Harokopio University of Athens
Department of Geography

ICIW 2008 The Third International Conference on
Internet and Web Applications and Services
June 8-13, 2008 - Athens, Greece

Web Services for Mapping

Tutorial

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Overview

- Tutorial Description
- Tutorial Schedule
- Tutorial Outline

This tutorial is also available at:

http://www.dbnet.ece.ntua.gr/~stefanak/WebServMap_Stefanakis.pdf

Tutorial Description

As geographic/map data sources **expand** and the demand to have access to them increases, the Web Mapping Services have been **grown** rapidly during the last years.

The Web services **specifications** for mapping come from the Open Geospatial Consortium (OGC) and have been implemented by commercial and open source map server software systems.

The **scope** of this tutorial is to present the web services for sharing and accessing geographic/map data on the Web.

Tutorial Schedule

Sunday, June 8th, 2008 ...

at 16:00 – 19:00...

- Part I: Theory
  - (duration ~ 1h 30 min)
- Part II: Practice
  - (duration ~ 1h 30 min)

Tutorial Outline

- Part I: Theory

1. Publishing Maps on the Web
2. XML-based languages for Geography and Mapping
3. Web Services for Mapping

- Part II: Practice

4. Mapping Servers/Services on the Web
5. Spatial Data Infrastructures (SDI)
6. The Heraklion SDI Web Services

Part I: Theory

1. **Publishing Maps on the Web**
   - **Static Maps**
   - **Interactive Maps**
     - **Extending the client**
     - **Extending the server**
2. XML-based languages for Geography and Mapping
3. Web Services for Mapping

Web Mapping

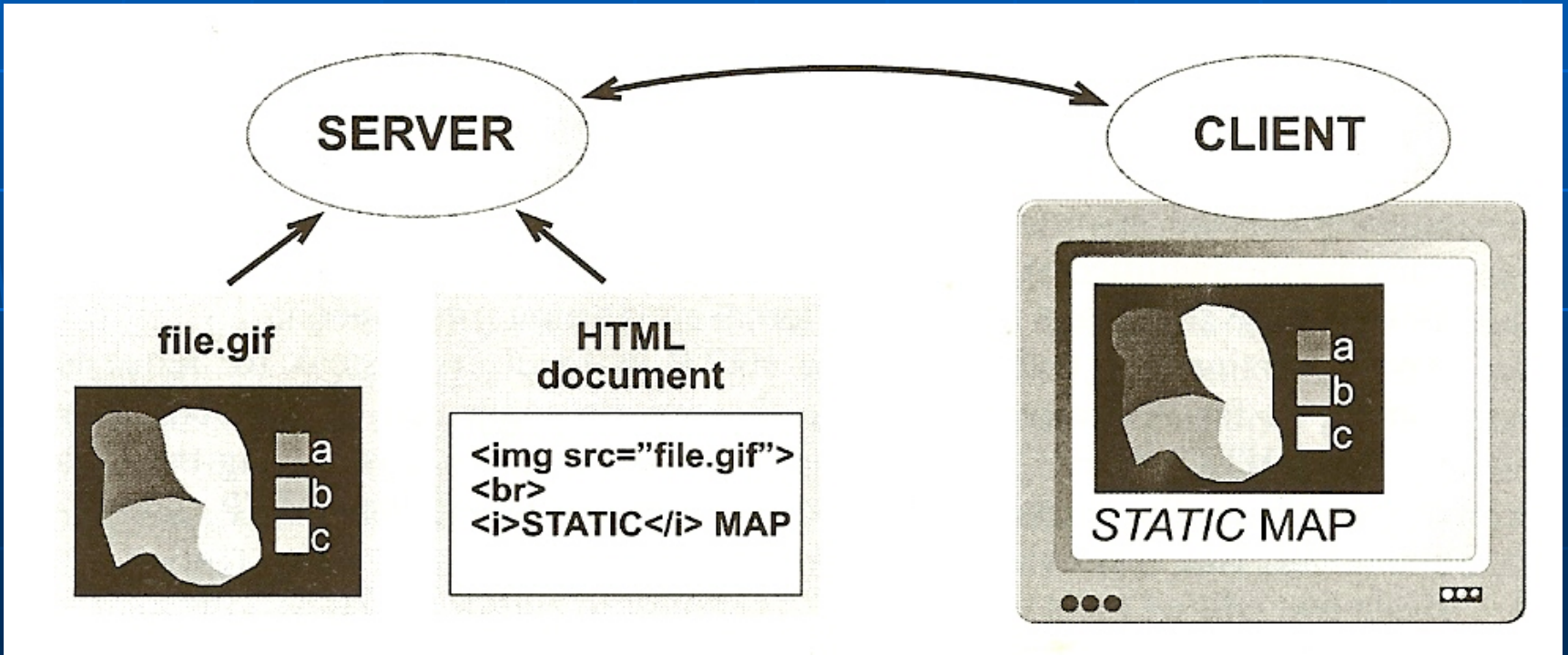
- Web …
  - A common means of publishing maps
- **Web maps** …
  - Million of people use web maps daily
  - Few of them know how they are actually generated

Web Mapping

- Publishing Maps on the Web ...
- Two approaches ...
  - **Static maps**
    - Apply the basic web resources
  - **Interactive maps**
    - Enriched functionality by extending
      - The **client side** functionality
      - The **server side** functionality

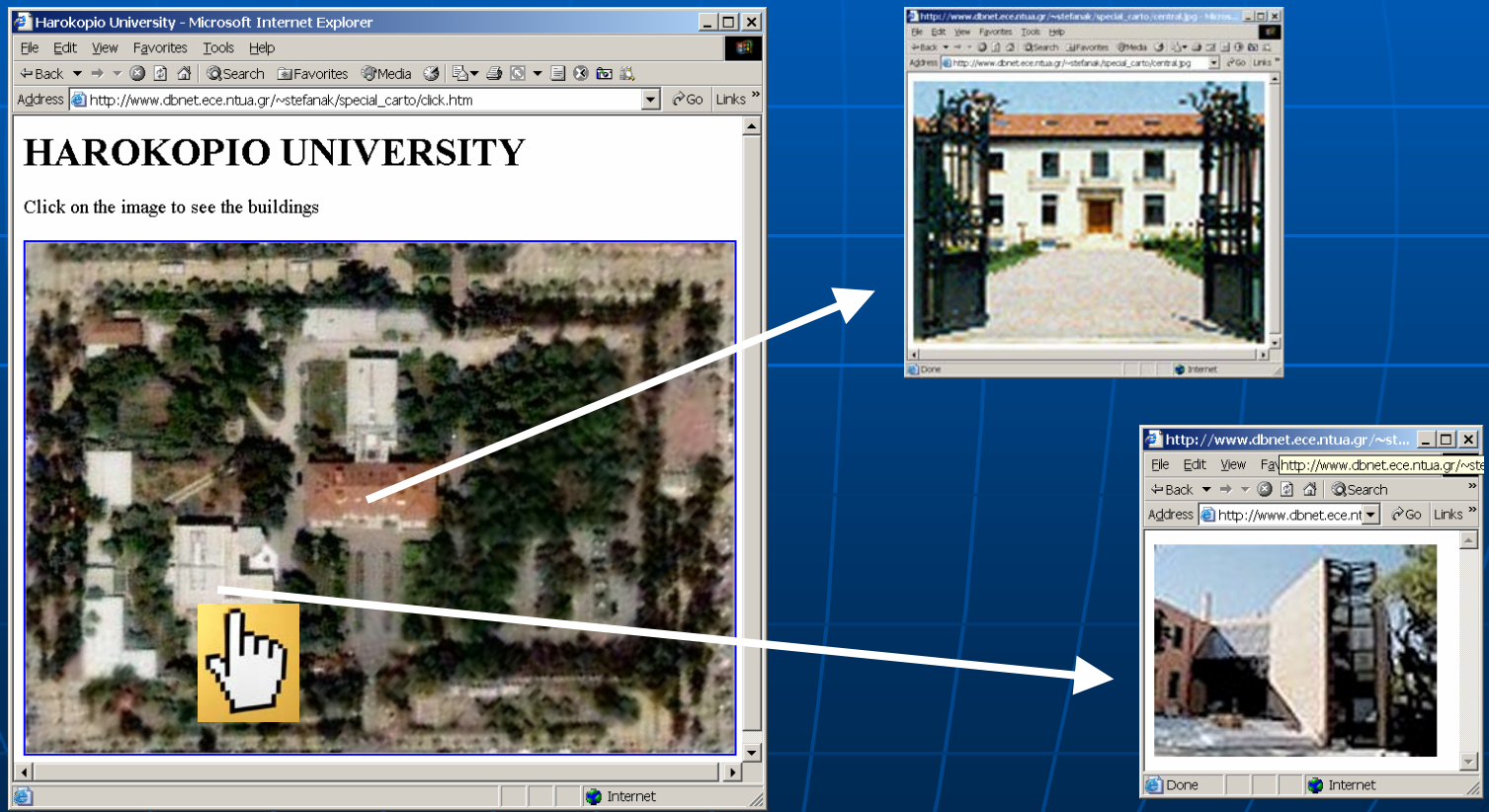
Static Maps

- Basic web publishing …
  - distribute scanned maps (as **images**)

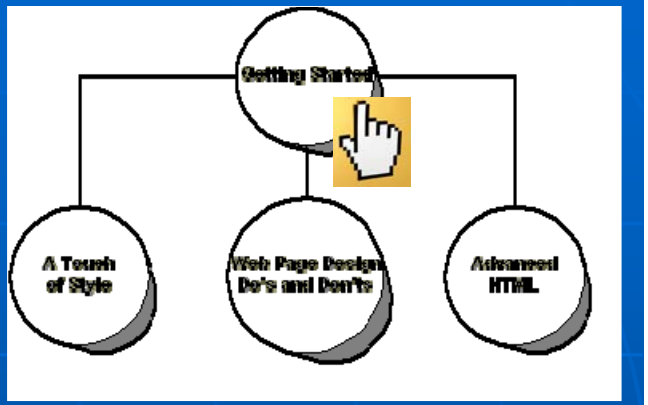


Static Maps

- Clickable maps …
  - Images may have “**sensitive areas**”…



Static Maps



- Clickable maps ...
  - HTML capabilities...
    - Insert an image:

```
<img src="pages.gif" width="384" height="245"
  alt="site map“>
```

    - Define clickable regions within an image:

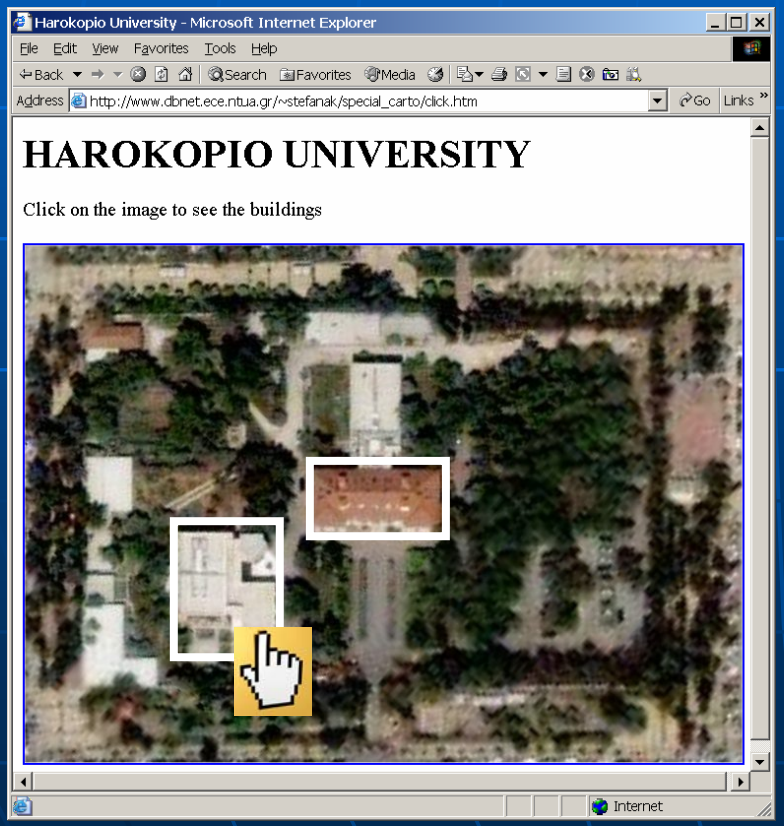
```
<img src="pages.gif" width="384" height="245"
  alt="site map" usemap="#sitemap">

<map name="sitemap">
   <area shape="circle" coords="186,44,45"
     href="Overview.html" alt="Getting Started">
   ...
</map>
```

Static Maps

- Clickable maps ...
  - Define clickable regions within an image
    - **Geometry types** supported in HTML...
      - Rectangle
        - rect: *left-x, top-y, right-x, bottom-y*
      - Circle
        - circle: *center-x, center-y, radius*
      - Polygon
        - poly: *x1,y1, x2,y2, ... xn,yn*

Static Maps

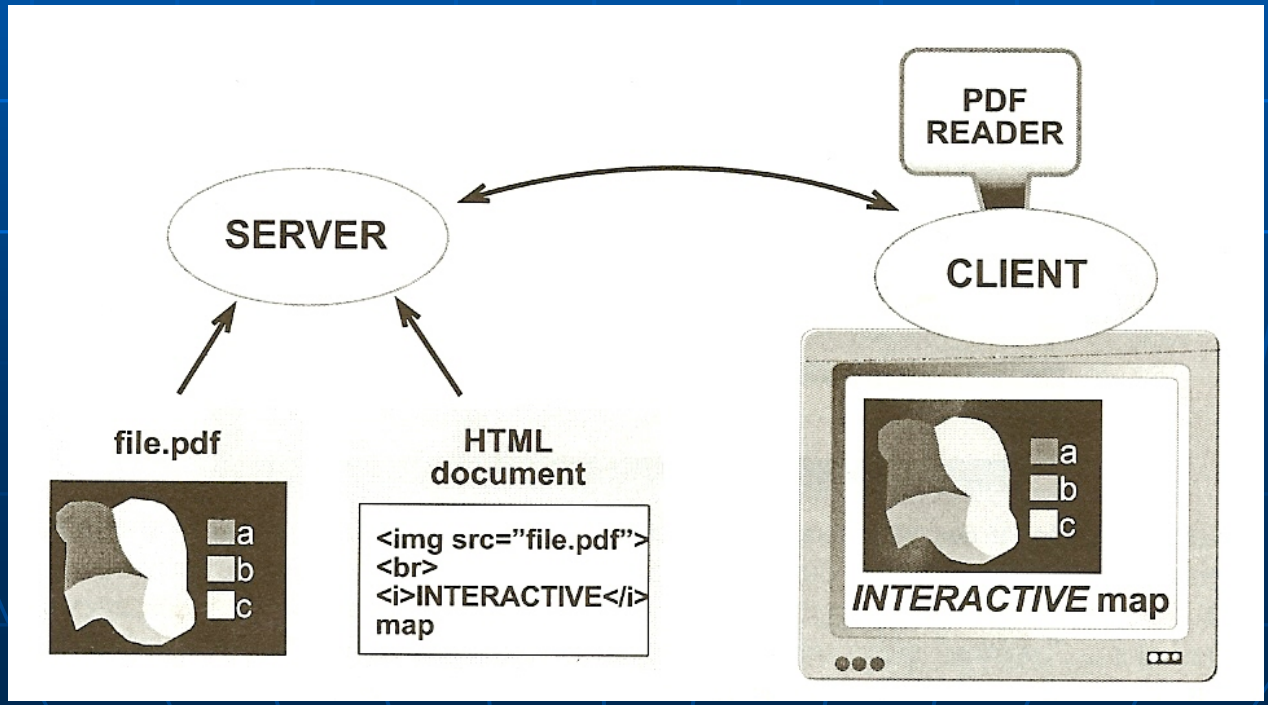
- Clickable maps ...




```
<html>
<title>Harokopio University</title>
<h1>HAROKOPIO UNIVERSITY</h1>
<p>Click on the image to see the buildings</p>
<p>

<img src="HUA.jpg" width="729"
  height="526" usemap="#HUAMap">

<map name="HUAMap">
<area href="central.jpg" shape="polygon"
coords="285,228,293,288,420,283,423,228">
<area href="geo.jpg" shape="rect"
coords="153, 292, 255, 403">
</map>

</p>
</html>
```

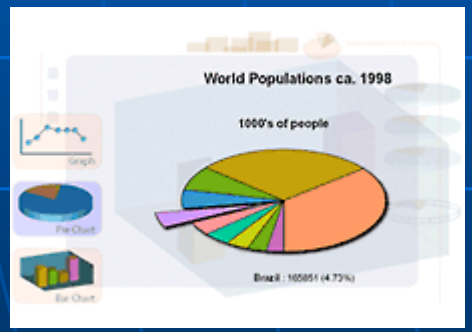
Interactive Maps

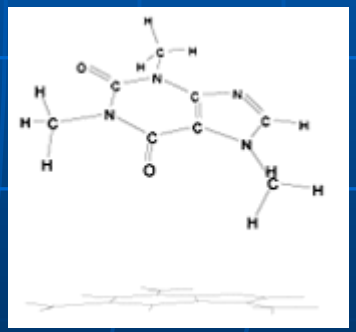
- Extending **client side** functionality
  - **Plugins**
    - Make the web browser capable to read and process additional formats



Interactive Maps

- Extending **client side** functionality
  - **Plugins – SVG Viewer**
    - **eg., http://www.adobe.com/svg/**





Interactive Maps

- Extending **client side** functionality
  - **Plugins – SVG Viewer**


Visual Building Search - Microsoft Internet Explorer
Adobe
SVG
Visual Building Search
find
Select Building
West Tower
East Tower
Select Floor
ELEVATOR NO. 1
SVG
ENABLED
West Tower
East Tower
13
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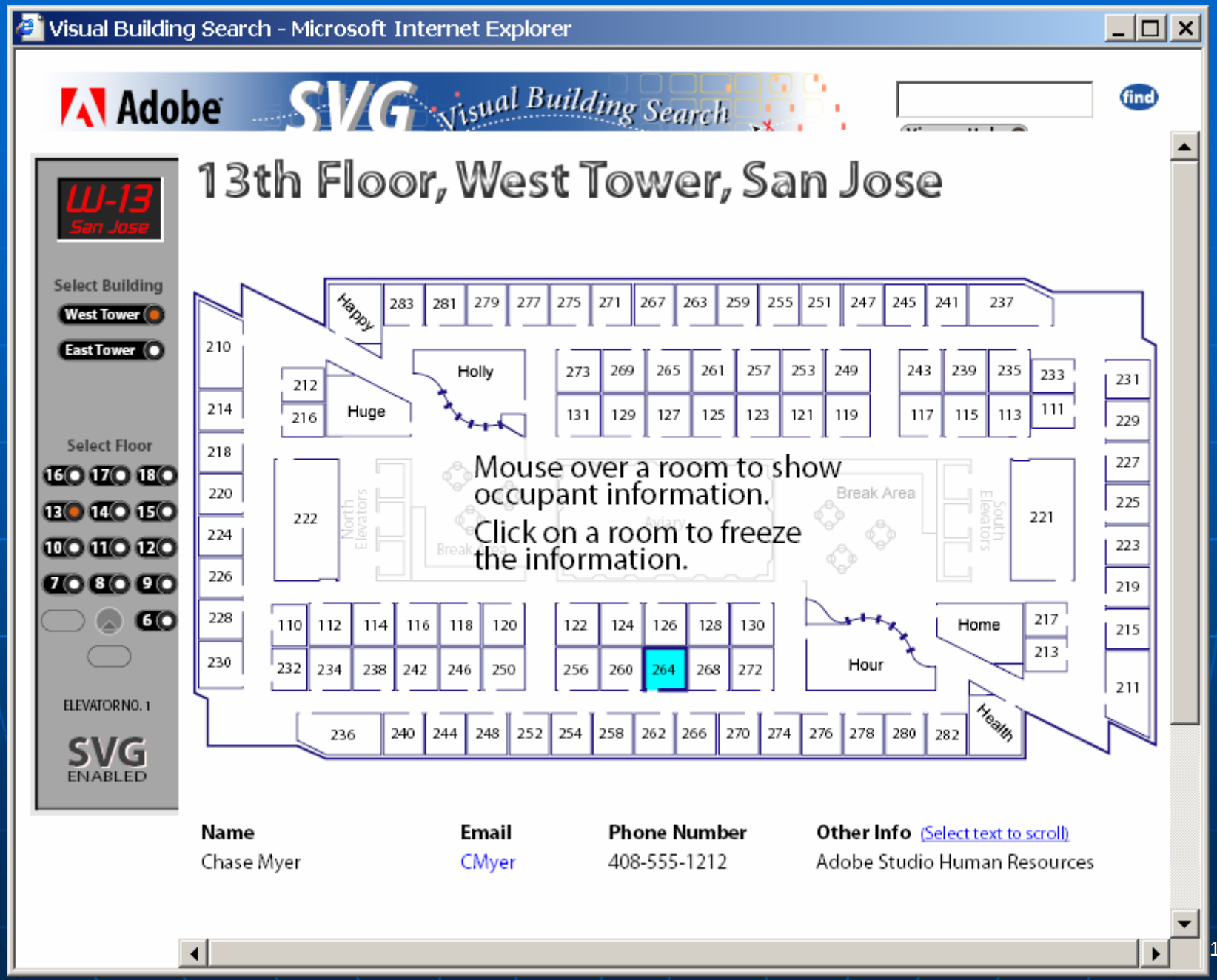
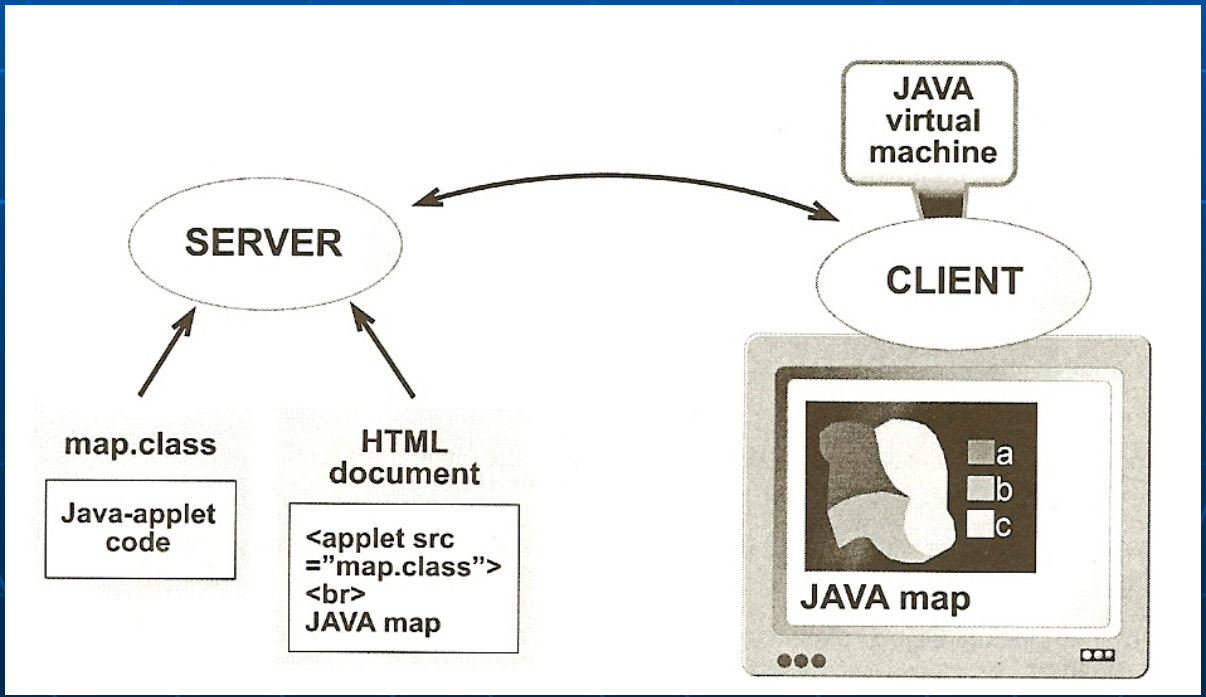

Visual Building Search - Microsoft Internet Explorer
Adobe SVG Visual Building Search
find
W-13 San Jose
Select Building
West Tower
East Tower
Select Floor
16 17 18
13 14 15
10 11 12
7 8 9
6
ELEVATOR NO. 1
SVG ENABLED
13th Floor, West Tower, San Jose
Happy
Holly
Huge
Home
Hour
Health
Break Area
Aviary
North Elevators
South Elevators
Mouse over a room to show occupant information.
Click on a room to freeze the information.
Name
Chase Myer
Email
CMyer
Phone Number
408-555-1212
Other Info (Select text to scroll)
Adobe Studio Human Resources

Interactive Maps

- Extending **client side** functionality
  - **Java + JavaScript**
    - The functionality varies …
      - from very simple button interactivity
      - to a sophisticated mapping environment



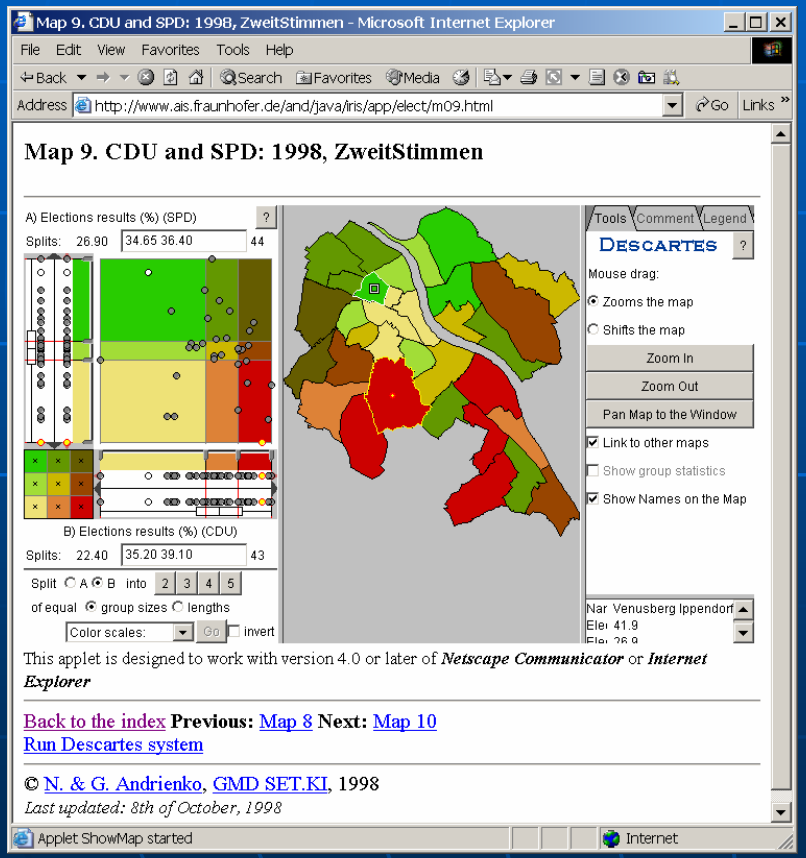
Example Applets:

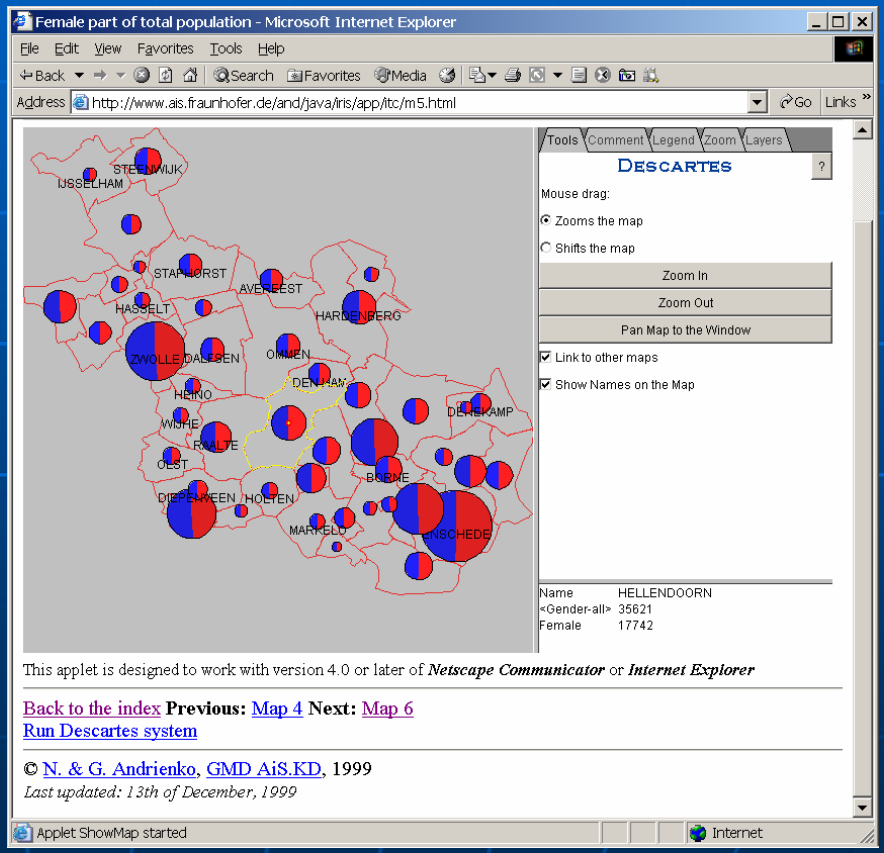
Election results in the city of Bonn

http://www.ais.fraunhofer.de/and/java/iris/app/elect/indexm.html

Overijssel (NL) demographic information

http://www.ais.fraunhofer.de/and/java/iris/app/elect/indexm.html

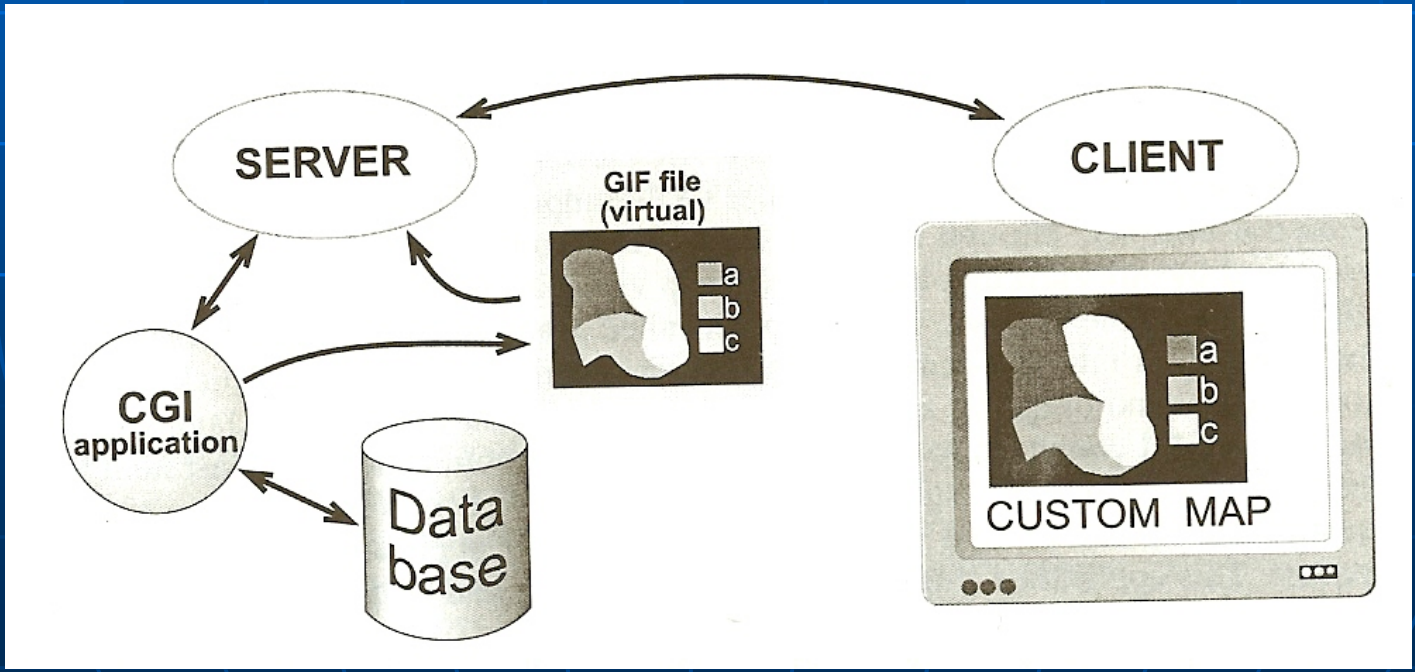




Interactive Maps

- Extending **server side** functionality
  - **Common Gateway Interface (CGI)**

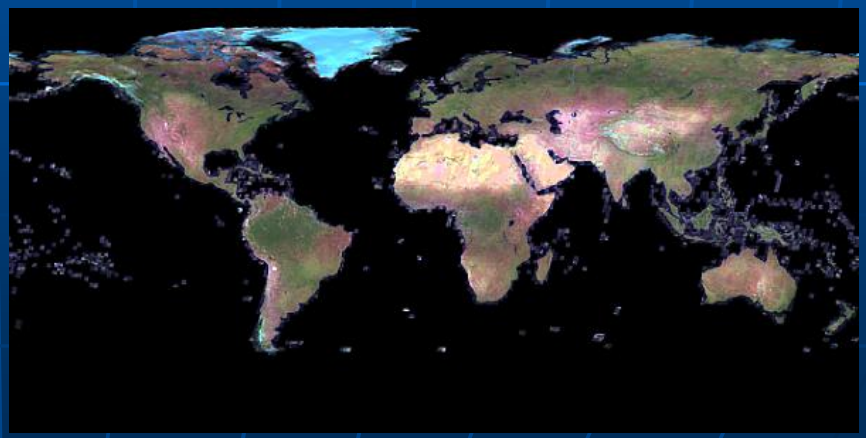
e.g., http://carto.server.gr**?**doThis**&**parameter1**&**parameter2



Interactive Maps

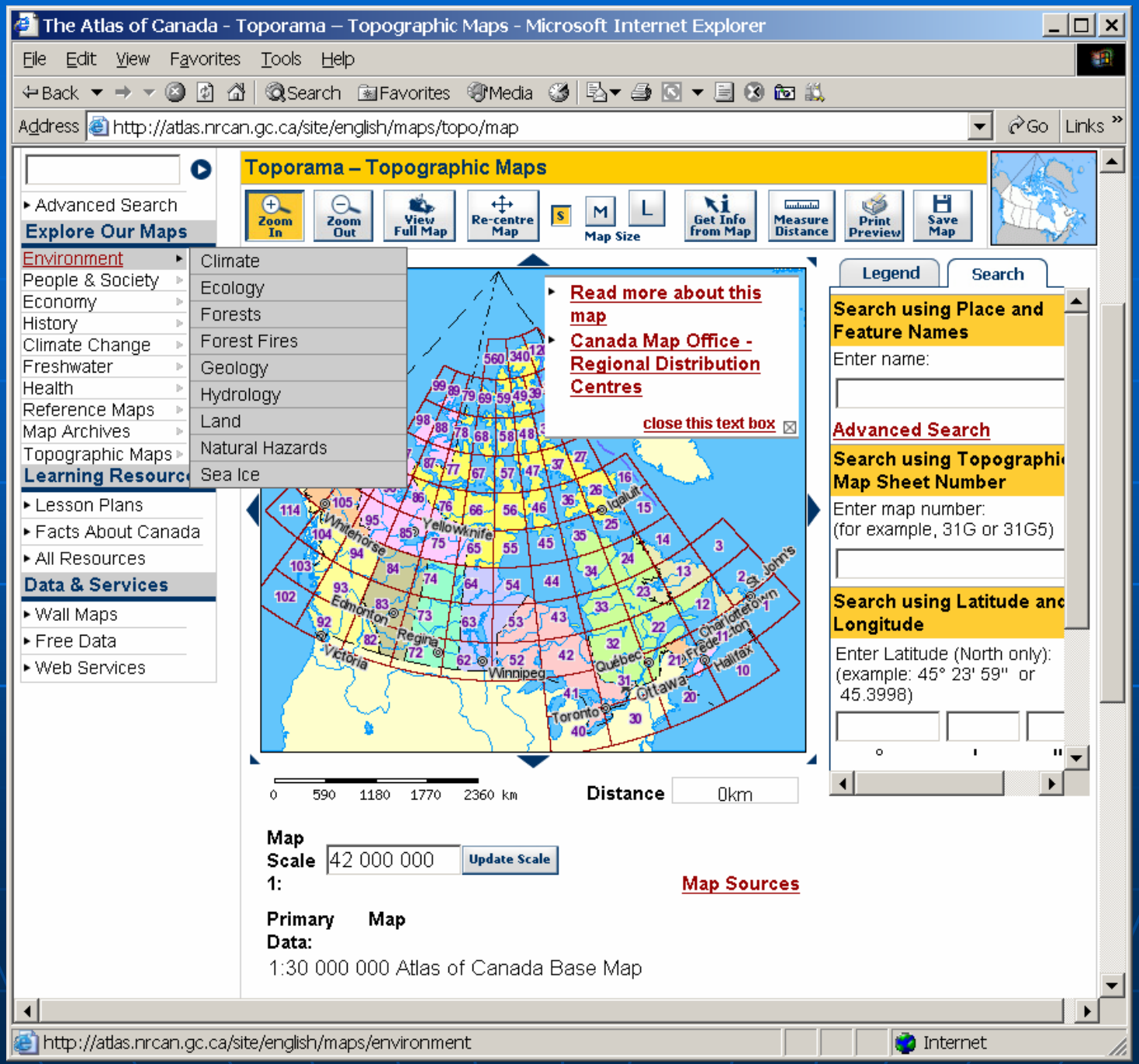
- Extending **server side** functionality
  - **Common Gateway Interface (CGI)**

http://wms.jpl.nasa.gov/wms.cgi
?request=GetMap
&service=WMS
&version=1.1.1
&srs=EPSG:4326
&format=image/jpeg
&styles=
&bbox=-180,-90,180,90
&width=600
&height=300
&layers=global_mosaic



Interactive Maps

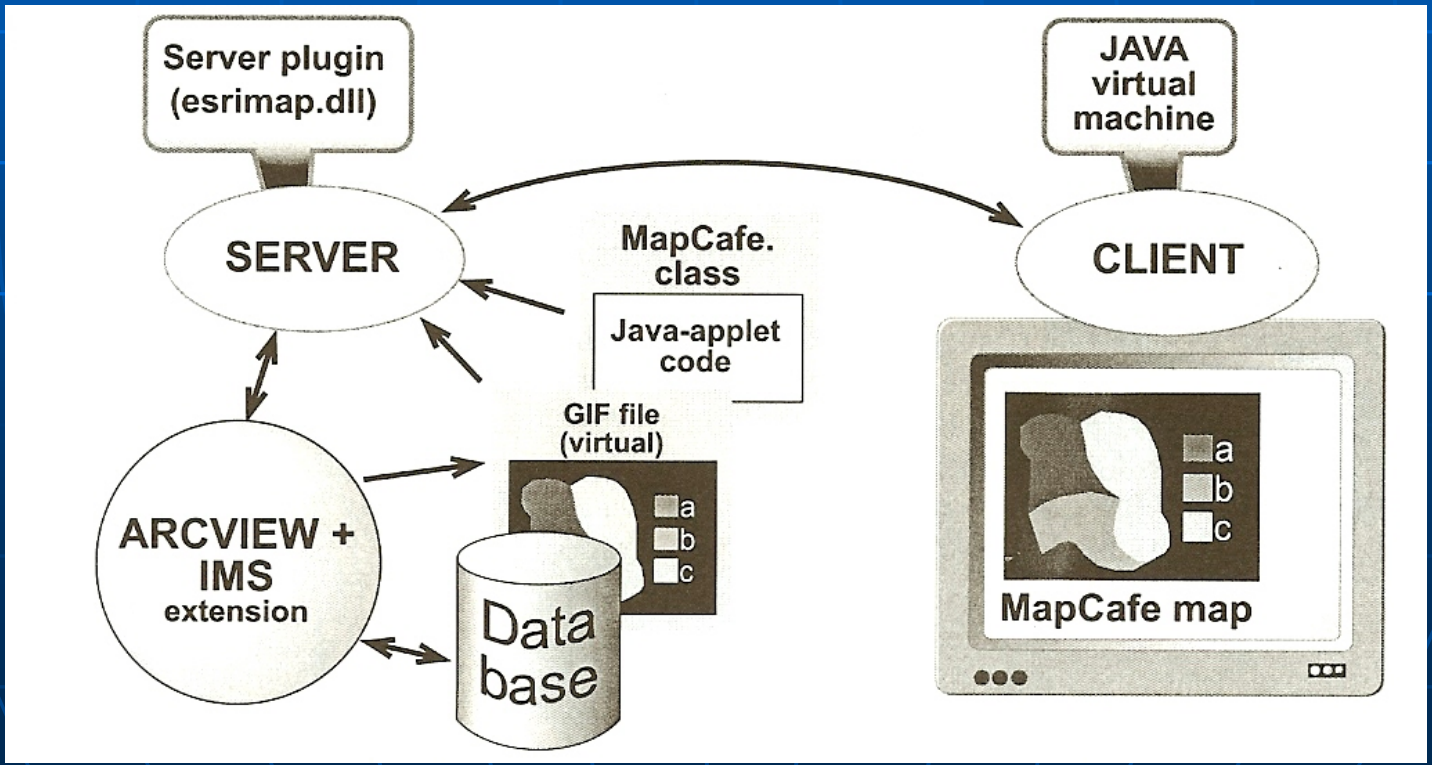
- Extending **server side** functionality


The Atlas of Canada - Toporama – Topographic Maps - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://atlas.nrcan.gc.ca/site/english/maps/topo/map
Go Links
Toporama – Topographic Maps
Zoom In
Zoom Out
View Full Map
Re-centre Map
S M L
Map Size
Get Info from Map
Measure Distance
Print Preview
Save Map
Advanced Search
Explore Our Maps
Environment
People & Society
Economy
History
Climate Change
Freshwater
Health
Reference Maps
Map Archives
Topographic Maps
Learning Resources
Lesson Plans
Facts About Canada
All Resources
Data & Services
Wall Maps
Free Data
Web Services
Climate
Ecology
Forests
Forest Fires
Geology
Hydrology
Land
Natural Hazards
Sea Ice
Read more about this map
Canada Map Office - Regional Distribution Centres
close this text box
Whitehorse
Yellowknife
Iqaluit
Edmonton
Regina
Victoria
Winnipeg
Québec
Ottawa
Toronto
Fredericton
Charlottetown
Halifax
St. John's
0 590 1180 1770 2360 km
Distance 0km
Map Scale 1: 42 000 000 Update Scale
Map Sources
Primary Map Data:
1:30 000 000 Atlas of Canada Base Map
Legend
Search
Search using Place and Feature Names
Enter name:
Advanced Search
Search using Topographic Map Sheet Number
Enter map number:
(for example, 31G or 31G5)
Search using Latitude and Longitude
Enter Latitude (North only):
(example: 45° 23' 59" or 45.3998)
http://atlas.nrcan.gc.ca/site/english/maps/environment
Internet

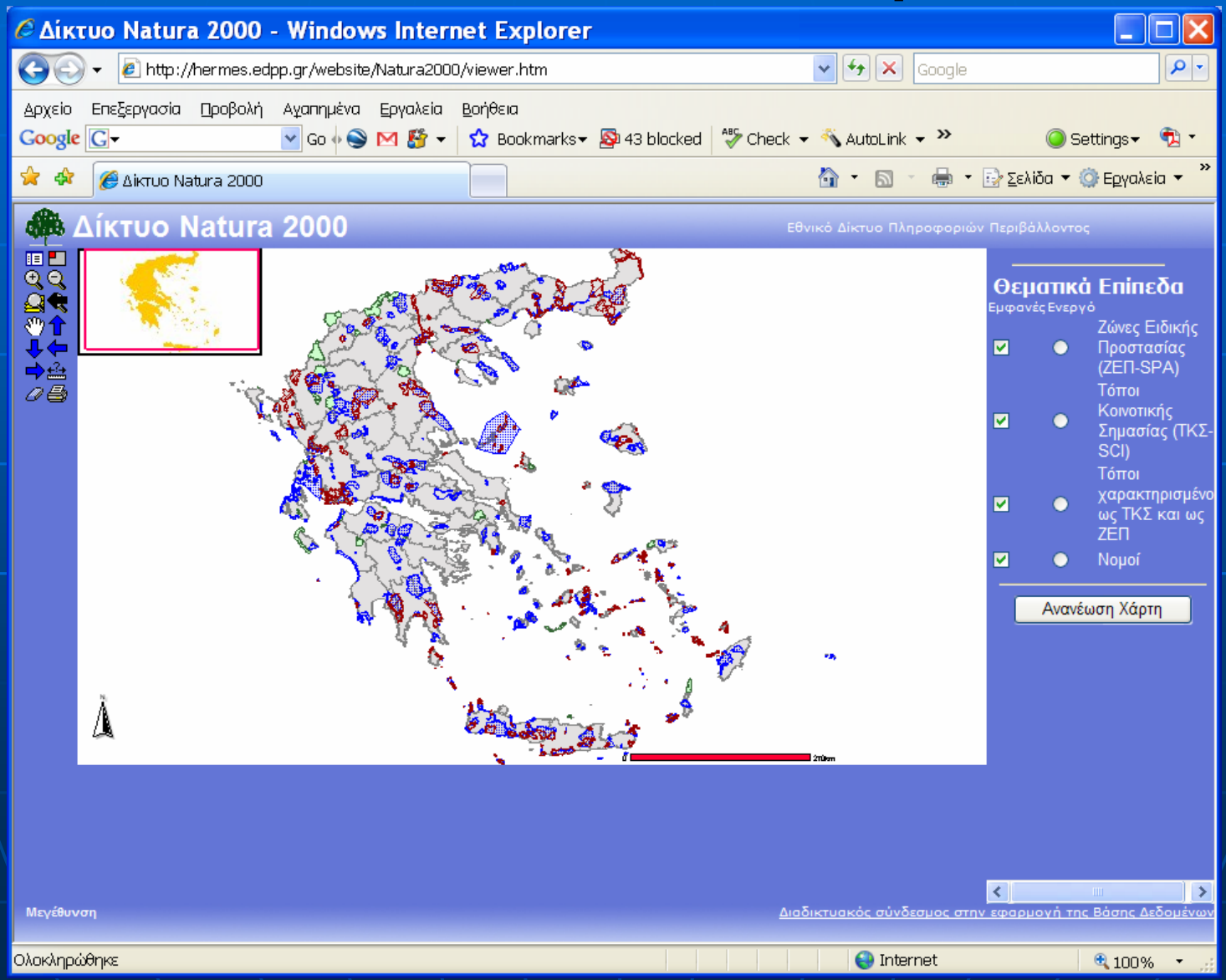
Interactive Maps

- Extending ...
  - both **server & client side** functionality

    e.g., ESRI Arc/IMS

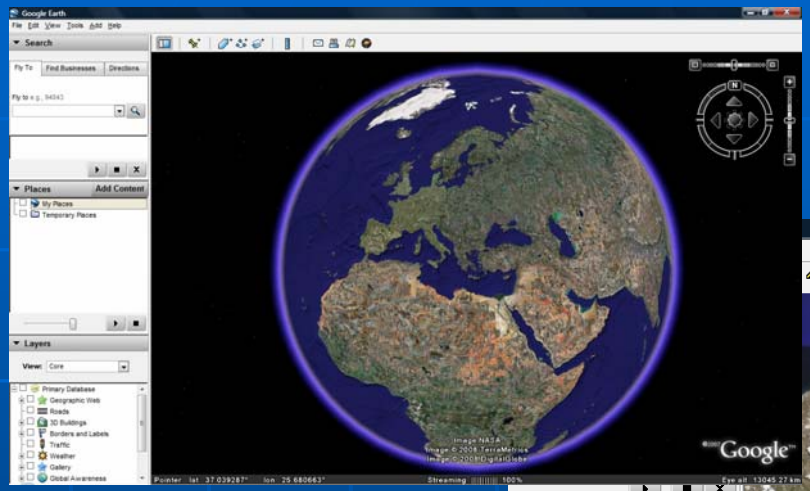


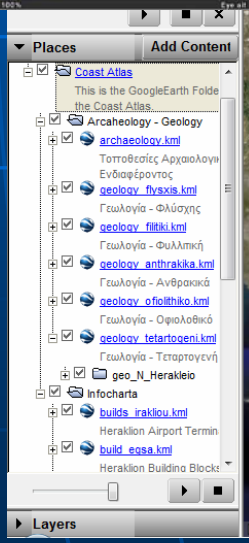
Interactive Maps

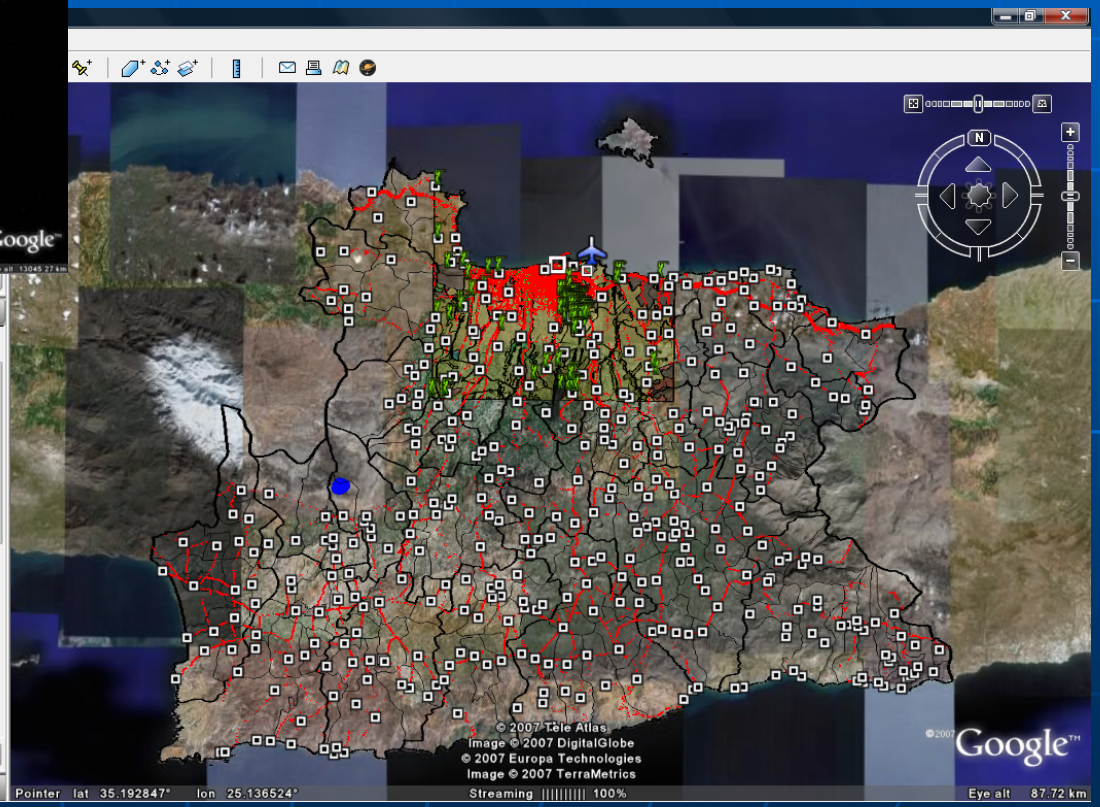


Interactive Maps

http://earth.google.com/







Part I: Theory

1. Publishing Maps on the Web

2. **XML-based languages for Geography and Mapping**
   - **GML – Geography Markup Language**
   - **SVG – Scalable Vector Graphics**
   - **KML – Keyhole Markup Language**

3. Web Services for Mapping

XML

- XML...
  - eXtensible Markup Language
  - Developed by the World Wide Web Consortium (**W3C**)
- Nowadays...
  - XML is widely used for **describing** and **exchanging** data

XML

- What is so **advantageous** about XML...
  - It is portable
    - it utilizes unicode
  - It is platform independent
  - It is human readable
    - it is a pure and editable text
  - It is extensible
    - extra info can be added to a format without breaking applications based on previous versions
  - It is well supported
    - A large number of off-the-self tools for processing XML exist

XML

- XML...
  - Has been built to support traditional applications (office and banking)
- What about applications involving **non-traditional** data ?
  - Other formats ... based on XML have been proposed
  - E.g.,
    - **GML** (Geography Markup Language) for transport and storage of geo-information
    - **CML** (Chemical Markup Language) for managing molecular information

Geographic Applications

- XML ...
  - has been adopted widely in geography
  - It is already a standard for geo-data sharing
- Main formats ...
  - **GML**
    - Geography Markup Language
  - **SVG**
    - Scalable Vector Graphics
  - **KML**
    - Keyhole Markup Language

Geography Markup Language (GML)

- An **XML-based** encoding standard
  - for transport and storage of geo-information
  - including both spatial and non-spatial features
- Developed by ...
  - the Open Geospatial Consortium – **OGC**

    { 270 companies, government agencies and universities }

http://www.opengeospatial.org/

Geography Markup Language (GML)

http://www.opengeospatial.org/

Geography Markup Language (GML)

- **GML versions ...**
  - Initial release: GML specification
    - based on DTD; not used anymore
  - Feb. 2000: GML2 specification
    - based on XMLSchema
  - Current (since 2003): **GML3** specification
    - based on XMLSchema; includes spatial relationships, 3D geometry, and time

Geography Markup Language (GML)

- GML represents the **content**…
  - An important distinction should be made between…
    - geographic data encoded in GML (the content) and
    - their visualization (the presentation)
  - Similarly to …
    - XML and HTML
    - XML is helping the Web to clearly **separate content from presentation**
    - GML will do the same in the world of geography!

Geography Markup Language (GML)

- GML is **Text**...
  - Like XML encoding...
    - GML represents geo-info in the form of **text**
  - Some year ago...
    - This might be censurable
  - Today...
    - This is desirable!
  - Text has advantages
    - Easy to inspect / Easy to change
  - Text formats for geography...
    - have been employed in the past (e.g., SAIF, VRML)

Geography Markup Language (GML)

- What is so different about GML ?
  - There are already...
    - Many encoding standards for GI
      - COGIF, SAIF, DLG, SDTS
  - Why GML ?
    - A simple text based encoding
    - Based on a common model of geography
      - OGC Abstract Specification
      - Developed and agreed by the vast majority of all GIS vendors
    - GML is based on XML

Geography Markup Language (GML)

- GML is based on XML (advantage...)
  - XML provides a method to verify data integrity
    - XMLSchema or DTD
  - XML can be read and edited using a simple text editor
    - Also several XML editors exist (e.g., XML Spy)
  - A large number of XML languages already available
    - e.g., XML-QL, XSL
  - XML is easy to transform
    - using XSLT or any programming language (Java, C++)
  - XML is a widely adopted public standard
    - A wide variety of commercial/free ware tools for XML exist
    - This leads to an **open (geographic) information**

Geography Markup Language (GML)

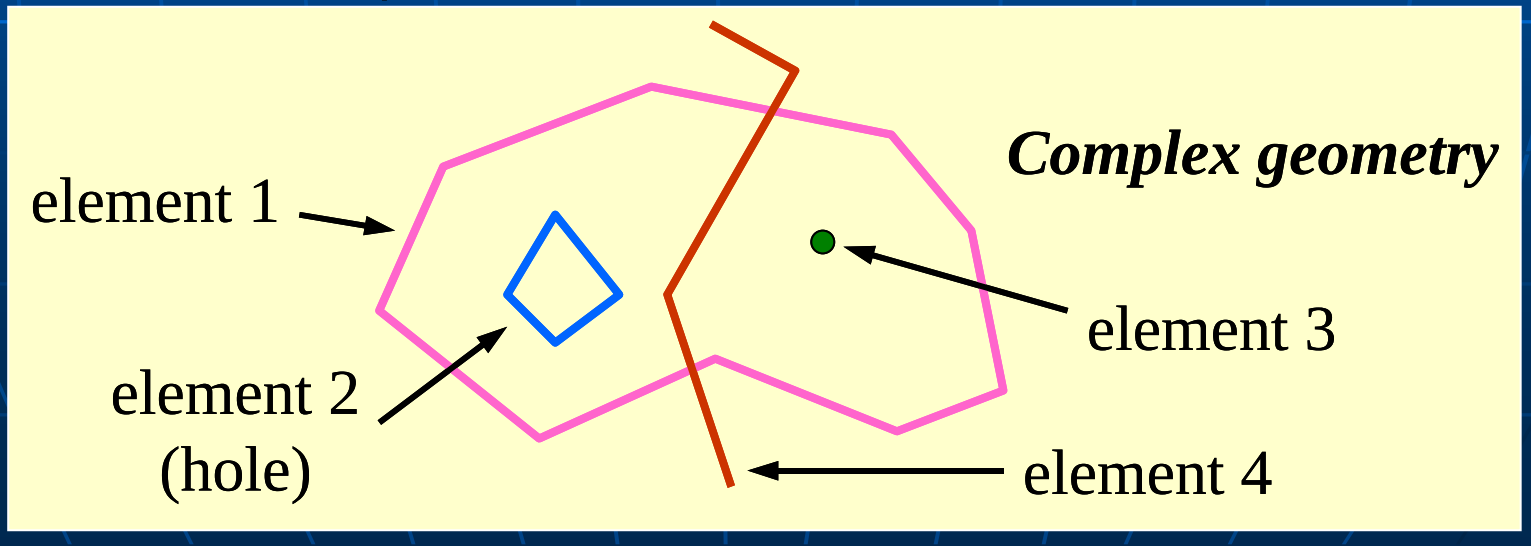
- GML Encodes Geographic Features
  - GML is based on…
    - The OGC abstract model of geography
  - Feature = Entity
    - A list of properties and geometry
  - Feature Property
    - Usual Name / type / value description
  - Feature Geometry
    - Basic building blocks
      - points, lines, curves, surfaces and polygons
    - Current version
      - 3D geometry / topological relationships / Time

Geography Markup Language (GML)

- GML Encodes Geographic Features
  - GML encoding allows ...
    - Quite complex features
  - A feature can be ...
    - Composed of other features
  - Example...
    - A Railway Station (RS)
      - is a single feature
    - composed of other features
      - Platforms
      - Ticket halls
      - Bus and taxi ways
      - Cafeterias and restaurants

Geography Markup Language (GML)

- GML Encodes Geographic Features
  - Same applies to geometry
    - A geometrically complex feature
    - composed of many geometric elements
      - Points / Line strings / Polygons
      - Example…



Geography Markup Language (GML)

- GML Encodes Feature Geometry

```
<MiddleSchool ID ="145l">
    <extentOf
        <Polygon srsName="epsg:27354">
            <outerBoundaryIs>
                <LinearRing>
                    <coordinates>
                        491888.99,5458045.99 491904.72,5458044.91
                        491908.42,5458064.58 491924.61,5458064.33
                        491925.62,5458079.59 491977.66,5458120.36
                    </coordinates>
                </LinearRing >
            </outerBoundaryIs>
        </Polygon>
    </extentOf>
</MiddleSchool >
```

Geography Markup Language (GML)

- GML Encodes Feature Properties

```
<MiddleSchool ID ="145l">
    <description>Balmoral Middle School</description>
    <NumStudents>987</NumStudents>
    <NumFloors>3</NumFloors>
    <extentOf
        <Polygon srsName="epsg:27354">
            <outerBoundaryIs>
                <LinearRing>
                    <coordinates>
                        ...
                    </coordinates>
                </LinearRing >
            </outerBoundaryIs>
        </Polygon>
    </extentOf>
</MiddleSchool >
```

Properties
(other than geometry)

Geography Markup Language (GML)

- GML Feature Collections
  - GML2, GML3 are based on XML1.0
  - XML1.0 uses ...
    - A feature collection as the basis of its document
  - Feature Collection is ...
    - A collection of features
      - Together with an envelop (it bounds features)
    - A collection of properties
      - They apply to the feature collection
    - An optional list of Spatial Ref. System Definitions
  - A Feature Collection ...
    - Can contain other Feature Collections

Geography Markup Language (GML)

- GML Encodes Spatial Ref. Systems
  - GML3 incorporates ...
    - An extensible earth based Spatial Ref. System
    - The main Projection and Geocentric Ref. Systems in use
  - The encoding scheme allows for ...
    - User defined units and Ref. System parameters
  - Future versions of GML will provide ...
    - More flexible encodings to handle local coordinate systems (e.g, mile logging)

Geography Markup Language (GML)

- GML Encodes Spatial Ref. Systems
  - Although optional ... it is very valuable...
    - Clients can validate Server SRS
      - SRS description is an XML document
    - Client can handle data from different Servers
      - GML services that transform GML data from one SRS to another are required
    - Server (web site) can accommodate (store)
      - any number of SRS definitions and related data

Geography Markup Language (GML)

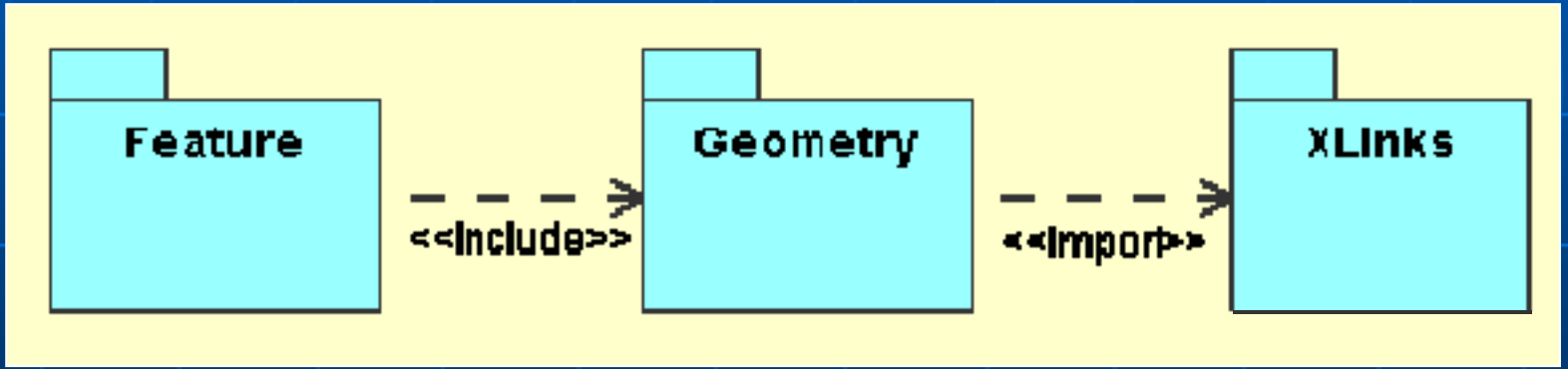
- **Schemas** for Spatial Data
  - A schema defines
    - The characteristics of a class of objects
  - In XML
    - A schema defines how data is **marked up**
  - GML3.0 is compliant with
    - XML Schema Candidate Recommendation
    - Published by OGC (2003)

Geography Markup Language (GML)

- GML **Base Schemas**
  - Three base schemas
    - Geometry Schema (geometry.xsd)
      - Replaces the DTD of GML1.0
    - Feature Schema (feature.xsd)
      - It support feature collections (as feature types)
      - It includes common properties
        - fid (identifier)
        - name
        - description
    - XLink Schema
      - Provides Xlink attributes
      - Supports linking functionality

Geography Markup Language (GML)

- GML Base Schemas
  - Base schemas as packages

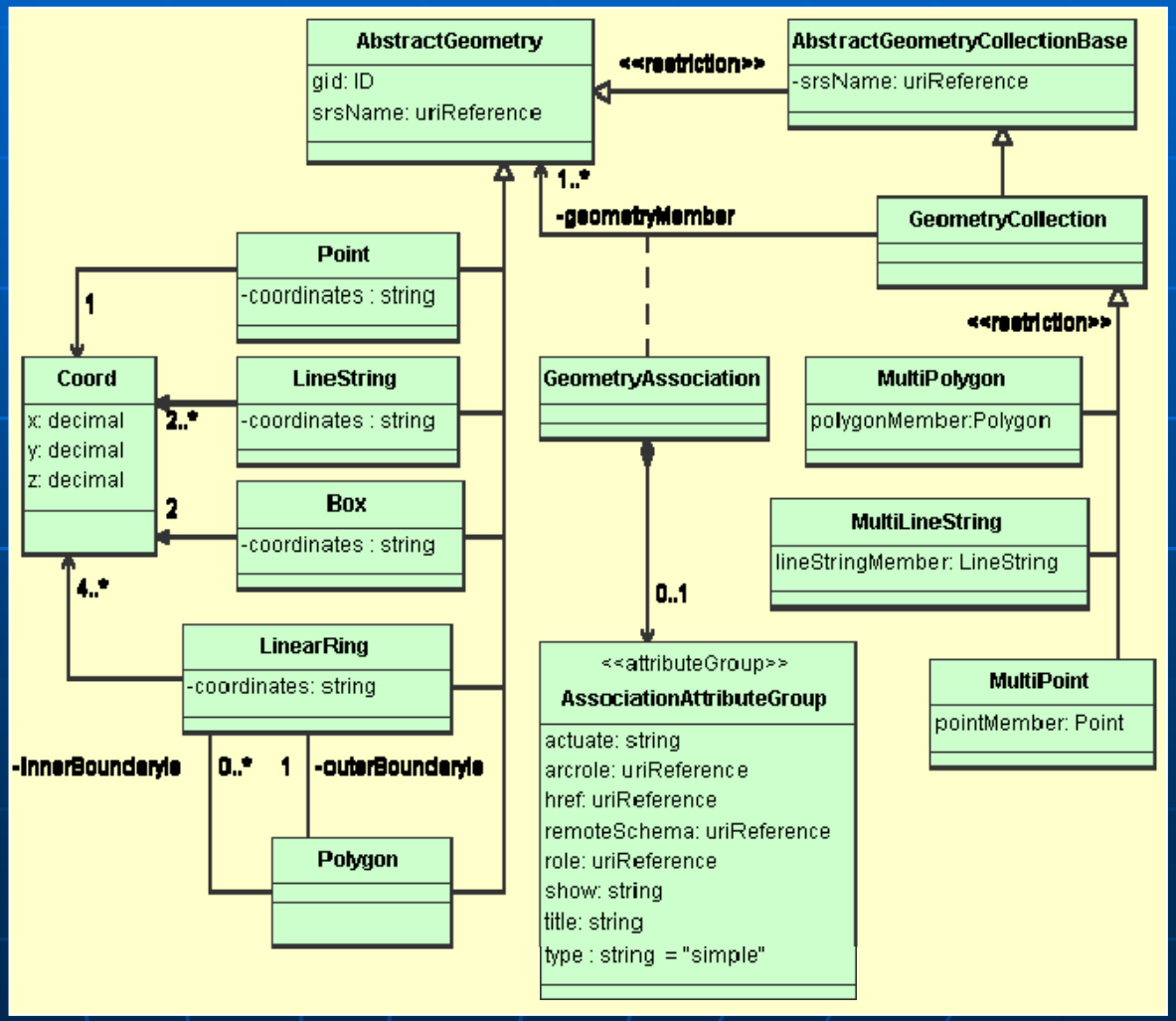


Geography Markup Language (GML)

- GML – **Geometry Schema**
  - It includes type definitions for …
    - Abstract geometry elements
      - (multi) point / line / polygon
    - Complex type definitions
      - For the underlying geometry types
  - It includes …
    - The structures described in the OGC Abstract Specification (Topic 1: Feature Geometry)

Geography Markup Language (GML)

- GML
  Geometry
  Schema
  (UML)



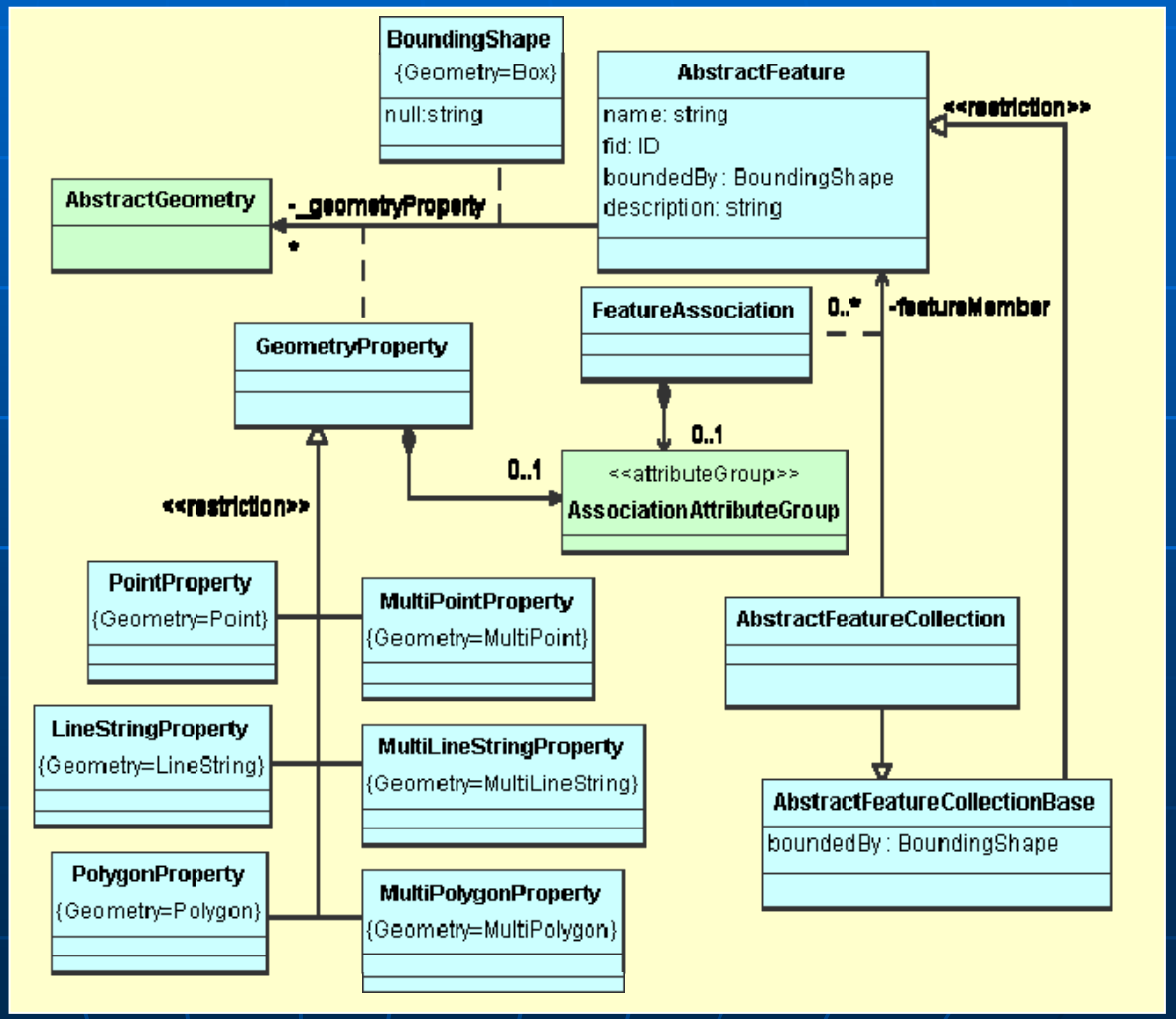
Geography Markup Language (GML)

- GML – **Feature Schema**
  - Uses ...
    - The <include> element

      <include schemaLocation="geometry.xsd"/>
    - To bring in GML geometry constructs
  - Hence ...
    - GML geometry constructs are available in defining feature types

Geography Markup Language (GML)

- GML
  Feature
  Schema
  (UML)



Geography Markup Language (GML)

- GML **Application Schemas**
  - The development of a schema for a ...
    - Particular domain (e.g., forestry)
    - Jurisdiction (e.g., France)
    - Information community
  - Incorporates the base GML schemas ...
    - Geometry schema
    - Feature schema
    - Xlink schema

Geography Markup Language (GML)

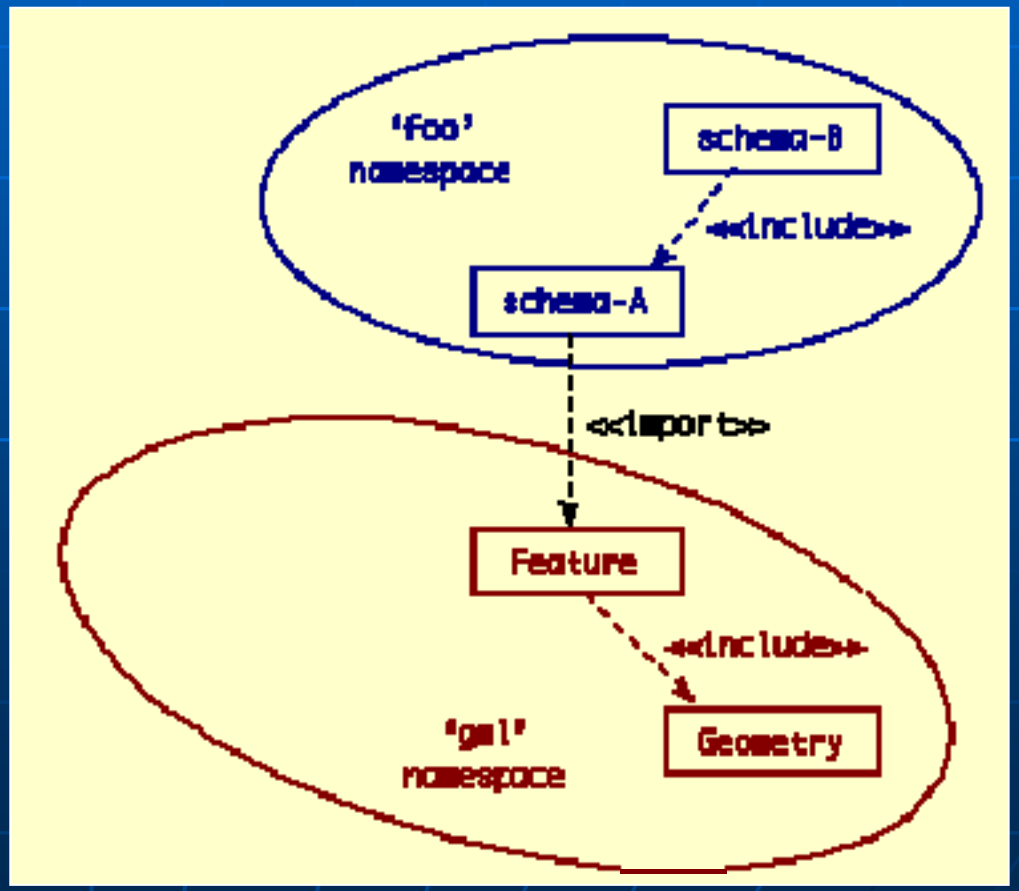
- Rules for GML **Application Schema**
  - Defines its own (new) feature types
    - They must be sub-typed from GML types
  - Defines new geometry properties
    - They must be sub-typed from GML types
  - Declares a target namespace
    - A mechanism to keep element names distinct
  - Imports schemas
    - The only means whereby GML constructs are brought in for use

Geography Markup Language (GML)

- Rules for GML **Application Schema**
  - Imports schemas
    - <import>

      vs

      <include>



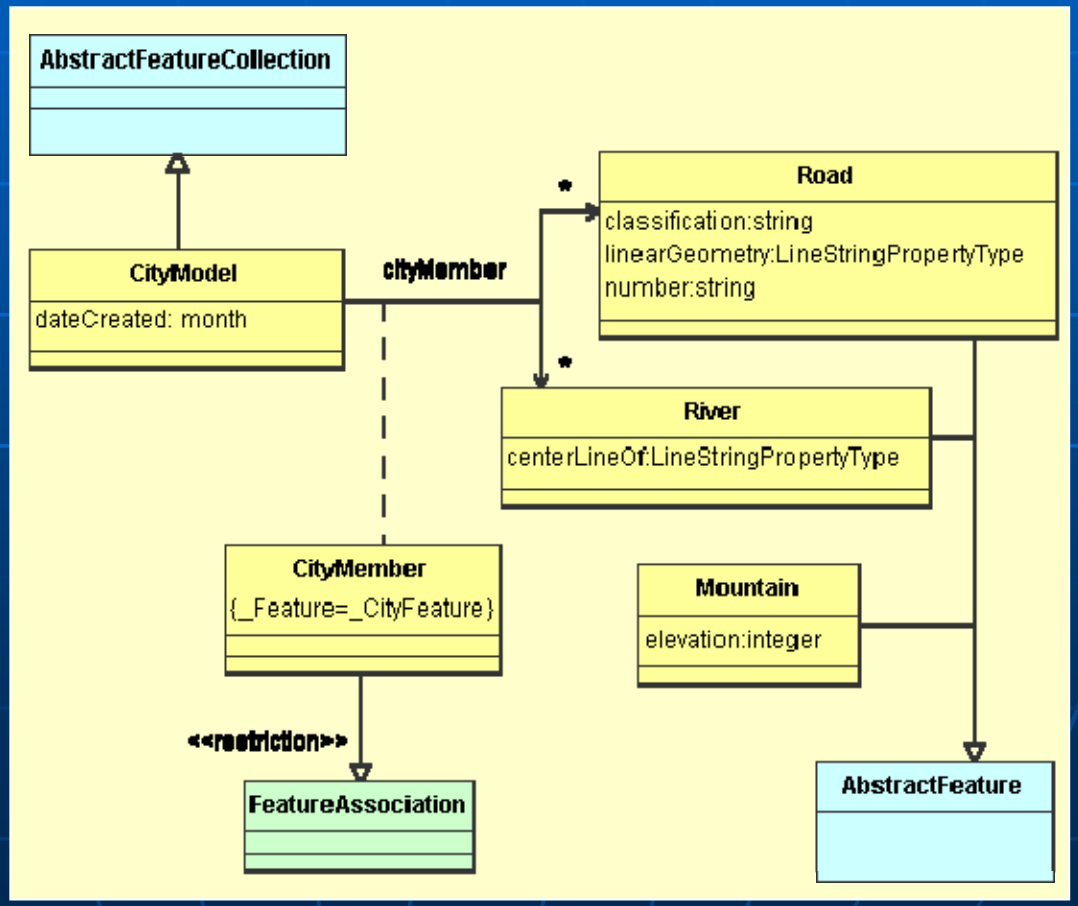
Geography Markup Language (GML)

- The Cambridge Example (Appl. Schema)
  - One Feature Collection
    - CityModel
      - String property
        - dateCreated (value:'Nov 2000')
      - Geometry property
        - boundedBy (the bounding box) [expressed in an SRS]
      - Two features (containment relationship: 'cityMember')
        - RiverType
          name: 'Cam', description: 'The River that runs…'
          geometry: centerLineOf [bounding box SRS]
        - RoadType
          description: 'M11', classification: 'motorway', number:'11'
          geometry: linearGeometry [bounding box SRS]

Geography Markup Language (GML)

- The Cambridge Example (Appl. Schema)

(UML)



Making Maps with GML

- How to make a map with GML data ?
  - GML represents the **content**...
  - Therefore...
    - GML data must be styled into a suitable graphical presentation
  - **Map styling**...
    - The process of transforming GML data into the geometry of a visual presentation
  - A similar process is applied ...
    - When an **XML** document is transformed to a presentation format, such as **HTML**
    - ... using tools like **XSLT** (XML Trasformation Language)

Making Maps with GML

- **Map styling**…
  - The target of GML Map Styling can be of any format
  - Usually, an XML graphical format is chosen
    - Such as SVG, VML, KML or X3D
- **Graphical rendering**…
  - The process of transforming the graphical representation of Map Styling process into a viewable image

Making Maps with GML

Performed on either the client or the server

Graphical Rendering Engine

Map Style Library

Map Styling Engine

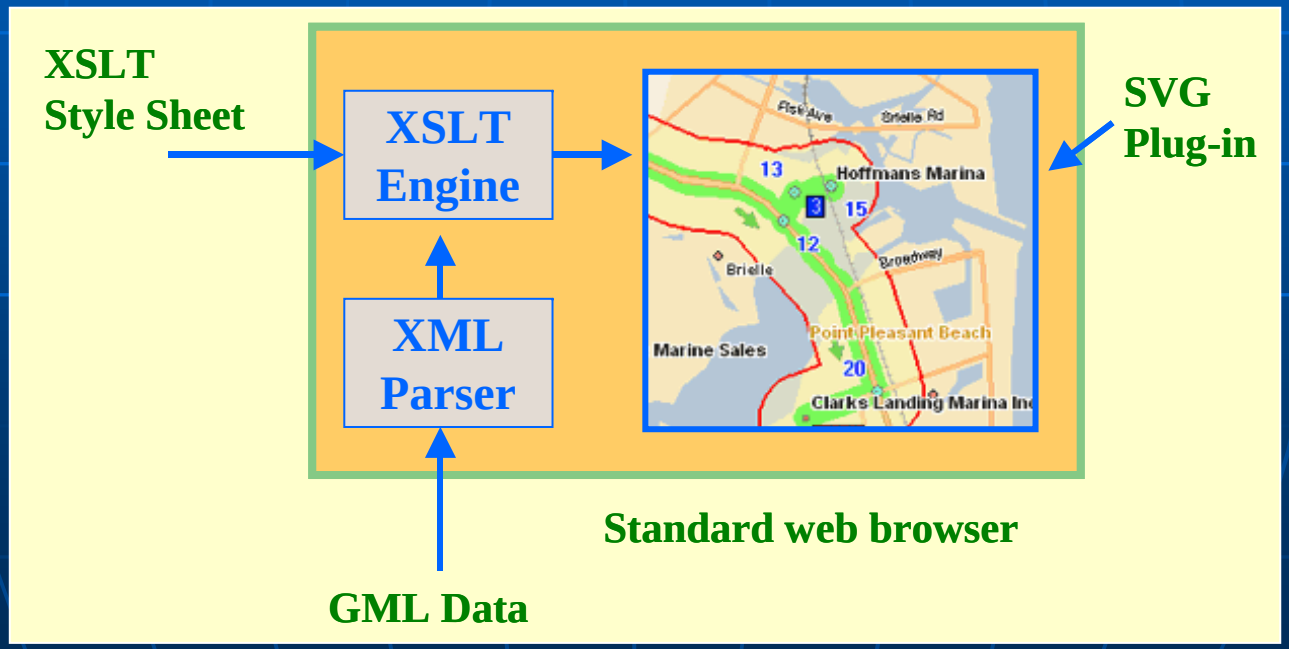
GML Data

Making Maps with GML

- **Graphical renders**…
  - There are a variety available
  - They support the different XML graphical formats
  - They are …
    - Either … native to the web browser
      - E.g., Internet Explorer built in VML processor
    - Or … distributed as plug-ins for many browsers
      - E.g., Adobe SVG Viewer
    - Or … stand alone viewers
      - E.g., Java Applet SVG viewer, Google Earth

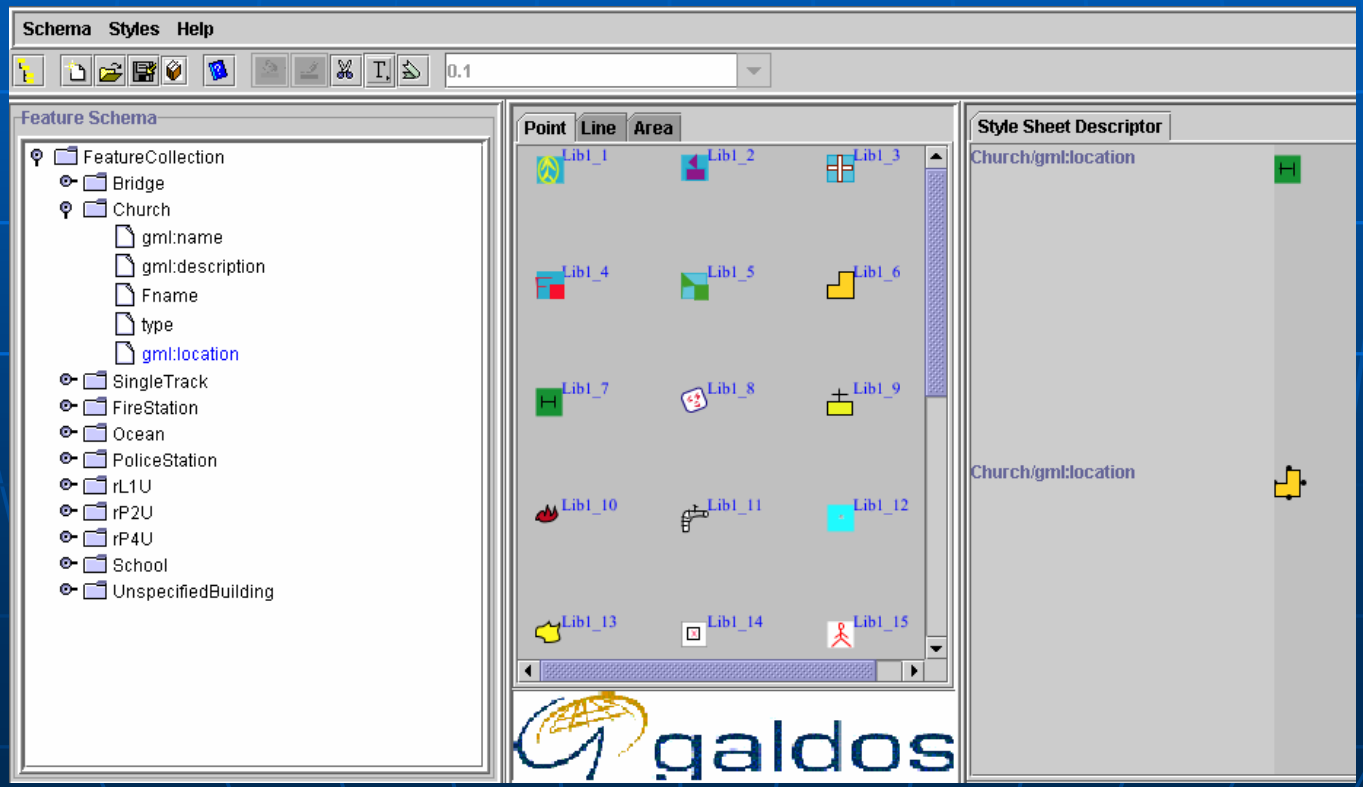
Making Maps with GML

- Making a Map with XSLT and SVG ...
  - (Galdos Systems Inc)



Making Maps with GML

- Map Style Editor ...
  - (Galdos Systems Inc)

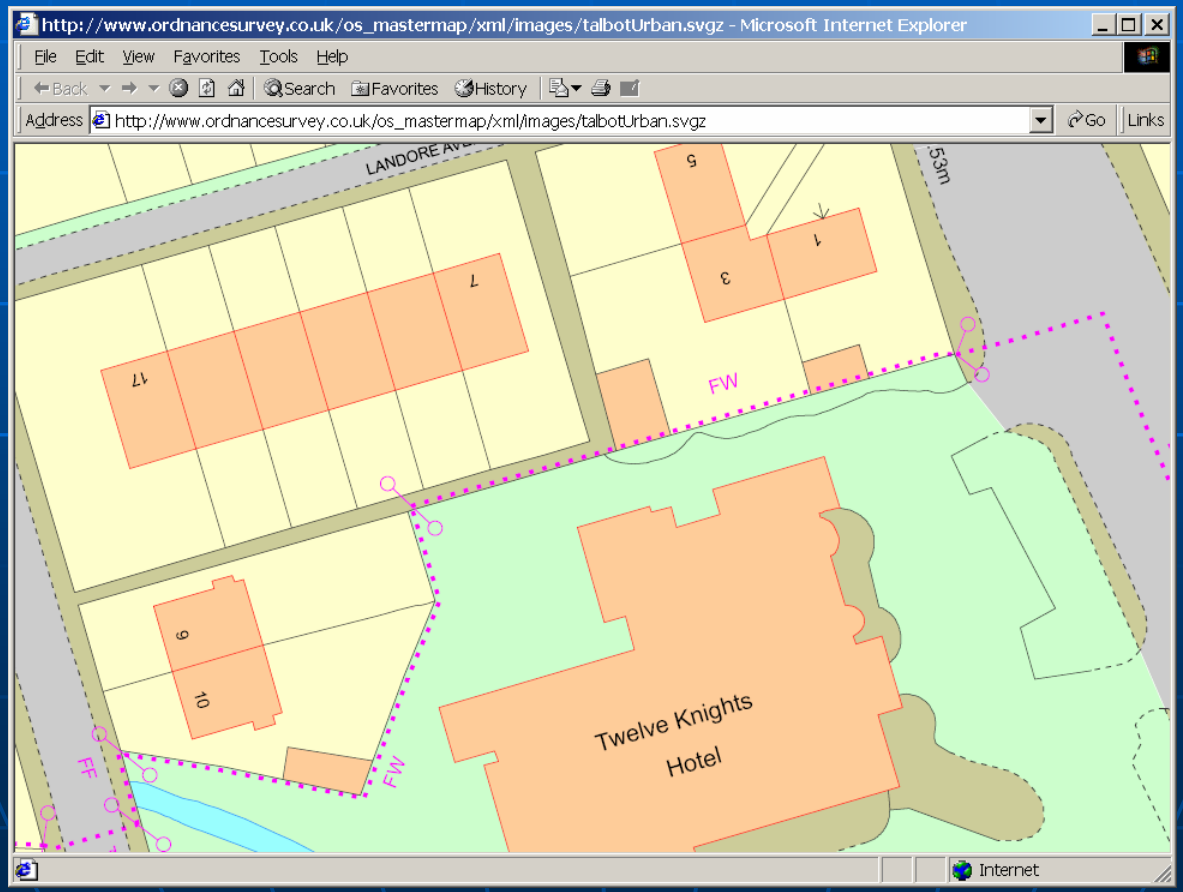


Making Maps with GML

- StruMap DNF Viewer
  - Displays Map files in GML
  - DNF (Digital National Framework) from **Ordnance Survey, U.K.**
  - The viewer supports ...
    - The display of features using appropriate symbols
    - Zoom-in/-out utilities
    - Display of attribute values assigned to features
    - Selection of themes to be displayed
    - Measuring distances/coordinate values

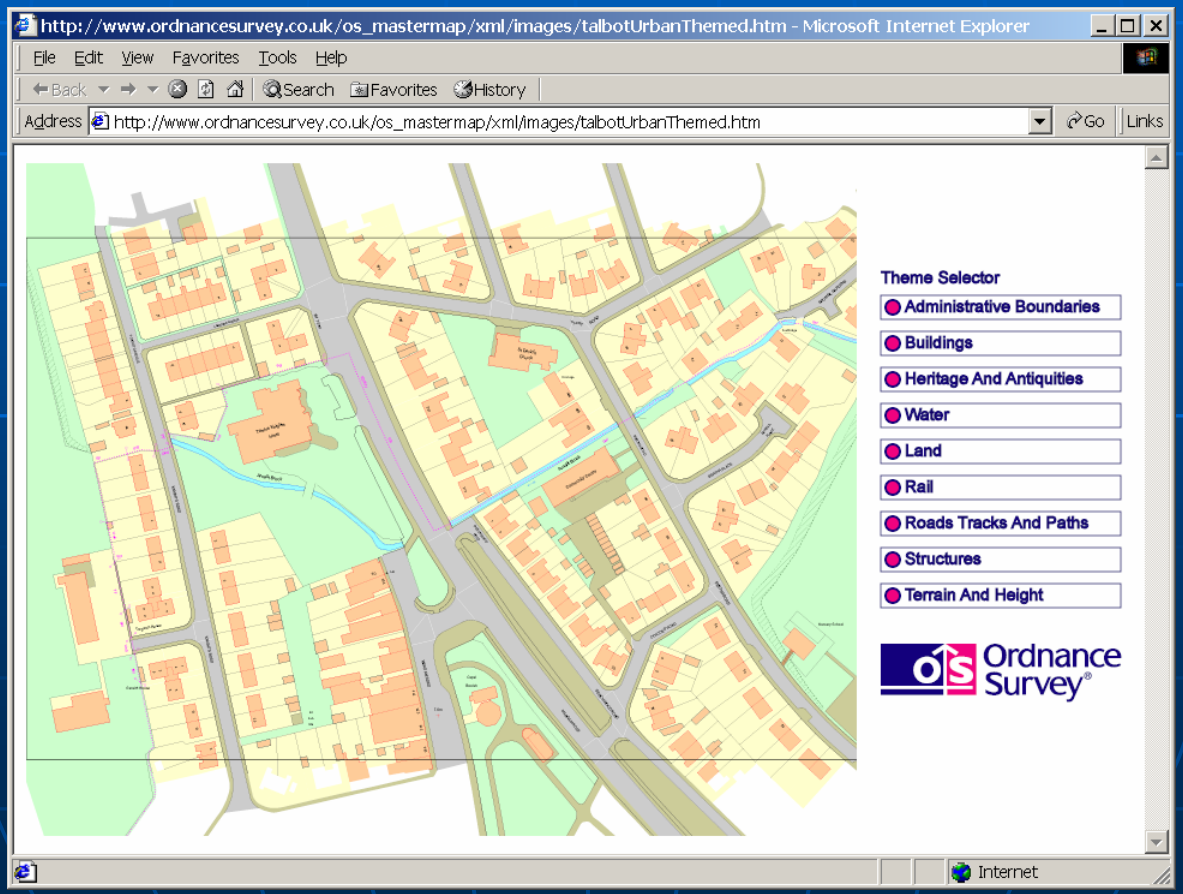
Making Maps with GML

- StruMap DNF Viewer



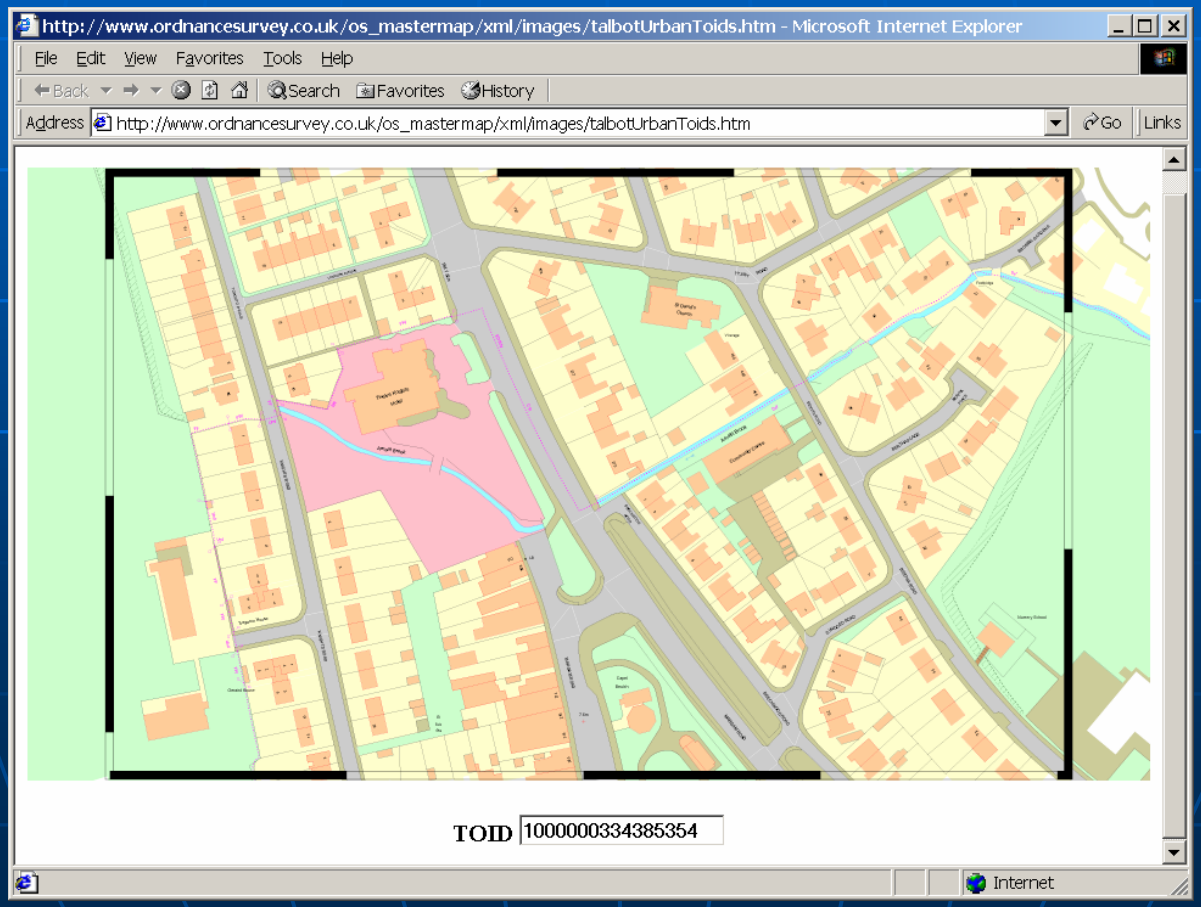
Making Maps with GML

- StruMap DNF Viewer (theme selector)



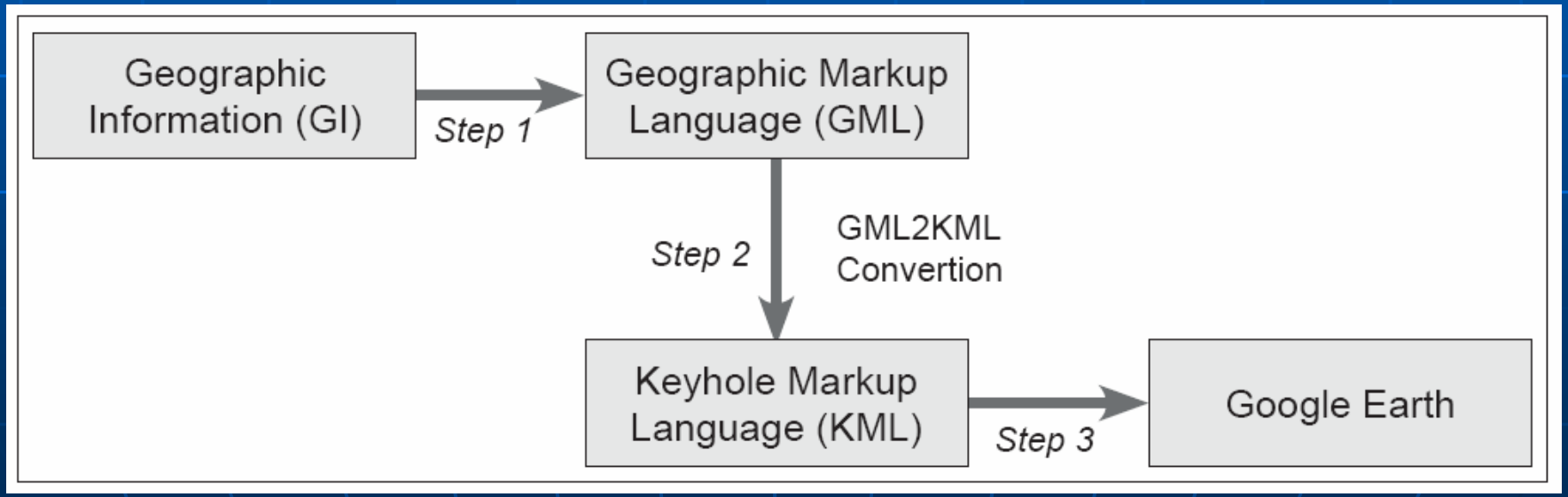
Making Maps with GML

- StruMap DNF Viewer (identifying features)



Making Maps with GML

- Many other options, e.g.,...
  - Convert GML to KML
  - Visualize the result in Google Earth



Making Maps with GML

- Convert GML to KML ...
  - OGR Simple Feature Library (OSGeo)
    - a C++ open source library
      - http://www.gdal.org/ogr/index.html

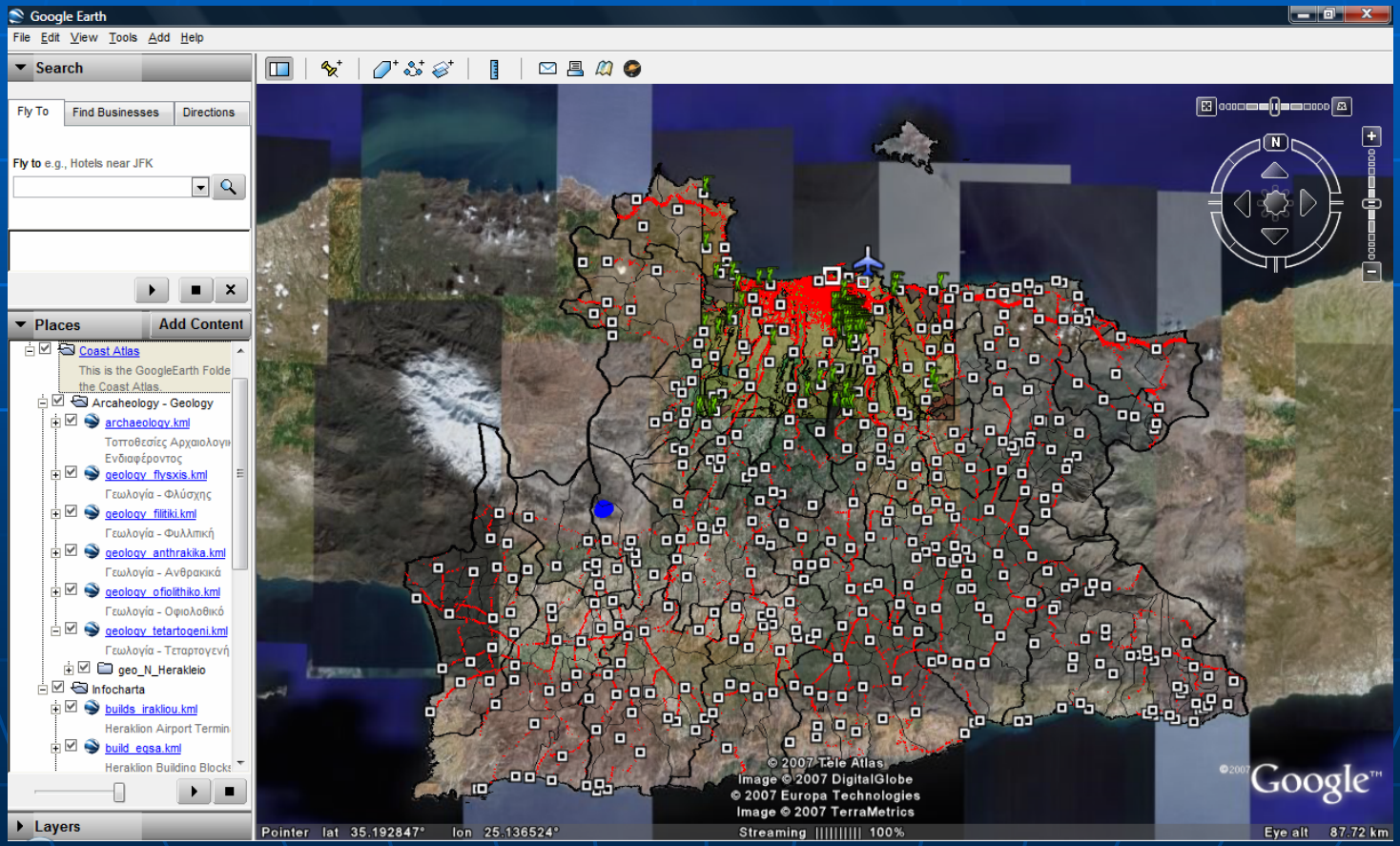
e.g.,

```
ogr2ogr -f "KML" .\infocharta\municipalities.kml
        .\infocharta\municipalities.gml
        -s_srs "epsg:2100"
        -t_srs "epsg:4326"

ogr2ogr -f "KML" .\infocharta\towns.kml
        .\infocharta\towns.gml
        -s_srs "epsg:2100"
        -t_srs "epsg:4326"
```

Making Maps with GML

- Convert GML to KML ...



Scalable Vector Graphics (SVG)

- SVG ...
  - language for describing...
    - two-dimensional graphics and
    - graphical applications
  - it is based on the XML standard
    - emphasis on the **visualization**
  - it describes...
    - **Content + Map Symbols + ...**

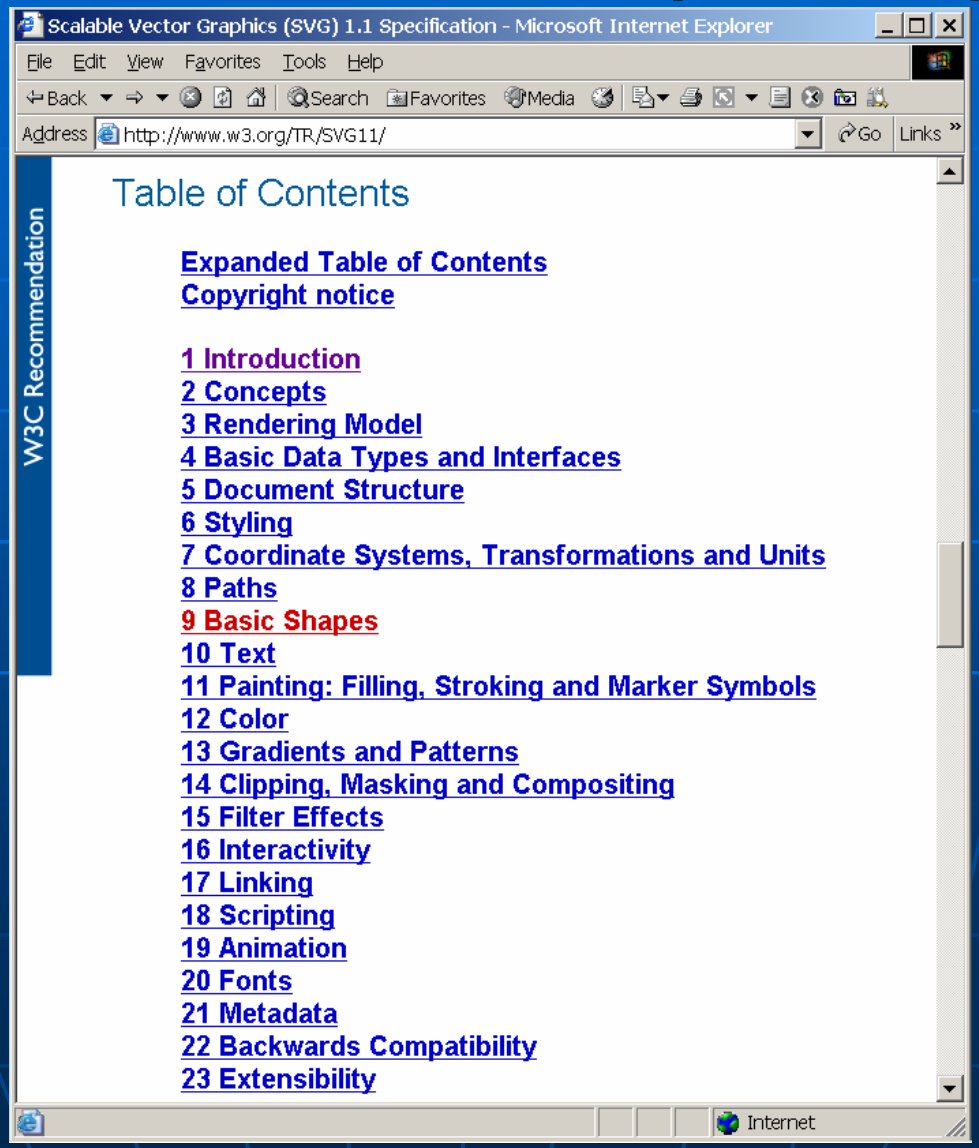
Scalable Vector Graphics (SVG)

- A **W3C** standard (current version 1.1)...
  - http://www.w3.org/Graphics/SVG/

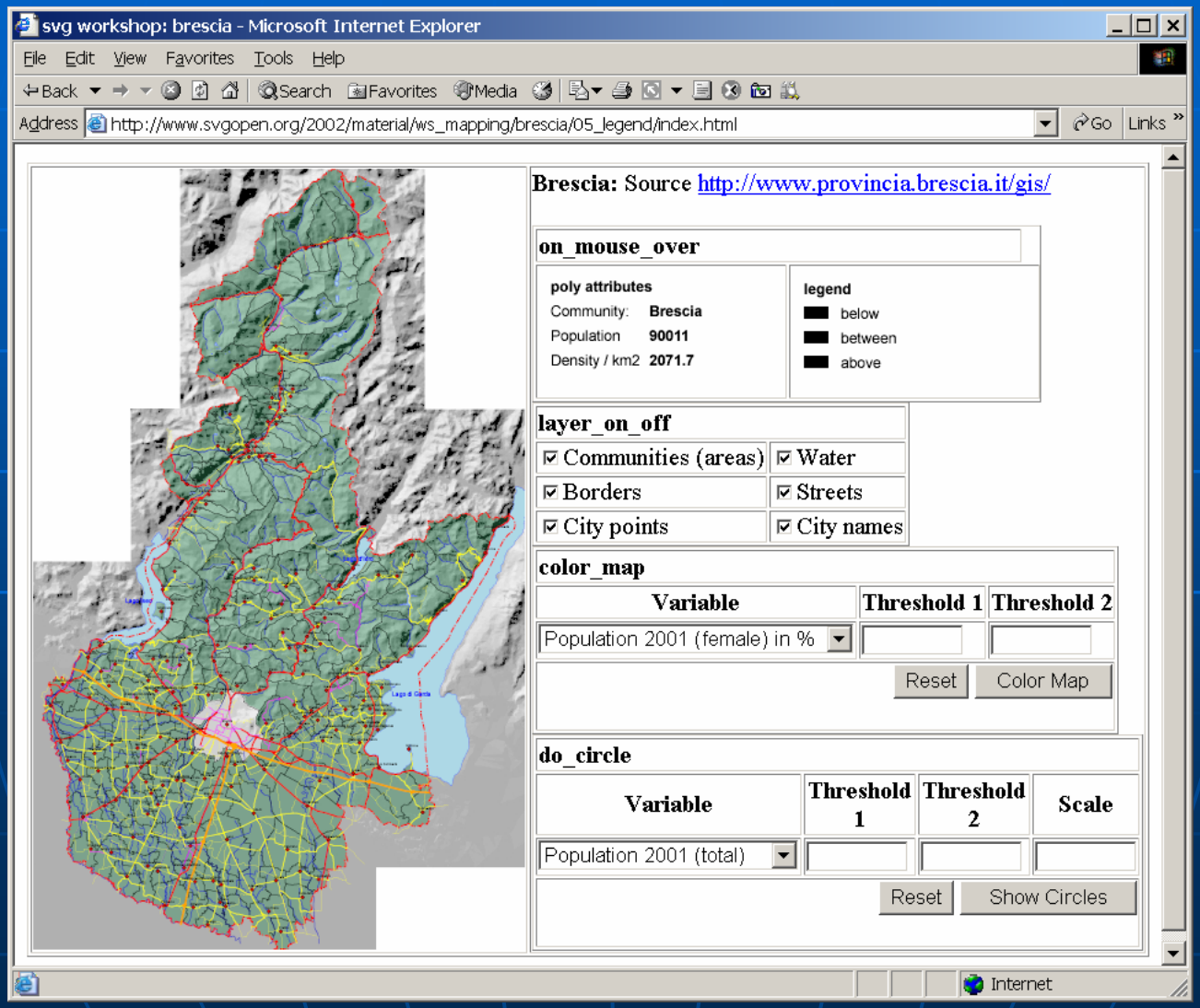
- SVG Document Type Declaration (DTD)

```
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN“
"http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">
```

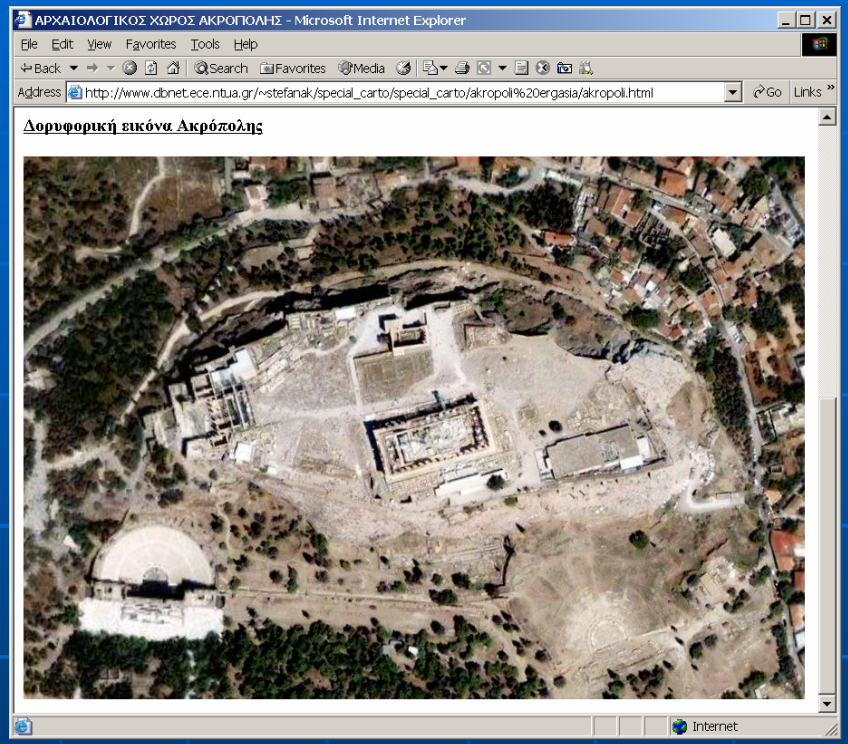
Scalable Vector Graphics (SVG)

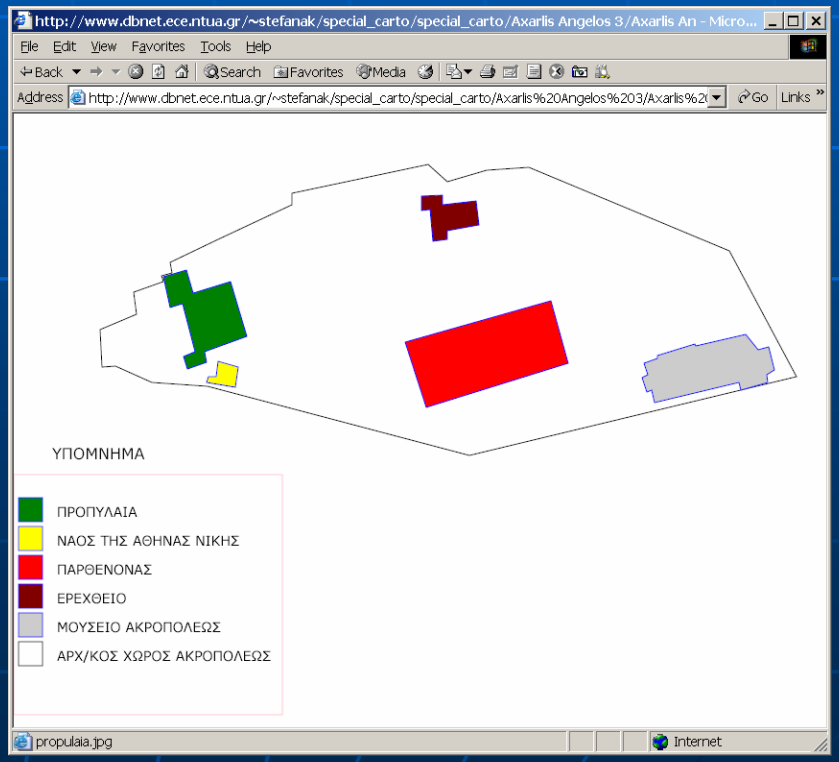


Scalable Vector Graphics (SVG)



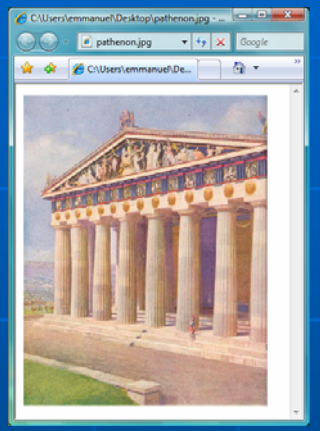
Scalable Vector Graphics (SVG)

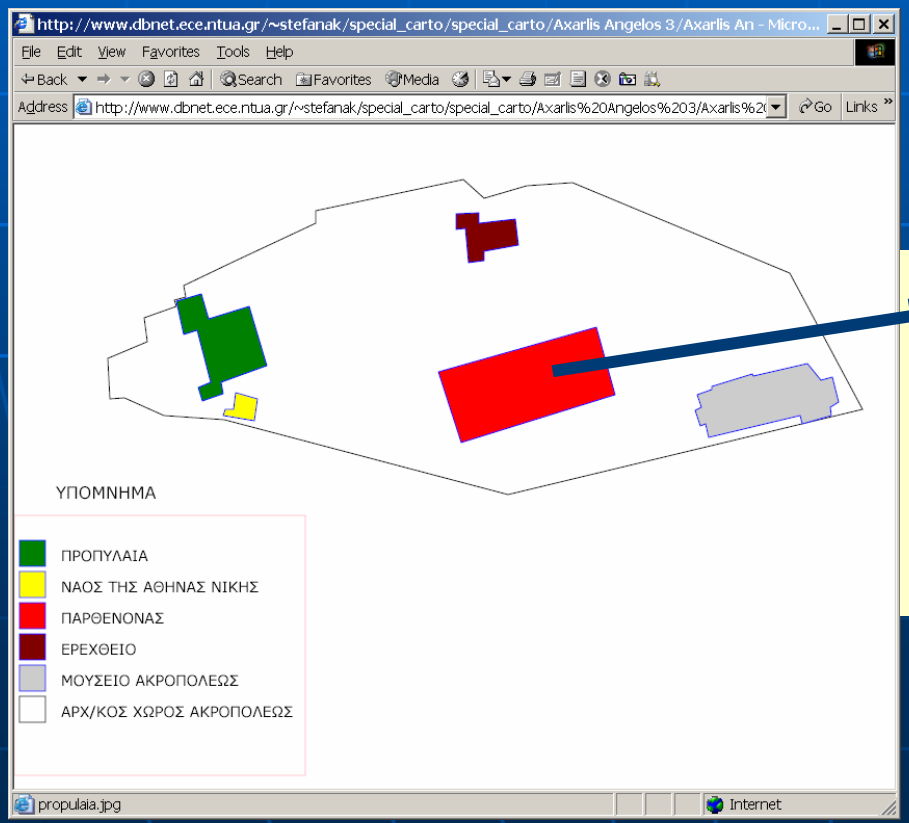




Scalable Vector Graphics (SVG)

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN"
"http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">
<svg width="100%" height="100%" version="1.1"
xmlns="http://www.w3.org/2000/svg">
```






```
<a xlink:href="parthenon.jpg">
<polygon points="408,238
 560,195  578,260  430,306"
 style="fill:red; stroke:blue;
 stroke-width:1"/>
</a>
```

Scalable Vector Graphics (SVG)

- An SVG document can be created...
  - from scratch in a text editor
  - using an SVG editor
  - as an output of another program
    - e.g., ArcGIS, Adobe Illustrator, etc.
- An SVG file can be viewed ...
  - in a Web browser, if an appropriate plugin is loaded
    - e.g., Adobe SVG Viewer - http://www.adobe.com/svg

Keyhole Markup Language (KML)

- **KML** ...
  - format to display geographic data in an Earth browser,
    - such as Google Earth, Google Maps, and Google Maps for mobile
  - to be adopted by **OGC**
  - it is based on the XML standard
    - emphasis on the **visualization**
  - it describes...
    - **Content + Map Symbols + View point + ...**

Keyhole Markup Language (KML)

- A KML file can be created ...
  - with the Google Earth user interface, or
  - from scratch ...
    - use an XML or simple text editor to enter "raw" KML
- KMZ...
  - KML files and their related images (if any) can be compressed using the ZIP format into KMZ archives

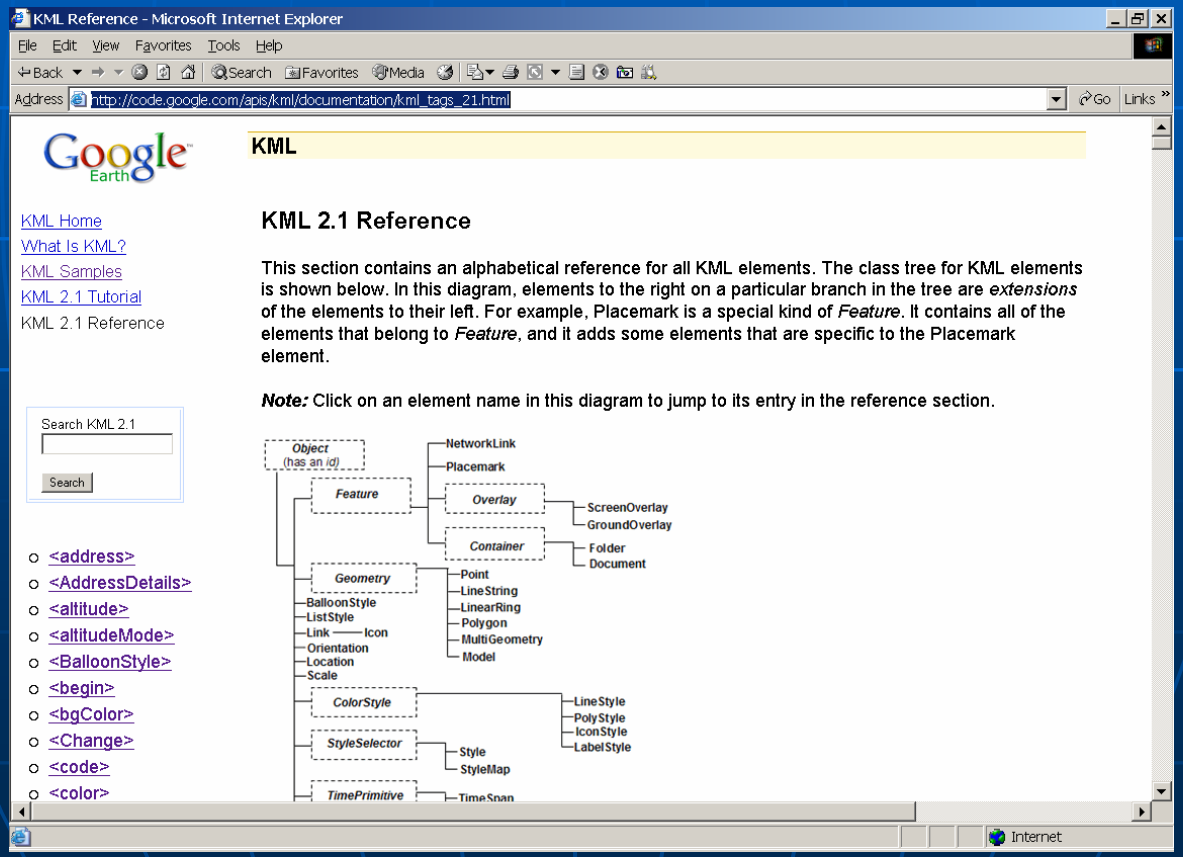
Keyhole Markup Language (KML)

- How to share KML and KMZ files...
  - you can e-mail them,
  - host them locally for sharing within a private internet, or
  - host them publicly on a web server
- Earth browsers ...
  - such as Google Earth can display KML files
    - Just as web browsers display HTML files

Keyhole Markup Language (KML)

- KML Specifications...

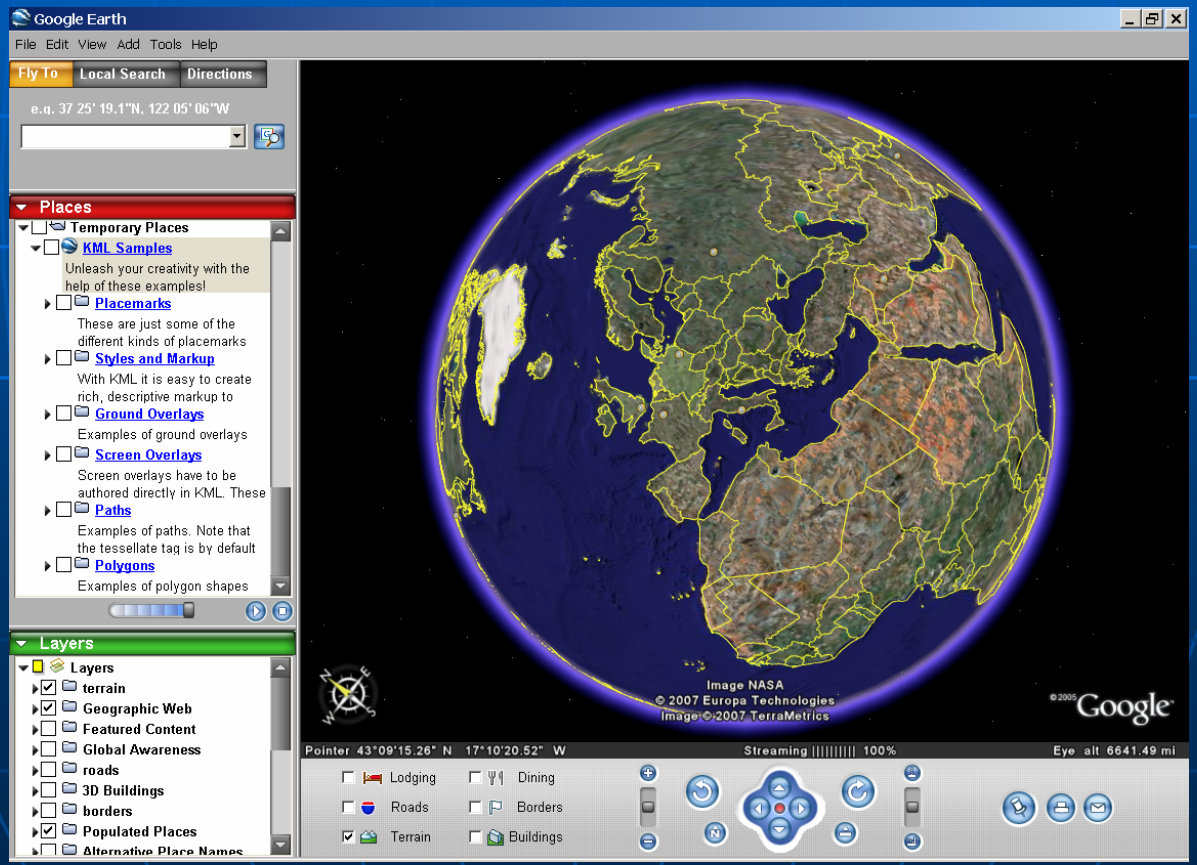
  http://code.google.com/apis/kml/documentation/kml_tags_21.html

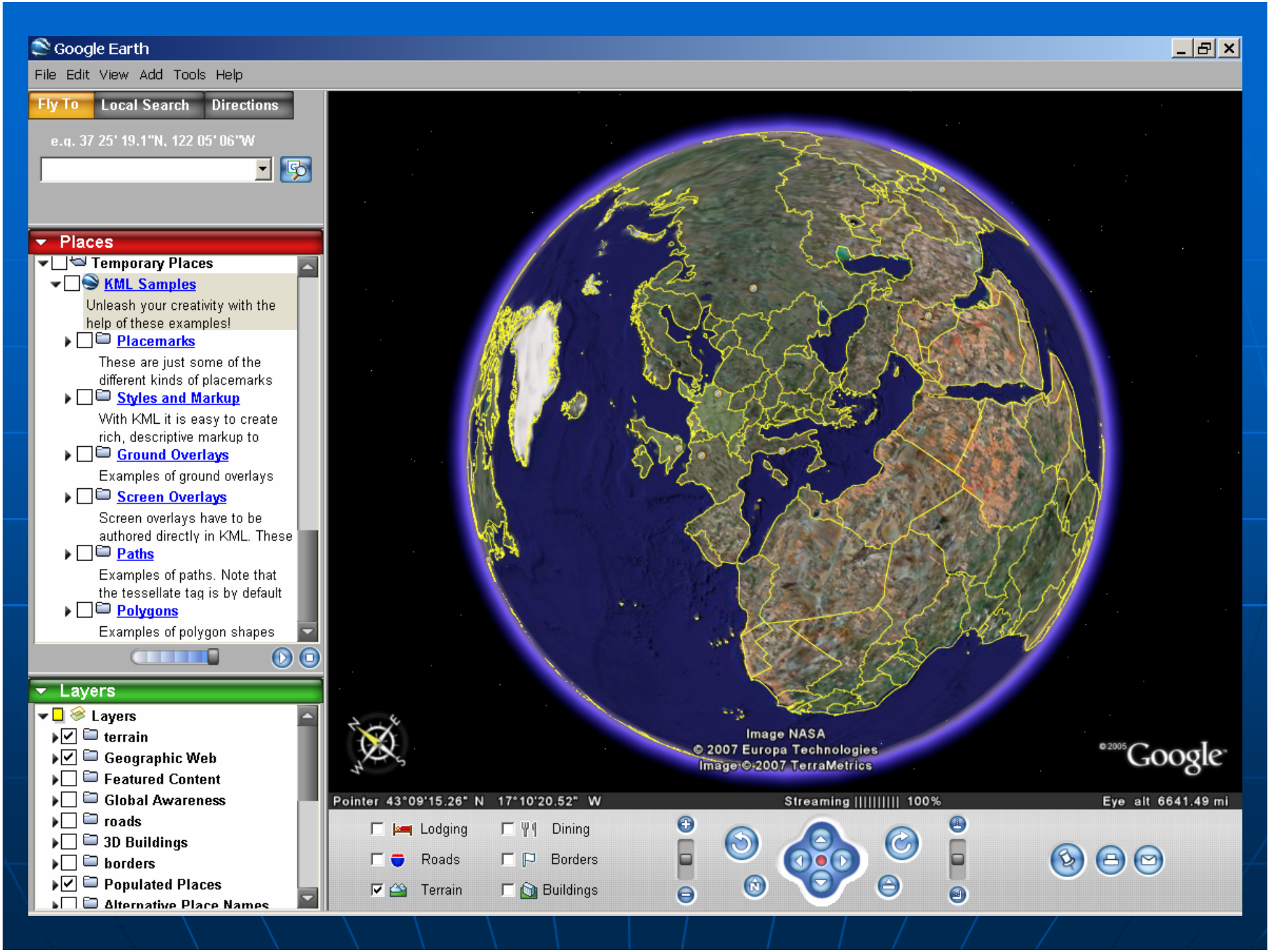


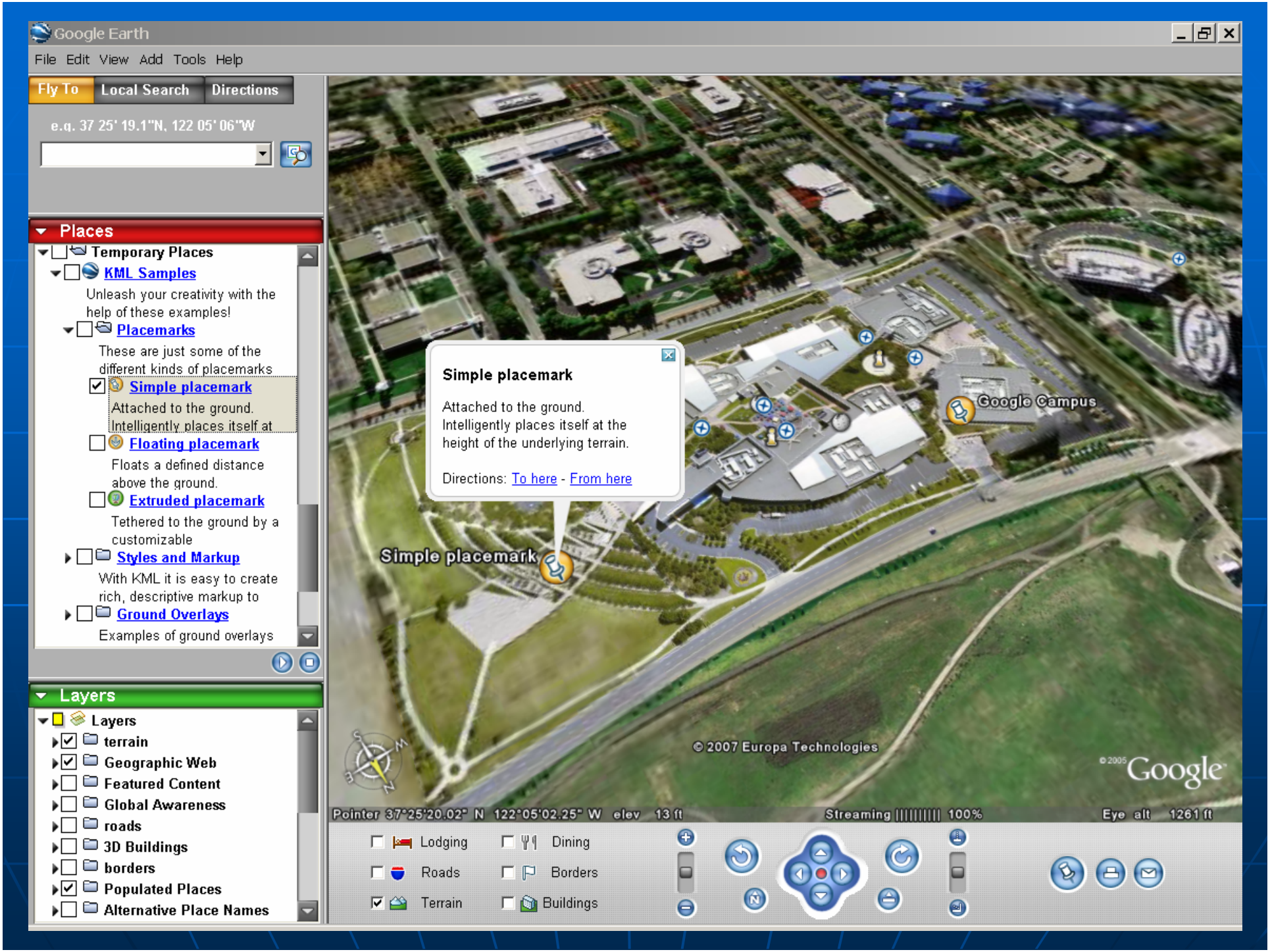
Keyhole Markup Language (KML)

- KML Samples...

http://code.google.com/apis/kml/documentation/KML_Samples.kml




Google Earth
File Edit View Add Tools Help
Fly To
Local Search
Directions
e.g. 37 25' 19.1"N, 122 05' 06"W
Places
Temporary Places
KML Samples
Unleash your creativity with the help of these examples!
Placemarks
These are just some of the different kinds of placemarks
Styles and Markup
With KML it is easy to create rich, descriptive markup to
Ground Overlays
Examples of ground overlays
Screen Overlays
Screen overlays have to be authored directly in KML. These
Paths
Examples of paths. Note that the tessellate tag is by default
Polygons
Examples of polygon shapes
Layers
Layers
terrain
Geographic Web
Featured Content
Global Awareness
roads
3D Buildings
borders
Populated Places
Alternative Place Names
Image NASA
© 2007 Europa Technologies
Image © 2007 TerraMetrics
© 2005 Google
Pointer 43°09'15.26" N 17°10'20.52" W
Streaming 100%
Eye alt 6641.49 mi
Lodging
Dining
Roads
Borders
Terrain
Buildings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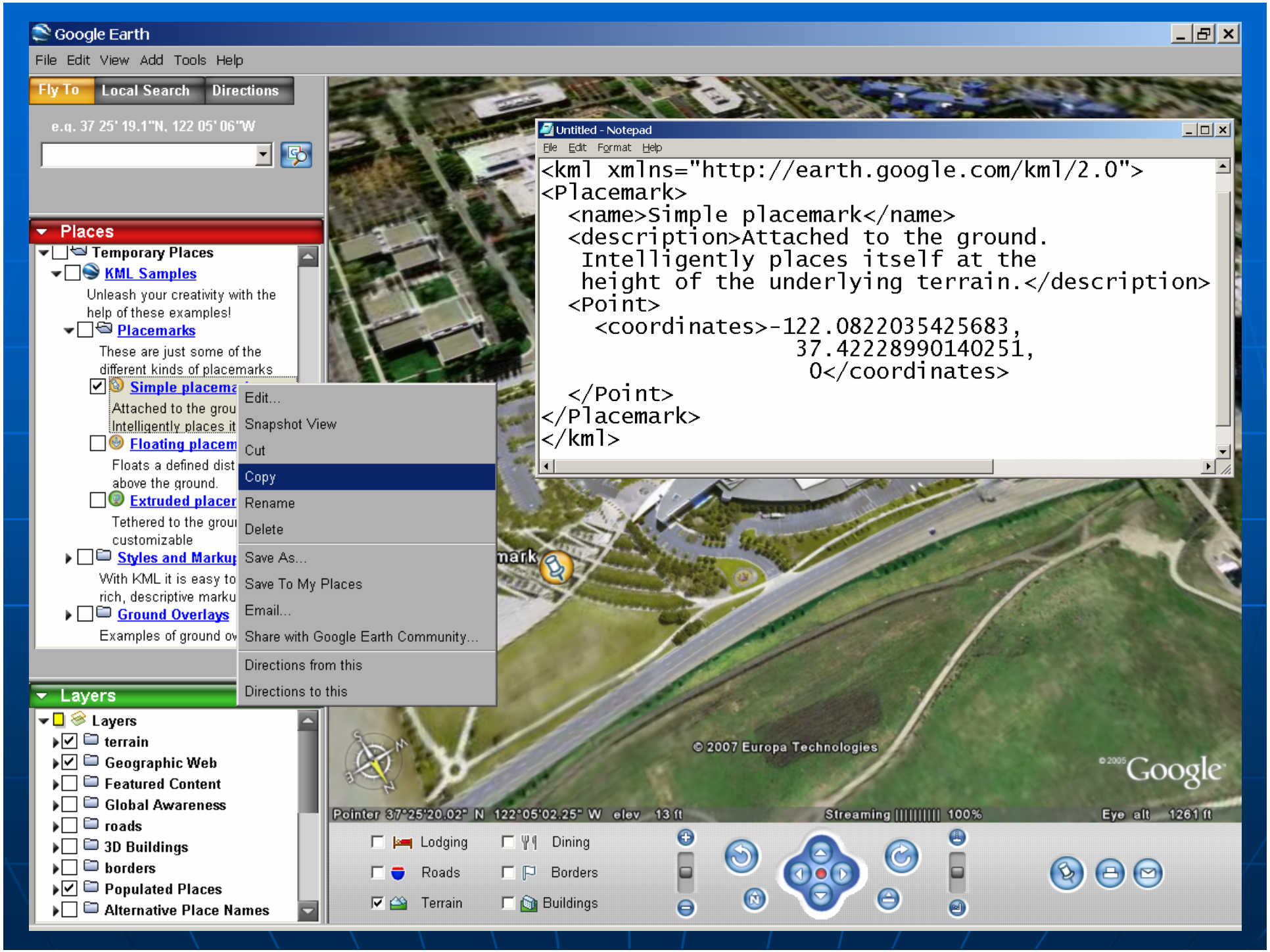
Placemarks
These are just some of the different kinds of placemarks
Simple placemark
Attached to the ground. Intelligently places itself at
Floating placemark
Floats a defined distance above the ground.
Extruded placemark
Tethered to the ground by a customizable
Styles and Markup
With KML it is easy to create rich, descriptive markup to
Ground Overlays
Examples of ground overlays
Layers
Layers
terrain
Geographic Web
Featured Content
Global Awareness
roads
3D Buildings
borders
Populated Places
Alternative Place Names
Simple placemark
Attached to the ground.
Intelligently places itself at the height of the underlying terrain.
Directions: To here - From here
Google Campus
Simple placemark
© 2007 Europa Technologies
© 2005 Google
Pointer 37°25'20.02" N 122°05'02.25" W elev 13 ft
Streaming 100%
Eye alt 1261 ft
Lodging
Dining
Roads
Borders
Terrain
Buildings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Ground Overlays
Examples of ground ov
Edit...
Snapshot View
Cut
Copy
Rename
Delete
Save As...
Save To My Places
Email...
Share with Google Earth Community...
Directions from this
Directions to this
Layers
Layers
terrain
Geographic Web
Featured Content
Global Awareness
roads
3D Buildings
borders
Populated Places
Alternative Place Names
Untitled - Notepad
File Edit Format Help
<kml xmlns="http://earth.google.com/kml/2.0">
<Placemark>
<name>Simple placemark</name>
<description>Attached to the ground.
Intelligently places itself at the
height of the underlying terrain.</description>
<Point>
<coordinates>-122.0822035425683,
37.42228990140251,
0</coordinates>
</Point>
</Placemark>
</kml>
© 2007 Europa Technologies
© 2005 Google
Pointer 37°25'20.02" N 122°05'02.25" W elev 13 ft
Streaming 100%
Eye alt 1261 ft
Lodging
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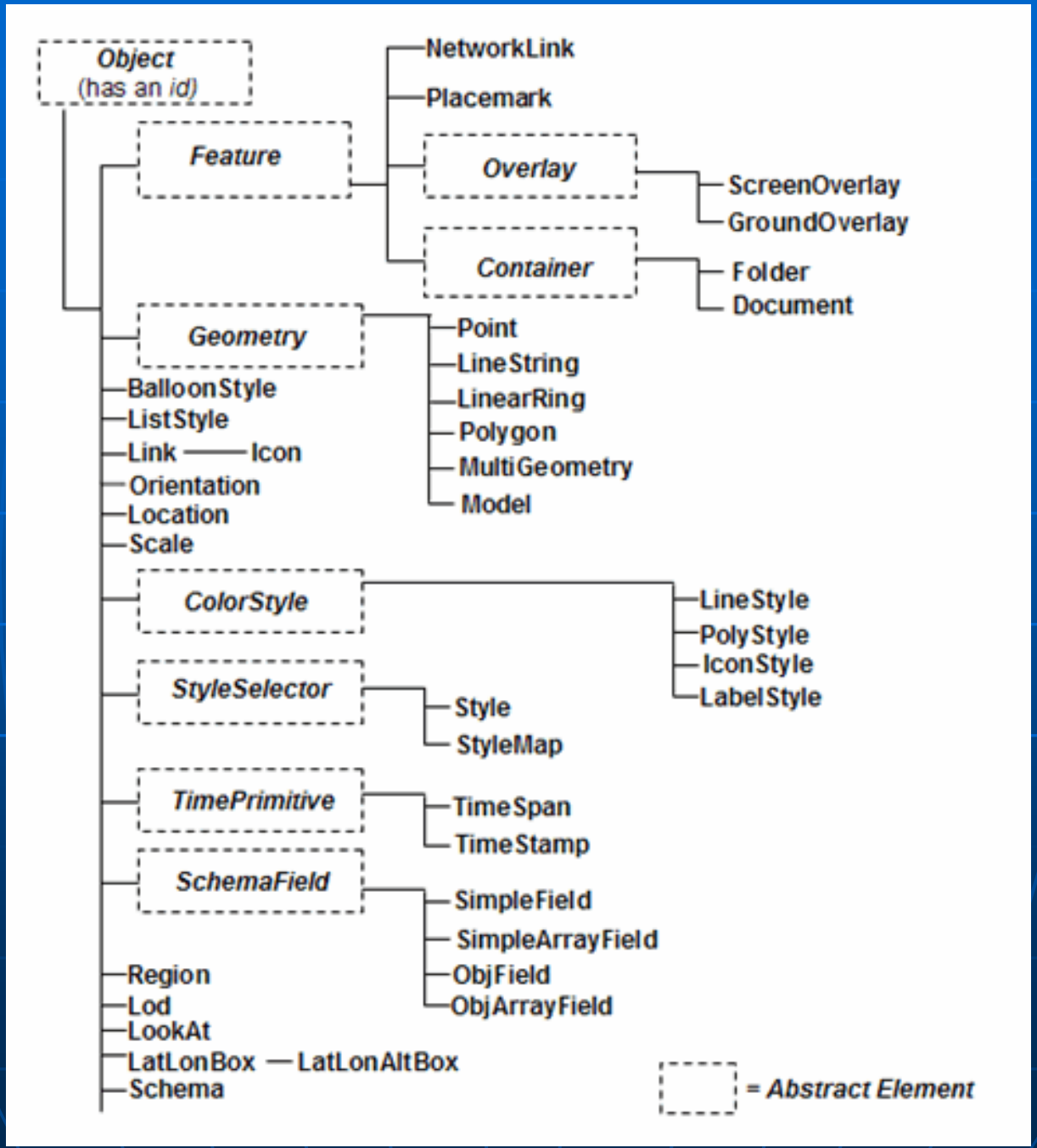
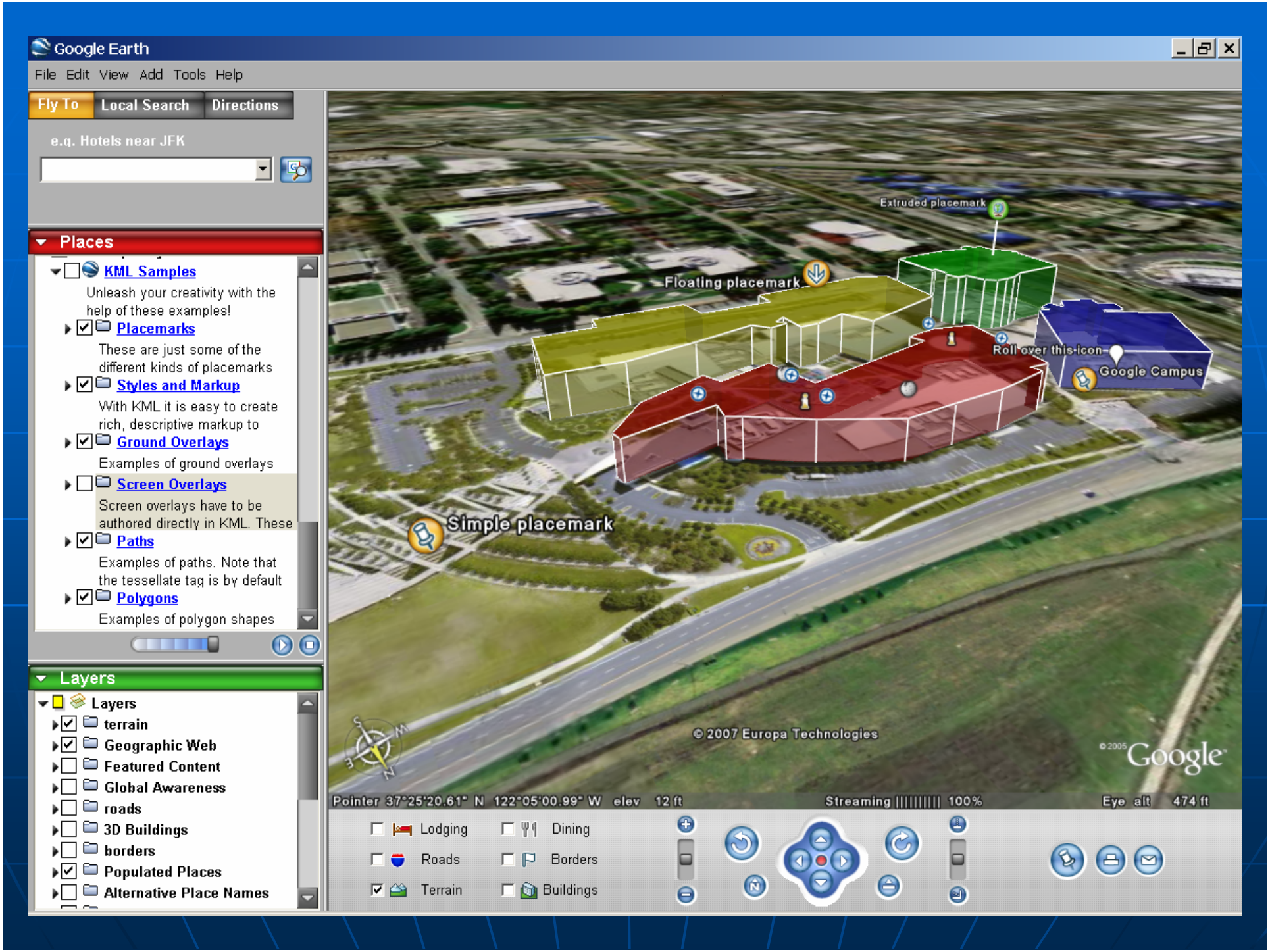

Object
(has an id)
NetworkLink
Placemark
Feature
Overlay
ScreenOverlay
GroundOverlay
Container
Folder
Document
Geometry
Point
LineString
LinearRing
Polygon
MultiGeometry
Model
BalloonStyle
ListStyle
Link
Icon
Orientation
Location
Scale
ColorStyle
LineStyle
PolyStyle
IconStyle
LabelStyle
StyleSelector
Style
StyleMap
TimePrimitive
TimeSpan
TimeStamp
SchemaField
SimpleField
SimpleArrayField
ObjField
ObjArrayField
Region
Lod
LookAt
LatLonBox
LatLonAltBox
Schema
= Abstract Element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File Edit View Add Tools Help
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e.g. Hotels near JFK
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Populated Places
Alternative Place Names
Extruded placemark
Floating placemark
Roll over this icon
Google Campus
Simple placemark
© 2007 Europa Technologies
© 2005 Google
Pointer 37°25'20.61" N 122°05'00.99" W elev 12 ft
Streaming 100%
Eye alt 474 ft
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Roads
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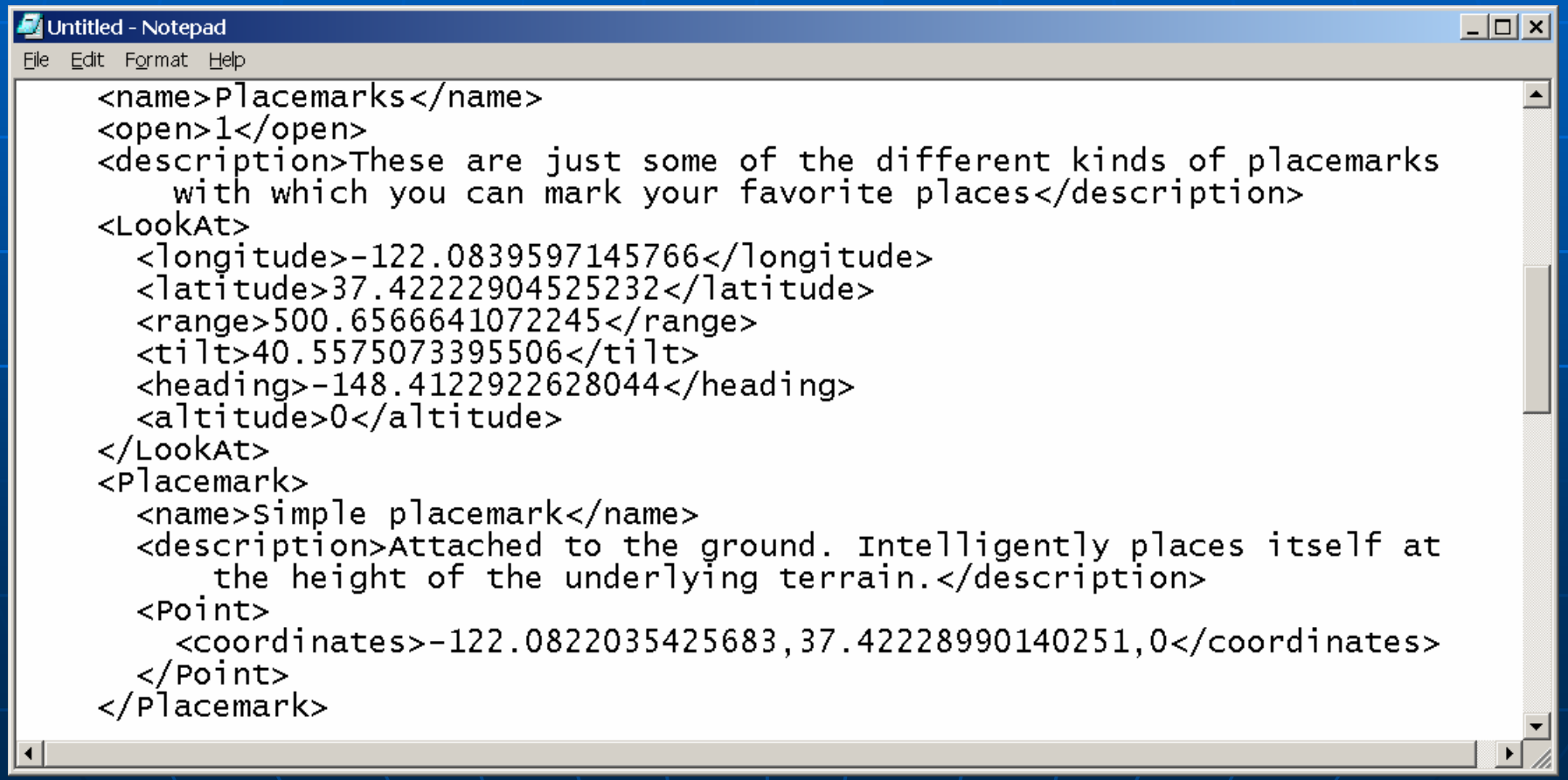
Terrain
Buildings

Keyhole Markup Language (KML)

Content + Map Symbols + View point + …



Part I: Theory

1. Publishing Maps on the Web
2. XML-based languages for Geography and Mapping

3. Web Services for Mapping

- **OGC Specifications**
  - **WMS – Web Map Service**
  - **WFS – Web Feature Service**

Web Services

- Definition...
  - ... any service that is available over the Internet
  - ... uses a standardized XML messaging system
  - ... it isn't tied to one operating system or programming language

(E. Cerami, 2005)

Web Services

- HTTP
  - Internet transfer protocol
- XML
  - Communication language
- Coupling {HTTP + XML}
  - allows the Internet to act as a communication network between applications
  - ... not just a service for sharing web applications

Web Services

- Significance...
  - Interoperability...
    - between applications, which were developed independently
- Web services standards ...

  {XML-RCP, UDDI, WSDL, SOAP ...}
  - Independent of ...
    - Programming languages
    - Operating systems
    - Platforms

Web Services for Mapping

- Web Services...
  - Provide a standardized method ...
    - of communicating between web-accessible applications
  - This is especially important ...
    - to mapping applications that use the Internet to share data

Web Services for Mapping

- Mapping web services ...
  - use similar approaches and follow some common communication protocols
  - however,
    - they are maintained independent of the web services in general
  - hence,
    - they are different from the general services a web developer may be familiar with

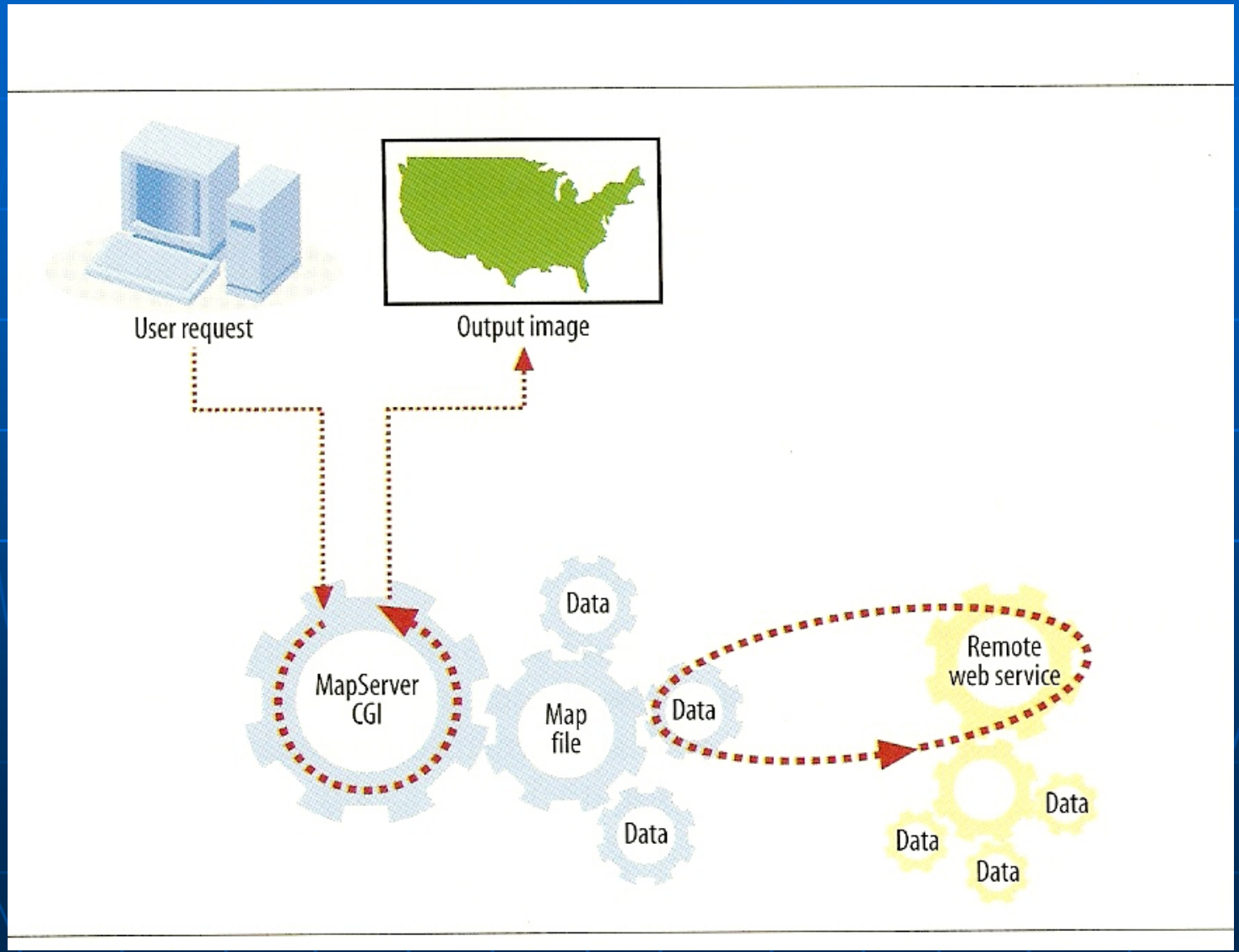
Web Services for Mapping

- All about …
  - Sharing geo-information through maps
- They fill two roles…
  1. Accessing remote data sources as **consumer**
  2. Serving up or sharing data as a **provider**

Web Services for Mapping

- Easy to use...
  - They don't require to know
    - a bunch of details about how requests are made or sent
  - Accessing a remote server ...
    - Requires some specific knowledge about the data source
      - Data layers, data format
  - Sharing your own data ...
    - Requires a few additions to the application so that others can access the data

Web Services for Mapping



OGC Specifications

- Open Geospatial Consortium

  http://opengeospatial.org

  - Develops the specifications

    { WMS, WFS, WCS, WMC, SLD, GML }
  - Focus on the specifications for sharing data

OGC Specifications

- Requests sent via URL...
  - parameters are included in the URL after a question mark (?), each separated by ampersands (&)
    - eg., “GET” method
    - Example URL:

      http://atlas.gc.ca/cgi-bin/atlaswms_en?
      REQUEST=GetCapabilities
  - Response can be ...
    - an XML document (GetCapabilities, GetFeature) or
    - an image (GetMap)

OGC Specifications

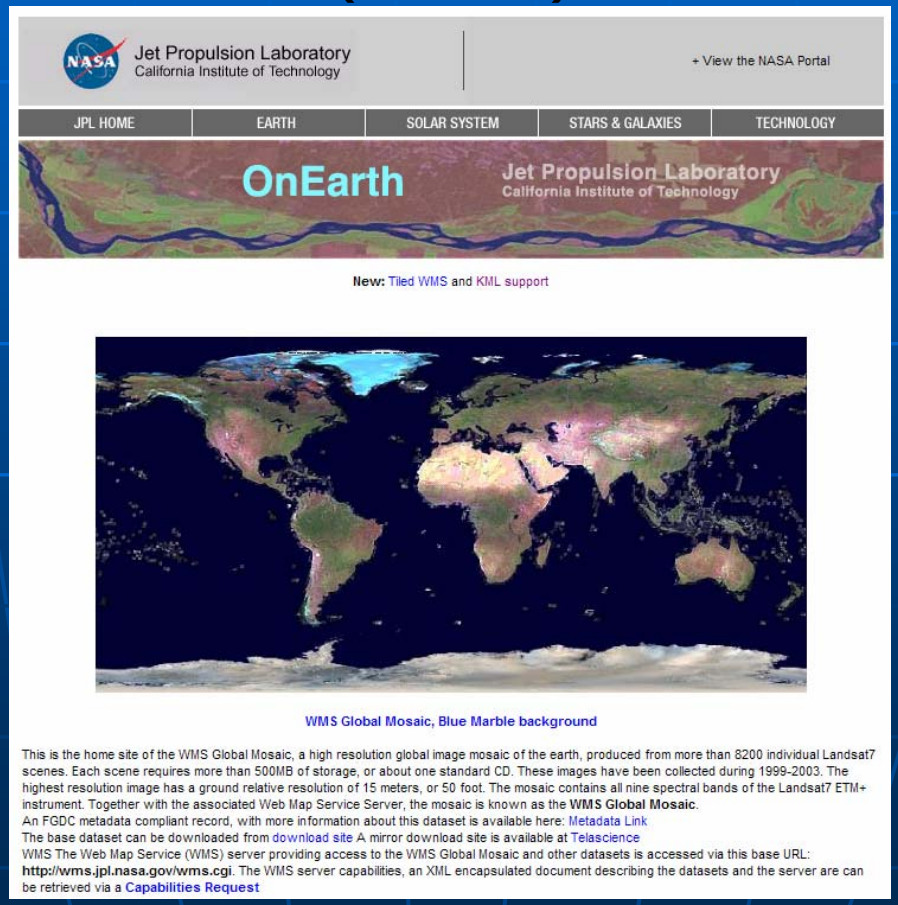
- Requests sent via URL...
  - Typical requests ...
    - **GetCapabilities**
      - What do you offer ?
    - **GetMap**
      - Give me the map as an image
    - **GetFeatures**
      - Give me the map features (as objects)
    - **GetFeatureInfo**
      - Give me the attribute values of a feature

OGC Specifications

- Web Map Service (WMS)
  - provides a way to send **map images** over the Web
  - GetMap request …
    - Requesting a map from remote sources that have a WMS available
    - a set of parameters and options must be defined (regarding the map content and look)

OGC Specifications

- Web Map Service (WMS)



http://wms.jpl.nasa.gov

OGC Specifications

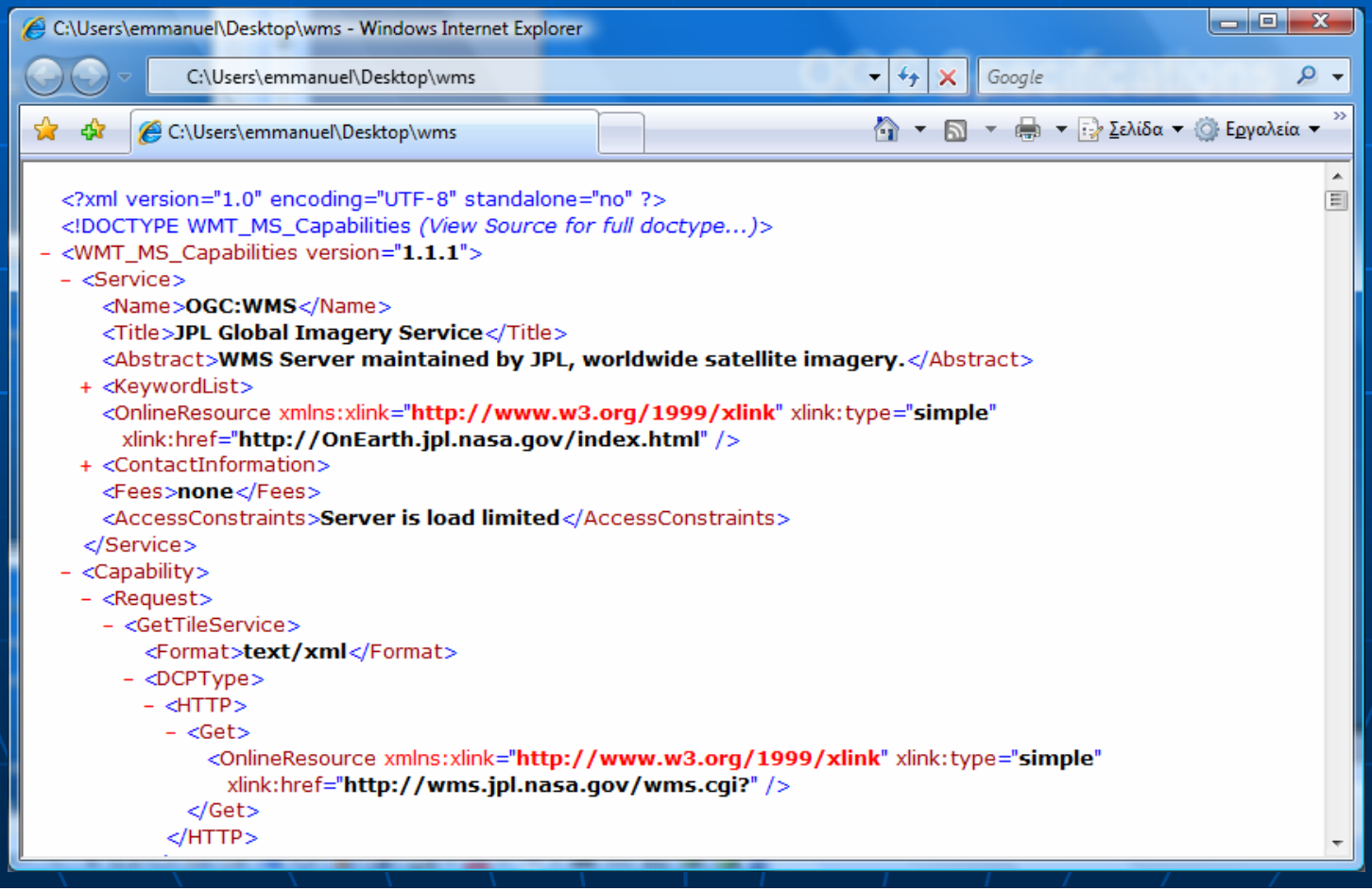
- Web Map Service (WMS)
  - GetCapabilities request ...

    http://wms.jpl.nasa.gov/wms.cgi?
    request=GetCapabilities

  - *What do you offer ???*

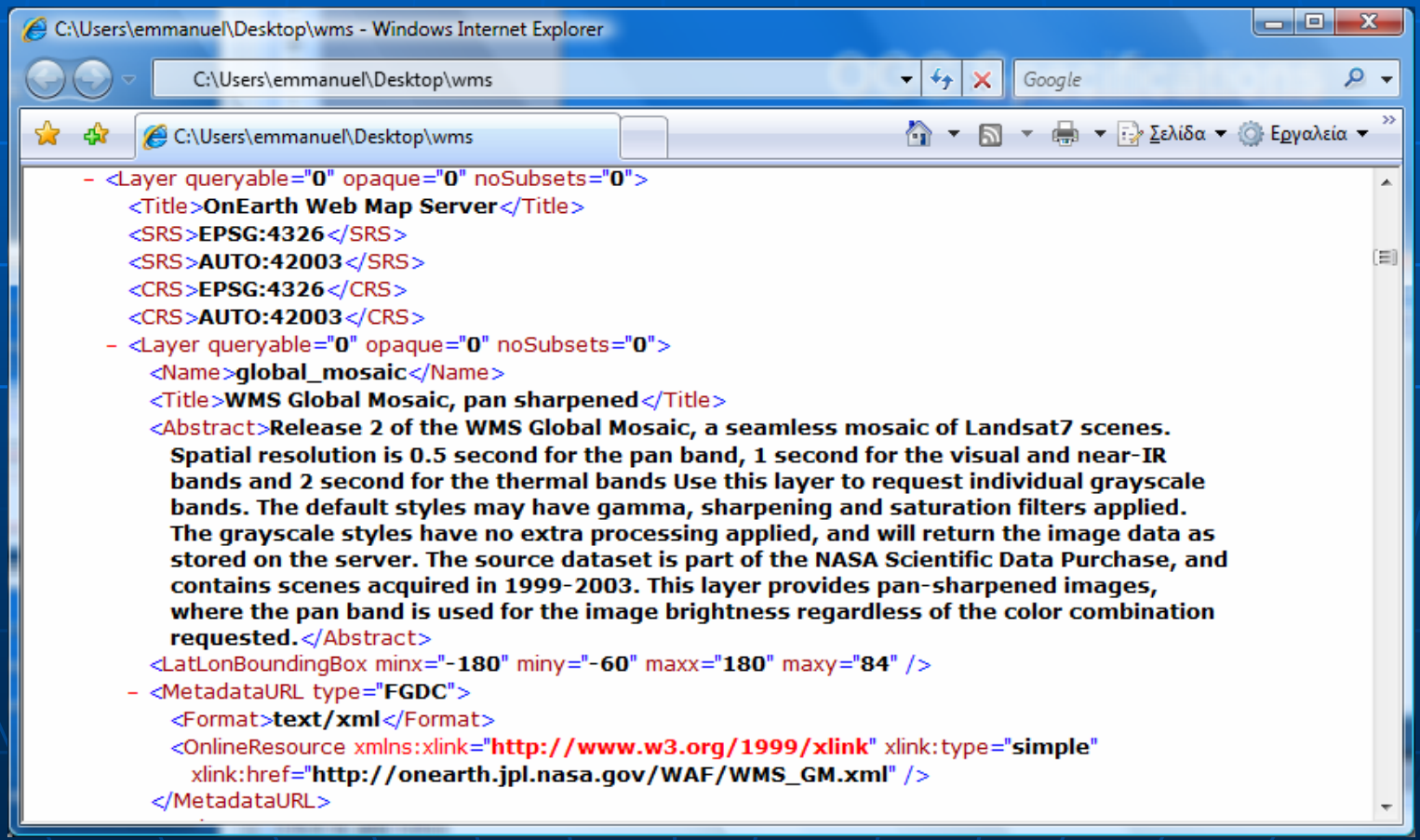
OGC Specifications

- Web Map Service (WMS)
  - GetCapabilities request …



OGC Specifications

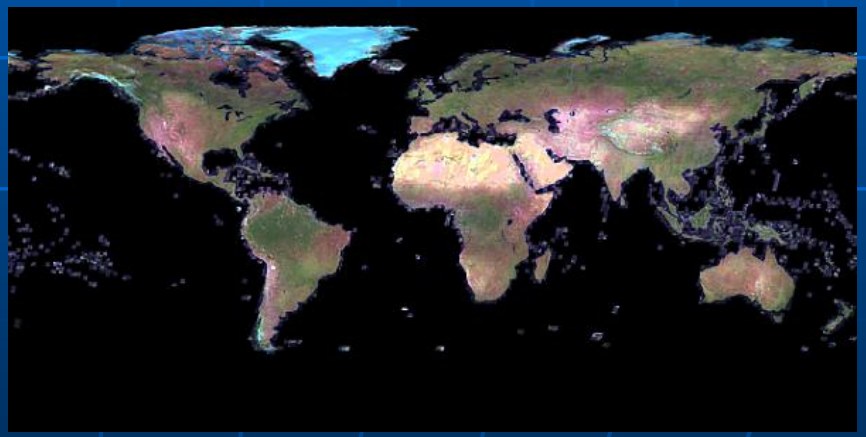
- Web Map Service (WMS)
  - GetCapabilities request …



OGC Specifications

- Web Map Service (WMS)
  - GetMap request …

http://wms.jpl.nasa.gov/wms.cgi?
request=GetMap
&service=WMS
&version=1.1.1
&srs=EPSG:4326
&format=image/jpeg
&styles=
&bbox=-180,-90,180,90
&width=600
&height=300
&layers=global_mosaic



OGC Specifications

- Web Map Service (WMS)
  - GetMap request ...

http://wms.jpl.nasa.gov/wms.cgi?
request=GetMap
&service=WMS
&version=1.1.1
&srs=EPSG:4326
&format=image/jpeg
&styles=
&bbox=23,37.5,25,38.5
&width=600
&height=300
&layers=global_mosaic

OGC Specifications

- Web Feature Service (WFS)
  - the actual **feature data** is returned to the client (in GML)
  - WMS (vs) WFS
    - WMS returns a map image
    - WFS returns geographic features (geometries and thematic data)

OGC Specifications

- Web Feature Service (WFS)

  http://map.ns.ec.gc.ca/envdat/map.aspx
  ?service=WFS
  &version=1.0.0
  &request=GetCapabilities

  - *What do you offer ???*

OGC Specifications

- Web Feature Service (WFS)

<?xml version="1.0" encoding="ISO-8859-1" ?>
-<WFS_Capabilities version="**1.0.0**" updateSequence="**0**" xmlns="**http://www.opengis.net/wfs**" xmlns:ogc="**http://www.opengis.net/ogc**" xmlns:xsi="**http://www.w3.org/2001/XMLSchema-instance**" xsi:schemaLocation="**http://www.opengis.net/wfs http://schemas.opengis.net/wfs/1.0.0/WFS-capabilities.xsd**">
<Service>
<Name>**MapServer WFS**</Name>
<Title>**Newfoundland and Labrador Water Quality Stations**</Title>
<Abstract>**ENVIRODAT is a repository of water quality information including chemical, physical, biological, and selected hydrometric data which are stored for surface, groundwater, wastewater, precipitation and various other water types**</Abstract>
...
</Service>
...
<FeatureType>
<Name>**envirodat**</Name>
<Title>**ENVIRODAT - Atlantic Region Water Quality Chemistry Database**</Title>
<SRS>**EPSG:4326**</SRS>
<LatLongBoundingBox minx="**-64.6622**" miny="**46.7594**" maxx="**-52.6808**" maxy="**55.2333**" />
<MetadataURL type="**FGDC**" format="**TXT**">**http://geodiscover.cgdi.ca/gdp/search?language=en&action=entrySummary&entryType=productCollection&entryId=14413&entryLang=en**</MetadataURL>
</FeatureType>

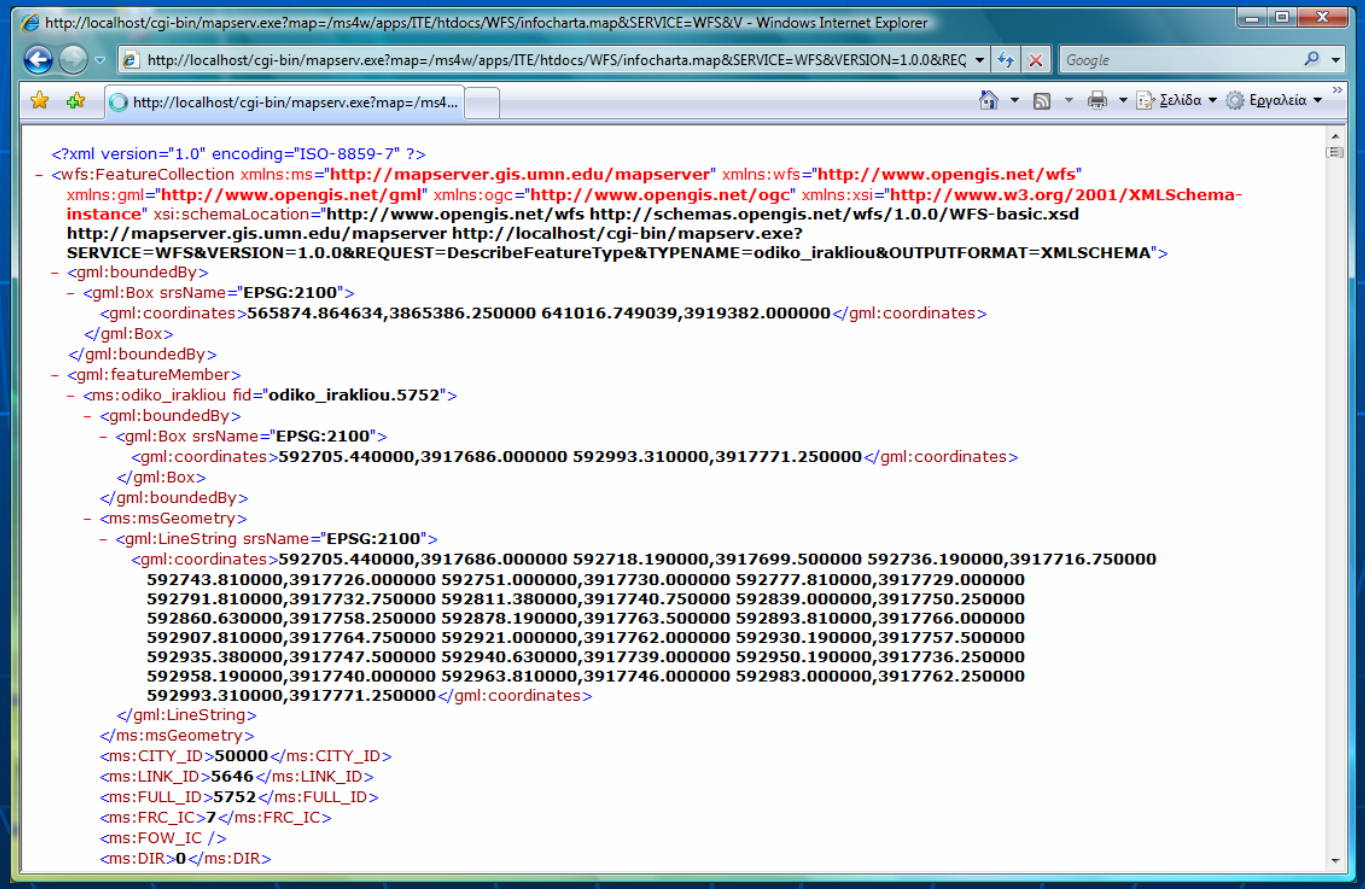
OGC Specifications

- The Web Feature Service (WFS)…
  - GetFeature request

```
http://localhost/cgi-bin/mapserv.exe?
map=/ms4w/apps/ITE/htdocs/WFS/infocharta.map&
SERVICE=WFS&VERSION=1.0.0&
REQUEST=GetFeature&
typename=odiko_irakliou
```

OGC Specifications

- The Web Feature Service (WFS)…
  - GetFeature request



Part II: Practice

4. Mapping Servers/Services on the Web

- **ICEDS Server**
- **GeoNames Web Service**
- **Google Earth's Technology**

5. Spatial Data Infrastructures (SDI)
6. The Heraklion SDI Web Services

ICEDS Server

- ICEDS...
  - Integrated CEOS European Data Server
  - CEOS...
    - Committee on Earth Observing Satellites
- Motivation / Data Sources...
  - CEOS Landsat and SRTM Project (CLASP)
  - NASA has provided to UN ...
    - SRTM (Shuttle Radar Topographer Mapper) and 3 sets of orthorectified Landsat scenes
  - The UN wish ...
    - to maximise access to these data to all of its agencies

ICEDS Server

- Web Service…
  - Developed by…
    - University College London – Dept. of Geomatics Eng.
    - ESYS plc
  - Funded by…
    - British National Space Center (BNSC)
- Functionality…
  - On-line access to …
    - a global SRTM Digital Elevation Model
    - Landsat satellite imagery for Africa and Europe
    - Other information layers

http://iceds.ge.ucl.ac.uk/

ICEDS Web Portal - Windows Internet Explorer

http://iceds.ge.ucl.ac.uk/

Google

ICEDS Web Portal

Σελίδα Εργαλεία

ICEDS - Integrated CEOS European Data Server

UCL

Welcome to the Integrated CEOS European Data Server (ICEDS)

A demonstration service provided by University College London and ESYS plc, funded by the British National Space Centre, serving global and continental-scale, full-resolution geographic information, particularly for Europe and Africa.

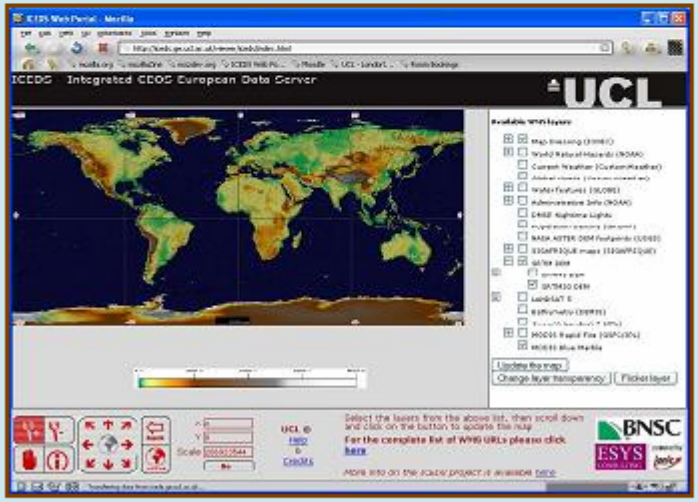
Introduction

ESYS plc and the Department of Geomatic Engineering at University College London (UCL) have been funded by the British National Space Centre (BNSC) to develop a web GIS service to serve global geographic data derived from remote sensing datasets. Funding was provided as part of the BNSC International Co-operation Programme 2 (ICP-2).

Particular aims of the project have been to:

1. use Open Geospatial Consortium (OGC, formerly OpenGIS Consortium) technologies for map and data serving;
2. serve datasets for Europe and Africa, particularly Landsat TM and Shuttle Radar Topography Mission (SRTM) digital elevation model (DEM) data;
3. provide a website giving access to the served data;
4. provide software scripts, etc., and a document reporting the data processing and software set-up methods developed during the project.

ICEDS Web GIS service



There are three methods for accessing the ICEDS service:

1. through a Web interface, allowing you to browse the datasets held on ICEDS and served through Web Map Services (WMS - OGC map portrayal services);

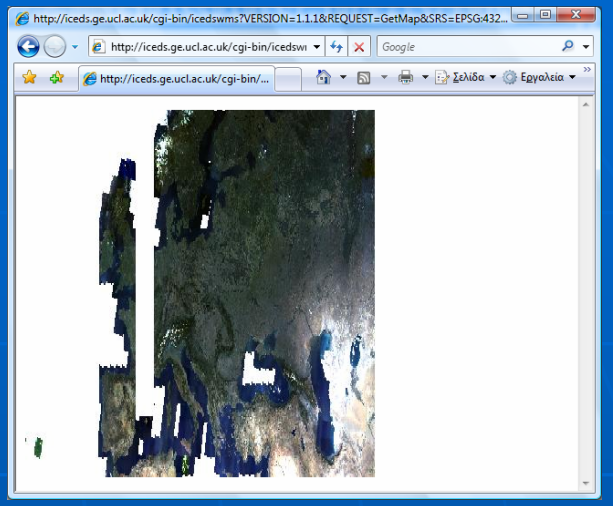
ICEDS Server

- RAID Server
  - 1.7TB capacity; dual Athlon MP 2400+ processors; 1 Gb of RAM
- Mandrake Linux 9
- Apache Web Server
  - Tomcat servlet container
- UMN MapServer (ver 4.4.1) (OSGeo)
- Ionic RedSpider web mapping s/w
  - Commercial package

ICEDS Server

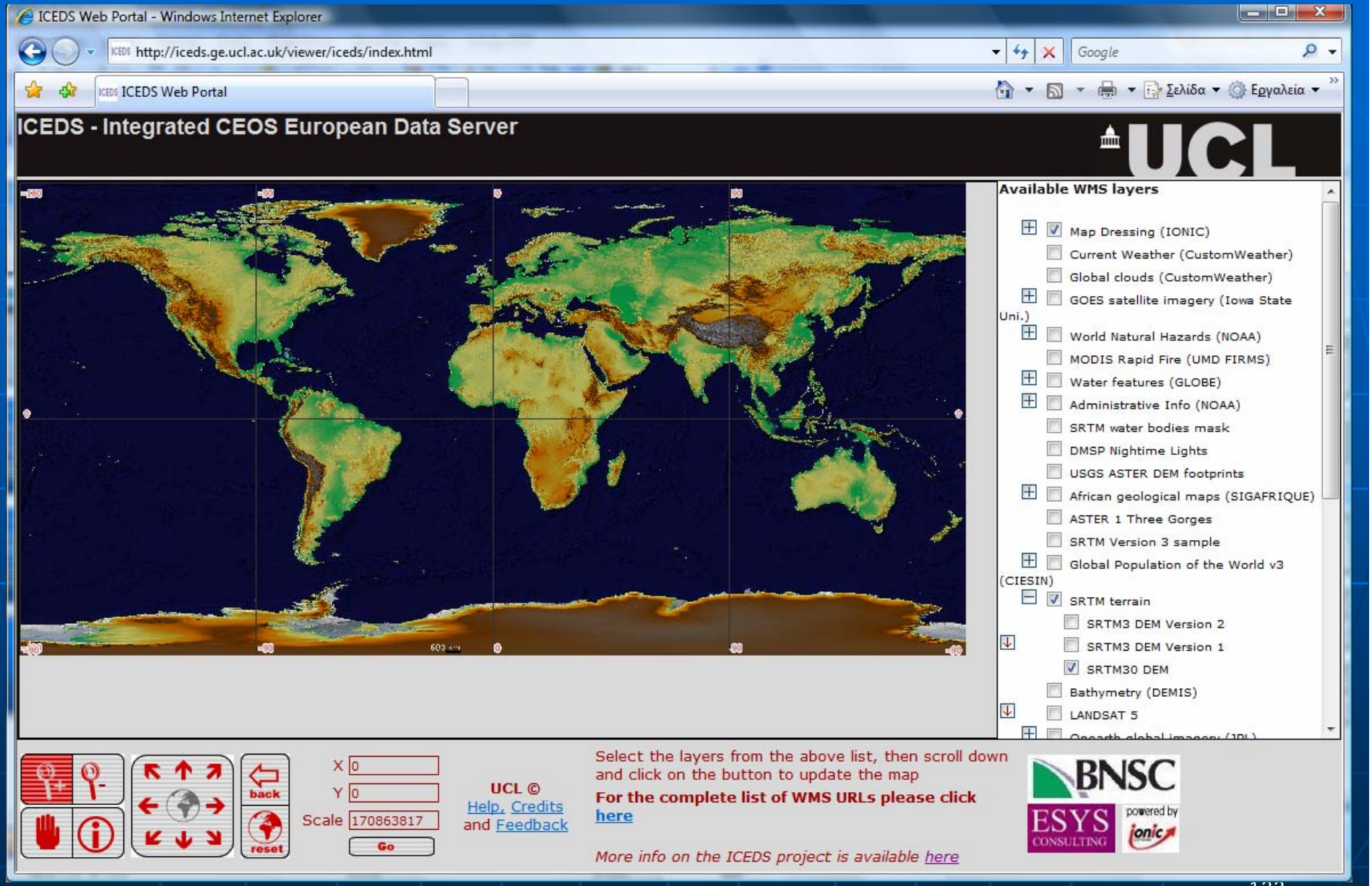
- Purely OGC-based services
  - Hence separation of client and server(s)
- ICEDS client …
  - based on Ionic's GAF client
  - HTML + Javascript only
- Good browser compatibility…
  - PC & Mac IE, Mozilla/Firefox/Seamonkey, Mac Safari

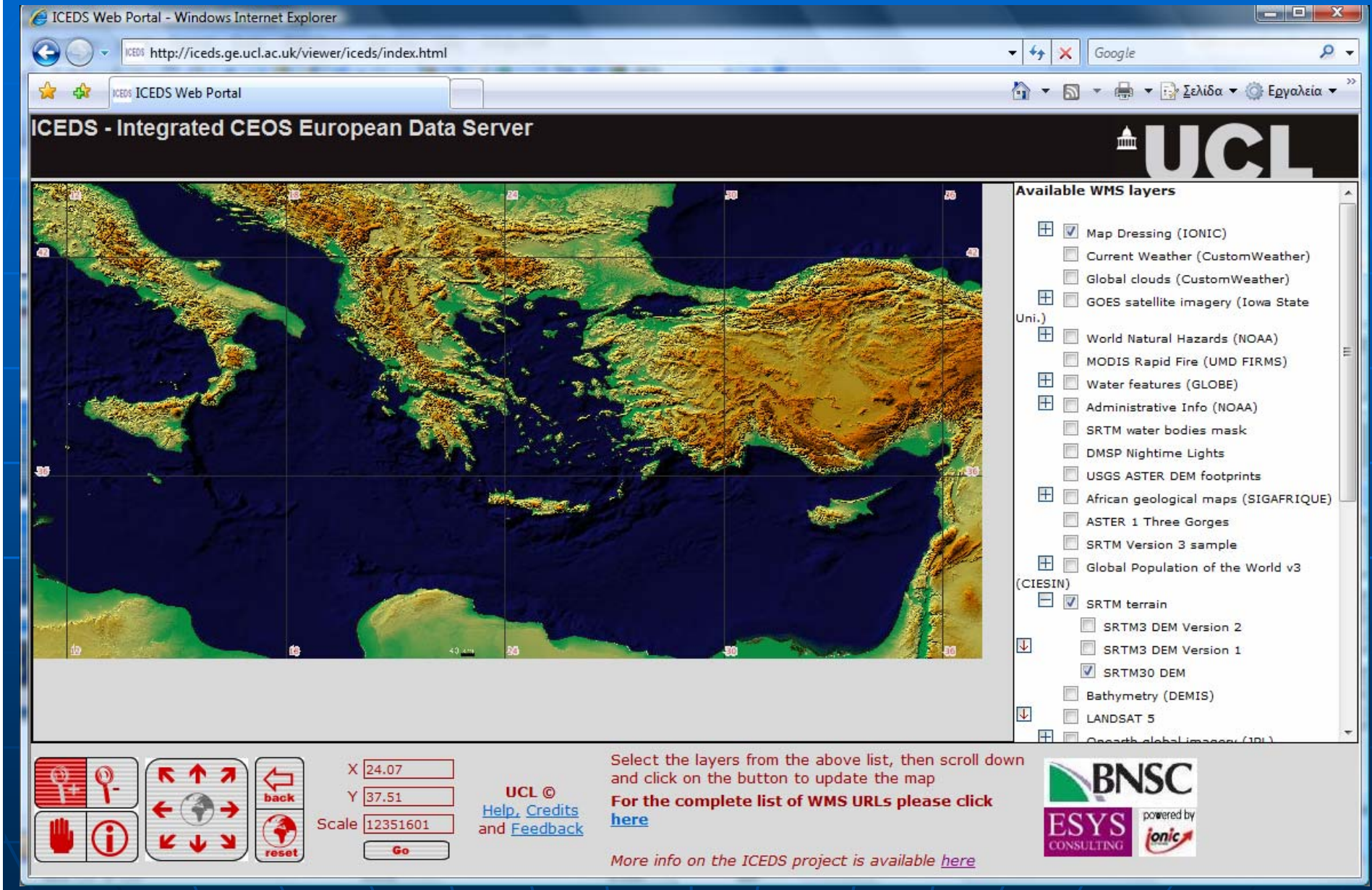
ICEDS Server



- Typical WMS request

http://iceds.ge.ucl.ac.uk/cgi-bin/icedswms?
VERSION=1.1.1&
REQUEST=GetMap&
SRS=EPSG:4326&
BBOX=-30,35,112.86,65&
WIDTH=600&HEIGHT=420&
LAYERS=LANDSAT5&
FORMAT=image/jpeg&BGCOLOR=0xffffff&
TRANSPARENT=TRUE&
EXCEPTIONS=application/vnd.ogc.se_inimage


ICEDS Web Portal - Windows Internet Explorer
http://iceds.ge.ucl.ac.uk/viewer/iceds/index.html
ICEDS Web Portal
ICEDS - Integrated CEOS European Data Server
UCL
Available WMS layers
Map Dressing (IONIC)
Current Weather (CustomWeather)
Global clouds (CustomWeather)
GOES satellite imagery (Iowa State Uni.)
World Natural Hazards (NOAA)
MODIS Rapid Fire (UMD FIRMS)
Water features (GLOBE)
Administrative Info (NOAA)
SRTM water bodies mask
DMSP Nightime Lights
USGS ASTER DEM footprints
African geological maps (SIGAFRIQUE)
ASTER 1 Three Gorges
SRTM Version 3 sample
Global Population of the World v3 (CIESIN)
SRTM terrain
SRTM3 DEM Version 2
SRTM3 DEM Version 1
SRTM30 DEM
Bathymetry (DEMIS)
LANDSAT 5
back
reset
X 0
Y 0
Scale 170863817
Go
UCL ©
Help, Credits and Feedback
Select the layers from the above list, then scroll down and click on the button to update the map
For the complete list of WMS URLs please click here
More info on the ICEDS project is available here
BNSC
ESYS CONSULTING
powered by ionic


ICEDS Web Portal - Windows Internet Explorer
http://iceds.ge.ucl.ac.uk/viewer/iceds/index.html
Google
ICEDS Web Portal
Σελίδα
Εργαλεία
ICEDS - Integrated CEOS European Data Server
UCL
Available WMS layers
Map Dressing (IONIC)
Current Weather (CustomWeather)
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SRTM water bodies mask
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ASTER 1 Three Gorges
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SRTM3 DEM Version 1
SRTM30 DEM
Bathymetry (DEMIS)
LANDSAT 5
back
reset
X 24.07
Y 37.51
Scale 12351601
Go
UCL ©
Help, Credits and Feedback
Select the layers from the above list, then scroll down and click on the button to update the map
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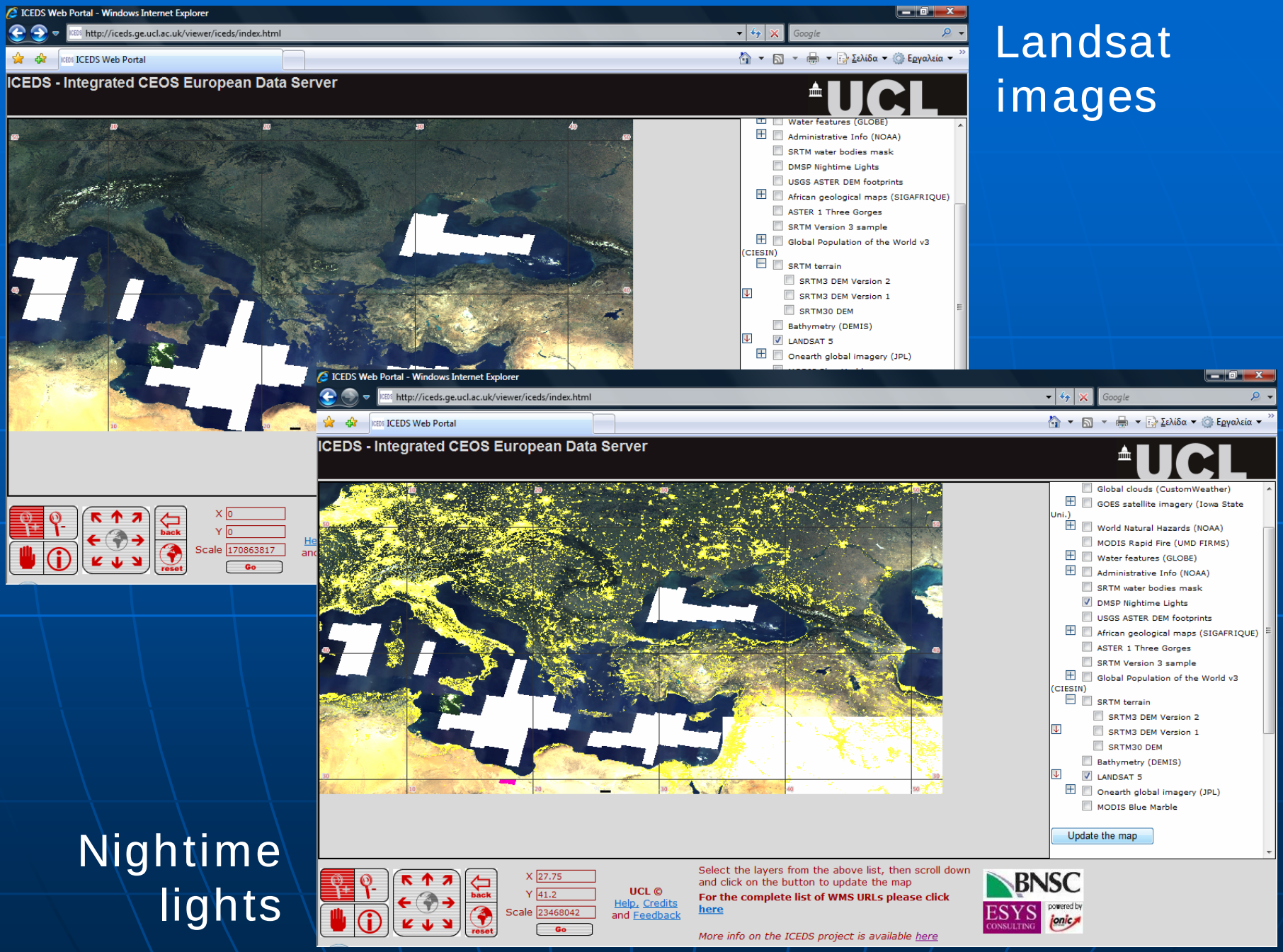
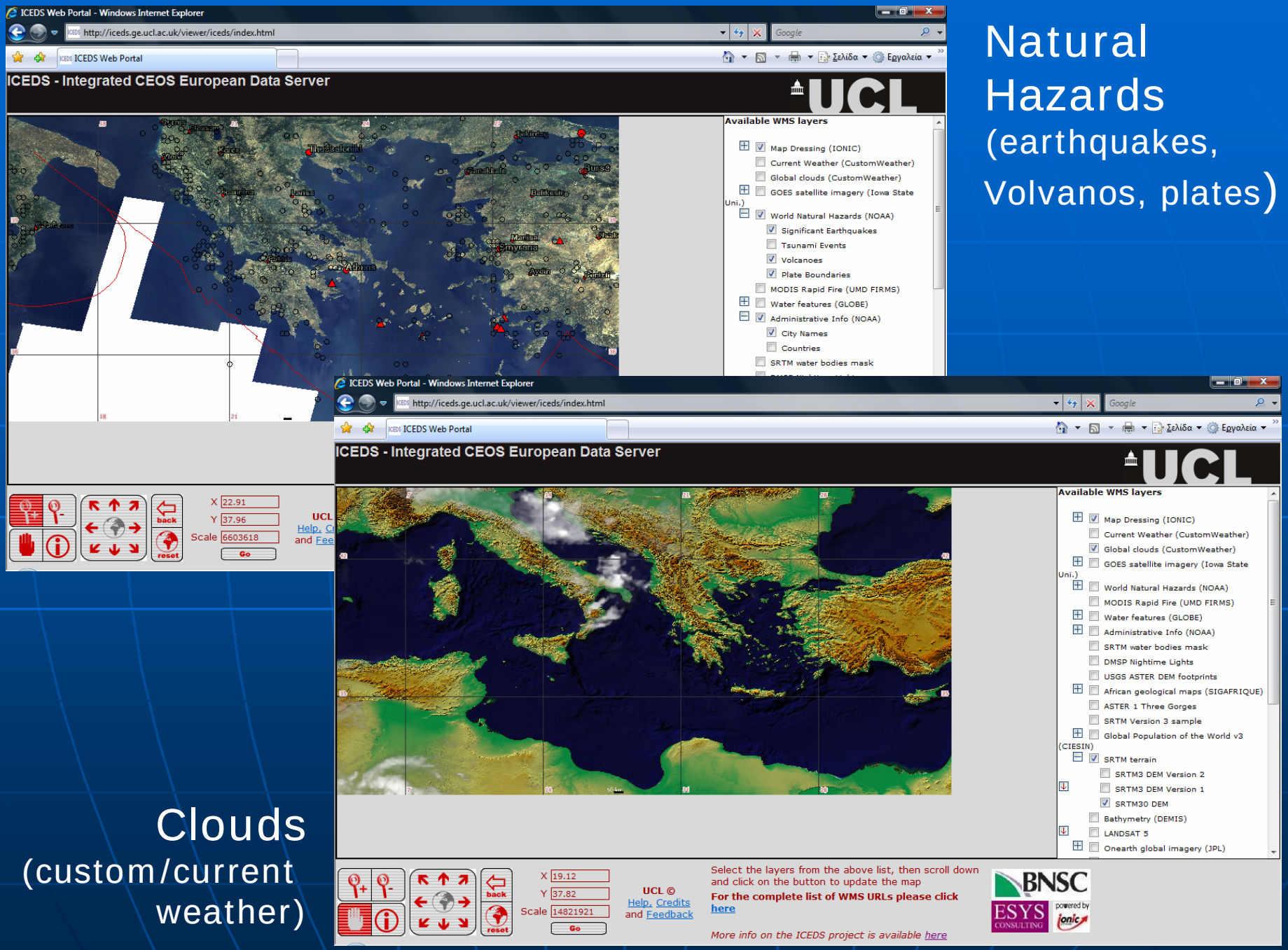
BNSC
ESYS CONSULTING
powered by ionic



Landsat images

Nightime lights



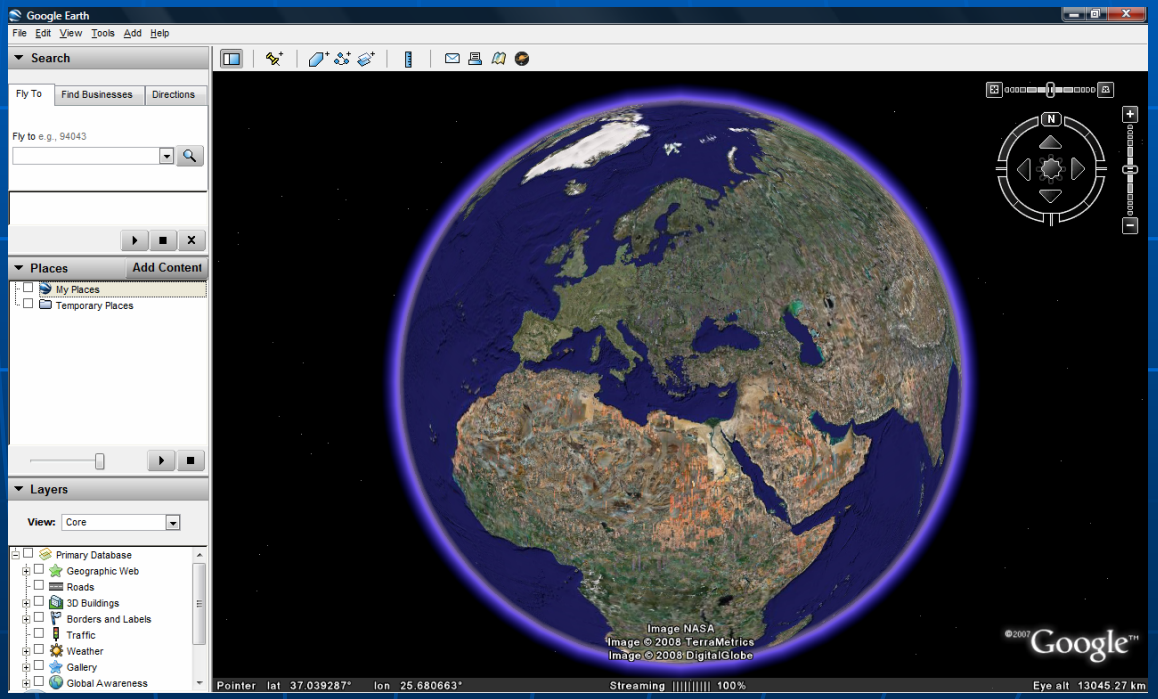
Natural Hazards (earthquakes, Volvanos, plates)

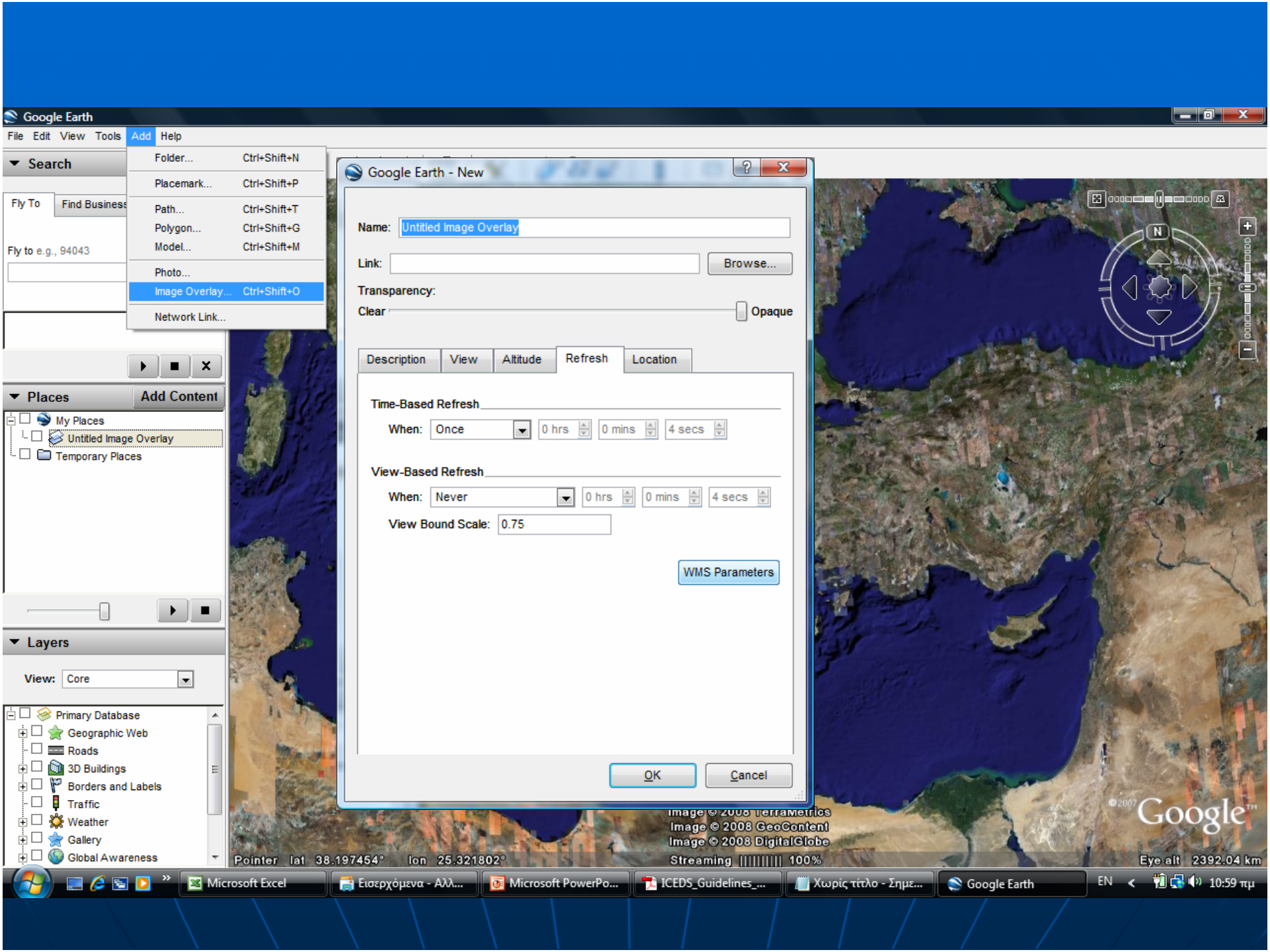
Clouds (custom/current weather)

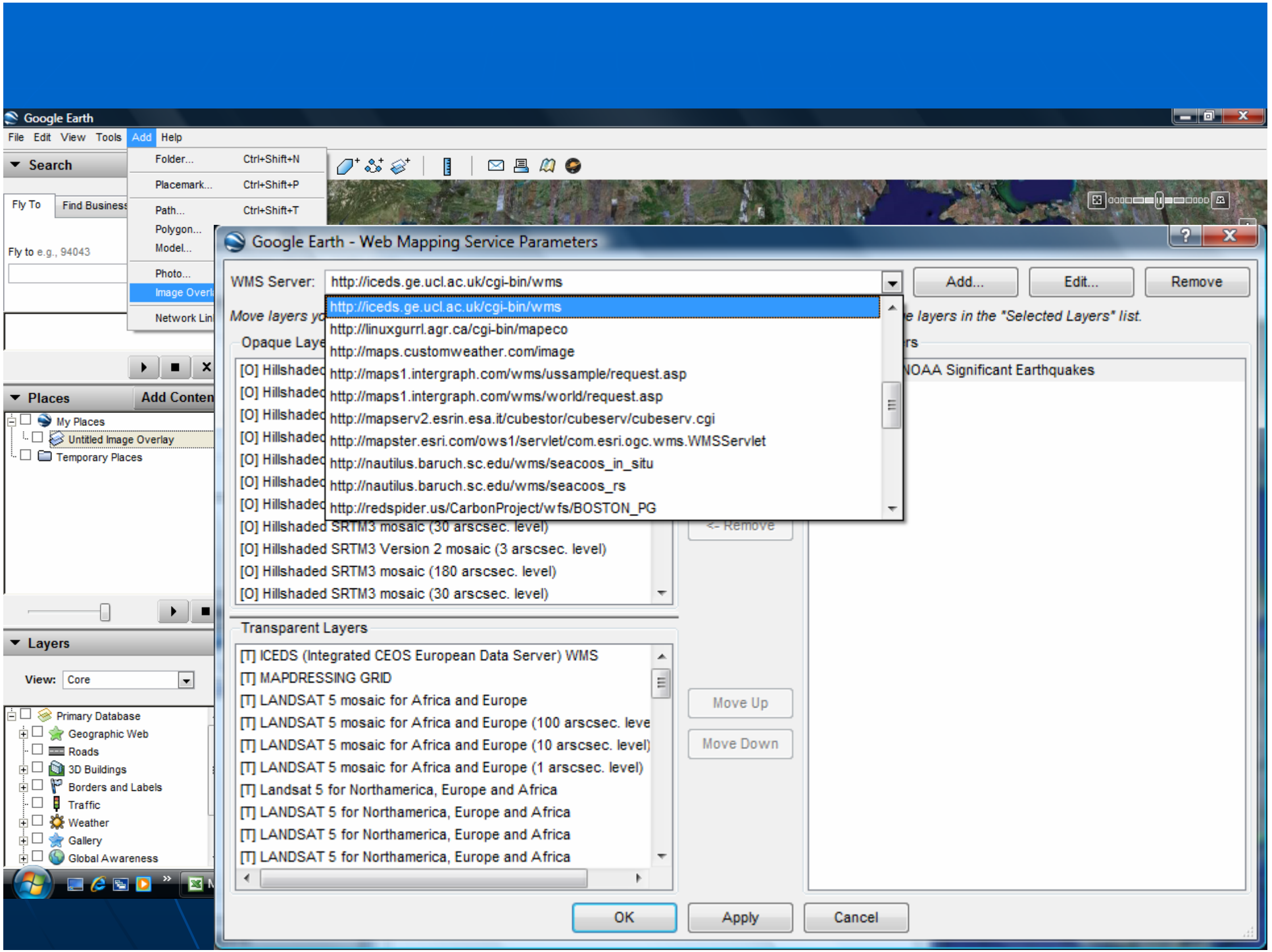
ICEDS Server & GE

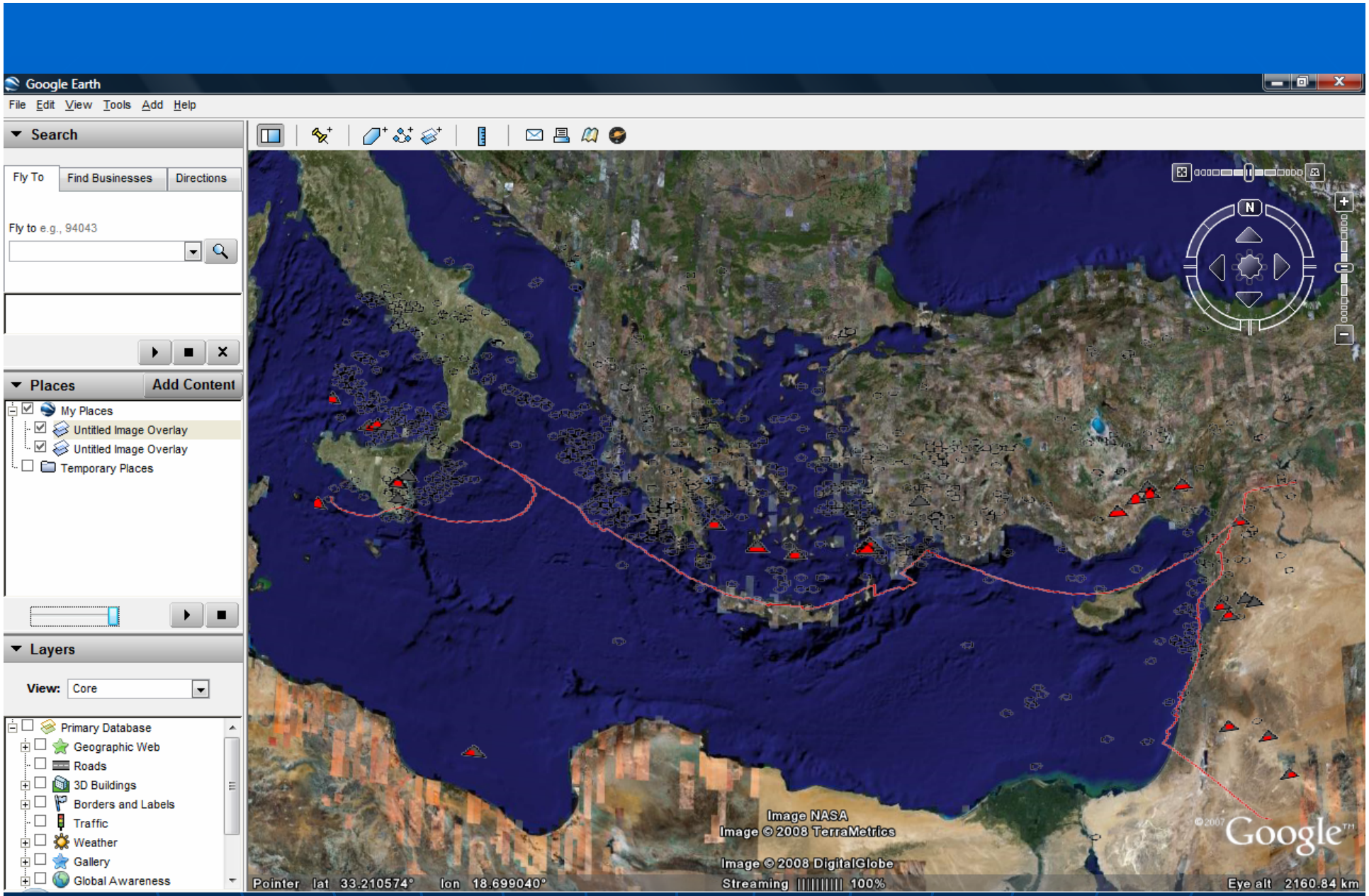
- Add ICEDS layers to Google Earth

Add >
Image Overlay >
WMS Layer

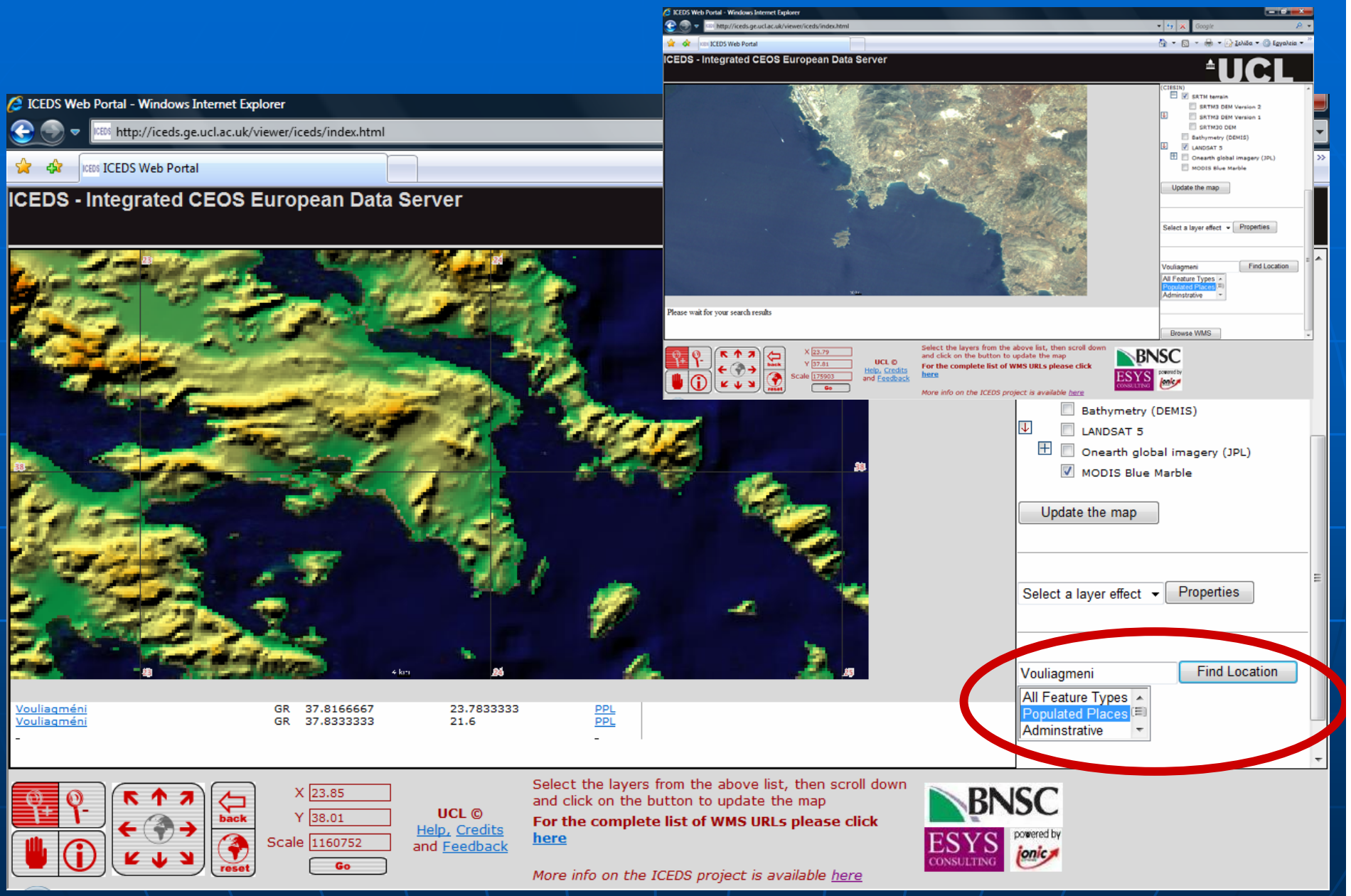



Google Earth
File Edit View Tools Add Help
Search
Fly To
Find Business
Fly to e.g., 94043
Folder... Ctrl+Shift+N
Placemark... Ctrl+Shift+P
Path... Ctrl+Shift+T
Polygon... Ctrl+Shift+G
Model... Ctrl+Shift+M
Photo...
Image Overlay... Ctrl+Shift+O
Network Link...
Places
Add Content
My Places
Untitled Image Overlay
Temporary Places
Layers
View: Core
Primary Database
Geographic Web
Roads
3D Buildings
Borders and Labels
Traffic
Weather
Gallery
Global Awareness
Google Earth - New
Name: Untitled Image Overlay
Link:
Browse...
Transparency:
Clear
Opaque
Description
View
Altitude
Refresh
Location
Time-Based Refresh
When: Once
0 hrs
0 mins
4 secs
View-Based Refresh
When: Never
0 hrs
0 mins
4 secs
View Bound Scale: 0.75
WMS Parameters
OK
Cancel
Image © 2008 TerraMetrics
Image © 2008 GeoContent
Image © 2008 DigitalGlobe
Streaming 100%
Pointer lat 38.197454° lon 25.321802°
Eye alt 2392.04 km
Google
Microsoft Excel
Microsoft PowerPo...
ICEDS_Guidelines_...
Google Earth
EN
10:59 πμ


Google Earth
File Edit View Tools Add Help
Folder... Ctrl+Shift+N
Placemark... Ctrl+Shift+P
Path... Ctrl+Shift+T
Polygon...
Model...
Photo...
Image Overl
Network Lin
Search
Fly To
Find Business
Fly to e.g., 94043
Places
Add Conten
My Places
Untitled Image Overlay
Temporary Places
Layers
View: Core
Primary Database
Geographic Web
Roads
3D Buildings
Borders and Labels
Traffic
Weather
Gallery
Global Awareness
Google Earth - Web Mapping Service Parameters
WMS Server: http://iceds.ge.ucl.ac.uk/cgi-bin/wms
Add...
Edit...
Remove
http://iceds.ge.ucl.ac.uk/cgi-bin/wms
http://linuxgurrl.agr.ca/cgi-bin/mapeco
http://maps.customweather.com/image
http://maps1.intergraph.com/wms/ussample/request.asp
http://maps1.intergraph.com/wms/world/request.asp
http://mapserv2.esrin.esa.it/cubestor/cubeserv/cubeserv.cgi
http://mapster.esri.com/ows1/servlet/com.esri.ogc.wms.WMSServlet
http://nautilus.baruch.sc.edu/wms/seacoos_in_situ
http://nautilus.baruch.sc.edu/wms/seacoos_rs
http://redspider.us/CarbonProject/wfs/BOSTON_PG
Move layers yo
e layers in the "Selected Layers" list.
Opaque Laye
rs
[O] Hillshaded
[O] Hillshaded SRTM3 mosaic (30 arscsec. level)
[O] Hillshaded SRTM3 Version 2 mosaic (3 arscsec. level)
[O] Hillshaded SRTM3 mosaic (180 arscsec. level)
[O] Hillshaded SRTM3 mosaic (30 arscsec. level)
NOAA Significant Earthquakes
<- Remove
Transparent Layers
[T] ICEDS (Integrated CEOS European Data Server) WMS
[T] MAPDRESSING GRID
[T] LANDSAT 5 mosaic for Africa and Europe
[T] LANDSAT 5 mosaic for Africa and Europe (100 arscsec. leve
[T] LANDSAT 5 mosaic for Africa and Europe (10 arscsec. level)
[T] LANDSAT 5 mosaic for Africa and Europe (1 arscsec. level)
[T] Landsat 5 for Northamerica, Europe and Africa
[T] LANDSAT 5 for Northamerica, Europe and Africa
[T] LANDSAT 5 for Northamerica, Europe and Africa
[T] LANDSAT 5 for Northamerica, Europe and Africa
Move Up
Move Down
OK
Apply
Cancel



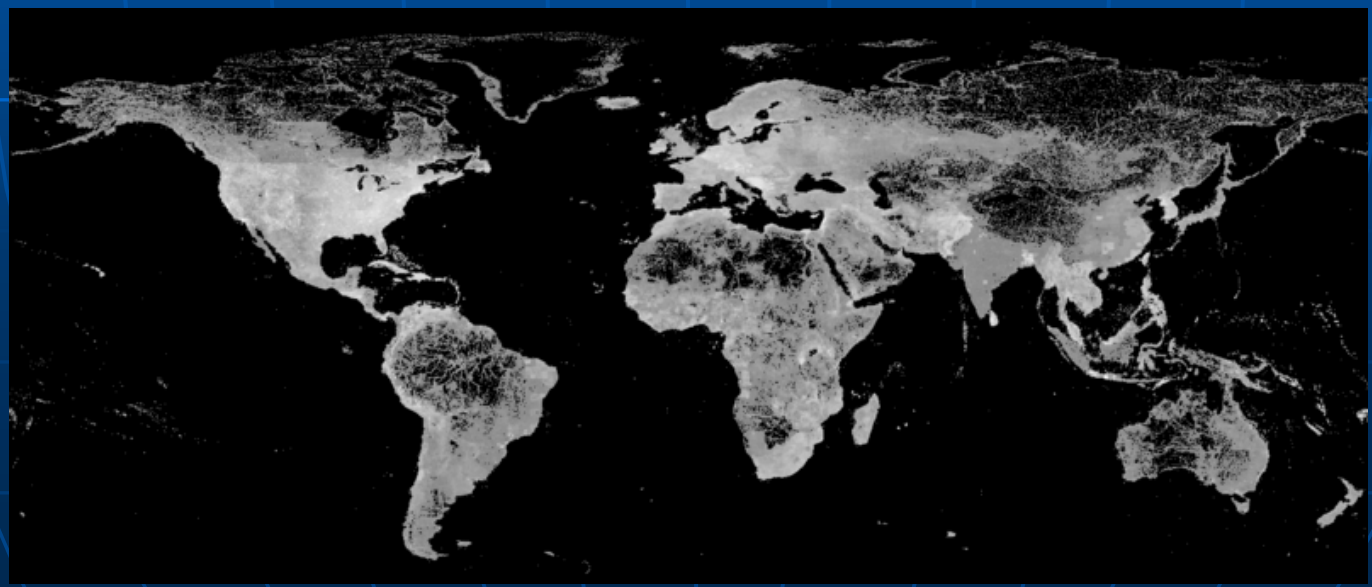
Earthquakes, Volcanos and Plate Boundaries



The gazetteer tool

GeoNames Web Service

- Feature Density Map ...
  - bright parts
    - high density areas (lot of features per km²)
  - dark parts
    - regions with no or only few features



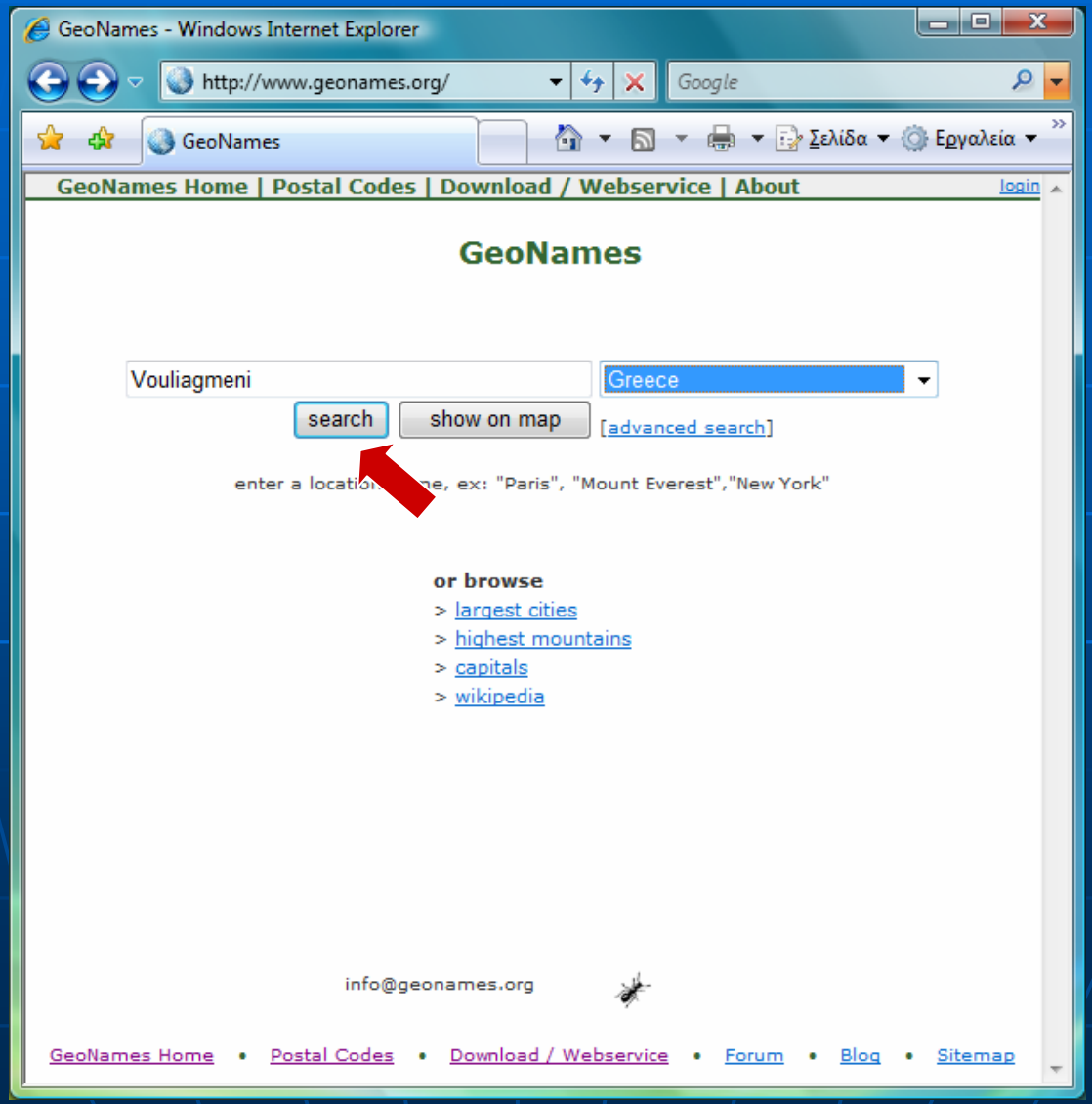
GeoNames Web Service

- The GeoNames database ...
  - is available for download free of charge
  - It contains ...
    - over 8 million geographical names
    - consists of 6.5 million unique features
      - whereof 2.2 million populated places and
      - 1.8 million alternate names.
  - All features are categorized ...
    - into 9 feature classes
    - further subcategorized into 645 feature codes

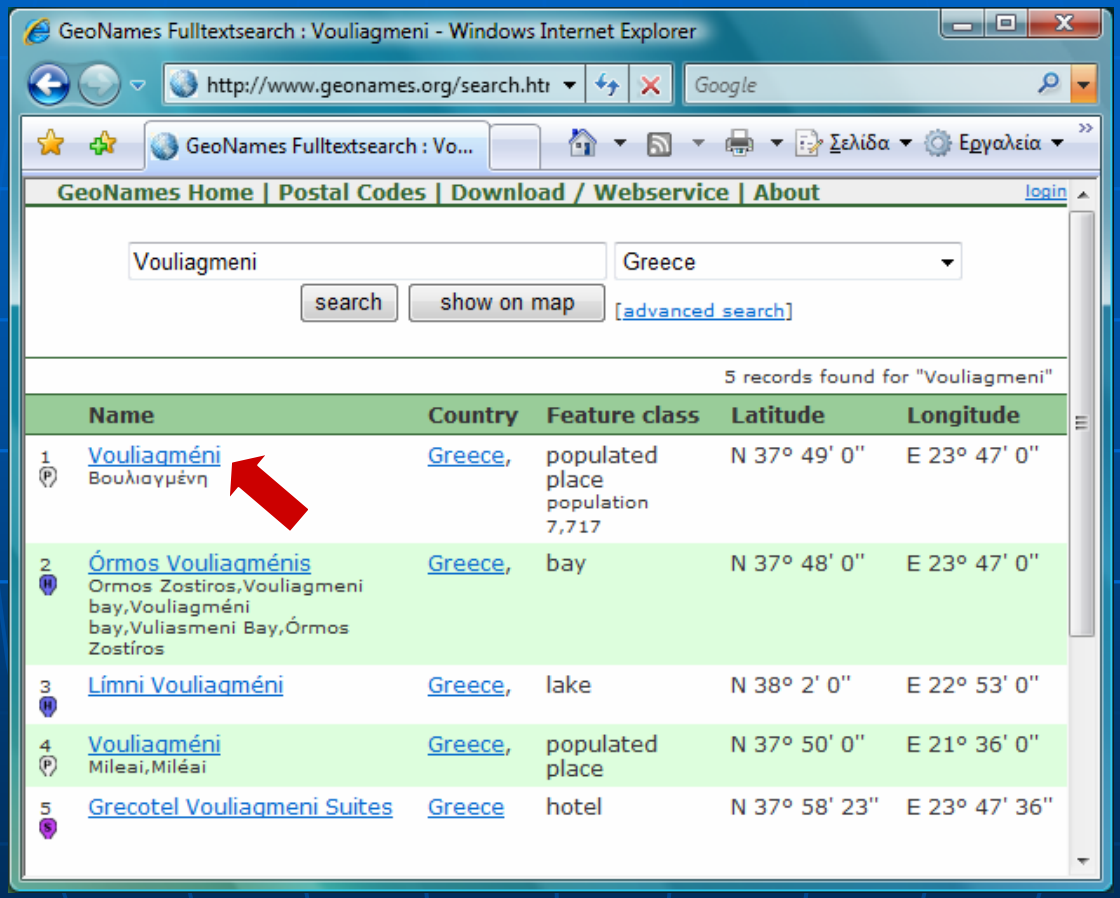
http://www.geonames.org/

GeoNames Web Service

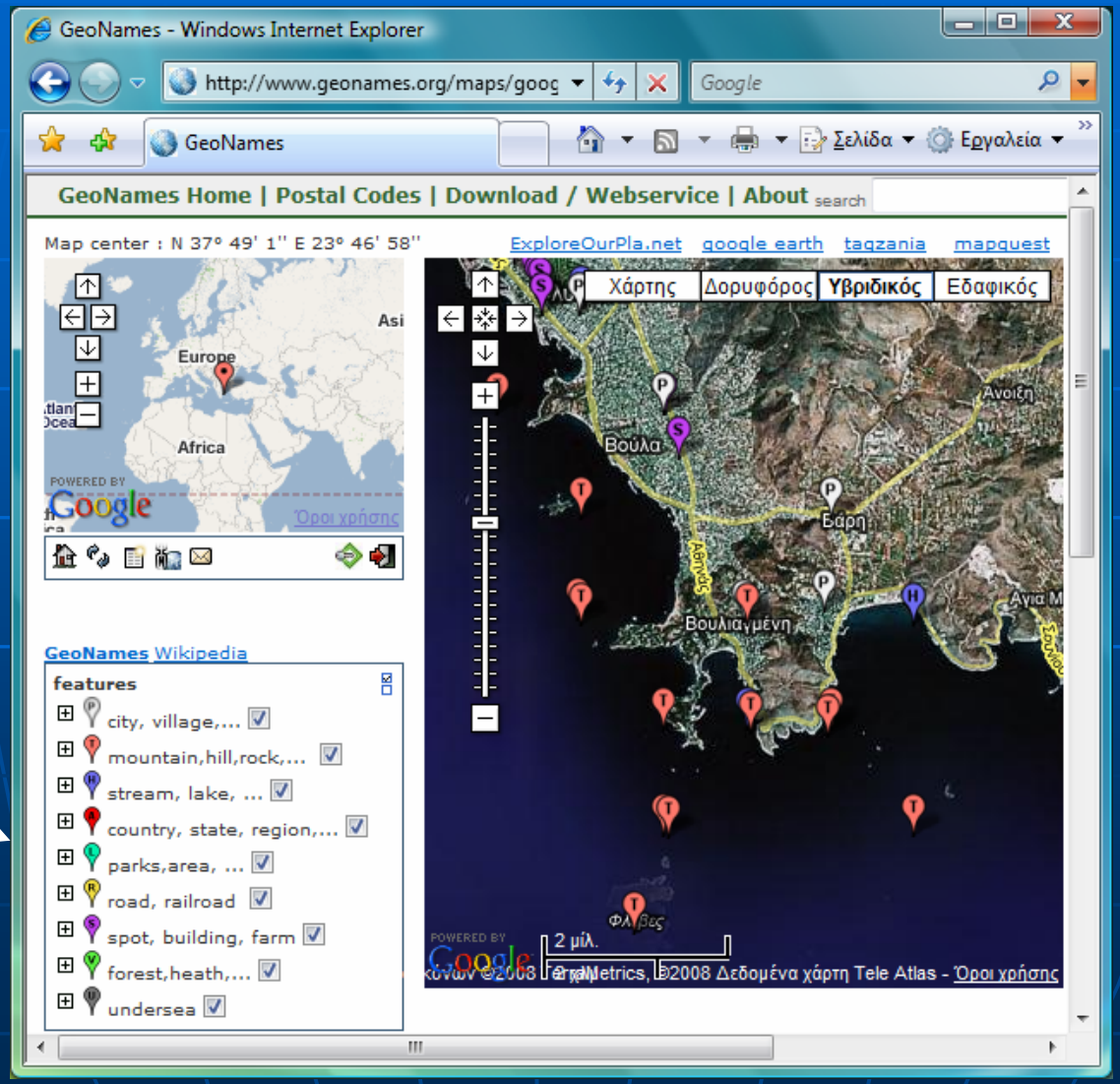
http://www.geonames.org/



GeoNames Web Service

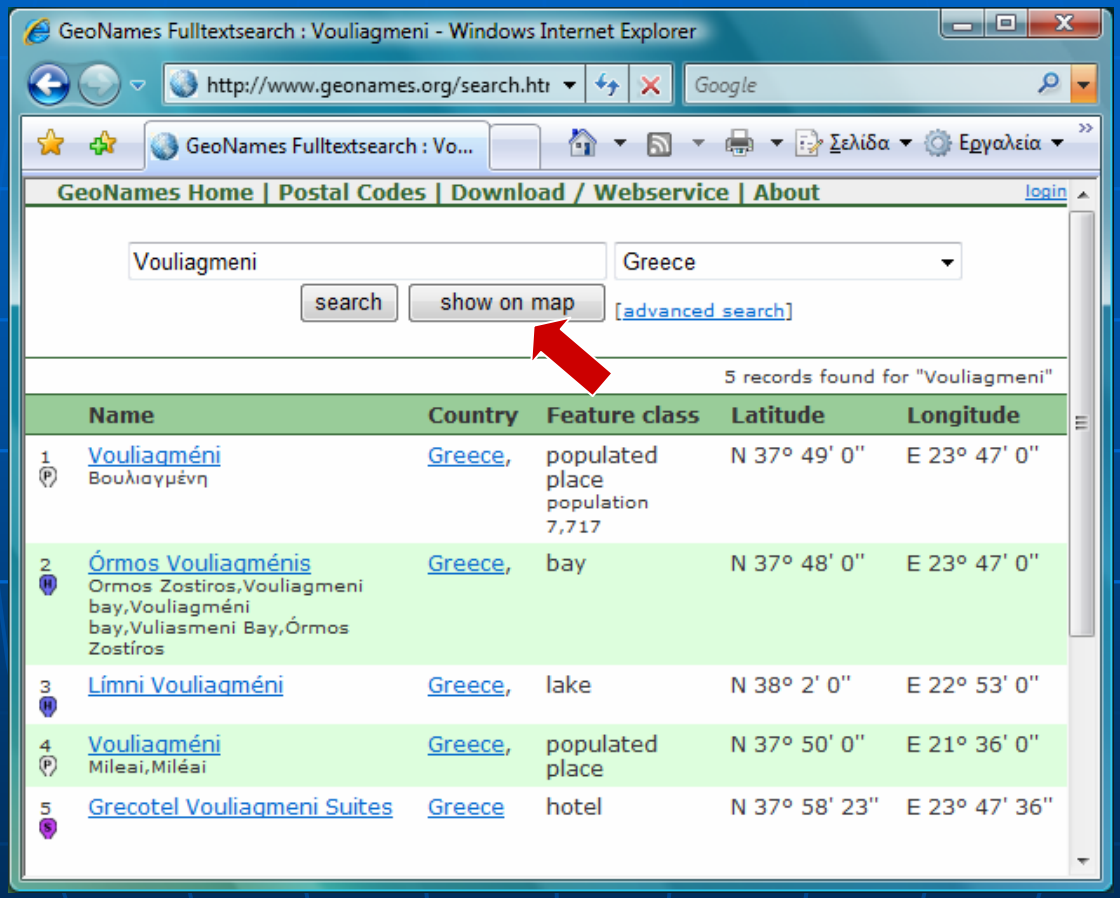


GeoNames Web Service

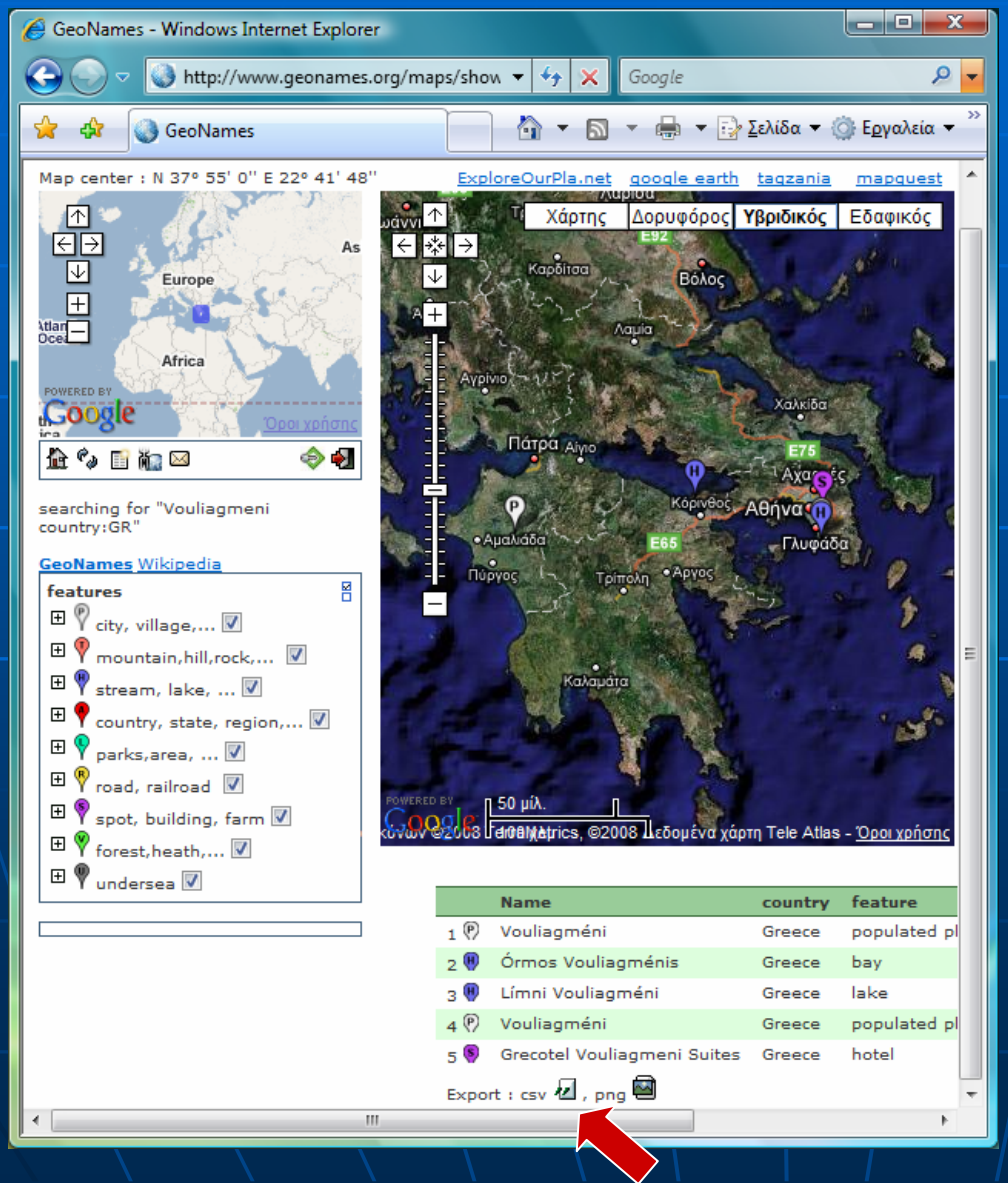


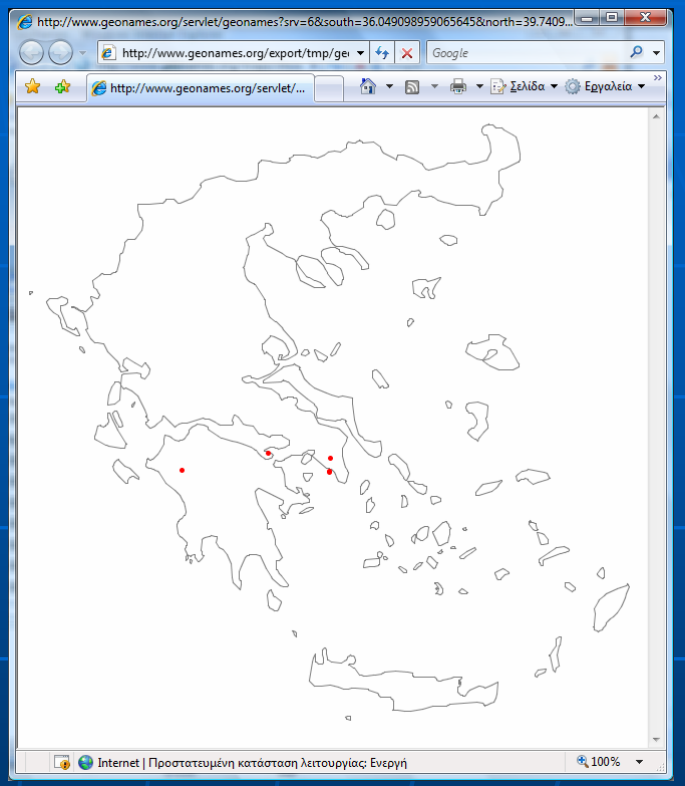
The 9 categories

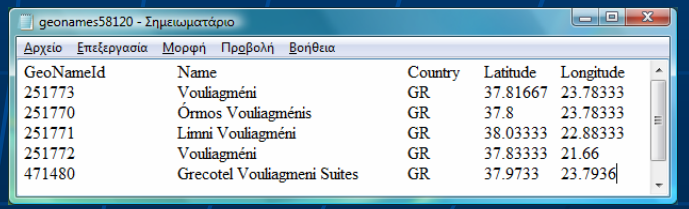
GeoNames Web Service



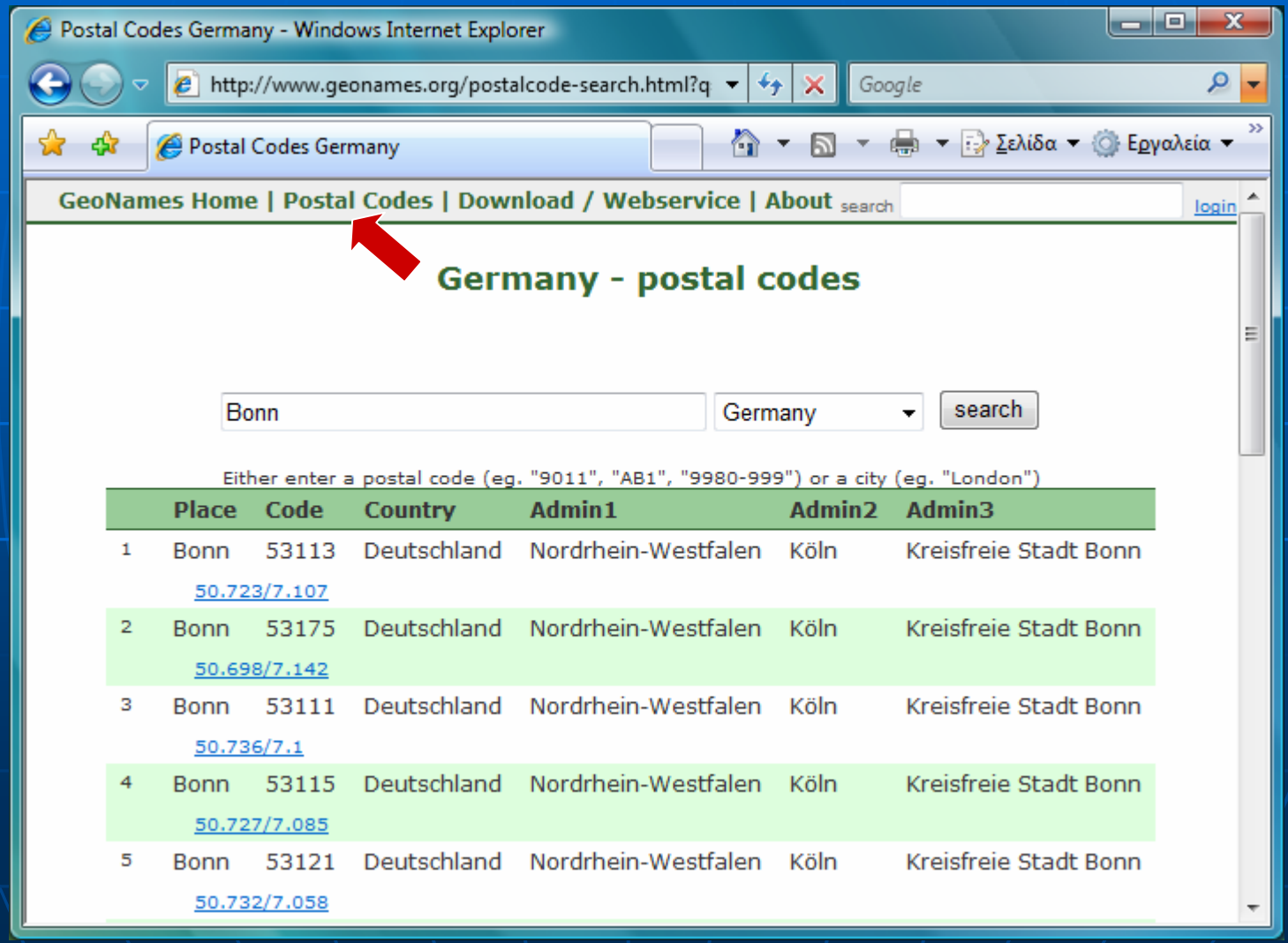
GeoNames Web Service



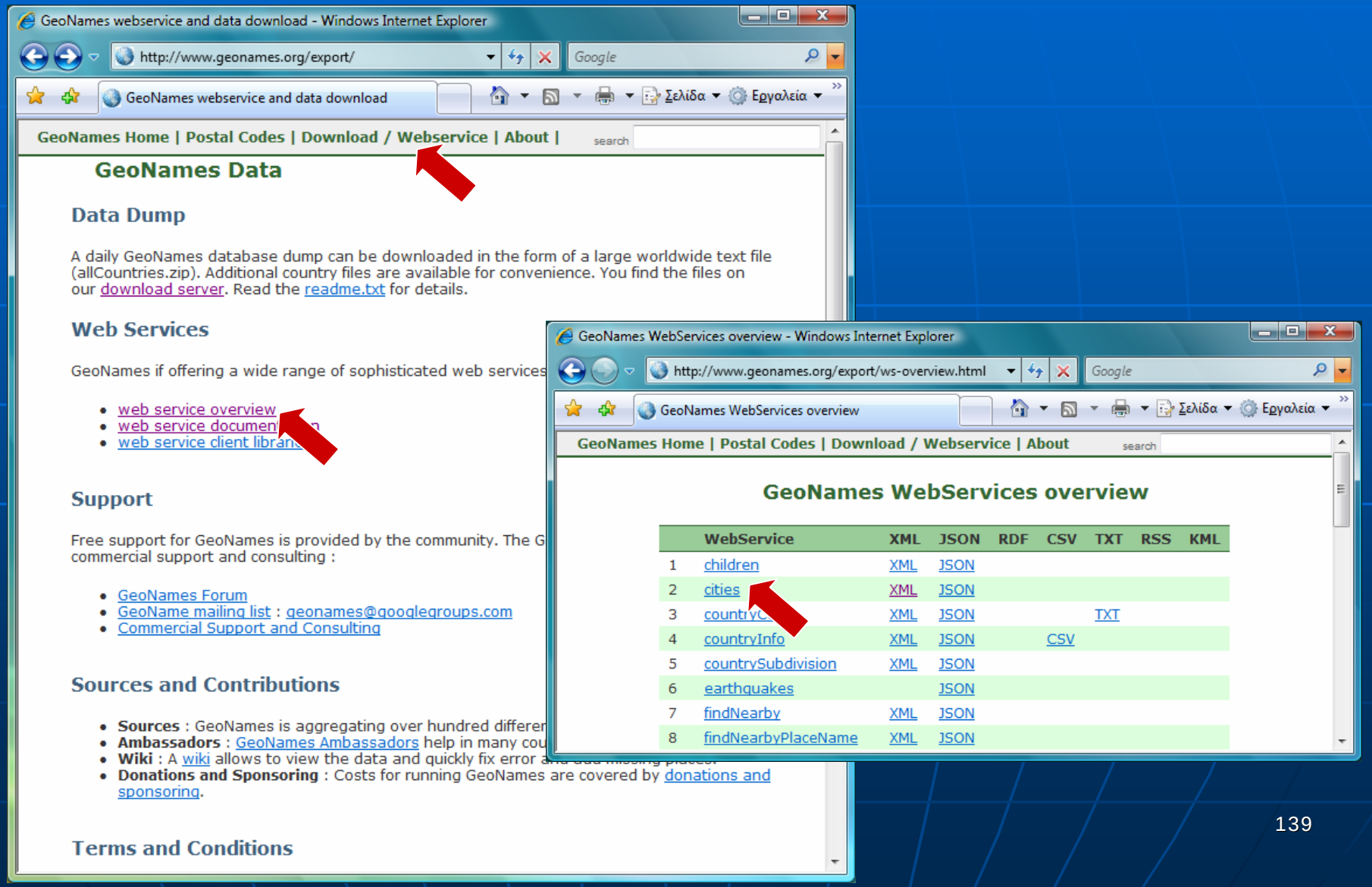




GeoNames Web Service



GeoNames Web Service



GeoNames Web Service

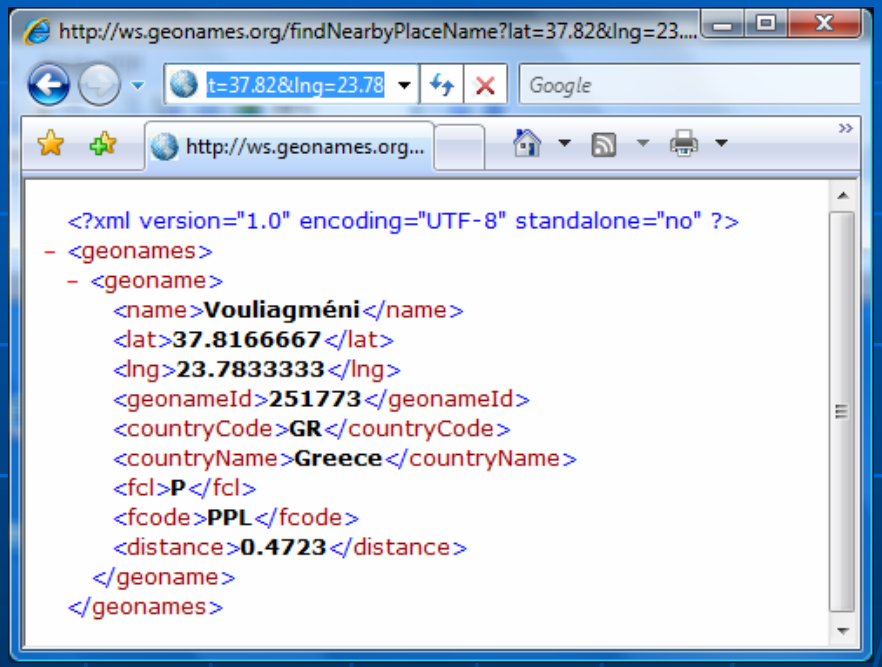
http://ws.geonames.org/cities?
north=38.3&
south=37.6&
east=24.1&
west=23.0

http://ws.geonames.org/cities?north=38.3&south=37.6&east=24.1&...

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
- <geonames>
  - <geoname>
      <name>Athens</name>
      <lat>37.9833333</lat>
      <lng>23.7333333</lng>
      <geonameId>264371</geonameId>
      <countryCode>GR</countryCode>
      <countryName>Greece</countryName>
      <fcl>P</fcl>
      <fcode>PPLC</fcode>
    </geoname>
  - <geoname>
      <name>Piraeus</name>
      <lat>37.9474464019929</lat>
      <lng>23.6370849609375</lng>
      <geonameId>255274</geonameId>
      <countryCode>GR</countryCode>
      <countryName>Greece</countryName>
      <fcl>P</fcl>
      <fcode>PPL</fcode>
    </geoname>
  - <geoname>
      <name>Peristérion</name>
      <lat>38.0166667</lat>
      <lng>23.7</lng>
      <geonameId>255524</geonameId>
      <countryCode>GR</countryCode>
      <countryName>Greece</countryName>
      <fcl>P</fcl>
      <fcode>PPL</fcode>
    </geoname>
```

GeoNames Web Service

http://ws.geonames.org/findNearbyPlaceName?
lat=37.82&
lng=23.78



GeoNames Web Service

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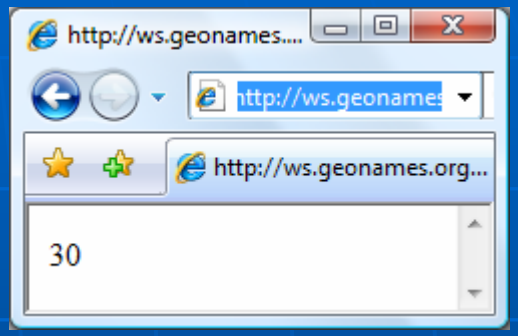
lng=23.78



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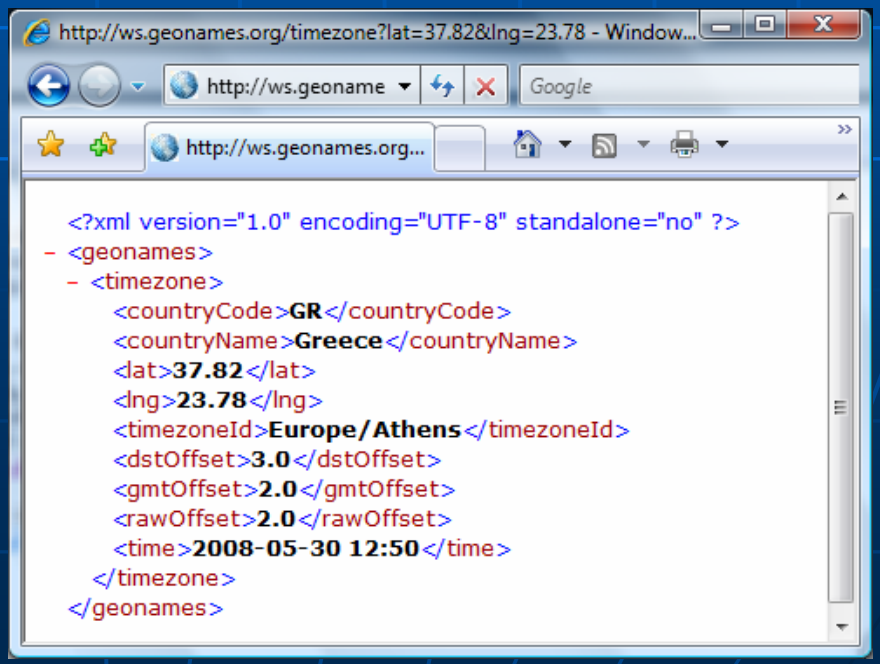
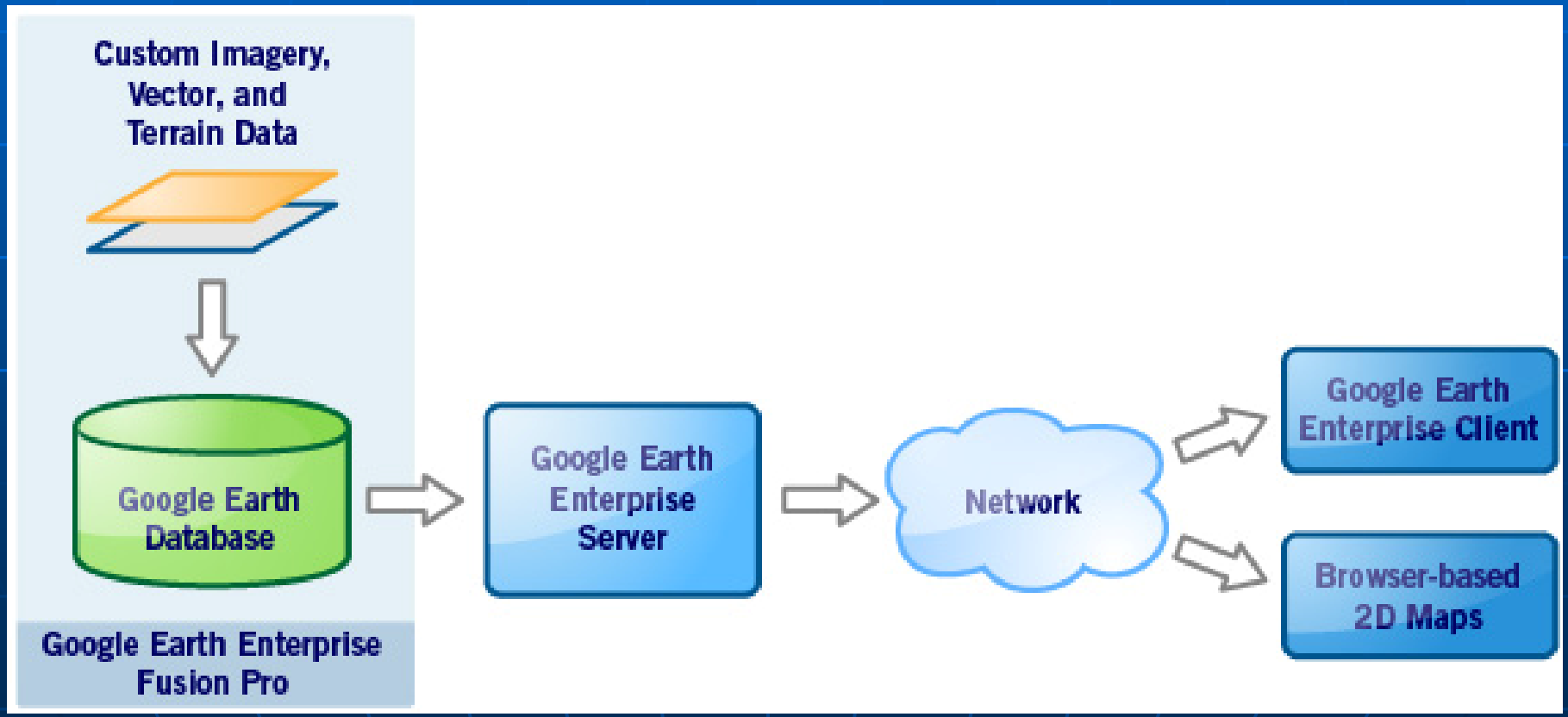


Google Earth's technology

- Explore Google Earth Database...



Google Earth's technology

- Google Earth provides ...
  - images/photographs cover the entire globe
  - taken sometime during the last three years
    - updated on a rolling basis
  - resolution varies from place to place
    - allows the user to see major geographic features and man-made development (towns and major roads)
    - for most of the major cities in US, Canada, Western Europe, and UK the resolution is high
      - 15cm to 1m (details for buildings, cars, humans)

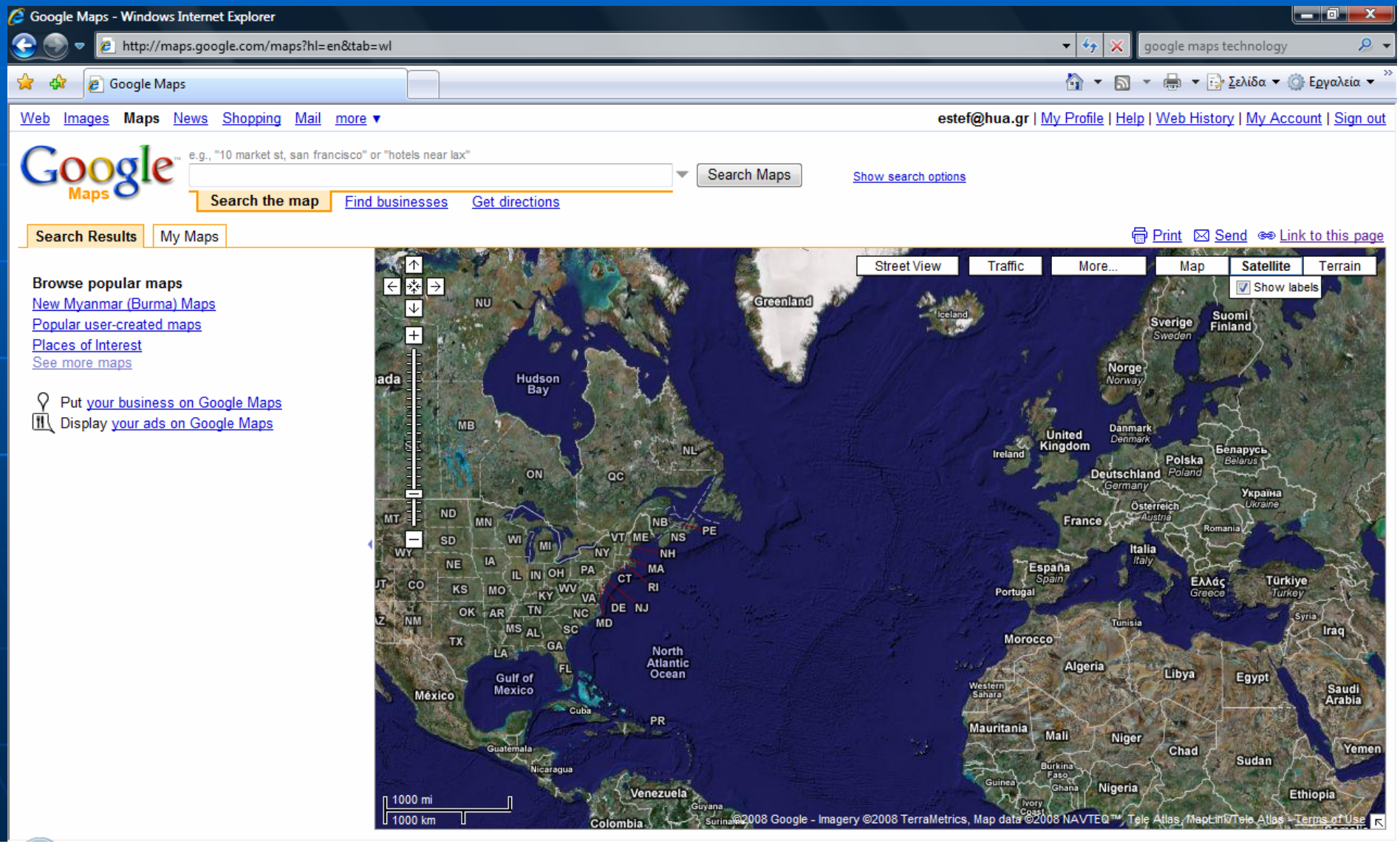
Google Earth's technology

- The coordinate system used ...
  - the standard **WGS84 datum**
- All images / photographs ...
  - are geo-referenced to this system
- All terrain data / GIS data ...
  - also stored and represented in this datum

Google Earth's Database

- Data provided by Google Earth ...
  - is mainly retrieved from Google Maps and
  - several satellite and aerial datasets
    - including private Keyhole images
    - DTM by NASA's Shuttle Radar Topography Mission
- Google Maps ...
  - is a Web map server maintained by Google
    - such as Mapquest or Yahoo!Maps
  - provides ...
    - high-resolution satellite imagery and aerial photography
    - International street-level datasets
    - many other map-based services

Google Maps


Google Maps - Windows Internet Explorer
http://maps.google.com/maps?hl=en&tab=wl
google maps technology
Google Maps
Web Images Maps News Shopping Mail more ▾
estef@hua.gr | My Profile | Help | Web History | My Account | Sign out
Google Maps
e.g., "10 market st, san francisco" or "hotels near lax"
Search Maps
Show search options
Search the map
Find businesses
Get directions
Search Results
My Maps
Print
Send
Link to this page
Browse popular maps
New Myanmar (Burma) Maps
Popular user-created maps
Places of Interest
See more maps
Put your business on Google Maps
Display your ads on Google Maps
Street View
Traffic
More...
Map
Satellite
Terrain
Show labels
Greenland
Iceland
Hudson Bay
Gulf of Mexico
North Atlantic Ocean
México
Cuba
Guatemala
Nicaragua
Venezuela
Colombia
Guyana
Suriname
Ireland
United Kingdom
Sverige
Sweden
Suomi Finland
Norge
Norway
Danmark
Denmark
Беларусь
Belarus
Polska
Poland
Deutschland
Germany
Україна
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Österreich
Austria
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España
Spain
Portugal
Ελλάς
Greece
Türkiye
Turkey
Syria
Iraq
Tunisia
Morocco
Algeria
Libya
Egypt
Saudi Arabia
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Yemen
Burkina Faso
Guinea
Ghana
Nigeria
Ivory Coast
Ethiopia
1000 mi
1000 km
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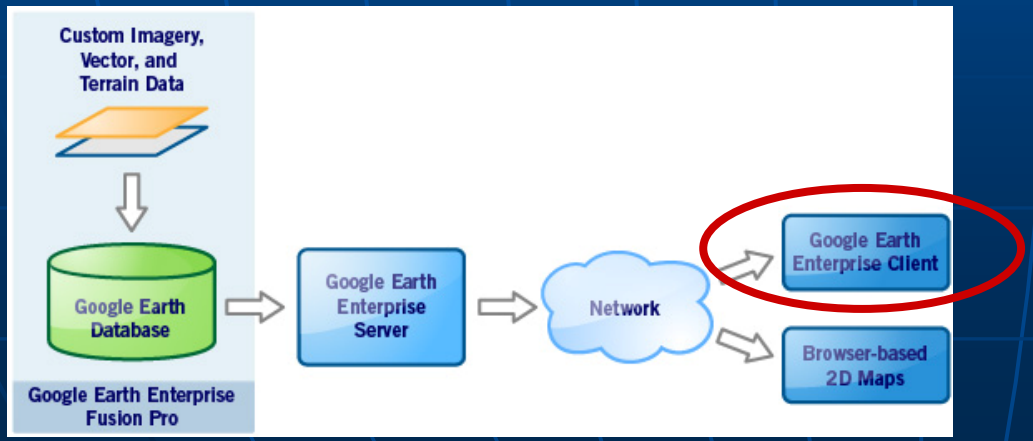
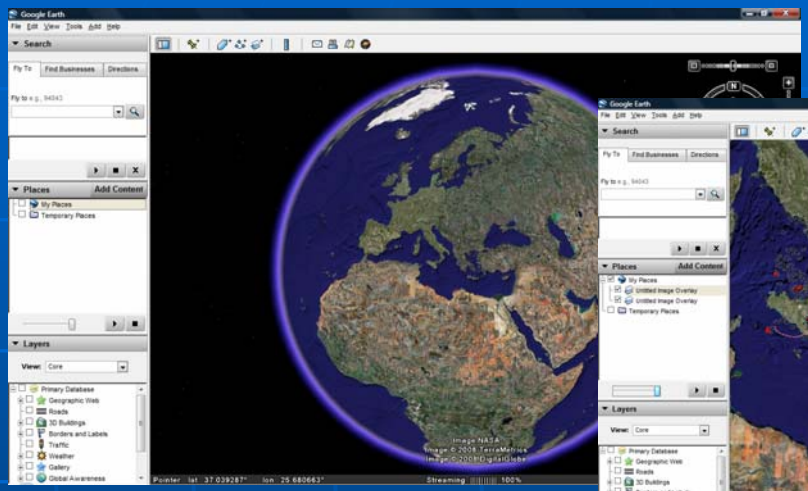
Google Earth Client

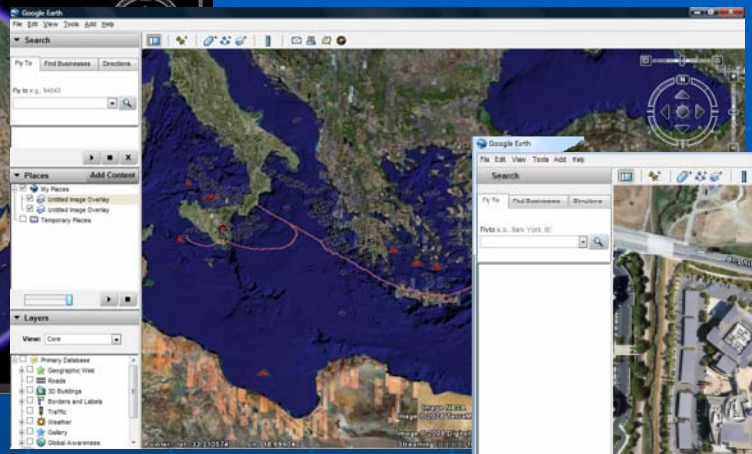
- Google Earth Client ...
  - a 3D visualization of
    - the earth
    - ... and more
  - integrates, organizes and publishes location data on Google Maps

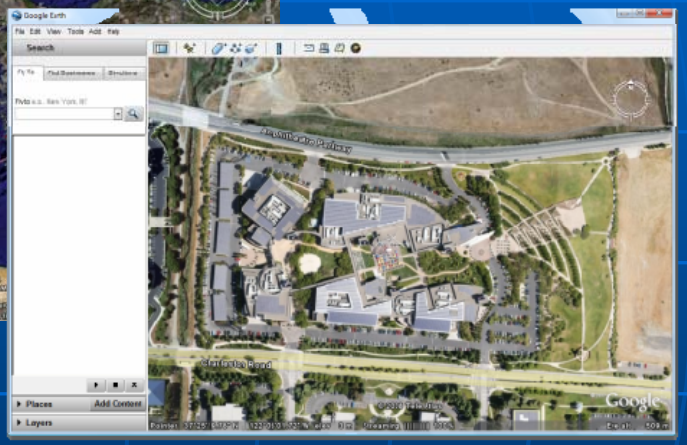


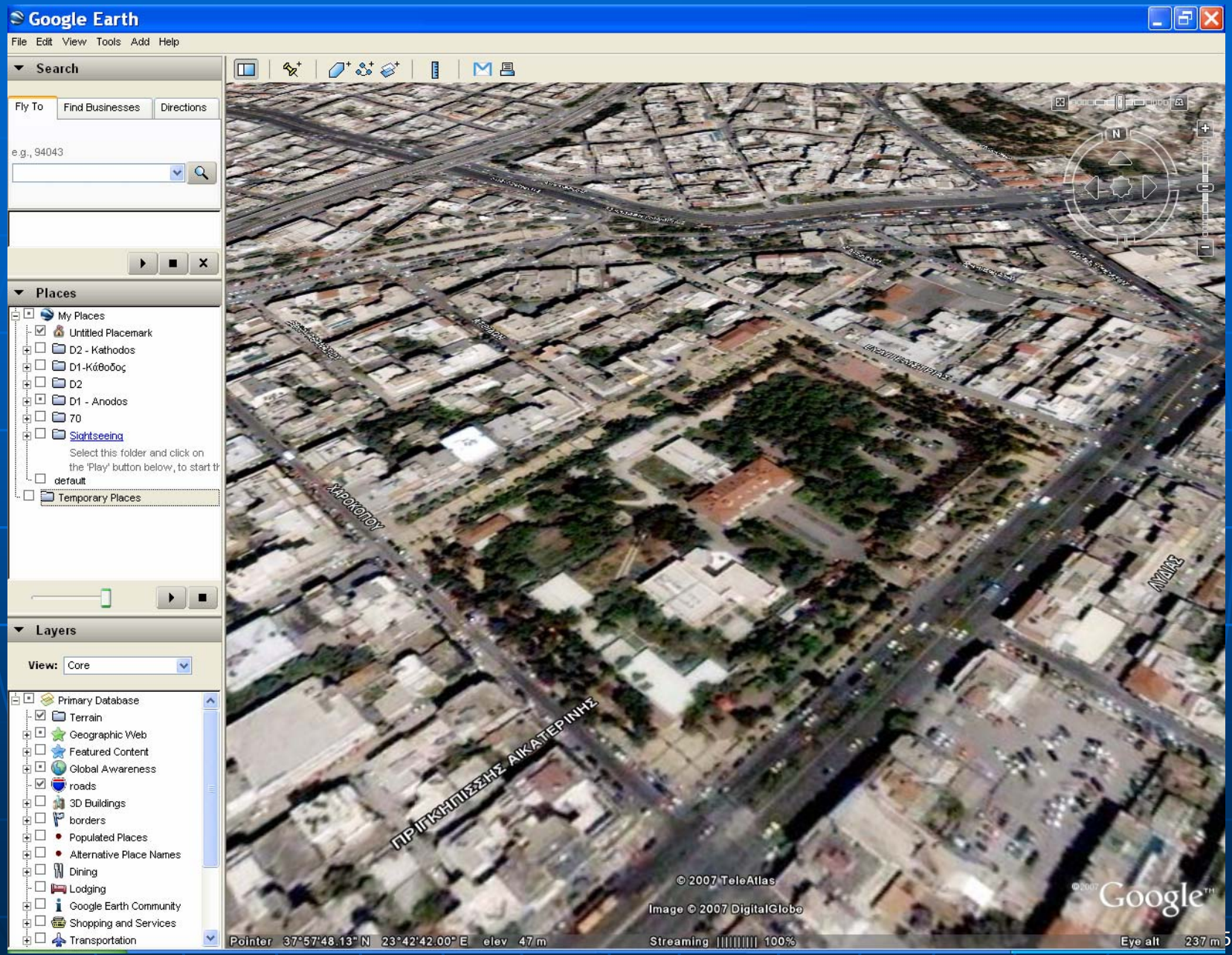
Google Earth Client

http://earth.google.com/








Google Earth
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Search
Fly To
Find Businesses
Directions
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Places
My Places
Untitled Placemark
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D1-Κάθοδος
D2
D1 - Anodos
70
Sightseeing
Select this folder and click on
the 'Play' button below, to start th
default
Temporary Places
Layers
View: Core
Primary Database
Terrain
Geographic Web
Featured Content
Global Awareness
roads
3D Buildings
borders
Populated Places
Alternative Place Names
Dining
Lodging
Google Earth Community
Shopping and Services
Transportation
ΧΑΡΟΚΟΠΟΥ
ΠΡΙΓΚΗΠΙΣΣΗΣ ΑΙΚΑΤΕΡΙΝΗΣ
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Pointer 37°57'48.13" N 23°42'42.00" E elev 47 m
Streaming 100%
Eye alt 237 m


Image © 2006 DigitalGlobe
© 2005 Google
Pointer lat 37.960746° lon 23.708141° elev 125 ft
Streaming 100%
Eye alt 343 ft


Dresden.
Image © 2007 GeoContent
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Google

Google SketchUp - Windows Internet Explorer

http://sketchup.google.com/intl/en/

google earth warehouse

Google SketchUp

Σελίδα Εργαλεία

Google SketchUp

Welcome to Google SketchUp

Change language: English

Google SketchUp is 3D for everyone

Download Google SketchUp

Google SketchUp is software that you can use to create, modify and share 3D models. It's easier to learn than other 3D modeling programs, which is why so many people are already using it.

We designed SketchUp's simplified toolset, guided drawing system and clean look-and-feel to help you concentrate on two things: getting your work done as efficiently as possible, and having fun while you're doing it.

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3D Warehouse
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Advanced Search
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3D Building Collections
Featured Google Earth Modelers
Help Model a City
Featured Google Earth Collections
Cities in Development
Experience your 3D world
Experience your 3D world using Google's interconnected suite of tools.
Google SketchUp
Google Earth
3D Warehouse
Featured Collections
RAIA - Royal Australian Institute of...
2008 International Model Your Campus...
Google SketchUp 3d Challenge
Film the World - Animation Competition
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Frequently asked questions
Acceptance criteria
Popular Models
More »
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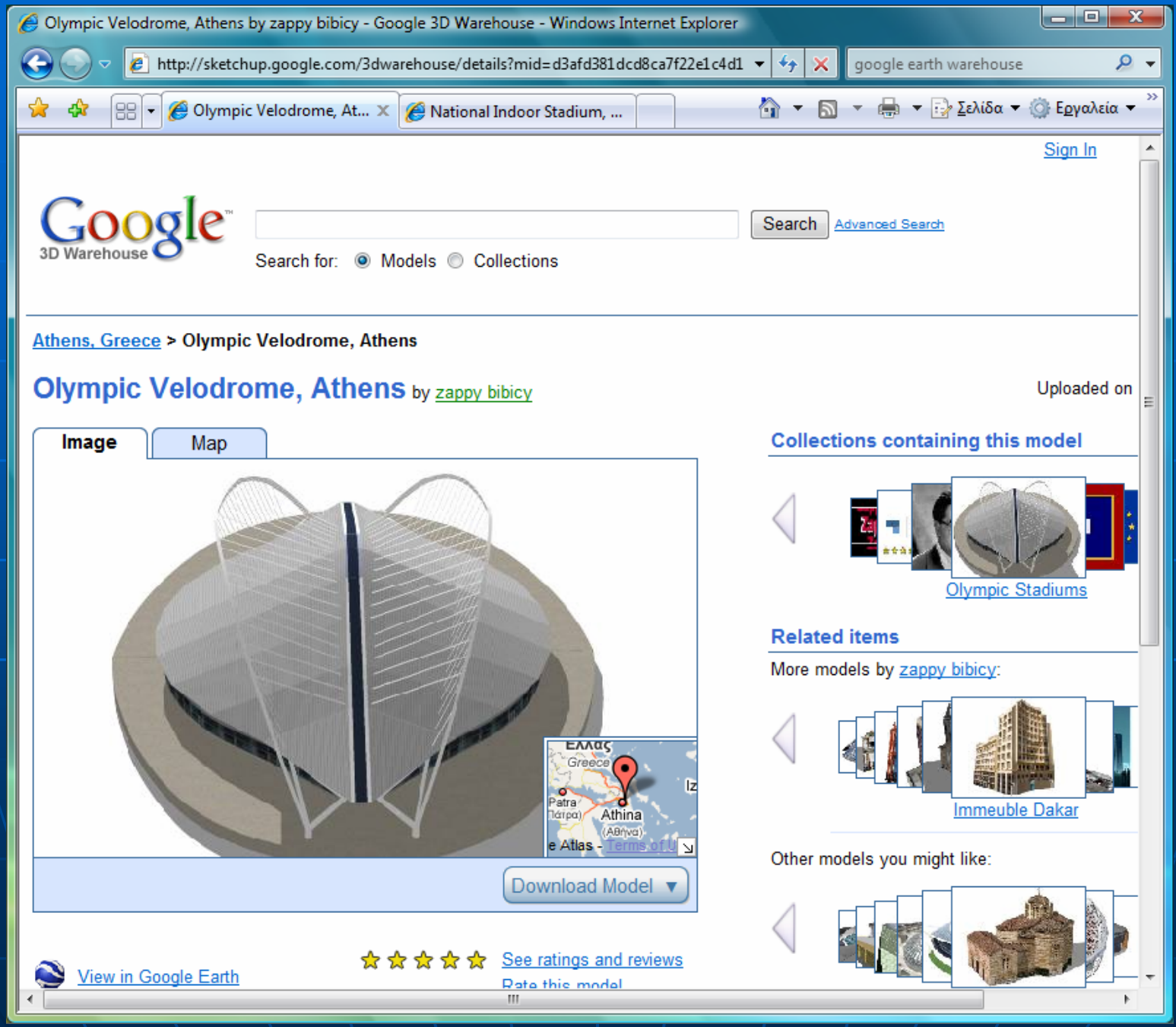
Palm Coast
Schiphol Air traffic
Prairie Cliff House


Olympic Velodrome, Athens by zappy bibicy - Google 3D Warehouse - Windows Internet Explorer
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Olympic Velodrome, At...
National Indoor Stadium, ...
Sign In
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Advanced Search
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Athens, Greece > Olympic Velodrome, Athens
Olympic Velodrome, Athens by zappy bibicy
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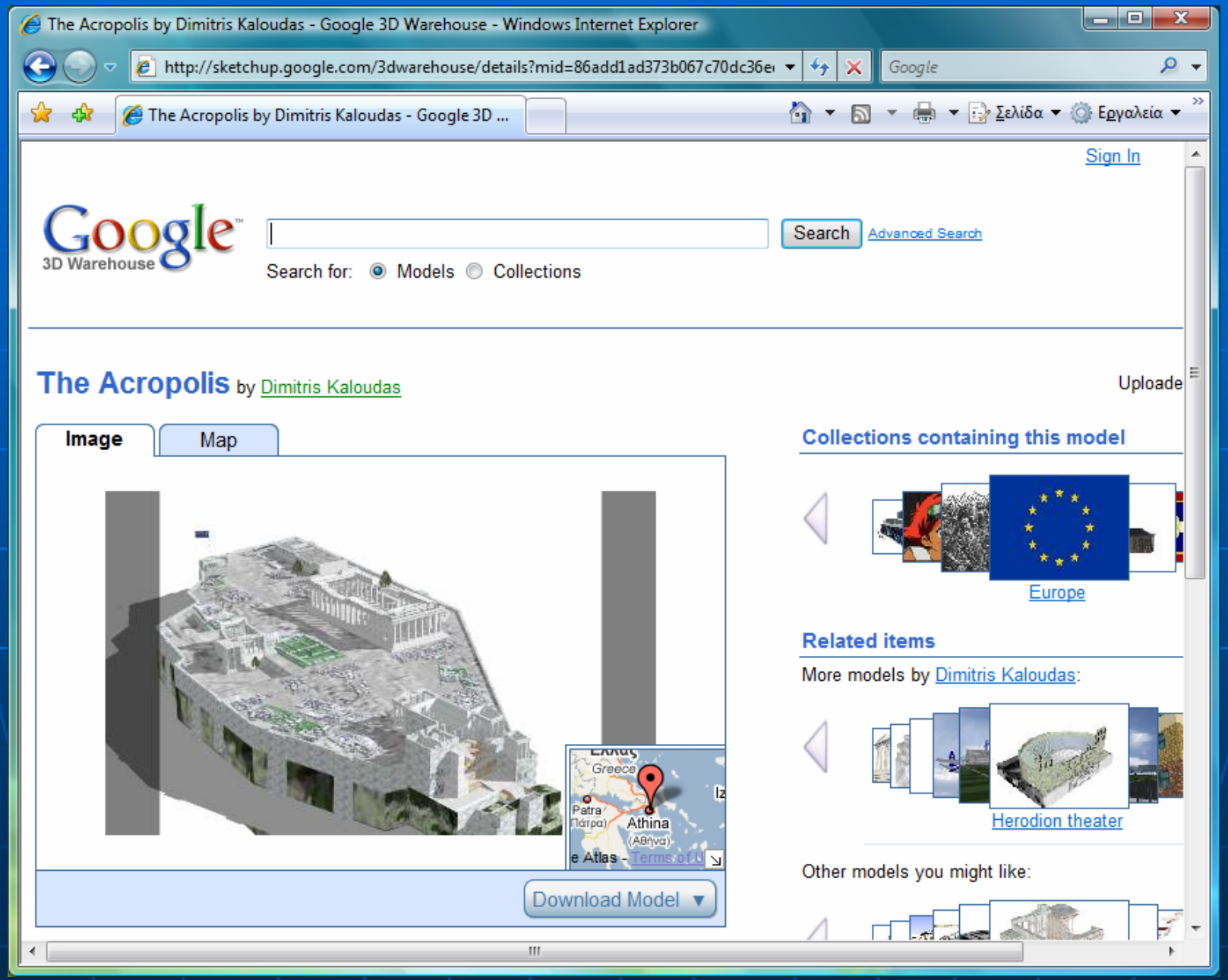
Other models you might like:


The Acropolis by Dimitris Kaloudas - Google 3D Warehouse - Windows Internet Explorer
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Patra
Athina
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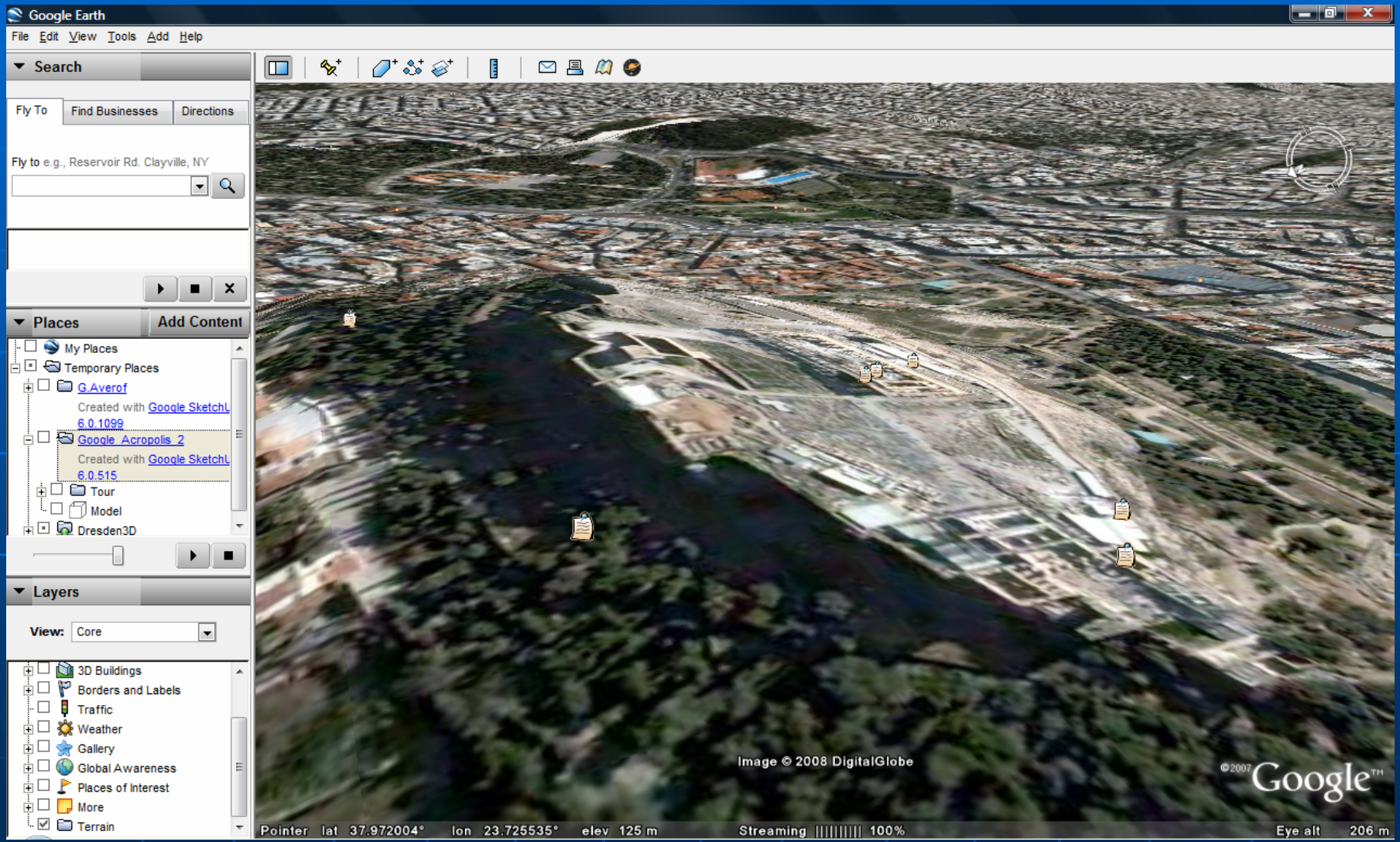
Google Earth
File Edit View Tools Add Help
Search
Fly To
Find Businesses
Directions
Fly to e.g., Reservoir Rd. Clayville, NY
Places
Add Content
My Places
Temporary Places
G.Averof
Created with Google SketchU
6.0.1099
Google_Acropolis_2
Created with Google SketchU
6.0.515
Tour
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Dresden3D
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Borders and Labels
Traffic
Weather
Gallery
Global Awareness
Places of Interest
More
Terrain
Image © 2008 DigitalGlobe
©2007 Google
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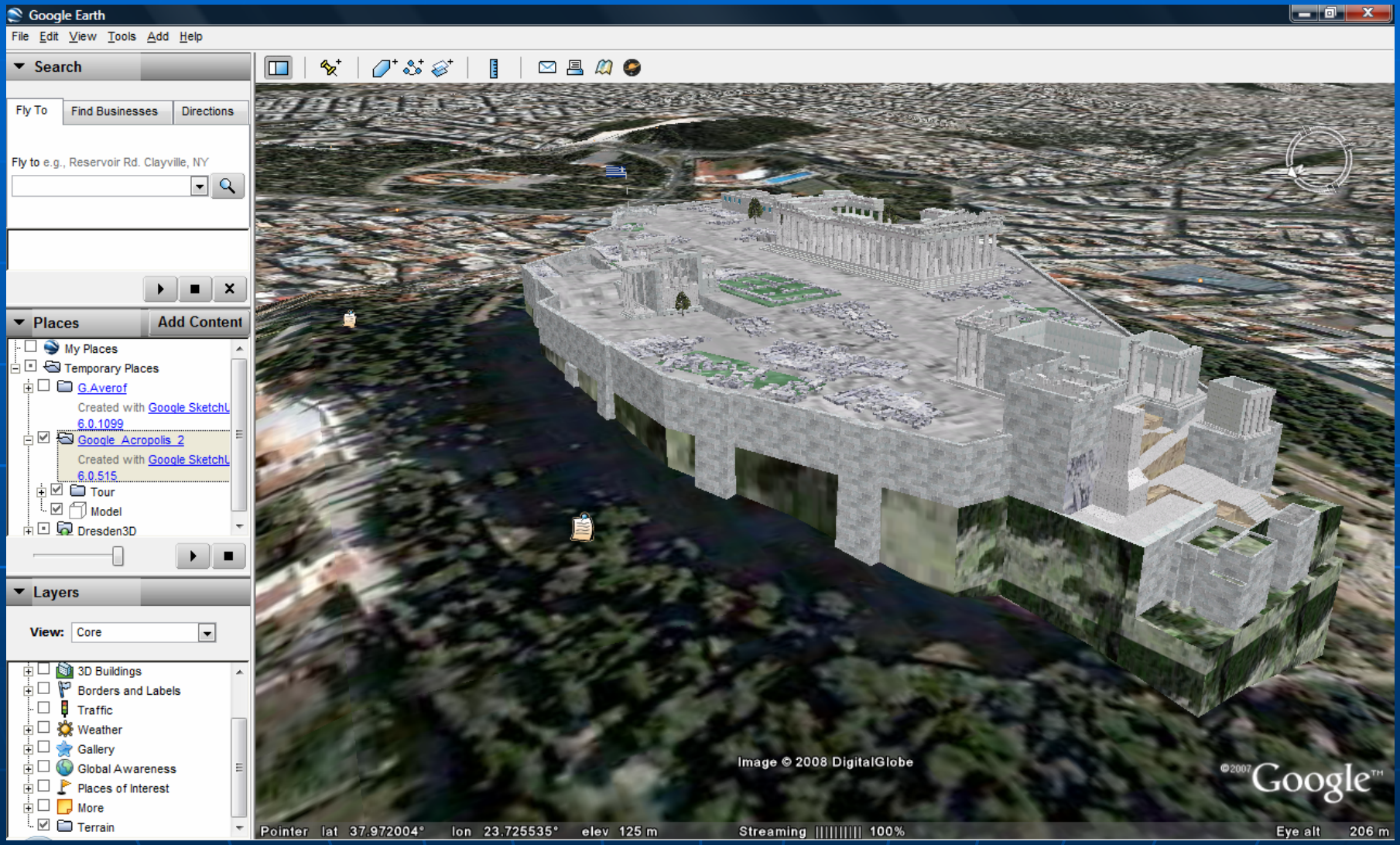
Streaming 100%
Eye alt 206 m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Google_Acropolis_2
Created with Google SketchU
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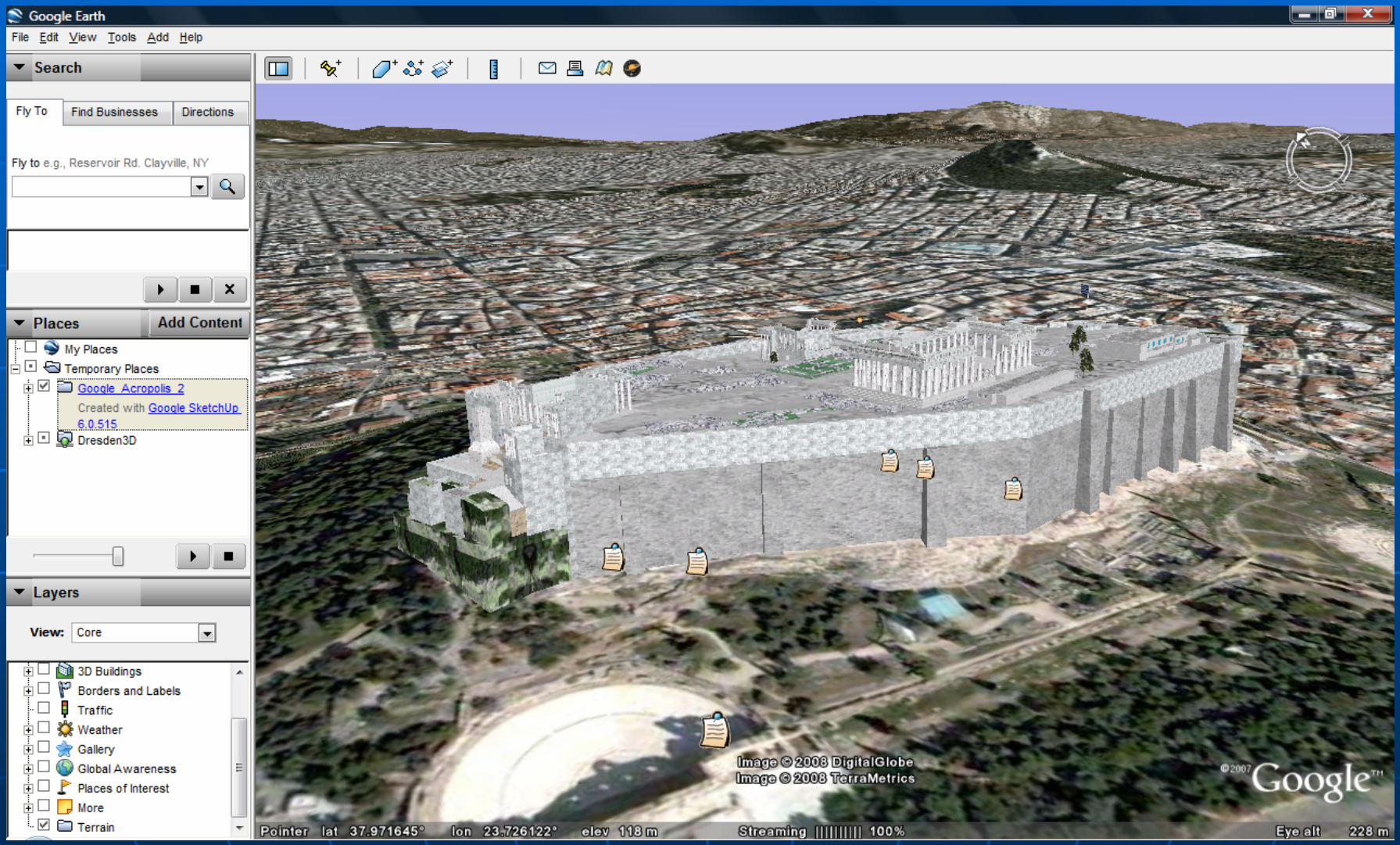
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Terrain
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Image © 2008 TerraMetrics
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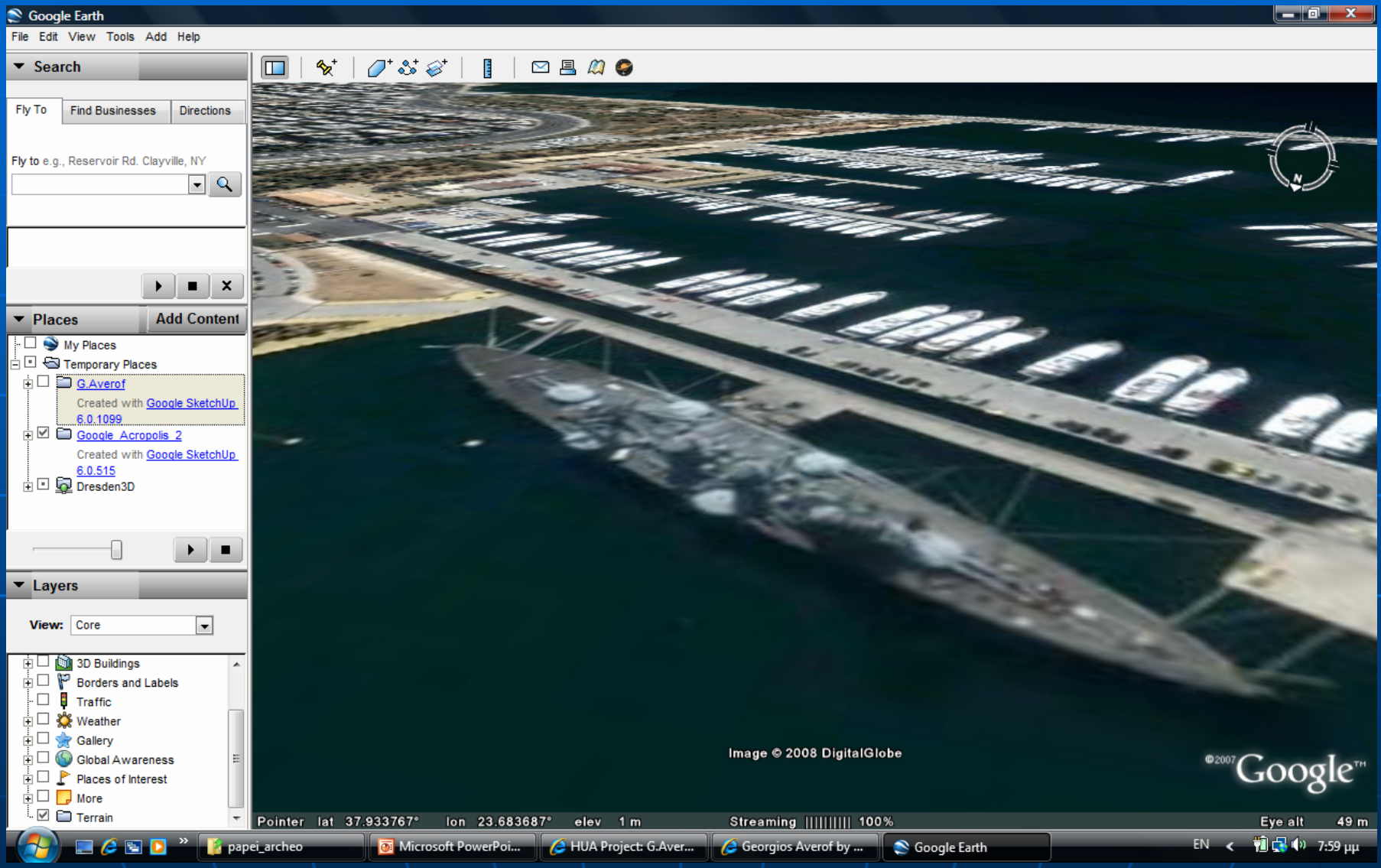
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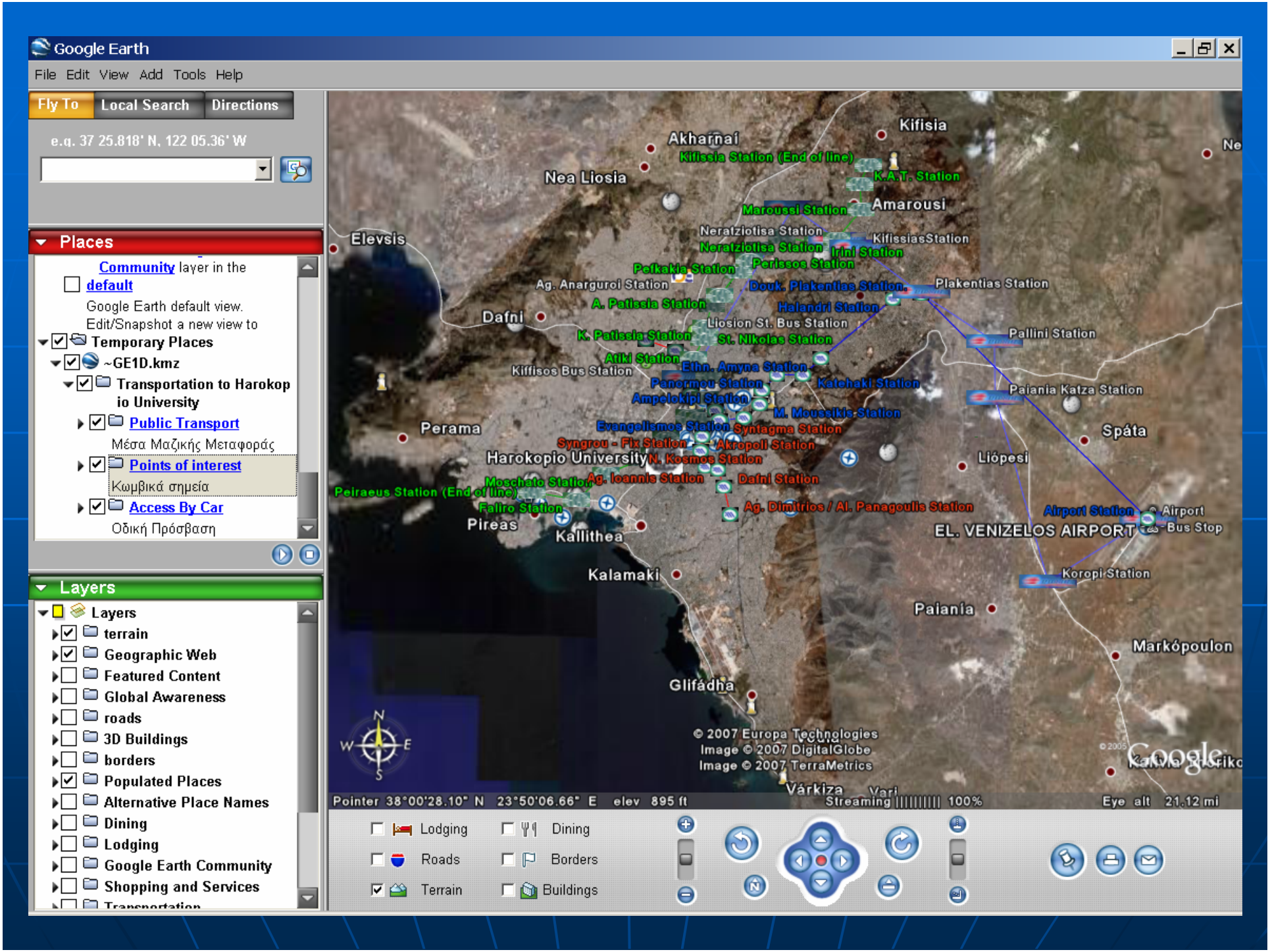
Google Earth
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Local Search
Directions
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Places
Community layer in the default
Google Earth default view. Edit/Snapshot a new view to
Temporary Places
~GE1D.kmz
Transportation to Harokopio University
Public Transport
Μέσα Μαζικής Μεταφοράς
Points of interest
Κωμβικά σημεία
Access By Car
Οδική Πρόσβαση
Layers
Layers
terrain
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3D Buildings
borders
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Alternative Place Names
Dining
Lodging
Google Earth Community
Shopping and Services
Kifisia
Akharnai
Nea Liosia
Elevsis
Amarousi
Dafni
Perama
Harokopio University
Pireas
Kallithea
Kalamaki
Glifádha
Váryiza
Spáta
Liópesi
Paiania
Markópoulon
EL. VENIZELOS AIRPORT
Kifissia Station (End of line)
K.A.T. Station
Maroussi Station
Neratziotisa Station
KifissiasStation
Irini Station
Perissos Station
Plakentias Station
Halandri Station
Pallini Station
Paiania Katza Station
Koropi Station
Airport
Bus Stop
Peiraeus Station (End of line)
Faliro Station
Moschato Station
Dafni Station
Syntagma Station
Akropoli Station
Evangelismos Station
Ampelokipi Station
Katehaki Station
Ethn. Amyna Station
Kiffisos Bus Station
Liosion St. Bus Station
St. Nikolas Station
Atiki Station
K. Patissia Station
A. Patissia Station
Ag. Anargyroi Station
Peikakia Station
Douk. Plakentias Station
M. Moussikis Station
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Pointer 38°00'28.10" N 23°50'06.66" E elev 895 ft
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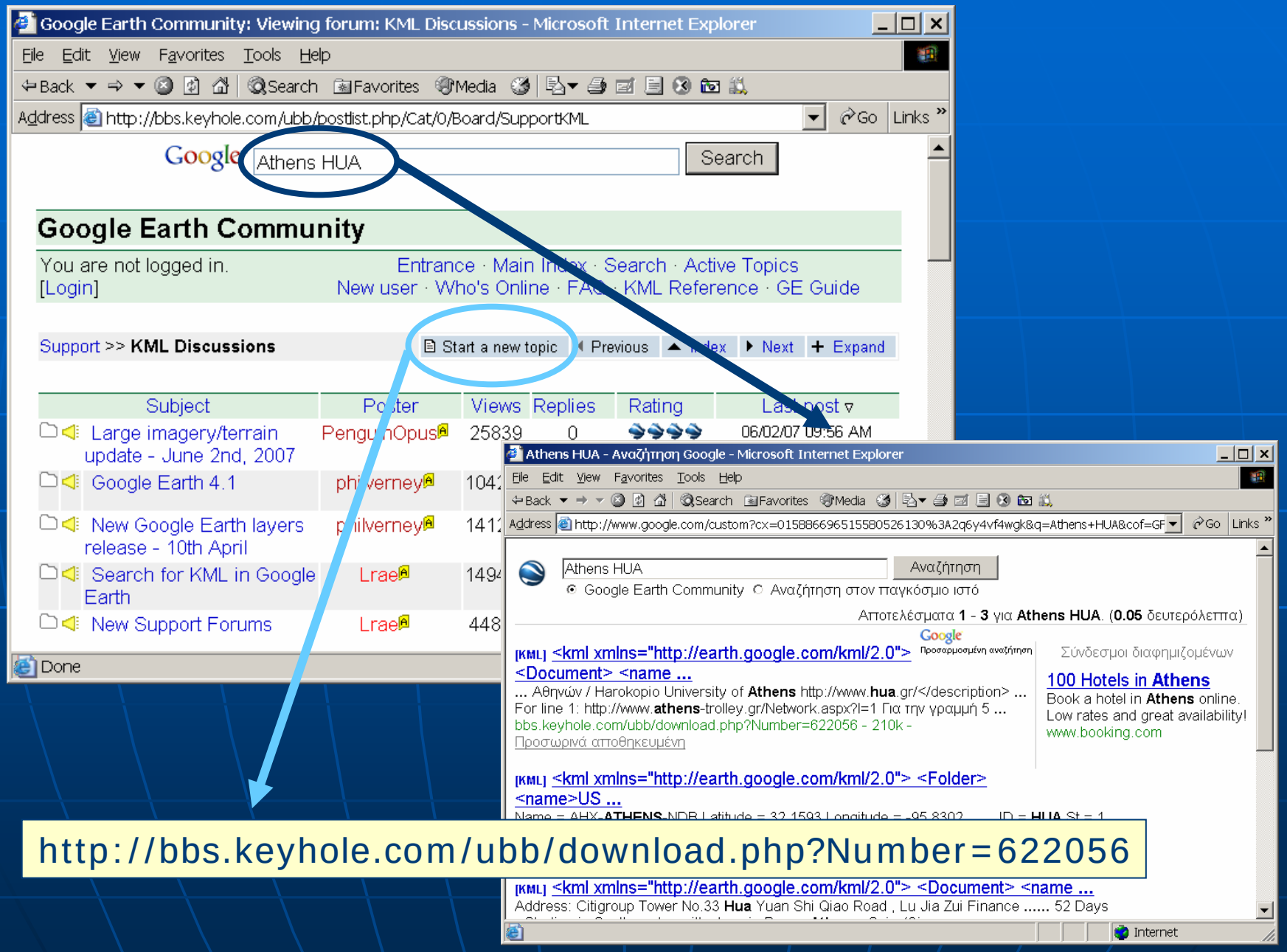
Google Earth Community: Viewing forum: KML Discussions - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://bbs.keyhole.com/ubb/postlist.php/Cat/0/Board/SupportKML
Go Links
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Entrance · Main Index · Search · Active Topics
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Support >> KML Discussions
Start a new topic
Previous
Next
Expand
Subject
Poster
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Rating
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Large imagery/terrain update - June 2nd, 2007
PenguinOpus
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Google Earth 4.1
New Google Earth layers release - 10th April
Search for KML in Google Earth
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New Support Forums
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Athens HUA - Αναζήτηση Google - Microsoft Internet Explorer
Athens HUA
Αναζήτηση
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Αναζήτηση στον παγκόσμιο ιστό
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bbs.keyhole.com/ubb/download.php?Number=622056 - 210k -
Προσωρινά αποθηκευμένη
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Σύνδεσμοι διαφημιζομένων
100 Hotels in Athens
Book a hotel in Athens online.
Low rates and great availability!
www.booking.com
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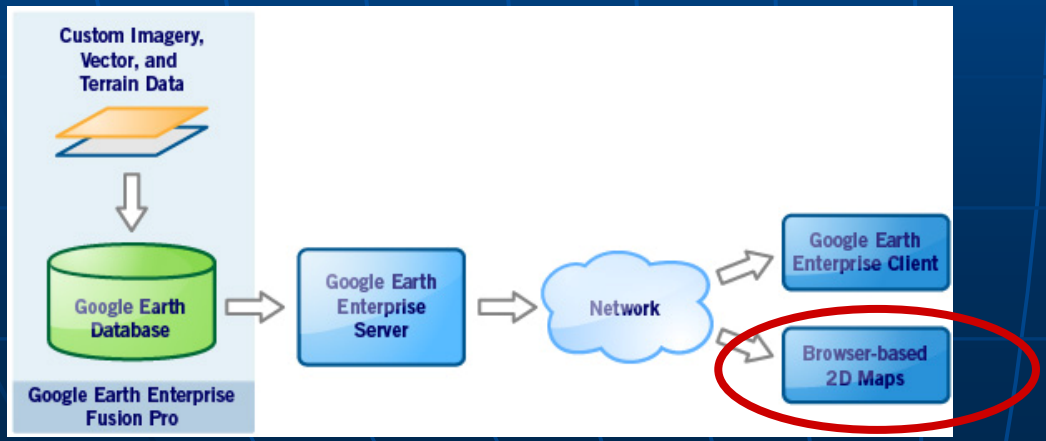
Address: Citigroup Tower No.33 Hua Yuan Shi Qiao Road , Lu Jia Zui Finance ..... 52 Days
Internet
http://bbs.keyhole.com/ubb/download.php?Number=622056

Google Maps API

- Allows Google Maps + user data
  - being integrated into web-based applications
  - viewed by any user, regardless of their client software



Google Maps API

- API ...
  - Application Programming Interface
  - A source code interface that an...
    - operating system,
    - library or
    - service

  ... provides to support requests made by computer programs

Google Maps API

- Google Maps API
  - created by Google
  - to facilitate developers integrating Google Maps into their web sites with their own data points
  - It is a free service
    - currently does not contain ads,
    - Google reserveS the right to display ads in the future

Google Maps API

- Lets you embed Google Maps ...
  - in web pages
  - with JavaScript
- Provides a number of utilities for
  - manipulating maps
  - adding content to the map
    - through a variety of services

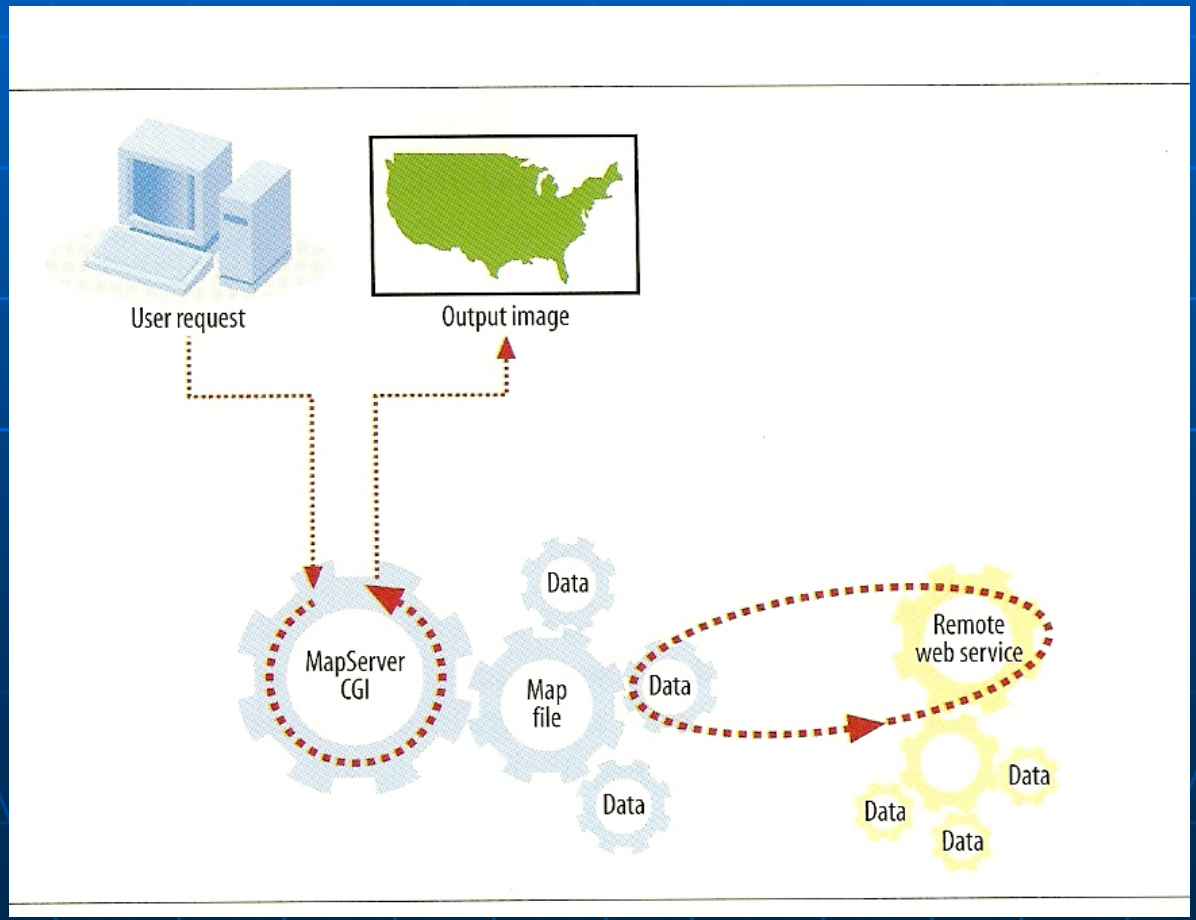
Google Maps API

- **Mapping Mashups**...
  1. the Google Map API along with others
  2. the Web 2.0 technologies

  ... lead to an expansion of the so-called mapping mashups
- **Mashup** is...
  - a website or Web application that
    - uses content from more than one source to create a completely new Web service

Google Maps API

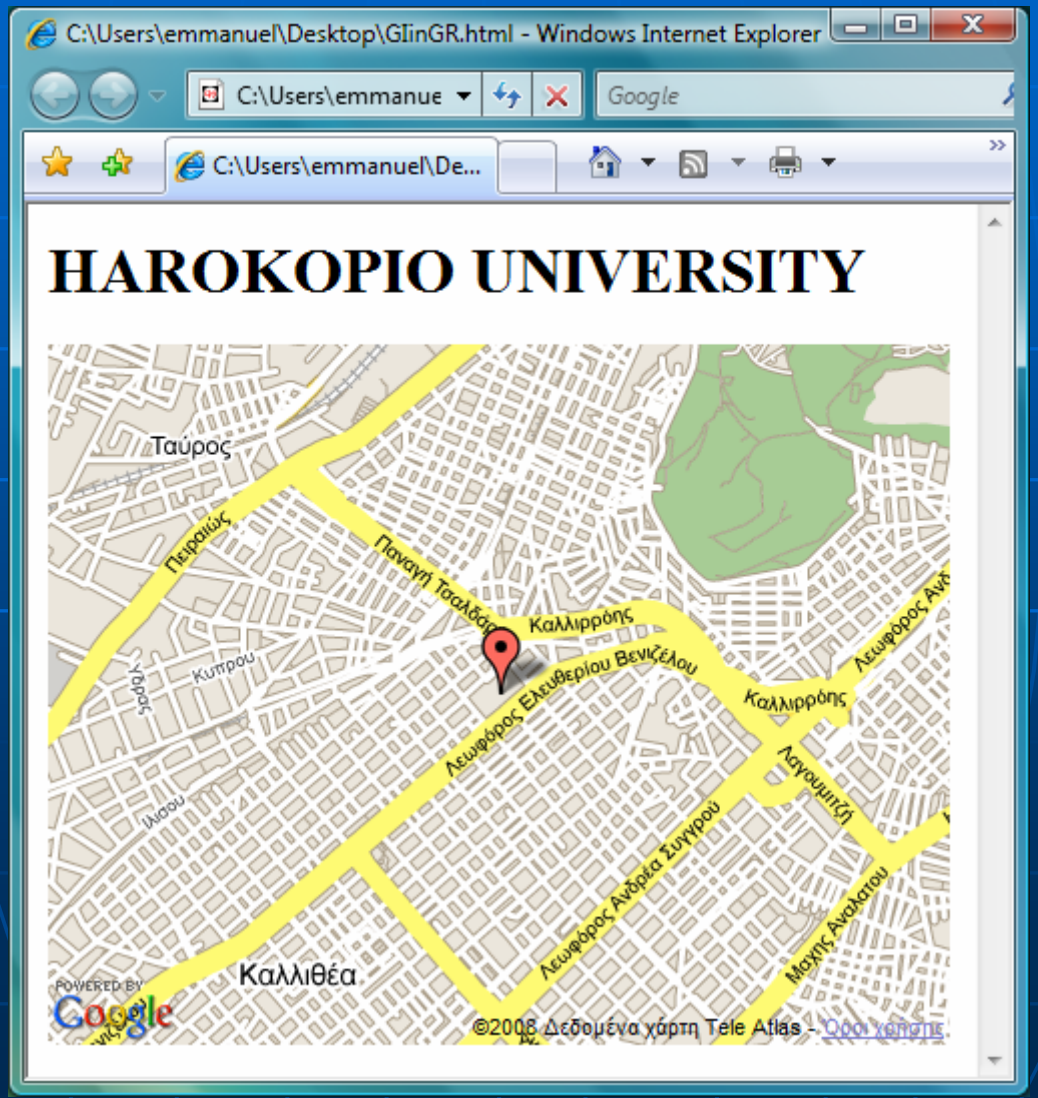
- **Mapping Mashups…**



Google Maps API

- The full Google Maps ...
  - can be embedded on an external web site
- Start by creating an API Key
  - it will be bound to the web site and directory
- Creating the map interface involves...
  - adding the Google JavaScript code to the web page, and
  - using Javascript functions to add points / objects to the map

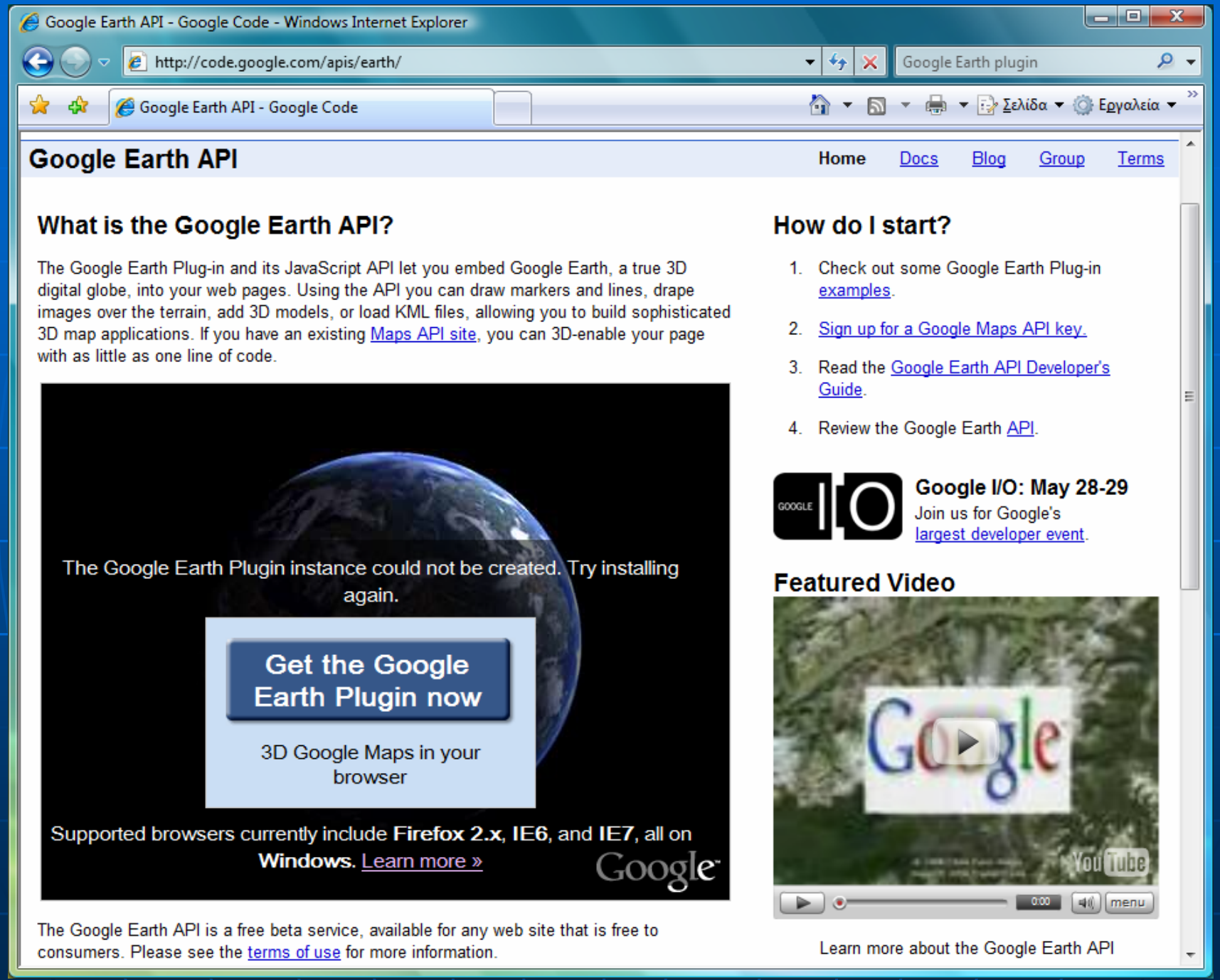
Google Maps API



GIinGR - Σημειωματάριο

Αρχείο Επεξεργασία Μορφή Προβολή Βοήθεια

```
<html>

<script src="http://maps.google.com/maps?file=api&amp;v=2&amp;
key=ABQIAAAAtNxdreQp4EAvf3ECF28WHhSubFl71VHwydoYiEmf
      3h21QVKzHBT4QGIPZ6akBuhlNZG6MXdRn3psHw"
    type="text/javascript"></script>
<script type="text/javascript">

function load() {

            var map = new GMap(document.getElementById("map"));
            map.centerAndZoom(new GPoint(23.708211,37.961252), 3);
            map.setMapType(G_MAP_TYPE);

            var point = new GPoint(23.708211,37.961252);
            var marker = new GMarker(point);
            map.addOverlay(marker);
}

</script>

<body onload="load()" onunload="GUnload()">

            <h1>HAROKOPIO UNIVERSITY</h1>
            <div id="map" style="width: 450px; height: 350px" </div>

</body>

</html>
```


Google Earth API - Google Code - Windows Internet Explorer
http://code.google.com/apis/earth/
Google Earth plugin
Google Earth API - Google Code
Σελίδα
Εργαλεία
Google Earth API
Home
Docs
Blog
Group
Terms
What is the Google Earth API?
The Google Earth Plug-in and its JavaScript API let you embed Google Earth, a true 3D digital globe, into your web pages. Using the API you can draw markers and lines, drape images over the terrain, add 3D models, or load KML files, allowing you to build sophisticated 3D map applications. If you have an existing Maps API site, you can 3D-enable your page with as little as one line of code.
The Google Earth Plugin instance could not be created. Try installing again.
Get the Google Earth Plugin now
3D Google Maps in your browser
Supported browsers currently include Firefox 2.x, IE6, and IE7, all on Windows. Learn more »
Google
The Google Earth API is a free beta service, available for any web site that is free to consumers. Please see the terms of use for more information.
How do I start?
1. Check out some Google Earth Plug-in examples.
2. Sign up for a Google Maps API key.
3. Read the Google Earth API Developer's Guide.
4. Review the Google Earth API.
GOOGLE I/O
Google I/O: May 28-29
Join us for Google's largest developer event.
Featured Video
Google
YouTube
0:00
menu
Learn more about the Google Earth API

Google Earth API - Google Code - Windows Internet Explorer

http://code.google.com/apis/earth/

Google Earth API - Google Code

Google Earth API

Home | Docs | Blog | Group | Terms

What is the Google Earth API?

The Google Earth Plug-in and its JavaScript API let you embed Google Earth, a true 3D digital globe, into your web pages. Using the API you can draw markers and lines, drape images over the terrain, add 3D models, or load KML files, allowing you to build sophisticated 3D map applications. If you have an existing Maps API site, you can 3D-enable your page with as little as one line of code.

4.3.9477.6413

The Google Earth API is a free beta service, available for any web site that is free to consumers. Please see the terms of use for more information.

How do I start?

1. Check out some Google Earth Plug-in examples.
2. Sign up for a Google Maps API key.
3. Read the Google Earth API Developer's Guide.
4. Review the Google Earth API.

Google I/O: May 28-29
Join us for Google's largest developer event.

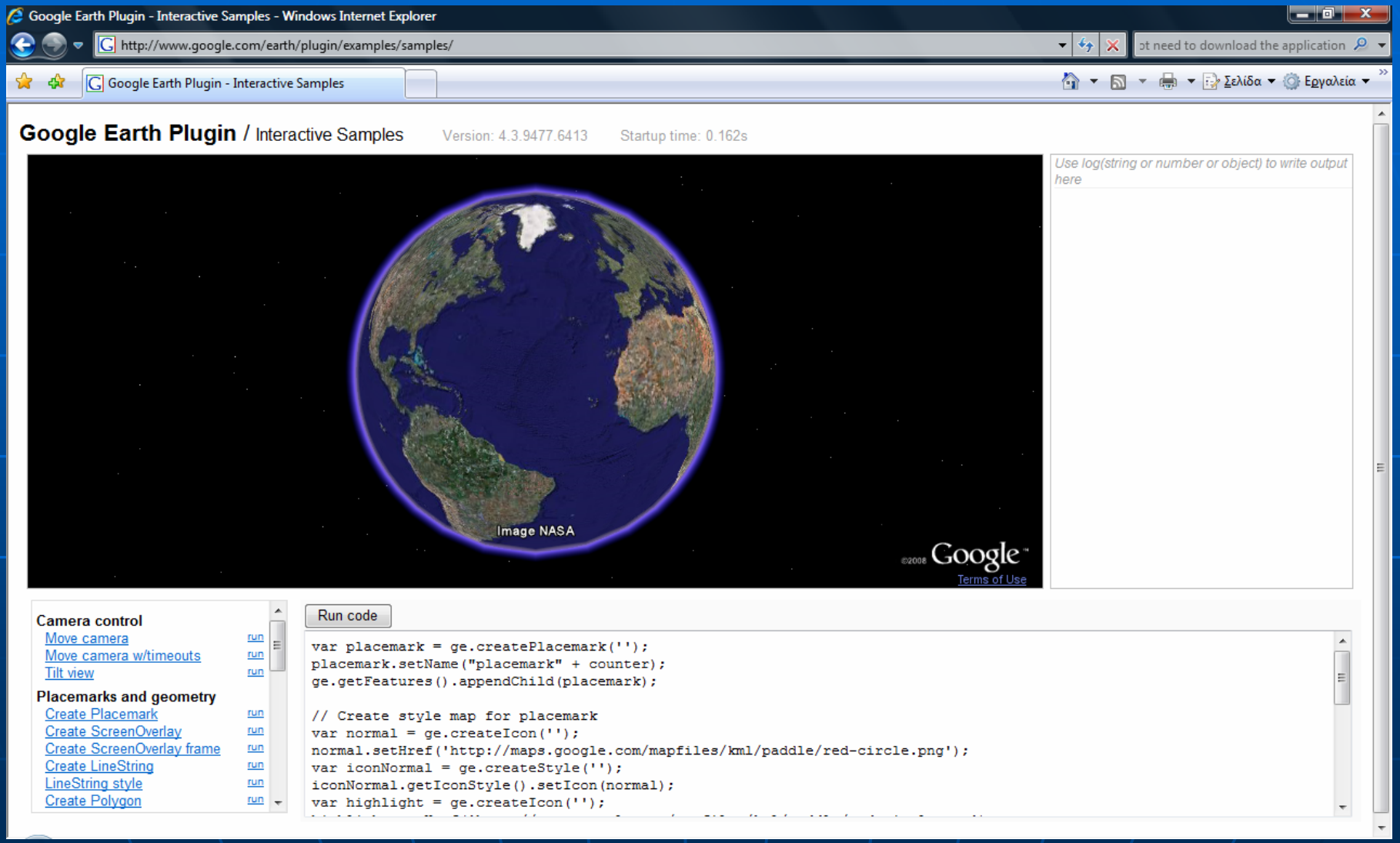
Featured Video

Learn more about the Google Earth API

earth[1] - Σημειωματάριο

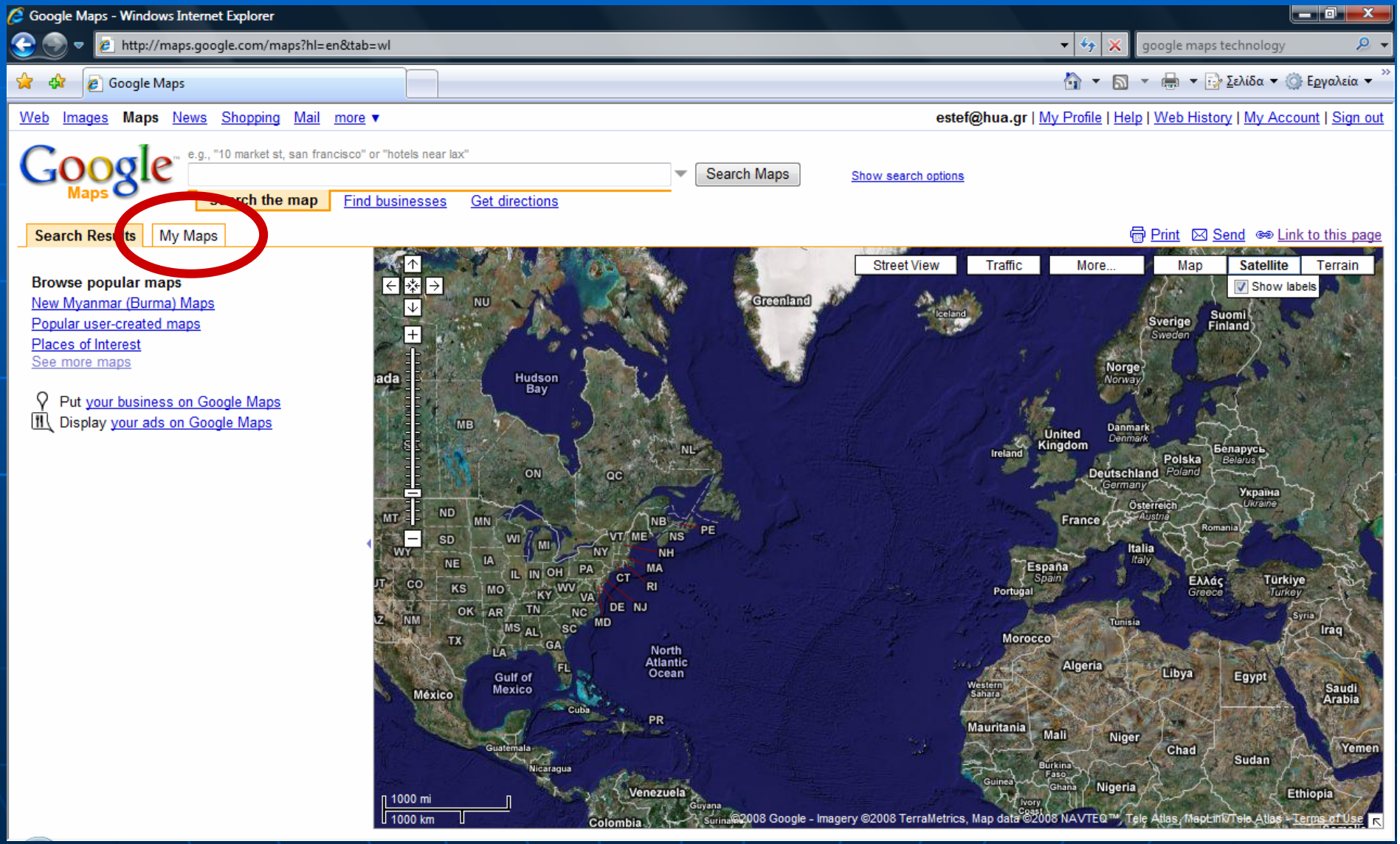
Αρχείο Επεξεργασία Μορφή Προβολή Βοήθεια

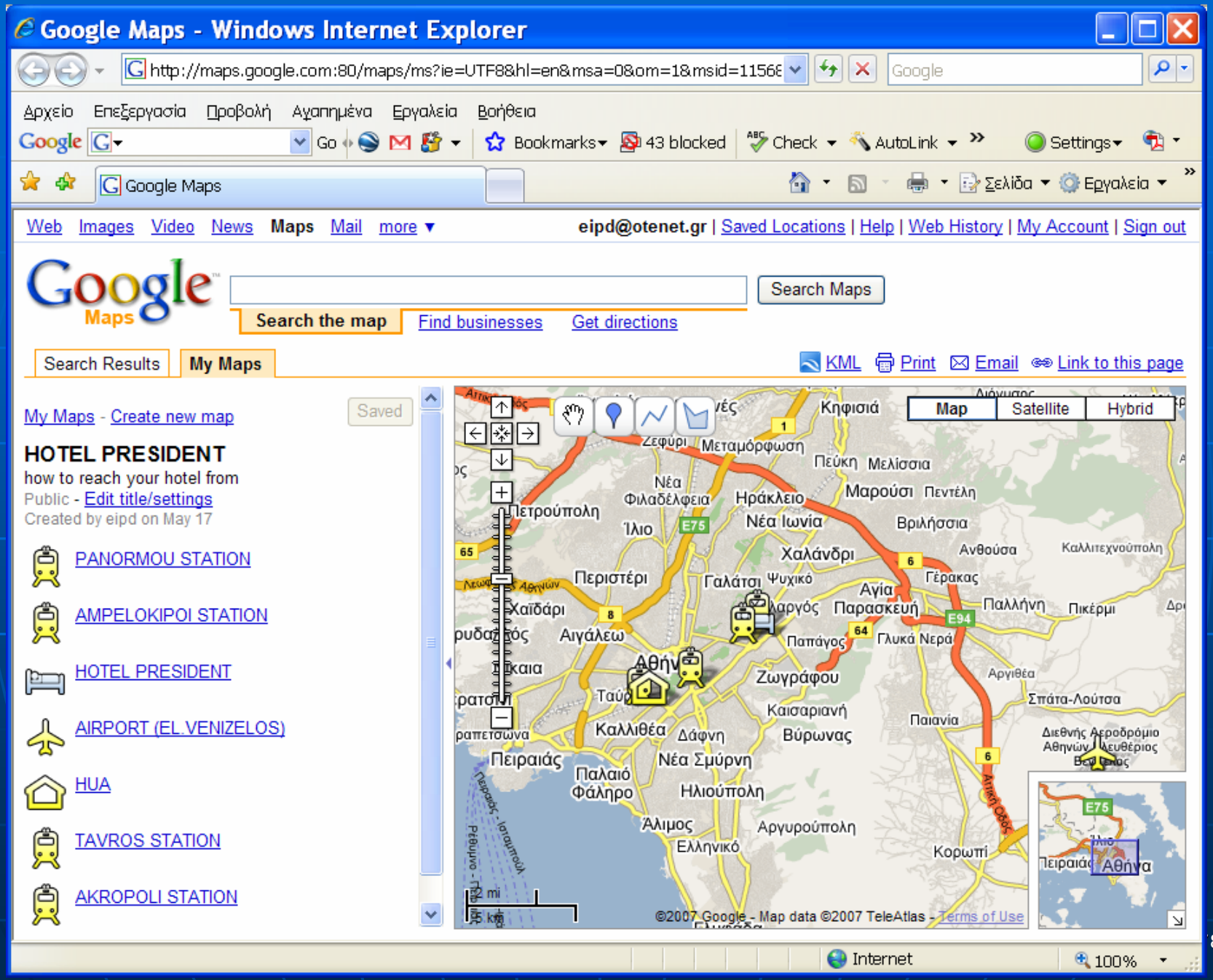
```
<script src="http://www.google.com/jsapi?key=ABQIAAAA5El50zA4PeDTEMlv-
sXFfRSsTL4WIgxhMZ0ZK_kHjwHeQuOD4xTdBhxbkZWuzyYTVeclkwYHpb17ZQ"></script>
<script>
google.load("earth", "1");
var ge = null;

function init() {
  google.earth.createInstance("map3d", initCallback, failureCallback);
}

function initCallback(object) {
  ge = object;
  ge.getWindow().setVisibility(true);
   var cam = ge.getView().copyAsCamera(ge.ALTITUDE_ABSOLUTE);
  cam.setAltitude(12000000);
  ge.getView().setAbstractView(cam);
  ge.getNavigationControl().setVisibility(ge.VISIBILITY_SHOW);
  document.getElementById('geplugin_version').innerHTML = ge.getPluginVersion();
}

function failureCallback(object) {
}
</script>
```

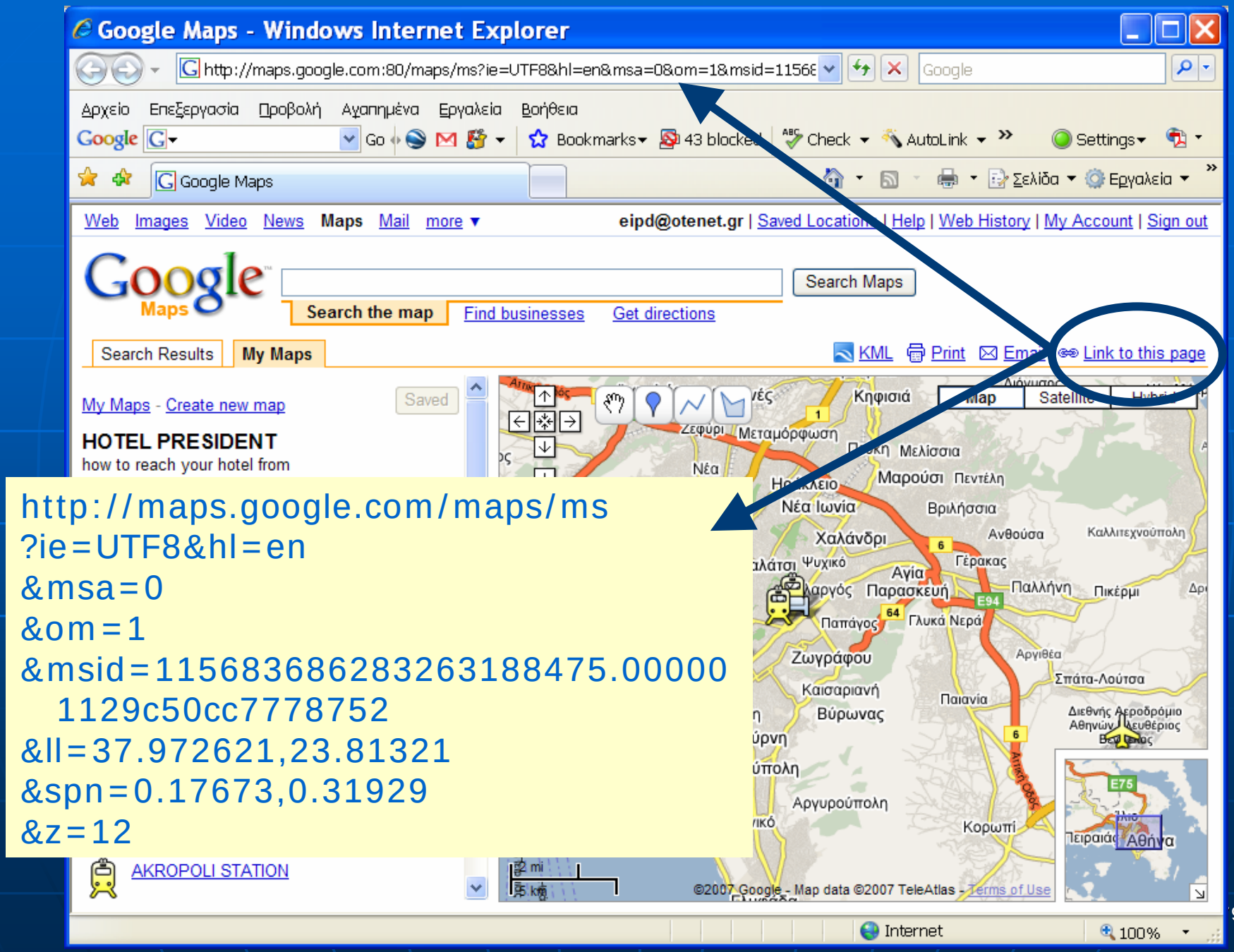


http://www.google.com/earth/plugin/examples/samples

Google Maps


Google Maps - Windows Internet Explorer
http://maps.google.com/maps?hl=en&tab=wl
google maps technology
Google Maps
Web Images Maps News Shopping Mail more ▾
estef@hua.gr | My Profile | Help | Web History | My Account | Sign out
Google Maps
e.g., "10 market st, san francisco" or "hotels near lax"
Search Maps
Show search options
Find businesses
Get directions
Search Results
My Maps
Print Send Link to this page
Browse popular maps
New Myanmar (Burma) Maps
Popular user-created maps
Places of Interest
See more maps
Put your business on Google Maps
Display your ads on Google Maps
Street View
Traffic
More...
Map
Satellite
Terrain
Show labels
Greenland
Iceland
Hudson Bay
Gulf of Mexico
North Atlantic Ocean
México
Cuba
Guatemala
Nicaragua
Venezuela
Colombia
Guyana
Suriname
Ireland
United Kingdom
Sverige
Sweden
Suomi Finland
Norge
Norway
Danmark
Denmark
Беларусь
Belarus
Polska
Poland
Deutschland
Germany
Україна
Ukraine
Österreich
Austria
Romania
France
Italia
Italy
España
Spain
Portugal
Ελλάς
Greece
Türkiye
Turkey
Syria
Iraq
Tunisia
Morocco
Algeria
Libya
Egypt
Saudi Arabia
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Yemen
Burkina Faso
Guinea
Ghana
Ivory Coast
Nigeria
Ethiopia
1000 mi
1000 km
©2008 Google - Imagery ©2008 TerraMetrics, Map data ©2008 NAVTEQ™, Tele Atlas, MapLink/Tele Atlas - Terms of Use


Google Maps - Windows Internet Explorer
http://maps.google.com:80/maps/ms?ie=UTF8&hl=en&msa=0&om=1&msid=11566
Google
Αρχείο Επεξεργασία Προβολή Αγαπημένα Εργαλεία Βοήθεια
Bookmarks 43 blocked Check AutoLink Settings
Google Maps
Σελίδα Εργαλεία
Web Images Video News Maps Mail more
eipd@otenet.gr | Saved Locations | Help | Web History | My Account | Sign out
Google Maps
Search Maps
Search the map Find businesses Get directions
Search Results My Maps
KML Print Email Link to this page
My Maps - Create new map
Saved
HOTEL PRESIDENT
how to reach your hotel from
Public - Edit title/settings
Created by eipd on May 17
PANORMOU STATION
AMPELOKIPOI STATION
HOTEL PRESIDENT
AIRPORT (EL.VENIZELOS)
HUA
TAVROS STATION
AKROPOLI STATION
Map Satellite Hybrid
Κηφισιά
Μεταμόρφωση
Πεύκη Μελίσσια
Μαρούσι Πεντέλη
Ηράκλειο
Νέα Ιωνία
Βριλήσσια
Ανθούσα
Καλλιτεχνούπολη
Χαλάνδρι
Περιστέρι
Γαλάτσι Ψυχικό
Αγία Παρασκευή
Γέρακας
Παλλήνη
Πικέρμι
Χαϊδάρι
Αιγάλεω
Παπάγος
Γλυκά Νερά
Αθήνα
Ζωγράφου
Καισαριανή
Βύρωνας
Παιανία
Καλλιθέα
Δάφνη
Πειραιάς
Νέα Σμύρνη
Παλαιό Φάληρο
Ηλιούπολη
Άλιμος
Αργυρούπολη
Ελληνικό
Κορωπί
Αργιθέα
Σπάτα-Λούτσα
Διεθνής Αεροδρόμιο Αθηνών Ελευθέριος Βενιζέλος
Αττική Οδός
E75
E94
©2007 Google - Map data ©2007 TeleAtlas - Terms of Use
Internet
100%



http://maps.google.com/maps/ms
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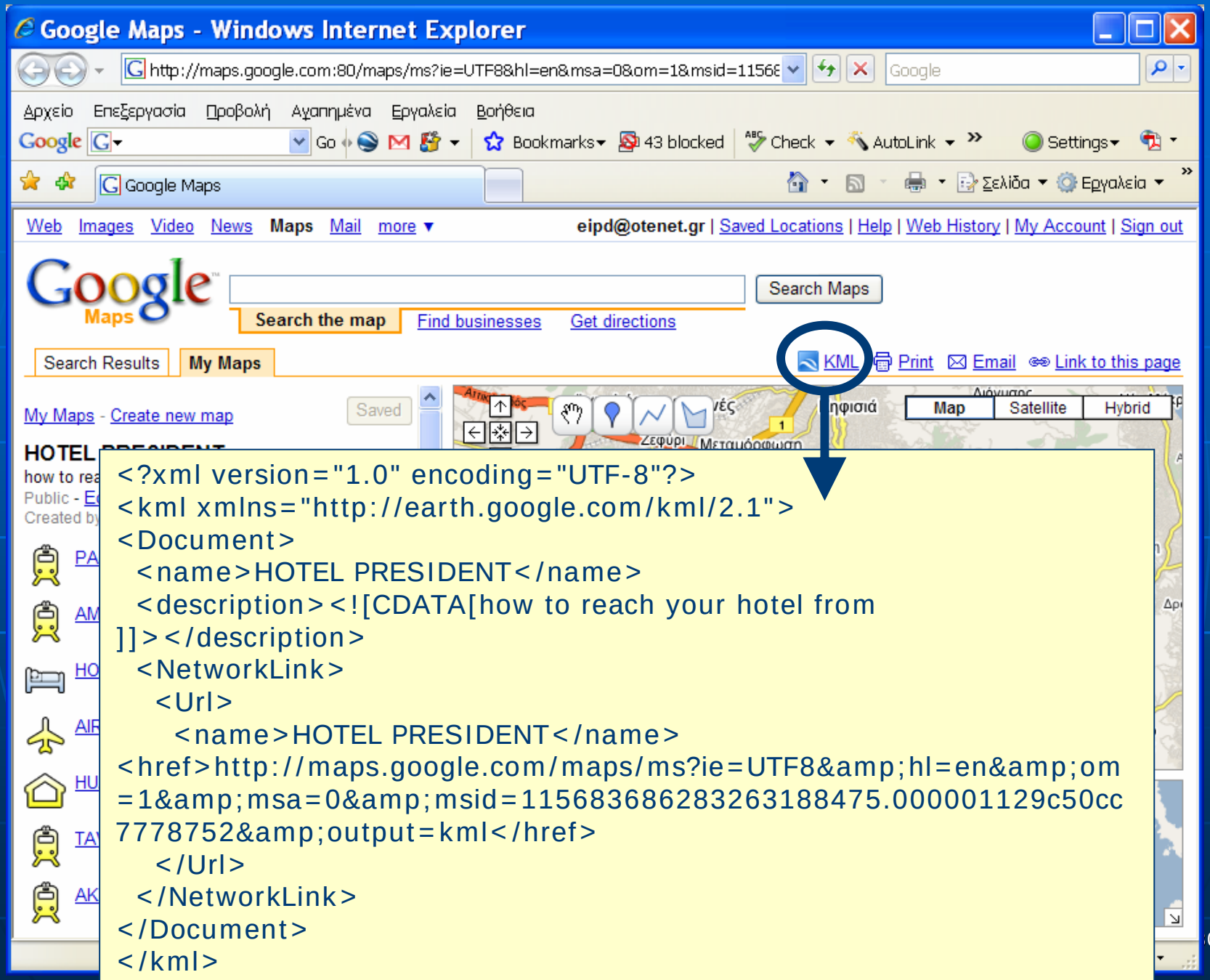
1129c50cc7778752
&ll=37.972621,23.81321
&spn=0.17673,0.31929
&z=12


Google Maps - Windows Internet Explorer
Search Maps
Search the map
Find businesses
Get directions
Search Results
My Maps
KML
Print
Email
Link to this page
Map
Satellite
Hybrid
My Maps - Create new map
Saved
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<Document>
<name>HOTEL PRESIDENT</name>
<description><![CDATA[how to reach your hotel from
]]></description>
<NetworkLink>
<Url>
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=1&msa=0&msid=115683686283263188475.000001129c50cc
7778752&output=kml</href>
</Url>
</NetworkLink>
</Document>
</kml>

Part II: Practice

4. Mapping Servers/Services on the Web

5. Spatial Data Infrastructures (SDI)

- **Architecture**
- **Components**
- **Initiatives (INSPIRE)**

6. The Heraklion SDI Web Services

Spatial Data Infrastructures (SDI)

- SDI's are frameworks of...
  - policies,
  - institutional arrangements,
  - data,
  - services,
  - technologies, and
  - people
- with a common scope...
  - to promote the **accessibility** and **usability** of **geospatial content (data and services)**

Spatial Data Infrastructures (SDI)

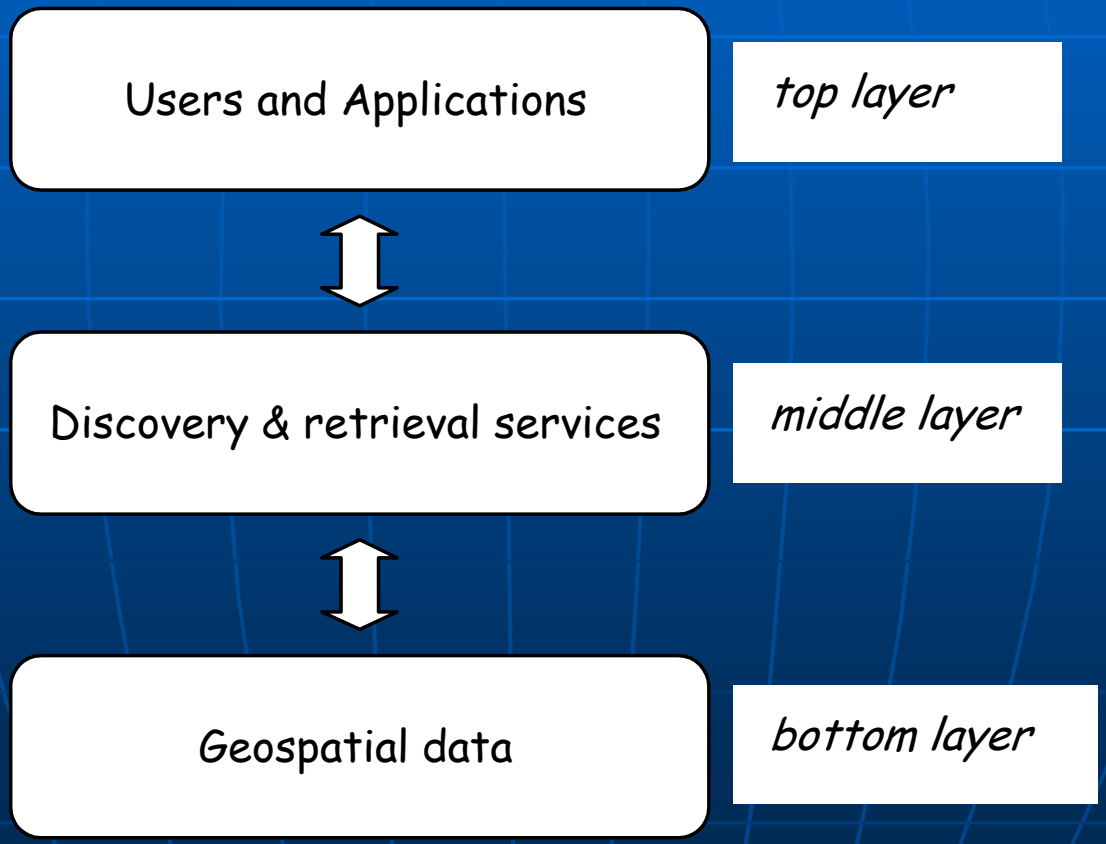
- SDI's are built at...
  - regional
  - national or
  - international level
- The participating organizations have agreed on the adoption of common...
  - vocabularies,
  - practices,
  - standards,
  - technical specifications and
  - operational components

Spatial Data Infrastructures (SDI)

- SDI is NOT a simple data repository...
- An SDI hosts...
  - geographic **content** (data and services)
  - sufficient description of this content (**metadata**)
  - effective methods to discover and evaluate this content (**data catalogs**)
  - tools to visualize the data (**web mapping**)
  - **services** and **software tools** to support specific application domains

Spatial Data Infrastructures (SDI)

- A three-tier architecture...



Spatial Data Infrastructures (SDI)

- The development of an SDI ...
  - supported by a set of sophisticated **(1)software systems and tools** and
  - must be compatible with a series of **(2)standards and specifications**

...in order to assure the **interoperability** between repositories with geospatial content

Spatial Data Infrastructures (SDI)

(1) Software Systems & Tools...

- **Commercial GIS packages** ...
  - may support the development of high quality SDIs
- **Open Source** Geospatial software ...
  - is now able to address the needs of geoscientists and professionals (OSGeo)

Spatial Data Infrastructures (SDI)

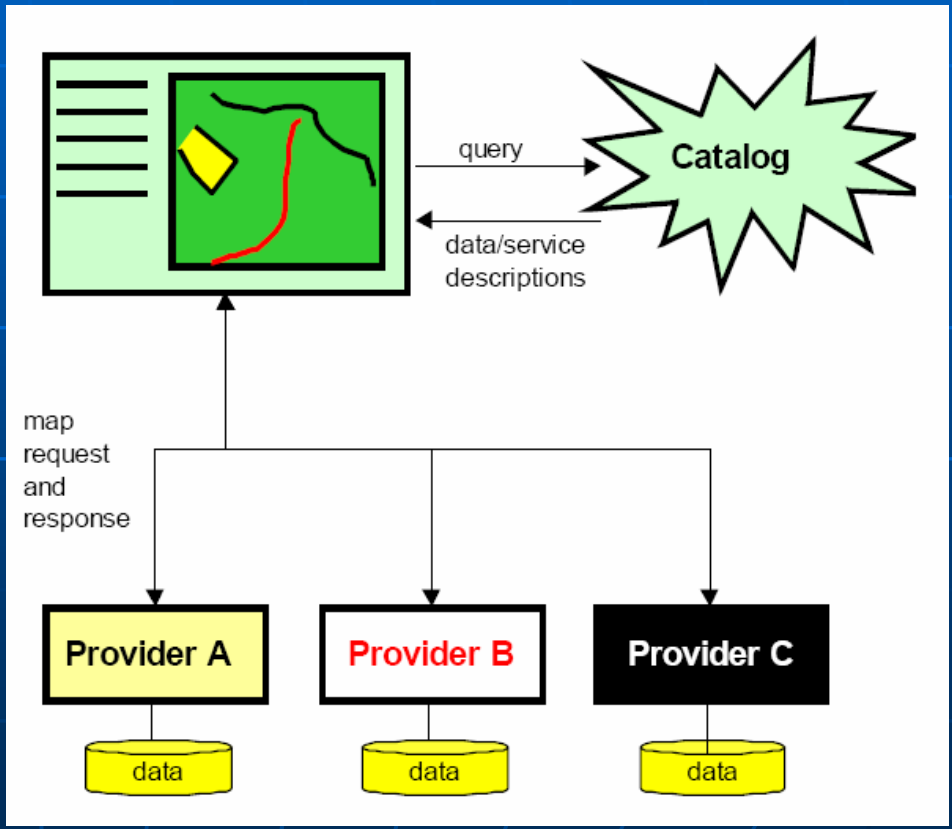
(2) Geospatial standards/specifications

- the Open Geospatial Consortium (OGC)
- the World Wide Web Consortium (W3C)
- the International Organization for Standardization (ISO)

... have already developed rich standards and specifications to support the interoperability between repositories with geospatial content

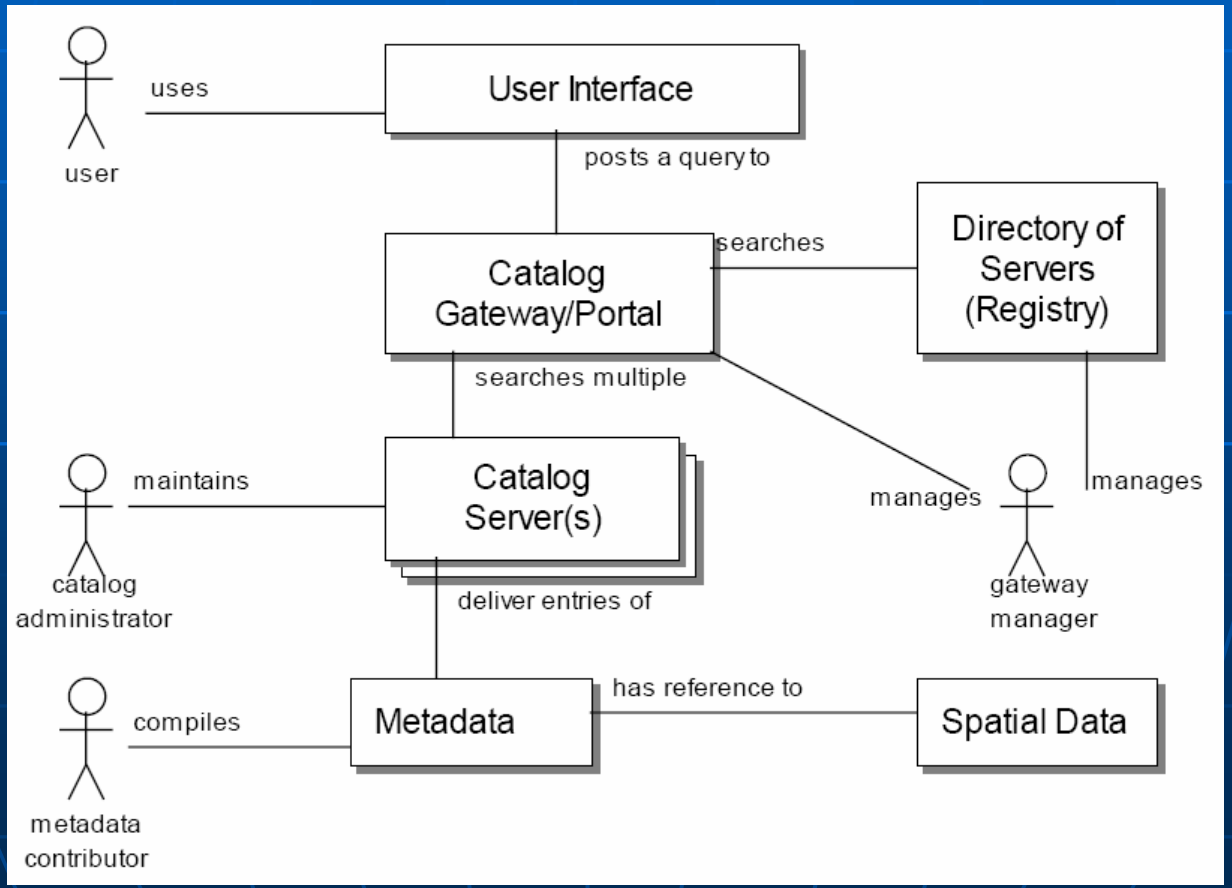
Spatial Data Infrastructures (SDI)

- SDI supports ...
  - many users (web clients)
  - many providers (web servers)



Spatial Data Infrastructures (SDI)

- SDI data/metadata/catalog services



Spatial Data Infrastructures (SDI)

- "SDI Initiatives"
  - any national, regional, and international programs and projects
  - "working to improve access to available spatial data, promote its reuse, and ensure that additional investment in spatial information collection and management results in an ever growing, readily available and useable pool of spatial information"

Spatial Data Infrastructures (SDI)

http://www.ec-gis.org/inspire/

Spatial Data Infrastructures (SDI)

- **The need for the INSPIRE initiative**
  - The general situation on spatial information in Europe is one of fragmentation of datasets and sources, gaps in availability, lack of harmonisation between datasets at different geographical scales and duplication of information collection. **These problems make it difficult to identify, access and use data that is available.**

- **The INSPIRE Concept**
  - *INSPIRE is ambitious*. The initiative intends to trigger the creation of a European spatial information infrastructure that delivers to the users integrated spatial information services. **These services should allow the users to identify and access spatial or geographical information from a wide range of sources**, from the local level to the global level, in an inter-operable way for a variety of uses. The target users of INSPIRE include policy-makers, planners and managers at European, national and local level and the citizens and their organisations. Possible services are the visualisation of information layers, overlay of information from different sources, spatial and temporal analysis, etc.

Part II: Practice

4. Mapping Servers/Services on the Web
5. Spatial Data Infrastructures (SDI)

6. The Heraklion SDI Web Services

- **SDI Architecture and Software Systems**
- **The WMS, WFS, WCS and KML Servers**
- **The Web Client Application**
- **The Mashups**
- **The Web Catalog Server**

The Heraklion SDI

- A regional SDI …
  - has recently been developed for the Heraklion Prefecture in Crete, Greece
  - using merely …
    - Geographic Free and Open Source Software (**GeoFOSS**)

http://heraklion-sdi.dynalias.net/coastatlas/index-en.html

Heraklion SDI

- This SDI is ...
  - compatible with the geospatial standards and specifications introduced by the Open Geospatial Consortium (OGC), and
  - serves the geospatial content through widely accepted web services (e.g., WMS, WFS, WCS and CSW)

http://heraklion-sdi.dynalias.net/coastatlas/index-en.html

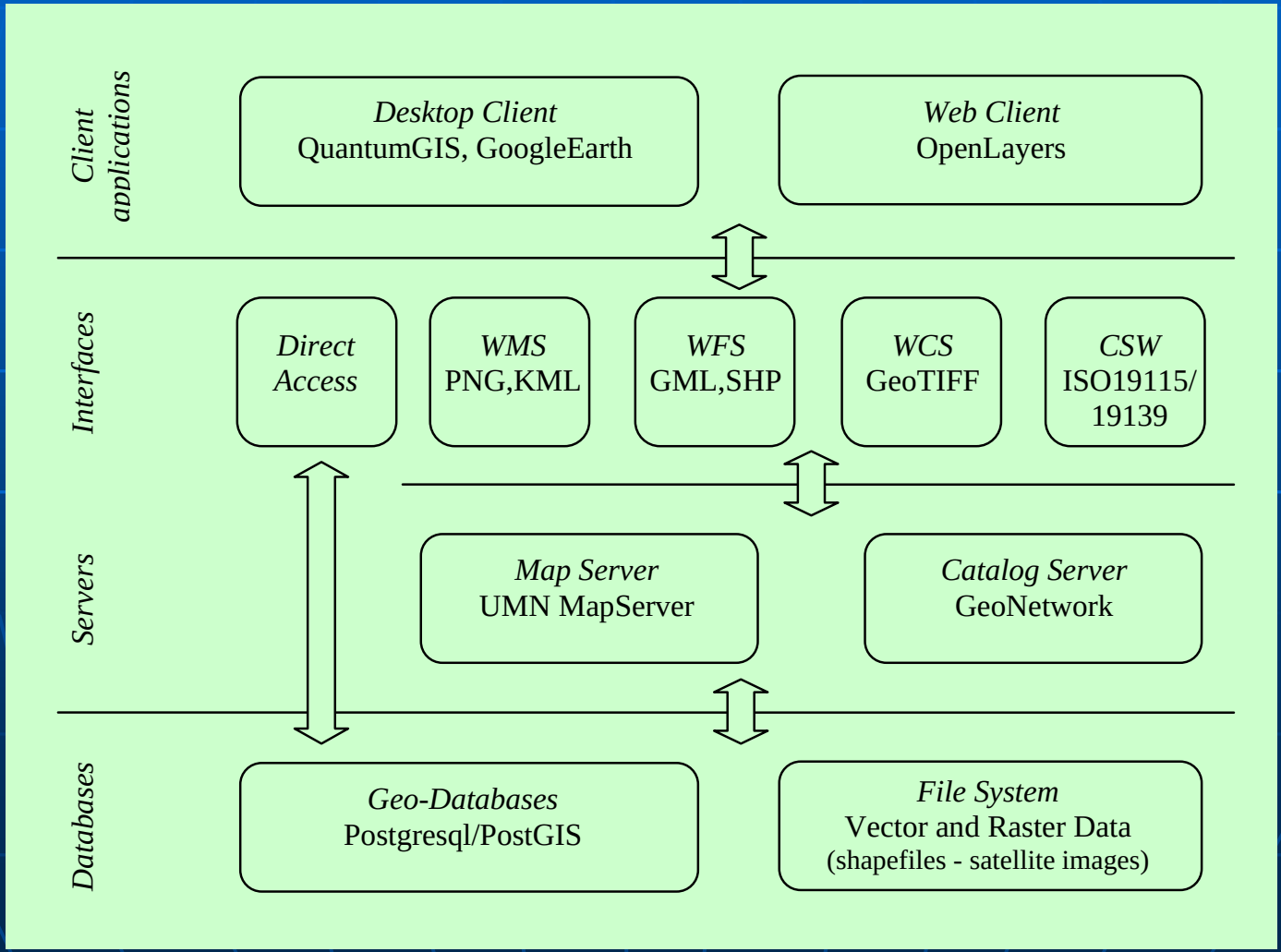
Heraklion SDI

- Public Datasets …

Layer Content/Description	*Format*	*Name*
Prefecture (outline)	Shapefile	*nomos_irakliou*
Municipalities (outlines)	Shapefile	*dhmoi_irakliou*
Municipalities Subdivisions (outlines)	Shapefile	*dhm_diamer_irakliou*
Urban Areas (outlines)	Shapefile	*bua_irakliou*
Towns and Villages (points)	Shapefile	*oikismoi_irakliou*
Road Network (lines)	Shapefile	*odiko_irakliou*
Heraklion City buildings (polygons)	Shapefile	*build_egsa*
Heraklion city Airport and Seaport (points)	Shapefile	*poi_irakliou*
Lakes (polygons)	Shapefile	*limnes_irakliou*
Geology cover (polygons)	Shapefile	*geo_N_Herakleio*
Archaeological spots (points)	Shapefile	*archaiologia_N_Herakleio*
Digital Elevation Model (raster)	GeoTiff	*dem*
Land Cover (raster)	GeoTiff	*lc*
Orthophoto Map (raster)	GeoTiff	*hr_ortho*

Architecture & Software Systems

- The architecture...

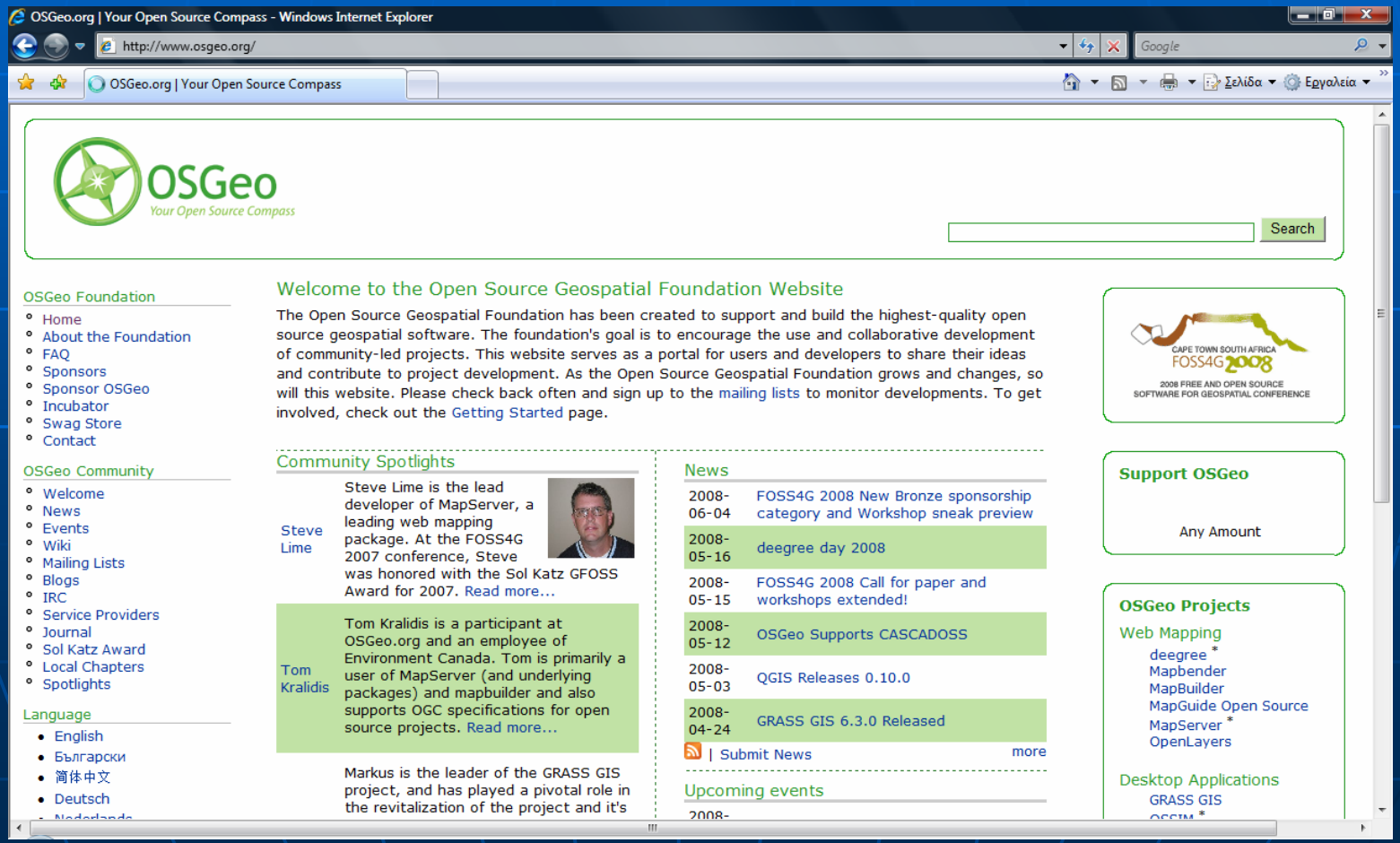


Architecture & Software Systems

- The geospatial layers of the SDI are served using ...
  - Services: WMS, WFS, WCS
  - Languages: GML, KML
  - Standards: ISO19115/139
- They are visualized via ...
  - a web application (web client)
  - a desktop GIS / GE (desktop client)

Architecture & Software Systems

- Open Source Software Systems...

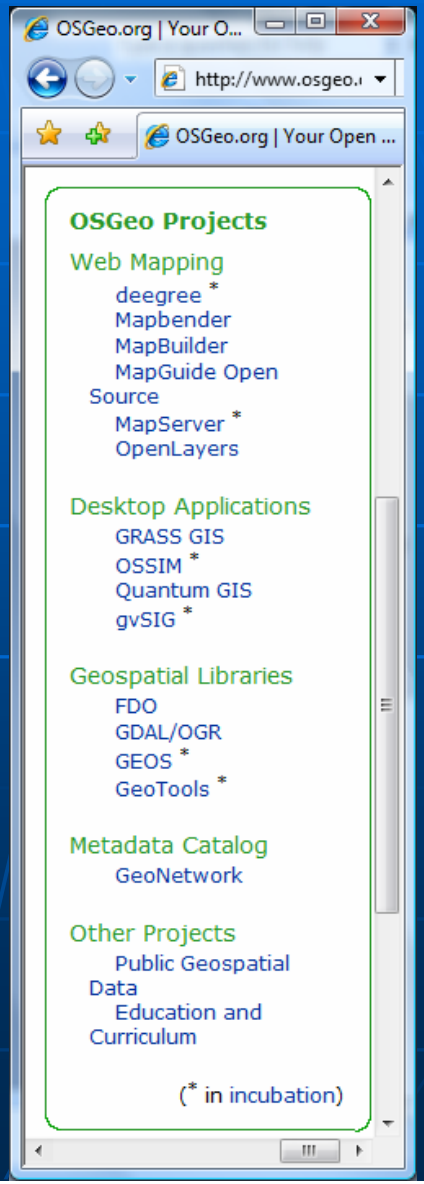


http://www.osgeo.org/

Architecture & Software Systems

- OSGeo...
  - The Open Source Geospatial Foundation...
    - has been created to support and build the highest-quality open source geospatial software
  - The foundation's goal is....
    - to encourage the use and collaborative development of community-led projects

http://www.osgeo.org/



Architecture & Software Systems

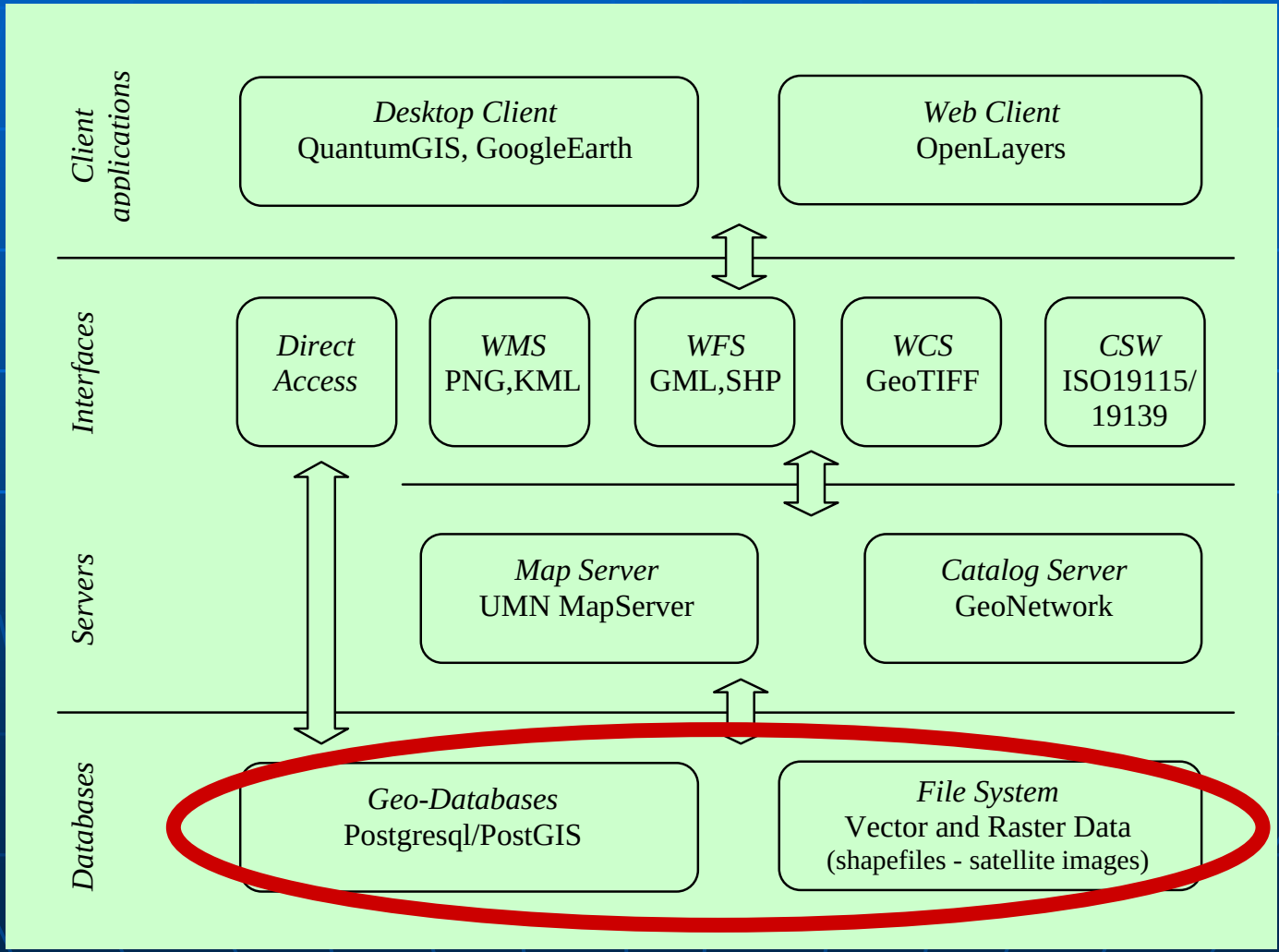
- Software Systems...
  - *Apache Web Server* (http://www.apache.org) in the role of the Web Server.
  - *OpenLayers JavaScript Library* (http://openlayers.org) in the role of the Web Client (Interface).
  - *QuantumGIS* (http://www.qgis.org) in the role of the Desktop Client.
  - *GoogleEarth* (http://earth.google.com) in the role of the Desktop Client (for the KML files).

Architecture & Software Systems

- Software Systems… (cont')
  - *UMN MapServer* (http://mapserver.gis.umn.edu) in the role of the Map Server.
  - *GeoNetwork Opensource* (http://geonetwork-opensource.org) in the role of the Catalog Server.
  - *GDAL/OGR* (http://www.gdal.org) in the role of the Geospatial Library.
  - *Postgresql/PostGIS* (http://www.postgis.org) in the role of the Spatial Database Server.

Architecture & Software Systems

- The architecture...



Heraklion SDI

- The Geo-Databases...

SDI Public Layers

Layer Content/Description	*Format*	*Name*
Prefecture (outline)	Shapefile	*nomos_irakliou*
Municipalities (outlines)	Shapefile	*dhmoi_irakliou*
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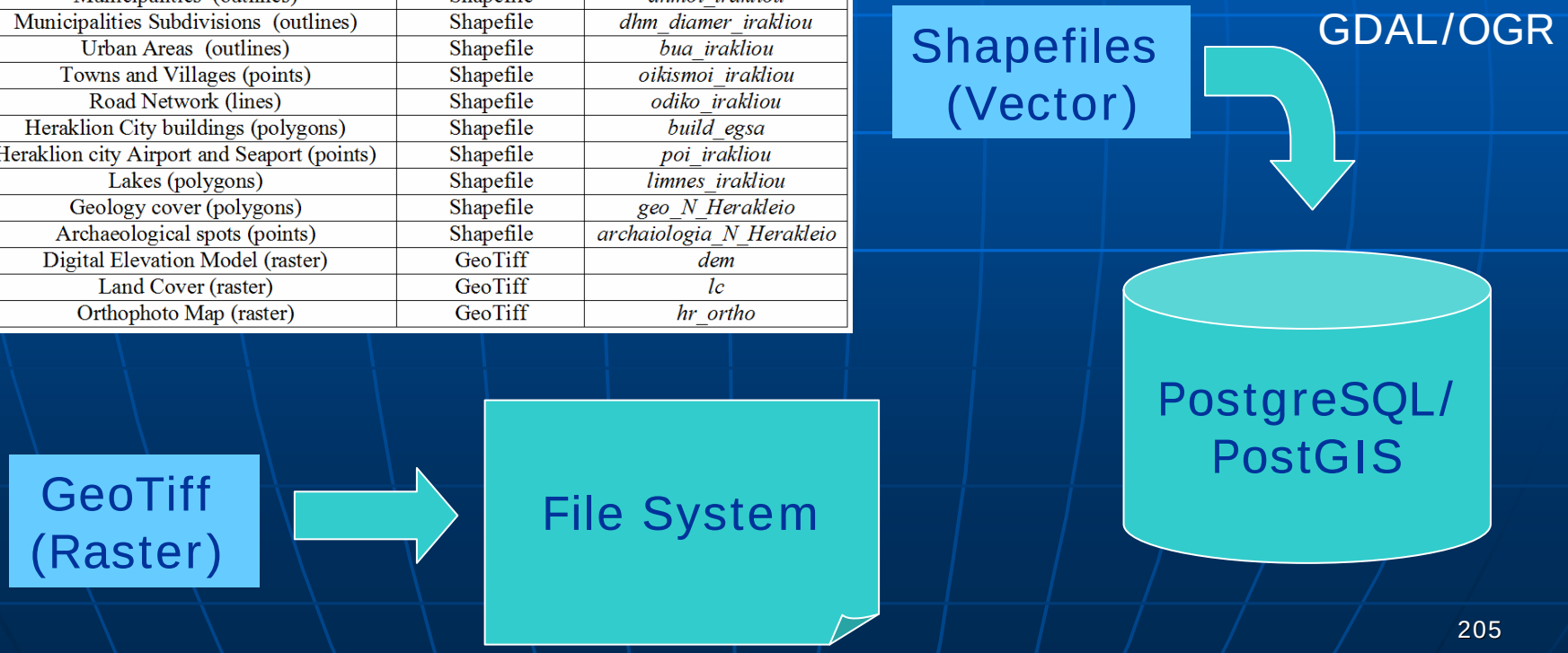
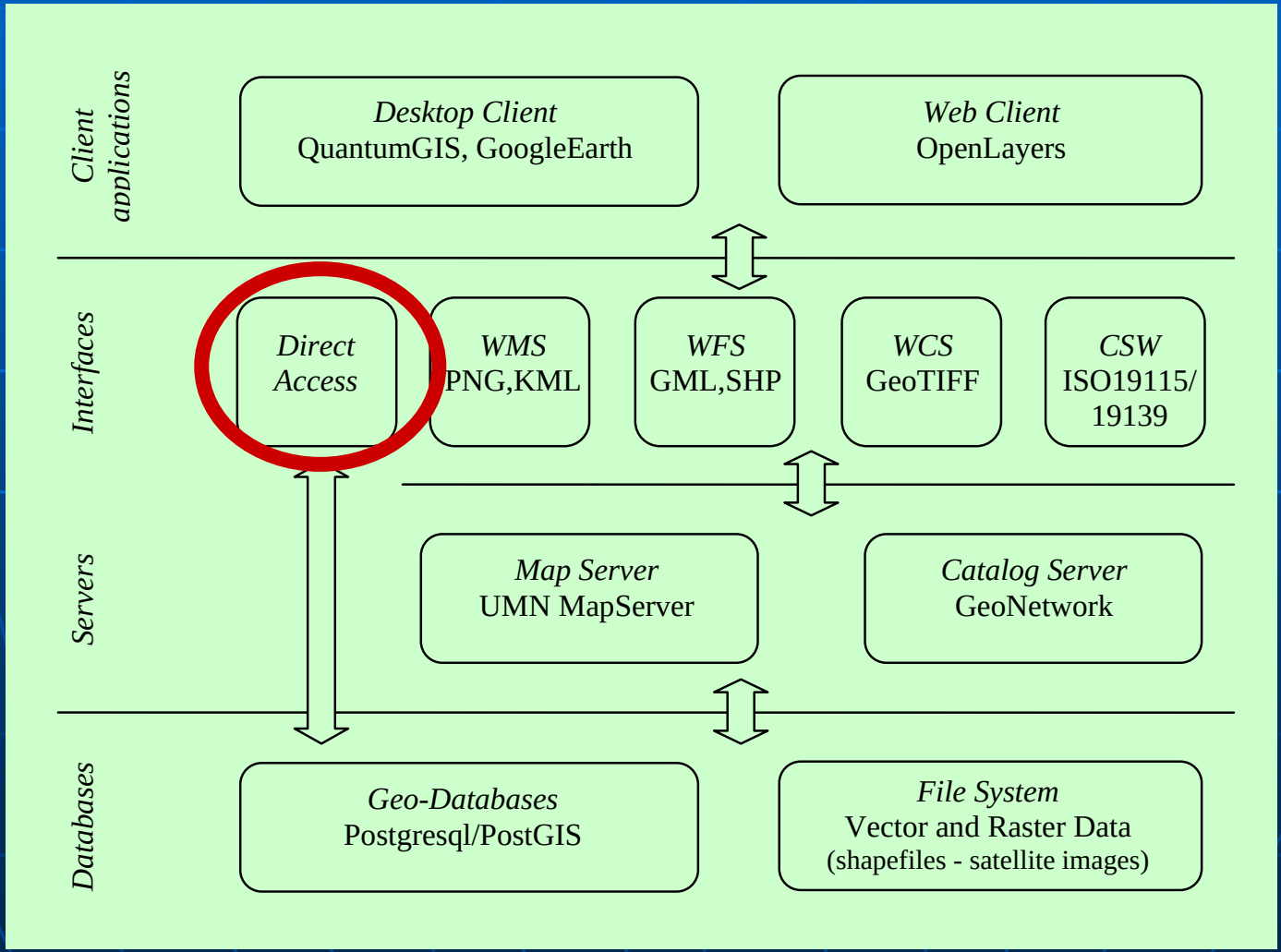


Architecture & Software Systems

- The architecture...



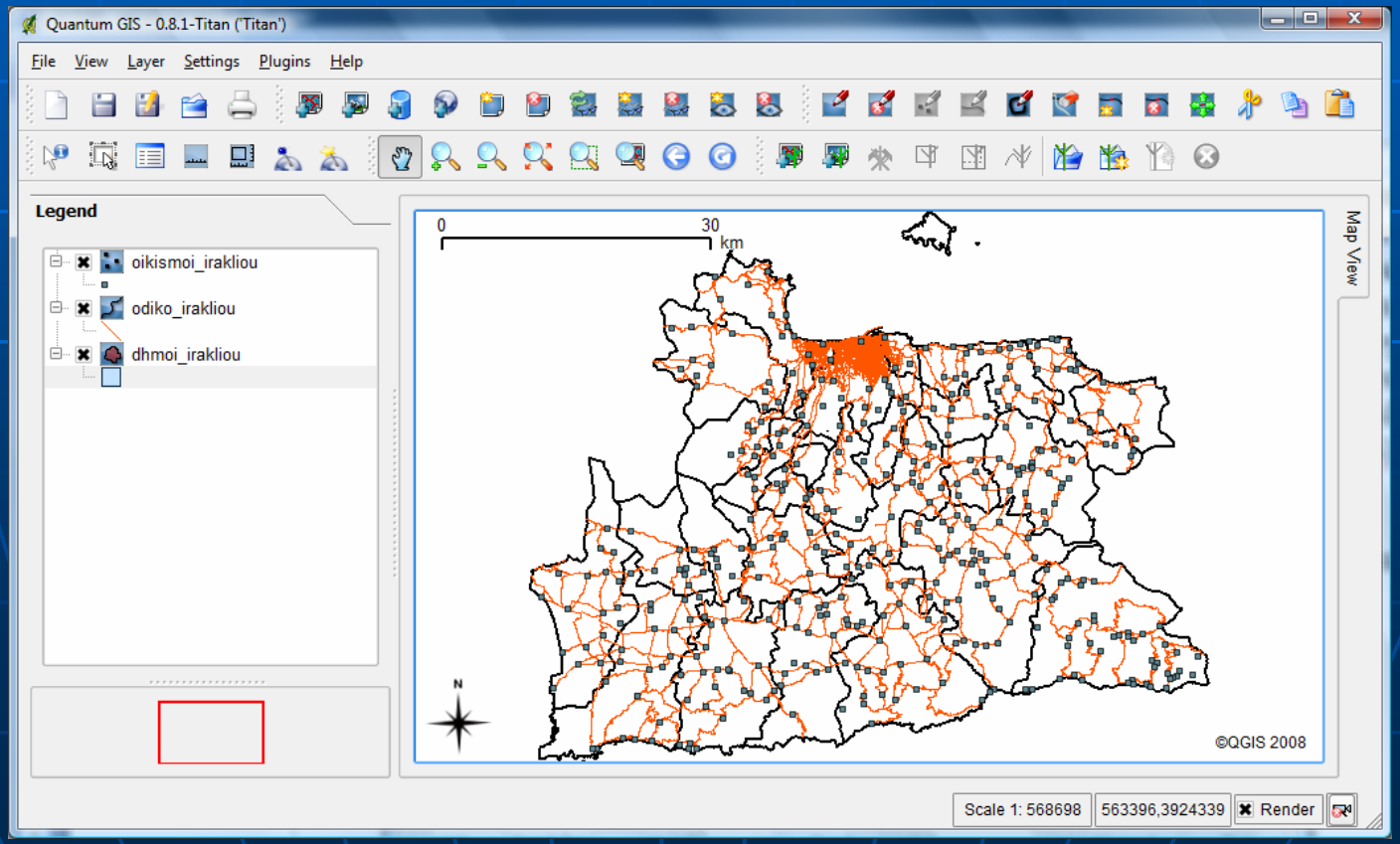
Heraklion SDI

- The middle layer...
  - provides the **Direct Access Interface**
    - to the geospatial content that resides in the spatial database server
  - The Direct Access Interface ...
    - may support effectively...
      - the querying and
      - the analysis

      ... of the geospatial content using SQL statements

Heraklion SDI

- The **Direct Access Interface**...
  - Example queries...



- **Table of Municipalities: "dhmoi_irakliou" (type: multi_polygon)**

```
SELECT gid, NAMF_EN, POP_01, AsText(the_geom)
FROM dhmoi_irakliou;
```

gid (identifier)	NAMF_EN (municipality name)	POP_01 (population in 2001)	the_geom (geometry column)
1	Municipality Of Irakleio	137711	MULTIPOLYGON(…)
2	Municipality Of Agia Varvara	5310	MULTIPOLYGON(…)
3	Municipality Of Arkalochori	10897	MULTIPOLYGON(…)
4	Municipality Of Archanes	4548	MULTIPOLYGON(…)
…	…	…	…

26 rows

- **Table of Cities/Villages: "oikismoi_irakliou" (type: point)**

```
SELECT gid, NAMEENG, POP01, AsText(the_geom)
FROM oikismoi_irakliou;
```

gid (identifier)	NAMEENG (city/village name)	POP01 (population in 2001)	the_geom (geometry column)
1	Agia Pelagia	553	POINT(592221 3918593)
2	Paralia Fodele	99	POINT(586237 3917962)
3	Achlada	119	POINT(589949 3917093)
4	Fodele	540	POINT(586850 3915575)
…	…	…	…

400 rows

- **Table of Road Network: "odiko_irakliou" (type: multi_linestring)**

```
SELECT gid, SPEED, EU_CODE, AsText(the_geom)
FROM odiko_irakliou;
```

gid (identifier)	SPEED (speed limit)	EU_CODE (E75 for national roads)	the_geom (geometry column)
1	50		MULTILINESTRING(…)
2	50		MULTILINESTRING(…)
3	80	E75	MULTILINESTRING(…)
4	70	E75	MULTILINESTRING(…)
…	…	…	…

12228 rows

Query 1: Find how many cities there are per municipality.

SQL Statement

```
SELECT r.NAMF_EN as Municipality,
   count(m.the_geom) as Number
FROM dhmoi_irakliou AS r,
     oikismoi_irakliou AS m
WHERE intersects(r.the_geom, m.the_geom)
GROUP BY r.NAMF_EN
ORDER BY number_of_cities DESC;
```

Output

```
Municipality                | Number
----------------------------+---------
Municipality Of Viannos     | 46
Municipality Of Arkalochori | 40
Municipality Of Asterousia  | 28
Municipality Of Gortyna     | 26
Municipality Of Kasteelli   | 24
…
```

Query 2: What is the length of roads fully contained within each municipality? Report only the 5 largest.

SQL Statement

```
SELECT m.NAMF_EN as Municipality,
 sum(length(r.the_geom))/1000 as Roads_km
FROM odiko_irakliou AS r,
     dhmoi_irakliou AS m
WHERE r.the_geom && m.the_geom
AND contains(m.the_geom,r.the_geom)
GROUP BY m.NAMF_EN
ORDER BY roads_km DESC
LIMIT 5;
```

Output

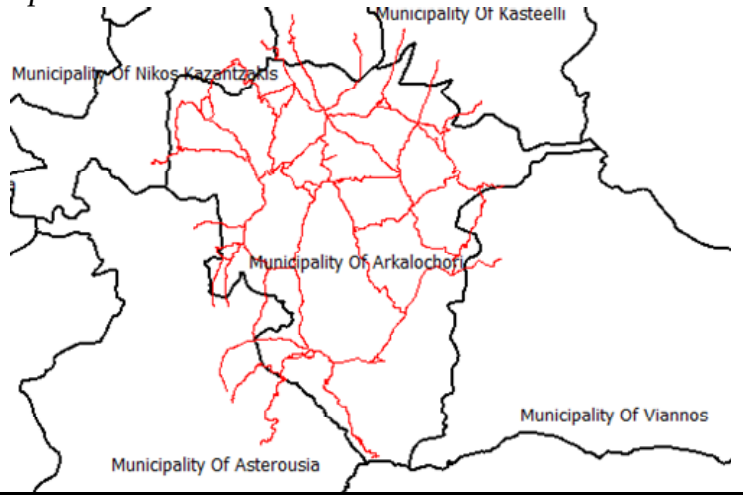
```
Municipality                | Roads_km
----------------------------+---------
Municipality Of Irakleio    | 595.440
Municipality Of Gazi        | 200.706
Municipality Of Arkalochori | 147.853
Municipality Of Asterousia  | 146.120
Municipality Of Viannos     | 137.159
----------------------------+---------
```

Query 3: Find the road segments intersected by the municipality of Arkalochori

SQL Statement

```
CREATE TABLE "ark_roads"
  (gid serial PRIMARY KEY,"id" int4);
SELECT AddGeometryColumn('','ark_roads',
  'the_geom','2100','MULTILINESTRING',2);
INSERT INTO ark_roads(id, the_geom)
SELECT r.gid, r.the_geom
FROM odiko_irakliou AS r,
     dhmoi_irakliou AS m
WHERE r.the_geom && m.the_geom
AND intersects(m.the_geom,r.the_geom)
AND m.NAMF_EN =
    'Municipality Of Arkalochori';
```

Output

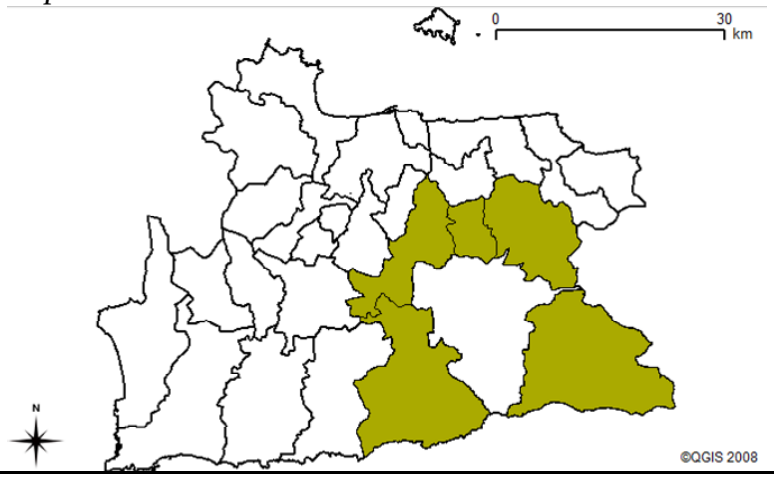


Query 4: Find the neighbors (with a common border) of the municipality of Arkalochori.

SQL Statement

```
CREATE TABLE "ark_neigh"
  (gid serial PRIMARY KEY,"id" int4);
SELECT AddGeometryColumn('','ark_neigh',
  'the_geom','2100','MULTIPOLYGON',2);
INSERT INTO ark_neigh (id, the_geom)
SELECT n.gid, n.the_geom
FROM dhmoi_irakliou as m,
     dhmoi_irakliou as n
WHERE m.NAMF_EN =
      'Municipality Of Arkalochori'
AND Touches(m.the_geom, n.the_geom);
```

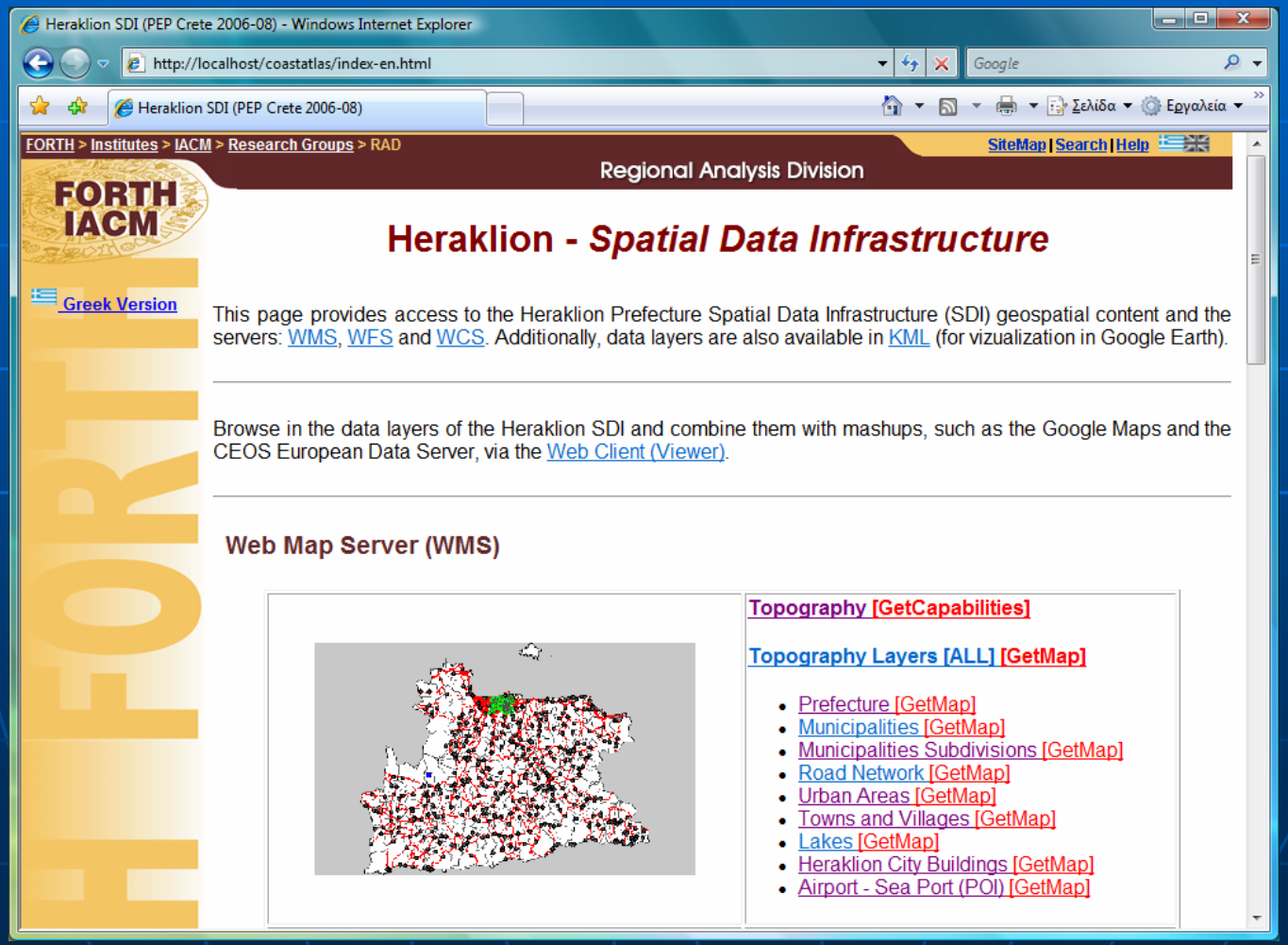
Output



Heraklion SDI

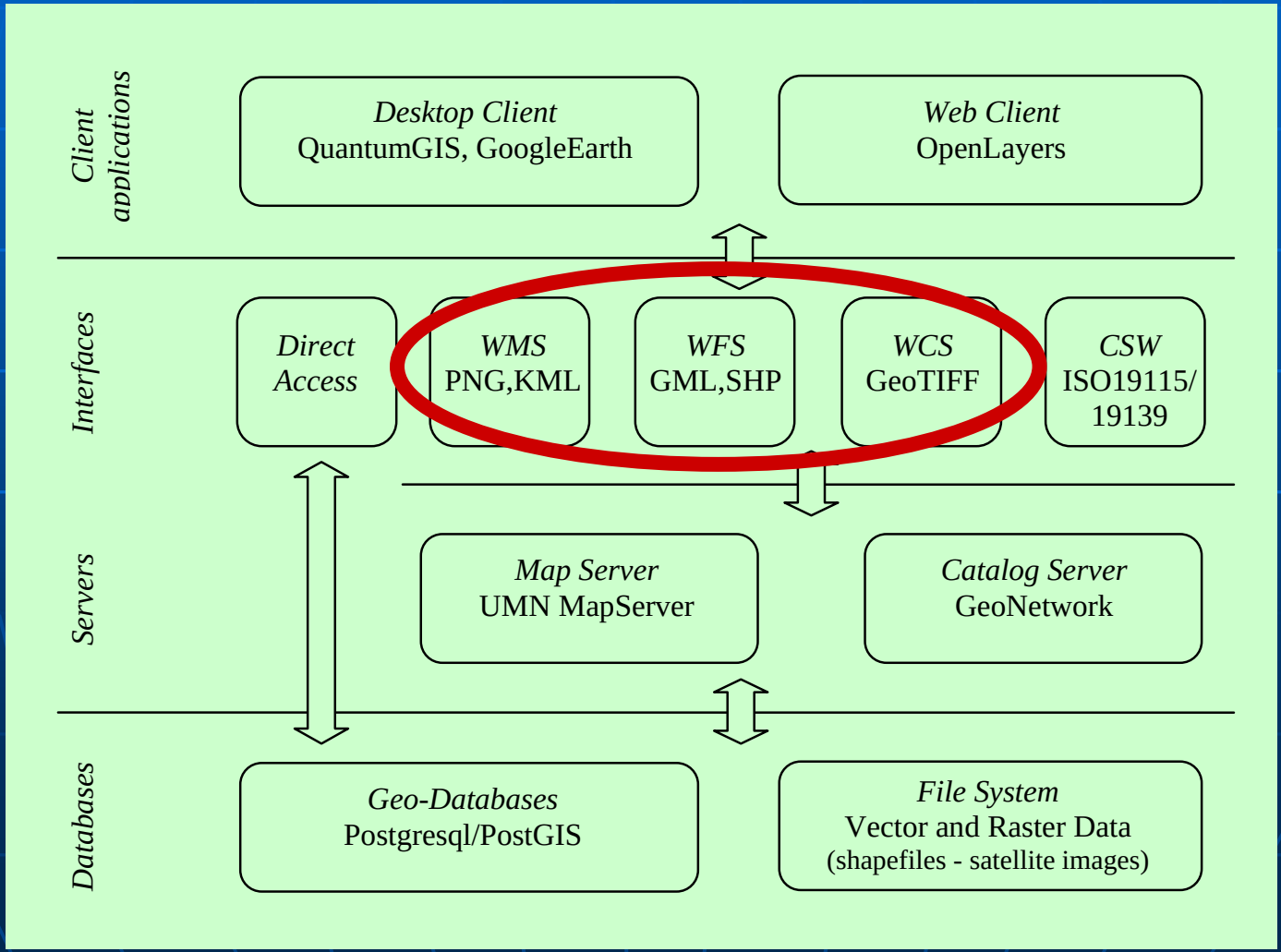
- The Web page…

http://heraklion-sdi.dynalias.net/coastatlas/index-en.html



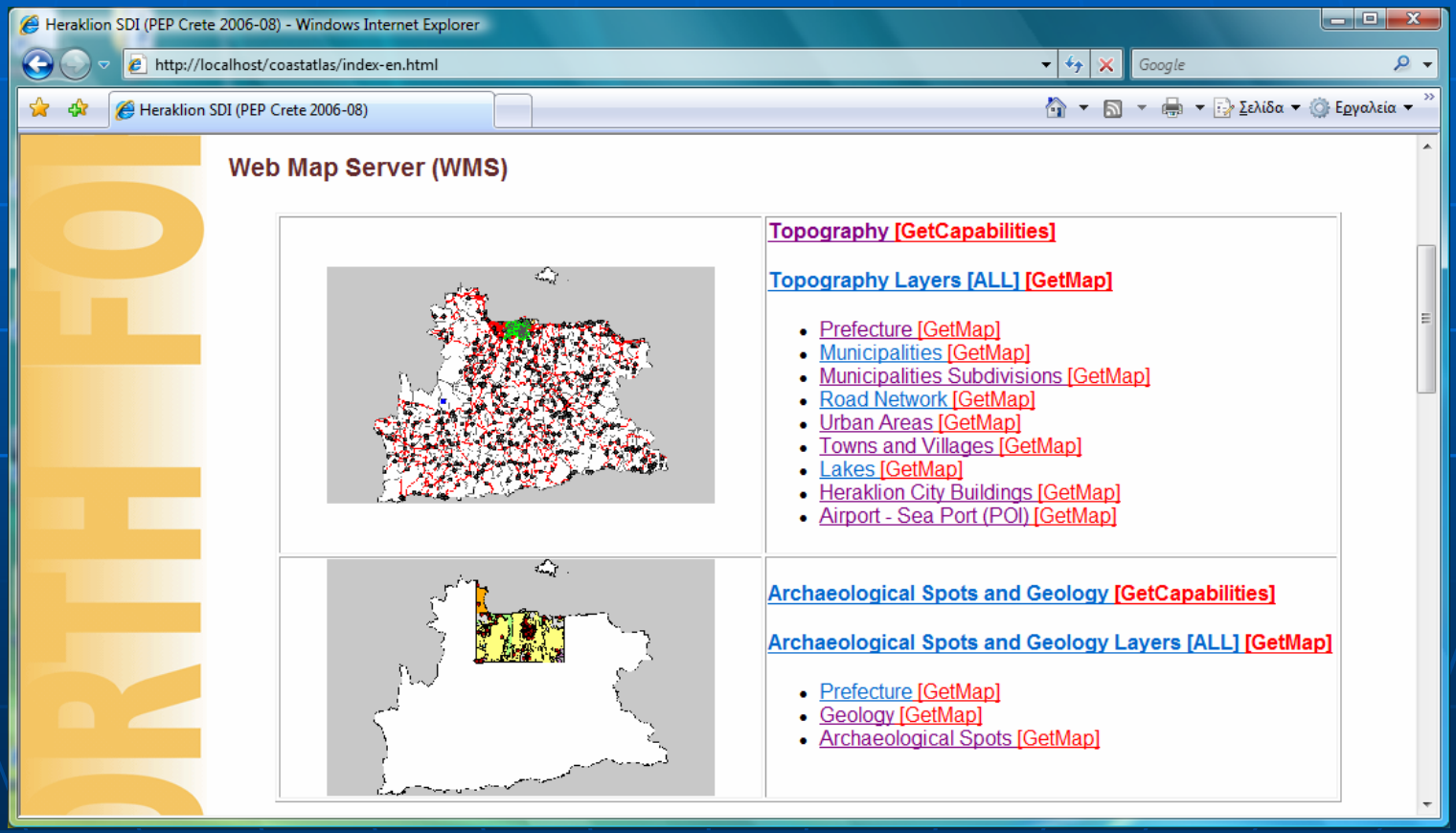
Architecture & Software Systems

- The architecture...



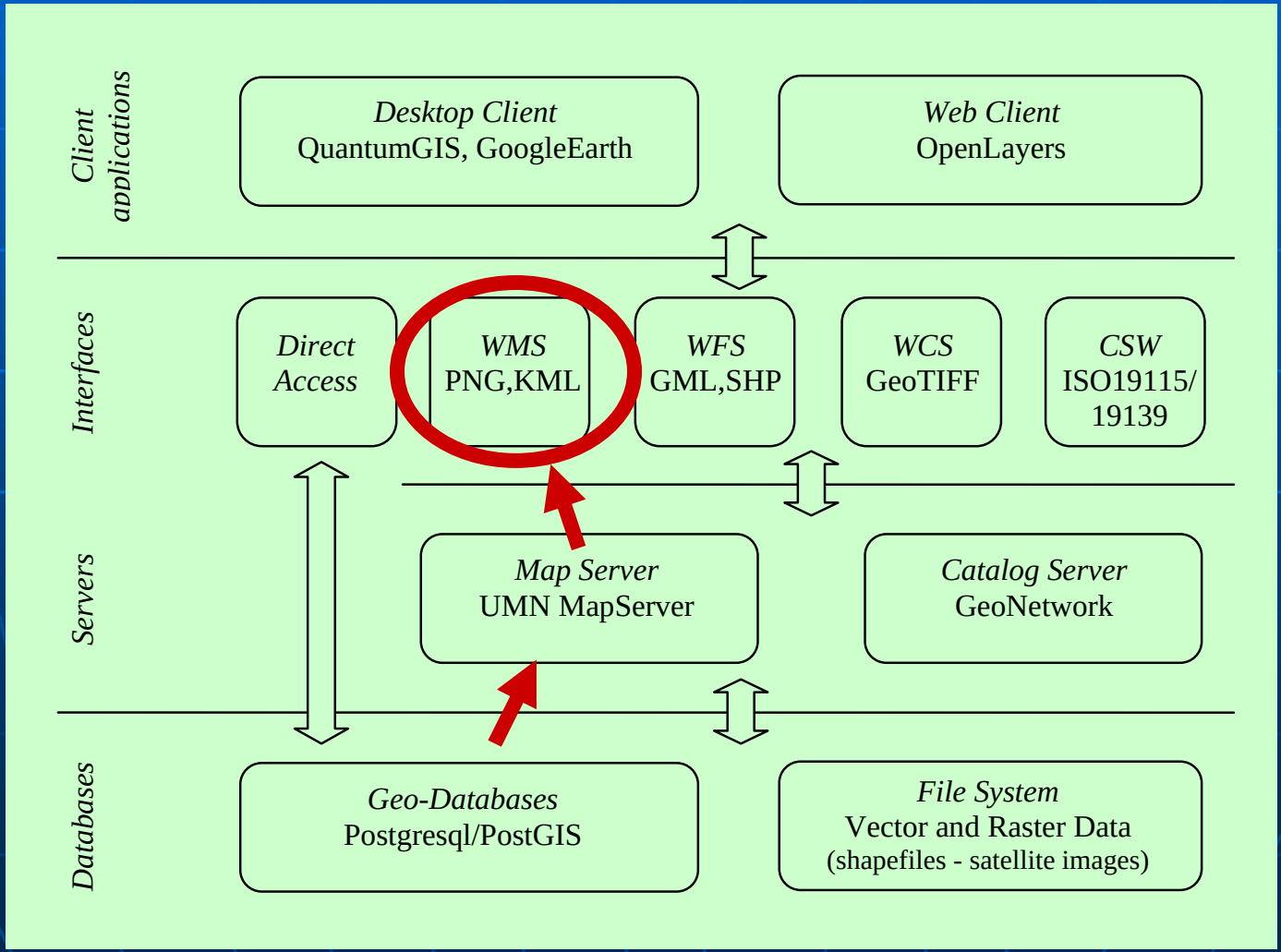
Heraklion SDI

- The Web Map Service (WMS)…



Architecture & Software Systems

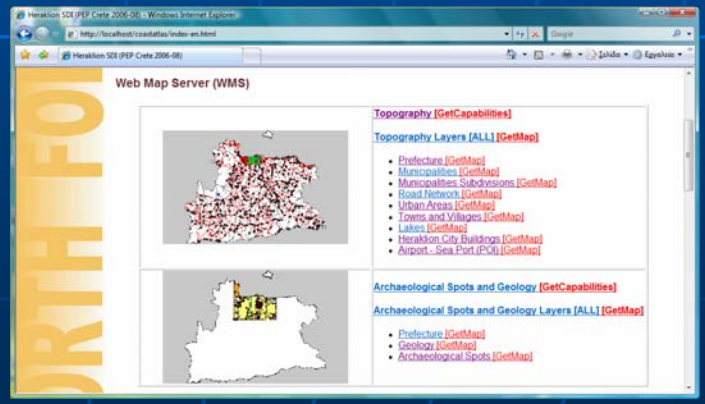
- The architecture...



Heraklion SDI

- The Web Map Service (WMS)…
  - maps served as images
    - GetCapabilities request

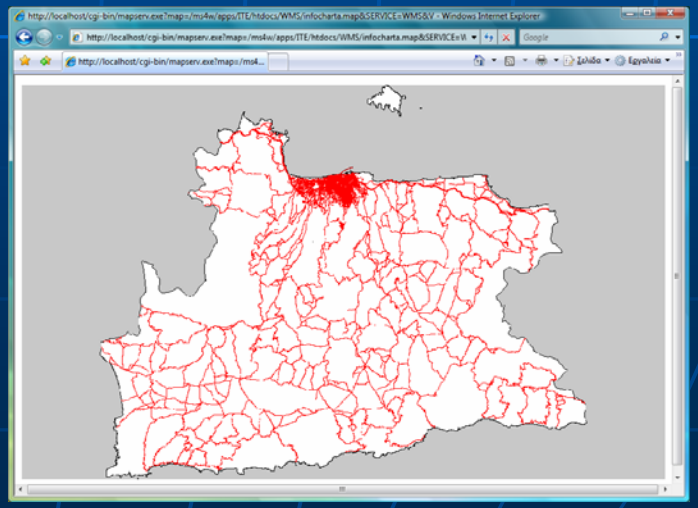
```
http://localhost/cgi-bin/mapserv.exe?
map=/ms4w/apps/ITE/htdocs/WMS/infocharta.map&
SERVICE=WMS&
REQUEST=GetCapabilities
```



Heraklion SDI

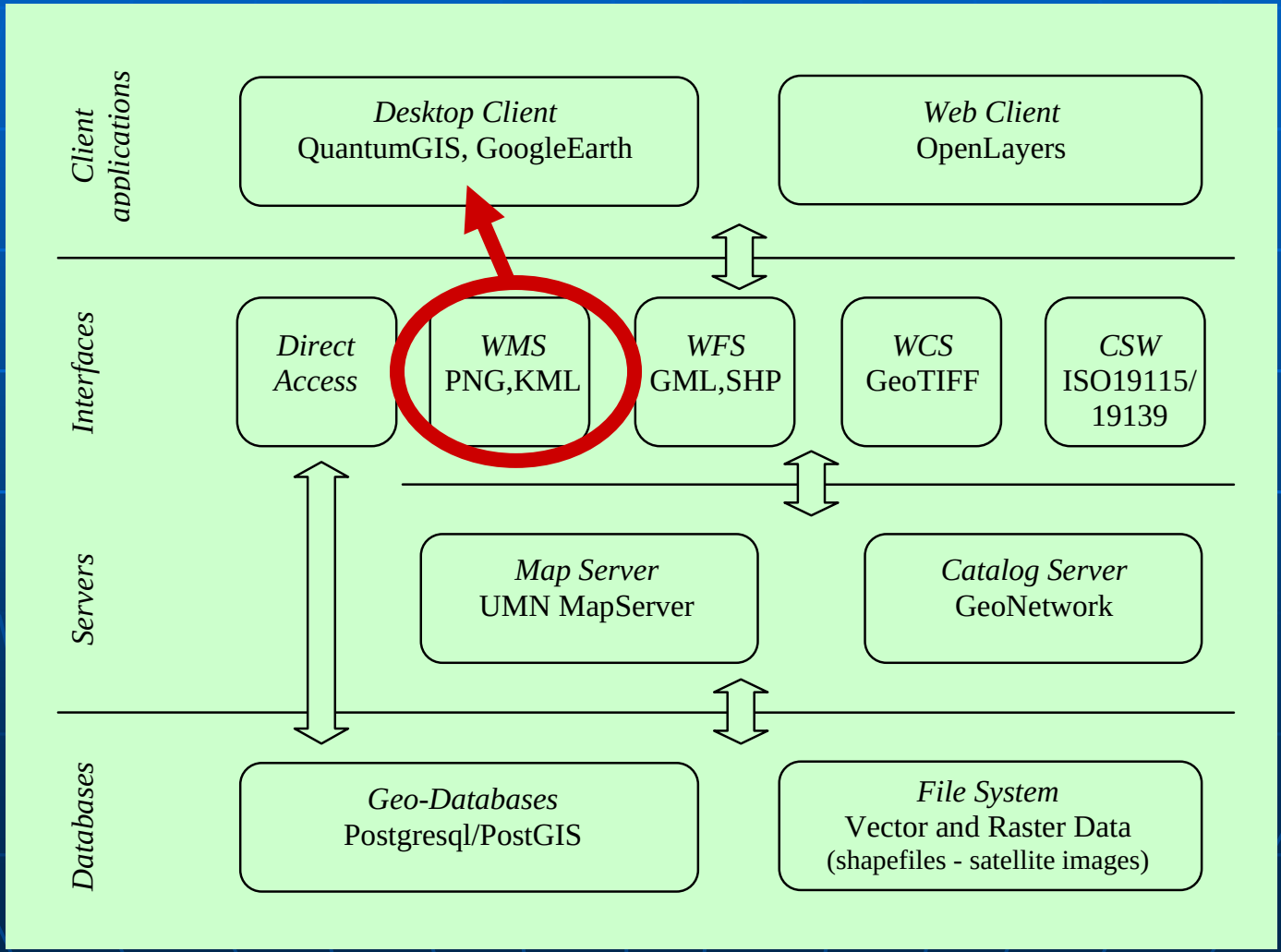
- The Web Map Service (WMS)…
  - GetMap request

```
http://localhost/cgi-bin/mapserv.exe?
map=/ms4w/apps/ITE/htdocs/WMS/infocharta.map&
SERVICE=WMS&VERSION=1.1.1&
REQUEST=GetMap&
LAYERS=odiko_irakliou&
BBOX=553530,3864020,653540,3925230&
STYLES=&
SRS=EPSG:2100&
WIDTH=500&HEIGHT=306&
FORMAT=image/png
```



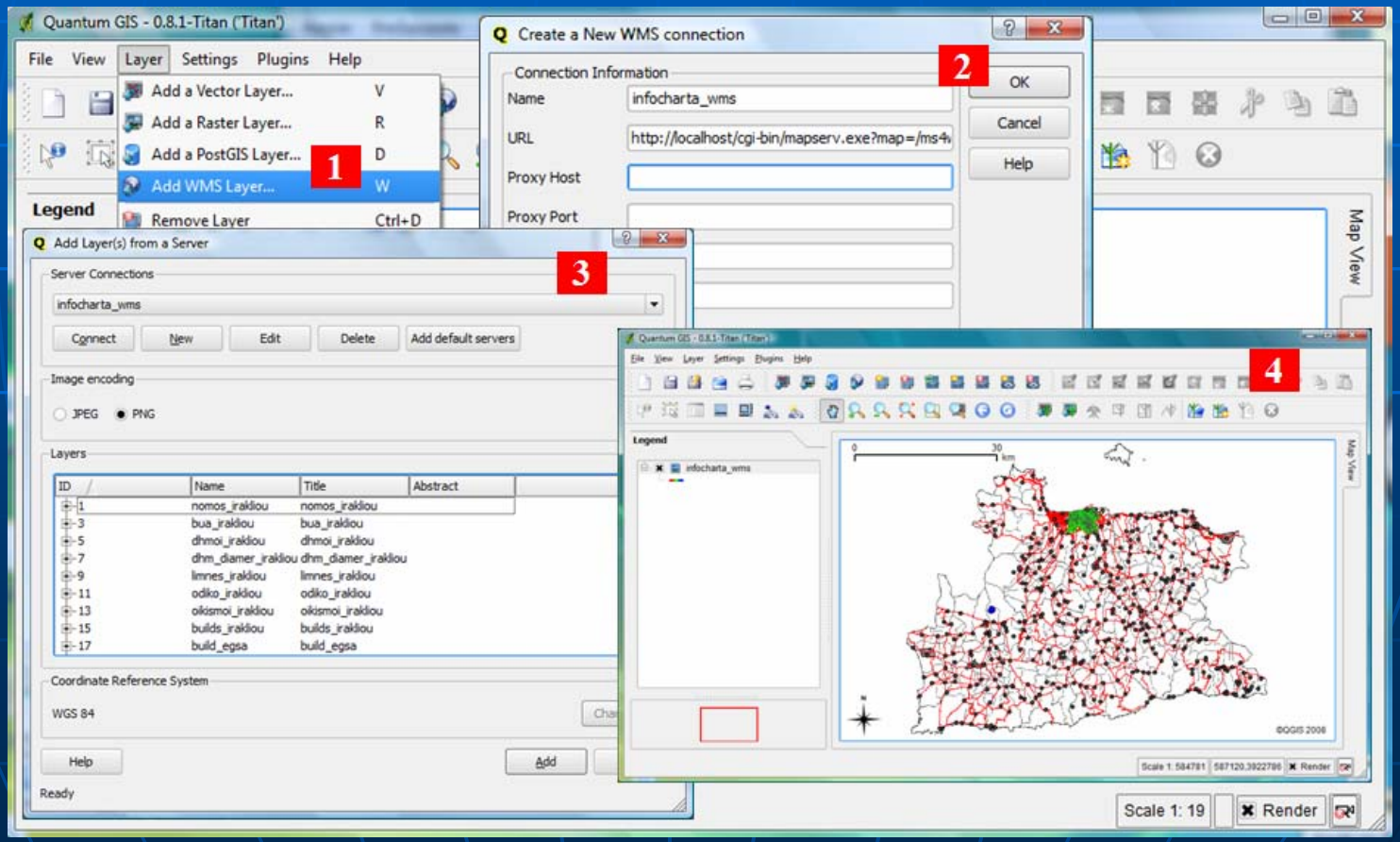
Architecture & Software Systems

- The architecture...



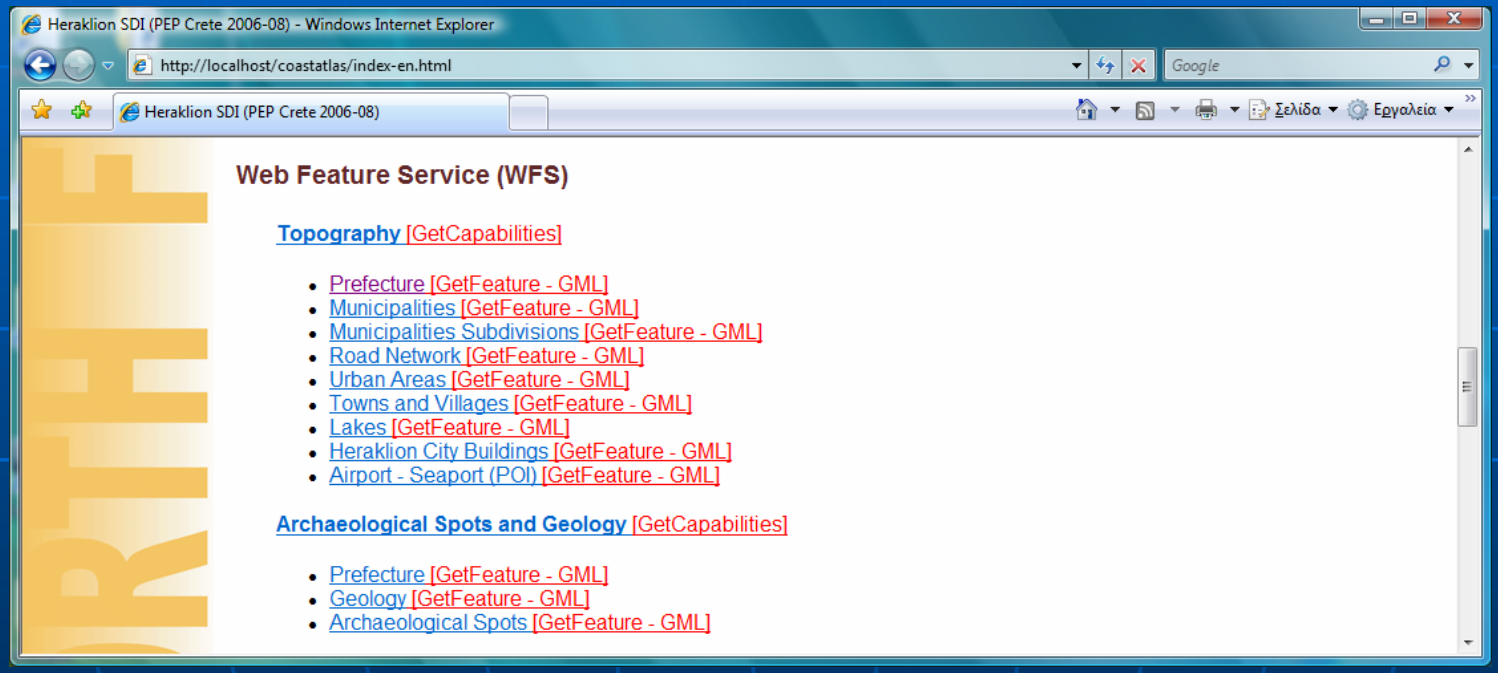
Heraklion SDI

- The Web Map Service (WMS)…
  - QGIS: Connect to the WMS



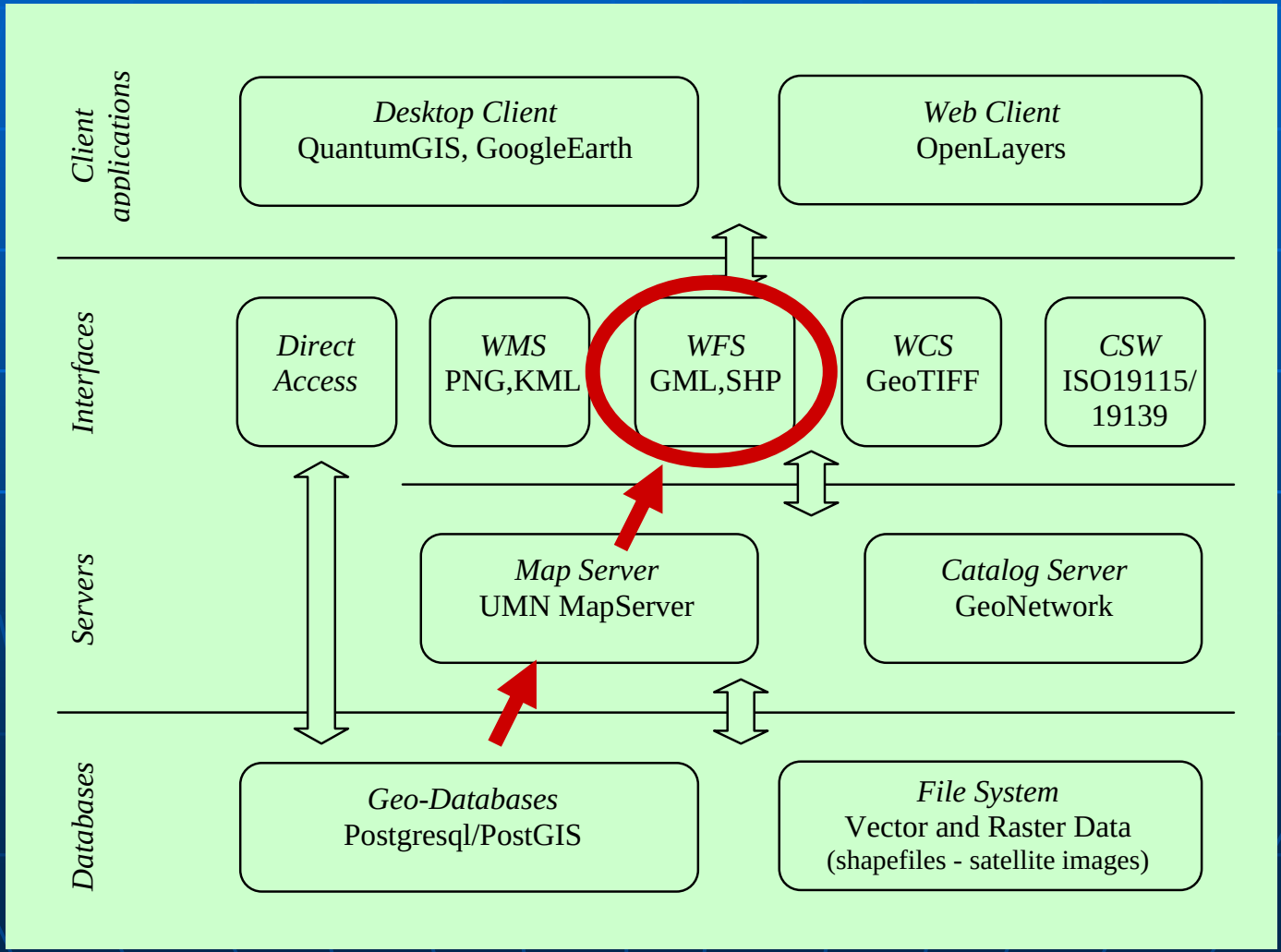
Heraklion SDI

- The Web Feature Service (WFS)…



Architecture & Software Systems

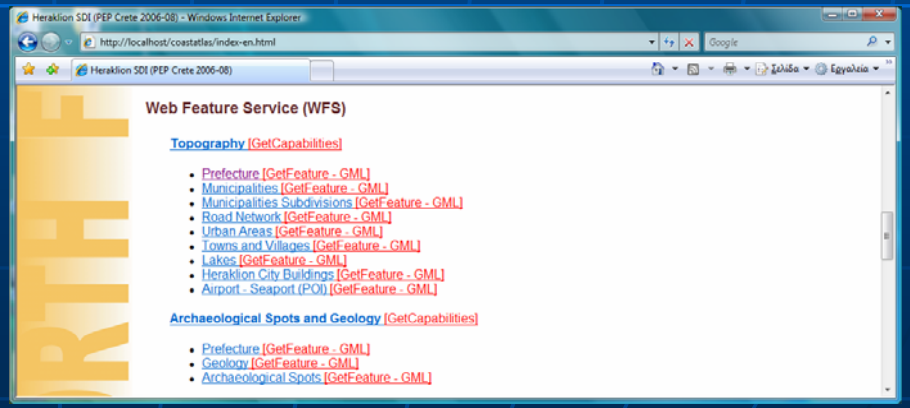
- The architecture...



Heraklion SDI

- The Web Feature Service (WFS)…
  - data served in GML
    - GetCapabilities request

```
http://localhost/cgi-bin/mapserv.exe?
map=/ms4w/apps/ITE/htdocs/WFS/infocharta.map&
SERVICE=WFS&
VERSION=1.0.0&
REQUEST=GetCapabilities
```



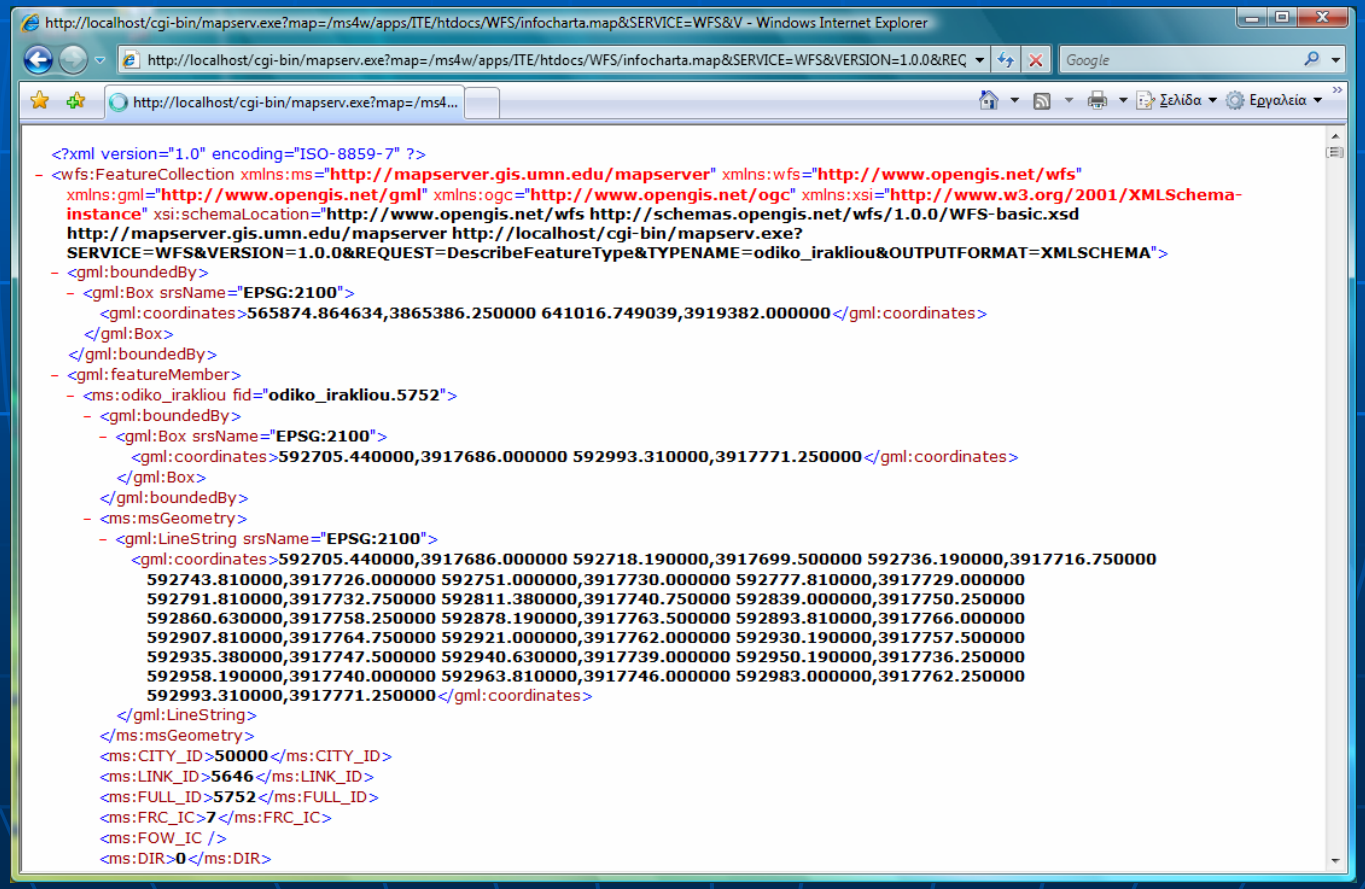
Heraklion SDI

- The Web Feature Service (WFS)…
  - GetFeature request

```
http://localhost/cgi-bin/mapserv.exe?
map=/ms4w/apps/ITE/htdocs/WFS/infocharta.map&
SERVICE=WFS&VERSION=1.0.0&
REQUEST=GetFeature&
typename=odiko_irakliou
```

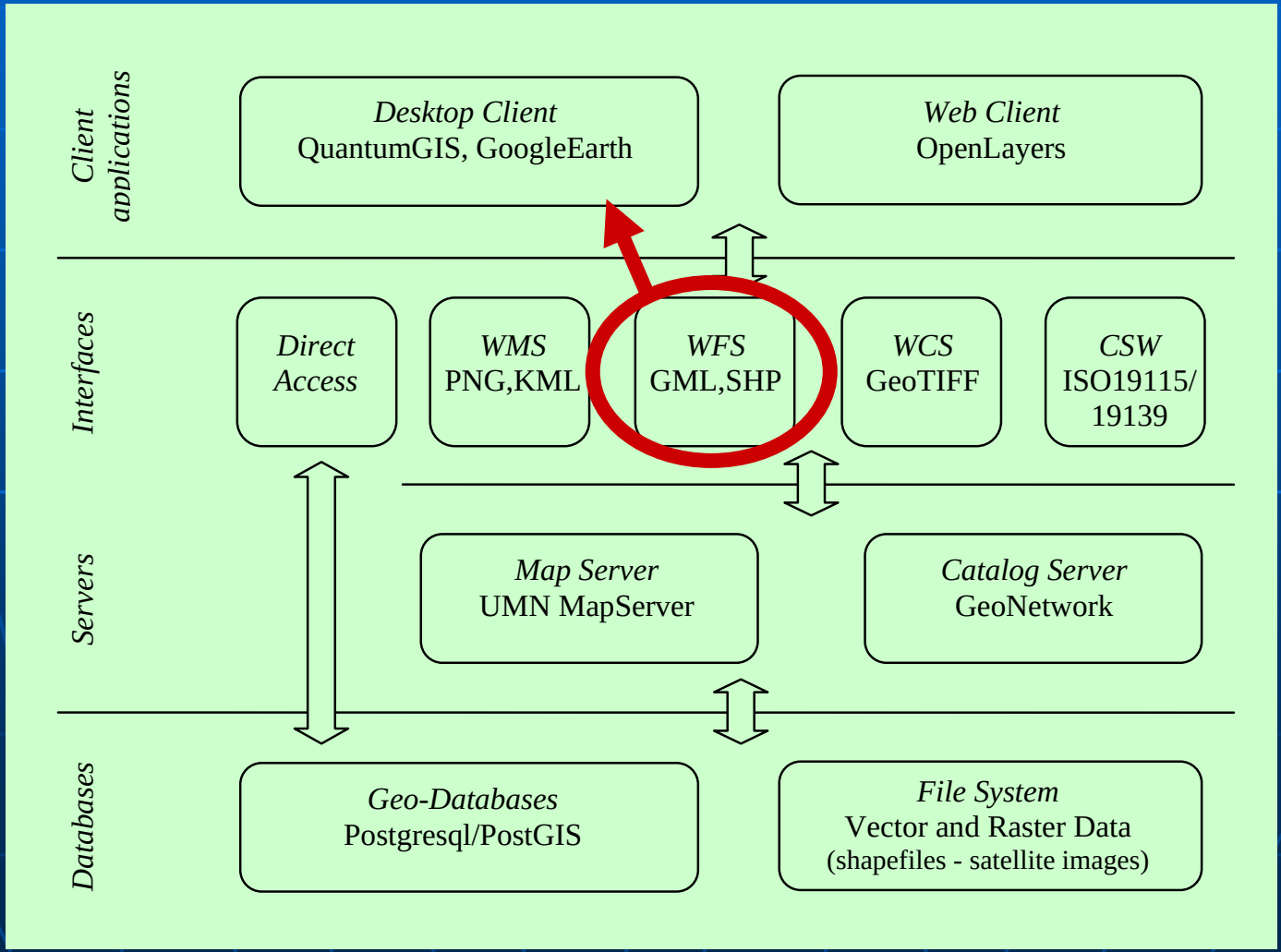
Heraklion SDI

- The Web Feature Service (WFS)…
  - GetFeature request



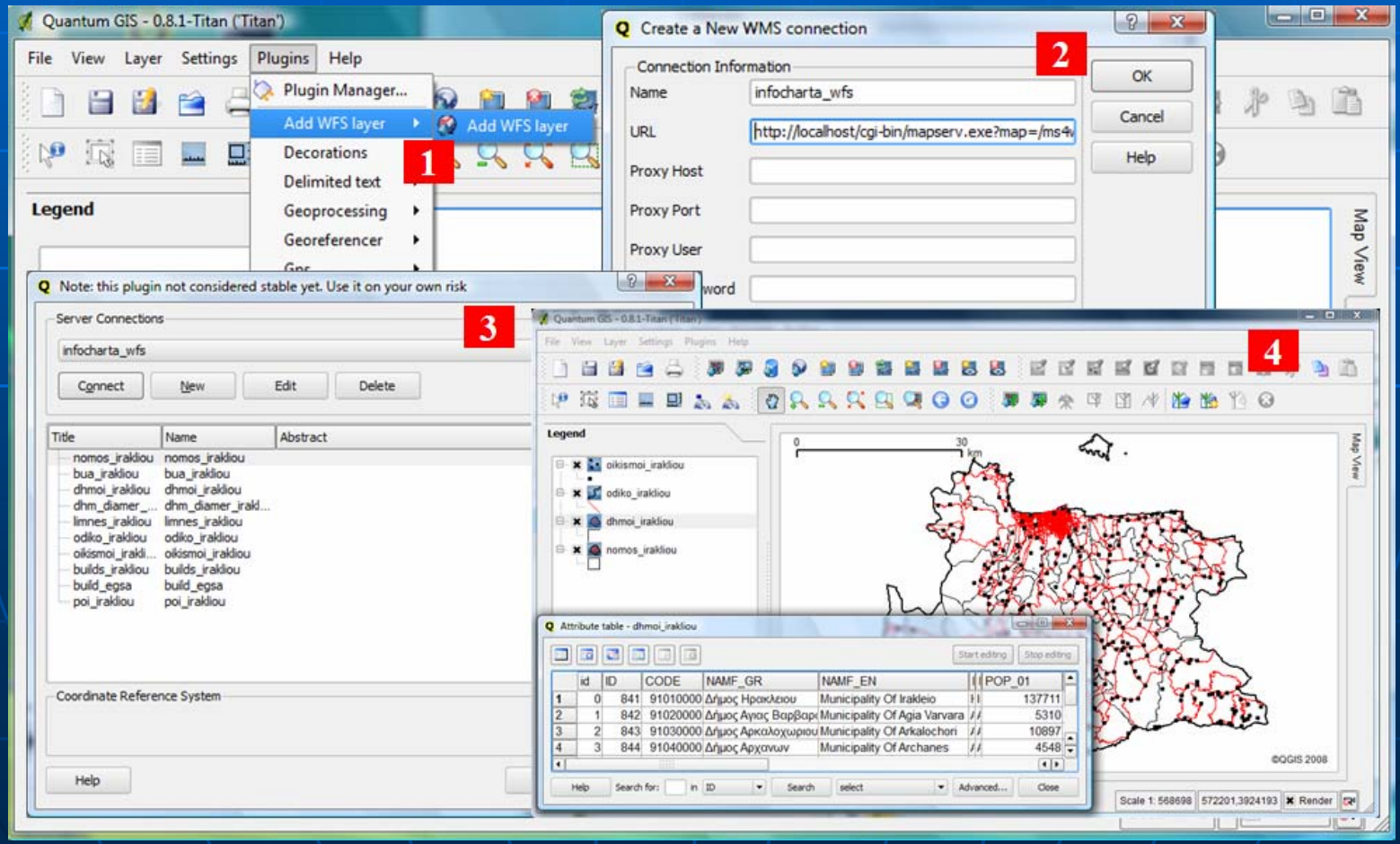
Architecture & Software Systems

- The architecture...



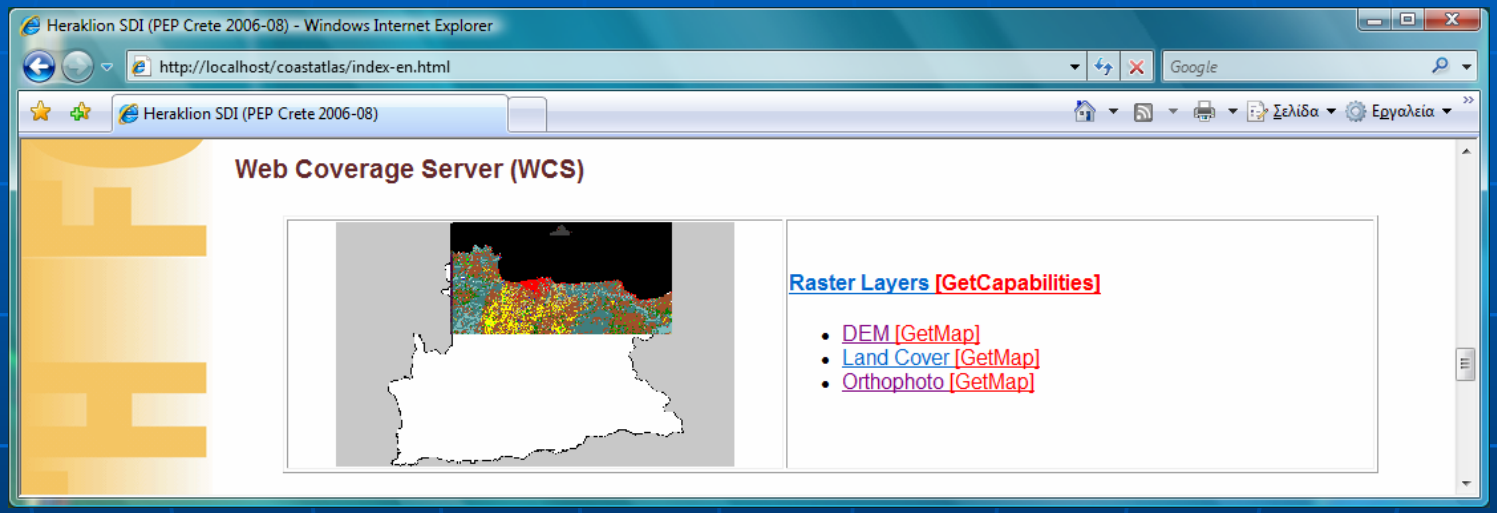
Heraklion SDI

- The Web Feature Service (WFS)...
  - QGIS: Connect to the WFS



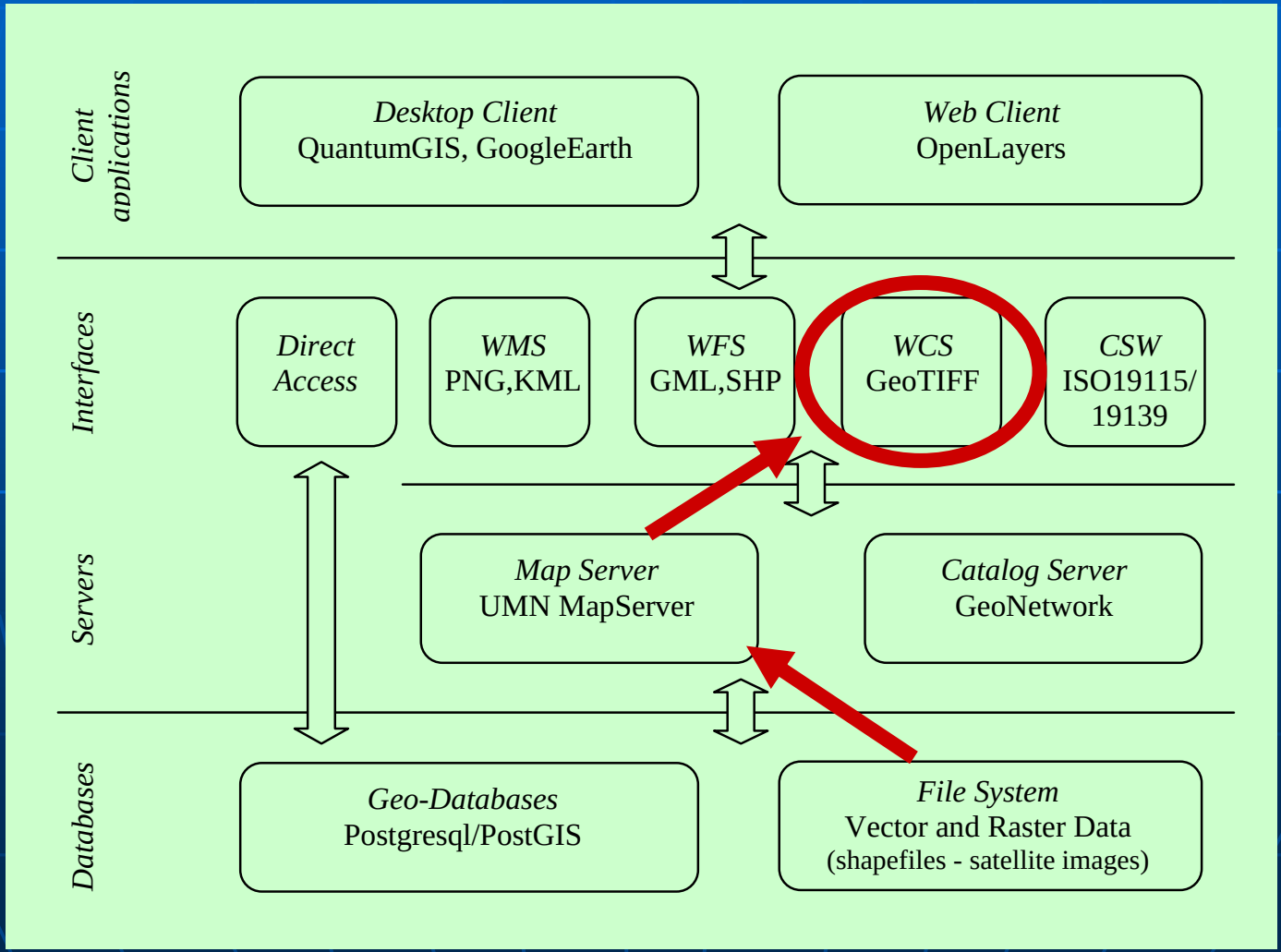
Heraklion SDI

- The Web Coverage Service (WCS)…



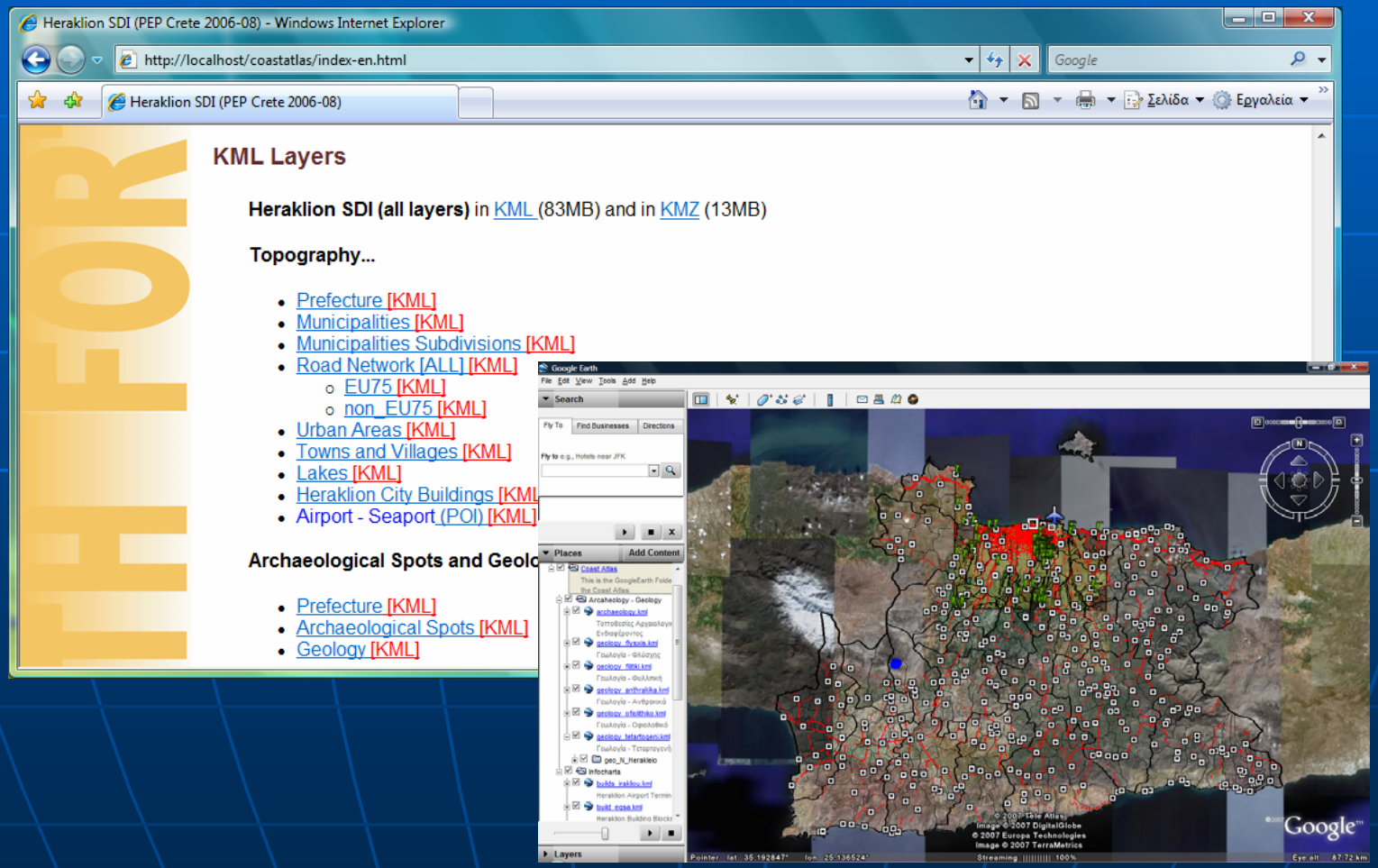
Architecture & Software Systems

- The architecture...



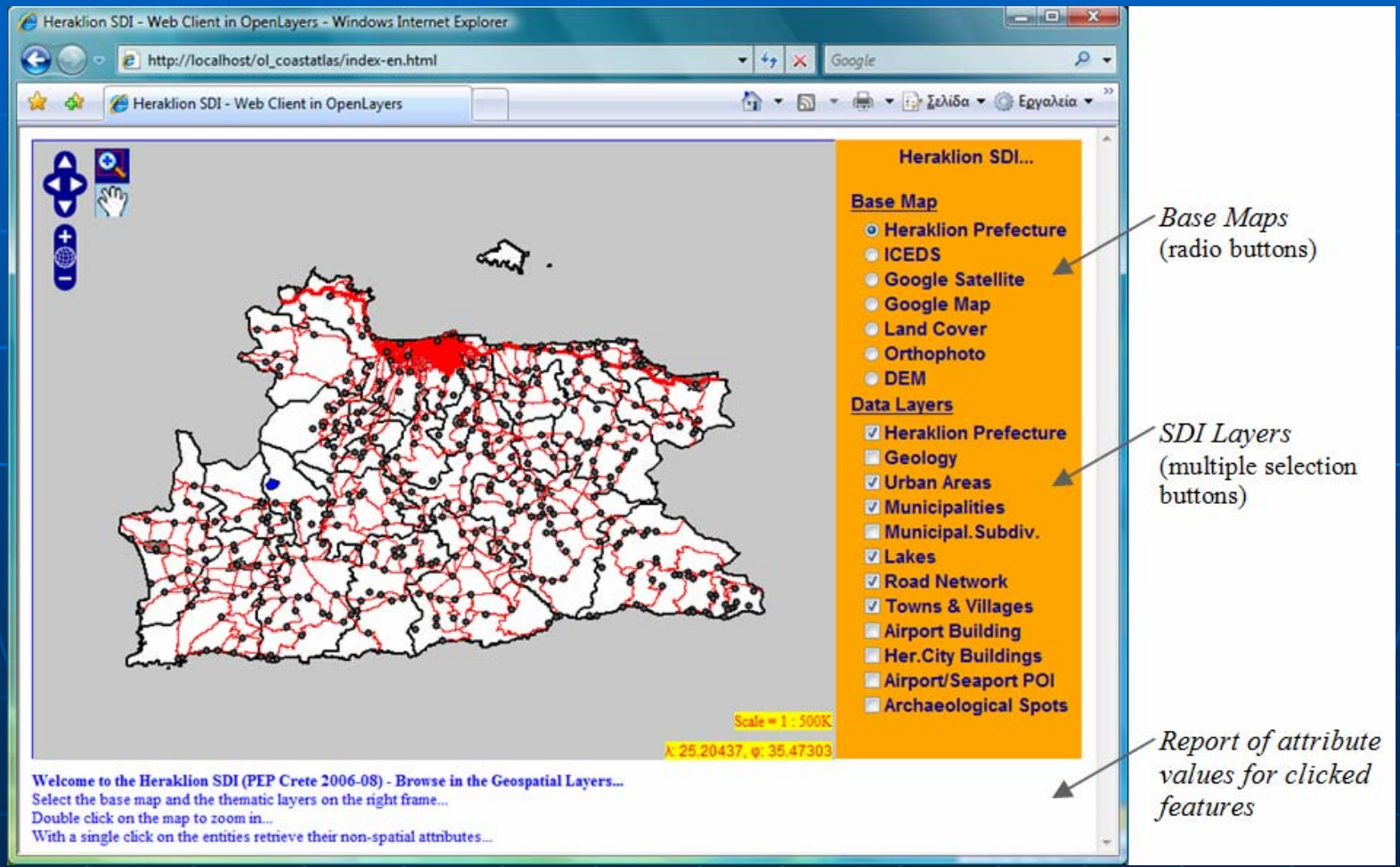
Heraklion SDI

- The KML Server...



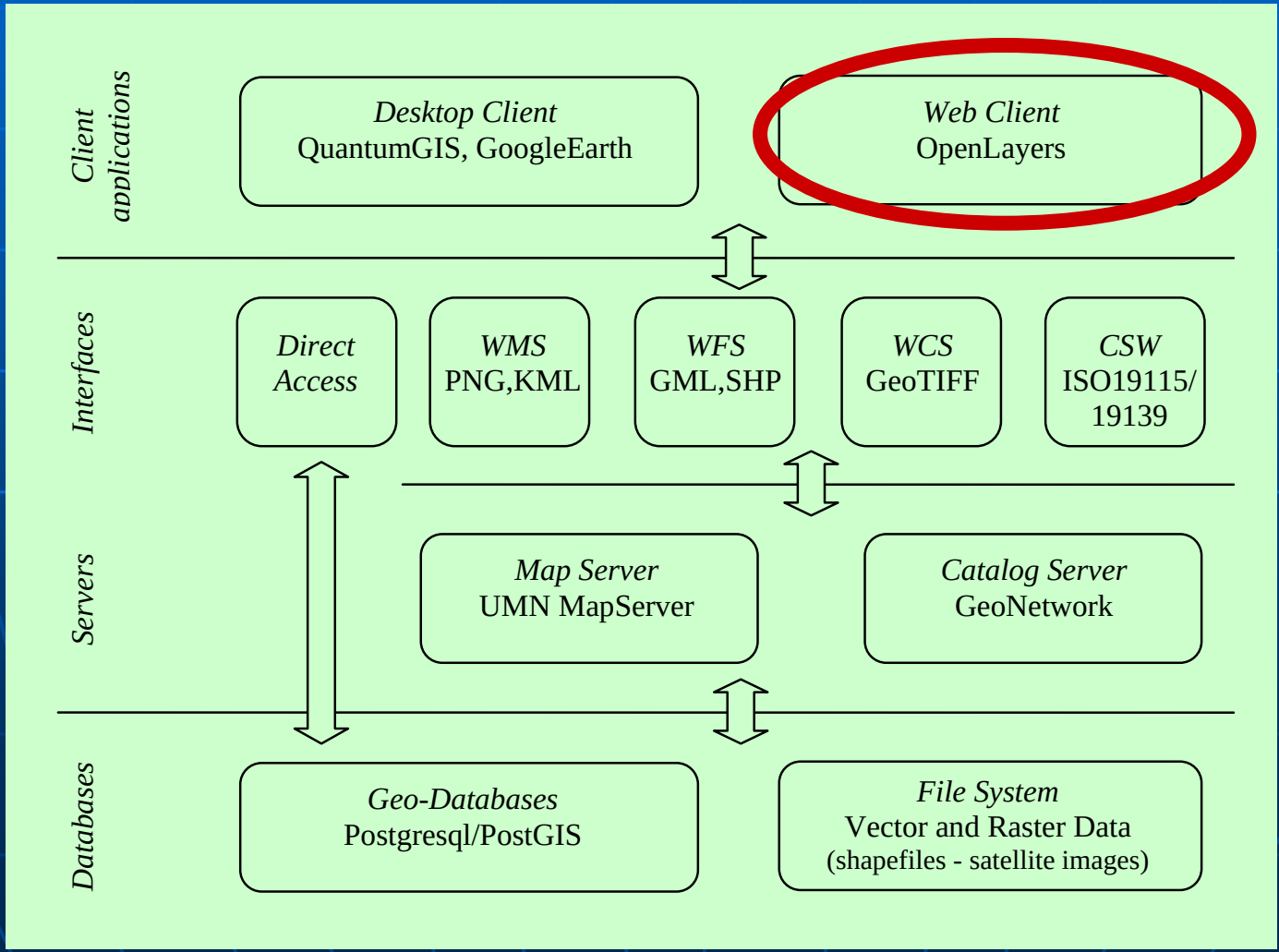
Heraklion SDI

- The Web Client Application ...



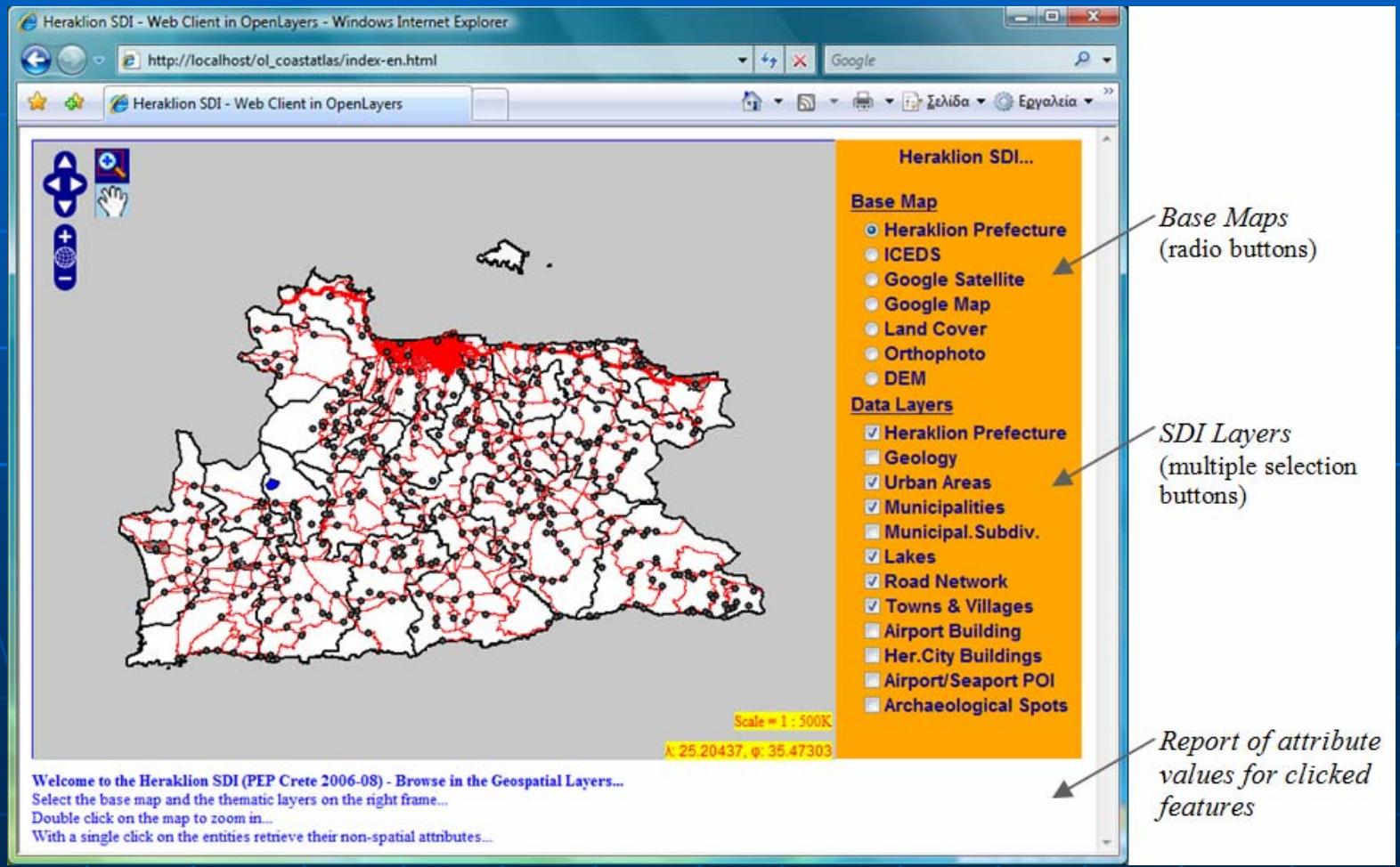
Architecture & Software Systems

- The architecture...



Heraklion SDI

- The Web Client Application ...



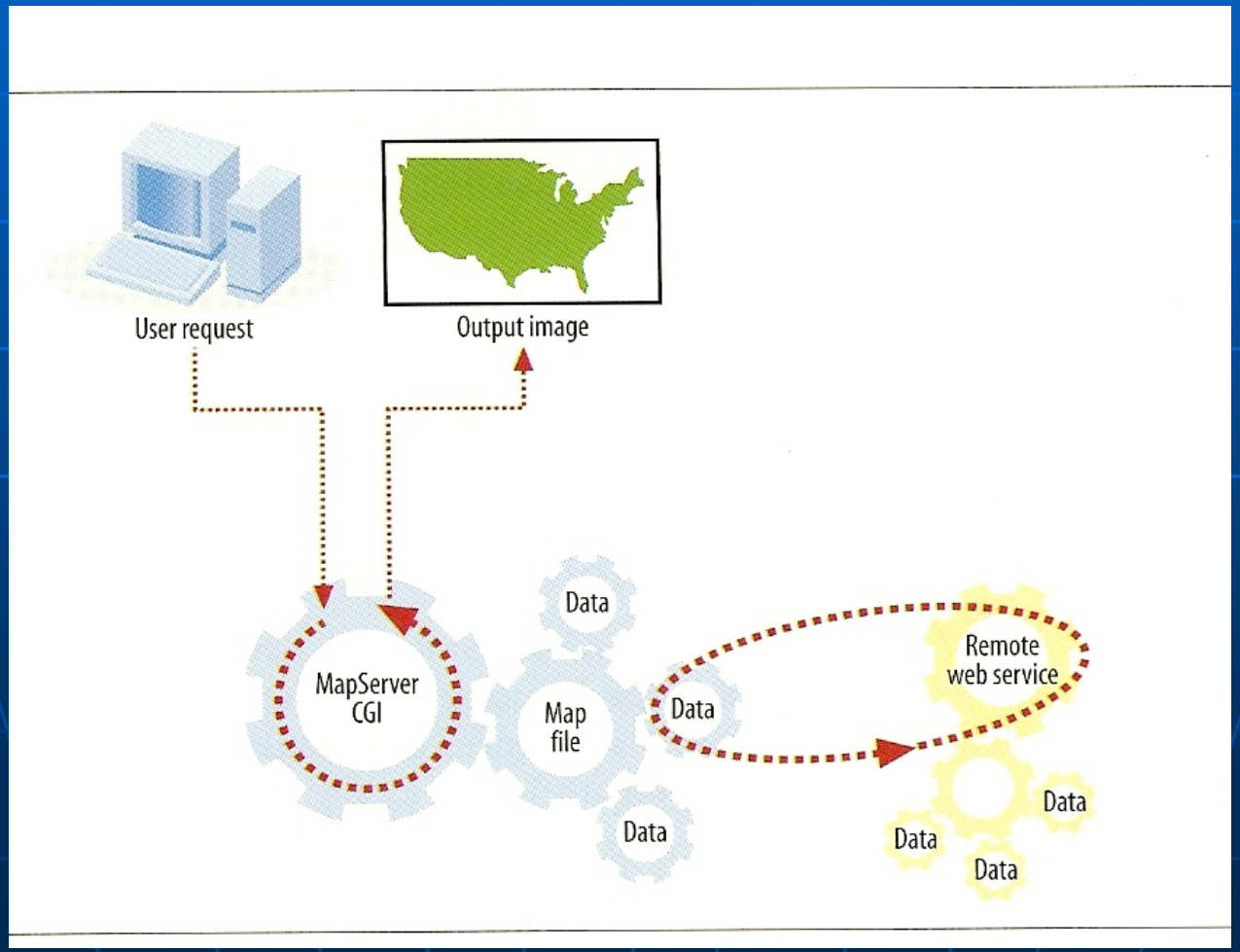
Heraklion SDI

- The Web Map Service (WMS)…
  - GetFeatureInfo request

```
dhmoi_irakliou.getFullRequestString({
REQUEST: "GetFeatureInfo",
EXCEPTIONS: "application/vnd.ogc.se_xml",
BBOX: dhmoi_irakliou.map.getExtent().toBBOX(),
X: e.xy.x, Y: e.xy.y,
INFO_FORMAT: "text/html",
FONT: "c:/ms4w/fontlist/times.ttf",
ENCODING: "ISO-8859-7",
QUERY_LAYERS: dhmoi_irakliou.params.LAYERS,
WIDTH: dhmoi_irakliou.map.size.w,
HEIGHT: dhmoi_irakliou.map.size.h});
```

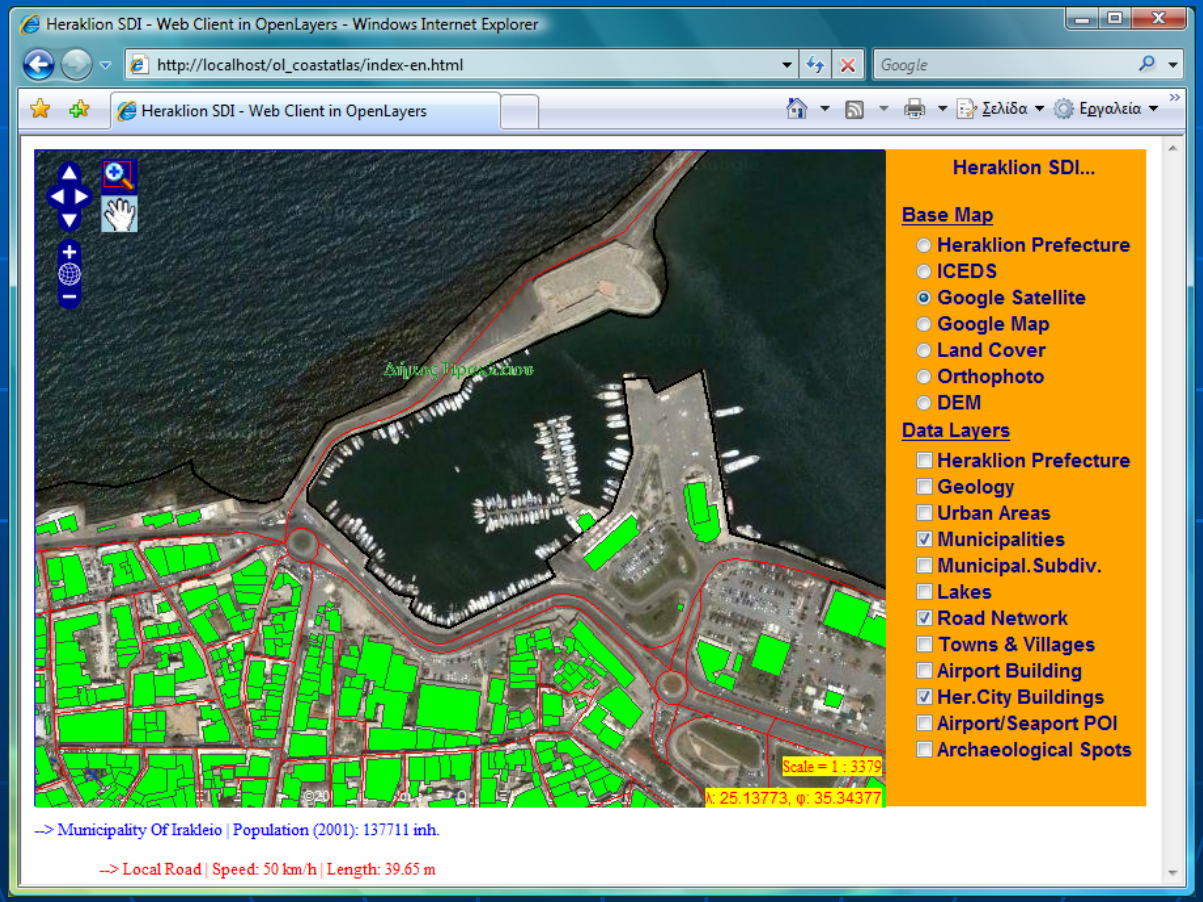
Heraklion SDI

- Mashups ...



Heraklion SDI

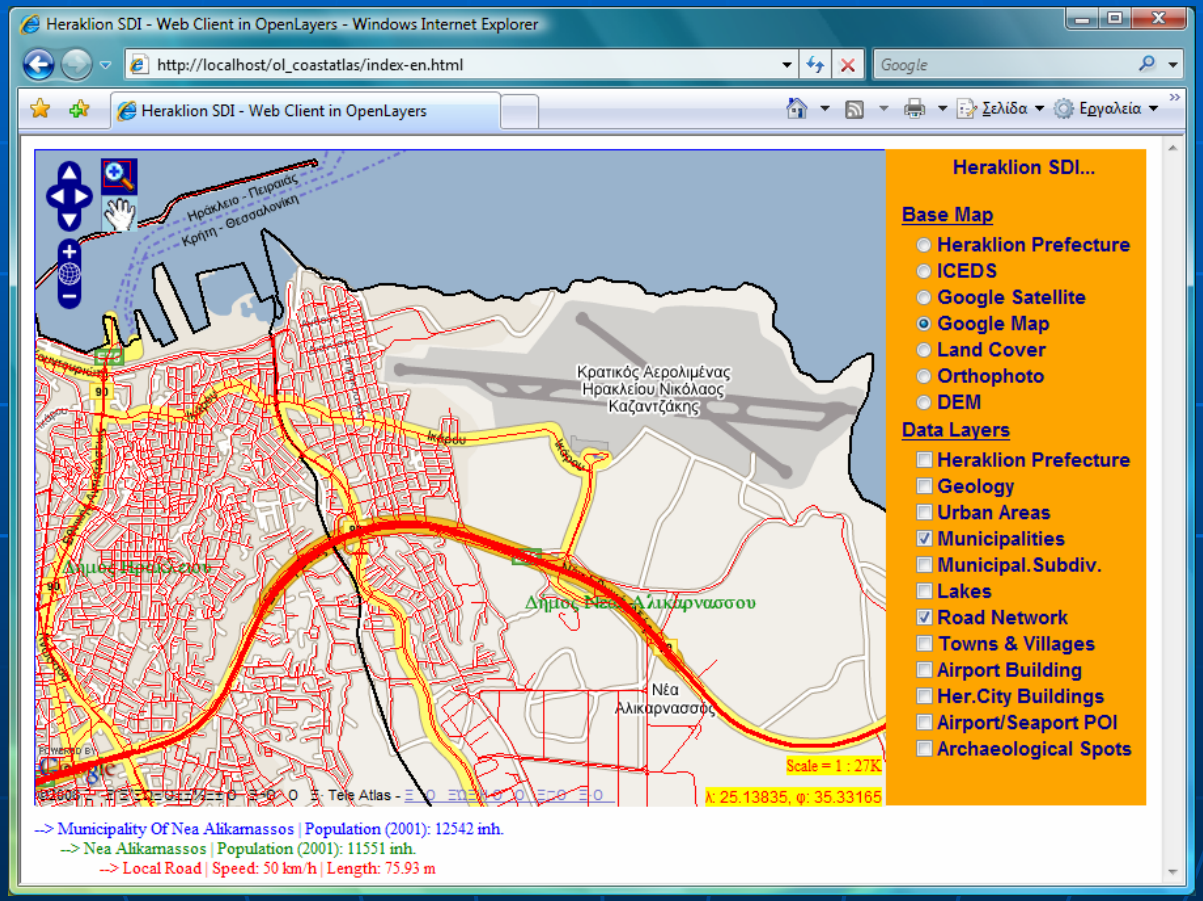
- Mashups ...



Base Map: Google Satellite
Layers: Municipalities, Road Network, Buildings

Heraklion SDI

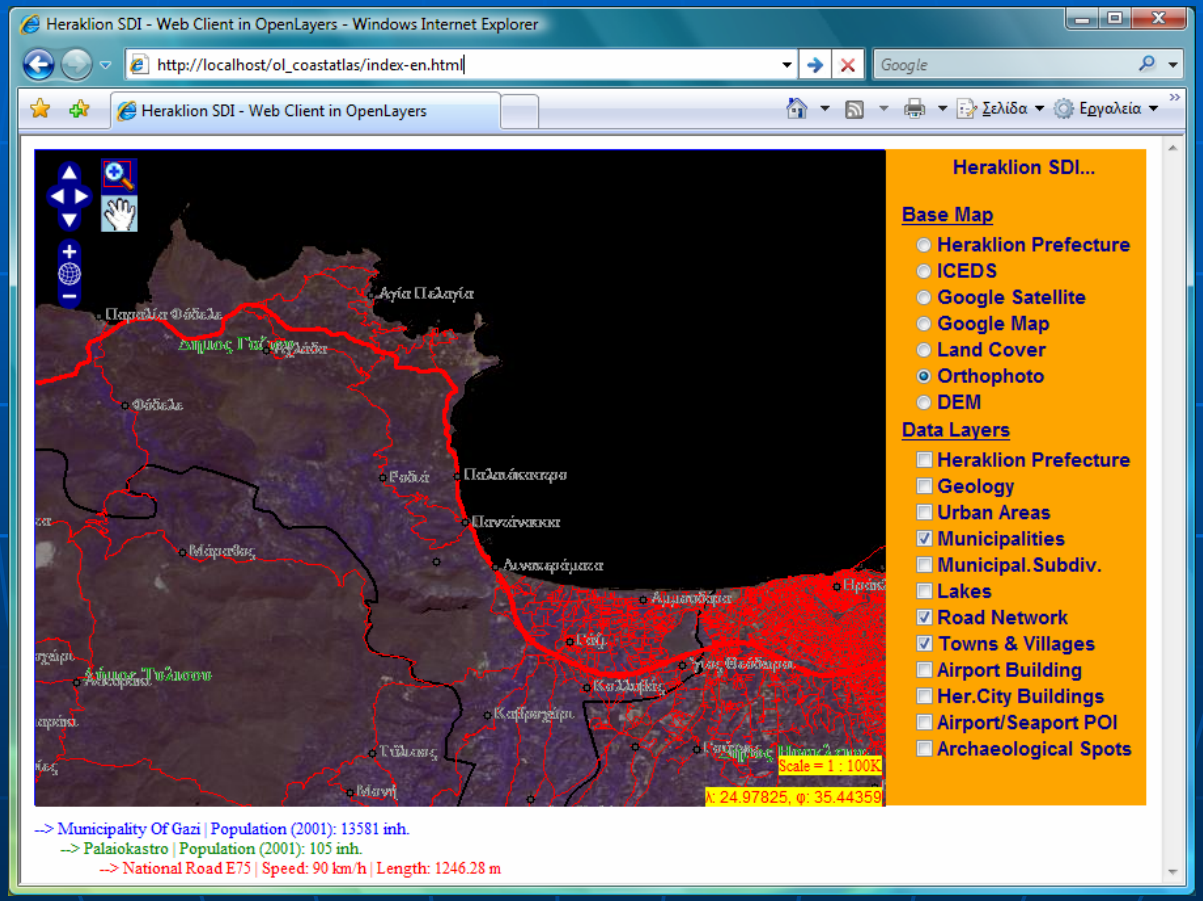
- Mashups ...



Base Map: Google Map
Layers: Municipalities, Road Network

Heraklion SDI

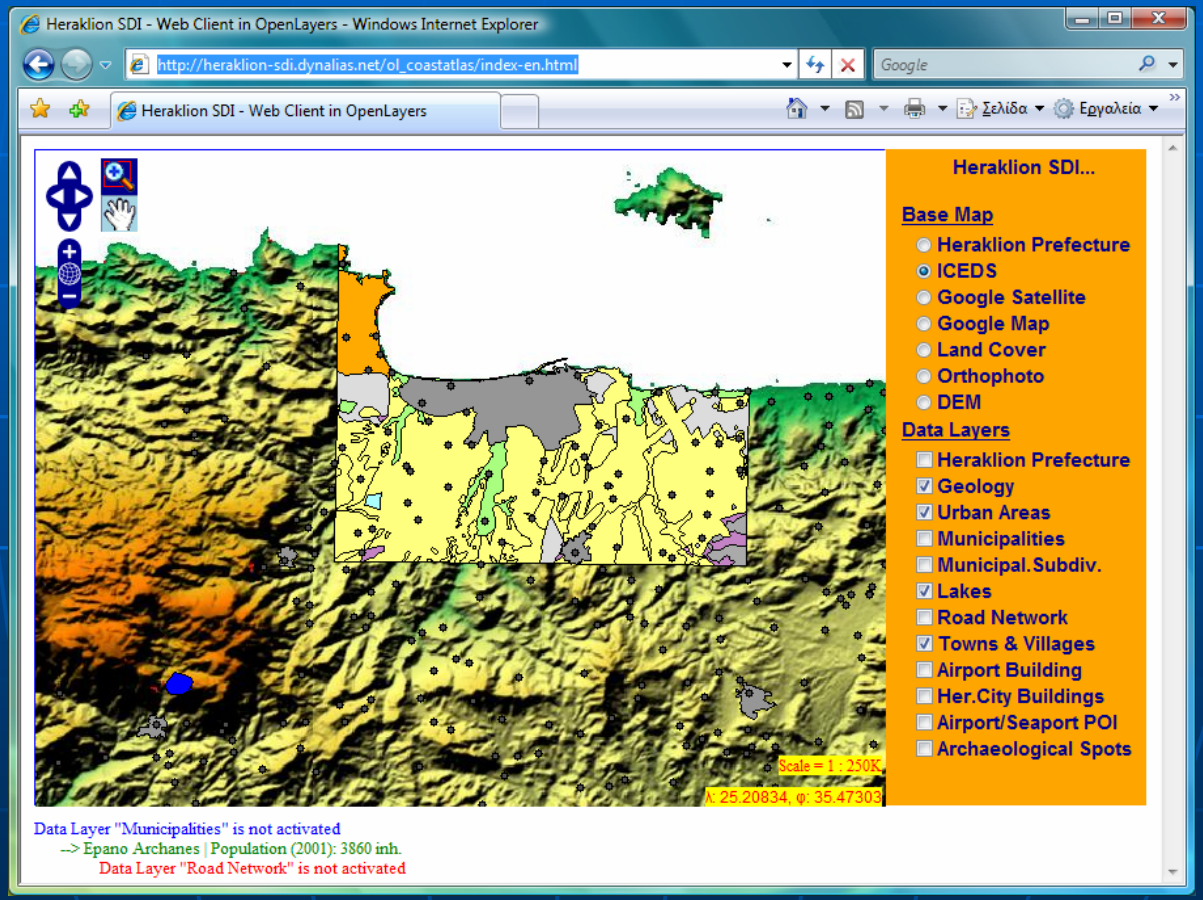
- Mashups ...



Base Map: Orthophoto Map
Layers: Municipalities, Towns, Road Network

Heraklion SDI

- Mashups ...



Base Map: ICEDS (WMS)
Layers: Geology, Urban areas, Towns, Lakes

Integrated CEOS European Data Server

Heraklion SDI

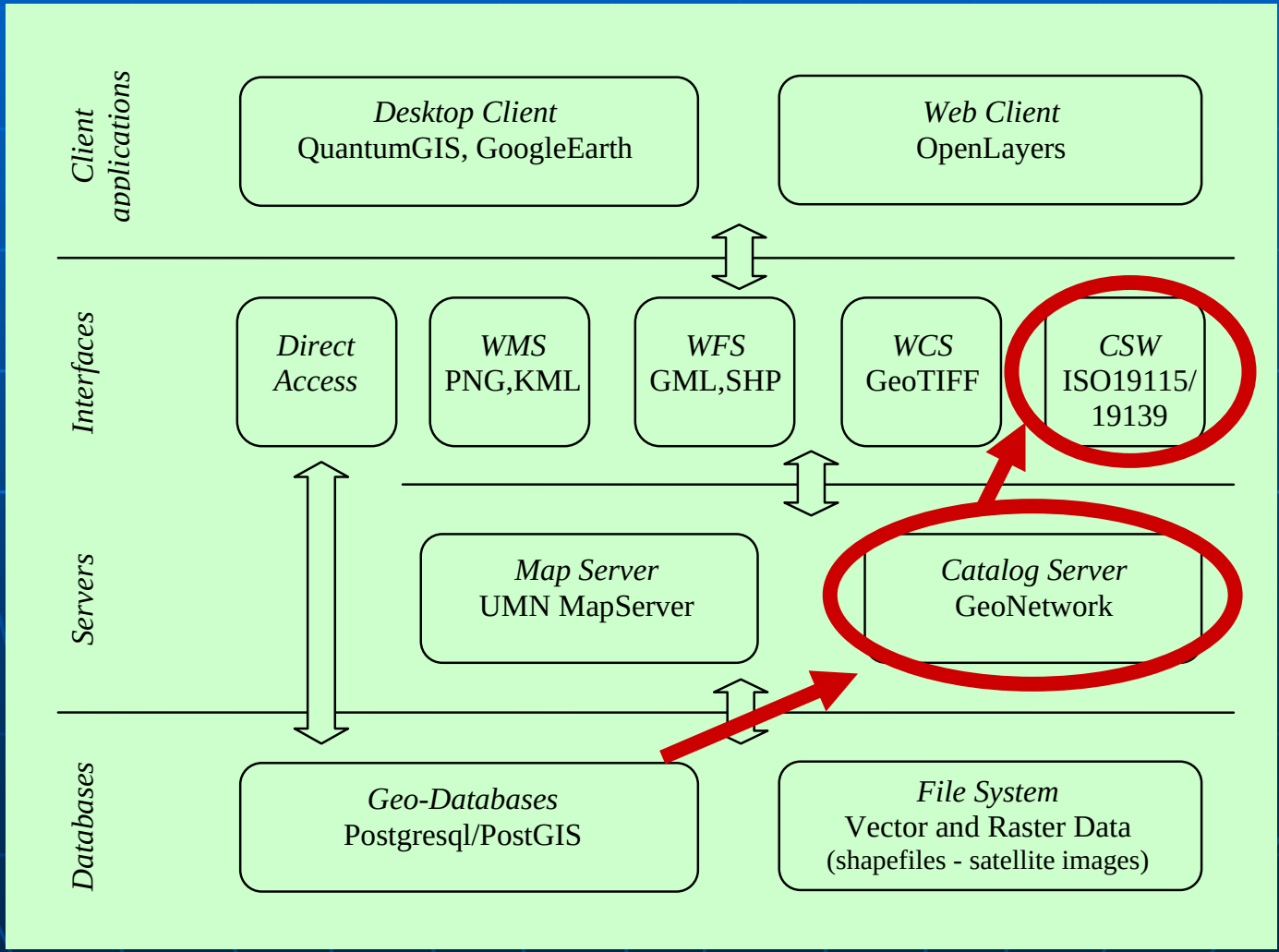
- The Catalog Server ...
  - Heraklion SDI accommodates...
    - a wide digital content of **various types and formats**
      - geospatial data layers
      - satellite images
      - web mapping applications and services

Heraklion SDI

- The Catalog Server ...
  - to make this content accessible on the web and assure its usability,
    - appropriate **metadata items** must be generated
    - a **data catalog server** is needed
      - to make the metadata items available on the web
      - support the efficient discovery and evaluation of the SDI content

Architecture & Software Systems

- The architecture...



Heraklion SDI

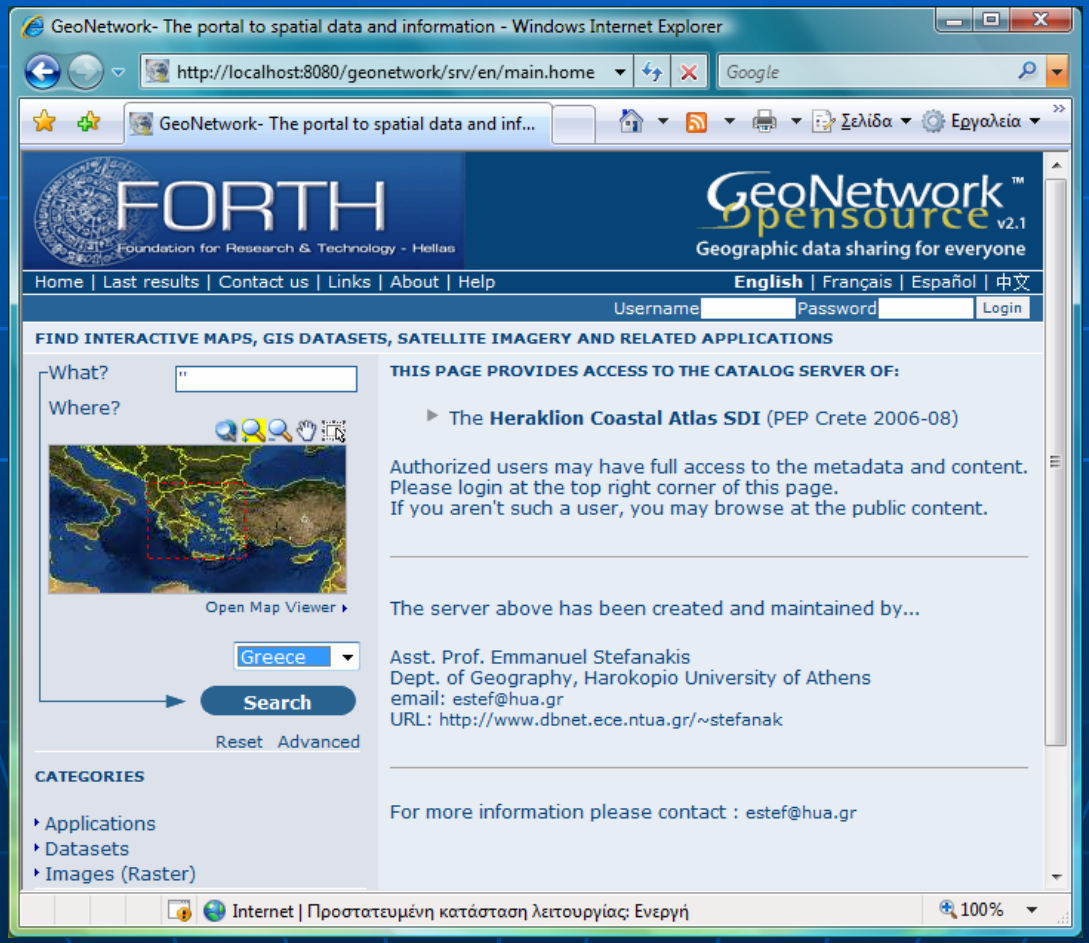
- The Catalog Server ...
  - The content items of the SDI ...
    - have been assigned appropriate metadata items in **XML format**
    - according to the specification of a customized **ISO19139 template**

Heraklion SDI

- The Catalog Server ...
  - ... then a catalog server has been implemented using **GeoNetwork Opensource Server** software ver. 2.1
  - The configuration adopted utilizes
    - the **PostgreSQL** in the role of the DBMS server and
    - the **Apache Tomcat v5.5** in the role of the Web Server.

Heraklion SDI

- The Catalog Server ...



Heraklion SDI

- The Catalog Server ...

Heraklion SDI

- The Catalog Server ...

Heraklion SDI

- The Catalog Server ...

Heraklion SDI

- The Catalog Server ...

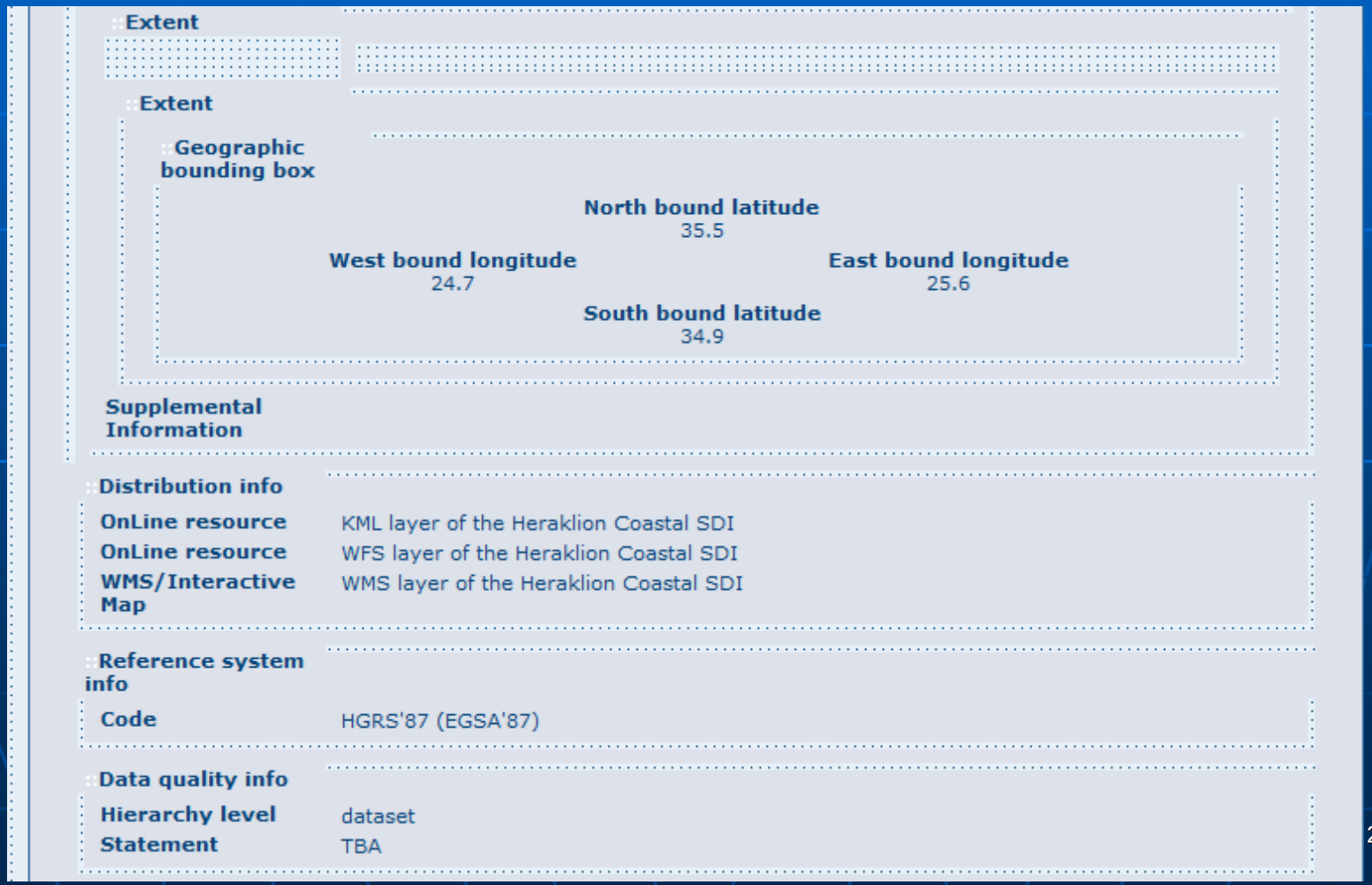
Heraklion SDI

- The Catalog Server ...

Point of contact	
Individual name	Emmanuel Stefanakis
Organisation name	Harokopio University of Athens
Position name	Asst Professor
Delivery point	
City	
Administrative area	
Postal code	
Country	
Electronic mail address	estef@hua.gr
Role	publisher
Maintenance and update frequency	notPlanned
Descriptive keywords	roads (theme).
Descriptive keywords	Heraklion, Crete Island, Greece (place).
Access constraints	copyright
Use constraints	copyright
Other constraints	copyright
Spatial representation type	vector
Equivalent scale	
Denominator	5000
Language	English
Character set	utf8
Topic category code	transportation

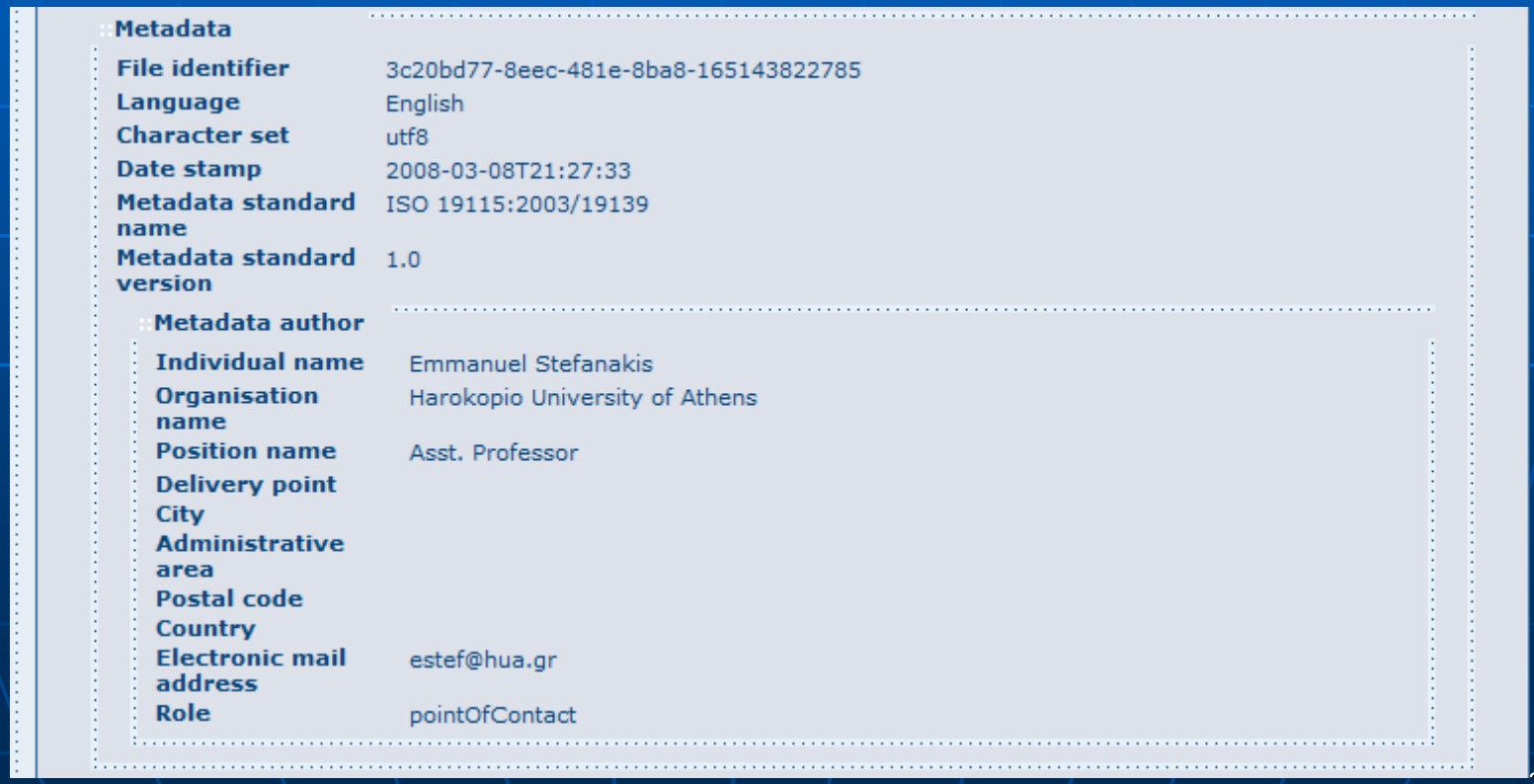
Heraklion SDI

- The Catalog Server ...



Heraklion SDI

- The Catalog Server ...



Metadata

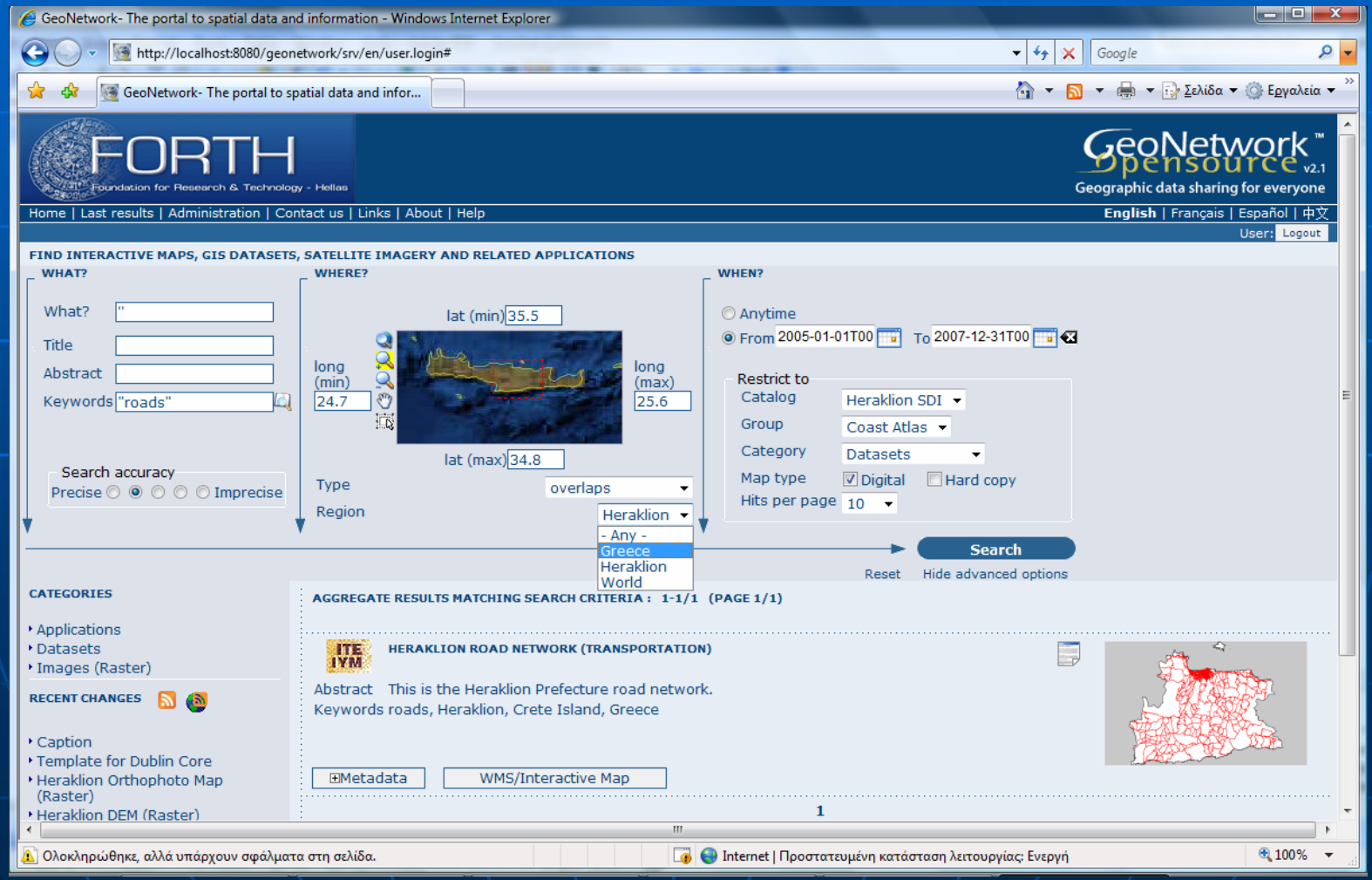
File identifier	3c20bd77-8eec-481e-8ba8-165143822785
Language	English
Character set	utf8
Date stamp	2008-03-08T21:27:33
Metadata standard name	ISO 19115:2003/19139
Metadata standard version	1.0

Metadata author

Individual name	Emmanuel Stefanakis
Organisation name	Harokopio University of Athens
Position name	Asst. Professor
Delivery point	
City	
Administrative area	
Postal code	
Country	
Electronic mail address	estef@hua.gr
Role	pointOfContact

Heraklion SDI

- The Catalog Server ...



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- Evans, J.D., 2003. Geospatial Interoperability Reference Model. *FGDC, WG GAI*. http://gai.fgdc.gov/girm/v1.0/
- ESRI, http://www.esri.com/
- GE – Google Earth, http://earth.google.com/
- GMaps – Google Maps, http://maps.google.com/
- GML – Geography Markup Language, http://www.opengeospatial.org/standards/gml
- INSPIRE: INfrastructure for SPatial InfoRmation in Europe, http://www.ec-gis.org/inspire/
- ISO – International Organization for Standardization, http://www.iso.org/
- ISO/TC211, http://www.isotc211.org/
- KML – Keyhole Markup Language, http://code.google.com/apis/kml/documentation/
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- Mitchell, T., 2005. *Web Mapping*. O'Reilly:USA.
- Nebert, D.D., (Ed.) 2004. Developing Spatial Data Infrastructures: The SDI Cookbook. Version 2. GSDI Publications. http://www.gsdi.org/docs2004/Cookbook/cook-bookV2.0.pdf

References

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- OSGeo – Open Source Geospatial Foundation, http://www.osgeo.org/
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- W3C – World Wide Web Consortium, http://www.w3.org/
- WCS – Web Coverage Server, http://www.opengeospatial.org/standards/wcs
- WFS – Web Feature Service, http://www.opengeospatial.org/standards/wfs
- Williamson, I.P., Rajabifard, A., and Feeney, M.E.F, (Eds) 2004. *Developing Spatial Data Infrastructures: From Concept to Reality*. Taylor & Francis Group.
- WMS – Web Map Server, http://www.opengeospatial.org/standards/wms

Harokopio University of Athens
Department of Geography

ICIW 2008 The Third International Conference on
Internet and Web Applications and Services
June 8-13, 2008 - Athens, Greece

Web Services for Mapping

Tutorial

Ευχαριστώ! Thank you !

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estef@hua.gr