Km4City: Smart City Ontology Building for Effective Erogation of Services

For: Cognitive Systems Institute Group Speaker Series

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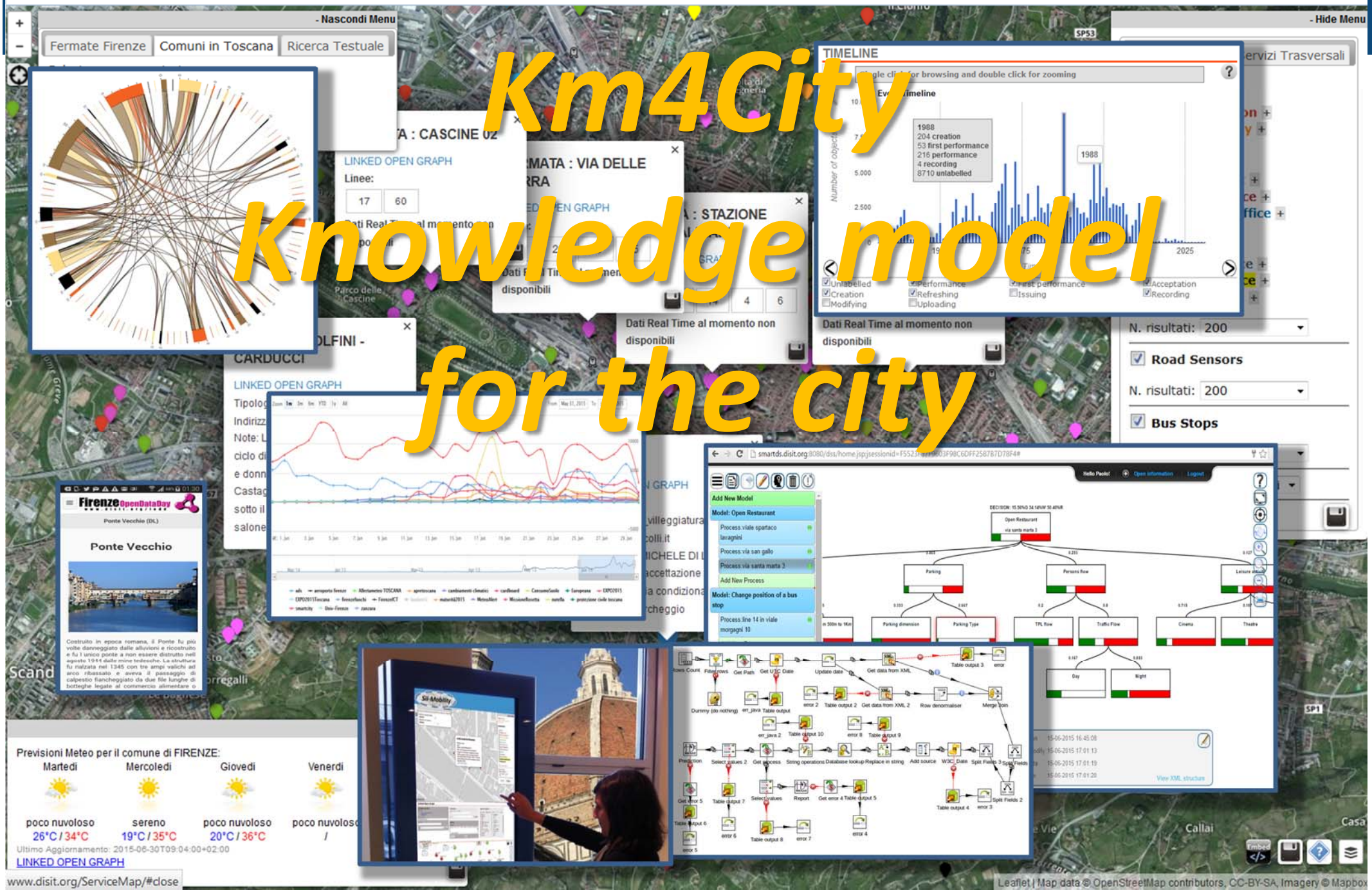
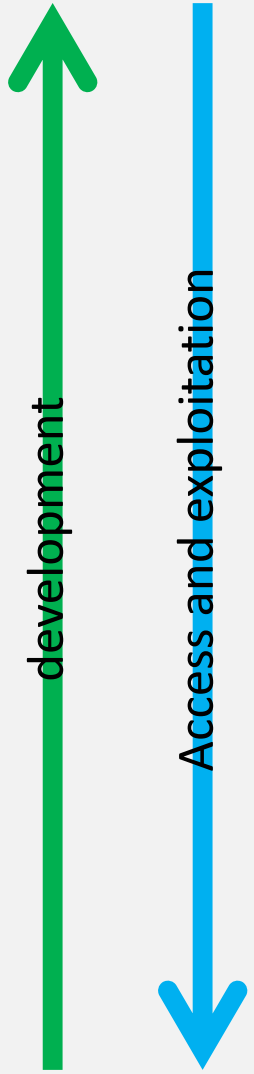

Km4City
Knowledge model
for the city
- Nascondi Menu
Fermate Firenze
Comuni in Toscana
Ricerca Testuale
LINKED OPEN GRAPH
Linee:
17
60
TIMELINE
Dati Real Time al momento non disponibili
- Hide Menu
Servizi Trasversali
N. risultati: 200
Road Sensors
Bus Stops
Ponte Vecchio
Previsioni Meteo per il comune di FIRENZE:
Martedì
Mercoledì
Giovedì
Venerdì
poco nuvoloso
26°C / 34°C
sereno
19°C / 35°C
poco nuvoloso
20°C / 36°C
Ultimo Aggiornamento: 2015-06-30T09:04:00+02:00
LINKED OPEN GRAPH
www.disit.org/ServiceMap/#close
Leaflet | Map data © OpenStreetMap contributors, CC-BY-SA, Imagery © Mapbox

Km4City Objectives

- **Provides a unique point of service** with integrated and aggregated data and tools for
  - Qualified users: public administrations → developers
  - Operators: mobility, energy, tourism, cultural, SME, shops, ….. → developers
  - Final users → citizens, students, pendular, tourists
- **Problems**:
  - Aggregated Data are not available:
    - not semantically interoperable, heterogeneous for: format, vocabulary, structure, velocity, volume, ownership/control, access / license, …
    - As OD, LD, LOD, private data, ..
  - Lack of Services and tools to make the adoption ***simple***

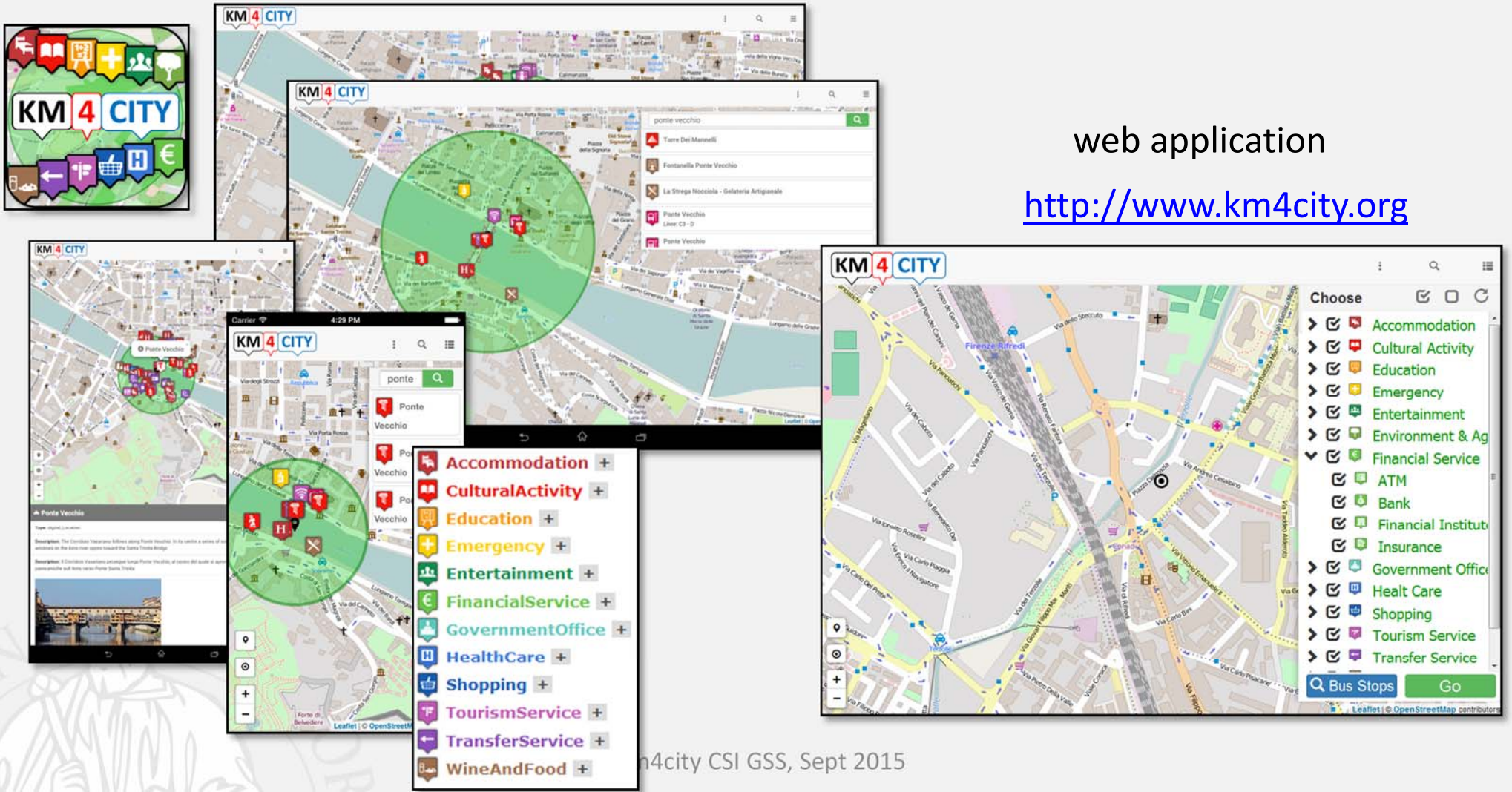
Km4City Tools

- **Final Users' Tools:**
  - *Km4City mobile app with personal assistant is coming…*
  - Km4City **mobile** applications: Google Play, Apple Store, …
  - Km4City web application: http://www.km4city.org
  - Open Source Mobile Application, FODD: an example in open source http://www.disit.org/6595
- **Public Administrators' Tools:**
  - Smart decision support system, http://smartds.disit.org
- **Developers http://www.disit.org/km4city tools:**
  - Service Map Server, plus API, http://servicemap.disit.org
  - LOG LOD browser: an ultimate visual tool to browse the RDF Store.
  - Ontology Documentation: an ultimate tool to understand, if needed !!



Km4CityMobile App: Google Play and Apple Store

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



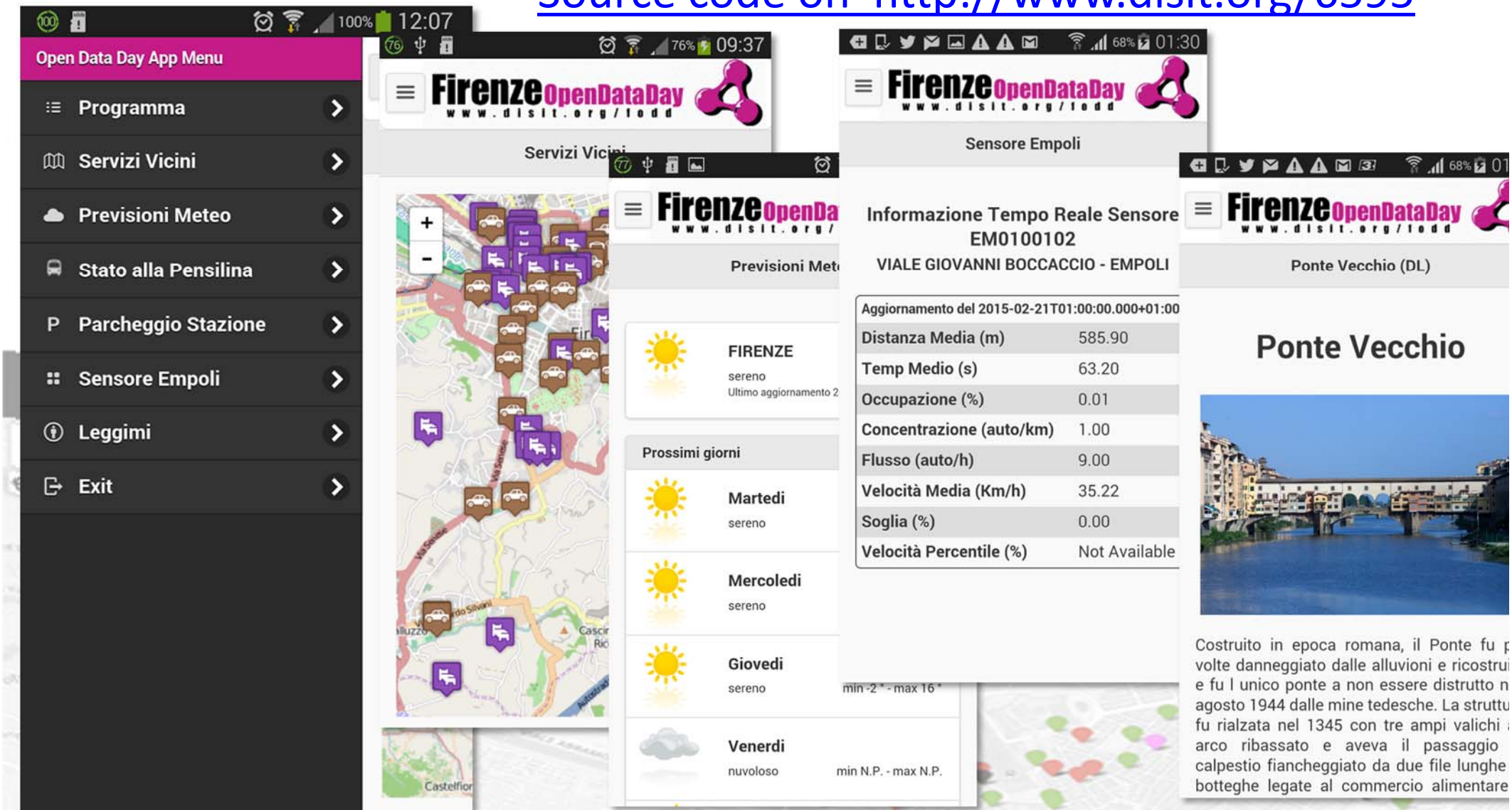
web application

http://www.km4city.org

https://play.google.com/store/apps/details?id=org.disit.fodd

Firenze OpenDataDay
www.disit.org/fodd

Source code on http://www.disit.org/6595



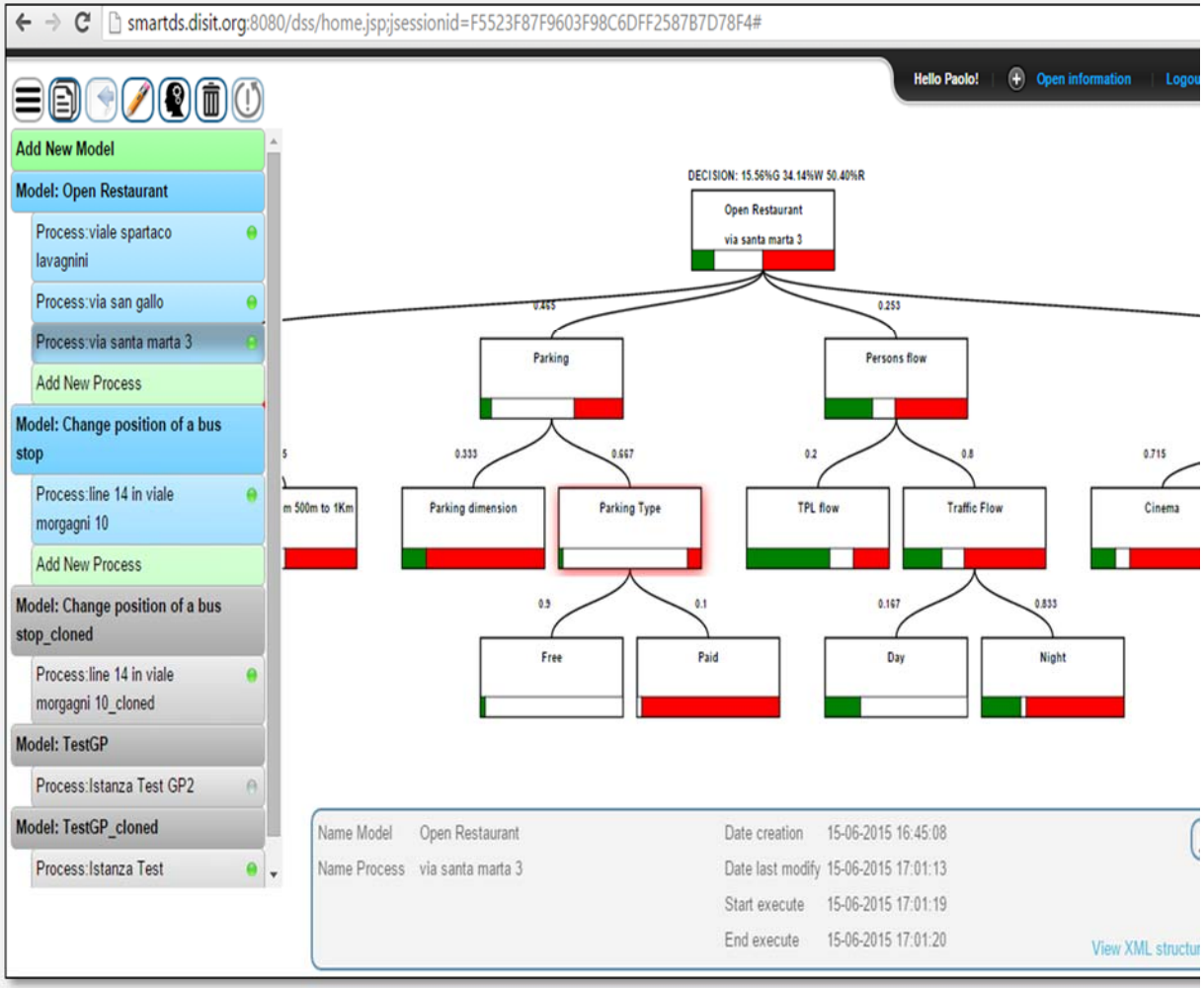
Smart City Decision Support

- http://smartds.disit.org (user paolo.nesi@unifi.it, password= prova)

- ***System Thinking***, well known tool for Smart City decision support sys..

Plus:

- Collaborative work…,
- reuse, copy past, …
- Processes connected with RDF Store of the city via SPARQL queries
- Mathematical model for propagation of decision confidence..



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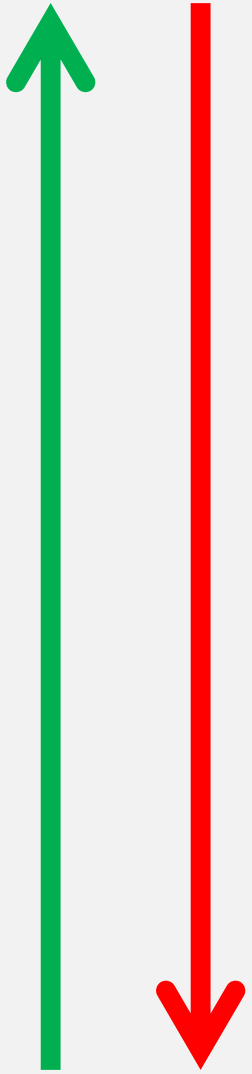


Km4City Developers for APPs

- **SME, not skilled on semantics, reasoning**..
  - SPARQL ?, RDF ?

➢ Simple development tools, mainly visual

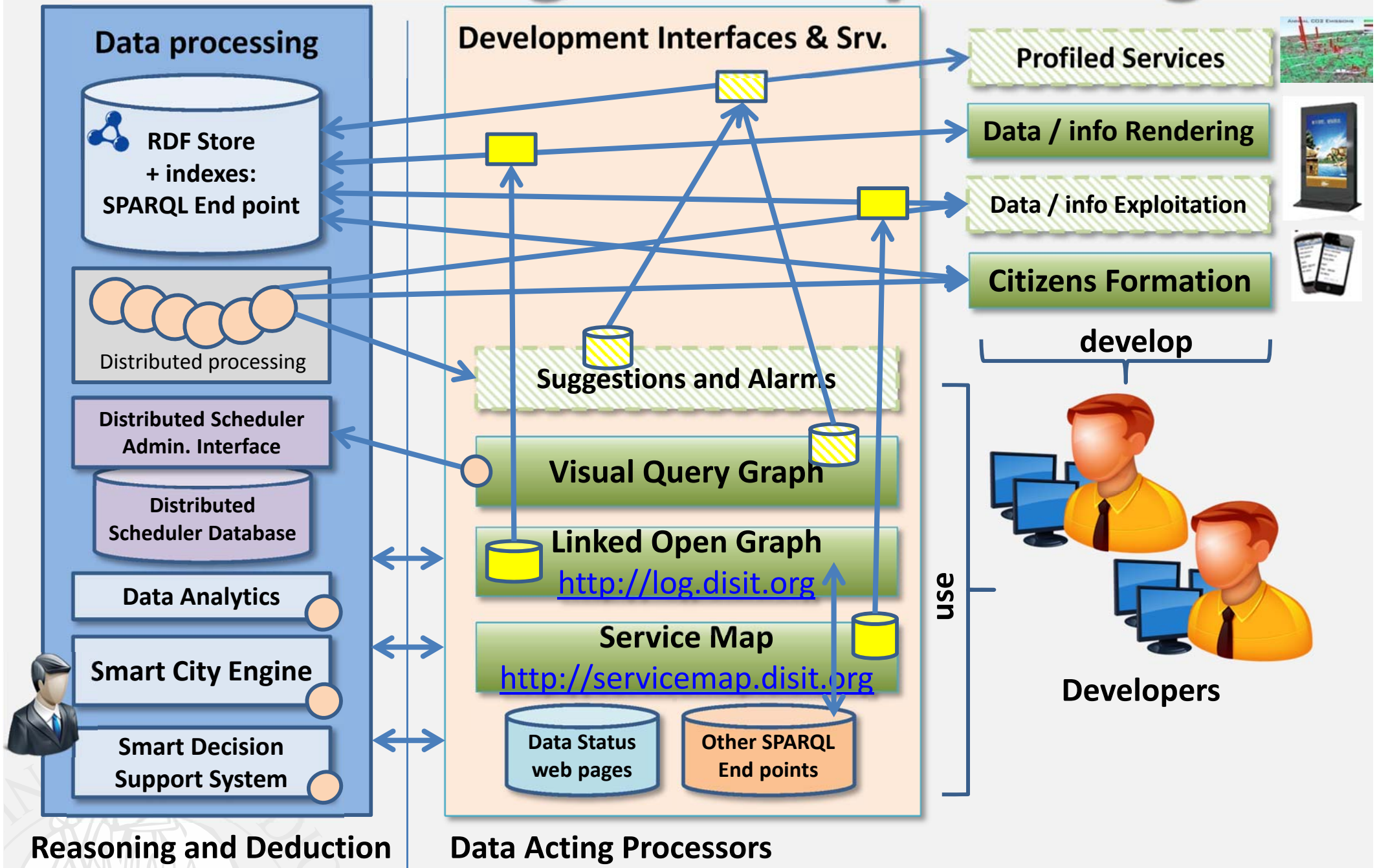
➢ Accessible examples

➢ Not depending on data

➢ Hackathons .. Tutorials..

- **THUS**:
  - **ServiceMap** Tool, plus API and documentation, http://servicemap.disit.org
  - **LOG LOD browser**: an ultimate visual tool to browse the RDF Store.
  - **Ontology** Documentation: an ultimate tool to understand, if needed !!

Reasoning and Exploiting



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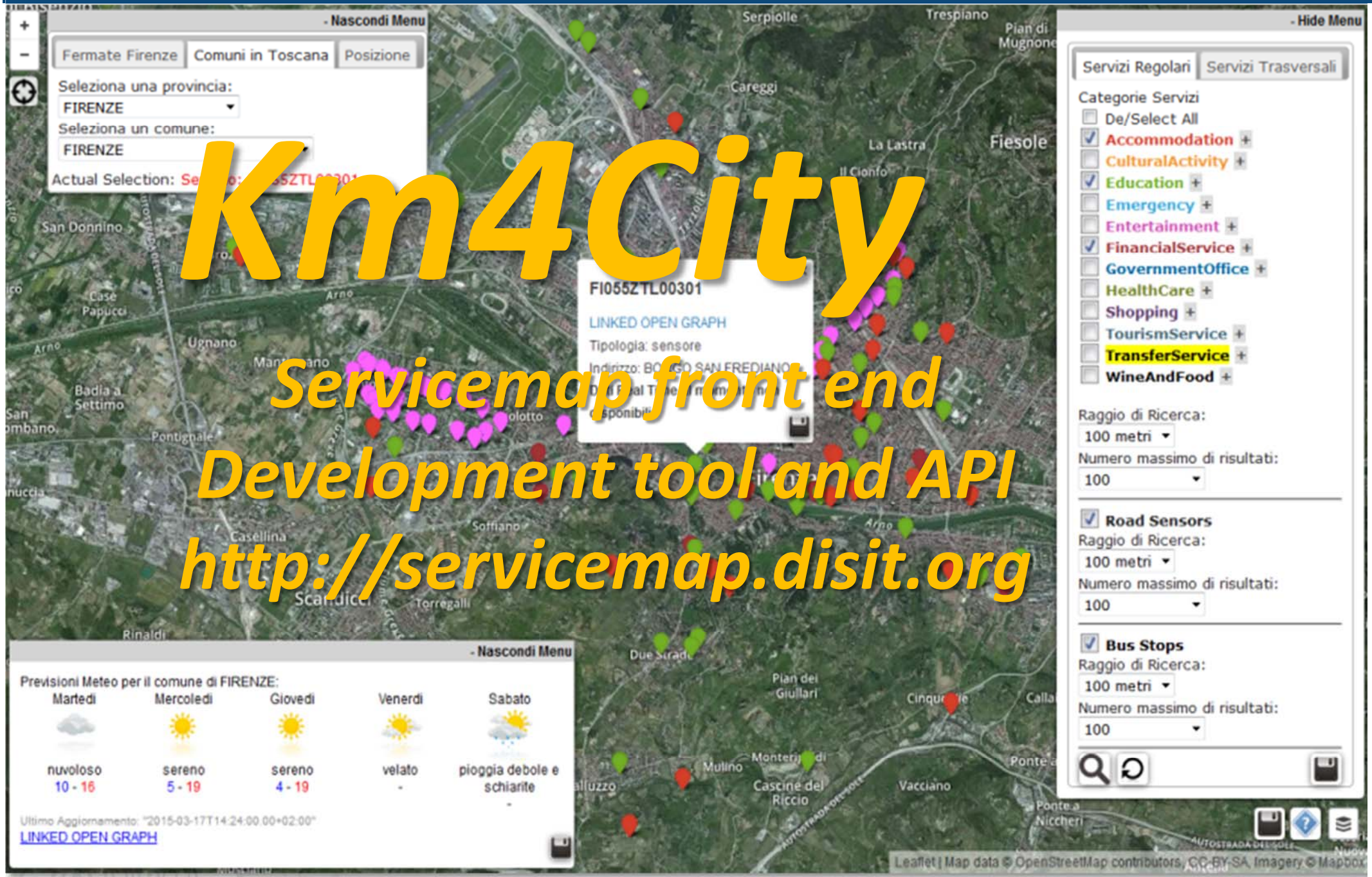
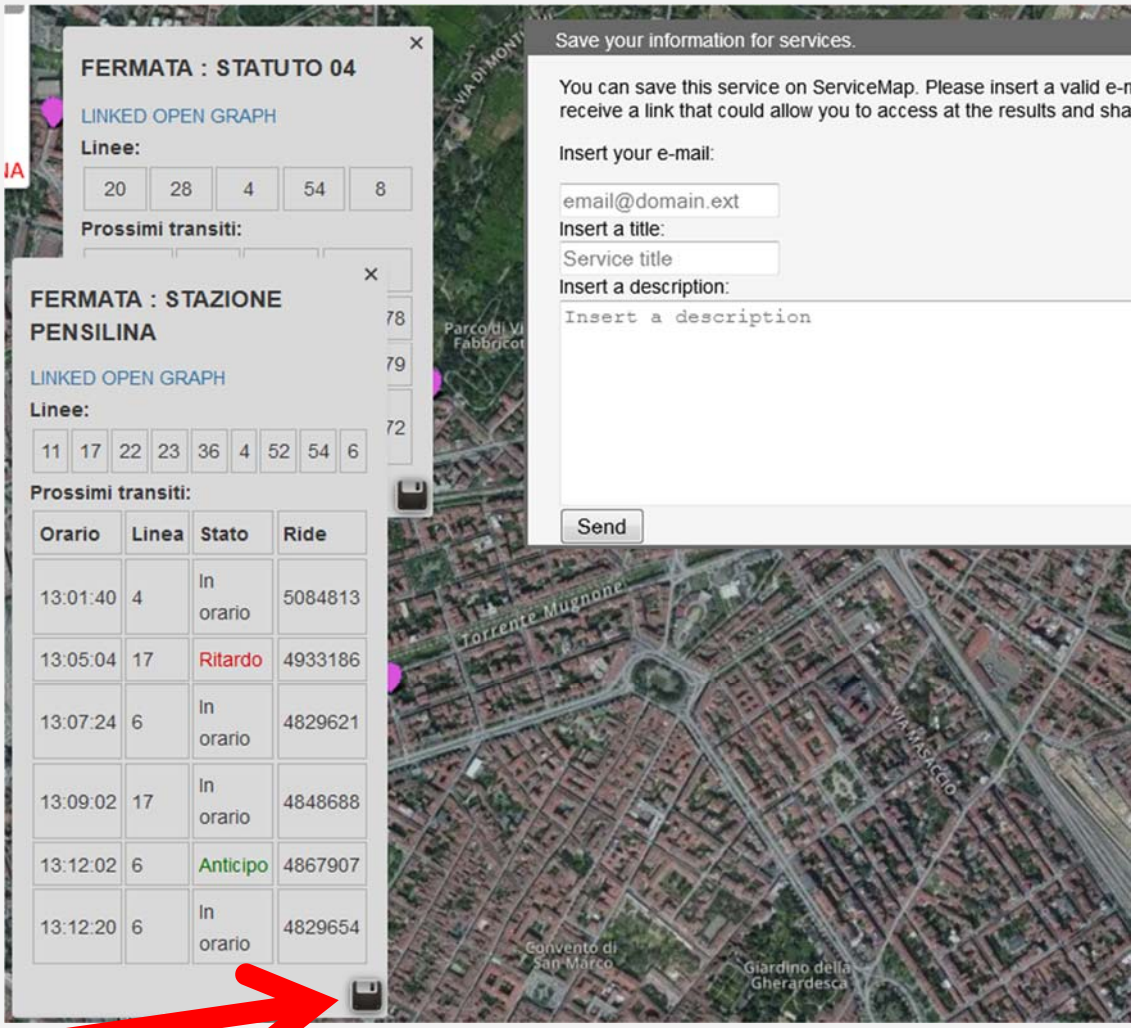


Km4City

Servicemap front end
Development tool and API
http://servicemap.disit.org

Km4City Servicemap & API

- 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



http://servicemap.disit.org

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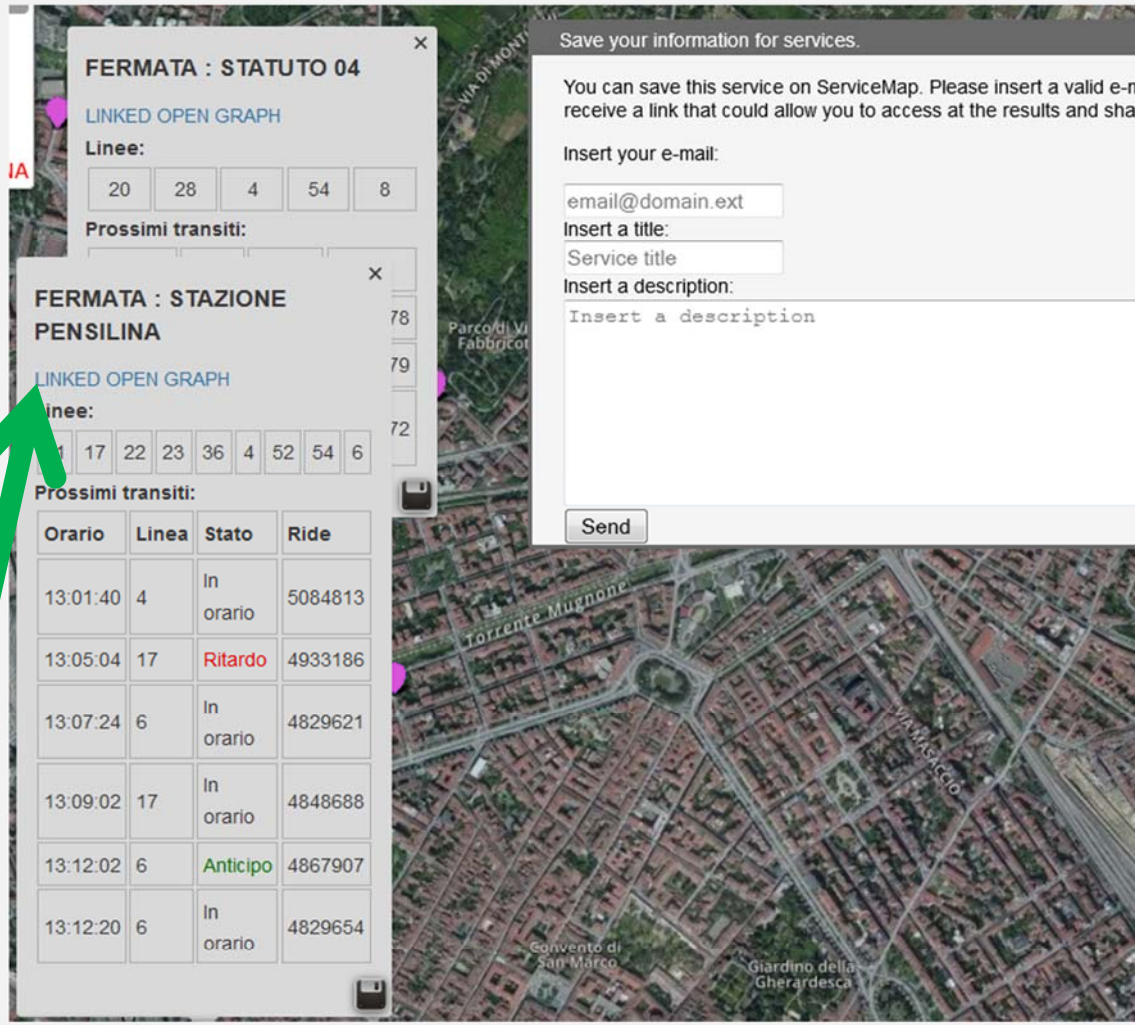
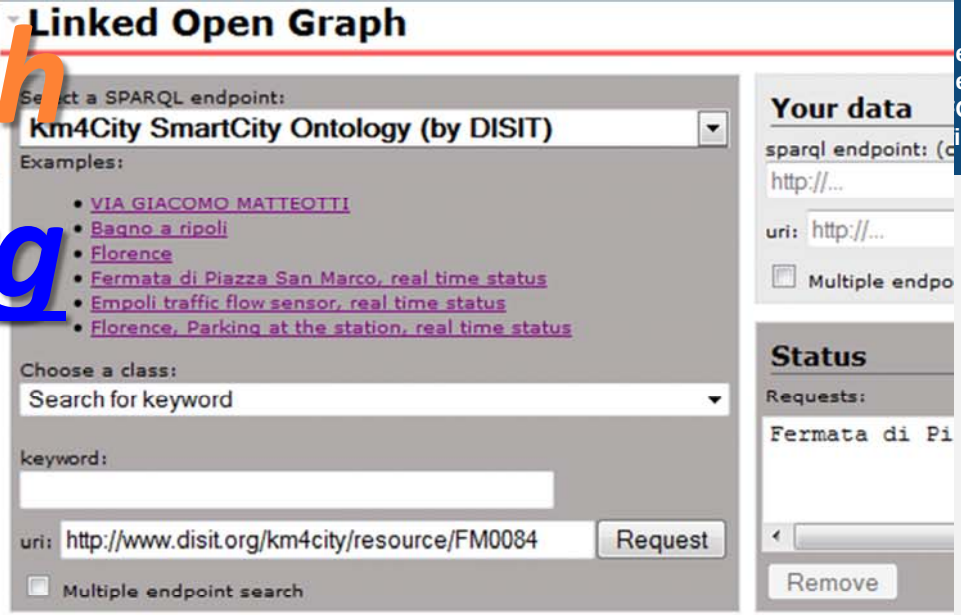


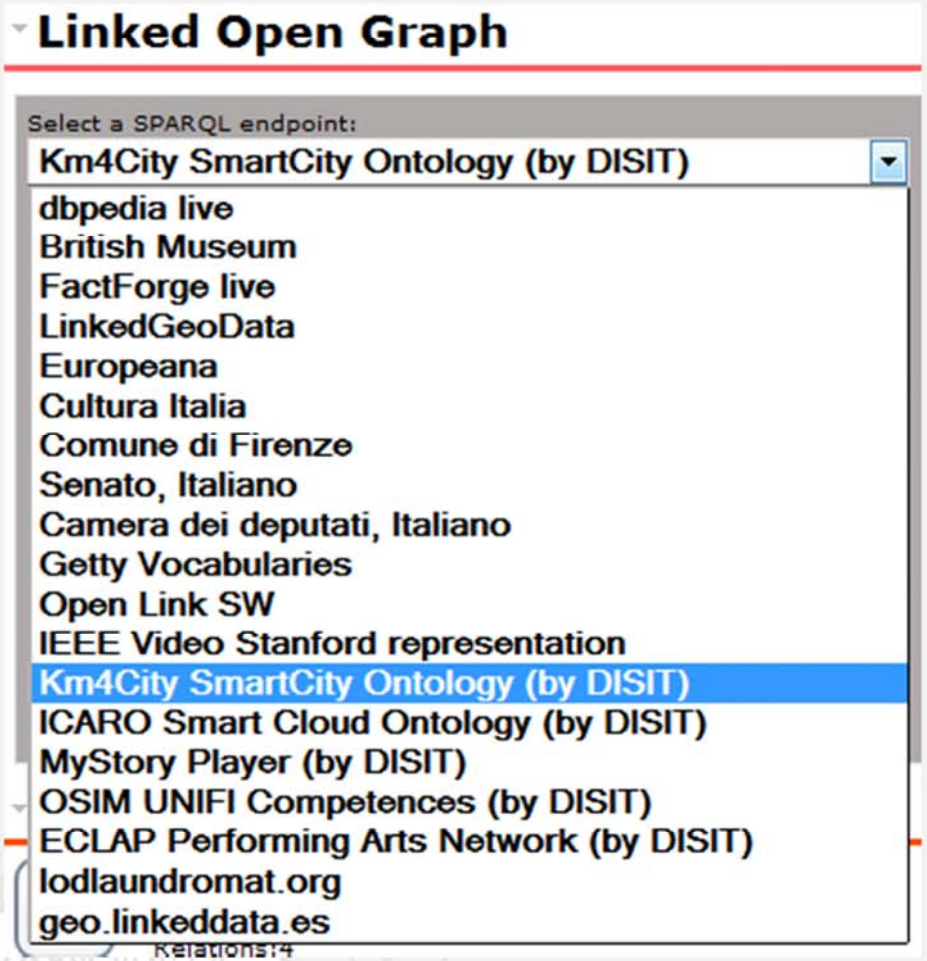
http://LOG.disit.org

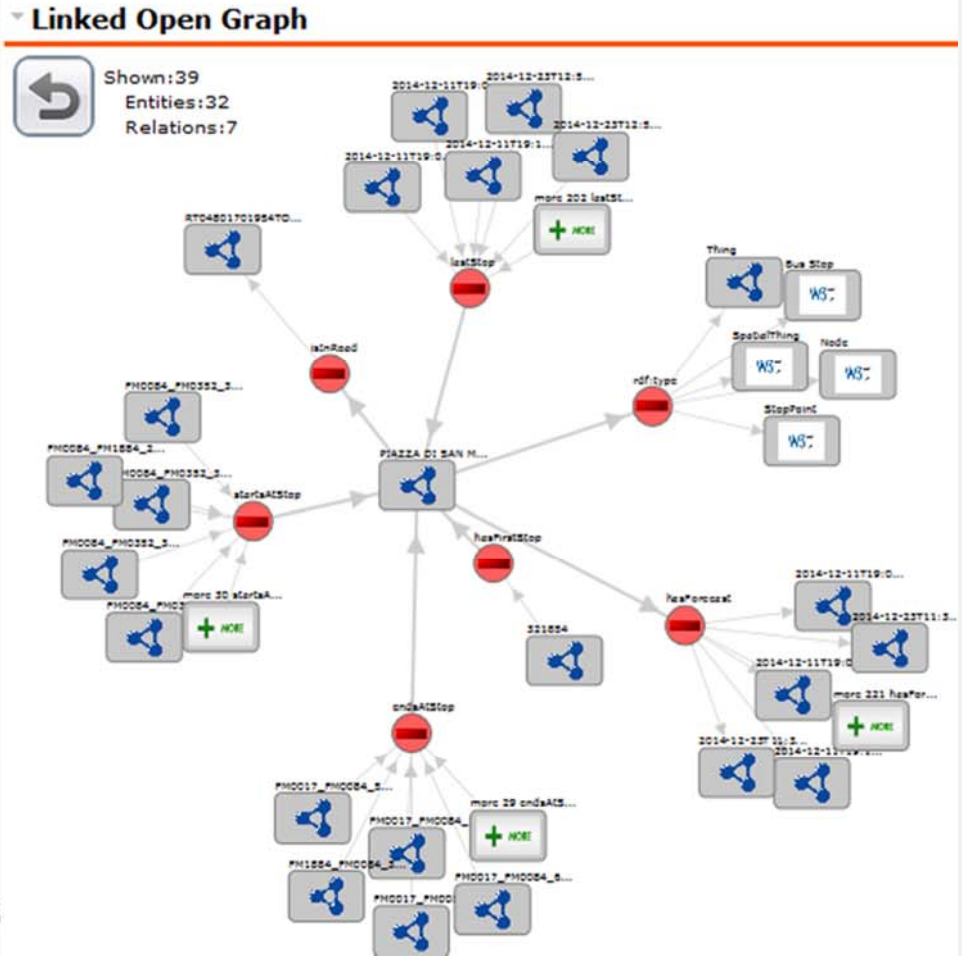
Linked Open Graph

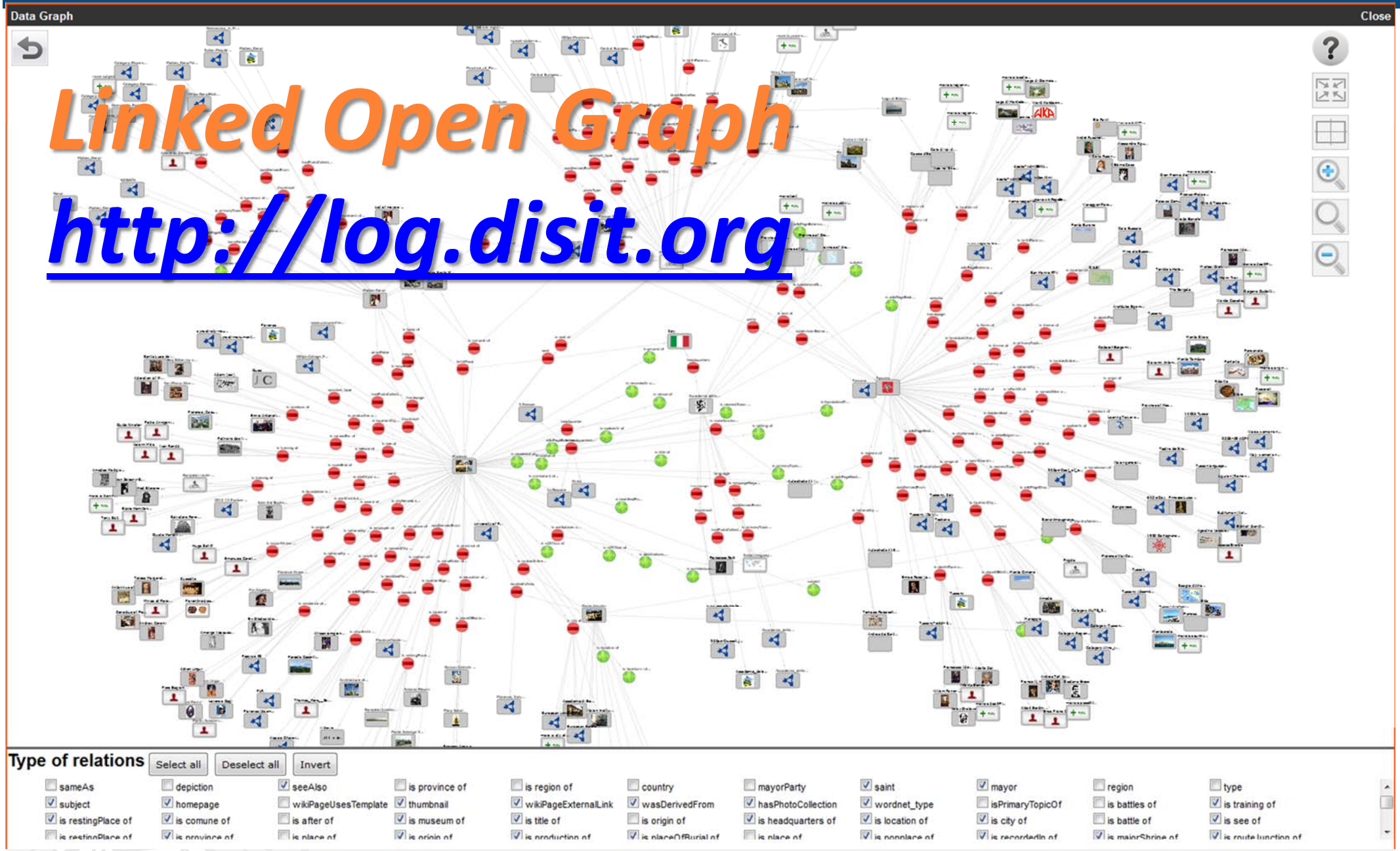
http://log.disit.org

A bus stop info….








Data Graph
Close
Linked Open Graph
http://log.disit.org
Type of relations
Select all
Deselect all
Invert
sameAs
depiction
seeAlso
is province of
is region of
country
mayorParty
saint
mayor
region
type
subject
homepage
wikiPageUsesTemplate
thumbnail
wikiPageExternalLink
wasDerivedFrom
hasPhotoCollection
wordnet_type
isPrimaryTopicOf
is battles of
is training of
is restingPlace of
is comune of
is after of
is museum of
is title of
is origin of
is headquarters of
is location of
is city of
is battle of
is see of

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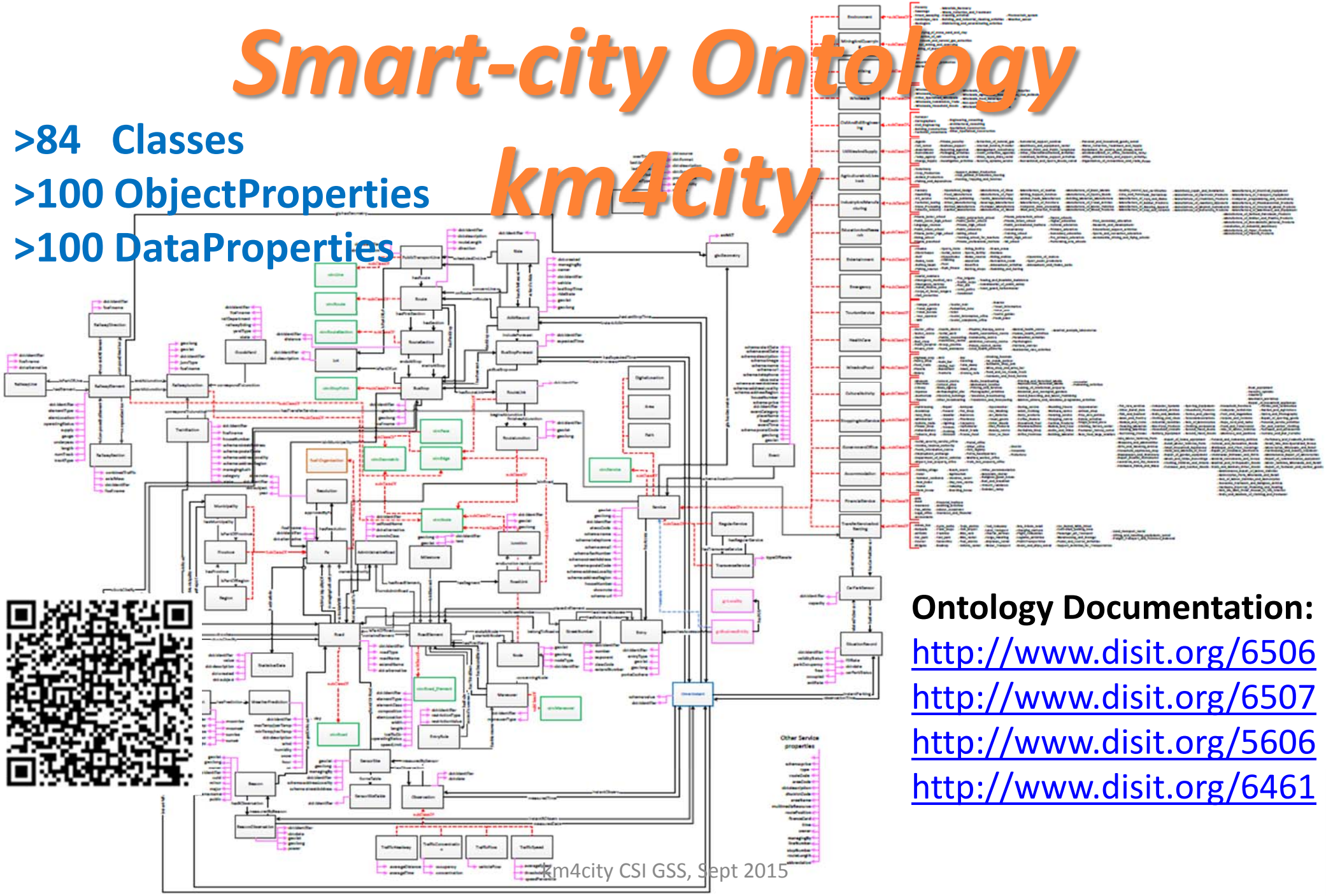
Smart-city Ontology km4city

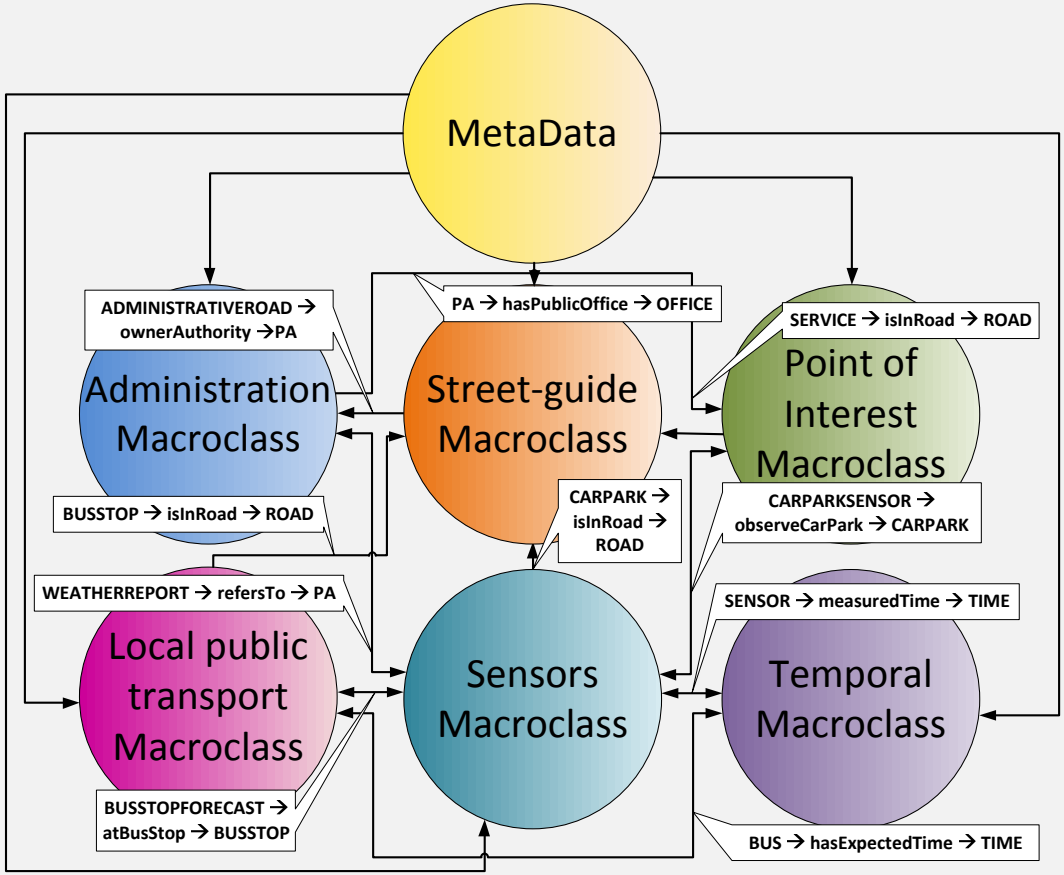
>84 Classes
>100 ObjectProperties
>100 DataProperties



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

Smart-city Ontology

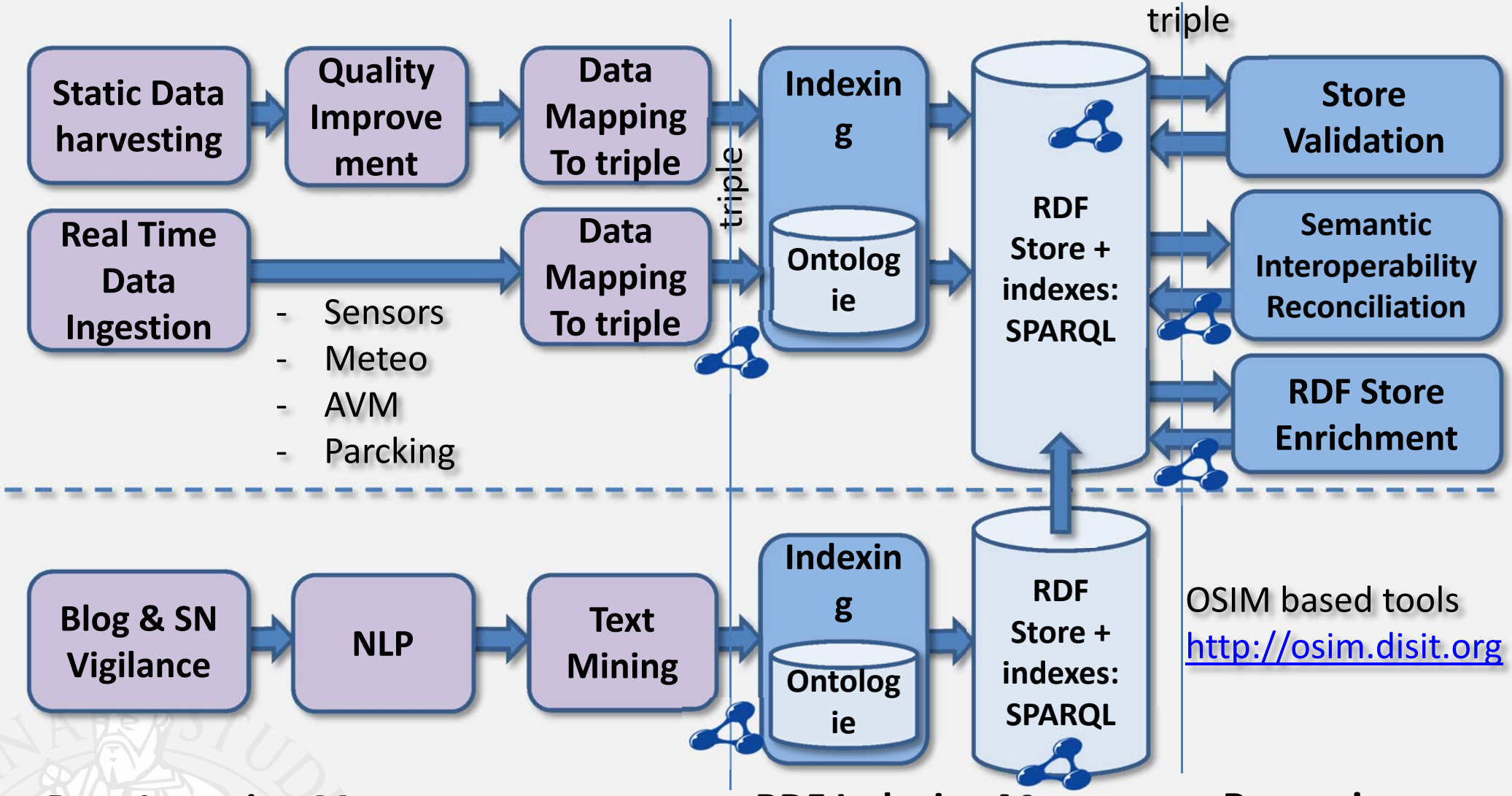
- The data model provided have been mapped into the ontology, it covers different aspects:
  - Administration
  - Street-Guide
  - Points of interest
  - Citations from strings
  - Local public transport
  - Sensors..
  - Temporal aspects
  - Metadata on the data
  - →Statistics
  - →Risk assessment



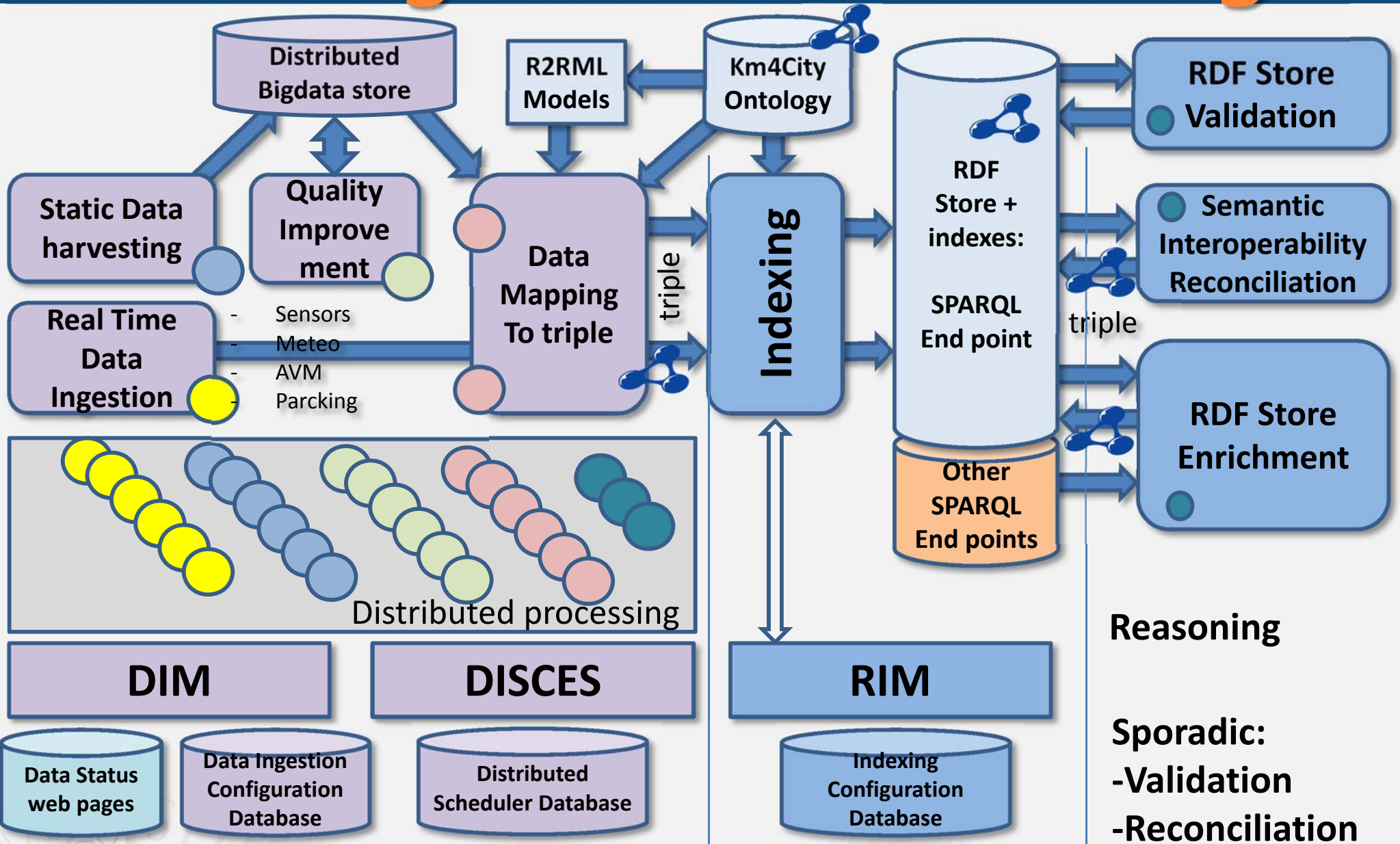
km4City Back Office Tools

- **The dirty work of Km4City service**
  - Data Ingestion Manager, DIM
  - RDF Indexer Manager, RIM
  - ..
  - RDF Store Methodology
  - RDF store enricher: dbPedia, ..
  - Distributed SCE Scheduler, DISCES
    - SCE: Smart City Engine
  - ..
  - Doc and info on http://www.disit.org/km4city

Data Ingestion and Mining



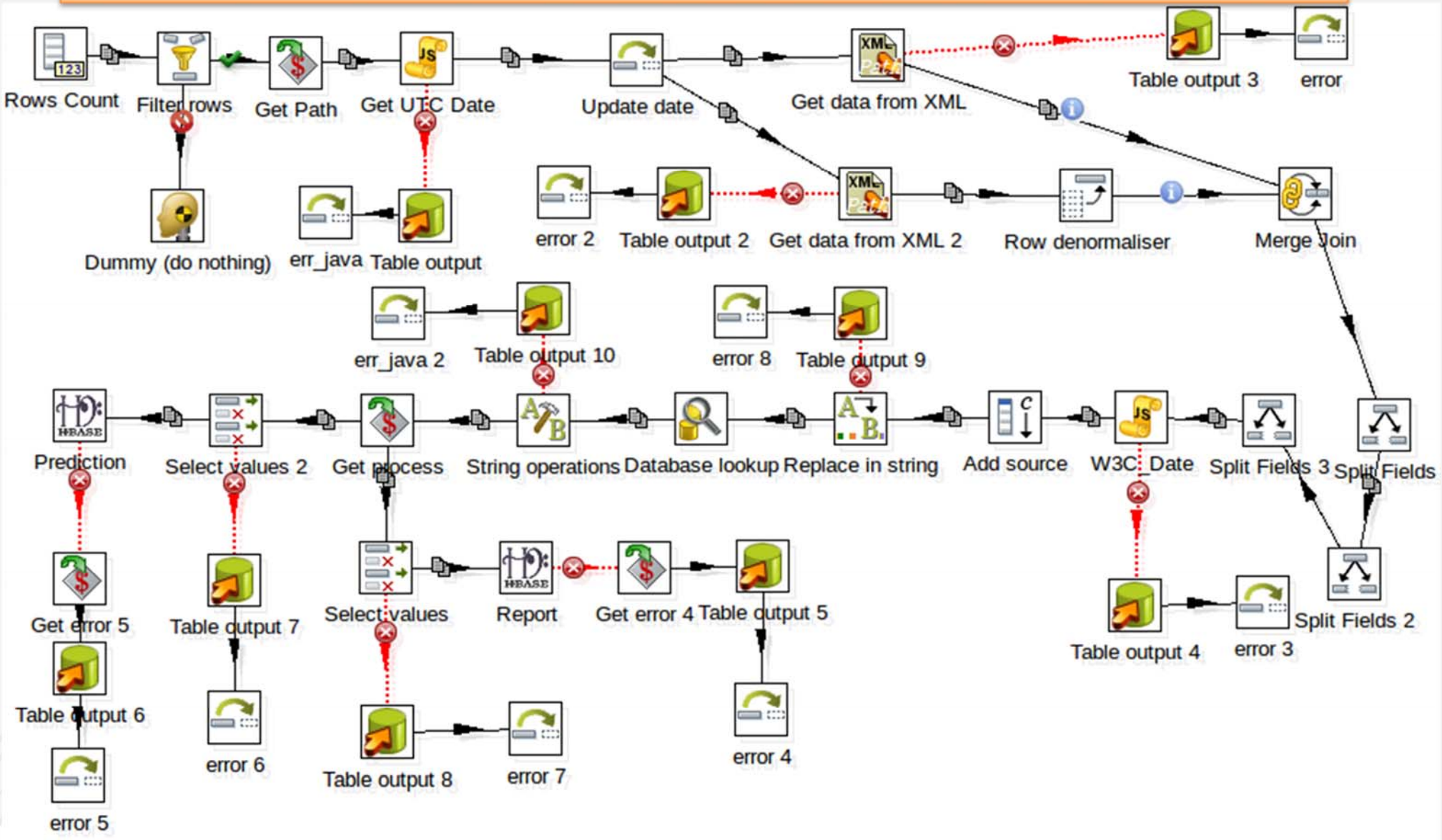
Data Ingestion and Mining



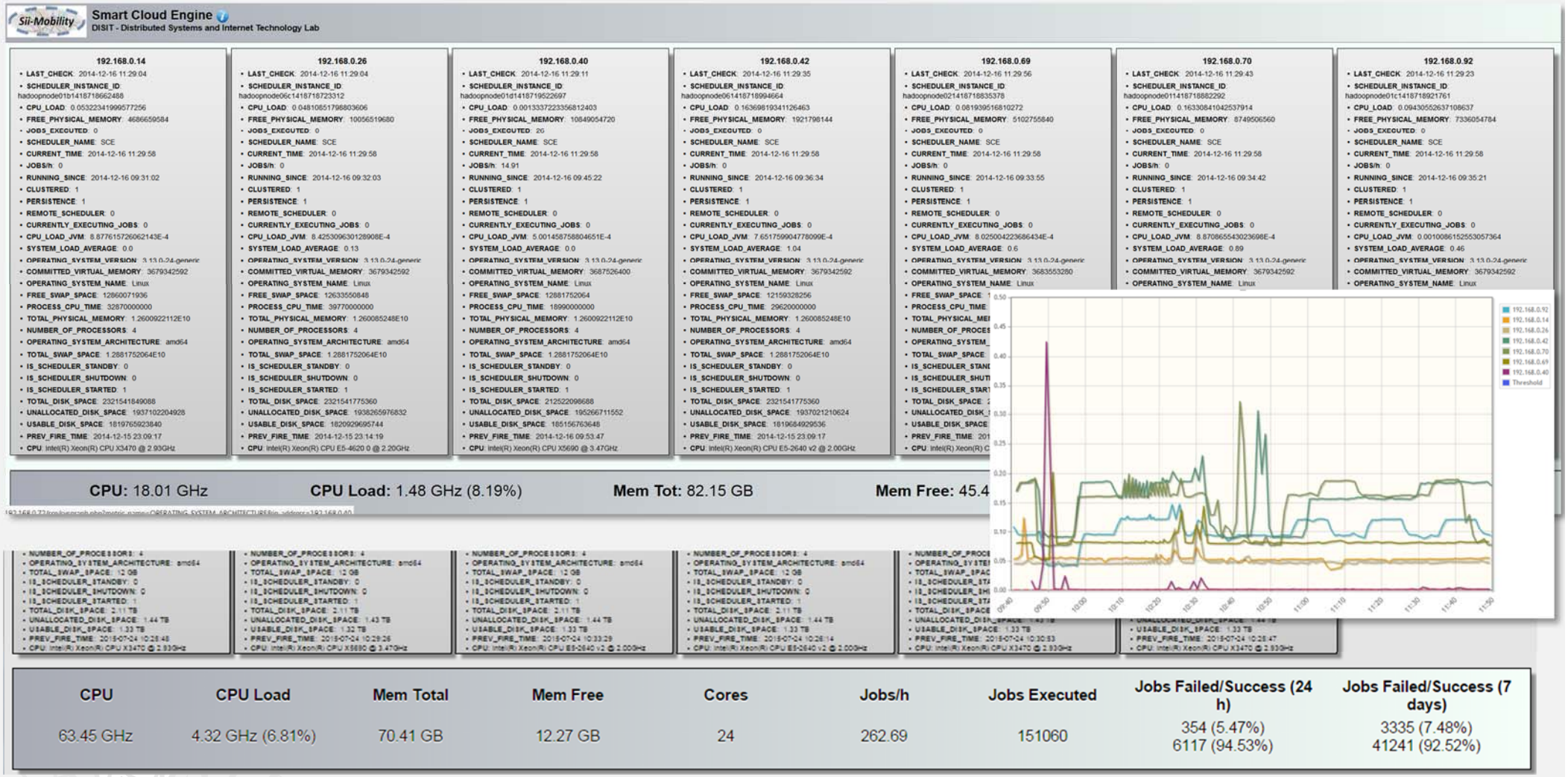
DIM and RIM

- **Data Ingestion Manager and SCE**
  - Managing workflow of thousands of different data sources
  - Scheduling activities
  - Executing processes on parallel and distributed architecture HBASE
  - ETL and ++ : **harvesting**, ingestion, enrichment, mapping, producing **triples**, etc., etc.,
  - http://www.disit.org/6732
- **RDF Indexing Manager**
  - Supporting methodology for ***ontology integration*** and ***RDF store building***
  - RDF store versioning
    - Recovering from snapshots, phases, ..
  - Making verification and validation of produced RDF stores
  - http://www.disit.org/6750

Example of Ingestion process



Distributed SCE Scheduler

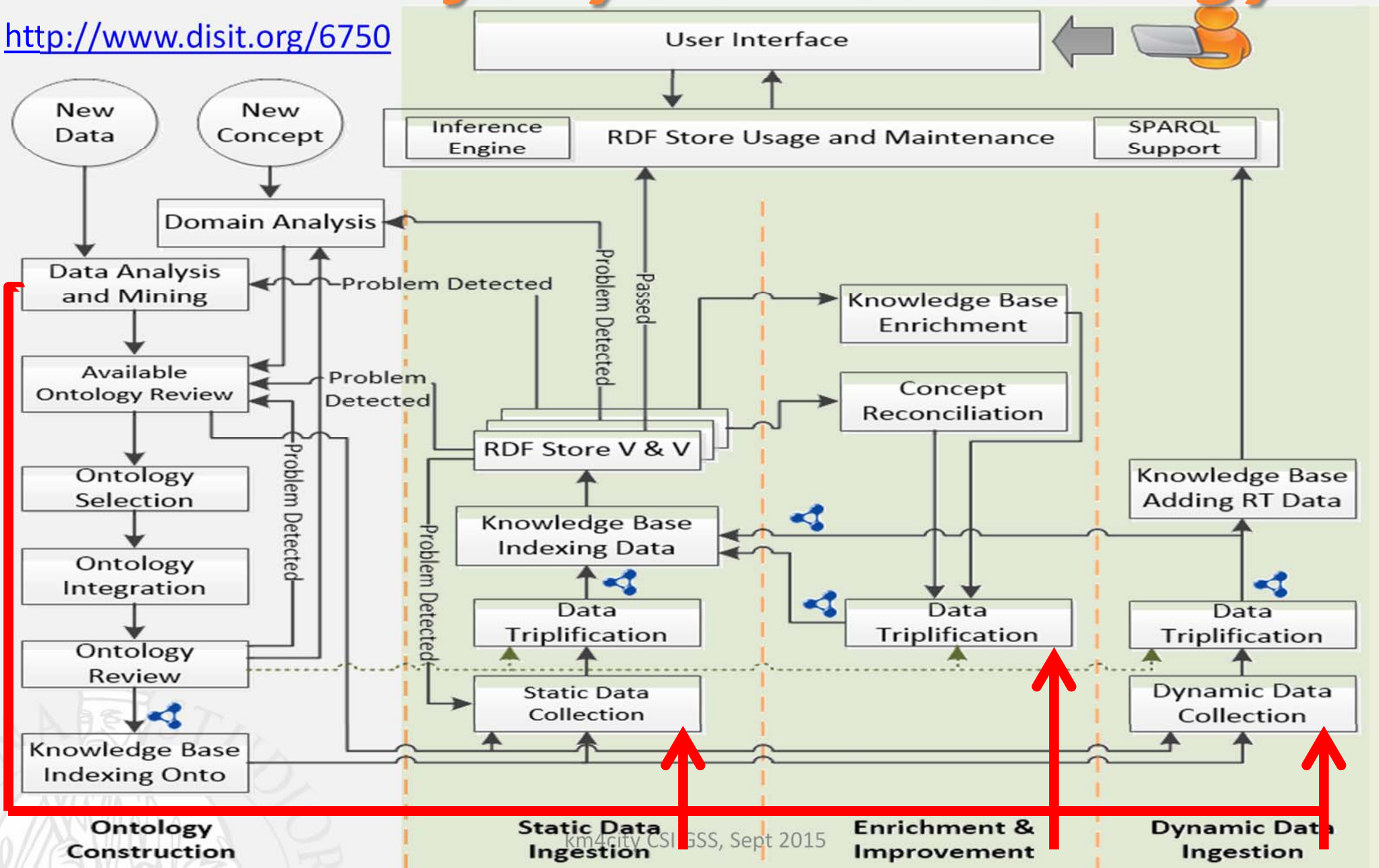


CPU	CPU Load	Mem Total	Mem Free	Cores	Jobs/h	Jobs Executed	Jobs Failed/Success (24 h)	Jobs Failed/Success (7 days)
63.45 GHz	4.32 GHz (6.81%)	70.41 GB	12.27 GB	24	262.69	151060	354 (5.47%) 6117 (94.53%)	3335 (7.48%) 41241 (92.52%)

http://www.disit.org/6746

RDF KB life cycle methodology

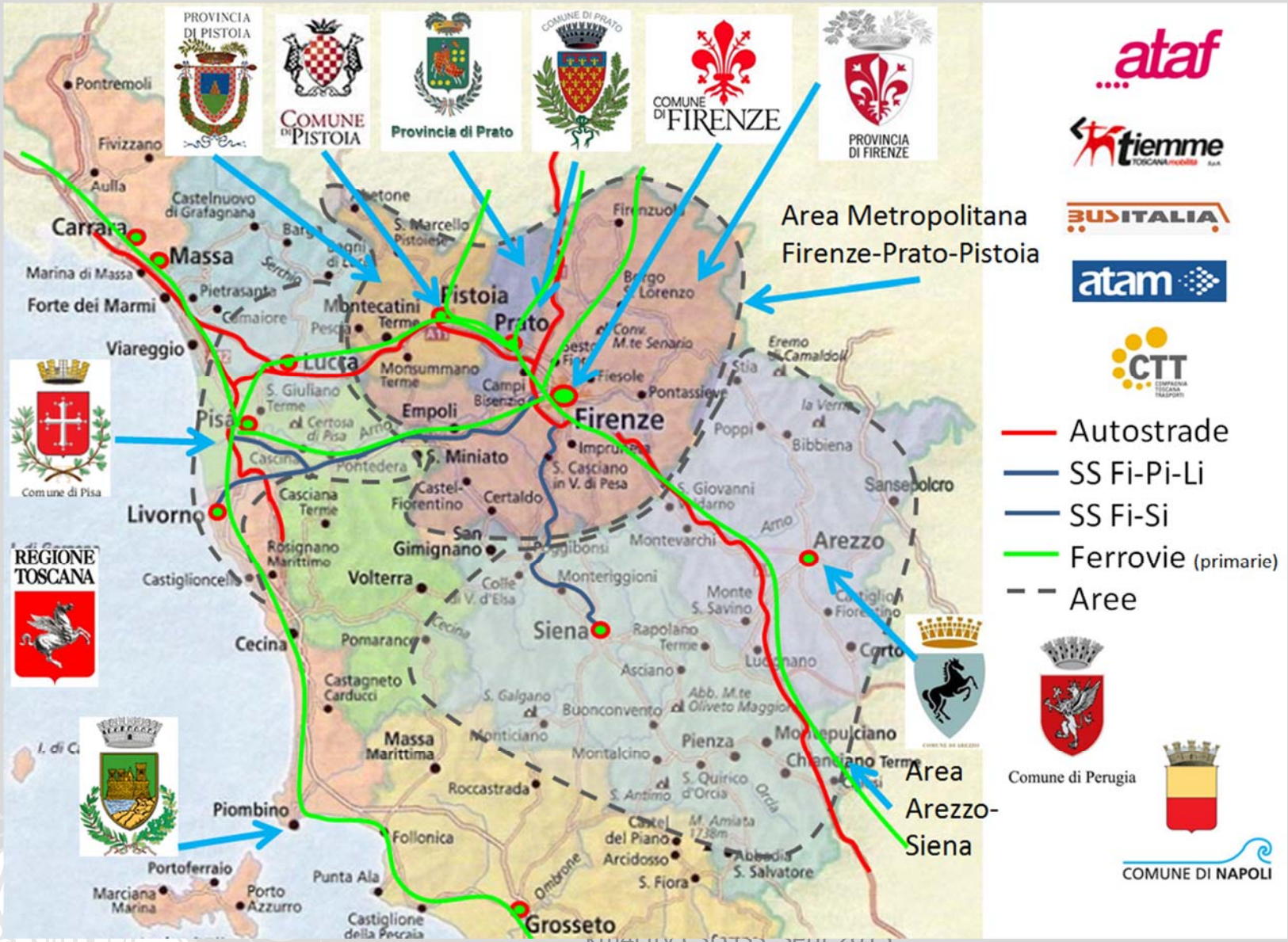
http://www.disit.org/6750



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

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



H2020 RIA project

- Develop a conceptual framework for creating/ maintaining Urban Transport Systems
- Develop European Resilience Management Guidelines (ERMG)
- 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
- Enhance resilience through improved support of human decision making processes, particularly by training professionals and civil users on the ERMG and the RESOLUTE system
- Adoption of the ERMG at EU and Associated Countries level

Conclusions

- ***Km4City model and tools are:***
  - Scalable, smart and flexible: solving the smart city data dilemma….
  - Supported by tools for developers, backoffice, public administrators, decision makers, and final users
  - Beyond the pure information retrieval exploiting
    - inference on (sameAs, sub, equivalent, inverse, transitive, symmetrical..,
    - reasoning on space, time,
    - Enrichment and textual indexing ….. All together
    - Ready for Personal Assistants as a Service, PAaaS

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