Google App Engine
Using Templates

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Textbook: Using Google App Engine, Charles Severance



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University of Michigan

University of Michigan School of Information





Internet



HTML JavaScript

AJAX CSS

HTTP Request

Response GET

POST

Python Data Store

Templates memcache

WebApp MVC

Templates

- While we could write all of the HTML into the response using self.response.out.write(), we really prefer not to do this
- Templates allow us to separately edit HTML files and leave little areas in those files where data from Python gets dropped in
- Then when we want to display a view, we process the template to produce the HTTP Response

http://docs.djangoproject.com/en/dev/ref/templates/builtins/?from=olddocs

Google App Engine
Basic Templates

ae-04-template

www.appenginelearn.com

```
class MainHandler(webapp.RequestHandler):

  formstring = '''<form method="post" action="/">
<p>Enter Guess:
<input type="text" name="guess"/></p>
<p><input type="submit"></p>
</form>'''

  def get(self):
    self.response.out.write('<p>Good luck!</p>\n')
    self.response.out.write(self.formstring)

  def post(self):
    stguess = self.request.get('guess')
    logging.info('User guess='+stguess)
    try:
```

YUCK!!

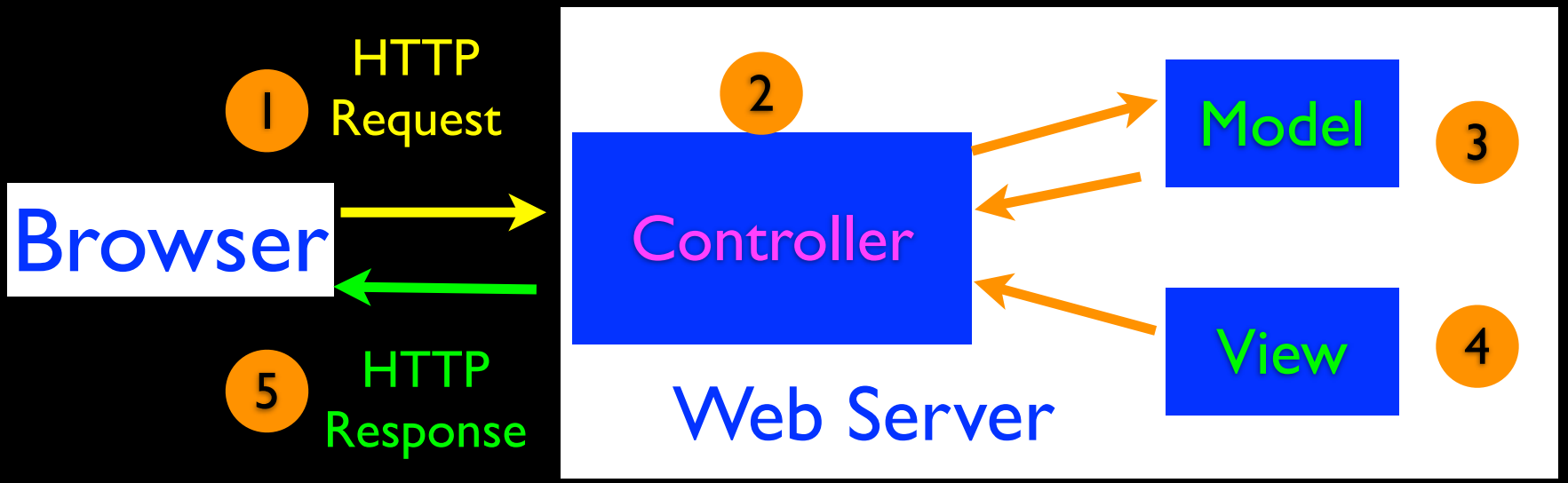
Python strings are a *lousy* way to store and edit HTML. Your code gets obtuse and nasty. Lets move the HTML into a separate file.

Separation of Concerns

- A well written App Engine Application has no HTML in the Python code - it processes the input data, talks to databases, makes lots of decisions, figures out what to do next and then
- Grabs some HTML from a template - replacing a few selected values in the HTML from computed data - and viola! We have a response.

Terminology

- We name the three basic functions of an application as follows
  - Controller - The Python code that does the thinking and decision making
  - View - The HTML, CSS, etc. which makes up the look and feel of the application
  - Model - The persistent data that we keep in the data store


1
HTTP
Request
Browser
5
HTTP
Response
2
Controller
Model
3
View
4
Web Server

MVC

- We call this pattern the "Model - View - Controller" pattern (or MVC for short)
- It is a very common pattern in web applications - not just Google Application Engine
  - Ruby on Rails
  - Spring MVC
- We will meet the "Model" later - for now we will work with the View and Controller

Back to: Templates

- A template is mostly HTML but we have some little syntax embedded in the HTML to drop in bits of data at run-time
- The controller computes the "bits" and gives them to the "Render Engine" to put into the template.

A Simple Template

```
<p>{{ hint }}</p>
<form method="post" action="/">
<p>Enter Guess: <input type="text" name="guess"/></p>
<p><input type="submit"></p>
</form>
```

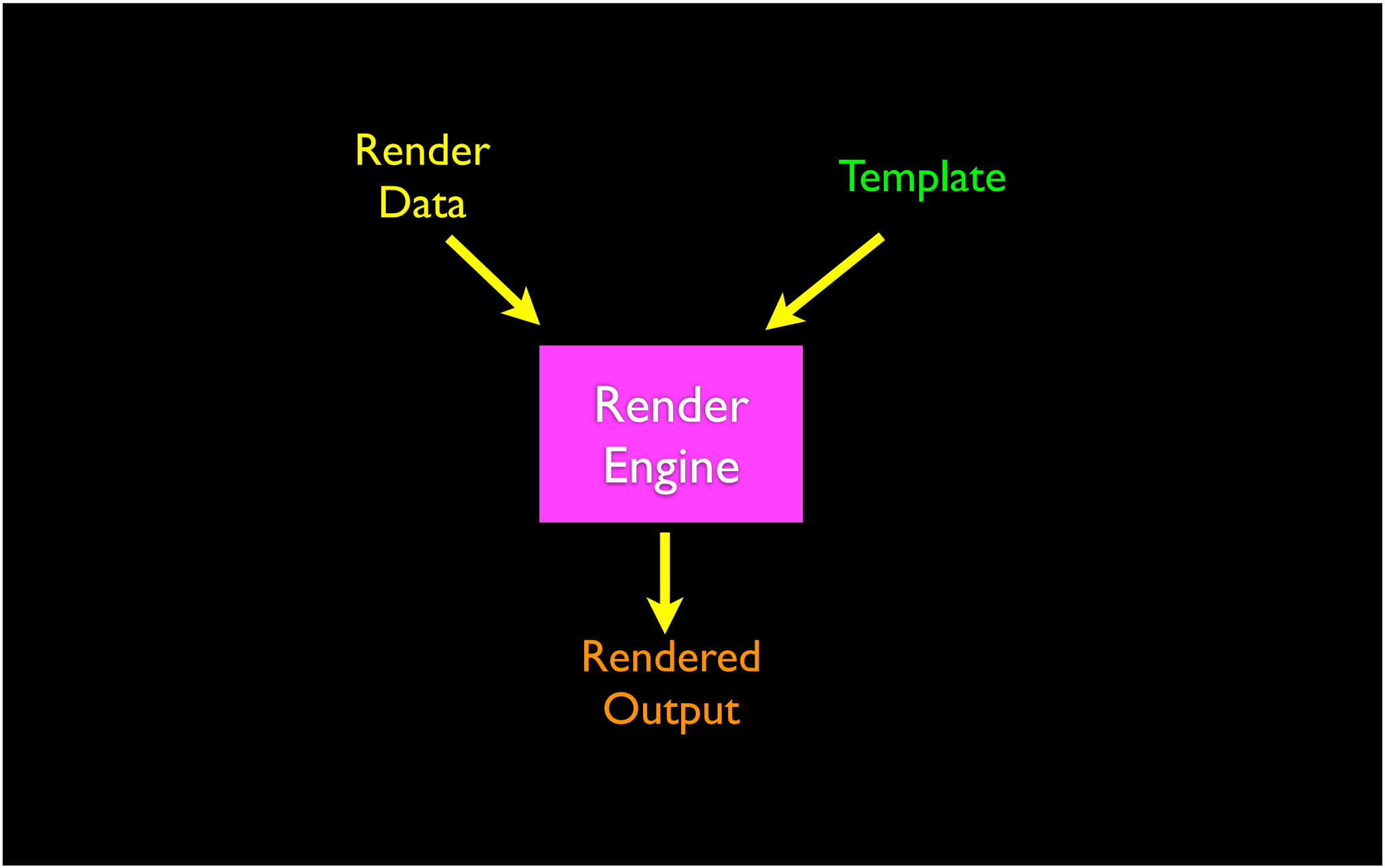
Mostly HTML - with a little place to drop in data from the Controller.

In The Controller

- In the controller, we prepare a Python Dictionary object with the data for the template and call the "Render Engine"

```
outstr = template.render(filepath, { 'hint' : 'Too low'})
```

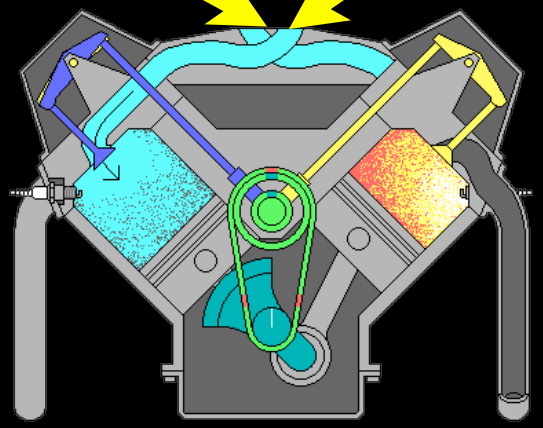
The Render Engine takes two parameters (1) the path to a template file, and (2) a Python dictionary with key value pairs of the data areas in the template.


Render
Data
Template
Render
Engine
Rendered
Output

{ ‘hint’ : ‘Too Low’ }

```
<p>{{ hint }}</p>
<form method="post"
    action="/">
...
```

V-8 Render Engine



```
<p>Too Low</p>
<form method="post"
    action="/">
...
```

Template Pattern

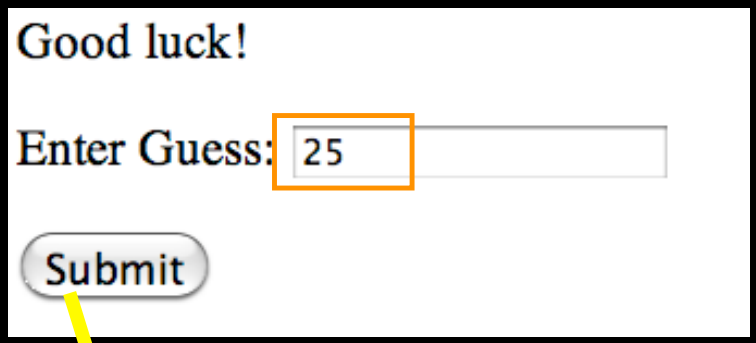
- We store templates in a folder called "templates" under the main application directory to keep the templates (views) separate from the Python code (controller)
- We need to load the template from the right place in our Python code (it is a little ugly...)

```
filepath = os.path.join(os.path.dirname(__file__), 'templates/index.htm')
outstr = template.render(filepath, { 'hint' : 'Too low'})
```

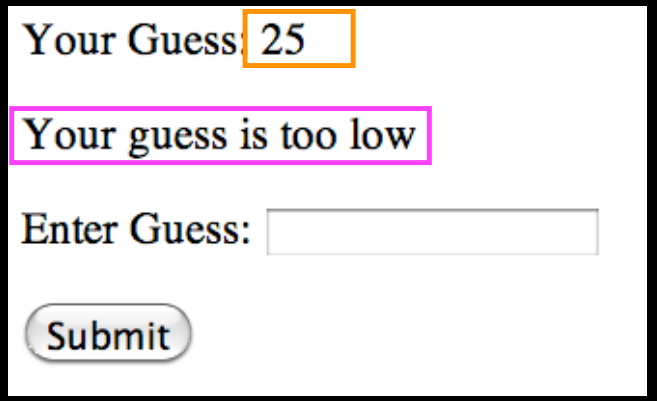
```
def post(self):
    stguess = self.request.get('guess')
    guess = int(stguess)
    if guess == 42:
      msg = 'Congratulations'
    elif guess < 42:
      msg = 'Your guess is too low'
    else:
      msg = 'Your guess is too high'

    temp = os.path.join(os.path.dirname(__file__),  'templates/guess.htm')
    outstr = template.render(temp, {'hint': msg, 'oldguess': stguess})
    self.response.out.write(outstr)
```

We read the guess, convert it to an integer, check if it is right or wrong, setting a message variable and then passing some data into a template to be rendered.



Controller and View




```
def post(self):
    stguess = self.request.get('guess')
    guess = int(stguess)
    if guess == 42:
      msg = 'Congratulations'
    elif guess < 42:
      msg = 'Your guess is too low'
    else:
      msg = 'Your guess is too high'

    temp = os.path.join(os.path.dirname(__file__),
          'templates/guess.htm')
    outstr = template.render(temp, {'hint': msg,
          'oldguess': stguess})
    self.response.out.write(outstr)
```

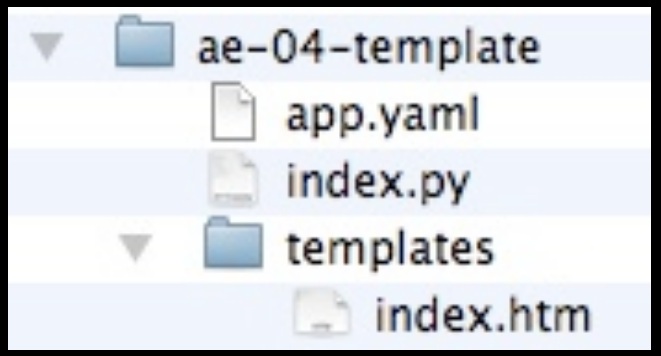
```
<p>Your Guess: {{ oldguess }}</p>
<p>{{ hint }}</p>
<form method="post" action="/">
<p>Enter Guess: <input type="text"
name="guess"/></p>
<p><input type="submit"></p>
</form>
```

Controller

View

Application Structure

- We keep the app.yaml and index.py files in the main application folder and the templates are stored in a folder called "templates"
- This is not a *rule* - just a pattern that it makes it easier to look at someone else's code



Template Summary

- We separate the logic of our program (Controller) from the HTML bits of the program (View) to keep things cleaner and more organization
- We use the Google templating engine to read the templates and substitute bits of computed data into the resulting HTML

```
<p>{{ hint }}</p>
<form method="post"
    action="/">
...
```

+ { 'hint' : 'Too Low' } =

```
<p>Too Low</p>
<form method="post"
    action="/">
...
```

Several Templates

Program: ae-05-templates

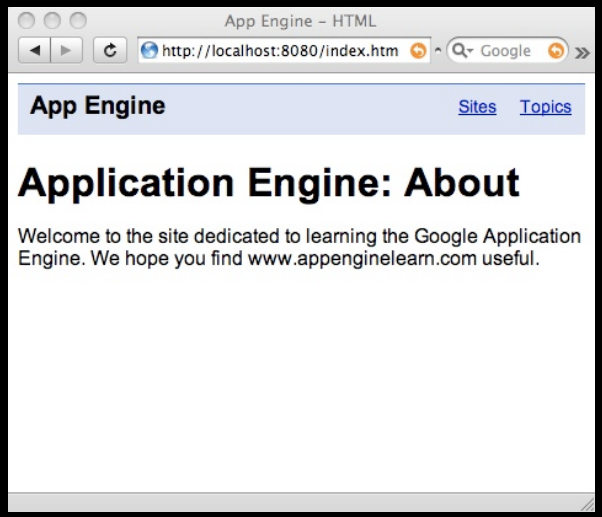
www.appenginelearn.com

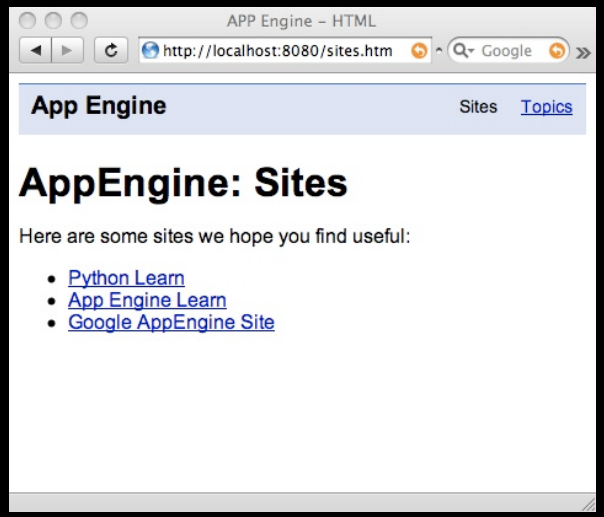
Real Applications

- Real applications have lots of handlers and lots of templates
- In this section we start to look at techniques for managing and organizing templates

http://docs.djangoproject.com/en/dev/ref/templates/builtins/?from=olddocs

Our Application



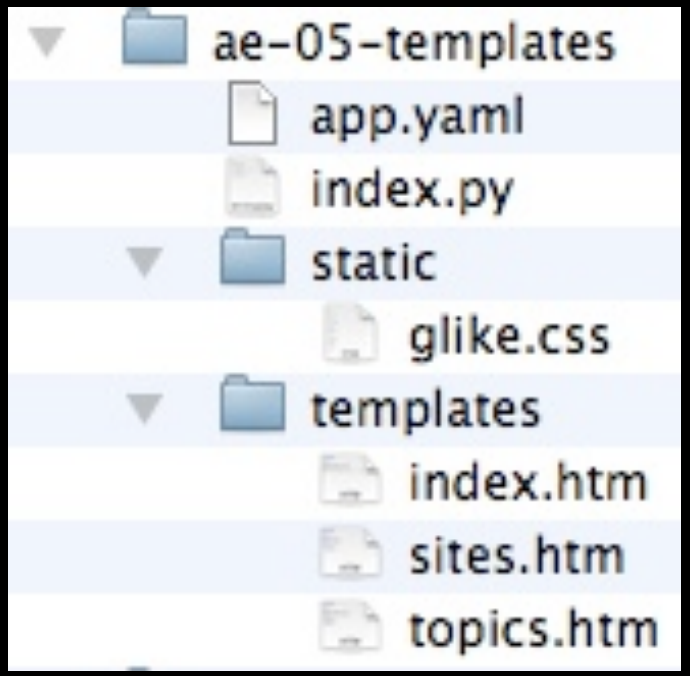




Our Application has three pages - no forms, and a bit of CSS to make the navigation pretty and light blue. It is mostly a static site.

Application Layout

- There are three templates in the templates directory
- The CSS file is in the static directory - this is a special directory



Looking at app.yaml

- The app.yaml file has a new handler for static data which does not change like images, CSS, javascript libraries, etc
- Google serves these "read-only" files *very* efficiently
- Identifying them as static can save you money

```
application: ae-05-templates
version: 1
runtime: python
api_version: 1

handlers:
- url: /static
  static_dir: static

- url: /.*
  script: index.py
```

Looking at app.yaml

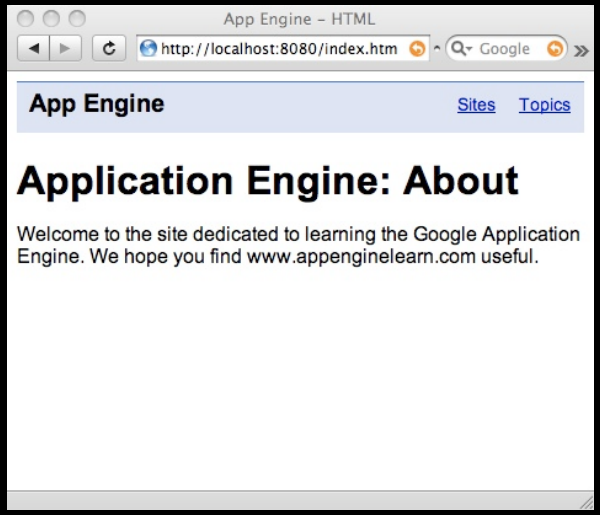
- The handlers in the app.yaml file are checked in order
- First it looks at the url to see if it starts with "/static"
- The last URL is a catch-all - send everything to the controller (index.py)

```
application: ae-05-templates
version: 1
runtime: python
api_version: 1

handlers:
- url: /static
  static_dir: static

- url: /.*
  script: index.py
```

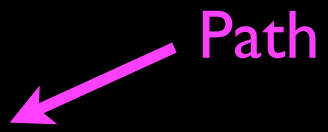
```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
 "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
 <head>
   <title>App Engine - HTML</title>
   <link href="/static/glike.css" rel="stylesheet" type="text/css" />
 </head>
 <body>
   <div id="header">
     <h1><a href="index.htm" class="selected">App Engine</a></h1>
     <ul class="toolbar">
       <li><a href="sites.htm">Sites</a></li>
       <li><a href="topics.htm" >Topics</a></li>
     </ul>
   </div>
   <div id="bodycontent">
     <h1>Application Engine: About</h1>
     <p>
     Welcome to the site dedicated to
     learning the Google Application Engine.
     We hope you find www.appenginelearn.com useful.
     </p>
   </div>
 </body>
</html>
```



The templates are just flat HTML. The only real App Engine change is that the CSS file is coming from "/static"

Controller Code

- The controller code is going to be very general
- It will look at the path on the URL and try to find a template of that name - if that fails, render the index.htm template



http://localhost:8080/topics.htm

For this URL, the path is /topics.htm

```
class MainHandler(webapp.RequestHandler):

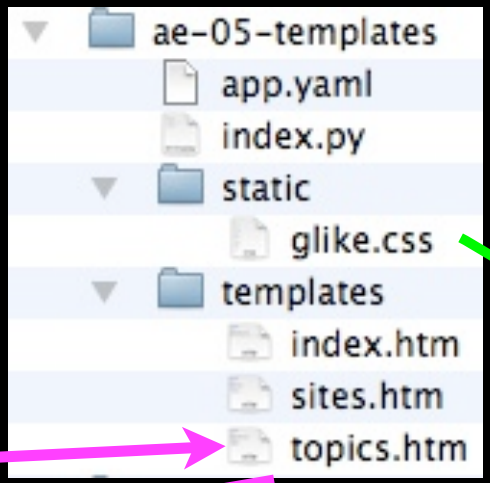
  def get(self):
    path = self.request.path
    try:
        temp = os.path.join(os.path.dirname(__file__), 'templates' + path)
        outstr = template.render(temp, { })
        self.response.out.write(outstr)
    except:
        temp = os.path.join(os.path.dirname(__file__), 'templates/index.htm')
        outstr = template.render(temp, { })
        self.response.out.write(outstr)
```

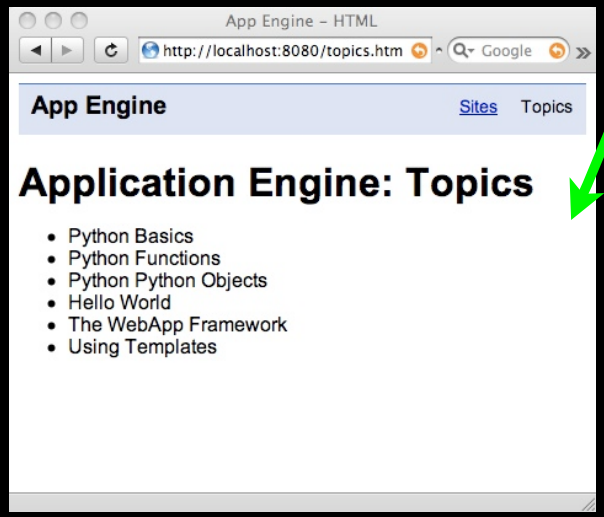
http://localhost:8080/topics.htm

If all else fails, render templates/index.htm
Note that we are *not* passing any data to the templates.

http://localhost:8080/topics.htm

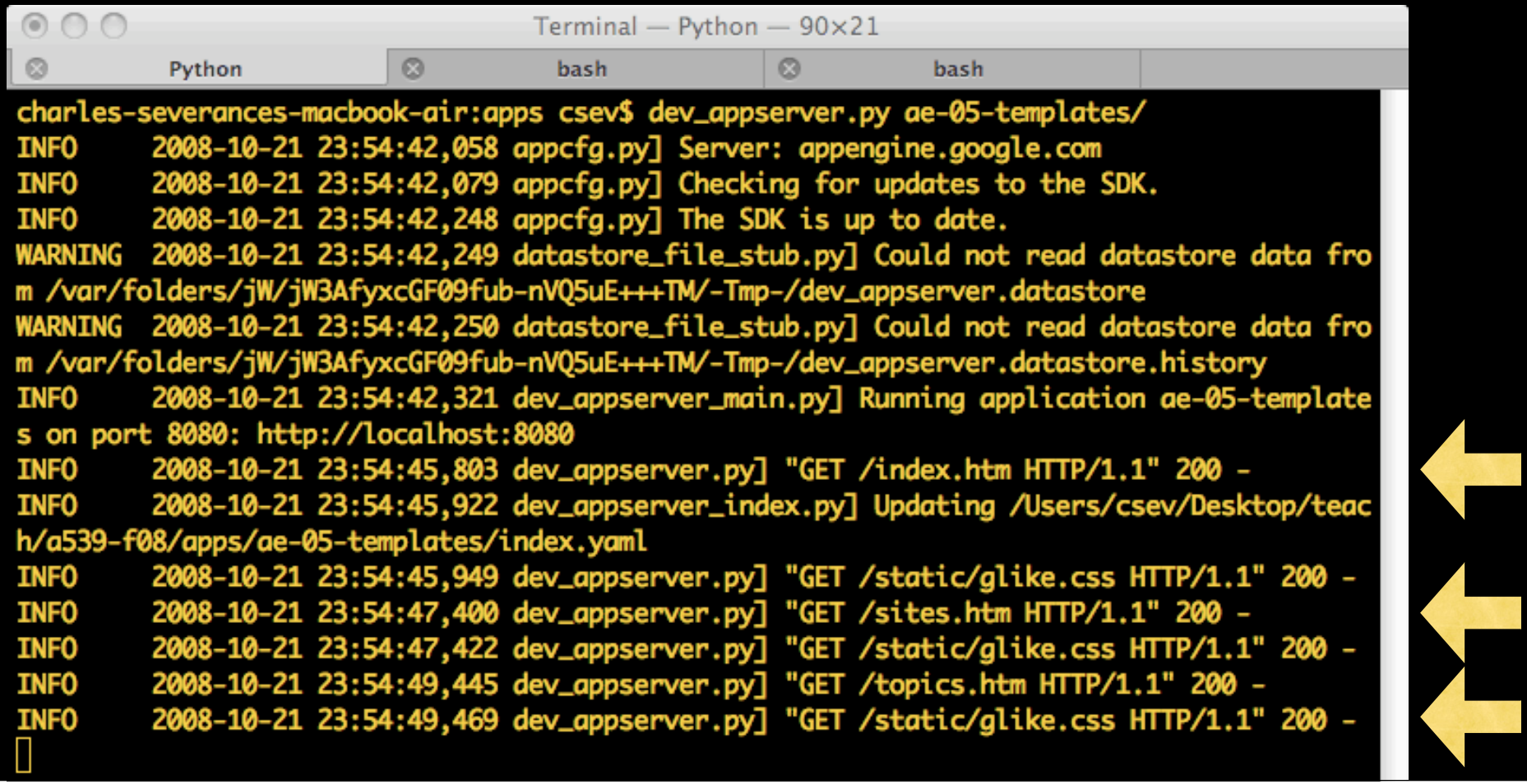
```
path = self.request.path
temp = os.path.join(... 'templates' + path)
outstr = template.render(temp, { })
self.response.out.write(outstr)
```





The browser also does a GET request for /static/glike.css

In the Log....


Terminal — Python — 90×21
Python
bash
bash
charles-severances-macbook-air:apps csev$ dev_appserver.py ae-05-templates/
INFO 2008-10-21 23:54:42,058 appcfg.py] Server: appengine.google.com
INFO 2008-10-21 23:54:42,079 appcfg.py] Checking for updates to the SDK.
INFO 2008-10-21 23:54:42,248 appcfg.py] The SDK is up to date.
WARNING 2008-10-21 23:54:42,249 datastore_file_stub.py] Could not read datastore data fro
m /var/folders/jW/jW3AfyxcGF09fub-nVQ5uE+++TM/-Tmp-/dev_appserver.datastore
WARNING 2008-10-21 23:54:42,250 datastore_file_stub.py] Could not read datastore data fro
m /var/folders/jW/jW3AfyxcGF09fub-nVQ5uE+++TM/-Tmp-/dev_appserver.datastore.history
INFO 2008-10-21 23:54:42,321 dev_appserver_main.py] Running application ae-05-template
s on port 8080: http://localhost:8080
INFO 2008-10-21 23:54:45,803 dev_appserver.py] "GET /index.htm HTTP/1.1" 200 -
INFO 2008-10-21 23:54:45,922 dev_appserver_index.py] Updating /Users/csev/Desktop/teac
h/a539-f08/apps/ae-05-templates/index.yaml
INFO 2008-10-21 23:54:45,949 dev_appserver.py] "GET /static/glike.css HTTP/1.1" 200 -
INFO 2008-10-21 23:54:47,400 dev_appserver.py] "GET /sites.htm HTTP/1.1" 200 -
INFO 2008-10-21 23:54:47,422 dev_appserver.py] "GET /static/glike.css HTTP/1.1" 200 -
INFO 2008-10-21 23:54:49,445 dev_appserver.py] "GET /topics.htm HTTP/1.1" 200 -
INFO 2008-10-21 23:54:49,469 dev_appserver.py] "GET /static/glike.css HTTP/1.1" 200 -

Extending Base Templates

Program: ae-06-templates

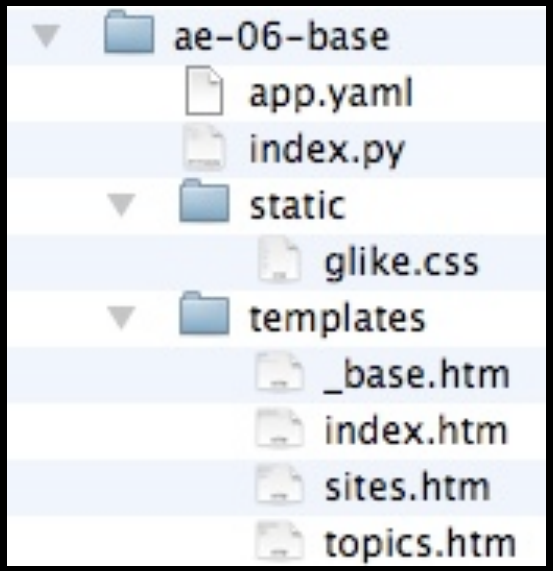
www.appenginelearn.com

Base Templates

- When building web sites there is a great deal of common material across pages
  - head
  - navigation
- Often only a small amount of information changes between pages

Application Layout

- This is the same as the previous application except we refactor the templates, putting the common material into the file _base.htm
- We reuse the _base.htm content in each of the other templates



```
<head>
  <title>App Engine - HTML</title>
  <link href="/static/glike.css" rel="stylesheet" type="text/css" />
</head>
<body>
  <div id="header">
    <h1><a href="index.htm" class="selected">
          App Engine</a></h1>
    <ul class="toolbar">
      <li><a href="sites.htm">Sites</a></li>
      <li><a href="topics.htm" >Topics</a></li>
    </ul>
  </div>
  <div id="bodycontent">
    <h1>Application Engine: About</h1>
    <p>
    Welcome to the site dedicated to
    learning the Google Application Engine.
    We hope you find www.appenginelearn.com useful.
    </p>
  </div>
 </body>
</html>
```

These files are nearly identical. And we have lots of files like this.

```
<head>
  <title>App Engine - HTML</title>
  <link href="/static/glike.css" rel="stylesheet" type="text/css" />
</head>
<body>
  <div id="header">
    <h1><a href="index.htm" >
          App Engine</a></h1>
    <ul class="toolbar">
      <li><a href="sites.htm">Sites</a></li>
      <li><a href="topics.htm" class="selected">Topics</a></li>
    </ul>
  </div>
  <div id="bodycontent">
    <h1>Application Engine: Topics</h1>
    <ul>
      <li>Python Basics</li>
      <li>Python Functions</li>
      <li>Python Python Objects</li>
      <li>Hello World</li>
      <li>The WebApp Framework</li>
      <li>Using Templates</li>
    </ul>
  </div>
 </body>
</html>
```

A Base Template

- We create a base template that contains the material that is common across the pages and leave a little place in the base template to put in the bits that change

```
<head>
  <title>App Engine - HTML</title>
  <link href="/static/glike.css" rel="stylesheet" type="text/css" />
</head>
<body>
  <div id="header">
    <h1><a href="index.htm" class="selected">
          App Engine</a></h1>
    <ul class="toolbar">
      <li><a href="sites.htm">Sites</a></li>
      <li><a href="topics.htm" >Topics</a></li>
    </ul>
  </div>
  <div id="bodycontent">
    {% block bodycontent %}
    <p>
      Replace this
      {% endblock %}
    </p>
  </div>
 </body>
</html>
```

_base.htm

```
<h1>About Application Engine</h1>
<p>
Welcome to this site dedicated to
learning the Google Application Engine.
We hope you find www.appenginelearn.com useful.
</p>
```

index.htm

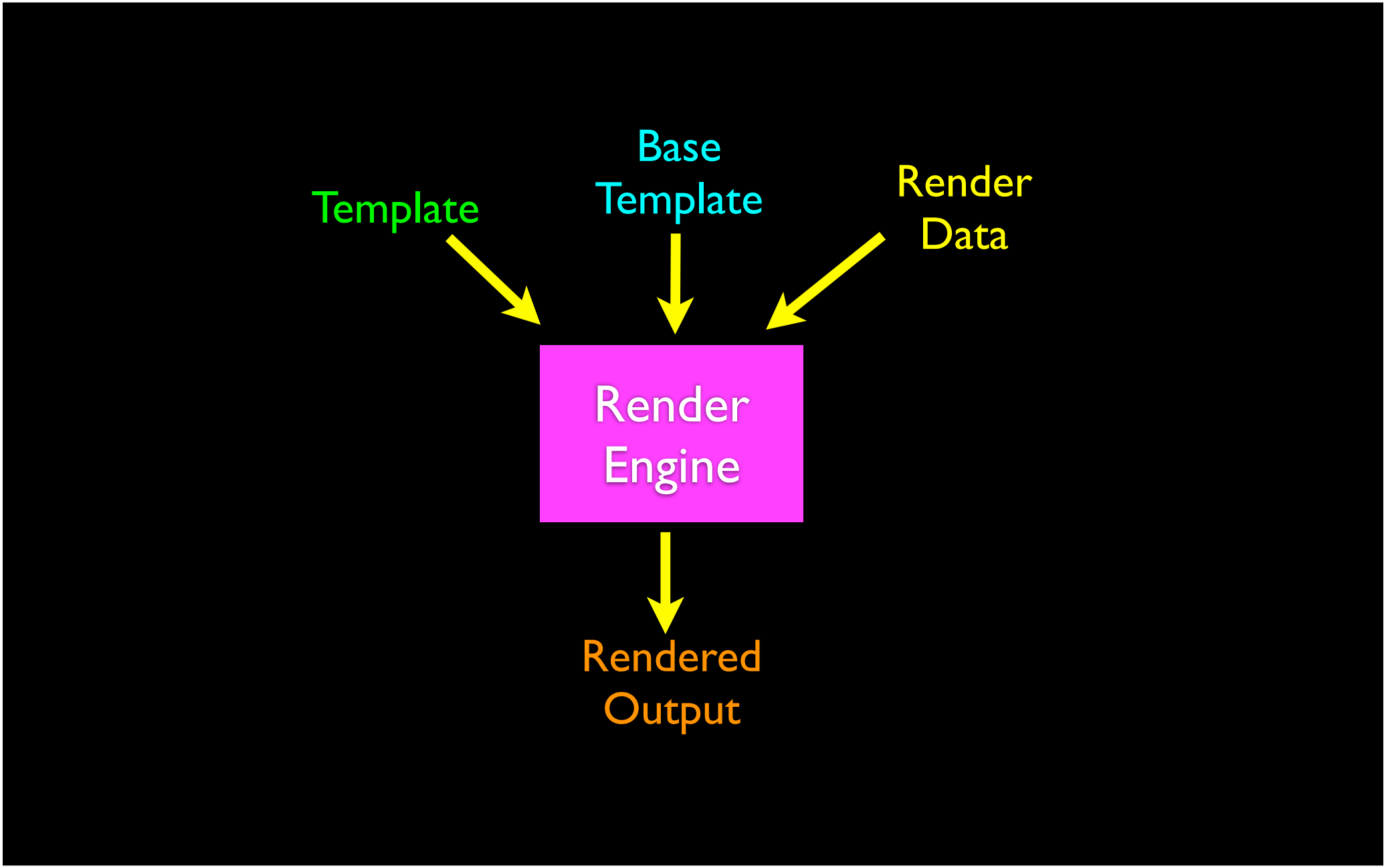
```
<head>
  <title>App Engine - HTML</title>
  <link href="/static/glike.css" rel="stylesheet" type="text/css" />
</head>
<body>
  <div id="header">
    <h1><a href="index.htm" class="selected">
          App Engine</a></h1>
    <ul class="toolbar">
      <li><a href="sites.htm">Sites</a></li>
      <li><a href="topics.htm" >Topics</a></li>
    </ul>
  </div>
  <div id="bodycontent">
    {% block bodycontent %}
        Replace this
    {% endblock %}
  </div>
</body>
</html>
```

_base.htm

The "extends" indicates that this page is to "start with" _base.htm as its overall text and replace the bodycontent block in _base.htm with the given text.

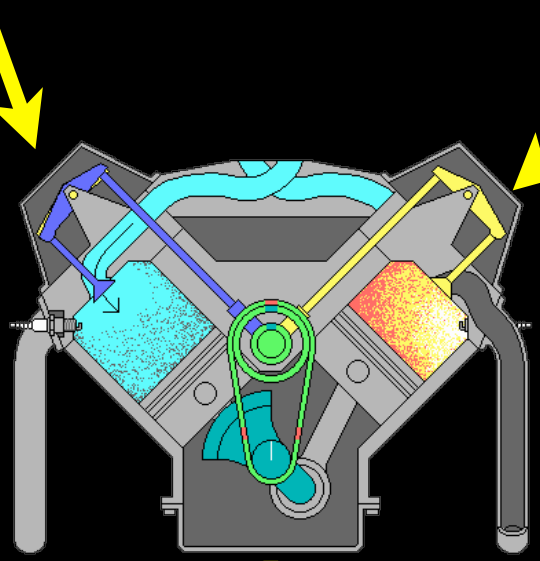
```
{% extends "_base.htm" %}
{% block bodycontent %}
    <h1>Application Engine: About</h1>
    <p>
    Welcome to the site dedicated to
    learning the Google Application Engine.
    We hope you find www.appenginelearn.com useful.
    </p>
{% endblock %}
```

index.htm


Template
Base Template
Render Data
Render Engine
Rendered Output

```
{% extends "_base.htm" %}
{% block bodycontent %}
    <h1>Application Engine: About</h1>
    <p>
    Welcome to the site dedicated to
    learning the Google Application Engine.
    We hope you find www.appenginelearn.com useful.
    </p>
{% endblock %}
```

```
<head>
  <title>App Engine - HTML</title>
 </head>
<body>
   </div>
  <div id="bodycontent">
    {% block bodycontent %}
        Replace this
    {% endblock %}
  </div>
</body>
</html>
```



{ ‘dat’ : ‘Fun Stuff’ }

V-8 Render Engine

```
....
    <div id="bodycontent">
        <h1> .....
    </div>
...
```

Extending a Base Template

- This capability to extend a base template is just part of the standard template render processing
- The template which is rendered is "index.htm"
- The render engine reads through index.htm. It sees the extend directive and goes to get the content of _base.htm as the starting point for index.htm

```
{% extends "_base.htm" %}
{% block bodycontent %}
    <h1>Application Engine: About</h1>
    ...
{% endblock %}
```

Making Navigation Look Nice

Program: ae-06-templates

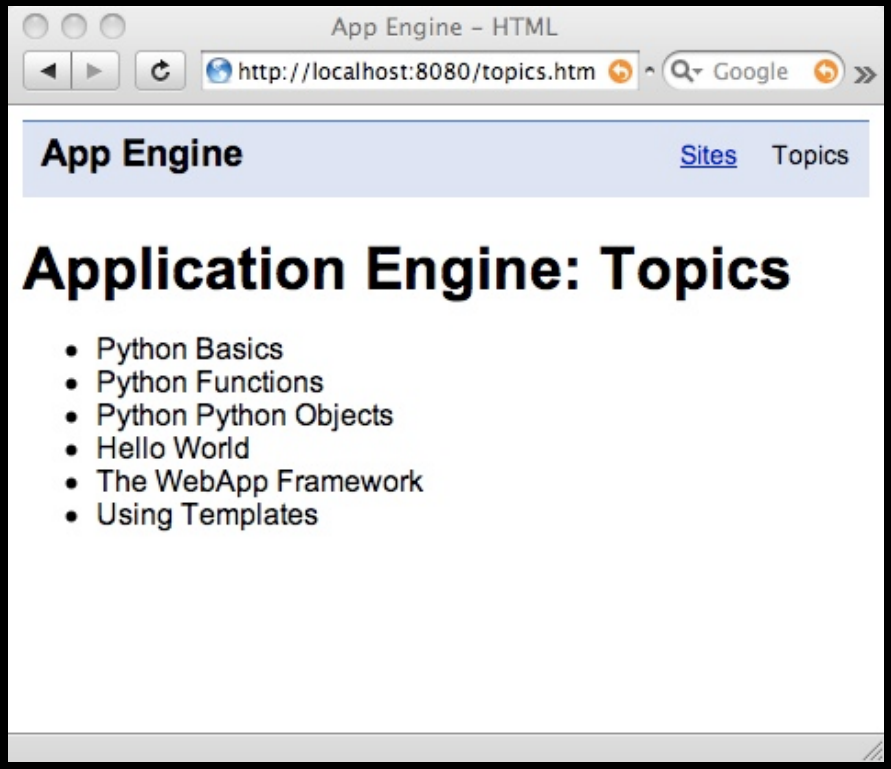
www.appenginelearn.com

Navigation Issues

- As we navigate between pages, we want the look of the "current" page to change color or provide some indication which page we are on.
- This is usually done with a CSS class on the <li> tag

```
<ul class="toolbar">
  <li><a href="sites.htm">Sites</a></li>
  <li><a href="topics.htm" class="selected">Topics</a></li>
</ul>
```

```
<ul class="toolbar">
  <li><a href="sites.htm">Sites</a></li>
  <li><a href="topics.htm" class="selected">Topics</a></li>
</ul>
```



In topics.htm, the style sheet changes the Topics link to be Black and not underlined.

```
a.selected {
  color: black;
  text-decoration: none;
}
```

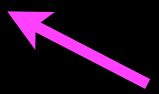
Problem

- In this situation - the link that is selected changes between pages
- We need to put class=”selected” on <a> tag for the current page but not for the other pages

Solution

- We pass the current path for the page into the template as a render parameter
- In the template we *check* the current path and only emit the class=”selected” when the path is the current page

http://localhost:8080/topics.htm



Path

```
class MainHandler(webapp.RequestHandler):

  def get(self):
    path = self.request.path
    try:
        temp = os.path.join(os.path.dirname(__file__), 'templates' + path)
        outstr = template.render(temp, { 'path': path })
        self.response.out.write(outstr)
    except:
        temp = os.path.join(os.path.dirname(__file__), 'templates/index.htm')
        outstr = template.render(temp, { 'path': path })
        self.response.out.write(outstr)
```

_base.htm

```
<ul class="toolbar">
  <li><a href="sites.htm"
        {% ifequal path '/sites.htm' %}
              class="selected"
        {% endifequal %}
       >Sites</a></li>
  <li><a href="topics.htm"
        {% ifequal path '/topics.htm' %}
              class="selected"
        {% endifequal %}
      >Topics</a></li>
</ul>
```

For each of the links, if the path matches, we emit class=”selected” otherwise we do not.

Conditional HTML generation.

_base.htm

```
<ul class="toolbar">
  <li><a href="sites.htm"
        {% ifequal path '/sites.htm' %}
              class="selected"
        {% endifequal %}
       >Sites</a></li>
  <li><a href="topics.htm"
        {% ifequal path '/topics.htm' %}
              class="selected"
        {% endifequal %}
      >Topics</a></li>
</ul>
```

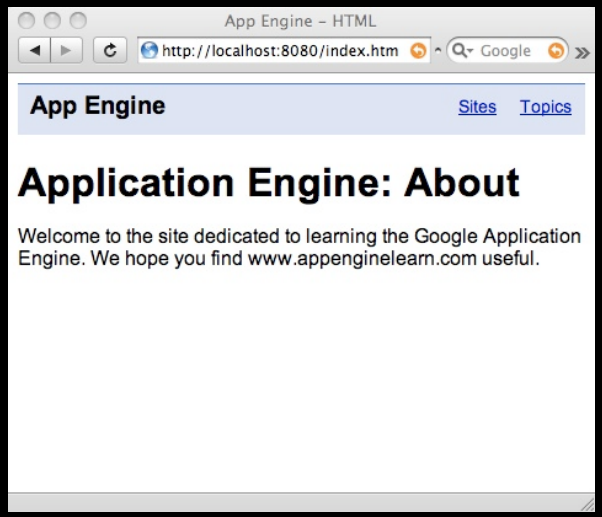


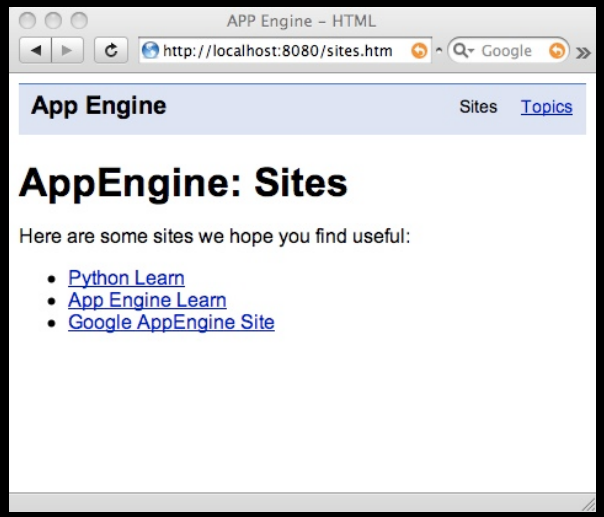
topics.htm (rendered)

```
<ul class="toolbar">
  <li><a href="sites.htm"
       >Sites</a></li>
  <li><a href="topics.htm"
              class="selected"
      >Topics</a></li>
</ul>
```

The path variable comes from the Python code.

Our Application







Program: ae-06-templates

More on Templates



- This is only scratching the surface of templates
- The Google Application Engine templating language is taken from the django application
- You can read further in the django documentation

http://docs.djangoproject.com/en/dev/ref/templates/builtins/?from=olddocs

Summary

- We can use the ability to create a base template and then extend it in our regular templates to reduce the amount of repeated HTML code in templates.
- We can even make pretty navigation links which change based on which page is the current page
- When we don't have to repeat the same code over and over - it is easy to make changes without breaking things