Integrating Geo-IT and Health
—
Geo-IT and Tools

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(thanks to Sherif Amer and Javier Morales)

What has space got to do with health?

- Where a patient lives, sleeps, works
- Where patients meet
- Where a clinic, a medic is
- Where an environmental factor exists
- Where an incident happens
- Where medication is available
- Where a patient must travel
- Where an intervention has taken place
- Where an infection occurs
- Where a disease occurs
- Where a medical facility should be

In the past and the negations of these in the future

Underlying problems

- Environmental degradation
- Looming climate change with unknown effects
- Rapid urbanization
- Continuing poverty
- Population mobility and growth

All of these also have a strong spatial dimension

The web is a powerful tool for

- *sharing between policy-makers, medics and public*
- *health information, such as risks, trends and vulnerabilities.*

Certainly when augmented with cell phone infrastructure to reach all of the population.

One important information base

The **Private** Health cycle

- Get ill
- Visit a medic
- Undergo treatment

The **Public** Health cycle

- Understand
- Intervene
- Monitor

Health geospatial data + models substrate

Geospatial data substrate

Important questions Private

Private Health role I: The **patient**

- Am I, is my family member, ill?
- Where/when to seek treatment
- What have others done
- Understand the risks and act

- Private Health role II: The **medic**

- Understand patient's context
- Do symptoms fit a known pattern
- What medication/advice to provide
- Is this an outbreak
- Communicate risks
- Learn of new risks

Important questions Public

Public health role I: The **researcher**

- Try-understand cycle
  - visualize spatial patterns and trends
  - describe pattern/trend
  - explain pattern/trend
  - stratify risks
  - predict pattern/trend
  - inform decision-making

Public Health role II: The **policy maker**

- Policy formulation and execution
- Which populations are at risk
- Planning of medical resources to service areas
- Target interventions

Disease types and data pairings

The search for *cause-effect relationships*

- Infectious diseases: spatiotemporal proximity of carrying agents
- Non-communicable diseases: environmental factors
- Diseases with known vectors: environmental factors again

- Spill-over to/from animal health:
  - bird flu, marburg virus, ebola, ...

The geospatial substrate contents

Health geospatial data + models substrate

Geospatial data substrate

- topography, hydrography, geology, soils, land cover
- meteorology and its effects on the land: e.g., soil moisture, land surface temperature, vegetation health, seasonality
- the manmade environment: transport infrastructure, land use, cadastre, industry & waste
- socio-economics, demographics, livestock practice and culture

Providers are mostly governmental and international: Census Bureau, Cadastre, NMO, Ministries, RS agencies, UN agencies, research institutes

Modes of data acquisition

- Ground surveying
- Airborne sensing
- Spaceborne sensing
- Sensor nets
- Volunteering

Volunteering nature observations

Waarneming.nl

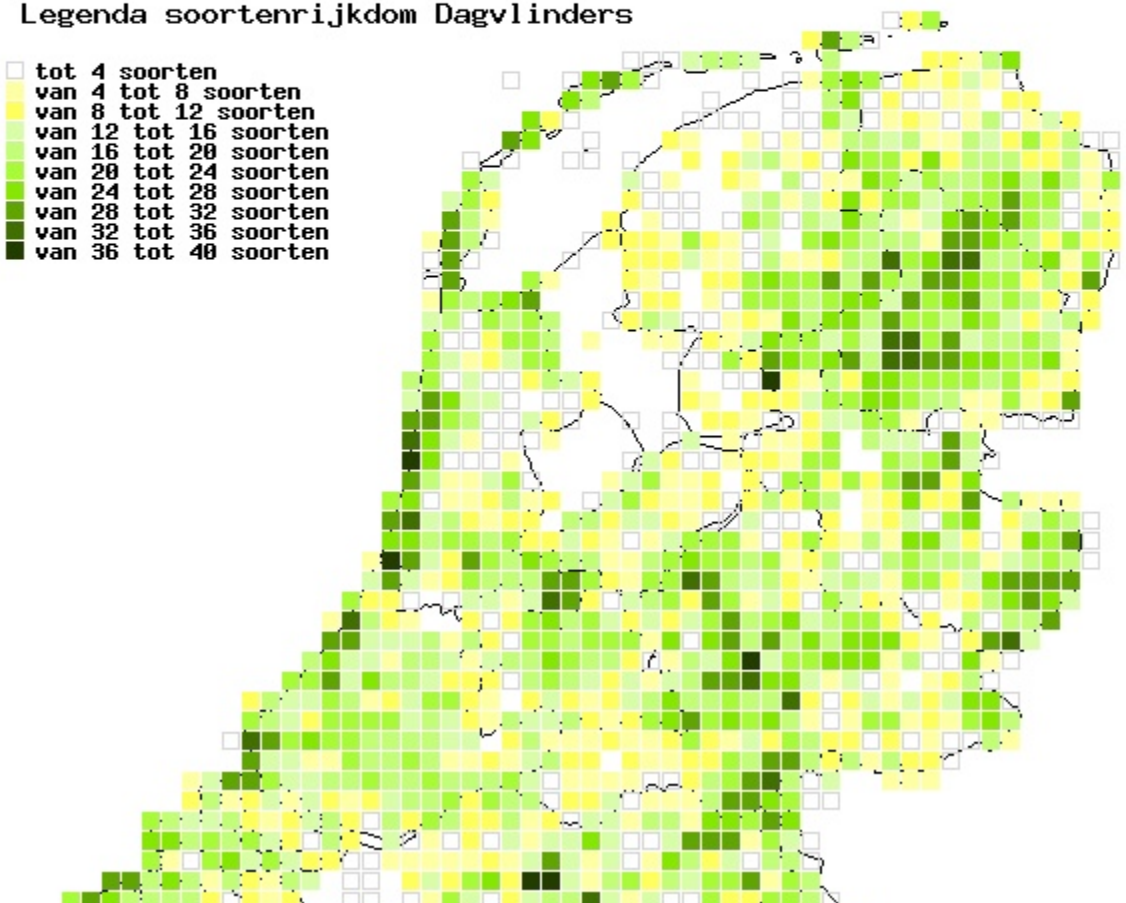
Ingelogd als Rolf de By Uitloggen Forum Help Kies taal en/of

Invoeren Recente waarnemingen Overzichten Mijn Waarneming.nl

Biodiversiteit

Last updated :2008-11-26 01:09:29.84263

soortgroep Dagvlinders OK

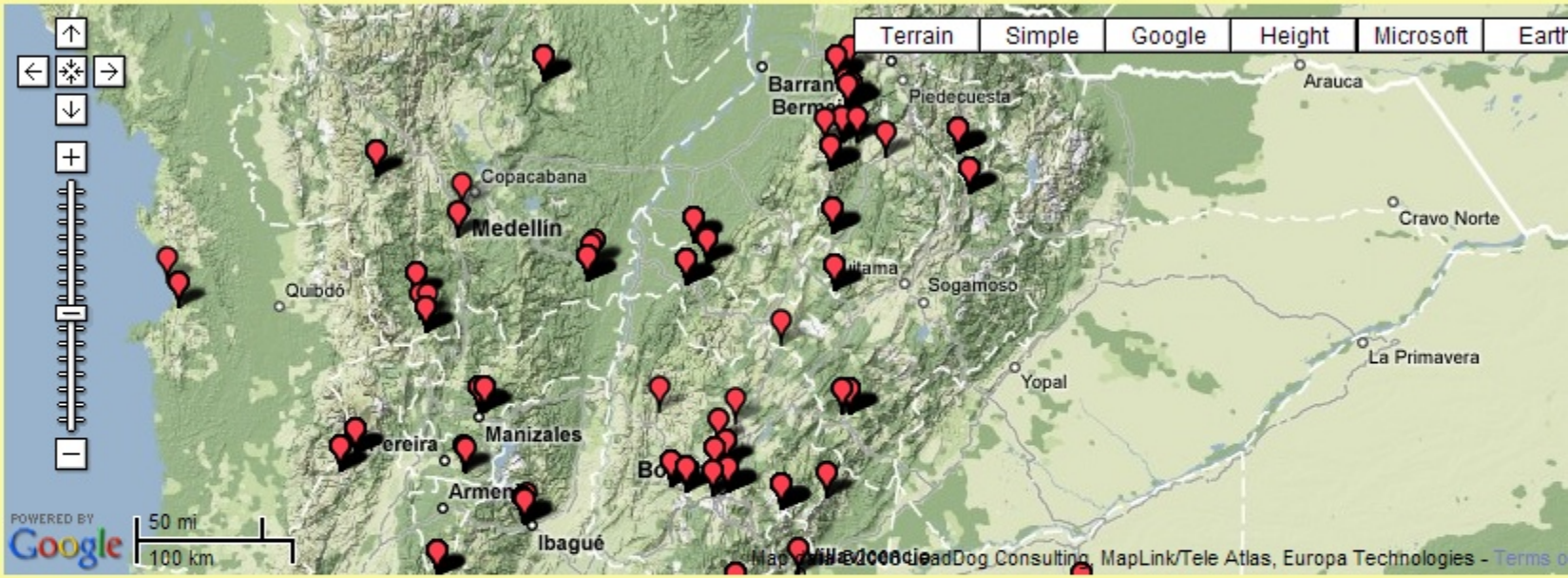


Volunteering bird sound recordings

PÃ¡GINAS DE CANTOS POR PAÃS :: COLOMBIA

Seleccione un paÃs Go!

Xeno-canto contiene **1870** grabaciones provenientes de **176** localidades en Colombia (algunas localidades no aparecen en el mapa de abajo).



ENDÃ©MICOS

Xeno-canto contiene 54 registros de un total de 69 aves endÃ©micas de Colombia.

InglÃ©s	RegiÃ³n de endemismo
Chestnut-winged Chachalaca	Cauca-Magdalena Valley
Variable Chachalaca	more than 1 region
Cauca Guan	Western Andes
Blue-billed Curassow	Cauca-Magdalena Valley
Chestnut Wood-Quail	more than 1 region

AUTORES

Estos autores han contribuido con grabaciones de Colomb

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Why is this all possible?

- Trend of fast code-fix-deploy cycle as propounded by Google Maps API
- PLs like Javascript, Ruby and Python
- Strong trend towards developing web-based (as opposed to desktop or server) applications.
- Provide only functions that are needed; and do go the last mile.
- Internet explosion and fun

Characteristics of Neogeography

- Based in old cartographic technology
- Not with GIS but with web map API, like Google Maps, MS Virtual Earth, OpenLayers
- Online, web-based mapping
- Dynamic, always changing maps: `mash-ups', ie., content is added to (draped over) a base map
- Crowd sourcing: End-user community contributes data
- Potential to include real-time sensor data

Example neogeo sites


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- <osm version="0.5" generator="OpenStreetMap server">
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      <tag k="created_by" v="Potlatch 0.7b" />
      <tag k="leisure" v="park" />
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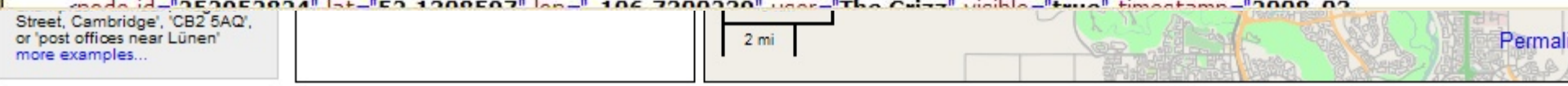
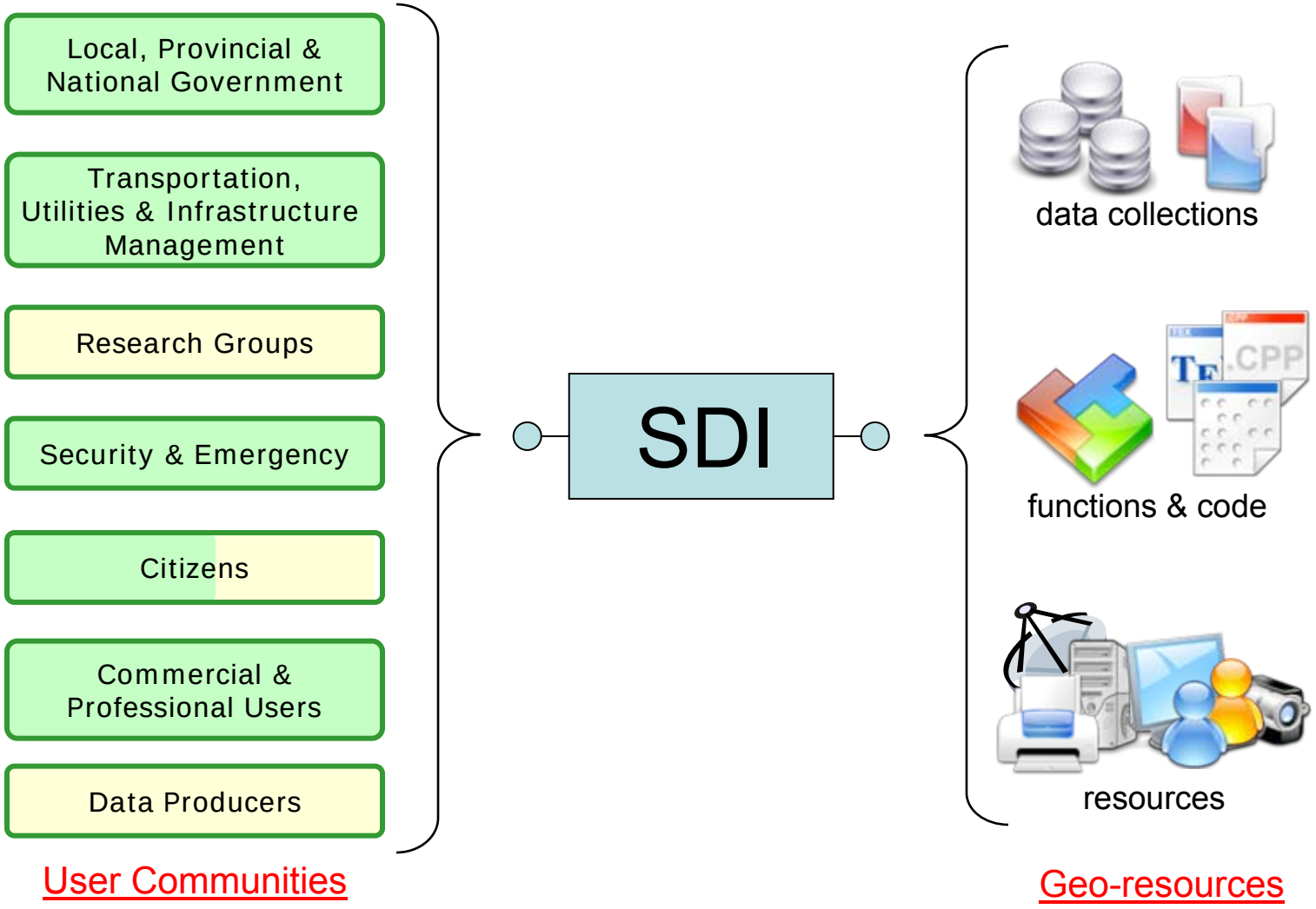
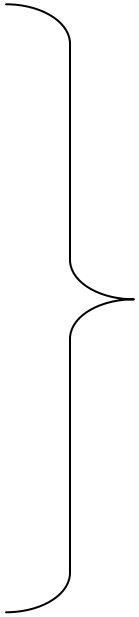


SDI and Geo-services



Geo-services

- A modern SDI is a facility that provides functions to
  - publish,
  - discover,
  - interpret,
  - access,
  - use,
  - combine &
  - administer

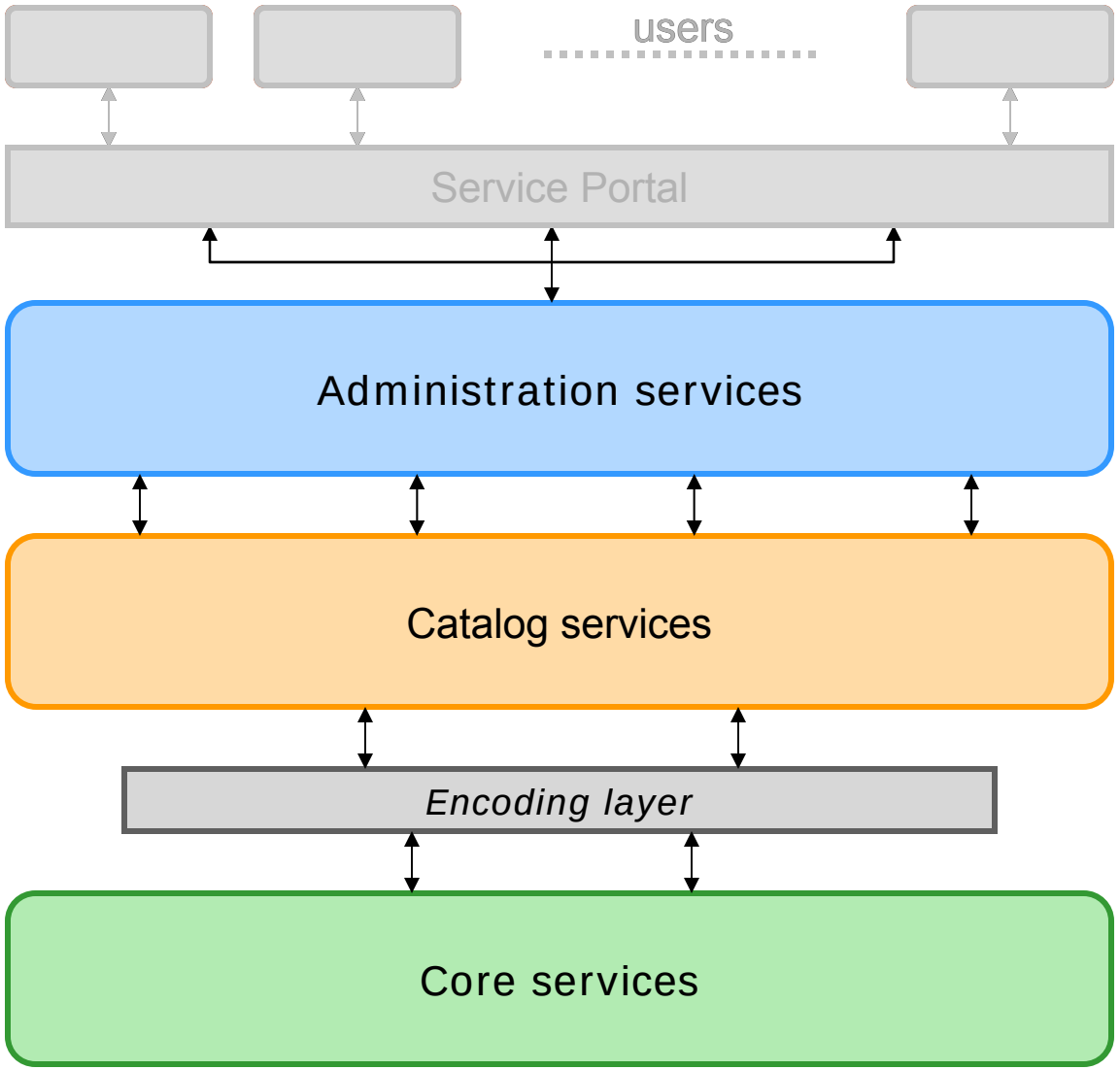


distributed geo-resources

These resources can be used by a user community to create geo-services fitting their specific needs

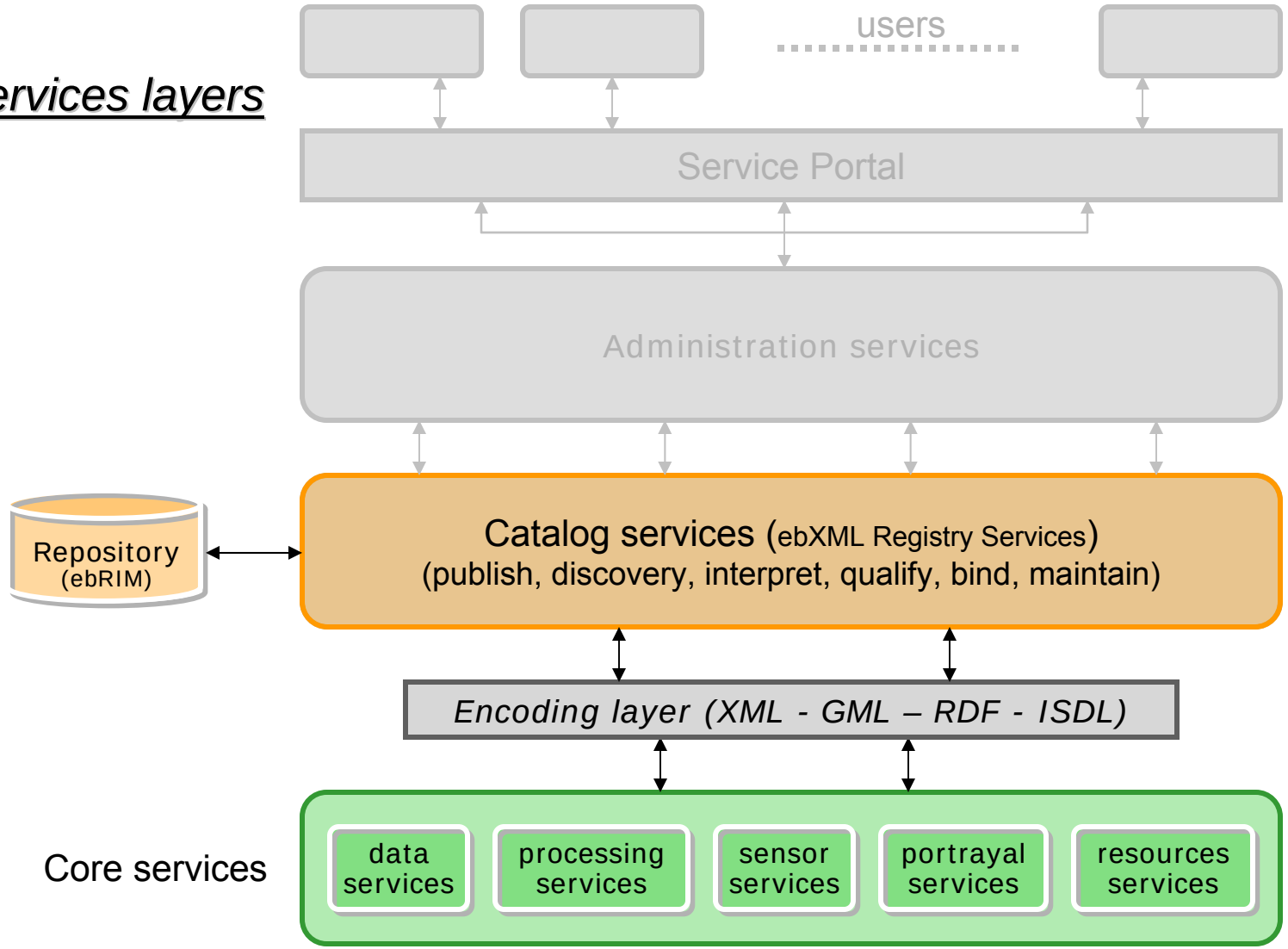
Geo-services sw stack

SDI services layers



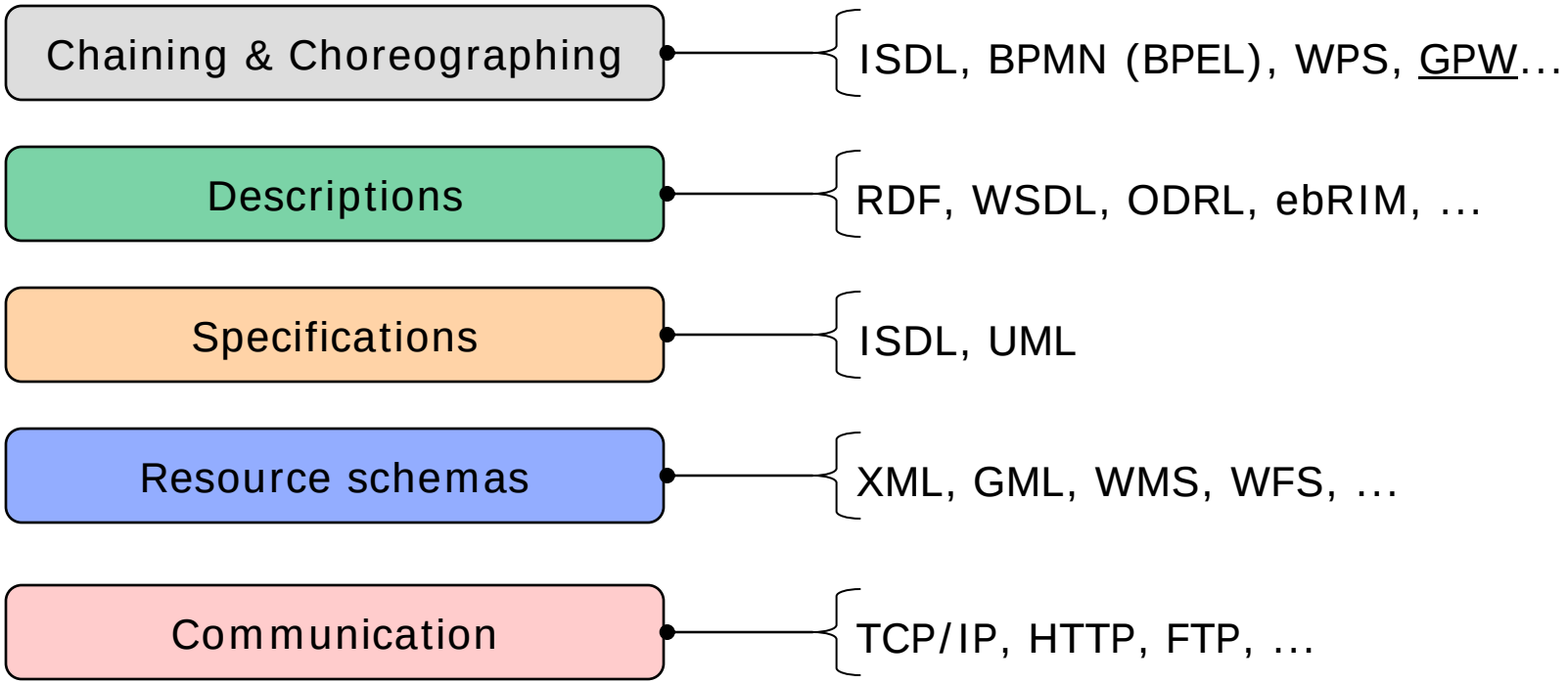
Geo - services

SDI services layers



Geo-services

- Encoding → standards



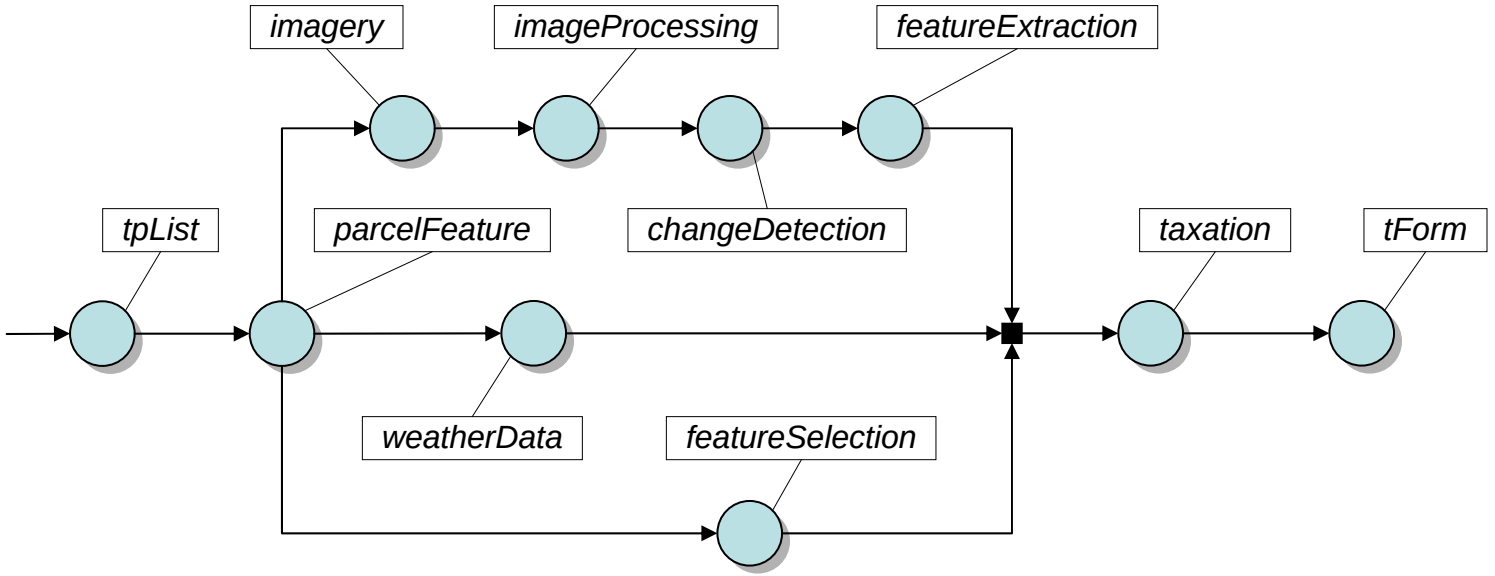
Geo-services

Service walkthrough:

- A *FoI Service* is used to obtain boundaries of *features of interest* (parcels).
- An *Imagery Service* uses the FoI and dates to obtain satellite images of an area of interest.
- A *Geo-referencing Service* attempts to tag en entity description with spatial information, turning it into a feature.
- A *Change Detection Service* identify areas with land-use change
- A *Weather Data Service* to obtain temperature, rainfall, etc. around an area of interest.
- A *FoI Service* to obtain data about infrastructure (roads, towns).

Geo - services

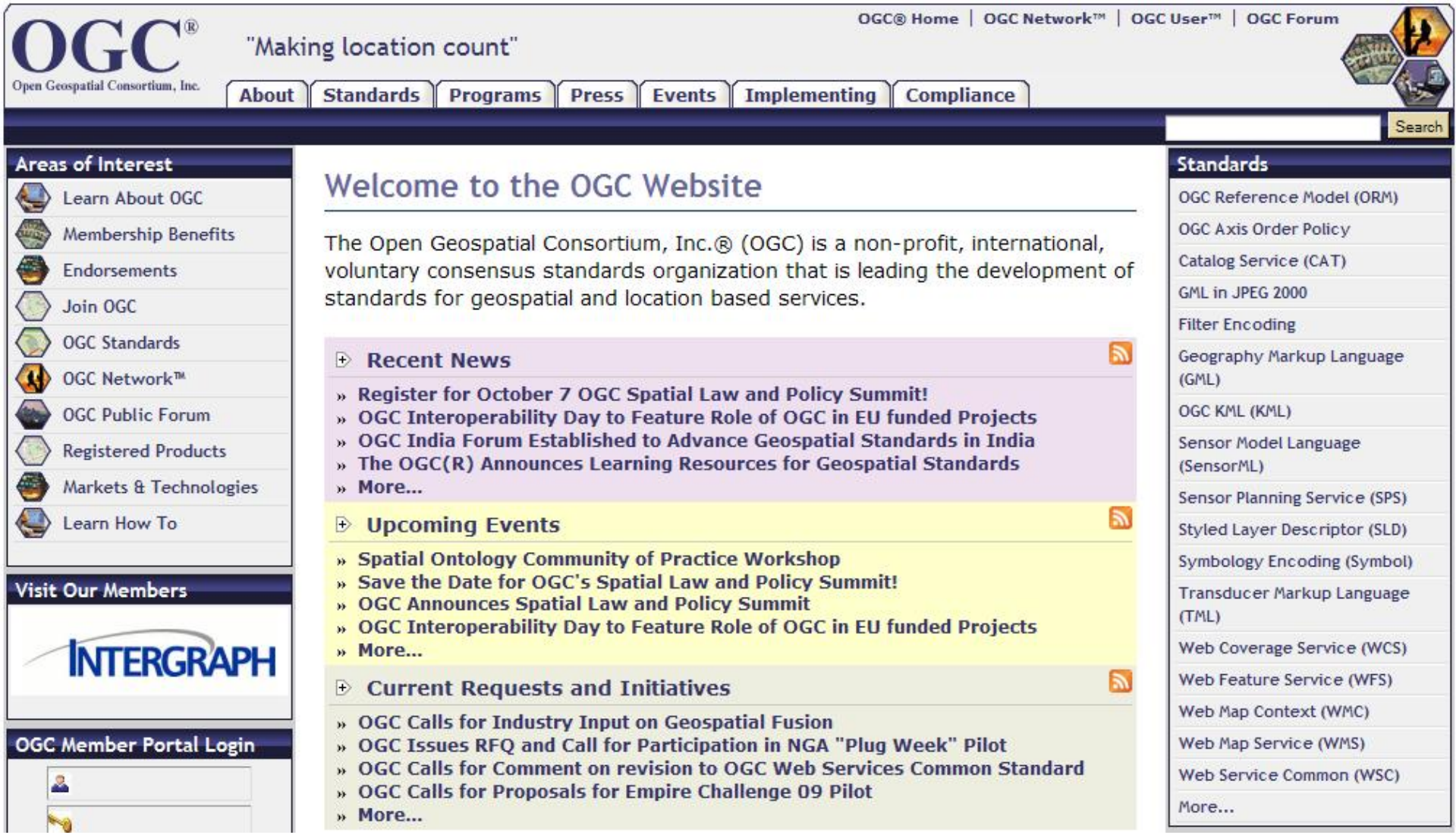
- Conceptual service chain



Let’s talk standards

- **OpenGeospatial Consortium** (OGC) as the unifying body of all software players, data providers in spatial data handling (incl. sensor data)
  - non-profit, voluntary consensus
  - 350+ organisations
  - OpenGIS® standards support interoperable solutions that "geo-enable" the Web, wireless and location-based services, and mainstream IT.

OpenGeospatial.org



What OGC products?

Document types:

- Abstract specifications
- Standards
- Change requests
- OpenGIS Reference Model
- Best practices
- Discussion papers
- Poublic engineering reports
- White papers

- Standards:
  - Catalogue Service
  - CityGML
  - Coordinate Transformation
  - Filter Encoding
  - Geographic Objects
  - Geography Markup Language
  - Geospatial eXtensible Access Control Markup Language (G
  - GML in JPEG 2000
  - Grid Coverage Service
  - KML
  - Location Services (OpenLS)
  - Observations and Measurements
  - Sensor Model Language
  - Sensor Observation Service
  - Sensor Planning Service
  - Simple Features
  - Simple Features CORBA
  - Simple Features OLE/COM
  - Simple Features SQL
  - Styled Layer Descriptor
  - Symbology Encoding
  - Transducer Markup Language
  - Web Coverage Service
  - Web Feature Service
  - Web Map Context
  - Web Map Service
  - Web Processing Service
  - Web Service Common

OSS Outline

- Open Source Software (OSS)

- OSS and the geospatial community
- Geo-services (SDI)
- SDI architectures based on OSS
- OSS role in ITC education

Open Source Software

Four basic freedoms

- The freedom to run the program, for any purpose.
- The freedom to study how the program works, and adapt it to your needs.
- The freedom to redistribute copies.
- The freedom to improve the program, and release your improvements to the public, so that the whole community benefits.

Open Source Software

- OSS drivers
  - Strong tendency towards compliancy to international standards
  - No license fees
  - Political Hype

    Motie Vendrik 20 November 2002
    "*government shall stimulate the use of OSS and open standards, pursuing that in 2006 all government bodies shall adopt open standards*"

  - Consumer products → looking at a computer screen and seeing reality... (Gelertner 1991, "Mirror Worlds")

Open Source Software

- Benefits
  - No acquisition cost
  - Source code is available, modifiable, augmentable
  - Development cycles are VERY fast
- Considerations
  - Higher technical skills (training)
  - Significant customization tasks
  - Maintenance and development
  - Multiple distributions
  - User oriented documentation
  - Total Cost of Ownership {TCO ≠ 0}

OSS & Geospatial Community

- Geospatial has joined IT mainstream (although as a latecomer) → *Consortia*
- Web applications are less complex than full-fledged desktop applications
- Web mapping is becoming a commodity
- Successful open source community
- Strong geospatial standards development

OSS & Geospatial Community

- Consequence → *Leading members of the geospatial community have joined forces.*
  - Open Source Geospatial Foundation (osgeo.org)

    Free And Open Source Software for Geoinformatics - FOSS4G2006
  - aprox. 200 different projects can be found on freegis.org
  - 52°North
  - GeoNetwork opensource
- Standardization efforts by OGC

OSGeo.org

OSGeo Foundation

- Home
- About the Foundation
- FAQ
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- Swag Store
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OSGeo Community

- Welcome
- Member Area
- News
- Events
- Wiki
- Mailing Lists
- Blogs
- Books
- IRC
- Service Providers
- Journal
- Sol Katz Award
- Local Chapters
- Spotlights
- Gallery

The Open Source Geospatial Foundation...

Created to support and build the highest-quality open source geospatial software. Our goal is to encourage the use and collaborative development of community-led projects. Join us by signing up to our mailing lists or check out the Getting Started page to become more involved.

News

2009-09-11	Sol Katz Award for Geospatial Free and Open Source Software - Call for Nominations
2009-09-09	OSGeo at Intergeo Industry Trade Fair
2009-09-02	Announcing the release of QGIS 1.2.0 'Daphnis'
2009-08-10	Server back online

| Submit News | more |

Upcoming events

2009-09-17	Geoinformatics FCE CTU 2009 Workshop, Prague
2009-09-21	OSGeo at Intergeo (Karsruhe, Germany)

Community Blogs

Edmar Moretti: Consulta pública sobre o Perfil de Metadados Geoespaciais do Brasil - MGB

Andrew Turner: End of Summer Events

Geoff Zeiss: Resolving the Municipal and Utility As-built Backlog

Fernando Quadro: Mapa dos Radares do Brasil

Tyler Mitchell: Open Source Car Needs Open Source Navigation

Tyler Mitchell (OSGeo): Vancouver Open Data Catalogue

Paul Ramsey: PostGIS Down Under

Geoff Zeiss: BIM and Sustainability

Geoff Zeiss: Vancouver Makes Spatial Data Freely Available

Tom Kralidis: Python, KML and Parishes

Support OSGeo

Make A Donation

Any Amount

OSGeo Projects

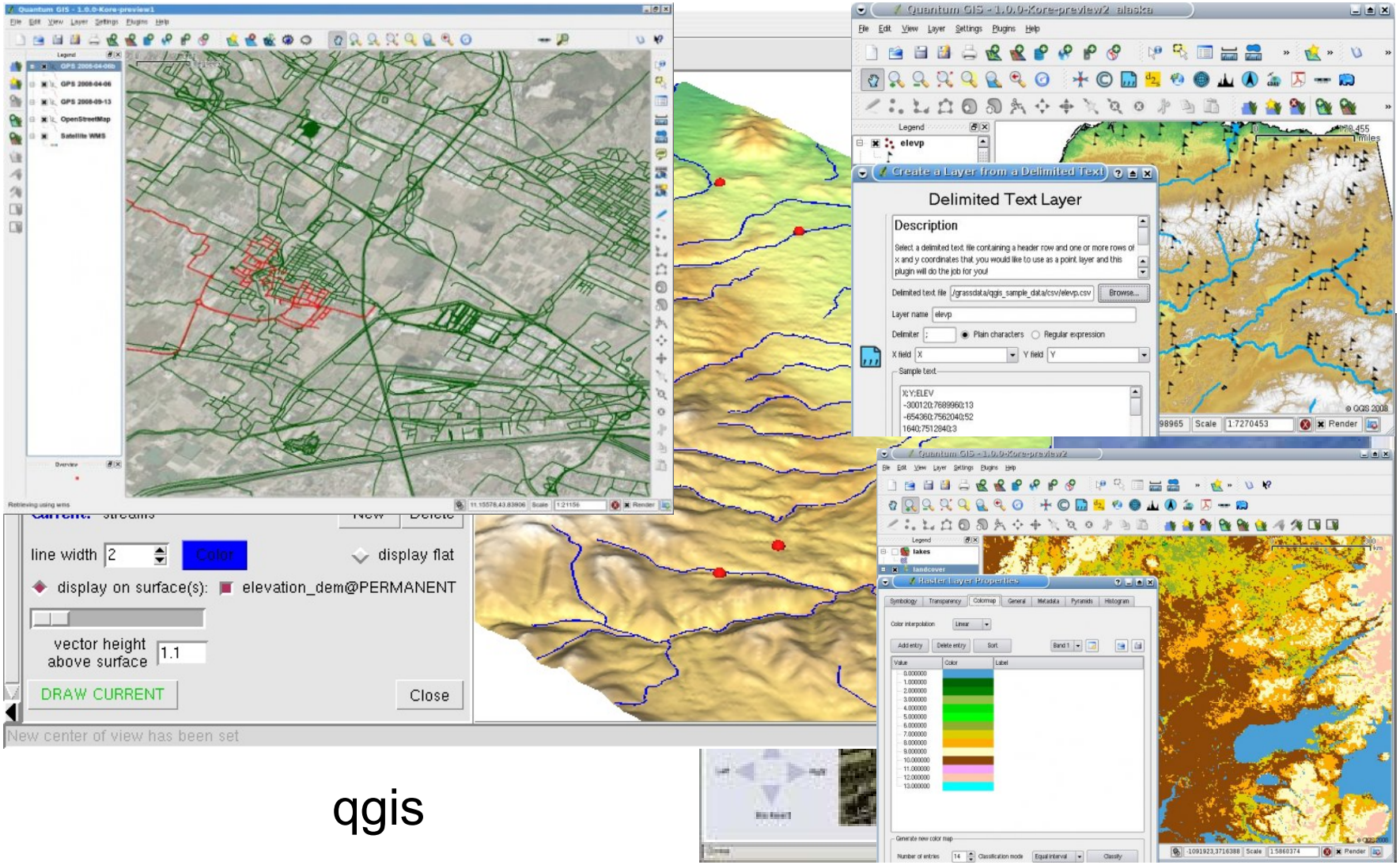
Web Mapping

- deegree
- Mapbender
- MapBuilder
- MapGuide Open Source
- MapServer

Some markable OSGeo projects

- All through the sw stack:
  - Spatial databases
  - Image repositories
  - Catalogs
  - Spatial data processing and (re)formatting
  - Spatiocomputational models
  - Web services and – chaining
  - Web mapping
  - GIS desktops

Example sw packages



qgis

Cell phone infrastructure as the web extension chord

- 4 out 5 people worldwide have access to a cell phone; score in Africa varies but not much worse
- Various projects ongoing to tap into this as one- or two-way communication channel
  - marketing information
  - banking
  - agriculture
  - water & sanitation
  - e-health
- Potential to unlock two-way communication and develop a never-before survey force with civilians

Example MIT projects

- GrameenPhone
- Moca
- ClickDiagnostics
- Zaca
- Dinube
- FrontlineSMS
- ...

A phone is not just a phone

Student projects explore innovative cellphone uses in developing world

David Chandler, MIT News Office

July 2, 2009

email	comment
print	share

Harvard graduate students Ankush Sharma, right, and Alexis Geancotes, left, (who also study at MIT) represent the MoCa team, which developed mobile diagnostics to improve health care in the developing world.
Photo - Photo / Donna Coveney

A cellphone is not just for calling, texting and taking pictures anymore. Several startup business ventures spawned by MIT students, sometimes as class projects and sometimes as independent work, are exploring new ways to harness the increasingly ubiquitous devices. They are using phones to help people, especially in developing nations, to raise their incomes, learn to read, get where they're going and even diagnose their ailments.

Cell challenges

- Erratic technological landscape
  - various generations cell phones, operating systems
  - largely different operator set-ups
  - various message techniques: SMS, MMS, USSD, GPRS, XML, HTML
  - positioning possibilities
- Localization, literacy, cultural sensitivity, gender
- Difficult-to-device business models
- Social network buy-in
- Trust, privacy & legislation
- Quality of volunteered information

Lots of interesting developments

- Difficult to overview the complete scene

International Journal of Health Geographics

BioMed Central

Research

Open Access

Towards Web-based representation and processing of health information

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NATIONAL GEOGRAPHIC NEWS
REPORTING YOUR WORLD DAILY
Tuesday, November 25, 2008

GPS-Equipped Pigeons Enlisted as Pollution Bloggers

Mason Inman
for National Geographic News
October 31, 2006

Part of the Digital Places Special News Series
More Digital Places Stories>>

If pigeons wrote their own blogs, they might talk about where to score breadcrumbs or find prime roosting spots.

Now, with the help of tiny high-tech backpacks, pigeons really have become bloggers—but they're posting messages about California smog.

In a project known as PigeonBlog, sensors in the backpacks collect data on toxic gases, such as carbon monoxide and nitrogen dioxide, as the birds wing through city skies.

The information is then sent back to a central computer, which automatically posts a map of the pollutants' concentration on the Internet. (Related: "Global Positioning Tech Inspires Do-It-Yourself Mapping Project" [October 18, 2006].)