Python Security

Introduction to Python Secure Coding

Deep dive into Python’s core libraries.

We will talk about some of the most critical issues that have been identified during a two year security code review.

Each issue will be analyzed and when possible we will provide a solution or a mitigation strategy.

Proper state of mind…

If we expect ..	but we get ..	for DEVELOPER this is…	but for SECURITY this is..
PASS	PASS	GOOD	USELESS
PASS	FAIL	BAD	GOOD
FAIL	PASS	VERY BAD	VERY GOOD
FAIL	FAIL	GOOD	USELESS

DATE and TIME

time, os

TIME

```
import time
initial_struct_time = [tm for tm in time.localtime()]

# Example on how time object will cause an overflow
# Same for: Year, Month, Day, minutes, seconds
invalid_time = (2**63)

# change ‘Hours' to a value bigger than 32bit/64bit limit
initial_struct_time[3] = invalid_time

overflow_time = time.asctime(initial_struct_time)
```

Python 2.6.x

OverflowError: long int too large to convert to int

Python 2.7.x

OverflowError: Python int too large to convert to C long

OverflowError: signed integer is greater than maximum

TIME

“time.gmtime” has a check against platform time_t

```
import time
print time.gmtime(-2**64)
print time.gmtime(2**63)
```

ValueError: timestamp out of range for platform time_t

But if value is between (-2^63) and (-2^56) or is between (2^55) to (2^62) then another type error is generated

```
import time
print time.gmtime(-2**63)
print time.gmtime(2**62)
```

ValueError: (84, 'Value too large to be stored in data type')

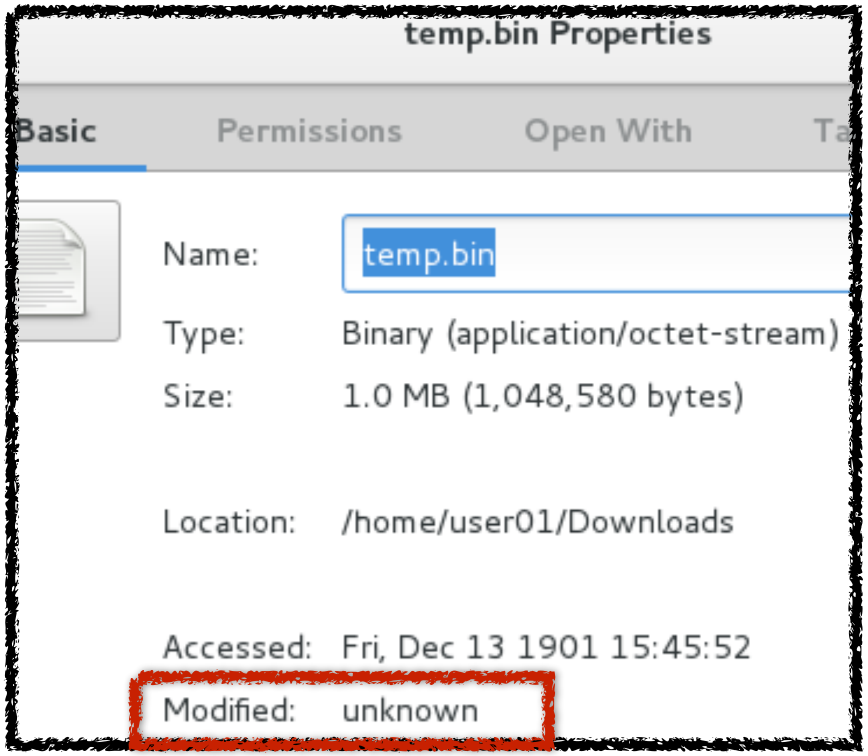
OS

```
import os
TESTFILE = 'temp.bin'

validtime = 2**55
os.utime(TESTFILE,(-2147483648, validtime))
stinfo = os.stat(TESTFILE)
print(stinfo)

invalidtime = 2**63
os.utime(TESTFILE,(-2147483648, invalidtime))
stinfo = os.stat(TESTFILE)
print(stinfo)
```

Python 2.6.x,
OverflowError: long int too large to convert to int

Python 2.7.x, Python 3.1
OverflowError: Python int too large to convert to C long

OS



Name: temp.bin

Type: Binary (application/octet-stream)

Size: 1.0 MB (1,048,580 bytes)

Location: /home/user01/Downloads

Accessed: Fri, Dec 13 1901 15:45:52

Modified: unknown

Normal representation:
Modify: 1141709097-06-13 01:26:08

String representation:
Modify: 4611686018427387904

But in some systems we can also have **OS** related issues:

```
$ ls -la temp.bin
Segmentation fault: 11
$ stat temp.bin
A:"Oct 10 16:32:50 2015"
M:"Dec 31 19:00:00 1969"
C:"Oct 10 16:32:50 2015"
```

!! WARNING !!
RISK OF SYSTEM CRASH
RISK OF DATA LOSS

Do **NOT** play with “os” module.

Modules do **not** include exhaustive tests for edge cases.

The maximum value for a 64bit system would be [2^63-1], but different errors will be generated depending on the used values.

Any number outside the valid range will generate an Overflow.

SOLUTION

Implement proper data validation.

NUMBERS

ctypes, xrange, len, decimal

CTYPES

```
import ctypes

#32-bit test with max 32bit integer 2147483647
ctypes.c_char * int(2147483647)

#32-bit test with max 32bit integer 2147483647 + 1
ctypes.c_char * int(2147483648)

#64-bit test with max 64bit integer 9223372036854775807
ctypes.c_char * int(9223372036854775807)

#64-bit test with max 64bit integer 9223372036854775807 + 1
ctypes.c_char * int(9223372036854775808)
```

Example of overflow message in a 64bit system:

```
>>> ctypes.c_char * int(9223372036854775808)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
OverflowError: cannot fit 'long' into an index-sized integer
```

Python ctypes calls			
c_byte	c_char	c_char_p	c_double
c_float	c_int	c_long	c_longdouble
c_longlong	c_short	c_wchar_p	c_void_p

- ctypes are not limited to size of memory
- overflow checks are mostly missing.

An overflow will occur in both 32bit and 64bit systems.

SOLUTION

Implement Overflow checking and data validation.

xrange()

```
valid = (2 ** 63) -1
invalid = 2 ** 63

for n in xrange(invalid):
    print n
```

OverflowError: Python int too large to convert to C long

This happens because xrange uses "Plain Integer Objects" and cannot accept objects of arbitrary length.

SOLUTION

Create function that uses python only "long integer object“ .

len()

```
valid = (2**63)-1
invalid = 2**63

class A(object):
    def __len__(self):
        return invalid

print len(A())
```

OverflowError: long int too large to convert to int

len() does not check for the length of the object and does not use "python int objects" (unlimited). This can cause an Overflow error as the object may contain a “.length” property.

SOLUTION

Use python “python int objects” that will allow numbers of arbitrary length as the limit will be the system's memory.

DECIMAL

```
from decimal import Decimal
try:
    # DECIMAL '1172837167.27'
    x = Decimal("1172837136.0800")
    # FLOAT '1172837167.27'
    y = 1172837136.0800
    if y > x:
        print("ERROR: FLOAT seems comparable with DECIMAL")
    else:
        print("ERROR: FLOAT seems comparable with DECIMAL")
except Exception as e:
    print("OK: FLOAT is NOT comparable with DECIMAL")
```

Python 2.6.5, 2.7.4, 2.7.10

ERROR: FLOAT seems comparable with DECIMAL (WRONG)

Python 3.1.2

OK: FLOAT is NOT comparable with DECIMAL (CORRECT)

Type Comparison

```
try:
    # STRING 1234567890
    x = "1234567890"
    # FLOAT '1172837167.27'
    y = 1172837136.0800
    if y > x:
        print("ERROR: FLOAT seems comparable with STRING")
    else:
        print("ERROR: FLOAT seems comparable with STRING")
except Exception as e:
    print("OK: FLOAT is NOT comparable with STRING")
```

Python 2.6.5, 2.7.4, 2.7.10

ERROR: FLOAT seems comparable with STRING (WRONG)

Python 3.1.2

OK: FLOAT is NOT comparable with STRING (CORRECT)

Python does not know how to compare STRING and FLOAT and instead of returning an Error returns a FALSE.

Same problem if we try to compare DECIMAL and FLOATS, python does not know how to compare this objects and returns a FALSE instead of returning an Error.

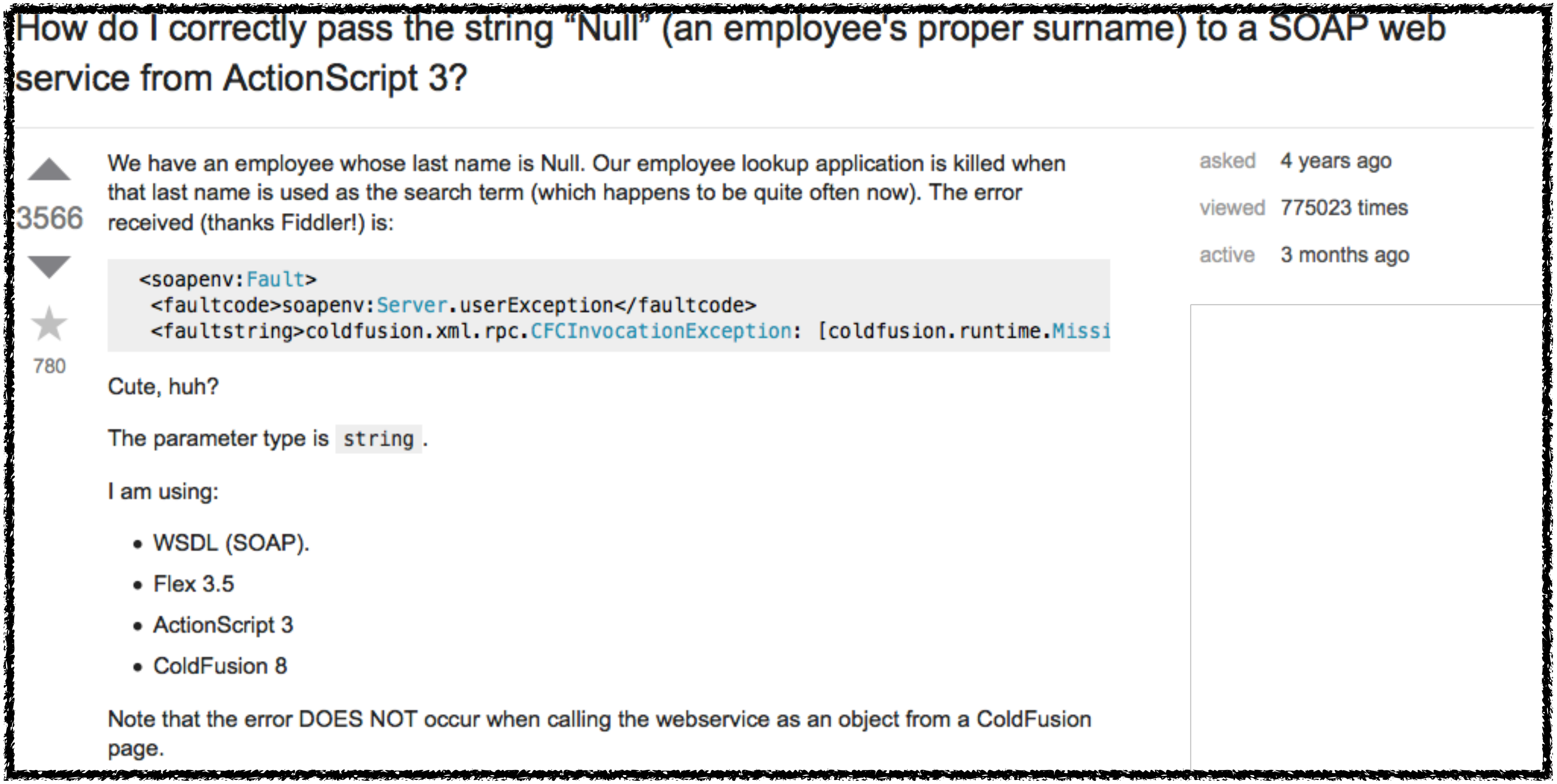
SOLUTION

Implement strong type checking and perform data validation.

STRINGS

input, eval, codecs, os, ctypes

How bad it can be….



How do I correctly pass the string “Null” (an employee's proper surname) to a SOAP web service from ActionScript 3?

We have an employee whose last name is Null. Our employee lookup application is killed when that last name is used as the search term (which happens to be quite often now). The error received (thanks Fiddler!) is:

```
<soapenv:Fault>
 <faultcode>soapenv:Server.userException</faultcode>
 <faultstring>coldfusion.xml.rpc.CFCInvocationException: [coldfusion.runtime.Missi
```

Cute, huh?

The parameter type is `string`.

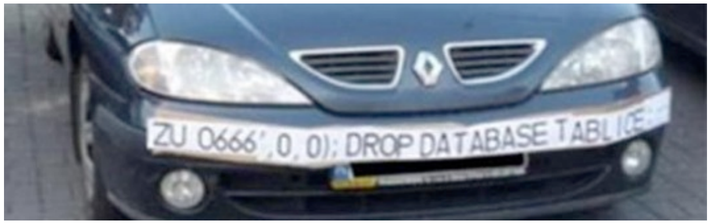
I am using:

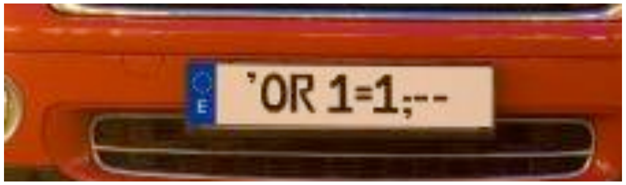
- WSDL (SOAP).
- Flex 3.5
- ActionScript 3
- ColdFusion 8

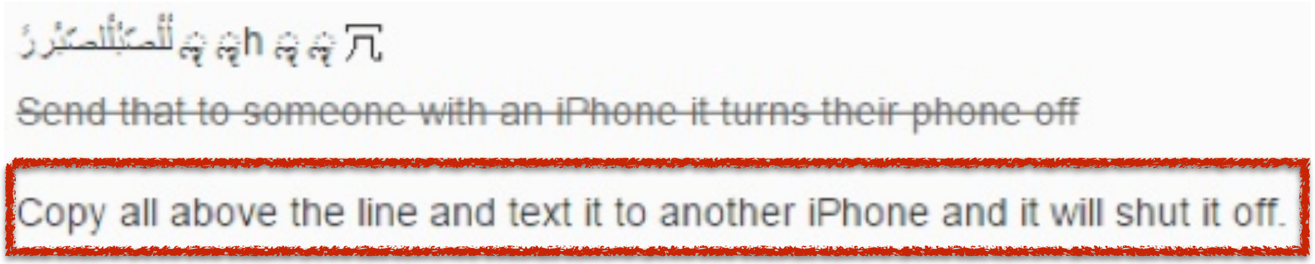
Note that the error DOES NOT occur when calling the webservice as an object from a ColdFusion page.

http://stackoverflow.com/questions/4456438/how-do-i-correctly-pass-the-string-null-an-employees-proper-surname-to-a-so

How bad it can be….







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~~Send that to someone with an iPhone it turns their phone off~~

Copy all above the line and text it to another iPhone and it will shut it off.

http://cdn.inquisitr.com/wp-content/uploads/2015/05/iphone-crash.jpg

08: 'NO PLATE' vanity tags causing system meltdown

NO PLATE, MISSING, NONE, VOID, XXXXXXX

This is not just a popular urban myth, this actually happened to a man named Robert Barbour. He requested personalized license plates from the California DMV in 1979. The DMV form asked to list three possible choices for his plates, and he entered:

1. SAILING

2. BOATING

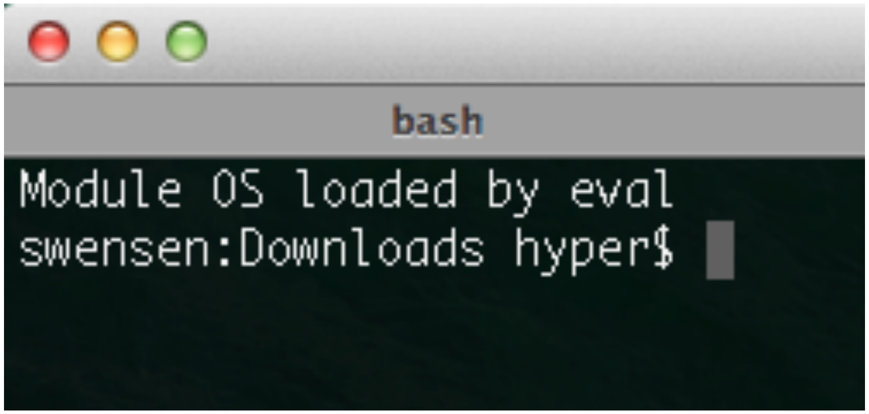
3. NO PLATE

California NOPLATE license tag

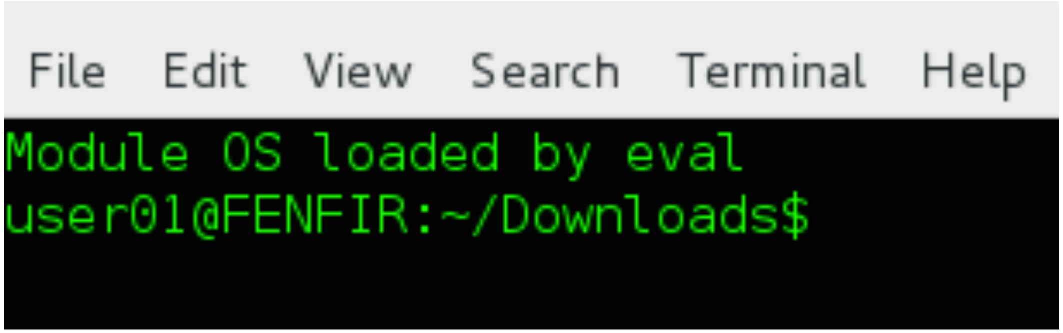
http://hubpages.com/autos/10-fun-facts-us-license-plates

eval()

```
import os
try:
    # Linux/Unix
    eval("__import__('os').system('clear')", {})
    # Windows
    #eval("__import__('os').system(cls')", {})
    print "Module OS loaded by eval"
except Exception as e:
    print repr(e)
```



```
Module OS loaded by eval
swensen:Downloads hyper$
```



```
Module OS loaded by eval
user01@FENFIR:~/Downloads$
```

Any code will be executed without limits in the context of the user that loaded the interpreter.

input()

```
Secret = "42"

value = input("Answer to everything is ? ")

print "The answer to everything is %s" % (value,)
```

```
Answer to everything is ? dir()
The answer to everything is
[‘Secret’, '__builtins__', '__doc__', '__file__', '__name__',
'__package__']
```

The dir() function returns “most” of the attributes of an object, and as a result we obtain the “Secret” object.

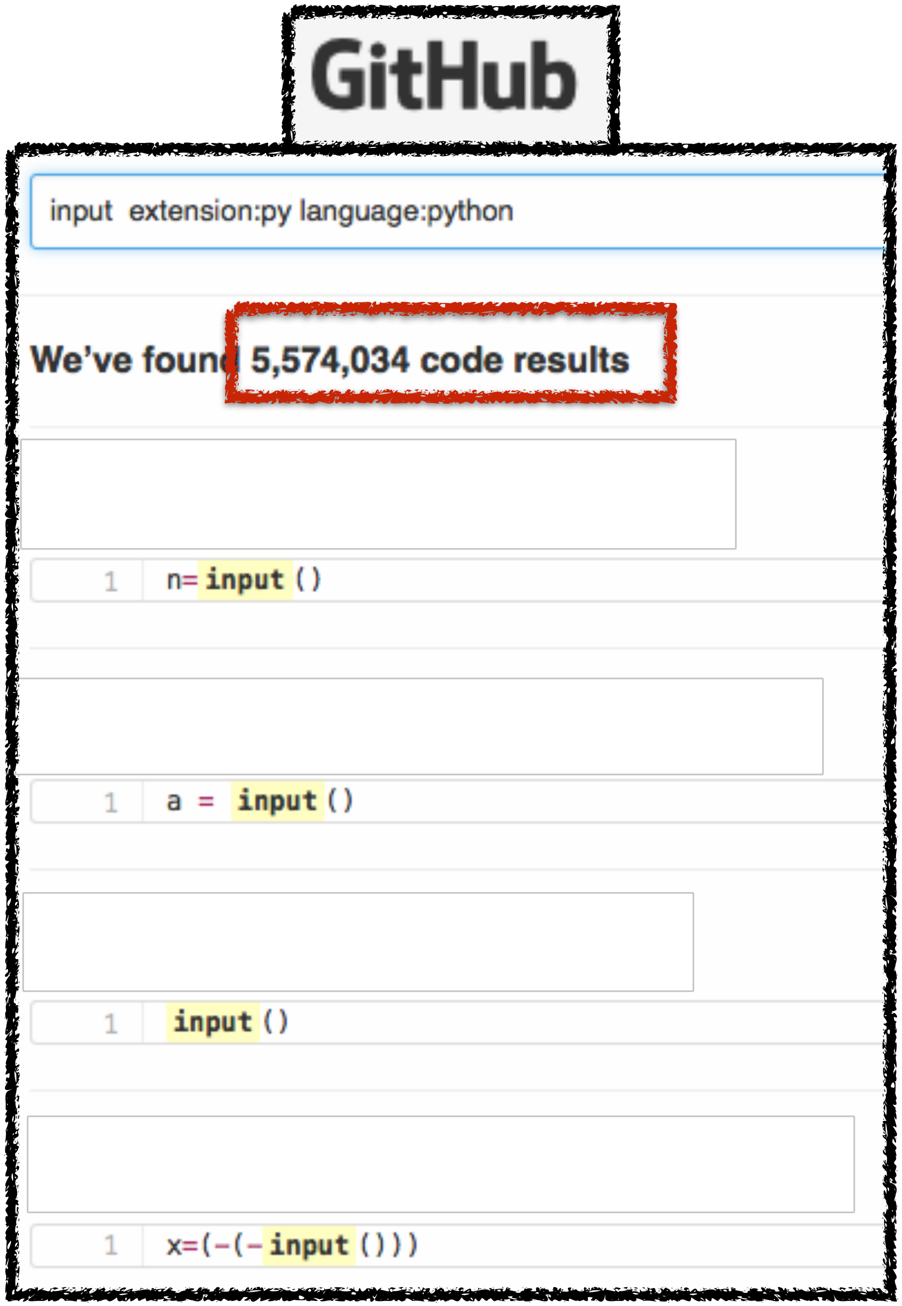
```
Answer to everything is ? Secret
 The answer to everything is 42
```

input()

SOLUTION

Python 2.x
Use raw_input()

Python 3.x
Not vulnerable



input extension:py language:python

We've found 5,574,034 code results

```
n=input()
```

```
a = input()
```

```
input()
```

```
x=(-(-input()))
```

CODECS

```
import codecs
import io
           Byte 1           Byte 2
b = b'\x41\xF5\x42\x43\xF4'
print("Correct-String %r") % ((repr(b.decode('utf8', 'replace'))))

with open('temp.bin', 'wb') as fout:
    fout.write(b)
with codecs.open('temp.bin', encoding='utf8', errors='replace') as fin:
    print("CODECS-String %r") % (repr(fin.read()))
with io.open('temp.bin', 'rt', encoding='utf8', errors='replace') as fin:
    print("IO-String %r") % (repr(fin.read()))
```

Expected UNICODE:

- Two characters, each of 4 bytes

Test UNICODE:

- **One valid** character (4 bytes), **one invalid** character (1 byte)

CODECS

Read by the OS:

read(3, "A\365BC\364", 8192) = 5

Read by the Python:

u'A\\ufffdBC\\ufffd'

The original string will be silently truncated at the first byte.

Correct-String —> “u'A\\ufffdBC\\ufffd'"
CODECS-String —> “u'A\\ufffdBC'" (WRONG)
IO-String —> “u'A\\ufffdBC\\ufffd'" (OK)

SOLUTION

Either use the “io” module or implement string recognition and validation to detect malformed characters.

OS

```
import os
os.environ['a=b'] = 'c'
try:
    os.environ.clear()
    print("PASS => os.environ.clear removed variable 'a=b'")
except:
    print("FAIL => os.environ.clear removed variable 'a=b'")
    raise
```

Names and syntax of environment variables names are also based on the specific rules used in each platform.

Python does not share the same logic and tried to implement a generic interface compatible with most operating systems.

This choice of preferring compatibility over security have allowed the existence of cracks in the logic used for environment variables.

OS

```
$ env -i =value python -c 'import pprint, os;
pprint.pprint(os.environ); del os.environ[""]'

environ({'': 'value'})
Traceback (most recent call last):
  File "<string>", line 1, in <module>
  File "Lib/os.py", line 662, in __delitem__
    self.unsetenv(encodedkey)
OSError: [Errno 22] Invalid argument
```

It is possible to define an environment variable with an empty key, or a variable that contains “=“, but not to remove it.

```
$ env -i python -c 'import pprint, posix, os;
os.environ["a="]="1"; print(os.environ); posix.unsetenv("a=")'

environ({'a=': ‘1'})
Traceback (most recent call last):
  File "<string>", line 1, in <module>
OSError: [Errno 22] Invalid argument
```

Python behaviour changes, depending on the version:

- Python 2.6 —> NO ERRORS, allows invalid operations !
- PYTHON 2.7 —> OSError: [Errno 22] Invalid argument
- PYTHON 3.1 —> NO ERRORS, allows invalid operations !

SOLUTION

Implement a solution to detect architecture and OS, then for each case prevent the usage of 'key-value' pairs associated to environment variable that are empty or invalid for several OS.

CTYPES

```
import ctypes
buffer=ctypes.create_string_buffer(8)

buffer.value='a\0bc1234'

print "Original value    => %r" % (buffer.raw,)
print "Interpreted value => %r" % (buffer.value,)
```

The ctypes module truncates NUL-containing strings.

```
Original value    => 'a\x00bc1234'
Interpreted value => 'a'
```

This behaviour is consistent with how C handles string, by considering a NUL character as a line terminator. Python in this case, by using ctypes, is inheriting the same logic therefore the string is silently truncated.

SOLUTION

Implement data validation to detect NUL-containing strings to protect them, or avoid using ctypes.

```
try:
    if 0:
        yield 5
    print(“NO-ERR")
except Exception as e:
    print("PASS")
    pass

try:
    if False:
        yield 5
    print("NO-ERR")
except Exception as e:
    print(repr(e))
    pass
```

Python Interpreter

Test should return syntax error like:

```
SyntaxError: 'yield' outside function
```

Python Version	Result Test 1	Result Test 2
2.6.5	<nothing>	ERROR
2.7.4	NO-ERR	ERROR
2.7.10	ERROR	ERROR
3.1.4	NO-ERR	NO-ERR

SOLUTION

Solved in latest Python 2.7.x, avoid constructs like “if 0:”, “if False:”, “while 0:” “while False:”.

FILES

sys, os, io, pickle, cpickle

PICKLE

```
import pickle
import io
badstring = "cos\nsystem\n(S'ls -la /'\ntR."
badfile = "./pickle.sec"
with io.open(badfile, 'wb') as w:
   w.write(badstring)
obj = pickle.load(open(badfile))
print "== Object =="
print repr(obj)
```

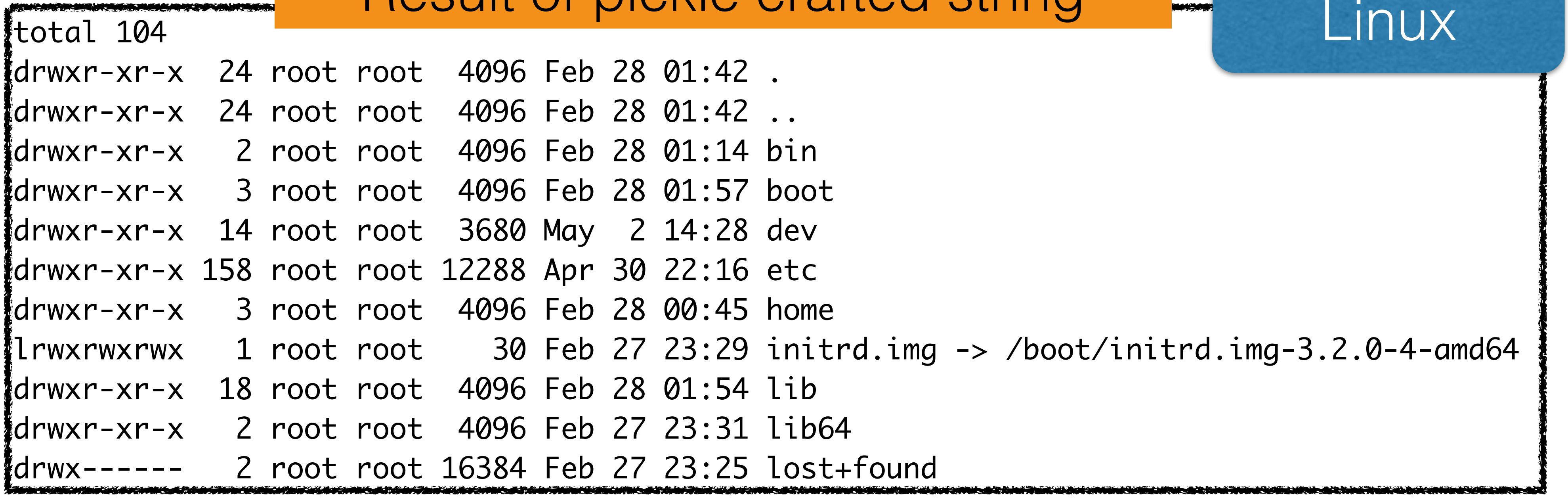
We are asking to pickle to load a string specially formatted that makes it executable by python.

Pickle is NOT designed to be safe/secure, we can make it execute whatever we want.

Pickle loads the string and by processing it executes “ls -la /“.

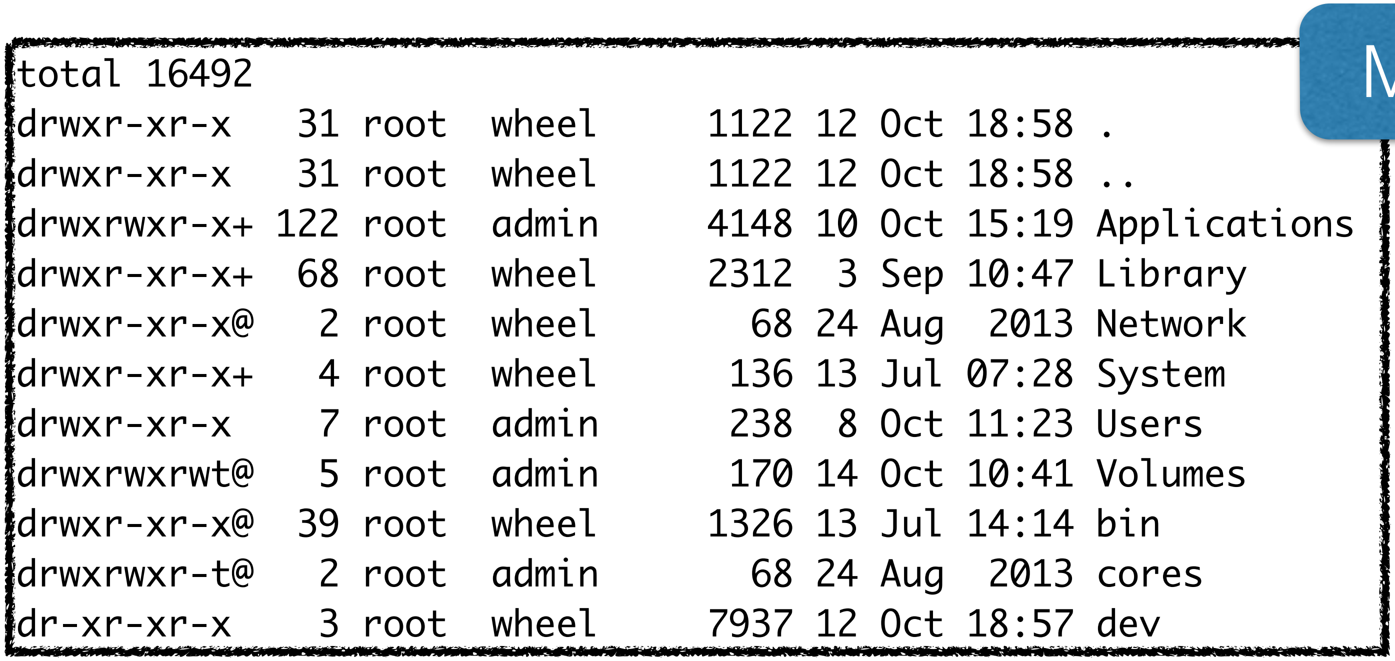
Result of pickle crafted string

Linux



```
total 104
drwxr-xr-x  24 root root  4096 Feb 28 01:42 .
drwxr-xr-x  24 root root  4096 Feb 28 01:42 ..
drwxr-xr-x   2 root root  4096 Feb 28 01:14 bin
drwxr-xr-x   3 root root  4096 Feb 28 01:57 boot
drwxr-xr-x  14 root root  3680 May  2 14:28 dev
drwxr-xr-x 158 root root 12288 Apr 30 22:16 etc
drwxr-xr-x   3 root root  4096 Feb 28 00:45 home
lrwxrwxrwx   1 root root    30 Feb 27 23:29 initrd.img -> /boot/initrd.img-3.2.0-4-amd64
drwxr-xr-x  18 root root  4096 Feb 28 01:54 lib
drwxr-xr-x   2 root root  4096 Feb 27 23:31 lib64
drwx------   2 root root 16384 Feb 27 23:25 lost+found
```

Mac OS X



```
total 16492
drwxr-xr-x    31 root  wheel     1122 12 Oct 18:58 .
drwxr-xr-x    31 root  wheel     1122 12 Oct 18:58 ..
drwxrwxr-x+ 122 root  admin     4148 10 Oct 15:19 Applications
drwxr-xr-x+  68 root  wheel     2312  3 Sep 10:47 Library
drwxr-xr-x@   2 root  wheel       68 24 Aug  2013 Network
drwxr-xr-x+   4 root  wheel      136 13 Jul 07:28 System
drwxr-xr-x    7 root  admin      238  8 Oct 11:23 Users
drwxrwxrwt@   5 root  admin      170 14 Oct 10:41 Volumes
drwxr-xr-x@  39 root  wheel     1326 13 Jul 14:14 bin
drwxrwxr-t@   2 root  admin       68 24 Aug  2013 cores
dr-xr-xr-x    3 root  wheel     7937 12 Oct 18:57 dev
```

pickle / cPickle

```
import os
import cPickle
import traceback
import sys
# bignum = int((2**31)-1) # 2147483647 -> OK
bignum = int(2**31) # 2147483648 -> Max 32bit -> Crash
random_string = os.urandom(bignum)
print ("STRING-LENGTH-1=%r") % (len(random_string))
fout = open('test.pickle', 'wb')
try:
    cPickle.dump(random_string, fout)
except Exception as e:
    print "###### ERROR-WRITE ######"
    print sys.exc_info()[0]
    raise
fout.close()
fin = open('test.pickle', 'rb')
try:
    random_string2 = cPickle.load(fin)
except Exception as e:
    print "###### ERROR-READ ######"
    print sys.exc_info()[0]
    raise
print ("STRING-LENGTH-2=%r") % (len(random_string2))
print random_string == random_string2
sys.exit(0)
```

Depending on the Python version used, pickle or cPickle will either save truncated data without error, or save a portion with a max size limited to 32bit size.

And depending on how Python has been compiled when installed in the system, it may return errors on either the size of random data requested, or report an OS error as invalid argument.

```
STRING-LENGTH-1=2147483648
###### ERROR-WRITE ######
<type 'exceptions.MemoryError'>
Traceback (most recent call last):
….
    pickle.dump(random_string, fout)
SystemError: error return without exception set
```

cPickle

cPickle (debian 7 x64)

```
STRING-LENGTH-1=2147483648
###### ERROR-WRITE ######
<type 'exceptions.MemoryError'>
Traceback (most recent call last):
….
File "/usr/lib/python2.7/pickle.py", line 488,
in save_string    self.write(STRING + repr(obj)
+ '\n')
MemoryError
```

pickle

pickle (debian 7 x64)

SOLUTION

Implement strong data validation to be sure that nothing dangerous will ever be processed, and limit data size to 32bit sizes even in 64bit systems.

File Write

```
import os
import sys
testfile = 'tempA'
with open(testfile, "ab") as f:
    f.write(b"abcd")
    f.write(b"x" * (1024 ** 2))
#########################################
import io
testfilea = 'tempB'
with io.open(testfilea, "ab") as f:
    f.write(b"abcd")
    f.write(b"x" * (1024 ** 2))
```

To check Python behaviour with file writes (on Linux):

```
strace python -OOBRttu script.py
```

PYTHON 2.6

Amount of data we want to write = 4 + 1.048.576 = 1.048.580

Expected results (using ‘io’ module):

```
write(3, "abcd", 4)                    = 4
write(3, "xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx"..., 1048576) = 1.048.576
```

All is fine if we use the ‘io’ module.

With normal calls (without ‘io’ module):

Results of ‘strace’ with standard ‘open’ call

```
write(3, "abcdxxxxxxxxxxxxxxxxxxxxxxxxxxxx"..., 4096) = 4.096
write(3, "xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx"..., 1044480) = 1.044.480
```

First call is buffered, instead of writing only 4 (abcd) it writes 4.092 ‘x’

Second call writes ‘x’ for a total of 1.044.480.

Checking the total data written something is not right.

- 1044480 + 4096 = 1.048.576 (missing 4, expected 1.048.580)

Waiting 5 second ‘fix’ the problem as the OS has flushed the cache.

PYTHON 2.7

Amount of data we want to write = 4 + 1.048.576 = 1.048.580

Expected results (using ‘io’ module):

```
write(3, "xxxx", 4)                      = 4
write(3, "abcdxxxxxxxxxxxxxxxxxxxxxxxxxxxx"..., 1048580) = 1048580
```

All is fine if we use the ‘io’ module.

With normal calls (without ‘io’ module):

Results of ‘strace’ with standard ‘open’ call

```
write(3, "abcdxxxxxxxxxxxxxxxxxxxxxxxxxxxx"..., 4096) = 4.096
write(3, "xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx"..., 1044480) = 1.044.480
write(3, "xxxx", 4)                      = 4
```

First call is buffered, instead of writing only 4 (abcd) it writes 4.092 ‘x’
Second call writes ‘x’ for a total of 1.044.480.
Third call will write the remaining ‘x’, and written data is correct.
Only ‘problem’ is that we were expecting ‘2’ calls and NOT ‘3’.

PYTHON 3.x

Amount of data we want to write = 4 + 1.048.576 = 1.048.580

Expected results (using ‘io’ module):

```
write(3, "abcd", 4)                     = 4
write(3, "xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx"..., 1048576) = 1.048.576
```

All is fine if we use the ‘io’ module.

With normal calls (without ‘io’ module):

Results of ‘strace’ with standard ‘open’ call

```
write(3, "abcd", 4)                     = 4
write(3, "xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx"..., 1048576) = 1.048.576
```

All is fine if we use the standard ‘open’ call.

SOLUTION

Atomic operation are NOT guaranteed in Python 2, core library are using the cache to read and write.
The ‘io’ module should be used when possible.

PROTOCOLS

socket, poplib, urllib, urllib2

httplib, smtplib, ftplib…

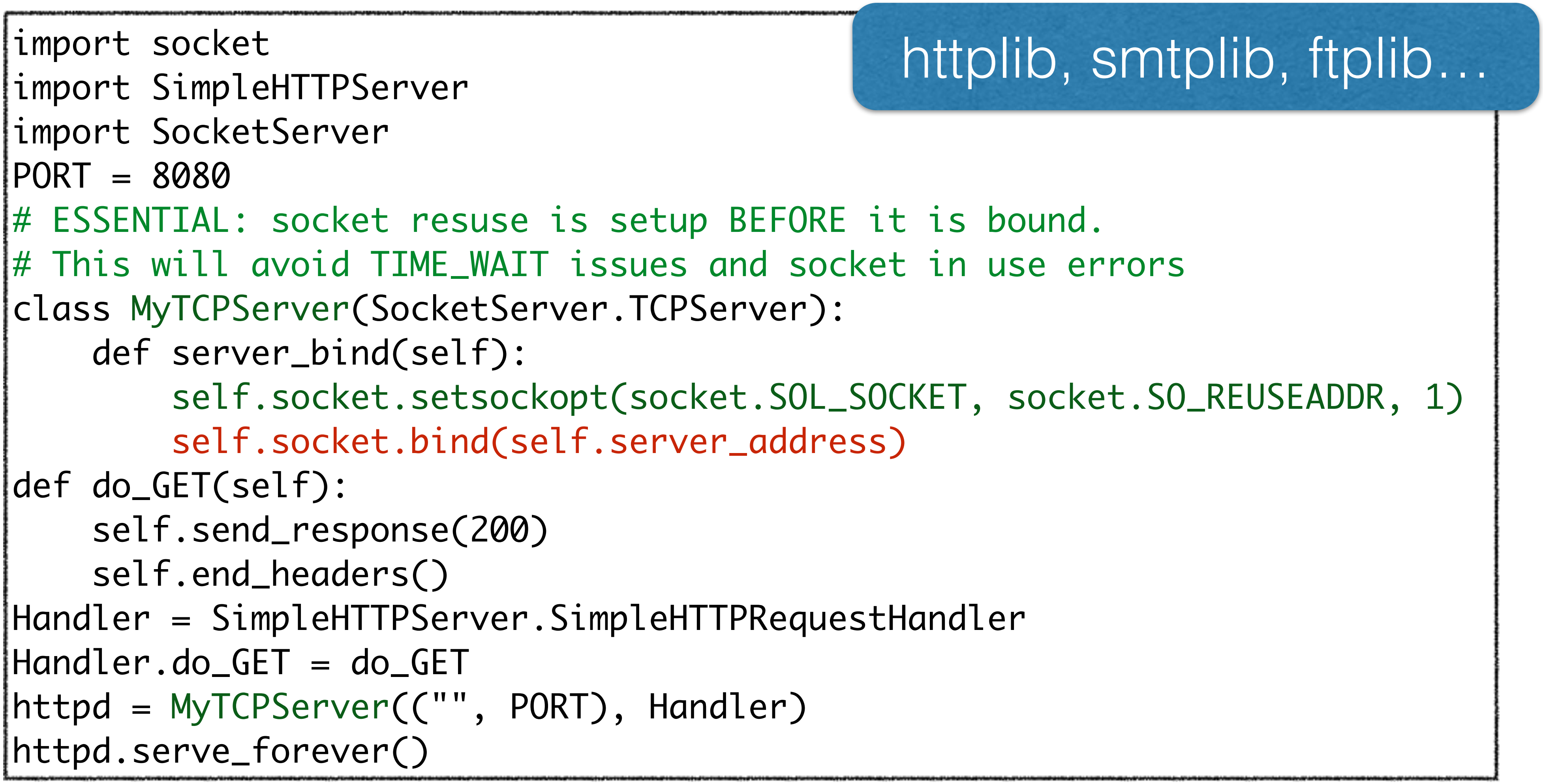
```
import SimpleHTTPServer
import SocketServer
PORT = 45678
def do_GET(self):
    self.send_response(200)
    self.end_headers()
Handler = SimpleHTTPServer.SimpleHTTPRequestHandler
Handler.do_GET = do_GET
httpd = SocketServer.TCPServer(("", PORT), Handler)
httpd.serve_forever()
```

Core libraries are OS independent, developer must know how to create proper communication channels for each OS, the library will permit to execute operation that are not safe and not correct.

```
socket.error: [Errno 48] Address already in use
```

If a client connects to the HTTP server and then we close the server, python will **NOT** release resources, the OS will **NOT** release the socket.

httplib, smtplib, ftplib…



```
import socket
import SimpleHTTPServer
import SocketServer
PORT = 8080
# ESSENTIAL: socket resuse is setup BEFORE it is bound.
# This will avoid TIME_WAIT issues and socket in use errors
class MyTCPServer(SocketServer.TCPServer):
    def server_bind(self):
        self.socket.setsockopt(socket.SOL_SOCKET, socket.SO_REUSEADDR, 1)
        self.socket.bind(self.server_address)
def do_GET(self):
    self.send_response(200)
    self.end_headers()
Handler = SimpleHTTPServer.SimpleHTTPRequestHandler
Handler.do_GET = do_GET
httpd = MyTCPServer(("", PORT), Handler)
httpd.serve_forever()
```

SOLUTION

Each protocol library should be wrapped by a library that, for each OS and each protocol, is properly setting up and tearing down communications, and releasing resources.

poplib, httplib …

Server

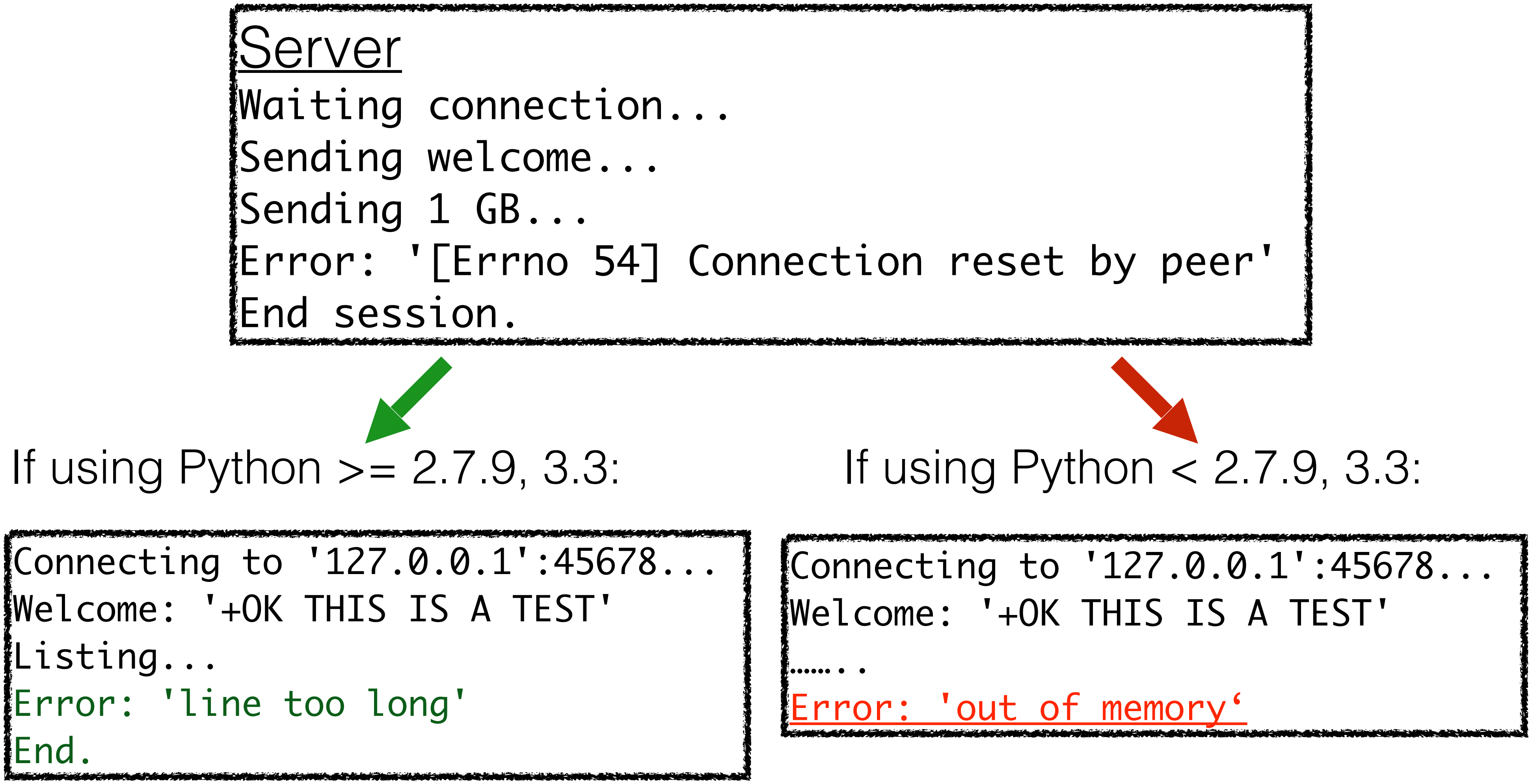
```
import socket
HOST = '127.0.0.1'
PORT = 45678
NULLS = '\0' * (1024 * 1024) # 1 MB
try:
    sock = socket.socket()
    sock.bind((HOST, PORT))
    sock.listen(1)
    while 1:
        print "Waiting connection..."
        conn, _ = sock.accept()
        print "Sending welcome..."
        conn.sendall("+OK THIS IS A TEST\r\n")
        conn.recv(4096)
        DATA = NULLS
        try:
            while 1:
                print "Sending 1 GB..."
                for _ in xrange(1024):
                    conn.sendall(DATA)
        except IOError, ex:
            print "Error: %r" % str(ex)
        print "End session."
        print
finally:
    sock.close()
print "End server."
```

Client

```
import poplib
import sys
HOST = '127.0.0.1'
PORT = 45678
try:
    print "Connecting to %r:%d..." % (HOST, PORT)
    pop = poplib.POP3(HOST, PORT)
    print "Welcome:", repr(pop.welcome)
    print "Listing..."
    reply = pop.list()
    print "LIST:", repr(reply)
except Exception, ex:
    print "Error: %r" % str(ex)
print "End."
sys.exit(0)
```

Simple test

1. Start a dummy server
2. Use client to connect to server
3. Server sends NULs
4. Client will keep receiving NULs
5. **Client memory if full….**
6. **OS crash!**



Server

```
Waiting connection...
Sending welcome...
Sending 1 GB...
Error: '[Errno 54] Connection reset by peer'
End session.
```

If using Python >= 2.7.9, 3.3:

```
Connecting to '127.0.0.1':45678...
Welcome: '+OK THIS IS A TEST'
Listing...
Error: 'line too long'
End.
```

If using Python < 2.7.9, 3.3:

```
Connecting to '127.0.0.1':45678...
Welcome: '+OK THIS IS A TEST'
……. .
Error: 'out of memory‘
```

SOLUTION

Use ‘Python > 2.7.9’ or ‘Python > 3.3’, if not possible implement controls to check for data type and size.

Libraries with “Unlimited data“ issues

Library	Link to Python bug
HTTPLIB	http://bugs.python.org/issue16037
FTPLIB	http://bugs.python.org/issue16038
IMAPLIB	http://bugs.python.org/issue16039
NNTPLIB	http://bugs.python.org/issue16040
POPLIB	http://bugs.python.org/issue16041
SMTPLIB	http://bugs.python.org/issue16042
XMLRPC	http://bugs.python.org/issue16043

urllib, urllib2

```
import io
import os
import urllib2 #but all fine with urllib
domain = 'ftp://ftp.ripe.net'
location = '/pub/stats/ripencc/'
file = 'delegated-ripencc-extended-latest'
url = domain + location + file
data = urllib2.urlopen(url).read()
with io.open(file, 'wb') as w:
    w.write(data)
file_size = os.stat(file).st_size
print "Filesize: %s" % (file_size)
```

Wrong file sizes

```
Filesize: 65536
Filesize: 32768
Filesize: 49152
```

urllib2 does NOT have proper logic to handle data streams and fails silently.

```
import os
import io
import urllib2
domain = 'ftp://ftp.ripe.net'
location = '/pub/stats/ripencc/'
file = 'delegated-ripencc-extended-latest'
with io.open(file, 'wb') as w:
    url = domain + location + file
    response = urllib2.urlopen(url)
    data = response.read()
    w.write(data)
file_size = os.stat(file).st_size
print "Filesize: %s" % (file_size)
```

Every proper size

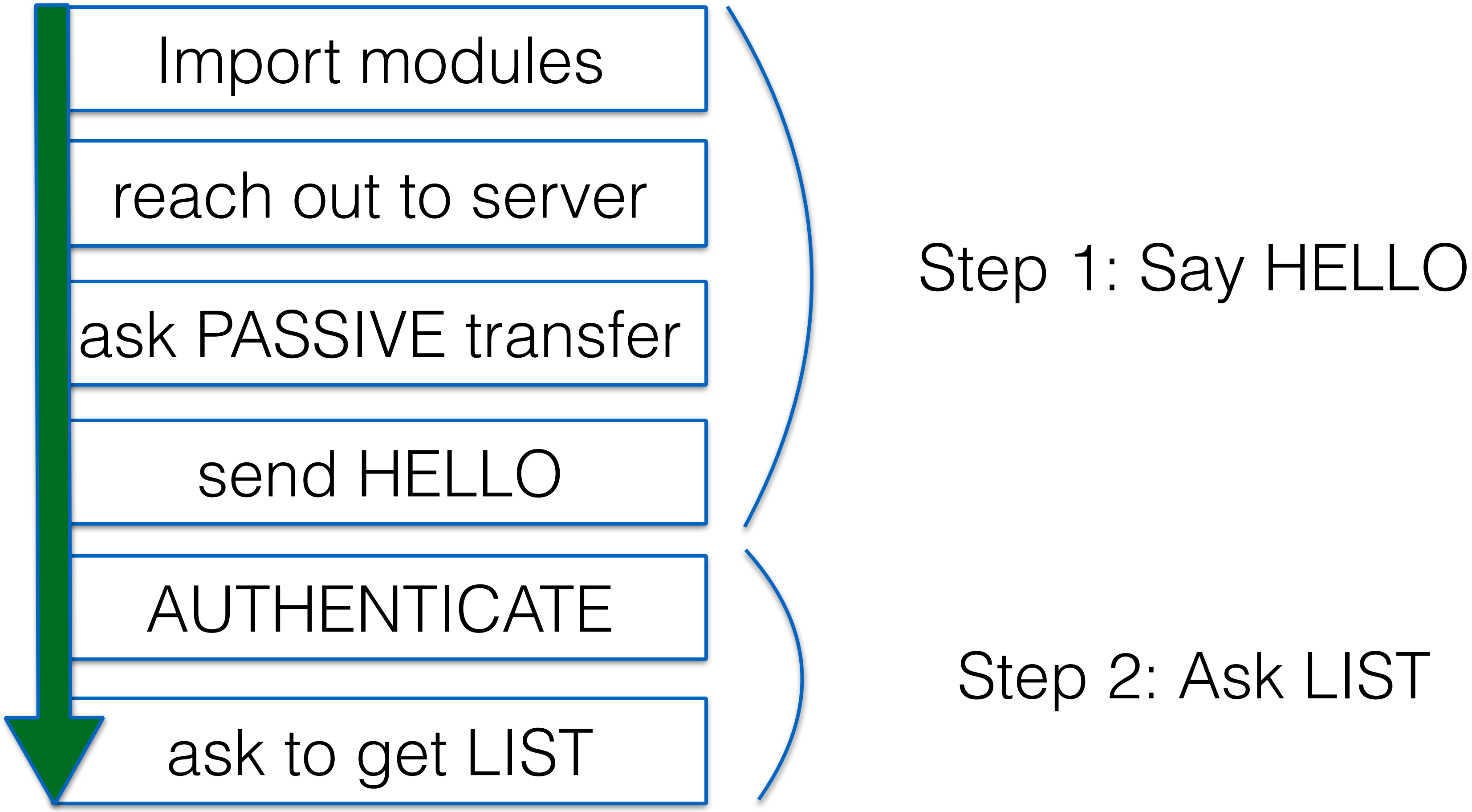
```
Filesize: 6598450
Filesize: 6598450
Filesize: 6598450
```

SOLUTION

Make use of the OS.

PROTOCOL logics

How Python is handling the FTP protocol ..



Import modules

reach out to server

ask PASSIVE transfer

send HELLO

AUTHENTICATE

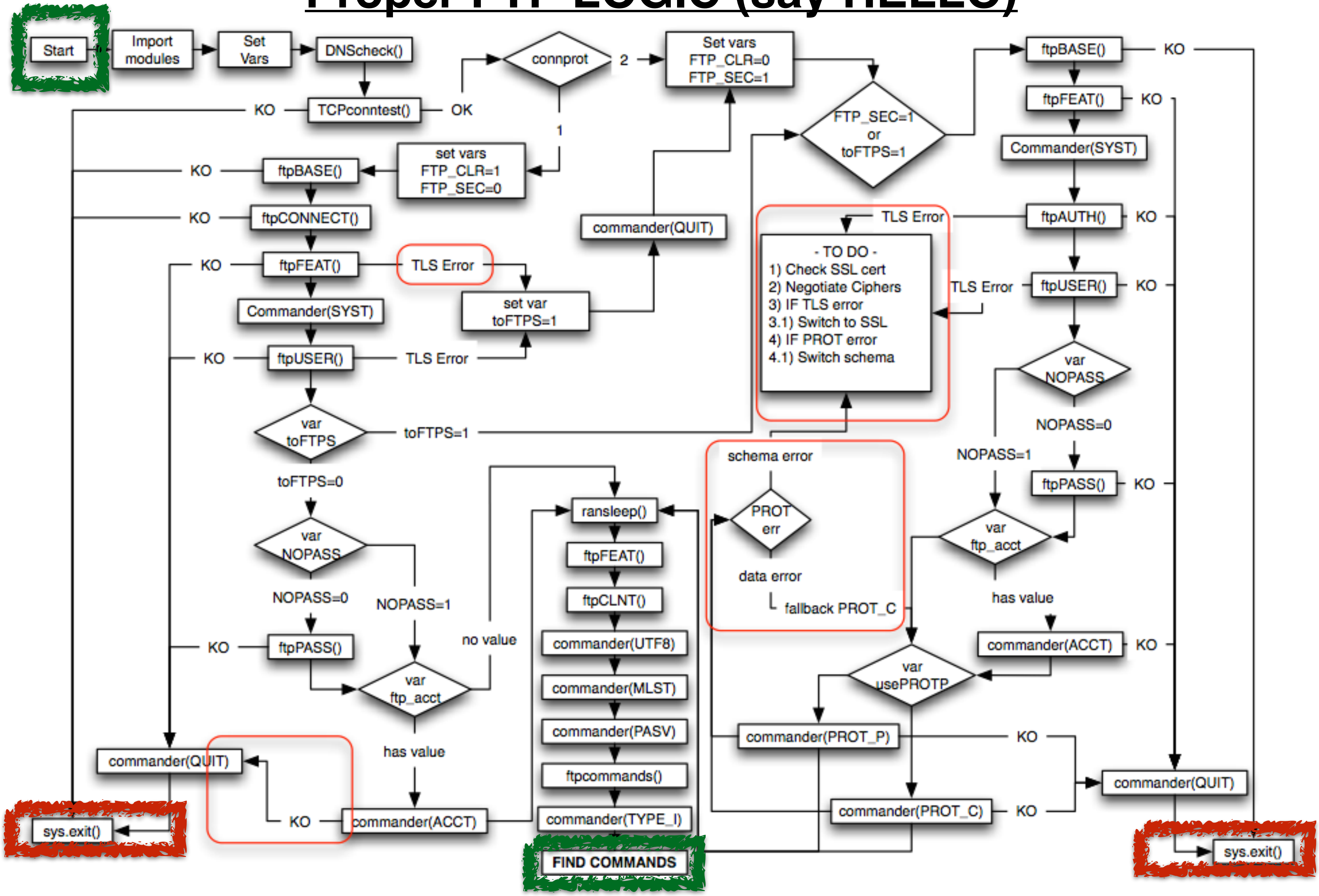
ask to get LIST

Step 1: Say HELLO

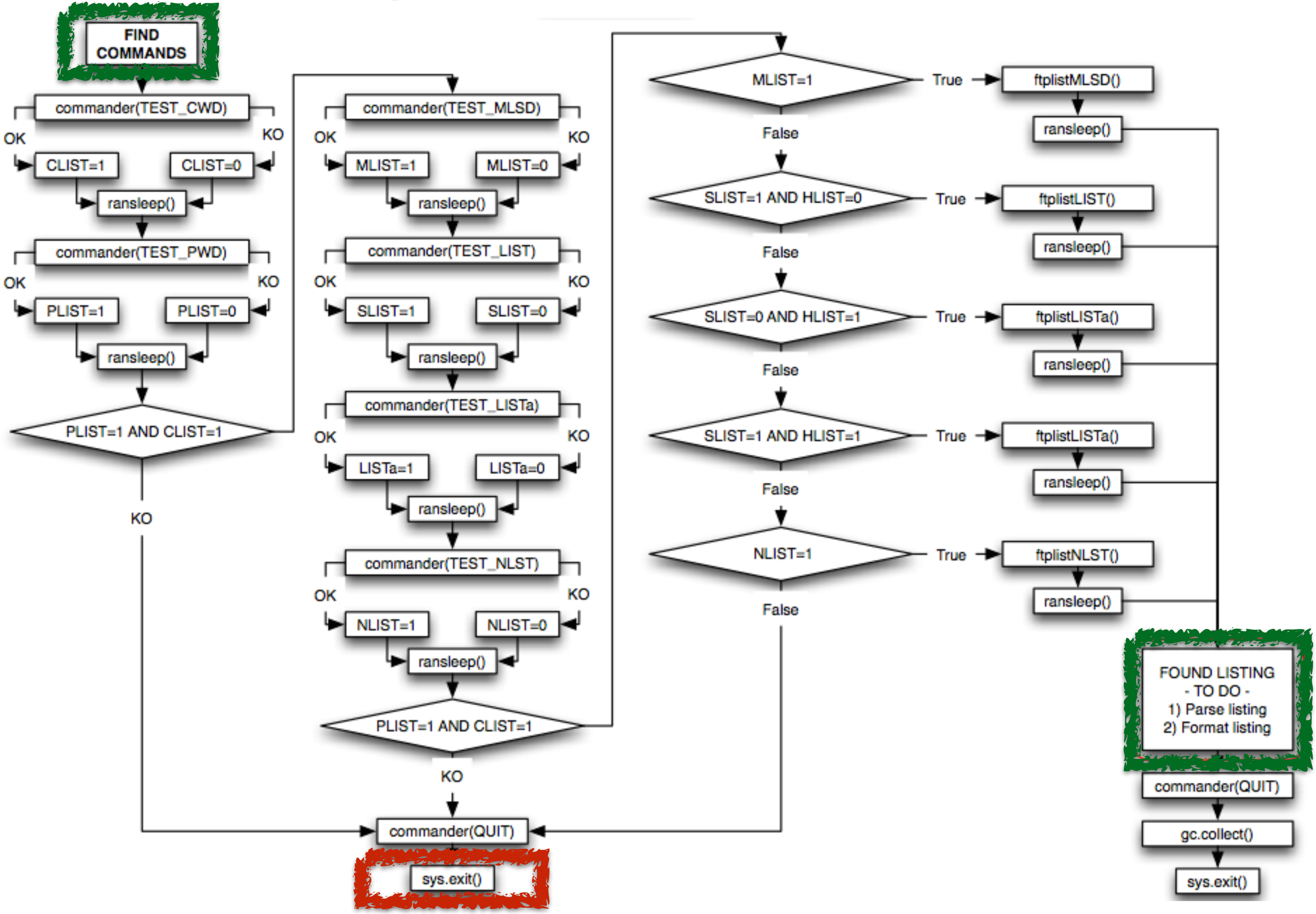
Step 2: Ask LIST

But to have something useful you need..

Proper FTP LOGIC (say HELLO)



Proper FTP LOGIC (ask LIST)



Known Unsafe Libs

ast

bastion

commands

cookie

cPickle / pickle

eval

marshal

mktemp

multiprocessing

os.exec

os.popen

os.spawn

os.system

parser

pipes

pty

rexec

shelve

subprocess

tarfile

urllib2

urlparse

yaml

zipfile

Closing comments:

- Security is VERY hard.
- Python is a great language, we like it very much and we will keep using it.
- Everything used to make this slides has been in the public domain for years, is just difficult to find.
- NEVER assume something is working as it should just because millions of people are using it.

Thank You

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OWASP Python Security project
https://github.com/ebranca/owasp-pysec/wiki