Google App Engine Using Templates

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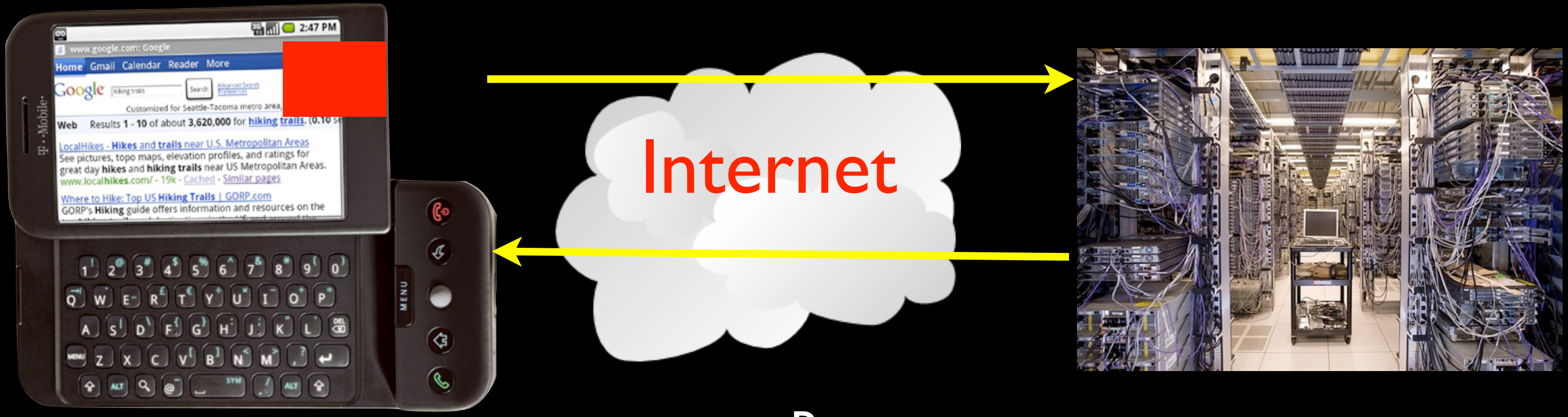
Textbook: Using Google App Engine, Charles Severance



HTML JavaScript

AJAX CSS

HTTP Request

Response GET

POST

Python Data Store

Templates memcache

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

```
  formstring = """<form method="post" action="/"
      enctype="multipart/form-data">
Zap Data: <input type="text" name="zap"><br>
Zot Data: <input type="text" name="zot"><br>
File Data: <input type="file" name="filedat"><br>
<input type="submit">
</form>"""

def dumper(self):
    self.response.out.write(self.formstring)
    self.response.out.write("<pre>\n")
    self.response.out.write('Request parameters:\n')
    for key in self.request.params.keys():
      value = self.request.get(key)
      if len(value) < 100:
         self.response.out.write(key+':'+value+'\n')
      else:
         self.response.out.write(key+':'+str(len(value))+' (bytes long)\n')
    self.response.out.write('\n')
```

YUCK!!

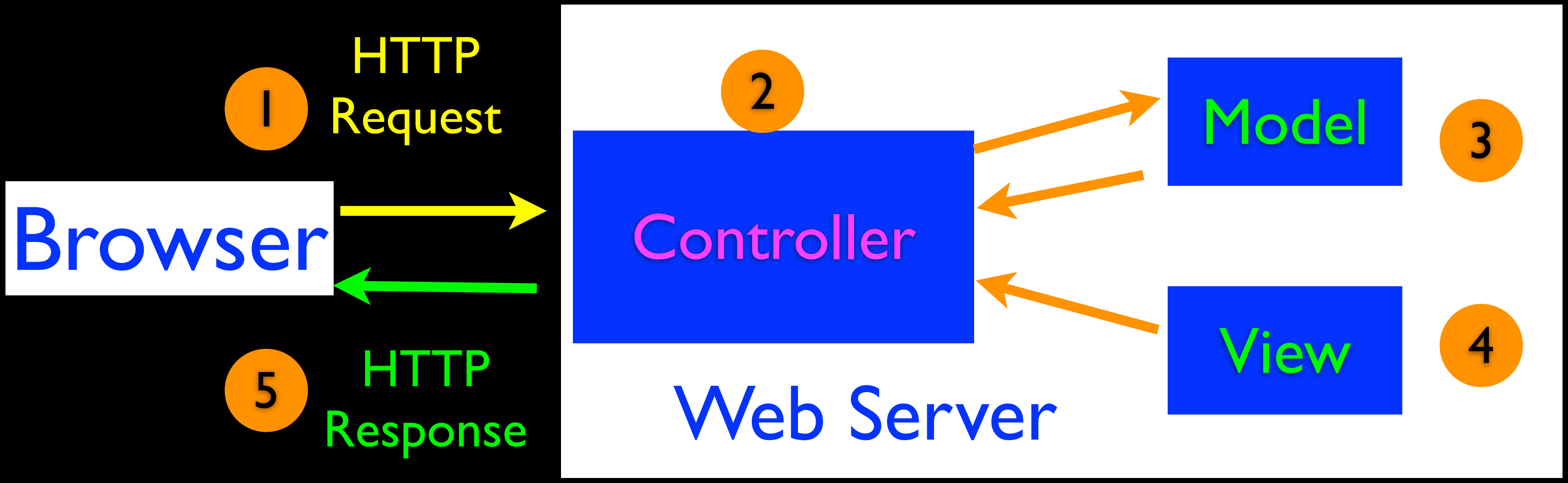
Python is a *lousy* way to store and edit HTML. Your code gets obtuse and nasty. Lets move the HTML into a separate file.

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

```
<form method="post" action="/"
     enctype="multipart/form-data">
Zap Data: <input type="text" name="zap"><br>
Zot Data: <input type="text" name="zot"><br>
File Data: <input type="file" name="filedat"><br>
<input type="submit">
</form>
<pre>
Request Data:
{{ dat }}
</pre>
```

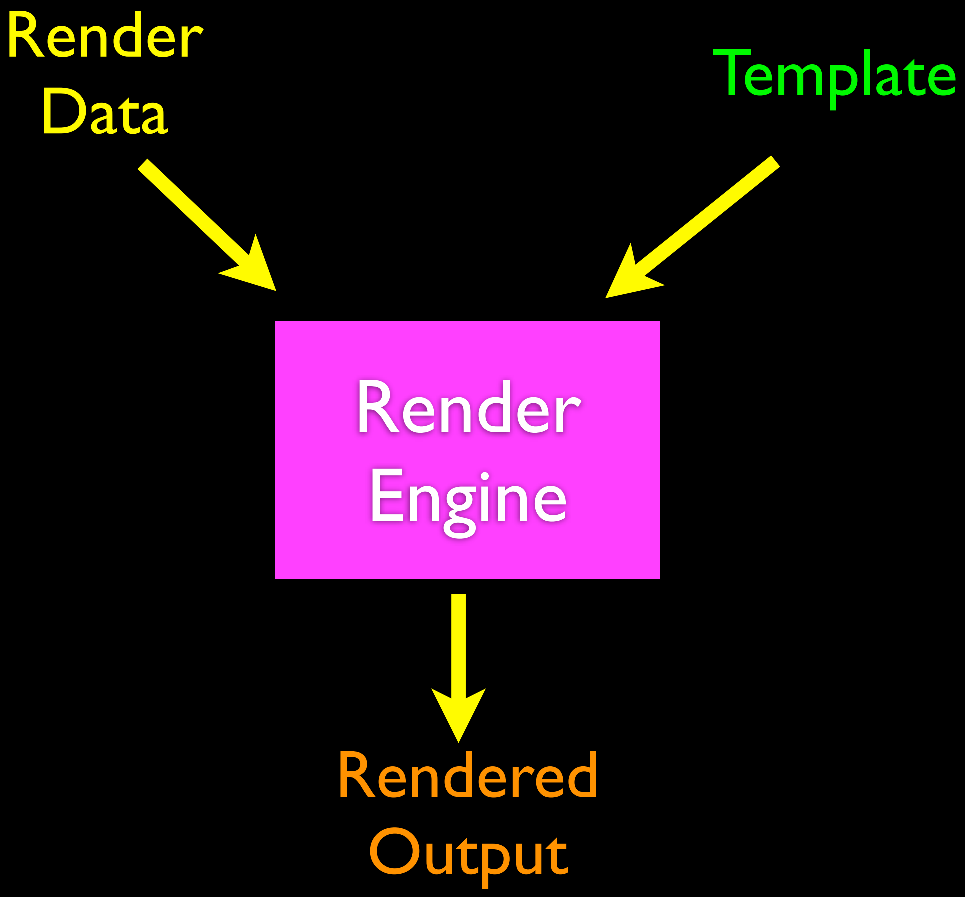
Mostly HTML - with a little place to drop in data from the Controller.

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, { 'dat' : 'hello there'})
```

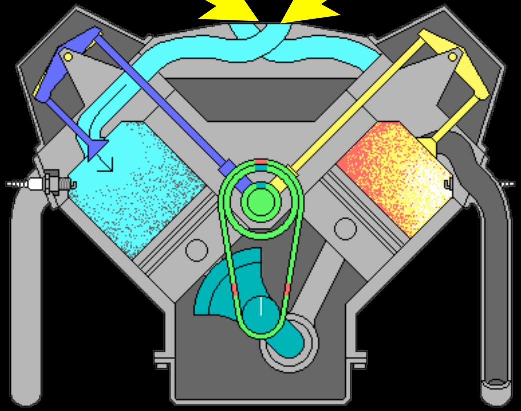
The Render Engine takes the path to a template file, and a dictionary with key value pairs of the data areas in the template.


Render Data
Template
Render Engine
Rendered Output

{ 'dat' : 'Fun Stuff' }

```
<h1>Hi!</h1>
<pre>
{{ dat }}
</pre>
```

V-8 Render Engine



```
<h1>Hi!</h1>
<pre>
Fun Stuff
</pre>
```

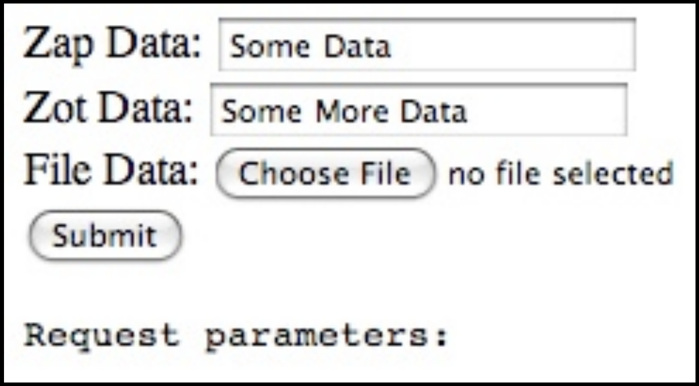
Template Pattern

- 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, { ‘dat’ : ‘hello there’})
```

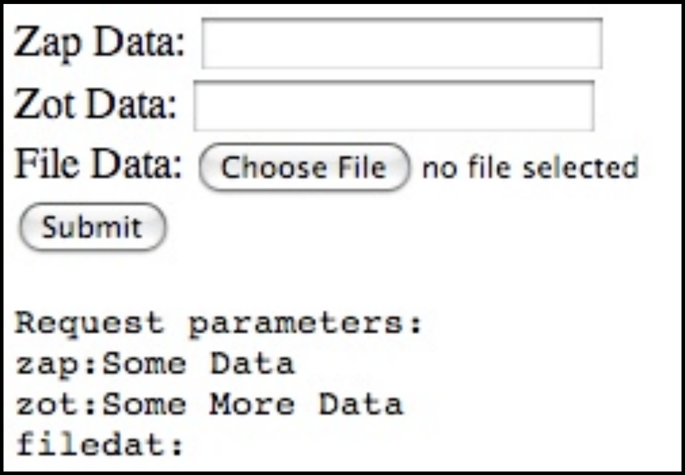
We loop through the parameters and make a string of the the parameter output and then render the template with this data.

```
def dumper(self):
  prestr = ‘ ‘
  for key in self.request.params.keys():
    value = self.request.get(key)
    if len(value) < 100:
       prestr = prestr + key+':'+value+'\n'
    else:
       prestr = prestr + key+':'+str(len(value))+' (bytes long)\n'

  temp = os.path.join(os.path.dirname(__file__), 'templates/index.htm’)
  outstr = template.render(temp, {'dat': prestr})
  self.response.out.write(outstr)
```



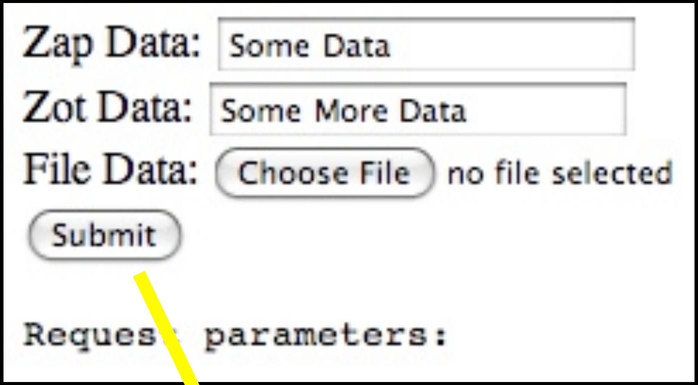
```
Request parameters:
```

No Separation of Concerns



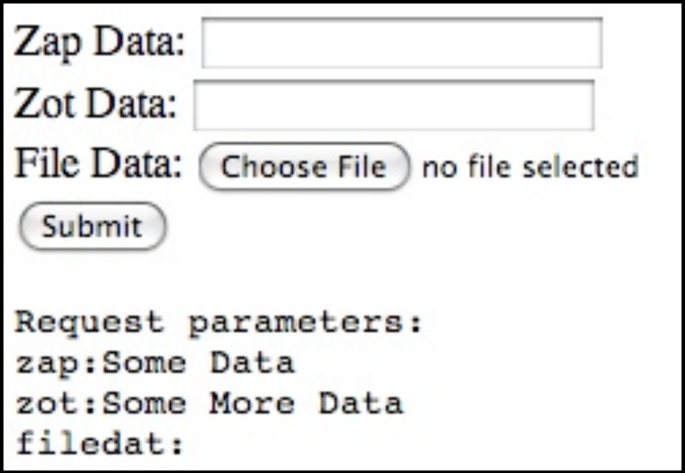
```
Request parameters:
zap:Some Data
zot:Some More Data
filedat:
```

```
def dumper(self):
    self.response.out.write(self.formstring)
    self.response.out.write("<pre>\n")
    self.response.out.write('Request parameters:\n')
    for key in self.request.params.keys():
      value = self.request.get(key)
      if len(value) < 100:
         self.response.out.write(key+':'+value+'\n')
      else:
         self.response.out.write(key+':'+str(len(value))+' (bytes long)\n')
    self.response.out.write('\n')
```



```
Zap Data: Some Data
Zot Data: Some More Data
File Data: Choose File  no file selected
Submit

Request parameters:
```

Controller and View



```
Zap Data:
Zot Data:
File Data: Choose File  no file selected
Submit

Request parameters:
zap:Some Data
zot:Some More Data
filedat:
```

```
def dumper(self):
  prestr = ‘ ‘
  for key in self.request.params.keys():
    value = self.request.get(key)
    if len(value) < 100:
      prestr = prestr + key+':'+value+'\n'
    else:
      prestr = prestr + key+':'+str(len(value))+’\n’;

  temp = os.path.join(os.path.dirname(__file__),
            'templates/index.htm’)
  outstr = template.render(temp, {'dat': prestr})
  self.response.out.write(outstr)
```

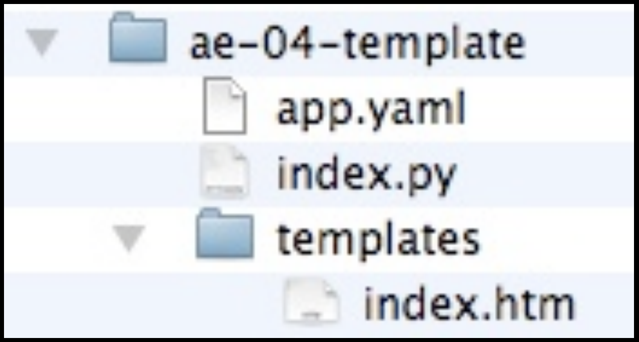
```
<form method="post" action="/"
     enctype="multipart/form-data">
Zap Data: <input type="text" name="zap"><br>
Zot Data: <input type="text" name="zot"><br>
File Data: <input type="file" name="filedat"><br>
<input type="submit">
</form>
<pre>
Request Data:
{{ dat }}
</pre>
```

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

```
<h1>Hi!</h1>
<pre>
{{ dat }}
</pre>
```

+ { 'dat' : 'Fun Stuff' } =

```
<h1>Hi!</h1>
<pre>
Fun Stuff
</pre>
```

Several Templates

Program: ae-05-templates

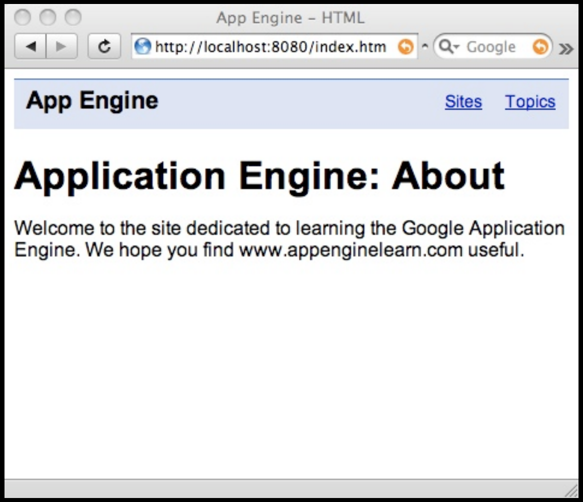
www.appenginelearn.com

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

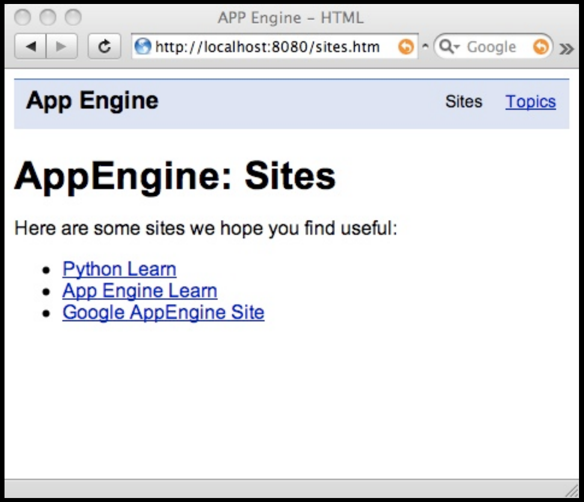

App Engine - HTML

http://localhost:8080/index.htm

App Engine Sites Topics

Application Engine: About

Welcome to the site dedicated to learning the Google Application Engine. We hope you find www.appenginelearn.com useful.


APP Engine - HTML

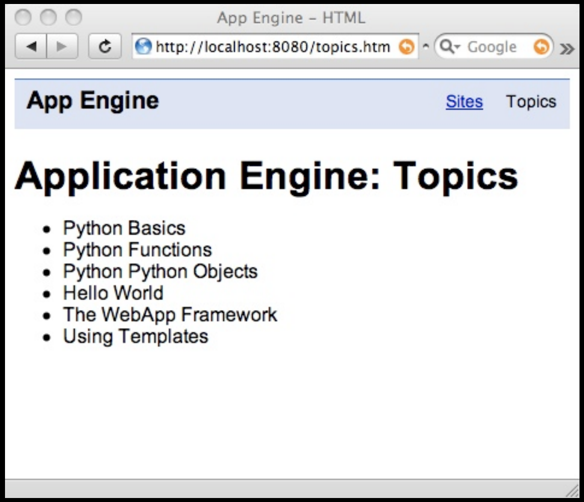
http://localhost:8080/sites.htm

App Engine Sites Topics

AppEngine: Sites

Here are some sites we hope you find useful:

- Python Learn
- App Engine Learn
- Google AppEngine Site


App Engine - HTML

http://localhost:8080/topics.htm

App Engine Sites Topics

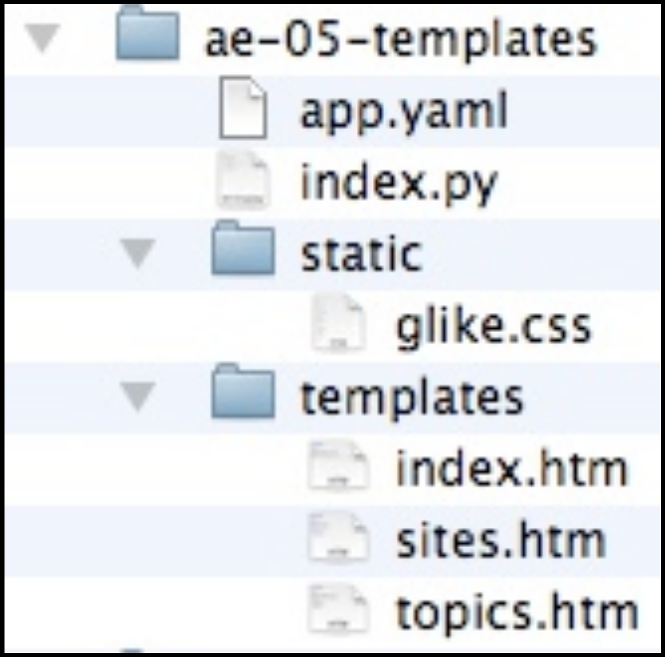
Application Engine: Topics

- Python Basics
- Python Functions
- Python Python Objects
- Hello World
- The WebApp Framework
- Using Templates

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

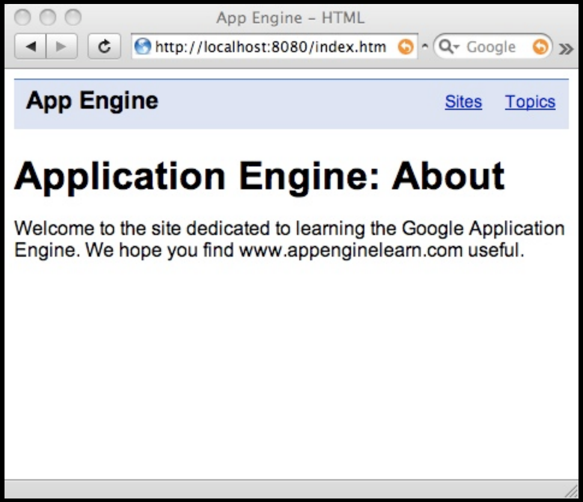
```
application: ae-05-templates
version: 1
runtime: python
api_version: 1

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>
```



Application Engine: About

Welcome to the site dedicated to learning the Google Application Engine. We hope you find www.appenginelearn.com useful.

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

Path

http://localhost:8080/topics.htm

For this URL, the path is /topics.htm

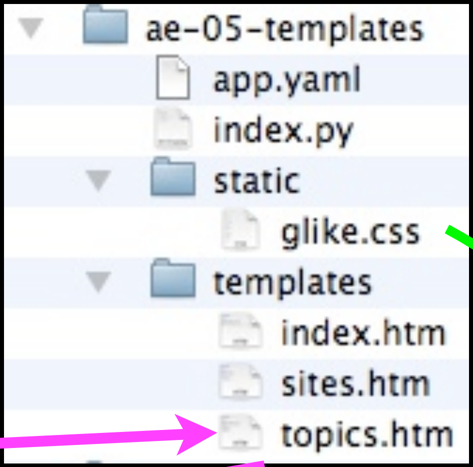
```
class MainHandler(webapp.RequestHandler):

 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)
```

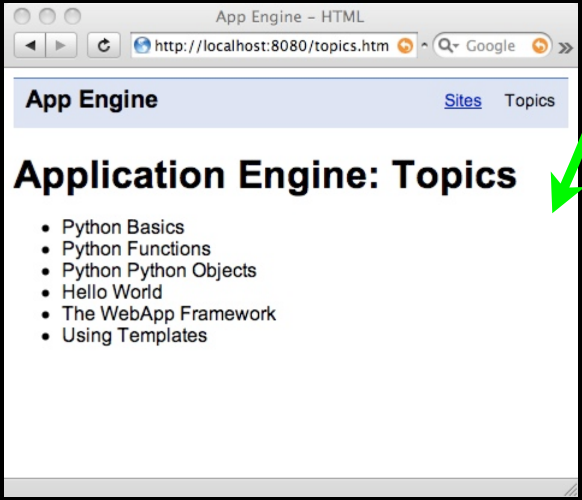
http://localhost:8080/topics.htm

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)
```



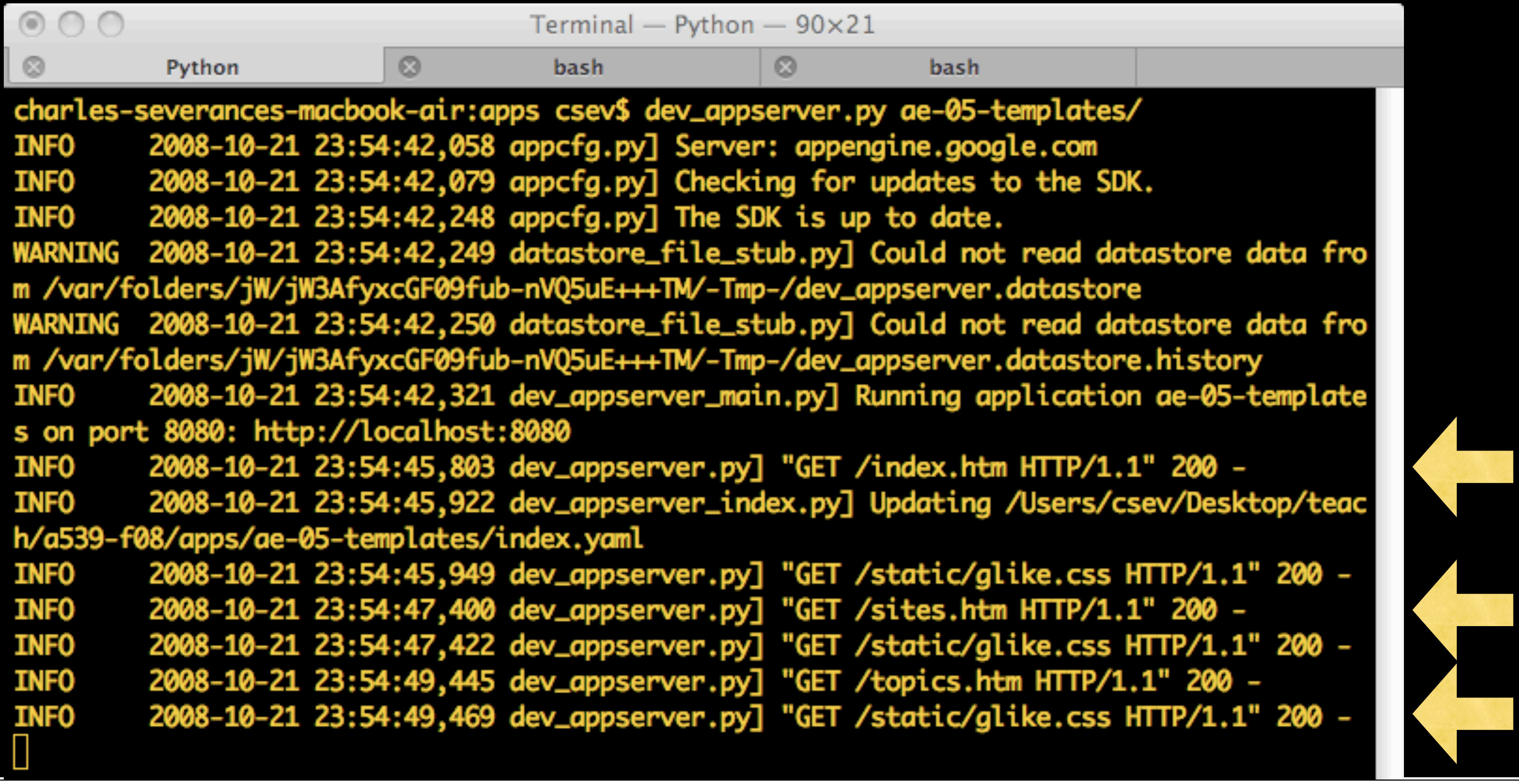


Application Engine: Topics

- Python Basics
- Python Functions
- Python Python Objects
- Hello World
- The WebApp Framework
- Using Templates

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

In the Log...



```
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

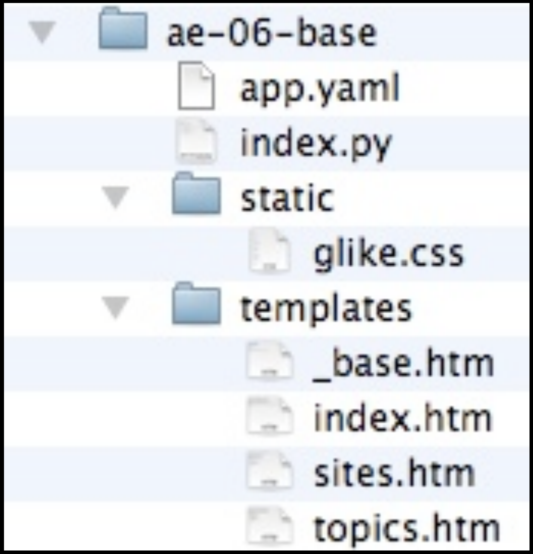
www.appenginelearn.com

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



```
ae-06-base
    app.yaml
    index.py
    static
        glike.css
    templates
        _base.htm
        index.htm
        sites.htm
        topics.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">
     <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 %}
        Replace this
      {% endblock %}
   </div>
 </body>
</html>
```

_base.htm

```
      <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>
```

```
      <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>
```

index.htm

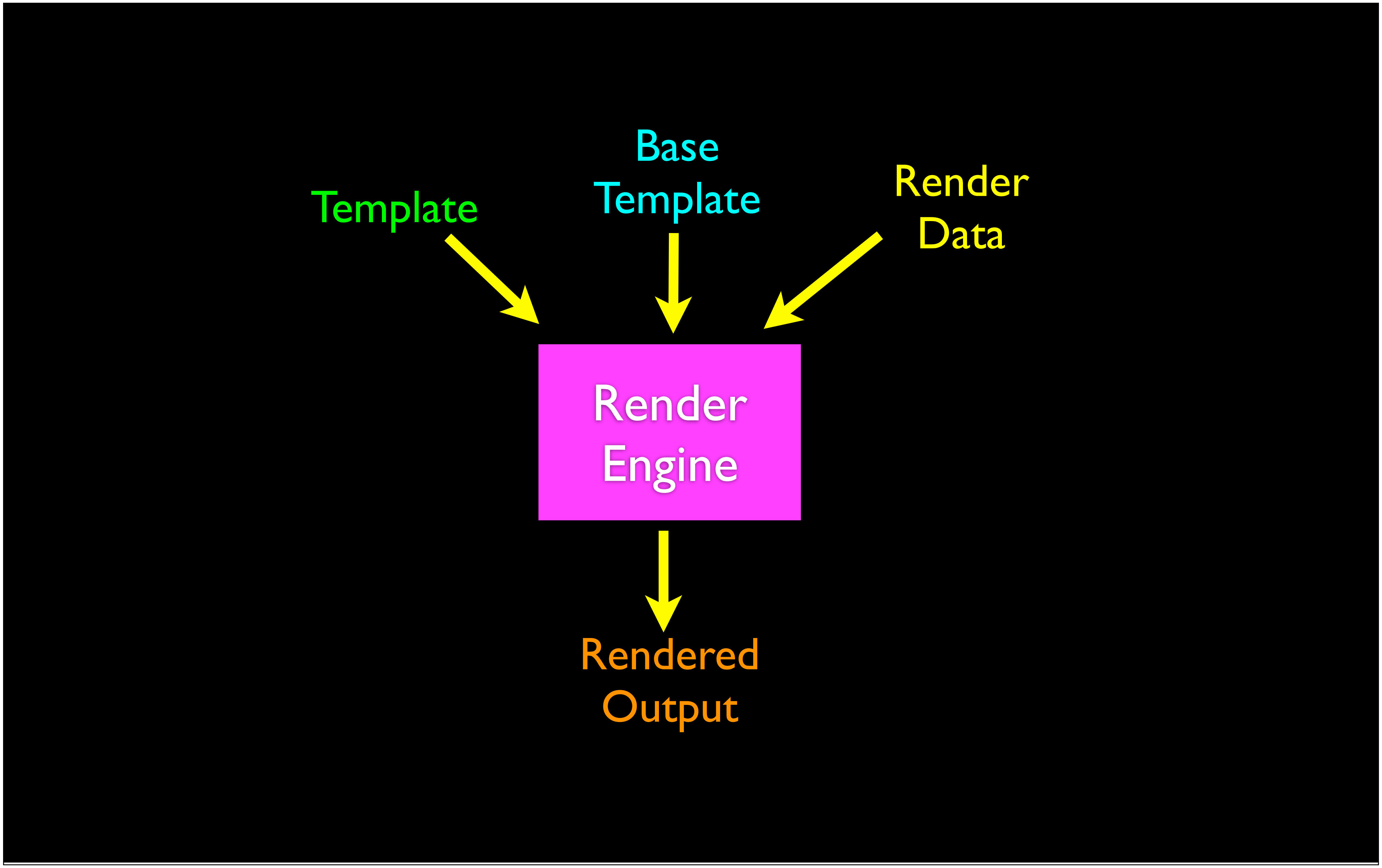
```
<head>
  <title>App Engine - HTML</title>
  <link href="/static/glike.css" rel="stylesheet" type="text/css" />
</head>
<body>
  <div id="header">
     <h1><a href="index.htm" class="selected">
             App Engine</a></h1>
     <ul class="toolbar">
       <li><a href="sites.htm">Sites</a></li>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

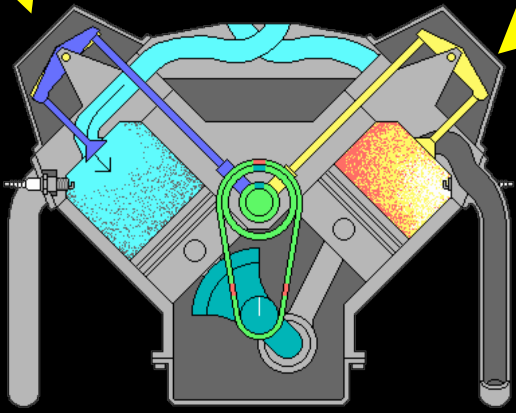
index.htm


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>
```

V-8 Render Engine



{ 'dat' : 'Fun Stuff' }

```
....
   <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

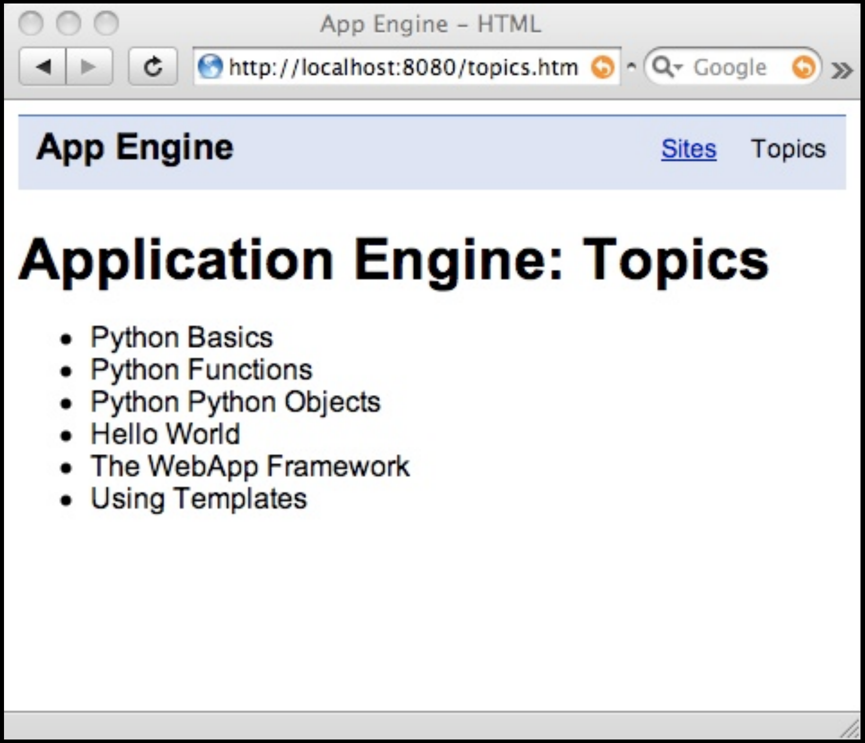
www.appenginelearn.com

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>
```



Application Engine: Topics

- Python Basics
- Python Functions
- Python Python Objects
- Hello World
- The WebApp Framework
- Using Templates

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

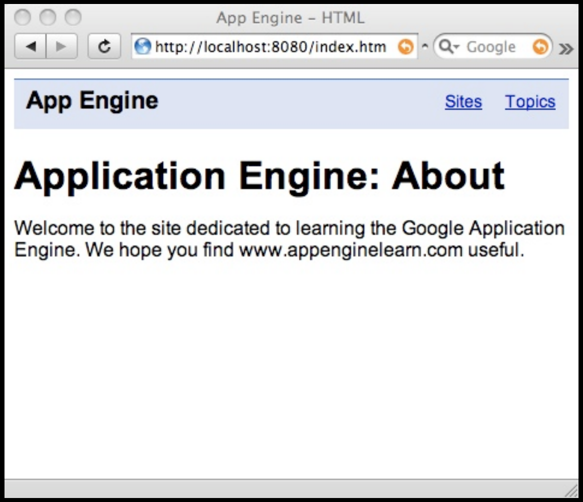
```
<ul class="toolbar">
  <li><a href="sites.htm"
        {% ifequal path '/sites.htm' %}
              class="selected"
        {% endifequal %}
       >Sites</a></li>
  <li><a href="topics.htm"
        {% ifequal path '/topics.htm' %}
              class="selected"
        {% endifequal %}
      >Topics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

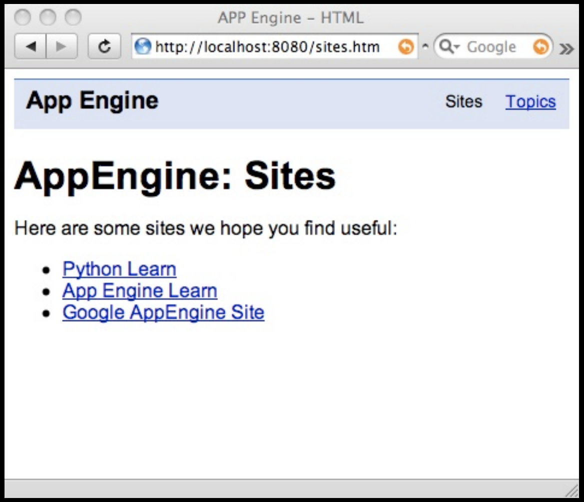

App Engine - HTML

http://localhost:8080/index.htm

App Engine Sites Topics

Application Engine: About

Welcome to the site dedicated to learning the Google Application Engine. We hope you find www.appenginelearn.com useful.


APP Engine - HTML

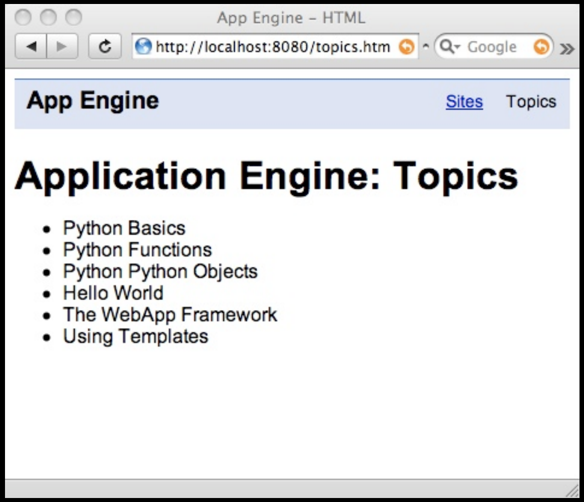
http://localhost:8080/sites.htm

App Engine Sites Topics

AppEngine: Sites

Here are some sites we hope you find useful:

- Python Learn
- App Engine Learn
- Google AppEngine Site


App Engine - HTML

http://localhost:8080/topics.htm

App Engine Sites Topics

Application Engine: Topics

- Python Basics
- Python Functions
- Python Python Objects
- Hello World
- The WebApp Framework
- Using Templates

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