

Open Research: Working with Open Software and Open Data in Academic-based GIS Research

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NUI MAYNOOTH
Ollscoil na hÉireann Má Nuad



Powerful drivers and incentives for a small academic research group

- **Spatial Data and Information:** Key National Datasets are not available under an open license in Ireland (yet)
- **Software:** Many software resources are available under academic license but...
- It is often necessary to experiment with many different tools, packages, etc
- Requirement to avoid “lock-in” - build research outputs which are software/vendor neutral

Economic Landscape has changed

July 20, 2010

Ireland's Universities Are Hit Hard as the Country's Economy Tumbles



Trinity College Dublin (Irish Universities Association)

[Enlarge Image](#)

successfully positioned itself as a global science and technology hub, luring to its shores scores of researchers and academics from abroad.

But just as Ireland became synonymous with the property-boom-fueled riches of the early years of this century, it has now become emblematic of the harsh toll exacted when governments impose severe austerity measures to deal with the fallout from the global economic crisis.

By Aisha Labi

London

As Ireland's economy boomed for much of the past two decades, prompting wonder at the transformation of one of Western Europe's poorer nations into the vaunted Celtic Tiger, the country's higher-education institutions, almost all of which are publicly financed, rode the wave of prosperity that swept the country. Budgets and salaries grew by more than 40 percent between 2002 and 2009, and Ireland

Britain, Estonia, Ireland, Italy, Lithuania, and Romania are cited for imposing what the report calls "heavy cuts" ranging from 5 to 10 percent. Cuts of up to 5 percent have been seen in many countries in Eastern and Southeastern Europe, including Croatia, the Czech Republic, Macedonia, Poland, and Serbia.

Decisions regarding expenditure are changing to work within tight budget constraints

IRISHTIMES.com Thursday, June 16, 2011

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The Irish Times - Friday, February 18, 2011

Computer services board drops Microsoft

IAN CAMPBELL

THE LOCAL Government Computer Service Board, a flagship Microsoft client, is moving to open-source software after nearly 10 years of allegiance.

The public sector body provides shared ICT services to local government and was a pioneering exponent of SharePoint, the Microsoft web-based product that is used as an intranet by many of the country's 33 councils.

In 2001, the board signed a landmark €10 million contract with Microsoft, licensing end-to-end software from desktop to database for use across local government. It was renewed in 2005, but only after assistant director Tim Willoughby looked at the open-source alternatives.

At the time he expressed a reluctance to entrust local government IT platforms to a "sandal-wearing" community, preferring the level of support offered by Microsoft.

UK government commits to open data

By Craig Grannell on May 16, 2011

Chancellor of the Exchequer George Osborne says datasets to be open to UK public



At Google Zeitgeist 2011, UK Chancellor of the Exchequer George Osborne unveiled ambitious plans regarding the opening up of government data, ostensibly in the name of accountability, but also in part perhaps as a cost-cutting and modernisation exercise.

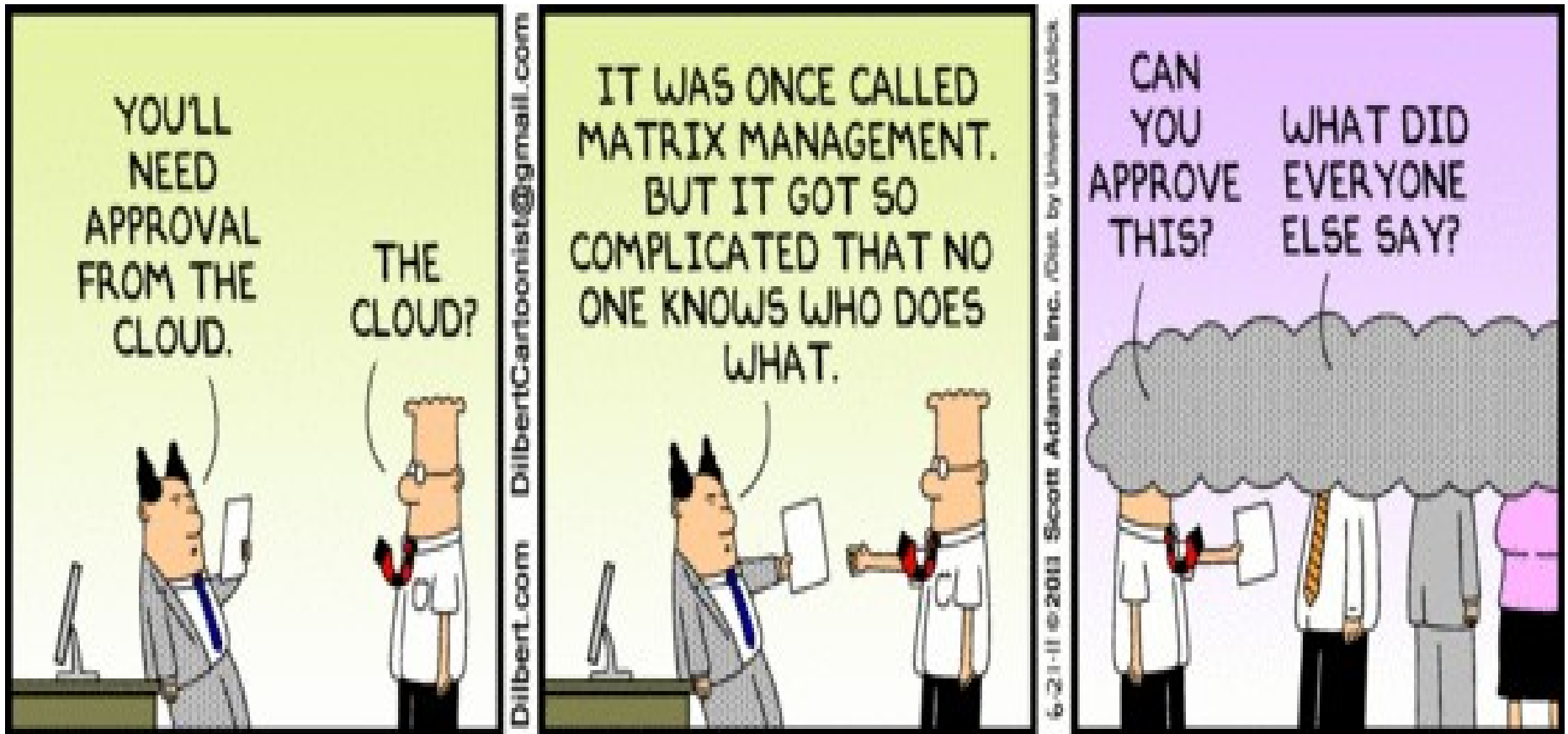
Osborne said: "Over the next 12 months, we're going to unlock some of the most valuable datasets still locked away in government servers. This is the raw data that will enable you for the first time to analyse the performance of public services, and of competing providers

within those public services."

Firms urged to allow workers to use own devices and apps
Magnet resists Eircom price spin

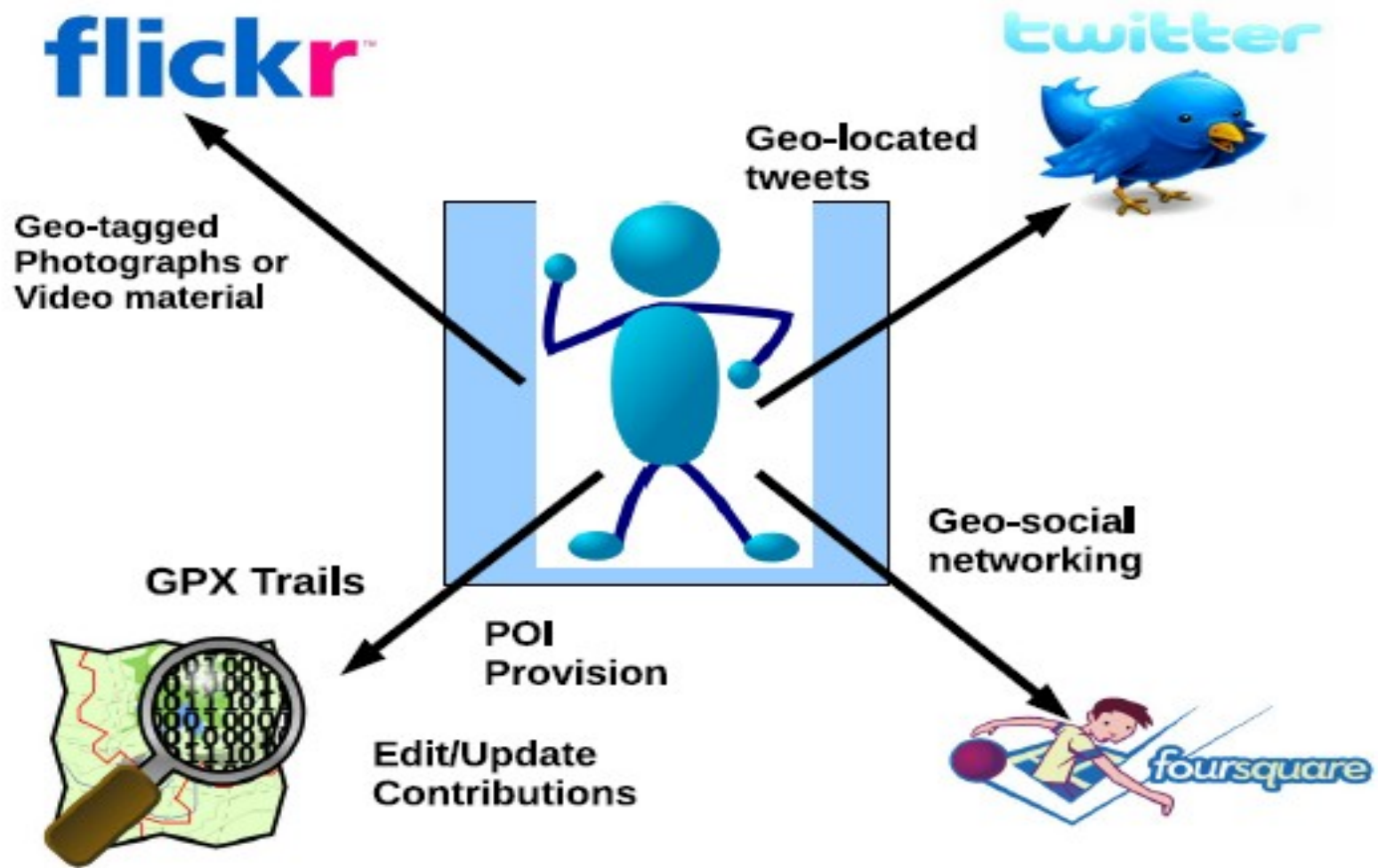
<http://www.netmagazine.com/news/uk-government-commits-open-data>

So many software, data, interface, storage, and access options!





The citizen contributor - Creating a global spatial archive



All available by: desktop, laptop, smart-phone

“80 percent of all commercial software applications will include open-source components by 2012”
(Gartner, 2008)

**“While open source software may not be suited for everyone if the price tag argument is set aside. But it is the best choice for research in GIS”
(Steinger and Bocher, 2009)**

Steiniger, S. and Bocher, E. [2009].

An overview on current free and open source desktop gis developments,
International Journal of Geographical Information Science 23(10): 1345 – 1370.

Our experience is that staff/researchers are free to use FOSS but no policy incentives

- *“No software costs, software tools are easily learned by personnel with general IT backgrounds, small software footprints, no need to commit to proprietary software, and compatibility with existing IT infrastructure” [1]*
- *Education sector has “failed to provide any form of training on open source software to IT coordinators or other staff” [2]*
-

[1] Anderson, G. and Moreno-Sanchez, R. [2003]. Building web-based spatial information solutions around openspecifications and open source software, Transactions in GIS 7(4): 447–466.

[2] Carmichael, P. and Honour, L. [2002]. Open source as appropriate technology for global education, International Journal of Educational Development 22(1): 47 – 53.

Why do we use Open Source?

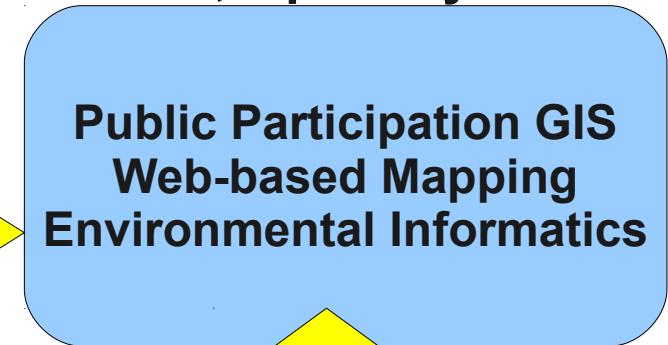
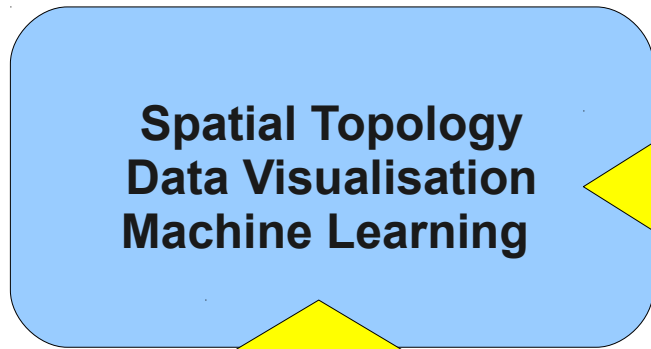
- FREEDOM – to choose
- “It gets the job done”
- Allows use to experiment, test, mix-up, etc with software packages, libraries, etc
- Access to a vast support network

So what are we doing with Open Source Software....



**Python, C++
HTML5, Inkscape,
Matplotlib, Numpy**

**PHP, Matplotlib
Apache HTTPd, Tomcat, etc
Java SDK, OpenLayers**



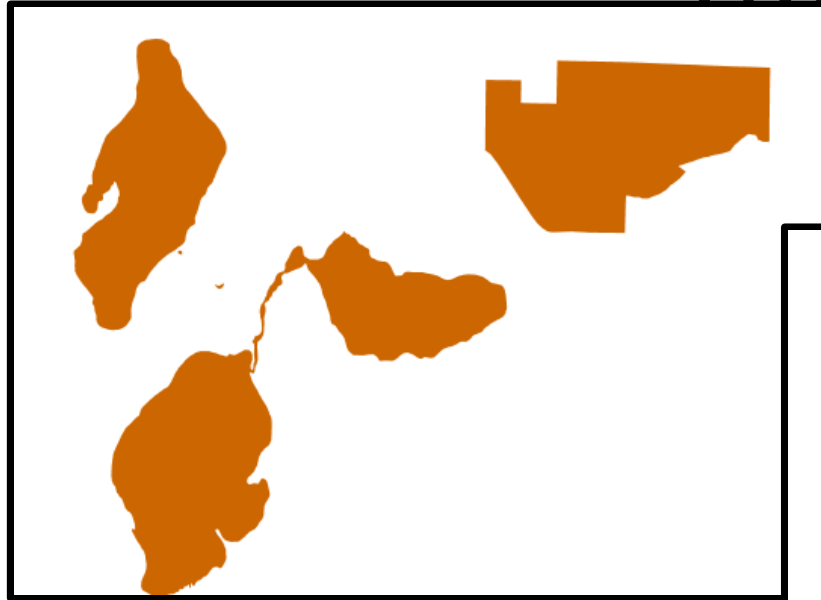
**OpenStreetMap Data
OSI UK OpenData
Twitter API
Open Environmental Data
Cloudmade API
etc**



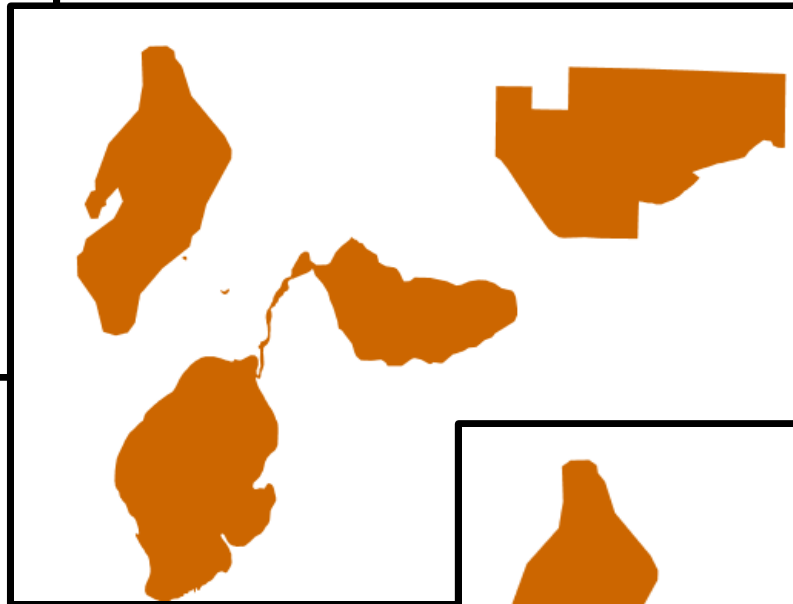
**Java
Android SDK
Processing SDK
Java Topology Suite**

**PHP, QGIS
Mapnik
PostGIS,
Various OSM tools**

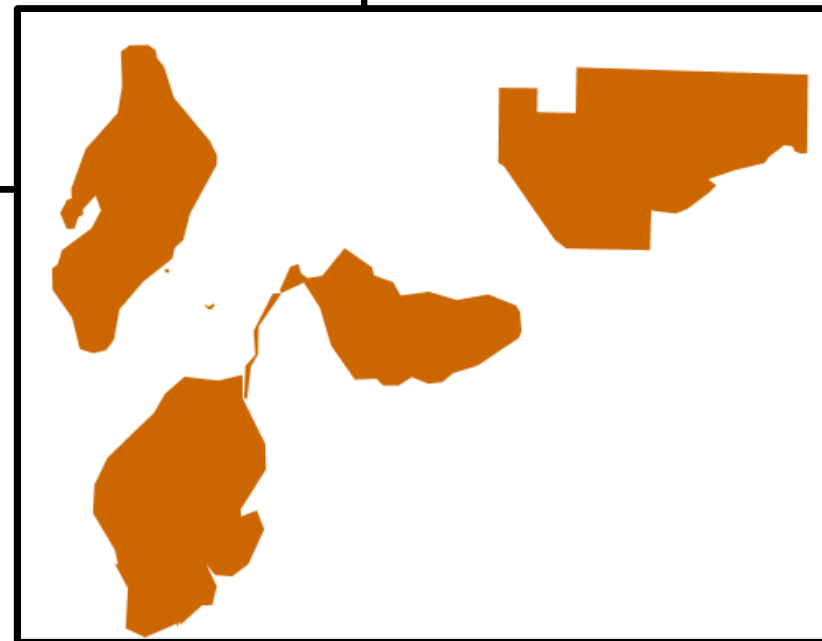
Fangli Ying – Progressive Transmission



Reduced by 40% (8.0 out of 10)



Final (mean 7.9 out of 10)



Reduced by 80% (8.1 out of 10)

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1.5.1 | 15 May 2011

Resources

- » [Tutorials](#)
- » [Examples](#)
- » [FAQ](#)



GeoTools

GeoTools The Open Source Java GIS Toolkit

GeoTools is an open source Java library that provides tools for geospatial data.



Client

Haptic Interaction Models

HapticStayonPath

4

Compass Required

HapticNavigator

HapticWayPointer

HapticDestinationPointer

1

ACTION,
Location,
Orientation,
Destination

2

3

Instructions

5

Response/Feedback

Haptic – Vibration alarm
Visual – Text/Colour code

User Action

User
Device

Server

Routing
Service



Spatial Data



Spatial Database



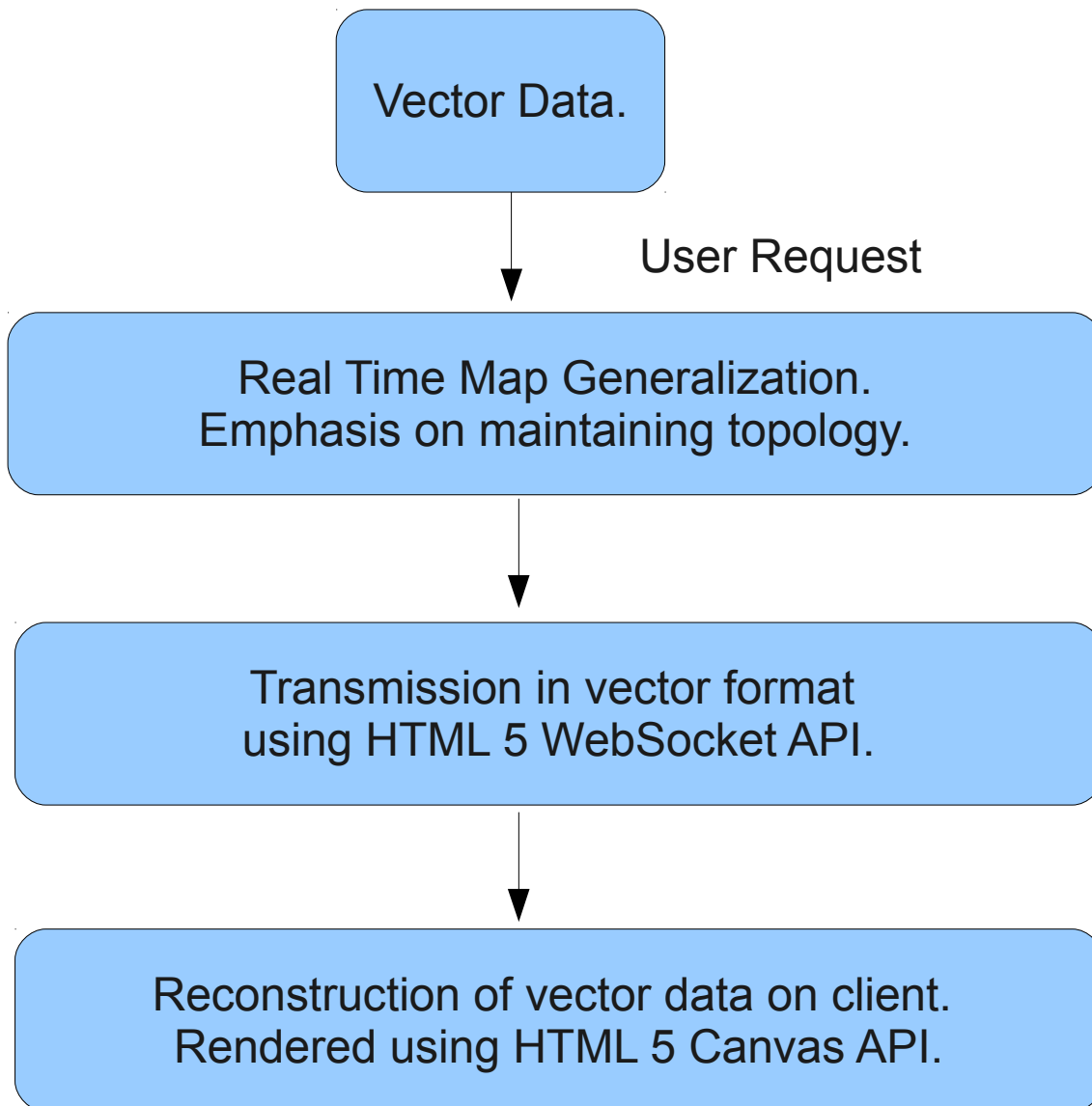
3a

Broker Service

Spatial PostgreSQL

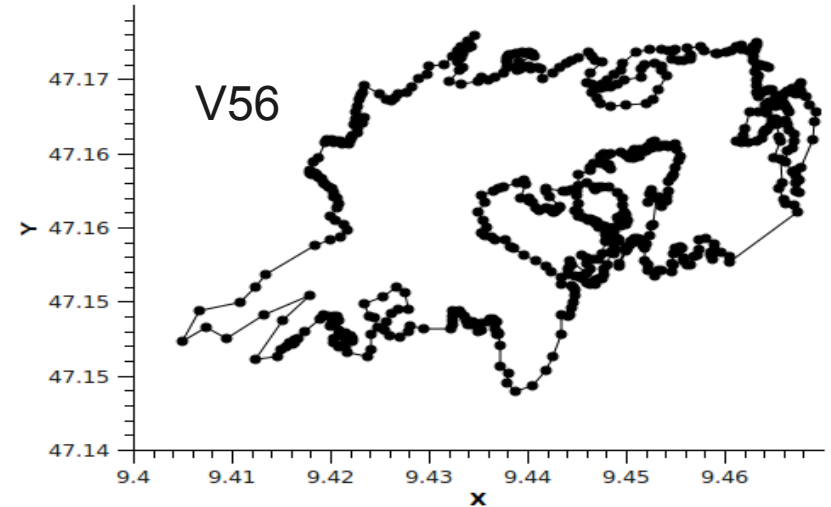
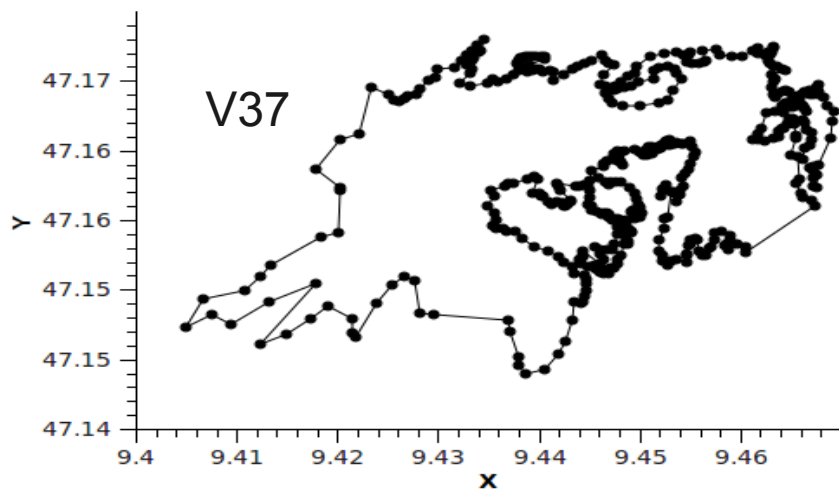
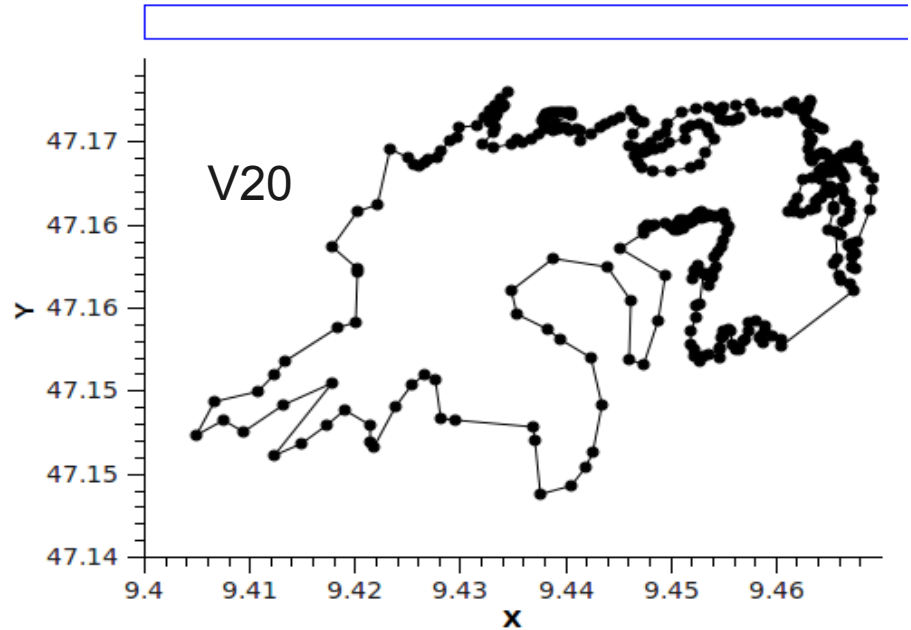
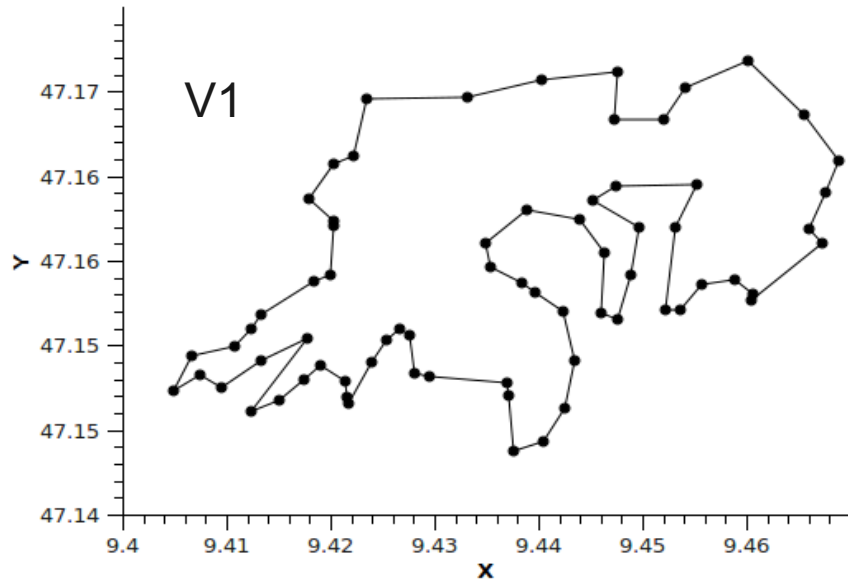
Data Logger
(Location,
Orientation,
Accelerometer,
Other user variables)

Padraig Corcoran - *Real-time Mapping Generation and Transmission*

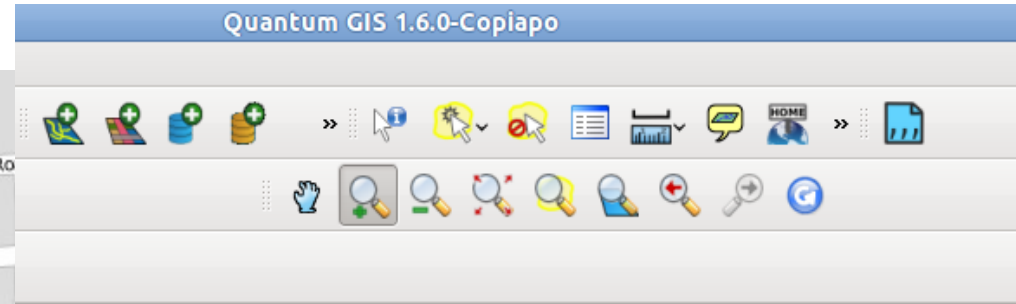


- Technologies:**
- **C++**
(generalization)
 - **Python (server)**
 - **HTML 5**
 - **JavaScript**

OSM shapes should *evolve* over time



B. Ciepluch – *Evolution of compound features in OSM as a data quality metric*



As Open Source tools become more mainstream and accessible

- And as the amount of openly accessible (spatial) data and (spatial) information increases
- The need for: quality, stewardship, etc becomes critical.
- The right tools, with the wrong data/information can lead to: misunderstandings, misinterpretations, etc. (lying with maps)

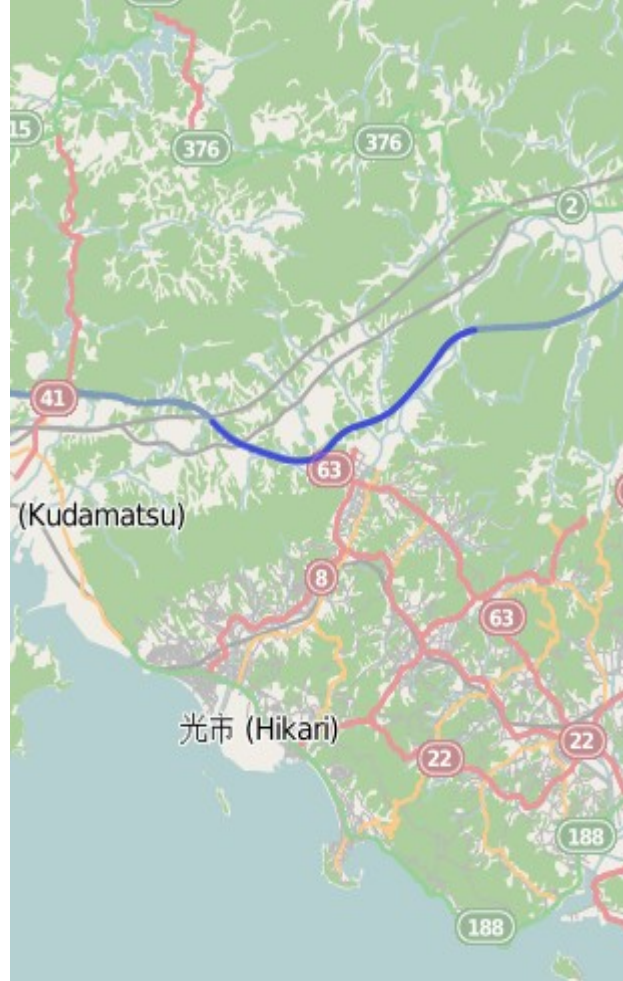
Historical Analysis of Contributions to OpenStreetMap as a means of development of “quality indicators”

“Those who cannot learn from history are doomed to repeat it”.
- George Santayana, Life of Reason 1905

The OSM Editing World Champions From Recent Planet.OSM



South W - JAPAN
24770043 V400



South W - Japan
24761888 , V399



Lausanne,
Switzerland
23381485, V323

The Champion



- 3 editors
- Start: 8-6-2008
- End: 5-1-2011
- One editor exclusively for first 398 versions!
- 10 Changesets
- Nodes: (278, 629,26)

24770043

Silver Medalist



- 1 editor
- Start: 08-06-2008
- End: 12-10-2009
- One editor for all 399 versions
- 7 Changesets
- Nodes: (444, 652,204)

24761888

Bronze medalist, but maybe actually gold medalist?

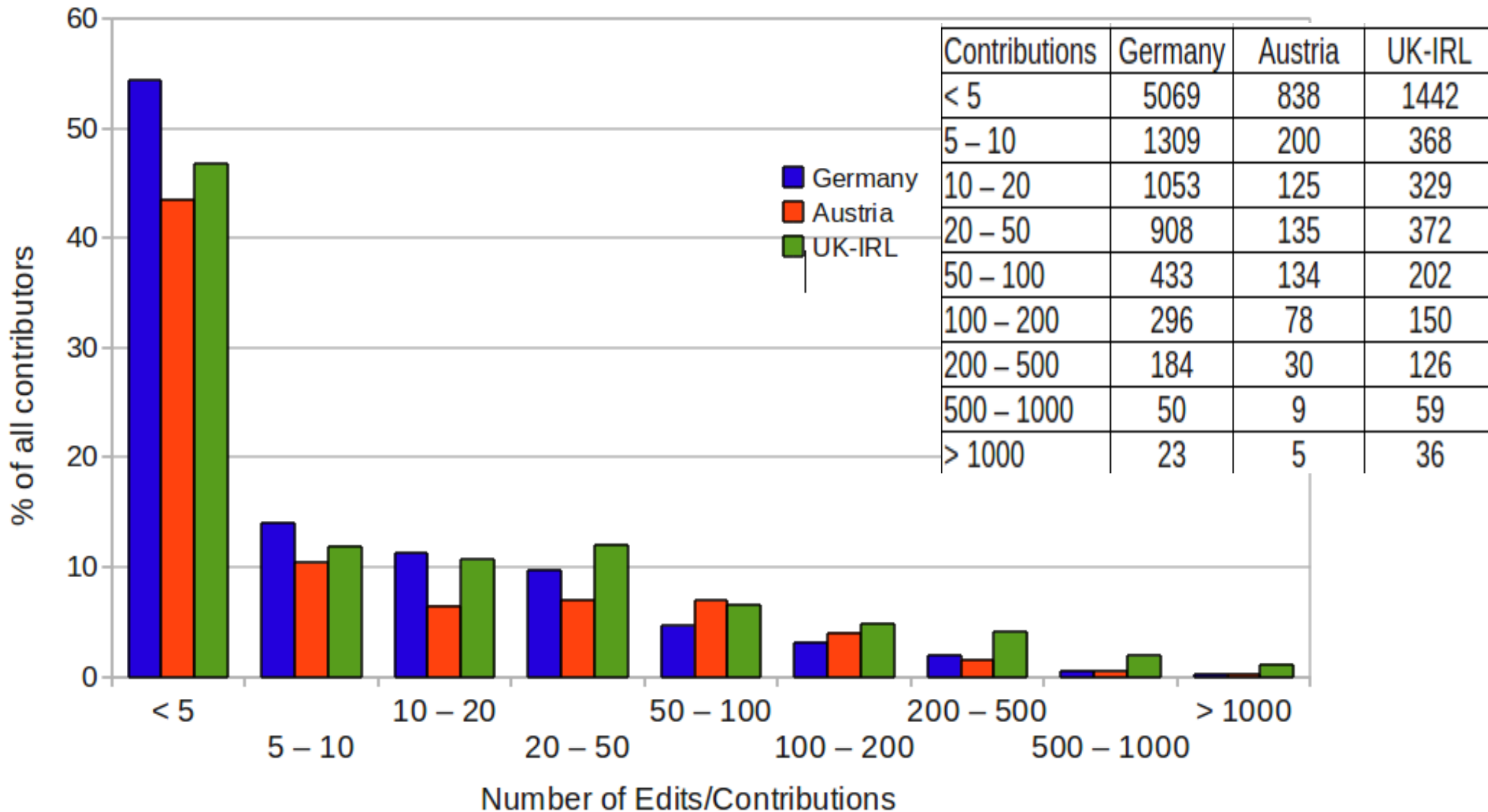


- 37 editors
- Start: 21-03-2008
- End: 19-10-2010
- One editor created 153 versions
- 149 Changesets
- Nodes: (444, 652,204)

24770043

**SOTM-EU 2011 -
“Volatile Volunteered Geographic Information”**

Contributor effort in HIGH edit features



AUSTRIA (1926 unique editors)

UK & Irl (3084 unique contributors)

Germany (9325 unique contributors)

Contributions are mostly restricted to very low volume edits

- Contributors who performed **10 or Less EDITS**
- **Ireland** (66% - from 355)
- **England** (58% from 2505)
- **Scotland** (61% from 379)
- **Wales** (68% from 316)
- **Austria** (74% from 1926)
- **Germany** (70% from 9325)

What do “one time” contributors do?

- **UK & Ireland: 1008 users** created polygons and polylines (44 users – one and only edit)
- **Germany: 944 users** created polygons and polylines (62 users – one and only edit)
- **Austria: 342 users** created polygons and polylines (20 users – one and only edit)
-
- These results indicate that this “high-edit” subset of OSM exhibits very similar characteristics to the entire global OSM database

Crowdsourcing the names of street/road features in OSM

Austria (4771112, 3 contributors)

5 changes

"Raststätte Kapellerfeld"

"Autobahnraststätte Kapellerfeld (in Bau)"

"Autobahnraststätte Deutsch-Wagram (in Bau)"

"Raststation Deutsch-Wagram (in Bau)"

"Raststation Deutsch-Wagram"

England (24276789, 2 contributors)

7 Changes

"Oakthorp Drive"

"Over Green Drive"

"Oak Thorp Cr"

"Oak Thorp Dr"

"Oak Thorp Dr; Broomcroft Rd"

"Oak Thorp Drive"

"Oak Thorpe Drive"

Scotland (4755815, 12 contributors)

5 changes . .

"A199"

"Edinburgh Road"

"Milton Road East"

Scotland (23602699, 2 contributors)

5 changes . .

"phenox cres"

"Phenoix cres"

"Phenoix crescent"

"Phenoix Crescent"

"Phoennoix Crescent"

"Phoenix Crescent"

Ongoing Tag Dispute

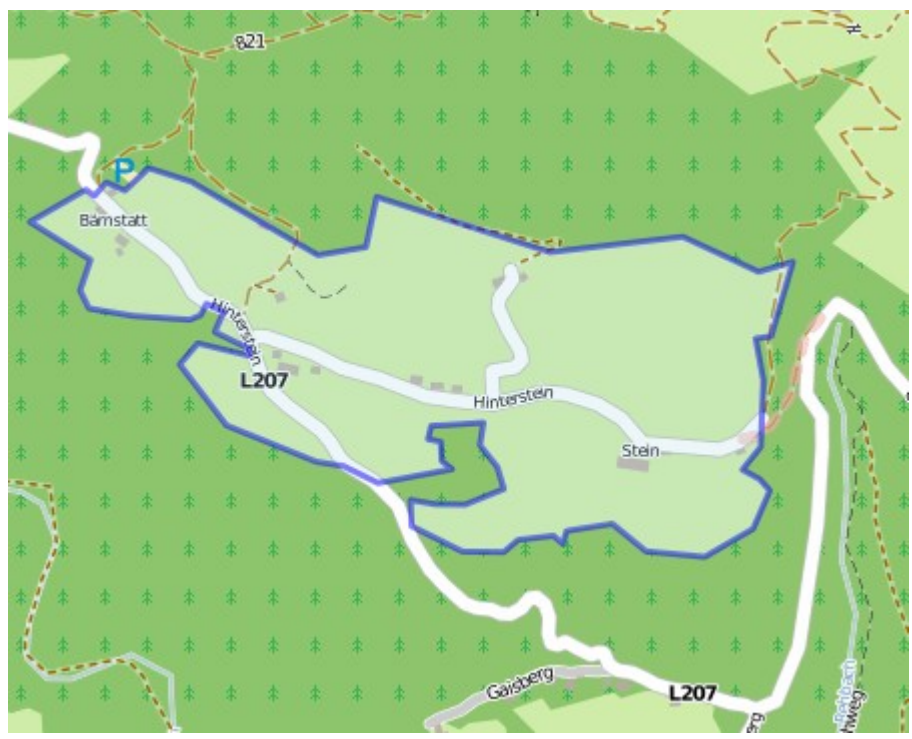
Version	Edit Date	#Users	UserID	KEY: highway	#Tags	#Nodes					
1 (First)	10-04-2008 (08:05)	1	8732	No highway tag specified	1	12					
3	10-04-2008 (08:07)	1	8732	construction	3	22					
13	21-08-2009 (09:59)	8	7010	trunk	3	29					
14	01-09-2009 (12:59)	9	35560	construction	4	29					
15	06-09-2009 (12:51)	9	7010	trunk	4	29					
16	09-09-2009 (18:49)	10	19889	construction	5	29					
18	13-10-2009 (23:00)	10	7010	trunk	4	29					
19	14-10-2009 (21:53)	10	19889	construction	34	12-11-2009 (18:34)	11	19889	construction	5	29
21	17-10-2009 (16:20)	10	7010	trunk	35	13-11-2009 (02:13)	11	7010	trunk	5	29
22	17-10-2009 (23:03)	10	24748	construction	37	13-11-2009 (14:17)	11	19889	construction	5	29
23	04-11-2009 (01:05)	10	7010	trunk	38	14-11-2009 (00:13)	11	7010	trunk	4	29
24	05-11-2009 (08:44)	10	20510	construction	39	14-11-2009 (17:13)	11	19889	construction	5	29
25	07-11-2009 (01:49)	10	7010	trunk	40	14-11-2009 (20:38)	11	7010	trunk	5	29
26	08-11-2009 (11:53)	11	149097	construction	43	23-11-2009 (11:29)	11	87090	construction	4	3
27	08-11-2009 (11:58)	11	7010	trunk	44	23-11-2009 (11:43)	11	7010	trunk	4	3
28	08-11-2009 (20:24)	11	149097	construction	45	23-11-2009 (11:52)	11	87090	construction	4	3
29	08-11-2009 (22:47)	11	7010	trunk	46	23-11-2009 (11:56)	11	7010	trunk_link	4	3
30	09-11-2009 (11:54)	11	20510	construction	47	23-11-2009 (12:02)	11	87090	construction	4	3
31	09-11-2009 (20:26)	11	7010	trunk	48	23-11-2009 (12:06)	11	7010	trunk	4	3
32	10-11-2009 (21:35)	11	19889	construction	49	23-11-2009 (12:08)	11	87090	construction	4	3
33	11-11-2009 (00:22)	11	7010	trunk	50	25-11-2009 (14:45)	11	7010	trunk	4	3
					51	25-11-2009 (14:57)	11	87090	construction	4	3
					52	27-11-2009 (01:33)	11	7010	trunk_link	4	3
					53	02-12-2009 (13:54)	12	204176	construction	3	3
					54	07-12-2009 (23:52)	12	7010	trunk_link	3	3
					55	08-12-2009 (01:54)	12	204176	construction	3	3
					56	20-12-2009 (20:38)	13	210596	trunk	3	3
					57	20-12-2009 (22:46)	14	206986	construction	3	3
					58	24-07-2010 (09:08)	14	20510	trunk	2	3
					60 (Final)	16-02-2011 (19:24)	16	145231	trunk	2	3

Watch for user **7010**

Who is right/wrong?
Interpretation problems....

With Prof. Giles Foody - University of Nottingham

8 Users
Say "forest"



OSM_ID	USER_ID	Version	Landuse
osm.org	4802	1	forest
10974299	37949	5	forest
10974299	78442	6	forest
10974299	35119	7	forest
10974299	35119	8	forest
10974299	35119	9	forest
10974299	45347	10	forest
10974299	45347	11	forest
10974299	45347	12	forest
10974299	54806	13	forest
10974299	45263	14	forest
10974299	45263	15	forest
10974299	45263	16	forest
10974299	45263	17	forest
10974299	45263	18	forest
10974299	268988	19	forest
10974299	268988	20	forest
10974299	268988	21	forest
10974299	45263	22	forest
10974299	45263	23	forest

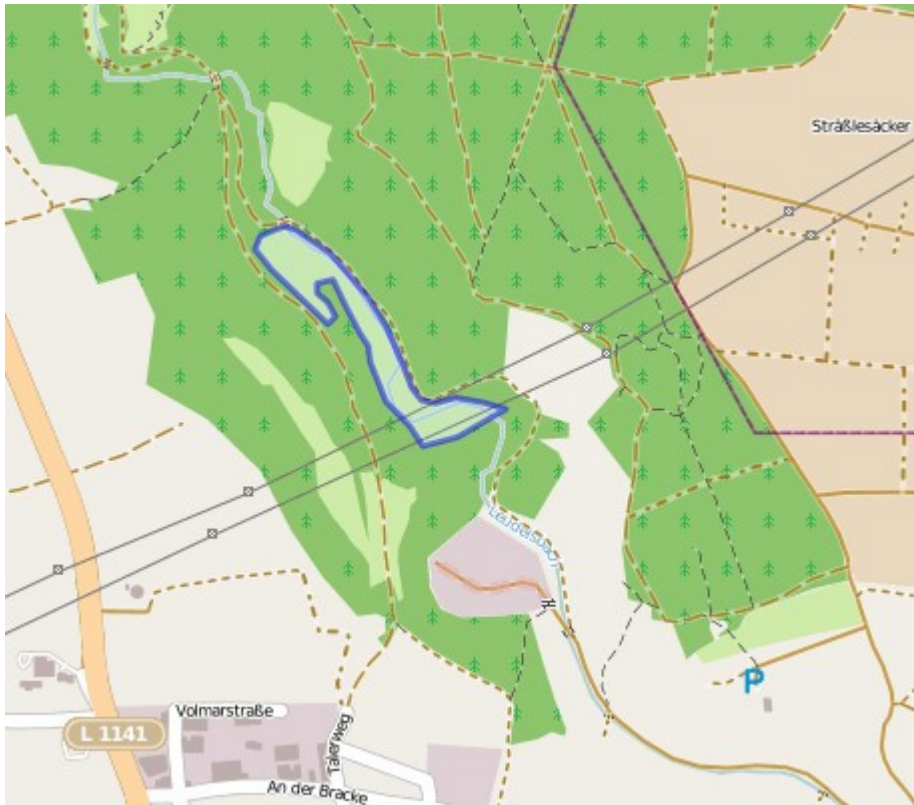
**German/Austrian Border
10974299 23 Versions**

**Just 2 weeks ago – landuse changed to
MEADOW**

Example 2: “Almost a consensus”



10 users say Forest
1 user says “meadow”



North of Stuttgart, Germany
103 Versions



Example 3: Disagreements



USER_ID	VERSION	LANDUSE
8748	1	military
8748	6	industrial
8748	7	military
85609	20	military
70260	21	military
8748	22	military
8748	23	wood
36809	24	wood

South of Munich, Germany
23880693 24 versions

With Prof. Jackson, Dr. J. Morely

- Analysis of the history of high edit, “slow refresh” features in VGI (OSM)
- *Current trend is: compare “current version” VGI with Mapping Agency data*
- BEFORE comparison/conflation with NMA data
- What this indicates about the crowd, their core interests, disputes, very high resolution but local concerns (ie environmental issues)
- As an update intelligence?

Open Source Software and Open Data allows “issues” to disappear

- We can successfully channel our research energy and resources into: solving problems, understanding location-related processes
- Communicate with others (proprietary and non-proprietary) in an interoperable way
- No wasted time/resources for solving infrastructure problems – thanks to Open Standards and Open Interfaces!

THANK YOU!

Collaborations/suggestions welcome:
email: peter.mooney@nuim.ie