

# Semantic Web – Food

# **The Application**

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# Overview

- Introduction
  - Use Case
  - Data Sources
  - Ontology
- Enrichment
  - LOD Linking
  - Information Extraction (NLP)
- Application
  - General Description
  - Validation with SHACL
  - Demo

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# Usecase

- knowledge-graph recipe application
- recipe search on a website:
  - ingredients
  - health labels
  - diet labels
- multifunctional search with respect to different user-intentions

# Data Sources

## Edamam

- organizes the world's food knowledge in one database
- 1,7+ million recipes
- very rich in terms of information

## Small Online Dataset

- 518 recipes
- insufficient recipe information



# Ontology

schema.org

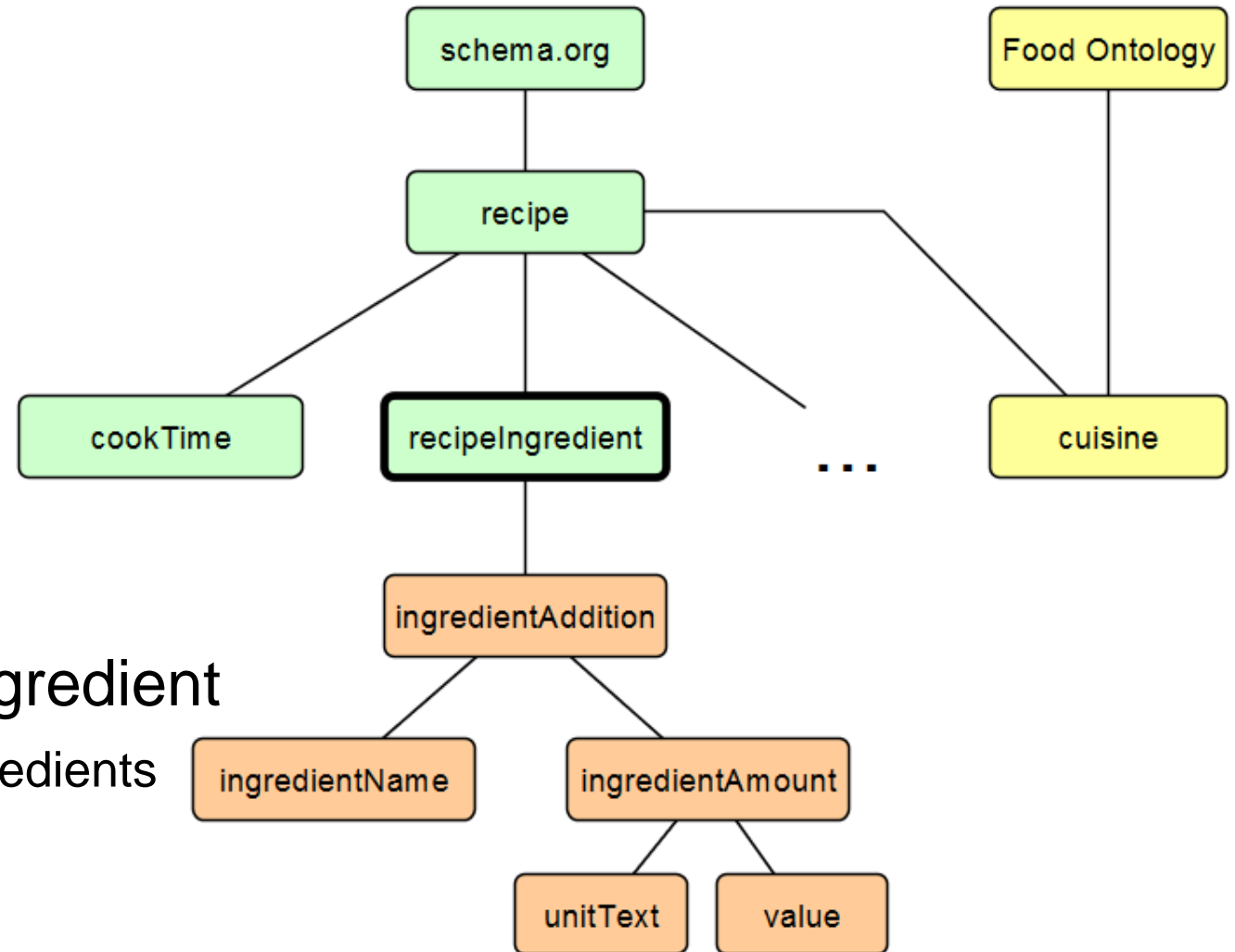
- base vocabulary

Food Ontology

- cuisine

extension of schema:recipeIngredient

- allows extensive description for ingredients



# Federated Query

```
17
18 SELECT DISTINCT ?item ?itemLabel ?localClass WHERE {
19     SELECT DISTINCT ?localClass ?z WHERE {
20         graph ?g { ?s ?p ?localClass . ?localClass a owl:Class . ?s a schema:Recipe . ?localClass rdfs:label ?z }.
21     } } SERVICE <https://query.wikidata.org/sparql> {
22     SERVICE wikibase:mwapi {
23         bd:serviceParam wikibase:api "EntitySearch" .
24         bd:serviceParam wikibase:endpoint "www.wikidata.org" .
25         bd:serviceParam mwapi:search ?z .
26         bd:serviceParam mwapi:language "en" .
27         bd:serviceParam mwapi:limit 5 .
28         ?item wikibase:apiOutputItem mwapi:item .
29     }
30     ?item rdfs:label ?itemLabel .
31     FILTER(LANG(?itemLabel) = "" || LANGMATCHES(LANG(?itemLabel), "en")).
32     ?item <http://www.wikidata.org/prop/direct/P1709> schema:Recipe
33 }
```

Press CTRL - <spacebar> to autocomplete

QUERY RESULTS

Table Raw Response

Showing 1 to 1 of 1 entries

Search:  Show 50 entries

	item	itemLabel	localClass
1	<a href="http://www.wikidata.org/entity/Q219239">http://www.wikidata.org/entity/Q219239</a>	"recipe"@en	<a href="#">schema:Recipe</a>

Showing 1 to 1 of 1 entries

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# LOD Linking

- extended schema-vocabulary with schema:Food —
- stated OWL axioms for the recipe class —

The screenshot displays a web interface for a class hierarchy. On the left, a list of classes is shown, with 'Recipe' and 'schema:Food' highlighted by a red box. On the right, the details for the 'Recipe' class are shown, with a green box highlighting the 'SubClass Of' section.

**Class Hierarchy (Left Panel):**

- Comment
- Conversation
- Course
- CreativeWorkSeason
- CreativeWorkSeries
- DataCatalog
- Dataset
- DefinedTermSet
- Diet
- DigitalDocument
- Episode
- ExercisePlan
- Game
- HowTo
  - Q219239
  - Recipe
  - schema:Food
- HowToDirection
- HowToSection
- HowToStep
- HowToTip
- Legislation
- Map
- MediaObject
- Menu

**Recipe Class Details (Right Panel):**

**Description:** Recipe

**Equivalent To:** Q219239

**SubClass Of:**

- Action
- HowTo
- not (schema:Food)
- schema:hasImage max 1 owl:Thing
- schema:hasIngredient min 3 owl:Thing
- schema:hasRecipeInstructions some CreativeWork

**General class axioms:**

**SubClass Of (Anonymous Ancestor):** Recipe

**Instances:** SchemaRecipe

**Target for Key:**

**Disjoint With:**

**Disjoint Union Of:**

# LOD Linking

- linked schema:Recipe with wikidata (Recipe = Q219239)
- subclasses are automatically inferred by the equivalence to schema:Recipe

Entity Creation Preferences

**Entity IRI**

Start with: ☐ Active ontology IRI  
☒ Specified IRI:

Followed by: ☒ #  
☐ /  
☐ :

Create a new Class

**Name**

IRI

Description: Q219239

Equivalent To   
● **Recipe**

SubClass Of   
● **Action**  
● **HowTo**

General class axioms

SubClass Of (Anonymous Ancestor)  
● **schema:hasImage** **max 1 owl:Thing**  
● **schema:hasIngredient** **min 3 owl:Thing**  
● **schema:hasRecipeInstructions** **some CreativeWork**  
● **not (schema:Food)**  
● **Q219239**

Instances

# Information Extraction (NLP)

used ML (NER)

1	QUANTITY
glass	UNIT
red	NAME
wine	NAME

1	QUANTITY
yellow	NAME
pepper	NAME
,	0
deseeded	0
and	0
thinly	0
sliced	0

...



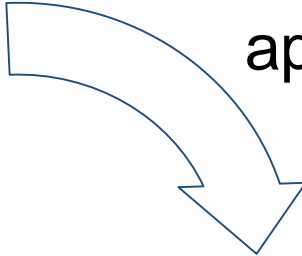
Training

Token  
Classifier  
Model

# Information Extraction (NLP)

```
{
  "@type" : "IngredientAddition",
  "ingredientName" : {
    "@type" : "Ingredient",
    "name" : "",
    "ingridientFullName" : "2 teaspoons finely chopped fresh rosemary"
  },
  "ingridientAmount" : {
    "@type" : "QuantitativeValue",
    "unitText" : "",
    "value" : ""
  }
  ,
  "potentialAction" : {
    "@type": "SearchAction",
    "target": "https://www.freshdirect.com/srch."
  }
},
```

applying NLP



```
{
  "@type" : "IngredientAddition",
  "ingredientName" : {
    "@type" : "Ingredient",
    "name" : "rosemary",
    "ingridientFullName" : "2 teaspoons finely chopped fresh rosemary"
  },
  "ingridientAmount" : {
    "@type" : "QuantitativeValue",
    "unitText" : "teaspoons",
    "value" : "2"
  }
  ,
  "potentialAction" : {
    "@type": "SearchAction",
    "target": "https://www.freshdirect.com/srch.jsp?searchParams=rosemary"
  }
},
```

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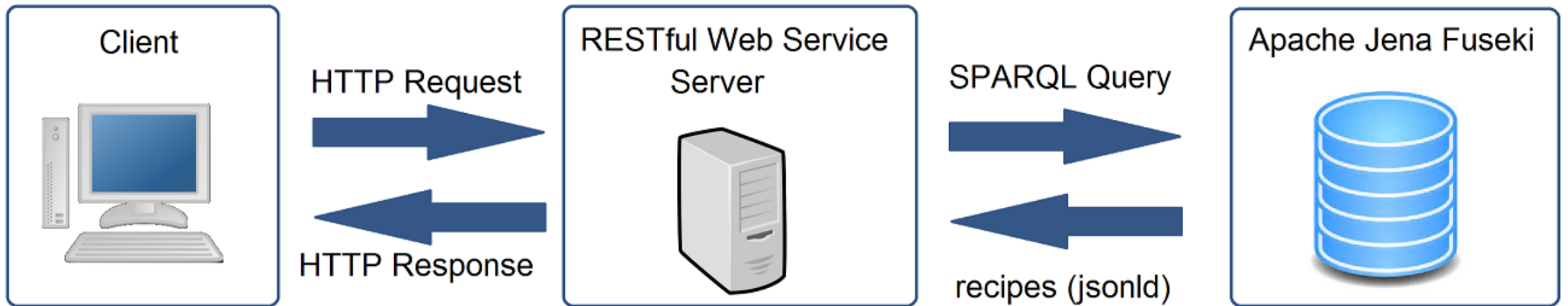
# Application

allows recipe search based on

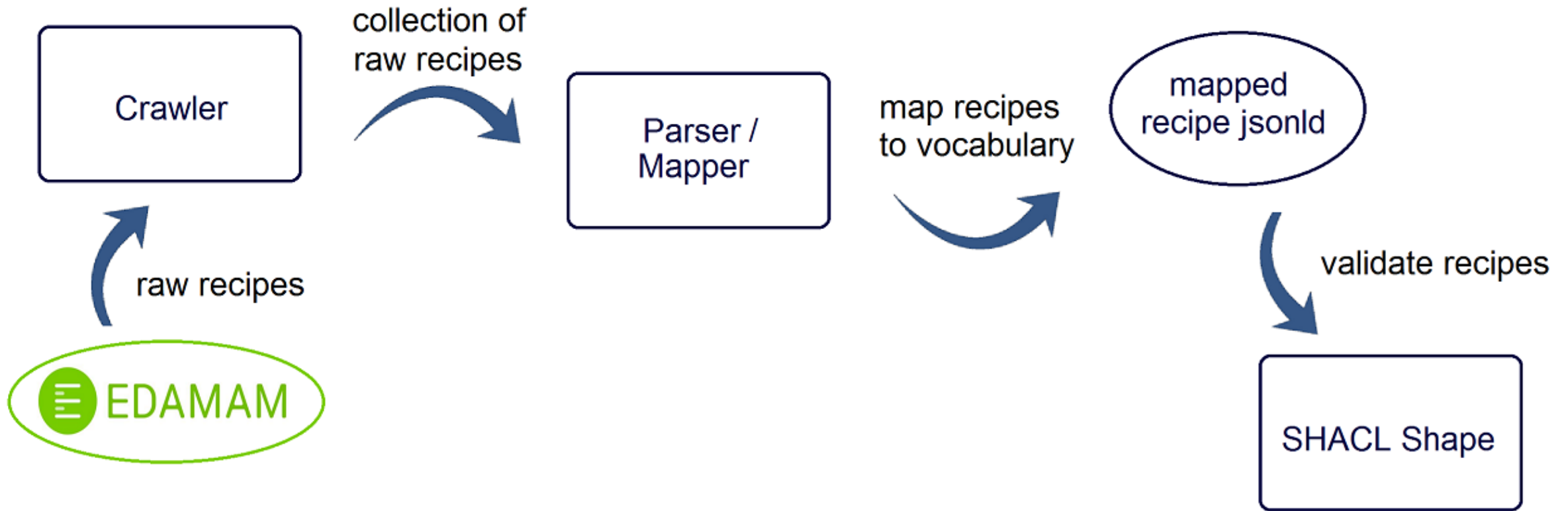
- multiple ingredients
- health labels
- diet labels

currently contains ~4500 different recipes

# Application - Architecture



# Obtaining Recipes





# Validation with SHACL Shapes

validate new recipes before uploading them to Fuseki



# Demo