Google Earth and Google Maps

Sebastian Rahtz

Basics
Google Earth and Google Maps
How to make use of Earth and Maps
KML, the language for Google Earth and Google Maps
Programming Google Maps
The OXPOINTS project
Conclusions
Google Earth and Google Maps

Basics

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Conclusions

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Outline

1. Basics
2. Google Earth and Google Maps
3. How to make use of Earth and Maps
4. KML, the language for Google Earth and Google Maps
5. Programming Google Maps
6. The OXPOINTS project
7. Conclusions
Mapping things using geographic metadata (latitude & longitude) is becoming ubiquitous:

- tagging photos in Flickr with their coordinates
- showing addresses in car Satnav systems
- making maps of archaeological remains
- online displays of flood plains, pubs, wifi zones...

(and not just maps but aerial and satellite views)
My holidays in Gran Canaria
Satnaving around
Far too much data
The frightening detail
How do you find these geographical goodies?

- Microsoft Live Search Maps
- Multimap
- Yahoo Maps
- Open data (eg OpenStreetMap project)
- Google Maps and Google Earth
- . . . and don’t forget your GPS receiver to work out where you are
Google Earth displays aerial/satellite views of earth. You can:

- search for a place by name, postcode etc, and jump there
- get directions from one place to another
- show or hide layers of overlaid data
- add your own annotations to the map
- view 3D terrain and buildings of (some) places

Earth is a free download for most platforms from http://earth.google.com. There is a Pro version for money.
Google Earth navigation
Demo

(search for London Eye)
(search for Uluru)
(turn Terrain and 3D Buildings on and off)
(search for Oxford)
Google Maps overview

Google Maps displays world-wide maps with optional satellite imagery overlay. You can:

- search for a place by name, postcode etc, and jump there
- get directions from one place to another
- find businesses or facilities in your area
- create and save personalized maps

Web-based free service at http://maps.google.co.uk.
Demo

(search for OX2 6NN)
(parking near Oxford)
(directions to Buckingham Palace)
(Satellite and hybrid views)
How to make use of Earth and Maps

In increasing order of difficulty:

- Just look at things
- Take advantage of 3rd-party mashups
- Create your own maps in Maps
- Create your own layers in Earth
- Embed Maps in your own web page
- Generate your own KML for Earth or Maps
- Draw maps in your web page using Maps API
Existing content

Look at

- Panoramio (user-contributed photos; visit Rome, Isola Tiberina)
- Wikipedia (links to Wikipedia)
- Places of interest
- Tours (eg Nelson’s Column)
mashups

Far too many to mention, but let’s look at:

- **GMaps Pedometer:**
  http://www.gmap-pedometer.com/
  
- **AntWeb (load)**
  http://www.antweb.org/AntWebImages.kmz

- **Oxford bus timetables**

- **3D buildings (White House)**

- **Maps Mashup catalogue:**
  http://googlemapsmania.blogspot.com/

- **Earth blog:** http://gearthblog.com/index.html
Adding objects in Google Earth

You can:

- place a marker
- draw a polygon (coloured and opaque, as needed)
- draw a path
- add an image overlay
- put in a description

and save the result.
Creating a map in Google Maps

You need a Google account to take advantage of this:

- Click My Maps
- Click Create new map.
- Add a title and description for your map.
- Decide whether the map should be public or unlisted. Public maps are automatically included in Google Maps search.
- Use the icons in the top left corner of the map. These include:
  - Selection tool. Use this to drag the map and select placemarks, lines and shapes.
  - Placemark tool. Use this to add placemarks.
  - Line tool. Use this to draw lines.
  - Shape tool. Use this to draw shapes.

You can return to your map at any time. Just go to Google Maps and click My Maps. Sign in to your Google Account and select the map from your list of maps.
Embed a Google Map in your web page

- go to Google Maps and find what you want
- select *Link to this page*

- paste generated HTML into your web page code
KML, the language for Google Earth and Google Maps

- KML is an XML vocabulary
- KML can also be gzip compressed and delivered with a .kmz extension
- You can load a KML file in Maps by putting the URL in the search box
- You can open KML files from within Earth
- Earth saves ‘My places’ in KML format
What you must provide in KML

- A root `<kml>` element
- A `<Document>` element, with an optional `<name>`
- At least one `<Placemark>` element, with
  - an `@id` attribute uniquely identifying it
  - a `<name>`
  - an optional `<description>` in which you can put (escaped) HTML code
  - at least a `<Point>`, with `<coordinates>`

You must have some way of getting the latitude and longitude to put in `<coordinates>`
How to get latitude and longitude

- create map in Maps or Earth and examine what it produces
- go out and measure them with a GPS
- find them in Wikipedia
- measure them from an atlas
Minimal Example

```xml
<kml:kml>
  <kml:Document>
    <kml:name>My first KML</kml:name>
    <kml:Placemark id="XXX">
      <kml:name>A name</kml:name>
      <kml:description>An interesting place</kml:description>
      <kml:Point>
        <kml:coordinates>-1.253042221069336, 51.75278555467572</kml:coordinates>
      </kml:Point>
    </kml:Placemark>
  </kml:Document>
</kml:kml>
```
Example with hierarchy of places

```
<kml:kml>
  <kml:Document>
    <kml:name>Oxford University</kml:name>
    <kml:Folder>
      <kml:name>All Souls College</kml:name>
      <kml:Placemark id="alls_1">
        <kml:name>All Souls College: Lodge</kml:name>
        <kml:description><![CDATA[<p><a href="http://www.all-souls.ox.ac.uk">http://www.all-souls.ox.ac.uk</a></p>]]></kml:description>
        <kml:Point>
          <kml:coordinates>-1.253042221069336,51.75278555467572</kml:coordinates>
        </kml:Point>
      </kml:Placemark>
    </kml:Folder>
  </kml:Document>
</kml:kml>
```
Other things you can do in KML

- set different markers
- draw lines and polyons
- set the viewpoint
- add overlays
All Souls again, with special marker

<kml:kml>
  <kml:Document>
    <kml:name>Oxford University</kml:name>
    <kml:Folder>
      <kml:name>All Souls College</kml:name>
      <kml:Placemark id="alls_1">
        <kml:name>All Souls College: Lodge</kml:name>
        <kml:description>A nice old pile</kml:description>
        <kml:styleUrl>#college_n_stylemap</kml:styleUrl>
        <kml:Point>
          <kml:coordinates>-1.253042221069336, 51.75278555467572</kml:coordinates>
        </kml:Point>
      </kml:Placemark>
    </kml:Folder>
  </kml:Document>
</kml:kml>
Defining KML stylemaps

```xml
<Style id="college_n_highlightState">
  <IconStyle>
    <scale>1.1</scale>
    <Icon>
      <href>http://www.oucs.ox.ac.uk/oxpoints/arrow_n.png</href>
    </Icon>
  </IconStyle>
  <LabelStyle>
    <scale>1.1</scale>
  </LabelStyle>
</Style>

<StyleMap id="college_n_stylemap">
  <Pair>
    <key>normal</key>
    <styleUrl>#college_normalState</styleUrl>
  </Pair>
  <Pair>
    <key>highlight</key>
    <styleUrl>#college_n_highlightState</styleUrl>
  </Pair>
</StyleMap>
```
Example of line

```
<kml:kml>
  <kml:Document>
    <kml:Placemark>
      <kml:name>A nice road</kml:name>
      <kml:visibility>1</kml:visibility>
      <kml:styleUrl>#lineStyle</kml:styleUrl>
    </kml:Placemark>
    <kml:MultiGeometry>
      <kml:LineString>
        <kml:coordinates>-1.266010,51.776118,77.200000
          -1.266010,51.776097,73.500000
          -1.265967,51.776103,72.600000
          -1.266090,51.776507,70.500000
          -1.266295,51.776890,70.300000
          -1.266352,51.776103,72.600000
          -1.266548,51.777260,68.100000
          -1.266865,51.777762,65.200000
          -1.266962,51.778107,62.200000
          -1.267097,51.778210,62.300000
          </kml:coordinates>
      </kml:LineString>
    </kml:MultiGeometry>
  </kml:Placemark>
</kml:Document>
</kml:kml>
```
Example of embedded HTML

```
<kml:kml>
  <kml:Document>
    <kml:name>Oxford University</kml:name>
    <kml:Folder>
      <kml:name>All Souls College</kml:name>
      <kml:Placemark id="alls_1">
        <kml:name>All Souls College: Lodge</kml:name>
        <kml:description><img width="200" height="150" src="http://www.oucs.ox.ac.uk/oxpoints/images/colleges/alls.jpg"></kml:description>
        <kml:Point>
          <kml:coordinates>-1.253042221069336,51.75278555467572</kml:coordinates>
        </kml:Point>
      </kml:Placemark>
    </kml:Folder>
  </kml:Document>
</kml:kml>
```
How to create KML

- Create objects in Google Earth or Maps and save result
- Write it from scratch
- Generate by transforming some other data source. eg
  http://maps.google.co.uk/?q=http://www.oucs.ox.ac.uk/oxcri/conted/archaeology.kml: Map of Continuing Education courses
KML in Google Maps

http://maps.google.com/?q=http://www.oucs.ox.ac.uk/cgi-bin/oxpoints.cgi?type=college
KML in Google Earth

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Limitations of KML

- Google Maps doesn’t support all of KML
- Google Earth does, but isn’t the web
- You cannot link with the rest of a web page

So what’s the alternative?
You can embed a Google Map in a web page and manipulate it as you like, using JavaScript:

- get an API key from Google
- load the Maps code, using your API

```html
<script type="text/javascript"
src="http://maps.google.com/maps?file=api&v=2&key=ABQIAAAAXWaYpACABYqQEjTJ7Xh76RQRDGKfPCBPJx7V3XOgbmepBWFGzRQ2l9HRmkLXUwGWT5ZZS4ZWjBM9hQ"
</script>

define the function `initialize`, giving centre point and zoom

```html
<script type="text/javascript">
function initialize()
{
if (GBrowserIsCompatible()) {
var map = new GMap2(document.getElementById("map_canvas"));
map.setCenter(new GLatLng(51.7592607,-1.2601876), 13);
}
}
</script>
When the page starts, initialize the map:

```html
<body onload="initialize()" onunload="GUnload()">...
```

Create a placeholder `<div>` for the map

```html
<div id="map_canvas" style="width: 500px; height: 300px"/>
```
Simple example with marker

```html
<html>
<head>
  <script type="text/javascript">
    function initialize() {
      if (GBrowserIsCompatible()) {
        var map = new GMap2(document.getElementById("map_canvas"));
        map.setCenter(new GLatLng(51.7592607,-1.2601876), 13);
        map.addOverlay(new GMarker(map.getCenter()));
      }
    }
  </script>
</head>
<body onload="initialize()" onunload="GUnload()">
  <div id="map_canvas" style="width: 500px; height: 300px"/>
</body>
</html>
```
Embedded maps
Embedded maps: live!

http://www.ox.ac.uk/colleges/map_of_the_colleges_and_halls/
Embedded maps: live! (2)

Oxford Around the Globe

We are connected to virtually every country in the world. Our community in Oxford is highly international: our students come from 139 countries and our academic staff from 80. Our academic research spans all regions of the globe, and tackles issues of major global significance, both within and across disciplines. Our international presence includes more than 44,000 alumni in 180 countries outside the U.K., the world's largest university press, and leading tropical medical research facilities.

The links on the left will take you to profiles of our engagement with parts of the world.

http://www.ox.ac.uk/international/oxford_around_the_globe/
Embedded maps: with sidebar
The OXPOINTS project

We have latitude and longitude for all the colleges, departments, units of the University that we know about. . .  this is a flexible concept. . .

- Buildings owned by the University?
- Buildings used for University business?
- Merton owns the Post Office building...
How did we gather our data?

We started with the OUCS unit data to provide the skeleton; then we added:

- a lot of points gathered by ITSS from each unit clicking on Google Maps and noting the coordinates
- another slew of missing ones we added ourselves
- a set of real-world data collected by walking around with a GPS

We picked up photographs of colleges through Wikipedia (choosing ones with appropriate licences).
Data storage

We’re using XML (according to the Text Encoding Initiative schema) to model *places* (colleges or units) which can contain other *places* (buildings). These have *locations* which include coordinates.

```xml
<place type="college" xml:id="mert">
  <label>Merton College</label>
  <location type="address">
    <address>
      <addrLine>Oxford</addrLine>
      <postCode>OX1 4JD</postCode>
    </address>
  </location>
  <location type="url">
    <desc>
      <ptr target="http://www.merton.ox.ac.uk/"/>
    </desc>
  </location>
</place>

<place type="building">
  <label>Lodge</label>
  <location when="2007-01-20T21:26:32.601Z">
    <geo>-1.252216100692749 51.75129113668488</geo>
    <note>recorded by Sebastian Rahtz</note>
  </location>
</place>
```

Not purely geographical — political too...
OxWorld: going wider

We also have data about where Oxford’s alumni around the world are based.

```xml
<place type="country" xml:id="MN">
  <placeName>Mongolia</placeName>
  <trait type="people">
    <p>1 student. <lb/>4 alumni.</p>
  </trait>
  <place subtype="primary" type="capitalcity">
    <placeName>Ulaanbaatar</placeName>
    <location>
      <geo>106.9118992307133 47.90379440483494</geo>
    </location>
  </place>
  <place type="bathycentric">
    <location>
      <geo>103.075260454048 46.8279818924065</geo>
    </location>
  </place>
</place>
```
Google Earth and Google Maps are an amazing resource

- they are free at the moment
- it is easy to create your own views
- you can add your own data

Go forth and create masterpieces of the mapping art...
Resources

- [http://maps.yahoo.com](http://maps.yahoo.com): Yahoo Maps
- [http://earth.google.com/](http://earth.google.com/): Google Earth home
- [http://www.oucs.ox.ac.uk/oxpoints/](http://www.oucs.ox.ac.uk/oxpoints/): OXPOINTS