



URBAN GEOMatics for Bulk Information Generation, Data assessment and Technology Awareness

M.A. Brovelli, P. Boccardo, G. Bordogna, M. Crespi,
R. Lanari, M. Munafò, F. Pirotti



PRIN PROJECT: *URBAN GEOMatics for Bulk Information Generation, Data Assessment and Technology Awareness*



MINISTERO DELL'ISTRUZIONE DELL'UNIVERSITA' E DELLA RICERCA



Overview

“Nowadays about the 54 % of world population lives in urban areas and this percentage is expected to increase up to 66 % by 2050.” [1]

How to manage this social and cultural change in a sustainable way?

- ▶ 2 use cases:
 - ▶ Intelligent Transport System
 - ▶ Soil Consumption
- ▶ 5 case studies: Milan, Turin, Rome, Naples and Padua
- ▶ 3 years of Project

[1] <http://www.un.org/en/development/desa/news/population/world-urbanization-prospects-2014.html>

Intelligent Transport Systems

- ▶ **ITSs** (Intelligent Transport Systems) are control and information systems that use integrated communications and data processing technologies for the purposes of:
 - **improving the mobility** of people and goods
 - **increasing safety**, reducing traffic congestion and managing incidents effectively
 - **meeting transport policy goals and objectives** - such as demand management or public transport priority measures

Intelligent Transport Systems: an example

► Traffic and road management

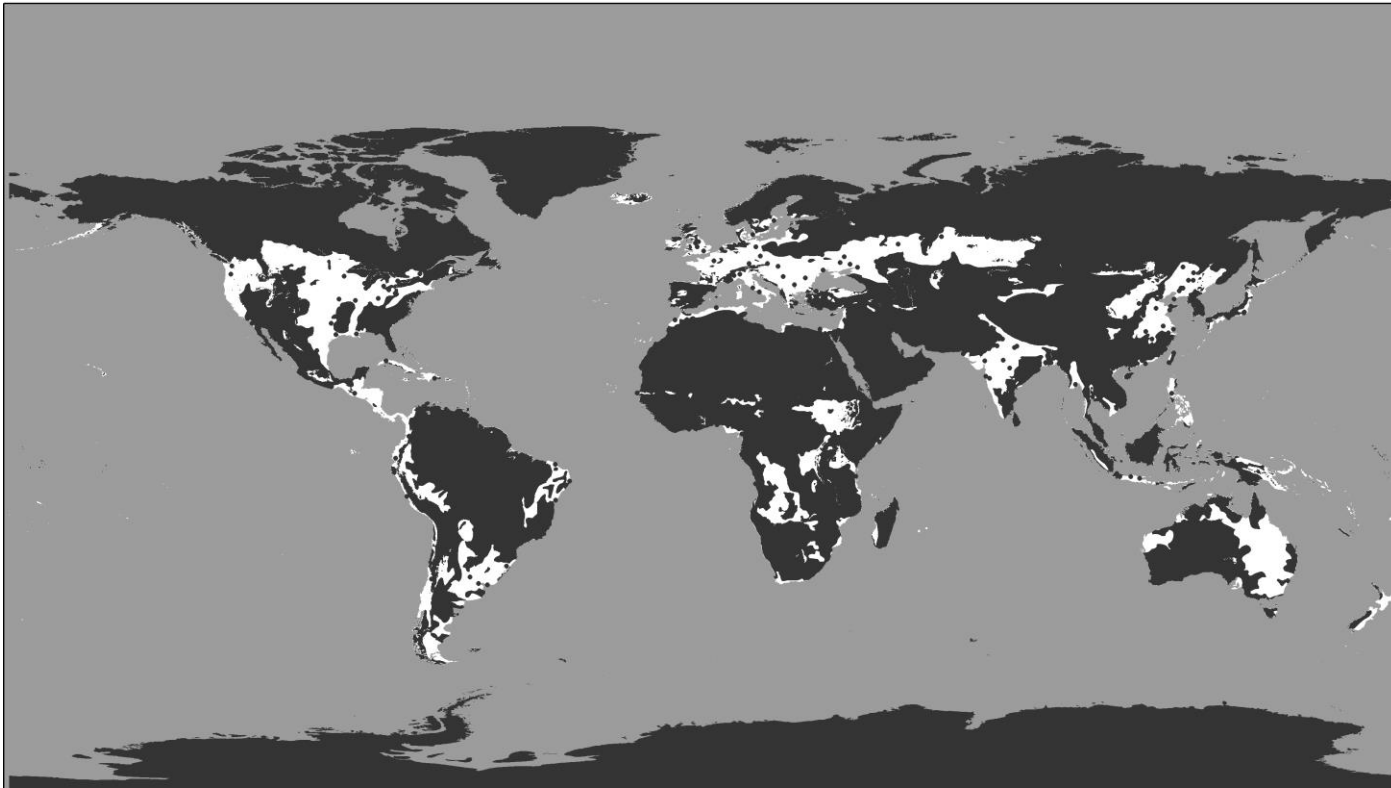
Traffic Operation Centre in **Turin** metropolitan area:

- **330** (out of 600) controlled intersections to regulate the cycle time of a traffic light
- over **1,500** inductive loops for real-time traffic flow measurement
- **36** above-ground sensors
- **71** cameras on 23 intersections
- Integration of FCD (Floating Car Data)



Soil Consumption

- The increase of settlement areas and artificial land use will result, depending on local circumstances, in actual **soil consumption**.



13 to 18% of earth lands is covered with naturally fertile soils

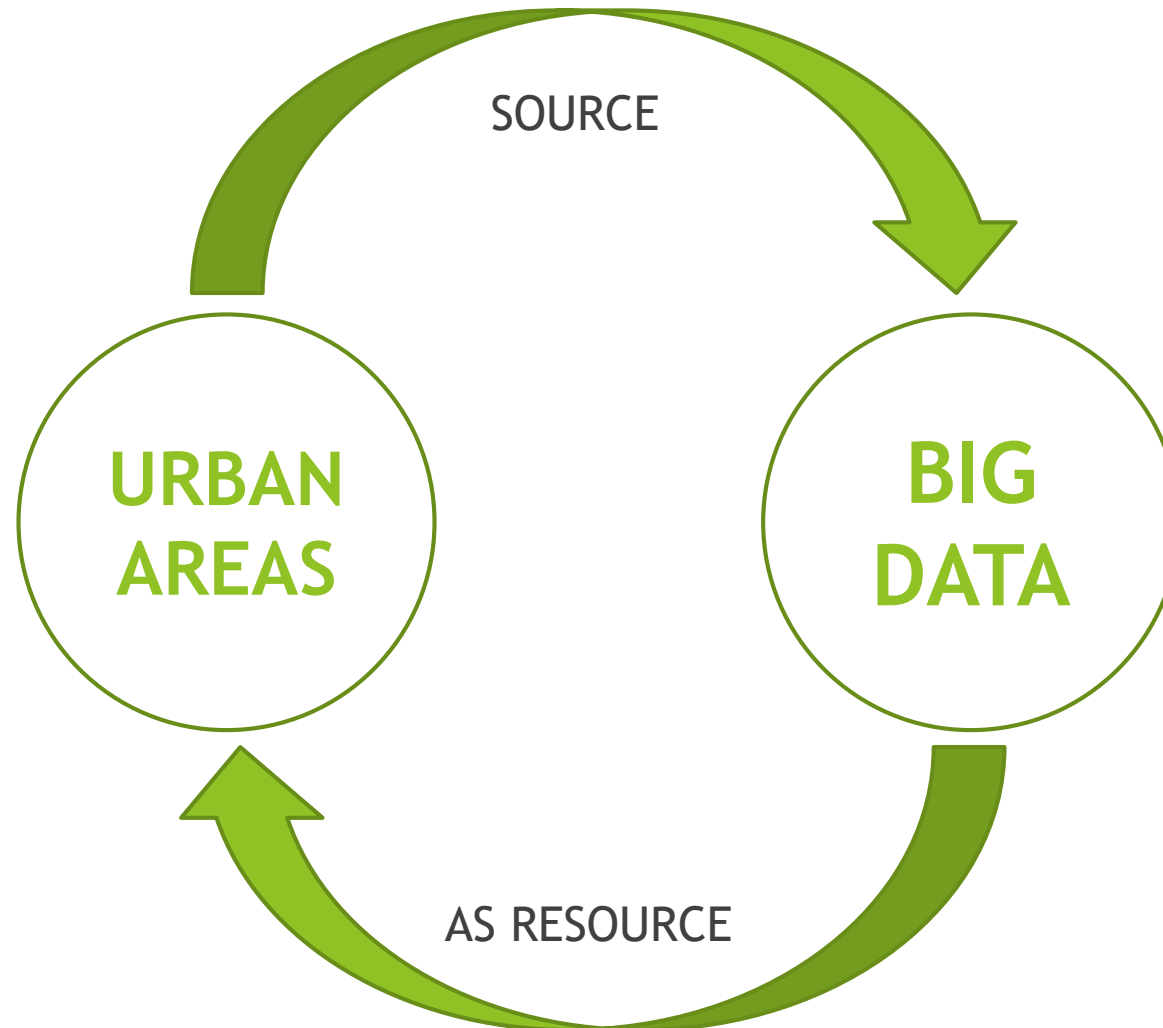
Soil Consumption

- ▶ At Regional level (2012):
 - ▶ Piedmont (Turin) 56,6 %
 - ▶ Lombardy (Milan) 58,6 %
 - ▶ Veneto (Padua) 60,3 %
 - ▶ Lazio (Rome) 56,4 %
 - ▶ Campania (Naples) 63,7 %

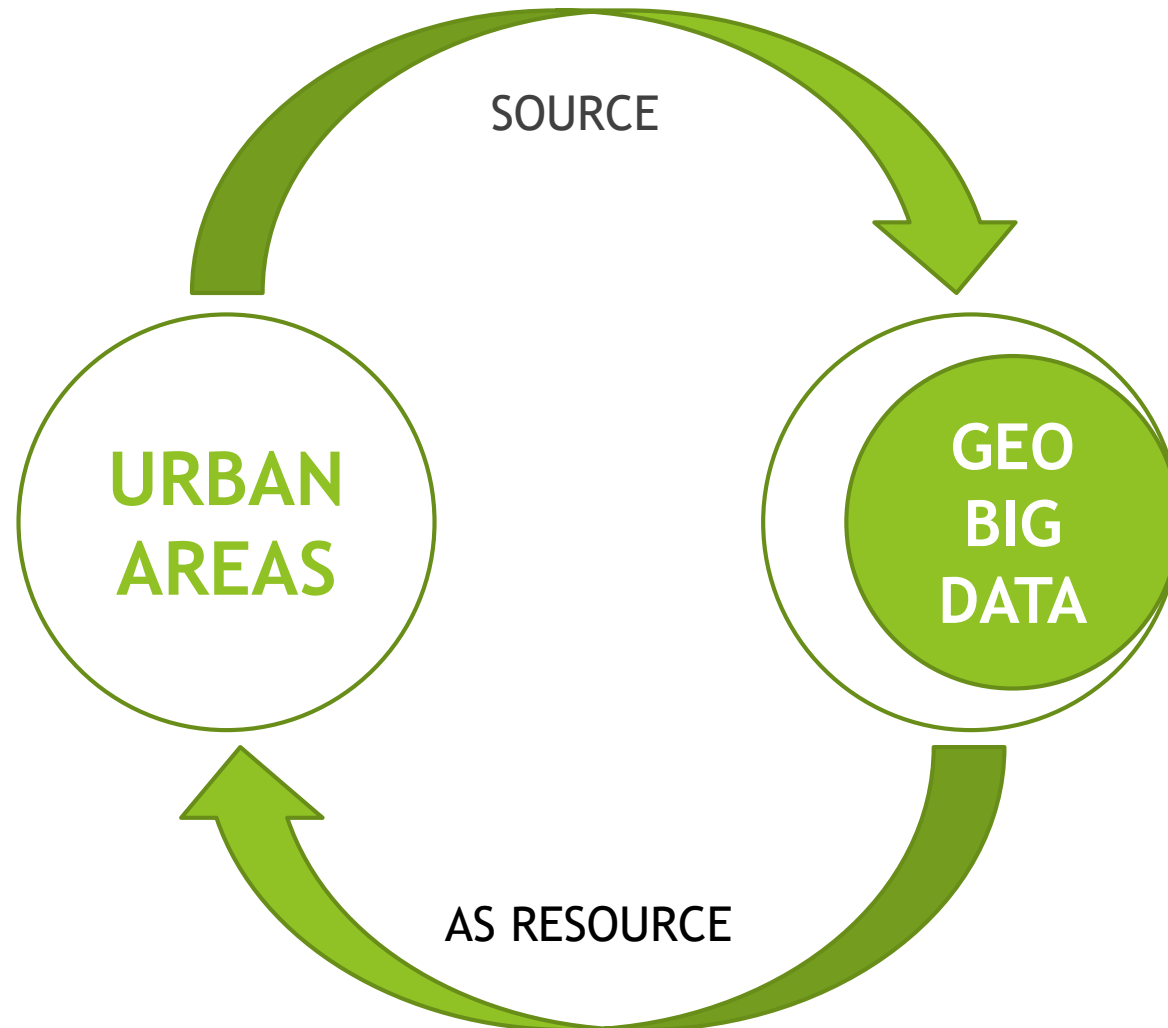
Common aspects

- ▶ The context (urbanscape: the «almost» static model of the city)
- ▶ The need of managing GEO BIG DATA
 - ▶ Real time geo big data in case of IIT
 - ▶ Multispectral/Multiplatform/Multiresolution imagery in case of Soil Consumption

The challenge

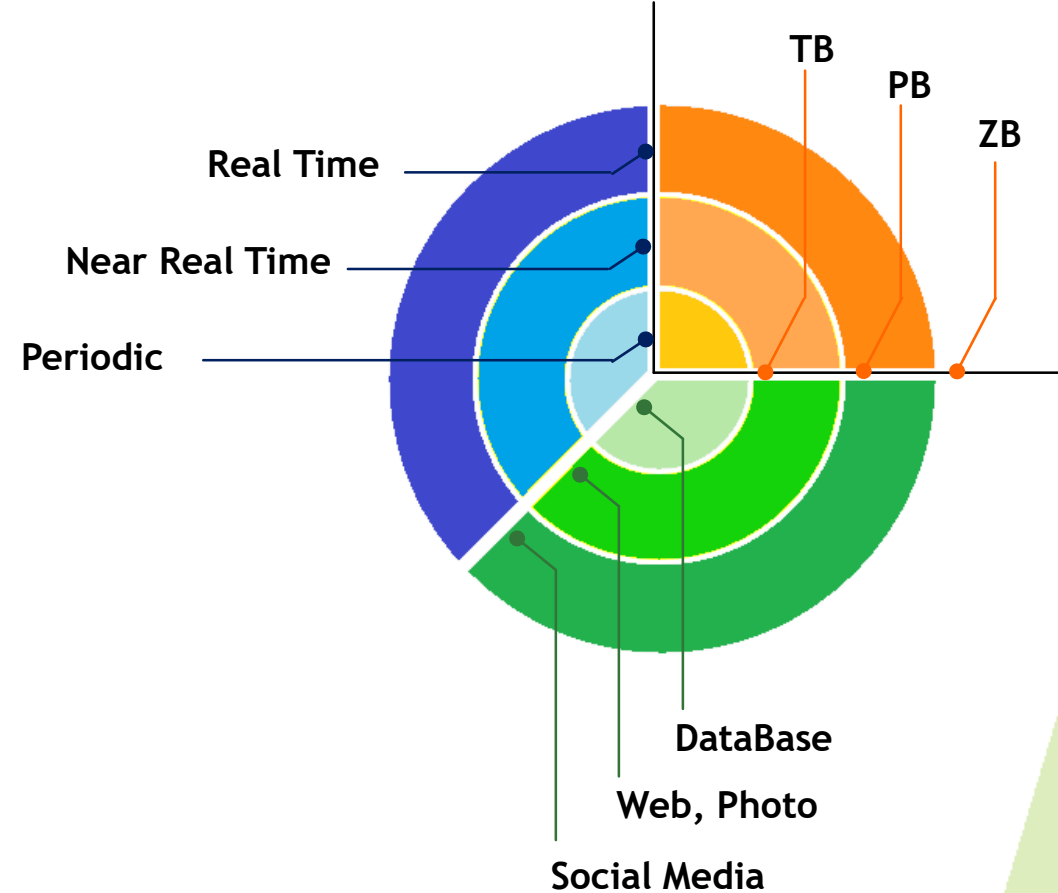


Project Overview



(Geo) Big Data

- ▶ “Big data is data that exceeds the processing capacity of conventional database systems. The data is too big, moves too fast, or doesn’t fit the structures of your database architectures. To gain value from this data, you must choose an alternative way to process it.” [2]
- ▶ **Volume**, **Velocity**, **Variety**,
Variability, **Veracity**,
Visualization, **Value**



[2] <https://www.oreilly.com/ideas/what-is-big-data>

Geo Big Data - Urbanscape Data

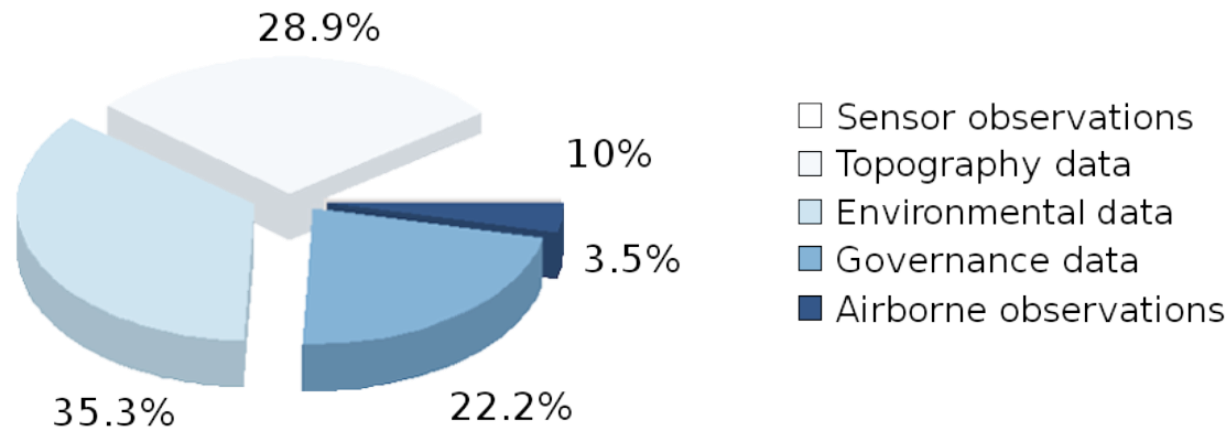
- ▶ Digital Terrain Model, Digital Surface Model
 - ▶ LiDAR data
- ▶ Geo Databases
- ▶ Static Imagery



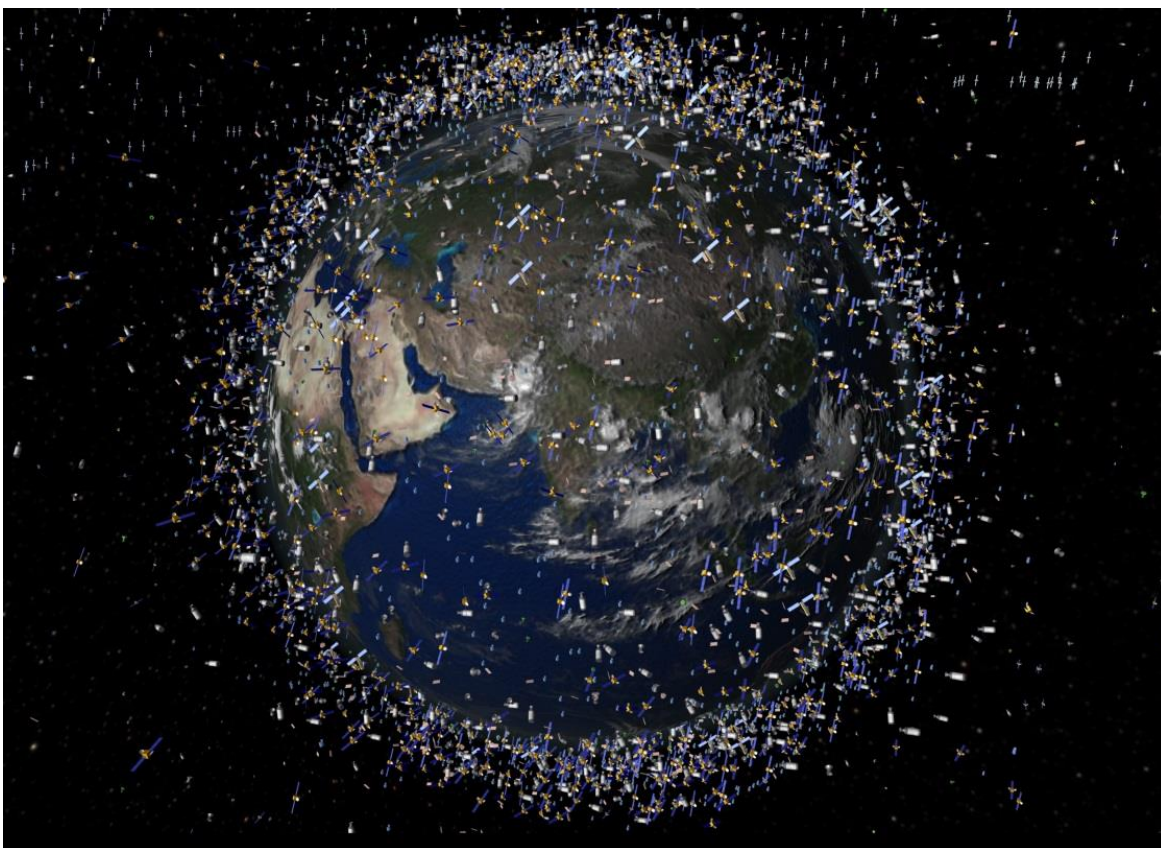
Authoritative Datasets

Authoritative datasets: an example

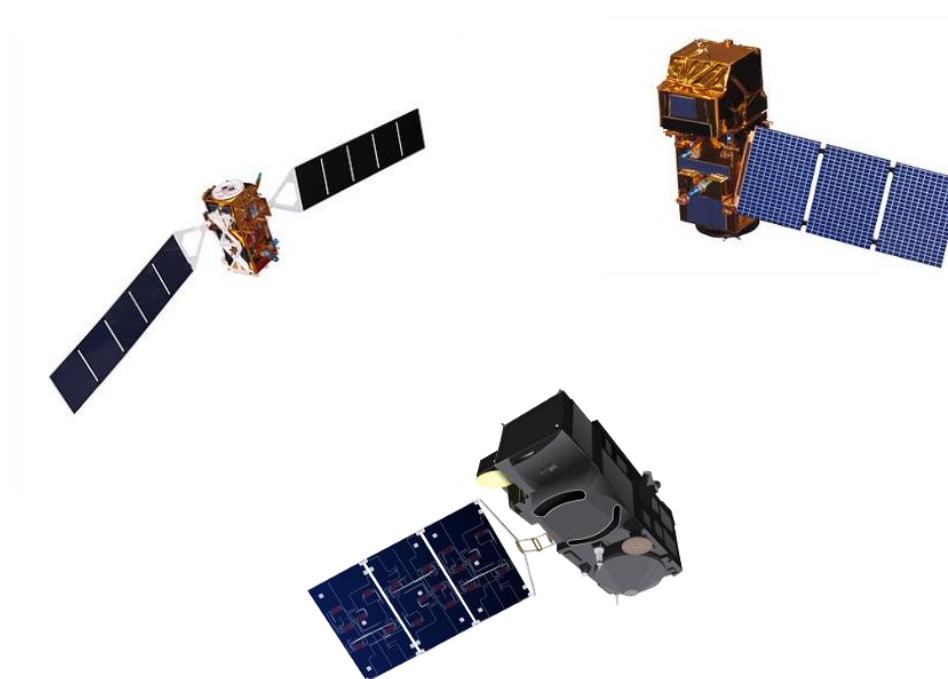
- For **Milan** an extensive collection of open geodata exist, published by local, regional, national, European and extra-European institution (1061 openly available geospatial datasets)



Geo Big Data - Satellites

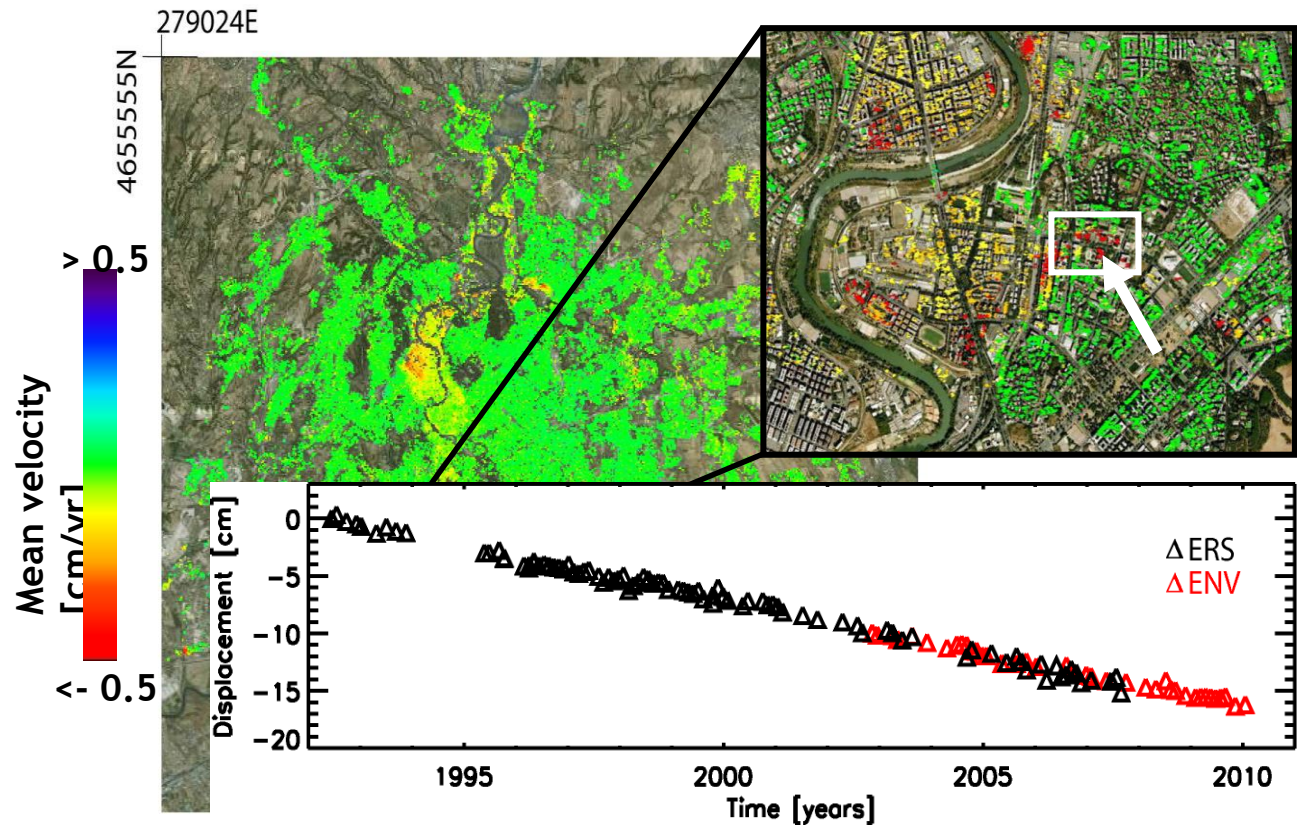


The Sentinels



Geo Big Data

► InSAR analysis for studying urban area deformations



131 ERS/ENVISAT images (1992 - 2010)

Geo Big Data - Satellites

PLANET LAUNCHES SATELLITE CONSTELLATION TO IMAGE THE WHOLE PLANET DAILY

NEWS

Robbie Schingler | February 14, 2017

88 - Flock 3p - isro - launch - mission 1 - pslv

February 14, 2017, 19:58 PST

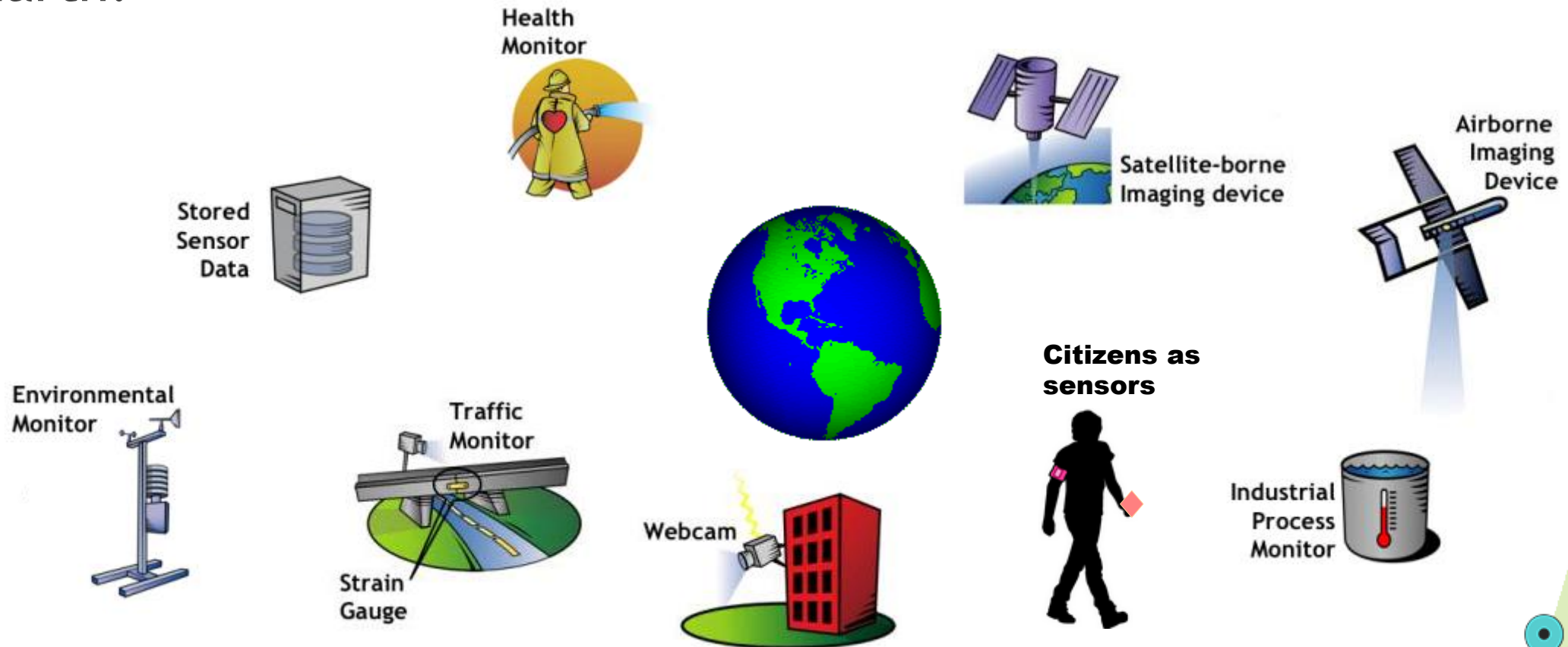
Today Planet successfully launched 88 Dove satellites to orbit—the largest satellite constellation ever to reach orbit. This is not just a launch (or a world record, for that matter!); for our team this is a major milestone. With these satellites in orbit, **Planet will reach its Mission 1: the ability to image all of Earth's landmass every day.**

<https://www.planet.com/pulse/planet-launches-satellite-constellation-to-image-the-whole-planet-daily/>



Geo Big Data - Sensors

Sensors are everywhere and they are the electronic skin of the Earth.

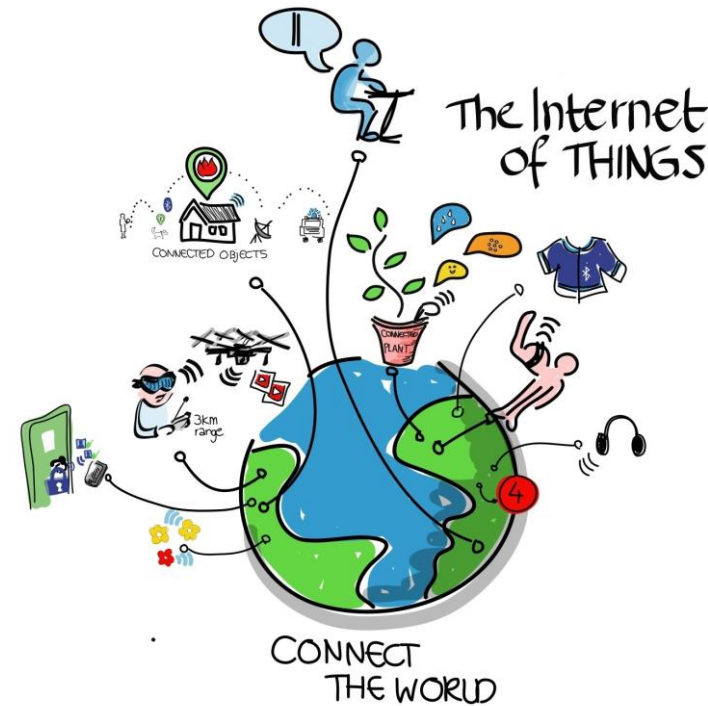


Geo Big Data - Internet of Things (IoT)

By 2020 there will be 50 billions of connected devices.[5]

The IoT is a possible evolution of the use of the Internet.

The objects become recognizable thanks to the ability to communicate data about themselves and to access information provided by others.



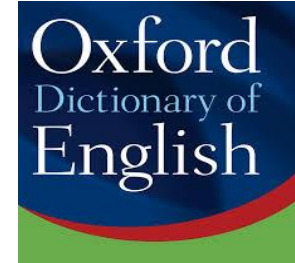
[5] http://www.cisco.com/c/dam/en_us/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf



Geo Big Data - Citizen Science

- Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions.

It is a fairly new name but an old practice



June 2014

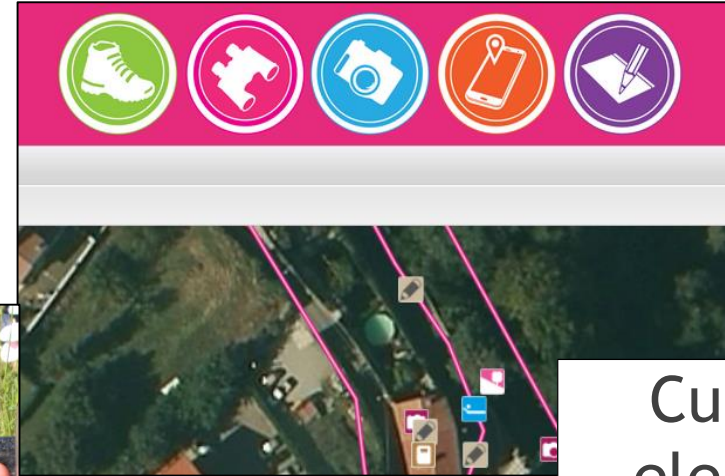


Citizen cyberscience: use of computers, GPS receivers and mobile phones → **participatory sensing**: applications centered on mobile phones capabilities

Geo Big Data - Participatory Sensing



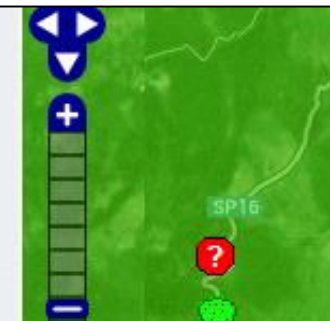
Architectural barriers



Cultural elements



Street furniture



Biodiversity

Geo Big Data - Participatory Sensing

► PSAB: Participatory Sensing App Builder

- It allows users to create apps for easily collect various data, even if they are not programmers
- It supports data collection on the Web and immediate aggregated data visualization
- User can change data format that they want to collect by using xls file.



부산대학교
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(Prof. Ki-Joune Li)

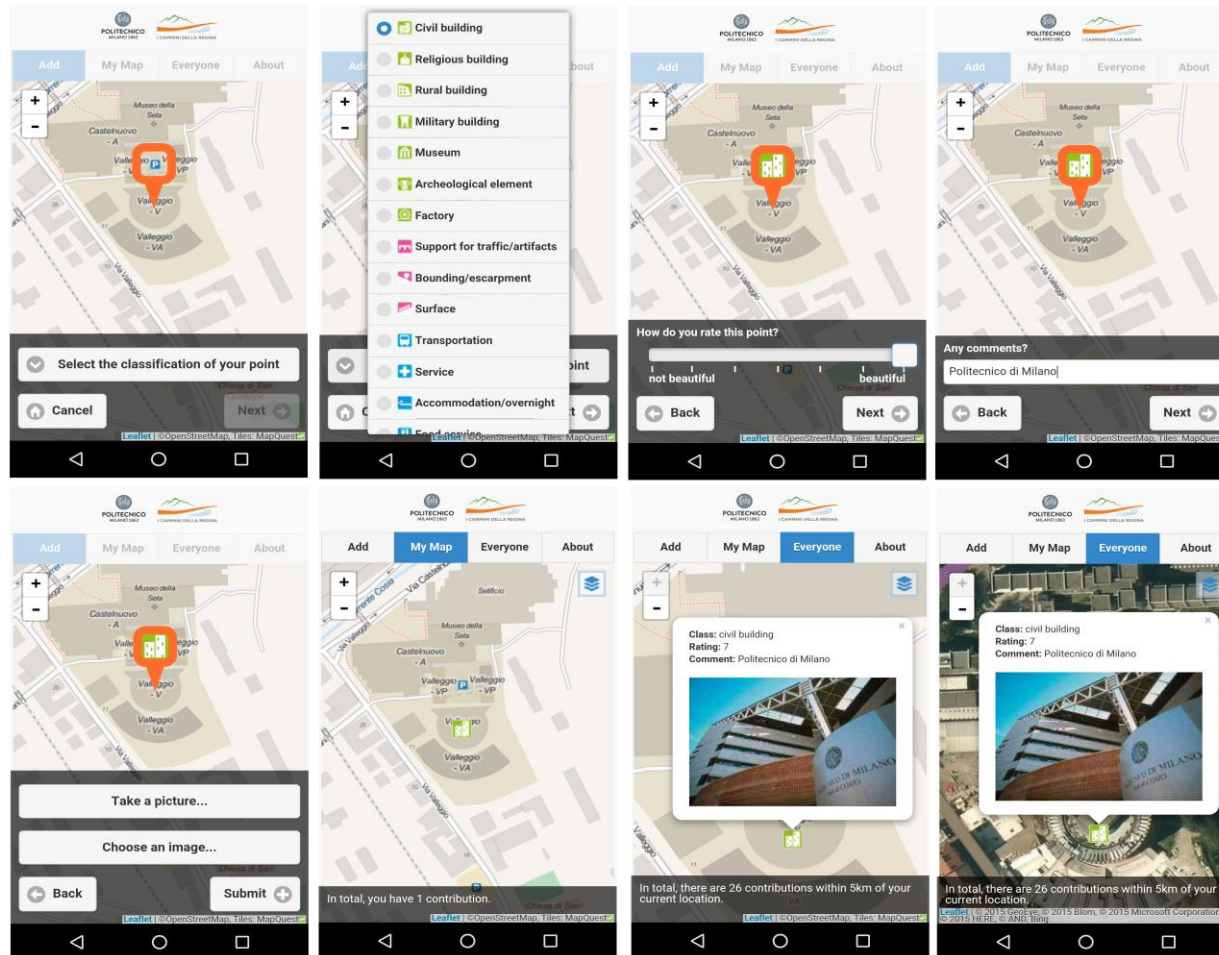


POLITECNICO MILANO 1863



► PSAB: an example

► Available as WebApp: <http://viaregina3.como.polimi.it/app/>



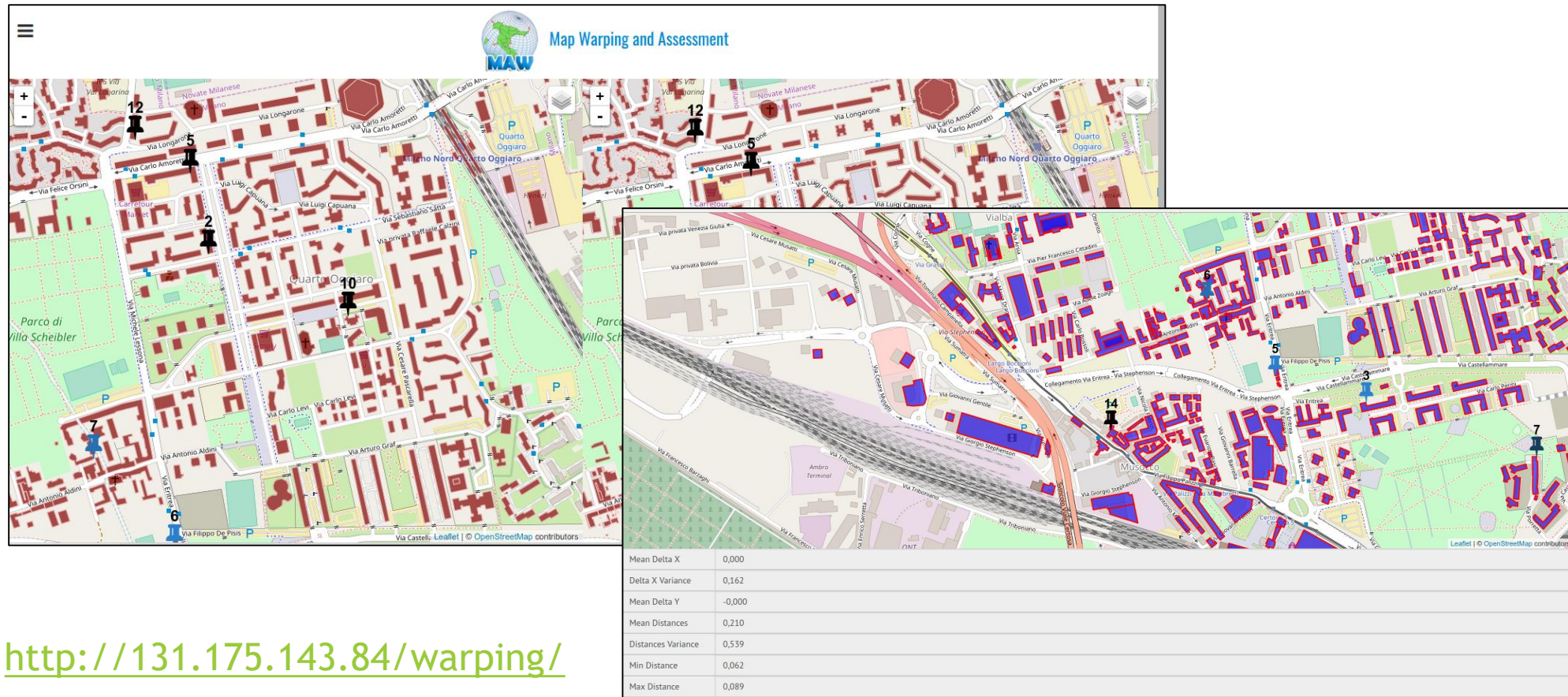
Geo Big Data - VGI

- ▶ OpenStreetMap (OSM) is the most popular project of Volunteered Geographic Information (VGI). Born in 2004 for streets, then evolved into the largest, most diverse, most complete & most up-to-date geospatial database of the world.
- ▶ increasing number of contributors (currently over 3M)
- ▶ database available under an open license (ODbL)
- ▶ increasing interest from the academic community



Geo Big Data - VGI

► MWA: Map Assessment and Warping



<http://131.175.143.84/warping/>

Geo Big Data - Geocrowdsourcing

internet live stats

live

1 second

- 7,531 Tweets sent in 1 second
- 769 Instagram photos uploaded in 1 second
- 1,215 Tumblr posts in 1 second
- 2,487 Skype calls in 1 second
- 42,520 GB of Internet traffic in 1 second
- 59,059 Google searches in 1 second
- 68,365 YouTube videos viewed in 1 second
- 2,569,258 Emails sent in 1 second

Retrieved March 3, 2017 from <http://www.internetlivestats.com/one-second>

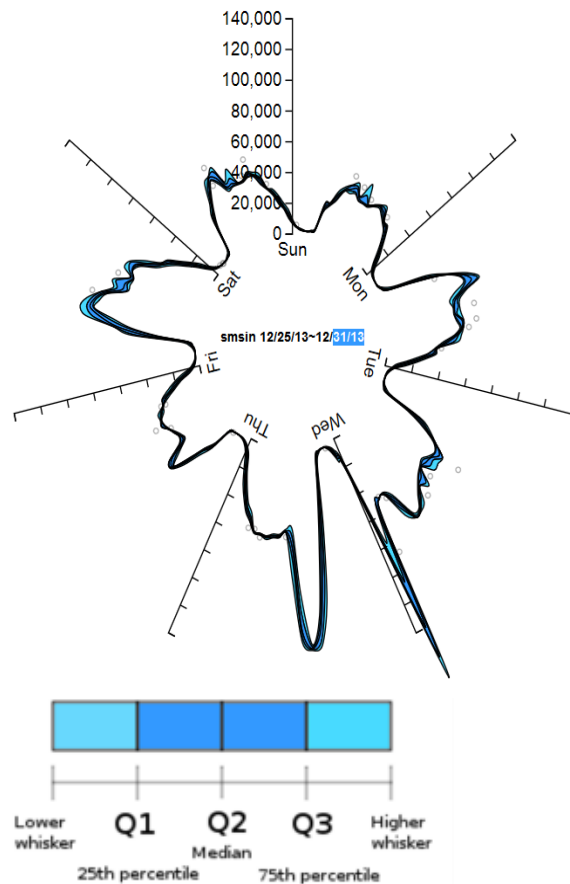


Geo Big Data - Geocrowdsourcing

- ▶ Example: Telecommunication data in **Milan**
 - ▶ Two months of data, with a temporal step of 10 minutes
 - ▶ Grid of 100 x 100 cells with size = 235 m
 - ▶ Received SMS texts, sent SMS texts
 - ▶ Received calls, sent calls
 - ▶ Internet connections
 - ▶ Geolocalised tweets

Geo Big Data - Telecommunication Data

- Generic data acquired by network cells once in connection with portable devices

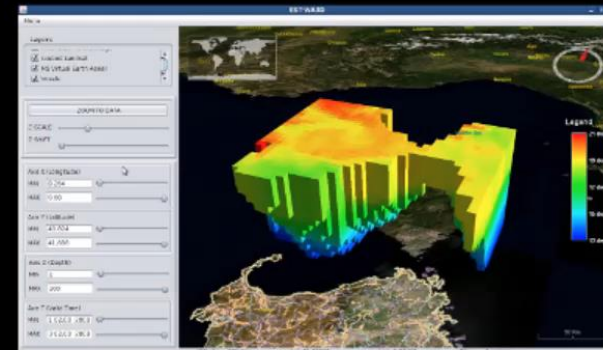




Visualising Social Media Data with EST-WA

a doxel-based tool for web visualization of environmental variables

<http://geomatica.como.polimi.it/elab/est-wa/>



OpenCitySmart

- ▶ Based on Open Source
- ▶ Viewer: Virtual Globe Web WorldWind (NASA/ESA)
- ▶ OpenStreetMaps
3D buildings + topography
- ▶ Collaborative effort



GitHub

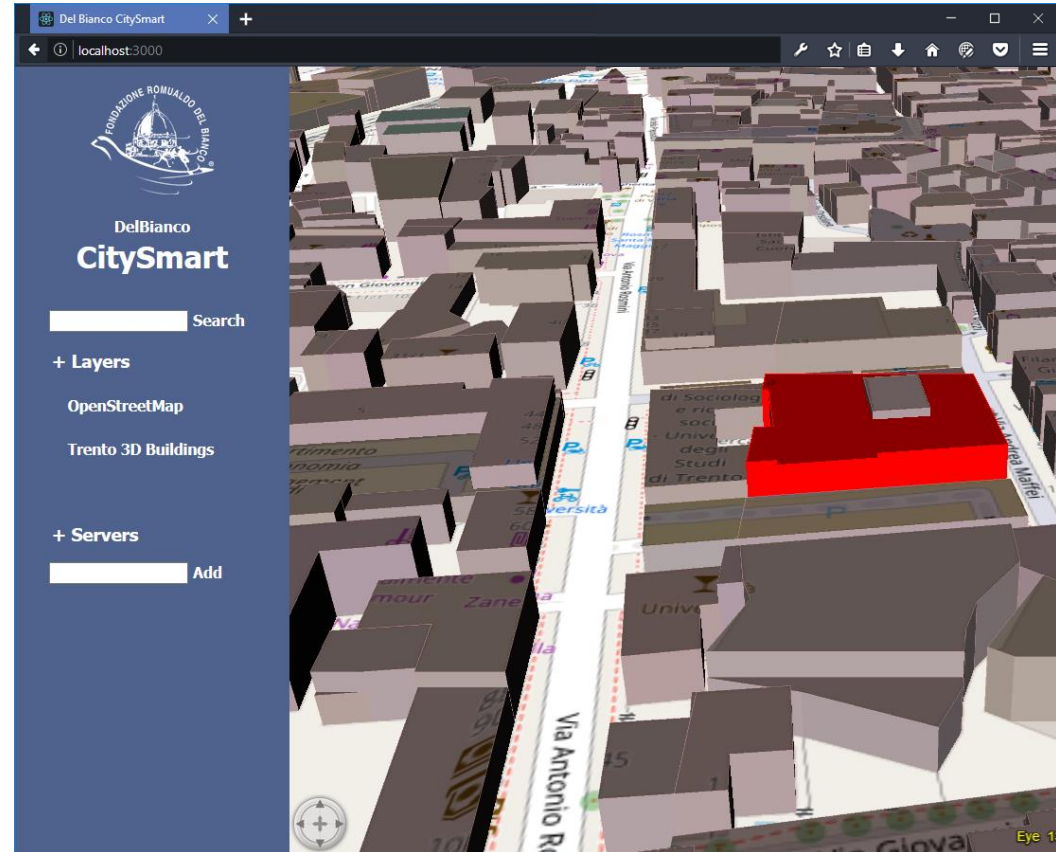
▶ <https://github.com/NASAWorldWindResearch/CitySmart>



docker

▶ <https://hub.docker.com/r/beakman/ubuntu-opengeo/>

- ▶ Thanks to: Patrick Hogan, Miguel Del Castillo Hoffman and Gabriel Lopes



Thanks for your attention!

Questions?

For contacts:
maria.brovelli@polimi.it

