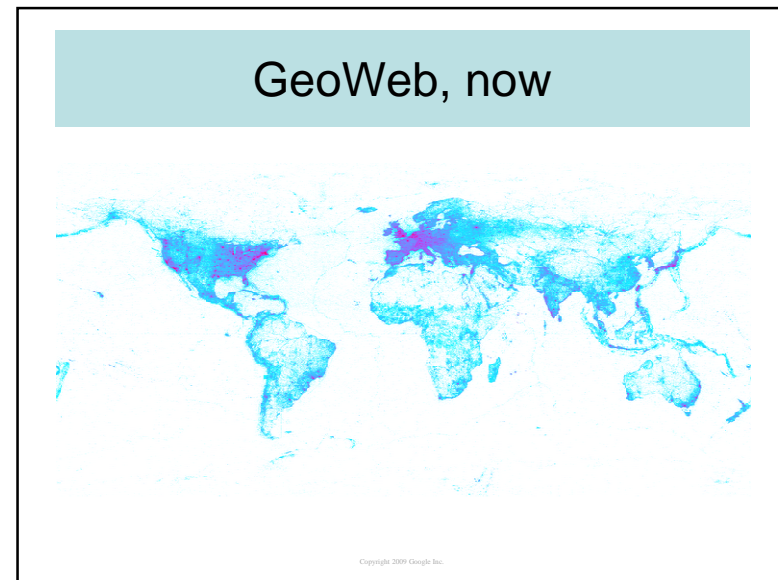
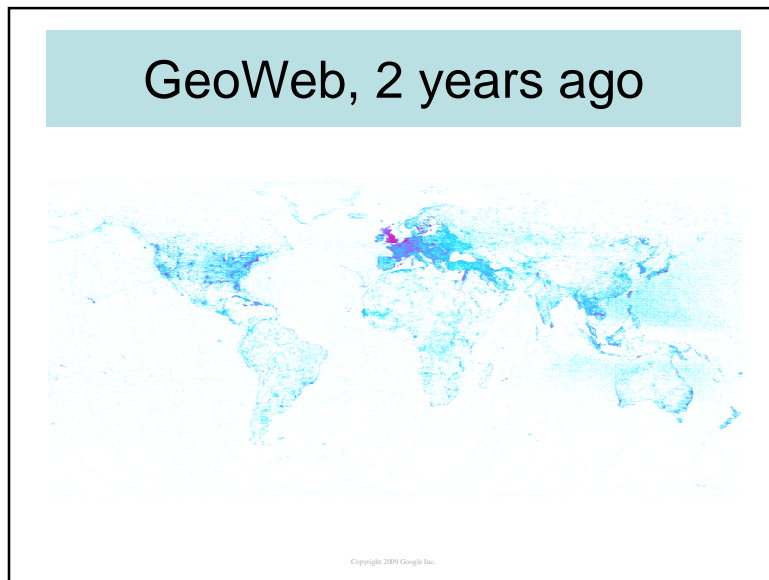


80 %

*“80 % of all data throughout the world have some geographic background”*



## Introduction to Geo Web

- 1 – Semantic Web / Geospatial Web
- 2 – Geocoding, Geonaming, Geoparsing, Geotagging
- 3 – KML and Mashups
- 4 – 3D Virtual Cities
- 5 – Geobrowsers
- 6 – Conclusions

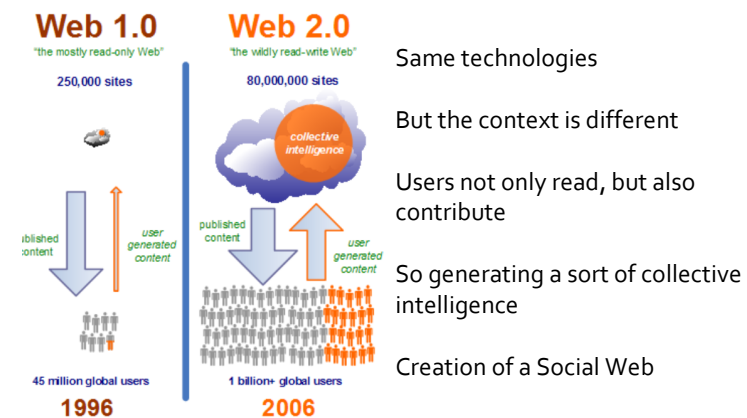
## 1 – Semantic Web / Geospatial Web

- GIS Evolution
- New functionalities
- New mentalities
- All the citizens can contribute

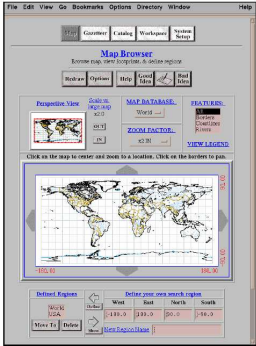
## Key-words of today's web

Comunicazione, collaborazione, condivisione, partecipazione, tagging, video online, sharing, widget, filtering, online documents editing, wiki, blog, corporate blogging, peer production, viral marketing, proximity marketing, internet of things, bookmarklet, social media, social networks, links, social news, citizen journalism, messaging, pooling, strutture emergenti, ordinare, prioritizzare, mashup, feeds...

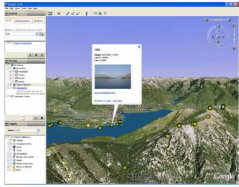
## From yesterday to today



## Evolution




From 1993 →




To 2009 →

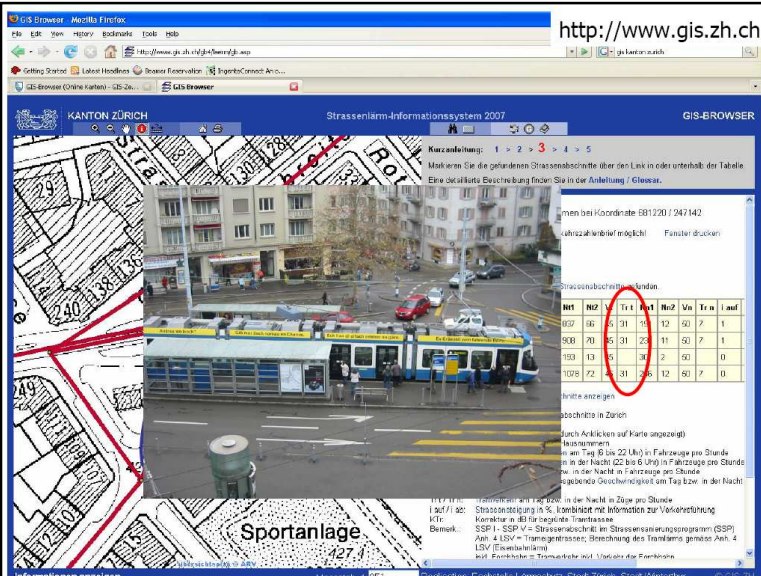
## Evolution



From 1993 →  
Structured spatial data



To 2009 →  
Non-structured spatial data



http://www.gis.zh.ch

Linie	Tr 1	Tr 2	Tr 3	Tr 4	Tr 5	Tr 6	Tr 7	Tr 8	Tr 9	Tr 10
101	101	101	101	101	101	101	101	101	101	101
102	102	102	102	102	102	102	102	102	102	102
103	103	103	103	103	103	103	103	103	103	103
104	104	104	104	104	104	104	104	104	104	104
105	105	105	105	105	105	105	105	105	105	105
106	106	106	106	106	106	106	106	106	106	106
107	107	107	107	107	107	107	107	107	107	107
108	108	108	108	108	108	108	108	108	108	108
109	109	109	109	109	109	109	109	109	109	109
110	110	110	110	110	110	110	110	110	110	110

## Semantic Web

- Transformation of the World Wide Web in an environment where the published (pages HTML, file, images, and so on)
- Association of information and data (metadata)
  - which specifies the semantic context of it in a proper format
  - for querying, to the interpretation and, in general, to the automatic elaboration.

Wikipedia: [http://en.wikipedia.org/wiki/Semantic\\_Web](http://en.wikipedia.org/wiki/Semantic_Web)

- With the interpretation of the content of the documents that the Semantic Web advocates:
  - It will be possible to make more evolved searches than the actual ones, based on the presence of key words in the document and
  - other special operations such as the construction of network of relationships and connections among documents according to more elaborate mechanisms than the simple hypertext link

## Scope of Semantic Web

- Development of applications for:
  - extraction of information from extemporaneous collections / dynamics of documents
  - validity check of the contents
  - identification of style
  - recognition of virtual hyperlink connections
  - intelligent agents

## GeoWeb

- The Geospatial Web or Geoweb is a relatively new term that implies the merging of geographical (location-based) information with the abstract information that currently dominates the Internet.
- This would create an environment where one could search for things based on location instead of by keyword only – i.e. “What is Here?”.

<http://en.wikipedia.org/wiki/Geoweb>

## Geoweb

- Intelligent location
- Use of Internet
- Toponyms → location on the globe
- postal Address.
- location on the globe
- Location-based relations
- Gazetteer

## Three ingredients of web 2.0

- Technological
  - interactive Web,
  - not more software products but services
- Sociological
  - to belong to a community,
  - to interact with other members
- Economic
  - Who provides the service spends few, but if in case of success, can earn a lot

## Mashup: What are they?

- Expression coming from pop music
- Integration of several existing services for generating fresh applications
  - SOAP
  - REST
  - JavaScript
  - RSS/Atom

## 1 browser, 1000 applications

- E-mail (Gmail)
- Cartography (Gmaps, Yahoo maps, VirtualEarth)
- Word processor (Writely, officelive)
- Spreadsheet (Google spreadsheet)
- Encyclopedia (Wikipedia)
- Agenda (30 boxes, Gcalendar)
- Bookmarks (del.icio.us)
- News, podcast, ecc. (Bloglines)
- Programmation (zimki)

## Geographic Information Retrieval (GIR)

- A great deal of data is not structured
- An investigation on text document says
  - 85% out of 20 000 British documents integrate place names,
  - and 13% out of 4 million queries on Internet have some place names



## GIR Key-elements

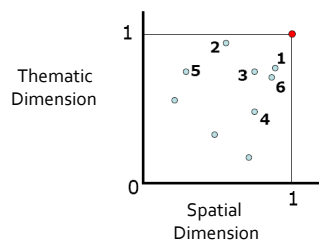
- Identification of footprints : identify place names in non-structured texts
- Query expansion : add place names not present in the initial query
- Spatial indexing and text indexing.
- Ranking : according to theme and location.
- Formulation of queries and result visualization

## Expansion of queries and spatial indexing

- Expansion : If Lyon, then add Villeurbanne, Caluire, etc.
- Necessity to know topology and neighboring place names
- Using a gazetteer
- If a user wants « castles around Zurich », a spatial index must integrate only Zurich and the vicinity

## Ranking

- Any retrieval system must bring documents with a score
- In GIR, scores and two-dimensional (thematic and spatial)



MetaCarta GeoSearch News - Windows Internet Explorer

Search: Enter a place... for politics Last 24 Hours

MetaCarta

Headlines

Headline	Place	Date
Sarkozy to rejoin government	France	40 minutes ago
WCC Presents Spring Film Series	Switzerland	43 minutes ago
POLITICAL EYE: Lowden takes aim at gun rights voters	Jersey	52 minutes ago
Lowden takes aim at gun rights voters	Jersey	1 hour ago
Book Review: On the Beach by Nevil Shute	Northern Hemisphere	1 hour ago
Elisabeth Murdoch on Shine: family succession and ...	France	1 hour ago
European Union's Foreign Policy vane	France	1 hour ago
Health Care Reform Passed. But Just the Beginning	Cadillac	1 hour ago
Quebec's duelling manifestos	France	1 hour ago
FRANCE: PM Fillon and Sarkozy hold talks after UM...	FRANCE,Charente	1 hour ago
President 'bling-bling' down in polls	Paris,France	1 hour ago
Sarkozy suffers heavy defeat in French regional electi...	France,Paris	1 hour ago
Sarkozy to reshuffle government	France,Paris	1 hour ago
Sarkozy suffers defeat	PARIS,France	2 hours ago
The Feminist in Charlotte Smith's Desmond	France	2 hours ago
Sarkozy left beuised in regional polls	France	2 hours ago
FRANCE: PM Fillon and Sarkozy to meet for talks aft...	FRANCE,Charente	2 hours ago
Sarkozy to rejig government after poll defeat (AFP)	France,PARIS	2 hours ago
Kufor Storms Ji's House	Geneva	3 hours ago
Ex-presidents will visit Haiti: Clinton, George W. Bus...	Preval	3 hours ago
Sarkozy to rejig government	France	3 hours ago
Sally Freeman McKenzie fired up the troops for patri...	Paris	3 hours ago

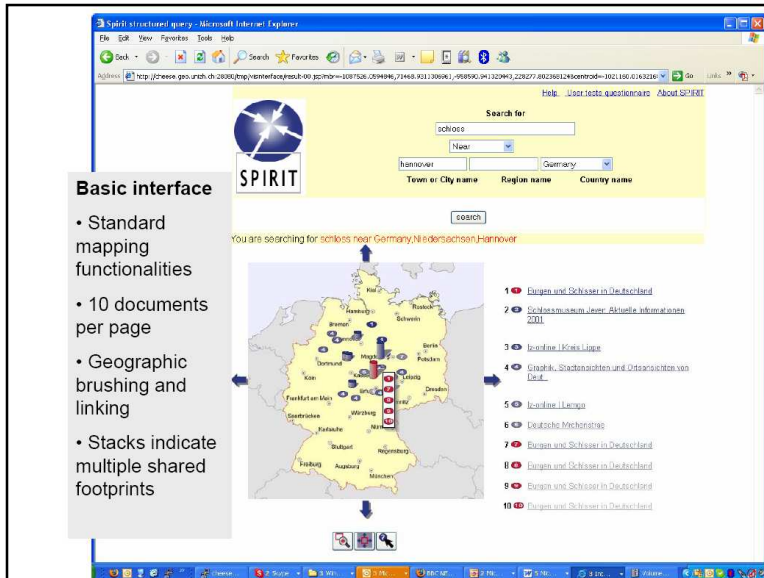
Map

Provence-Alpes-Cote-D'Azur  
French prime minister concedes defeat in regional elections l...

Sarkozy suffers heavy defeat in regional elections - Summary

Sarkozy suffers heavy defeat in regional elections (Roundup)

Displaying articles 1 - 100 of 155



**Basic interface**

- Standard mapping functionalities
- 10 documents per page
- Geographic brushing and linking
- Stacks indicate multiple shared footprints

## 2 – Geocoding, Geonaming Geoparsing and Geotagging

- Geocoding
  - Finding coordinates of a place
- Geonaming
  - Give a name to a place
- Geoparsing
  - From a text, find the corresponding place
  - Solving ambiguities
- Geotagging
  - Annotate a place on a map

## Geocoding

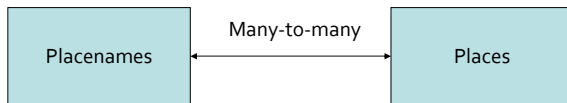
- Assigning coordinates to a place with longitude and latitude
- Two representations
  - Degrees, minutes, second ( $gg^{\circ} mm' ss''$ )
  - Decimal degrees ( $gg, ddd$ )  
 $ddd = mm/60 + ss/3600$
  - Certain cases: interpolation (f.e. roads)
    - Linear interpolation for the numbers along the roads based the coordinates of the crossroads

## Geonaming

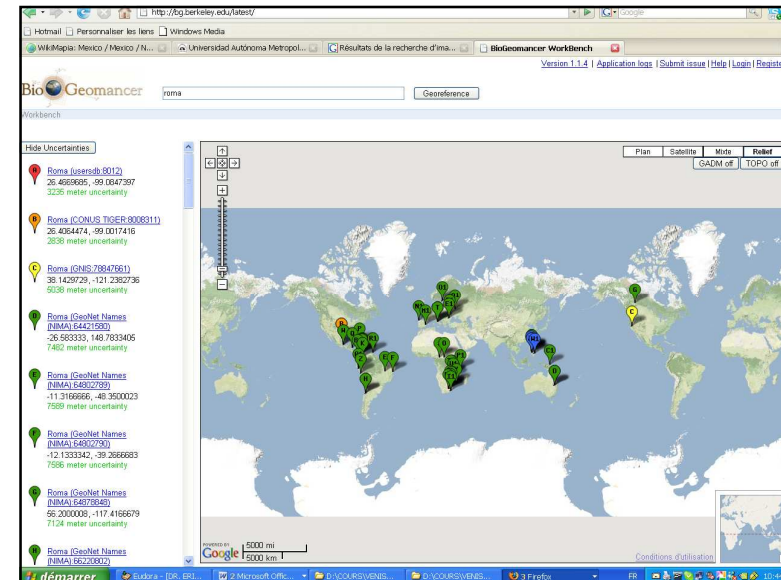
- From the coordinates of a place, assigning a name to this place
  - line
  - area
- Problems of linguistics
  - multilingual problem
- What name?
  - Name in the official language of the country
  - Name in the language of the user
  - Name in the language of the system

## GeoParsing

- Analyzing for locating



- Example: Mississippi (river/state ?)
- Example: Roma



## GeoParsing: 3 definitions

- Placenames → Location (=coordinates)
  - Where is located Cholula pyramid?
- Relation to a placename → Location
  - At 15 Km Southwest of Oaxaca
- Text Analysis → Location
  - Historical text, Bible, etc.

## Geoparsing instruments

- Geographic ontologies
  - Semantic network of geographic vocabulary
  - Topological relations
- Gazetteers
  - Dictionary of Placenames



## Gazetteers

- List of placenames (toponyms)
- Database of toponyms
- Languages
  - Venezia, Venice, Venise, Venecia, Venedig, Benetke, Benátky... etc.
  - Monaco di Baviera, Monaco,
  - Saõ Paulo, San Pablo

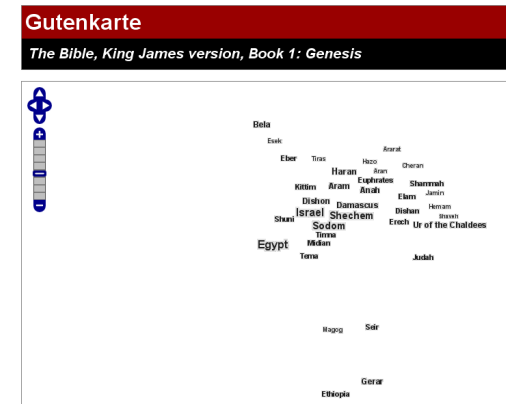
## Difficulties for text analysis

- Mrs Florence Manchester  
2345 New York Avenue  
97347 Aberdeen, WA
- Señor Ernesto Madrid  
Garibaldi 345  
Vicente López  
Argentina

## Web Sites for GeoParsing

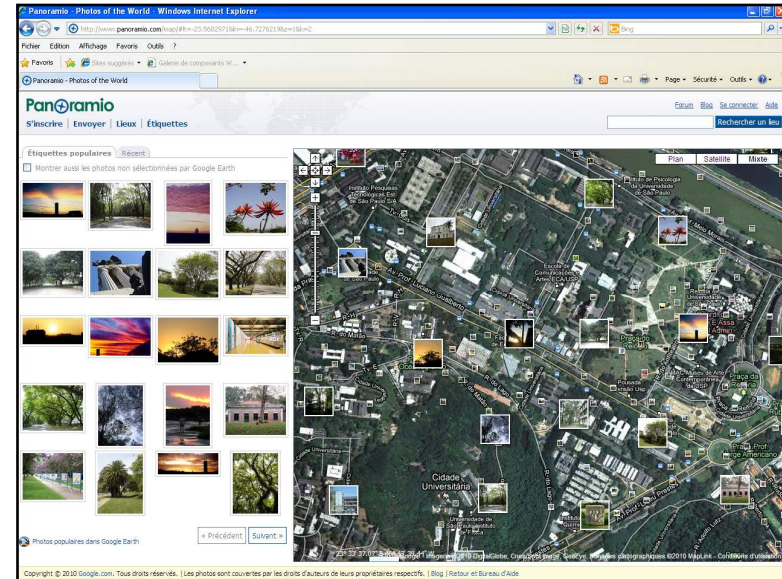
- NGA GEONet Names Server (GNS)
  - <http://earth-info.nga.mil/gns/html/>
- BioGeoMancer  
<http://bg.berkeley.edu/latest/>
- Edina GeoParser
  - <http://edina.ac.uk/projects/geoxwalk/geoparser.html>
- Etc.

## Example in the Bible



## Geotagging

- Geographical annotations are generally multimedia
  - Photos
  - Texts
  - Video
  - Voice,
  - Music
- Existing systems
  - Panoramio
  - Flickr
  - EveryScape
  - Wikimapia
  - Trippermap



## Other sites

- <http://www.flickr.com/map/>
- <http://www.everyscape.com/washington-dc.us.aspx>
- <http://wikimapia.org/#lat=19.0361561&lon=-98.2397461&z=10&l=0&m=a&v=2&search=puebla>
- <http://www.geonames.org/maps/showOnMap?q=puebla+country:MX>
- <http://www.supergeotagged.com/>

## Comparison

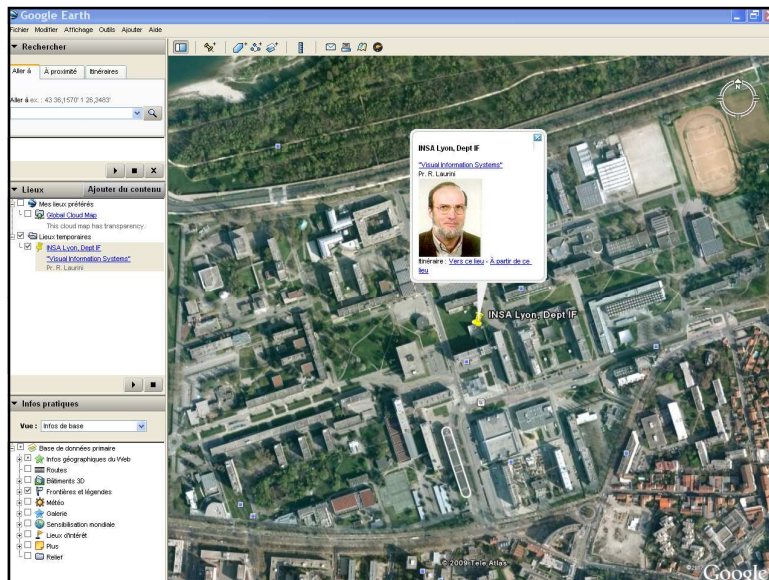
Features	Google Maps	Google Earth	Panoramic Google	Flickr	EveryScape	Wikimapia	TripperMap	Live Search Maps
Trace Routes	✓	✓				✓ (user)	✓	✓
Places of Interest	✓	✓				✓ (user)	✓	✓
Include Items	✓	✓				✓	✓	✓
Add Photos	✓	✓	✓ (best quality)	✓	✓	✓	✓	✓
Links	✓	✓		✓		✓	✓	✓
Satellite Images	✓	✓		✓		✓	✓	✓
Real Image as pictures	✓	✓			✓ (360° photos)	✓	✓	✓
Customize maps	✓	✓				✓	✓	✓
Language	JavaScript	JavaScript / XML		Atom, RSS				JavaScript
3D feature								✓
Comments	Usable by Google Mashup Editors		Generally used by bloggers for photo hosting	Not designed for maps	Photos put together	Based on Google Maps	Based on Google Maps	Usable by Microsoft Popfly

## 3 – KML and mashups

- Created by Google for mapping with Google Earth
- KML: Keyhole Markup Language
- a KMZ file is a zipped version of KML
- KML is an open standard officially named the OpenGIS® KML Encoding Standard (OGC KML).
- Maintained by the Open Geospatial Consortium (OGC).
- The complete specification for OGC KML can be found at <http://www.opengeospatial.org/standards/kml/>.
- <http://code.google.com/apis/kml/documentation/kmlreference.html>

## KML Example

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.0">
<Placemark>
  <name>INSA Lyon, Dept IF</name>
  <description><![CDATA[<a href="http://lisi.insa-lyon.fr/~laurini/"
    target=_blank>"Visual Information Systems"</a><br>
    Pr. R. Laurini<br>
    ]]></description>
  <Point id="khPoint600">
    <coordinates>4.8720471, 45.782474</coordinates>
  </Point>
</Placemark>
</kml>
```

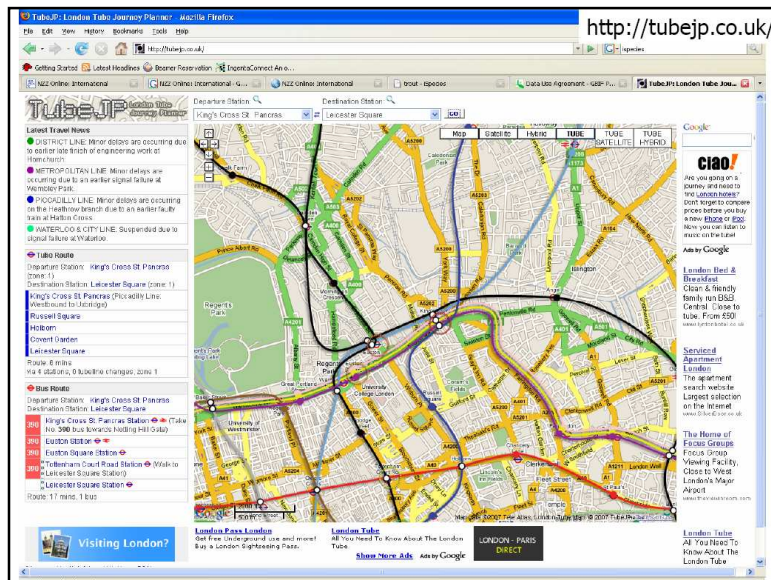
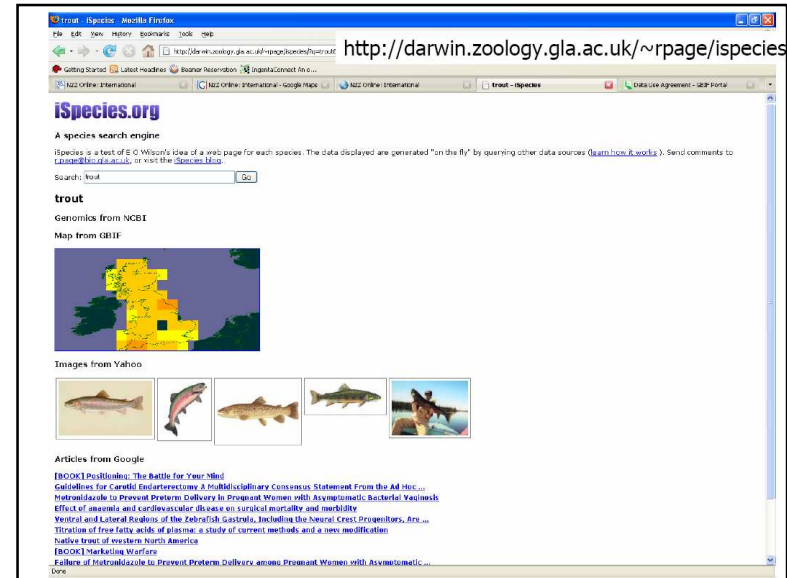


## Mashup

- Mash-up / Mashup
- Expression coming from music
- Mash-up = *An audio recording that is a composite of samples from other recordings, usually from different musical styles*

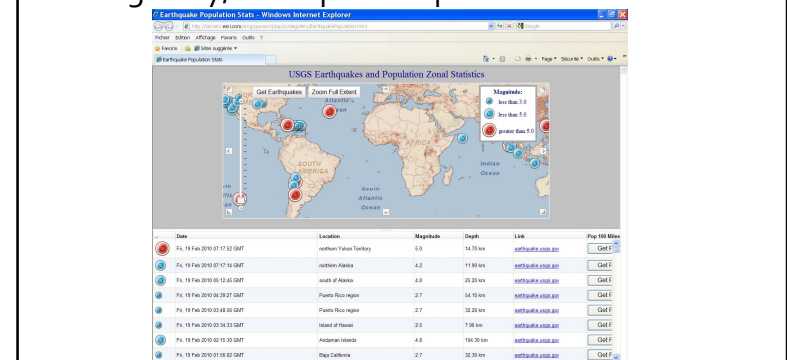
## Internet Mashup

- The mashups integrate data coming by multiple sources to realize new products and useful applications
- To allow the creation of the mashups with data and services, and the suppliers must furnish the interfaces to their data in order to create a chain of services on the web
- The mashups allow the interactive mapping of the data in real time.
- This was not possible with the paper maps (for example where is now my train?)



## Earthquakes

- <http://serverx.esri.com/arcgisjavascriptapi/coverage/EarthquakePopulation.html>



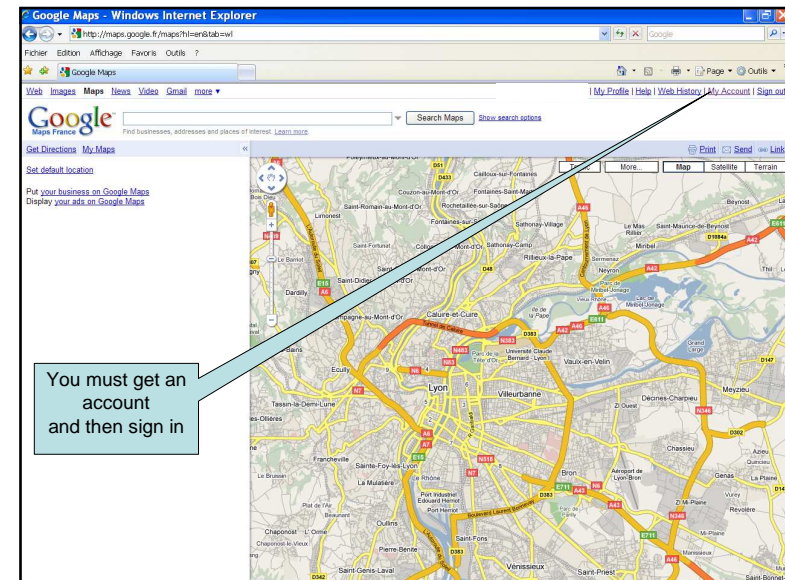
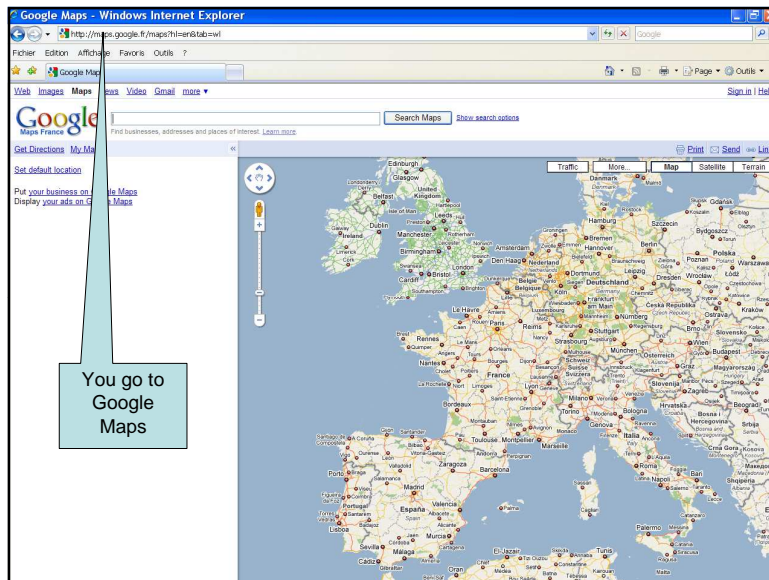


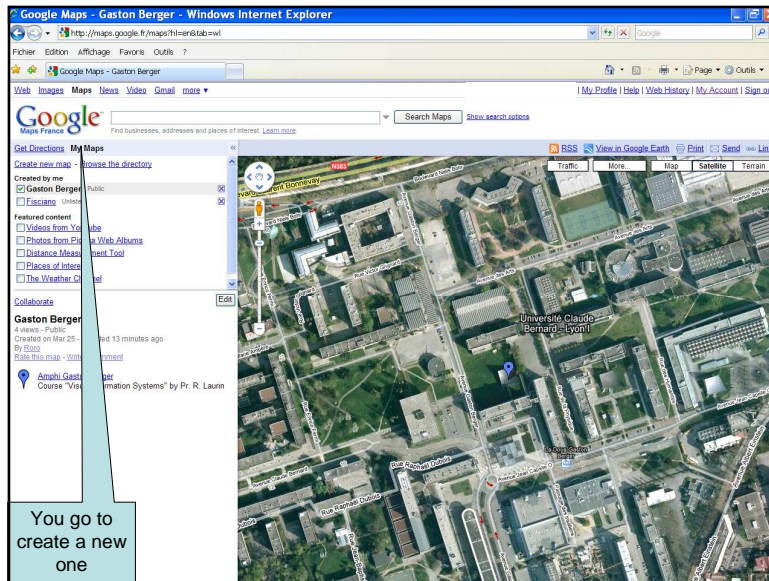
## Mashup examples

- To question the animal species, to ask information on their distributions, on the images and on the scientific articles or the books on demand
- To map an itinerary on the subway stations
- To map airplanes and relative information in real time near Zurich
- To map the crimes in Copenhagen

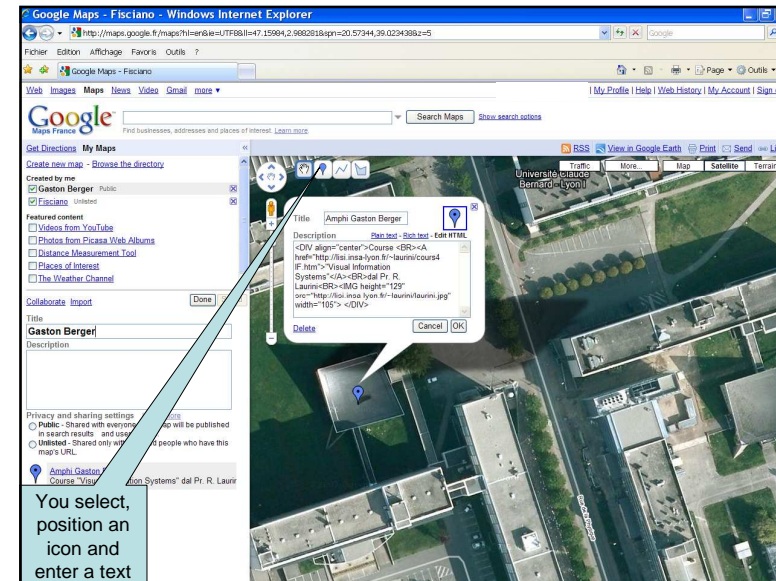
## Example: Creating a mashup

- Run Google Maps
- Create/use a Google account
- Creating a map with annotation
- Getting the HTML fragment
- Inserting the HTML fragment into a web page
- Uploading the web page on the server

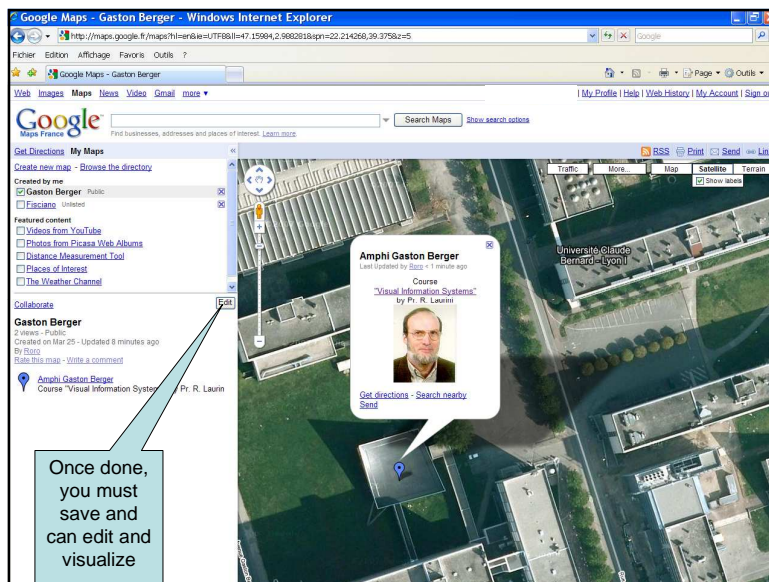




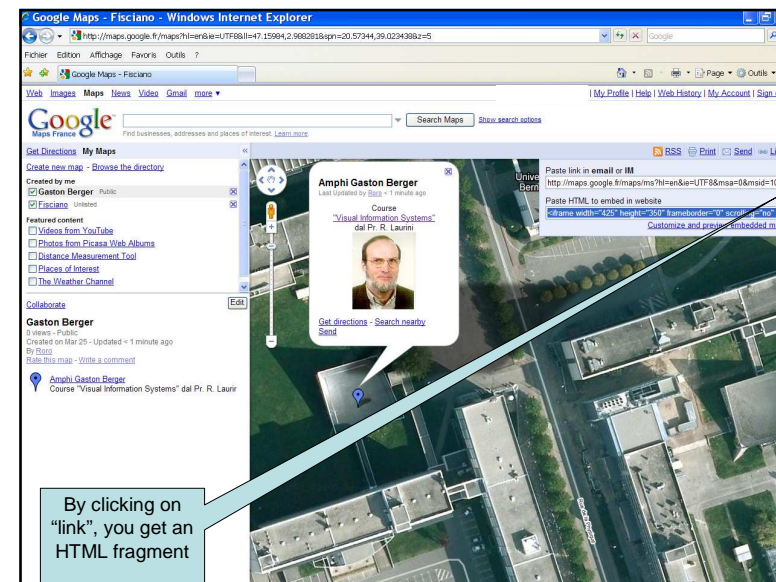
You go to create a new one



You select, position an icon and enter a text



Once done, you must save and can edit and visualize



By clicking on "link", you get an HTML fragment

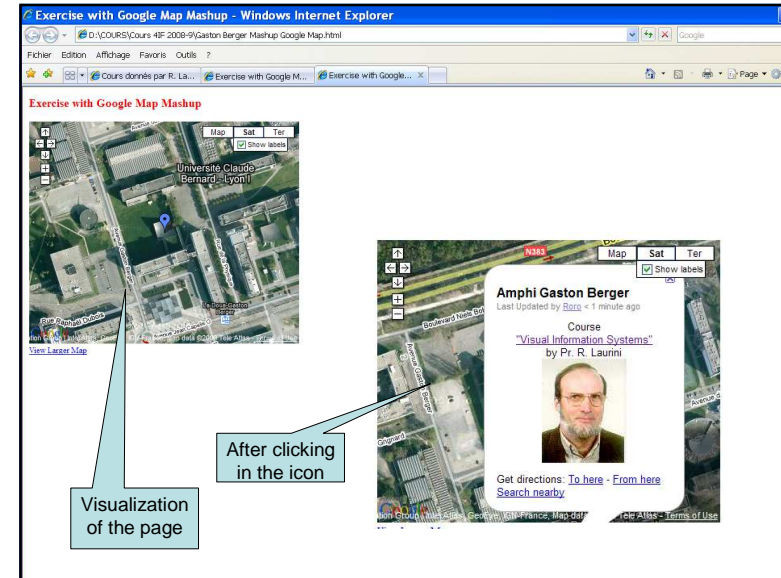


```
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01//EN"
"http://www.w3.org/TR/html4/strict.dtd"><html><head>
<meta content="text/html; charset=ISO-8859-1" http-equiv="content-
type"><title>Exercise with Google Map Mashup</title>
```

```
</head><body><big style="font-weight: bold; color: red;">
Exercise with Google Map Mashup</big><br>
<br>
<div>
```

You insert  
the HTML  
fragment  
into your  
page

```
<iframe width="425" height="350" frameborder="0" scrolling="no"
marginheight="0" marginwidth="0"
src="http://maps.google.fr/maps/ms?hl=en&ie=UTF8&msa=0&mp:msid=104519661041078174045.000465f0013f392a2795a&ll=45.782444,4.872061&spn=0,0&t=h&output=embed">
</iframe><br />
<small><a
href="http://maps.google.fr/maps/ms?hl=en&ie=UTF8&msa=0&mp:msid=104519661041078174045.000465f0013f392a2795a&ll=45.782444,4.872061&spn=0,0&t=h&source=embed"
style="color:#0000FF;text-align:left">View Larger Map</a></small>
</div>
</body></html>
```



## KML vs Mashup

- Knowing KML
- Totally independent application
- You own the code
- Integrating a map into an existing application
- You don't own the code

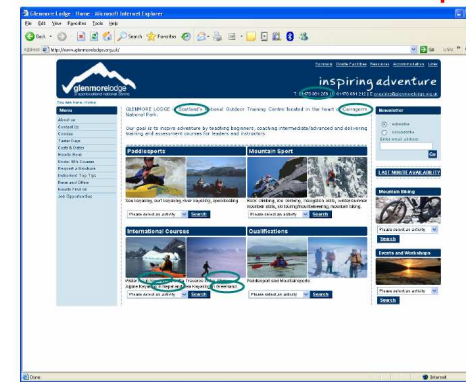
## Geographic Information Retrieval

- Huge part of data that we see on a daily base are not structured or partially structured (for example textual documents)
- Research shows that
  - 85% of 20 000 British documents contain a placename (Purves and others, 2007);
  - 13% of 4 million questions on the web contain a geographical component (Zhang and others, 2006)

## Key-elements of GIR

- Identification of the place:
  - identify places mentioned in not structured texts
- Expansion of a query:
  - adding names not introduced in the query
  - spatial indexing and textual indexing
- Classifications:
  - according to the theme and the location
- Formulation of queries and visualization of the results:
  - interface allowing the consumers to formulate and to explore the spatial queries

## Analysis of documents



Scotland  
Cairngorm National Park  
Norway  
Alps  
Nepal  
Greenland  
**01479 861256**  
Glenmore Lodge  
Glenmore  
Aviemore  
Inverness-Shire  
PH22 1PL  
Tel: 01479 861256

 A screenshot of the SPIRIT web application. It shows a search interface with a search bar containing 'schloss', a dropdown menu for 'Namen', and fields for 'Town or City name', 'Region name', and 'Country name'. Below the search bar is a map of Germany with several red markers indicating search results. A list of results is shown on the right side of the map.
 

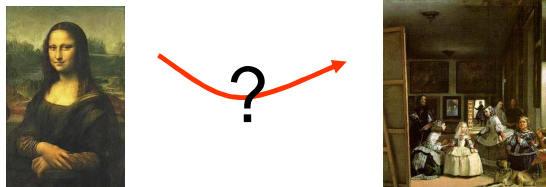
**Basic interface**

- Standard mapping functionalities
- 10 documents per page
- Geographic brushing and linking
- Stacks indicate multiple shared footprints

## Conclusion on mashups

- Generation of simple and complicated maps by mixing information coming from different sources
- Web services for cartography
- Interfaces to data that allow consumers to query and provide data
- Methods to realize such services and to use the standard OGCs in order to allow exchanging different elements
- The use of the mashups allows such chains of the services
- Necessity of techniques web to allow exploit not structured data

## Roadmap generation between two Physical Hypermedia



- How to go from *la Gioconda* of Leonardo of the Louvres Museum in Paris to *las Meninas* in the Prado Museum in Madrid?
- Generation of a W-link in the PH domain.

## Example of pervasive cooperation

- From Louvres database → exit from *Gioconda* to the next metro station
- From Paris public transportation company database → go from this station to Paris airport
- From airline database → go from Paris airport to Madrid airport
- From Madrid public transportation company database → go from Madrid airport to Prado museum nearest station
- From Prado database → go from the previous station to the Prado gate, and then to *Meninas*.

## 4 – Virtual 3D Cities

- 3D Visualization of cities
- Languages such as CityGML
- New projects covering the whole earth
  - Google Earth
  - Microsoft's Virtual Earth
- Global vision and local search
- Integration of data coming from different sources

## Components

- Modeling of buildings and human artifacts
- Modeling of terrains
- Modeling of urban furniture

## Berlin



## Heidelberg



## Potential applications

- Simulation of urban noise, air pollution
- Simulation of floods
- Simulation of natural and technological hazard consequences
- Comparison of real building heights and maximum authorized heights
- Visual impact of a new project
- Checking declaration for local taxes
- Etc.

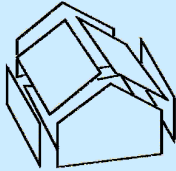
## Others applications

- Geomarketing: visual impact of advertising
- Real estate agencies: give an idea of the vicinity
- Tourism: landmarks to visit
- Mobile phone: location of hotspots (intervisibility)
- Solar panels: optimal location
- Helicopters: places to land
- History and archaeology: modeling cities in previous centuries/millennia
- Etc.

## 3D Models of buildings

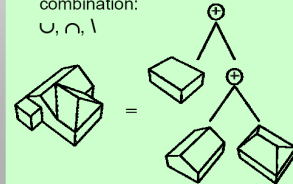
### GIS: *accumulative* Boundary Representation

- Aggregation of all surfaces enclosing the object's volume



### CAD: *generative* Constructive Solid Geometry

- Volumetric primitives
- Set theoretical operators for combination:



## Examples



## Californian suburbs



## Reconstitution of Pompeii





## Maya Architecture



## CityGML

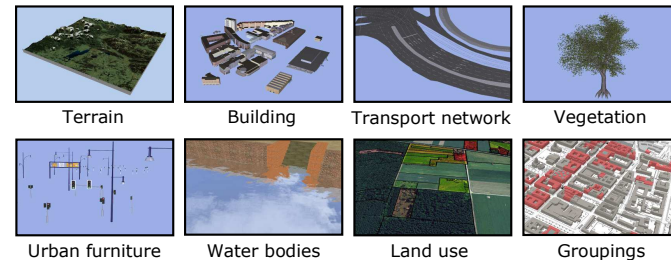
- German initiative
- Extension of GML
- Objective: 3D virtual city modeling



## CityGML objects

- Natural terrain
- Buildings, constructions,
- Bridges, tunnels, walls
- Excavations, streets, transports, railways,
- Water bodies, vegetation
- Traffic lights
- Urban furniture

## Examples of CityGML objects

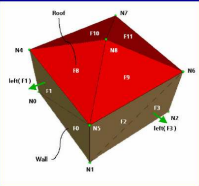




## Simple model

### 3D Data Model 1


- Define Geometry by point coordinates
- Example:  
 x0 y0 z0, x1 y1 z1, x5 y5 z5, #F0  
 x0 y0 z0, x5 y5 z5, x4 y4 z4, #F1  
 x1 y1 z1, x6 y6 z6, x5 y5 z5, #F2
- Redundancy: Each Point coordinate is stored 6 times !!!
- Used in CityGML, Spatial DB



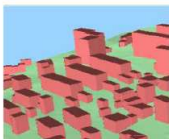
## Levels of details

- LoD0 – Regional Model
  - 2.5D Terrain Model
- LoD1 – City/Model of the site
  - Block model w/o roofs
- LoD2 – City/Model of the site
  - Texture of roofs and façades
- LoD3 – City/Model of the site
  - Detailed architectural Model
- LoD4 – Inside Model
  - Navigation within the building


## Levels of details




LOD0




LOD1





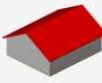
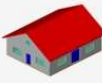
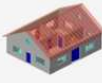
LOD2



LOD3



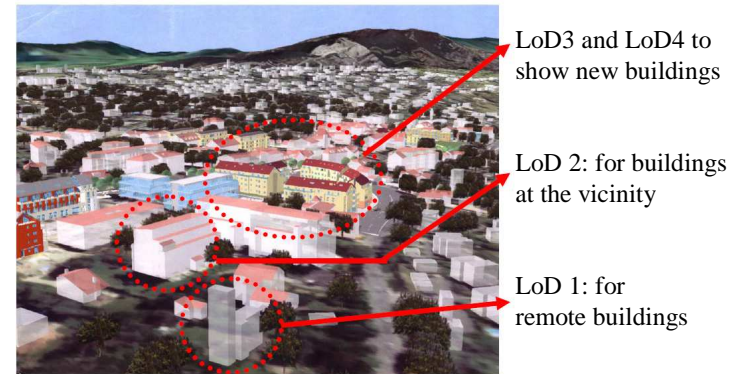
LOD4

	
	CityGML LoD 1 Modell
	
	CityGML LoD 2 Modell
	
CityGML LoD 3 Modell	
	
CityGML LoD 4 Modell	
IFC Modell	CityGML LoD 4 Modell

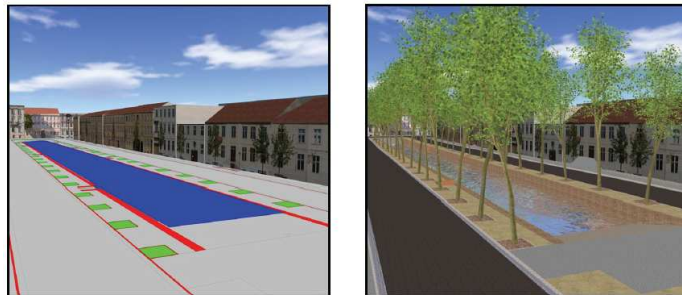
## Levels of details – example 1



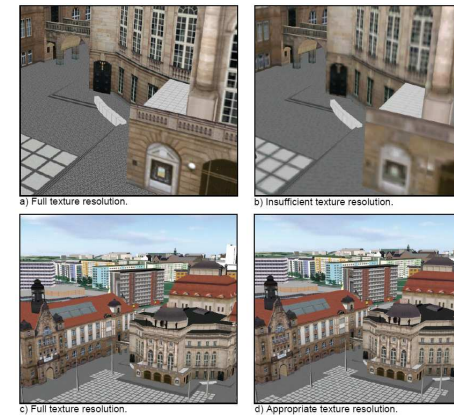
## Levels of details – example 2



## Habillage



## Texture and resolution

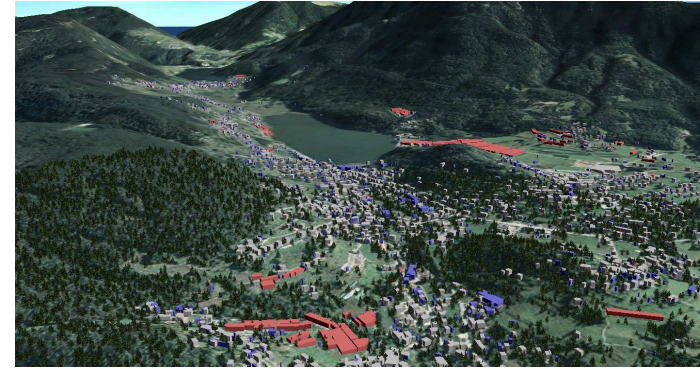




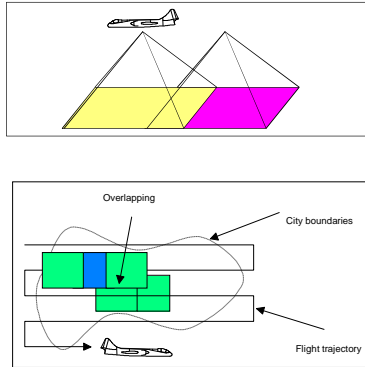
## Near Bonn



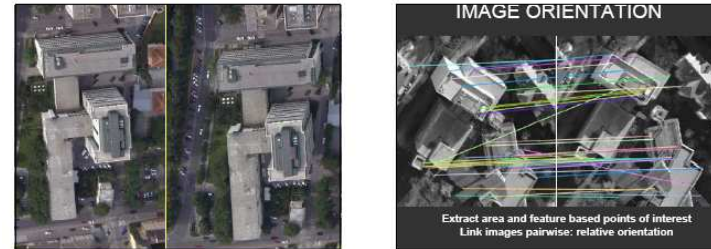
## Near Trento



## Aerial photos



## Extraction of homologous points



## 5 – Geobrowsers

- Retrieval of geographic information
- Approach
  - Global vision
  - Local details
- Systems
  - Google Earth
  - Bing
  - Google Street View

## Google Earth

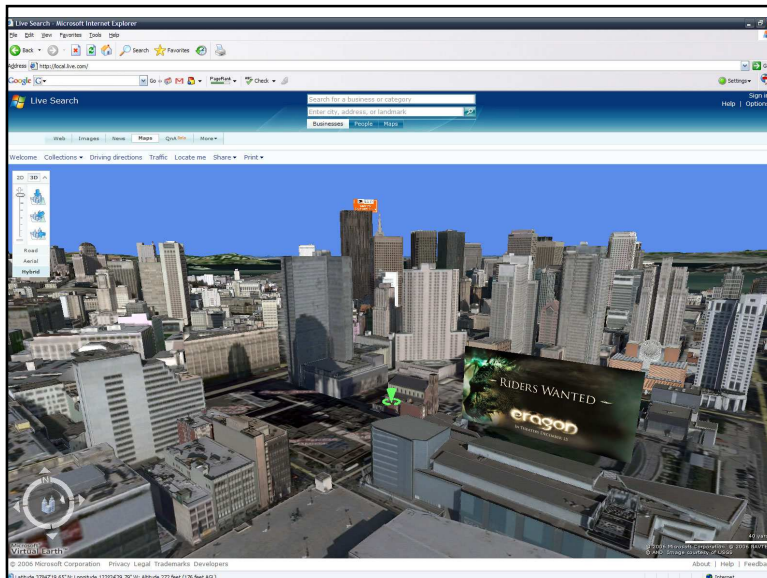
- « *Organize the world's information and make it universally accessible and useful* »
- Keyhole → Google
- Global infrastructure to organize information
- Google book search: places mentioned in books

## Microsoft's Virtual Earth

- « *Mind-expanding* »
- Vexcel → Microsoft
- Global infrastructure for geo-referenced applications
- Orthorectified aerial photos (pixel = 15cm)
- Bird's eye
- Buildings with textures
- Augmented reality

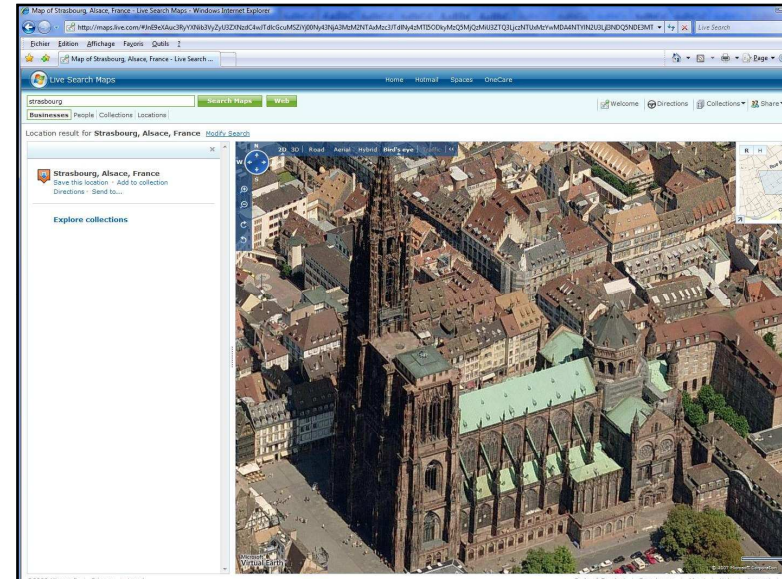
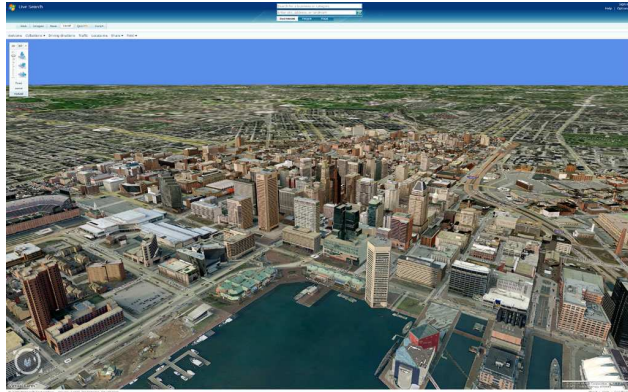
## Microsoft

- Virtual Earth:
  - <http://maps.live.com/>
  - [http://www.metacafe.com/fplayer/496241/flying\\_in\\_virtual\\_earth.swf](http://www.metacafe.com/fplayer/496241/flying_in_virtual_earth.swf)
  - [http://www.metacafe.com/watch/511066/boston\\_virtual\\_real\\_estate\\_viewing/](http://www.metacafe.com/watch/511066/boston_virtual_real_estate_viewing/)
- Demo
  - <http://imagine-windowslive.com/minisites/livemaps/default.aspx>





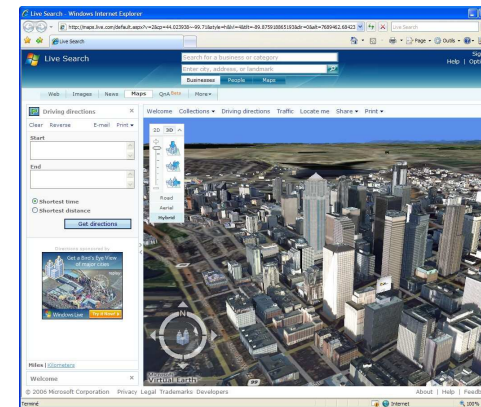
## Baltimore



## Comparison

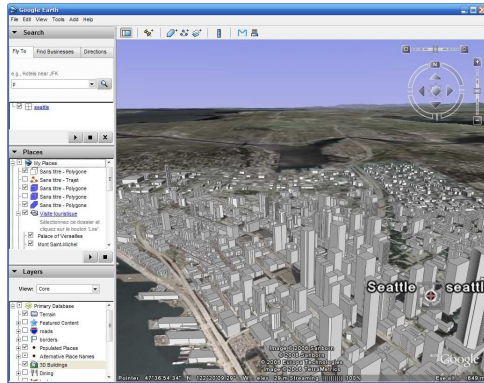
- [http://www.metacafe.com/watch/496217/google\\_and\\_virtual\\_earth\\_city\\_by\\_city/](http://www.metacafe.com/watch/496217/google_and_virtual_earth_city_by_city/)

## Seattle (Virtual Earth)





## Seattle (Google Earth)



## Google Street View

- Navigate in a city such as a pedestrian
- Panoramic photos (360 grades) in all streets
- Create a giant image database
- Provide an access system

## Google Street View

- Provides street pictures, 360° horizontally and 290° vertically
- Launched in May 2007 with only 4 US cities
- Extended to several thousands cities throughout the world.

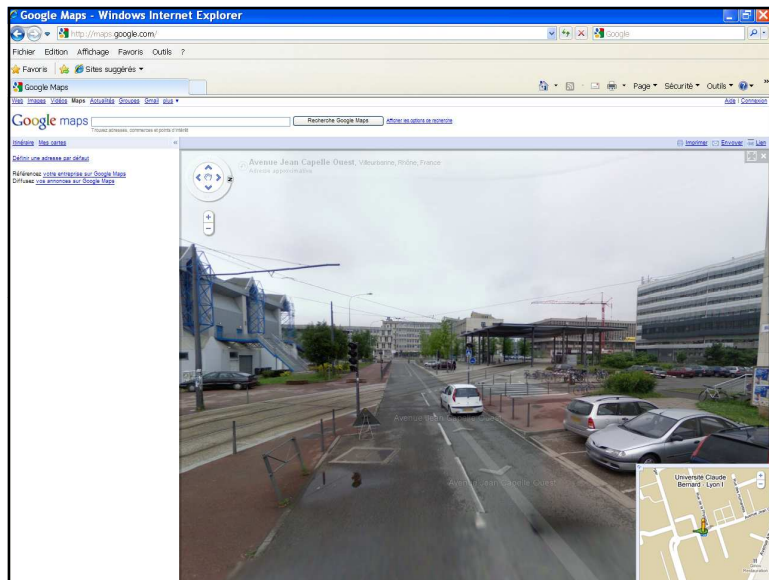
## Vehicles with camera



## Vehicles with camera



## Street View Interface



## Bike with camera

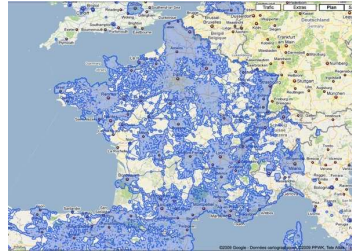


## Street View



La couverture de Google Street View dans le Monde (novembre 2009)

■ Actuelle  
■ Future  
■ Pas de couverture



<http://maps.google.fr/help/maps/streetview/where-is-street-view.html>

## 6 – Conclusions

- Importance of semantic web
- Importance of GeoWeb
- Retrieval of geographic information
- Geobrowsers
  - Global vision, local search

