Ontologies for Chatbots

Integration in Python

World Wide Web Consortium

The Internet Standard

The World Wide Web Consortium (W3C) is the main international standards organization for the World Wide Web founded in 1994.

W3C develops standards for exchanging data across internet, such as:

- HTTP protocols (loading websites)
- HTML format (displaying websites)
- XML format (describing complex objects)
- OWL (exchanging ontologies)
  etc.

Example: DBpedia

Biggest Open Source Ontology

DBpedia (from "DB" for "database") is a project aiming to extract structured content from the information created in the Wikipedia project.

DBpedia structure:

- **RDF**
- ontology
- resources
- properties

Objects
(activated classes)

Classes
(templates)

resources
Barack_Obama

label = "Barack Obama"
birthDate = 1961-08-04
birthPlace = Hawaii
party = Democratic
vicePresident =
resources(Joe_Biden)

Classes
(templates)

ontology
President

party
vicePresident
years_in_office

RDF
Person

label
birthDate
birthPlace

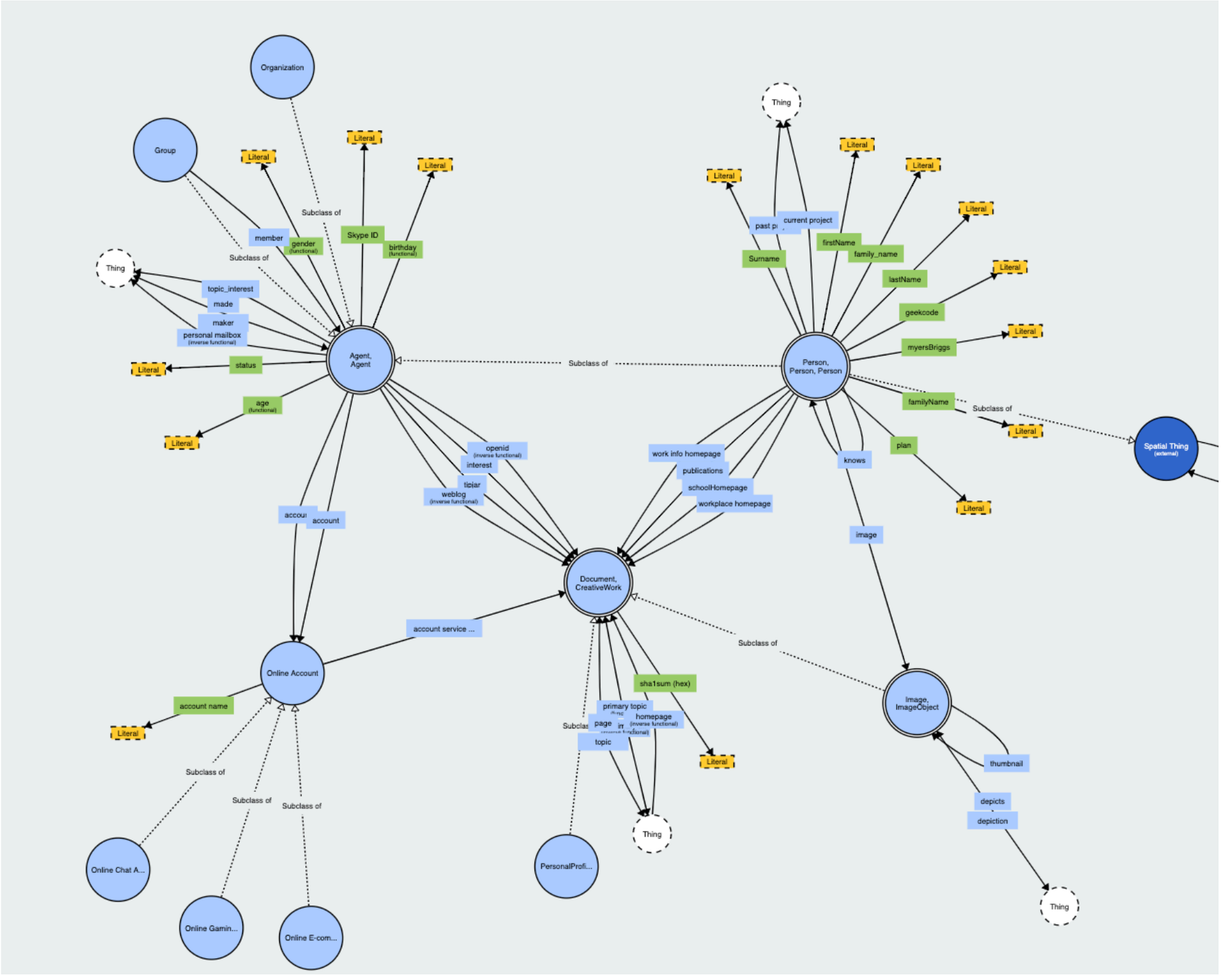
vicePresident

ontology
vicePresident

resources
Joe_Biden

label = "Joe Biden"
etc...

Visualizing



http://www.visualdataweb.de/webvowl/

Ontology Standards and Formats

The main ontology standard format is called **RDF (Resource Description Framework)**.

RDFS - RDF Schema - a set of classes with certain properties using RDF.

This is the beginning *template* of an ontology.

Classes [edit]

rdf [edit]

- `rdf:XMLLiteral` – the class of XML literal values
- `rdf:Property` – the class of properties
- `rdf:Statement` – the class of RDF statements
- `rdf:Alt`, `rdf:Bag`, `rdf:Seq` – containers of alternati
- `rdf:List` – the class of RDF Lists
- `rdf:nil` – an instance of `rdf:List` representing the er

rdfs [edit]

- `rdfs:Resource` – the class resource, everything
- `rdfs:Literal` – the class of literal values, e.g. strings an
- `rdfs:Class` – the class of classes
- `rdfs:Datatype` – the class of RDF datatypes
- `rdfs:Container` – the class of RDF containers
- `rdfs:ContainerMembershipProperty` – the class of
  `rdfs:member`

Creating an Ontology

On top of basic RDF, we can create more concrete classes for your ontology's purposes. For instance, basic DBpedia classes are Person, Animal, Country etc.

RDF Class

The raw RDF format is more complex than XML.

```
<owl:Class rdf:about="#newspaper">
    <rdfs:label>newspaper</rdfs:label>
    <rdfs:comment><![CDATA[All newspapers are either broadsheets or tabloids.]]></rdfs:comment>
    <rdfs:subClassOf>
        <owl:Class rdf:about="#publication"/>
    </rdfs:subClassOf>
    <rdfs:subClassOf>
        <owl:Class>
            <owl:unionOf rdf:parseType="Collection">
                <owl:Class rdf:about="#broadsheet"/>
                <owl:Class rdf:about="#tabloid"/>
            </owl:unionOf>
        </owl:Class>
    </rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:about="#bus+company">
    <rdfs:label>bus company</rdfs:label>
    <rdfs:comment><![CDATA[]]></rdfs:comment>
    <rdfs:subClassOf>
        <owl:Class rdf:about="#company"/>
    </rdfs:subClassOf>
</owl:Class>
```

DBpedia Person class

Thankfully, DBpedia structures the RDF in user interface.

About: person

An Entity of Type : Property, from Named Graph : http://dbpedia.org/resource/classes#, within Data Space : dbped

Property	Value
rdf:type	▪ rdf:Property ▪ owl:ObjectProperty
rdfs:domain	▪ dbo:PersonFunction
rdfs:isDefinedBy	▪ http://dbpedia.org/ontology/
rdfs:label	▪ person (en)
rdfs:range	▪ dbo:Person
rdfs:subPropertyOf	▪ dul:isRoleOf
wdrs:describedby	▪ dbo:data/definitions.ttl
prov:wasDerivedFrom	▪ http://mappings.dbpedia.org/index.php/OntologyProperty:person

Resources

A resource is an actual object created using the classes from the ontology, also recorded in an RDF.

About: Barack Obama

dbo:award	▪ dbr:Nobel_Peace_Prize
dbo:birthDate	▪ 1961-08-04 (xsd:date) ▪ 1961-8-4
dbo:birthPlace	▪ dbr:Hawaii ▪ dbr:Honolulu ▪ dbr:Kapiolani_Medical_Center_for_Women_and_Children
dbo:orderInOffice	▪ 44th President of the United States
dbo:party	▪ dbr:Democratic_Party_(United_States)
dbo:region	▪ dbr:Illinois
dbo:religion	▪ dbr:Protestantism
dbo:residence	▪ dbr:White_House
dbo:seniority	▪ United States Senator

Facts in DBpedia and SPARQL

A resource is compiled of **facts** such as:

subject	verb	object
(Barack_Obama	spouse	Michelle_Obama)

These can be called using the ontology query language, SPARQL.

To test SPARQL requests:
https://dbpedia.org/sparql

Queries in DBpedia

1) define a PREFIX:

PREFIX dbo: <http://dbpedia.org/ontology/>

2) use SQL-style syntax (like data base requests) to start the query:

SELECT ?
WHERE {}

3) use facts three-tuple syntax to specify what to extract from the ontology:

prefix:object_class prefix:label_class ?

This will return the subject.

SPARQL Example

Request:

Default Data Set Name (Graph IRI)

http://dbpedia.org

Query Text

```
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX dbo: <http://dbpedia.org/ontology/>
PREFIX dbr: <http://dbpedia.org/resource/>
PREFIX prop: <http://dbpedia.org/property/>

SELECT ?president

WHERE {
    ?president rdf:type dbo:President
}
```

Output:

president
http://dbpedia.org/resource/Carlos_Menem
http://dbpedia.org/resource/Chen_Shui-bian
http://dbpedia.org/resource/Erich_Honecker
http://dbpedia.org/resource/Eva_Perón
http://dbpedia.org/resource/Franco_Maria_Malfatti
http://dbpedia.org/resource/Gervasio_Antonio_de_Posadas
http://dbpedia.org/resource/Jean-Marie_Le_Pen
http://dbpedia.org/resource/Laurent-Désiré_Kabila
http://dbpedia.org/resource/Lee_Teng-hui
http://dbpedia.org/resource/Shimon_Peres
http://dbpedia.org/resource/Urho_Kekkonen
http://dbpedia.org/resource/Vicente_Fox
http://dbpedia.org/resource/Walter_Ulbricht
http://dbpedia.org/resource/Warren_G._Harding
http://dbpedia.org/resource/Yasser_Arafat

Practice

1. practice SPARQL
2. SPARQL in Python
3. update Dialogflow
4. Dialogflow NER for the president’s name
5. connect to the chatbot