

# Linked Data and the Internet of Services

**John Domingue**

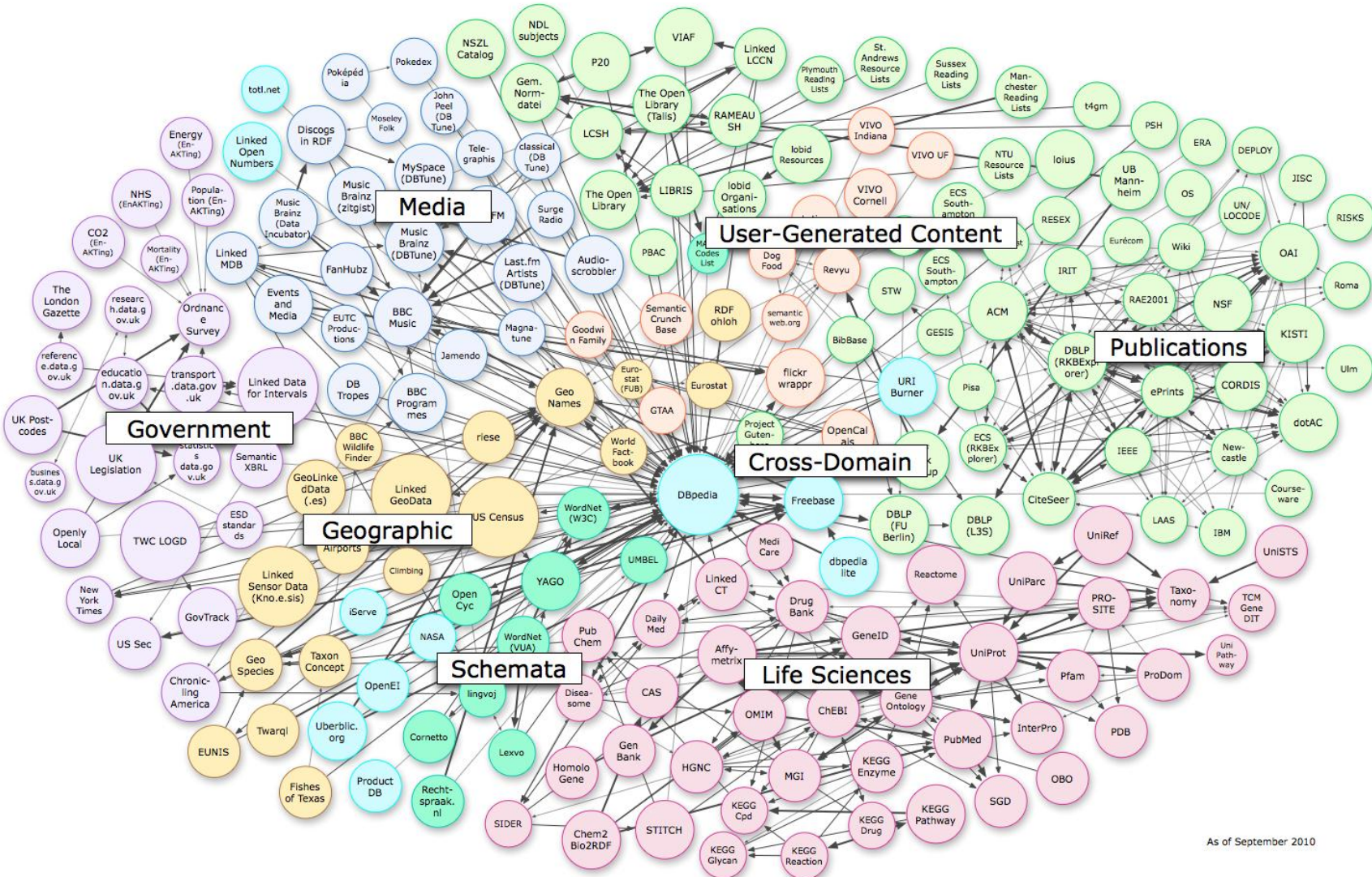
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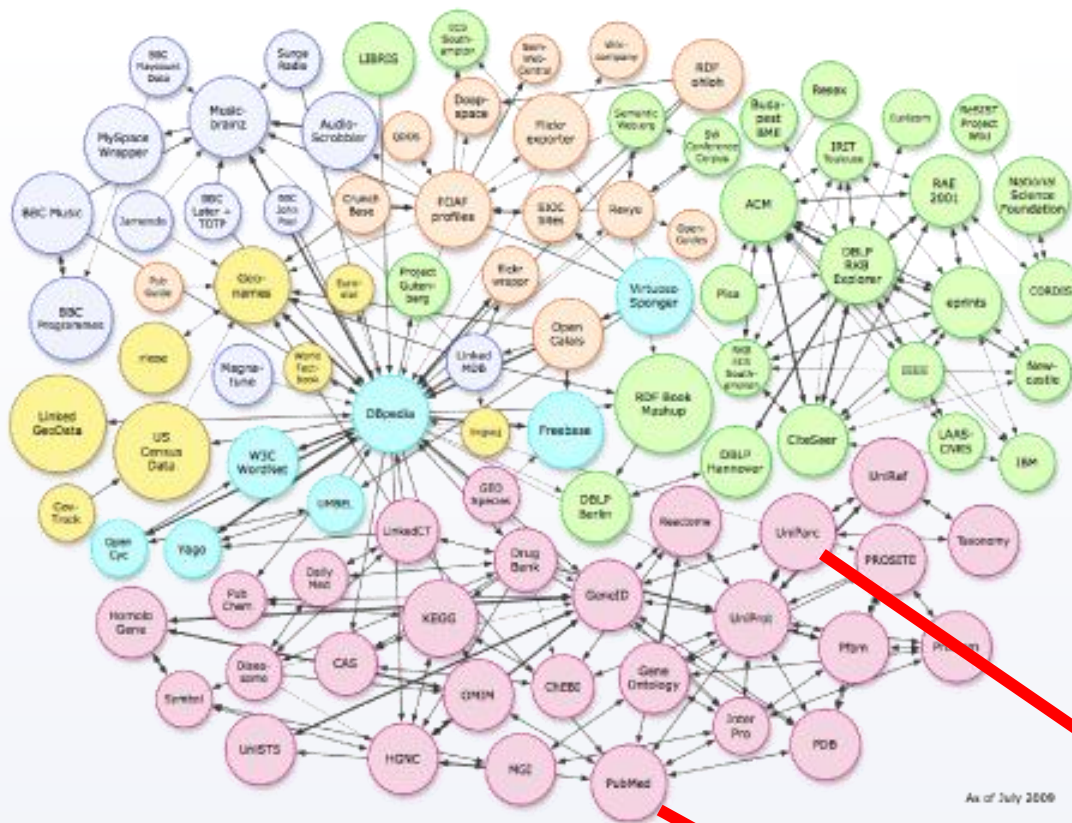
# Services Over Linked Data



As of September 2010







Navigator  
<http://www.geonames.org/export/web-services.html>

**Country Info** (Bounding Box, Capital, Area in square km, Population)

Webservice Type : REST  
 Url : [ws.geonames.org/countryInfo?](http://ws.geonames.org/countryInfo?)  
 Parameters : **country** (default = all countries)  
 lang : ISO-639-1 language code (en,de,fr,it,es,...) (default = english)

Result : Country information : Capital, Population, Area in square km, Bounding Box of mainland (excluding offshore islands)

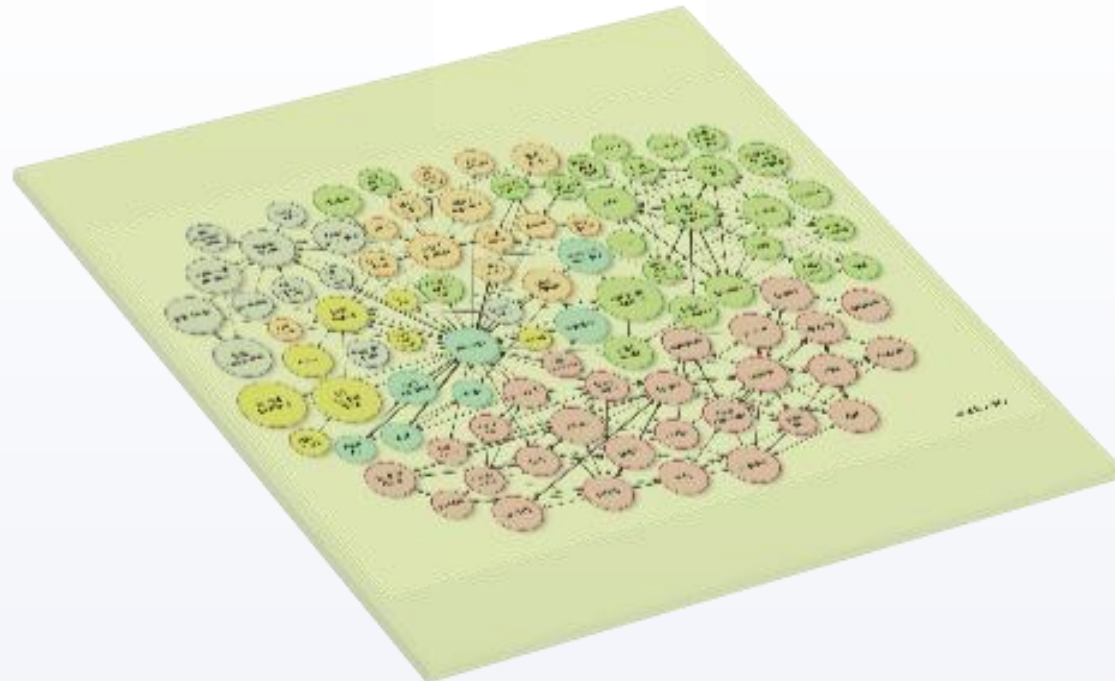
Example : <http://ws.geonames.org/countryInfo?>

An other countryInfo service is available as csv output :  
 Example : <http://ws.geonames.org/countryInfoCSV?lang=it&country=DE>

Annotation Editor  
 Service Properties  
 Service Annotations  
 country  
 language  
 Capital  
 Population  
 Area

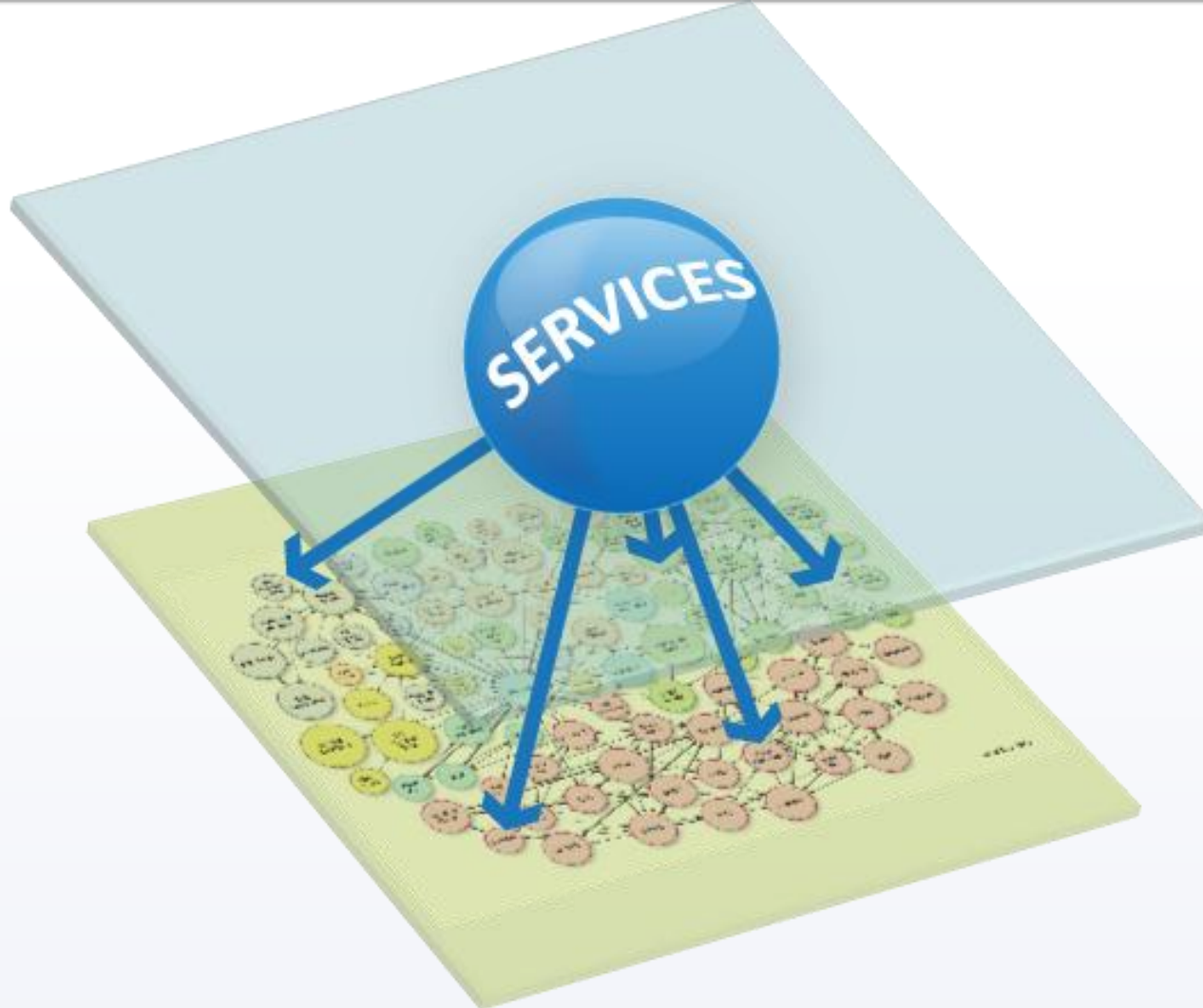
Domain Ontologies  
 Annotations Overview

Details



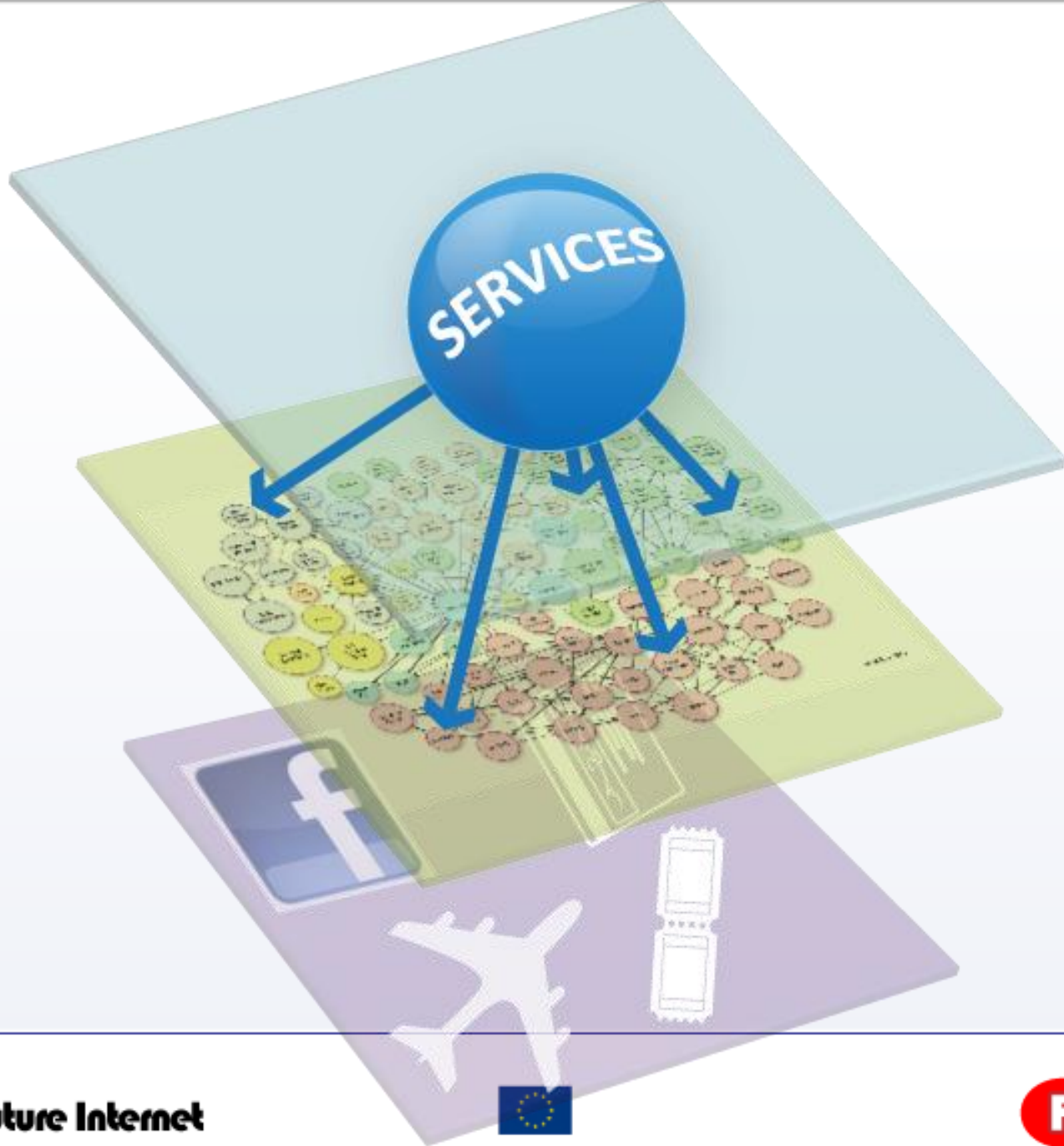
**future Internet**





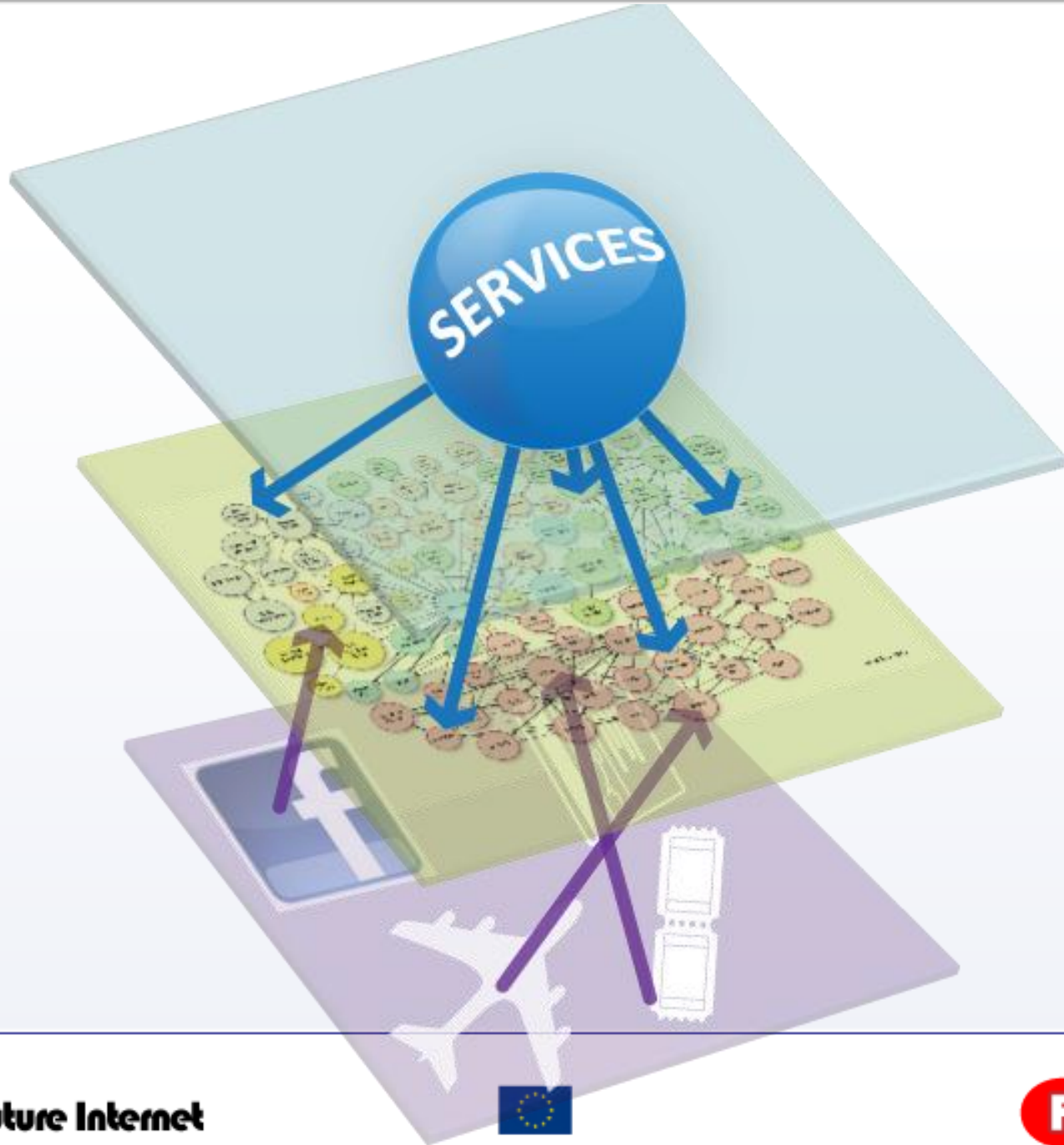
**future Internet**





**future Internet**





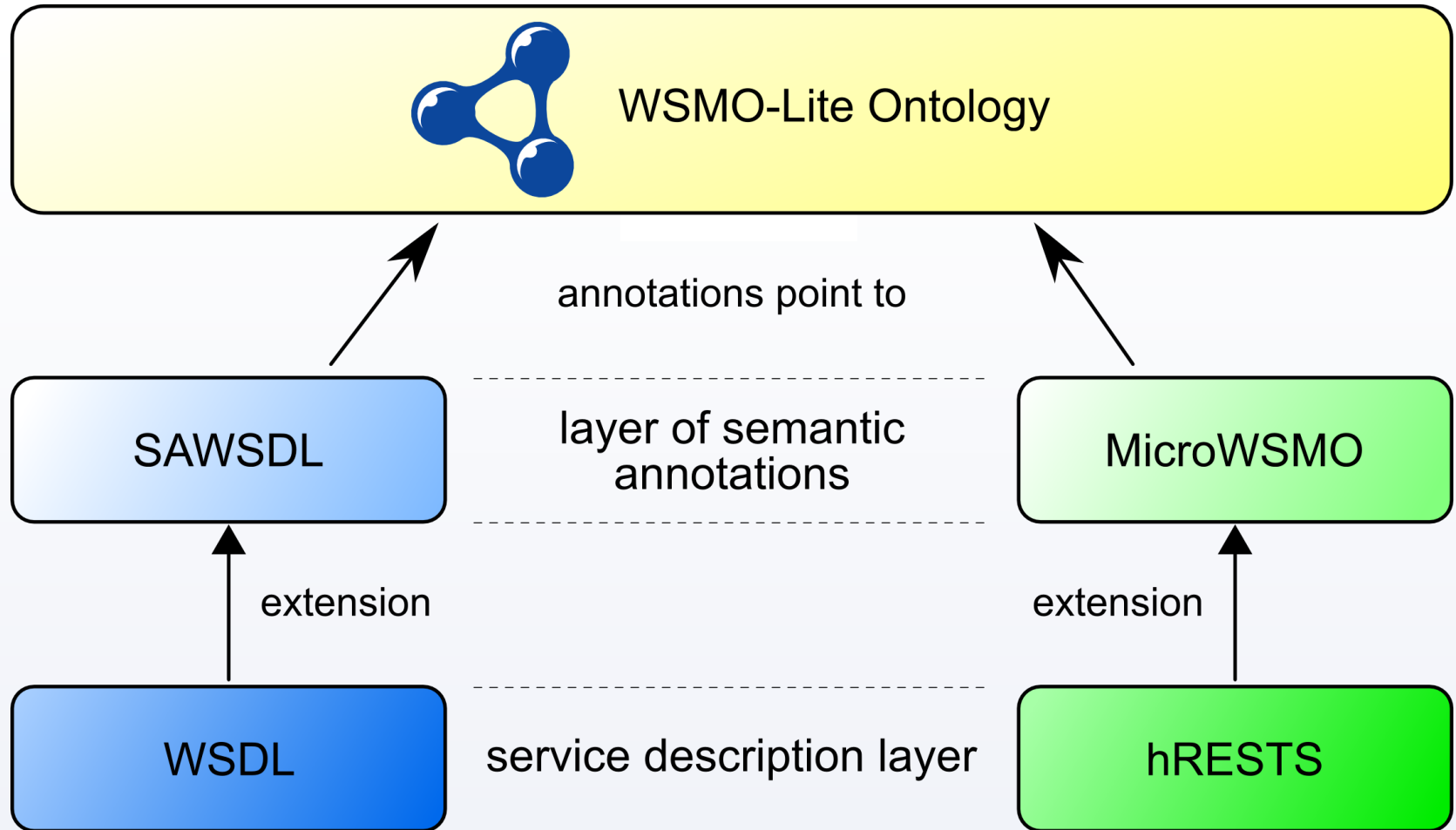
**future Internet**



# Linked Services are

- Services described as Linked Data
  - Inputs, outputs, functionality, etc is described using RDF(S) and using existing vocabularies
- Consume and produce RDF
  - Applications may contain 'standard services' too
- Process layer on top of the Web of Data

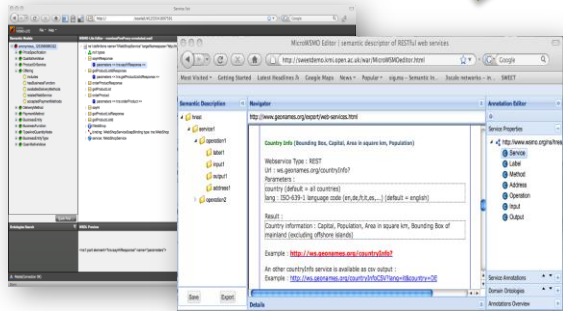
# MicroWSMO & WSMO-Lite



# Comprehensive Tool Suite



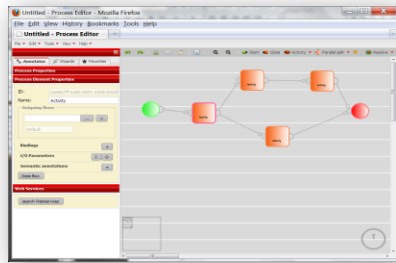
SWEET & SOWER



Discovery & Ranking

LPML deployment

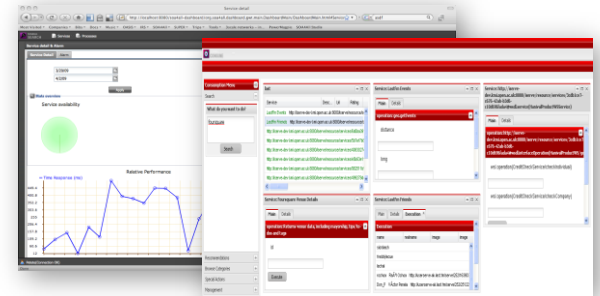
Process Editor



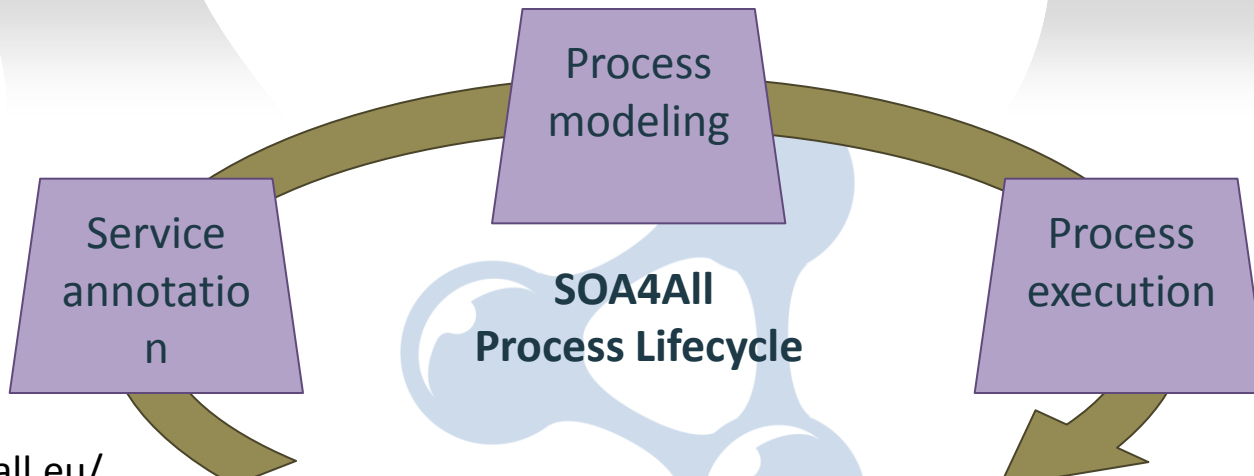
incl. TG, Optimizer, DTC

Analysis & Monitoring

SPICES



incl. BPEL-based execution



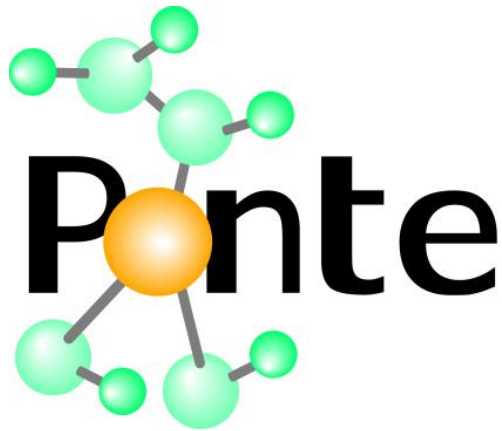
# Envision



(ENVIronmental Services Infrastructure with Ontologies)

- Provide support for users with little technical skills in the process of publication, discovery and adaptive chaining and composition of environmental services
- Linked Open Services
  - Semantic annotations of geospatial services, OGC Web services and integration with WSDL/RESTful Web services
  - Uses WSMO-Lite
- <http://www.envision-project.eu/>





# & Linked Data: Integrating heterogeneous and autonomous data sources over the web

Efficient [P]atient Recruitment for Inn[O]vative Cli[N]ical [T]rials of [E]xisting Drugs to other Indications

FP7 project (2010 – 2012) – 3,3 M€

<http://www.ponte-project.eu/>

## PONTE Clinical Trials Authoring Tool & Patient Recruitment

### PONTE Core Ontology

*Integrating,  
Annotating  
& Querying*

*Integrating  
& Querying*

Unstructured

Semi-Structured

Structured

EHR, Drugs, Diseases



Medical  
Literature

### Linked Data:

- **Link discovery:** Discovering and integrating on-the-fly data sources
- **WS integration:** SOAP/XML, RESTful WS, SPARQL

# Summary

- **Linked Services**
  - Services described as Linked Data
  - Consume and produce RDF
  - Process layer on top of the Web of Data
- **SOA4All** implements a Linked Services approach
  - Lightweight ontologies: Minimal Service Model, WSMO-Lite and MicroWSMO
  - Suite of open source tools of which predominately work within a web browser
- **Envision** applies Linked Services to environmental services
- **Ponte** uses Linked Data to integrate heterogeneous and autonomous data sources over the Web for clinical trials