An Introduction to the Zope 3 Component Architecture

Brandon Craig Rhodes
Georgia Tech

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This talk, on the whole, is divided into four parts

1. Enhancing objects

1. Enhancing objects
2. Adapting objects

1. Enhancing objects
2. Adapting objects
3. Component framework

1. Enhancing objects
2. Adapting objects
3. Component framework
4. Adapting for the web

Let's go!

Many programming languages use *static* typing

```
float half(int n)
{
    return n / 2.0;
}
```

```
float half(int n)
{
    return n / 2.0;
}
```

Python typing is *dynamic*

```
def half(n):
    return n / 2.0
```

You don't worry about whether an object is of the right type

You simply try using it

“Duck Typing”

(Alex Martelli)

“Duck Typing”

Walks like a duck?
Quacks like a duck?
It's a duck!

```
def half(n):
    return n / 2.0
```

```
def half(n):
    return n / 2.0
```

(Is *n* willing to be divided by two?
Then it's number-ish enough for us!)

Now, imagine...

Imagine a wonderful duck-processing library to which you want to pass an object

But…

The object you want to pass *isn't* a duck?

What if it *doesn't* already quack?

What if it bears
not the least resemblance
to a duck!?

Example!

You have a “Message” object from the Python “email” module

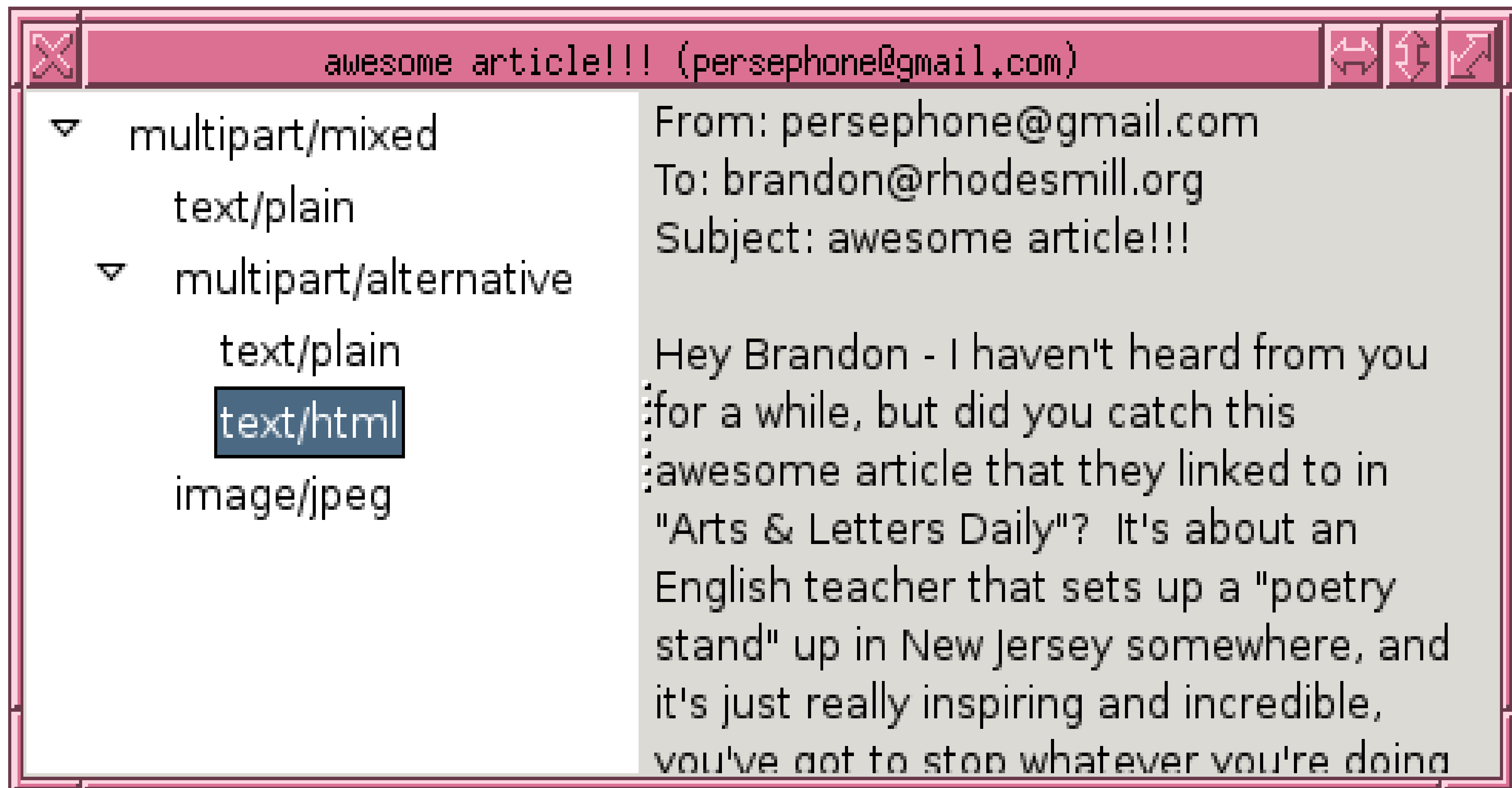
```
>>> from email import message_from_file
>>> e = message_from_file(open('msg.txt'))
>>> print e
<email.message.Message instance at ...>
>>> e.is_multipart()
True
>>> for part in e.get_payload():
...     print part.get_content_type()
text/plain
text/html
```

Messages can be recursive

```
multipart/mixed
    text/plain
    multipart/alternative
        text/plain
        text/html
    image/jpeg
```

Imagine that we are writing a GUI email client

And we want to show the parts in a TreeWidget



The Tree widget needs:

```
method name() - returns name under which
    this tree node should be displayed

method children() - returns list of child
    nodes in the tree

method __len__() - returns number of child
    nodes beneath this one
```

How can we add these behaviors to our Message?

(How can we make an object which is *not* a duck behave like a duck?)

1. Subclassing

Create a “TreeMessage” class that inherits from the “Message” class…

```python
class TreeMessage(Message):

  def name(self):
    return self.get_content_type()

  def children(self):
    if not self.is_multipart(): return []
    return [ TreeMessage(part) for part
                 in self.get_payload() ]

  def __len__(self):
    return len(self.children())
```

What will the test suite look like?

Remember:

“Untested code
is broken code”

— Philipp von Weitershausen,
Martin Aspeli

Your test suite
must instantiate a
"TreeMessage" and verify
its tree-like behavior...

```
txt = """From: persephone@gmail.com
To: brandon@rhodesmill.org
Subject: what an article!

Did you read Arts & Letters Daily today?
"""
m = message_from_string(txt, TreeMessage)
assert m.name() == 'text/plain'
assert m.children == []
assert m.__len__() == 0
```

We were lucky!

Our test can cheaply instantiate Messages.

```
txt = """From: persephone@gmail.com
To: brandon@rhodesmill.org
Subject: what an article!

Did you read Arts & Letters Daily today?
"""
m = message_from_string(txt, TreeMessage)
assert m.name() == 'text/plain'
assert m.children == []
assert m.__len__() == 0
```

What if we were subclassing an LDAP connector?!

We'd need an LDAP server just to run unit tests!

We were lucky (#2)!

The “message_from_string()” method let us specify an alternate factory!

```
txt = """From: persephone@gmail.com
To: brandon@rhodesmill.org
Subject: what an article!

Did you read Arts & Letters Daily today?
"""
m = message_from_string(txt, TreeMessage)
assert m.name() == 'text/plain'
assert m.children == []
assert m.__len__() == 0
```

Final note: *we have just broken the “Message” class's behavior!*

Python library manual 7.1.1 defines “Message”:

`__len__():`

Return the total number of headers, including duplicates.

```
>>> t = """From: persephone@gmail.com
To: brandon@rhodesmill.org
Subject: what an article!

Did you read Arts & Letters Daily today?
"""
>>> m = message_from_file(t, Message)
>>> print len(m)
3
>>> m = message_from_file(t, TreeMessage)
>>> print len(m)
0
```

So how does subclassing score?

- No harm to base class

- No harm to base class
- Cannot test in isolation

- ✓ No harm to base class
- ● Cannot test in isolation
- ● Need control of factory

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- Breaks if names collide

- ✔ No harm to base class
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Subclassing: D

2. Using a mixin

Create a “TreeMessage” class that inherits from both “Message” and a “Mixin”…

```python
class Mixin(object):
  def name(self):
    return self.get_content_type()
  def children(self):
    if not self.is_multipart(): return []
    return [ TreeMessage(part) for part
               in self.get_payload() ]
  def __len__(self):
    return len(self.children())

class TreeMessage(Message, Mixin): pass
```

Your test suite can then inherit from a mocked-up "message"…

```
class FakeMessage(Mixin):
  def get_content_type(self):
    return 'text/plain'
  def is_multipart(self): return False
  def get_payload(self): return ''

m = FakeMessage()

assert m.name() == 'text/plain'
assert m.children() == []
assert m.__len__() == 0
```

How does
a mixin rate?

- No harm to base class

- ✔ No harm to base class
- ✔ Can test mixin by itself

- ✔ No harm to base class
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- ● Breaks if names collide

Mixin: C

3. Monkey patching

To “monkey patch” a class, you add or change its methods dynamically…

```
def name(self):
  return self.get_content_type()
def children(self):
  if not self.is_multipart(): return []
  return [ Message(part) for part
             in self.get_payload() ]
def __len__(self):
  return len(self.children())

Message.name = name
Message.children = children
Message.__len__ = __len__
```

Is this desirable?

- ✔ Don't care about factory

- ✔ Don't care about factory
- ● Changes class itself

- Don't care about factory
- Changes class itself
- Broken by collisions

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- ✔ Don't care about factory
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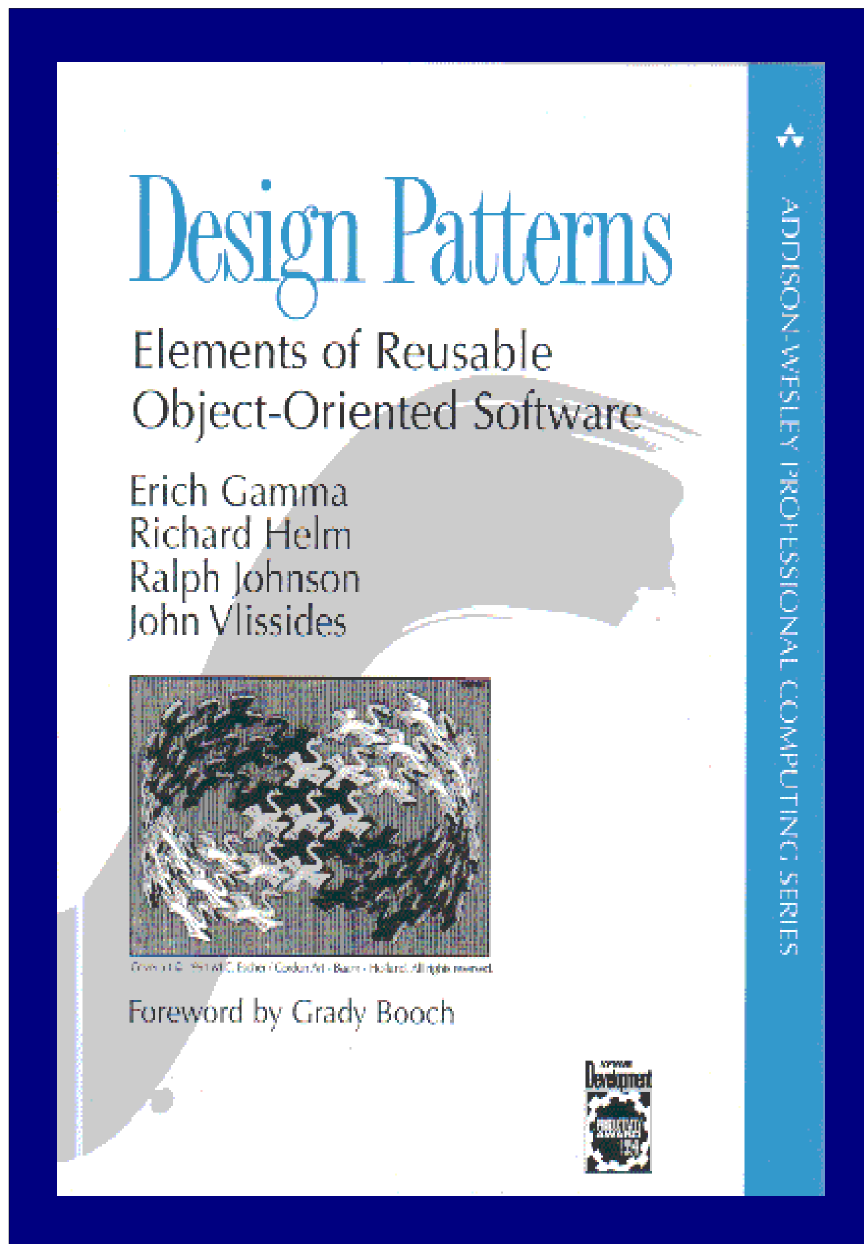
- ● Ruby people do this

Monkey patching: F

4. Adapter



Touted in the Gang of Four book (1994)

Idea: provide “Tree” functions through an entirely separate class

Message

- get_content_type()
- is_multipart()
- get_payload()

← call

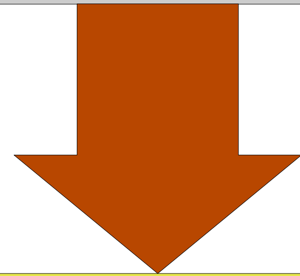
MessageTreeAdapter

- name()
- children()
- __len__()

```python
class MessageTreeAdapter(object):
  def __init__(self, message):
    self.m = message
  def name(self):
    return self.m.get_content_type()
  def children(self):
    if not self.m.is_multipart(): return []
    return [ TreeMessageAdapter(part)
      for part in self.m.get_payload() ]
  def __len__(self):
    return len(self.children())
```

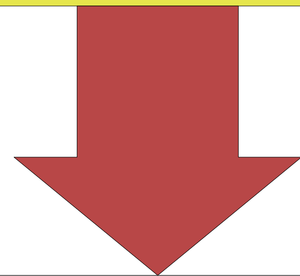
How does wrapping look in your code?

IMAP library (or whatever)



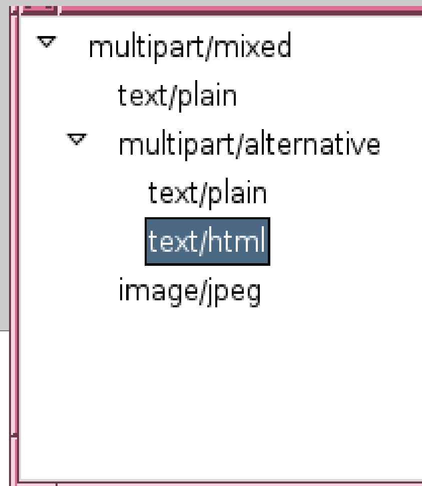
Message object

`tw = TreeWidget(MessageTreeAdapter(msg))`



Adapted object

TreeWidget



Test suite can try adapting a mock-up object

```python
class FakeMessage(object):
  def get_content_type(self):
    return 'text/plain'
  def is_multipart(self): return True
  def get_payload(self): return []

m = MessageTreeAdapter(FakeMessage())
assert m.name() == 'text/plain'
assert m.children == []
assert m.__len__() == 0
```

How does the Adapter design pattern stack up?

- No harm to base class

- ✔ No harm to base class
- ✔ Can test with mock-up

- ✔ No harm to base class
- ✔ Can test with mock-up
- ✔ Don't need factories

- ✓ No harm to base class
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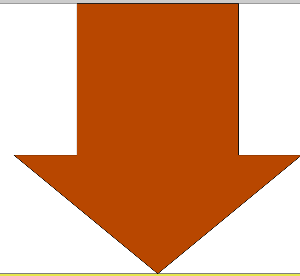
Adapter: B

Q: Why call wrapping "annoying"?

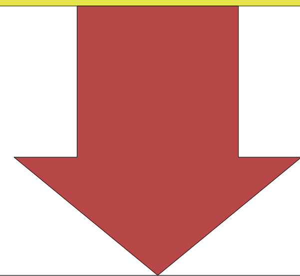
The example makes
it look so easy!

IMAP library (or whatever)



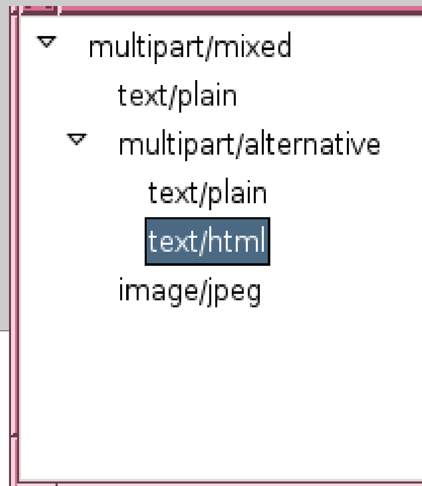
Message object

```
tw = TreeWidget(TreeMessageAdapter(msg))
```



Adapted object

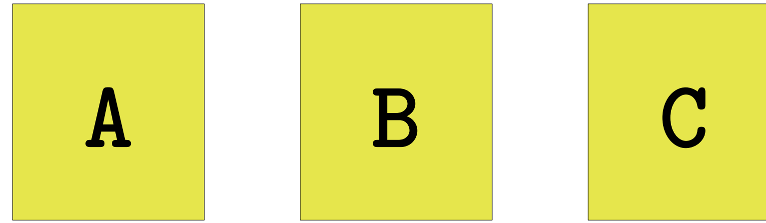
TreeWidget



A: The example looks easy because it only does adaptation *once*!

But in a real application, it happens all through your code…

Adapters



Your application

3rd party Producers

IMAP
Genealogy
DB
email

objects

msg
C(msg)
A(famtree)
B(msg)
C(msg)

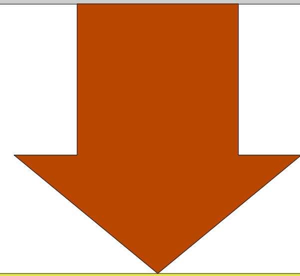
objects

3rd party Consumers

Web
Widget
GUI

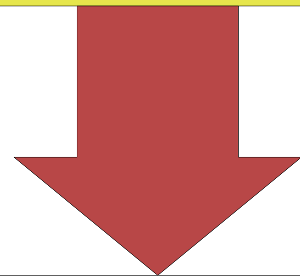
How can you avoid repeating yourself, and scattering information about adapters and consumers everywhere?

IMAP library (or whatever)



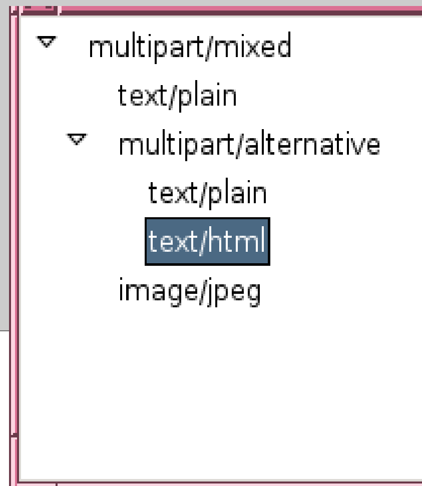
Message object

```
tw = TreeWidget(TreeMessageAdapter(msg))
```



Adapted object

TreeWidget



```
tw = TreeWidget(TreeMessageAdapter(msg))
```

```
tw = TreeWidget(TreeMessageAdapter(msg))
```

The key is seeing that this code conflates *two* issues!

```
tw = TreeWidget(TreeMessageAdapter(msg))
```

Why does this line work?

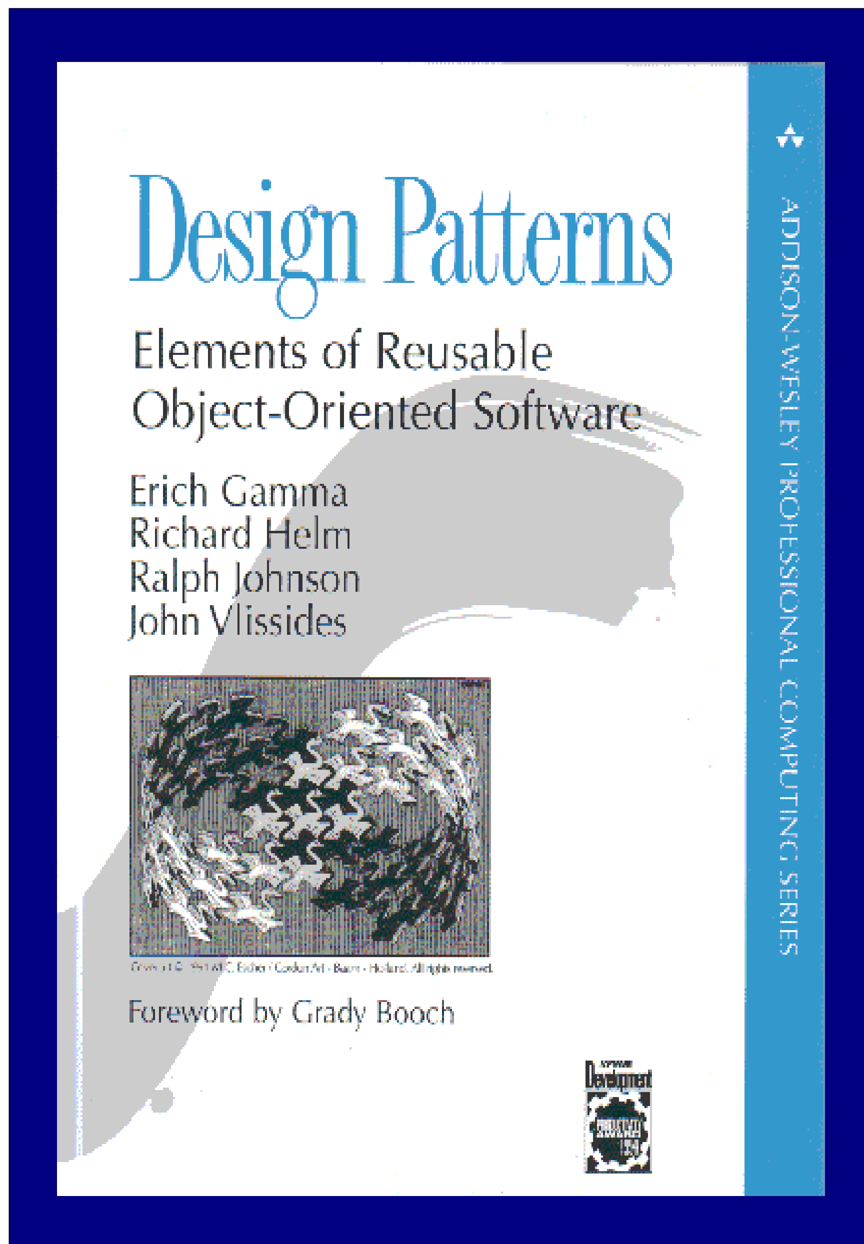
```
tw = TreeWidget(TreeMessageAdapter(msg))
```

It works because a TreeWidget *needs* what our adapter *provides*.

```
tw = TreeWidget(TreeMessageAdapter(msg))
```

But if *we* call the adapter then the **need = want** is *hidden inside of our head!*

We need to define what the TreeWidget needs that our adapter provides!



An *interface* is how we specify a set of behaviors

(1988)

(1995)

An *interface* is how we specify a set of behaviors

ZOPE®

For the moment, forget Zope-the-web-framework

Instead, look at Zope the component framework:

zope.interface
zope.component

With three simple steps, Zope will rid your code of manual adaptation

1. *Define* an interface
2. *Register* our adapter
3. *Request* adaptation

Define

```
from zope.interface import Interface

class ITree(Interface):
  def name():
    """Return this tree node's name."""
  def children():
    """Return this node's children."""
  def __len__():
    """Return how many children."""
```

Register

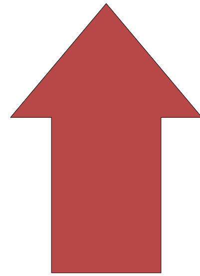
```
from zope.component import provideAdapter

provideAdapter(MessageTreeAdapter,
               adapts=Message,
               provides=ITree)
```

Request

```
from your_interfaces import ITree
class TreeWidget(...):
    def __init__(self, arg):
        tree = ITree(arg)
        ...
```

Request

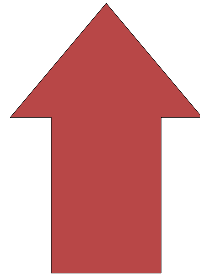
```
from your_interfaces import ITree
class TreeWidget(...):
  def __init__(self, arg):
    tree = ITree(arg)
    ...
```



```
Zope will: 1. Recognize need
           2. Find the registered adapter
           3. Wrap and return the Message
```

Request

```
from your_interfaces import ITree
class TreeWidget(...):
  def __init__(self, arg):
    tree = ITree(arg)
    ...
```



(Look! Zope
is Pythonic!)

```
i = int(32.1)
l = list('abc')
f = float(1024)
```

And that's it!

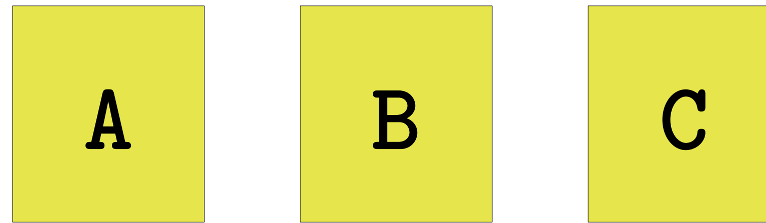
And that's it!

Define an interface
Register our adapter
Request adaptation

- ✓ No harm to base class
- ✓ Can test with mock-up
- ✓ Don't need factories
- ✓ No collision worries
- ✓ Adapters now dynamic!

Registered adapter: A

Adapters



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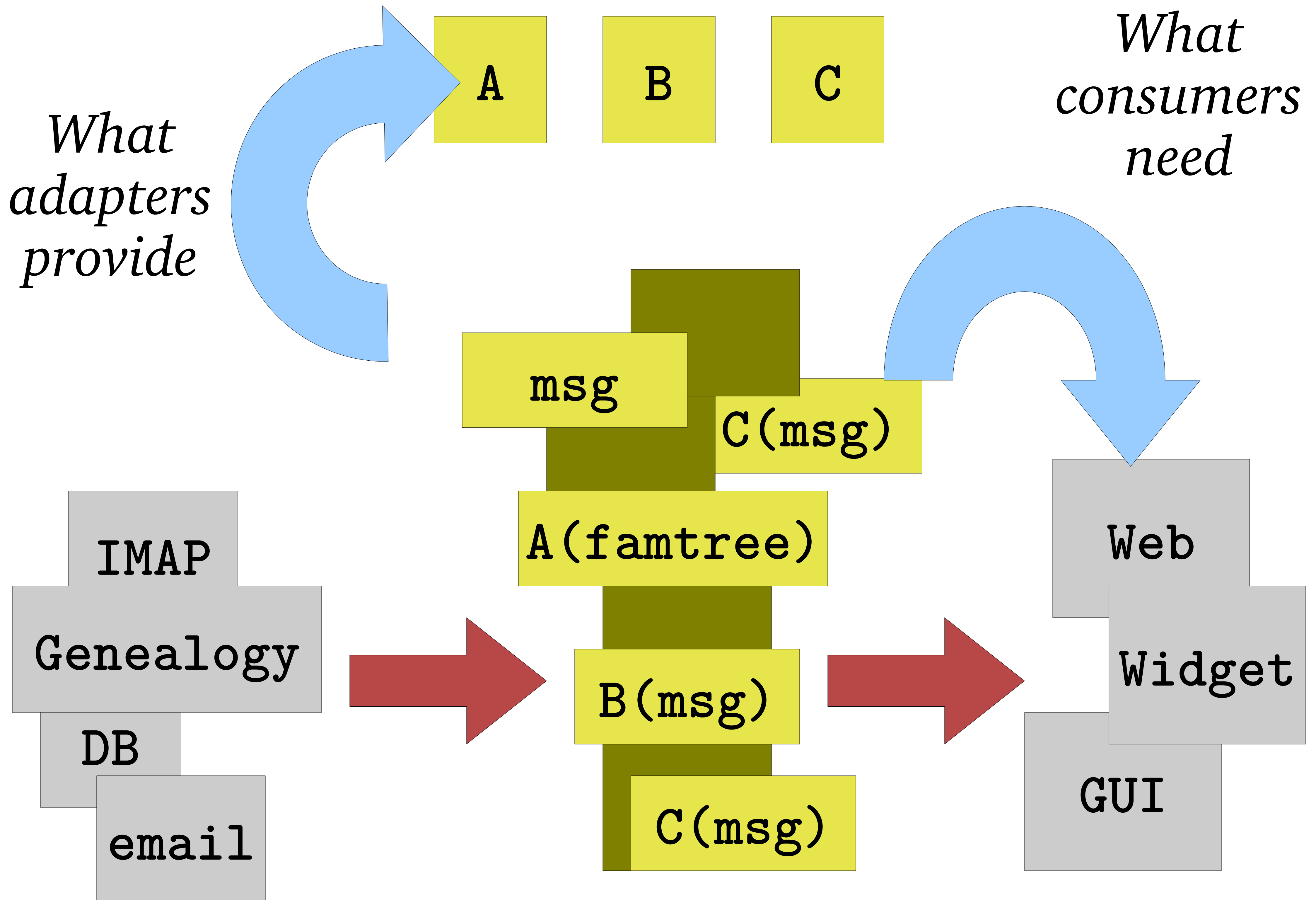
What adapters provide
A
B
C
What consumers need
msg
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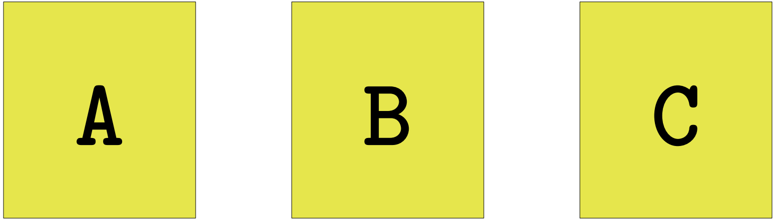
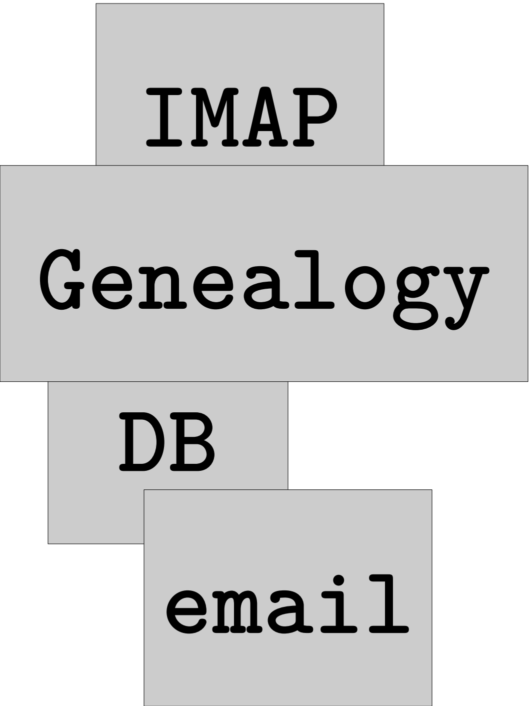

A
B
C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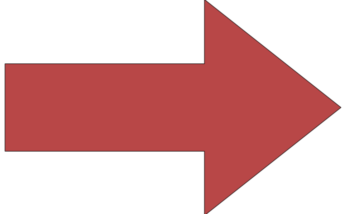
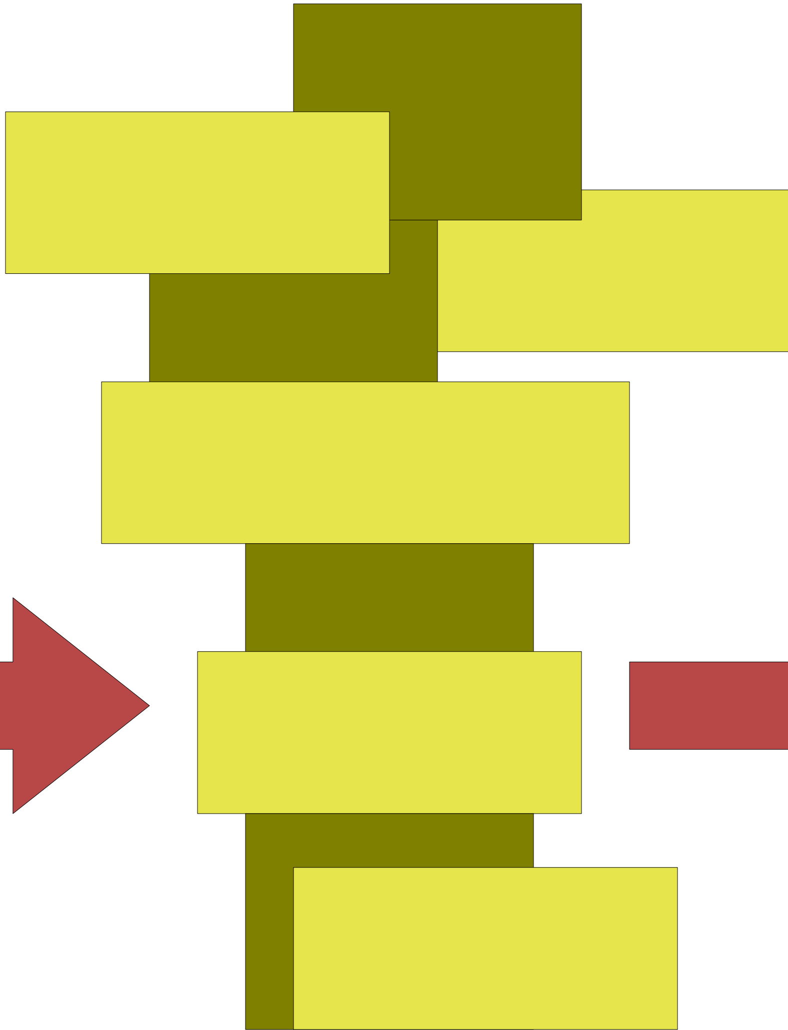
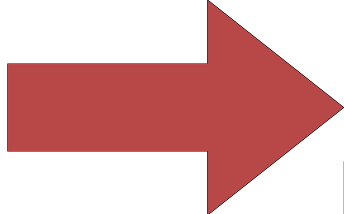
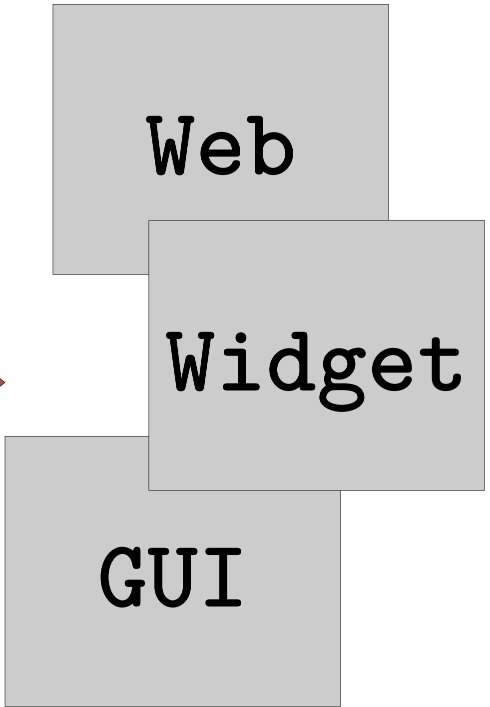







Web
Widget
GUI

The finale

Adapting for the Web

dum ... dum ... dum ...

DAH DUM!

Grok

Web framework
built atop Zope 3
component architecture

Grok makes
Zope 3 simple to use
(and to present!)

Imagine a Person class

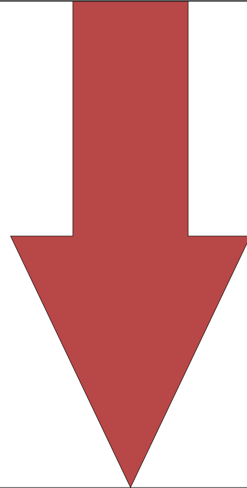
The Person class was written by someone else

The Person class is full of business logic, and stores instances in a database

We want to browse Person objects on the Web

What might the Web need the object to do?

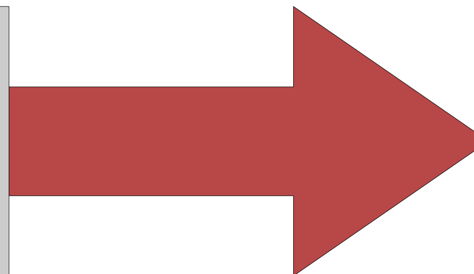
http://person_app/Joe



1. What's at a URL

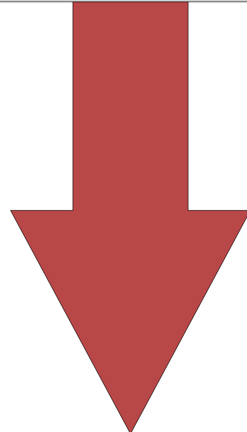
2. HTML document

Person



<HTML>
<HEAD>
<TITLE>Person JOE
</TITLE>
</HEAD>
<BODY>
This page presents the basic data we have regarding Joe.
...

3. What is its URL



http://person_app/Joe

1.

What's at this URL?

What's at this URL?

`http://person_app/Joe`

```
# how Zope processes this URL:
r = root
j = ITraverser(r).traverse('person_app')
k = ITraverser(j).traverse('Joe')
return k
```

What's at this URL?

`http://person_app/Joe`

```
# what we write:
class PersonTraverser(grok.Traverser):
  grok.context(PersonApp)
  def traverse(self, name):
    if person_exists(name):
      return get_person(name)
    return None
```

What's at this URL?

`http://person_app/Joe`

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      return get_person(name)
```

2.

How does a Person render?

How does a Person render?

app.py

```
class PersonIndex(grok.View):
  grok.context(Person)
  grok.name('index')
```

app_templates/personindex.pt

```
<html><head><title>All about
 <tal tal:replace="context/name"/>
</title></head>...
```

3.

What is a person's URL?

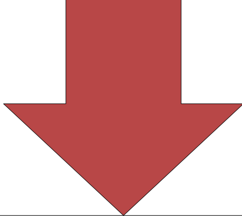
What is a person's URL?

```
class PersonURL(grok.MultiAdapter):
  grok.adapts(Person, IHTTPRequest)
  grok.implements(IAbsoluteURL)
  def __init__(self, person, req):
    self.person, self.req = person, req
  def __call__(self):
    base = grok.url(grok.getSite())
    return base + '/' + self.person.name
```

$5 + 3 + 8 = 16$ lines

http://person_app/Joe

PersonTraverser



1. What's at a URL

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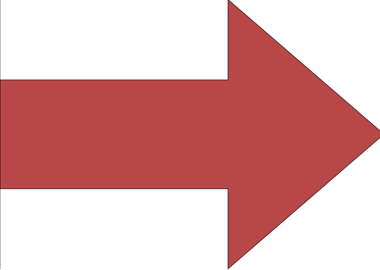
Person



PersonIndex

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 This page presents
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 ...
```
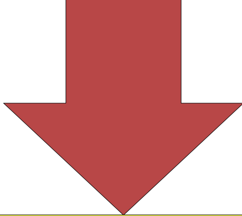

3. What is its URL



PersonURL

http://person_app/Joe

Other Zope adapter uses

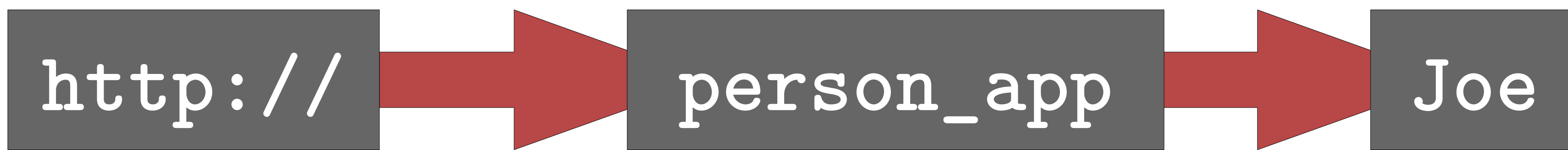
Other Zope adapter uses

Indexing — Index, Query, Search, ...
Data schemas — Schema, Vocabulary, DublinCore ...
Form generation — AddForm, EditForm, ...
Security — SecurityPolicy, Proxy, Checker, ...
Authentication — Login, Logout, Allow, Require, ...
Copy and paste — ObjectMover, ObjectCopier, ...
I18n — TranslationDomain, Translator, ...
Appearance — Skins, macros, viewlets, ...

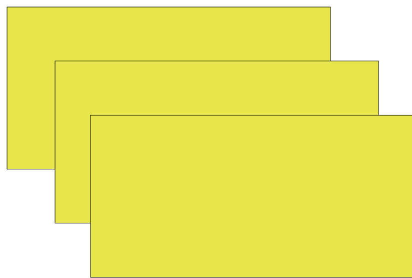
Much, much more!

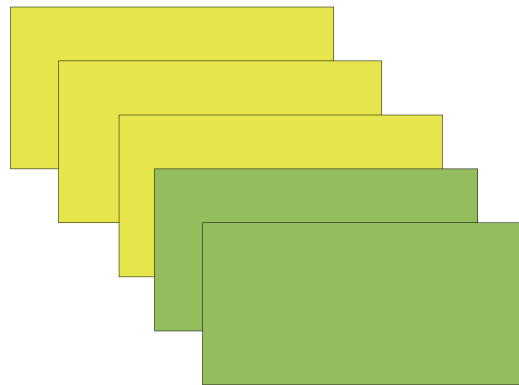
Adapters can be local!

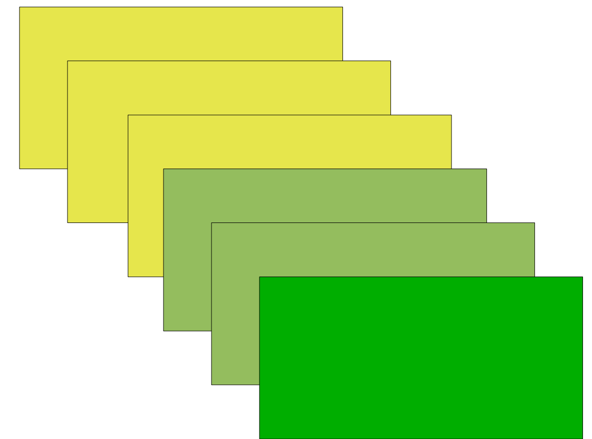
`http://person_app/Joe`



Global adapters







Local adapters

Coming Attraction

five.grok

five.grok

Lennart Regebro

Thank you!

http://zope.org/Products/Zope3
http://grok.zope.org/
http://rhodesmill.org/brandon/adapters
http://regebro.wordpress.com/
zope-dev@zope.org mailing list
grok-dev@zope.org mailing list
Web Component Development with Zope 3 by PvW