Goal: Demonstrate the convenience of using Linked Data to represent Sensor Data
No Domain yet: *Needs Assessment has to be done on a targeted audience. Which is the Audience?* --> Search for a scenario and then an audience.

Scenarios

1. **Planet Conservation:** Smart Waste Management, Renewable energy
2. **Urban Planning**: how the city is used by the citizens; active citizen participation to Urban Planning
3. **Continuous Health Care**: Alzheimer's disease, reduced cumbersom vistis to doctor, avoid nursing home
4. **Public safety**:
5. **Transit system**: Intelligent commuter, Mobile Payment: no tickets, fairer charge
6. **Product Management**: rfid tag including all the prod. details + monitor consumers' appreciation
7. **Home Automation**: access, energy, heating according to preferences, environmental conditions, your location, prices -> smart meters, IP-TV integrated with home network
8. **Information delivery**: events / shopping /advertising
9. **Agriculture**: orchard's: crops condition, plants state, workers activity

Characters. Teenagers: Aoife; Adults: Tina, Gianfranco; Elderlies: Pia

1. Planet Conservation
Tina and Gianfranco have a large family. They both work and try to save money whenever they can. Since they are busy among family duties and work, they have never really cared about the environment, relying on politics and others who - they say - are paid to take care of that. One day Tina reads on a newspaper that the local taxes can be reduced up to 50% according to the proportion #family members / #correctly recycled trash objects. She soon gets interested and collects all the information about how to enter this program and how to correctly recycle. Then she requests and receives from the city council, a trash bin with a motion sensor inside (tot: 30euro) which counts how many objects are thrown in the bin (and detracts when one is picked up again). She also receives a roll of printed QR-codes that she has to attack on each trash bag before throwing it away, in order to be able to open the public recycling bin while, at the same time, being identified. Once Tina throws the trash bag, the recycling bin checks through its chemical sensors, for the presence of incorrect materials inside the trash bag. In case everything has been properly recycled, the public bin details are aggregated with Tina's family's and her sensor's ones and the credits she has just gained are immediately displayed only while Tina is still close to the bin. As she leaves the display is reset (presence sensor). At the end of the month when paying local taxes, Tina's family receives a big discount and all of her family's members are perfectly educated and motivated about recycling.
DataSources: (1)Registry office (family details); (2)Public trash bin registry; (3)Personal trash bin; (4)Public taxation

Related successful real case: German feed-in tariffs for renewable energy (lower fees on auto-produced renewable energy)
Malta is building a smart grid that links the power and water systems, and will detect leakages, allow for variable pricing and provide more control to consumers. Ultimately, it will enable this island country to replace fossil fuels with sustainable energy sources
Sensors: motion, presence, chemical, image

2. Urban Planning
Re-shuffle the way issues get discussed
Street cleaning. Aoife is walking around the city centre. As she stops at a traffic light, she notices a display (*actually already existing muni-meters might be enhanced by this functionality*) on which localized information about the air quality and road works are shown. Contacts of politicians who take care of such aspects are also listed and is possible to send them comments. Aoife had noticed the street was dirty and then she logs in by using her tax code and sends a complain about it, using the predefined template for reporting dirty streets. She reads also that there's an application for her smartphone on which she could perform those same actions; then she downloads it. As she moves far from that display, she is automatically logged out.
Air pollution. She decide to sit right in front of the sea since the air seems very healthy and it's a sunny day. Suddenly she receives a notification on her smartphones: the surrounding environmental sensors have communicated to her application about the presence of an high percentage of amiantus and its carcinogenic risk. Again the politicians in charge of this topic are listed and she immediately send a complaint to them, while moving somewhere else. She also shares this new knowledge with her friends on Twitter and Facebook. She had never known about this problem before. Some of her friends living close by that place, had heard rumors about the carcinogenic risk but they didn't know precisely the gravity of the situation, the numbers. As they get to know better, soon the referent politicians get millions of complaints. Gianfranco is a journalist. His task is to monitor the activities of the local politicians. Consequently he had subscribed to the datasource on which all the citizen's complaints are collected. He had set to receive a notification as complaints about one same topic overcome a defined threshold. After few hours since Aoife's social activity, he gets notified of the asbestos issue and writes a big article on the local journal about it. Then politicians who were thinking to ignore the complaints, can not avoid their duties anymore, because of the public resonance and citizen awareness that the problem has gain
Radiations. The application that Aoife has downloaded on her smartphone, periodically scans for environmental sensors available around. As it finds someone, it checks the healthy threshold related to that particular observed property and, in case the threshold is overcome, it notifies Aoife. She is going to visit an apartment to rent and as she gets closer, the applications notifies her of a high percentage of radiations. In case of radiations before sending the notification, the data is also checked against reliability by crossing it with data about eventual recent rain (which usually causes readings to rise) in that location.
Datasources: (1)Tax code registry; (2)Citizen comments data: (3)Linked GeoData; (4)Environmental sensor data; (5)Politician roles registry; (6)Healthy-Threshold-For-Substances data; (7)Influence of rain over radiation data (ruleset)
Sensors: environmental, proximity, location
Related successful real case: Citizen awareness rise up after the analysis of private real sensor data about airport noises and dangerous Jet A fuel emissions, which happen to be more reliable than the official ones.
Urbanflow, a scenario exactly the same as this has been proposed but the followup is unclear.
Notes: citizen engagement journalism and drone journalism

3. Continuous Health Care

According to 2011 statistics 35% of Americans who are older than 20 have diabetes. It was the 7th leading cause of death in US, in 2007, though it is likely to be under reported as a cause of death. The risk for death among people with diabetes is about twice that of people of similar age but without diabetes and medical expenses are 2.3 times higher, too. It also causes several complications like kidney failure, amputations, new case of blindness, hypertension, heart diseases (the risk is 2 to 4 times higher) and stroke.

"Working together, people with diabetes, their support network, and their health care providers can reduce the occurrence of these and other diabetes complications by controlling the levels of blood glucose, blood pressure, and blood lipids, and by receiving other preventive care practices in a timely manner"

What is more timely than immediate? Which place is more comfortable than wherever?

Pia is 70 and is affected by diabetes. Her daughter, Tina, has bought for her a meter some other. So he still has to help Pia to perform such tests but they dislike other existing more intrusive solutions like under-skin sensors, and the meters bring additional advantages. In fact it:

- stores an history of all the results
- aggregate each test result with information, from either the same day or in the previous ones, about (a)what Pia has actually eaten, (b)the exercise Pia has undertaken, (c)the eventually stressful activities she has performed, (d)the illness she had, (e)the medications she applied. In fact both food, exercise, medications, stress and illness affect blood sugar.

Alerting actions are immediately notified to Tina while alerting results are forwarded directly to doctors, as well.

Air Pollution and *Radiation* scenarios in the "Urban Planning" section, can fit here as well.

Datasources: blood sugar readings, motion exercise data, activity calendar, activities description data (where they are performed so that a cross check can be done with location sensors to verify whether the activity planned in the calendar have been actually performed), illness(detected by unusual lack of movement and time spent in bed) and (more serious) diseases (manually inserted in the history), affecting features, home map, linked geoData (points of interest in the city)

Sensors: motion sensor, gps/gprs, blood sugar sensor, accelerometer.

Related successful real case: **glucose meters**, home medical supplies for diabetes

4. Public safety

The immediate reaction to any change in the usual situations is the common feature to any scenario involving sensors. In this case the situation is a crime site and the changes are all the potential clues recorded in that site during the same time period of the crime. The Chief Inspector Gianfranco is investigating on a car burglary that occurred in a main street of the city. He gets to know that the same crime occurs always on rainy days and with the same characteristics in the same area. Also both the type of attacked cars and the driver traits are the same, and a sensor positioned to the corner closer to the crime site, always detect the presence of someone staring for at least half an hour and having a certain height. In this way without using any camera, Gianfranco has got many connections as clues, immediately as the crime was committed.

Datasources: crime details, linked geodata, stolen objects details, criminal registry, unusual happenings

Sensors: location sensors, chemical detector sensors, noise, light

Related successful real case: dontflush.me Raw sewage dumped into the harbor in NYC, coming from the Combined Sewer Overflows (CSOs) that open when the sewer system is overloaded. By notifying residents about the overflow risk they could reduce their waste water production before and during the overflow event. Planned to be mashed up with a new tool from the NYC DEP that allows building water use to be tracked on a daily basis.

New York, Rio de Janeiro and Memphis (reduced serious crime by more than 30 percent, including a 15 percent reduction in violent crimes since 2006) are using data analytics, wireless and video surveillance capabilities to strengthen crime fighting and the coordination of emergency response units

Data warehouse for the NY police department which makes connections across multiple databases to collect all the details related to a crime, including mundane details (what used to take days).

5. Transit System

Gianfranco rarely uses the local bus system. His workplace is at 30 minutes of distance on foot from his home and he is usually on time constrains so that he prefers to walk instead of risking to wait too long to hop on the bus and then arriving late at work. One day he notices an application for his smartphone, in which he can see the bus moving on a map in real time. The time he has to wait until it reaches the stop then, is reliably calculated and since it seems he would arrive earlier by catching it, he decides to wait. Once on the bus, he asks the driver to buy a ticket but the driver says that the payment is done online and as soon as he pays the entry barrier will automatically open to let him enter and sit down. In fact Gianfranco receives a request to allow a payment on his smartphone, from the bus company. As he allows it, the barrier opens, while as he hops off, he gets notified on how much he has been charged proportionally to the length of his trip on the bus.

Datasources: bus movement, bus identities

Sensors: gps/gprs, accelerometer on the bus, something to recognize who is hopping off/on and when

Related successful real case: universal ticket to pay any mean of transport, enhanced by displaying the current balance. Singapore is working with IBM to develop smart systems ranging from predictive tools to smart cards to congestion charging in order to reduce traffic and pollution.

to handling its transportation and utilities infrastructure, Cambridge, Ontario, acquired a sophisticated new work and asset management system.

6. Product Management

Gianfranco is the product manager in a supermarket and he has been asked to select those products among vegetarian foods, on which it would be strategically convenient to apply a discount.Instead of manually checking the selling information and conducting surveys among customers, he performs the task in few minutes. In fact he simply search for vegetarian products and since the list is already linked with the customers time spent in their proximity, he just has to count on the amount of people who after stopping didn't purchase at the end. In this way he identifies the amount of customers attracted but discouraged, and can try to encourage them by lowering the price.

Datasources: products, customers, productCustomer interactions

Sensors: pressure (to identify a customers picking up a product), motion/presence/proximity/orientation (to identify the proximity of a customer to a product), RFID tag (to both identify and locate a product), shopping card (to associate a customer profile to the purchased items)

Related successful real case: ?

7. Home Automation

Smart meters. Tina as the majority of people, repeats the same actions every working day. Such data have been collected and then when she has a shower only the necessary amount of water is pre-heated and consumed; while she is eating the light turns on only in case there is not enough already coming in from the window; while she reads more light is provided but focused on where she is positioned. When she needs to use the washing machine and the dishwasher at the same time, together with the oven, at the oven is given higher priorities while the other devices will automatically switch on in the particular combination that will allow to save both energy and money according to the bill.

Temperature-related. Pia does not know how to regulate the heater and both her and asks her daughter to do it for her. But the weather is particularly unpredictable so Pia keeps complaining about the not satisfying temperature and after being opening windows for some times in order to balance the temperature, she gets a cold. Then Tina decides to let someone

deploy an hom automation system that will automatically regulate the indoor temperature by both opening windows and switching on the heater at a proper power, in different moments, according to both Pia's habits (e.g., the room where she uses to spend more time and when), the energy bill plan and the weather forecast, with the aim to save money, too. Also in case the forecast happens to be wrong, the issue is detected and the temperature is balanced again.
Private Safety. With the increasing amount of home burglars happening while the owners are inside, especially in villas, Gianfranco gets concerned and decides to start using an advanced alarm system. Such system unlike the other existing ones, can be left on even while people are inside the house, since it is able to detect an intrusion as someone who either enters the house without being welcomed by any member of the family, or stay for long time touching the front door without ringing the bell. Members of the family are recognized by RFID tags. In this way even if Gianfranco is alone, listening to loud music on the first floor, he can be sure that no burglar could have ever entered the ground floor, because of the alarm system.
Datasources: members of the family (habits, details, ids), home map, weather forecast, outdoor temperature, indoor temperature, indoor light, family indoor movements, electricity bill plan
Sensors: motion, presence, rfid tags / readers, light, temperature, (actuator to open the window)
Related successful real case: water consume reduction of 6% after knowing the amount of wasted water caused by leakages + other smart meters and money saving solutions in the city of Dubuque

8. Information delivery
Gianfranco owns a butcher and would like to let all the potential customers know about the convenient discounts he is applying. He has been writing a sign on the street but noticed people were ignoring it: sometimes people were distracted and some other times they were walking a different street and so couldn't read it. One day he gets to know by a colleague, of a smartphone application by which a customer like Tina, can broadcast a request for discounts on the items she needs to buy, to all the shop in an area whose radius can be customized according to her preference. The application automatically collects price information by the items themselves. In this way Tina gets the best deal and Gianfranco's offers will reach a broader range of customers. Tina is also able to read comments of other customers related to either the item brand, or shop in which it is sold.
Datasources: items, discounts, linked geodata, customer feedback
Sensors: rfid, gps/gprs
Related successful real case:?

9. Agriculture
Tina owns a farm equipped with sensors that monitor the condition of the crops in different orchards, duration and level of sunlight, temperature, humidity, level of rainfall, wind speed. Whenever the duration of sunlight is lower than the recommended threshold, in specific areas, artificial lights are switched on only in those sites. In the same way whenever the humidity level is higher a dehumidifier is switched on and vice versa. The same monitoring approach applies to single plants and trees.
Datasources: natural products cultivation details, natural products, weather forecast, sensor reading (light, temp. etc.), orchard map
Sensors: rfid (to identify and precisely locate both plants and areas), environmental sensors
Related successful real case:?

Sensors

1. **Location Sensors**: *can be used as a* filter for info of immediate interest
    - meeting/studying/working room finder

- expert finder
- friend/colleague/people-sharing-interests finder
- shop/shopping items finder
- **customer finder (ads)**
- historical/entertainment places finder

2. **Environment Sensor**: *can be used as a* support for decision making in domains affected by the environment
   - conservation of items (esp. food)
   - production of items (esp. natural foods, e.g. farm, orchard)
   - activity planning
   - disease prevention/cure
   - planet conservation
   - energy/money saving
3. **Body Sensors**: can be used as a support for decision making in the health care domain
   - disease prevention/cure
   - patient care (disease/cure downsides prevention/cure)
   - fitness activity planning / performing

Body Sensors, Environment Sensors, Location Sensors

Planet Conservation	Urban Planning	Continuous HealthCare	Public Safety	Transportation System	Product Management	Building Automation	Information Delivery	Agriculture	Use Cases / Sensors	
X		X	X	X	X	X			Motion	Location-
			X		X	X			Pressure	----------
X	X		X		X	X			Proximity	----------
			X		X				Orientation	----------
	X	X	X	X		X	X		GPS / GPRS	----------
		X	X	X					Accelerometer	----------
			X						Sonar	----------
X			X						Image	----------
					X	X	X	X	RFID tag	----------
								X	Wind	Environm
						X		X	Temperature	----------
								X	Humidity	----------
	X								**Methan Gas**	----------
	X							X	**CO / CO2**	----------
X	X		X					X	**Chemical detection**	----------
	X								**Radiations**	----------
	X								**Air Quality**	----------

									Energy Consumption	
									Water Current	
									Water Quality	
			X						Noise	
			X			X		X	Light	
									Blood Pressure	**Body**
		X							Blood sugar	
									Heart Rate	
									Ultrasonic	