Intro to Python

by Daniel Greenfeld

Intro to Python

a.k.a.

21 cool things you can do with Python

Tons of content

- Please hold your questions until the end
- Latest slides: http://slidesha.re/intro-to-python
- Special thanks to: http://bit.ly/x610Au
  - Raymond Hettinger
  - David Beazley
  - Audrey Roy
  - The Python community

Daniel Greenfeld

http://www.flickr.com/photos/pydanny/4442245488/

- pydanny
- twitter.com/pydanny
- github.com/pydanny
- pydanny.blogspot.com
- pydanny-event-notes.rtfd.org

Daniel Greenfeld

http://www.flickr.com/photos/pydanny/4442245488/

- Python/Django Developer
- Cartwheel Web
  - Makers of Consumer Notebook
  - Makers of Open Comparison
- Los Angeles
- Capoeira
- Fiancee is Audrey Roy

Intro to Python

Who uses Python?

All the cool kids do!

Who uses Python?

grove

cars.com
Confidence Comes Standard.®

Massachusetts Institute of Technology

FreeBSD

NetBSD®

NASA

Walt Disney ANIMATION STUDIOS

NOKIA Connecting People

YAHOO!

instagram

redhat

evite.com

Atlassian bitbucket

YouTube

CANONICAL

LexisNexis®

Consumer Notebook

NATIONAL WEATHER SERVICE

Los Angeles Times

EVE ONLINE

ebay

ableton

mozilla Firefox®

Google™

bit.ly

AstraZeneca

reddit

Quora

TRUECar Know the Real Price™

Dropbox

INDUSTRIAL LIGHT & MAGIC A LUCASFILM COMPANY

What is Python?

What is Python?

- Over 20 years old
- Dynamic, strongly typed scripting language
- Multi-paradigm programming language
  - Object Oriented
  - Functional
  - Procedural
  - Reflective

What is Python?

- Free and open source
- Fast enough
  - Check out PyPy
- Batteries included language

What is Python?

http://en.wikipedia.org/wiki/File:Flyingcircus_2.jpg

It's named after Monty Python

Python is similar to...

- Perl
- Ruby
- Lisp
- Java

Python is different than...

- Perl
- Ruby
- Lisp
- Java

Python Core Concepts

Whitespace!

```
""" whitespace.py """
from random import randrange

def numberizer():
    # Generate a random number from 1 to 10.
    return randrange(1, 11)

number = numberizer()
if number > 5:
    print("This number is big!")

class RandomNumberHolder(object):
    # Create and hold 20 random numbers using numberizer

    def __init__(self):
        self.numbers = [numberizer(x) for x in range(20)]

random_numbers = RandomNumberHolder()
```

Whitespace!

```
def numberizer():
    # Generate a random number from 1 to 10.
    return randrange(1, 11)
```

Whitespace!

```
number = numberizer()
if number > 5:
    print("This number is big!")
```

Whitespace!

```
class RandomNumberHolder(object):
    # Create and hold 20 random numbers
        # using numberizer

    def __init__(self):

        self.numbers = [numberizer(x) for x...

random_numbers = RandomNumberHolder()
```

Philosophy of Core Developers

- Conservative growth
- Aim for a simple implementation
- “We read Knuth so you don’t have to”

Zen of Python

```
>>> import this
The Zen of Python, by Tim Peters

Beautiful is better than ugly.
Explicit is better than implicit.
Simple is better than complex.
Complex is better than complicated.
Flat is better than nested.
Sparse is better than dense.
Readability counts.
Special cases aren't special enough to break the rules.
Although practicality beats purity.
Errors should never pass silently.
Unless explicitly silenced.
In the face of ambiguity, refuse the temptation to guess.
There should be one-- and preferably only one --obvious way to do it.
Although that way may not be obvious at first unless you're Dutch.
Now is better than never.
Although never is often better than *right* now.
If the implementation is hard to explain, it's a bad idea.
If the implementation is easy to explain, it may be a good idea.
Namespaces are one honking great idea -- let's do more of those!
```

Culture of Documentation

- Django Web Framework
  - http://djangoproject.com
- Document everything and document well
- Make your documentation accessible
  - http://readthedocs.org
  - http://python-requests.org
  - http://bit.ly/oc_ref (Open Comparison reference)

Which Python?

For learning and simple scripting...

Use what is on your system by default.

If you are running Linux or
BSD you already have Python

```
$
$ python
Python 2.7.1+ (r271:86832, Apr 11 2011,
18:13:53)
[GCC 4.5.2] on linux2
Type "help", "copyright", "credits" or
"license" for more information.
>>>
>>> 3 + 4
7
>>> a = 5 * 10
>>> a
50
>>> def add(a, b):
...     return a + b
...
>>> add(3,4)
7
>>> add('Py','thon')
'Python'
```

Don’t have Python yet?

Download 3.2

Unless you are working with a tool
with a specific Python dependency
(e.g. Django requires Python 2.7)

21 cool things you can do with Python

#1 Run it anywhere

Linux	Windows	
FreeBSD	Mac OS X	JVM
OpenBSD	Solaris	.NET
NetBSD	HP-UX	Android OS
BSD	OS/2	

http://en.wikipedia.org/wiki/CPython#Supported_platforms

#2 Learn it fast

Python is easy to learn but powerful.

Experienced developers get up to speed in days.

Lots of tutorials in the area taught by PyLadies.

http://learnpythonthehardway.org/

#3 Introspect

a.k.a Introducing the String type

```
>>> foo = 'bar'
>>> spam = 'eggs'
>>> fun = 'spam and EGGS    '
>>> dir(fun)
['__add__', '__class__', '__co                                    , '__doc__',
'__eq__', '__format__', '__ge_                                    '__getitem__',
'__getnewargs__', '__getslice_                                    , '__init__',
'__le__', '__len__', '__lt__',                                    __ne__',
'__new__', '__reduce__', '__reduce_ex__', '__repr__', '__rmod__',
'__rmul__', '__setattr__', '__sizeof__', '__str__','__subclasshook__',
'_formatter_field_name_split', '_formatter_parser', 'capitalize',
'center', 'count', 'decode', 'encode', 'endswith', 'expandtabs',
 'find', 'format', 'index', 'isalnum', 'isalpha', 'isdigit', 'islower',
'isspace', 'istitle', 'isupper', 'join', 'ljust', 'lower', 'lstrip',
'partition', 'replace', 'rfind', 'rindex', 'rjust', 'rpartition',
'rsplit', 'rstrip', 'split', 'splitlines', 'startswith', 'strip',
'swapcase', 'title', 'translate', 'upper','zfill']
```

ilt-in function

http://en.wikipedia.org/wiki/File:Flyingcircus_2.jpg

#3 Introspect

a.k.a Introducing the String type

```
>>> fun
'spam and EGGS   '
>>> fun.strip()
'spam and EGGS'
>>> spam.title()
'Spam And Eggs   '
>>> fun.capitalize()
'Spam and eggs   '
>>> fun.index('a')
2
>>> type(fun)
<type 'str'>
>>> len(fun) # built-in that gives length of object
16
>>> fun[0:5] # String slicing
'spam '
>>> help(fun)
no Python documentation found for 'spam and EGGS   '
>>> help(str)
```

type() returns the type of object

Line comments start with '# '

help() is a Python built-in

str is the Python string type object

#3 Introspect

a.k.a Introducing the String type

```
>>> help(str)
Help on class str in module __builtin__:

class str(basestring)
 |  str(object) -> string
 |
 |  Return a nice string representation of the object.
 |  If the argument is a string, the return value is the same object.
 |
 |  Method resolution order:
 |      str
 |      basestring
 |      object
 |
 |  Methods defined here:
 |
 |  __add__(...)
 |      x.__add__(y) <==> x+y
 |
 |  __contains__(...)
 |      x.__contains__(y) <==> y in x
```

#3 Introspect

a.k.a Introducing the String type

```
>>> help(str)
|  capitalize(...)
|      S.capitalize() -> string
|
|      Return a copy of the string S with only its first character
|      capitalized.
|
|  center(...)
|      S.center(width[, fillchar]) -> string
|
|      Return S centered in a string of length width. Padding is
|      done using the specified fill character (default is a space)
|
|  count(...)
|      S.count(sub[, start[, end]]) -> int
|
|      Return the number of non-overlapping occurrences of substring sub
in
|      string S[start:end].  Optional arguments start and end are
interpreted
|      as in slice notation.
```

#4 Things with Strings

```
>>> scale = 'Southern California Linux Expo'
>>> scale[0]
'S'
>>> scale[0:8]
'Southern'
>>> scale[:-5]
'Southern California Linux'
>>> scale[0:8] = 'Northern'
Traceback (most recent call last):
  File "<input>", line 1, in <module>
TypeError: 'str' object does not support item assignment
>>> scale.replace('Southern California','SoCal')
'SoCal Linux Expo'
>>> scale
'Southern California Linux Expo'
>>> scale = scale.replace('Southern California','SoCal')
>>> scale
'SoCal Linux Expo'
>>> scale.startswith('Windows')
False
>>> scale.endswith('Windows')
False
>>> scale.startswith('SoCal')
True
>>> 'Windows' in scale
False
>>> 'Linux' in scale
True
```

Strings are immutable

#5 String formatting

```
>>> a = "Daniel"
>>> b = "Adam"
>>> c = "Greenfeld"
>>> a + b + c
'DanielAdamGreenfeld'
>>> "{0} {1} {2}".format(a, b, c)
'Daniel Adam Greenfeld'
>>> "{first} {middle} {last}".format(first=a, middle=b, last=c)
'Daniel Adam Greenfeld'
>>> lst = [a,b,c]
>>> lst
['Daniel', 'Adam', 'Greenfeld']
>>> name =" ".join(lst)
>>> name
'Daniel Adam Greenfeld'
```

#6 Basic Operations

```
>>> x, y, z = 5, 10, 15
>>> 5 < 10
True
>>> 5 > 10
False
>>> True == False
False
>>> (5 == x) or (10 == x)
True
>>> (5 == x) and (10 == x)
False
>>> x + y - z
0
>>> 10 * 5
50
>>> 10 / 5
2
>>> 10 + 5
15
>>> 10 ** 2
100
```

Python has advanced math features that comes with the standard library.

For scientific needs, **numpy** is available.

#7 Lists

```
>>> my_list = [1, 2, 3]
>>> my_list.append(4)
>>> my_list
[1, 2, 3, 4]
>>> my_list.insert(2, 'dog')
>>> my_list
[1, 2, 'dog', 3, 4]
>>> my_list.extend([5, 6])
>>> my_list
[1, 2, 'dog', 3, 4, 5, 6]
>>> my_list.append([7, 8])
>>> my_list
[1, 2, 'dog', 3, 4, 5, 6, [7, 8]]
>>> my_list.pop(2)
'dog'
>>> my_list
[1, 2, 3, 4, 5, 6, [7, 8]]
>>> my_list.reverse()
>>> my_list
[[7, 8], 6, 5, 4, 3, 2, 1]
```

Lists are mutable

Tuples are not mutable

#8 Lists + Functional Programming

```
>>> def divisible_by_2(x):
...     return x % 2 == 0
...
>>>
>>> def cube(x):
...     return x ** 3
...
>>>
>>> numbers = [1, 2, 3, 4, 6, 31]
>>>
>>> filter(divisible_by_2, numbers)
[2, 4, 6]
>>>
>>> map(cube, numbers)
[1, 8, 27, 64, 216, 29791]
```

Filter constructs a list from those elements of an iterable for which the specified function returns True.

Map applies the specified function to every item of the iterable and returns the results.

#9 List Comprehensions

```
""" whitespace.py """
from random import randrange

def numberizer():
    # Generate a random number from 1 to 10.
    return randrange(1, 11)

number = numberizer()
if number > 5:
    print("Thi

class RandomNumberHolder(object):
    # Create and hold 20 random numbers using numberizer

    def __init__(self):
        self.numbers = [numberizer(x) for x in range(20)]

random_numbers = RandomNumberHolder()
```

Remember this from the beginning?

List Comprehension!

#9 List Comprehensions

```
>>> items = [x for x in range(20)]
>>> items
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]
>>> [x for x in range(20) if x % 2]
[1, 3, 5, 7, 9, 11, 13, 15, 17, 19]
```

List Comprehensions are
wonderful syntactical sugar.

```
>>> # Fizzbuzz solved using Python's List Comprehension
>>> lst = [(x, 'Fizz', 'Buzz', 'FizzBuzz') \
...            [(not x % 3) | (not x % 5) << 1] for x in range(20)]
```

Backslash can be used to
break up long statements.
Please use sparingly!

#10 Generators

```
>>> def countdown(n):
...     print("Counting down from {0}".format(n))
...     while n > 0:
...         yield n
...         n -= 1

>>> x = countdown(10)
>>> x
<generator object at 0x58490>
>>> x.next()
Counting down from 10
10
>>> x.next()
9
>>> x.next()
8
>>> x.next()
7
```

A generator evaluates only when the iterable is at that iteration. This is really powerful, especially when working with large iterables.

A billion iterations for a generator is NOTHING.

http://dabeaz.com/generators/Generators.pdf

#11 Generator Expressions

```
>>> items = (str(x) for x in xrange(10000))
>>> items
<generator object <genexpr> at 0x100721460>
```

Generator expressions are shorthand for generators. Just like list comprehensions, but with () instead of [].

http://dabeaz.com/generators/Generators.pdf

#11 Generator Expressions

Problem: count the bytes saved to huge apache access log.

```
wwwlog = open("access-log")
total = 0
for line in wwwlog:
    bytestr = line.rsplit(None,1)[1]
    if bytestr != '-':
        total += int(bytestr)
print "Total", total
```

Open the whole file, then iterate through the results. Lots of memory usage!

Generator way

```
# generator expressions way
wwwlog     = open("access-log")
bytecolumn = (line.rsplit(None,1)[1] for line in wwwlog)
bytes      = (int(x) for x in bytecolumn if x != '-')
print "Total", sum(bytes)
```

http://dabeaz.com/generators/Generators.pdf

#12 Sets

```
>>> lst = [1,1,1,1,1,2,2,2,3,3,3,3,3,3]
>>> s = set(lst)
>>> s
set([1,2,3])
```

Counting unique words in the Gettysburg Address

```
>>> address = """Four score and seven years ago our fathers brought..."""
>>> for r in [',','.','-']:
...     address = address.replace(r,'')
>>> words = address.split(' ')
>>> len(words)
278
>>> unique_words = set(words)
>>> len(unique_words)
143
```

All items in a set need to be of the same type.

#13 Dictionaries

Mutable Key/Value objects

```
>>> data = {
        'name':'Daniel Greenfeld',
        'nickname':'pydanny',
        'states_lived':['CA','KS','MD','NJ','VA','AD'],
        'fiancee':'Audrey Roy'
        }
>>> data['name']
'Daniel Greenfeld'
>>> data['nickname'] = 'audreyr'
>>> data['nickname']
'audreyr'
>>> data['nickname'] = 'pydanny'
>>> data.keys()
['fiancee', 'nickname', 'name', 'states_lived']
>>> data.get('fiancee')
'Audrey Roy'
>>> data.get('fiance')
None
>>> data.pop('fiancee')
'Audrey Roy'
>>> data
{'nickname': 'pydanny', 'name': 'Daniel Greenfeld', 'states_lived': ['CA',
'KS', 'MD', 'NJ', 'VA']}
>>> data['fiancee'] = 'Audrey Roy'
>>> data
{'fiancee': 'Audrey Roy', 'nickname': 'pydanny', 'name': 'Daniel
Greenfeld', 'states_lived': ['CA', 'KS', 'MD', 'NJ', 'VA', 'AD']}
```

#14 Object-Oriented Programming

```
class Animal(object):
    def __init__(self, name):
        self.name = name
    def talk(self):
        raise NotImplementedError("Subclass must implement abstract method")

class Cat(Animal):
    def talk(self):
        return 'Meow!'

class Dog(Animal):
    def talk(self):
        return 'Woof! Woof!'

animals = [Cat('Missy'),
           Cat('Mr. Mistoffelees'),
           Dog('Lassie')]

for animal in animals:
    print animal.name + ': ' + animal.talk()
```

```
Missy: Meow!
Mr. Mistoffelees: Meow!
Lassie: Woof! Woof!
```

Barely scratching the surface!

http://en.wikipedia.org/wiki/Polymorphism_in_object-oriented_programming#Examples

#15 Isolate Environments

```
$ curl http://bit.ly/get-pip | python
$ pip install virtualenv
$ virtualenv my_env
$ source my_env/bin/activate
(my_env) $
```

Pro Tip: easy_install is legacy. Use pip.

```
(my_env) $ pip install django==1.3.1
(my_env) $ pip install requests==0.9.1
(my_env) $ pip install mongoengine==0.5.2
(my_env) $ pip install celery==2.4.6
(my_env) $ pip freeze
celery==2.4.6
django==1.3.1
mongoengine==0.5.2
requests==0.9.1
(my_env) $ pip freeze > requirements.txt
...
(another_env) $ pip install -r requirements.txt
```

Warning!
Only installs
Python drivers!
Not MongoDB
or RabbitMQ

#16 Colorize Code

How Github and Bitbucket do it

```
$ pip install pygments
```

pygments_demo.py

```
from pygments import highlight
from pygments.lexers import get_lexer_by_name
from pygments.formatters import HtmlFormatter

if __name__ == '__main__':
    # get this file
    code = open("pygments_demo.py", "rw").read()

    # figure out the lexer
    lexer = get_lexer_by_name("python", stripall=True)

    # construct the formatter
    formatter = HtmlFormatter(linenos=False, cssclass="source")

    # style and formatting
    css = HtmlFormatter().get_style_defs('.source')
    highlighted_code = highlight(code, lexer, formatter)
    page = """
        <html>
            <head><style>{css}</style></head>
            <body>{highlighted_code}</body>
        </html>
        """.format(css=css, highlighted_code=highlighted_code)
    print(page)
```

```
$ python pygments_demo.py > text.html
```

Output of the program

text.html

```python
from pygments import highlight
from pygments.lexers import get_lexer_by_name
from pygments.formatters import HtmlFormatter

if __name__ == '__main__':
    # get this file
    code = open("pygments_demo.py", "rw").read()

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    # style and formatting
    css = HtmlFormatter().get_style_defs('.source')
    highlighted_code = highlight(code, lexer, formatter)
    page = """
        <html>
            <head><style>{css}</style></head>
            <body>{highlighted_code}</body>
        </html>
        """.format(css=css, highlighted_code=highlighted_code)
    print(page)
```

#17 Work with Relational Databases

(my_env)$ pip install django

Internationalization!

```
from datetime import datetime

from django.contrib.auth.models import User
from django.db import models
from django.utils.translation import ugettext_lazy as _

class Post(models.Model):

    author = models.ForeignKey(User)
    title = models.CharField(_('Title'), max_length=100)
    content = models.TextField(_("Content"))
    pub_date = models.DateTimeField(_("Publication date"))

class Comment(models.Model):
    post = models.ForeignKey(Post)
    name = models.CharField(_('Title'), max_length=100)
    content = models.TextField(_("Content"))
```

#18 Work with NoSQL

(my_env)$ pip install pymongo


```
>>> import pymongo
>>> connection = pymongo.Connection("localhost", 27017)
>>> db = connection.test
>>> db.name
u'test'
>>> db.my_collection
Collection(Database(Connection('localhost', 27017), u'test'),
u'my_collection')
>>> db.my_collection.save({"x": 10})
ObjectId('4aba15ebe23f6b53b0000000')
>>> db.my_collection.save({"x": 8})
ObjectId('4aba160ee23f6b543e000000')
>>> db.my_collection.save({"x": 11})
ObjectId('4aba160ee23f6b543e000002')
>>> db.my_collection.find_one()
{u'x': 10, u'_id': ObjectId('4aba15ebe23f6b53b0000000')}
>>> db.my_collection.create_index("x")
u'x_1'
>>> [item["x"] for item in db.my_collection.find().limit(2).skip(1)]
[8, 11]
```

#19 Message Queues

```
(my_env)$ pip install celery==2.4.6
(my_env)$ pip install requests==0.9.2
```

products/tasks.py

```
import logging
import requests
from celery import task

from products.models import Product

logger = logging.getLogger('products.tasks')


@task
def check_all_images():

    for product in Product.objects.all():
        response = request.get(product.medium_image.url)
        if response.status_code != 200:
            msg = "Product {0} missing image".format(product.id)
            logging.warning(msg)
```

Decorators wrap a function or method with a function.

```
>>> from products.tasks import confirm_all_images
>>> result = confirm_all_images.delay()
>>> result.ready()
False
>>> result.ready()
True
```

#20 Work with JSON

```
>>> import json
>>> data = {
    'name':'Daniel Greenfeld',
    'nickname':'pydanny',
    'states_lived':['CA','KS','MD','NJ','VA','AD'],
    'fiancee':'Audrey Roy'
    }
>>> type(data)
<type 'dict'>
>>> payload = json.dumps(data)
>>> payload
'{"fiancee": "Audrey Roy", "nickname": "pydanny", "name": "Daniel
Greenfeld", "states_lived": ["CA", "KS", "MD", "NJ", "VA", "AD"]}'
>>> type(payload)
<type 'str'>
>>> restored = json.loads(payload)
>>> type(restored)
<type 'dict'>
>>> restored
{u'fiancee': u'Audrey Roy', u'nickname': u'pydanny', u'name': u'Daniel
Greenfeld', u'states_lived': [u'CA', u'KS', u'MD', u'NJ', u'VA', u'AD'
]}
```

#21 Serve the Web

$ pip install flask==0.8

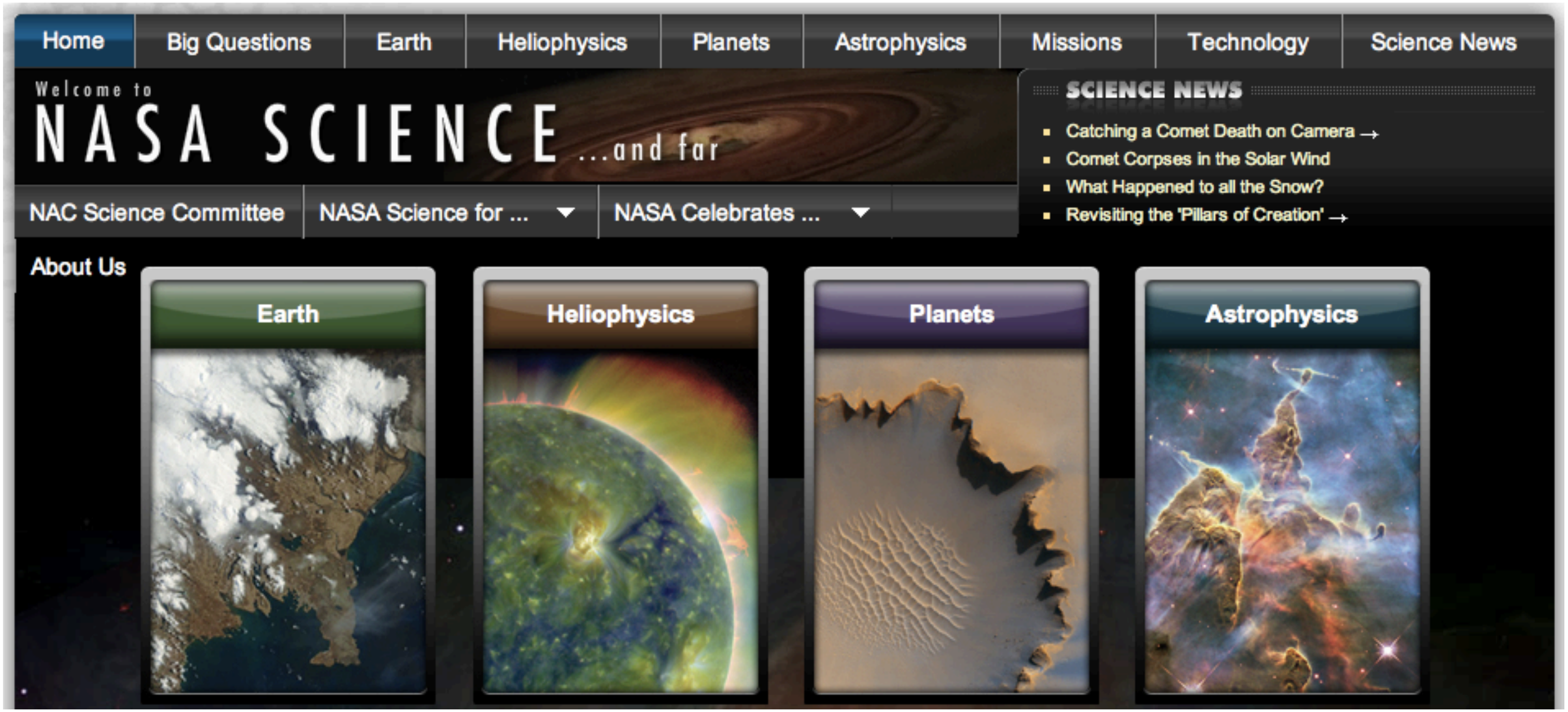
```
# webapp.py
from flask import Flask
app = Flask(__name__)

@app.route("/")
def hello():
    return "Hello World!"


if __name__ == "__main__":
    app.run()
```

flask.pocoo.org

#21 Serve the Web

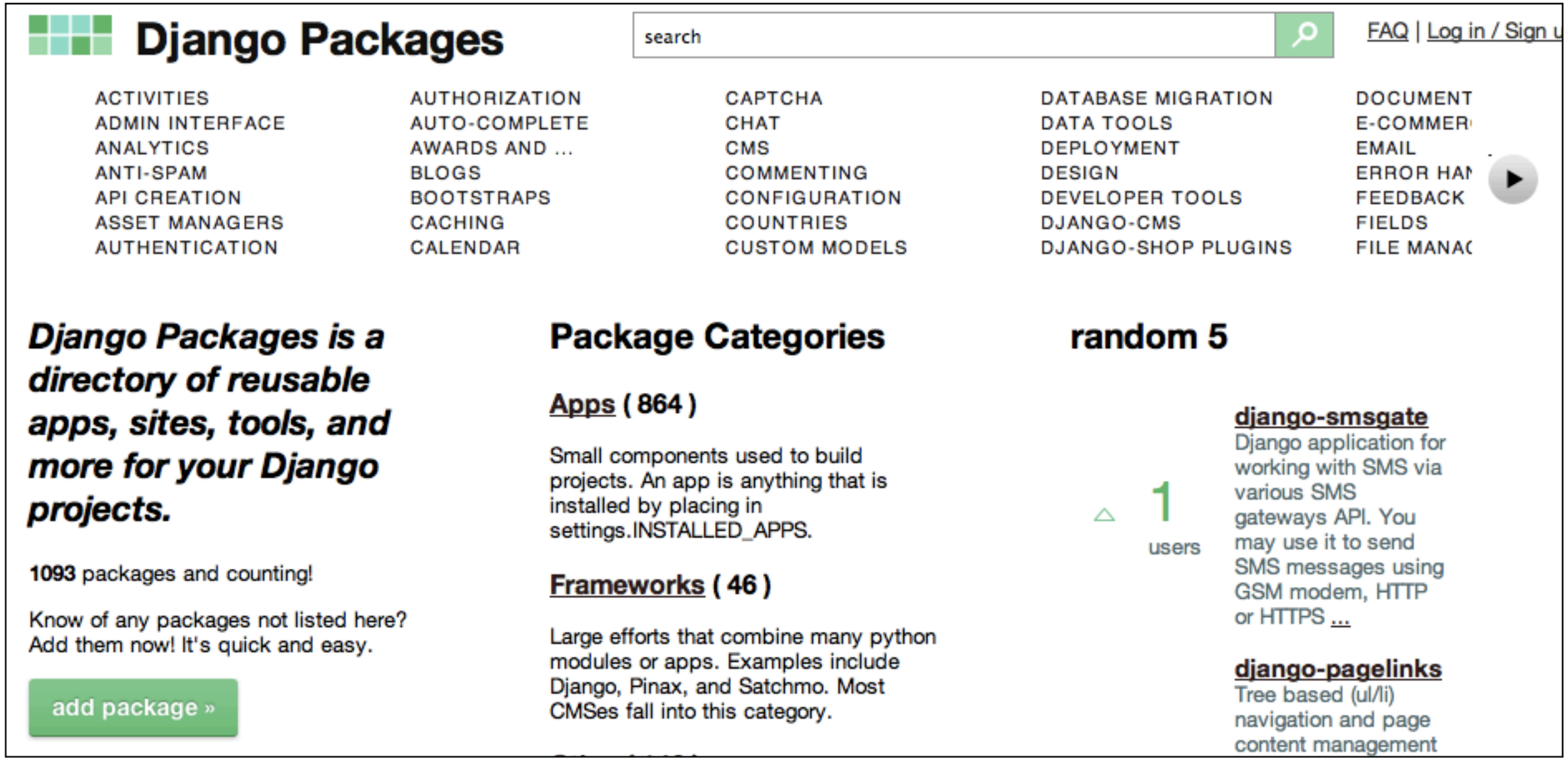
Lots more frameworks!

#21 Serve the Web



http://science.nasa.gov/

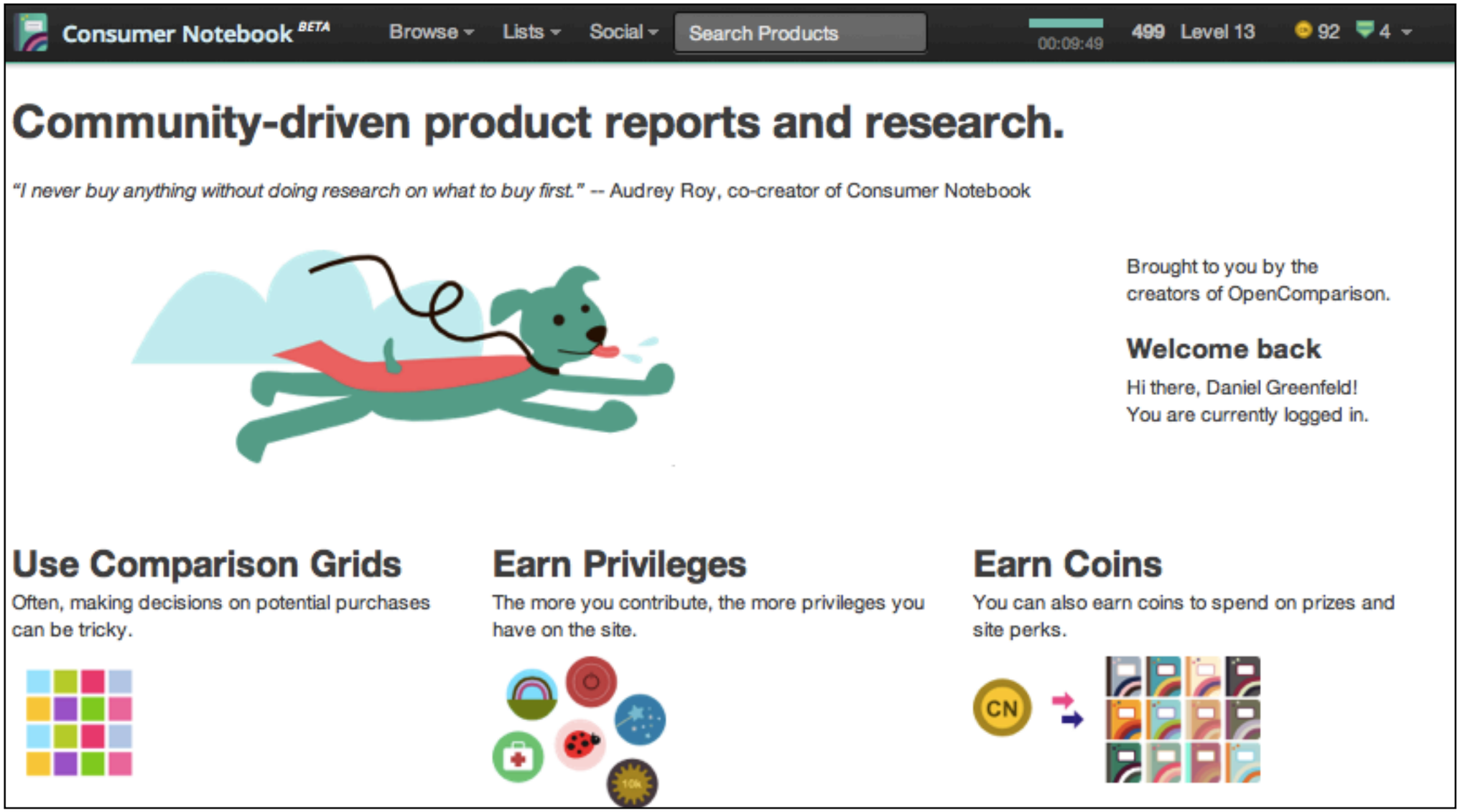
#21 Serve the Web



http://djangopackages.com

http://opencomparison.org

#21 Serve the Web



http://consumernotebook.com

#21 Serve the Web

http://grove.io

Hosted IRC

Finis

- Learn more at the following booths:
  - Python
  - Django
  - Pyladies

Questions?