

Smart City @ DISIT Lab

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

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Major topics addressed

- Smart City Concepts 
- Architecture of Smart City Infrastructures
 - Peripheral processors
 - Data ingestion and mining
 - Reasoning and Deduction
 - Data Acting processors
- SmartCity Project Coll@bora
- SmartCity Project Sii-Mobility
- Data Mining and smart City problematic
 - DISIT Smart City Ontology
 - Data ingestion and integration
 - Service Map and Linked Open Graph
- Blog Vigilance via Natural Language Processing
- Mobile Emergency

Motivations

- **Societal challenge**

- We see a strong increment of population of our cities, since in the cities the life is simple and of higher quality in term of services and working opportunities
- The cities needs to be adapted to the increment of population, to new evolving ages, to the new technologies and expectations of population

- → **Sustainability of the growth**

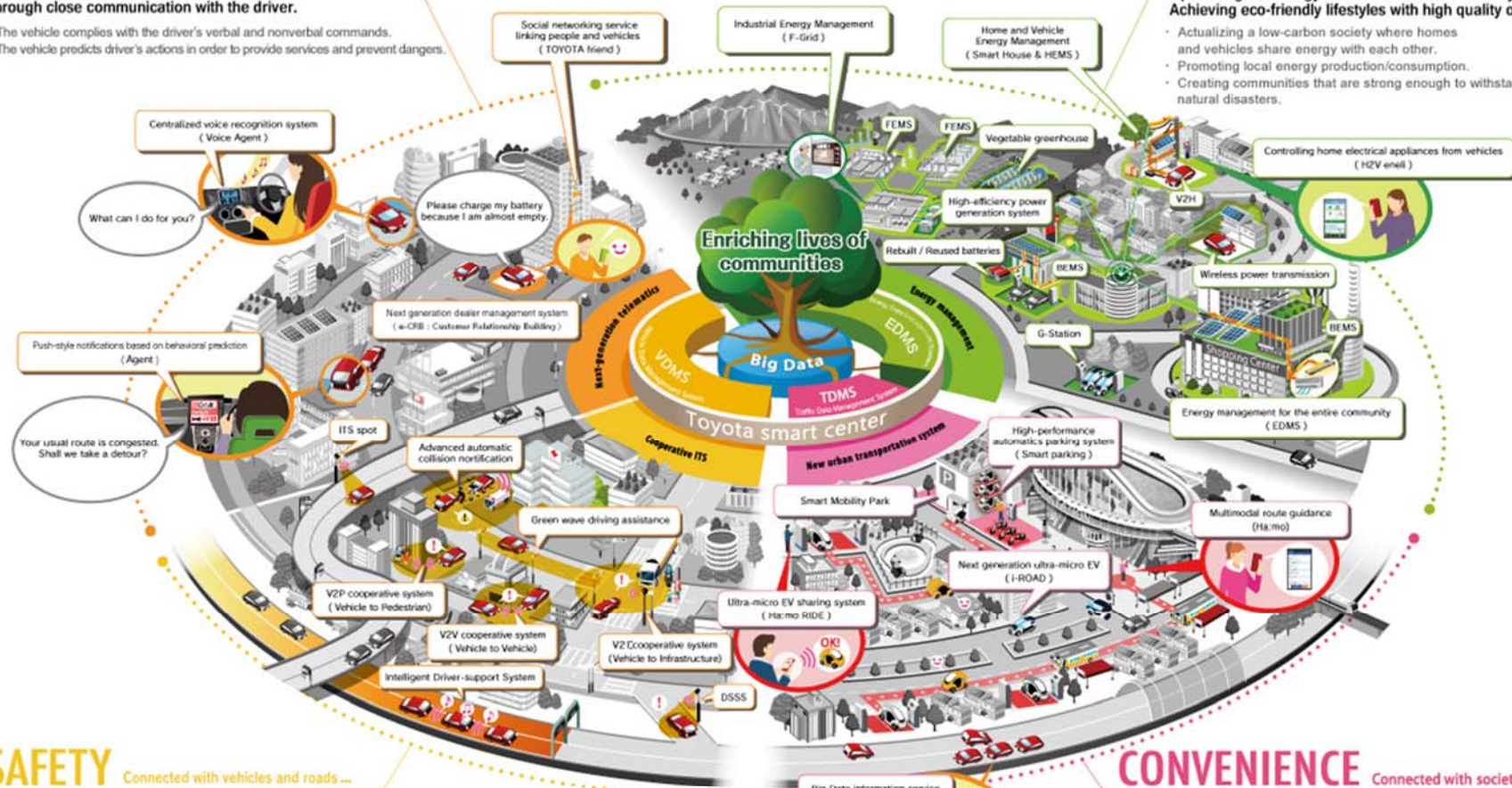
TOYOTA's Activities towards SMART MOBILITY SOCIETY

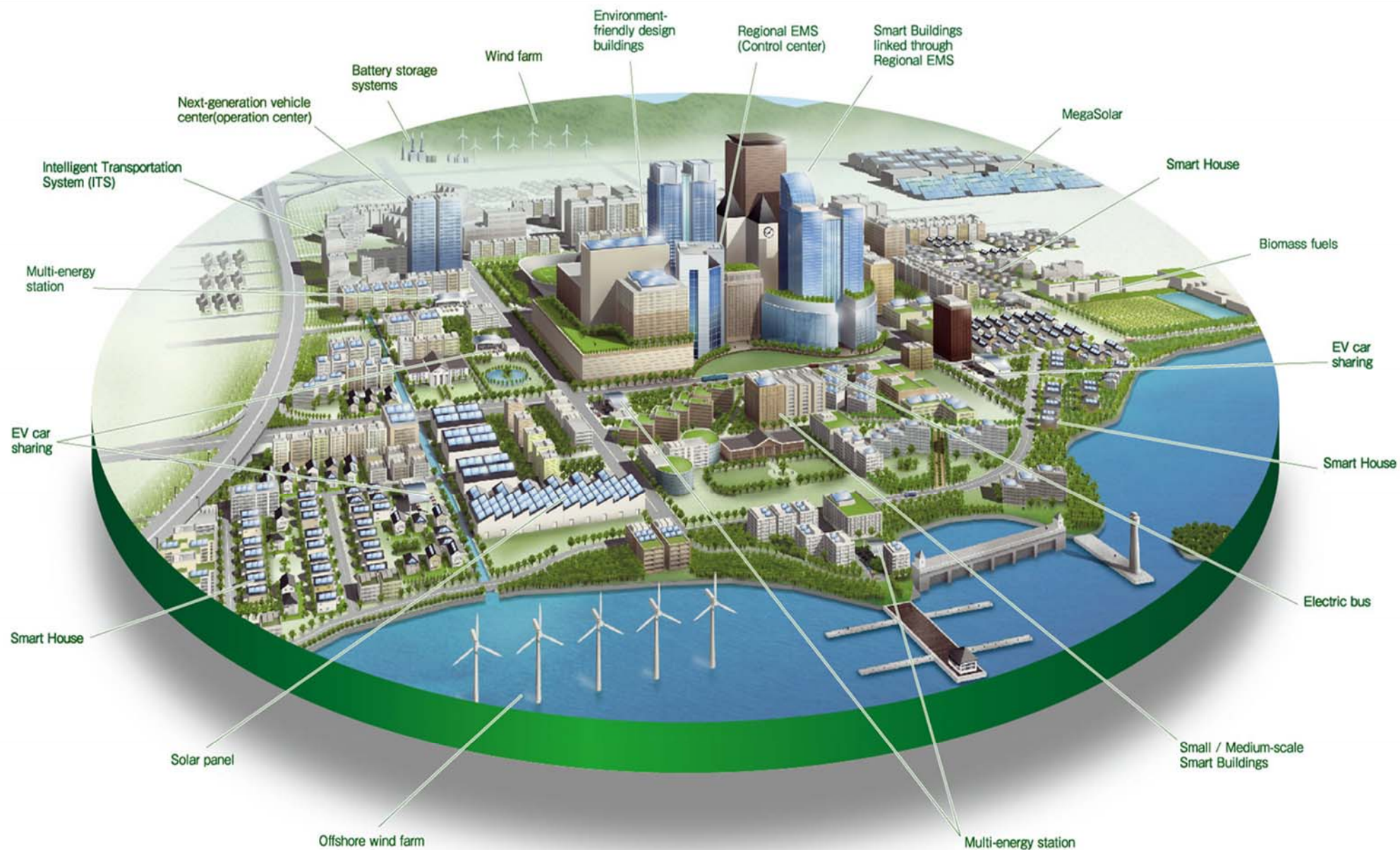
Toyota aims to create a smart mobility society where people feel secure and happy in transport and everyday life.

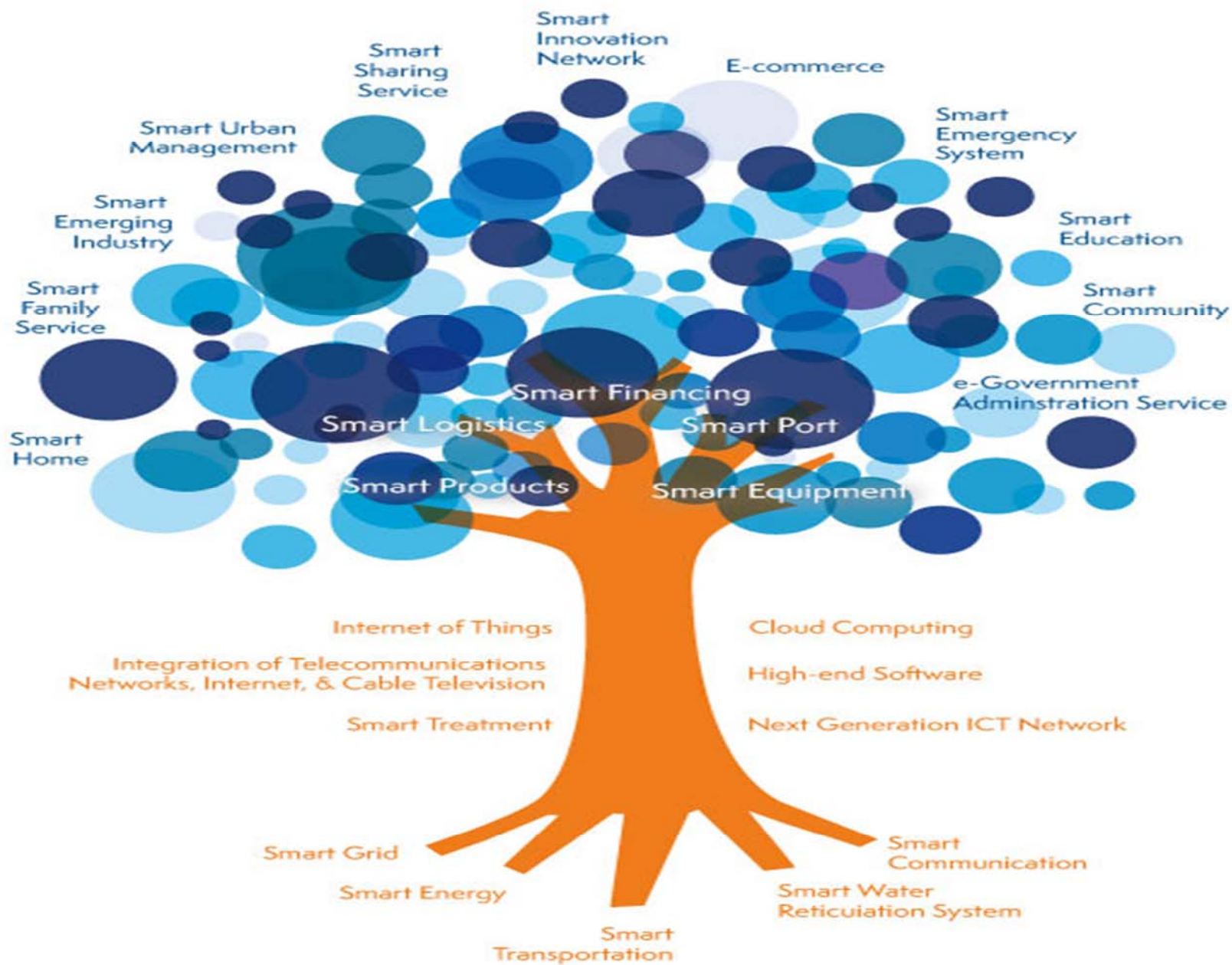
COMFORT Connected with people...

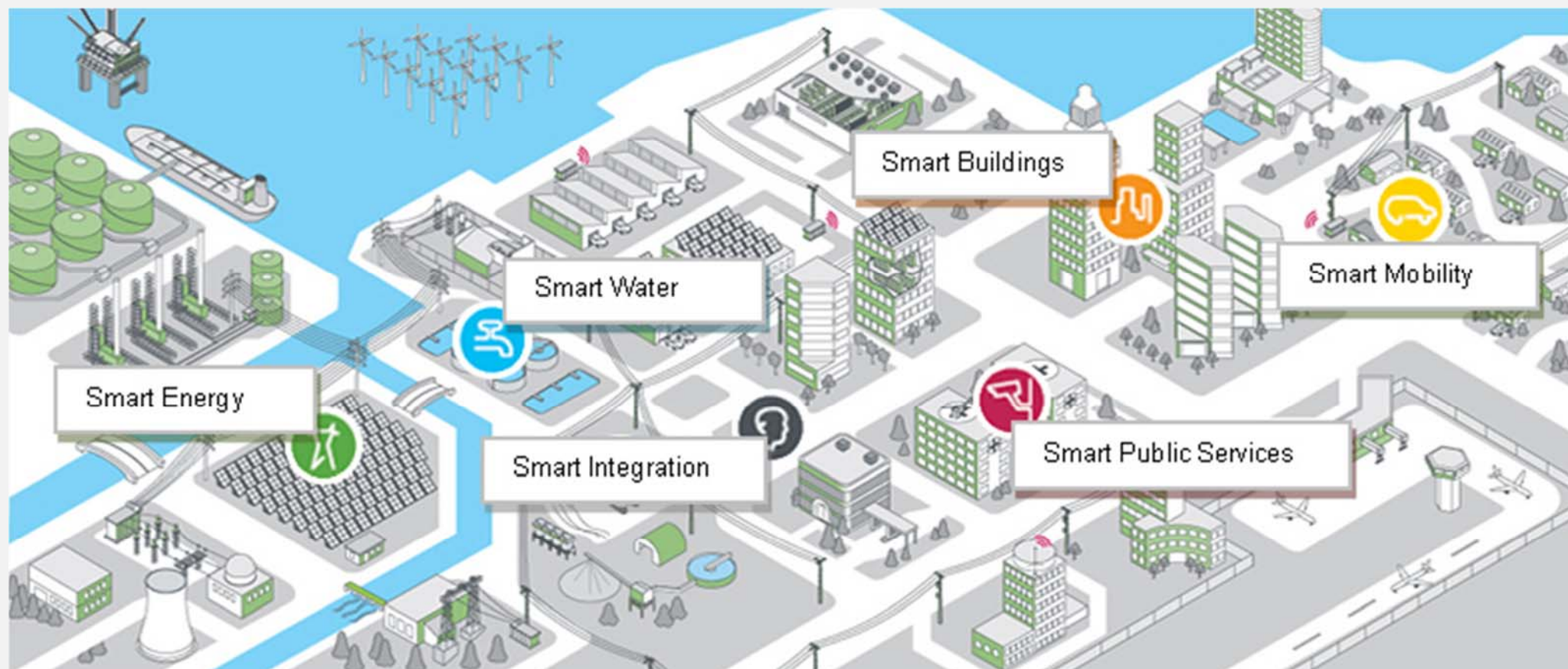
The vehicle will become a trusted partner through close communication with the driver.

- The vehicle complies with the driver's verbal and nonverbal commands.
- The vehicle predicts driver's actions in order to provide services and prevent dangers.









Sustainability of the Growth

- To be **planned and managed** with respect to increment of population and their needs
 - increment of efficiency:
 - compensation of the increments of costs
 - Increment of quality of life:
 - compensation of the decrement of quality of life
 - provisioning of new services:
 - compensation of the inadequacy of services
 - Decision support for strategic aspects
 - Corrections, prediction, new services, etc.
- **Towards citizens**
 - Informing citizens on the new adaptations, making them aware about that
 - Forming citizens to adopt virtuous behaviour in the usage of services and resources

Smartness, smart city needs 6 features

- Smart Health
- Smart Education
- Smart Mobility
- Smart Energy
- Smart Governmental
 - Smart economy
 - Smart people
 - Smart environment
 - Smart living
- Smart Telecommunication

Smart health

(can be regarded as smart governmental)

- Online accessing to health services:
 - booking and paying
 - selecting doctor
 - access to EPR (Electronic Patient Record)
- **Monitoring** services and users for,
 - learn people behavior, create collective profiles
 - personalized health
 - Inform citizens to the risks of their habits
 - Improve efficiency of services
 - redistribute workload, thus reducing the peak of consumption



Smart Education

(can be regarded as smart governmental)

- Diffusion of ICT into the schools:
 - LIM, PAD, internet connection, tables, ..
- Primary and secondary schools → university
→ industry & services
- **Monitoring** the students and quality of service,
 - learn student behavior, create collective profiles,
 - personalized education
- suggesting behavior to
 - Informing the families
 - moderate the peak of consumption
 - increase the competence in specific needed sectors, etc.
 - Increase formation impact and benefits



Smart Mobility



- Public transportation:
 - bus, railway, taxi, metro, etc.,
- Public transport for services:
 - garbage collection, ambulances,
- Private transportation:
 - cars, delivering material, etc.
- New solutions (public and/or private):
 - electric cars, car sharing, car pooling, bike sharing, bicycle paths
- Online:
 - ticketing, monitoring travel, infomobility, access to RTZ, parking, etc.



Smart Mobility and urbanization

- **Monitoring** the city status,
 - learn city behavior on mobility
 - learn people behavior
 - create collective profiles
 - tracking people flows
- **Providing Info/service**
 - personalized
 - **Info** about city status to
 - help moving people and material
 - education on mobility,
 - moderate the peak of consumption
- **Reasoning to**
 - make services sustainable
 - make services accessible
 - Increase the quality of service



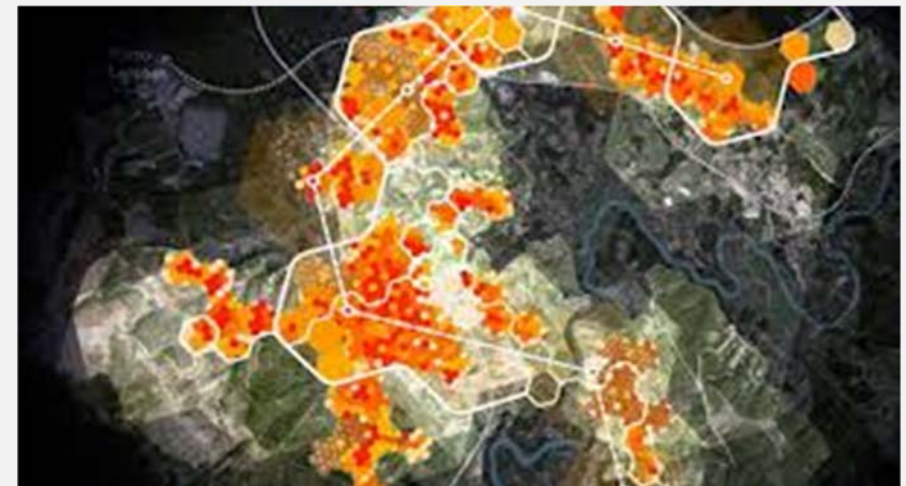
Smart Energy

- **Smart building:**
 - saving and optimizing energy consumption, district heating
 - renewable energy: photovoltaic, wind energy, solar energy, hydropower, etc.
- **Smart lighting:**
 - turning on/off on the basis of the real needs
- **Energy points for electric:**
 - cars, bikes, scooters,
- **Monitoring** consumption, learn people/city behavior on energy consumption, learn people behavior, create collective profiles
- **Suggesting consumers**
 - different behavior for consumption: different time to use the washing machine
- **Suggesting administrations**
 - restructuring to reduce the global consumption,
 - moderate the peak of consumption



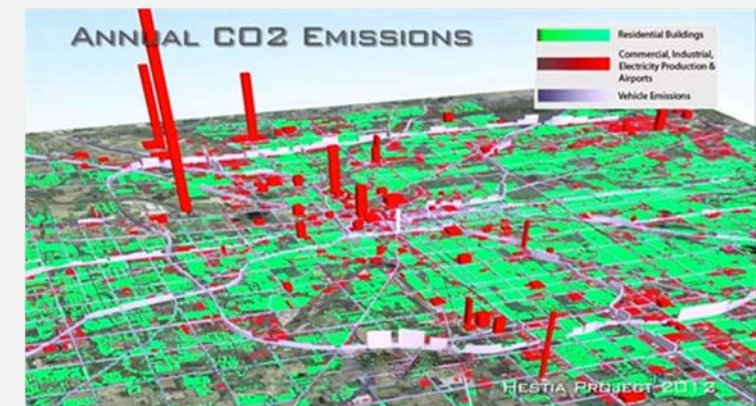
Smart Governmental Services

- Service toward citizens:
 - on-line services:
 - register, certification, civil services, taxes, use of soil, ...
 - Payments and banking:
 - taxes, schools, accesses
 - Garbage collection:
 - regular and exceptional
 - Quality of air:
 - monitoring pollution
 - Water control:
 - monitoring water quality, water dispersion, river status



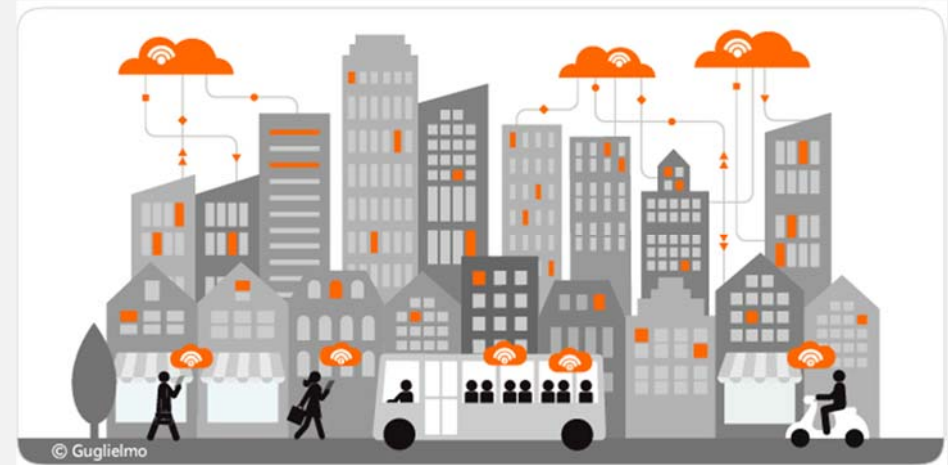
Smart Governmental Services

- **Service toward citizens:**
 - **Cultural Heritage:** ticketing on museums,
 - **Tourism:** ticketing, visiting, planning, booking (hotel and restaurants, etc.)
 - **social networking:** getting service feedbacks, monitoring
- **Social sustainability of services:**
 - crowd services
- **Social recovering** of infrastructure,
 - New services, exploiting infrastructures
- **Monitoring** consumption and exploitation of services, learn people behavior, create collective profiles
 - Discovering problems of services,
 - Finding collective solutions and new needs...



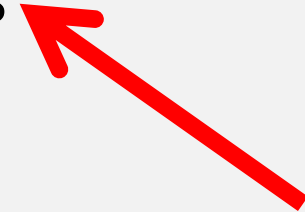
Telecommunication, broadband

- **Fixed Connectivity:**
 - ADSL or more, fiber,
- **Mobile Connectivity:**
 - Public wifi, Services on WiFi, HSPDA, LTE
- **Monitoring** communication infrastructure
- Providing information and formation on:
 - how to exploit the communication infrastructure
 - Exploiting the communication for the other services,
 - moderate the peak of consumption



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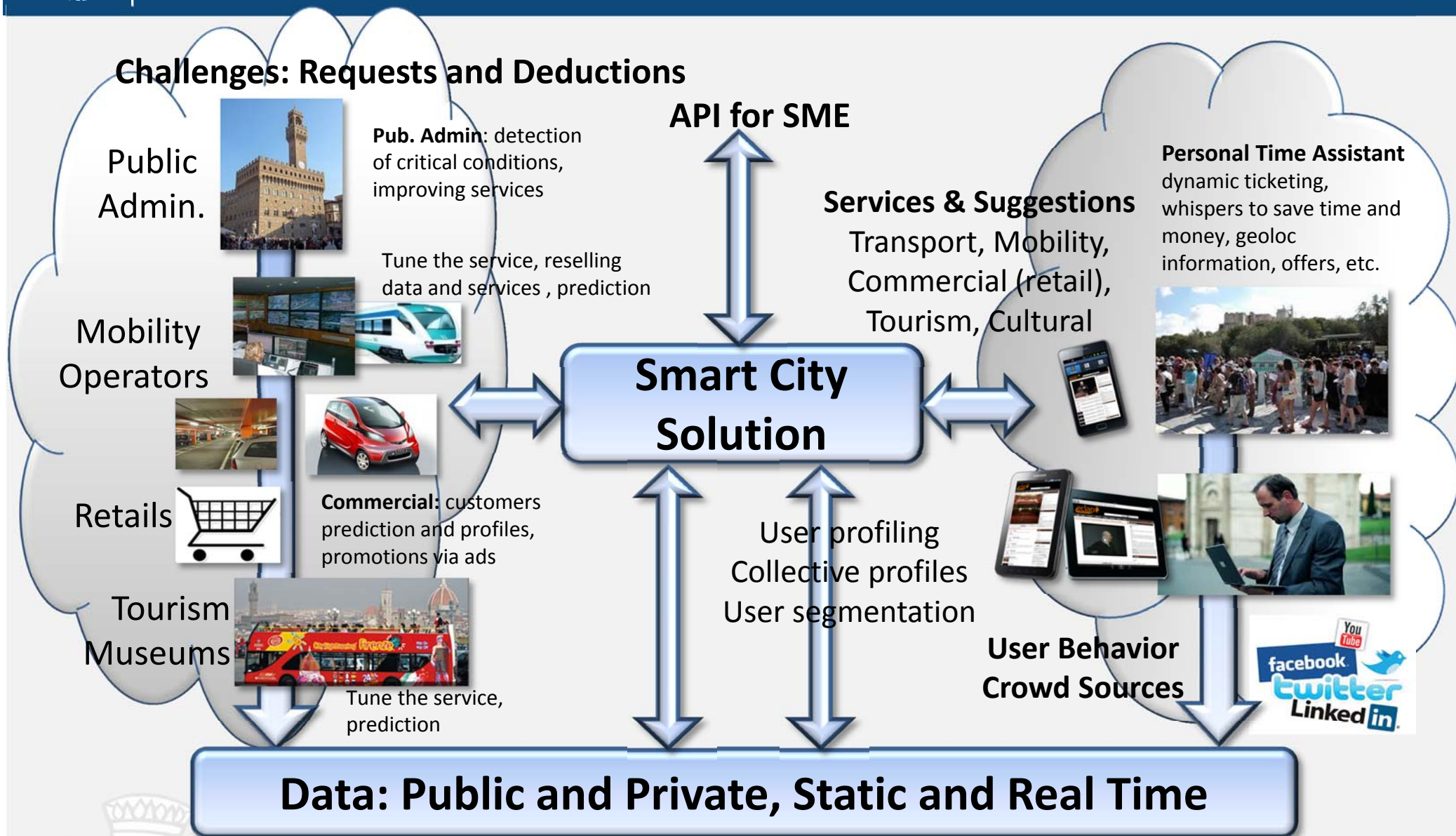
Smart-City

- *Main Aim*

- Provide a platform able to ingest and take advantage a large number of the above data, big data:
 - *Exploit data integration and reasoning*
 - *Deliver new services and applications to citizens,*
Leverage on the ongoing Semantic Web effort

- *Problems & Challenges*

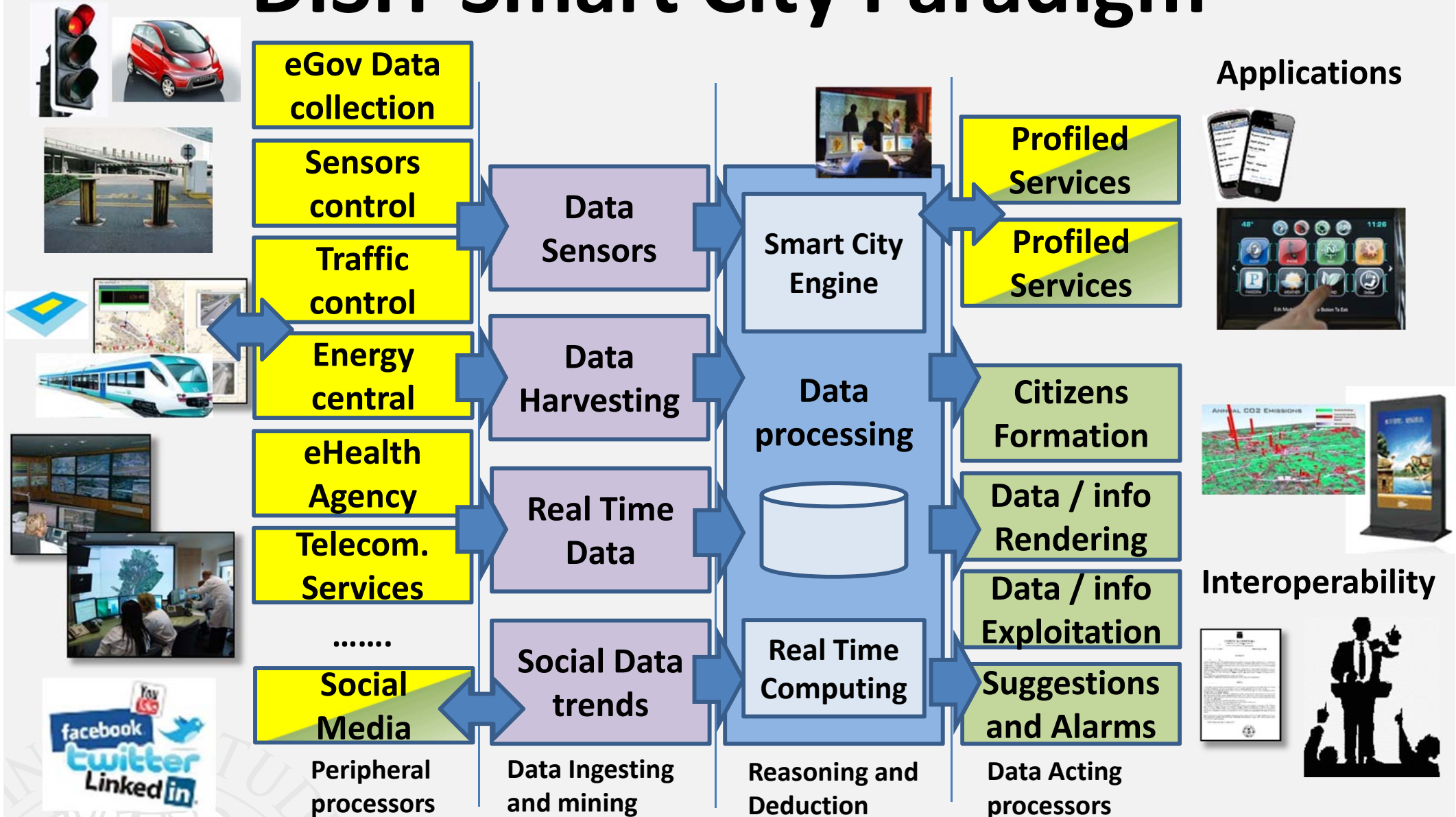
- Data are provided in many different formats and protocols and from many different institutions, different convention and protocols, a different time, !
- Data are typically not aligned (e.g., street names, dates, geolocations, tags, ...). That is, they are **not semantically interoperable**
- resulting a big data problem: volume, velocity, variability, variety,



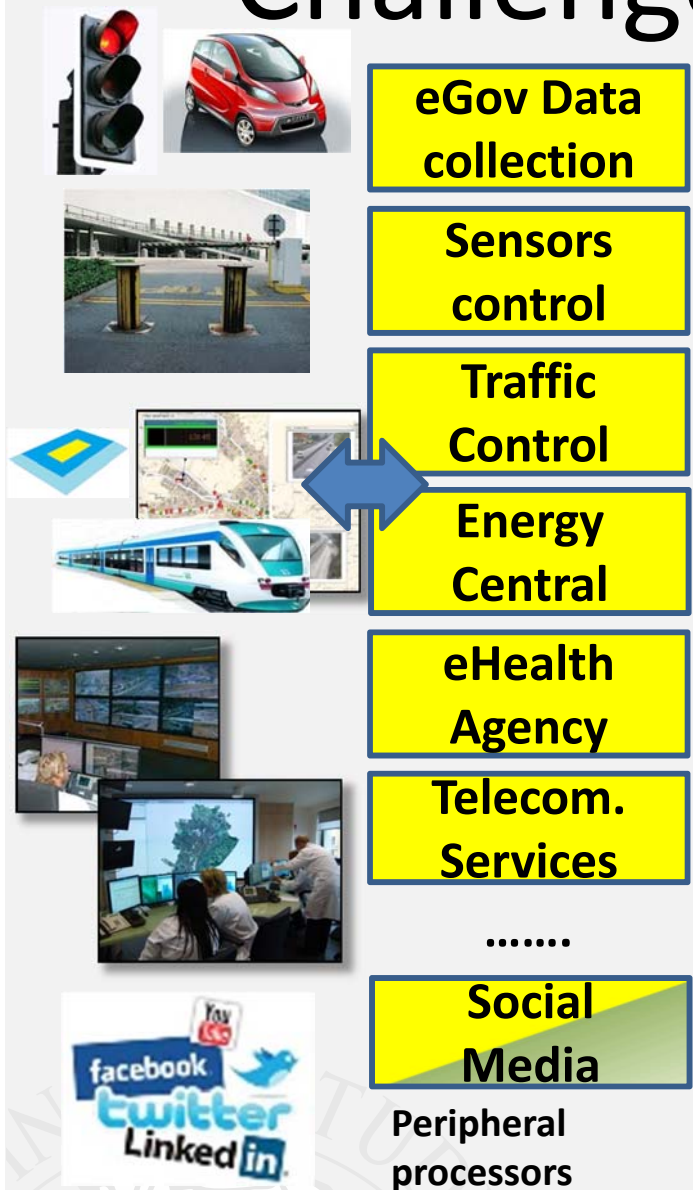
Private: user movements, social media, crowd sources, commercial (retail)

Public: infomobility, traffic flow, TV cameras, flows, ambient, weather, statistic, accesses to LTZ, services, museums, point of interests, ...

DISIT Smart City Paradigm



Challenges (addressed by DISIT)



- Social Media blog analysis
- Energy Control for bike sharing
- Wi-Fi as a sensor for people mobility
- Internet of Things as sensors
 - Low costs Bluetooth monitoring devices
 - Vehicle kits with sensors
 - Sensors networks spread in the city and managed by centrals
 - Traffic flow sensors
- ..

Challenges (addressed by DISIT)

Data
Sensors

Data
Harvesting

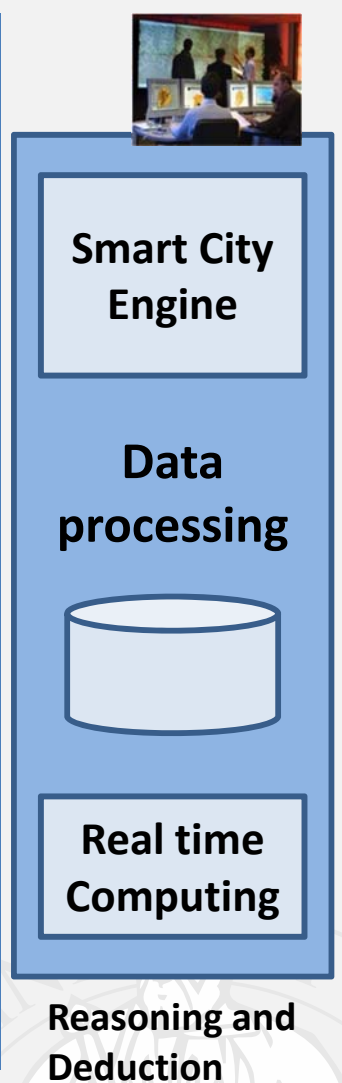
Real Time
Data

Social Data
trends

Data Ingesting
and mining

- OD/LOD, Open Data/Linked Open Data:
 - gathering, collection,
- Data Mining:
 - ontology mapping, integration, semantically interoperable
 - reconciliation, enrichment,
 - quality assessment and improvement
- Data Filtering on Streaming
- Blog Vigilance

Challenges (addressed by DISIT)



- **Reasoning and Data processing**
 - Data analytics, Semantic computing
 - Link Discovering
 - Inferential reasoning
 - Identification of critical condition
 - unexpected correlations
 - predictions, etc.
- “Real time” Computing out of peripherals
 - Action / reaction
- **Activation of rules**
 - Firing conditions for activating computing
 - Acceptance of external rules

Challenges (addressed by DISIT)

Applications



Interoperability



- User profiling, collective profiles
- Computing Suggestions:
 - Information and formation
 - Virtuous behavior stimulation
 - For citizens and administrators
 - ...
- Data export:
 - API, LOD, ..
 - Connection with other Smart City

Profiled
Services

Profiled
Services

Citizens
Formation


Data / info
Rendering

Data / info
Exploitation

Suggestions
and Alarms

Data Acting
processors

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Smart City solutions



Sii-Mobility (Smart City) new technologies and smart solutions for improving the interoperability of management and control systems of urban infomobility, mobility and transport in the city and metropolis. (terrestrial transport and mobility)

Coll@bora (Smart City → Social Innovation) collaborative tools for the protection of information and data among health care institutions and families for people with imparities. (Welfare and inclusion technologies)

Coll@bora




- **Title:** Collaborative Support for Parents and Operators of Disabled
- **Objectives:** providing strong advantages for
 1. Relatives interested in facilitating relations with the management team;
 2. Associations in order to offer a better service to the families and people with disabilities by providing a collaborative support to the involved teams, but also to manage the wealth of knowledge, to support the training of the staff, etc.

Coll@bora provides a secure collaboration tool for the teams and for the association to support the families and the disabled people.

- **Link:** <http://www.disit.dinfo.unifi.it/collabora.html>

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Sii-Mobility

- **Title:** Support of Integrated Interoperability for Services to Citizens and Public Administration
- **Objectives:**
 1. Reduction of social costs of mobility;
 2. Simplify the use of mobility systems;
 3. Developing working solutions and application, with testing methods;
 4. Contribute to standardization organs, and establishing relationships with other smart cities' management systems.



The Sii-Mobility platform will be capable to provide support for SME and Public Administrations. Sii-Mobility consists in a federated/integrated interoperable solution aimed at enabling a wide range of specific applications for private services to citizen and commercial services to SME.

- **Coordinatore Scientifico:** *Paolo Nesi, DISIT DINFO UNIFI*
- **Partner:** ECM; Swarco Mizar; University of Florence (svariati gruppi+CNR); Inventi In20; Geoin; QuestIT; Softec; T.I.M.E.; LiberoLogico; MIDRA; ATAF; Tiemme; CTT Nord; BUSITALIA; A.T.A.M.; Sistemi Software Integrati; CHP; Effective Knowledge; eWings; Argos Engineering; Elfi; Calamai & Agresti; KKT; Project; Negentis.
- **Link:** <http://www.disit.dinfo.unifi.it/siimobility.html>

Comments from
citizens, Social Media



AVM Public
transport



Sensors,
monitoring system

Materials



Sensors for
private transport

Parking
sensors



Traffic monitoring,
highways



Railways



Environmental
parameters

Public Services

Ordinances: events,
large scale works
...



UTC



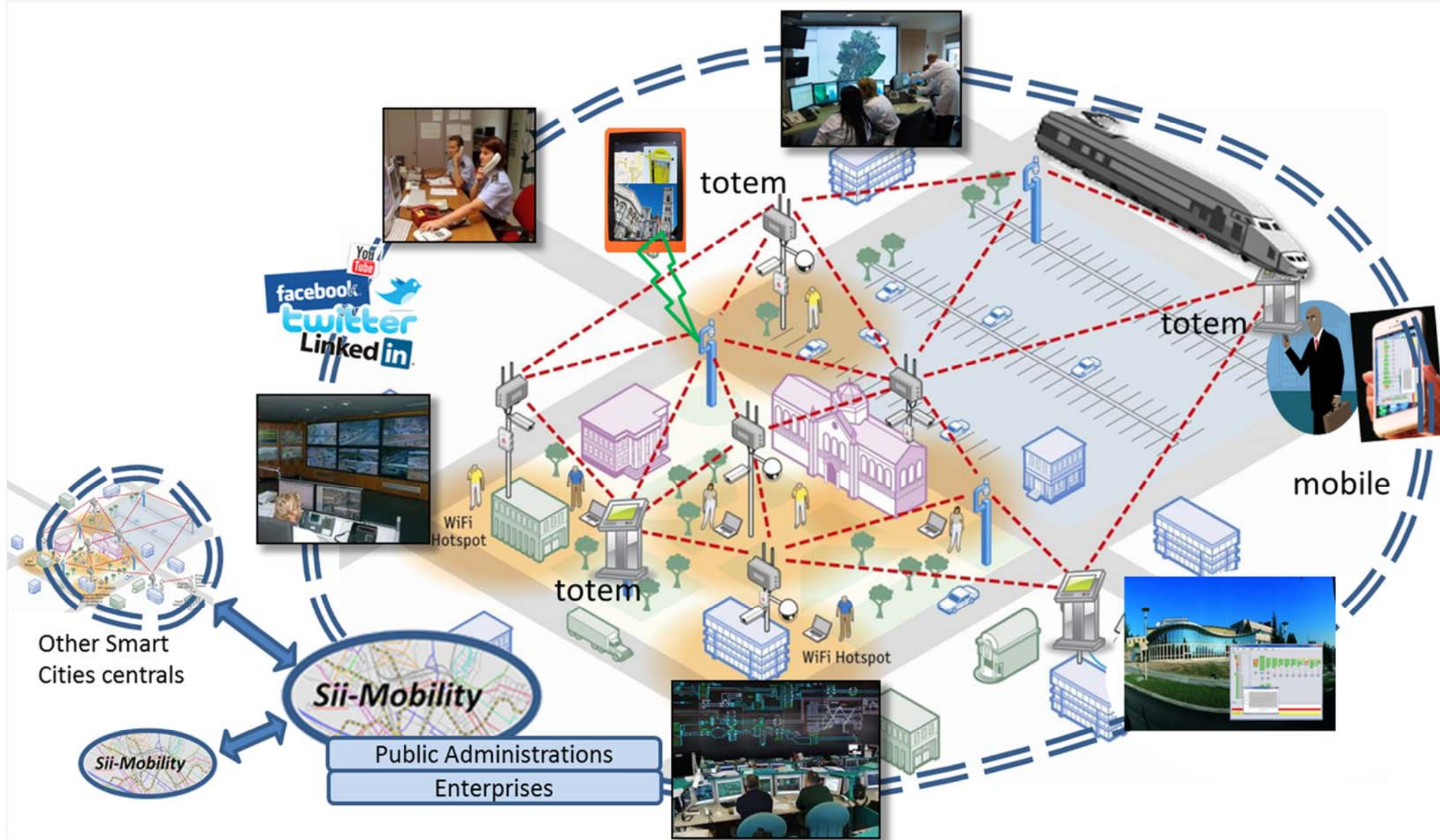
Infomobility



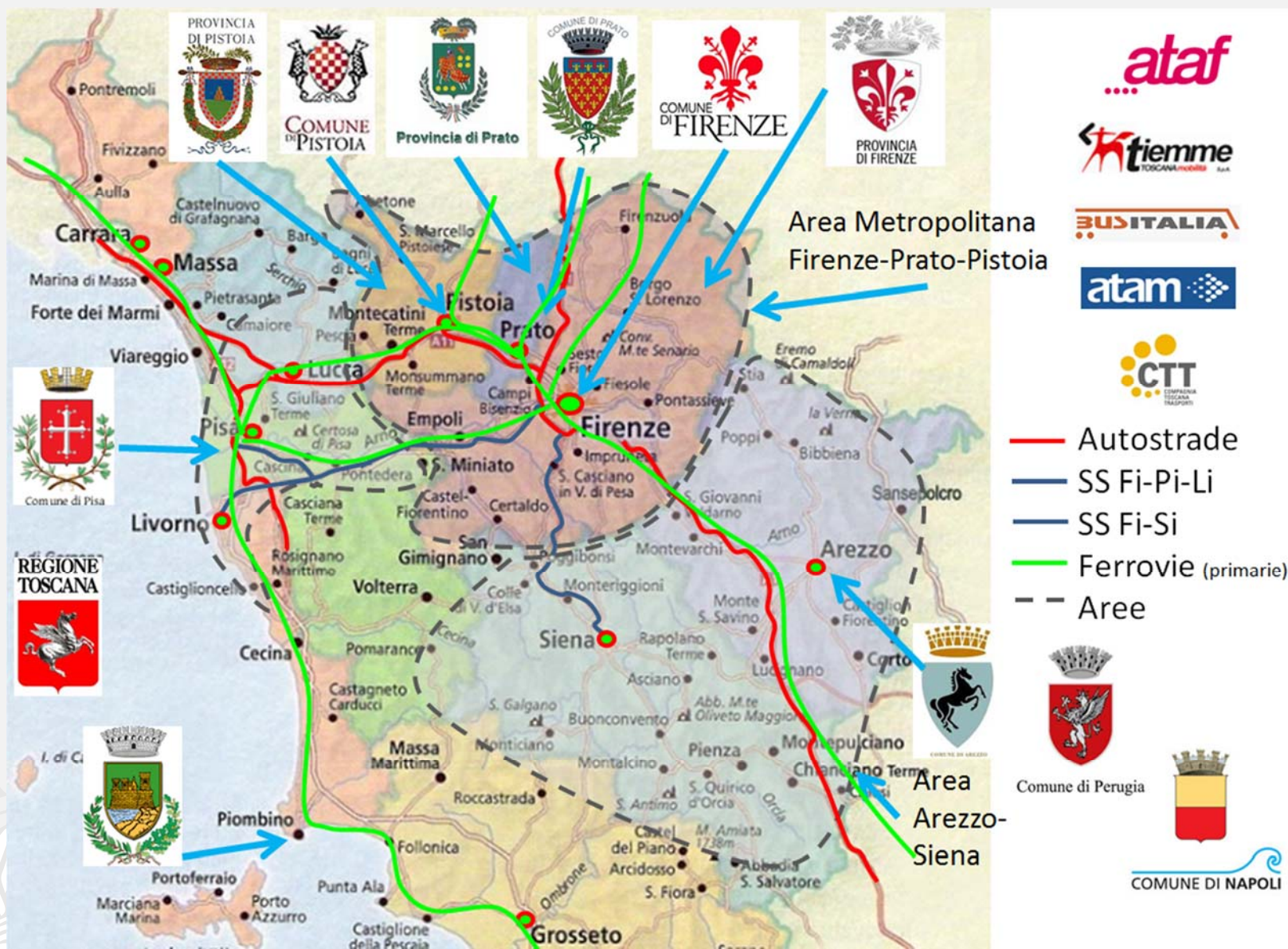
Telematic
passages, ZTL

Emergency,
police, 118





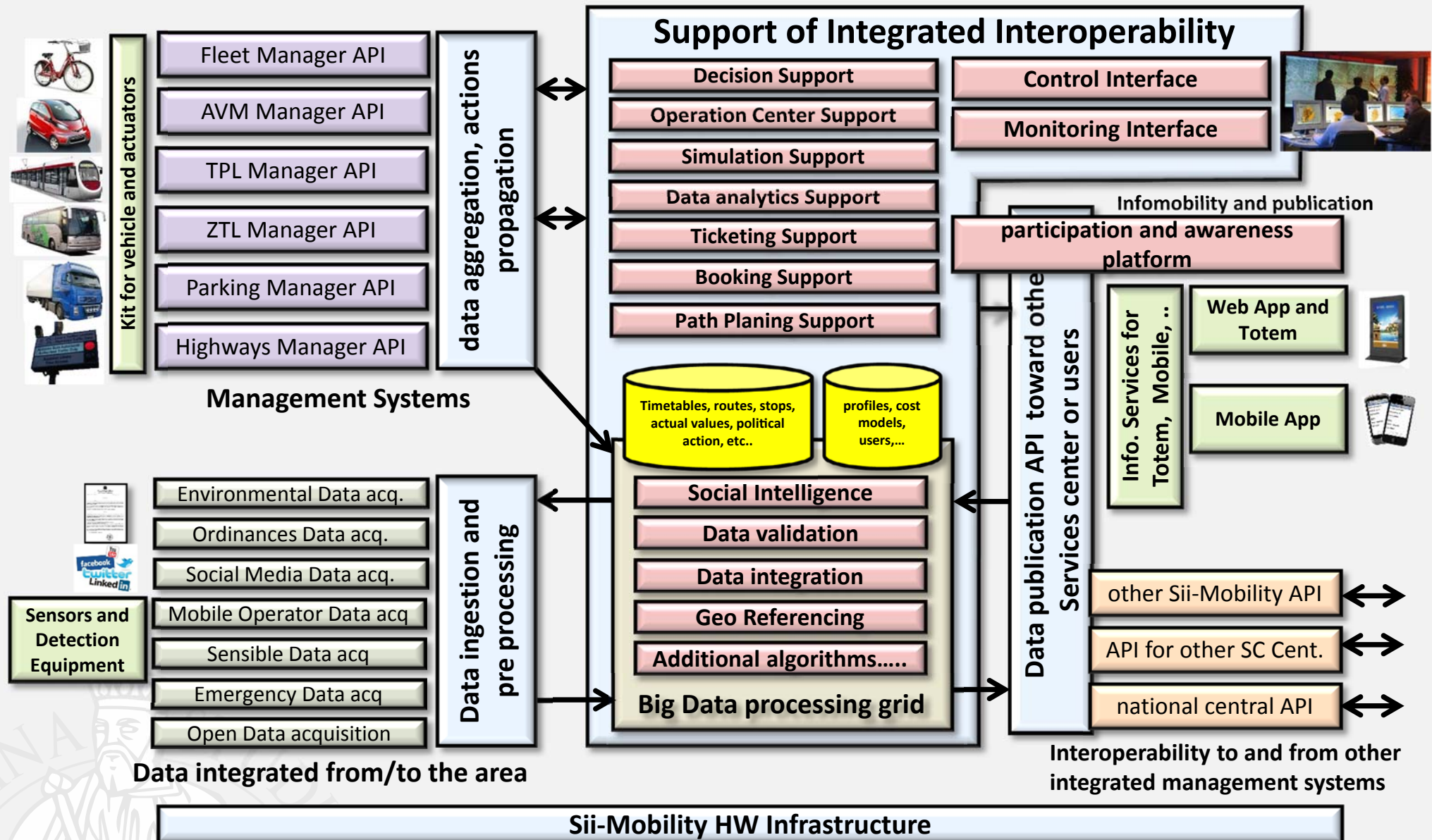
- Experimentations and validation in Tuscany
- Integration with present central station and subsystems



Sii-Mobility: main scenarios

- solutions of connected guide / path
 - personalized services, alarms, vehicle / person receives commands and information in real time, personalized and contextualized;
- Platform of participation and awareness
 - to receive information from the citizen, the citizen as Intelligent Sensor, to inform and educate the citizen, through totem, mobile applications, web applications, etc .;
- personalized management of access policies
 - Incentive policies of deterrence and the use of the vehicle, Credit mobility, flow monitoring;
- interoperability and integration of management systems
 - contribution to standards, testing and data validation, data reconciliation, etc .;
- integration of methods of payment and identification
 - Political pay-per-use, monitoring user behavior;
- dynamic management of the boundaries of the areas controlled traffic
 - dynamic pricing and category of vehicles;
- management shared network data exchange between services (PA and private)
 - data reliability and separation of responsibilities, integration of open data, reconciliation,;
- monitoring of supply and demand of public transport in real time
 - solutions for the integration and processing of data.

Sii-Mobility Architecture



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Research objectives

- **Why:** Create an ontology that allows to combine all data provided by the *city of Florence* and the *Tuscan region*.
- **Problems:** data have different formats, they must be reconciled in order to be effectively interconnected to each other, but sometimes information is incomplete.
- **Objective:** take advantage of the created repository and ontology to implement new integrated services related to mobility; to provide repository access to *SMEs* to create new services.

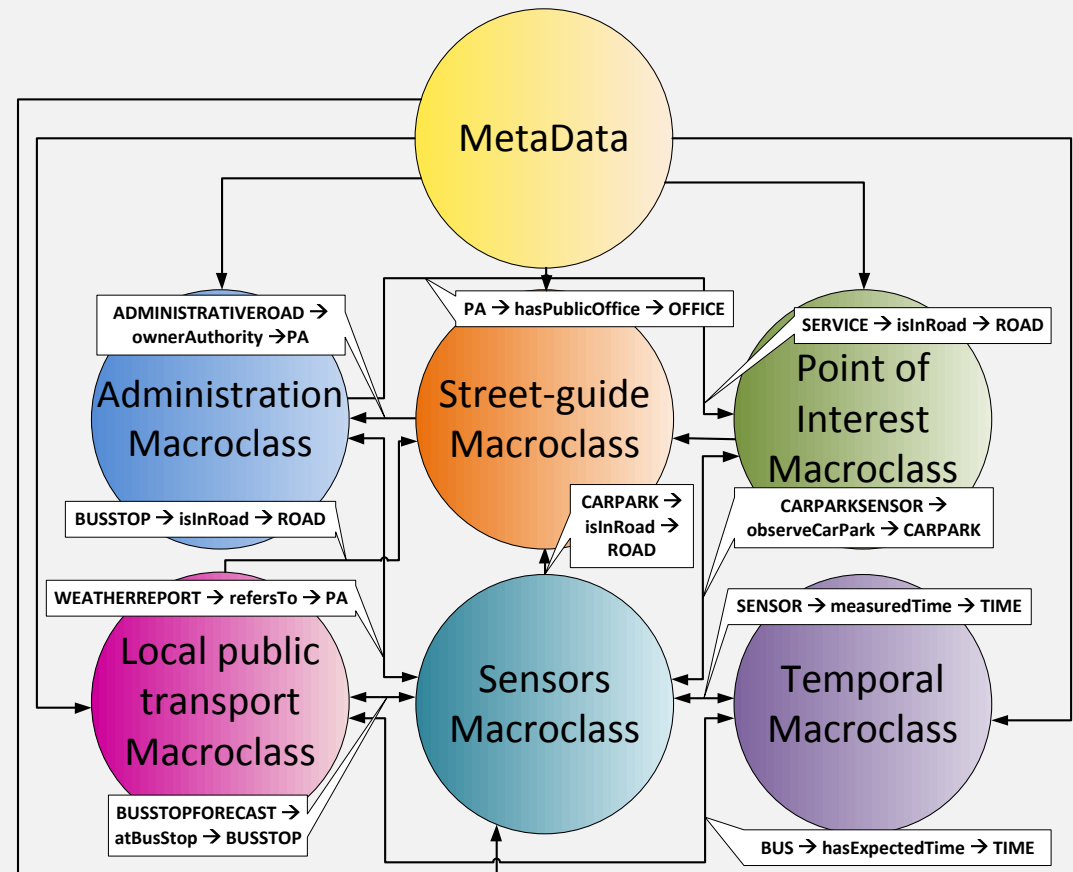
DataSet already integrated

- From MIIC web services (real time)
 - Parking payloadPublication (updated every h)
 - Traffic sensors payloadPublication (updated every 5-10min)
 - AVM client pull service (updated every 24h)
 - Street Graph
- From Municipality of Florence:
 - Tram line: KMZ file that represents the path of tram in Florence
 - Statistics on monthly access to the LTZ, tourist arrivals per year, annual sales of bus tickets, accidents per year for every street, number of vehicles per year
 - Municipality of Florence resolutions
- From Tuscany Region:
 - Museums, monuments, theaters, libraries, banks, courier services, police, firefighters, restaurants, pubs, bars, pharmacies, airports, schools, universities, sports facilities, hospitals, emergency rooms, doctors' offices, government offices, hotels and many other categories
 - Weather forecast of the consortium Lamma (updated twice a day)

Smart-city Ontology

- The data model provided have been mapped into the ontology, it covers different aspects:

- Administration
- Street-guide
- Points of interest
- Local public transport
- Sensors
- Temporal aspects
- Metadata on the data



Smart-city Ontology

- **Administration:** structure of the general public administrations (*Municipality*, *Province* and *Region*) also includes *Resolutions* (ordinance issued by administrations, may change the viability, infrastructural works, schedule for RTZ, etc.)
- **Street-guide:** formed by entities as *Road*, *Node*, *RoadElement*, *AdministrativeRoad*, *Milestone*, *StreetNumber*, *RoadLink*, *Junction*, *Entry*, *EntryRule*, *Maneuver*,... represents the entire road system of the region, including the permitted maneuvers and the rules of access to the limited traffic zones. Based on OTN (Ontology of Transportation Networks) vocabulary
- **Points of Interest:** includes all *Services*, activities, which may be useful to the citizen and who may have the need to search for and to arrive at, commercials, public administration, Cultural,

Smart-city Ontology

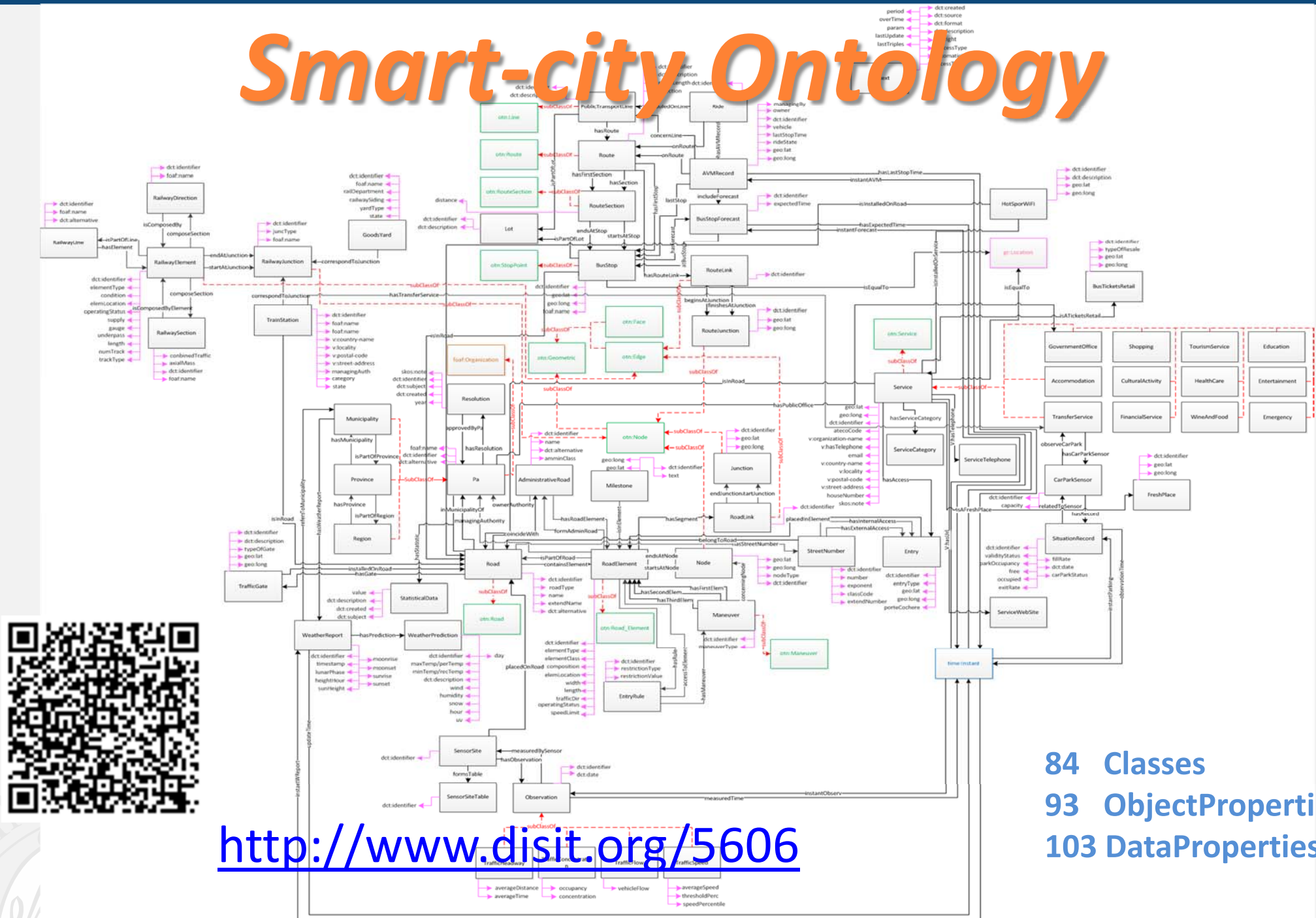
- **Local public transport:** includes the data related to major local public transport companies as **scheduled times**, the **rail graph**, and data relating to **real time passage at bus stops**, **real time position**, ...
- **Sensors:** data provided by sensors: currently, data are collected from various sensors (**parking status**, **meteo**, **pollution**) installed along some streets of Florence and surrounding areas, and from sensors installed into the main car parks of the region.
 - Plus: car sharing, bike sharing, AVM, RTZ, etc.
- **Temporal:** that puts **concepts related with time** (time intervals and instants) into the ontology, so that associate a timeline to the events recorded and is possible to make forecasts. It uses time ontologies such as OWL-Time.

Smart-city Ontology


- **Metadata:** modeling the additional information associated with:
 - **Descriptor** of Data sets that produced the triples: data set ID, title, description, purpose, location, administration, version, responsible, etc..
 - **Licensing** information
 - **Process** information: IDs of the processes adopted for ingestion, quality improvement, mapping, indexing,.. ; date and time of ingestion, update, review, ...;

When a problem is detected, we have the information to understand when and how the problem has been included
- **Including basic ontologies as:**
 - DC: Dublin core, standard metadata
 - OTN: Ontology for Transport Network
 - FOAF: for the description of the relations among people or groups
 - vCard: for a description of people and organizations
 - wgs84_pos: for latitude and longitude, GPS info
 - OWL-Time: reasoning on time, time intervals
 - GoodRelations: commercial activities models

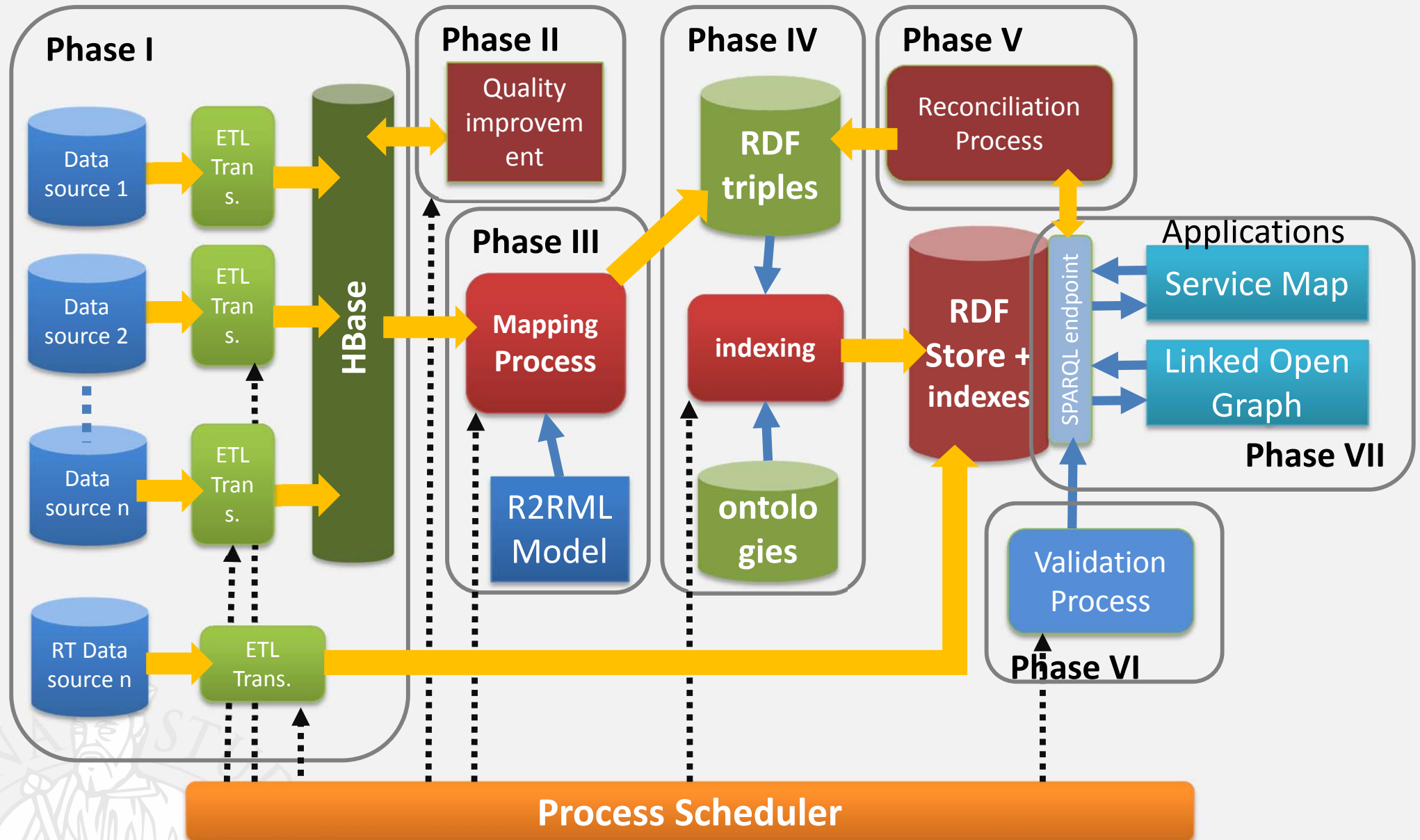
Smart-city Ontology



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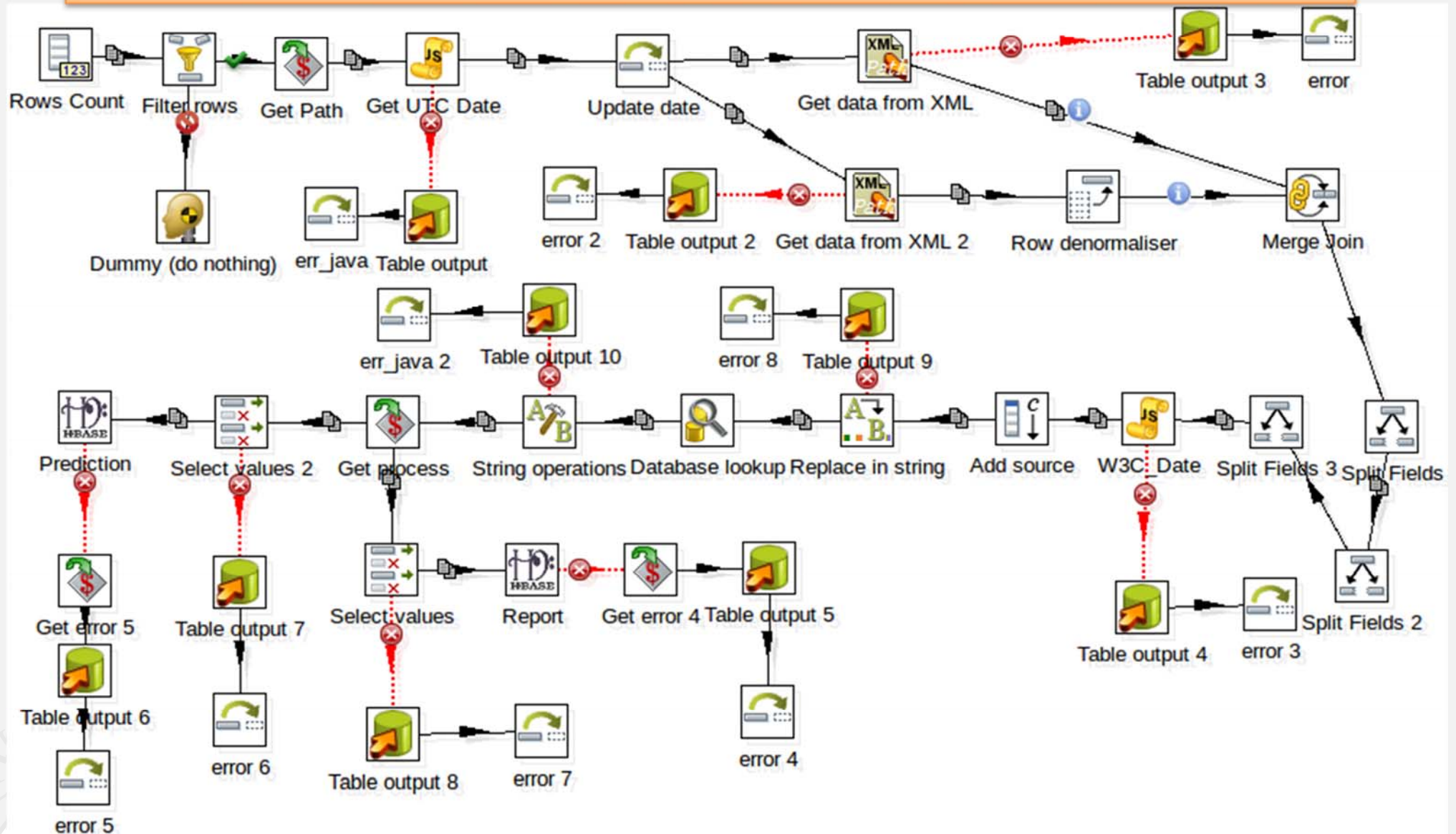
Data Engineering Architecture



Phase I - Data Ingestion

- **Ingesting a wide range of OD/PD:** public and private data, static, quasi static and/or dynamic real time data.
- For the case of Florence, we are addressing about **150 different data sources** of the 564 available, plus the regional, province, other municipalities,
- Using **Pentaho - Kettle** for data integration (Open source tool)
 - using specific ETL Kettle transformation processes (one or more for each data source)
 - data are stored in HBase (Bigdata NoSQL database)
- **Static and semi-static data** include: points of interests, geo-referenced services, maps, accidents statistics, etc.
 - files in several formats (SHP, KML, CVS, ZIP, XML, etc.)
- **Dynamic data** mainly data coming from sensors
 - parking, weather conditions, pollution measures, bus position, etc.
 - using Web Services.

Example of Ingestion process



Phase II - Data Quality Improvement

- **Problems kinds:**
 - Inconsistencies, incompleteness,...
- **Problems on:**
 - CAPs vs Locations
 - Street names (e.g., dividing names from numbers, normalize when possible)
 - Dates and Time: normalizing
 - Telephone numbers: normalizing
 - Web links and emails: normalizing
- **Partial Usage of**
 - Certified and accepted tables and additional knowledge
- **Enrichment** process may need several versions:
 - VIP names, GeoNames, etc..

Phase III - Data mapping

- Transforms the data from HBase to RDF triples
- Using **Karma Data Integration tool**, a mapping model from SQL to RDF on the basis of the ontology was created
 - Data to be mapped first temporarily passed from Hbase to MySQL and then mapped using Karma (in batch mode)
- The mapped data in triples have to be uploaded (and indexed) to the **RDF Store** (OpenRDF – sesame with OWLIM-SE)

Phase IV - Indexing

- **Periodic task** for reindexing: triples, text, space (GPS), dates, etc.
- **Indexing triples**: ontologies, all RDF files for OD, RT triples (from - to), reconciliation triples for OD, triples for enrichments, etc.
- ***If you do not index, you cannot identify all missing reconciliations***

Phase V - Data Reconciliation/alignment

- After the loading and indexing into the RDF store a dataset may be connected with the others **if entities refer to the same triples**
 - **Missed connections** strongly limit the usage of the knowledge base,
 - e.g. the services are not connected with the road graph.
- To associate each **Service** with a **Road** and an **Entity** on the basis of the street name, number and locality
- **It is not easy!** data coming from different sources

Phase V - Data Reconciliation/alignment

- **Examples:**

- Typos;
- Missing street number, or replaced with "0" or "SNC";
- Municipalities with no official name (e.g. Vicchio/Vicchio del Mugello);
- Street names and street numbers with strange characters (-, /, ° ? , Ang., ,);
- Road name with words in a different order (e.g. Via Petrarca Francesco, exchange of name and surname);
- Red street numbers (for shops);
- Presence/absence of proper names in road name (e.g. via Camillo Benso di Cavour / via Cavour);
- Number wrongly written (e.g. 34/AB, 403D, 36INT.1);
- Roman numerals in the road name (e.g., via XXVII Aprile).

- **Steps:**

1. *SPARQL Exact match* – match the strings as they are
2. *SPARQL Enhanced Exact Match* – make some substitutions (Via S. Marta → Via Santa Marta, ...)
3. *Last Word Search* – use only the last word of street name
4. Use Google GeoCoding API
5. Remove 'strange chars' (-, /, °, ? , Ang., ,) from Street number
6. Remove 'strange chars' from Street name
7. Rewrite wrong municipality names

Phase V - Data Reconciliation/alignment

Comparing different reconciliation approaches based on

- SILK link discovering language
- SPARQL based reconciliation described above

Method	Precision	Recall	F1
SPARQL –based reconciliation	1,00	0,69	0,820
SPARQL -based reconciliation + additional manual review	0,985	0,722	0,833
Link discovering - Leveisthein	0,927	0,508	0,656
Link discovering - Dice	0,968	0,674	0,794
Link discovering - Jaccard	1,000	0,472	0,642
Link discovering + heuristics based on data knowledge + Leveisthein	0,925	0,714	0,806

Thus automation of reconciliation is possible and produces acceptable results!!

Phase VI - Validation

- A set of queries applied automatically to verify the consistency and completeness, after new re-indexing and new data integration
 - I.e.: the KB regression testing!!!!

Phase VII - Data access

- Applications can access the data using the SPARQL endpoint, currently we have two applications:
 - ServiceMap (<http://servicemap.disit.org>) for a map based application
 - Linked Open Graph (<http://log.disit.org>) for browsing the data from SPARQL/Linked Data sources

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Data access and applications

- **Linked Open Graph (LOG):** a tool developed to allow exploring semantic graph of the relation among the entities. It can be used to access to many different LOD repository.

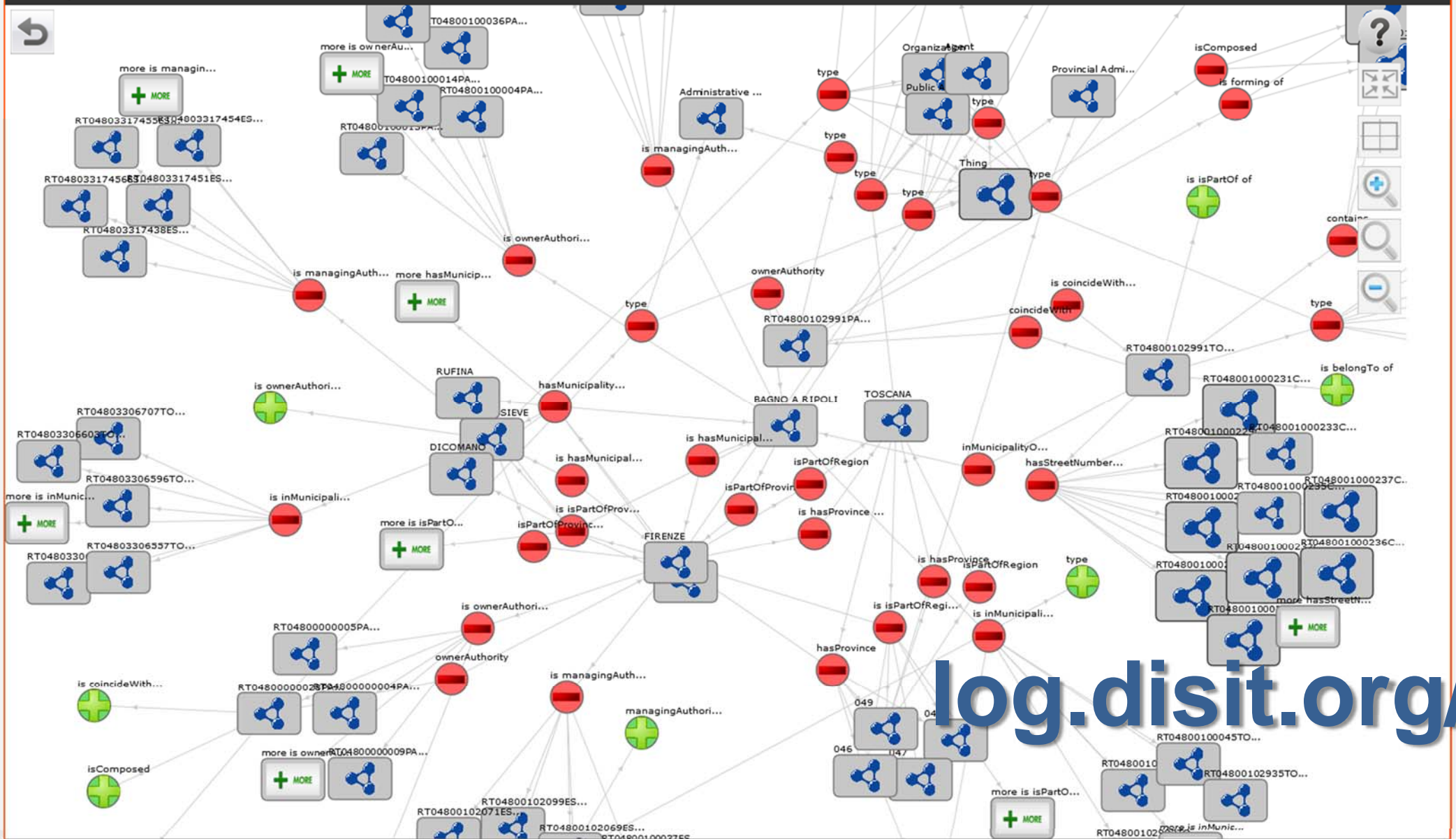
(<http://log.disit.org/>)

- **Maps:** service based on OpenStreetMaps that allows to search services available in a preset range from the selected bus stop.

(<http://servicemap.disit.org/>)

Data Graph

Close



log.disit.org/

Type of relations

Select all Deselect all Invert

- | | | | | | | | | |
|----------------------------------------------------|----------------------------------------------------|----------------------------------------------------|---------------------------------------------------|------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------|
| <input type="checkbox"/> sameAs | <input type="checkbox"/> depiction | <input checked="" type="checkbox"/> seeAlso | <input checked="" type="checkbox"/> type | <input checked="" type="checkbox"/> contains | <input checked="" type="checkbox"/> coincideWith | <input checked="" type="checkbox"/> inMunicipalityOf | <input checked="" type="checkbox"/> hasStreetNumber | <input checked="" type="checkbox"/> is isPartOf of |
| <input checked="" type="checkbox"/> is belongTo of | <input checked="" type="checkbox"/> ownerAuthority | <input checked="" type="checkbox"/> isComposed | <input checked="" type="checkbox"/> is forming of | <input checked="" type="checkbox"/> isPartOfProvince | <input checked="" type="checkbox"/> is managingAuthority | <input checked="" type="checkbox"/> is hasMunicipality of | <input checked="" type="checkbox"/> isPartOfRegion | <input checked="" type="checkbox"/> is hasProvince of |
| <input checked="" type="checkbox"/> ends | <input checked="" type="checkbox"/> starts | <input checked="" type="checkbox"/> is placedIn of | | | | | | |

servicemap.disit.org



<http://servicemap.disit.org>

USE CASE 1
Seleziona una linea:
Linea 4
Seleziona una fermata:
TUTTE LE FERMATE
Seleziona un comune:
MONTEVARCHI

Villa Fabbricotti
Tipologia: teatro
Email:
Indirizzo: Via Vittorio Emanuele II, 64
Note:
[LINK LOD](#)

FERMATA: STATUTO

FERMATA: GUIDO MONACO

Bernini
Tipologia: ristorante
Email: info.flo@albanihotels.com
Indirizzo: Via Fiume, 2
Note:
[LINK LOD](#)

Tipo Servizio:
☒ Accommodation
☐ Cultural Activity
☒ Education
☒ Emergency
☒ Entertainment
☐ Financial Service
☒ Government Office
☐ Health Care
☒ Shopping
☐ Tourism Service
☐ Transfer Service
☒ Wine And Food
☐ Near Bus Stops

Raggio di Ricerca:
Entro 100 metri
Cerca!

Previsioni Meteo per il comune di MONTEVARCHI:
Sabato: poco nuvoloso 8 - 16
Domenica: nuvoloso 5 - 14
Lunedì: pioggia debole e schiarite 7 - 15
Martedì: nuvoloso -
Mercoledì: pioggia debole e schiarite

DISIT Lab (DINFO UNIFI) October 2014

Leaflet | Map data © 2011 OpenStreetMap contributors, Imagery © 2012 CloudMade

- Nascondi Menu

- Nascondi Menu

Ricerca Fermata Bus Firenze

Ricerca Servizi in Toscana

Seleziona una provincia:

FIRENZE

Seleziona un comune:

FIRENZE

Selezione Attuale:

Servizio: MUSEO SALVATORE
FERRAGAMO

Cerca Attività

Tipo Servizio:

- ☒ De/Seleziona tutto
- ☒ Servizi di Alloggio +
- ☒ Attività Culturali +
- ☒ Educazione +
- ☒ Emergenze +
- ☒ Intrattenimento +
- ☒ Servizi Finanziari +
- ☒ Uffici Governativi +
- ☒ Sanità +
- ☒ Shopping +
- ☒ Servizi Turistici +
- ☒ Servizi di Trasferimento +
- ☒ Ristorazione +
- ☒ Fermate Autobus

Raggio di Ricerca:

Entro 500 metri

Numero massimo di risultati:

Nessun Limite

Cerca!

Pulisci

MUSEO SALVATORE FERRAGAMO

Tipologia: museo

Email:

Indirizzo: VIA DEI TORNABUONI, 2

Note: Il museo dedicato alla storia dell'azienda ferragamo e alla produzione di calzature dal 1927 al 1960 Sono esposti in ordine cronologico a rotazione oltre diecimila modelli Tra i pezzi i i dcollet in coccodrillo marrone di Marilyn Monroe la famosa zeppa in sughero brevettata nel 1936

[LINKED OPEN GRAPH](#)

<http://servicemap.disit.org>

+ Mostra Menu

<http://log.disit.org>

Linked Open Graph

← → ↻ log.disit.org/service/?graph=df5b467d0173d50115552f68e1e

Linked Open Graph

SiiMobility (by DISIT)

Examples:

- [VIA GIACOMO MATTEOTTI](#)
- [Bagno a ripoli](#)
- [Florence](#)

Choose a class:

Search for keyword

keyword:

uri: http://...

Request

Your data

sparql endpoint: (optional)

http://...

uri: http://...

Request

Status

Requests:

<http://www.disit.dinfo.unifi.it/SiiMobility/MUSE>

Remove

Clear

Type of relations

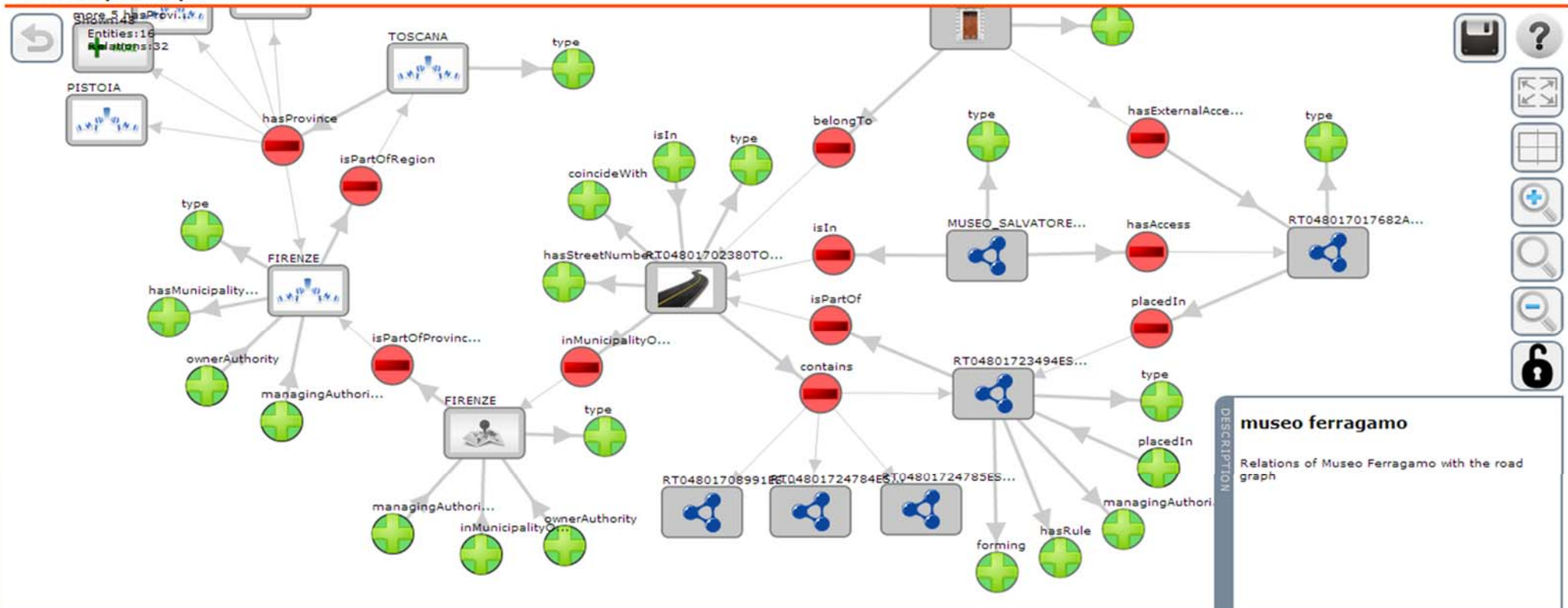
Deselect all

Invert

☐ Hide all inverse

- | | |
|-------------------------------------------------------|------------------------------------------------------|
| <input checked="" type="checkbox"/> belongTo | <input checked="" type="checkbox"/> coincideWith |
| <input checked="" type="checkbox"/> contains | <input type="checkbox"/> depiction |
| <input type="checkbox"/> ends | <input checked="" type="checkbox"/> forming |
| <input type="checkbox"/> has | <input checked="" type="checkbox"/> hasAccess |
| <input checked="" type="checkbox"/> hasExternalAccess | <input checked="" type="checkbox"/> hasMunicipality |
| <input checked="" type="checkbox"/> hasProvince | <input checked="" type="checkbox"/> hasRule |
| <input checked="" type="checkbox"/> hasStreetNumber | <input checked="" type="checkbox"/> inMunicipalityOf |
| <input checked="" type="checkbox"/> isIn | <input checked="" type="checkbox"/> isPartOf |
| <input checked="" type="checkbox"/> isPartOfProvince | <input checked="" type="checkbox"/> isPartOfRegion |
| <input checked="" type="checkbox"/> managingAuthority | <input checked="" type="checkbox"/> ownerAuthority |
| <input checked="" type="checkbox"/> placedIn | <input type="checkbox"/> sameAs |
| <input checked="" type="checkbox"/> seeAlso | <input type="checkbox"/> starts |

▼ **Linked Open Graph**



AXCPCloud

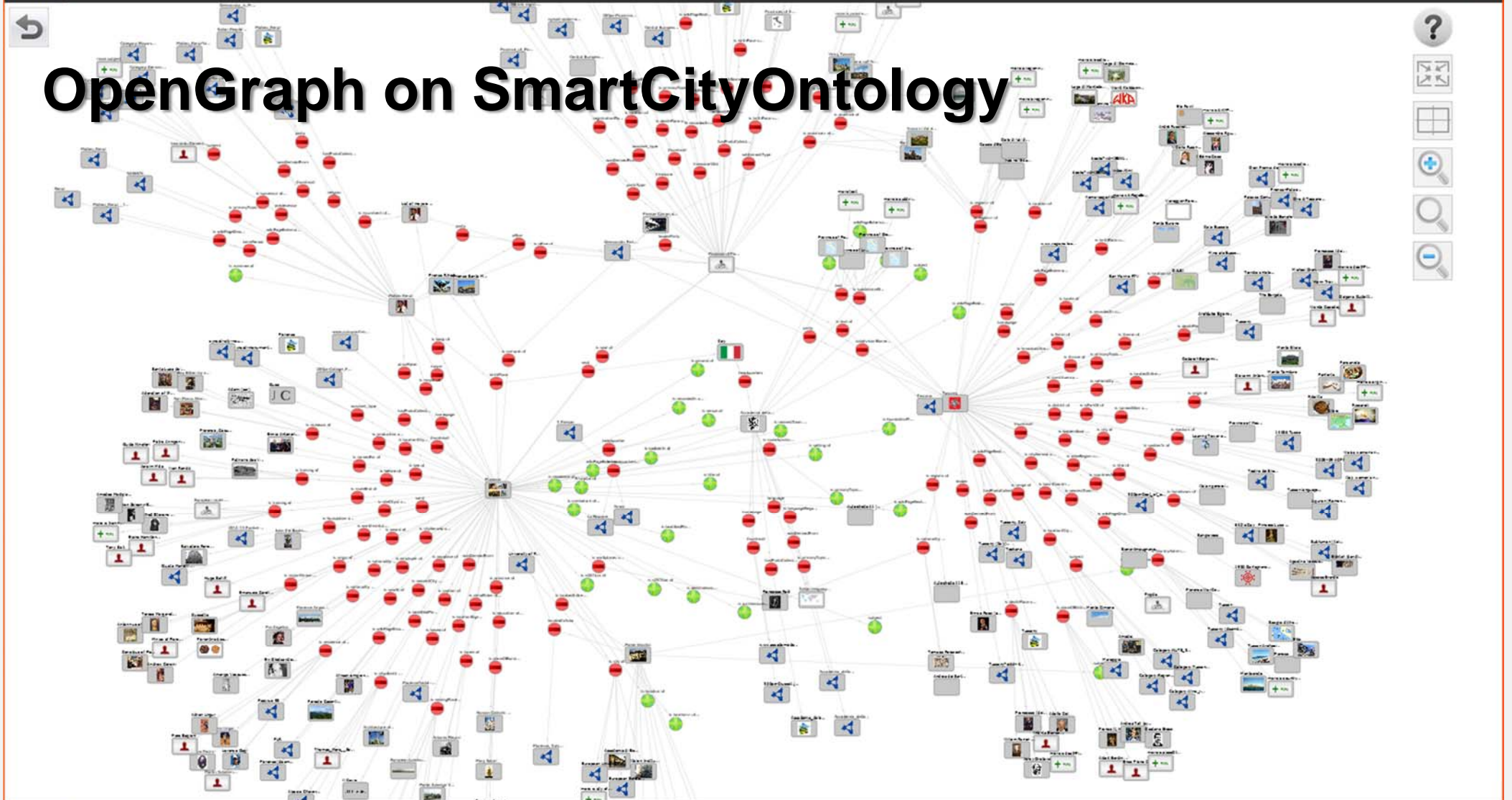
The collage illustrates the AxCP Cloud application's interface, which includes a visual procedure editor for workflow design, a script editor for custom logic, a project table for managing procedures, and a help window for the rule editor.

The backoffice platform for content management

Data Graph

Close

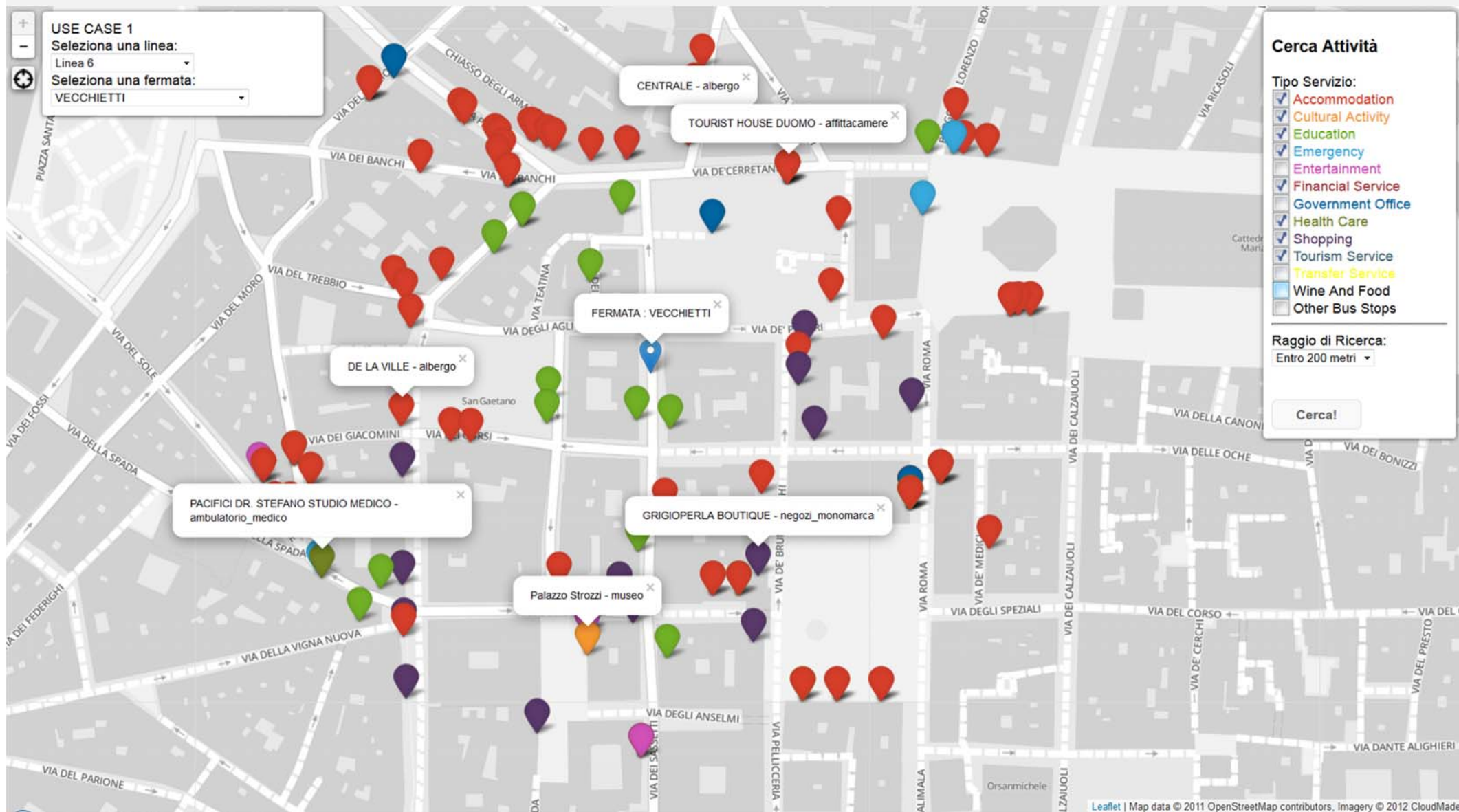
OpenGraph on SmartCityOntology



Type of relations

Select all Deselect all Invert

- | | | | | | | | | | | |
|--------------------------------------------------------|----------------------------------------------------|-----------------------------------------------|--------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------------|----------------------------------------------------|------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------|
| <input type="checkbox"/> sameAs | <input type="checkbox"/> depiction | <input checked="" type="checkbox"/> seeAlso | <input type="checkbox"/> is province of | <input type="checkbox"/> is region of | <input type="checkbox"/> country | <input type="checkbox"/> mayorParty | <input checked="" type="checkbox"/> saint | <input checked="" type="checkbox"/> mayor | <input type="checkbox"/> region | <input type="checkbox"/> type |
| <input checked="" type="checkbox"/> subject | <input checked="" type="checkbox"/> homepage | <input type="checkbox"/> wikiPageUsesTemplate | <input checked="" type="checkbox"/> thumbnail | <input checked="" type="checkbox"/> wikiPageExternalLink | <input checked="" type="checkbox"/> wasDerivedFrom | <input checked="" type="checkbox"/> hasPhotoCollection | <input checked="" type="checkbox"/> wordnet_type | <input type="checkbox"/> isPrimaryTopicOf | <input type="checkbox"/> is battles of | <input checked="" type="checkbox"/> is training of |
| <input checked="" type="checkbox"/> is restingPlace of | <input checked="" type="checkbox"/> is comune of | <input type="checkbox"/> is after of | <input checked="" type="checkbox"/> is museum of | <input checked="" type="checkbox"/> is title of | <input type="checkbox"/> is origin of | <input checked="" type="checkbox"/> is headquarters of | <input checked="" type="checkbox"/> is location of | <input checked="" type="checkbox"/> is city of | <input type="checkbox"/> is battle of | <input checked="" type="checkbox"/> is see of |
| <input type="checkbox"/> is restingPlace of | <input checked="" type="checkbox"/> is province of | <input type="checkbox"/> is place of | <input checked="" type="checkbox"/> is origin of | <input checked="" type="checkbox"/> is production of | <input checked="" type="checkbox"/> is placeOfBurial of | <input type="checkbox"/> is place of | <input checked="" type="checkbox"/> is nonplace of | <input checked="" type="checkbox"/> is recordable of | <input checked="" type="checkbox"/> is mainShrine of | <input checked="" type="checkbox"/> is route function of |



<http://servicemap.disit.org>

Major topics addressed

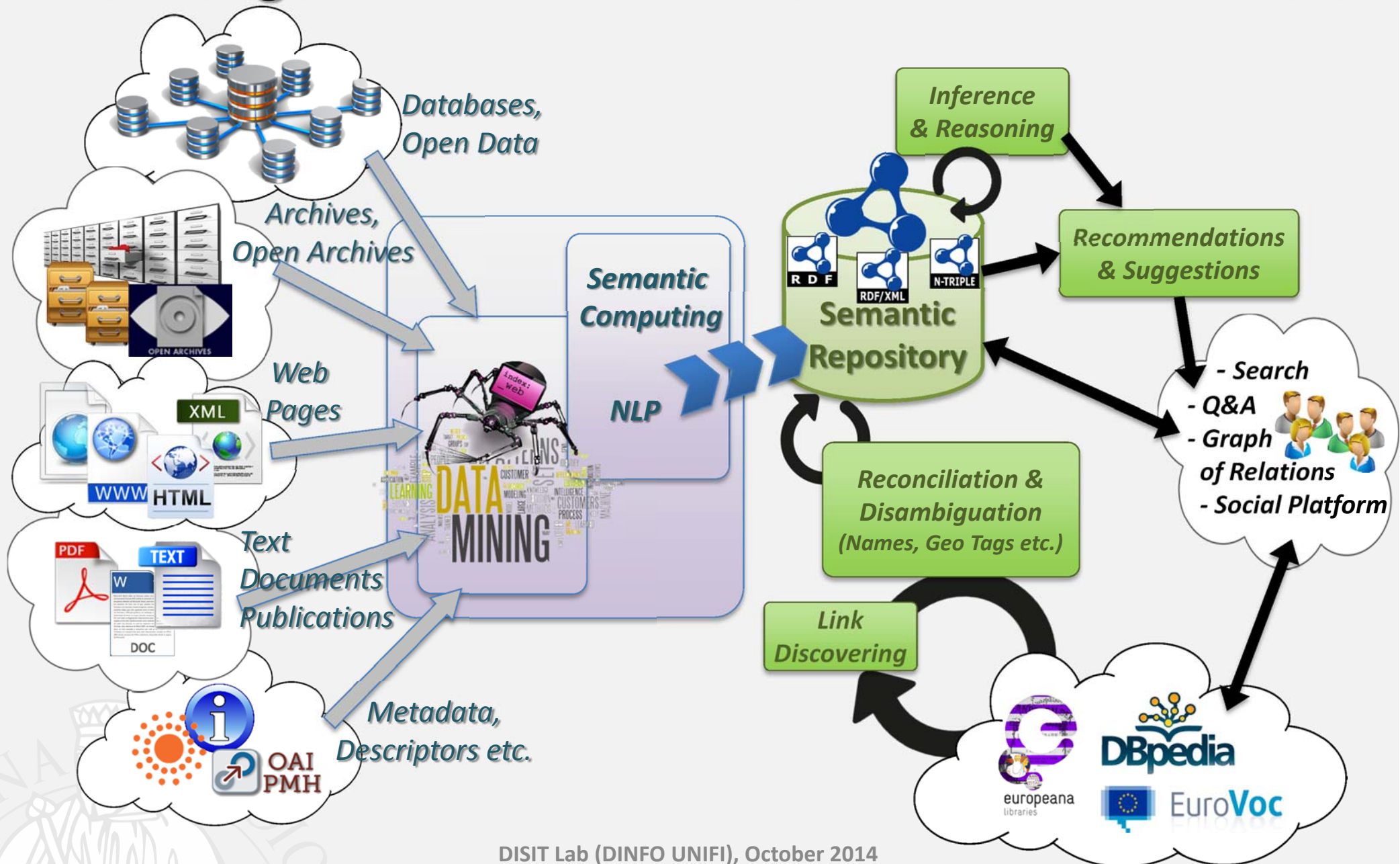
- **Smart City Concepts**
- **DISIT Architecture of Smart City Infrastructures**
 - Peripheral processors
 - Data ingestion and mining
 - Reasoning and Deduction
 - Data Acting processors
- **SmartCity Project Coll@bora**
- **SmartCity Project Sii-Mobility**
- **Data Mining and smart City problematic**
 - DISIT Smart City Ontology
 - Data ingestion and integration
 - Service Map and Linked Open Graph
- **Blog Vigilance via Natural Language Processing**
- **Mobile Emergency**



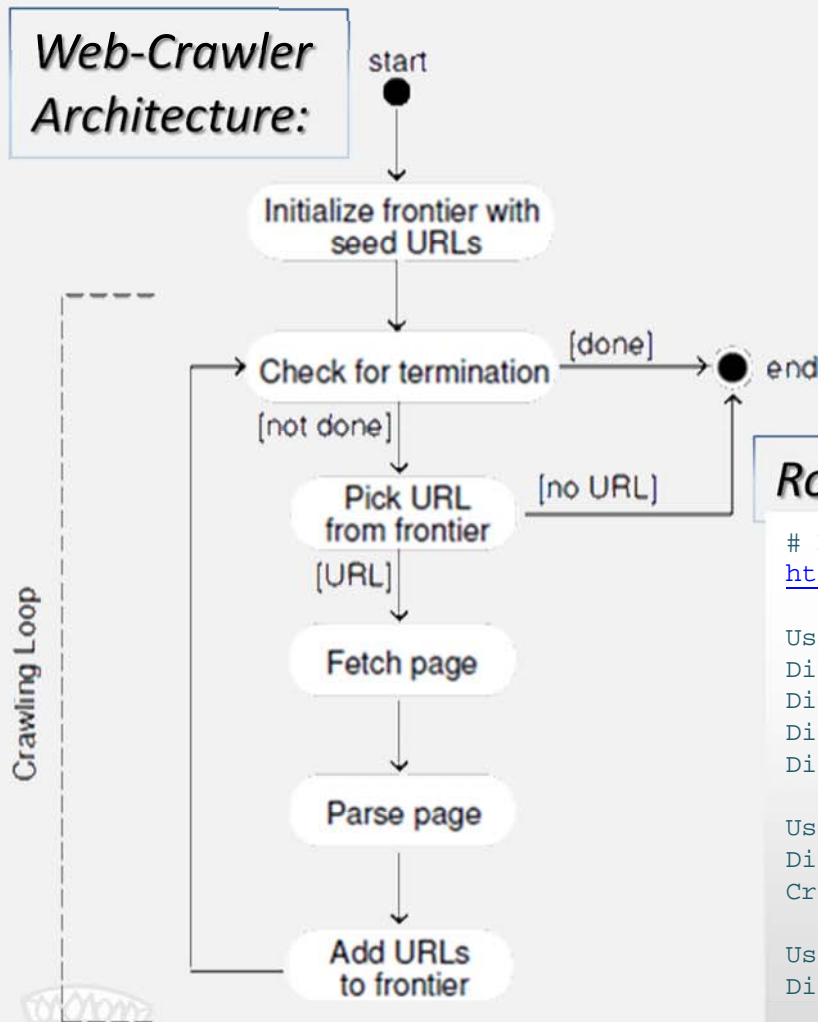
Data Integrity: Accuracy and Reliability of Data

- *Monitoring the moods of the population vs city services.*
- Big Data Mining issues, Many different formats
- Ambiguities and inconsistencies of descriptors, metadata etc.
- Unstructured, decontextualized data does not allow to extract high level information
- Several different efforts of structure KBs, ontologies, taxonomies etc. in many fields of Knowledge
- There is necessity of:
 - Reconciliation and disambiguation of ingested data
 - Organize data into proper forms of structured knowledge
 - Standardize definitions, languages, vocabularies etc.
 - Link discovering among different knowledge bases
 - Make inference to produce additional knowledge
 - Detect unexpected correlations, produce suggestions and recommendations
 - Provide semantic interoperability among resources and applications.

Knowledge Work-flow: from Sources to Final Users

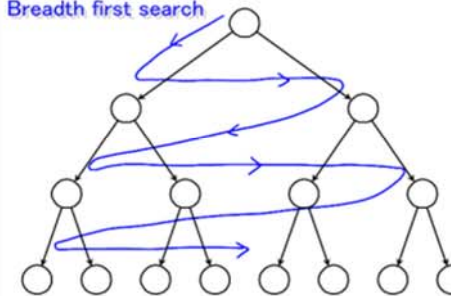


Web Crawling and Data Mining

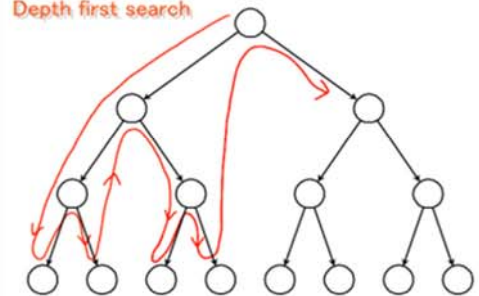


Crawling Strategies:

Breadth first search



Depth first search



Robot Exclusion Protocol

Robots.txt for
<http://www.springer.com> (fragment)

User-agent: Googlebot
Disallow: /chl/*
Disallow: /uk/*
Disallow: /italy/*
Disallow: /france/*

User-agent: MSNBot
Disallow:
Crawl-delay: 2

User-agent: scooter
Disallow:

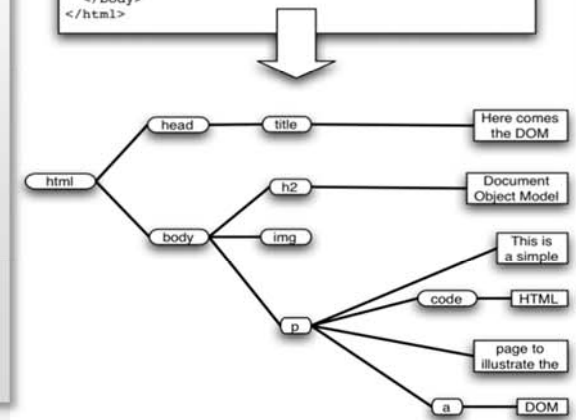
all others
User-agent: *
Disallow: /

Document / Pages Parsing:

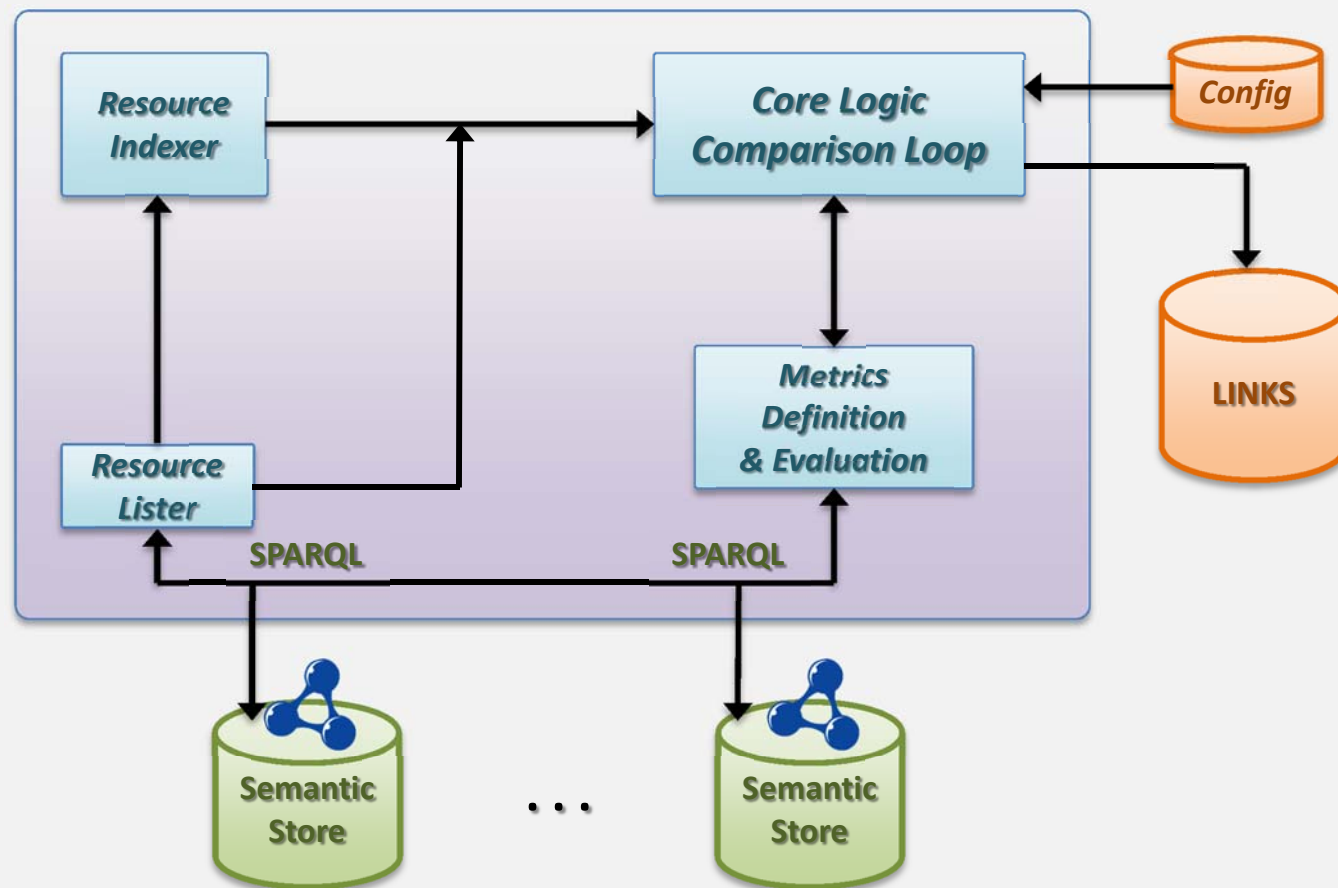
```

<html>
<head>
<title>Here comes the DOM</title>
</head>
<body>
<h2>Document Object Model</h2>

<p>
This is a simple
<code>HTML</code>
page to illustrate the
<a href="http://www.w3.org/DOM/">DOM</a>
</p>
</body>
</html>
    
```



- Finding relationships between entities, LODs etc., within different RDF data sources.



Source: SILK - http://events.linkedata.org/ldow2009/papers/ldow2009_paper13.pdf

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Context

- **Complex and large systems of buildings** with activities of maintenance and emergency
 - implies movements of people in a non fully known environment.
 - Hospitals, industrial plant, airports, etc.
- **Personnel does not know** the position of every room and service device or tool (POI, Point of Interest) that can be needed to perform activities of rescue or maintenance
- **Conditions and positions can change**, and teams and people may be not aware about those changes in real time

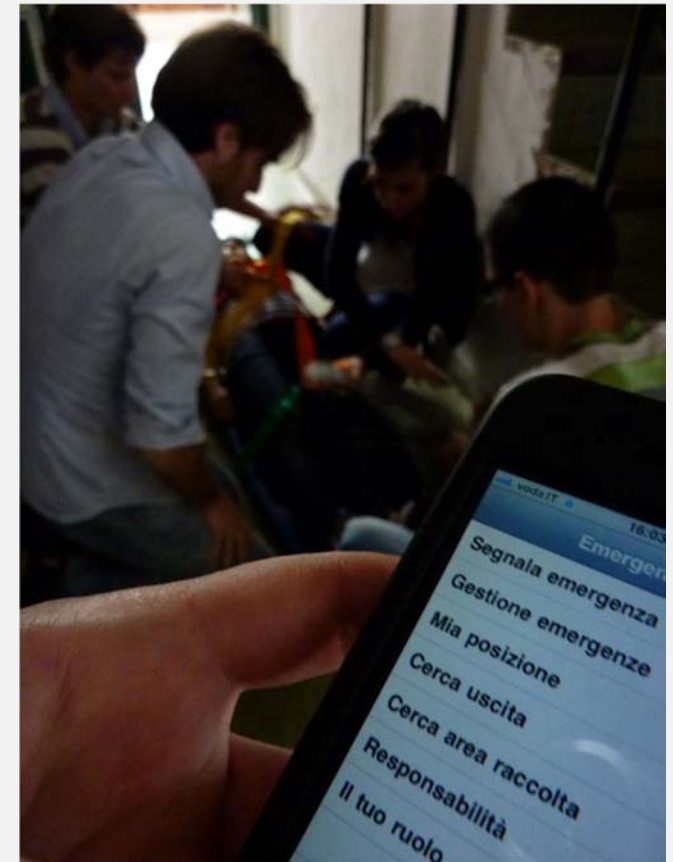


State of the art

- Digital documentation → Aug. Reality, ..
- **Present solutions** for navigation
 - Tables and books for navigation
 - RFID, QR codes for making points and devices
 - Paper and wall maps for indoor navigation
 - Navigators for outdoor navigation
 - Pedometer for indoor inertial navigator
- **Lack of:**
 - integrated indoor/outdoor navigation
 - Precision in the indoor inertial navigation

Overview and aim of Mob Emerg.

- **Managing team and singles**
 - Communication, collaborative work, access to on line documentation, recovering people, Creating Teams, etc.
- **Moving teams and singles**
 - pushing them towards meeting points, POI, emergency points, recalling them, etc.
 - help them to get the exists !!
- **Aim:**
 - *Reduction of Costs!!*
 - *Reduction of the intervention time!!*
 - *Access to updated information in real time!! (maps, manuals, guidelines, ...)*

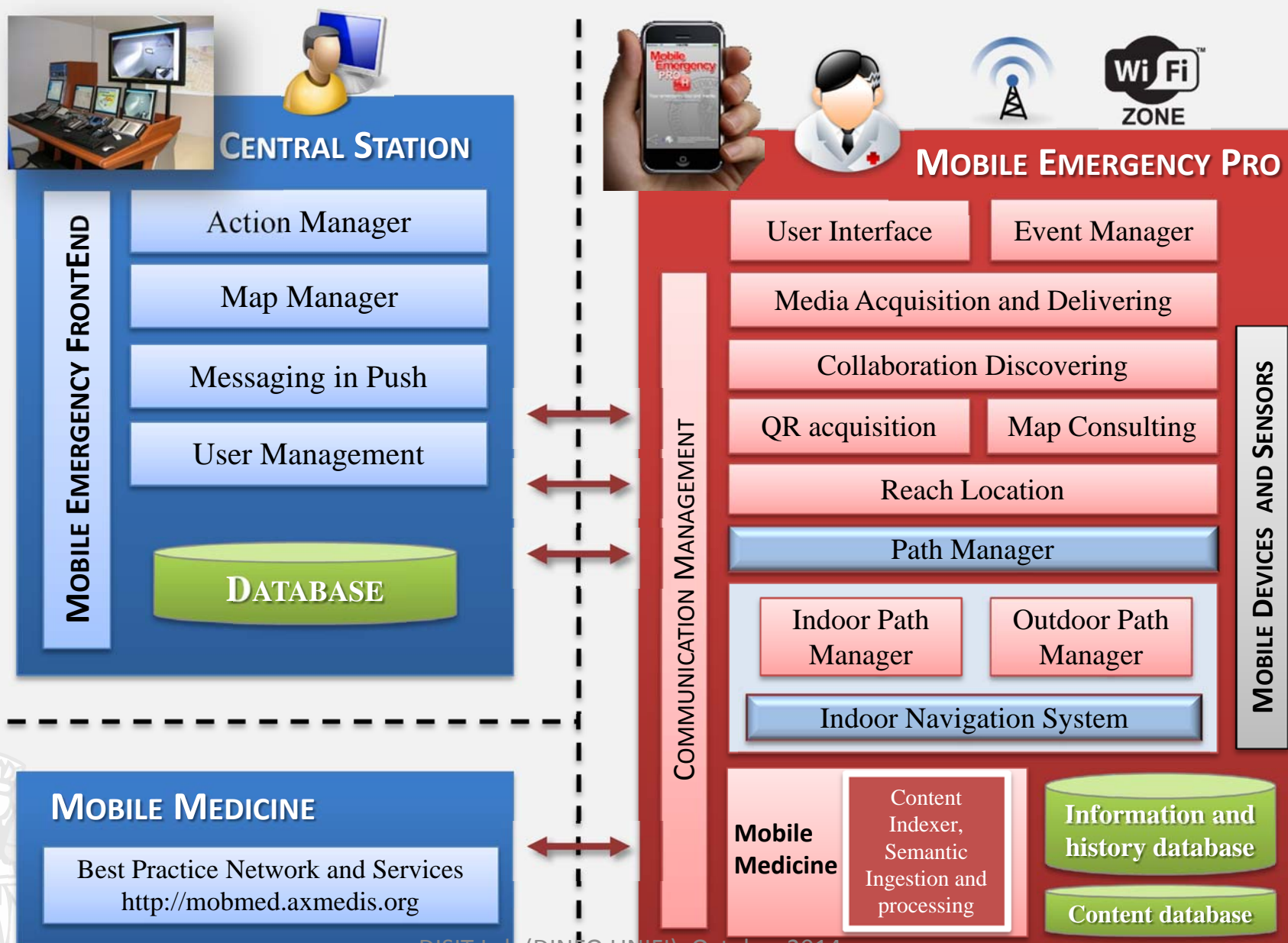


How they use

- **Improving the coordination among personnel (medical and/or for maintenance)**
 - Sending instruction to form teams and join other colleagues
 - Signaling about critical conditions and intervention
 - Continuous connection and communication with the central station for monitoring and emergency
- **Delivering fresh and updated information**
 - Documentation, exits,
 - positions of POI and colleagues



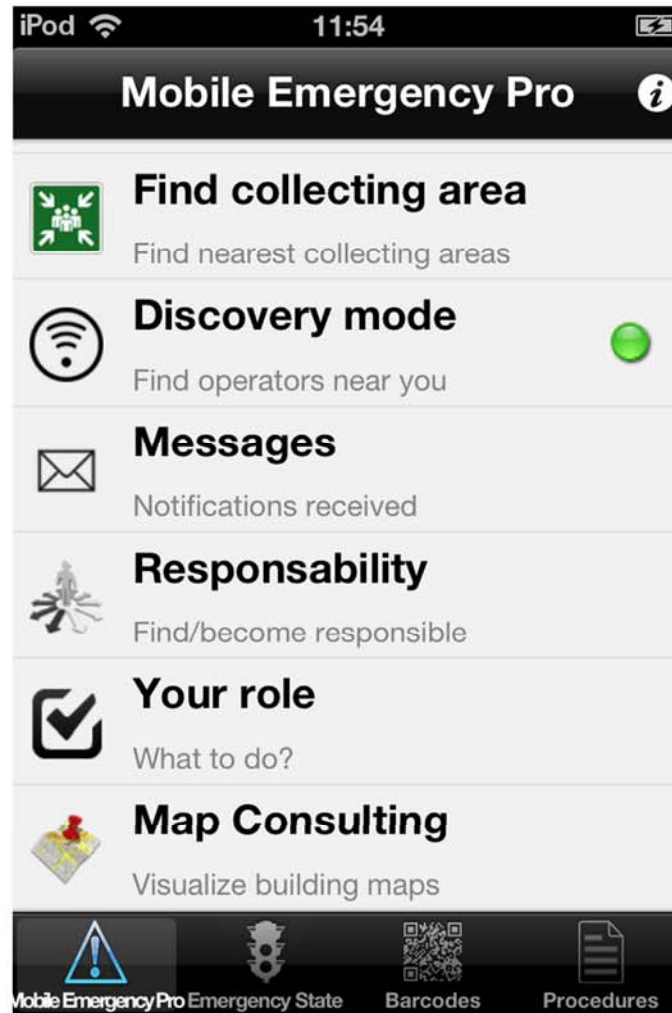
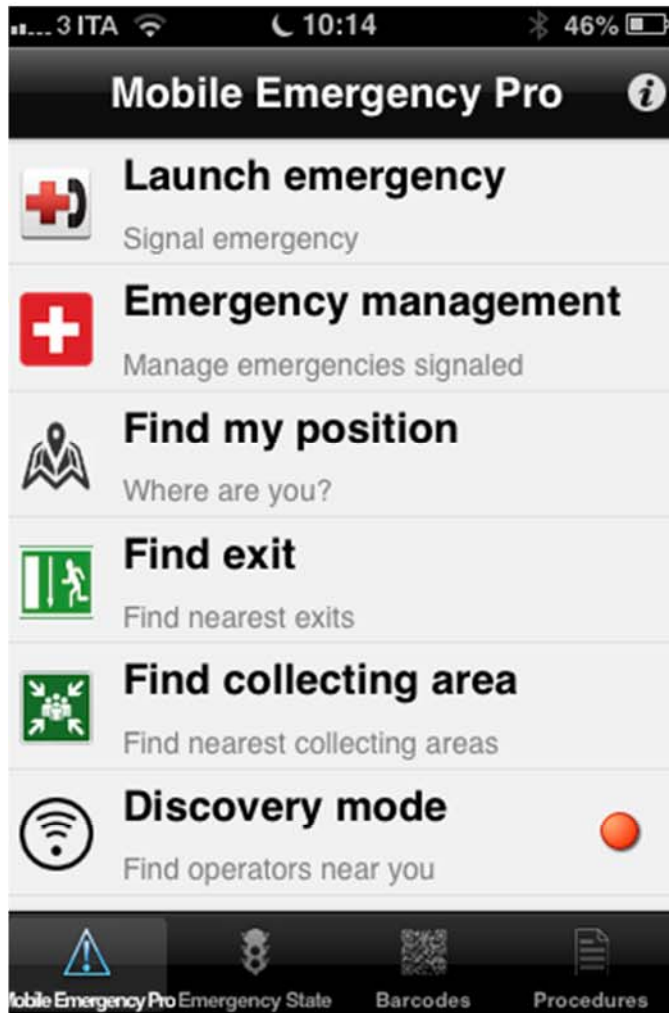
General Architecture



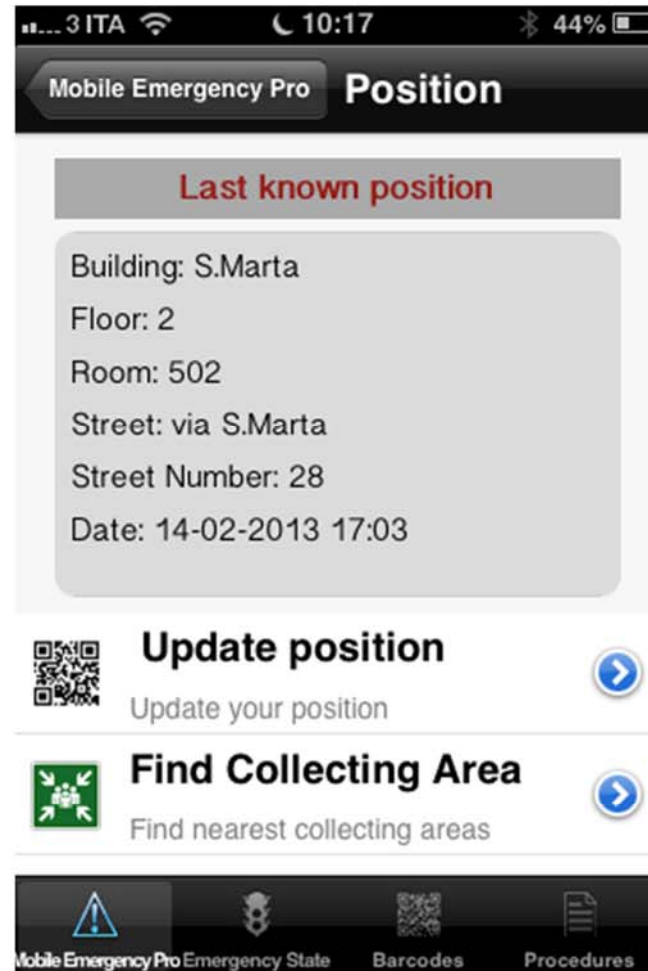
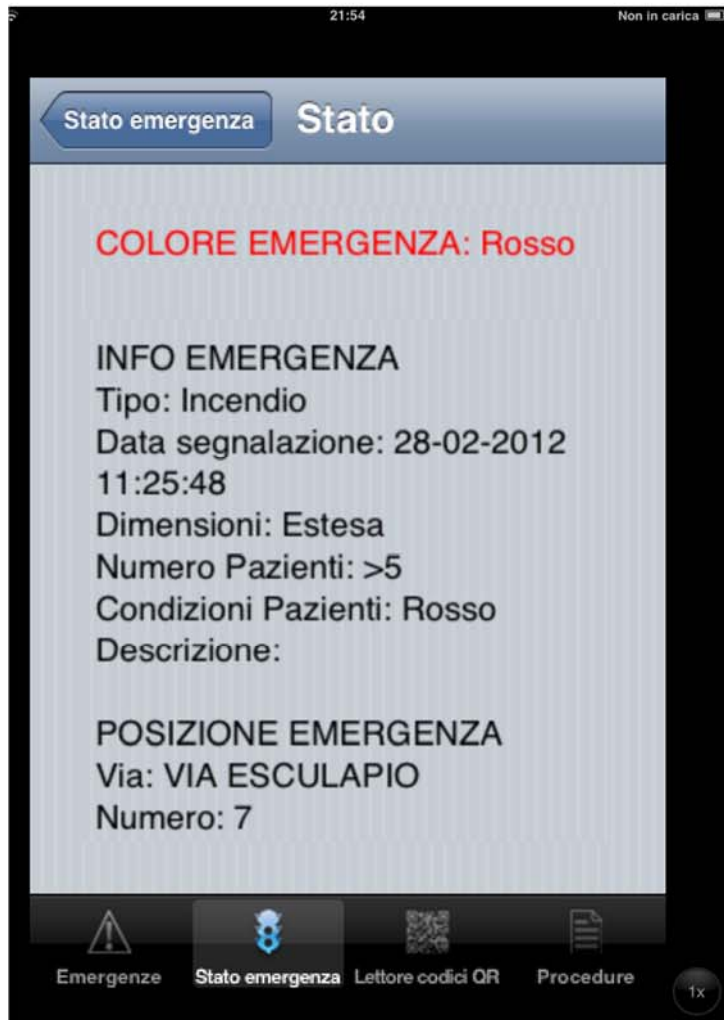
Central Station

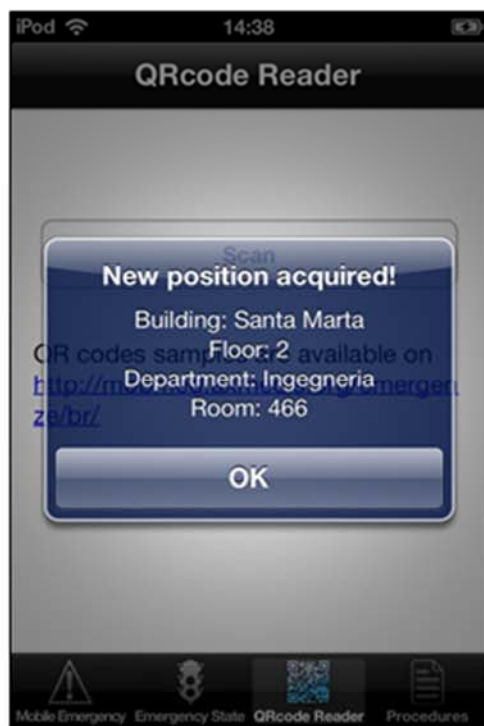
- **receives alarms/requests** for intervention with a suitable protocol
- **supports people** involved in the event:
 - Providing: event status, viable exits, position of personnel, POIs,
 - Moving people and patients, moving materials, establishing teams
- **Sends messages** in push via APN, or polling to recall personnel, interrupts, etc.

Mobile Emergency



Mobile Emergency





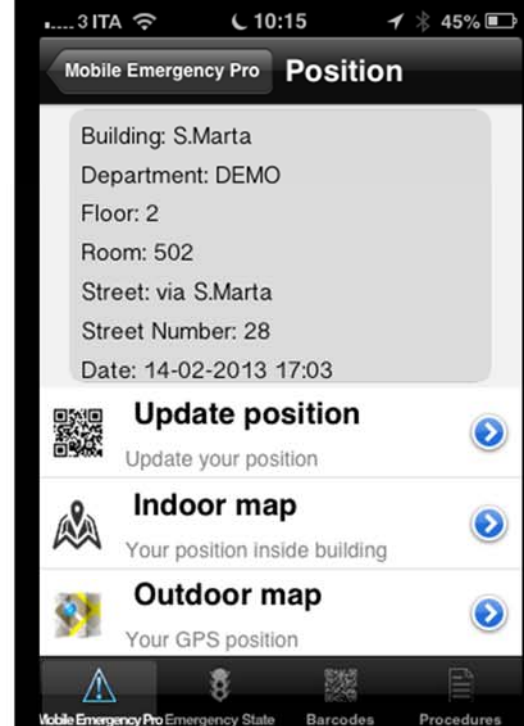
13.1



13.2



13.3



14.1



14.2





14.3

Indoor / Outdoor Navigation

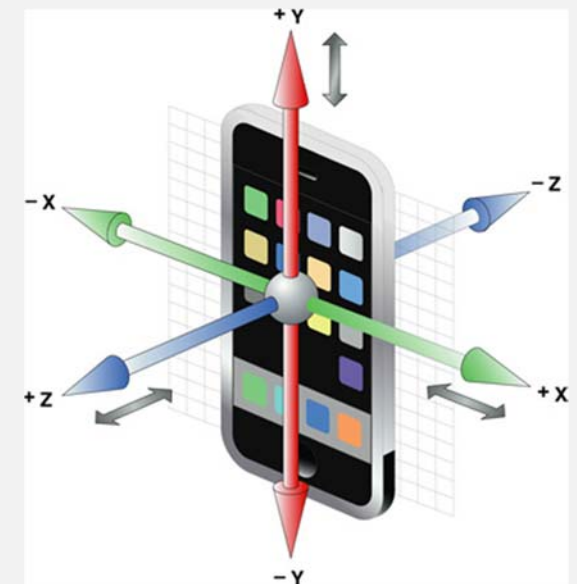
- **Outdoor navigation** based on GPS: Google Map, Open Street view, etc.
- **Indoor navigation** based on Markers and Fields:
 - RFID, QR, Laser, Wi-Fi, images,...
- **Detection of Indoor/outdoor passages:**
 - changes in signal power of GPS
 - presence of markers: QR, NFC (on android)
 - **Hyp**: Access to specific knowledge and maps integrating outdoor and indoor connected points (doors, windows, etc.)

Get position

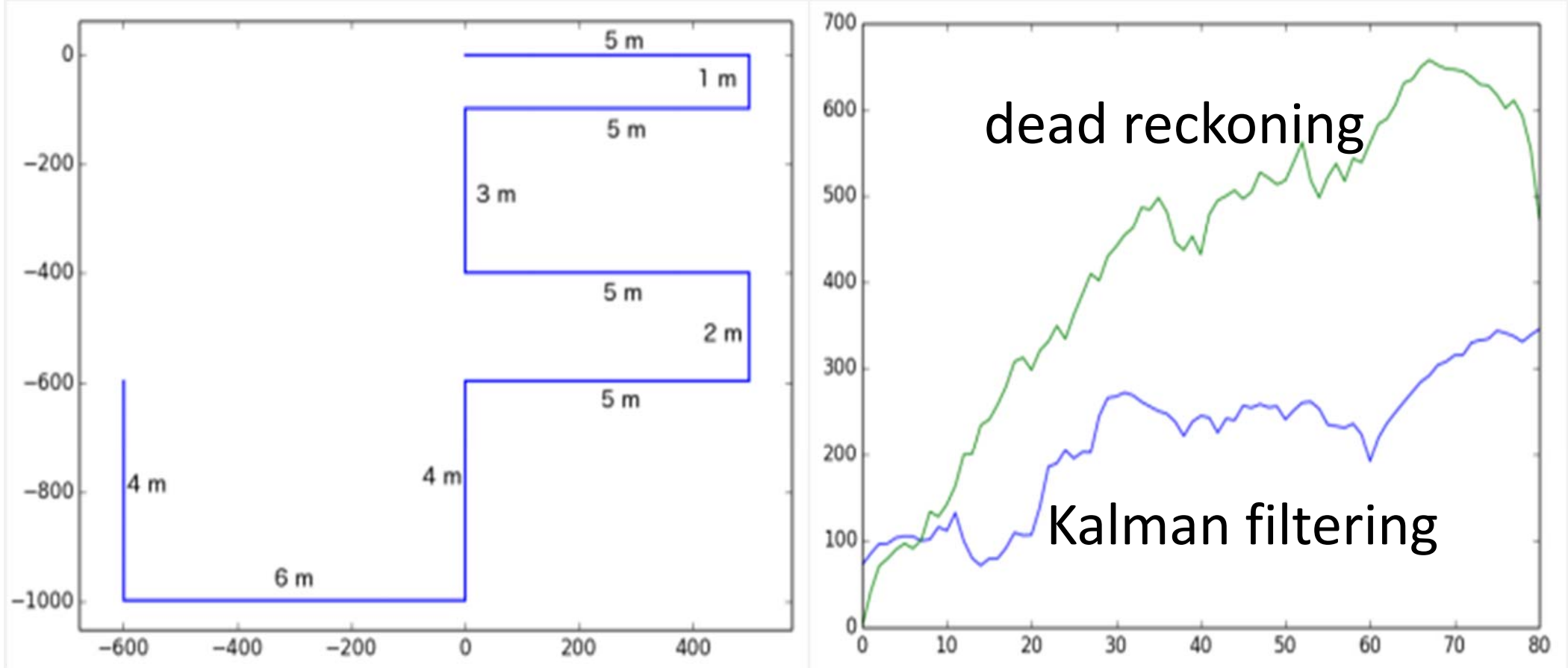
QR code aspect	Description and meaning of the QR code for location, an example	Map provided to standard QR readers
	<p>“00039”: position identifier of QR “n”: control code based on SHA-1 algorithm. String BarCode: http://mobmed.axmedis.org/me/ID00039n</p>	

Indoor navigation

- Once marked a point in an indoor Map, a precise inertial navigation support is needed to reach the successive point,
for example by using internal sensors of the mobile device:
 - gyroscopes, magnetic compass, accelerometers
 - as an *Inertial Navigation System*
- → *STOA lead to cumulative error in space and time:*
 - step counters, dead reckoning
 - traditional Kalman filter

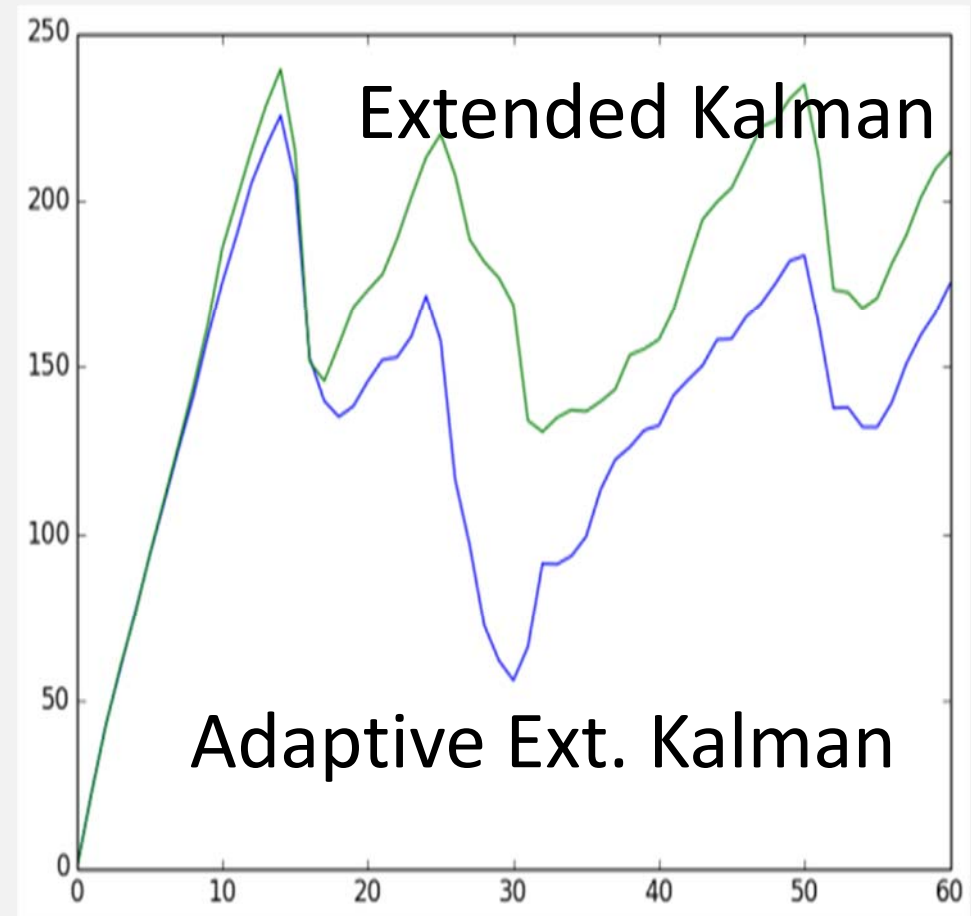


Dead Reckoning vs Kalman filtering



Extended Kalman Filtering

- First Kalman was with constant Q
- Extended Kalman addresses the non linearity
- Adaptive Ext. Kalman adapted Q using
 - Q at the previous time instant and a corrective scale factor (estimated on the basis of the ratio from the innovation covariance and the predicted value)
 - Q reported at Q_0 when a singularity is detected.



Mobile emergency

- A solution for **integrated indoor/outdoor inertial navigation** has been proposed, addressing
 - map and knowledge modeling
 - adaptive Extended Kalman filtering
- **Compared with state of the art** solutions, the proposed solution obtained
 - errors < 20 cm at the end of the path, 40mt.
 - saving 18% in time to reach the target point for team that do not know the area

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Smart City @ DISIT Lab

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

Prof. Paolo Nesi

DISIT Lab

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