Designing Beautiful Software

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What is Beauty?

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What is beautiful software design?

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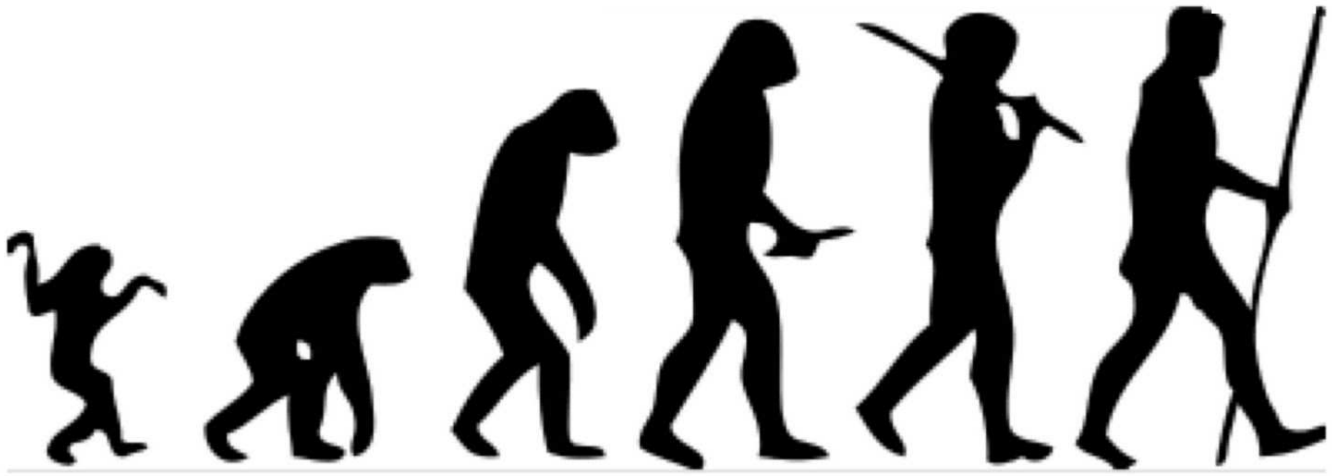
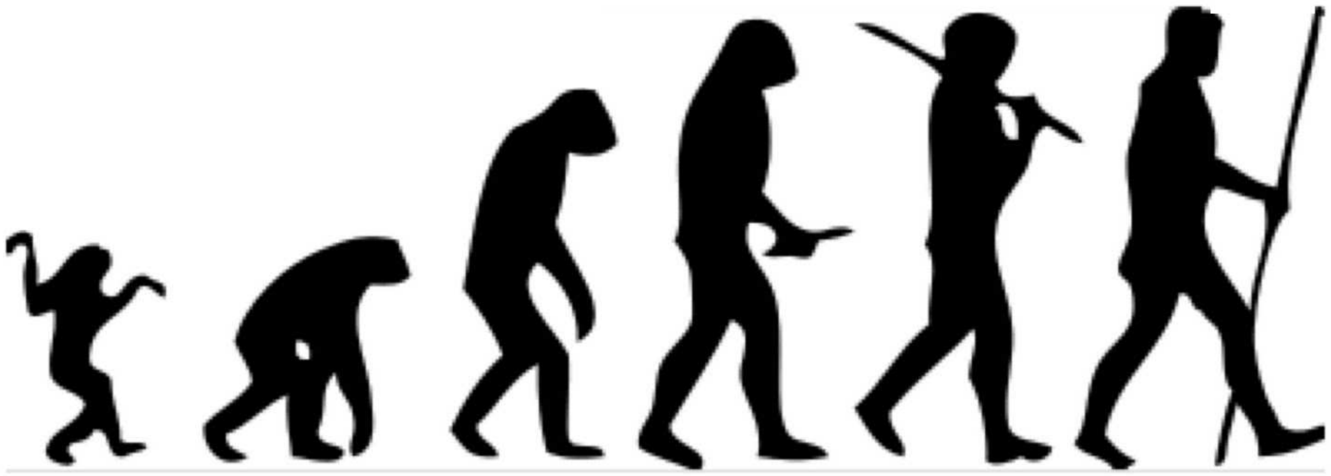
Software Evolution



Software Evolution



or, how to go from code monkey to architect

Examining a real-world problem

Requirements

- The application needs to send email

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- The application needs to send email
- I know the sender is always the same
- I want to BCC an address for verification

```php
function shop_mail($to, $subject, $body)
{
    $headers = "From: shop@example.com\r\n"
             .= "Bcc: shop-sent@example.com\r\n";
    mail($to, $subject, $body, $headers);
}
```

Is it beautiful?

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- It prevents us having to specify `$headers` manually each call
- It’s little more than a wrapper on `mail()`

What if we introduce requirements?

- For instance, we add another shop on a different domain, using much (if not all) the same code.

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- For instance, we add another shop on a different domain, using much (if not all) the same code.
- Now the “From” and “Bcc” addresses need to be different.

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- …at least, not after this change.
- So, let’s introduce a “configuration” parameter.

```php
function shop_mail($to, $subject, $body, $shop = 'original')
{
    switch ($shop) {
        case: 'subdomain':
            $from = 'shop@subdomain.example.com';
            $bcc  = 'shop-sent@subdomain.example.com';
            break;
        case: 'original':
        default:
            $from = 'shop@example.com';
            $bcc  = 'shop-sent@example.com';
            break;
    }

    $headers = "From: $from\r\n"
            .= "Bcc: $bcc\r\n";
    mail($to, $subject, $body, $headers);
}
```

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- We need to know what the value of that last argument will be.
- The number of arguments may not justify wrapping `mail()`

Evolution:
use classes

Base functionality

```php
class ShopMail
{
    protected static $from = 'shop@example.com';
    protected static $bcc  = 'shop-sent@example.com';

    public static function send($to, $subject, $body)
    {
        $headers = "From: " . static::$from . "\r\n"
                .= "Bcc: " . static::$bcc . "\r\n";
        mail($to, $subject, $body, $headers);
    }
}
```

Subclass

```php
class SubdomainMail extends ShopMail
{
    protected static $from = 'shop@subdomain.example.com';
    protected static $bcc  = 'shop-sent@subdomain.example.com';
}
```

Potential usage

```
define('MYENV', 'Subdomain');

$mailer = MYENV . 'Mail::send';
call_user_func($mailer, $to, $subject, $body);
```

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- Strategy selection requires knowledge of environment

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- Requires extension
- Strategy selection requires knowledge of environment
- Debugging requires knowledge of environment

Evolution:
use configuration

```
$config = new ArrayObject(array(),
    ArrayObject::ARRAY_AS_PROPS);
$config->env = "Subdomain';

$mailer = $config->env . 'Mail::send';
call_user_func($mailer, $to, $subject, $body);
```

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- Would be easier to just indicate the class to use, and have it be the same throughout the application(s).
- What if I have a new requirement, such as sending HTML mails?

Evolution:
use *objects*

Mailer class

```
class Mailer
{
    protected $from = 'shop@example.com';
    protected $bcc  = 'shop-sent@example.com';
    protected $contentType = 'text/plain';

    public function setFrom($from) { ... }
    public function setBcc($bcc) { ... }
    public function setContentType($type) { ... }
    public function send($to, $subject, $body)
    {
        $headers = "From: " . $this->from . "\r\n"
                .= "Bcc: " . $this->bcc . "\r\n"
                .= "Content-Type: " . $this->contentType .
                    "\r\n";
        mail($to, $subject, $body, $headers);
    }
}
```

Usage

```
$mailer = new Mailer();
$mailer->setFrom($config->from)
       ->setBcc($config->bcc)
       ->setContentType('text/html');
$mailer->send($to, $subject, $body);
```

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- Specific headers are hard-coded
- What if we don't want to use `mail()`?

Take a shower

- We’ve identified several needs:

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  - Configurable, arbitrary headers
  - Configurable, arbitrary transports

Evolution:
use *composition* and *interfaces*

Mail transports and headers

```
interface MailTransport
{
    public function send($to, $subject, $body, $headers);
}

class MailHeaders extends ArrayObject
{
    public function toString()
    {
        $headers = '';
        foreach ($this as $header => $value) {
            $headers .= $header . ': ' . $value . "\r\n";
        }
        return $headers;
    }
}
```

Mailer: setters

```
class Mailer
{
    protected $headers, $transport;

    public function setHeaders(MailHeaders $headers) {
        $this->headers = $headers;
        return $this;
    }

    public function getHeaders() {
        return $this->headers;
    }

    public function setTransport(MailTransport $transport) {
        $this->transport = $transport;
        return $this;
    }

    /* ... */
}
```

Mailer: construction and functionality

```
class Mailer
{
    protected $headers, $transport;

    public function __construct(MailTransport $transport)
    {
        $this->setTransport($transport);
        $this->setHeaders(new MailHeaders());
    }
    public function send($to, $subject, $body)
    {
        $this->transport->send(
            $to, $subject, $body,
            $this->headers->toString()
        );
    }
}
```

Mailer: usage

```
$mailer  = new Mailer(new SmtpTransport);
$headers = new MailHeaders();
// or $headers = $mailer->getHeaders();

$headers['From']         = $config->from;
$headers['Bcc']          = $config->bcc;
$headers['Content-Type'] = 'text/html';
$mailer->setHeaders($headers) // if instantiated separately
       ->send($to, $subject, $body);
```

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- Sending is separate from message composition
- Problems
  - No validation or normalization of header keys
  - No validation of header values
  - Should a message send itself? or should we pass a message to the transport?

Evolution:
semantic object relations

Message

```
interface MailMessage
{
    public function setTo($to);
    public function setSubject($subject);
    public function setBody($body);
    public function setHeaders(MailHeaders $headers);

    public function getTo();
    public function getSubject();
    public function getBody();
    public function getHeaders();
}
```

Headers and Transport

```
interface MailHeaders
{
    public function addHeader($header, $value);
    public function toString();
}

interface MailTransport
{
    public function send(MailMessage $message);
}
```

Usage

```
$message = new Message();
$headers = new MessageHeaders();
$headers->addHeader('From', $from)
        ->addHeader('Content-Type', 'text/html');
$message->setTo($to)
        ->setSubject($subject)
        ->setBody($body)
        ->setHeaders($headers);
$transport = new SmtpTransport($config->transport);
$transport->send($message);
```

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- Headers can now potentially have validation and normalization…
  - …and implementation can be varied if necessary.
- The message is self-contained, and contains all metadata related to it.
- The mail transport accepts a message, and determines what to use from it, and how.

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What are the real questions?

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- Can I change how it works easily as needed?

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- Adopt a sane class -> filesystem convention.
- Think about how classes relate semantically, and apply this to the class hierarchy.
  - Consider how this relates to namespaces.

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- Define your requirements as tests.
- Play with the API and how you use the code before you write it.
- Having tests ensures that as you fix bugs or introduce features, you don’t break your original contract.

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- There's nothing *wrong* with the following code. It's fast, and easily understandable.

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```

- However, we can't swap out the transport easily, or test it.

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Writing configurable or extensible code usually requires *some* verbosity.

- Separating out objects by areas of concern leads to a proliferation of objects.
- Deal with it.
- It’s easier to digest small bites than it is a whole roast at a time.

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- Inline is nice, but makes it difficult to swap out later.
- Containers are nice, but you then need to pass the container around somehow.

Choose beauty

- Think about long-term maintainability
- Think about extensibility

Thank you!

- Feedback: `http://joind.in/3395`
- Twitter `http://twitter.com/weierophinney`