# Km4City Status, Gennaio 2016

## http://www.disit.org/km4city
## http://www.disit.org/smartcitybigdata2015

### Distributed Data Intelligence and Technologies Lab
### Distributed Systems and Internet Technologies Lab

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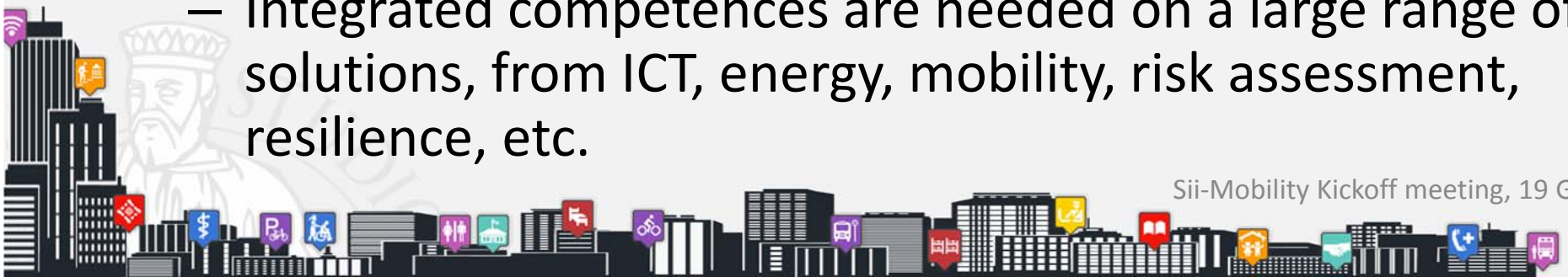
# Km4City
# Knowledge model
# for the city

# The Km4City Challenge

- **Huge amount of data** are produced from: Open Data, Linked Data, Real Time sensors, Twitter, WiFi, etc. (**big data: velocity, variety, volume, veracity, …**)
  - Most of them are not semantically interoperable
- A common model is the only solution to provide services to Public Administrations, Citizens, City Operators (mobility, energy, telecom, etc.)
  - None of them may have the global view
  - Cities needs to create a control room with open tools
  - Integrated competences are needed on a large range of solutions, from ICT, energy, mobility, risk assessment, resilience, etc.



# Km4City: Aggregated Data

- produce more results than the simple add.
  - Offering Aggregated data as a service, API
    - Enabling **risk and resilience** assessment
    - Providing integrated services
  - Large companies (as city operators) may have back their data augmented with the data of others stakeholders, plus OD, etc.
  - Reduction of costs to make innovative services, facilitating the work for the SME
  - Exploiting inference, self correction, reasoning
  - reduction of time of adding new data in the integrated environment
  - Increasing city **resilience and smartness**

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DISIT
DISIT Lab, Distributed Data Intelligence and Technologies
Distributed Systems and Internet Technologies
Department of Information Engineering (DINFO)
http://www.disit.dinfo.unifi.it

# Big Data Smart City Architecture







Open Data
Sensors Data
Traffic Control
Energy central
eHealth Agency
.....

Data Ingestion Manager
(static and real time)

Smart City Engine, SCE
Distributed processing
Km4City
Dashboards

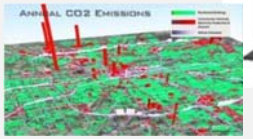
Km4City API
Smart Decision Sup.
Sugg. and Alarms
Process In / Data Export
Linked Open Graph
Service Map

Making Decision
Making Suggestions
Interoperability
Development

Data / info Rendering
Profiled Services
Citizens Formation






Applications

Social Media
Social Vigilance


Peripheral processors
Data Ingesting and mining
Reasoning and Deduction
Data Acting processors

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# Km4City

Transport systems
Mobility, parking

Public Services
Govern, events,

Sensors, IOT
Cameras, ..

Environment,
Water, energy

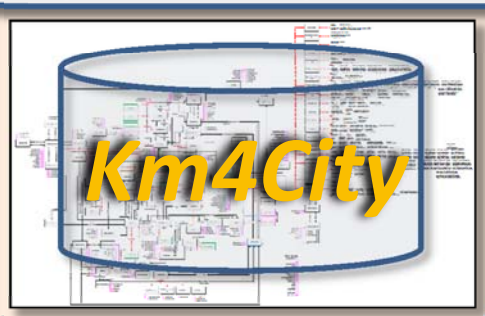
Shops, services,
operators

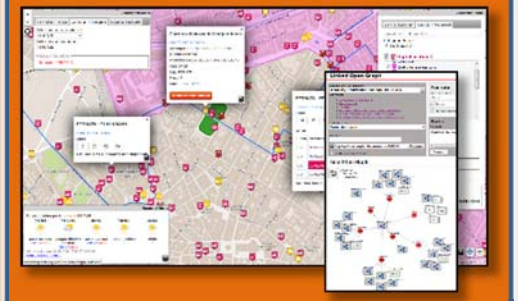
Social Media
WiFi, network

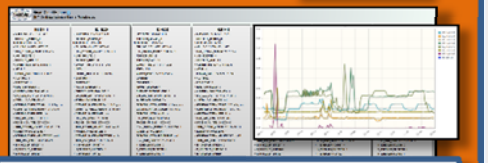
Static, Slow and Real Time data flows

DISCES -- Distributed and parallel architecture on Cloud

## Km4City Smart City Engine

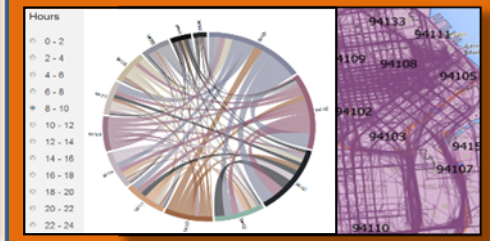




**User Profiling and Suggestions on Demand**

**Flow and Origin Destination Matrix**
Http://www.disit.org/odsf

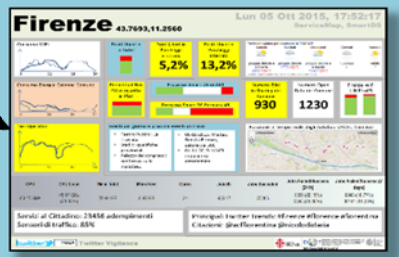



**Km4City Tools for Developers**

Km4City Smart City API

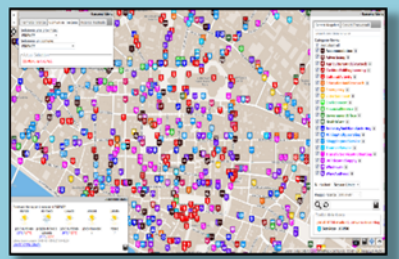
## Tools for Operators

**Smart City Dashboard**
Http://www.disit.org/dash




**Smart Decision Support**
Http://Smartds.disit.org

**Service map browser**
Http://servicemap.disit.org



**Twitter Vigilance**
Http://www.disit.org/tv

## Tools for Final Users

**Mobile e Web Apps**


Http://www.km4city.org

# Firenze

43.7693, 11.2560

Tue 10 Nov @ 12:53:21

ServiceMap, SmartDS

**Wifi operativi** 21

10.7% 89.3%

**SmartDS: via santa marta 3** 21

58.8% 21.3% 20.1%

**Informazioni disponibili** 21

Servizi al Cittadino: 23452

Eventi giornalieri: 29

Open Data disponibili: 143

**Servizi duplic.** 20

19.4%

**Accessi ai servizi singoli (web e mobile)** 22


**Bus attivi** 20

29

**Ataf RT** 20

64.1%

**Parcheggi liberi** 20

0%

**Twitter trends/citazioni**

Principali Twitter [illegible]: Firenze

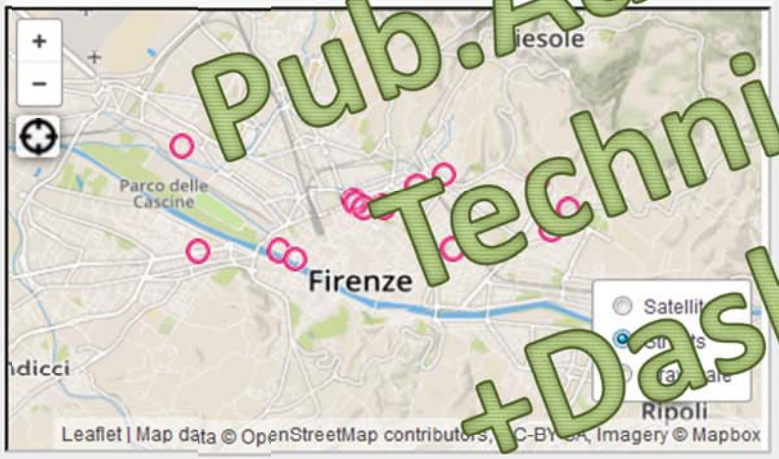
#fi[illegible] #ponteve[illegible]

[illegible]: @comunefi #fiorentina

#ponte[illegible]

**Rilievi wifi** 22


**Posizione in tempo reale degli autobus ATA**




**Previsioni RT** 20

99.9%

**Previsioni meteo del comune di FIRENZE** 299961


**Parcheggi liberi**

66.0%

**Smart City Engine**

| CPU | Memoria totale | Job Eseguiti |
|---|---|---|
| 0.1% | 24034 MB | 954 |

**Query Servicemap** 22


**Stato corse ATAF** 21

Linee: 6 17 4

| in Orario | in Anticipo | in Ritardo |
|---|---|---|
| 60.6% | 17.1% | 22.4% |

**Sensori RT**

99.3%

**Eventi del giorno** 22

- L'arte di Francesco - Capolavori d'arte e terre d'Asia dal XIII al XV secolo
- "The Medici Dynasty Show"
- TOSCANA '900
- Carlo Dolci 1616- 1687

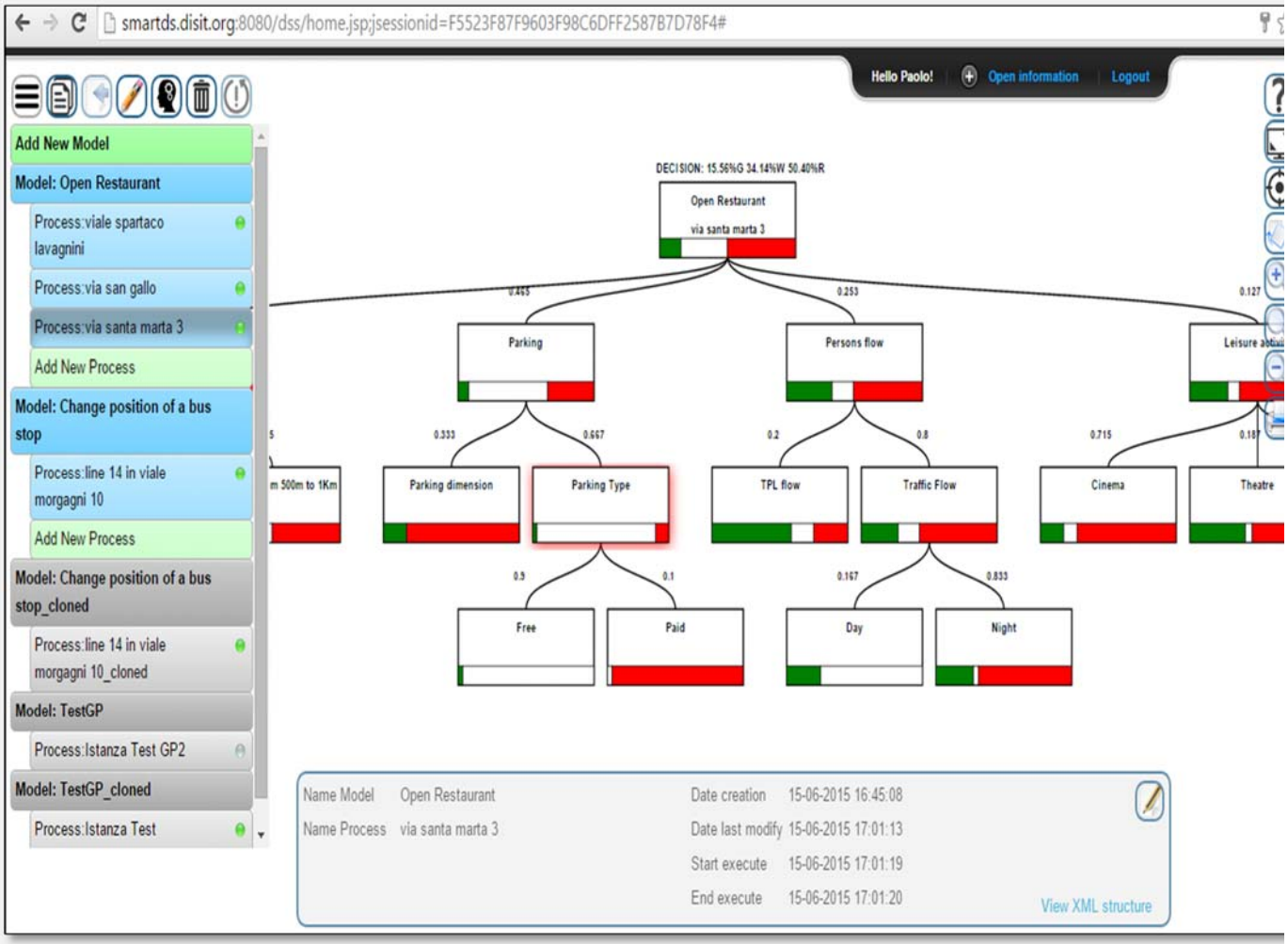
**Query Km4city API** 22

# Smart City Decision Support

- ***Smart Decision Support System*** *based on System Thinking plus*
- Actions to city reaction, resilience, smartness..

**Enforcing**

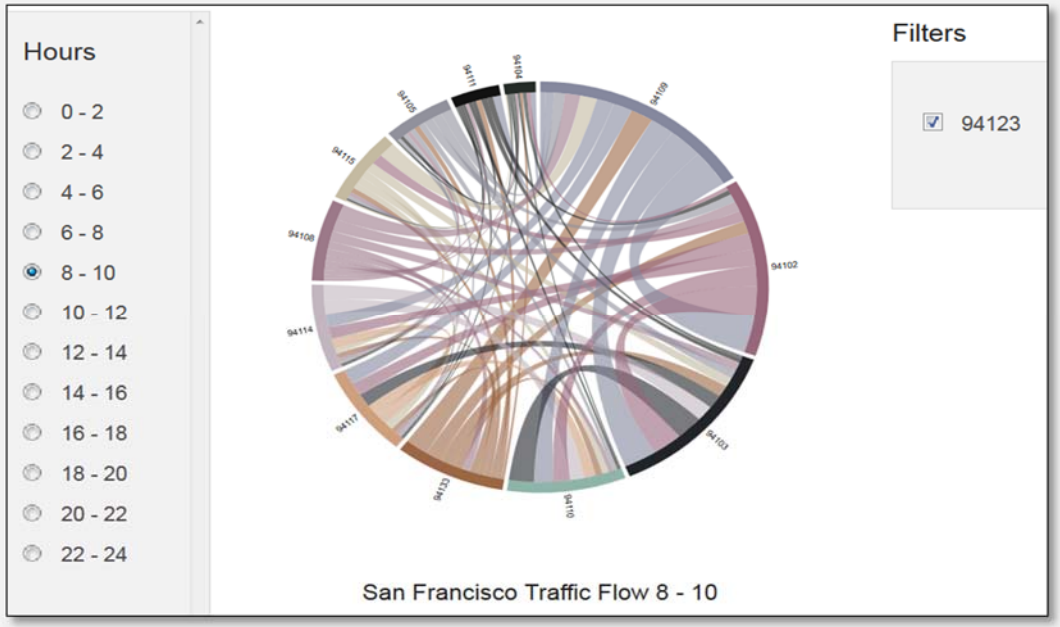
- Mathematical model for propagation of decision confidence..
- Collaborative work…,
- Processes connected to city data: DB, RDF Store, Twitter, etc.
- Production of alerts/alarms
- Data analytics process
- Twitter Processes
- reuse, copy past, …

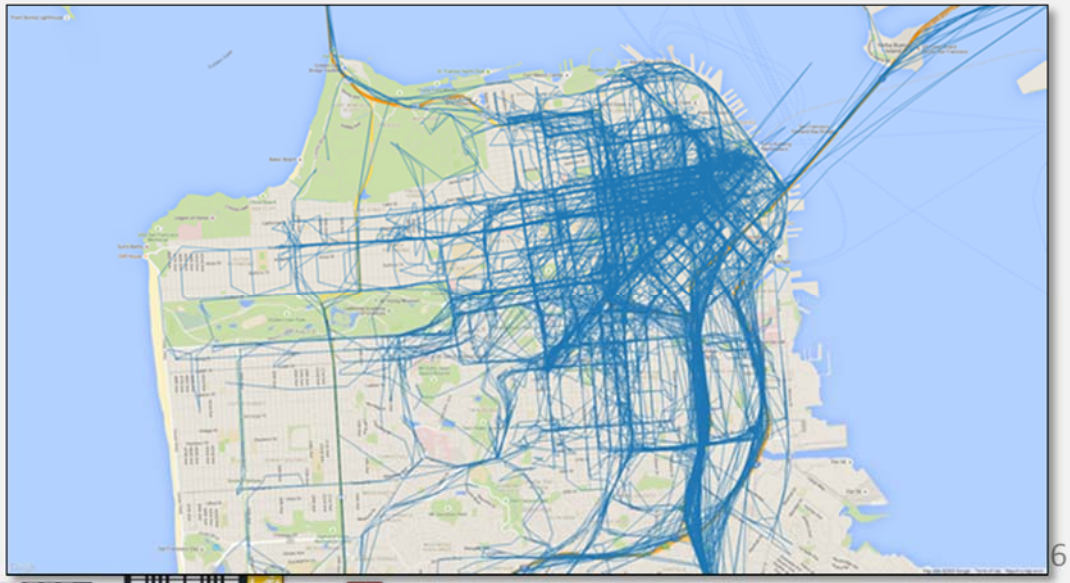


# Traffic and People Flow Assessment

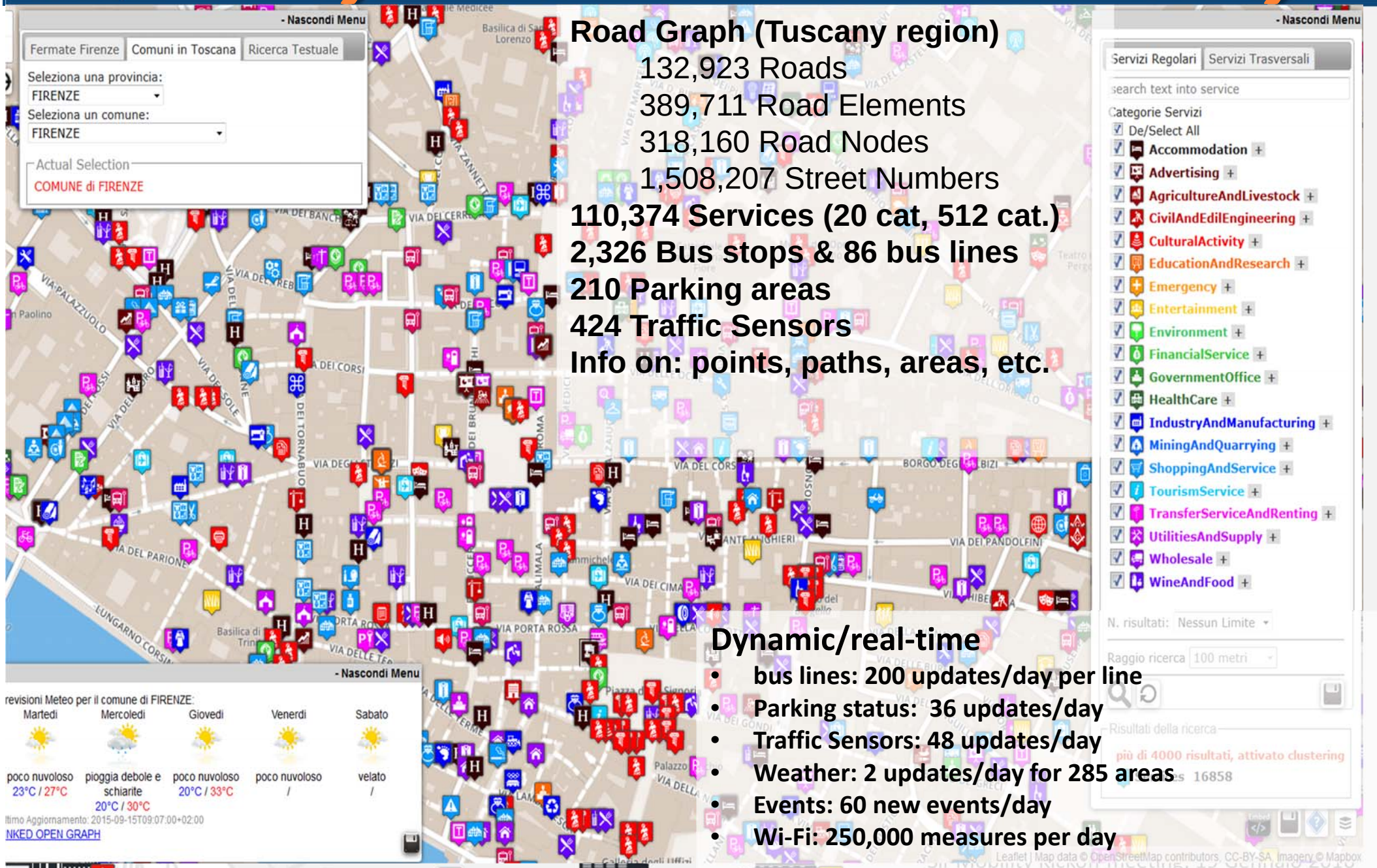
- **Origin Destination Matrix**
  - Specific Sensors, vehicle Kits, mobile App, Wi-Fi Access Points, etc.
- **Assess people and traffic flows to**
  - improve services
  - predict critical conditions on Crit. Infra.
  - take real time decisions and sending messages in push to population
  - Increase city resilience
  - optimize traffic flow
  - take decision of routing

http://www.disit.org/6694



# Km4City on Firenze & Tuscany




**Road Graph (Tuscany region)**
- 132,923 Roads
- 389,711 Road Elements
- 318,160 Road Nodes
- 1,508,207 Street Numbers

**110,374 Services (20 cat, 512 cat.)**

**2,326 Bus stops & 86 bus lines**

**210 Parking areas**

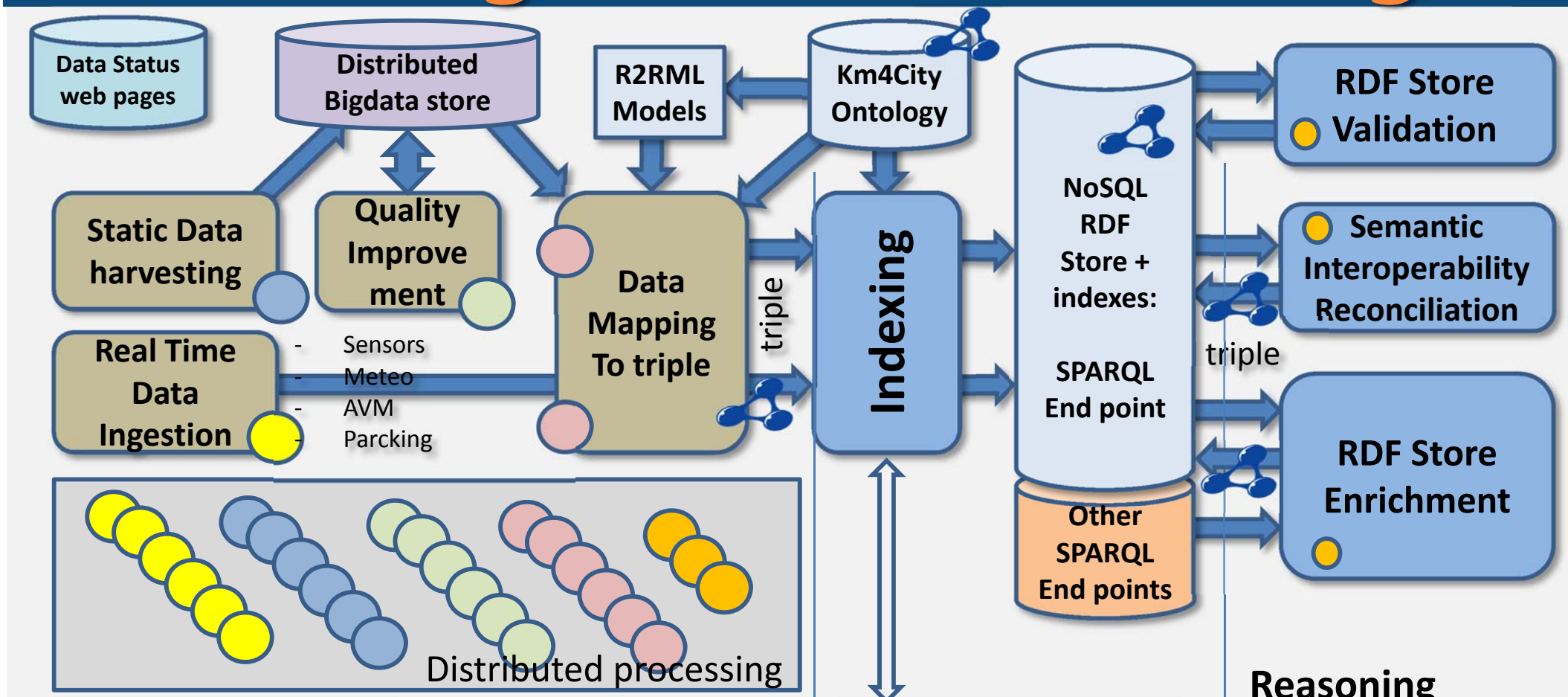
**424 Traffic Sensors**

**Info on: points, paths, areas, etc.**

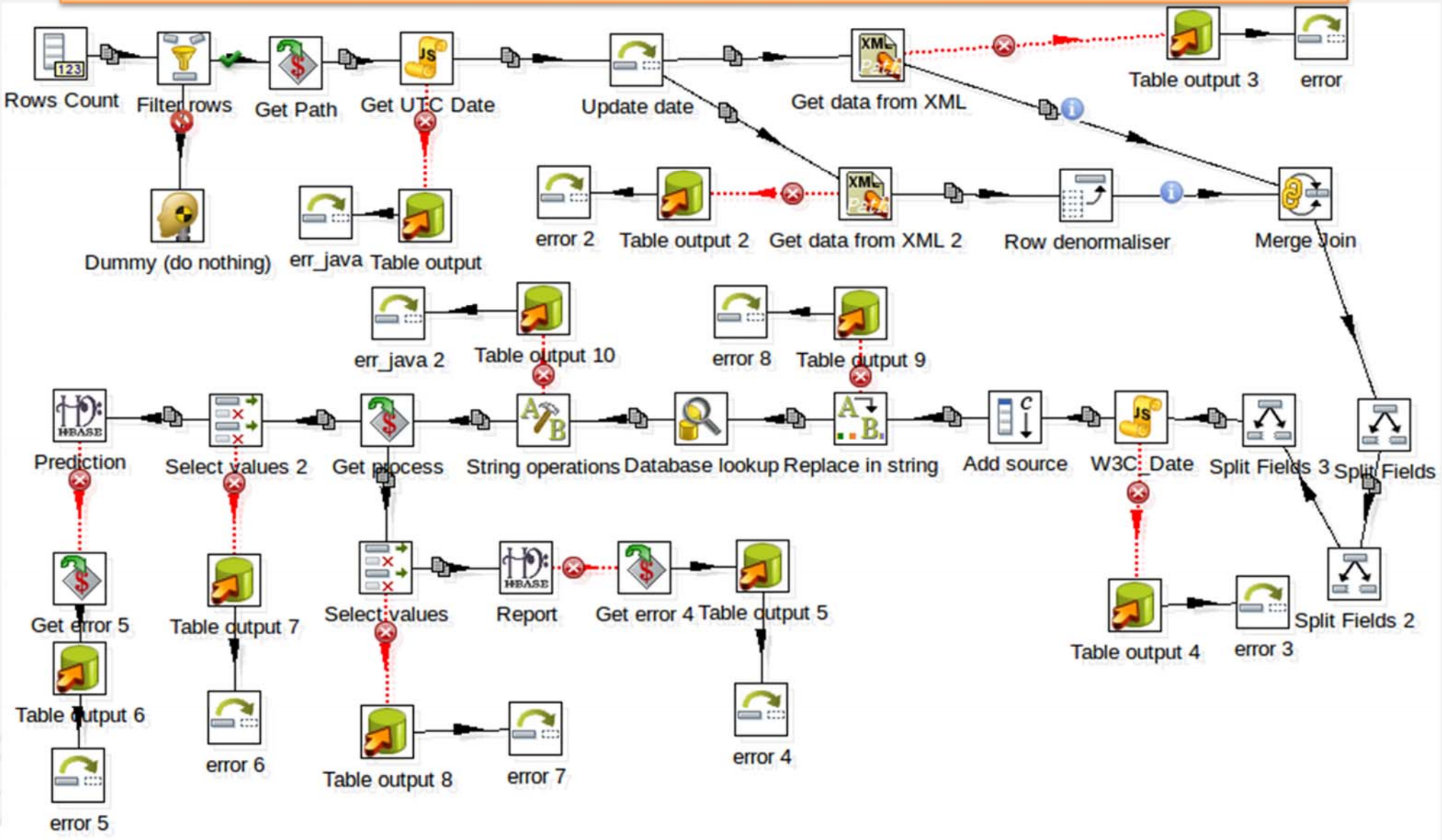
## Dynamic/real-time

- **bus lines: 200 updates/day per line**
- **Parking status: 36 updates/day**
- **Traffic Sensors: 48 updates/day**
- **Weather: 2 updates/day for 285 areas**
- **Events: 60 new events/day**
- **Wi-Fi: 250,000 measures per day**

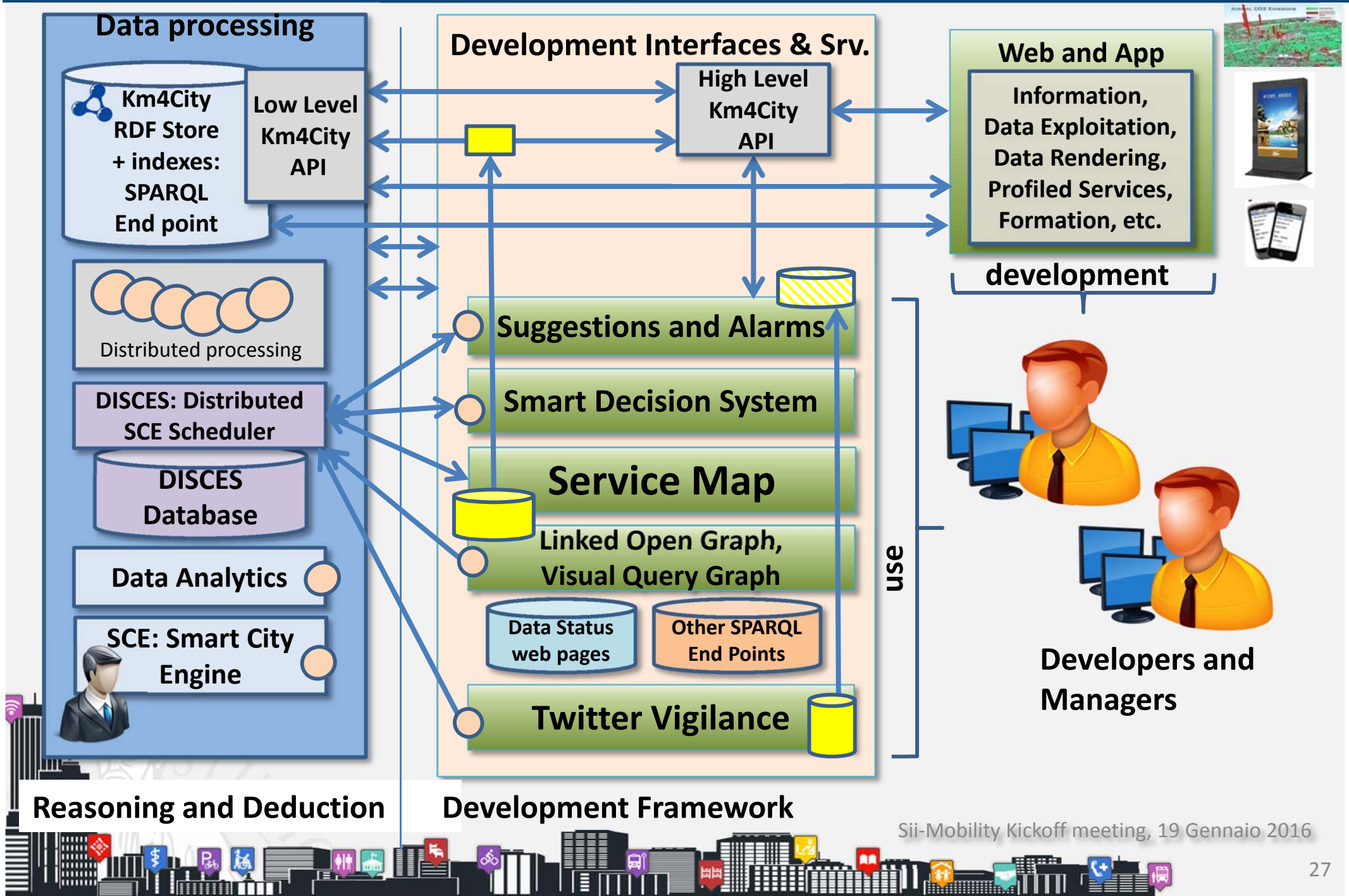
# Data Ingestion and Mining



# Example of Ingestion process

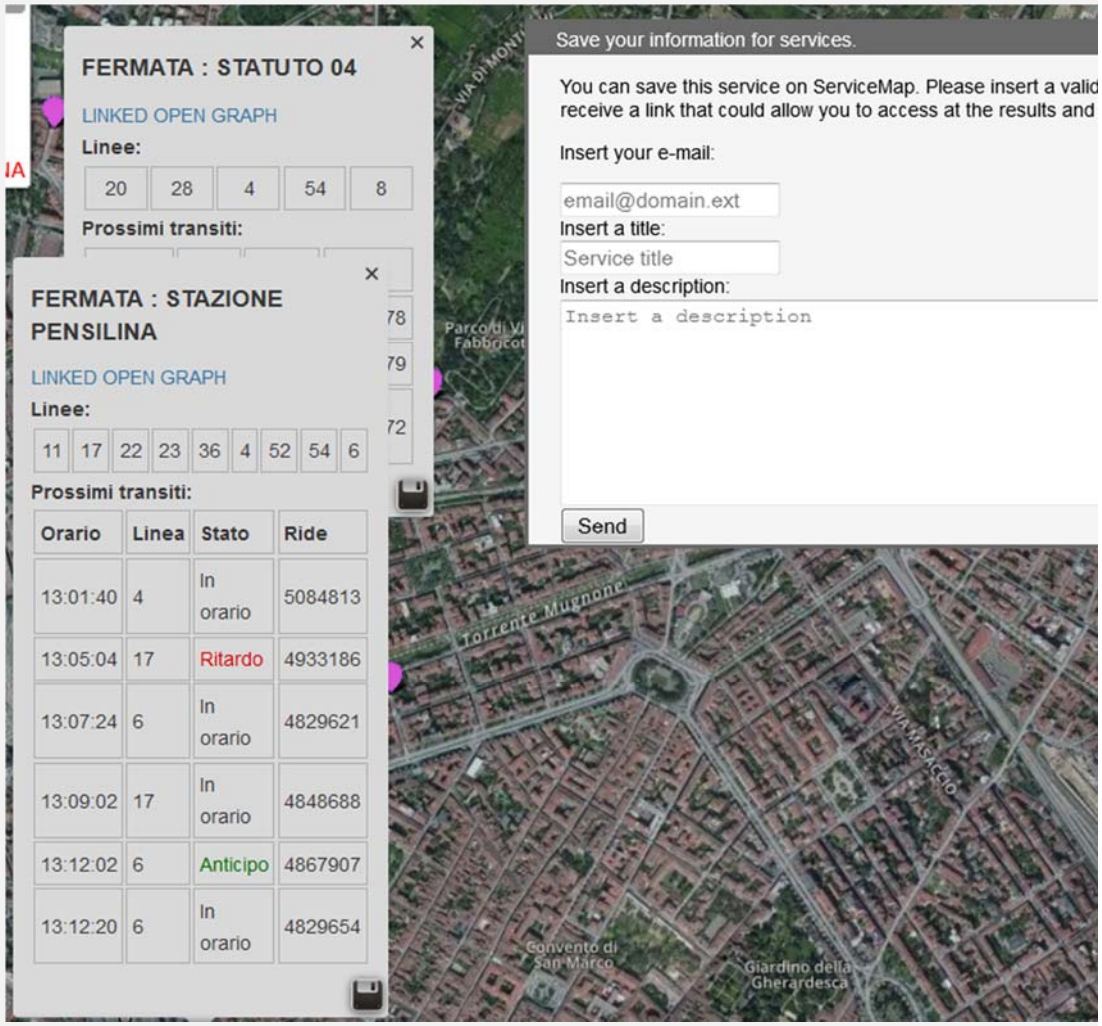


# Exploiting Big Data Reasoning

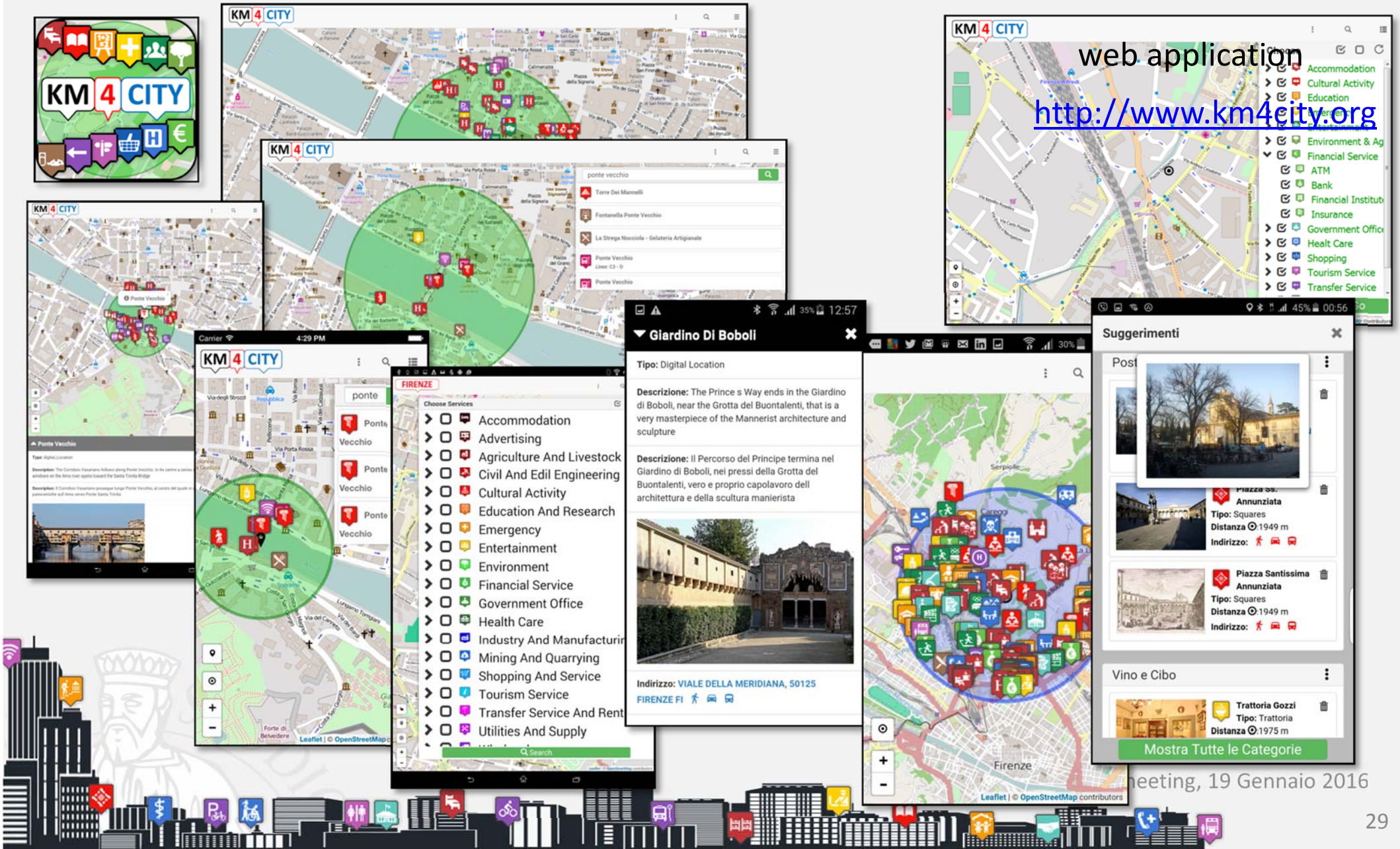


# Km4City API via ServiceMap

- http://www.disit.org/6597
  - REST API: serviceURI or Selection or GPS
  - REST API: Query ID
  - Receive an email
  - Get a JSON, HTML, …
- EMBED facility in third party web pages



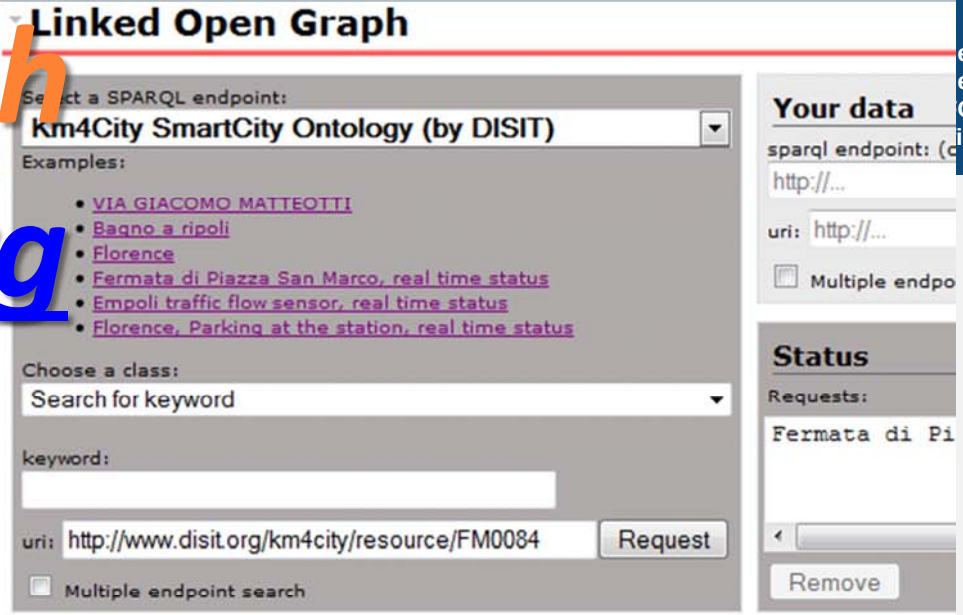
# Km4CityMobile App: all stores

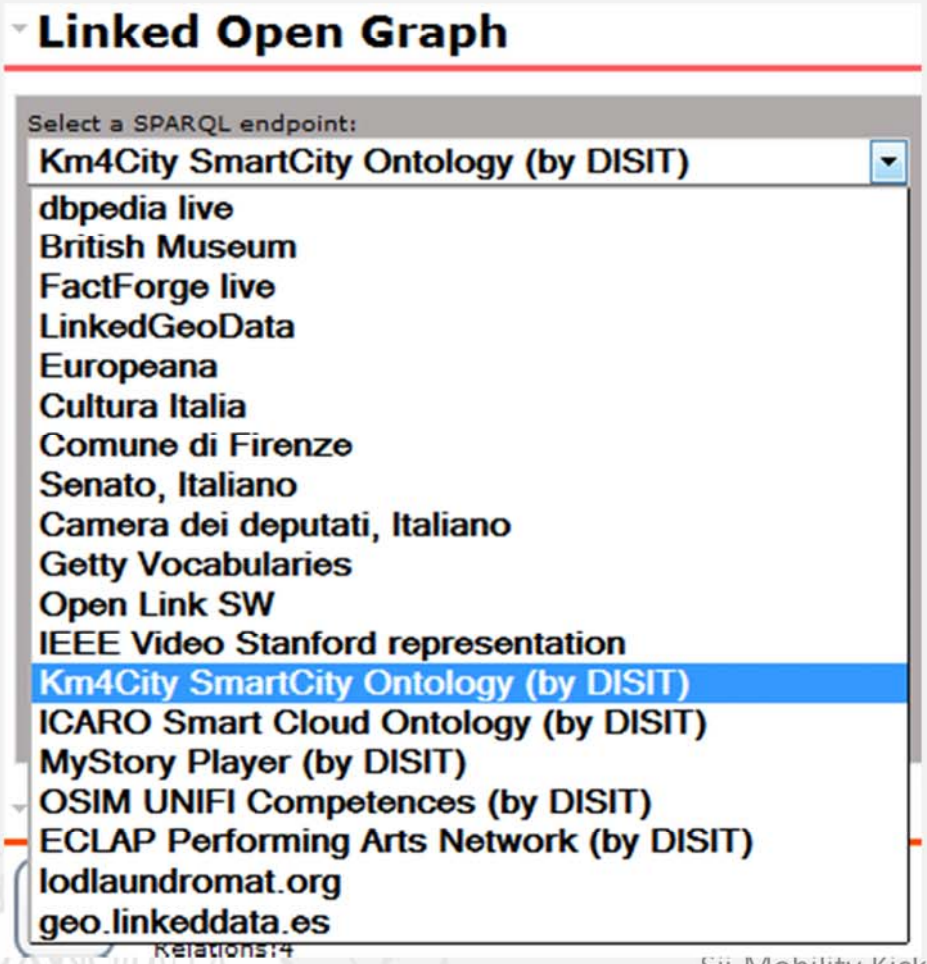


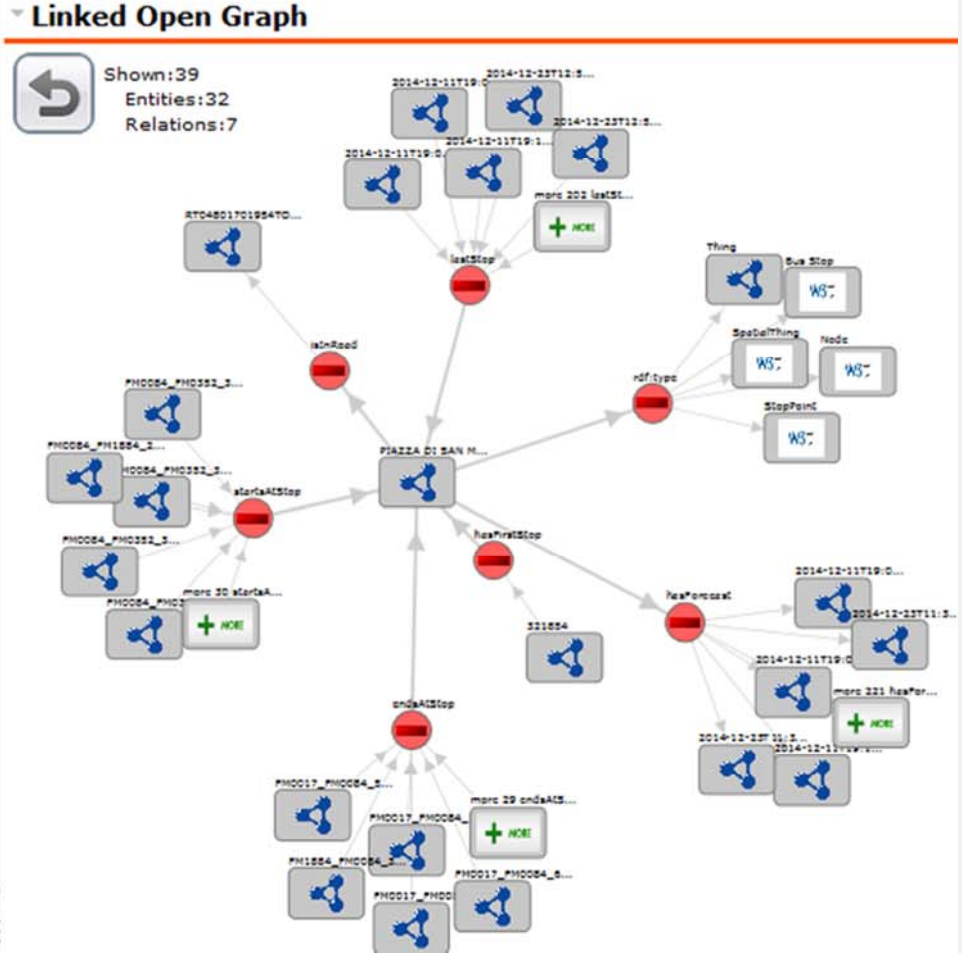
# Linked Open Graph

## http://log.disit.org

## A bus stop info….

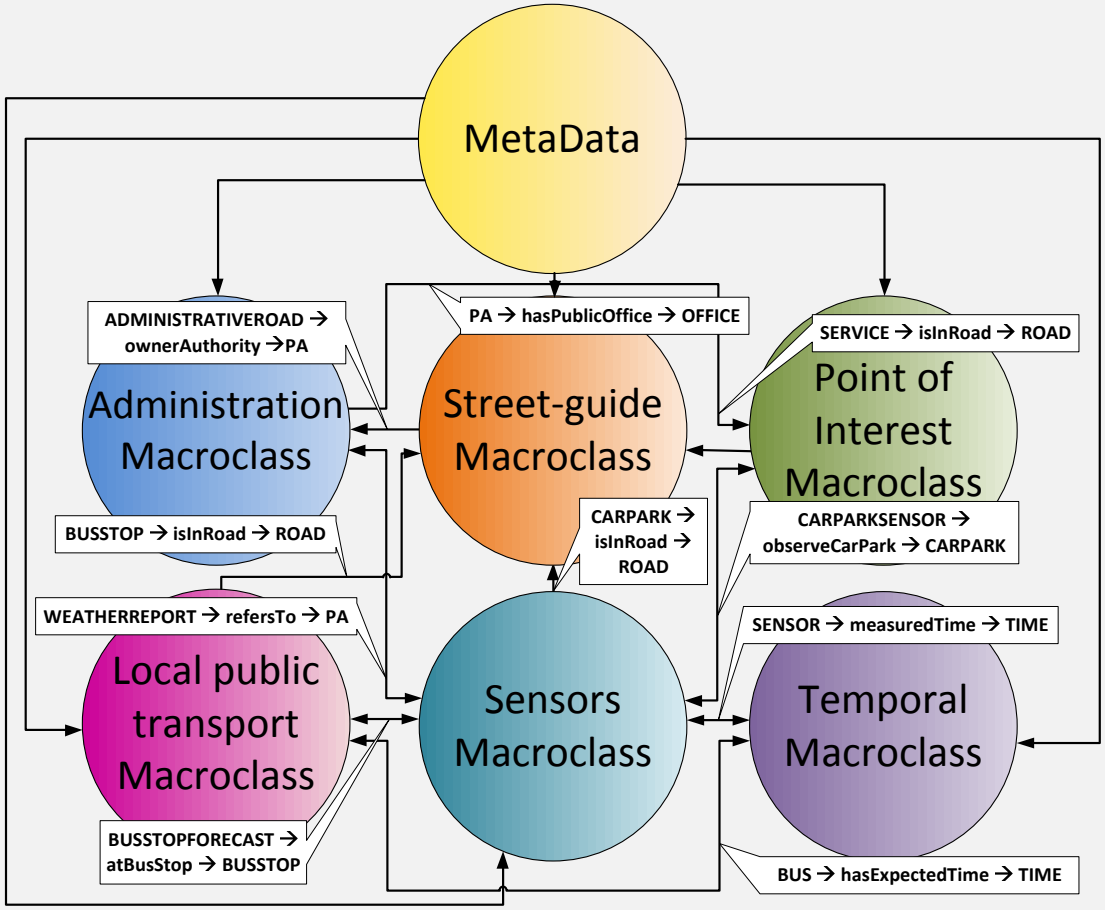


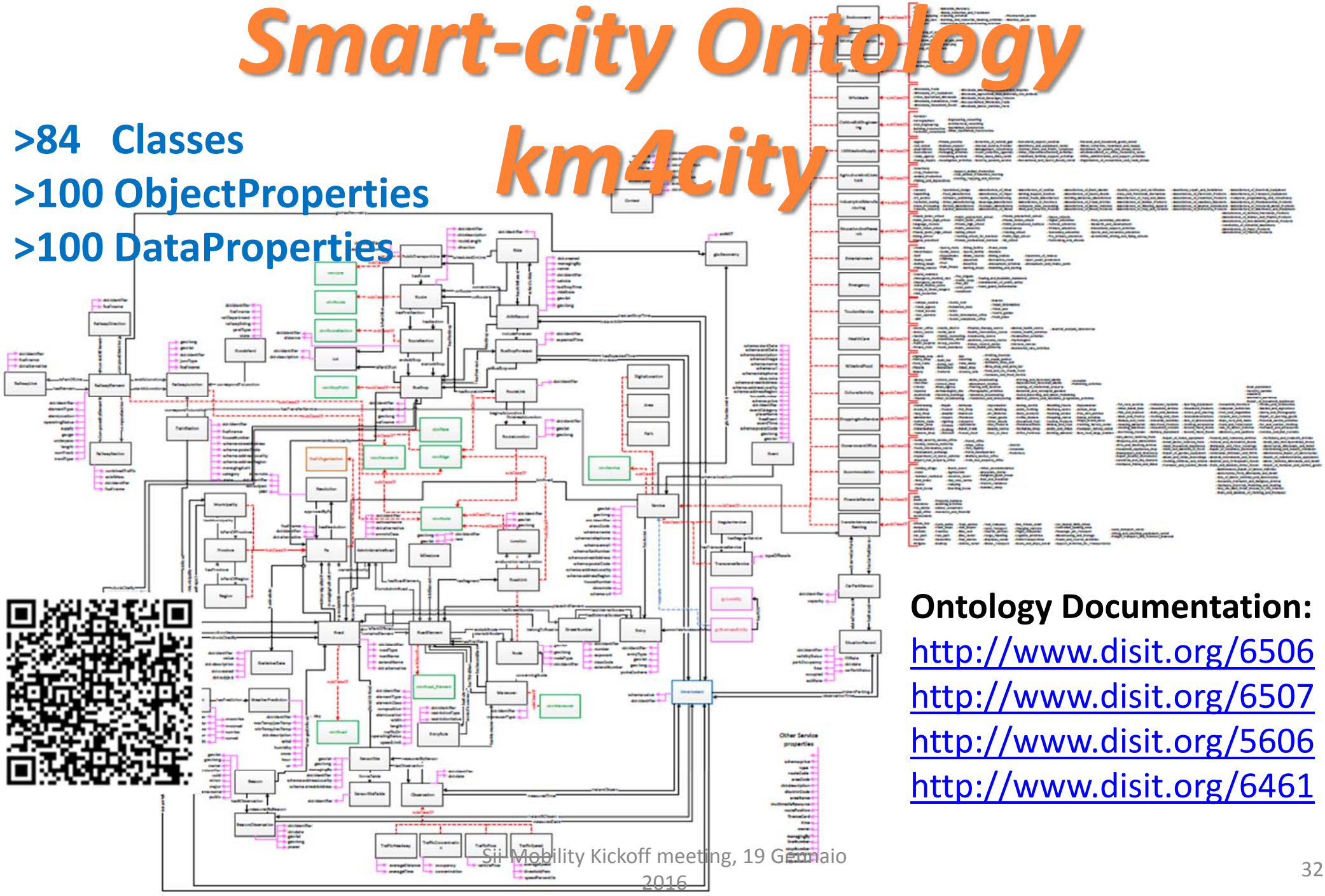
# Smart-city Ontology

- The data model provided have been mapped into the ontology, it covers different aspects:
  - Administration
  - Street-Guide
  - Points of interest
  - Citations from strings
  - Local public transport
  - Sensors..
  - Temporal aspects
  - Metadata on the data
  - →Statistics
  - →Risk assessment



# Smart-city Ontology km4city

**>84 Classes**
**>100 ObjectProperties**
**>100 DataProperties**



**Ontology Documentation:**
http://www.disit.org/6506
http://www.disit.org/6507
http://www.disit.org/5606
http://www.disit.org/6461

# Km4City EcoSystem

- **Final Users tools:**
  - Km4City mobile applications
  - Km4City web application: http://www.km4city.org
- **Public administrator tools:**
  - Smart City Dashboards http://dashboard.km4city.org
  - ServiceMap Server, http://servicemap.disit.org
  - Smart decision support system, http://smartds.disit.org
  - Twitter Vigilance, http://www.disit.org/tv
  - Traffic and People Flow Assessment http://www.disit.org/6694
- **Developers tools: http://www.disit.org/km4city**
  - ServiceMap Server, plus API, http://servicemap.disit.org
  - Ontology Documentation http://www.disit.org/km4city
  - LOG LOD browser http://log.disit.org
  - Open Source Mobile Application, FODD http://www.disit.org/6595
- **Back Office tools for Public Administrations**
  - Data Ingestion Manager, DIM, http://www.disit.org/6732
  - Distributed Smart City Engine Scheduler, DiSCES http://www.disit.org/6515
  - RDF Indexer Manager, RIM, http://www.disit.org/6708
  - RDF store enricher with dbPedia

# Km4city roadmap

- http://servicemap.disit.org, API
- http://log.disit.org
- http://www.disit.org/fodd
- http://www.disit.org/tv **Twitter Vigilance**
- http://smartds.disit.org **Beta testing**

Weather
Cultural Heritage
Energy: recharge pillar
WiFi
Events in the city

-Embed
-more API
-iBeacon

SmartDS
Km4City App

**-REPLICATE H2020 2016-2020**
**-Sii-Mobility SCN: *-2018**

**2013** Km4city 1.1
**2014** Km4city 1.4
**2015** Km4city 1.5
today Km4city 1.6.2
**2016**

- Tuscany Map
- Services
- AVM
- Sensors
- Parking
- …
- …

Cultural Heritage
Enrichment-cites
Events in the city
DigitalLocations
Fresh places
…….

**RESOLUTE H2020 2015-2017 Started**

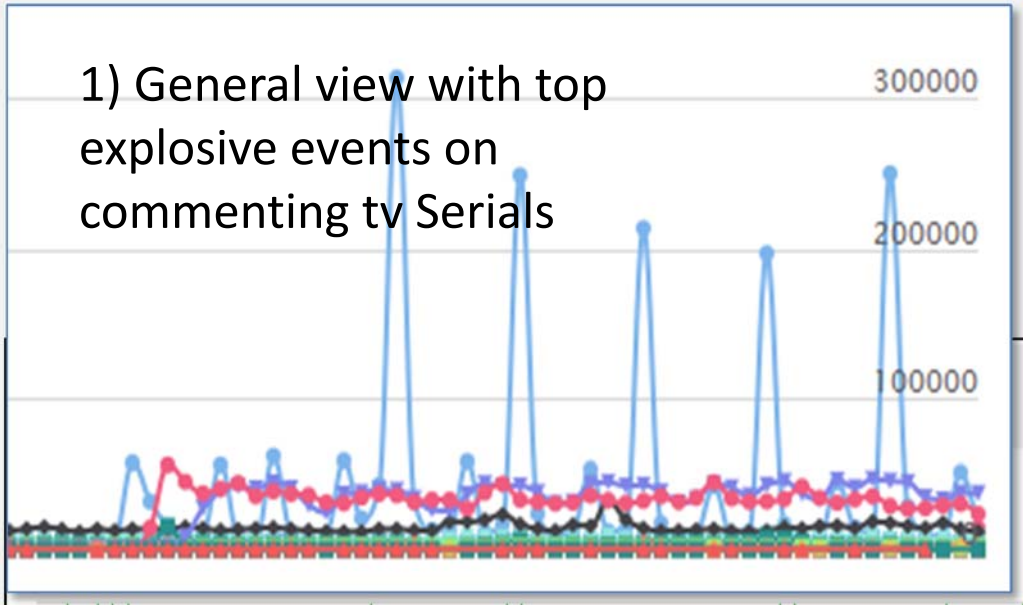
- *Suggestions on demand*
- *Dashboards*
- People flow tracking
- Risk analysis
- Territorial, areas and paths
- Environmental: water, hearth,
- Statistics, Energy, IOT, ..
- Data Licensing models
- User Engagement

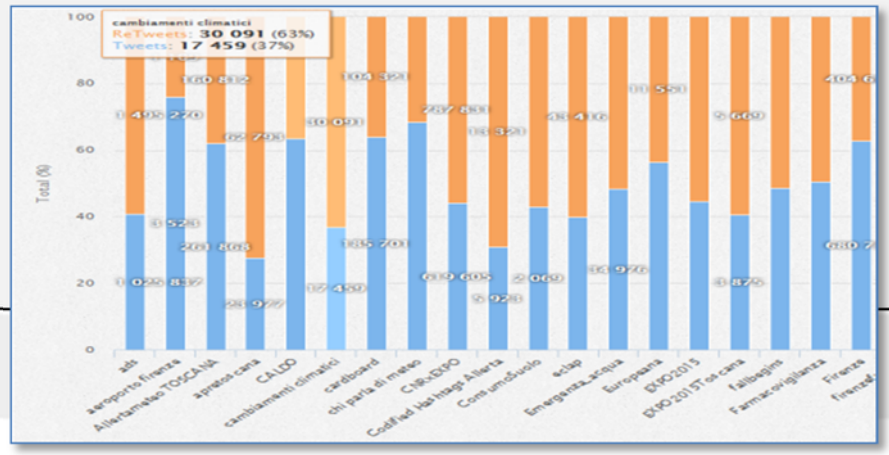
# Twitter Vigilance Objectives

- **Public parts accessible** on: http://www.disit.org/tv
- **Monitoring** twitter channels with
  - high reliability & precision, following slow, fast and explosive events
  - Multiuser managing multiple: public and private channels
  - Access to data, advanced search, data analytics, sentiment analysis, .....
- A ***Twitter Vigilance*** channel is a set of real time adaptive searches on twitter.
  - Each of them may have a complex syntax according to twitter API and service
  - Each user may manage a number of channels and searchers
- Active since April 2015 with data collection, since Sept. with big data analytics, since October with Sentiment Analysis
  - Easy addressing about 600.000 per day
  - Over than 30 Million of tweets

# All Channels (private information)

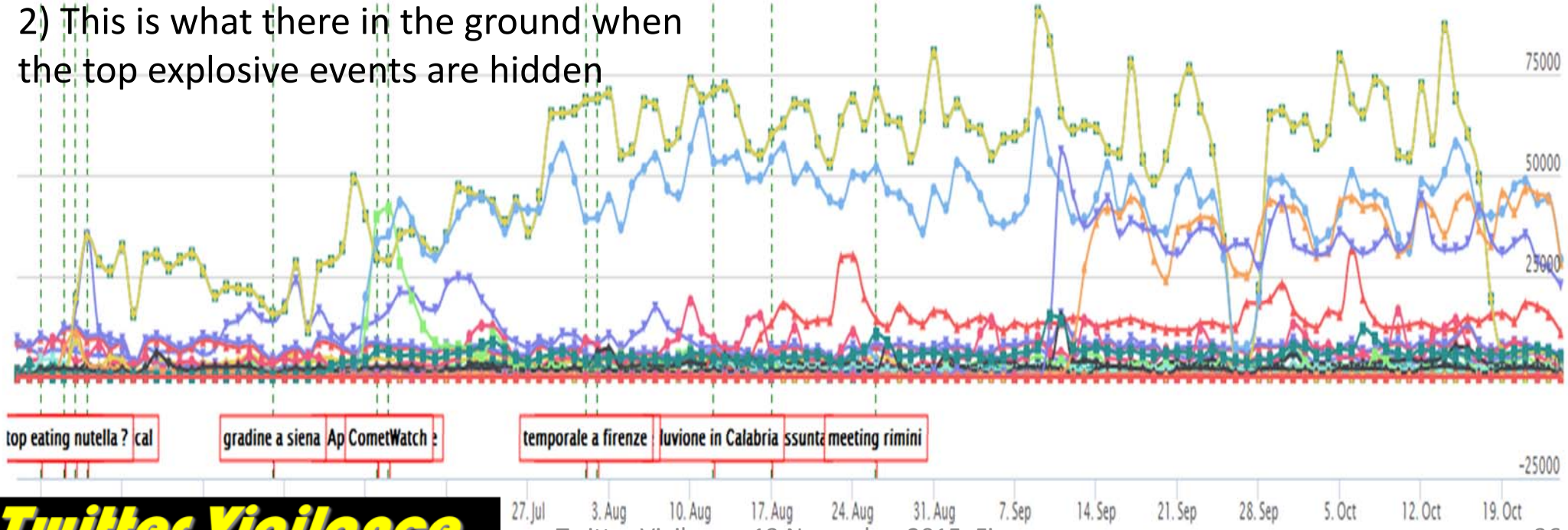
1) General view with top explosive events on commenting tv Serials




From Jun 12, 2015 To Oct 24, 2015

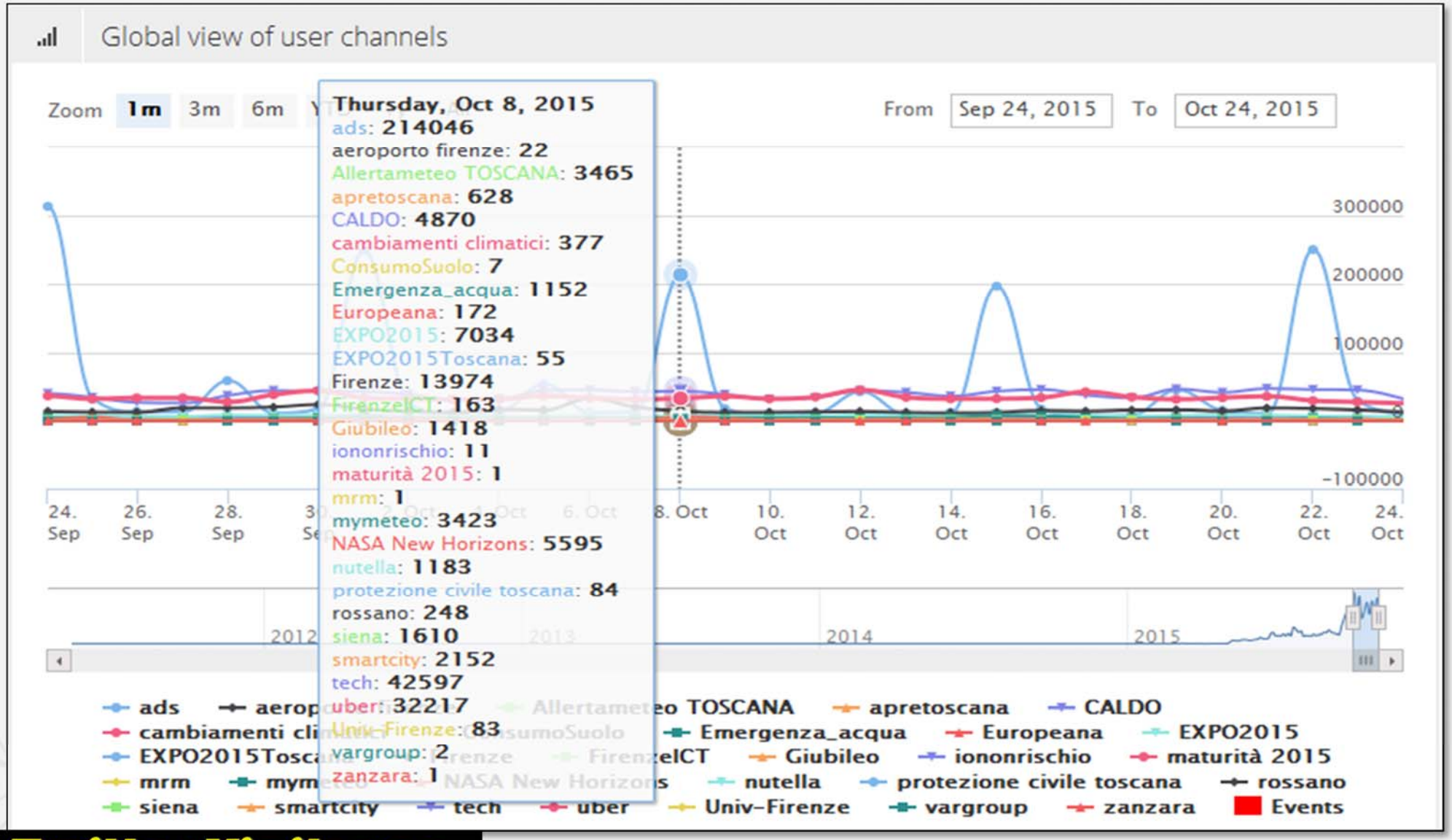
2) This is what there in the ground when the top explosive events are hidden



# Example of TwitterVigilance channels

- **http://www.disit.org/tv public channel results**
  - **Esempi di Canali:**
    - EXPO 2015, CNR EXPO2015,
    - Firenze, ApreToscana, maturità,
    - ConsumoSuolo, meteo, allerta meteo toscana, protezione civile,
    - farmaco vigilanza, smart drug,
    - laudatesi, ECLAP ed Europeana, advertising, etc.
- **Aree tematiche:** meteo, ambiente, advertising, eventi pubblici, farmacovigilanza, smart city, politica, etc.

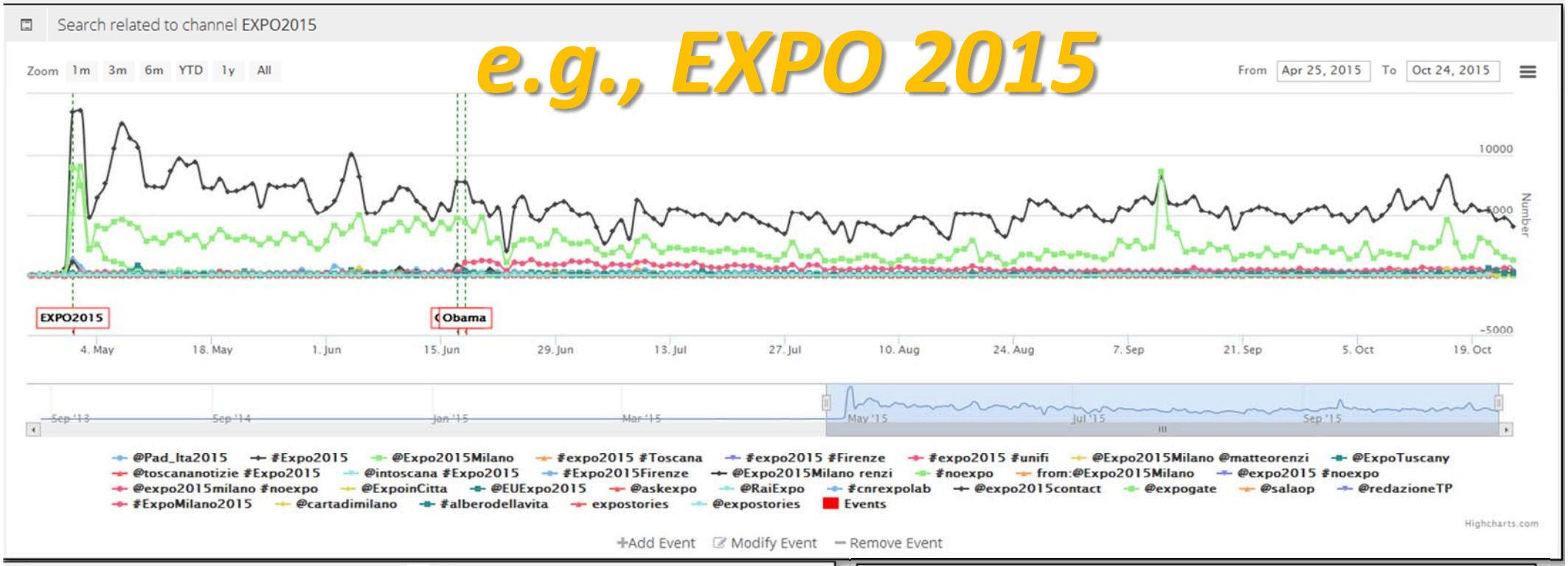
# Some Public Channels

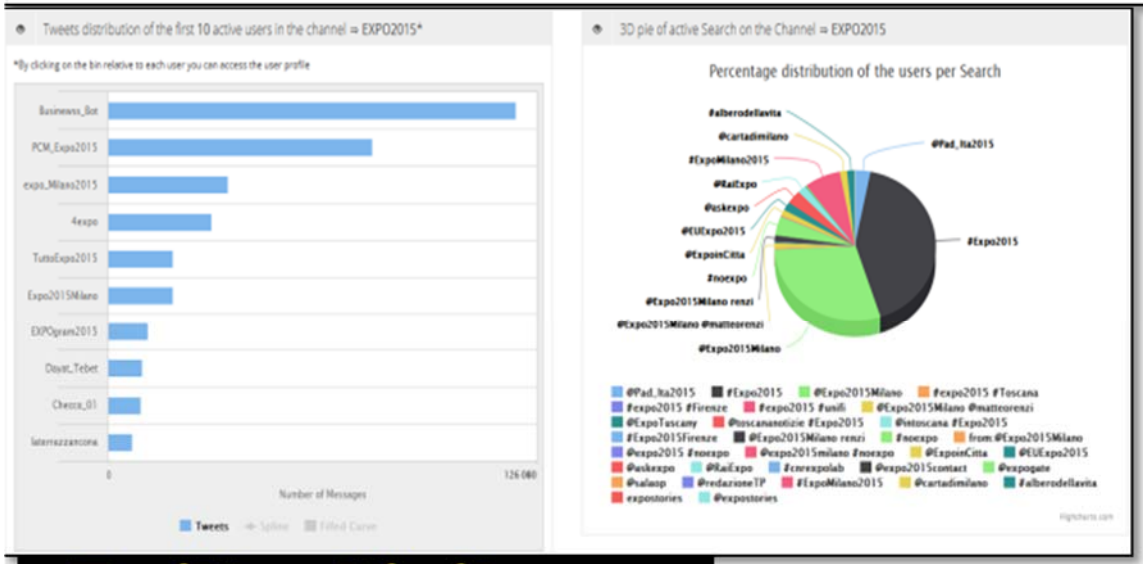


# TV: High level purposes

- **Analysis and characterization of the communication, human perception and events;**
- **Discover and compute**
  - Inception of new occurrences in real time: events, facts, weather, critical conditions, etc.
    - In advance to improve reaction time, reduce costs, increase resilience
  - who influence the communication, the community and how: pushers, actors, etc.
  - predictors of event attendance, on periodic events
  - indirect measures based on perception of the population

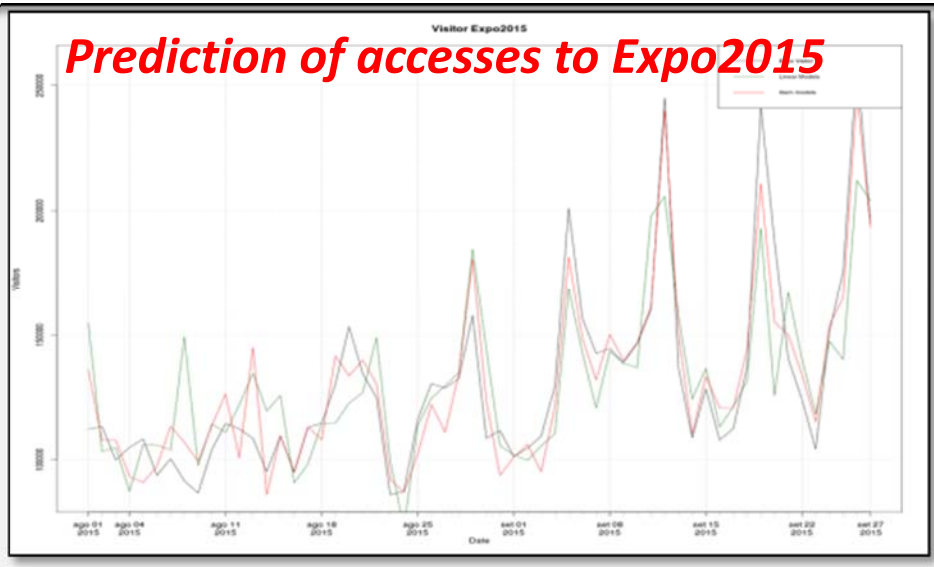
# e.g., EXPO 2015









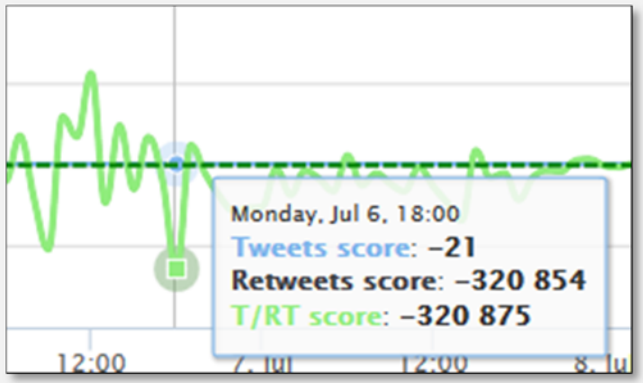

Twitter Vigilance

# High level purposes

- **Monitor and analyse** level of appreciation or dissent for:
  - products, services, people, advertising, changes in the city, political actions, large events, TV programme, actors, singers ("auditel" surrogate)
  - deriving
    - trends for products and services
    - competitor analysis
    - appreciation analysis
  - Producing detectors in quasi real time of the event inception, use the users as diffuse sensors.

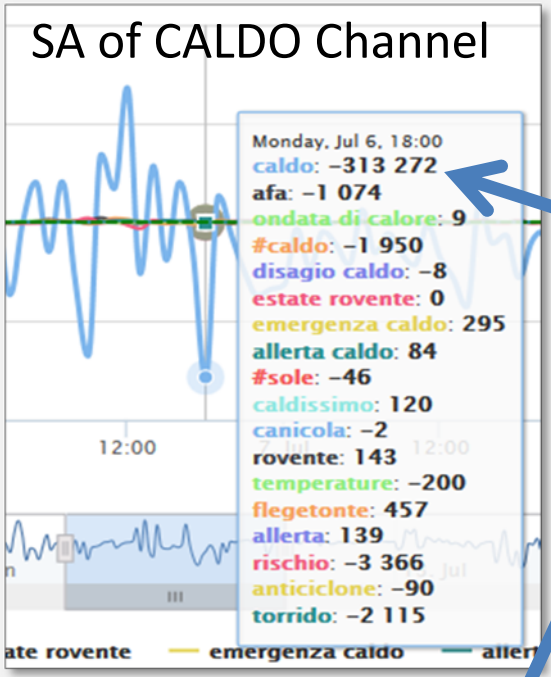
# Sentiment Analysis

T/TW on a CALDO channel

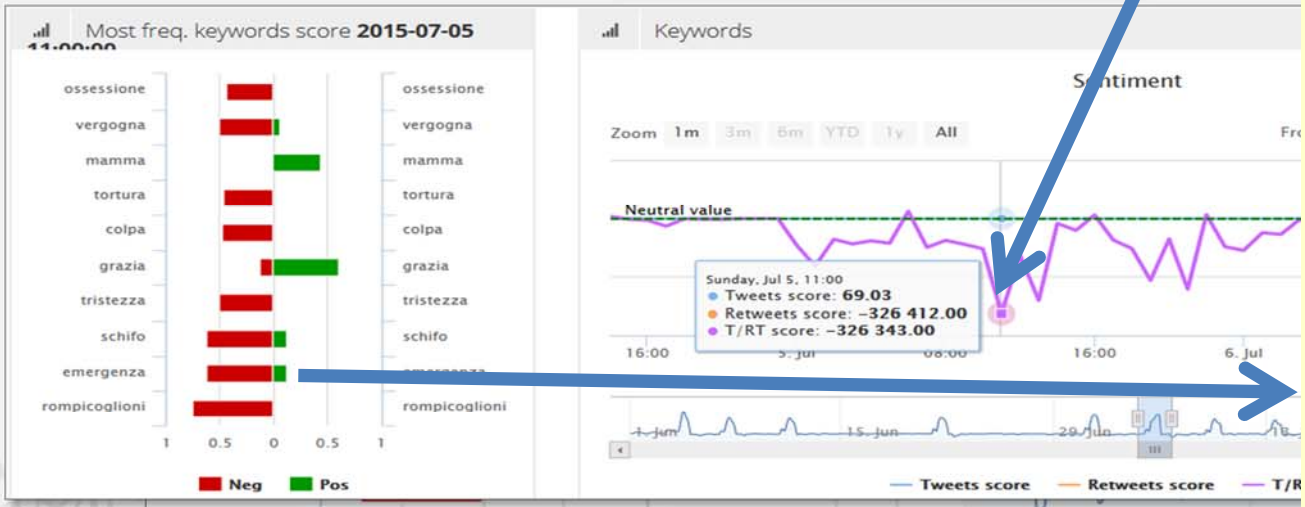



A few negative Tweets provoked a huge amount of negative reTweets

SA of CALDO Channel



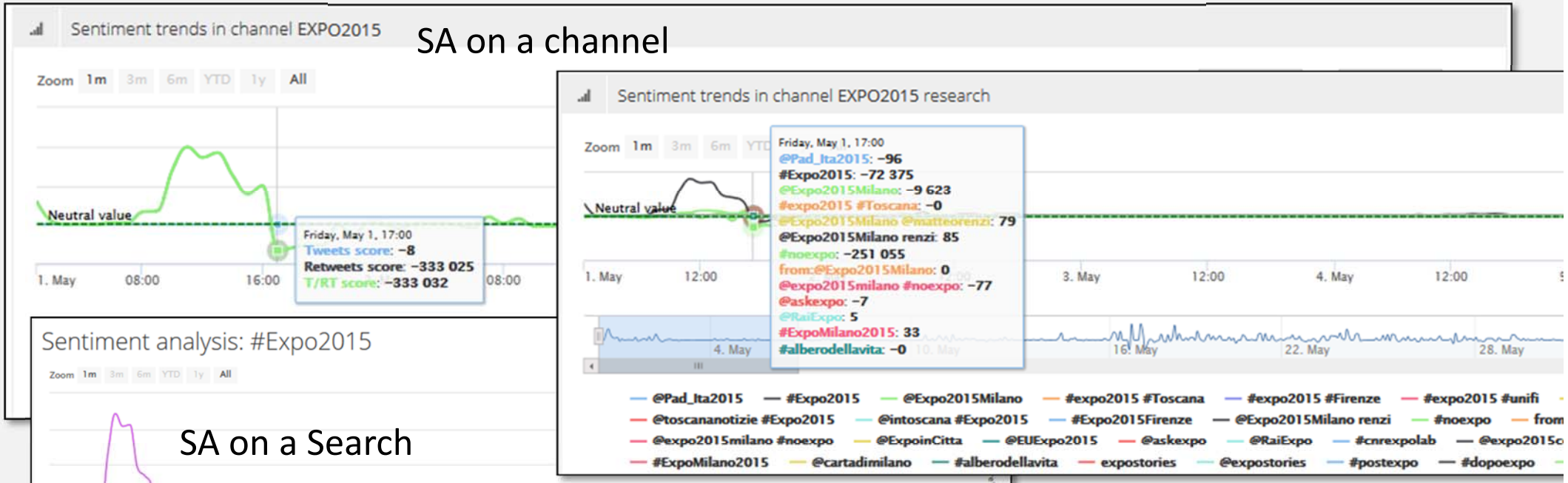

A Negative Sent: -313272

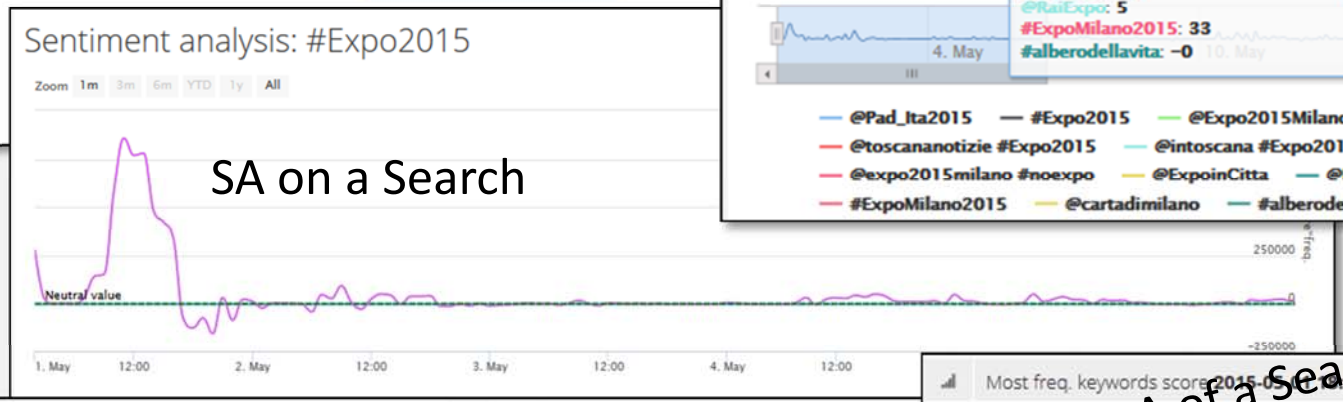



- **emergenza** caldo, una rete per i più deboli http://t.co/x6e4dkwqk8
- continua l'**emergenza** #caldo. domani fino a 43 gradi percepiti in #piemonte http://t.co/gvuyafeq0o
- cerolini su gestione **emergenza** caldo a pescara http://t.co/zecmr7t4zv #**emergenza**caldo #pescara
- **emergenza** caldo, in arrivo i 38 gradi nella cittò metropolitana di milano. consulta il bollettino emesso: http://t.co/n5oocelibv

# Sentiment Analysis

SA on a channel




SA on a Search

Some views on details of the SA of a Search