

# Social Internet of Things

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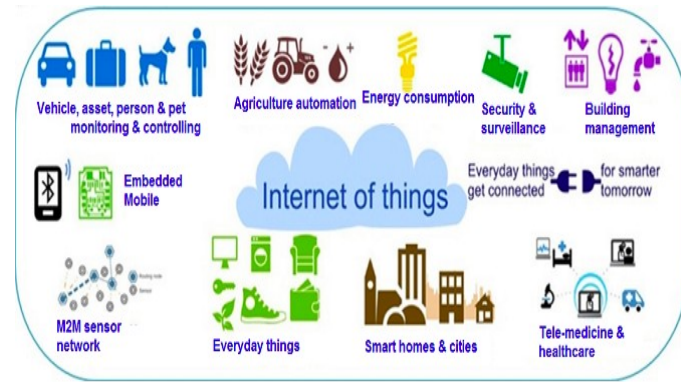
IIIT Allahabad

# Social Internet of Things ( SloT )



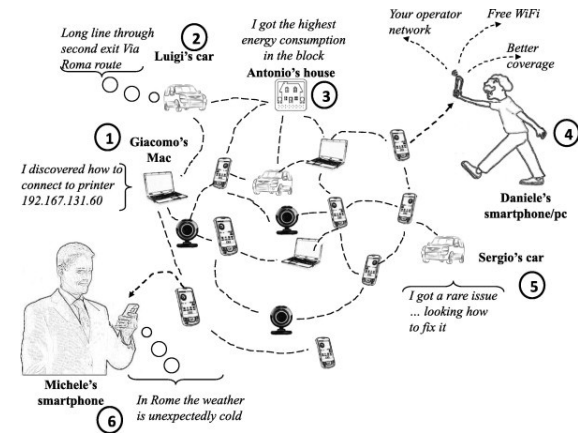
Social Networks

+



Intelligent Objects

=



Social Relation of Objects

- Example 1 : A set of mobile phones in a geographical area provide data on the radio coverage to the new visitor.
- Example 2 : PCs in the same local area establish relationship to solve common setting problem such as installing drivers
- Example 3 : Cars of the same brand, make, year share data to overcome a common electrical problem
- First proposed by Luigi Atzori, Antonio Iera and Giacomo Morabito in [3]

[3] Atzouri *et al.*, SIOT: Giving a Social Stricture To The Internet of Things, IEEE COMMUNICATIONS LETTERS, Vol. 15, No. 11, November 2011

[4] Ning and Wang, Future Internet Of Things Architecture, IEEE COMMUNICATIONS LETTERS, Vol. 15, No. 4, 2011

[5] Kanz *et al.*, Things That Twitter : Social Network and Internet Of Things, What Can Internet Do For The Citizens (CIoT) Workshop, Pervasive, May 2010

# Social Structure of Things

- Ownership Object Relationship
- Co-location and Co-Work Relationship
- Parental Relationship
- Social Object Relationship

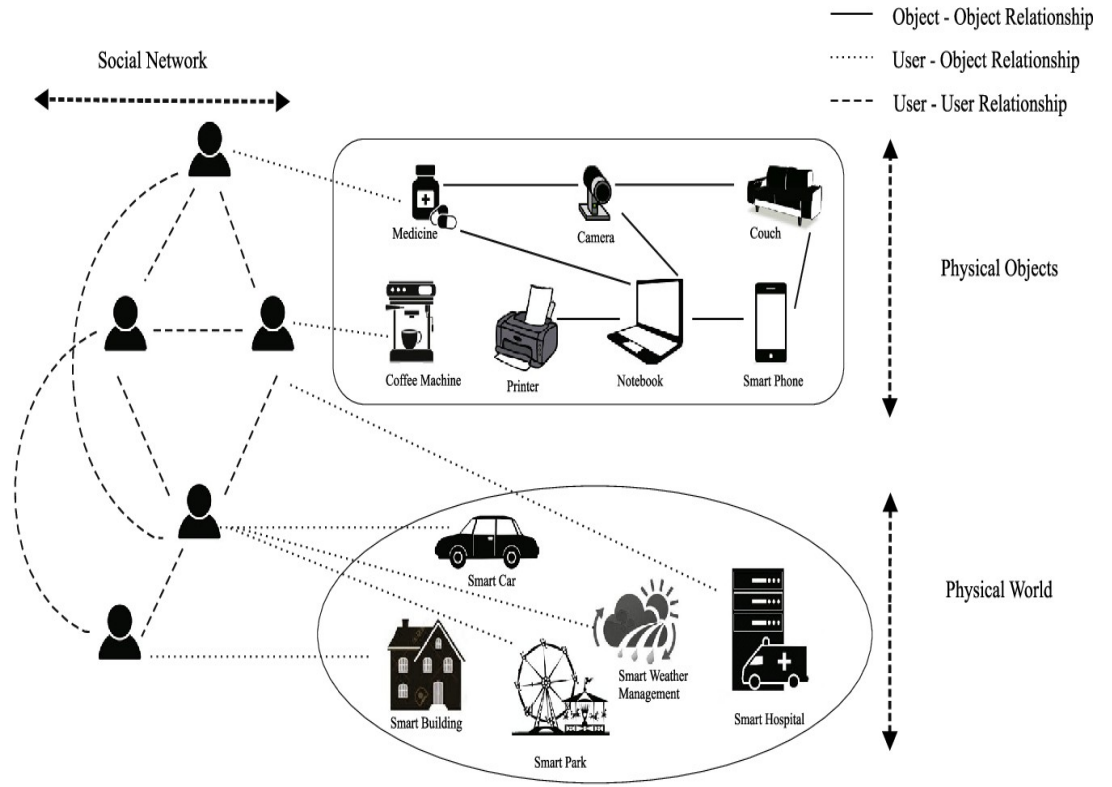
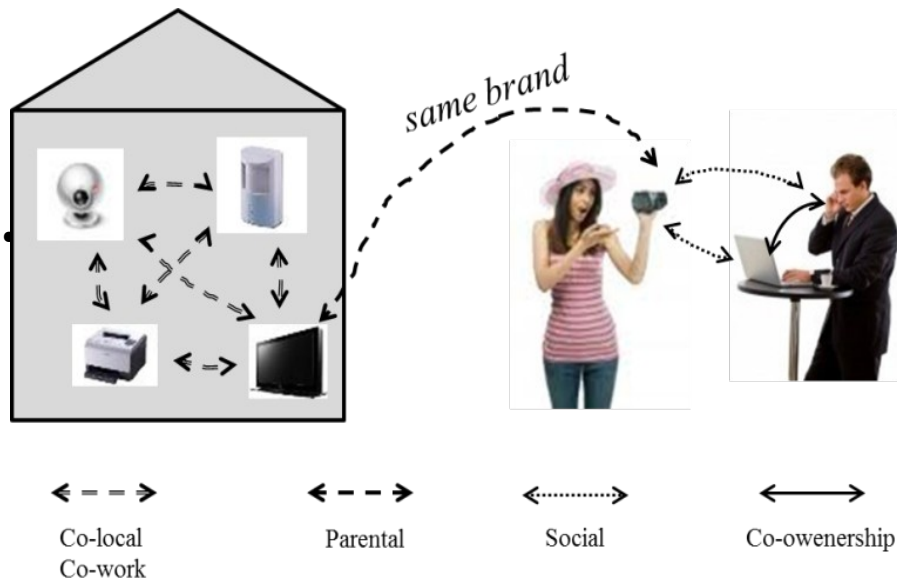
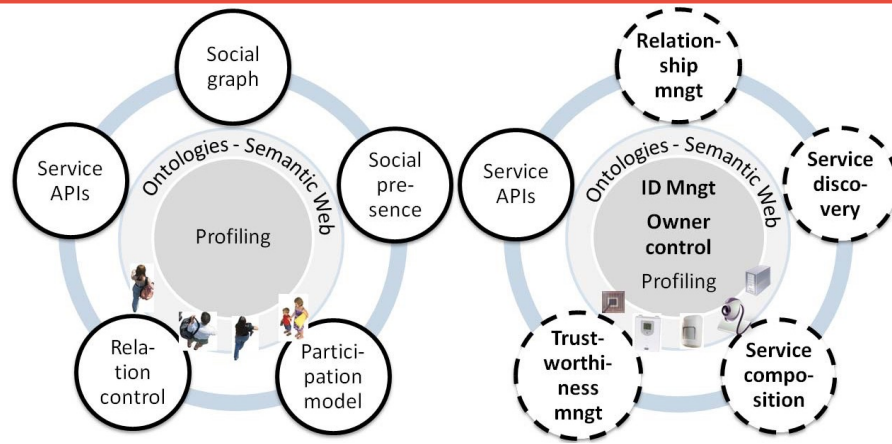


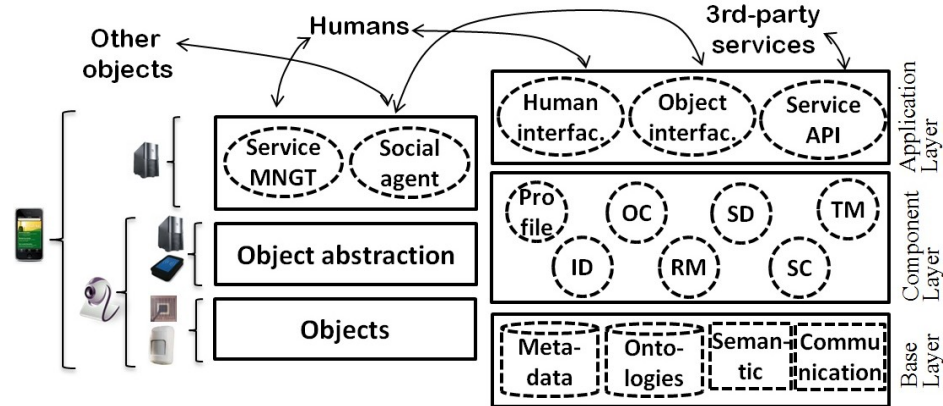
Fig. 1. Components of the Social Internet of Things.

Source : Luigi Atzori, Antonio Iera and Giacomo Morabito, Social Internet of Things: Turning Smart Objects into Social Objects to Boost the IoT, Newsletter, IEEE Internet of Things, November 2014

# SIoTT Components and Architecture



Social network components of humans      Social network components of Things [3]



Architecture of SIoT :

Client

Server

[3] Atzouri *et al.*: SIOT: Giving a Social Stricture To The Internet of Things, IEEE COMMUNICATIONS LETTERS, Vol. 15, No. 11, November 2011

# Early SIoT Implementation

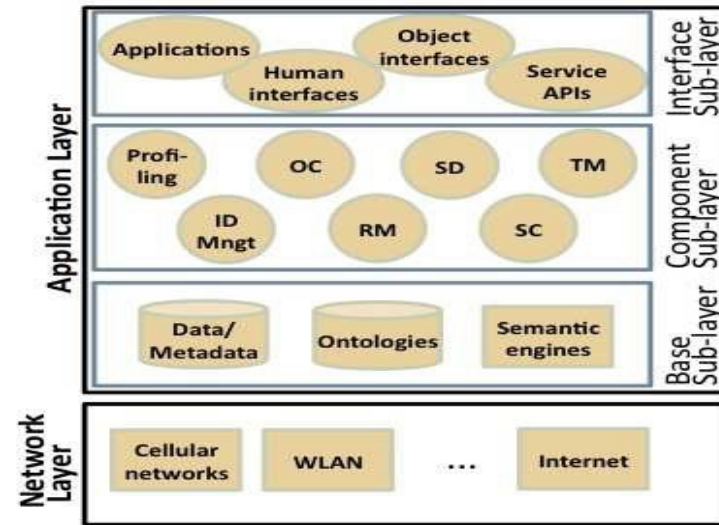
## **Paraimpu [9] : Social Web of Things**

- **Connects physical and virtual things to the web**
- **People to connect together sensors, actuators and other web applications, taking care to forward data among the objects**
- **Virtual things are resources available in other IoT platforms and are not intended as autonomous software agents**
- **Social in human sense – sharing things among users thorough human social networks; through integration of Twitter, an user can obtain data from his/her friend**
- **Paas implementation – instantiate interfaces to access devices**
- **Limitation – No functionalities for deployment of apps**

**Data owned by platform provider**

- [9] Antonio Pintus, Davide Carboni, and Andrea Piras. 2012. Paraimpu: a platform for a social web of things. In Proceedings of the 21st International Conference on World Wide Web (WWW '12 Companion).

# SIoT Implementation [11] – Server Architecture



SIoT SERVER

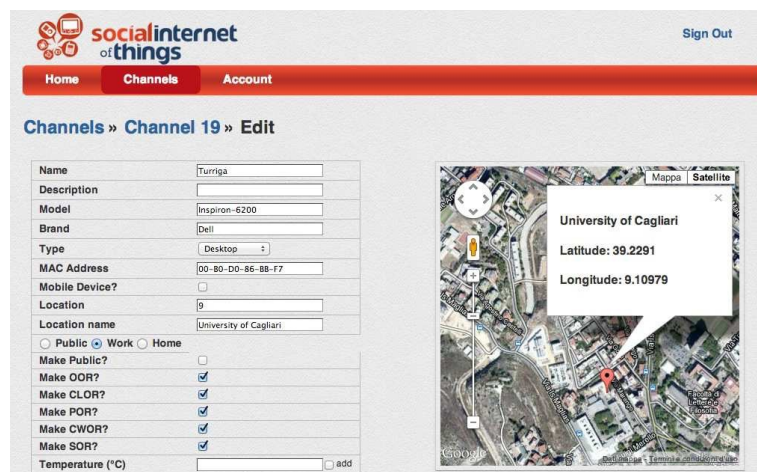
**Base sub-layer :** Database for the storage and the management of different data types, such as temperature, latitude, longitude, humidity.

**Component sub-layer :** implements functionalities of objects

**Interface sub-layer :** interfaces and service APIs ( read / write keys) reside

[11] R. Girau, M. Nitti, and L. Atzori, “Implementation of an experimental platform for the social Internet of Things,” in *Proc. IEEE 7th Int. Conference on Innovations in . Mobile Internet Services Ubiquitous Computing. (IMIS)*, Taichung, Taiwan, 2013, pp. 500–505.

# SloT Implementation[11] – Server Functionalities



The screenshot shows the 'socialinternet of things' web interface. The top navigation bar includes 'Home', 'Channels', and 'Account'. The main content area is titled 'Channels » Channel 19 » Edit'. On the left, there is a form for editing a channel with the following fields:

Name	Turriga
Description	
Model	Inspiron-6200
Brand	Dell
Type	Desktop
MAC Address	00-80-D0-86-88-F7
Mobile Device?	<input type="checkbox"/>
Location	9
Location name	University of Cagliari
Public	<input checked="" type="radio"/>
Work	<input type="radio"/>
Home	<input type="radio"/>
Make Public?	<input type="checkbox"/>
Make OOR?	<input checked="" type="checkbox"/>
Make CLOR?	<input checked="" type="checkbox"/>
Make POR?	<input checked="" type="checkbox"/>
Make CWOR?	<input checked="" type="checkbox"/>
Make SOR?	<input checked="" type="checkbox"/>
Temperature (°C)	<input type="text"/> add

On the right, there is a map showing the location of the University of Cagliari. A pop-up window displays the following information:

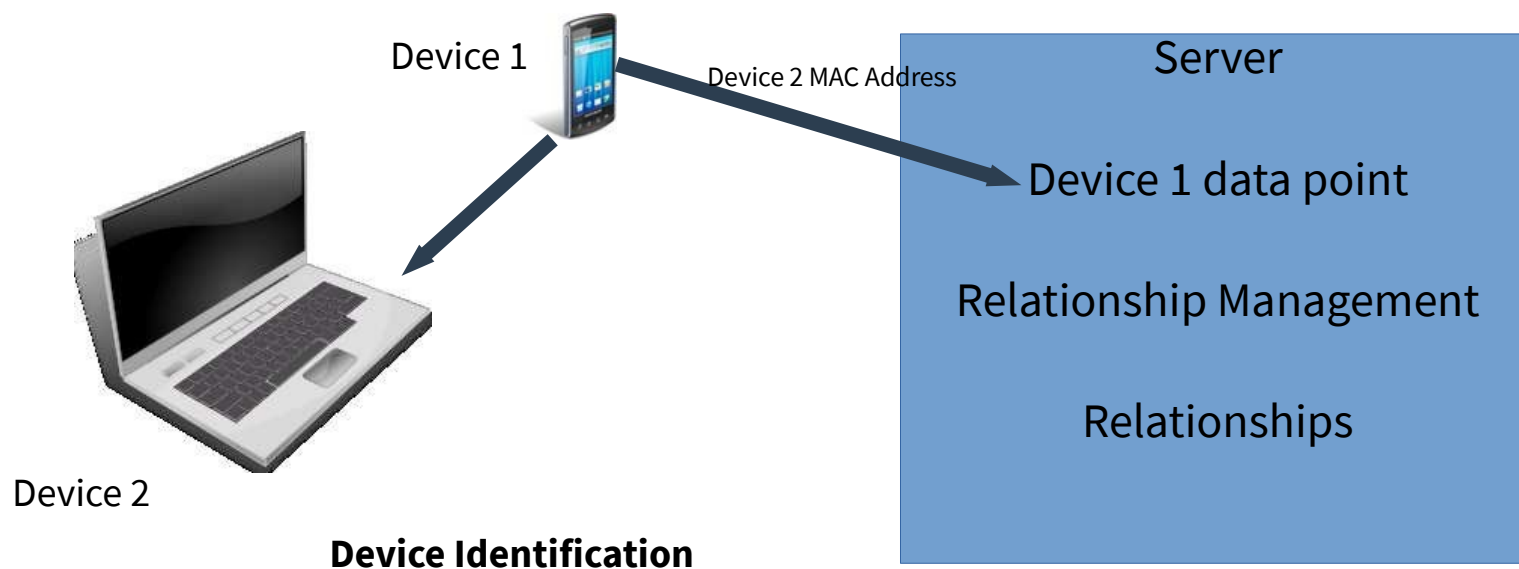
University of Cagliari  
Latitude: 39.2291  
Longitude: 9.10979

**As a RESTful architecture, a URI is associated to every resource. These resources are modelled as follow:**

- Every object is identified by a channel which represents a real entity such as smartphone, laptop or sensor
- Every device can have one or more field associated with it, based on the number of sensors; each field is identified by a data point
- User registers a new channel using profiling module; fills characteristics of objects (name, description, mobility, brand, location)
- User can choose which relationship the objects can create with other peers and which fields should be activated
- Objects start creating own social relationship
  - Profile relation – Ownership, colocation, Parental
  - Dynamic relation – Co-work, Social object

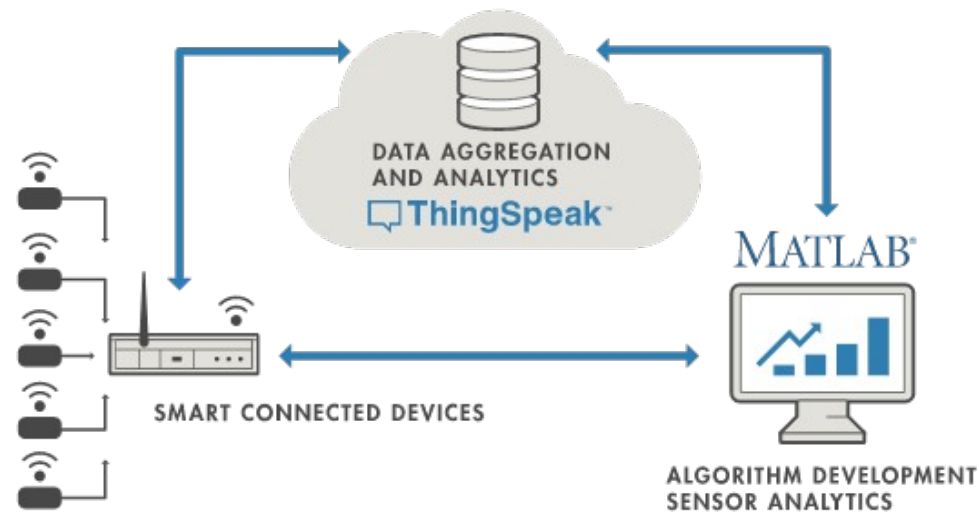


- RM module activated when a new object is registered or object sends information about own location or ids
- For dynamic relationship, devices must be in visibility for certain amount of time for a friendship request storing
- Every pass in friendship request is managed by server and devices send only server data





# SIoTT Implementation Using ThinkSpeak

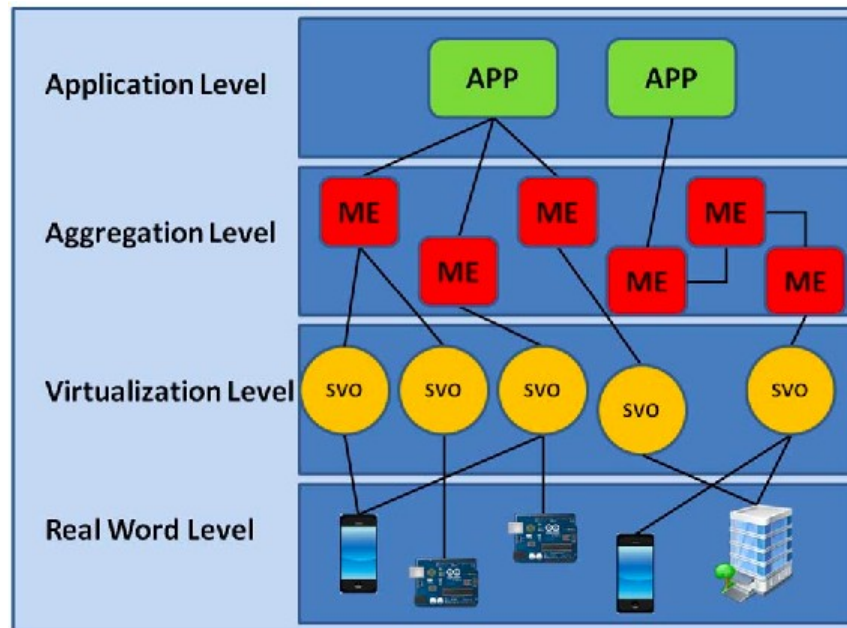


**Relationship management module integrated which can create relationships among registered devices**

**<http://siot.diee.unica.it:8088/>**

# Lysis Platform

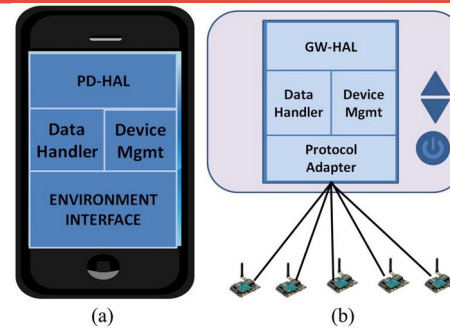
**Social Objects are implemented in a horizontal distribution by using independent Web services that run in the cloud space managed by users**



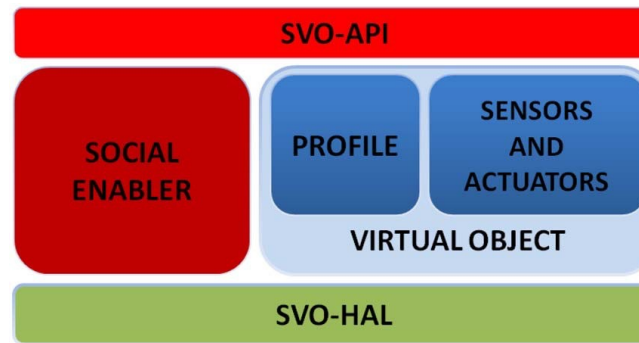
**Girau et al. Lysis : Platform For IoT Distributed Applications Over Socially Connected Objects , IEEE Internet Of Things Journal, Vol.4, No. 1, 2017**

# Implementing Lysis

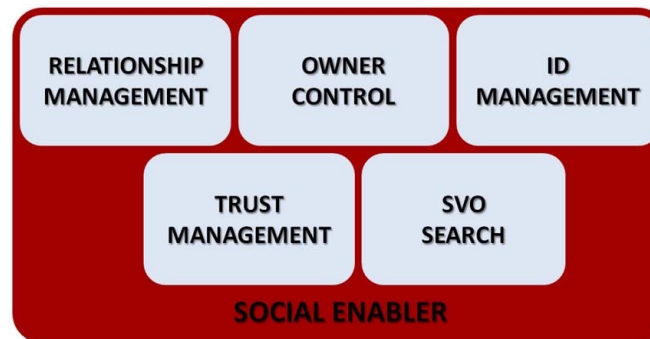
Real World Level :



Virtualization Level :

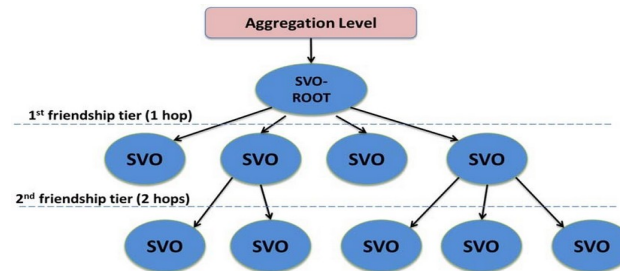


Aggregation Level :

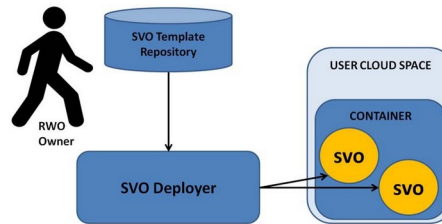


# Addressing Key Requirements

- Social Virtual Object (SVO)



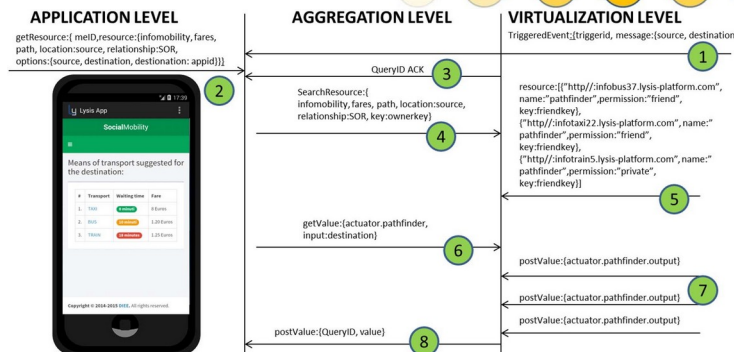
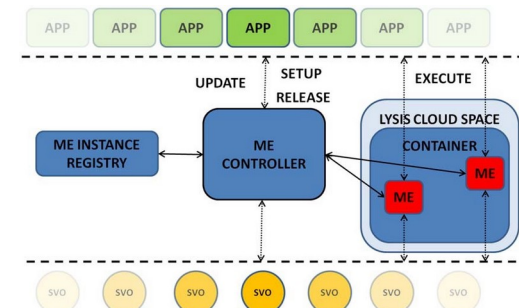
- PaaS oriented :



- Reusability

- Data Ownership

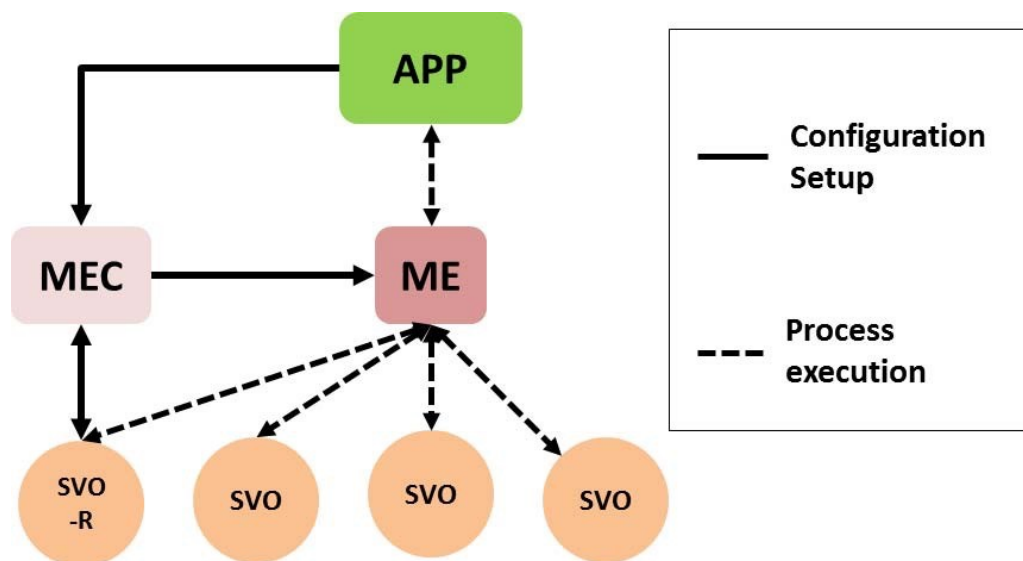
- Security and Trustworthiness



- Platform available at : <http://www.lysis-iot.com>

# SloT for Sensing Task Assignment In IoT

## Use of SloT for Mobile Crowd Sensing



Atzouri et al., Assignment of Sensing Tasks to IoT Devices : Exploitation of a Social Network of Objects, IEEE Internet Of Things Journal, Vol.6, No. 2, 2019

# Platform for Research on SloT : Lysis Platform

The screenshot shows the Lysis Platform interface for creating a new Social Virtual Object (SVO). The interface is divided into a left sidebar, a main content area, and a right sidebar.

**Left Sidebar (MAIN NAVIGATION):**

- Social Virtual Object Dashboard
- Your Objects
- New Social Virtual Object
- Application Dashboard
- Your Applications
- Application Market

**Main Content Area:**

## Social Virtual Object New

### New Social Virtual Object

**Name**

**Type**

**Google App Engine Id**

Select google app-engine or create a new one [New App Engine](#) [Choose App Engine](#)

**Virtual object Template**

**Enabled Social Relationships**

- OOR
- CLOR
- POR
- SOR
- CWOR

[Create](#)

**Right Sidebar:**

### SVO Description

Select SVO template

### Helper

Give a name to your new SVO. note that the names are not unique then you can have two objects with the same name; give them a name easy to be remembered. Select the SVO type: if you choose "fixed" then provide the SVO Location using the map. Create a new Google App Engine and type the App Engine Id in "Google App Engine Id". Select the Virtual Object Template appropriate for your device. Select which type of friendship your object can create.

# Tools and Platforms

Website : <http://social-iot.org>



The screenshot shows the homepage of the Social Internet of Things website. At the top, there is a navigation bar with links for Home, Community, News, Contact Us, and Downloads, along with a search box. The main content area features the 'social internet of things' logo, which includes icons for a smartphone, a laptop, a camera, and a network. Below the logo, there is a section titled 'When Things get smart, the Internet of Things gets Social!' with a paragraph of text. To the right, there is a 'news' section with several articles, including 'The IoT Crawler Project is about to end', 'Our IoT / SIoT Network Dataset is back online!', 'A Special Issue of the IEEE Transactions on Network Science...', 'The program of the next IEEE World Forum on Internet...', and 'The first module of the IEEE course on "The Emerging...".' Below the news section, there is a 'most read' section with a link to 'The Team is addressing SIoT related issues within the EC Pro...'. At the bottom, there is a 'Social Internet of Things Concepts' section with a link to 'The Team is addressing SIoT related issues within the EC Pro...'. The footer contains the text 'Italian Ministry of Research MIUR'.

Dataset : Lysis Data Set

## IoT Network Dataset

From this site, you can download the datasets used in our papers to construct the SIoT Network, which are based on real IoT objects available in the city of [Santander](#) and categorized following the typologies and data model for objects introduced in the [EiWARE Data Model](#).

### Citing the dataset

If you use the dataset in a scientific publication, we would appreciate citations to the following paper:

**Marche, Claudio, et al. "How to exploit the Social Internet of Things: Query Generation Model and Device Profiles' Dataset". *Computer Networks* (2020): 107248.**

Show BibTeX ([link](#)) - Read on Elsevier ([link](#))  
Thank you!

### Downloads

- Objects description: [link](#);
- Objects profiles: [link](#);
- Services and applications description: [link](#);
- Private devices (static and mobile): [link](#);
- Public devices (static and mobile): [link](#);
- Adjacency matrix for each relationship and completely SIoT network: [link](#);
- Lysis Dataset: [link](#).

Some other Projects : CloT (<http://clout-project.eu>)