

Open APIs  
for Open  
Minds

schema.fiware.org

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# Background

Introduction to [schema.org](http://schema.org)

# Introduction

- **What is schema.org?** <http://schema.org>
  - A *collaborative, vendor-neutral, community-based* initiative targeted to provide a **shared** set of *harmonized, cross-domain vocabularies* for publishing and consuming **structured data** on the web
  - Enables structured data **exchange** in an *interoperable* fashion
  - In **widespread** use today (>**12 million sites** using it and growing everyday)
- **Why schema.org?**
  - search engines can **understand** “the meaning” of web content
  - **richer** and more **interactive** user experiences when searching for information
  - interoperability between the Web and/or other applications  
calendars, email clients, personal assistants, ...
- **Who is behind schema.org?**
  - Major **search engine** providers (Google, Yahoo!, Microsoft, Yandex, ...) which act as project sponsors
  - A community of developers / domain experts making contributions
  - *W3C Community Group* <https://www.w3.org/community/schemaorg/>
    - A CG is not governed by the official W3C Process

# Introduction (II)



restaurante figon de recoletos valladolid

Todo Maps Imágenes Noticias Vídeos Más Herramientas de búsqueda

Aproximadamente 3.660 resultados (0,63 segundos)

Valladolid El Figón de Recoletos | Asador de Aranda  
[www.asadordearanda.net/es/content/valladolid-el-figon-de-recoletos](http://www.asadordearanda.net/es/content/valladolid-el-figon-de-recoletos)  
El Figón de Recoletos ... Acera de Recoletos, 3, 47004 Valladolid ... Imprescindible recibir un mail de confirmación por parte del restaurante para hacer efectiva ...

Estadua de José Zorrilla  
Map data ©2016 Google, Inst. Geogr. Nacional

Ver exterior

## Restaurante asador El Figón de Recoletos ★

Sitio web Cómo llegar

4,0 ★★★★★ 64 reseñas de Google

Asador

Asador castellano con horno de leña y lechazo asado, decorado con madera tallada en paredes y techos.

**Dirección:** Calle Acera de Recoletos, 3, 47004 Valladolid

**Teléfono:** 983 39 60 43

**Horario:** Abierto hoy · 10:00–23:30 ▾

Sugerir un cambio

Horas punta ?

Lunes ⇅

Ahora: No suele estar concurrido

----- máximo -----

Nowadays: Web search has turned out to be the best consuming application for the graph of knowledge

# Introduction (III)

- In order to provide any kind of structured data, it is needed:
  - **Data Model** (structural organization of data):  
Graph vs DLG vs Tree vs Entity-Attribute vs vertical-specific ...
  - **Syntax** (underlying format used to represent such data structure):  
JSON vs XML vs RDF vs HTML5 vs JSON-LD vs RDFa vs Turtle ...
  - **Vocabulary** (dictionary):  
Terms → *Entities* (types, classes), *relations* (attributes, properties)  
and *enumerations* (tabulated values)
  - **Identifiers for instances** (entity ids)
- Many years of formal standards work, battles, bells & whistles ...
  - **The stick**

# schema.org - Facts

- Work started in **August 2010**
  - Sponsored Microsoft, Google, Yahoo!, Yandex
- *Goals:*
  - Make it very easy for the webmaster
    - write once** for all search engines using **one vocabulary** (single schema)
  - Make it possible to use it in **combination** with other vocabularies
  - **Wide range** of cross-domain topics (297 classes, 187 relations, initially)
    - people, places, events, products, offers, recipes, businesses, opening hours
    - ...
- **Successful** initiative, de facto standard, thanks to:
  - Being the substrate behind contemporary web search engine experiences
  - Supported by popular CMS tools and multiple verticals
    - Drupal, Wordpress, Blogger, Youtube
    - Ticketmaster, ebay, alibaba, BBC, European Broadcasting Union, etc.

# schema.org - Structure and core data

## model

- schema.org core data model is a graph, roughly, similar to RDF
- **schema.org** defines the following term categories:
  - o *Data types* (Number, DateTime, Text, URL, etc.)
  - o *Entity types* (Event, Restaurant, Person, Offer, Place, etc.)
    - Arranged in a multiple inheritance hierarchy
    - Currently **583** (core vocabulary)
  - o *Relations* (properties)
    - multiple domain and range
    - Currently **846** (core vocabulary)
  - o *Enumerations*
    - wherever there are a limited number of typical values for a property, there is a corresponding enumeration specified in schema.org
    - Ex. <http://schema.org/ItemAvailability>
    - Currently **114** (core vocabulary)
- **schema.org is not intended to be a universal ontology.**
  - o it should be used in combination with other vocabularies

# schema.org - Design principles

- Avoid the *over generalization trap*
  - o Concrete classes and properties. Escape from terms like 'Agent'.
  - o Try to find the right **initial** level of **generality**
- *Avoid the mess* of unique URIs for each instance
  - o Use only unique URIs for *schema.org terms*
  - o **Reconcile** entities as per attribute values
- *Incremental complexity. Start simple. Go back and fill in the blanks*
  - o And let applications ask for *sophistication later*, after mass adoption
    - Adding new subtypes or more descriptive properties
  - o Not trying to find the perfect model
    - respond to the demands of applications* and data providers
  - o Move **fast**. Iterate fast. Accept mistakes
    - Publish** schemas **early** even though it is known that improvements will be needed
- *Pragmatic Extensibility*
  - o A small *core vocabulary* for each topic and rely on extensions for fine grain details
  - o Work together with interest communities



# schema.org - Application example




```
<script type="application/ld+json">
{
  "@context": "http://schema.org/",
  "@type": "Recipe",
  "name": "Perfect Apple Pie",
  "author": "Gin Blanco",
  "image": "http://images.edge-generalmills.com/56459281-6fe6-4d9d-984f-385c9488d824.jpg",
  "description": "A classic apple pie takes a shortcut with easy Pillsbury® unroll-fill refrigerated pie crust.",
  "aggregateRating": {
    "@type": "AggregateRating",
    "ratingValue": "4.5",
    "reviewCount": "276",
    "bestRating": "5",
    "worstRating": "1"
  },
  "prepTime": "PT30M",
  "totalTime": "PT3H",
  "recipeYield": "8",
  "nutrition": {
    "@type": "NutritionInformation",
    "servingSize": "1 medium slice",
    "calories": "230 calories",
    "fatContent": "1 g",
    "carbohydrateContent": "43 g",
    "cholesterolContent": "0 mg",
    "fiberContent": "1 g",
    "proteinContent": "1 g",
    "saturatedFatContent": "2 1/2 g",
    "servingSize": "1 Serving",
    "sodiumContent": "200 mg",
    "sugarContent": "27 g",
    "transFatContent": "0 g"
  }
},
```

JSON-LD representation  
(Web page)

Search page enriched snippets

Recetas



Perfect Apple Pie  
support.google.com  
4.5 ★★★★★ 276 reseñas  
3 h · 230 calorías

Vista previa de la tarjeta enriquecida  
<https://support.google.com › answer>

Your search result snippet goes here.

Your rich card item title goes here  
<https://support.google.com › answer>

Your rich card item snippet goes here.

Valoración	4.5 ★★★★★ (276)
Tiempo de cocción	3 h
Calorías	Calorías: 230

# schema.org - Application example

```
<script type="application/ld+json">
{
  "@context": "http://schema.org",
  "@type": "FlightReservation",
  "reservationNumber": "RXJ34P",
  "reservationStatus": "http://schema.org/Confirmed",
  "underName": {
    "@type": "Person",
    "name": "Eva Green"
  },
  "reservationFor": {
    "@type": "Flight",
    "flightNumber": "110",
    "airline": {
      "@type": "Airline",
      "name": "United",
      "iataCode": "UA"
    },
    "departureAirport": {
      "@type": "Airport",
      "name": "San Francisco Airport",
      "iataCode": "SFO"
    },
    "departureTime": "2017-03-04T20:15:00-08:00",
    "arrivalAirport": {
      "@type": "Airport",
      "name": "John F. Kennedy International Airport",
      "iataCode": "JFK"
    },
    "arrivalTime": "2017-03-05T06:30:00-05:00"
  }
}
</script>
```

JSON-LD representation (email content)

enriched Gmail inbox



A flight reservation in Inbox

FIWARE + schema.org

# FIWARE + schema.org - Introduction (I)

- Idea :
  - apply all the successful design principles and workflows of schema.org to produce **harmonized schemas** in the "Internet of Things" (IoT) area enabling semantic interoperability that bridges **IoT and non-IoT applications**  
real scope is “**real world things**” rather than Internet of Things.
- In cooperation with **GSMA** and mobile operators
  - <http://www.gsma.com/connectedliving/wp-content/uploads/2016/12/CLP.26-v1.0.pdf>
- IoT + schema.org complementary initiative introduced by Dan Brickley (schema.org chairman) through the following position paper:
  - <https://docs.google.com/document/d/1mE2hN83IXzqXA-RQYMURJxIIEktcZkFB252BQCCnkKk/edit#>

# FIWARE + schema.org - introduction (II)

- Does this really make sense?:
  - o (IoT) data provider role, publishing data using [iot.schema.org](http://iot.schema.org), will be similar than the role played by a Webmaster
  - o Application / (IoT) data consumer, role, will be similar than the search engine, email client, etc. roles.

Dashboards, smart (interoperable) applications, etc.

- **We can bring all the schema.org benefits from the Web to the IoT-Big Data domain**

- o avoiding silos, fragmentation, etc.
- o Give **carrots** to data / IoT providers instead of **sticks** (ex. lengthy ontologies)
- o *“We give value to your data if it is harmonized”*
- o IoT and non-IoT entities can be easily “linked” following schema.org principle of “local view” but a “single” coherent vocabulary

## FIWARE DATA MODELS



### Alarms

Events related to risk or warning conditions which require action taking.



### Environment

Enable to monitor air quality and other environmental conditions for a healthier living.



### Civic Issue tracking

Data models for civic issue tracking interoperable with the de-facto standard Open311.



### Device

IoT devices (sensors, actuators, wearables, etc.) with their characteristics and dynamic status.



### Indicators

Key performance indicators intended to measure the success of an organization or of a particular activity in which it engages.



### Parking

Real time and static parking data (on street and off street) interoperable with the EU standard DATEX II.



### Parks & Gardens

Data models intended to make an efficient, effective and sustainable management of green areas.



### Point of Interest

Specific point locations that someone may find useful or interesting. For instance, weather stations, touristic landmarks, etc.



### Street Lighting

Modeling street lights and all their controlling equipment towards energy-efficient and effective urban illuminance.



### Vehicle

Vehicle data models for smart mobility and efficient management of municipal services.



### Waste Management

Enable efficient, recycling friendly, municipal or industrial waste management using containers, litters, etc.



### Weather

Weather observed, weather forecasted or warnings about potential extreme weather conditions.

# Entity modelling with schema.fiware.org



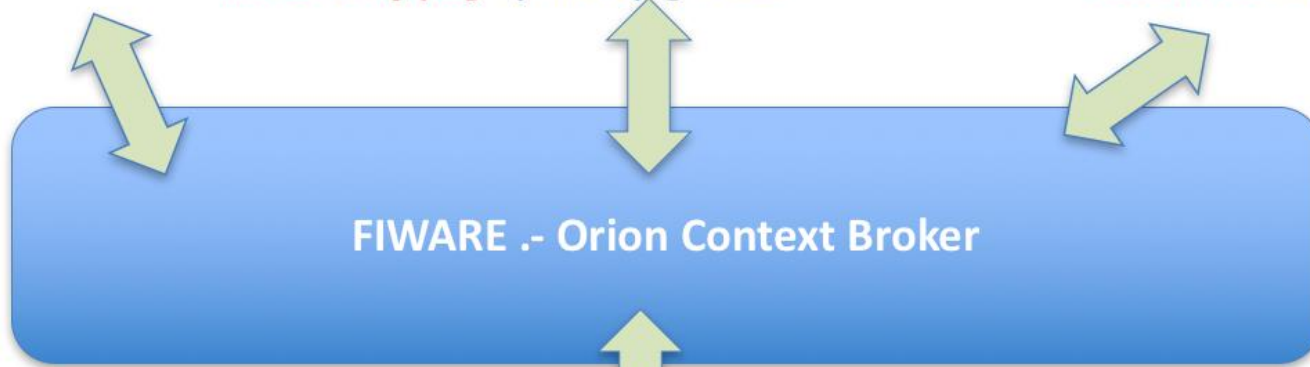
Waste Container

**id:** anaga-wc-2432,  
**type:** WasteContainer,  
**location:** "lat,long",  
**fillingLevel:** 0.56,  
**temperature:** 21,  
**status:** ok,  
**refWasteContainerModel:** m34  
**dateLastEmptying:** <yesterday @ 05:12>



Vehicle

**id:** tr-garbage-456,  
**type:** Vehicle,  
**vehicleType:** truck,  
**location:** "lat, long",  
**speed:** 45,  
**cargoWeight:** 765,  
**serviceProvided:** [garbageCollection],  
**areaServed:** Centro



Air Quality Station

**id:** airquality-los-dragos-08:00,  
**type:** AirQualityObserved,  
**location:** "lat,long",  
**stationName:** Los Dragos – SCTef,  
**NO2:** 114,  
**O3:** 21,  
**dateObserved:** <today @ 08:00>,  
**source:**  
<http://www.gobiernodecanarias.org>



Citizen

**id:** wf-sct-2016-11-11,  
**type:** Open311:ServiceRequest,  
**location:** "lat,long",  
**status:** open,  
**description:** "Container broken"  
**requested\_datetime:** <yesterday@ 23:17>  
**media\_url:** <<link to photo>>

Weather Forecast



**id:** wf-sct-2016-11-11,  
**type:** WeatherForecast,  
**address:** "Santa Cruz de TF",  
**temperature:** 22,  
**relativeHumidity:** 0.75,  
**weatherType:** clear,  
**dateIssued:** <today @ 08:00>,  
**source:** www.aemet.es

# schema.fiware.org .- An open source project

Contributions are welcome!

Fiware / dataModels

Unwatch 10 Unstar 3 Fork 10

Code Issues 32 Pull requests Pulse Graphs Settings

This repository contains code and specifications to support harmonized data models developed by FIWARE — Edit

152 commits 8 branches 0 releases 4 contributors MIT

Branch: master New pull request Create new file Upload files Find file Clone or download

jmcanterafonseca	Missing aemet.py file	Latest commit a79fb4d 7 days ago
Alarm/doc	Leaving the portal on a good shape	5 months ago
Device	Correcting minor md syntactic issues	a month ago
Environment	FIX minor issue with readthedocs and length of curl instruction	9 days ago
IssueTracking	`dateUpdated` --> `timestamp` (#31)	2 months ago
KeyPerformanceIndicator/doc	`dateUpdated` --> `timestamp` (#31)	2 months ago
Parking	ParkingSpot. Add reference to IoT Device (#74)	2 months ago
ParksAndGardens/doc	Leaving the portal on a good shape	5 months ago
PointOfInterest	Point of interest	5 months ago
StreetLighting	Fix units and phases clarifications. solves #26 #27 (#45)	2 months ago
Vehicle	[Vehicle] Refining vehicle model as per latest feedback and solves #52 ...	2 months ago
WasteManagement	Missing "" in JSON example	2 months ago



# Questions

# References

- <http://schema.org/docs/documents.html>
- <https://www.w3.org/community/schemaorg/how-we-work/work-in-progress-mechanisms-webschemas-and-the-pending-area/>
- <https://www.w3.org/community/schemaorg/how-we-work/issue-management-on-github/>
- [http://events.linkeddata.org/ldow2014/slides/ldow2014\\_keynote\\_guha\\_schema\\_org.pdf](http://events.linkeddata.org/ldow2014/slides/ldow2014_keynote_guha_schema_org.pdf)
- <http://queue.acm.org/detail.cfm?id=2857276>
- <https://search.google.com/structured-data/testing-tool>
- <https://developers.google.com/gmail/markup/reference/>
- <https://msdn.microsoft.com/en-us/library/dn632191.aspx>
- <https://developers.google.com/search/docs/guides/enhance-site>
- <http://schema.fiware.org>
- <http://webschemas.org/docs/cg/sdo-wot-tpac-2016-09.pdf>
- <https://docs.google.com/document/d/1mE2hN83IXzqXA-RQYMURJxIIKtcZkFB252BQCCnkKk/edit#>

| Thank you!

<http://fiware.org>

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