
Google
Developer
Day2009

Building Scalable Geo Applications

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Google Developer Day 2009

Difficulties in Serving Data

- Client
  - Google takes care of it
- Users
  - The more you have, the harder it is to serve
  - More Users == More Machines
- Machines
  - More Machines ==
    - Load Balancing
    - Maintenance
    - Time
    - Sharding
    - Energy
    - Money

Difficulties in Serving Data

- Multiple format output
- Specialized spatial queries
- Highly Customizable
- Relies on open geo standards

What Google Offers

Building in our cloud

	Multiple output formats	Specialized spatial queries	Customiz -able	Serve large number of requests	Relies on open geo standards
App Engine	✓		✓	✓	
Maps Data API	✓	Soon	Some	✓	✓
Google Base	✓	✓	Some	✓	✓

Google Base API

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Google Base

A giant XML store

- Backend for a lot of Google Services
- Easily discoverable
- Bounding box and radius searches
- Google Data API (built on AtomPub)
- Can be accessed as just a feed of XML
- Multiple client libraries
- Standard and customizable attributes
- XML or JSON output
- Upload time can be long

Putting an Item into Base

```
POST /base/feeds/items
Content-Type: application/atom+xml
Authorization: AuthSub token=...
X-Google-Key: key=...

<?xml version='1.0'?>
<entry xmlns='http://www.w3.org/2005/Atom'
xmlns:g='http://base.google.com/ns/1.0'>
<title type="text">MyDate</title>
<g:item_type type="text">Personals</g:item_type>
<g:location>San Francisco, CA</g:location>
<g:gender>male</g:gender>
<g:marital_status>single</g:marital_status>
…
</entry>
```

Spatial Query

http://www.google.com/base/feeds/snippets?bq=[item%20type:personals][location(location):@+34-086..@+37-092+%205mi]&content=geocodes

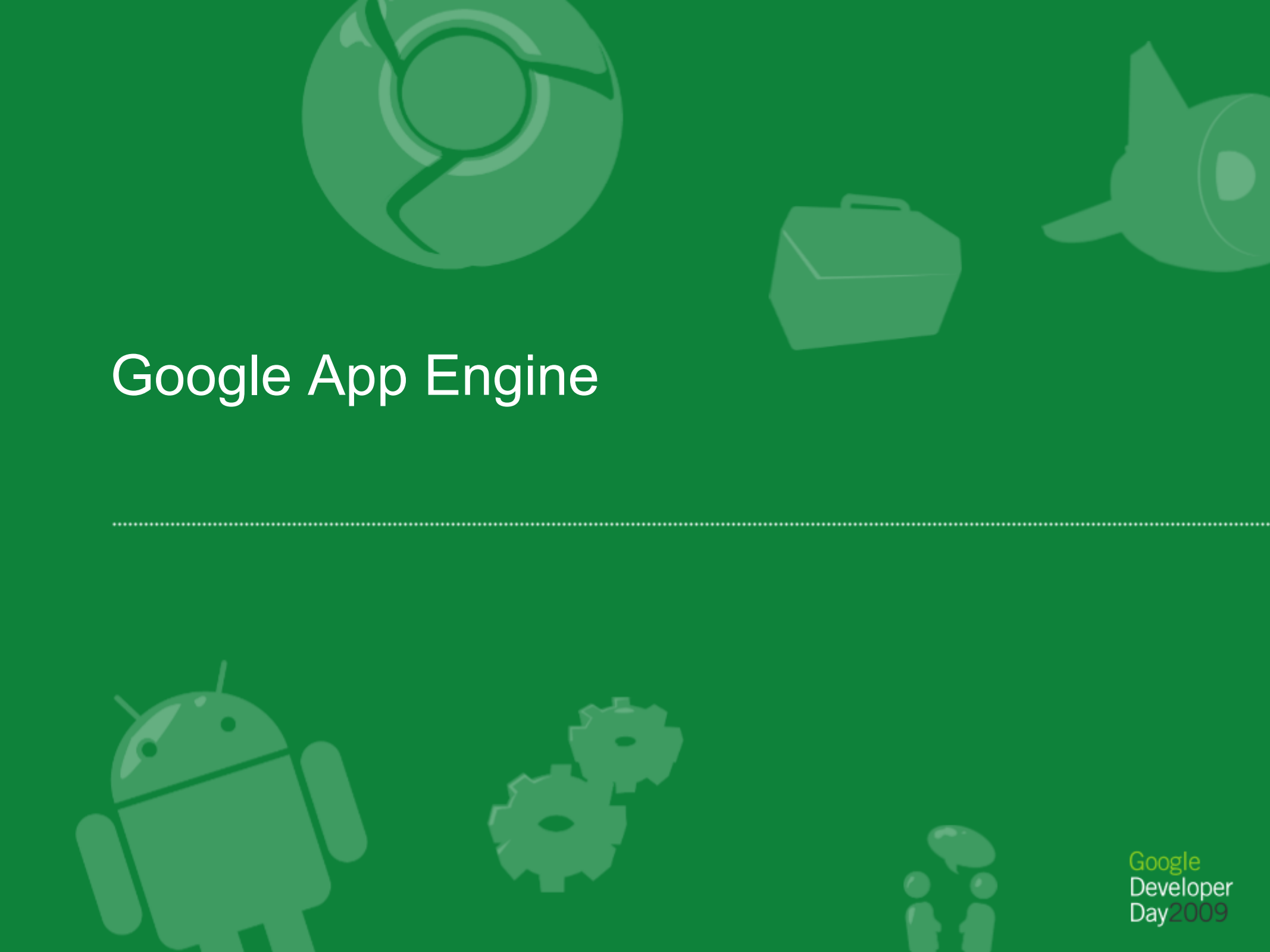
http://www.google.com/base/feeds/snippets

bq=[item 20type:personals]

[location(location):@+34-086..@+37-092+ 5mi]&content=geocodes

Demo

Valentine's Day: Find love with Google Earth and Base



Google App Engine

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Google App Engine

- High performance
- High availability
- Easy Development
- Python or Java environments
- Free to get started
- Built on Google Infrastructure: Work how we work

Advantages

- Built for scaling
  - Build it once and we handle the rest
  - No need (or transparency) for machine management
  - No need for your own servers
- Replicated in data centers around the world
- Use standard Python or Java libraries
- Easy authentication built in
- Highly customizable

Disadvantages for a Spatial Apps

- Very limited spatial support in queries
- Inequality limitations on one property only
  - So no obvious bounding box
- Different (but cooler) way of building applications

Simple Model

```
from google.appengine.ext import db

class myLocation:

  name = db.StringProperty()
  location = db.GeoPtProperty()
```

Simple Query

```
from google.appengine.ext import db
import mylocation

myLocations = MyLocation.gql("WHERE name= :1", 'foo')
```

Geohashing

- Open Source
- Simple radius search
- Uses only one inequality query

Geo Model

- Divide world into 4X4 grid (like a quad-tree but 16)
  - Divide each cell into a 4X4 grid
  - Keep going until you reach maximum number of layers
- Assign your entity to a cell at each zoom level
- Compute cells for each bounding box query
- Find all entities in each cell
- Order them
- Display them

Geo Model Advantages

- Doesn’t use inequality query
- Customizable different zoom levels, resolution, grids

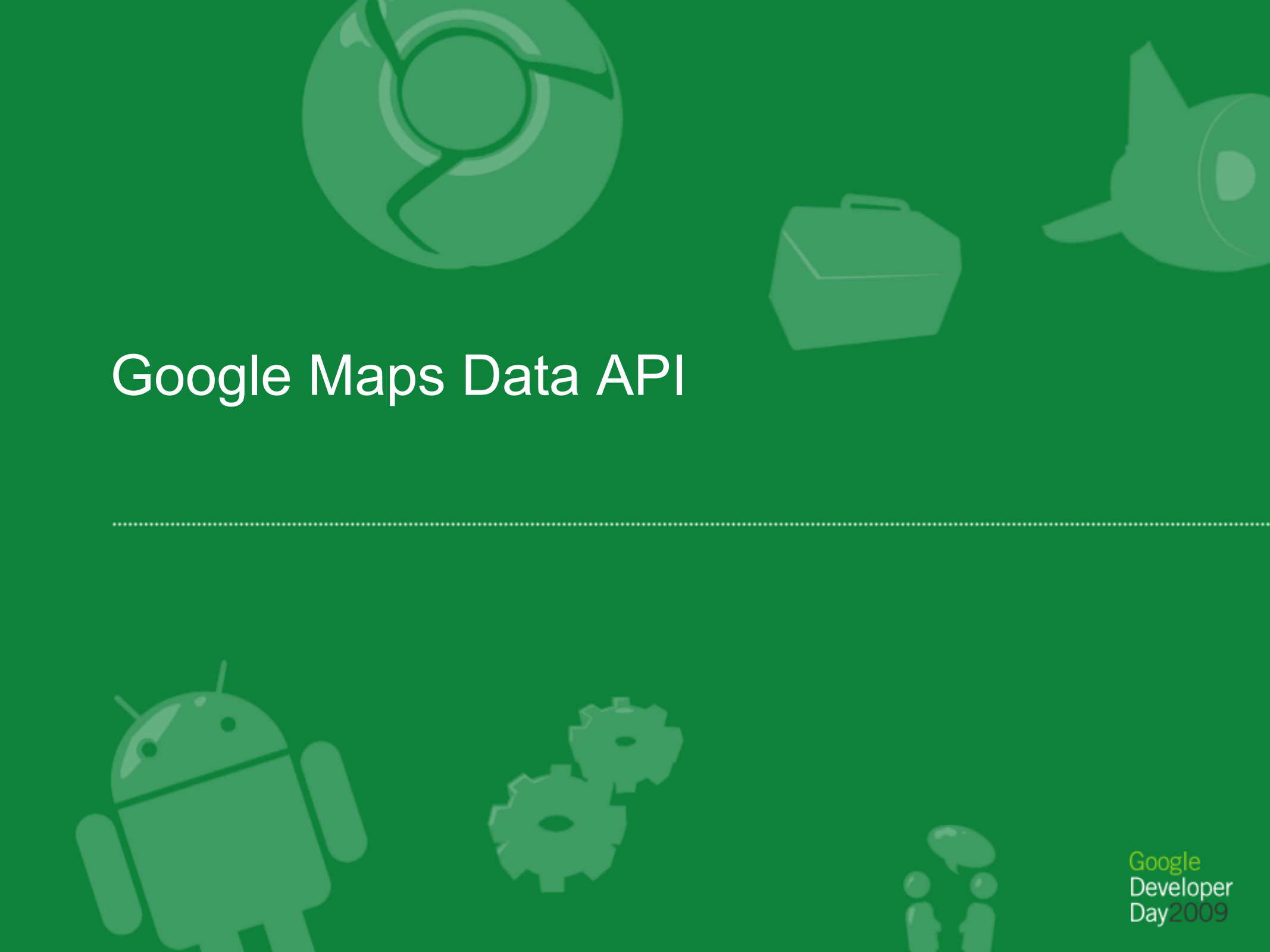
Geo Model Disadvantages

- Complex
- Doesn’t scale well to other geometry types

Geo Model Calculating Cell

```
while len(cell) < resolution:
  subcell_lon_span = (east - west) / GEOCELL_GRID_SIZE
  subcell_lat_span = (north - south) / GEOCELL_GRID_SIZE
  x = min(int(GEOCELL_GRID_SIZE * (point.lon - west) /
    (east - west)), GEOCELL_GRID_SIZE - 1)
  y = min(int(GEOCELL_GRID_SIZE * (point.lat - south) /
    (north - south)), GEOCELL_GRID_SIZE - 1)
  cell += _subdiv_char((x,y)) # Adds x/y pos of a cell
  south += subcell_lat_span * y
  north = south + subcell_lat_span
  west += subcell_lon_span * x
  east = west + subcell_lon_span
return cell
```

Demo



Google Maps Data API

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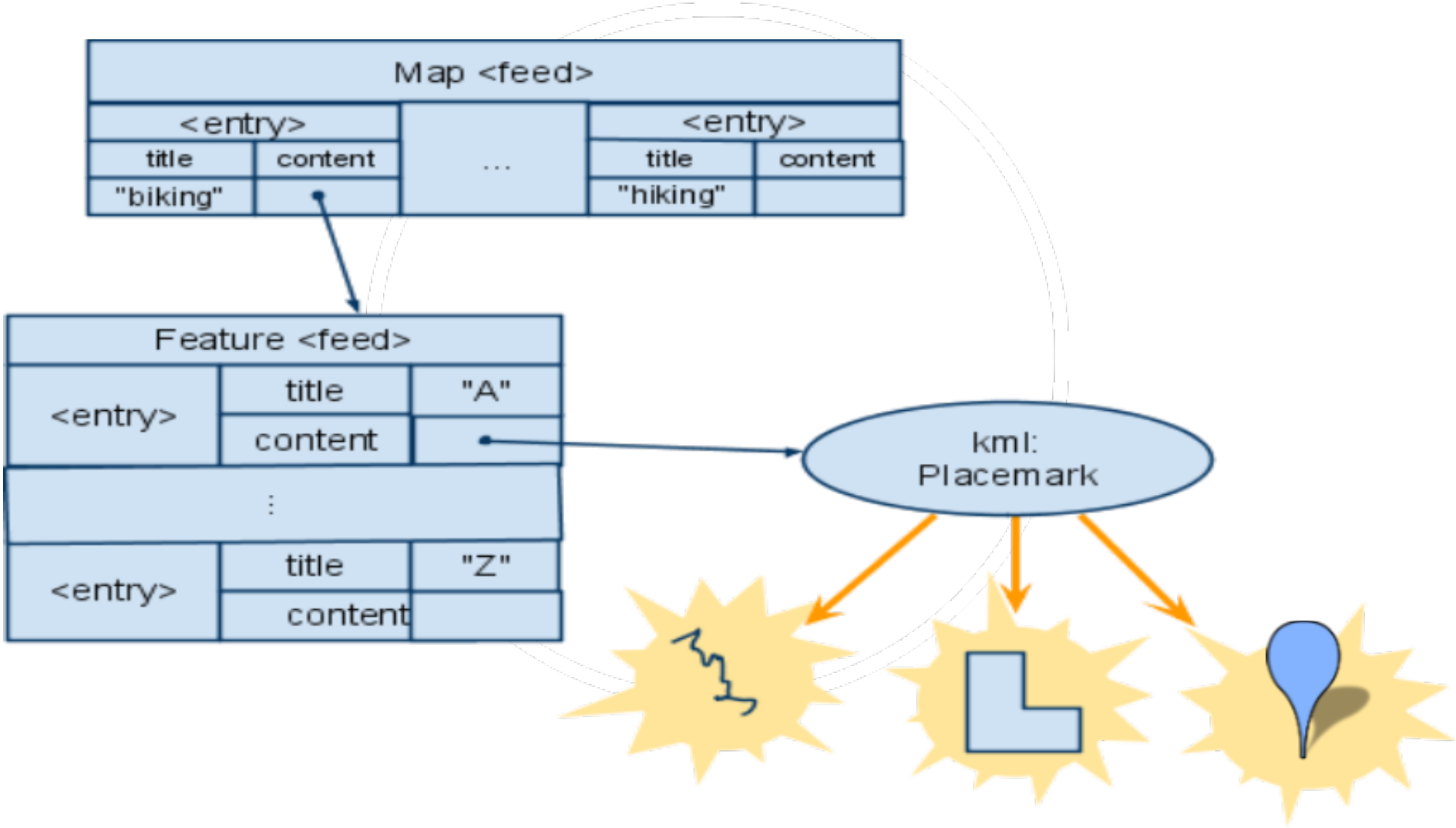
Google Maps Data API

- Google Data API = AtomPub
  - XML/HTTP protocol for reading and writing to data feeds.
  - http://code.google.com/apis/gdata/
- Google Maps Data API offers
  - Storage of geospatial data
  - Point, polyline and polygon geometry, with more to come
  - Create and edit My Maps
  - Content optionally indexed and searchable in Google Maps
  - Unlimited user-defined attributes
  - Batch operations
  - Incremental upload and download of changes
  - Client libraries in a variety of languages

Google Maps Data API



Google Maps Data API

- Requests require authentication token in HTTP headers
  - AuthSub, OAuth
  - ClientLogin: service name is "local"

- My maps:
  - http://maps.google.com/maps/feeds/maps/default/full

Maps feed

- http://maps.google.com/maps/feeds/maps/default/full
  - GET: list my maps
  - POST: add a new map
  - PUT: edit the metadata of a map
  - DELETE: remove a map

- Set title and summary
- Set public/unlisted (draft) stAccess the feed of features in the map

Features feed

- http://maps.google.com/maps/feeds/features/...
  - GET: list the contents of the map
  - POST: add a new feature to the map
  - PUT: edit a feature
  - DELETE: remove a feature from a map

- Set the title
- Point, line or polygon geometry
- Embedded <Style> to control appearance
- HTML description
- Associate custom properties with the feature

Adding a feature to a map

HTTP POST an entry to the edit link of the feature feed

```
<atom:entry xmlns:atom='http://www.w3.org/2005/Atom'
            xmlns:gact="http://schemas.google.com/maps/2008"
xmlns='http://www.opengis.net/kml/2.2'>
  <atom:title>Random place of the day</atom:title>
  <atom:content type='application/vnd.google-earth.kml+xml'>
    <Placemark>
      <atom:author>
        <atom:name>John Q. Random</atom:name>
      </atom:author>
      <description> Some place </description>
      <Style> ... </Style>
      <Point>
        <coordinates>
          -90.869489,48.254501,0.0
        </coordinates>
      </Point>
    </Placemark>
  </atom:content>
</atom:entry>
```

Controlling which content is indexed

Not all your content need be indexed

```
<entry>
 <category term="http://schemas.google.
com/maps/2008#map"
           scheme="http://schemas.google.
com/g/2005#kind"/>
 <app:control xmlns:app="http://www.w3.org/2007/app">
  <app:draft>yes</app:draft>
 </app:control>
 <title>MyMapsPoly</title>
 ...
</entry>
```

You decide

Controlling attribution

By default

- Content is attributed to the account it was created under
- Links from search results display the content in Google Maps

If you want different behavior, use KML attribution

- atom:author to specify the true author
- atom:link to link back to your site

Client Libraries

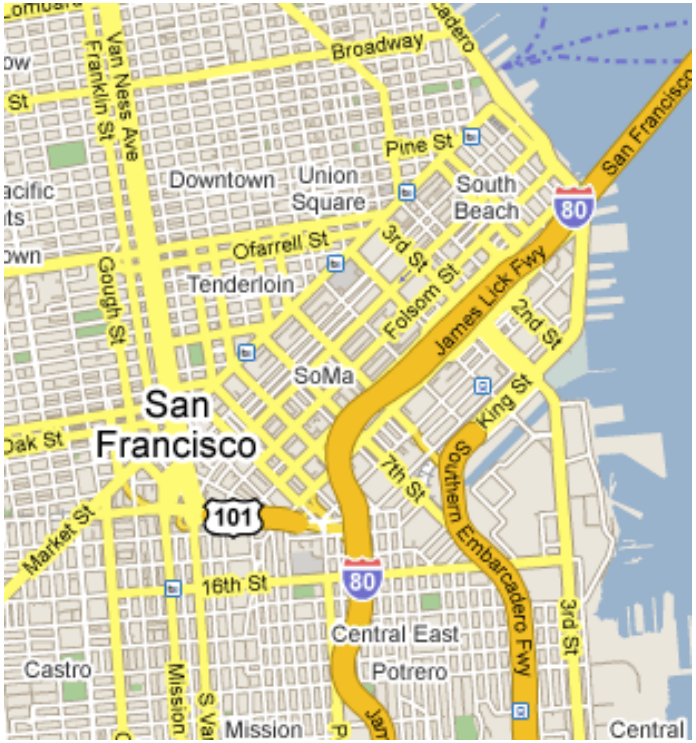
- No need to talk HTTP directly
- Client libraries in Java, Javascript, Objective-C
- Web ready PHP library from We-Create
  http://wecreate.com/ces/webready
- Use libkml for KML processing
  http://code.google.com/p/libkml/

Java example

```
URL queryUrl =
    new URL("http://maps.google.com/maps/feeds/features/"
            + MAPID + "/full");

GoogleService myService = new MapsService("exCo-exApp-1");
myService.setUserCredentials(USERNAME, PASSWORD);

FeatureFeed feed = myService.getFeed(queryUrl, FeatureFeed.
class);

for (FeatureEntry entry : feed.getEntries()) {
   entry.addCustomProperty(
     new CustomProperty("annotation", null, null,
                        entry.getTitle()));
   myService.update(new URL(entry.getEditLink().getHref()),
entry);
}
```

Road Map

- There's more to come
  - Search via the API
    - by keyword
    - by attribute
    - by location
  - Richer content
  - Better Maps API integration
  - More structure
  - New feeds

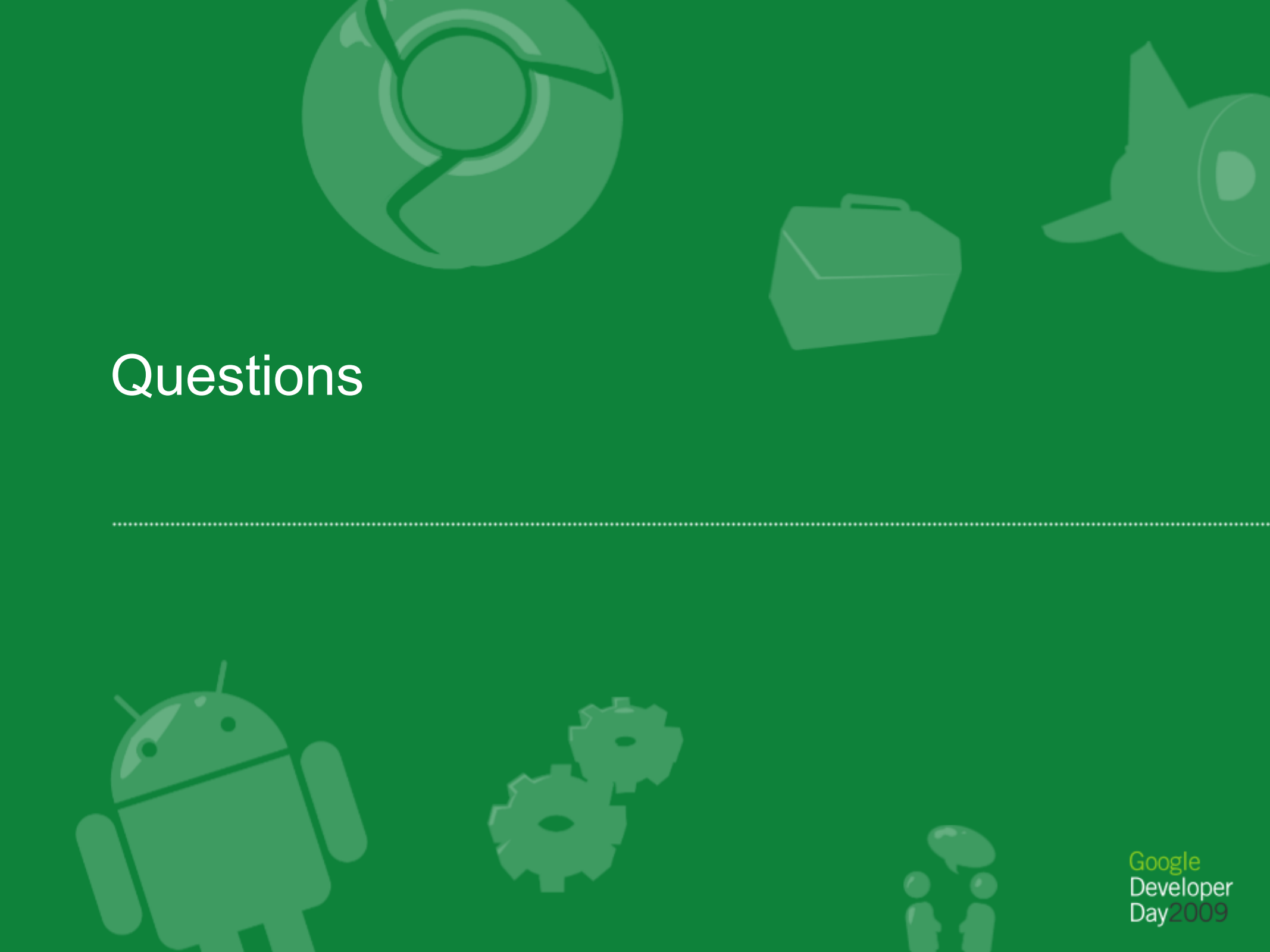


Demos

- ConnectorLocal
- MyEarth

Get More Information

- Maps Data API
  http://code.google.com/apis/maps/documentation/mapsdata/
- Developer Forum
  http://groups.google.com/group/google-maps-data-api


Questions
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