

geodjango

Rapid Geographic Web Application with GeoDjango

May 14, 2008

Where 2.0

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Django Intro

geodjango



(Crazily brief) Introduction



**Django is a high-level
Python web framework
that encourages rapid
development and clean,
pragmatic design.**



More...

<http://toys.jacobian.org/presentations/2008/pycon/tutorial/>

<http://www.djangoproject.com/documentation/>

[design_philosophies/](http://www.djangoproject.com/documentation/design_philosophies/)

<http://www.djangobook.com/en/1.0/chapter01/>

```
$ django-admin.py startproject where2
```

where2/

__init__.py

manage.py

settings.py

urls.py

```
from django.db import models  
class County(models.Model):  
    name = models.CharField(...)
```

```
>>> County(name='x').save()
```

```
>>> County(name='y').save()
```

```
>>> County.objects.count()
```

```
2
```

```
>>> c = County.objects.get(name='y')
```

```
CREATE TABLE "app_county" (  
  "id" integer NOT NULL PRIMARY KEY,  
  "name" varchar(50) NOT NULL  
);
```

```
from django.contrib.gis.db \
    import models
from django.contrib.gis.geos \
    import Point
class County(models.Model):
    name = models.CharField(...)
    center = models.PointField(srid=4269)
    objects = models.GeoManager()
```

```
>>> p1 = 'POINT (0 1)'
>>> p2 = Point(10, 20)
>>> County(name='x', center=p1).save()
>>> County(name='y', center=p2).save()
>>> County.objects.count()
2
>>> y = County.objects.get(center=p2)
```

```
CREATE TABLE "app_county" (  
  "id" integer NOT NULL PRIMARY KEY,  
  "name" varchar(50) NOT NULL,  
  );  
SELECT AddGeometryColumn('app_county',  
                          'center', 4269,  
'POINT', 2  
  );
```

```
$ ./manage.py syncdb
```

```
Creating table auth_message
```

```
Creating table auth_group
```

```
...
```

```
Creating table app_county
```

```
...
```

```
$ ./manage.py runserver 0:8000
```

```
Validating models...
```

```
0 errors found.
```

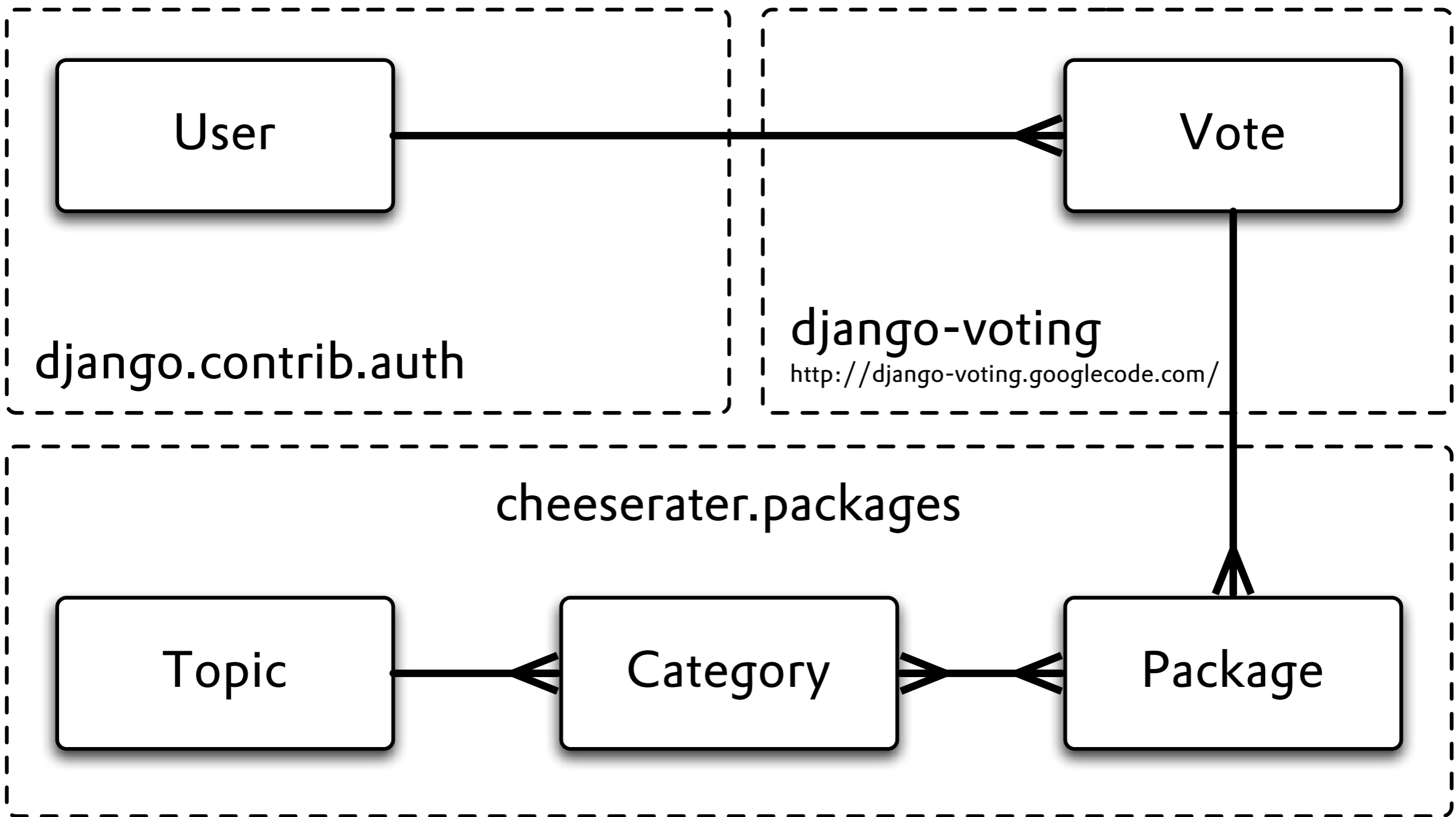
```
Django version 0.97-pre-SVN-7400, using settings 'settings'
```

```
Development server is running at http://0:8000/
```

```
Quit the server with CONTROL-C.
```

"Apps"

**[http://www.b-list.org/weblog/2008/mar/15/
slides/](http://www.b-list.org/weblog/2008/mar/15/slides/)**



“Views”

The guts.

Dissecting a request

- `GET /some_url/`
- `settings.ROOT_URLCONF = 'urls'`
- `urls`
- `(r'^some_url/', include('app.urls'))`
- `app.urls`
- `('^$', county_list)`
- `county_list(request)`

```
from django.conf.urls.defaults import *  
from app.views import *
```

```
urlpatterns = patterns('',  
    ('^app/$', county_list),  
)
```

```
from django.shortcuts import render_to_response
from models import County

def county_list(request):
    cs = County.objects.order_by('name')
    return render_to_response('county_list.html',

{'counties':cs})
```

Templates

Skinning

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01//EN">
<html lang="en">
<head><title>Counties</title></head>
<body>
  <ul>
    {% for c in counties %}
      <li>{{ c.name }}</li>
    {% endfor %}
  </ul>
</body>
</html>
```

The magic dot

→ `p["name"]`

→ `p.name`

→ `p.name()`

More...

<http://www.djangoproject.com/documentation/>

<http://www.djangoproject.com/documentation/>

<http://www.djangoproject.com/documentation/>

No, really.

<http://www.djangoproject.com/documentation/>



Installation

Installation: it builds character

- Relying on relatively new versions of the most libraries.
- But ctypes saves us (sort-of).
- We plan to fix this at some point.
 - For now, hurrah for virtualization!



Third-Party Libraries

Third-Party Libraries

- GEOS
- GDAL
- GeoIP (BSD-licensed)

Third-Party Libraries

- Why?
 - Powerful open source libraries; temperamental SWIG interfaces
 - `ctypes` enables all-Python interfaces (no compilation necessary)
 - Use of C APIs allows for high degree of cross-platform compatibility

GEOS

Geometry Engine Open Source

```
>>> from django.contrib.gis.geos import *
>>> pnt = Point(5, 23)
>>> ring = LinearRing((0, 0), (0, 50), (50, 50), (50, 0),
    (0, 0))
>>> poly = Polygon(ring)
>>> print poly.contains(pnt)
True
>>> print poly
POLYGON ((0.000000000000000000 0.000000000000000000,
    0.000000000000000000 50.000000000000000000,
    50.000000000000000000 50.000000000000000000,
    50.000000000000000000 0.000000000000000000, 0.000000000000000000
    0.000000000000000000))
>>> print poly.kml
<Polygon><outerBoundaryIs><LinearRing><coordinates>0.0,0.0,0
    0.0,50.0,0 50.0,50.0,0 50.0,0.0,0 0.0,0.0,0</
    coordinates></LinearRing></outerBoundaryIs></Polygon>
```

GDAL

Geospatial Data Abstraction Library

```
>>> from django.contrib.gis.gdal import *
>>> s1 = SpatialReference(4326)
>>> s2 = SpatialReference('NAD83')
>>> s3 = SpatialReference('+proj=lcc +lat_1=27.5 +lat_2=35
+lat_0=18 +lon_0=-100 +x_0=1500000 +y_0=5000000 +ellps=GRS80
+units=m +no_defs')
>>> geom = OGRGeometry('POINT(5 23)', s1)
>>> geom.transform(900913)
>>> print geom
POINT (556597.453966367174871 2632018.637504272162914)
```

GeoIP

```
>>> from django.contrib.gis.utils import GeoIP
>>> g = GeoIP()
>>> print g.country('refractions.net')
{'country_name': 'Canada', 'country_code': 'CA'}
>>> print g.city('refractions.net')
{'city': 'Vancouver', 'region': 'BC', 'area_code': 0,
 'longitude': -123.13330078125, 'country_code3': 'CAN',
 'latitude': 49.25, 'postal_code': 'v6c2b5', 'dma_code': 0,
 'country_code': 'CA', 'country_name': 'Canada'}
>>> print g.geos('refractions.net')
POINT (-123.133300781250000 49.2500000000000000000)
```

*** This is not enabled on the VM.**



Inspection & Import

Gameplan

- Delete all states (so we have room to play)
- Inspect shapefile
 - ogrinfo - human-readable
 - ogrinspect - model creation
- Define model
- Load with LayerMapping

Delete states

```
>>> from census.models import State  
>>> State.objects.all().delete()
```

Inspect Shapefile

```
>>> from django.contrib.gis.utils \
...     import ogrinfo, ogrinspect
>>> ogrinfo(df('st'), num_features=2)
...
>>> print ogrinspect(df('st'), \
...     'State', srid=4269)
...
```

Define Model

```
class State(models.Model):
    #STATE
    fips = models.CharField(max_length=2)
    #NAME
    name = models.CharField(max_length=20)
    #MULTIPOLYGON
    mpoly = models.MultiPolygonField(srid=4269)
    objects = models.GeoManager()
```

Define

```
>>> mapping = {
...     'fips': 'STATE',
...     'name': 'NAME',
...     'mpoly': 'MULTIPOLYGON'
... }
>>> lm = LayerMapping(State, \
...     df('st'), mapping, \
...     unique=('name', 'fips'), \
...     encoding='cp437', \
...     transform=False)
>>> lm.save(verbose=True)
```

(Bonus if time)

Your turn:
Load Counties!
Ask questions.



Exploration

Spatial Queries

```
Neighborhood.objects.filter(poly__intersects=zipcode.mpoly) |  
    Neighborhood.objects.filter(poly__within=county.mpoly)
```

VS.

```
SELECT "houston_neighborhood"."id",  
"houston_neighborhood"."name", "houston_neighborhood"."poly"  
FROM "houston_neighborhood" WHERE  
    (ST_Intersects("houston_neighborhood"."poly",  
ST_Transform(ST_GeomFromWKB('\001\006\000 ... ', 4269),  
32140)) OR ST_Within("houston_neighborhood"."poly",  
ST_GeomFromWKB('\001\006\000 ... ', 32140))
```

Spatial Queries

- Available PostGIS lookup types:
 - `overlaps, bboverlaps`
 - `overlaps_left, overlaps_right`
 - `overlaps_below, overlaps_above`
 - `strictly_below, strictly_above`
 - `left, right`
 - `same_as/exact`
 - `contained, bbcontains`
 - `equals, disjoint, touches, crosses, within, intersects, relate`

Distance Queries

- Projected/Geodetic coordinate system a source of confusion for beginners.
 - Inherent PostGIS limitation,
- Distance Lookups:
 - `distance_lte`, `distance_lt`
 - `distance_gte`, `distance_gt`

Distance Queries

```
# Distances will be calculated from this point,  
# which does not have to be projected.  
>>> pnt = fromstr('POINT(-96.876369 29.905320)', srid=4326)  
  
# If numeric parameter, units of field (meters in this case)  
# are assumed.  
>>> qs = SouthTexasCity.objects.filter(  
    point_distance_lte=(pnt, 7000))  
  
# Find all Cities w/in 7km of pnt  
>>> qs =SouthTexasCity.objects.filter(  
    point_distance_lte=(pnt, D(km=7)))  
  
# Find all Cities > 20 miles away from pnt.  
>>> qs = SouthTexasCity.objects.filter(  
    point_distance_gte=(pnt, D(mi=20)))  
  
# More obscure units, such as chains, are supported.  
>>> qs = SouthTexasCity.objects.filter(  
    point_distance_gte=(pnt, D(chain=100)))
```

Distance Queries

- `Distance` object eases conversion between units of measure.

```
>>> from django.contrib.gis.measure import Distance
>>> dist = Distance(ft=5280)
>>> print dist.mi
1.0
```

- Projected/Geodetic coordinate system a source of confusion for beginners.

Automatic Transformation

- If a geometry with a different SRID is used, it will be automatically transformed -- one less thing to worry about.

```
>>> pnt = Point(-95.4067, 29.7183, srid=4326)
>>> qs = Neighborhood.objects.filter(mpoly__intersects=pnt)
>>> print qs.query.as_sql()
SELECT "texas_neighborhood"."id",
"texas_neighborhood"."name", "texas_neighborhood"."state",
"texas_neighborhood"."city", "texas_neighborhood"."county",
"texas_neighborhood"."region", "texas_neighborhood"."mpoly"
FROM "texas_neighborhood" WHERE
ST_Intersects("texas_neighborhood"."mpoly", ST_Transform(%s,
3084))
```

GeoQuerySet Methods

- `gml`
 - `County.objects.all().gml`
 - `Neighborhood.objects.all().gml()[0].gml`
 - `<gml:MultiPolygon
srsName="EPSG:3084">...</
gml:MultiPolygon>`

GeoQuerySet Methods

- kml
 - `Neighborhood.objects.all().kml()[0].kml`
 - `<MultiGeometry><Polygon><outerBoundaryIs>...</MultiGeometry>`

GeoQuerySet Methods

- **distance**
 - `p=Neighborhood.objects.all()[2].mpoly.centroid`
 - `Neighborhood.objects.all().distance(p)[0].distance`



Admin

"Old" Admin

How you currently create an admin interface in trunk:

```
from django.contrib.gis.db import models

class Location(models.Model):
    name = models.CharField(max_length=30)
    point = models.PointField()

class Admin:
    list_display = ['name']
    search_fields = ['name']
```

"Old" Admin

Old style admin URLs:

```
urlpatterns = patterns('',  
    (r'^admin/', include('django.contrib.admin.urls')),  
)
```

"Old" Admin

Change location

History

Name:

FooDawg

Point:

```
POINT (5.0000000000000000  
23.0000000000000000)
```

 Delete

Save and add another

Save and continue editing

Save

newforms-admin

- The newforms-admin branch decouples Admin settings from your models.
- More flexibility and customization
- Other goal is to convert the Admin to use Django's "newforms."

gis-newforms

- Django has branch policy prohibiting merges between SVN branches.
- I couldn't wait for new functionality -- so I created mercurial merge between two branches.

gis-newforms

How to create new admin interface:

```
from django.contrib.gis import admin
from django.contrib.gis.db import models

class Location(models.Model):
    name = models.CharField(max_length=30)
    point = models.PointField()

class LocationAdmin(admin.GeoModelAdmin):
    list_display = ['name']
    search_fields = ['name']
```

gis-newforms

How to create new admin interface (in `urls.py`):

```
from django.contrib.gis import admin
from geoapp.models import Location
from geoapp.admin import LocationAdmin

admin.site.register(Location, LocationAdmin)

urlpatterns = patterns('',
    (r'^admin/(.*)', admin.site.root),
)
```

gis-newforms

Included in your VM as the default distribution.

May change to GIS SVN trunk via:

```
$ sudo chdjango.py gis
```

To change back:

```
$ sudo chdjango.py gis-newforms
```



Mapping

Mapping

- We will leave the presentation to explore a mini app (included on your VM) that shows TABC (Texas Alcoholic Beverage Commission) license permits in a particular Houston neighborhood
- Neighborhood data provided by Zillow ®.



Conclusion