Web Programming in Python with Django!

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Course Overview

- What is Django?
- Apps, Models, and Views
- URL Structure
- Templates
- Admin Interface
- Forms
- Examples / Tutorials

What is Django?

What is Django?

django [jāngō]
-noun

1. a shiny web framework that allows one to build dynamic, professional-looking websites in python: *Need to make a slick website? Use django!*
2. masculine form of popular Hasbro game Jenga® (will not be discussed tonight)
3. magic

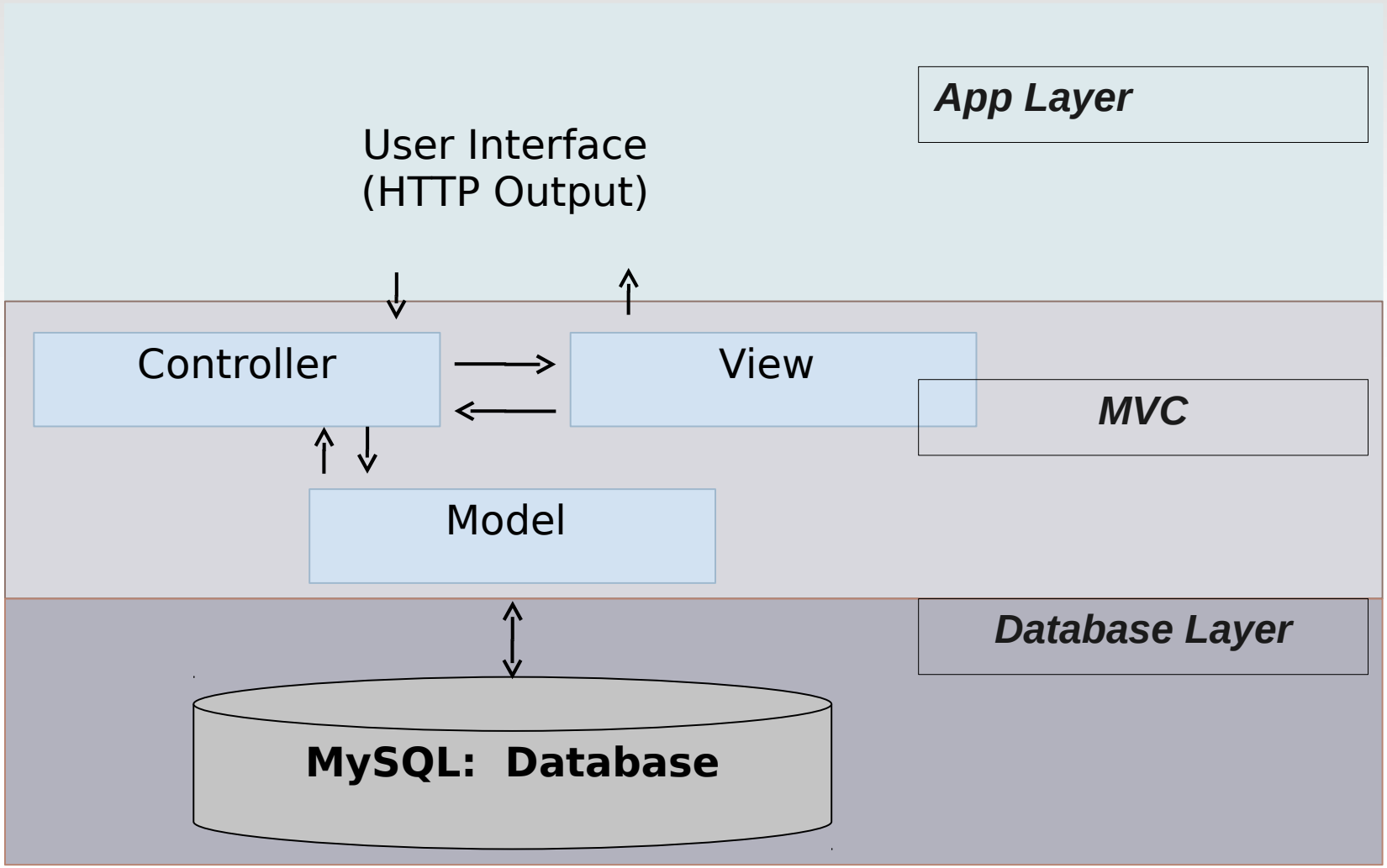
Funk-tacular Features

- projects or “apps” are pluggable
- object-relational mapper: combines the advantages of having a database with the advantages of using an object-oriented programming language
- database allows for efficient data storage and retrieval
- Python allows for cleaner and more readable code

Funk-tacular Features

- automatic admin interface offers the functionality of adding, editing, and deleting items within a database in a graphical, user-friendly way
- flexible template language that provides a way to retrieve data and display it on a webpage in its desired format
- url design is elegant and easy to read

Marvelous Websites Made the Django Way: Models & Views



Marvelous Websites Made the Django Way: Models & Views

***App Layer**: Outputs* HTML (controls how data is displayed to the user)

MVC Layer

1. *Model*: Models contains classes definitions for holding data
2. *View*: The View controls the access and filtration of data in order to be passed onto the app layer for display.
3. *Controller*: The Controller receives and manages inputs to update the Model layer. Additionally, it also updates the elements for the View layer as necessary.

Database Layer: The models are stored in database tables in MySQL.

The Django Way

Amazing Apps

- Django does not work quite like PHP, or other server-side scripting languages
- Django organizes your website into apps
- An app represents one component of a website
- Example: a simple web poll, blog, etc.
- Apps can be used in multiple different websites/projects (“pluggable”), and a website can have multiple apps

Amazing Apps

- Each app has its own data and webpages associated with it – called **models** and **views**, respectively
- Example: a poll that lets users vote on questions
  - **Views** (different webpages):
    - Page with questions + choices (actual voting page)
    - Statistics page that shows past results
  - **Models** (data):
    - Poll questions
    - Choices associated with each question
    - The actual voting data! (set of selected choices)

Amazing Apps

- When you create an app, Django makes a folder, appname/ in your project directory
- It contains, among some other files:
  - **models.py**
  - **views.py**
  - **urls.py** (will be discussed later)
- The app looks like a package (ex., `polls.view`, `polls.models`, etc.)

Models

Magnificent Models

- Models store data for your app
- Key for making dynamic websites!
- Models are implemented as Python classes, in models.py file
- Awesome feature of Django: the “object relational mapper”
  - Allows you to access/change a database (ex., MySQL) just by calling functions on your models

Magnificent Models

Example models:

```
from django.db import models

class Poll(models.Model):
    question = models.CharField(max_length=200)
    pub_date = models.DateTimeField('date published')

class Choice(models.Model):
    poll = models.ForeignKey(Poll)
    choice = models.CharField(max_length=200)
    votes = models.IntegerField()
```

Magnificent Models

- Can easily create instances of your model:

```
p = Poll(question="What's up?",
   pub_date=datetime.datetime.now())
```

- Save it to the database:

```
p.save()
```

- The object relational mapper takes care of all the MySQL for you!

Magnificent Models

- The object relational mapper even automagically sets up your MySQL database
- Example generated code:

```
BEGIN;
CREATE TABLE "polls_poll" (
    "id" serial NOT NULL PRIMARY KEY,
    "question" varchar(200) NOT NULL,
    "pub_date" timestamp with time zone NOT NULL
);
CREATE TABLE "polls_choice" (
    "id" serial NOT NULL PRIMARY KEY,
    "poll_id" integer NOT NULL REFERENCES "polls_poll" ("id"),
    "choice" varchar(200) NOT NULL,
    "votes" integer NOT NULL
);
COMMIT;
```

Magnificent Models

- Example methods and fields:
  - `Poll.objects.all() - returns list of all objects`

    `p.question`

    `Poll.objects.filter(question__startswith='What')`

    (This function was autogenerated by Django!)

A word about databases

- Although Django certainly does do a lot for you, it helps to know a bit about databases
- When designing a model, useful to think about good database practice

Digestible Databases

Good Database Design in a Nutshell:

1. Groups of related fields belong in the same table
2. New tables should be created for data fields that are almost always empty
3. Most of the time the information contained in unrelated fields will not need to be retrieved at the same time, so those groups of fields should be in separate fields as one another

Digestible Databases

Example Database:

(a) Patient Table

Patient ID	Last Name	First Name	Room No.

(b) Medication Table

Prescription ID	Patient ID	Medication	Dosage	Instruction

(c) Schedule Table

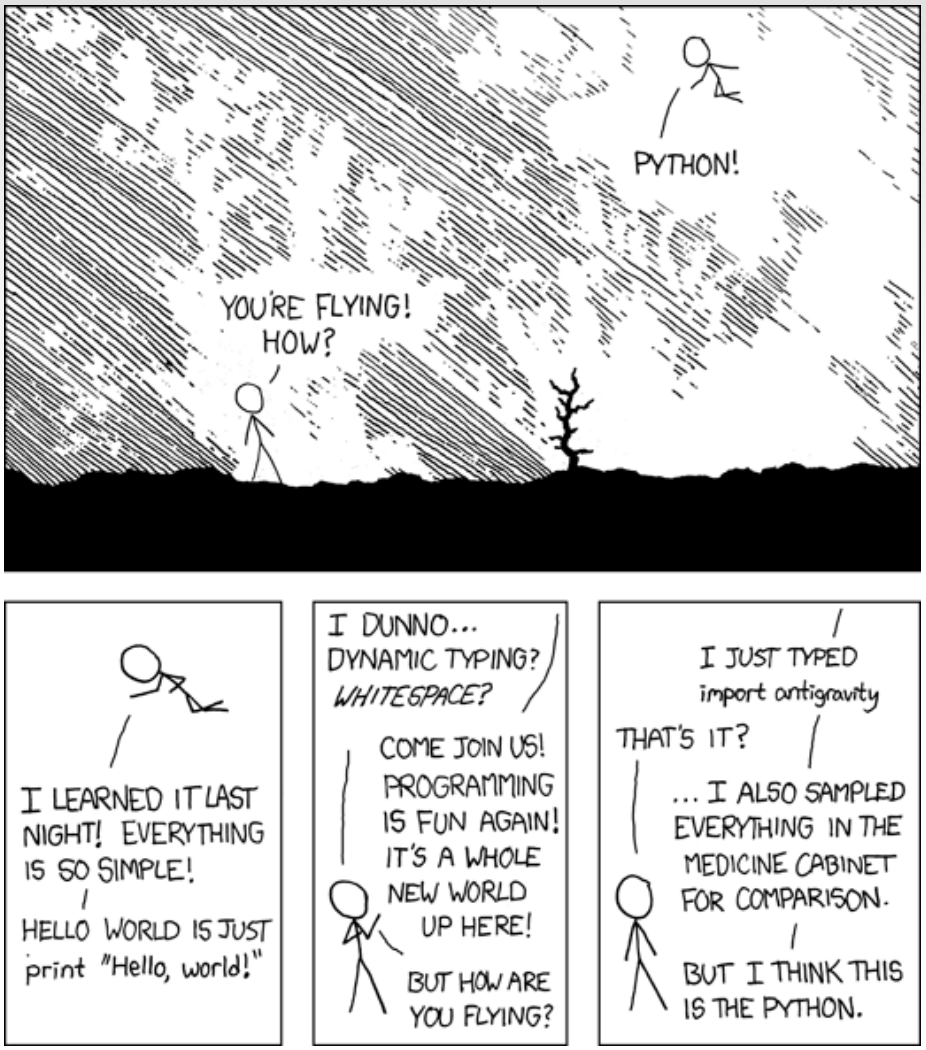
Schedule ID	Prescription ID	Time	Next Admin Date	M	T	W	R	F	Sa	Su

Views

Vivacious Views

- Views are Python functions - they make the web pages users see
- Can make use of models for getting data
- Can use anything that Python has to offer!
  - ...and there's A LOT Python can do! Makes for interesting websites

Vivacious Views



Vivacious Views

- View functions take as input: HttpResponse object – contains useful information about the client, sessions, etc.
- Return as output HttpResponse object – basically HTML output
- Most often, views don't actually write HTML – they fill in **templates**! (discussed shortly)

Vivacious Views

- Example view:

```
from django.shortcuts import render_to_response
from mysite.polls.models import Poll

def index(request):
    latest_poll_list = Poll.objects.all().order_by('-pub_date')[:5]
    return render_to_response('polls/index.html', {'poll_list': poll_list})
```

Templates

Templates, Tags, & Tricks

The Django ***template*** language consists of ***tags***, which perform many functions and may be embedded in a text file to do neat ***tricks***.

Templates, Tags, & Tricks

Tags:

Ex. variable

```
{{ poll.question }}
```

Ex. for-loop

```
{% for choice in poll.choice_set.all %}
                                        ...
{% endfor %}
```

Ex. if-statement

```
{% if patient_list %}
        ...
{% else %}
        ...
{% endif %}
```

Templates, Tags, & Tricks

Example: *Displaying poll results*

```
<html>

<h1>{{ poll.question }}</h1>

<ul>

{% for choice in poll.choice_set.all %}

    <li>{{ choice.choice }} -- {{ choice.votes }}
  vote{{ choice.votes|pluralize }}</li>

{% endfor %}

</ul>

</html>
```

Django URL Structure

Utterly Unblemished URL's

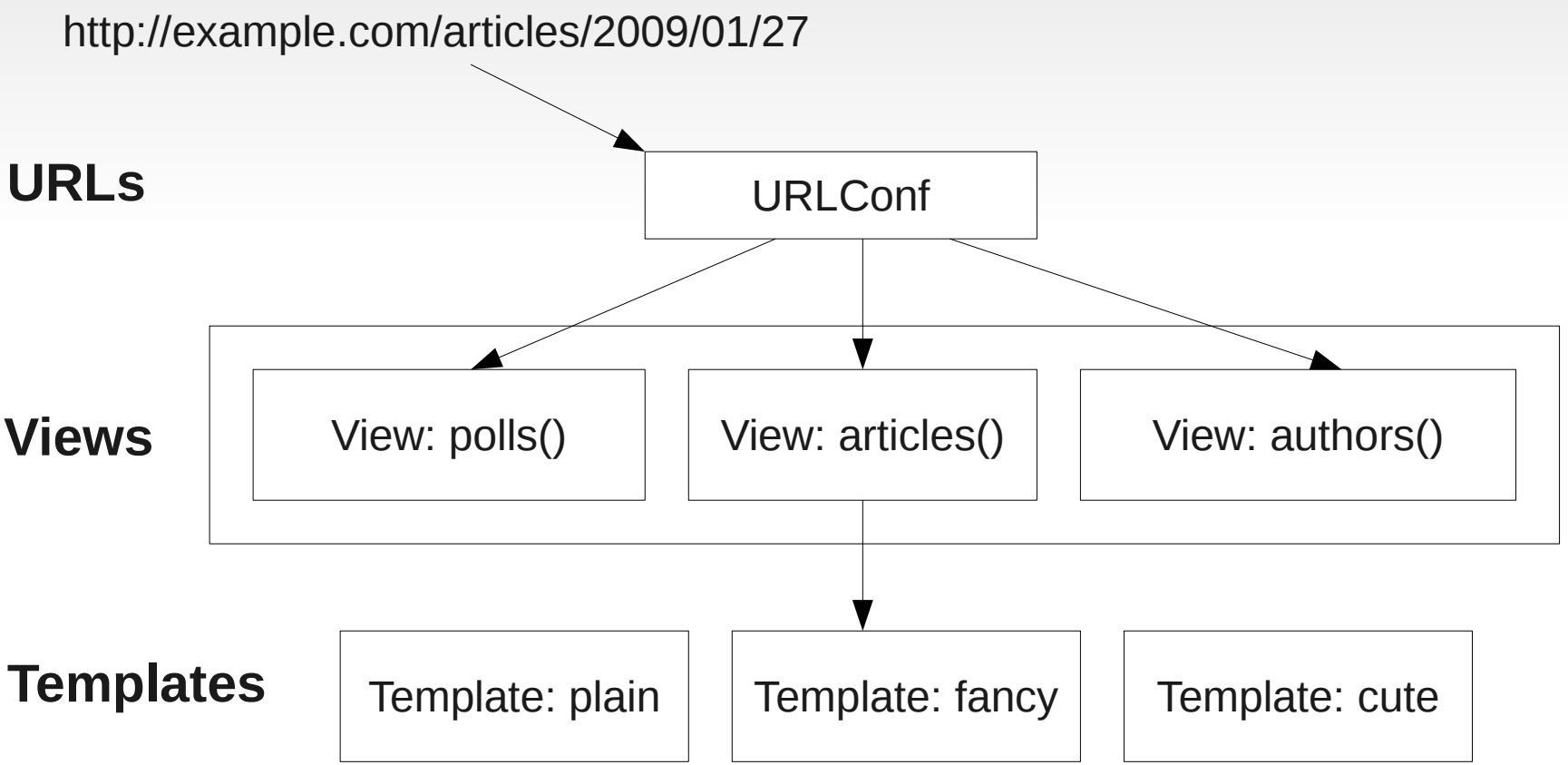
- Django structures your website URL's in an interesting way
- Recap: the URL is the text you type to get to a website
- For non-Django websites:
  - http://www.example.com/some/directory/index.php
  - Refers to a file /some/directory/index.php on the server
- Different in Django! URL's are organized more elegantly and more easily understandably

Utterly Unblemished URL's

- Consider this example:
  - http://example.com/articles/2005/03/
- URL specifies article date, not a reference to a specific file
- Allows a more logical organization, that is less likely to change over time

Utterly Unblemished URL's

- Overview of how Django works, using URL's



Utterly Unblemished URL's

- URL patterns map to Views
- Views may use templates
- Templates contain HTML (discussed later)
- This puts a layer of abstraction between URL names and files
- The file **urls.py** that specifies how URL's get mapped to views, using regular expressions

Utterly Unblemished URL's

- Example urls.py:

```
urlpatterns = patterns('',
    (r'^articles/2003/$', 'news.views.special_case_2003'),
    (r'^articles/(?P<year>\d{4})/$', 'news.views.year_archive'),
    (r'^articles/(?P<year>\d{4})/(?P<month>\d{2})/$', 'news.views.month_archive'),
    (r'^articles/(?P<year>\d{4})/(?P<month>\d{2})/(?P<day>\d+)/$', 'news.views.article_detail'),
)
```

- http://example.com/articles/2009/03/14 will result in `news.views.article_detail(request, year='2009', month='03', day='14')` being called

Utterly Unblemished URL's

- These are mostly like regular expressions, which are outside of the scope of this class

Admin Interface

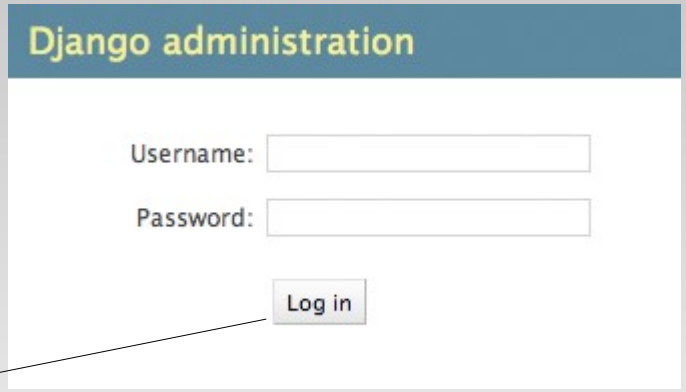
Awesome Automatic Admin

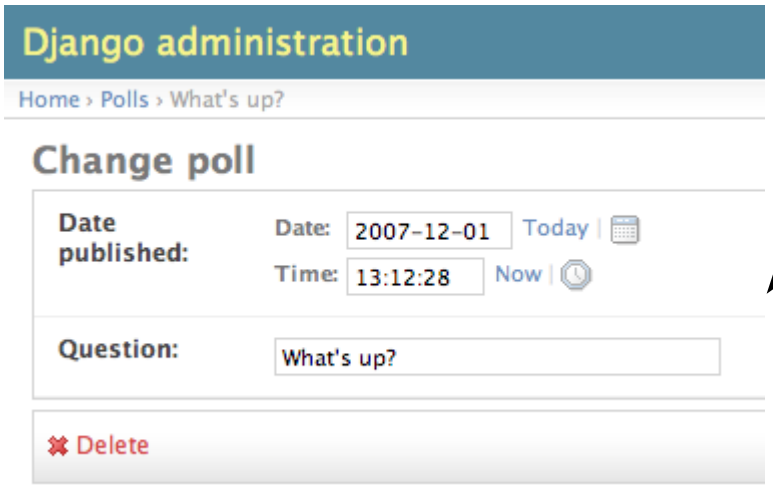
"Generating admin sites for your staff or clients to add, change and delete content is tedious work that doesn't require much creativity. For that reason, Django entirely automates creation of admin interfaces for models.

Django was written in a newsroom environment, with a very clear separation between "content publishers" and the "public" site. Site managers use the system to add news stories, events, sports scores, etc., and that content is displayed on the public site. Django solves the problem of creating a unified interface for site administrators to edit content.

The admin isn't necessarily intended to be used by site visitors; it's for site managers."

Reference: http://docs.djangoproject.com/en/dev/intro/tutorial02/





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Forms

Fun with Forms

Why use them?

1. Automatically generate form widgets.
2. Input validation.
3. Redisplay a form after invalid input.
4. Convert submitted form data to Python data types.

Fun with Forms

Example:

```
<h1>{{ poll.question }}</h1>

{% if error_message %}<p><strong>{{ error_message }}</strong></p>{% endif %}

<form action="/polls/{{ poll.id }}/vote/" method="post">
{% csrf_token %}
{% for choice in poll.choice_set.all %}
    <input type="radio" name="choice" id="choice{{ forloop.counter }}"
value="{{ choice.id }}" />
    <label
for="choice{{ forloop.counter }}">{{ choice.choice }}</label><br />
{% endfor %}
<input type="submit" value="Vote" />
</form>
```

Fun with Forms

Schedule

Wednesday, January 27.

1:06:53 P.M.

Time	Room #	Last Name	Medication	Dosage
13:10:00	518	Rodriguez	chocolate	200000 g

Name: Rodriguez, Maria
Room: 518

Medication: chocolate
Dosage: 200000 g
Instruction: take with milk

Administered

Other Nifty Django Features

Satisfying Sessions

- You can uses sessions in Django, just like the sessions in PHP
  - Sessions allow you to store state across different pages of your website
  - Common uses: store logged in username, shopping cart information, etc.
- If you write to a session in one view (webpage), it will be visible in all views afterwards as well
- Session is found in the HttpResponse object

Real Live Examples!

Real-World Apps

- MedSched

http://priyaram.scripts.mit.edu/practice/medsched/admin/

- Shiny!

http://sjlevine.scripts.mit.edu/django/shiny/

Tutorial: Polling

Setting up Django through Scripts:

1. connect to athena:

>>ssh username@linerva.mit.edu

2. set up scripts

>>add scripts

>>scripts

3. Follow instructions from there to install Django

4. connect to scripts:

>>ssh scripts.mit.edu

>>cd ~/Scripts

Helpful Commands

- From project folder run mysql
- type “show databases;” to see your databases
- type “use <database_name>;” to use a database
- type “show tables;” to view the tables in that database
- type “drop table <table_name>;” to drop a table
- Drop affected tables each time fields within your models change.

Helpful Commands

- >>./manage.py syncdb

  or

  >>python manage.py syncdb

  Updates database tables whenever you drop tables or add applications to INSTALLED_APPS in settings.py

- >>add scripts

  >>for-each-server pkill -u maria python

  Restarts the development server to see your changes.

Handy References

- Official Django website:
  http://www.djangoproject.org/
  - Contains an amazing tutorial that you should follow
  - Information on setting up Django
  - Documentation for various classes, functions, etc.