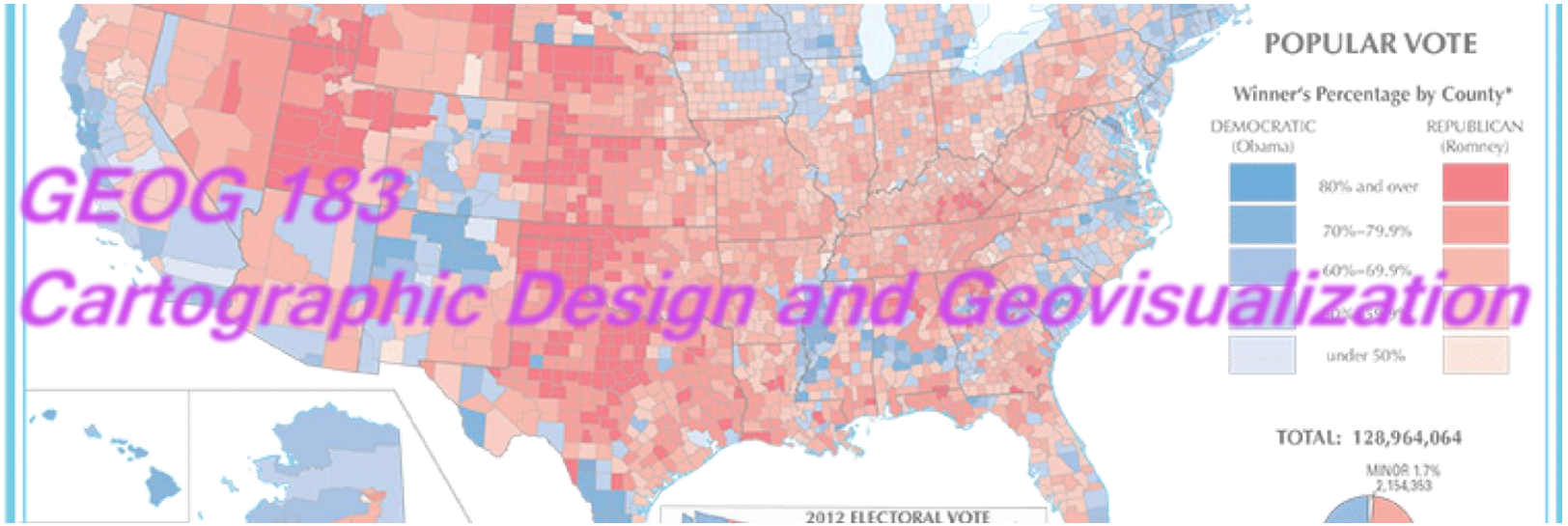


Geog183: Cartographic Design and Geovisualization Spring Quarter 2020

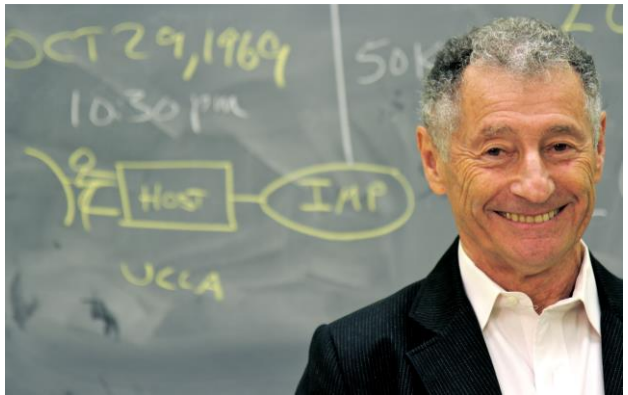
Lecture 16: Web-based cartography

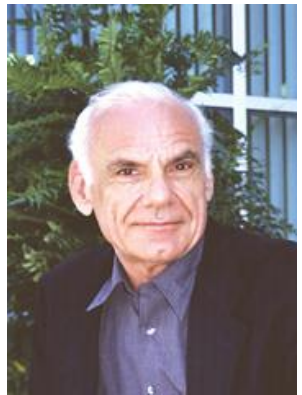
Web cartography

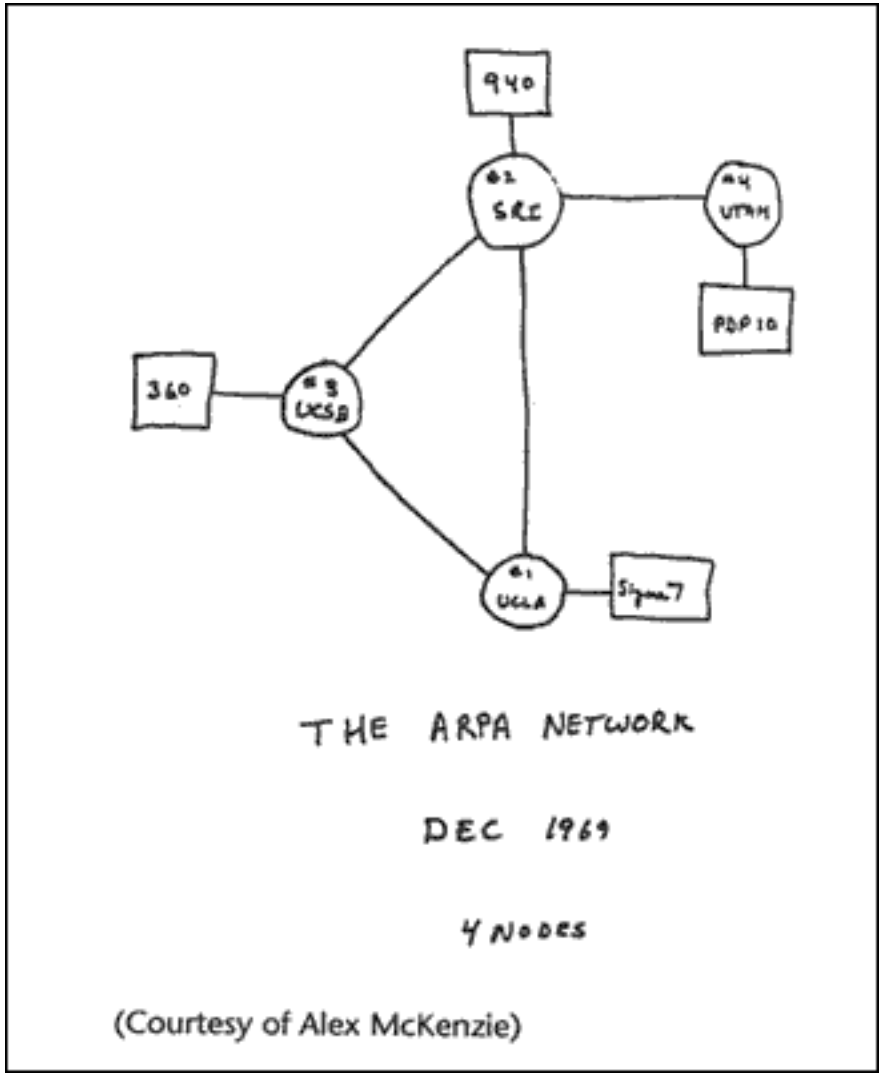
- Examine history of the WWW
- Maps and the web, and how they developed
- New capabilities, data, search, distribution, interaction
- The evolution of the client-server model
- Mobile computing and the web
- The GoogleMaps/Earth Era
- Spatially enabled Location-based services and maps
- What next?

Early Internet History

- J.C.R. Licklider of MIT, then DARPA, first proposed a global network of computers in 1962. Predicted interactivity, GUIs
- Leonard Kleinrock of MIT and later UCLA developed the theory of networks and packet switching
- Lawrence Roberts of MIT connected a Massachusetts computer with a California computer in 1965 over dial-up telephone lines
- Kleinrock's packet switching theory was confirmed.
- Roberts moved over to DARPA in 1966 and developed his plan for ARPANET

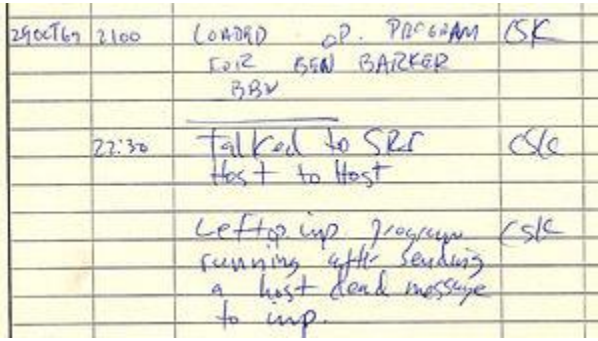






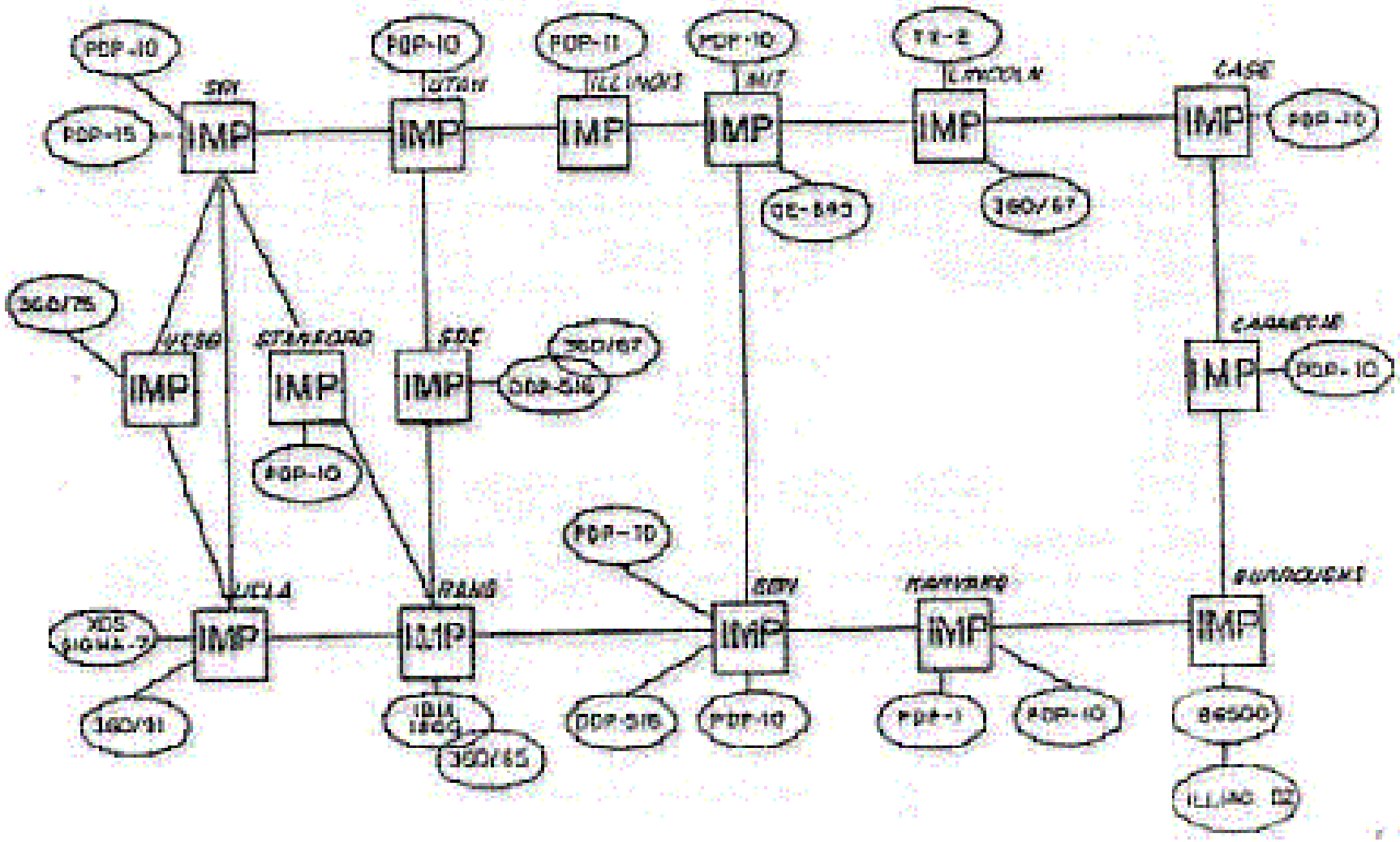
Leonard Kleinrock demonstrates how the first Internet communication was made with the help of an Interface Message Processor machine at his office at the UCLA Computer Science Department in Los Angeles

Simple beginnings



- ARPANET brought online in 1969
- Initially connected four major computers at universities in the southwestern US (UCLA, Stanford Research Institute, UCSB, and the University of Utah)
- 1970, MIT, Harvard, BBN, and Systems Development Corp in Santa Monica, Cal. were added.
- 1971, Stanford, MIT's Lincoln Labs, Carnegie-Mellon, and Case-Western Reserve U were added.
- Also, NASA/Ames, Mitre, Burroughs, RAND, and the U of Illinois plugged in.
- First message: Charlie Kline at UCLA sent the first packets on ARPANet as he tried to connect to Stanford Research Institute on Oct 29, 1969
- The system crashed as he reached the G in LOGIN!

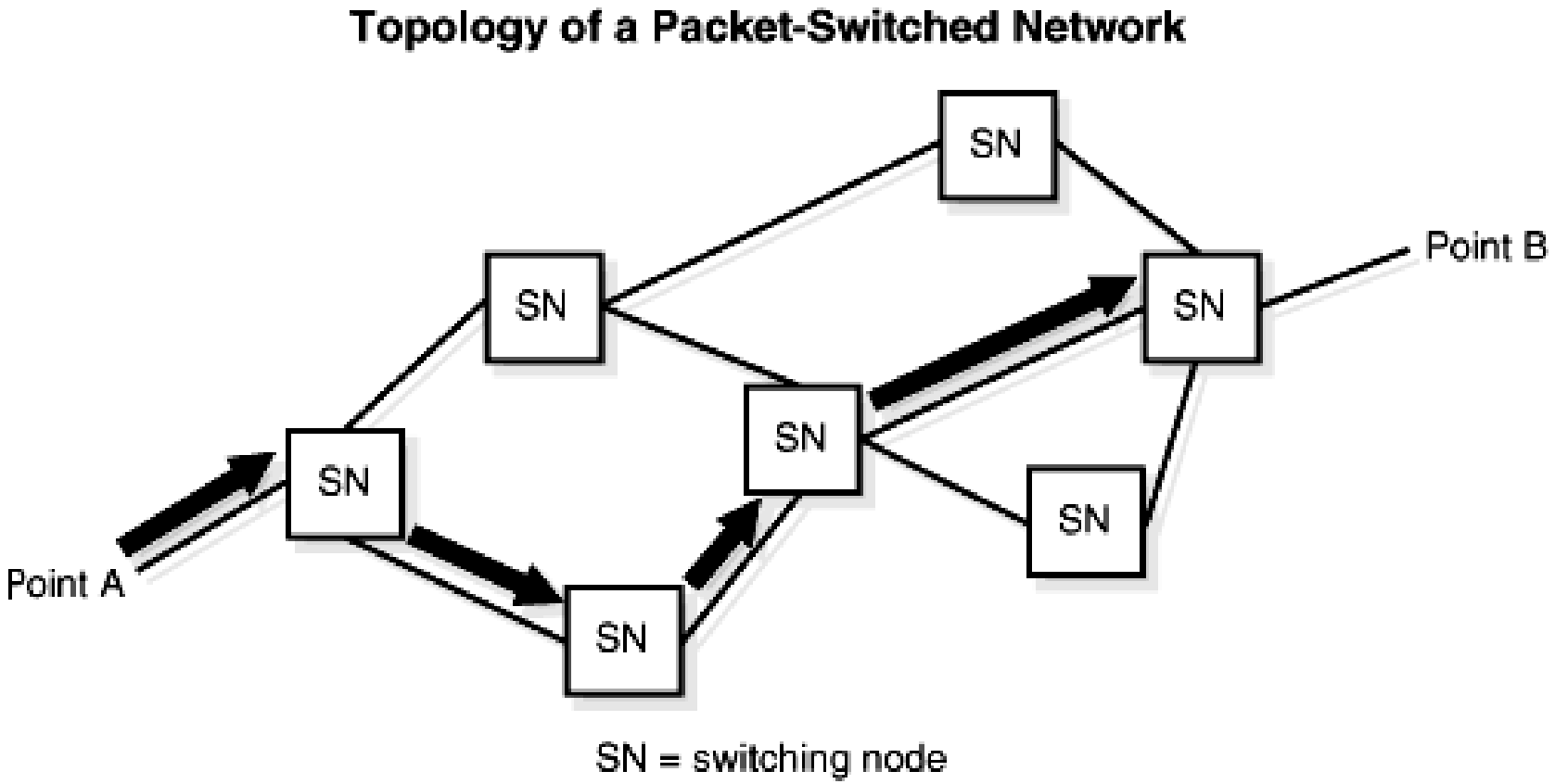
The doubling begins



Important landmarks

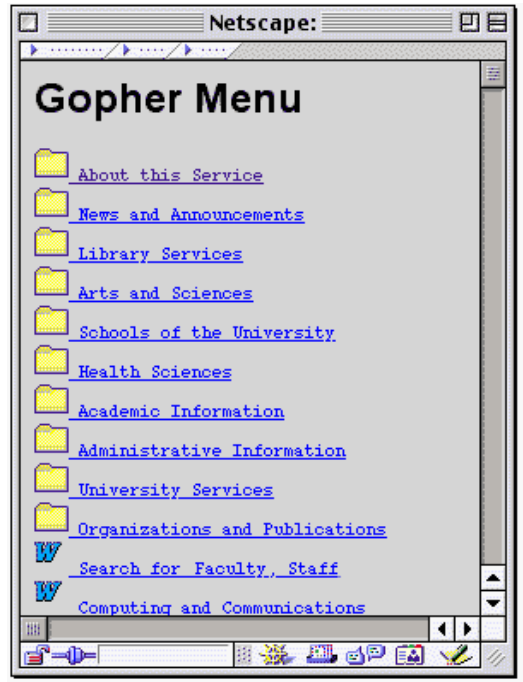
- E-mail 1972 (Ray Tomlinson of BBN selects @) When Tomlinson showed it to his colleague Jerry Burchfiel, Tomlinson said "Don't tell anyone! This isn't what we're supposed to be working on."
- Telnet, ftp 1972-3
- Ethernet 1974, outgrowth of Bob Metcalfe's Harvard dissertation on "Packet Networks."
  - The dissertation was initially rejected by the University for not being analytical enough
- Frederick G. Kilgour of the Ohio College Library Center (now OCLC, Inc.) led networking of Ohio libraries during the '60s and '70s.
- TCP/IP develops 1970s onward
- BITNET connected IBM mainframes around the educational community and the world to provide mail services beginning in 1981 (includes listserves)
- 1986, the National Science Foundation funded NSFNet
- 1989 Archie, WAIS

Packet switching



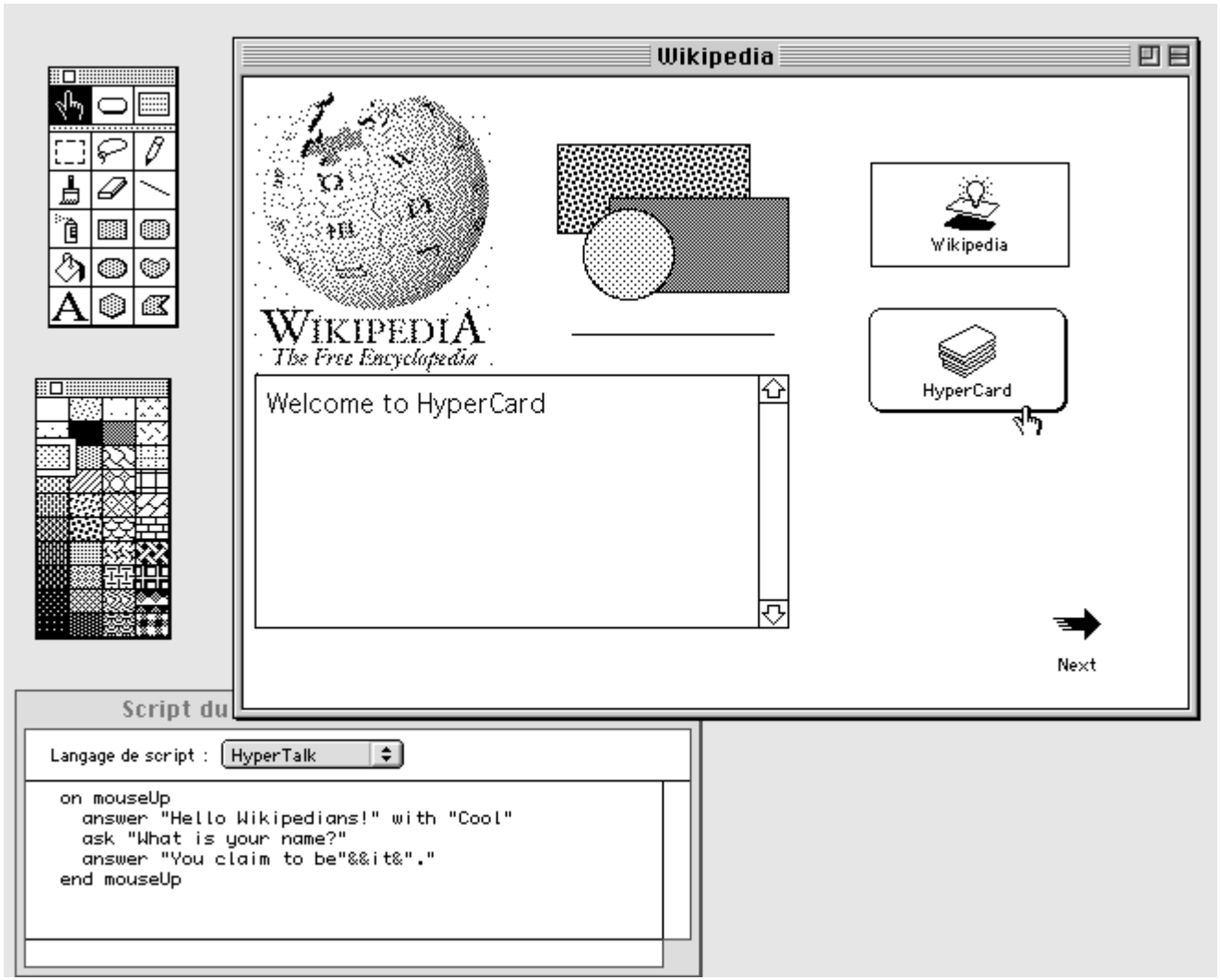
Protocols
Send/Acknowledge
Wrapper: target
IP address
Divided content
Handshake
Header, Path

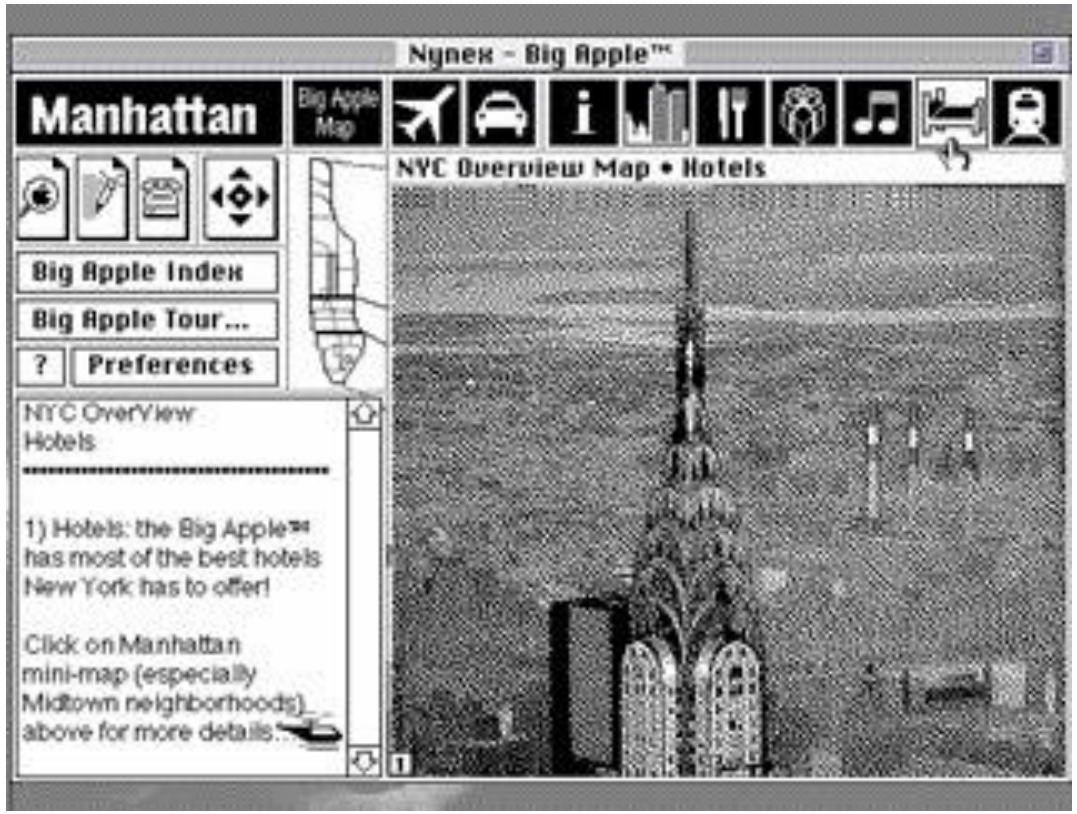
Web landmarks



- **Gopher** (distributed document search and retrieval network protocol)
  - Used hyperlinking features
  - Replaced by HTTP protocol
- Later tools built upon HTTP: e.g. Mosaic, Mozilla
- Mosaic was developed at the National Center for Supercomputing Applications (NCSA) beginning in late 1992
- NCSA released the browser in 1993, and officially discontinued development and support on January 7, 1997
- Led to Netscape and Mozilla
- NSF Network project BITNET

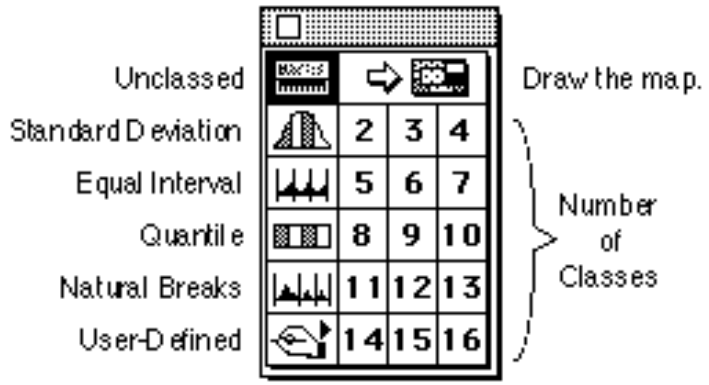
Apple’s Hypercard “Stacks”



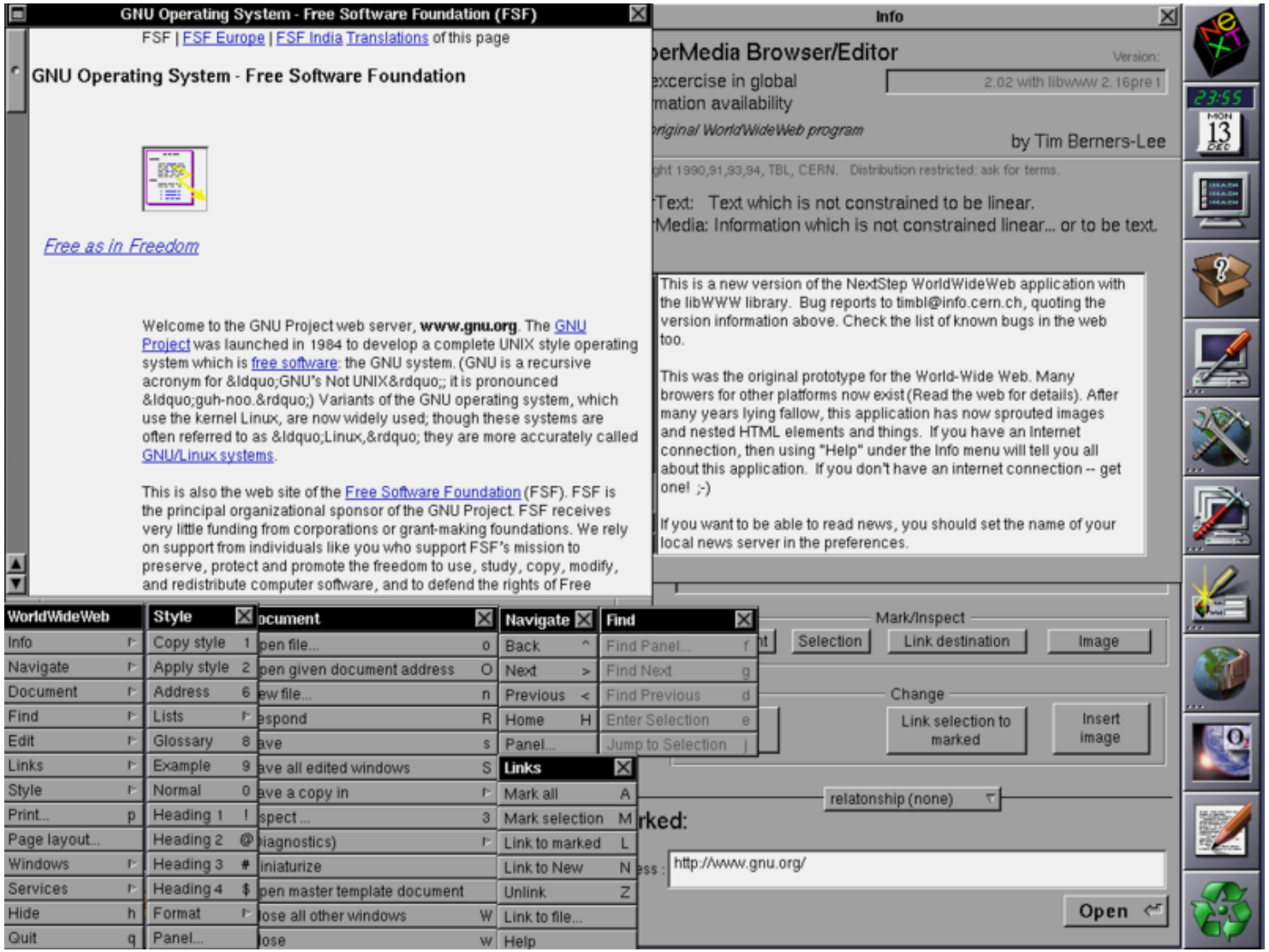


Interactive map software

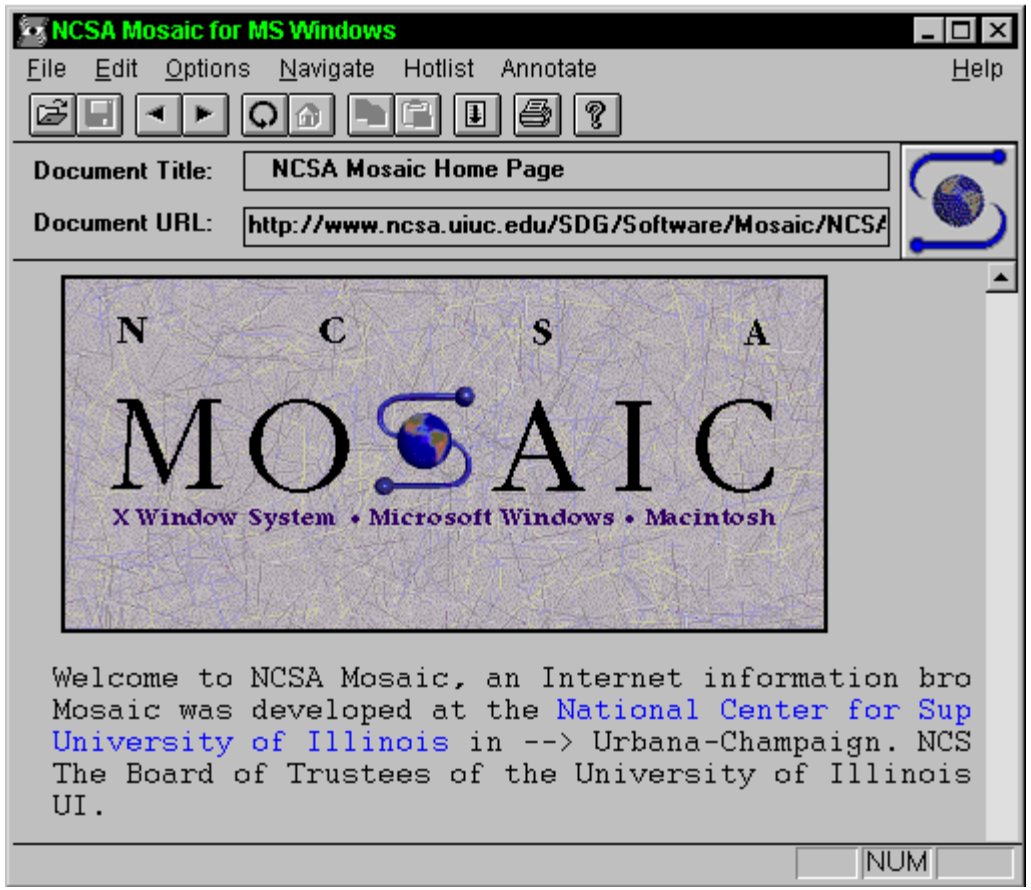
- Mike Peterson Mapping with Small Computer Systems. *Plan and Print*, Vol. 55, No.10, 1982, pp. 43-45. (with Kenneth Lepczyk)
- Created interactive Choropleth mapping program using hypercard and Fortran: MacChoro 1986
- Added animation in 1988

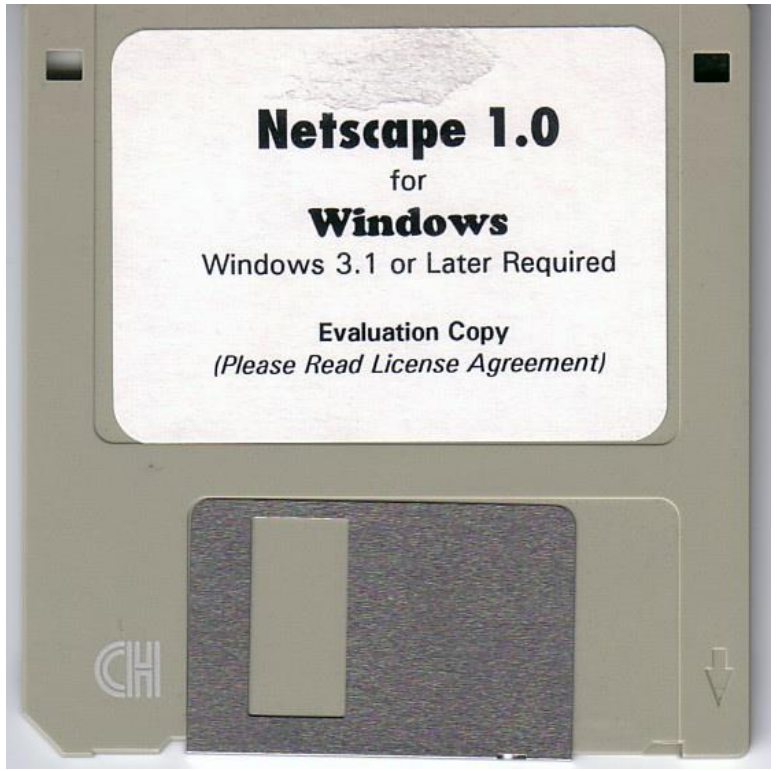


WorldWideWeb for NeXT (1991)

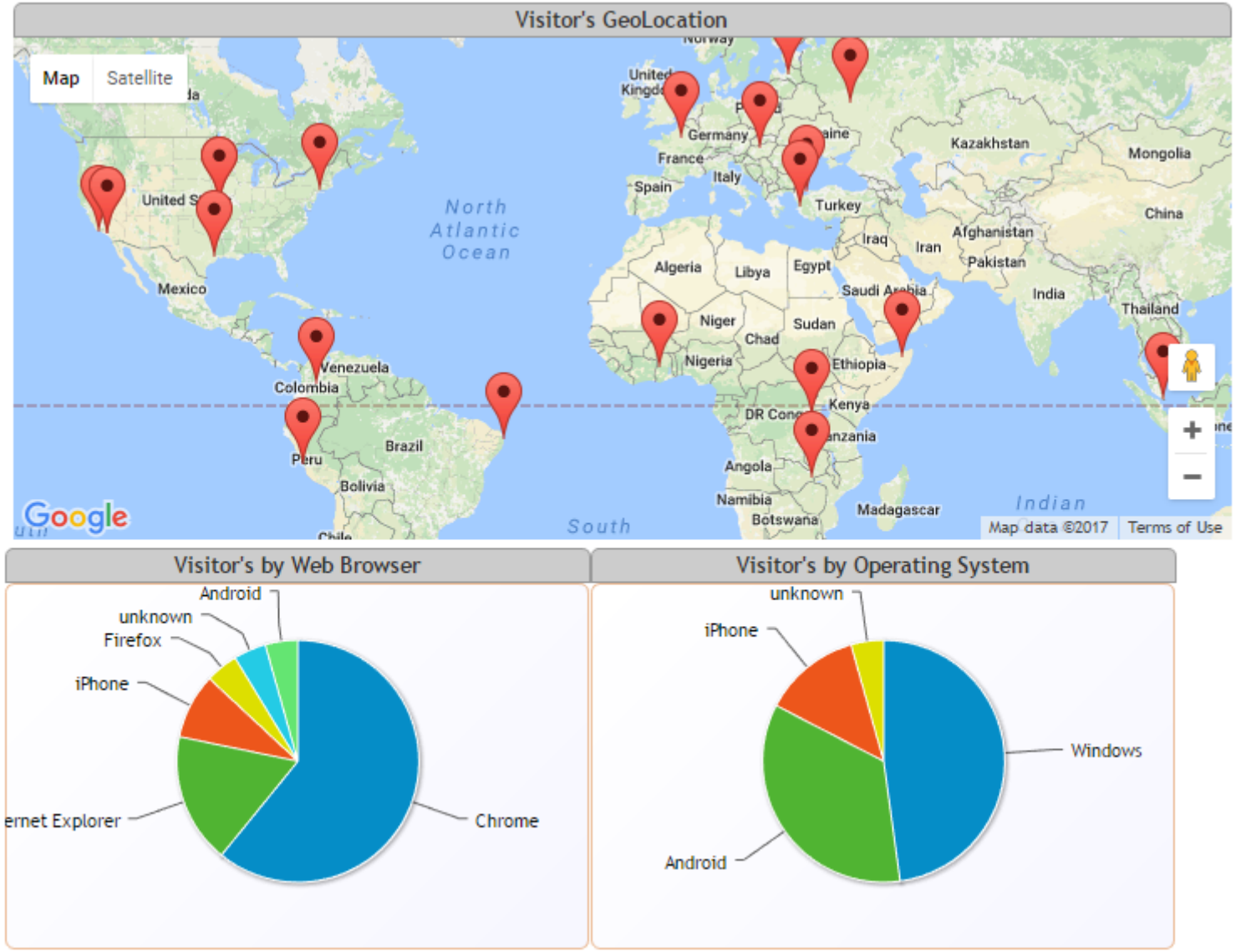


Arrival of the Browsers



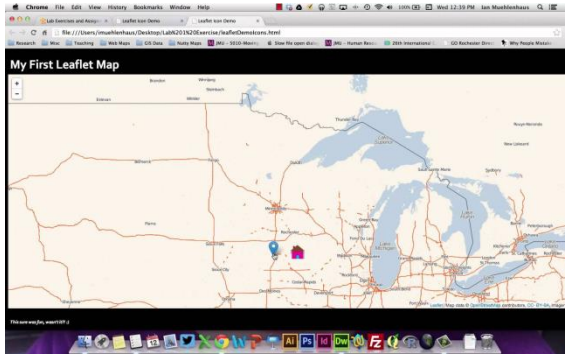


Browsers galore: MapMyUser



Web cartography would have been impossible without…

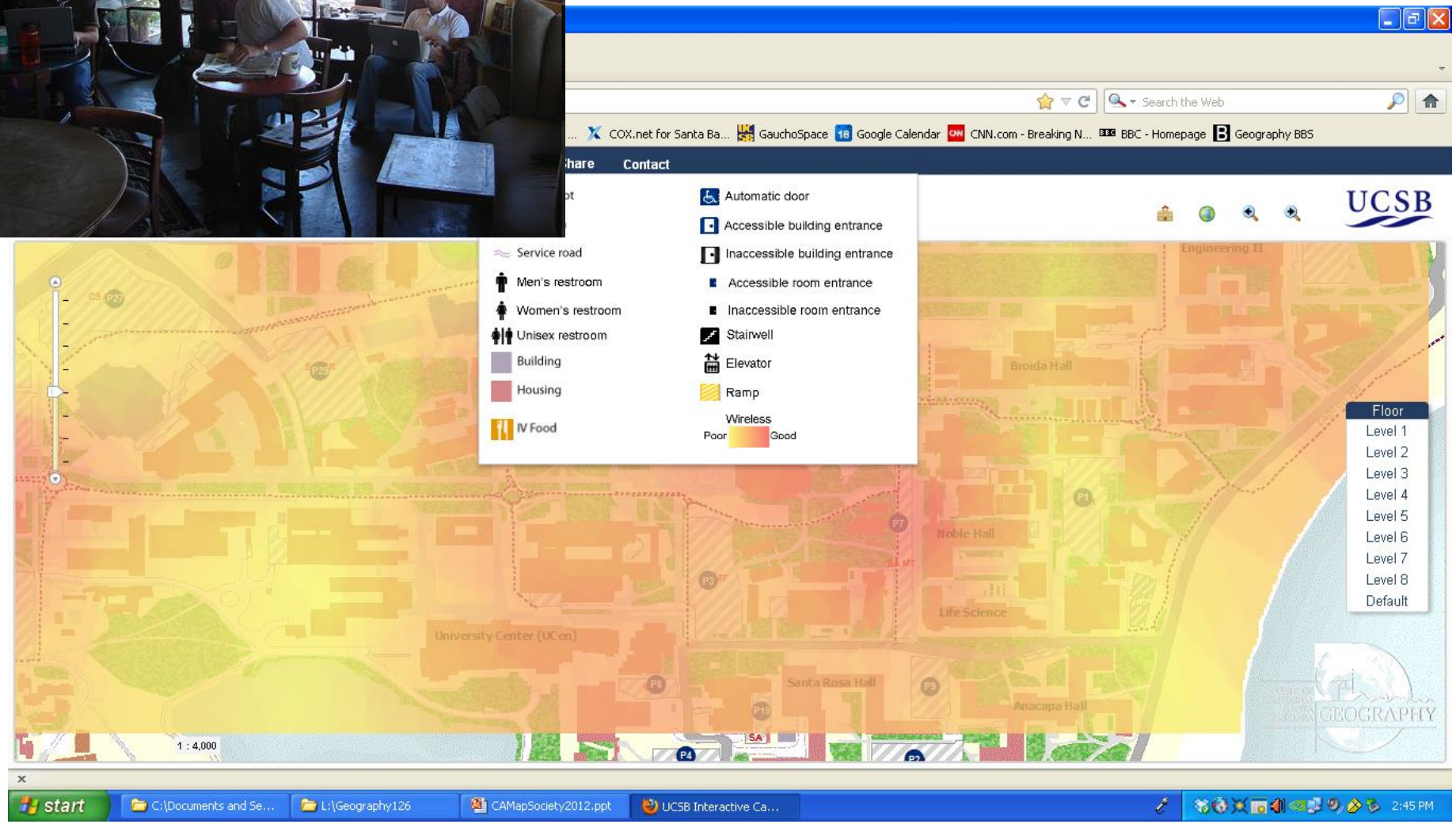
- The Internet
- Precise positioning
- Mobile computing
- Wireless communications
- Standards
- Open Source software



The first GNSS: GPS

Mobile computing

Wireless


Search the Web
COX.net for Santa Ba...
GauchoSpace
Google Calendar
CNN.com - Breaking N...
BBC - Homepage
Geography BBS
Contact
UCSB
Automatic door
Accessible building entrance
Inaccessible building entrance
Accessible room entrance
Inaccessible room entrance
Stairwell
Elevator
Ramp
Wireless
Poor
Good
Service road
Men's restroom
Women's restroom
Unisex restroom
Building
Housing
IV Food
Floor
Level 1
Level 2
Level 3
Level 4
Level 5
Level 6
Level 7
Level 8
Default
Broida Hall
Noble Hall
Life Science
University Center (UCen)
Santa Rosa Hall
Anacapa Hall
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Standards


Firefox
Open Geospatial Consortium | OGC(R)
www.opengeospatial.org
Search the Web
OGC
Making location count.
Home
Standards
Programs
Participate
OGC Blog
Events
About OGC
Member Login
Search
Geospatial and location standards for:
Aviation
Built Environment & 3D
Business Intelligence
Defense & Intelligence
Emergency Response & Disaster Management
Geosciences & Environment
Government & Spatial Data Infrastructure
Mobile Internet & Location Services
Sensor Webs
Earth Observation
Analysis
Crowdsourcing
Navigation
CAD
BIM
Open Source
Proximity
Global
GIS
Place
Spatial Policy
Open
Points of Interest
Linked Data
Monitoring
Location
Where
Sensor Web
hydrology
Map
Interoperability
Geoweb
Share
Open Data
Geosemantics
Shared Understanding
Information Integration
Time
Planning
Geosynchronization
SDI
Indoor/Outdoor
Climate
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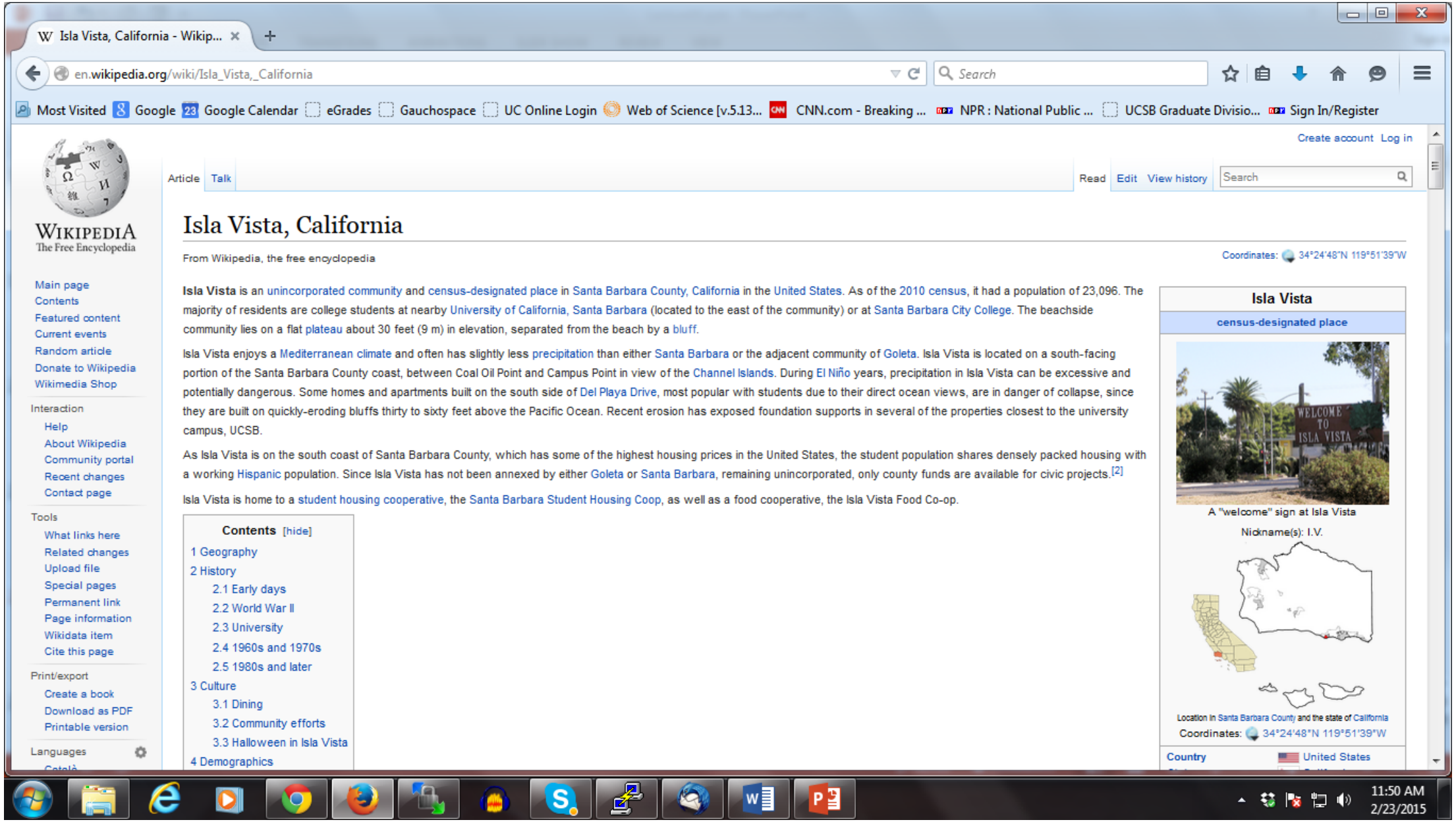
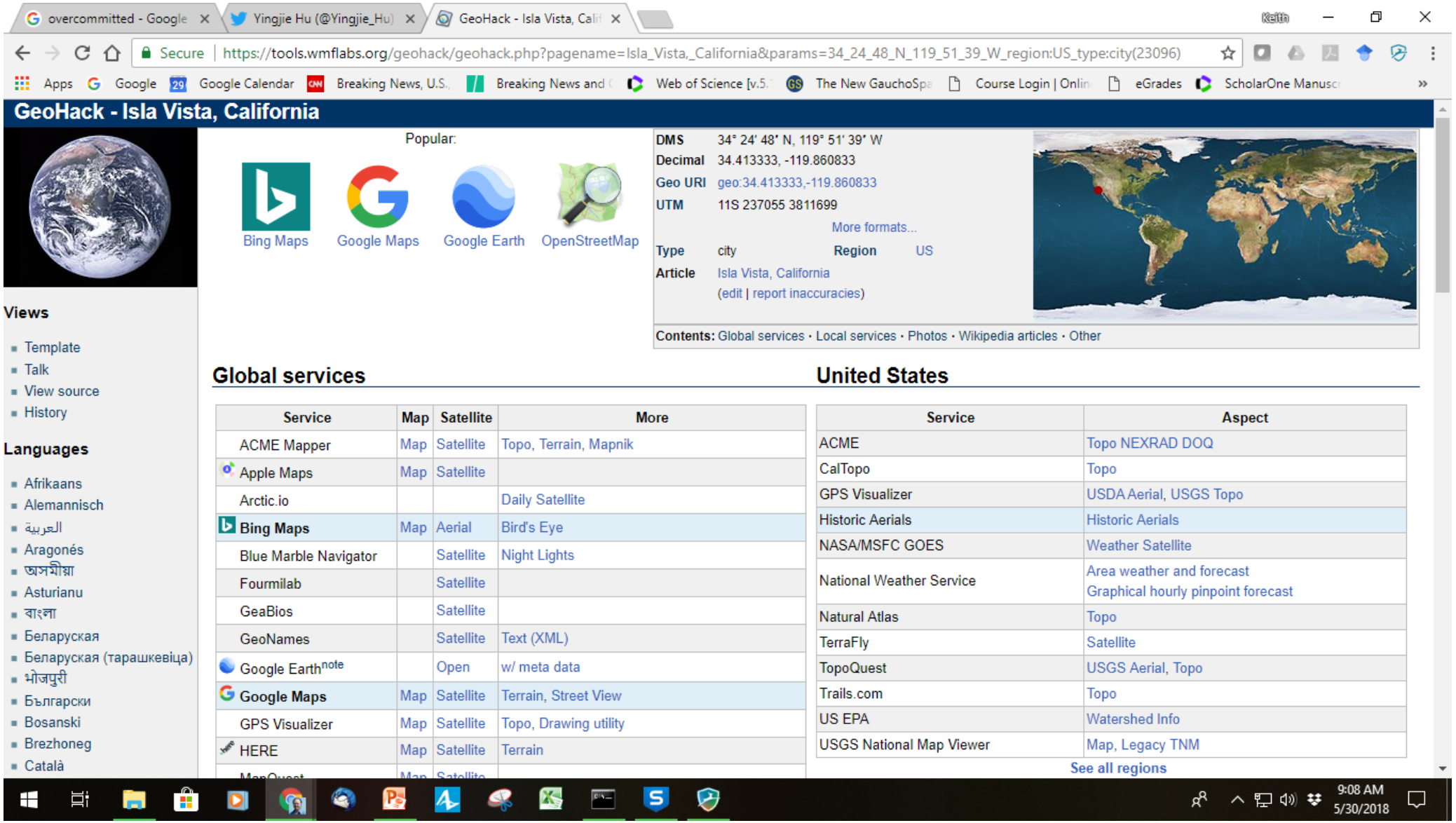
Open Source Software

Isla Vista Wiki entry



geohack


overcommitted - Google
Yingjie Hu (@Yingjie_Hu)
GeoHack - Isla Vista, Cali
Keith
Secure
https://tools.wmflabs.org/geohack/geohack.php?pagename=Isla_Vista,_California&params=34_24_48_N_119_51_39_W_region:US_type:city(23096)
Apps
Google
Google Calendar
Breaking News, U.S.
Breaking News and
Web of Science [v.5
The New GauchoSpa
Course Login | Onlin
eGrades
ScholarOne Manusc
GeoHack - Isla Vista, California
Popular:
Bing Maps
Google Maps
Google Earth
OpenStreetMap
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Decimal 34.413333, -119.860833
Geo URI geo:34.413333,-119.860833
UTM 11S 237055 3811699
More formats...
Type city
Region US
Article Isla Vista, California
(edit | report inaccuracies)
Contents: Global services · Local services · Photos · Wikipedia articles · Other
Views
Template
Talk
View source
History
Languages
Afrikaans
Alemannisch
العربية
Aragonés
অসমীয়া
Asturianu
বাংলা
Беларуская
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Català
Global services
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Map
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ACME Mapper
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Satellite
Topo, Terrain, Mapnik
Apple Maps
Map
Satellite
Arctic.io
Daily Satellite
Bing Maps
Map
Aerial
Bird's Eye
Blue Marble Navigator
Satellite
Night Lights
Fourmilab
Satellite
GeaBios
Satellite
GeoNames
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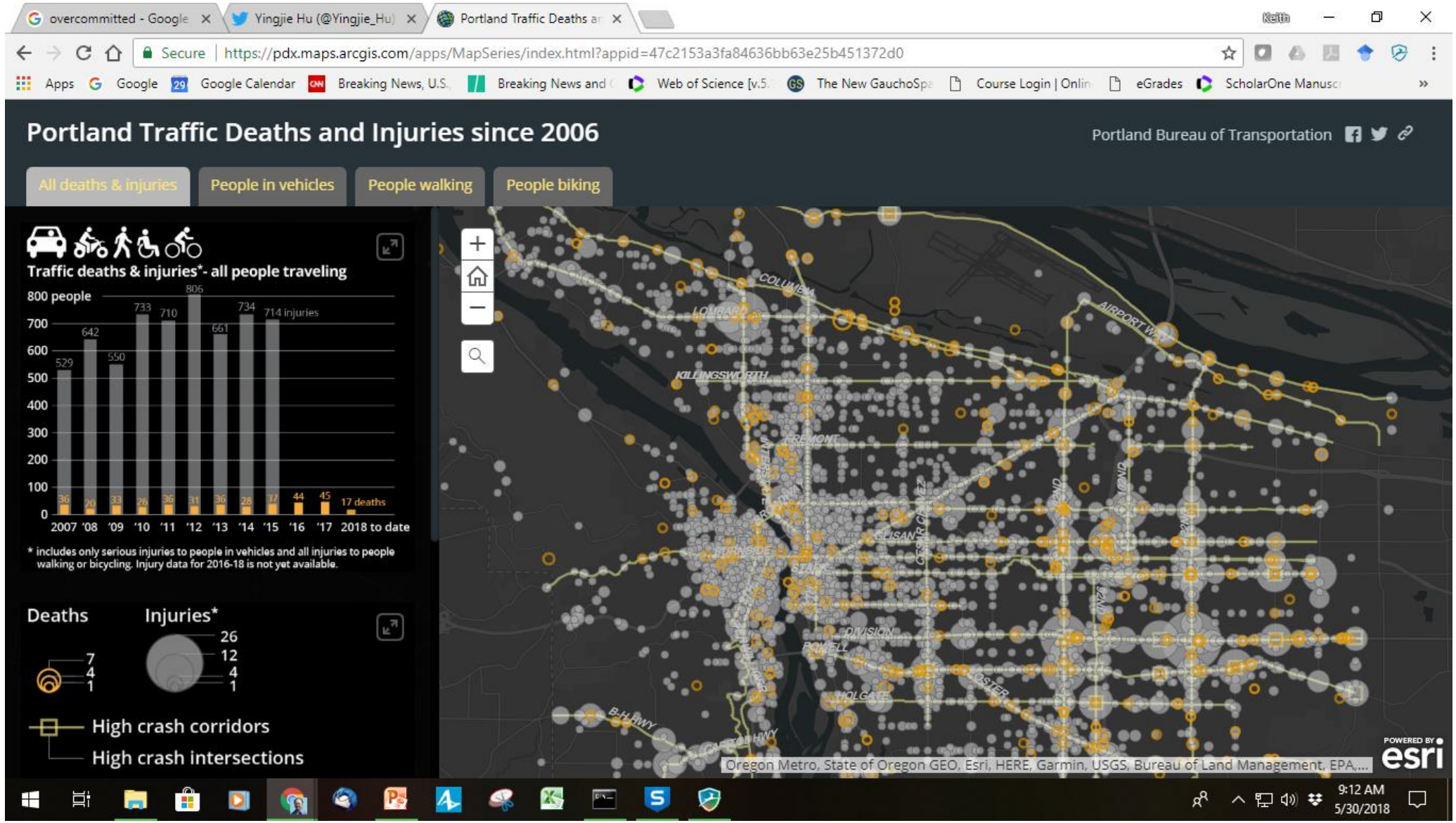
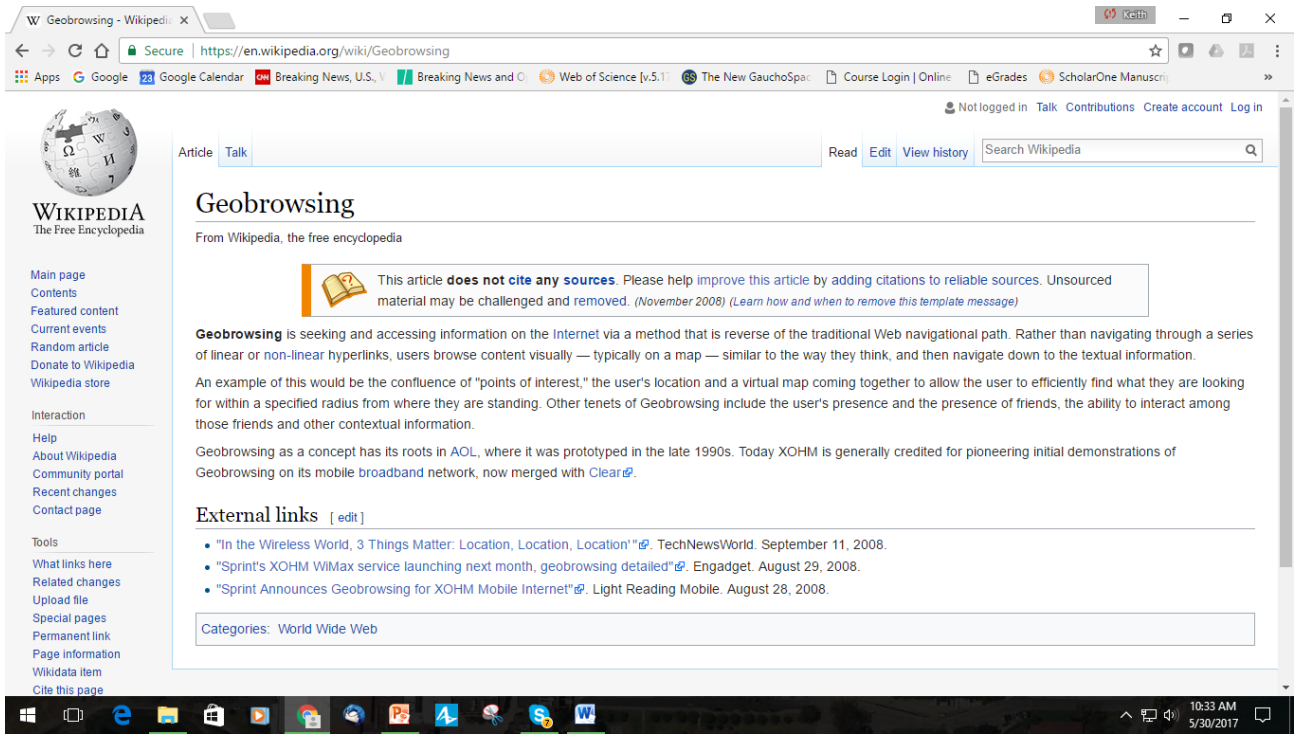
Text (XML)
Google Earthnote
Open
w/ meta data
Google Maps
Map
Satellite
Terrain, Street View
GPS Visualizer
Map
Satellite
Topo, Drawing utility
HERE
Map
Satellite
Terrain
United States
Service
Aspect
ACME
Topo NEXRAD DOQ
CalTopo
Topo
GPS Visualizer
USDA Aerial, USGS Topo
Historic Aerials
Historic Aerials
NASA/MSFC GOES
Weather Satellite
National Weather Service
Area weather and forecast
Graphical hourly pinpoint forecast
Natural Atlas
Topo
TerraFly
Satellite
TopoQuest
USGS Aerial, Topo
Trails.com
Topo
US EPA
Watershed Info
USGS National Map Viewer
Map, Legacy TNM
See all regions
9:08 AM
5/30/2018

Software Mash-Ups

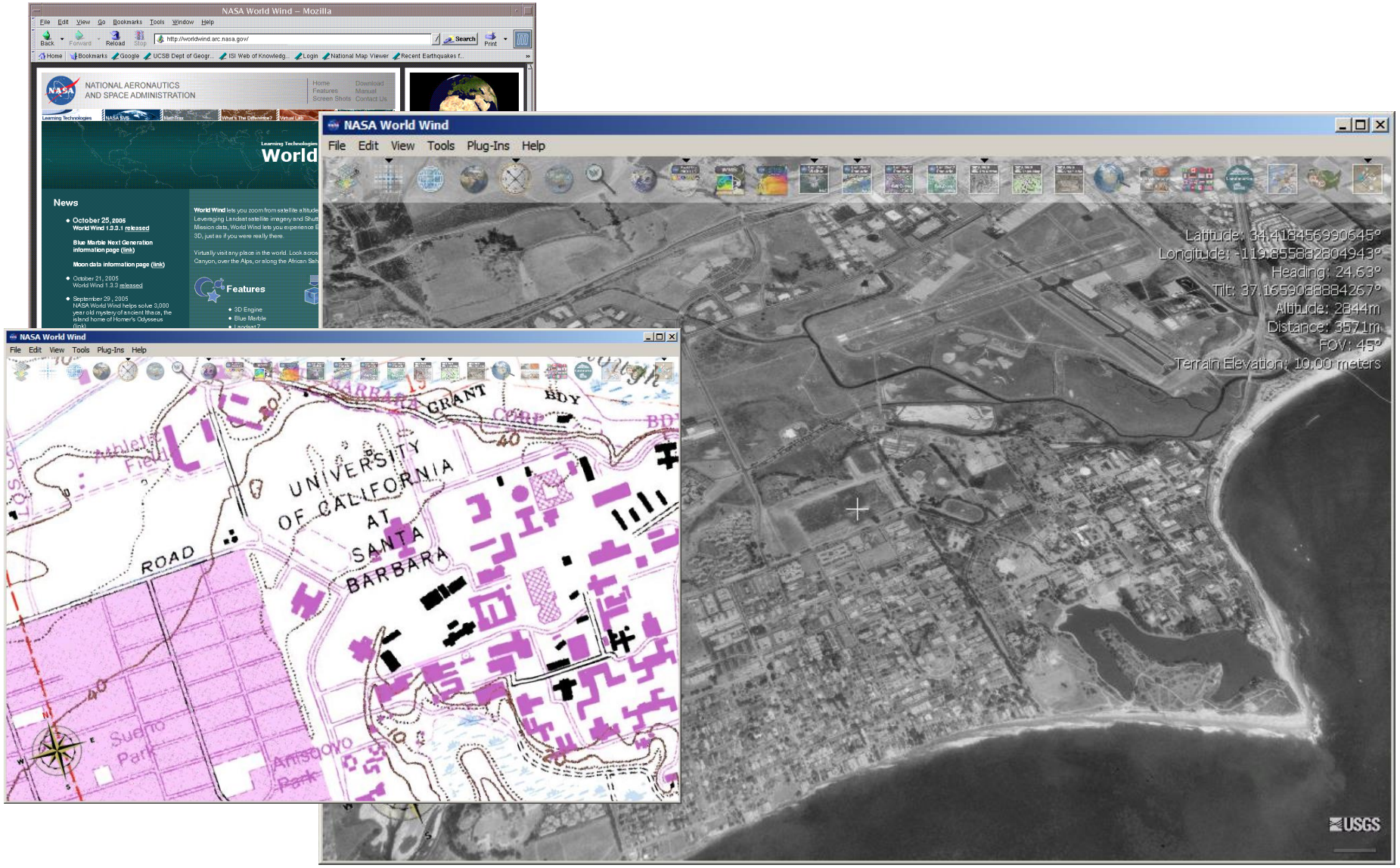


Enter the GeoBrowser

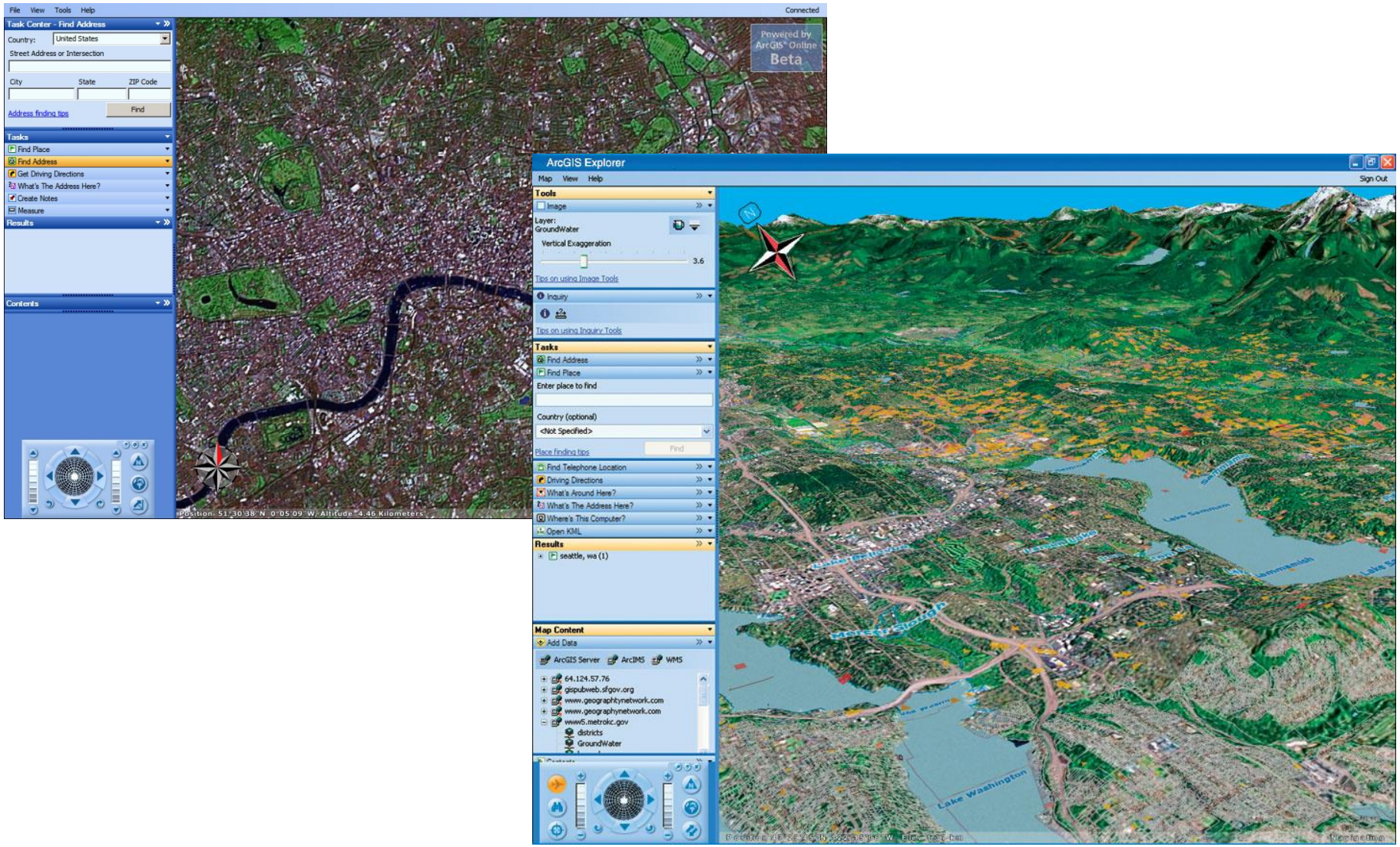
- Google Local 2004-5, Google Earth/Maps 2005
- Data “Portals”
- Data “Clearinghouses”
- NSDI -> GSDI
- Vision of Digital Earth



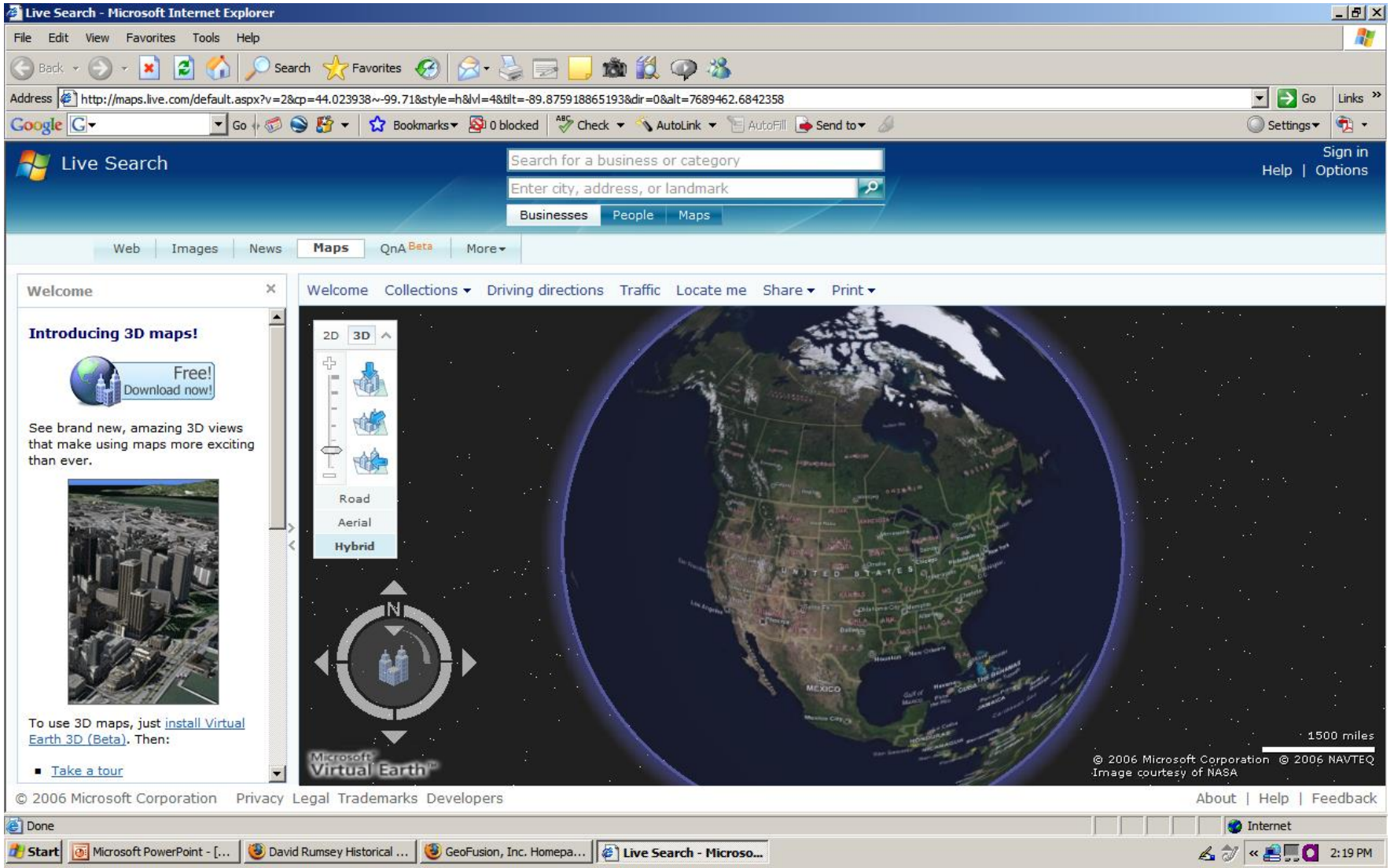
NASA World Wind



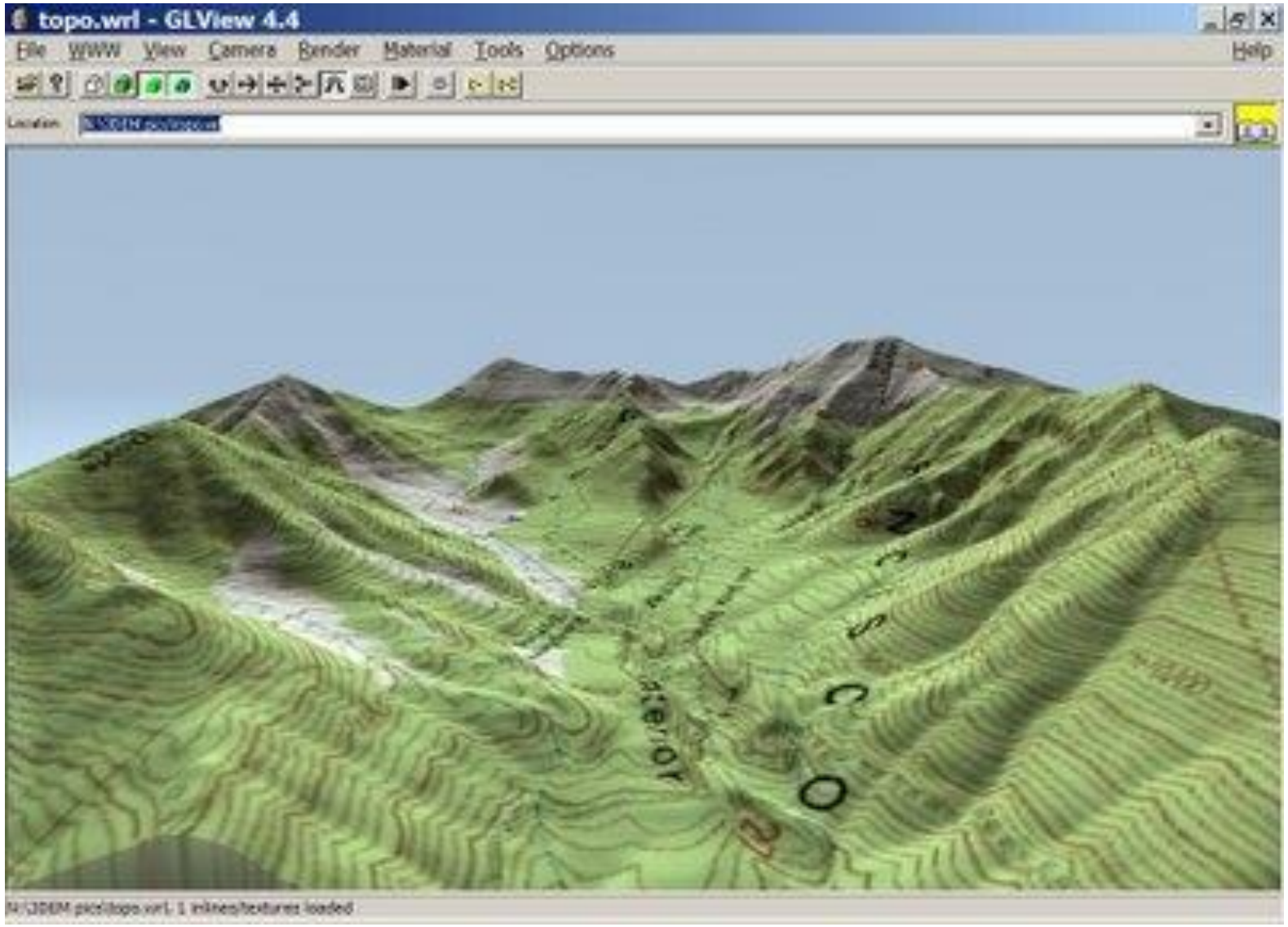
ArcExplorer (2006) -> ArcGIS Online



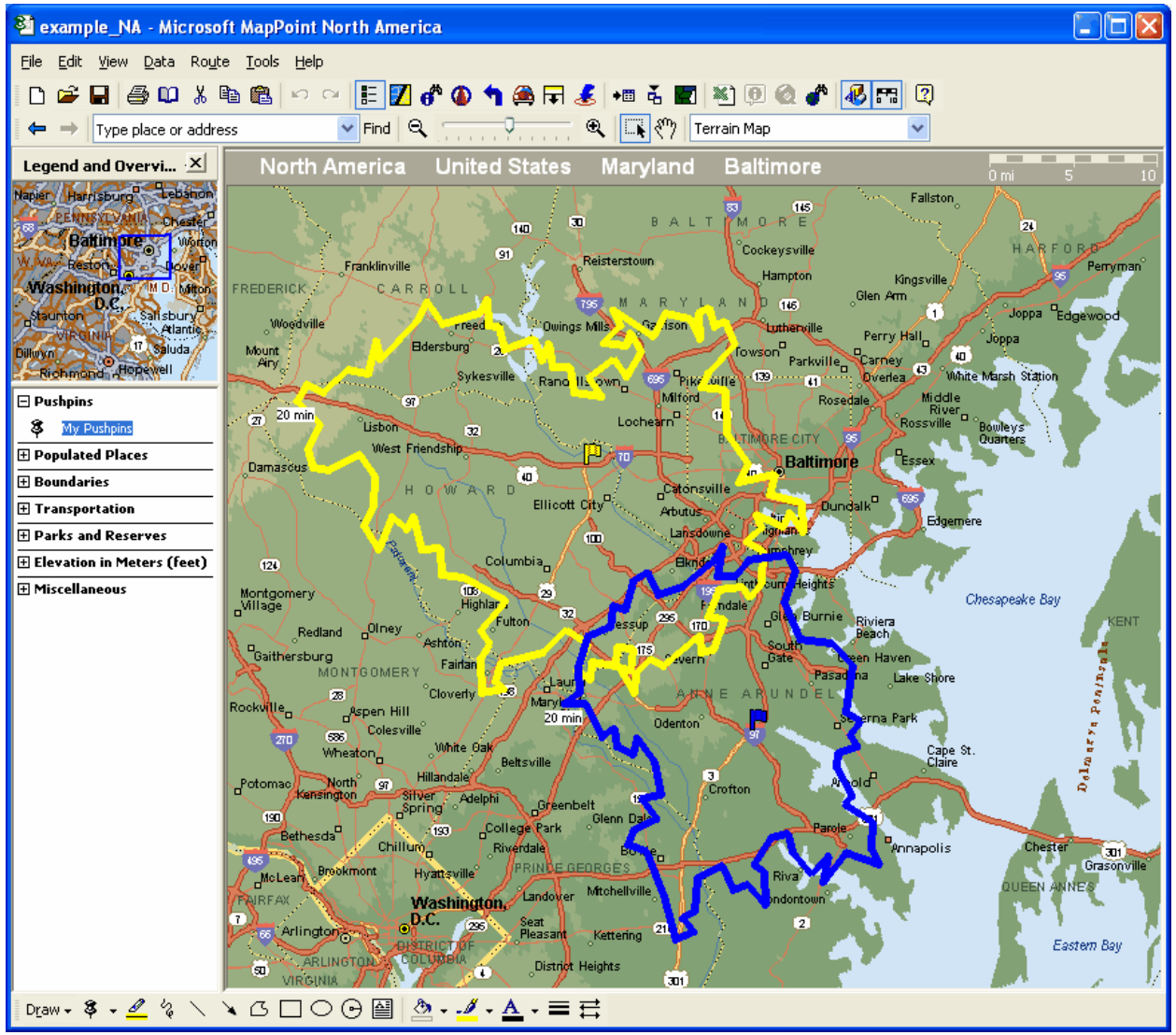
Microsoft: Virtual Earth



VRML and GeoVRML



GML (XML) and SVG



An example: Google Earth

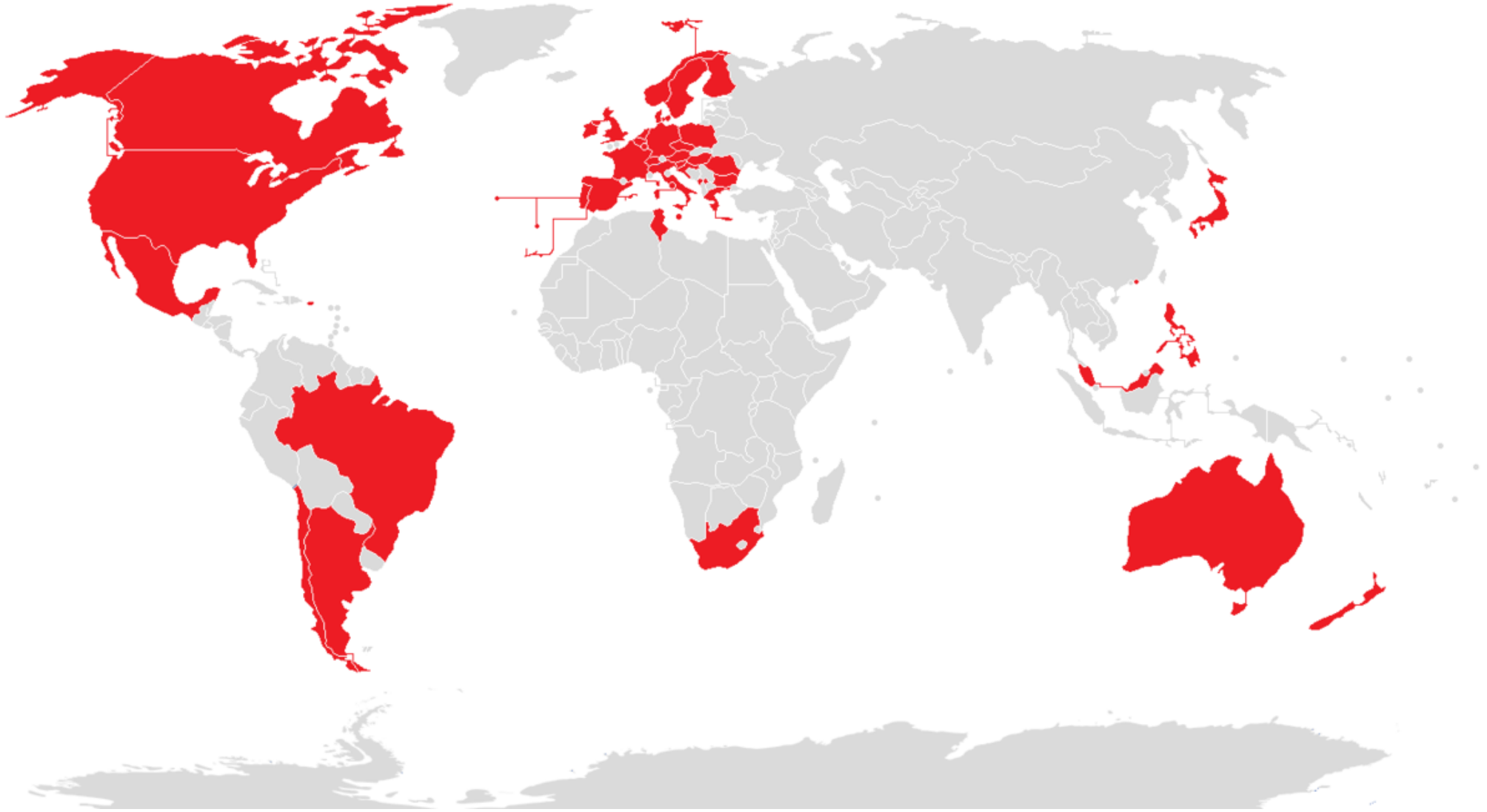
“We are like an iPod for Earth images.”

Michael T. Jones, Chief Technologist, Google Earth (Nov 2006)

Google Earth: A history

- Gore in the US Senate, 1985-1992. VP 1993-2001. Senate Select Committee on Intelligence
- Dayton Peace Agreement /Wright-Patterson Air Force Base, Ohio Dec 1995, ends war in Bosnia
- Google founded 1998
- Keyhole Earthviewer (2002) In-Q-tel funding
- Google buys Keyhole (Oct. 2004)
- 100 million downloads: Version 4 (Nov. 2006)
- 1 Billion downloads: Version 6 (2011)
- 4 Billion by about 2017
- An entirely redesigned version of the program; Currently only available for Google Chrome and Android. The desktop application continues to be Google Earth Pro, with regular updates

3D Google Earth Coverage



By Eugen Simion 14 - Own work, CC0, https://commons.wikimedia.org/w/index.php?curid=40198759

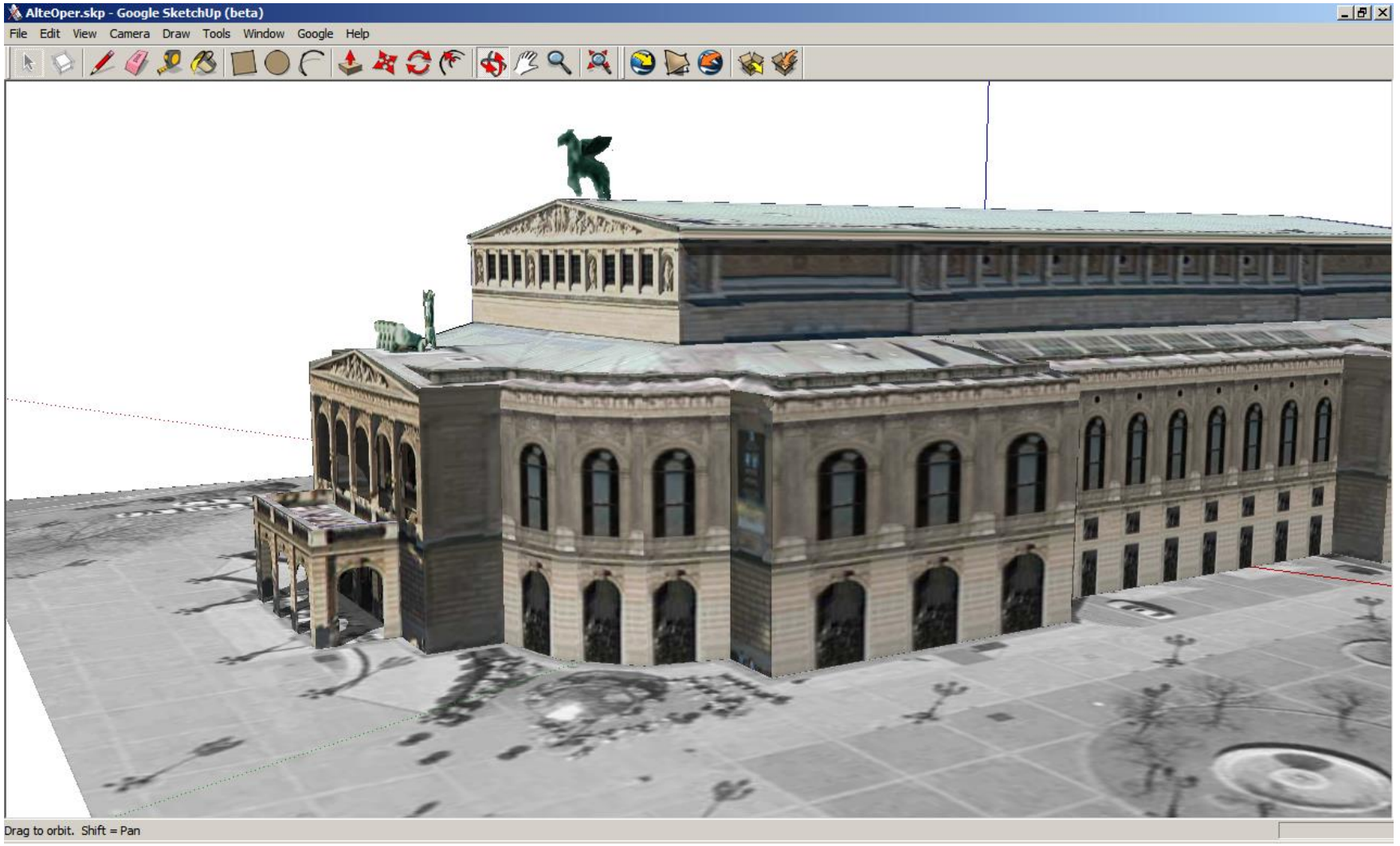
Keyhole EarthViewer 3D

Google Earth Today

- Google Earth viewer 6
  - Timeline
  - Historical
  - Community Bulletin Board
- Google Earth Plus
- Google Earth Pro (now the standard, free)
- Google Earth Builder
- Google Earth Enterprise
- API support from Google ended in 2015

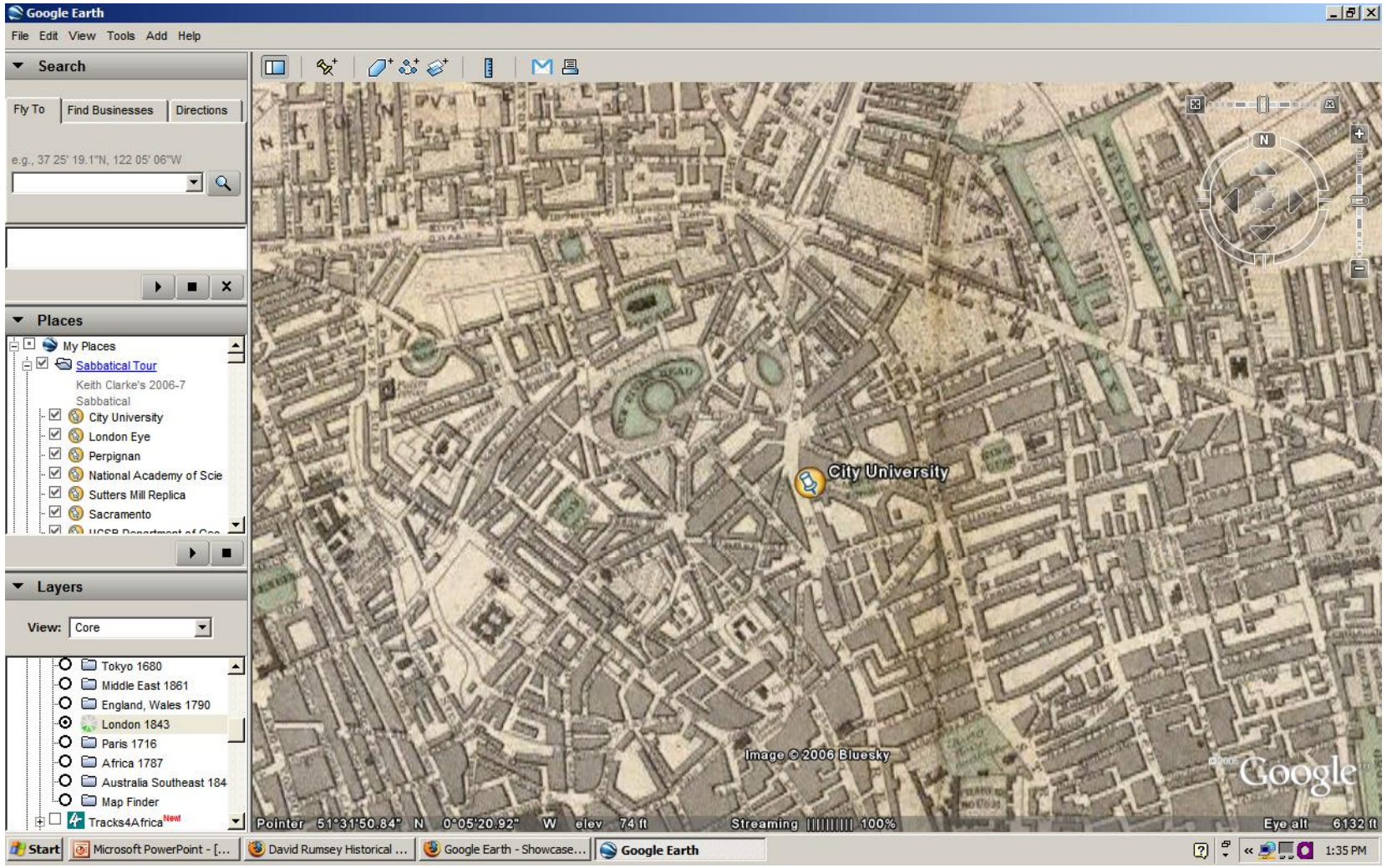
Google Earth Mania

Google SketchUp
Model of the Alte Oper, Frankfurt



3D Warehouse (ended 2015)

Multi-temporal: Rumsey Map Collection



Basic KML

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  <name>Simple placemark</name>
  <description>Attached to the ground.
  Intelligently places itself at the height
  of the underlying terrain.</description>
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  <coordinates>
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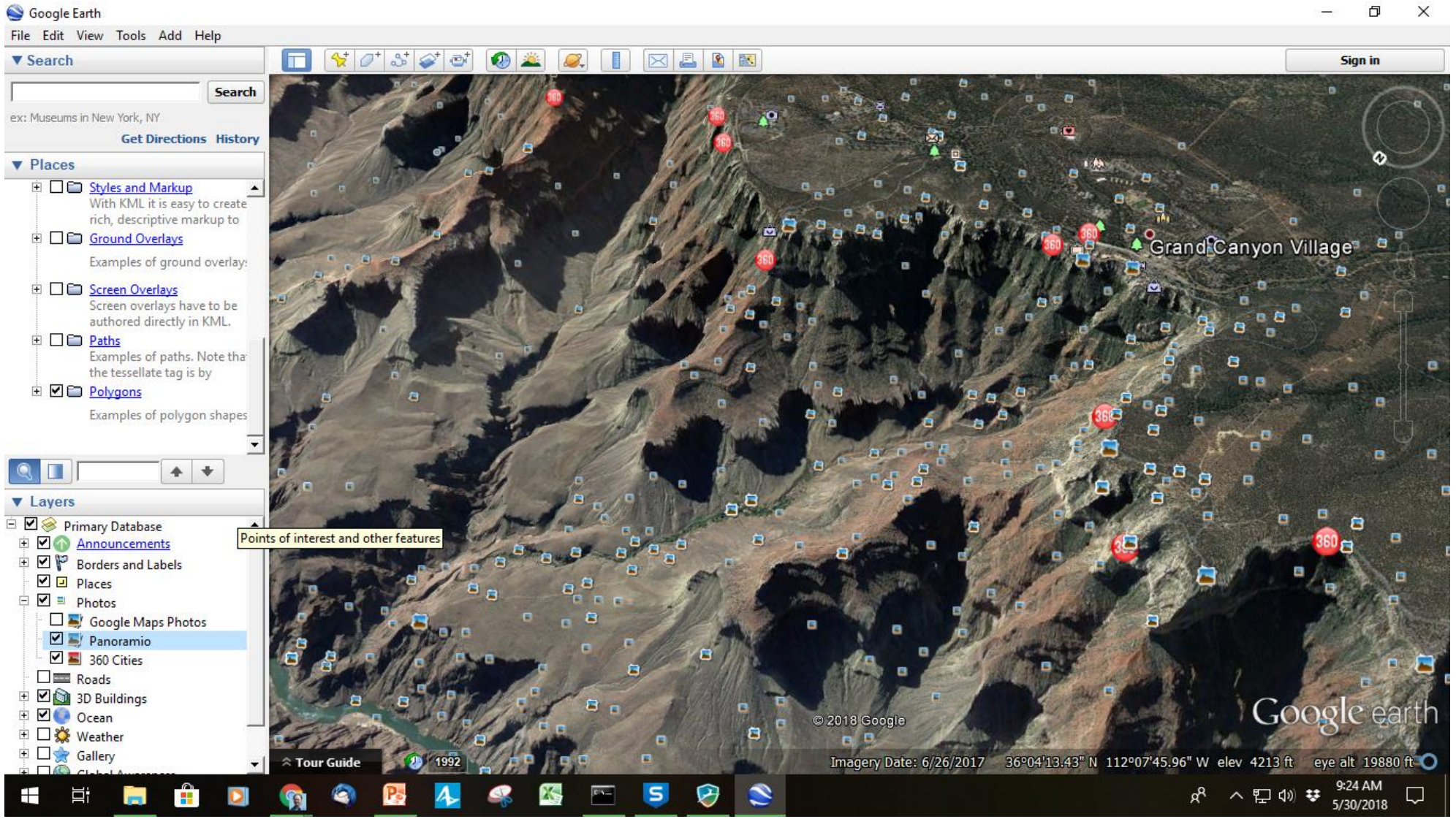
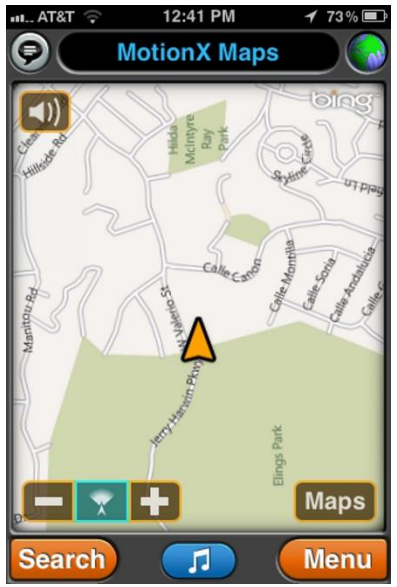
  </Point>
  </Placemark>
</kml>
```

Photos and 3D Panoramas



Computer mapping

- Now ubiquitous e.g. GoogleMaps
- Supports mobile applications and LBS
- Birth of Location Enabled Social Networking



Computer mapping

- Classic paper “Automation and cartography” W. R. Tobler 1959

FIG. 7—Map of the United States drawn directly by machine from a deck of 343 punched cards. Plotting time, approximately 15 minutes. The map has been reduced, but not retouched. Bipolar oblique conic conformal projection (outline of original map from the American Geographical Society's Map of the Americas, 1:5,000,000). (Plotter courtesy the Benson–Lehner Corporation, Los Angeles.)

AUTOMATION AND CARTOGRAPHY*

WALDO R. TOBLER

AUTOMATION, it would seem, is here to stay. Advantages in speed and accuracy seem likely to make the use of computing machinery more common, despite the relatively high initial cost. In view of recent developments in automation and high-speed data processing, it is appropriate to ask, Do possibilities for automation exist in cartography? And if so, where can these possibilities be found? In order to answer these questions, the preparation of maps should be viewed as a complex data-processing system. Certain similarities then become apparent between data processing in general and cartographic processing in particular.

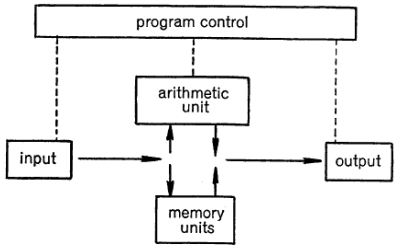
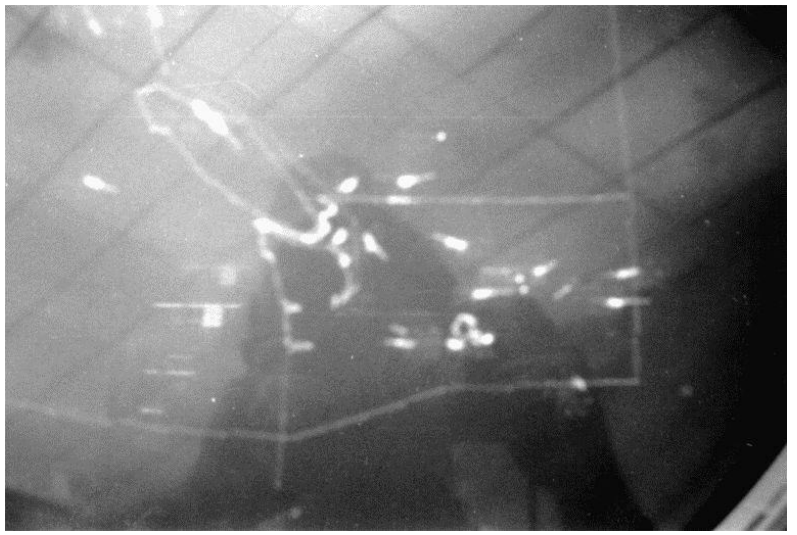


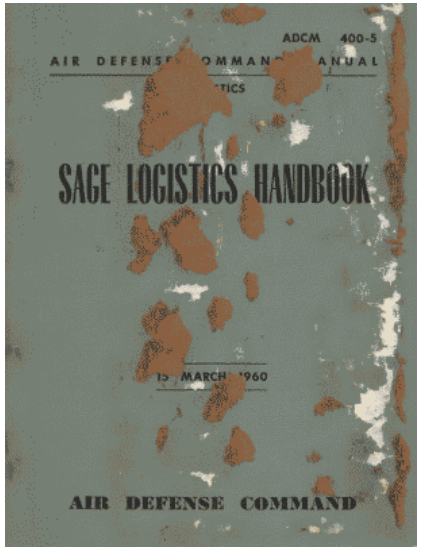
FIG. 2—The data-manipulation phase of a data-processing system.

THE MAP AS A COMPUTER INPUT

The conceptualization of a map as a data-storage medium leads directly to the concept of it as a computer input element (Fig. 4). Here two methods of use seem possible. In the simpler, data are extracted from a map, translated into some symbology that available machinery will accept, and then operated upon by the data-manipulation unit. Examples would include the

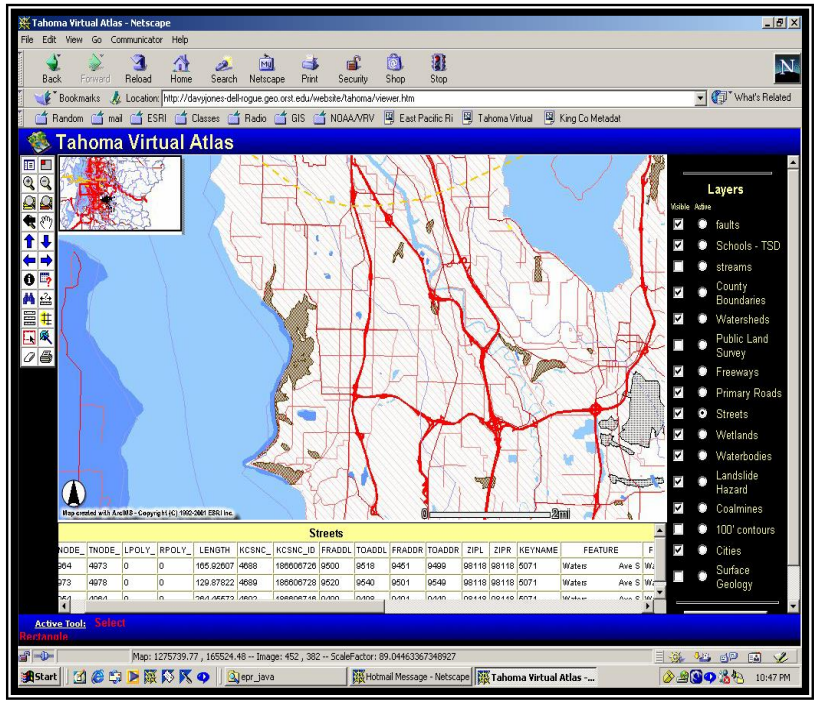
Automation and cartography





Arc Internet Map Server (ArcIMS)

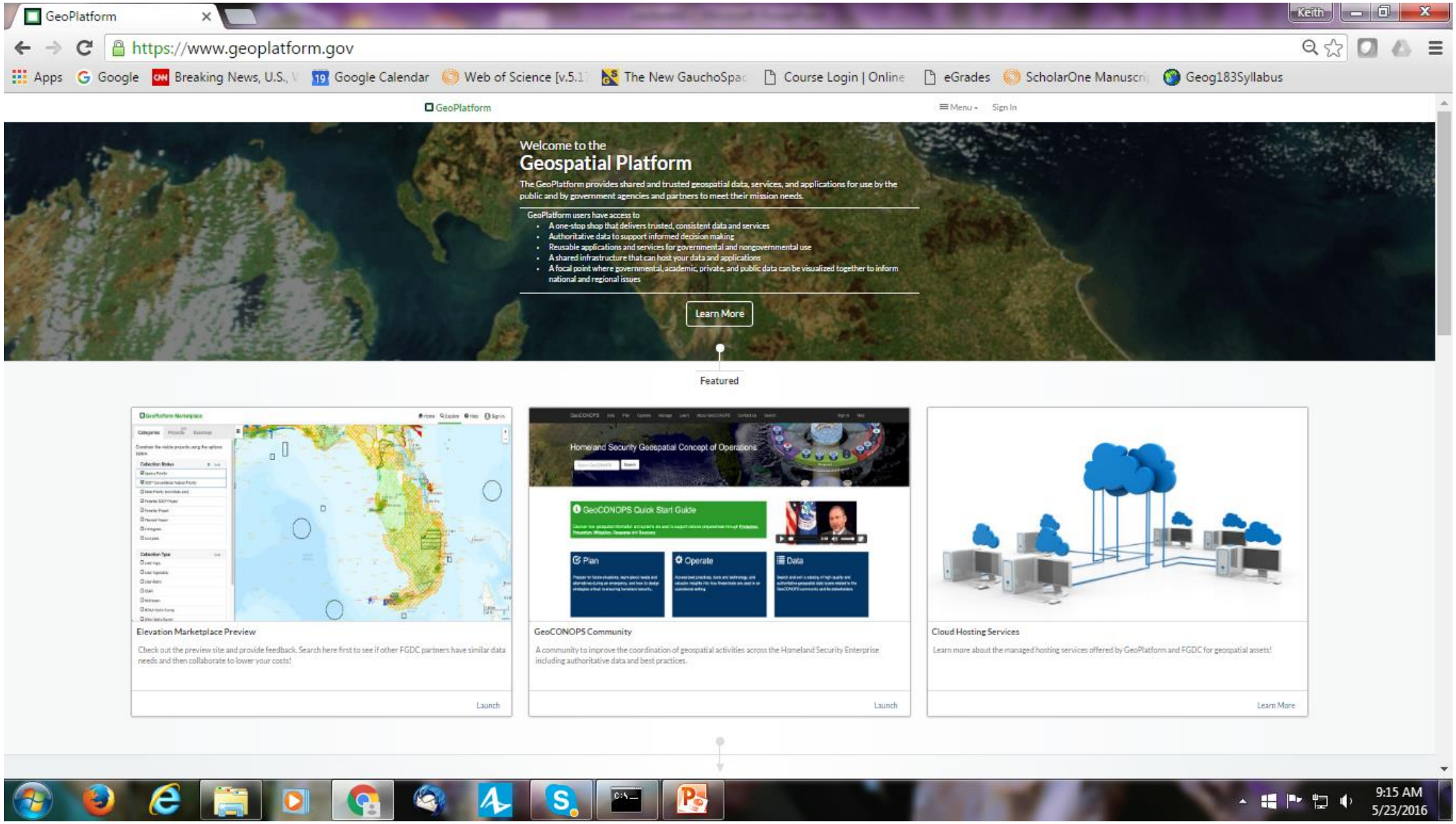
- Advanced web GIS
- Product of ESRI
- Simplified ArcView
  - Basic GIS functions
- Single interface
- Uses ArcView Shapefiles



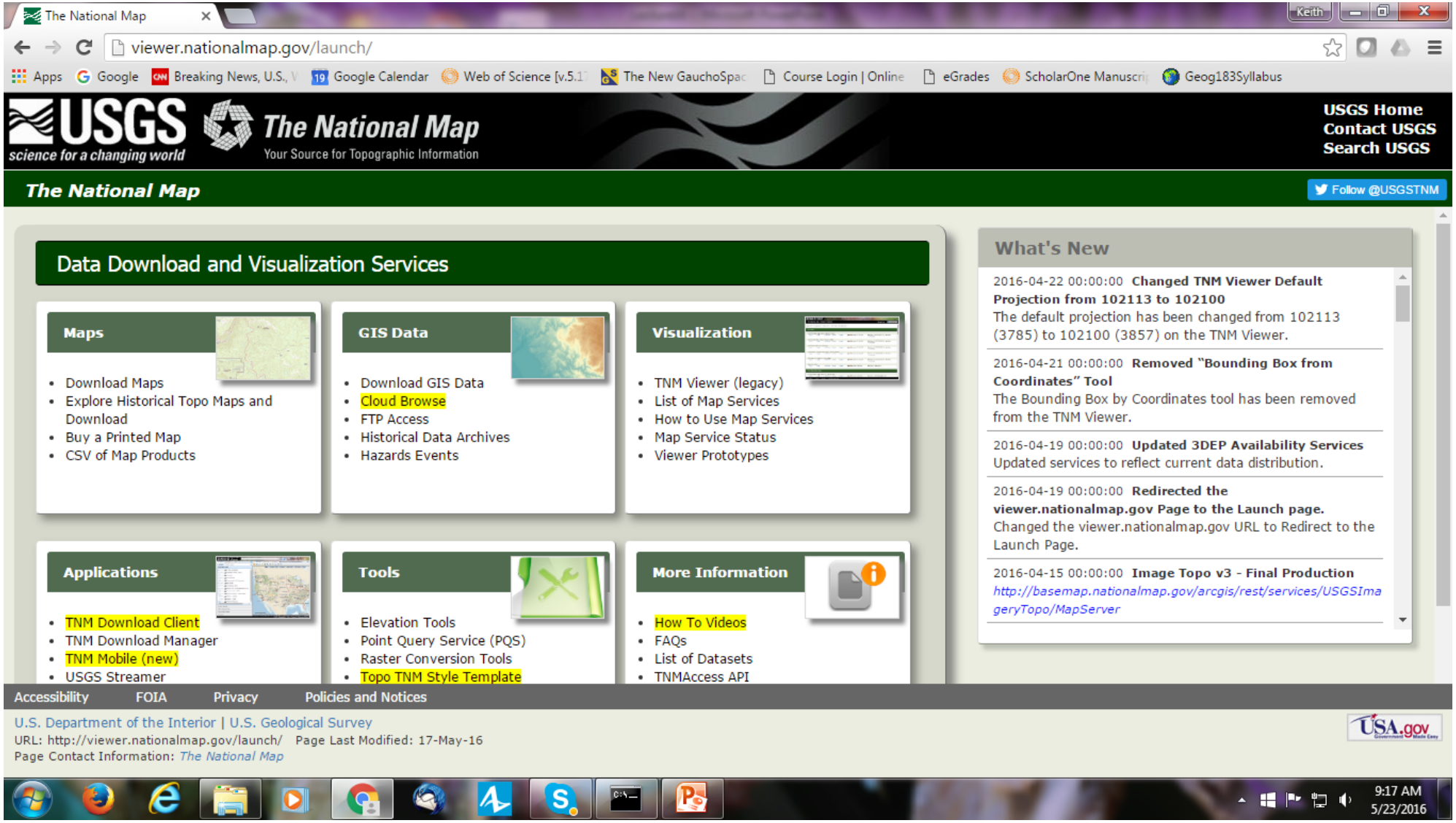
New mobile applications

Server-side applications today

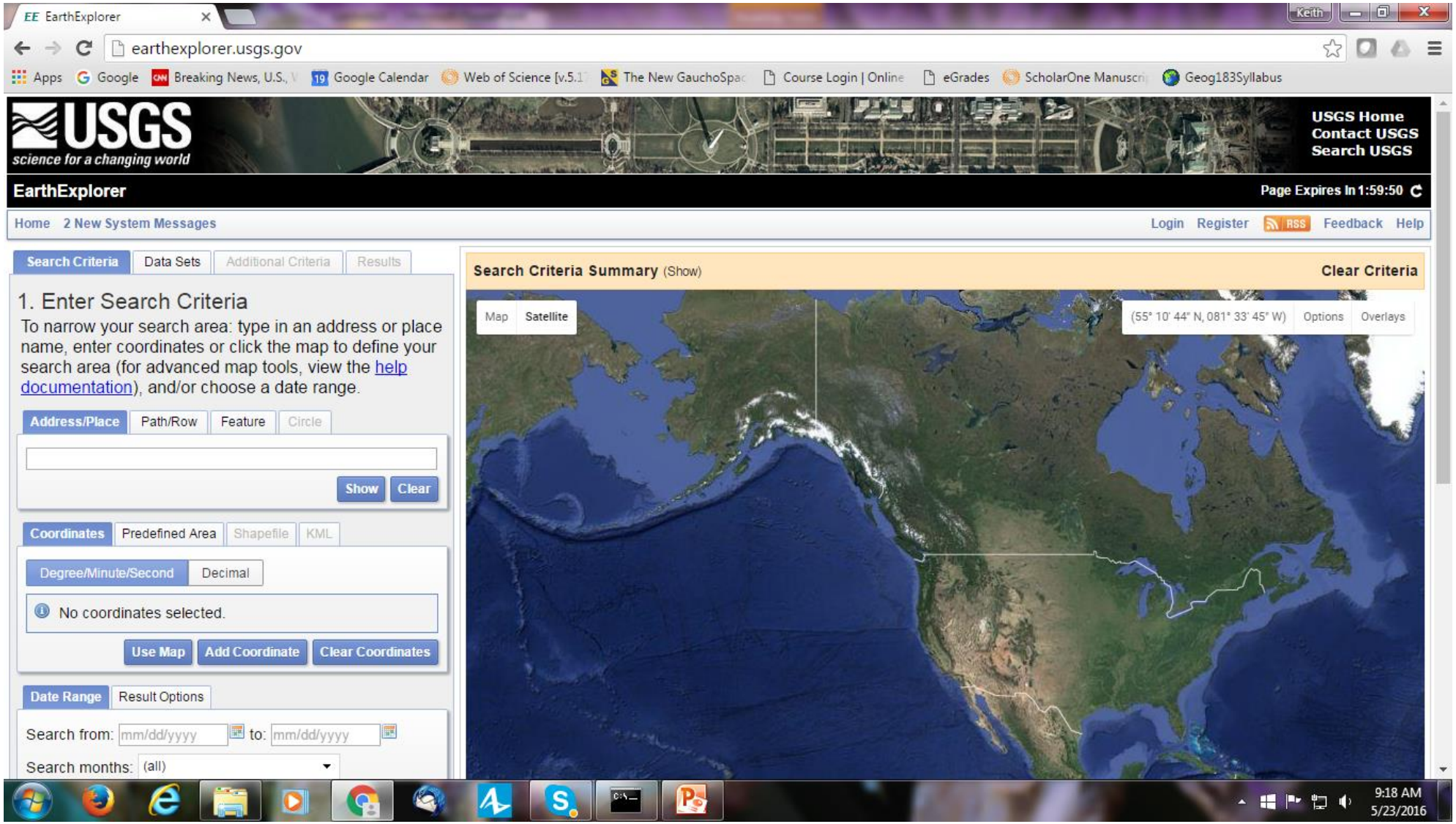
Data discovery



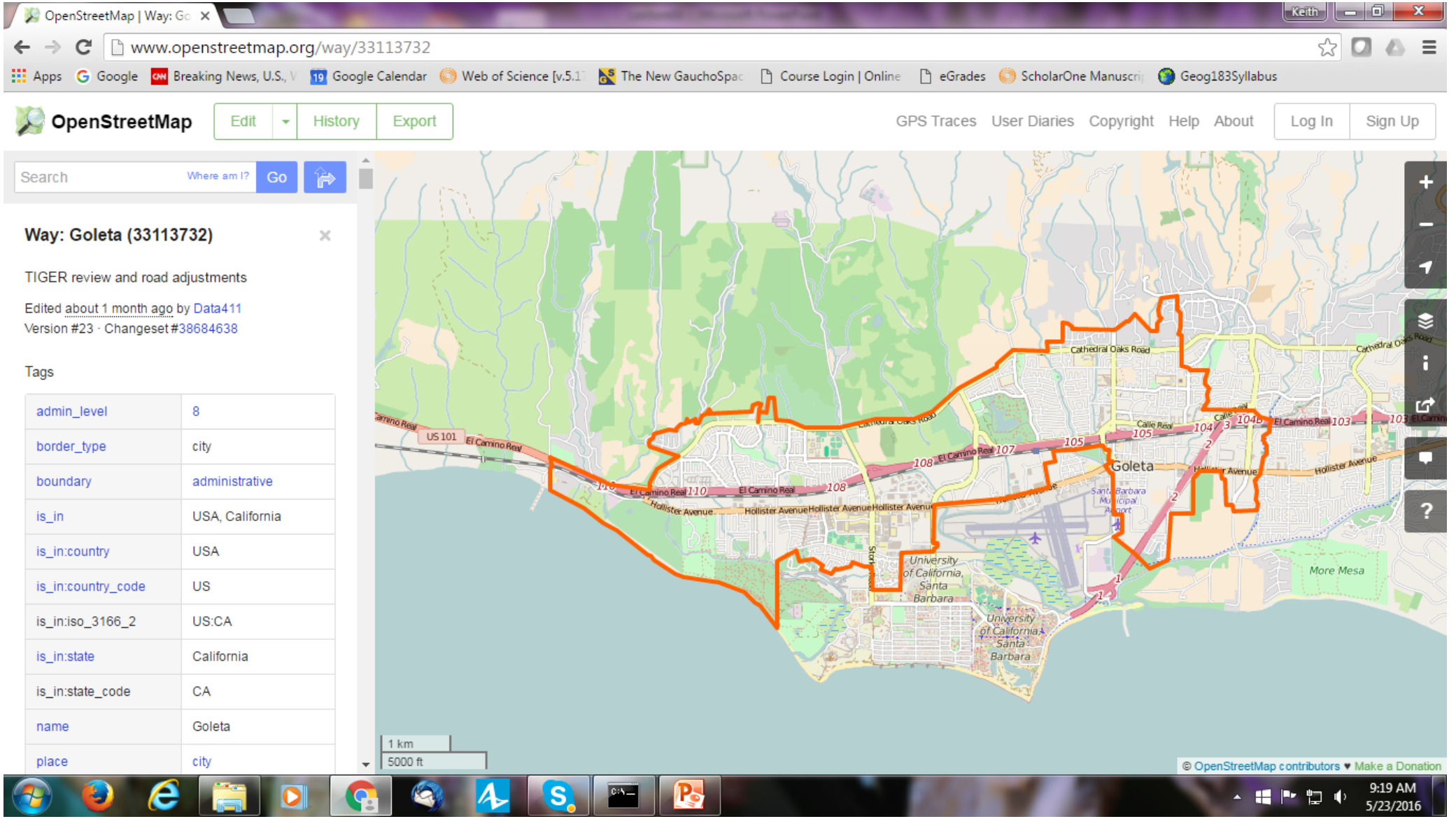
National Map Viewer



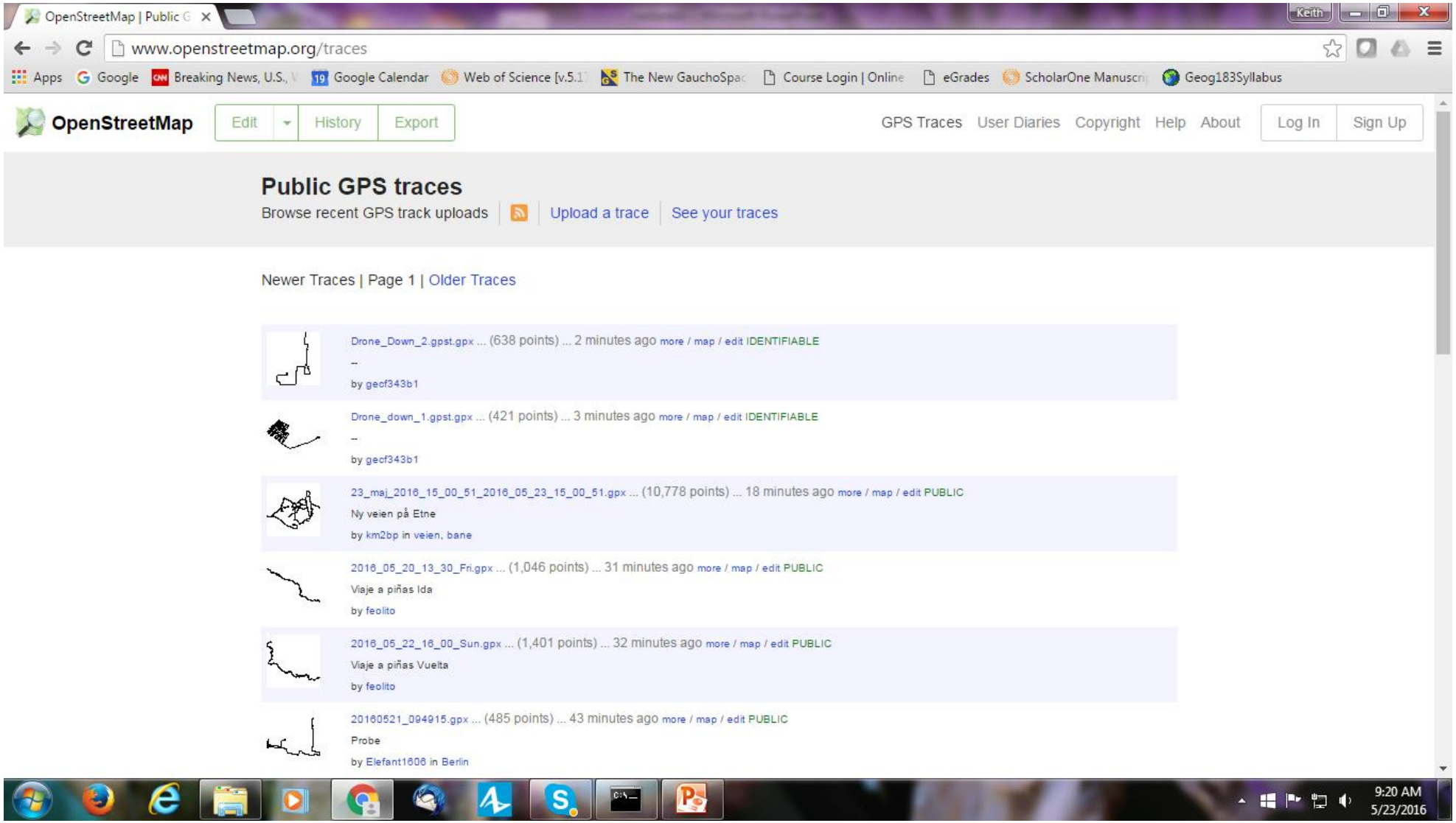
Earth explorer



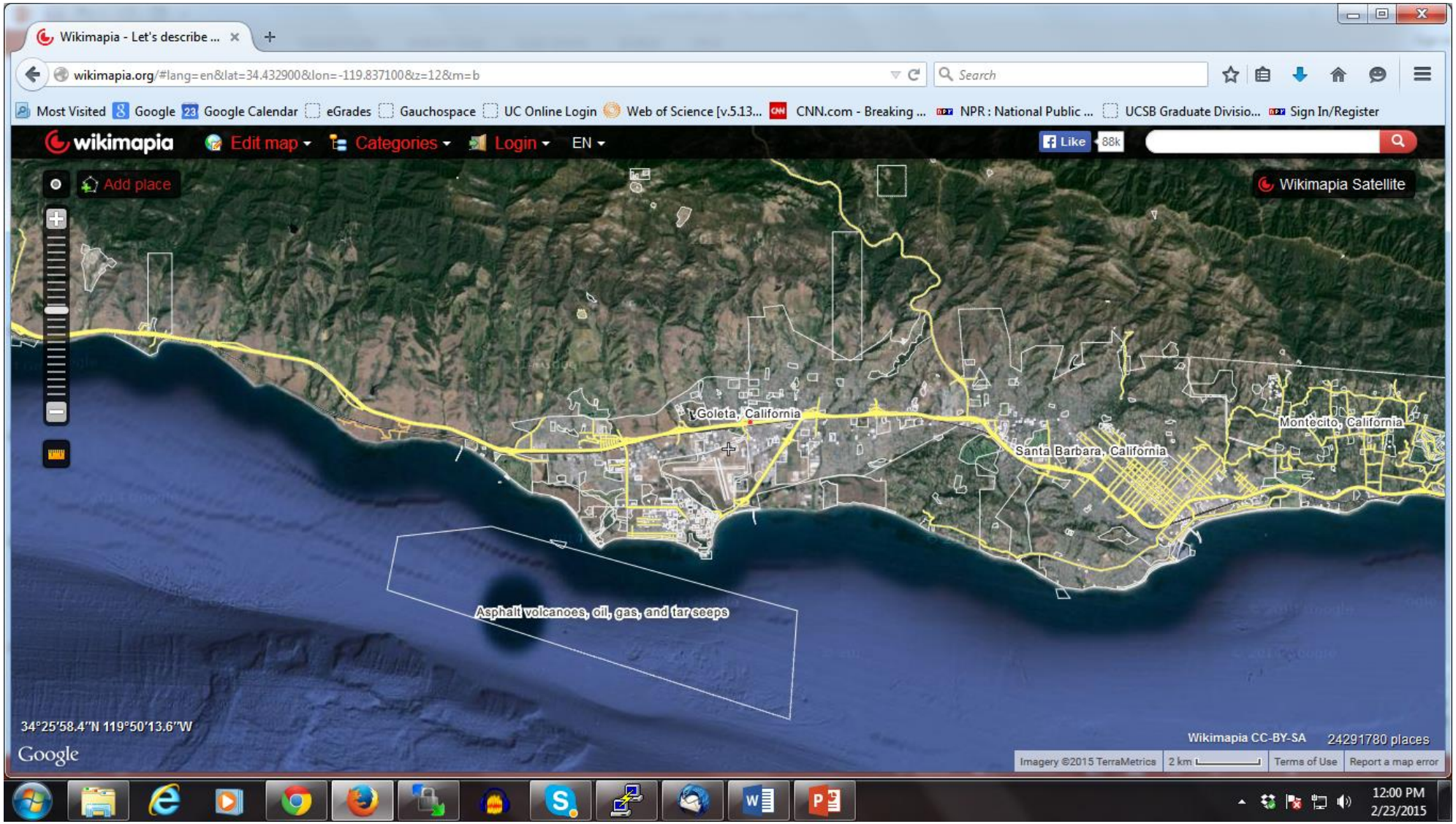
Openstreetmap.org



GPS traces/User diaries



Wikimapia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Santa Barbara, California
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Asphalt volcanoes, oil, gas, and tar seeps
34°25'58.4"N 119°50'13.6"W
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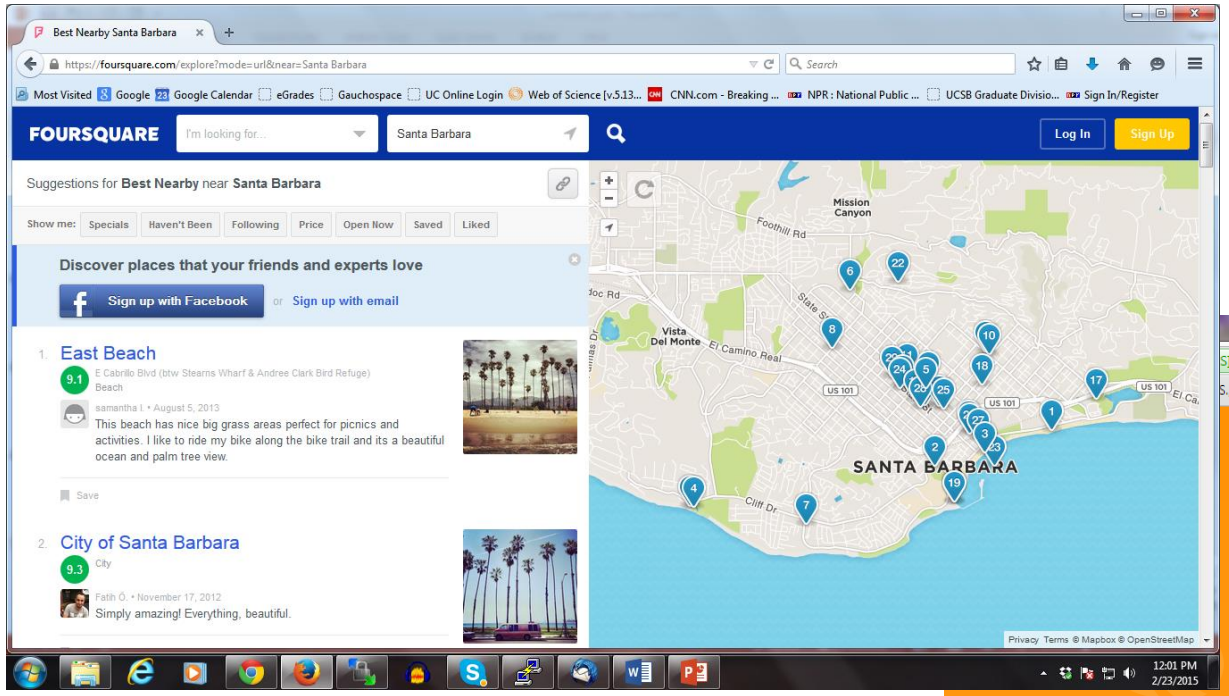
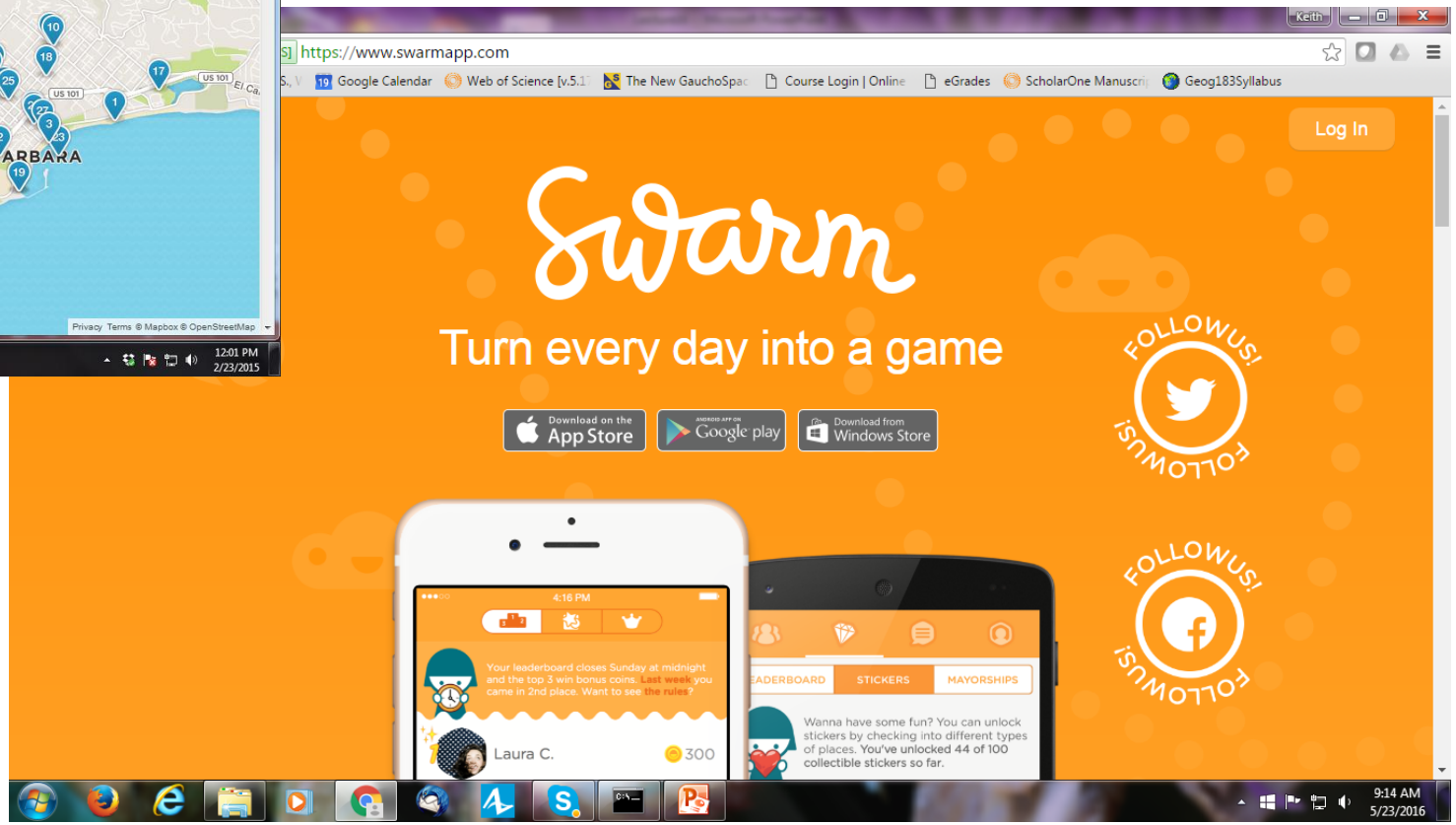
Foursquare/Swarm





Summary

- Examined history of Internet WWW and early web mapping
- Search -> Discovery, Static -> Interactive
- Evolution of the browser/geobrowser
- Importance of parallel technologies
- GIS and computer mapping goes web based (Client Server model)
- New applications possible, VGI, social media etc.