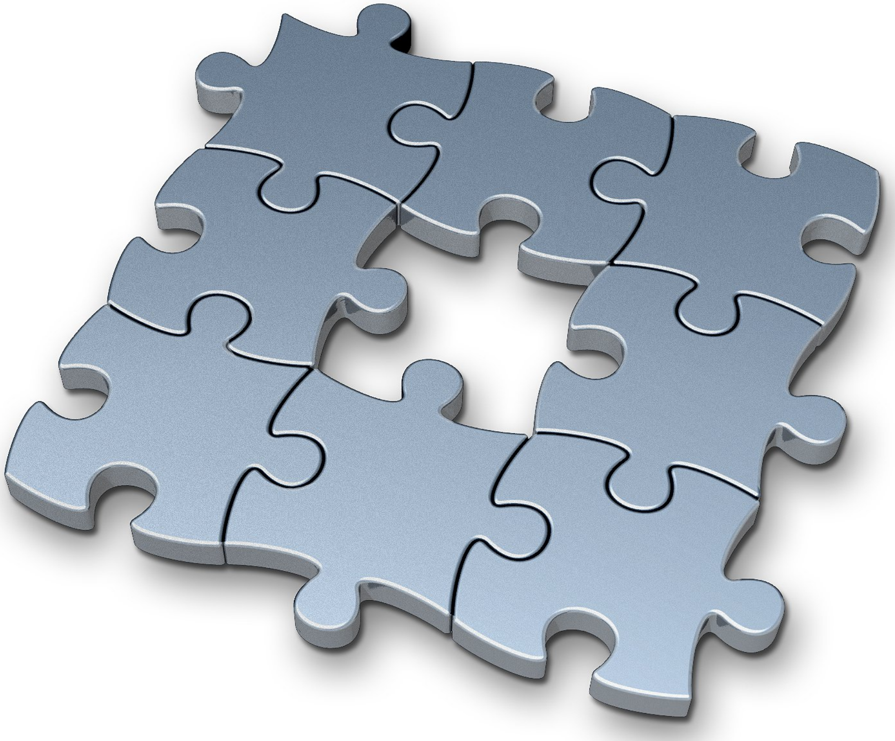
Why Python?

- Language specific
  - Object-oriented
  - Byte compiled
  - Fast
- Wide support
  - Many security tools written in Python
  - Plenty of help available
  - Plenty of resources for learning available

Where Does Python Fit?



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A Few Tools

Scapy sulley Pyscan

w3af SpikeProxy MonkeyFist

sqlmap Canvas wapiti

Peach DeBlaze ProxyStrike

Pcapy MyNav Idapython

Python Implementations

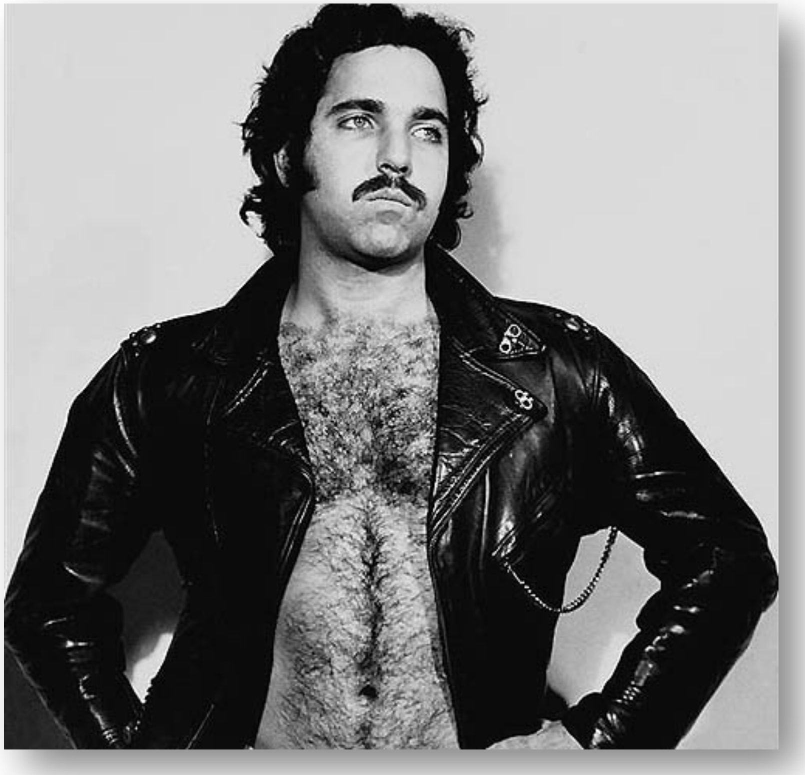
- CPython
  - http://python.org
- Jython
  - http://jython.org
- IronPython
  - http://ironpython.net

Want To Learn Python

- Start with http://python.org
  - http://docs.python.org/
  - http://docs.python.org/tutorial/index.html
- Google's Python Class
  - http://code.google.com/edu/languages/google-python-class/
- There are differences between Python 2.x and 3.x

First Things First

- Walk like a duck and quack like a duck



Helpful Modules

Standard Lib

- httplib
- urllib / urllib2
- urlparse
- HTMLParser
- struct
- xml
- json (Python 2.6)
- difflib

3rd Party

- httplib2
- lxml
- zsi / suds
- PyAMF
- pydermonkey
- Twisted

Capabilities of HTTP Modules

- httplib
  - Standard HTTP Module
  - Good for GETs and POSTs
  - HTTP / HTTPS support
- httplib2
  - Expanded HTTP method support
  - Supports various auth methods
  - Automatically follows 3xx redirects

More Modules

- urllib
  - High level module for opening resources
  - Has URL encoding capabilities
- urllib2
  - Expanded support for handlers
- Merged in Python 3 along with urlparse

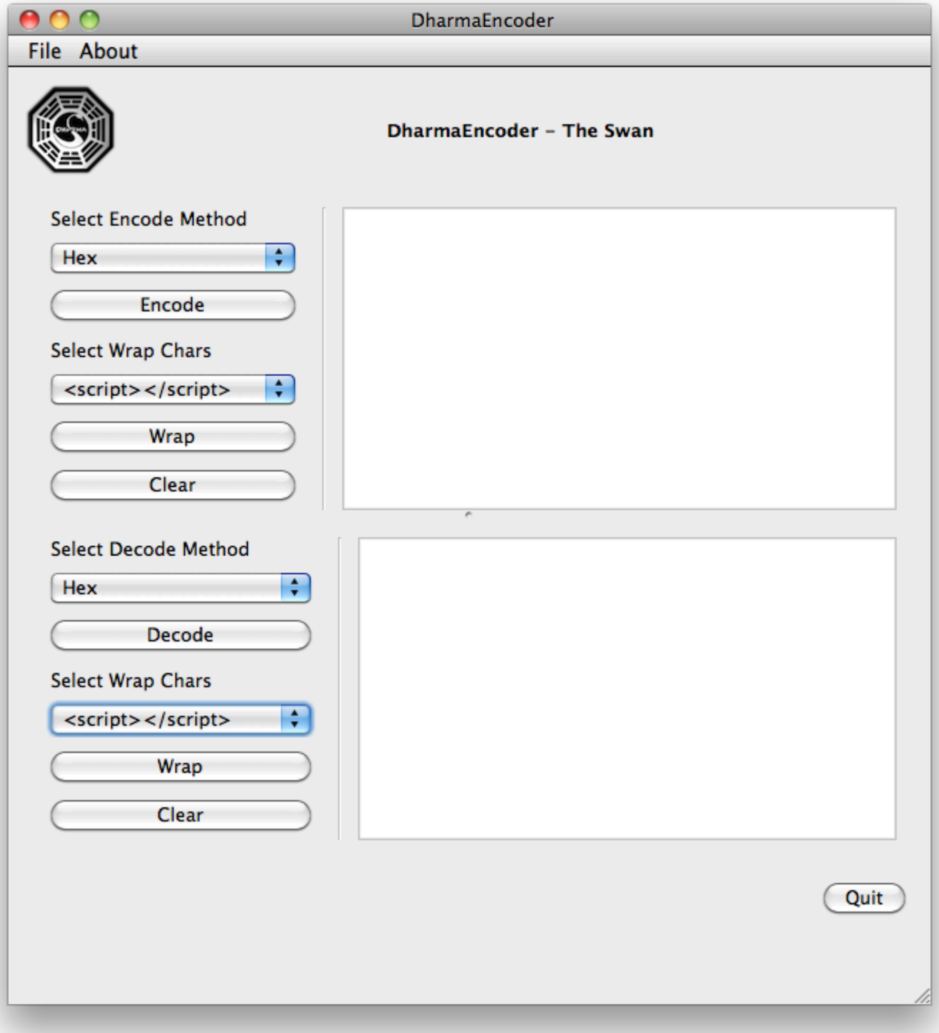
Basic HTTP Clients

- Examples

Encoding and Data Types

- Perform transition magic
  - URL encoding and Escaping
  - String methods (base64 / hex / rot13, etc)
  - Data representations (decimals / entities / etc)
- DharmaEncoder
  - Provides methods to encode and wrap values
  - http://hexsec.com/labs

DharmaEncoder



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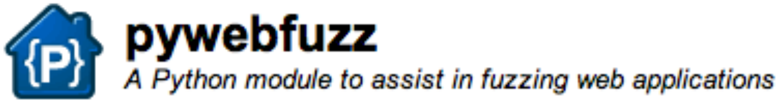
Fuzz Cases

- Do the legwork
  - Know your app
  - Know your parameters
  - Know your data
- Work smarter
  - Create accurate ranges
  - itertools methods
  - Don’t empty the clip

pywebfuzz

- Web fuzzing lib for Python
  - http://code.google.com/p/pywebfuzz/
  - Usable in Python 2.x
  - Easy to distributable and repeat tests
- Convenience
  - Fuzzdb values accessible through classes
  - Request Logic
  - Range generation and encoding /decoding



pywebfuzz

A Python module to assist in fuzzing web applications

pywebfuzz Examples

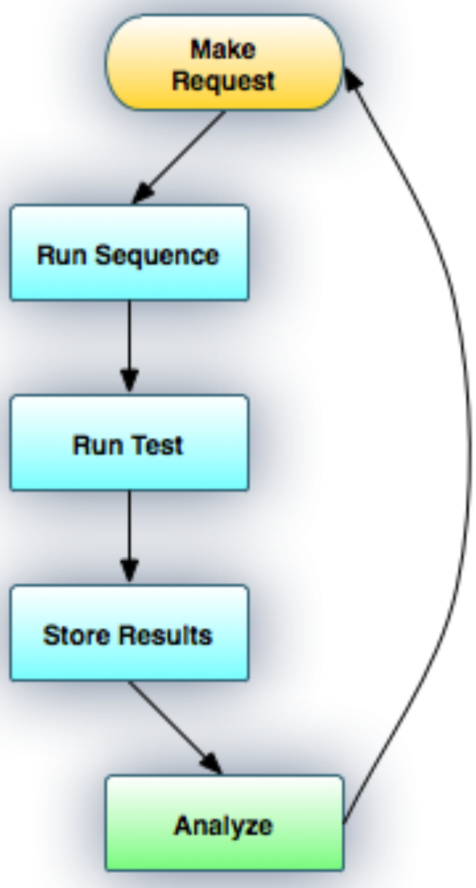
- Basic request fuzzing
- Finding an error condition

Parsing Content

- First things first
  - Determine content type, use appropriate parser
  - Don’t use HTMLParser

```
if html:
    use lxml.html
elif xhtml:
    use lxml.etree
elif xml:
    use lxml.etree
elif json:
    use json
```

Sequenced Operations



Sequence Difficulties

- State Issues
  - Account login / logout
  - Randomized values
  - Maintaining proper state while testing
- Request
  - Process headers (referer and cookies)
  - Unable to parse content properly
  - Resort to regular expressions

Test Driving the Browser

- Selenium
  - – http://seleniumhq.org/
- Windmill
  - – http://www.getwindmill.com/

Browser Integration

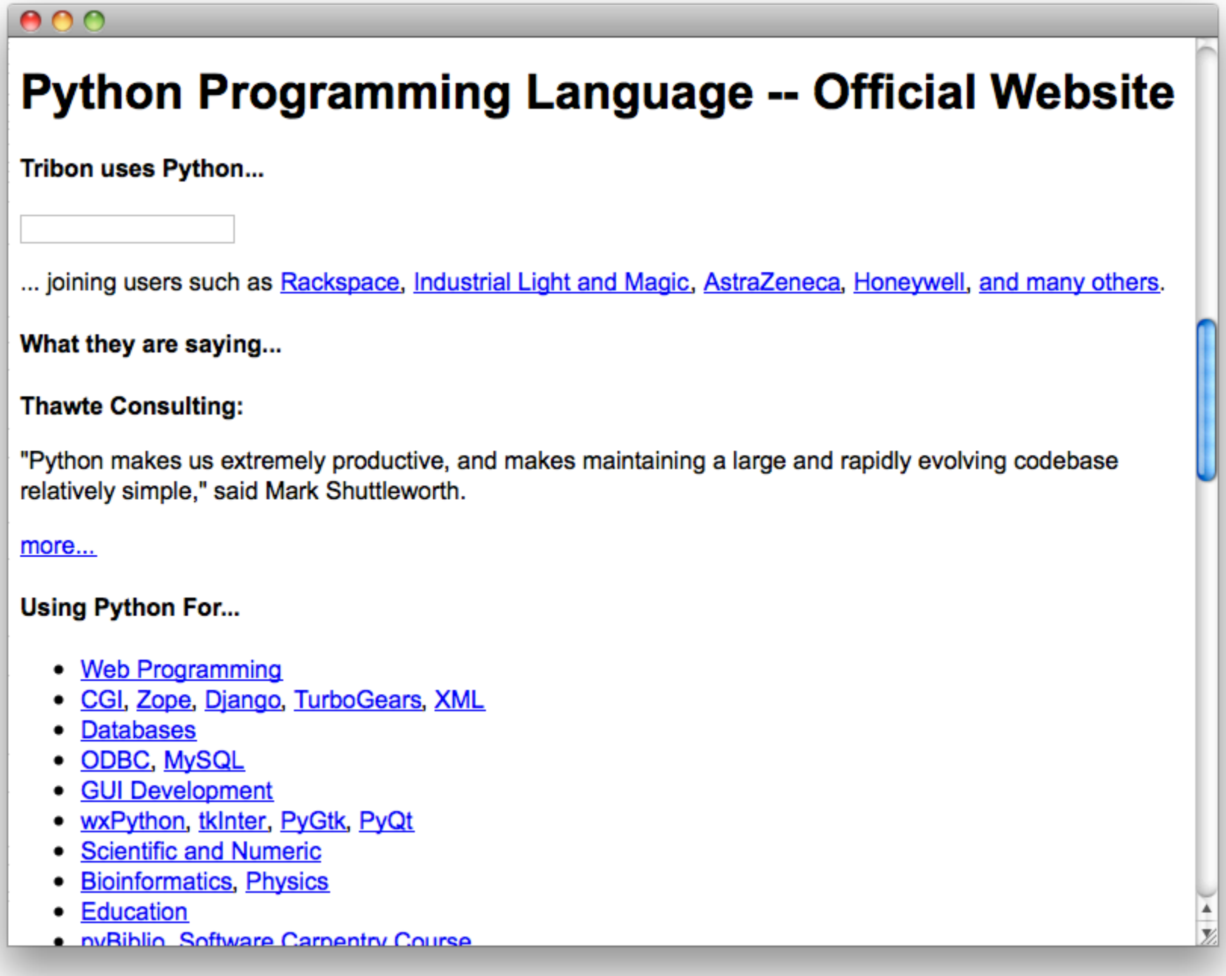
- Firefox / XULRunner
  - pyxpcomext
    - http://pyxpcomext.mozdev.org/no_wrap/tutorials/pyxulrunner/python_xulrunner_about.html
- Webkit
  - PyGtk / PyWebKitGtk
    - http://code.google.com/p/pywebkitgtk/
  - PyQT
    - http://wiki.python.org/moin/PyQt4
  - PySide (Official Support from Nokia)
    - http://www.pyside.org/

Webviews

- Render returned requests from other libs in just a couple of lines of code

```
from PyQt4.QtGui import *
from PyQt4.QtWebKit import *
import httplib2

http = httplib2.Http()
headers, content = http.request("http://python.org", "GET")
app = QApplication(sys.argv)
web = QWebView()web.setHtml(content)
web.show()
sys.exit(app.exec_())
```

Example



Python Programming Language -- Official Website

Tribon uses Python...

... joining users such as Rackspace, Industrial Light and Magic, AstraZeneca, Honeywell, and many others.

What they are saying...

Thawte Consulting:

"Python makes us extremely productive, and makes maintaining a large and rapidly evolving codebase relatively simple," said Mark Shuttleworth.

more...

Using Python For...

- Web Programming
- CGI, Zope, Django, TurboGears, XML
- Databases
- ODBC, MySQL
- GUI Development
- wxPython, tkInter, PyGtk, PyQt
- Scientific and Numeric
- Bioinformatics, Physics
- Education
- pyBiblio, Software Carpentry Course

Web Services

- Traditional
  - ZSI
  - Suds
- RESTful
  - Both High and Low Rest
  - httplib
  - httplib2

Web Services Examples

- Example

Passive Content Analysis

- Identify issues passively
  - Cookie issues
  - Cache-control
  - Encoding issues
- Augment other tools
  - Perform inspection on captured data
  - Use your favorite inspection proxy
  - No need to send data to endpoint

Working with Flex

- PyAMF is most popular
- Action Message Format encoder/decoder
- Create remoting clients, gateways
- Bind client-side classes to server-side POJOs

Object Factories

- Start with a simple Python design pattern

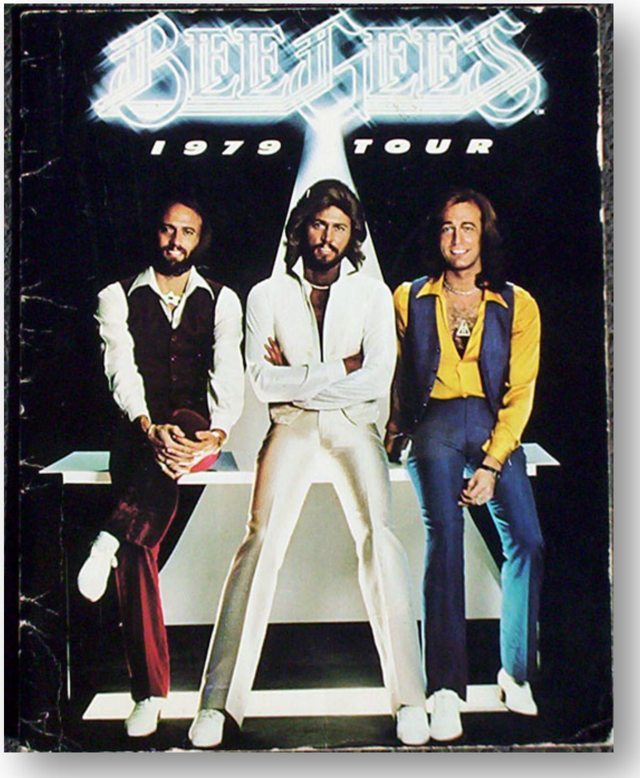
```
class Factory(object):
  def __init__(self, *args, **kwargs):
    self.__dict__.update(kwargs)

pyamf.register_class(Factory,
  "namespace.of.object.Class")
```

Binary Protocols

- You’re presented with an app that communicates via a custom binary protocol
- Oh what to do without my scanner…

Intro to Struct Module

- Convert between Python values and C structs



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Example Binary Protocol

```
U8      = unsigned 8-byte integer
U16     = unsigned 16-byte integer
UTF-8   = U16 * (UTF8-char) ; as defined in RFC3629
DOUBLE  = 8-byte IEEE-754 double precision
        ; floating point in network byte order

msg                 = message-count parameters
message-count       = U16
parameters          = number-type | boolean-type | string-type
number-marker       = 0x00
boolean-marker      = 0x01
string-marker       = 0x02
number-type         = number-marker DOUBLE
boolean-type        = boolean-marker U8
string-type         = string-marker UTF-8
```

Working with Numbers

- Write the appropriate type-marker to buffer
- Followed by the value as a Double

```
buf.write("\x00")
buf.write(struct.pack("!d", val)
```

Working with Numbers

- Reading is just the opposite
- Struct unpacks into a Tuple

```
while pos < len(buf):
  ..snip..
  if buf[pos] == "\0x00":
    pos += 1
    val = struct.unpack("!d", buf[pos:pos+8])[0]
    pos += 8
```

Booleans

- Writing a Boolean

```
def write_bool(buf, val):
  buf.write("\x01")
  buf.write(struct.pack("?", val))
```

Booleans

- Parsing a Boolean

```
while pos < len(buf) + 1:
  ..snip..
  if buf[pos] == "\0x01":
    pos += 1
    val = struct.unpack("?", buf[pos])[0]
    pos += 1
```

Strings

- Writing a String

```
def write_string(buf, val):
  u = val.encode("utf-8")
  strlen = len(u)
  buf.write("\x02")
  buf.write("H%ds" % strlen, strlen, u)
```

Strings

- Parsing a String

```
while pos < len(buf) + 1:
  ..snip..

  if buf[pos] == "\0x02":
    pos += 1
    s_len = struct.unpack("H", buf[pos:pos+2])[0]
    pos += 2
    val = struct.unpack("%ds" % strlen, buf[pos:pos+s_len])[0]
    pos += s_len
```

Congratulations!

- You may have noticed that we wrote a simple state-machine
- A `while` loop that iterates over a buffer, keeping track of the state it's in

- Here's a cookie: <cookie pic here>

Putting it all together

```
def decode(buf):
  state = "START"

  while pos < len(buf):
    if state == "START":    # get message count
    elif state == "MARKER": # parse marker
    elif state == "NUMBER": # parse number
    elif state == "BOOL":   # parse boolean
    elif state == "STRING": # parse string
```

Questions?

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