Using Grok to Walk Like a Duck

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for PyCon 2008
in the Windy City

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?

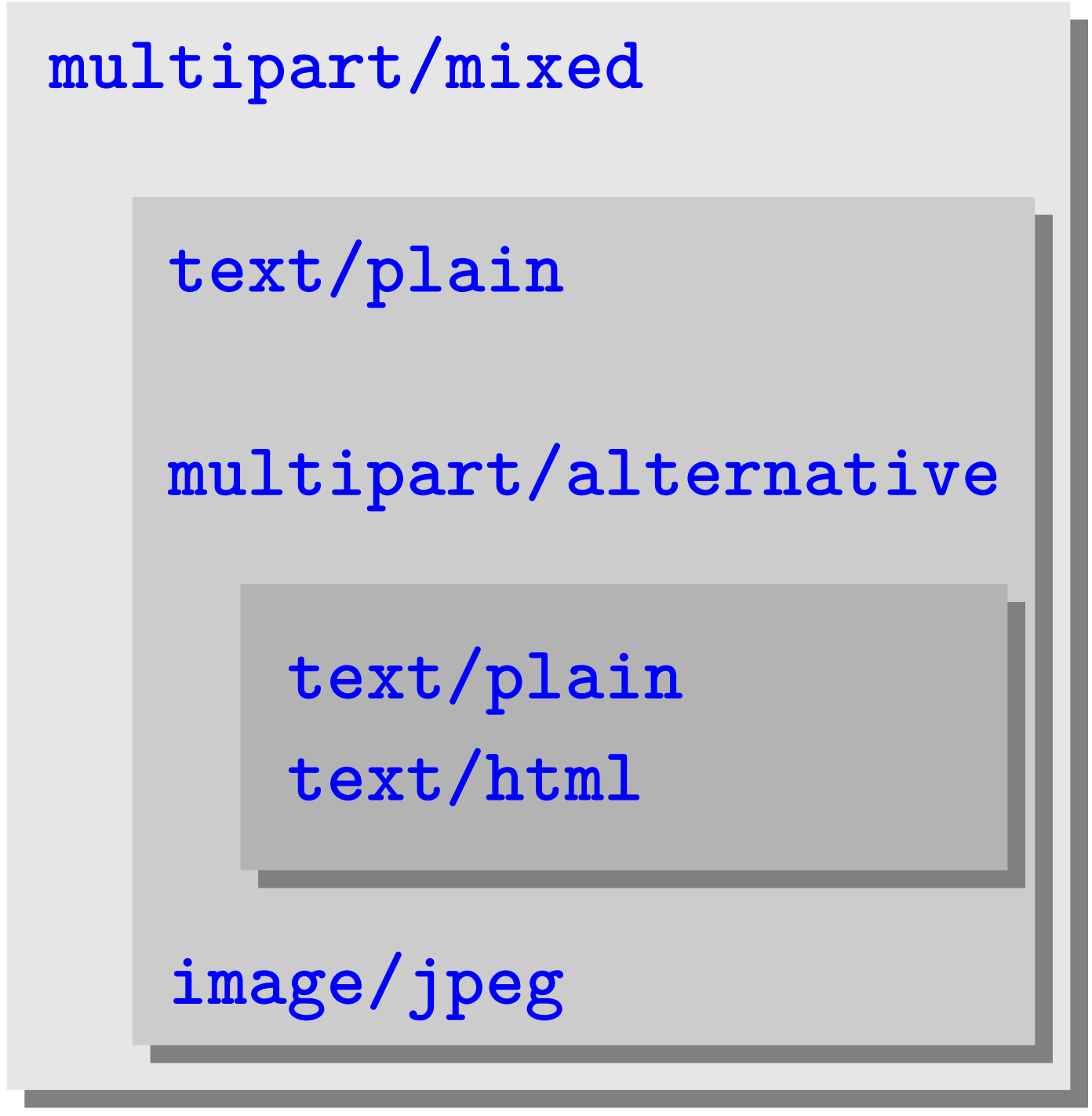
What if it bears
not the least resemblance
to a duck!?

Example!

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

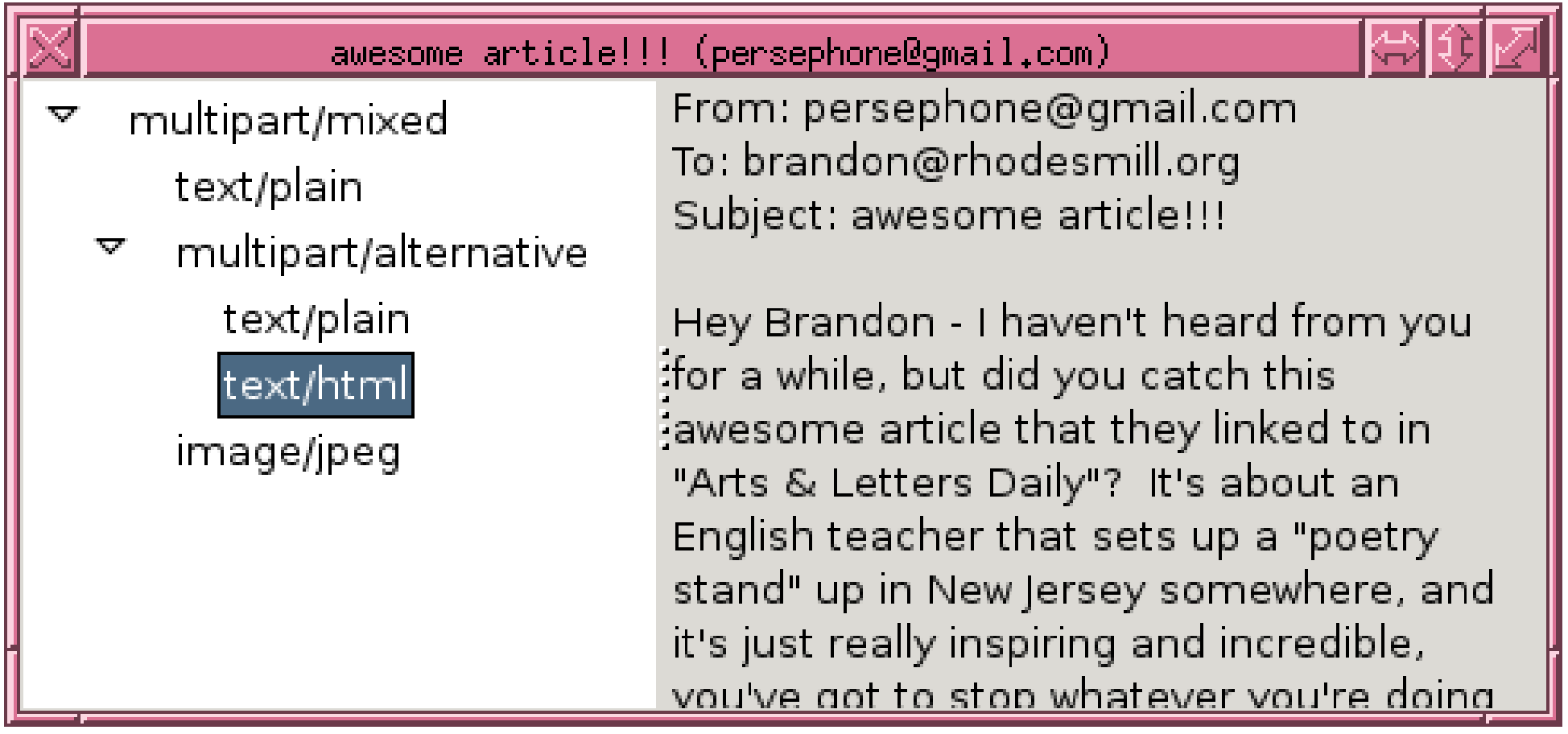
```
>>> from email import message_from_file
>>> e = message_from_file(open('msg.txt'))
>>> print e
<email.message.Message instance at ...>
>>> e.is_multipart()
True
>>> for part in e.get_payload():
...     print part.get_content_type()
text/plain
text/html
```

Messages can be recursive



Imagine that we are writing a GUI email client

And we want the Message displayed 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...

```
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 library?!

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”:

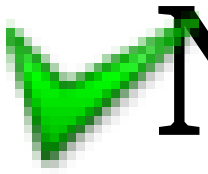
`__len__()`:

Return the total number of headers, including duplicates.

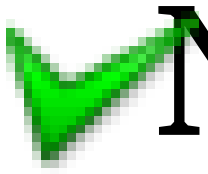
```
>>> t = """From: persephone@gmail.com
To: brandon@rhodesmill.org
Subject: what an article!

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



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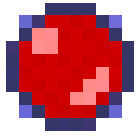
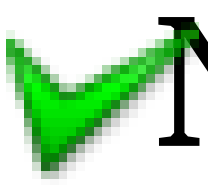


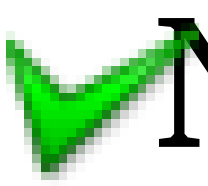
Cannot test in isolation

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



No harm to base class

- Cannot test in isolation
- Need control of factory
- Breaks if names collide



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Subclassing: D

2. Using a mixin

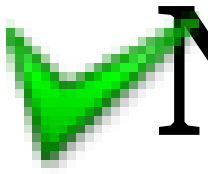
Create a “TreeMessage” class that inherits from both “Message” and a “Mixin”...

```
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”...

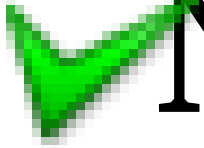
```
class FakeMessage(Mixin):
  def get_content_type(self):
    return 'text/plain'
  def is_multipart(self): return False
  def get_payload(self): return ''

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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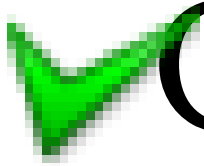
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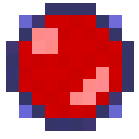
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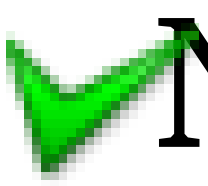
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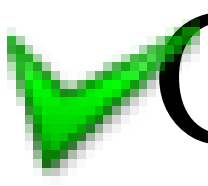
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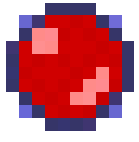
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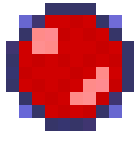
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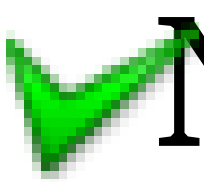
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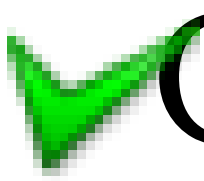
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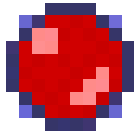
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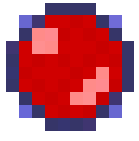

Breaks if names collide

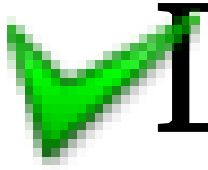
Mixin: C

3. Monkey patching

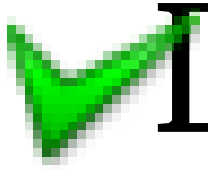
To “monkey patch” a class, you add or change its methods dynamically...

```
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 need factory



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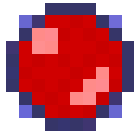
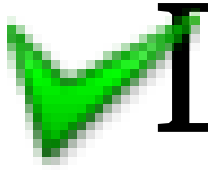


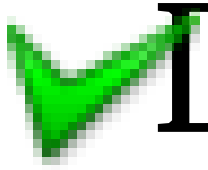
Changes class itself

- Don't need factory
- Changes class itself
- Broken by collisions



Don't need factory

- Changes class itself
- Broken by collisions
- Patches fight each other



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- Ruby people do this

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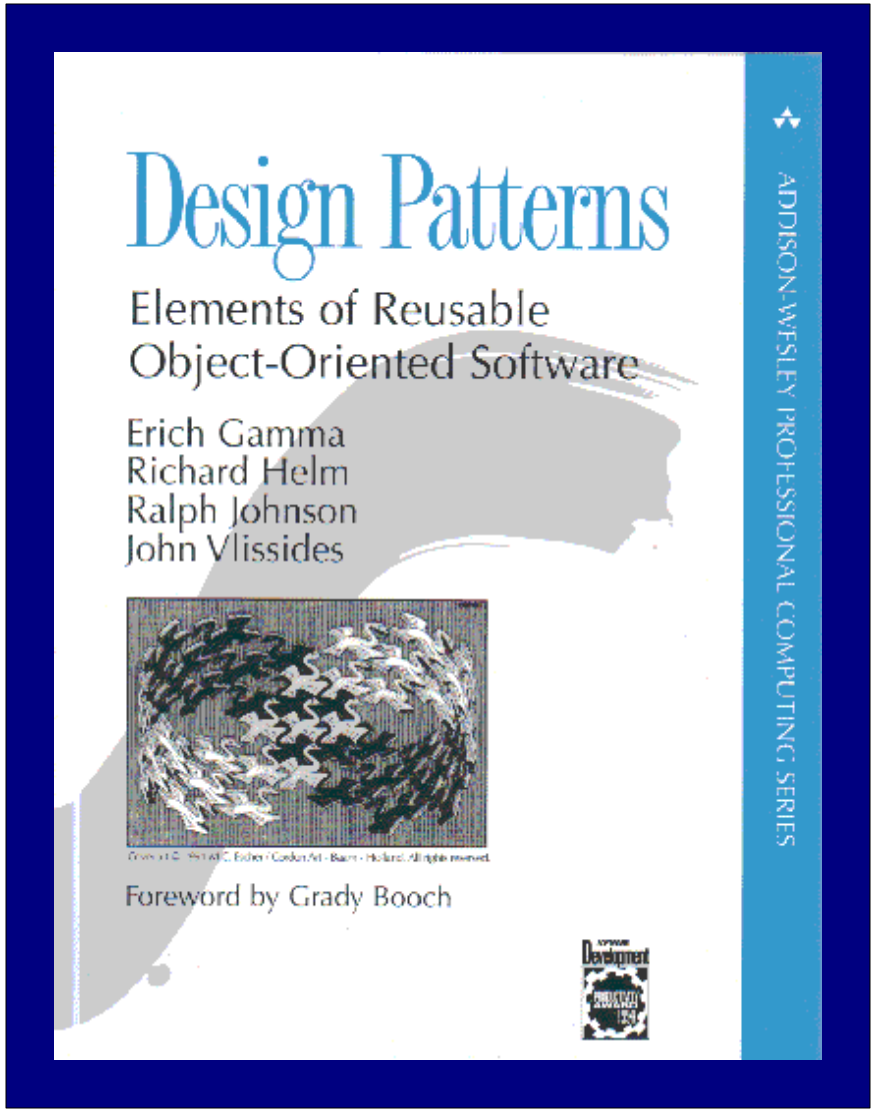
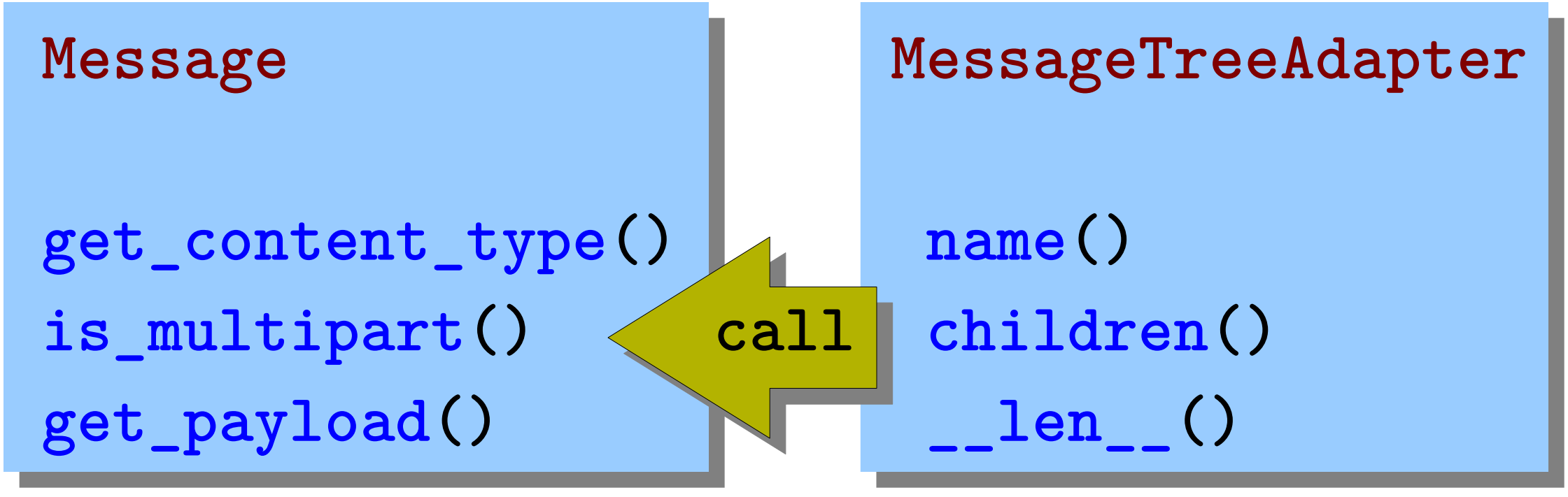
Monkey patching: F

4. Adapter



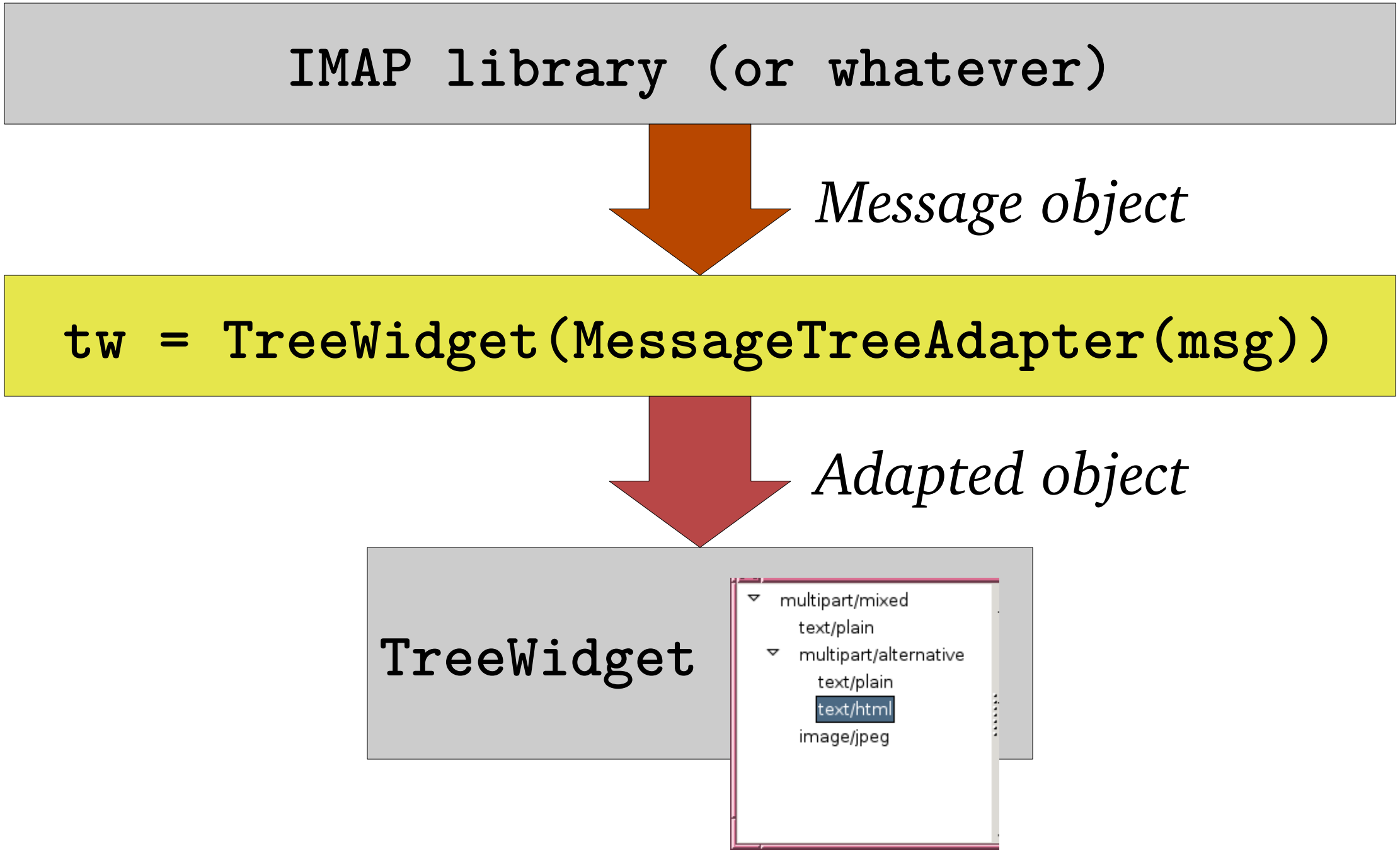
Touted in the Gang of Four book (1994)

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



```
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?

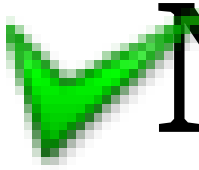

IMAP library (or whatever)
Message object
tw = TreeWidget(MessageTreeAdapter(msg))
Adapted object
TreeWidget
multipart/mixed
text/plain
multipart/alternative
text/plain
text/html
image/jpeg

Test suite can try adapting a mock-up object

```
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?



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Adapter: B

Q: Why call wrapping “annoying”?

The example makes it look so easy!

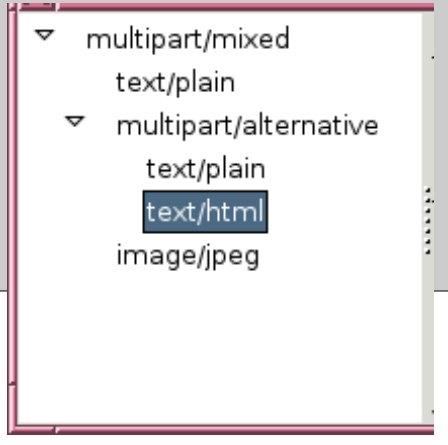
IMAP library (or whatever)

Message object

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

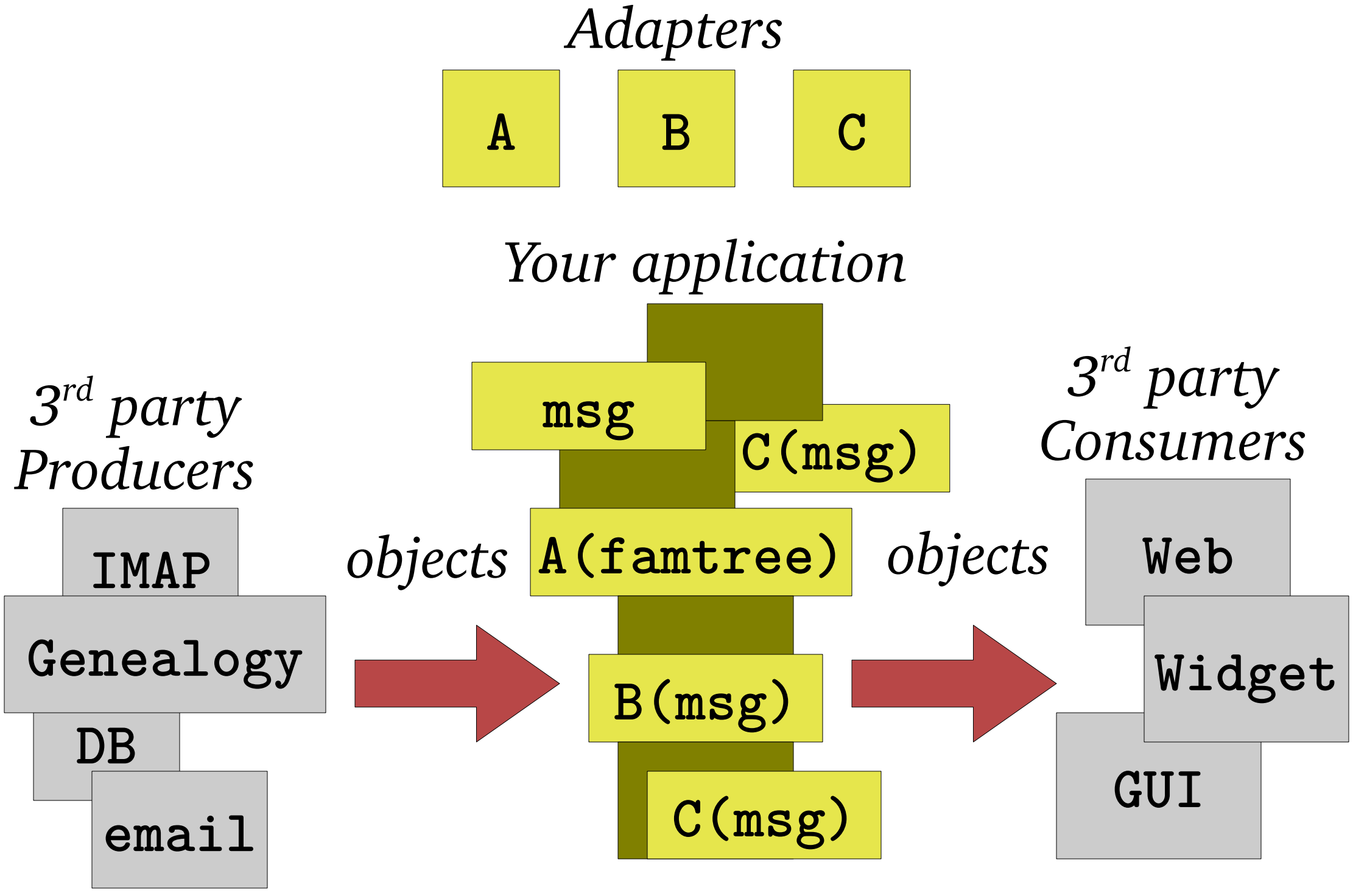
Adapted object

TreeWidget



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

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


Adapters
A
B
C
Your application
msg
C(msg)
A(famtree)
B(msg)
C(msg)
3rd party Producers
IMAP
Genealogy
DB
email
objects
objects
3rd party Consumers
Web
Widget
GUI

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

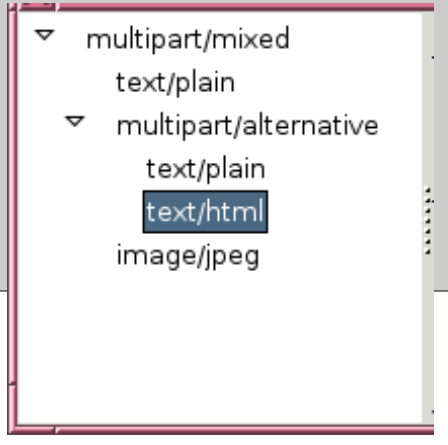
IMAP library (or whatever)

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?

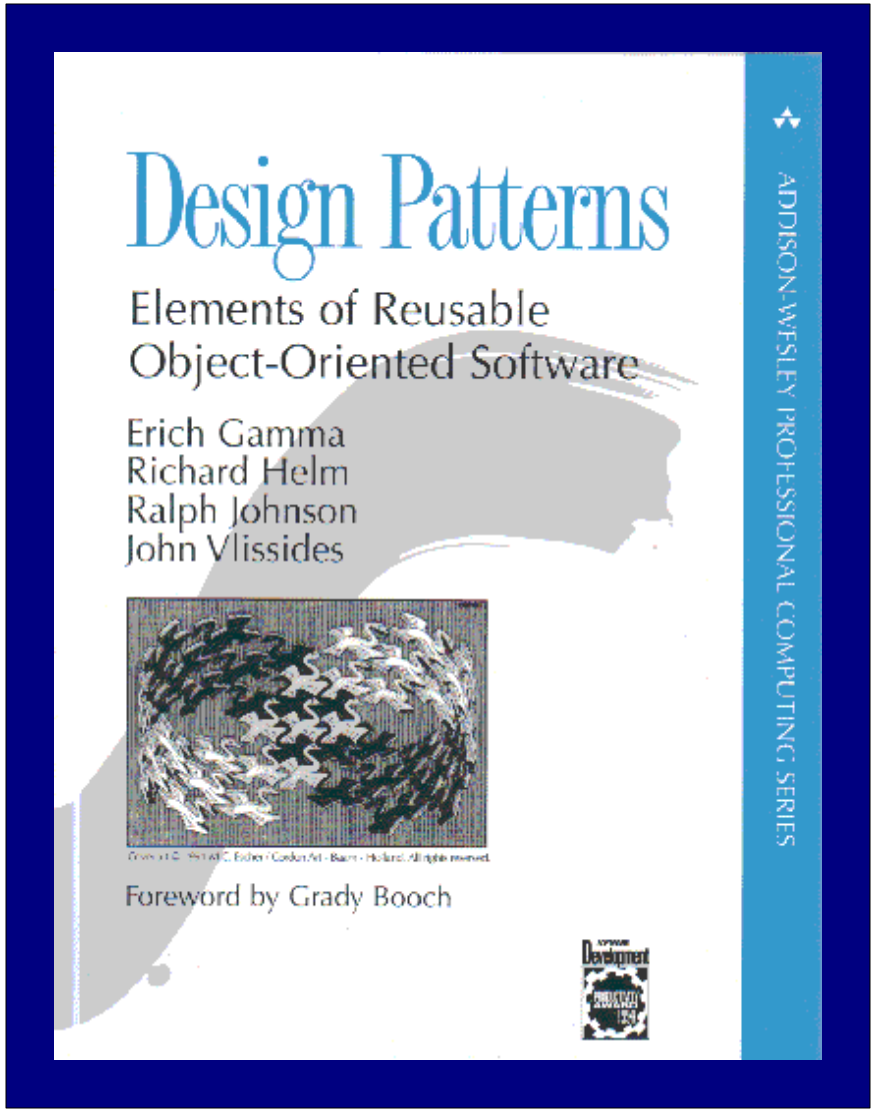
```
tw = TreeWidget(TreeMessageAdapter(msg))
```

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

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

But this line of code keeps that information *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

Define an interface
Register our adapter
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):
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    ...
```
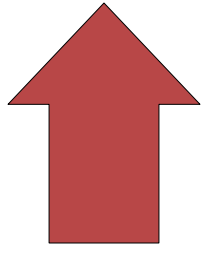



(Look! Zope is Pythonic!)

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

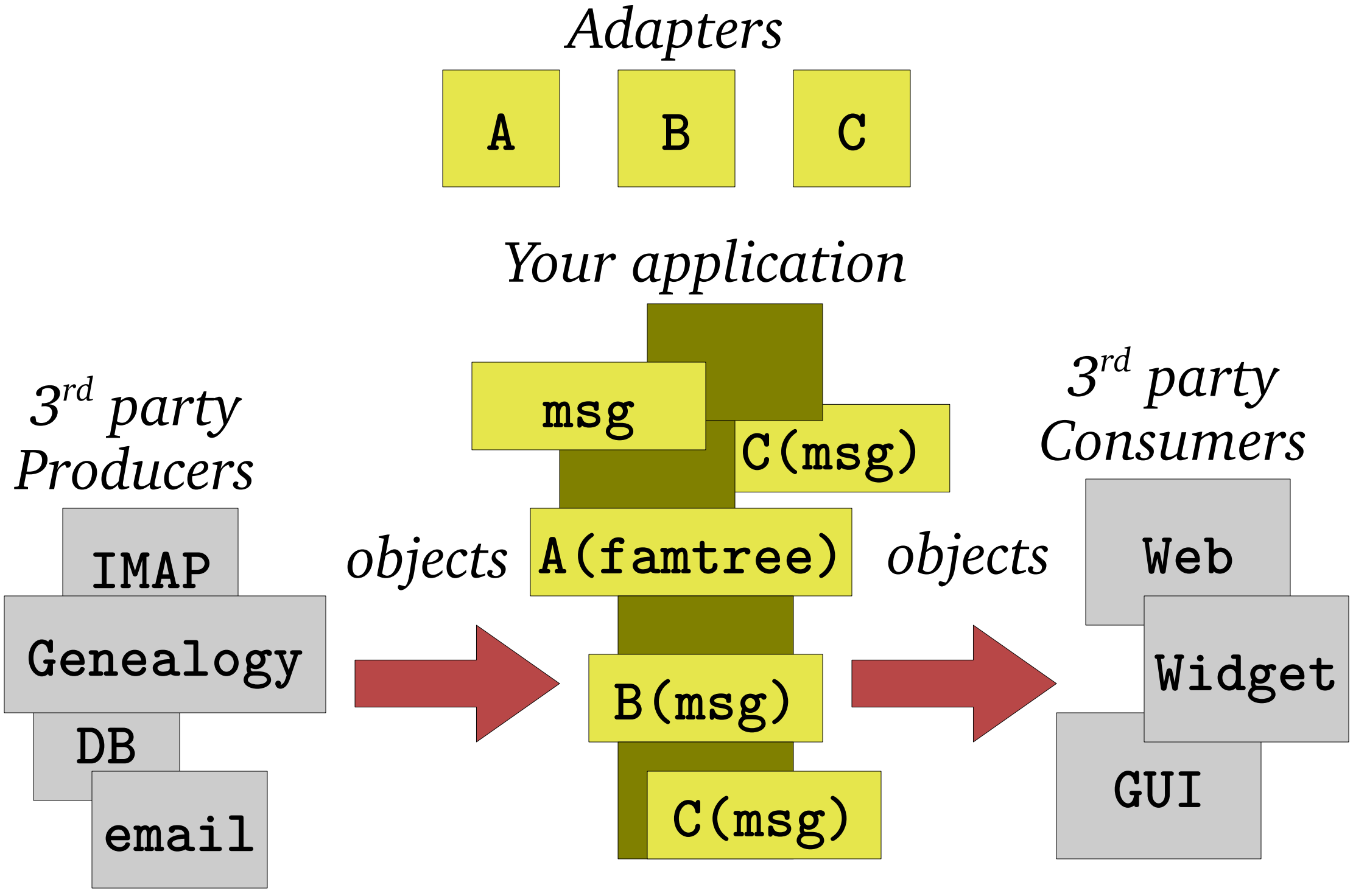
And that's it!

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
- Zope framework is cool

Registered adapter: A


Adapters
A
B
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Your application
msg
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A(famtree)
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3rd party Producers
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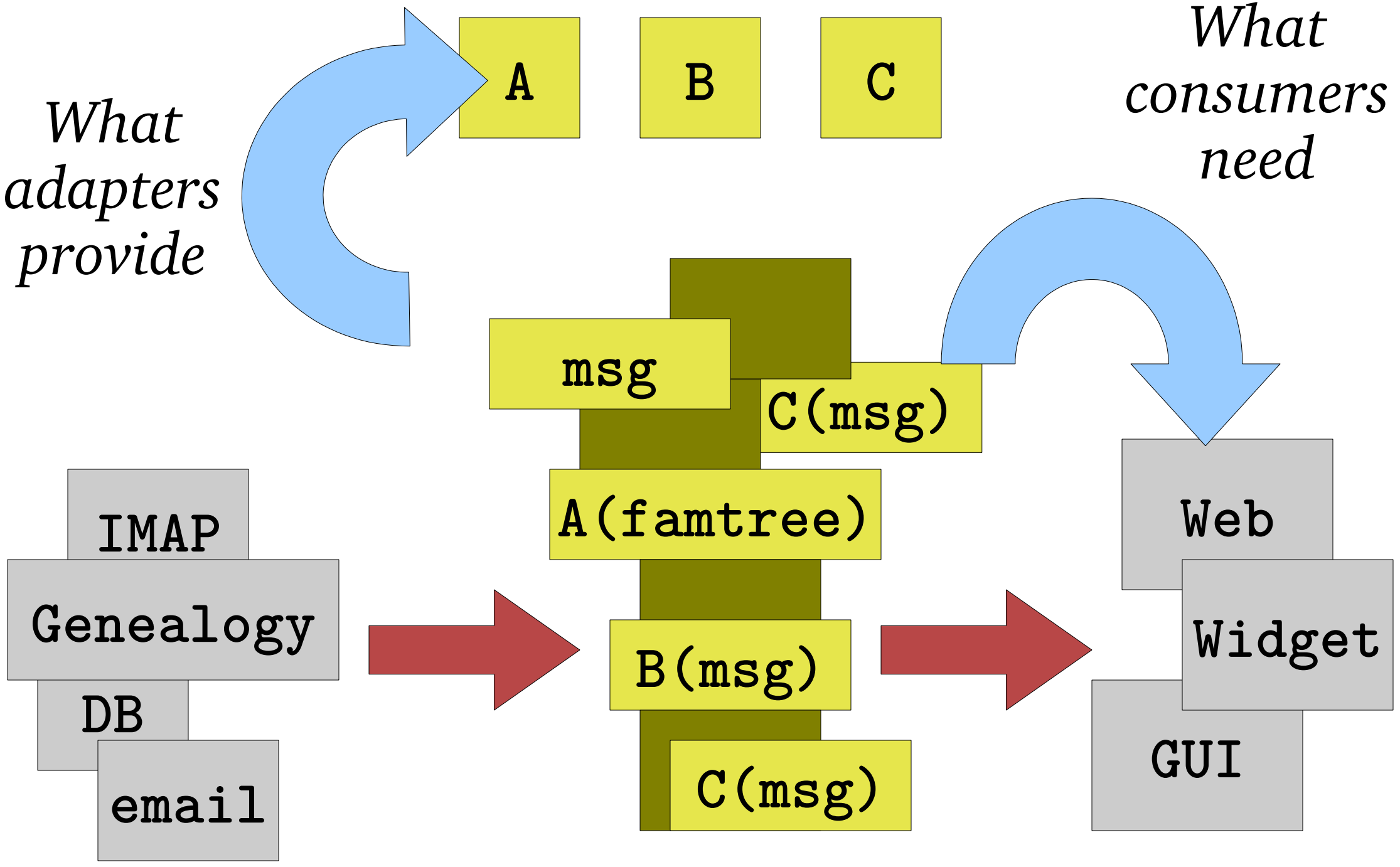
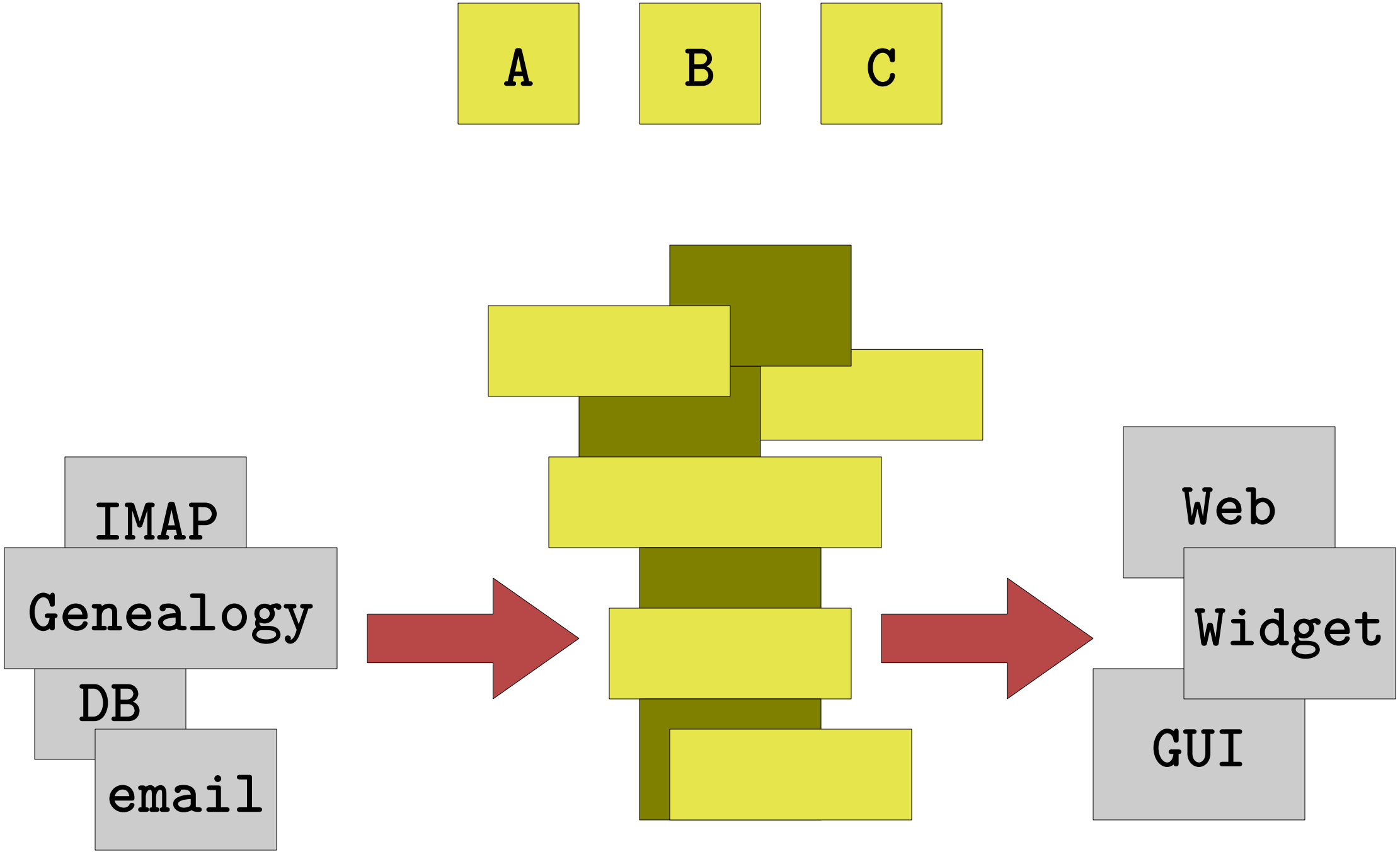
GUI


What adapters provide
A
B
C
What consumers need
msg
C(msg)
A(famtree)
B(msg)
C(msg)
IMAP
Genealogy
DB
email
Web
Widget
GUI


A
B
C
IMAP
Genealogy
DB
email
Web
Widget
GUI

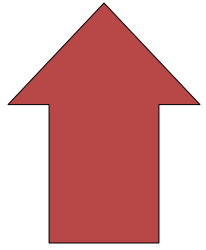
To conclude:

3 practical tips
3 closing statements

Practical tip #1: you can provide a default argument for adaptation

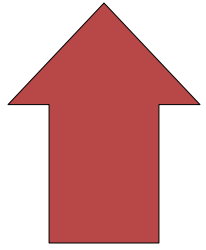
```
from your_interfaces import ITree

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

```
from your_interfaces import ITree


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



Q: What if Zope doesn't know how to adapt the object?

```
from your_interfaces import ITree

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



Q: What if Zope doesn't know how to adapt the object?

A: It throws an exception!

What if that annoys you?

What if some objects
“just work” natively?

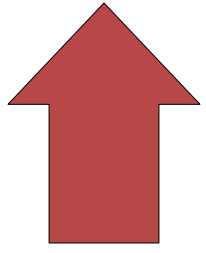
Right way out
and an
Easy way out

Right way: Mark up other classes that already provide interface

```
from zope.interface import alsoProvides
alsoProvides(GenealogyTree, ITree)
alsoProvides(FileSystemTree, ITree)
```

Request

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



(Look! Zope is Pythonic!)

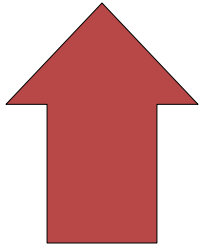
```
          i = int(3)
          f = float(3.1415)
```

Fast way:
Provide a default for
when there is no adapter

```
from your_interfaces import ITree

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

```
from your_interfaces import ITree


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

```
from your_interfaces import ITree

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



(Look! Zope is Pythonic!)

```
        item = mydict.get(32, None)
        attr = getattr(obj, 'name', '')
```

Practical tip #2: your adapter can announce what it adapts

Define / Register

```
class MessageTreeAdapter(object):
  def __init__(self, message):
    ...

from zope.component import provideAdapter
provideAdapter(MessageTreeAdapter,
               adapts=Message,
               provides=ITree)
```

Define / Register

```
class MessageTreeAdapter(object):
   adapts(Message)
   implements(ITree)
   def __init__(self, message):
      ...

from zope.component import provideAdapter
provideAdapter(MessageTreeAdapter)
```

Practical tip #3:
There are actually three ways to register

a. Call "provideAdapter"

```
class MessageTreeAdapter(object):
  adapts(Message)
  implements(ITree)
  def __init__(self, message):
    ...

from zope.component import provideAdapter
provideAdapter(MessageTreeAdapter)
```

b. Use ZCML

```
<configure
    xmlns="http://namespaces.zope.org/zope"
    i18n_domain="zope"
    >
    <adapter factory="MessageTreeAdapter"
      for="Message"
      provides="ITree"
      />
</configure>
```

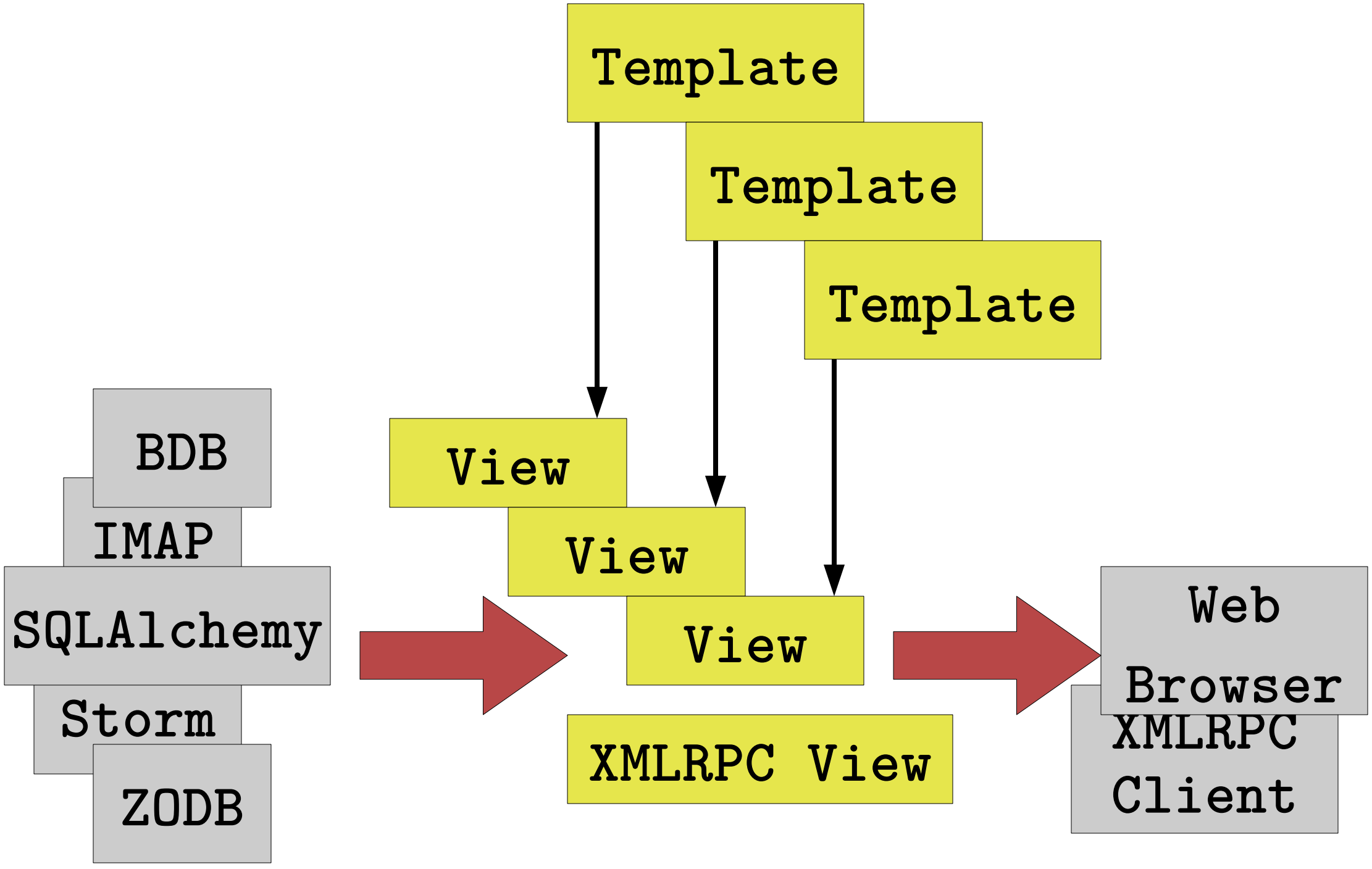
c. Use Grok!

```
class MessageTreeAdapter(grok.Adapter):
  adapts(Message)
  provides(ITree)
  def __init__(self, message):
    ...
```

Closing Statement #1:

Grok is cool

Grok lets you define *View* adapters that prep your objects for the Web

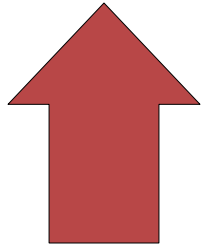

Template
Template
Template
BDB
IMAP
SQLAlchemy
Storm
ZODB
View
View
View
XMLRPC View
Web
Browser
XMLRPC
Client

Grok lets you create *space suits* so your objects can survive the web

Closing Statement #2:

Dynamic adaptation might feel like a type declaration, but it's not!

```
from your_interfaces import ITree

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



Isn't this an evil old-fashioned type declaration, like in C?

A: No, it's not!

It specifies a *behavior,* not a *type*; it's dynamic; it's optional.

Think of adapters as “two-storey” attributes and methods!

In the old days attributes were just names:

```
def gather_info(arg):
  title = arg.title
  content = arg.content
  encoding = arg.encoding
```

Now we ask for an adapter.attribute:

```
def gather_info(arg):
    author = IAnnotations(arg).author
    content = ITextContent(arg).content
    encoding = IEncoded(arg).encoding
```

Closing Statement #3:

This is the future!

Sprint with me!

Grok for the masses!

http://rhodesmill.org/brandon/adapters

http://rhodesmill.org/brandon/adapters

Thank you!