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# Introduction to CGI::Prototype

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# Overview

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- *Why CGI::Prototype?*
- *The basic architecture*
- *A sample application*
- *CGI::Prototype::Hidden*

# Why CGI::Prototype?

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- *Web apps are backwards*
- *Ad hoc solutions don't scale*
- *Existing CPAN solutions weren't enough*
- *I had a client that needed a solution  
“yesterday” “and make it flexible!”*
- *Together with Class::DBI and Template Toolkit, I wanted to establish a “best of breed” trifecta*

# Backwards web apps?

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- *In traditional GUIs, the program drives the display, and therefore the user*
- *In a web app, the user drives the display, and therefore the app!*
- *Every web app must figure out how to manage control state between hits*
- *The logic is common, but the specifics are particular to an app*

# The main flow

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- *A web app needs to figure out initially what state a particular hit is in*
- *Based on that decision, some code must run to deal with the incoming data*
- *Based on those results, more code must run to generate some browser response*
- *Errors happen*
- *At bad times*

# Ad hoc code

- *For a tiny web app, we end up writing the same thing:*

```
if (param) {...response...} else {... show form ...}
```

- *The “param” here “dispatches” to one of two “pages”, which have the responsibility to “respond” to the params and “render” a result*
- *But what if there’s a user error?*
- *Now we need to show the form again!*

# Separation of concerns

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- *Let's separate the three parts*
  - *Dispatcher: decide which responder*
  - *Responder: analyze params, and decide which renderer*
  - *Renderer: generate the response*
- *And to further use best of breed, let's drive TT for most of the renderer, and use CGI.pm for forms and params*

# Using objects

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- *Let's also use objects—lots of them!*
- *Objects will allow similar behaviors to be captured, and distinct behaviors to be encoded or data-driven*
- *In fact, let's use `Class::Prototyped` for easy accessors and maximum flexibility*
- *And `Class::DBI` objects for data*

# Separation of MVC

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- *The buzzword is Model-View-Controller*
- *Class::DBI provides Model (data)*
- *Template Toolkit provides View  
(rendering back to the browser)*
- *All we need is a good reusable abstract  
Controller that we can subclass*
- *Enter CGI::Prototype*

# The Basic Architecture

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- *The controller is about as minimal as you can get*
- *Call “dispatch”, which returns a “respond” object*
- *Call the “respond” object which returns a “render” object, containing a template*
- *Process “render” Template with TT*
- *Return the template output to STDOUT*

# Hierarchy of classes

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- *Create an application class, which inherits from CGI::Prototype*
- *Create render and respond objects, which inherit from the application class*
- *Create templates referenced by the respond objects*
- *It's simpler than the description, actually*

# A sample application

- *The trivial sample application relies on all the default values:*

```
#!/usr/bin/perl  
use base CGI::Prototype;  
__PACKAGE__->activate; # main->activate;
```

- *This application says (using CGI.pm)*  
*“This page intentionally left blank”*
- *To override that, define a template:*

```
sub template { 'input.tt' }
```

# Looking under the hood

- *The core of what ->activate is doing:*

```
my $self = shift; # $self is the app object
my $this_page = $self->dispatch;
my $next_page = $this_page->respond;
$self->render;
```

- *The default dispatch returns \$self*
- *The default respond returns \$self*
- *render calls \$self->template, which returns the “blank” template, or our overridden filename*

# Errors

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- *That's all wrapped in an eval block*
- *Any exception calls `$self->error($@)`*
- *The default error handler dumps the error with a text/plain header*
- *You can override it to do what you want, of course*

# The classic two-pass app

- *Let's do the typical “form—response”*

- *First, let's not use main:*

```
BEGIN {  
    package MyApp;  
    use base CGI::Prototype;  
} # simulates “use MyApp” within this file  
MyApp->activate;
```

- *Create our first pass:*

```
BEGIN {  
    package MyApp::One;  
    use base MyApp;  
    sub template { ‘the_form.tt’ }  
}
```

# Second pass

- *We'll dispatch to the second pass if any params are seen*
- *Second pass needs to respond to params*
- *Since we can do that within the template, no code to write again!*

```
BEGIN {  
  package MyApp::Two;  
  use base MyApp;  
  sub template { 'the_response.tt' }  
}
```

# Dispatcher

- *We'll need to dispatch to the first page if no params, and second if some, so let's*

*add a dispatch:*

```
sub MyApp::dispatch {  
    my $self = shift;  
    return $self->param ? 'MyApp::Two' : 'MyApp::One';  
}
```

- *Where is “param”? It's provided by the base class, just like ->CGI to get at the CGI.pm object*

# the\_form.tt

- *Templates are called with “self” as \$self*
- *So self.CGI is the CGI object*
- *Thus we can call back easily:*

```
[% self.CGI.header %]<html><head></head><body>  
<h1>Welcome!</h1>  
Please enter your first and last name  
[% self.CGI.start_form; self.CGI.textfield('first');  
  self.CGI.textfield('last'); self.CGI.submit;  
  self.CGI.end_form %]  
</body></html>
```
- *Callbacks are also used for data fetch*

# the\_response.tt

- *A simple response based on the incoming parameters:*

```
[% self.CGI.header %]  
<html><head></head><body>  
<h1>Welcome!</h1>  
Greetings, [% self.param('first') | html %]  
[% self.param('second') | html %]!  
</body></html>
```

- *Once again, a fully working application!*
- *View code is in TT, controller in Perl*
- *We can hand off the TT to a designer*

# Dealing with problems

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- *If there are params, but they aren't complete, we should render the form again instead of the response*
- *The dispatcher can check this, but...*
- *Better to check it in MyApp::Two*

# Just override respond

- *We'll just override respond from the app-wide default of “return \$self” to something that makes a choice:*

```
sub MyApp::Two::respond {
  my $self = shift;
  unless ($self->param('first') =~ /\S/ and
          $self->param('last') =~ /\S/) {
    return 'MyApp::One'; # back to the form
  }
  return $self;
}
```

- *So we think of these pages as “states”*

# A better way to do that

- *We could have gone the other way:*

```
sub MyApp::dispatch { return 'MyApp::One' }
sub MyApp::One::respond {
  my $self = shift;
  if ($self->param('first') =~ /\S/ and
      $self->param('last') =~ /\S/) {
    return 'MyApp::Two'; # good params, move on
  }
  return $self; # bad params? stay here
}
```

- *This gives us the “stay here until you get it right” model*

# Multi-page apps

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- *If an app has more than two pages, the rules get more complicated*
- *Better to have some sort of “app state”*
- *The dispatcher can then use the correct ->respond based on the state*
- *The ->respond then decides the new state by selecting a page to ->render*
- *“stay on this page” for errors is easy*

# Determining state in dispatch

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- *How does the dispatcher know the page that most recently executed ->render?*
- *Could do it with a hidden field in a form*
  - *Hint: CGI::Prototype::Hidden*
- *Could do it with a mangled-URL*
- *Could do it with a cookie*
- *Could mix any of those with some server-side session database*

# More hooks than a pirate

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- *Lots of places to customize*
- *MUMBLE\_enter: before calling*
- *MUMBLE\_leave: after calling*
- *Example: app\_enter called before anything else*
- *app\_leave called after everything else*
- *By default, hooks do nothing*

# Page “control”

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- *A page has “control” while it is being either a responder or renderer or both*
- *So `$page->control_enter` is called just before a page gets control*
- *And `$page->control_leave` is called just after a page loses control*
- *Good place to put per-page setup and teardowns*

# Page render or respond

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- *Similarly, hooks are provided for `respond_enter`, `respond_leave`, `render_enter`, `render_leave`*
- *Called against the page that will do the `respond` or `render`*
- *Example: put code in `render_enter` hooks to preload sticky fields for CGI form generation*

# Activate, fully rendered

- *In all of its glory:*

```
sub activate {
  my $self = shift;
  eval {
    $self->app_enter;
    my $this_page = $self->dispatch;      ### DISPATCH ###
    $this_page->control_enter; $this_page->respond_enter;
    my $next_page = $this_page->respond;  ### RESPOND ###
    $this_page->respond_leave;
    if ($this_page ne $next_page) {
      $this_page->control_leave; $next_page->control_enter;
    }
    $next_page->render_enter;
    $next_page->render;                  ### RENDER ###
    $next_page->render_leave; $next_page->control_leave;
    $self->app_leave;
  };
  $self->error($@) if $@;
}
```

# Rendering, in detail

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- *“render” defaults to pushing \$self->template through a TT engine, passing { self => \$self } as the global vars*
- *Engine is \$self->engine*
- *The results are displayed by passing them to \$self->output (default STDOUT)*
- *override “output” for testing*

# The TT engine

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- *The default `$self->engine` creates a `Template->new` object with no parameters*
- *The engine is “autoloaded”, so in `mod_perl` environments, it persists*
- *You can override `->engine` to provide additional configuration controls*
- *Future `CGI::P` may have more hooks*

# CGI::Prototype::Hidden

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- *A subclass of CGI::Prototype*
- *Allows the “state” to be easily maintained in a hidden field*
- *Correlates the page classnames with the corresponding template names*
- *Classes lazy-loaded for good CGI speed*
- *Establishes “wrapper” template*
- *Easy framework for multi-page apps*

# Defaults everywhere

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- *config\_state\_param, default “\_state”*:  
*name of the param you have to put in every form as a hidden field so that the response is appropriately dispatched*
- *config\_class\_prefix, default “My::App”*:  
*establishes My::App as the parent of My::App::This and My::App::That pages*

# Initial page

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- *config\_default\_page, default*  
“welcome”: the name of the class (and page) if no other page matches
- Thus, you will go to *welcome.pm* and *welcome.tt* on your first hit

# The wrapper

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- *config\_wrapper*, default “My/App/  
WRAPPER.tt”: default wrapper  
template
- Called to process each page
- Should call [% PROCESS \$template %]
- Good place to define common macros or  
blocks, and put headers and footers

# The enhanced basics

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- *dispatch* looks for `$self->param(“_state”)`
- *If not found, uses “welcome”*
- *Hands off response to `My/App/welcome.pm`*
- *respond returns render class (or `$self`)*
- *Default template for that class is `My/App/welcome.tt`*

# The minimum app

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- *You must provide “welcome.pm”, “welcome.tt”, and “WRAPPER.tt”, “My/ App.pm” at least*
- *The TT search path is set to the @INC path (cheap hack), so your pm and tt files are in the same directory*
- *Every additional page: \$x.pm, \$x.tt, where \$x comes from param(‘\_state’)*

# The hidden field

- *Every form must include the state param*

```
[% self.CGI.start_form %]  
[% self.CGI.hidden(self.config_state_param) %]  
... rest of form ...  
[% self.CGI.submit; self.CGI.end_form %]
```
- *Without this, the dispatch gets lost*
- *Good idea to put this in WRAPPER as a macro or block*
- *If you generate URLs, also include the state param*

# More things to override

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- *render\_enter\_per\_page*: additional hook for per-page render items: use this instead of defining *render\_enter*
- *respond\_per\_app*: return a page, or undef (defaults to calling *respond\_per\_page*)
- *respond\_per\_page*: return a page for render (defaults to *\$self*)

# Callbacks

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- *If the foo.tt needs some data, it can call `self.some_method(arg1, arg2)`*
- *Define this in foo.pm*
- *When some callback is needed by more than one page, move it into the App.pm*
- *Thus, the TT file never needs to do heavy lifting for data: push that to Perl code*

# Data push

- *Instead of callbacks, use data push*
- *In render\_enter(\_per\_page), add a slot:*

```
sub render_enter_per_page {  
  my $self = shift;  
  my @data = map { int rand 10 } 1 .. 10;  
  $self->reflect->addSlot(data => \@data);  
}
```
- *Now you can access this in TT:*  
The lotto numbers are [% self.data.join(", ") %]
- *Be sure to clean up in render\_leave*
- *Good place to fetch Class::DBI stuff*

# App-wide notes

- *Clear a slot in the app during app\_enter*

```
__PACKAGE__->reflect->addSlot(errors => []);  
sub app_enter { shift->errors([]) } # reset  
sub add_errors { push @{$shift->errors}, @_ }
```

*Now everyone can add a note:*

```
unless ($self->param("first")) {  
    $self->add_errors("You forgot your first name");  
    return $self; # stay on this page  
}
```

- *Access this in the template:*

```
[% FOR e = self.errors;  
IF loop.first; "<h2>Errors:</h2><ul>"; END;  
"<li>"; e | html;  
IF loop.last; "</ul>"; END; END; %]
```

# Advantages of paged-based apps

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- *You design a page as a TT file*
- *You put the response in ->respond*
- *That response decides “stay here” (for errors) or “go to next state”*
- *You add callbacks for heavy data*
- *It looks like you’re calling the user, instead of the other way around*

# Summary

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- *CGI::Prototype*—the archetypal web application
- *CGI::Prototype::Hidden*—a great base class for multi-page web applications
- *Web applications*—easier to write when you have the right tools
- *More stuff on the way! Stay tuned!*