Km4City: Smart City Model and Tools for City Knowledge Exploitation

http://www.disit.org/km4city

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CINI Annual Workshop on
ICT for Smart Cities & Communities (I-CiTies 2015)
Palermo, October 29-30, 2015

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Distributed Systems and Internet Technologies Lab
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The Km4City Challenge

- Huge amount of data are produced from: Open Data, Linked Data, Real Time sensors, Twitter, etc.
  - 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 are not capable to sustain the creation of control rooms made by proprietary tools
  - A join venture is needed, huge competence are needed on a large range of solutions, from ICT, energy, mobility, risk assessment, resilience, etc.
- Cities are sociotechnical systems, non linear models are needed, several methods to assess and interact


Km4City
Knowledge model
for the city
- Nascondi Menu
Fermate Firenze
Comuni in Toscana
Ricerca Testuale
- Hide Menu
Servizi Trasversali
TIMELINE
Dati Real Time al momento non disponibili
LINKED OPEN GRAPH
Linee:
N. risultati: 200
Road Sensors
Ponte Vecchio
Previsioni Meteo per il comune di FIRENZE:
Martedì
Mercoledì
Giovedì
Venerdì
poco nuvoloso
26°C / 34°C
sereno
19°C / 35°C
poco nuvoloso
20°C / 36°C
poco nuvoloso
/
sereno
/
Ultimo Aggiornamento: 2015-06-30T09:04:00+02:00
LINKED OPEN GRAPH
www.disit.org/ServiceMap/#close
Firenze
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

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

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Km4City

Transport systems
Mobility, parking

Public Services
Govern, events,

Sensors, IOT
Cameras, ..

Environment,
Water, energy

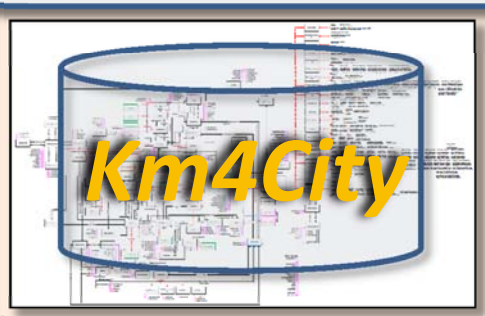
Shops, services,
operators

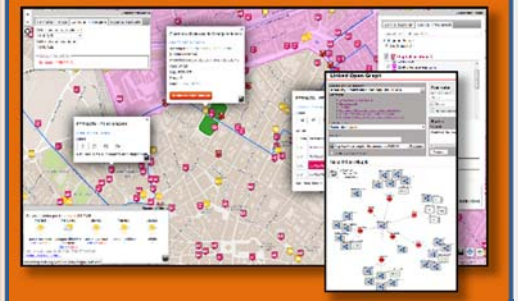
Social Media
WiFi, network

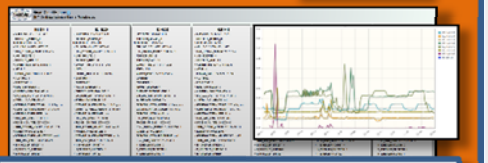
Static, Slow and Real Time data flows

DISCES -- Distributed and parallel architecture on Cloud

Km4City Smart City Engine

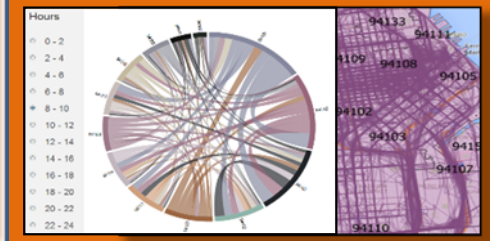






User Profiling and Suggestions on Demand

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

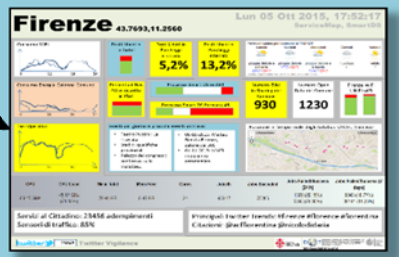


Km4City Tools for Developers

Km4City Smart City API

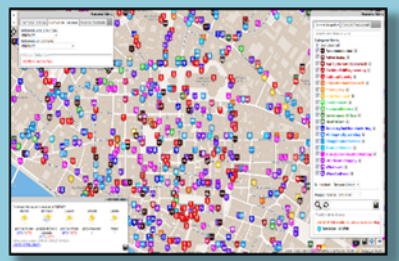
Tools for Operators

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

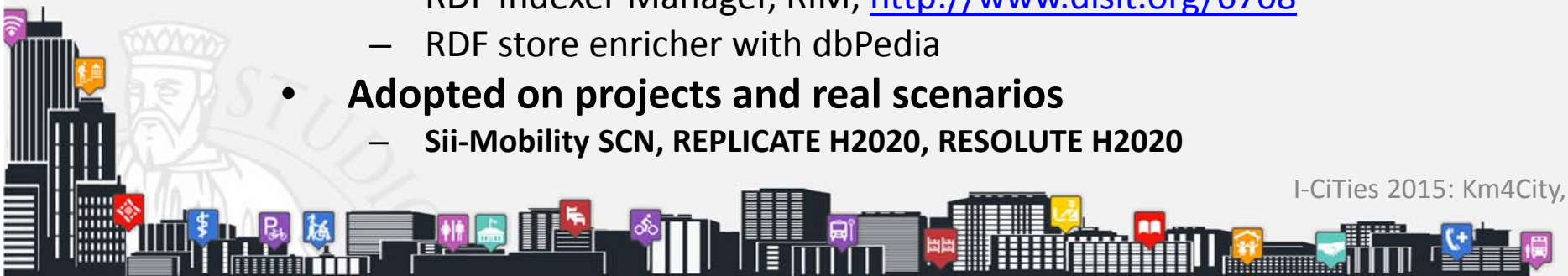
Tools for Final Users

Mobile e Web Apps

Http://www.km4city.org

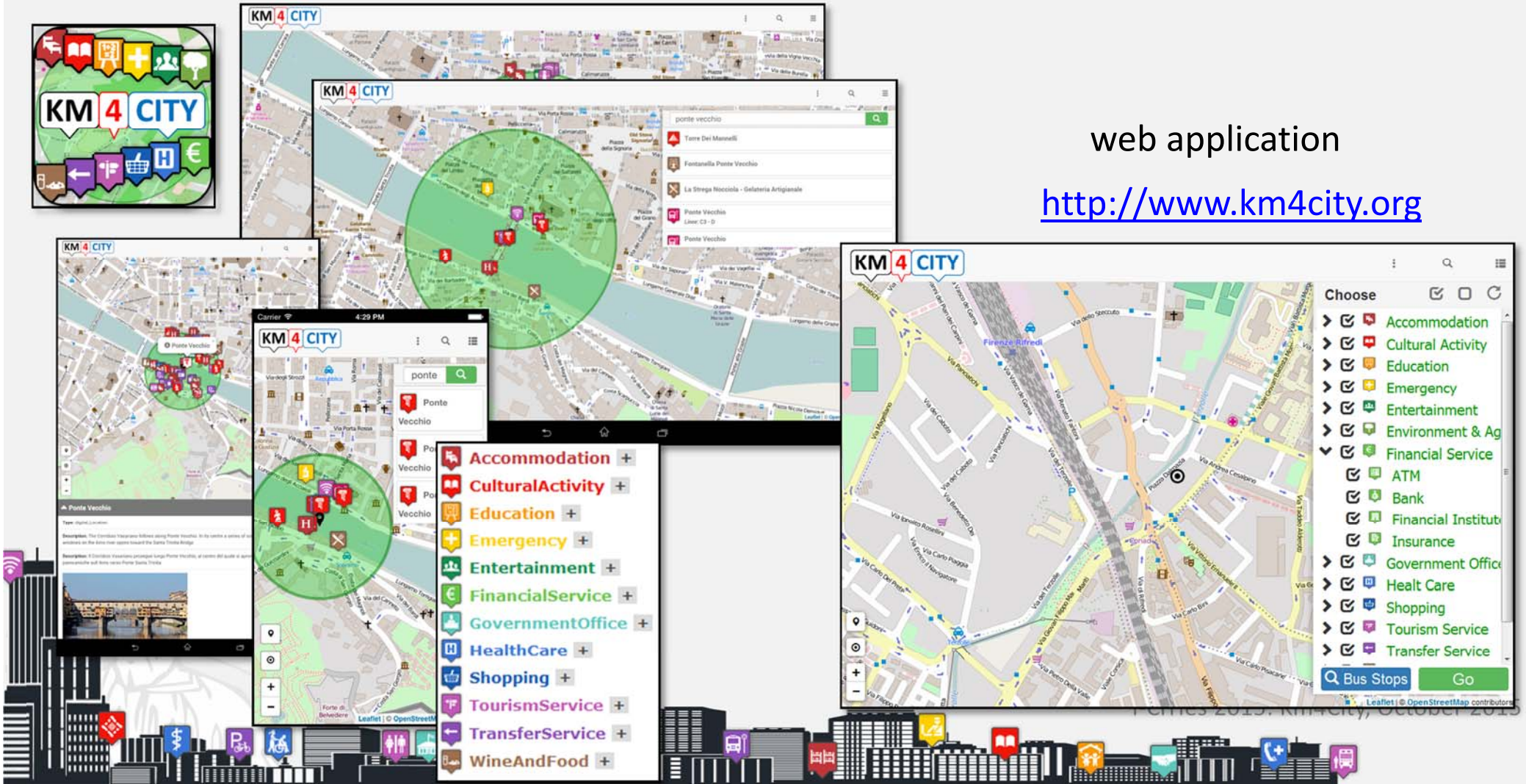
Km4City EcoSystem

- **Final Users tools:**
  - Km4City mobile applications
  - Km4City web application: http://www.km4city.org
- **Public administrator tools:**
  - Smart City Dashboards
  - 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
  - Smart City Engine, SCE, the smart scheduled processes http://www.disit.org/6515
  - RDF Indexer Manager, RIM, http://www.disit.org/6708
  - RDF store enricher with dbPedia
- **Adopted on projects and real scenarios**
  - **Sii-Mobility SCN, REPLICATE H2020, RESOLUTE H2020**



Km4CityMobile App: all stores

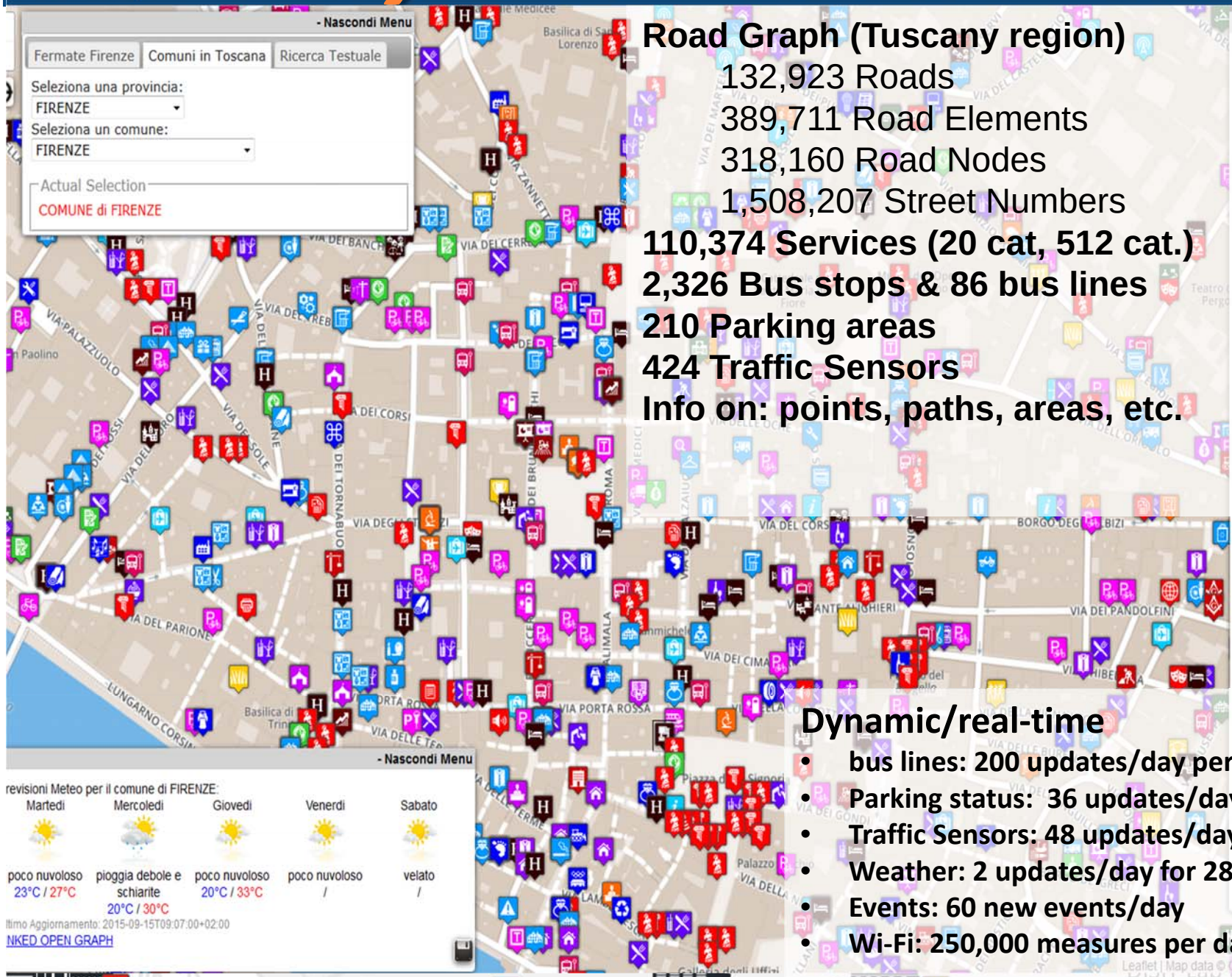
- https://play.google.com/store/apps/details?id=org.disit.siiMobile
- https://itunes.apple.com/us/app/florence-km4city/id1028356115?mt=8



web application

http://www.km4city.org

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**

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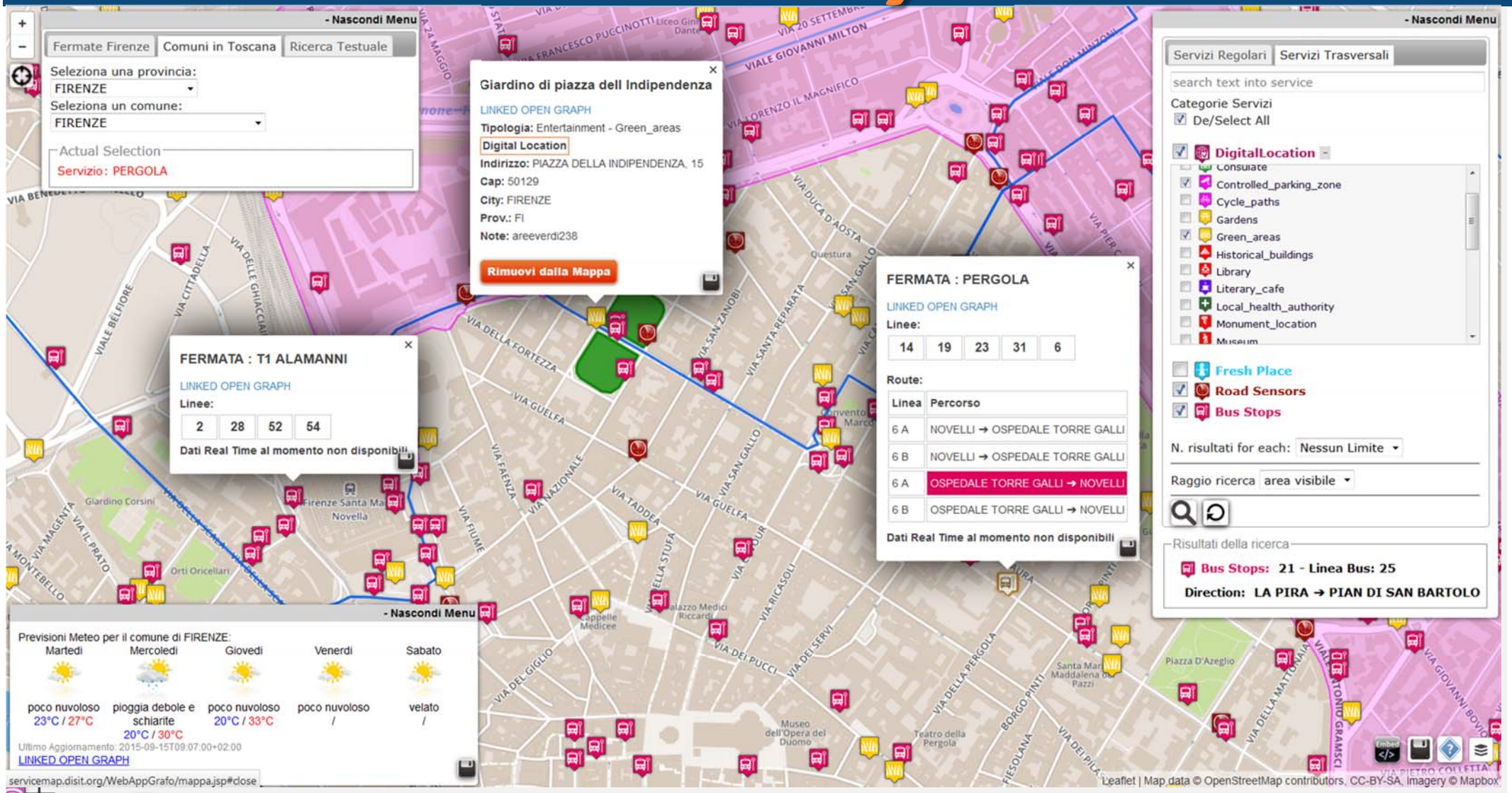
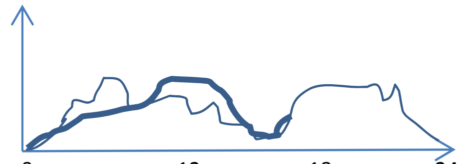


- **Areas, Bus lines, bike lanes, tram, RTZ, etc.**

Firenze 43.7693,11.2560

Lun 05 Ott 2015, 17:52:17
ServiceMap, SmartDS

Consumo WiFi



Posti Liberi in in hotel

Posti Liberi in Parcheggi in strada
5,2%

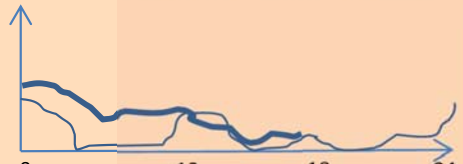
Posti Liberi in Parcheggi interrati
13,2%

Previsioni Meteo per il comune di FIRENZE:

Lunedi	Martedi	Mercoledi	Giovedi	Venerdi
pioggia debole e schiarite	pioggia debole	pioggia debole schiarite	nuvoloso	velato
20°C / 24°C	17°C / 22°C	15°C / 2?°C	/	/

Ultimo Aggiornamento: 2015-10-05T09:40:00+02...

Consumo Energia Colonne Comune



Percentual Bus Attivi rispetto al Plan

Processo Smart DS rest34

Processo Smart DS Ferma... 45

Numero ... in ... Comune
930

Numero Open Data del Comune
1260

Firenze WiFi UNIFI wiFi

Taxi Operativi

Eventi del giorno e ... di rilievo

- ...ro P...
- Stadio: qualifiche provinciali
- Palazzo dei con...: conferm... ...e ma...ttie..
- 06-10-2015 ... Renzi Firenze, ... dei 50
- 0?-1?-2015: UNIFI inizio anno accademico

...osizione tempo reale degli Autobus <...AF, Tramvia>

Pub.Aadmin. Dashboards
Technical Dashboards
+Dashboard Designer

CPU	CPU Load	Mem Total	Mem Free	...o...	Jobs/h	Jobs Executed	Jobs Failed/Success (24 h)	Jobs Failed/Success (7 days)
63.45 GHz	45.57 GHz (71.83%)	70.41 GB	8?.?7 GB	24	433.17	75285	1361 (20.15%) 5395 (79.85%)	9043 (18.77%) 39141 (81.23%)

Servizi al Cittadino: 23456 adempimenti
Sensori di traffico: 85%

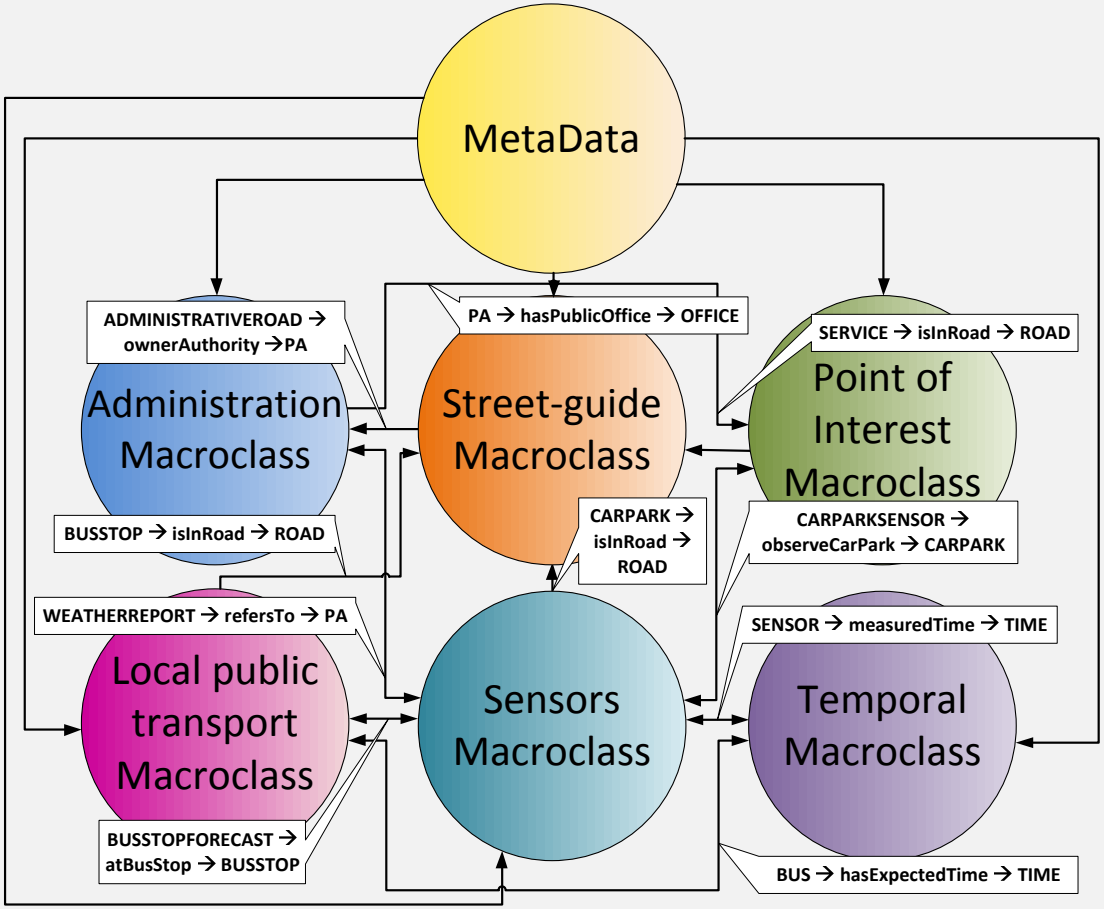
Principali Twitter Trends: #firenze #florence #fiorentina
Citazioni: @acffiorentina @nicolodidaria

twitter 23045 Twitter Vigilance

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

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



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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

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

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

- Tuscany Map
- Services
- AVM
- Sensors
- Parking
- ...
- ...

Sii-Mobility Smart City National

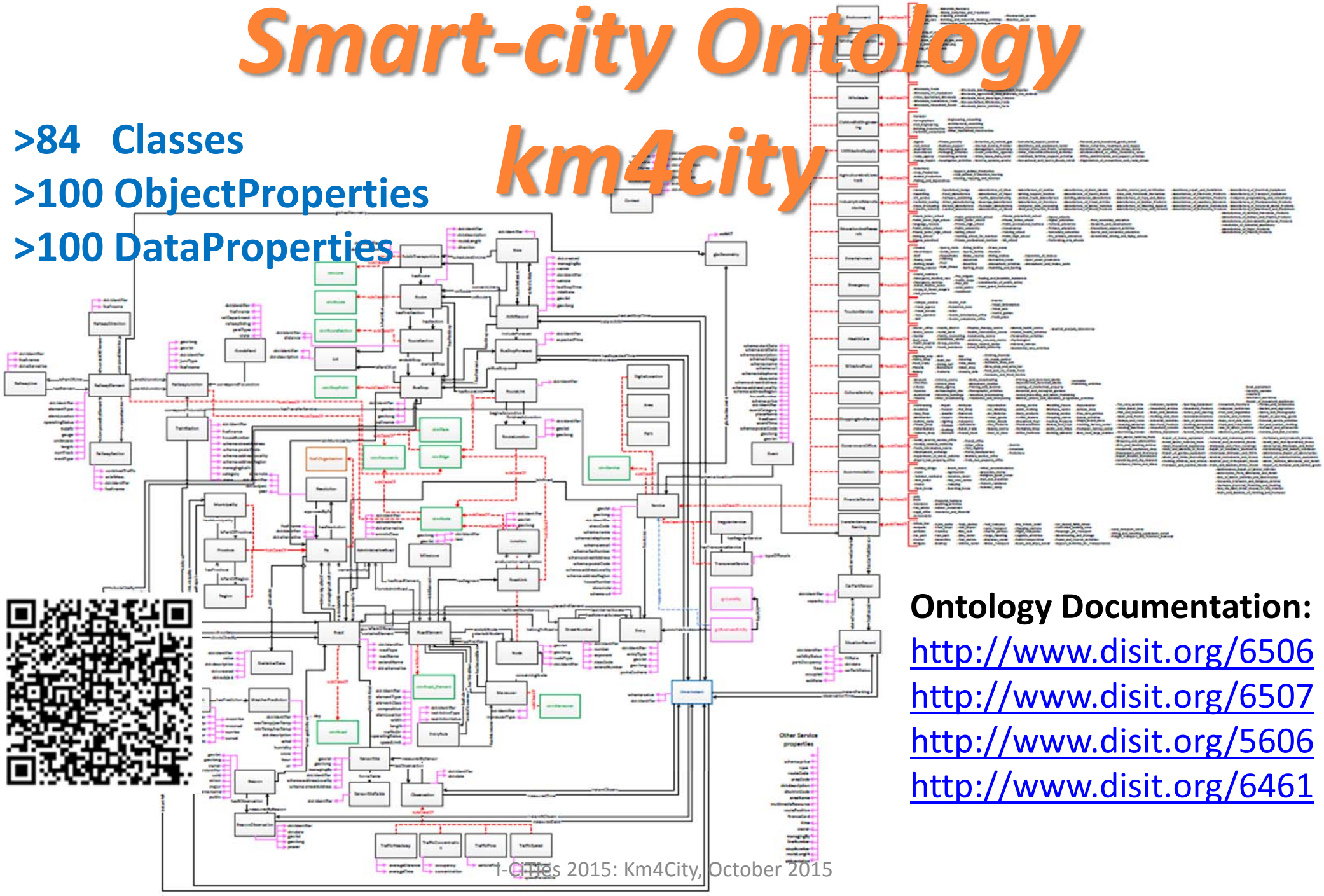
Cultural Heritage
Enrichment-cites
Events in the city
DigitalLocations
Fresh places
.....

RESOLUTE H2020 2015-2017 Started

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

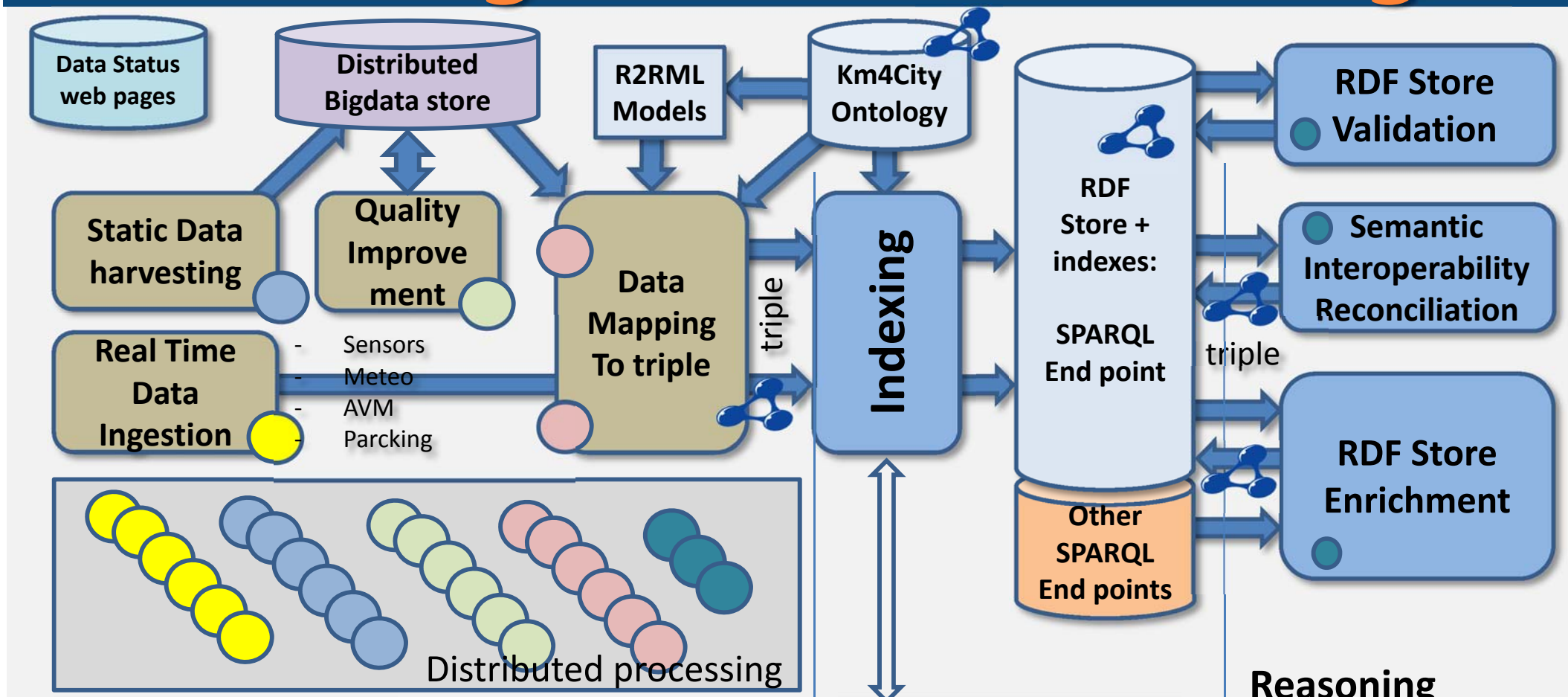
Smart-city Ontology km4city

>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

Data Ingestion and Mining



RDF Triples generated

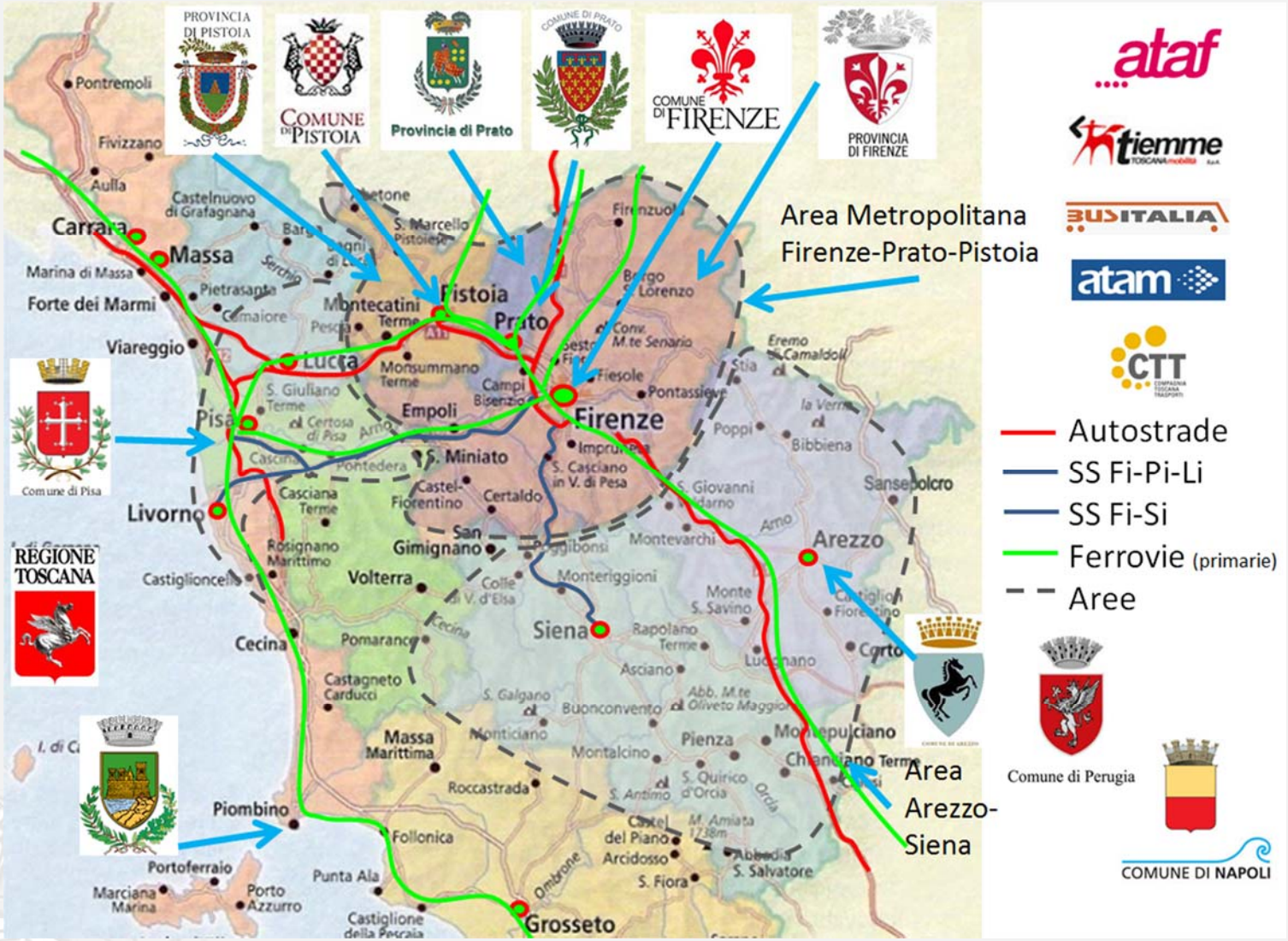
Macro Class	Static Triples	Reconciliation Triples	Real Time Triples Loaded	Total on 1.5 months
Administration	2.431	0	--	2.431
Metadata of DataSets	416	0	--	416
Point of Interest (35.273 POIs in Tuscany)	471.657	34.392	--	506.049
Street-guide (in Tuscany)	68.985.026	0	--	68.985.026
Local Public Transport (<5 lines of FI)	644.405	2.385	135.952 per line per day, to be filtered, read every 30 s, they respond in minutes	(static) 646.790
Sensors (<201 road sensors, 63 scheduled every two hours)	--	4.240	102 per sensor per read, every 2 hours, they are very slow in responding	51.111.078
Parking (<44 parkings, 12 scheduled every 30min)	--	1.240	7920 per park per day, 3 read per hour, they respond in seconds	
Meto (286 municipalities, all scheduled every 6 hours)	--	--	185 per location per update, 1-2 updates per day	
Temporal events, time stamp	--	--	6 for each event	1.715.105
Total	70.103.935	42.257		122.966.893

Km4City Scenarios and adoptions

- **Km4City is at the basis of real scenarios**
  - the Florence data aggregator, presented at FODD 2015, February
  - http://servicemap.disit.org, see mobile Apps, etc.
- **Km4City is adopted in running projects up to 2020**
  - Sii-Mobility Smart City National, 13.5 Meuro
  - RESOLUTE H2020 DRS7 project of the EC, 3.8 Meuro
  - REPLICATE H2020 SCC1 project of the EC, 29 Meuro
  - …..

- Experimentations and validation in Tuscany
- Integration with present central station and subsystems

http://www.Sii-Mobility.org



H2020 RIA project

http://www.resolute-eu.org

- Develop European Resilience Management Guidelines (ERMG)
  - Develop a conceptual framework for creating/ maintaining Urban Transport Systems
- Enhance resilience through improved support of human decision making processes, particularly by training professionals and civil users on the ERMG and the RESOLUTE system
- Operationalize and validate the ERMG by implementing the RESOLUTE Collaborative Resilience Assessment and Management Support Systems (CRAMSS) for Urban Transport Systems addressing Road and Urban Rail Infrastructures
  - Pilots in Florence and Athens
- Adoption of the ERMG at EU and Associated Countries level

COMUNE DI FIRENZE

Smart Florence Plan

Horizon 2020
European Union Funding
for Research & Innovation

Città di FIRENZE

REPLICATE

REnaissance of PLaces
with Innovative Citizenship
And TEchnology

- *demonstrate Smart City technologies in energy, transport and ICT in districts in San Sebastian, Florence and Bristol, follower cities of Essen, Nilufer and Lausanne*
- *Cities are the customer: considering local specificities*
- *Solutions must be replicable, interoperable and scalable.*
  - *Integrated Infrastructure: deployment of ICT architecture, from internet of things to applications*
  - *Low energy districts*
  - *Urban mobility: sustainable and smart urban services*

Conclusions

- Km4City EcoSystem includes a model, ontology and number of tools
  - Km4City will become FiWare compatible/interoperable
- All of them are OpenSource
  - A number of them are already accessible on https://github.com/disit on DISIT portal.
  - All the other are coming…. Push us to publish them if you need them
- Documentation is available on Http://www.disit.org
- We can provide help in entering in the platform mechanisms

http://www.disit.org/smartcitybigdata2015

13 Novembre 2015, Scuola di Ingegneria, Via S. Marta 3, Firenze

- **Progetti e strumenti/risultati**: km4city, matchmaking, RESOLUTE, REPLICATE, LOG.DISIT.ORG, Twitter Vigilance, Collabora, ApreToscana, Sii-Mobility, …
- **Presentazioni, Dimostrazioni** e info-desk
- **Master** Big Data Analytics for Business, MABIDA