

A Linked Data Approach for describing Emotions and Sentiments

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Agenda

- Emotion & Sentiment Analysis
 - E & S models
 - Challenges
- Eurosentiment: Linked Data perspective
 - Vocabularies: Marl & Onyx
 - Service and Annotation - NIF
 - Lexical model: Lemon
 - Example
- Conclusions & next steps
 - W3C CG on LD models for E & S Analysis



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Trip Advisor Review

Graenn Kostur

Skolavordustigur 8b, Reykjavik 101, Iceland (Miðborg)

+354 552 2028 [Website](#) [E-mail](#) [Update restaurant details](#)



25 visitor photos

Ranked #35 of 280 restaurants in Reykjavik

93 Reviews

Certificate of Excellence 2013

Price range: 7 € - 12 €

Cuisines: Vegan, Vegetarian, International

Dining options: Breakfast/Brunch, Takeout

Neighbourhood: Miðborg

"I LOVED THIS PLACE"

Reviewed 16 May 2014

The service isn't exactly warm but after being in Reykjavik for a few days it is such a great feeling to walk into a vegetarian cafe! Lots of colour and variety in the meals, and I got a green smoothie! I am so happy we found this place! We got lasagne and vegetable curry, it was really filling and tasty!! Really recommend this place for a hearty vegetarian meal!



Sentiment Analysis

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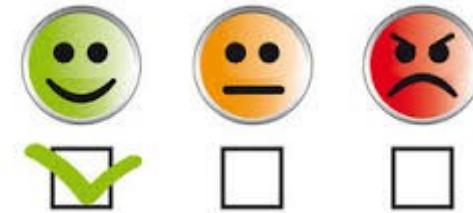
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or ?

Feature based Sentiment Analysis



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Service



Food



or ?



Emotion Analysis

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sadness



disgust



anger



surprise



fear



happiness

Areas of Affective computing



- Detecting and recognising emotions
 - Multimodal emotion recognition (facial expression, body gesture analysis, speech analysis, physiological monitoring)
 - **Sentiment and Emotion recognition in texts**
- Simulating Emotions

Sentiment Analysis

(Liu, 2010)



- Techniques for inferring people's sentiments based on their language
- An opinion / sentiment is a quintuple $\langle o_j, f_{ij}, p_{ijkl}, h_i, t_i \rangle$ (Liu, 2012)
 - o_j : object of the opinion
 - f_{ij} : feature of object o_j
 - p_{ijkl} : polarity of feature f_{ij} of object o_j
 - h_i : opinion holder
 - t_i : time when the opinion is expressed



Emotion Analysis

-
- Techniques for inferring people's emotional state based on their language (and multimodal analysis)



Emotion Representation

- Different complementary approaches (Hudlicka, 2011)
- Approaches for representing emotions
 - **Categorical representation:** labels (joy, fear, anger, sadness, ...)
 - **Dimensional representation:** valence, arousal (activation/deactivation), dominance
 - **Appraisal representation:** model emotion based on subjective evaluation of environment events, based on appraisal variables

Sentiment & Emotion Analysis



- An emotion analysis is in the middle of categorical and dimensional analysis:
 - Ordered labels (positive, negative & neutral) valence (Calvo & Kim, 2013)
- Sentiment analysis is an emotion analysis focused on valence dimension (polarity)



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Challenges E & S Analysis (Denis, 2013)



- Prior polarity vs contextual priority
- Domain dependence
 - Machine learning algorithm dependence
 - Prior polarity dependence
 - Emotion model dependence
- Interoperability:
 - Emotion models & representation
 - Semantic & NLP resources
- Multilinguality

Prior vs contextual polarity (Wilson 2008)



- Most Sentiment analysis provide only prior polarity: “cold beer” or “cold pizza”

ID	PosScore	NegScore	
a 01251128	0	0.75	cold#1
having a low or inadequate temperature or feeling a sensation of coldness or having been made cold by e.g. ice or refrigeration; "a cold climate"; "a cold room"; "a cold beer", ...			SentiWordNet

- Context can influence the polarity. E.g.
 - Domain, Target (Entity)
 - Negation: it is not good (valence shifter)
 - Multiple opinions (The hotel is good but the room is small), multiple holders, ...

Interoperability

Emotions models & representation



- There is not a unified model of emotions
- There are different emotion theoretical perspectives
- Their selection can depend on
 - the affective process (e.g. appraisal for emotion generation; dimensional PAD for dynamics emotion expression; categorical for emotion detection, ...)
 - available annotated LR

Emotion Markup Language (EmotionML) 1.0



- W3C Recommendation for
 - Manual annotation of emotions of contents
 - Automatic recognition of emotions
 - Generation of emotion-related responses
- Annotation of emotions and related states
- Possibility to define vocabularies for different emotion representation theories
- Applications (Buckhard, 14):
conversational agents, virtual agents,
facial expressions, speech synthesis



Challenges EmotionML

- Focused on emotion models
 - Sentiments can be easily integrated as vocabularies
- Limited support for sentiment annotation
 - Entities and features (parts / properties)
- It does not follow a Linked Data Approach
 - Annotations cannot be linked to other semantic resources
- Lack of support for LR

Interoperability opinions & LD



- Publish sentiment/emotion information on the web so that it can be queried and combined
 - Follow LD principles
 - URI for things (opinions, opinion holder, ...)
 - HTTP URIs and RDF/SPARQL at these URIs
 - Include links to other URIs
- Make interoperable sentiment & emotion services from different providers
- Interoperability of language resources

Interoperability NLP & LOD (Hellman, 2013)



- Identification – unique ids for (parts of) text, entities, relationships, NLP concepts, annotations, ...
- Provenance - tracking the lineage of text and annotations



Case study

Tell me the opinions about the film Avatar



IMDb





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- FP7 EU Project 2012-2014
- <http://eurosentiment.eu>
- Partners:
 - SME: Paradigma, Expert System, SindiceTech
 - Academic: FBK, Insight/NUIG, UPM





What is EuroSentiment?

- EuroSentiment is a cloud marketplace that provides
 - Multilingual Sentiment & Emotion services
 - Pipelines for enriching lexical resources
 - Lexical and Semantic Resources for Sentiment & Emotion Analysis, such as
 - Annotated Corpora
 - Sentiment & Emotion lexicons for several domains

EuroSentiment Goals

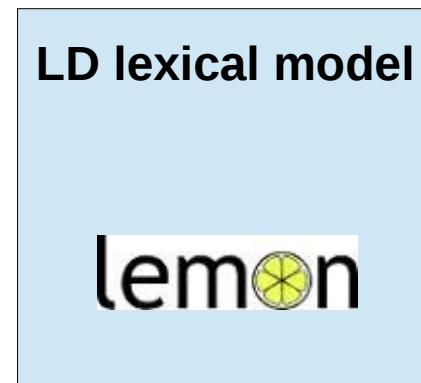
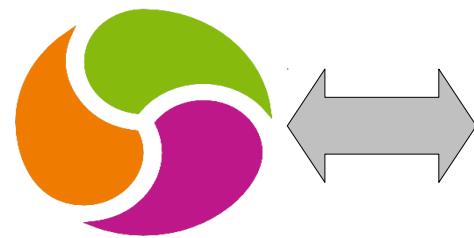


- Improve interoperability of sentiment resources
- Follow a domain sentiment analysis approach, combining semantic and linguistic analysis
- Provide a public pool for sharing resources based on public specifications



Eurosentiment Model

Linked Open
Data Cloud



emotionML





Example of Services

Services	Resources	Name	Description	Language	Domain	Free
		ES – Domain detection	Domain detection service developed by Expert System	English German Italian	Hotels Electronics	<input checked="" type="checkbox"/> Yes
		ES – Language detection	Language detection service developed by Expert System	English German Italian	Hotels Electronics	<input checked="" type="checkbox"/> Yes
		ES – Sentiment & Emotion analysis	Sentiment & Emotion analysis service developed by Expert System	English German Italian	Hotels Electronics	<input checked="" type="checkbox"/> Yes
		PT - Language detection	Text language detection	English German French Spanish Italian Portuguese Catalan Other	Other	<input checked="" type="checkbox"/> Yes
		PT - Emotion Analysis	Wordnet Affect based emotion analysis	English French Spanish Italian Portuguese Catalan	Other	<input checked="" type="checkbox"/> Yes



Example of LR

Services	Resources			
Name	Description	Language	Domain	Free
13919 Catalan human-annotated triplets - Hotel	13919 Catalan triplets human-annotated triplets for domain of hotel with sentiment score	Catalan	Hotels	<input checked="" type="checkbox"/> Yes
22599 English human-annotated triplets - Hotel	22599 English triplets human-annotated triplets for domain of hotel with sentiment score	English	Hotels	<input checked="" type="checkbox"/> Yes
8595 Spanish human-annotated triplets - Hotel	8595 Spanish triplets human-annotated triplets for domain of hotel with sentiment score	Spanish	Hotels	<input checked="" type="checkbox"/> Yes
2648 French human-annotated triplets - Hotel	2648 French triplets human-annotated triplets for domain of hotel with sentiment score	French	Hotels	<input checked="" type="checkbox"/> Yes
15369 Italian human-annotated triplets - Hotel	15369 Italian triplets human-annotated triplets for domain of hotel with sentiment score	Italian	Hotels	<input checked="" type="checkbox"/> Yes

How you can benefit from EuroSentiment?



- Use our free language resources for sentiment & emotion analysis
- Join to EuroSentiment as LR provider
- Join EuroSentiment User Group



<http://eurosentiment.eu/>



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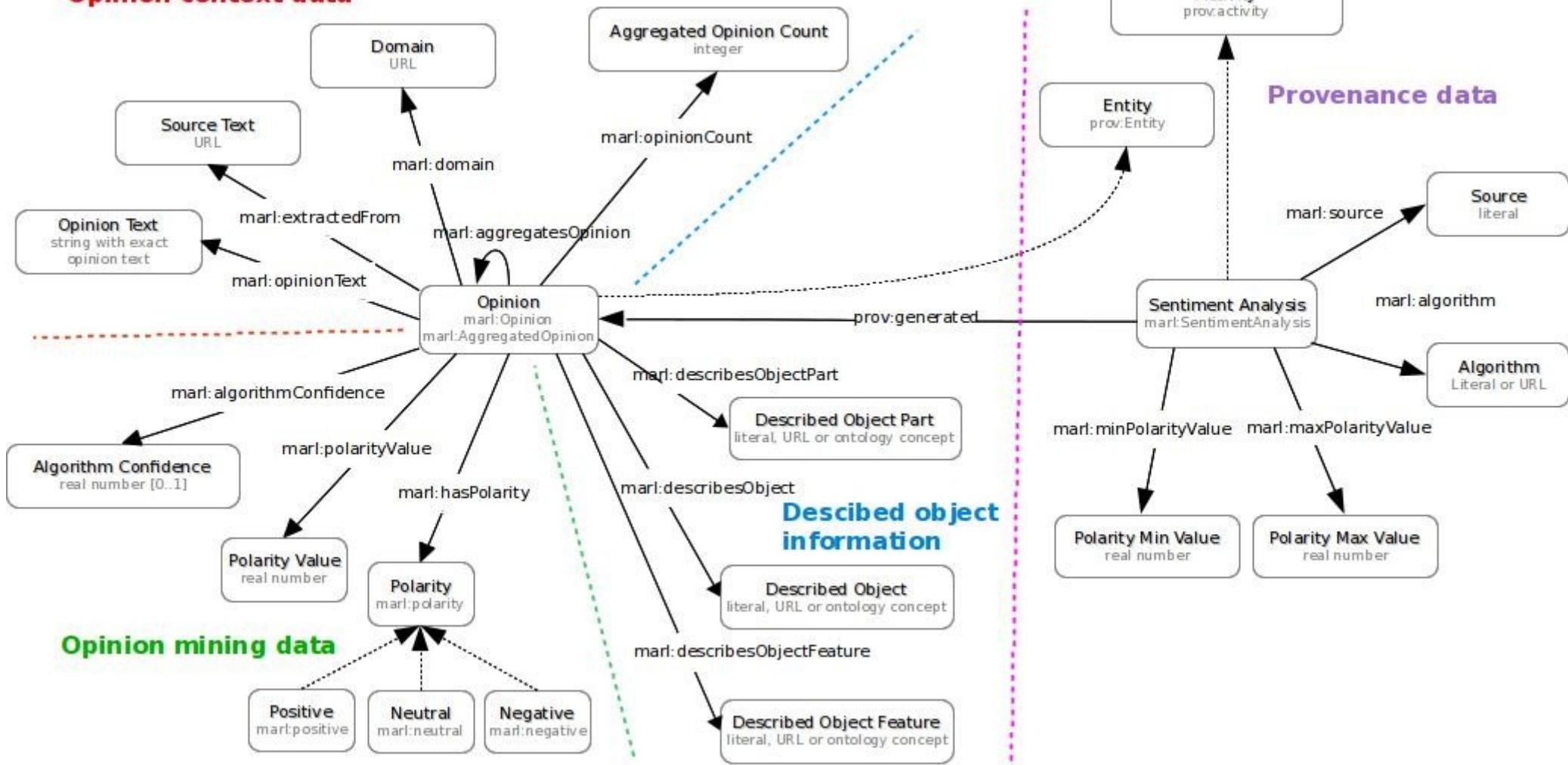
Marl

- Vocabulary for annotating sentiments
- Used both for lexical resources and service outputs
- Aligned with PROV-O ontology and published in LOV
- Adopted by several EU / National projects



Marl

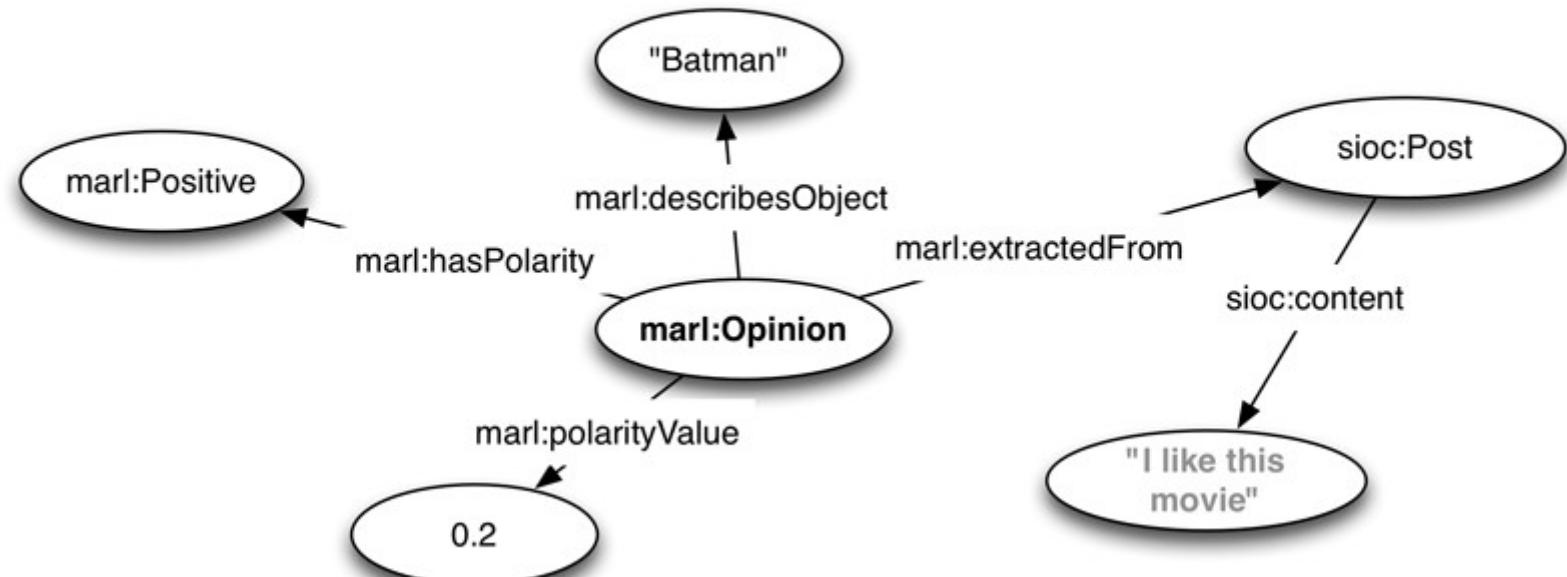
Opinion context data



I like this Movie

Marl Opinion Ontology

Use Case Study - Movie Opinions

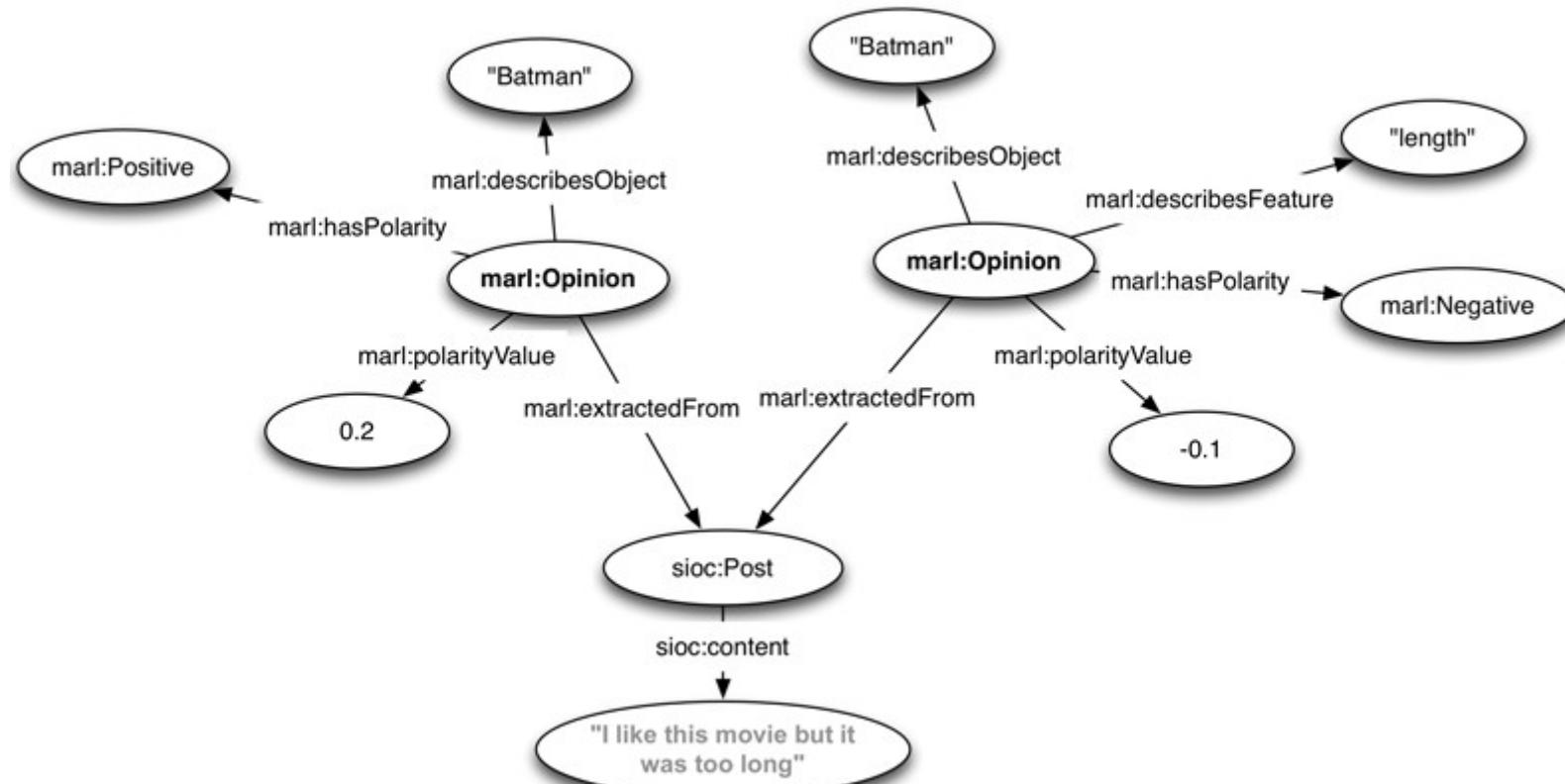


```

marl:extractedFrom http://gi2mo.org/.../comment/054321/rdf;
marl:describesObject "Batman";
marl:polarityValue "0.2";
marl:hasPolarity http://purl.org/marl/ns#Positive;
rdf:type http://purl.org/marl/ns#Opinion.
  
```

I like this movie but it was too long (I)

Marl Opinion Ontology
Use Case Study - Movie Opinions



I like this movie but it was too long (II)

```
#Opinion #1: gi2mo.org/.../comment/054321/opinion/1/rdf
marl:extractedFrom http://gi2mo.org/.../comment/054321/rdf ;
marl:describesObject "Batman" ;
marl:polarityValue "0.2" ;
marl:hasPolarity http://purl.org/marl/ns#Positive ;
rdf:type: http://purl.org/marl/ns#Opinion .
```



```
#Opinion #2: gi2mo.org/.../comment/054321/opinion/2/rdf
marl:extractedFrom http://gi2mo.org/.../comment/054321/rdf ;
marl:describesObject "Batman" ;
marl:describesFeature "length" ;
marl:polarityValue "-0.1" ;
marl:hasPolarity http://purl.org/marl/ns#Negative ;
rdf:type http://purl.org/marl/ns#Opinion .
```

Show all positive opinions about Avatar

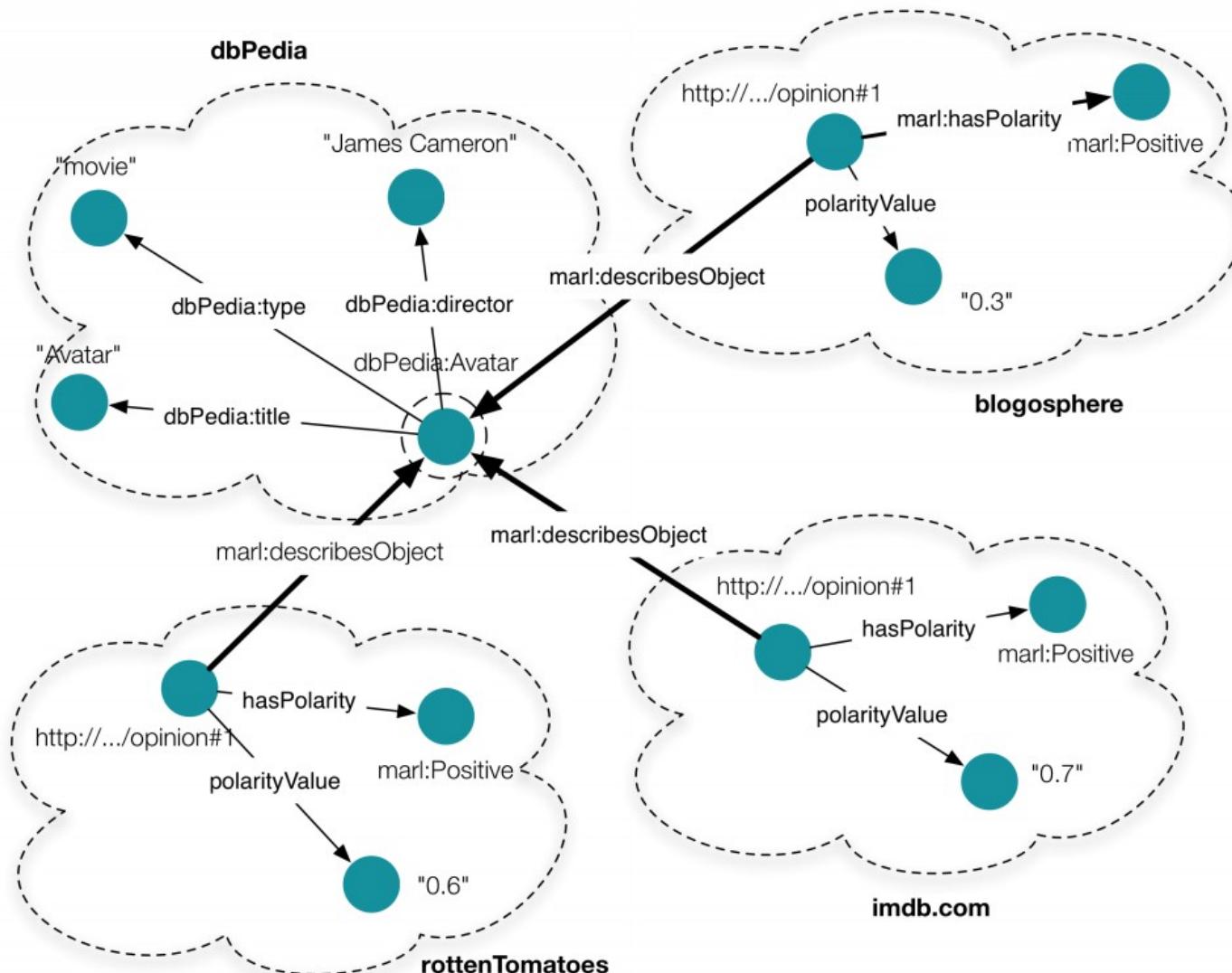


```
PREFIX sioc: <http://rdfs.org/sioc/ns#> .
PREFIX marl: <http://purl.org/marl/ns#> .
SELECT ?opinion_full_text ?opinion_uri WHERE {
    ?comment_uri a sioc:Post .
    ?comment_uri sioc:content ?opinion_full_text .
    ?comment_uri marl:hasOpinion ?opinion_uri .
    ?opinion_uri marl:hasPolarity marl:Positive .
    ?opinion_uri marl:describesObject ?opinion_about .
    FILTER regex(?opinion_about, "Avatar") .
}
```

Show all positive opinions about acting in Avatar

```
PREFIX sioc: <http://rdfs.org/sioc/ns#> .
PREFIX marl: <http://purl.org/marl/ns#> .
SELECT ?opinion_full_text ?opinion_uri WHERE {
    ?comment_uri a sioc:Post .
    ?comment_uri sioc:content ?opinion_full_text .
    ?comment_uri marl:hasOpinion ?opinion_uri .
    ?opinion_uri marl:hasPolarity marl:Positive .
    ?opinion_uri marl:describesObject ?opinion_about .
    ?opinion_uri marl:describesFeature ?opinion_about_feature
    .
    FILTER regex(?opinion_about, "Avatar") .
    FILTER regex(?opinion_about_feature, "acting") .
}
```

Marl

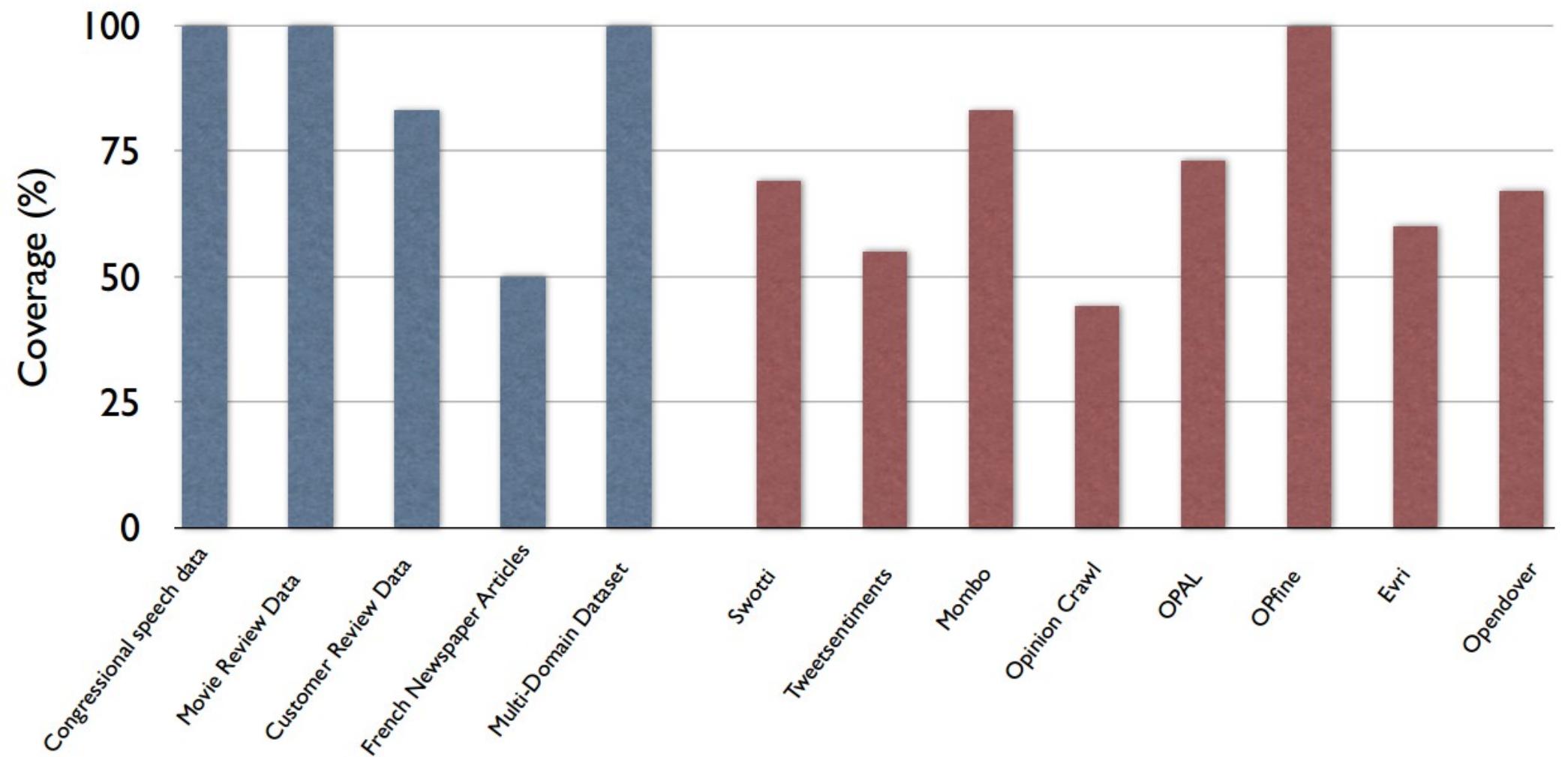




Coverage

Average Coverage: 76%

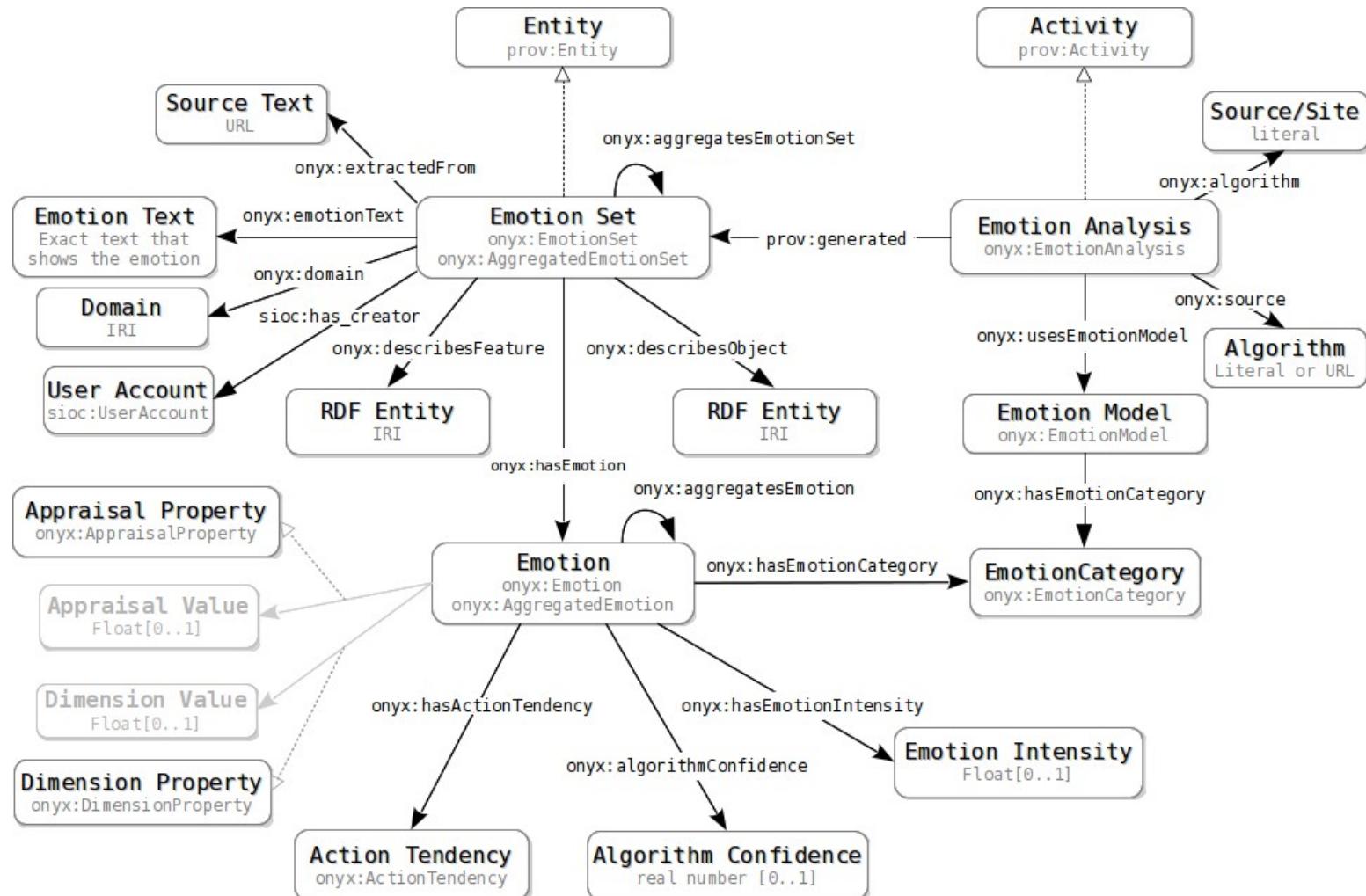
■ Research Datasets ■ Services



Onyx

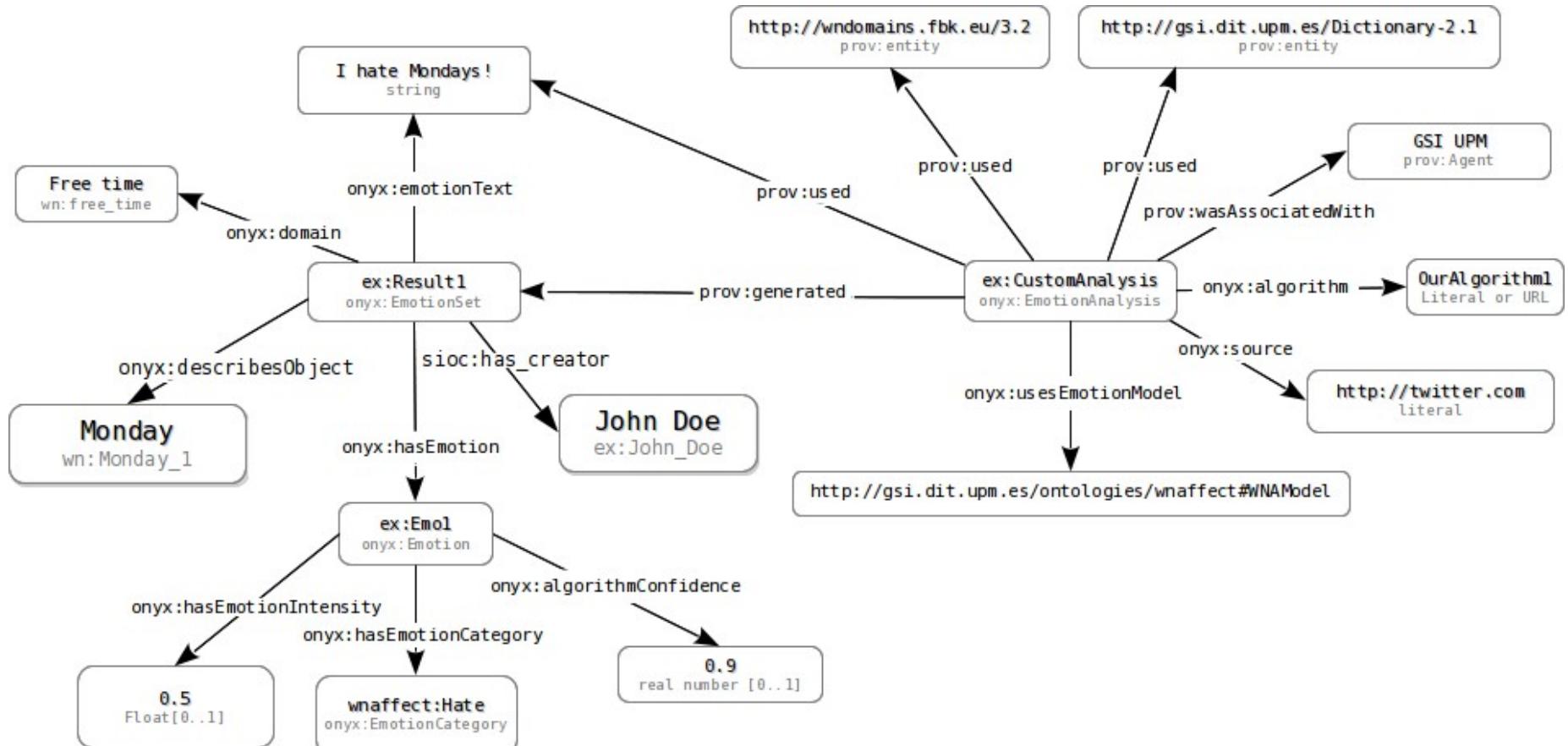
-
- Vocabulary for Emotion analysis
 - Benefits from PROV-O
 - Published in LOV
 - Based on a generic model on emotions
 - Same approach as EmotionML but aligned with LD

Onyx





Onyx for Emotion Analysis



Onyx for Emotion Analysis Results



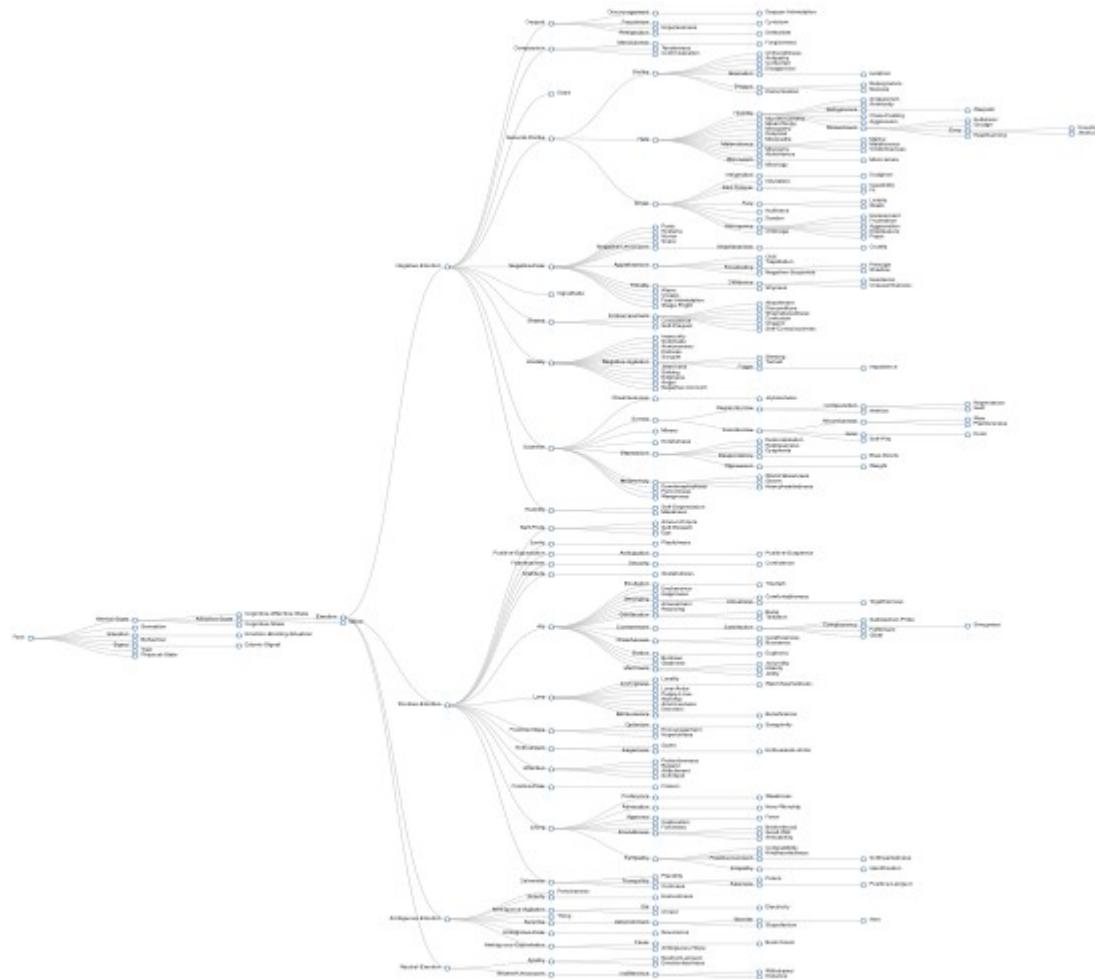
```
x:CustomAnalysis
  a onyx:EmotionAnalysis;
  onyx:algorithm "SimpleAlgorithm";
  onyx:usesEmotionModel wna:WNAModel.

ex:Result1
  a onyx:EmotionSet;
  prov:wasGeneratedBy :customAnalysis;
  sioc:has_creator [ sioc:UserAccount
    <http://twitter.com/JohnDoe> . ];
  onyx:hasEmotion [
    onyx:hasEmotionCategory wna:Hate;
    onyx:hasEmotionIntensity 0.5;
    onyx:algorithmConfidence 0.9; ];
  onyx:emotionText "I hate Mondays!" ;
  onyx:describesObject wn:Monday_1;
  dcterms:created "2013-05-16T19:20:30+01:00"^^dcterms:W3CDTF.
```

Onyx Extension: WN-Affect

- A-Labels to SKOS Concepts
- 300+ affects
- Transitive hierarchical relationships
- Publicly available
- Navigable tree
- Onyx Model with all these categories

Onyx extensions: WN-Affect



<http://www.gsi.dit.upm.es/ontologies/wnaffect/>



Onyx extensions: EmotionML

- Automatically process EmotionML vocabularies
- Generate the Onyx model with its categories and dimensions

Emotion composition

- Anticipation and Joy result in Optimism

```
INSERT {  
    ?this onyx:hasEmotion ?emotion .  
    ?emotion a onyx:Emotion .  
    ?emotion a onyx:AggregatedEmotion .  
    ?emotion onyx:hasEmotionCategory plutchik:Optimism .  
}  
WHERE {  
    ?this onyx:hasEmotion _:0 .  
    ?this onyx:hasEmotion _:1 .  
    _:0 onyx:hasEmotionCategory plutchik:Joy .  
    _:1 onyx:hasEmotionCategory plutchik:Anticipation .  
    BIND (IRI(CONCAT("http://example.org/id/#Emotion", SUBSTR(str(RAND()), 3, 16))) AS ?emotion) .  
}
```



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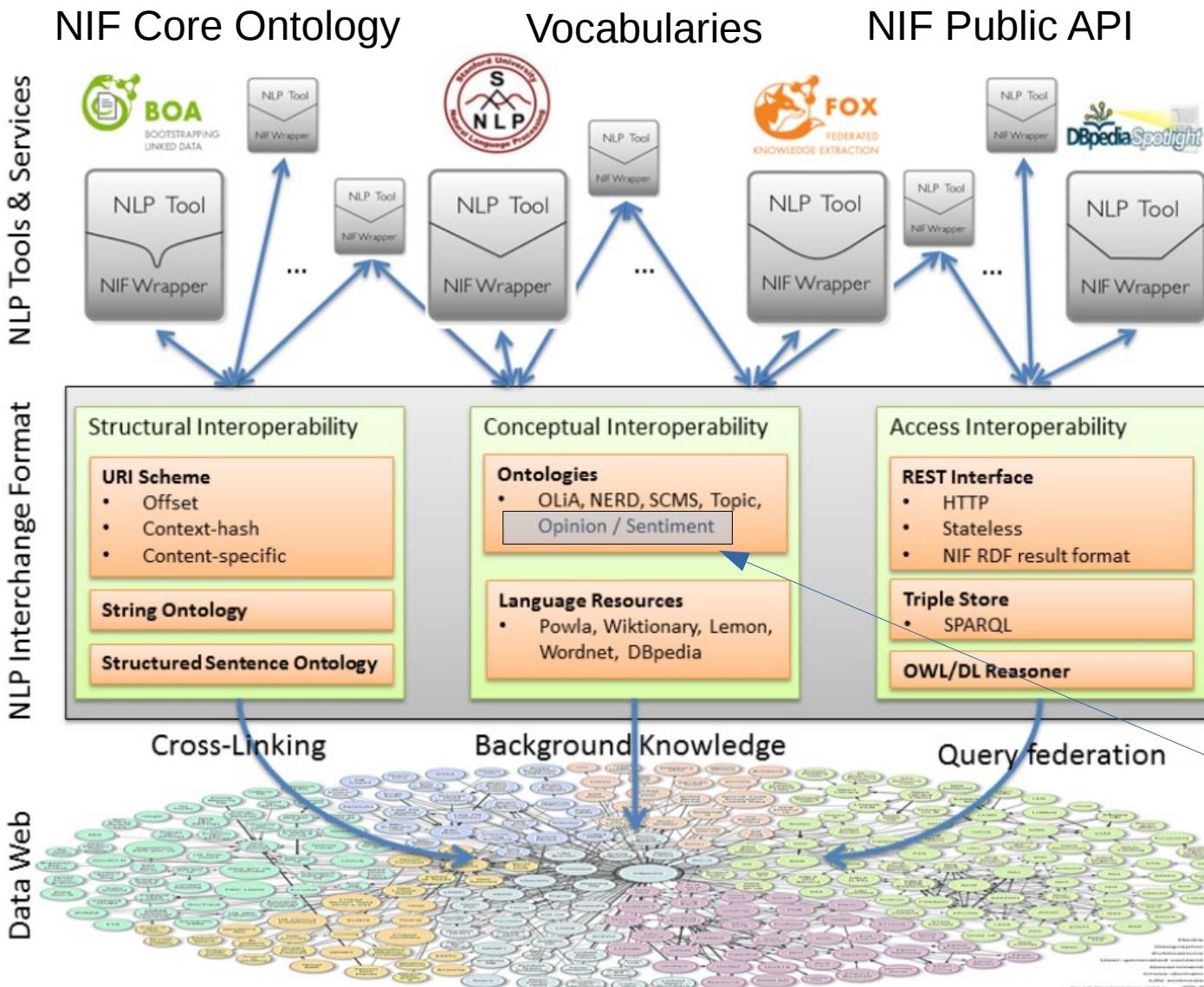
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NIF



- NLP Interchange Format (NIF) is an RDF/OWL format for interoperability between NLP tools, language resources and annotations
- Developed in the Univ. Of Leipzig
- Two main parts:
 - NIF Core Ontology → LD text annotation
 - NIF Public API → NIF compliant services
- Extensible with vocabulary modules
 - Includes a Marl vocabulary

NIF – Architecture (Aurer and Hellman, 2012)



NIF Core Ontology



- Provides classes and properties to describe the relations between text, substrings and URI schemes
- Main classes:
 - Full document: class nif:Context (extends nif:String)
 - String/Word: nif:String
 - URI: nif:URI (extends nif:String)



An URI for a paragraph

- URL doc: <http://example/mytext.txt>
- LD URI

```
<http://example/mytext#char=0,47>
  rdf:type nif:RDF5147String , nif:Context ;
  nif:beginIndex "0" ;
  nif:endIndex "47" ;
  nif:sourceURL <http://example/mytext.txt>
  nif:isString "I love Avatar. James Cameron is a good director".
```

0 15 27 46

nif:sourceURL is a subproperty
of prov:hadPrimarySource

Offset [beginIndex, endIndex)



An URI for subset of a text

- URL doc: <http://example/mytext.txt>
- LD URI

```
<http://example/mytext#char=15,28>
  rdf:type nif:RDF5147String ;
  nif:beginIndex "15" ;
  nif:endIndex "28" ;
  nif:sourceURL <http://example/mytext.txt>
  nif:anchorOf "James Cameron".
```

```
<http://example/mytext_name1#char=0,13>
  rdf:type nif:RDF5147String , nif:Context ;
  nif:beginIndex "0" ;
  nif:endIndex "13" ;
  nif:sourceURL <http://example/mytext.txt>
  nif:wasConvertedFrom <http://example/myText#char=15,27>
  nif:isString "James Cameron".
```



Annotations with NIF

```
<http://example/mytext#char=15,28>
itsrdf:taIdentRef <http://dbpedia.org/resource/James_Cameron>;
Itsrdf:taClassRef <http://dbpedia.org/ontology/director>.
```

```
<http://example/mytext#char=39,47>
nif:anchorOf "director" ;
Its:termInfoRef wiktionary:director-English-Noun-1en .

<wiktionary:director-English-Noun-1en>
rdf:type <http://www.monnet-project.eu/lemon#LexicalSense>.
```

Publish text and annotations with NIF



- Given <http://example/mytext.txt>
- We create new non informative LD URI
<http://example/mytext>
- The Web server redirects using content negotiation depending on HTTP Accept Header
 - text/plain → mytext.txt
 - text/html → HTML visualisation mytext.php
 - text/turtle → RDF turtle mytext.ttl
 - application/ld+json → mytext.json

NIF Public API



- Two interfaces for NIF implementations:
 - NIF Web Services (NIF-WS)
 - Command Line Interface (NIF-CLI)
- Specify
 - Required and optional input parameters
 - HTTP Request & Response mapping

NIF Public API Parameters



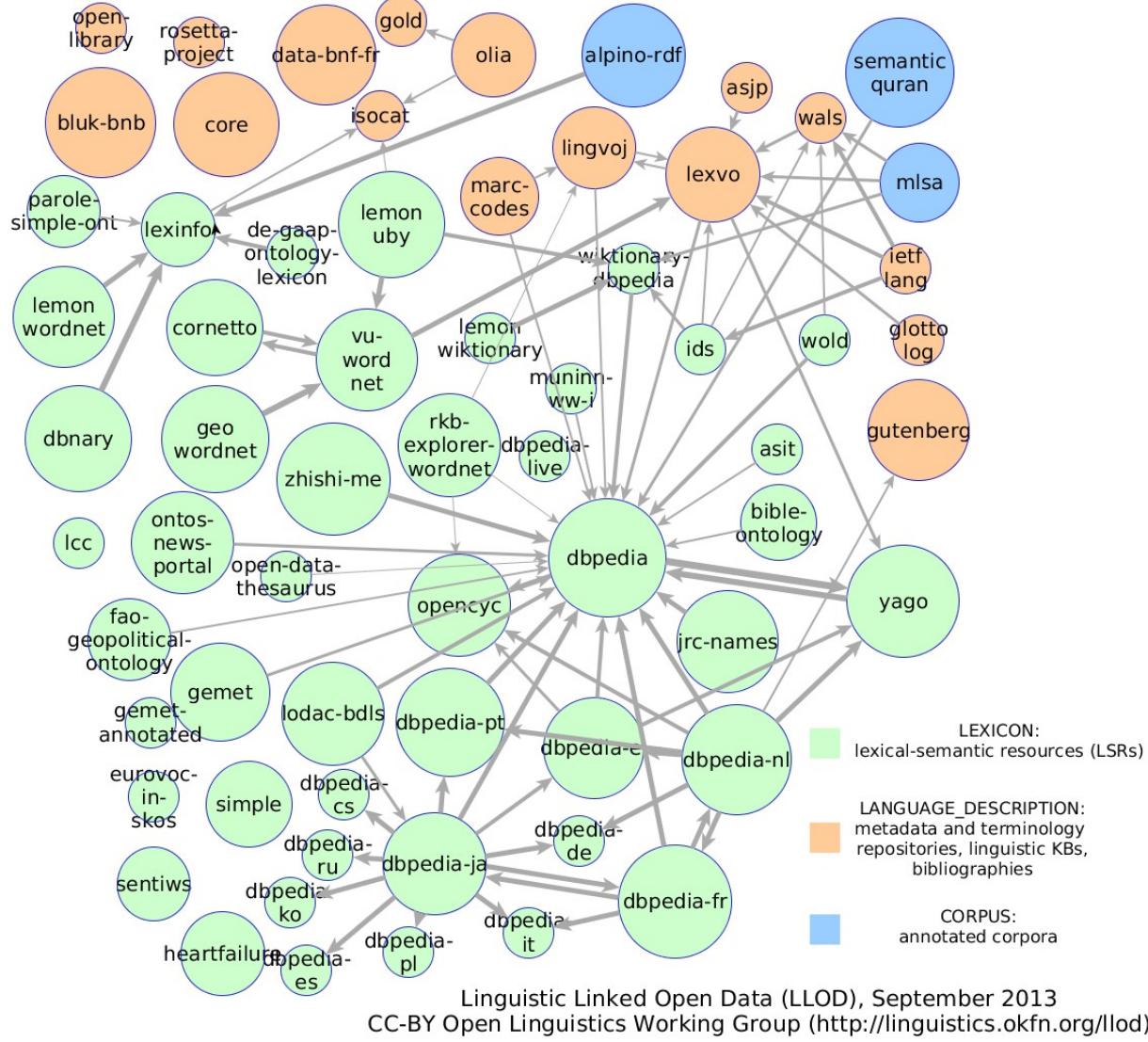
- input (i): entry (mandatory)
- informat (f): input format
- outformat (o): output format
 - *turtle*, *text*
 - Future: json-ld, rdfxml, ntriples, pdf, ...
- intype (t): input type
 - *direct (stdin in CLI or http get/post)*, url, file
- urischeme (u): *RFC5147String*, *CStringInst*
- prefix: prefix for new URIs *Notation. default value*



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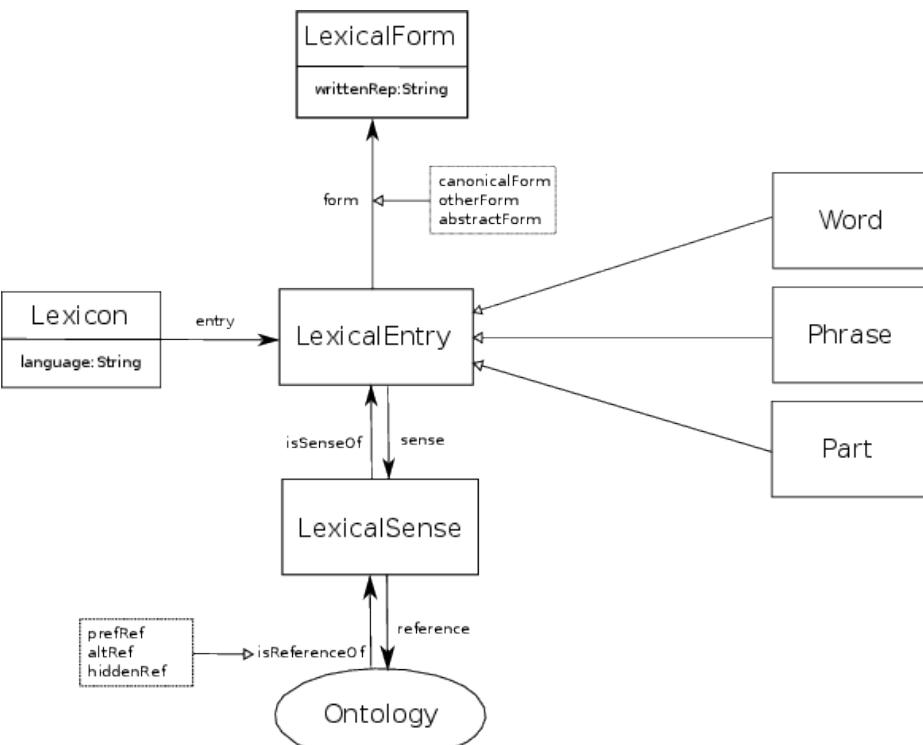
Linguistic LOD Cloud 2013



- Lexicon model for ontologies based on previous standards such as ISO LMF
- Provides native integration of lexica and domain ontologies
- Value proposition: Linguistic linked data
- Separation of lexicon and ontology layers, to ensure compatibility with existing OWL models
- Used by DBpedia Wiktionary, Babelnet, Monnet project

Lemon model

lemon

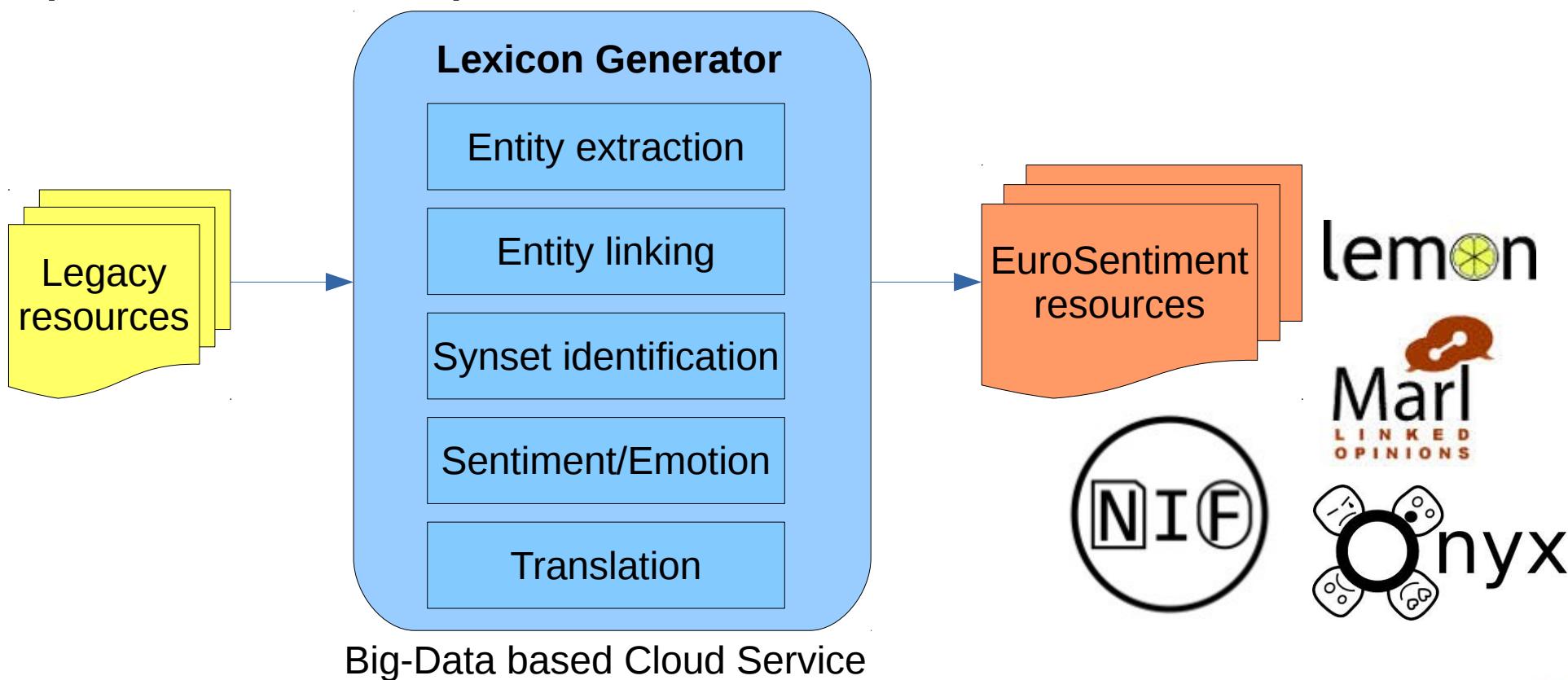


- **Ontology Entity:** URI of an ontology element to which a Lexical Form points, providing a possible linguistic realisation for that Ontology Entity
- **Lexical Sense:** functional object that links a Lexical Entry to an Ontology Entity, providing a sense-disambiguated interpretation of that Lexical Entry
- **Lexical Entry:** morpho-syntactic normalisation of one or more Lexical Form
- **Lexical Form:** morpho-syntactic variant of a Lexical Entry, including inflection, declination and syntactic variation
- **Representation:** standard written or phonetic representation for a Lexical Form



Eurosentiment Approach

- Create Sentiment domain lexicons
(Vulcu,2014)





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Example

<http://tripadvisor.com/myhotel.txt>



Like many Paris hotels, the rooms are too small

NIF REPRESENTATION

```
<http://tripadvisor.com/myhotel#char=0,49>
    rdf:type nif:RDF5147String , nif:Context ;
    nif:beginIndex "0" ;
    nif:endIndex "49" ;
    nif:sourceURL <http://tripadvisor.com/myhotel.txt>
    nif:isString "Like many Paris hotels, the rooms are too small".
```



Name spaces convention

- Wordnet Domains

wd: <http://www.eurosentiment.eu/lexicon/wndomains/>

- Hotel Lexicon English

le: <http://www.eurosentiment.eu/lexicon/hotel/en/>

- Hotel Lexical Entry English

lee: <http://www.eurosentiment.eu/lexicalentry/hotel/en/>

Eurosentiment sentiment domain lexicon



euro
senti
ment

Services ▾

Resources ▾

Profile ▾

Subscription ▾

F.A.Q.

Name	22599 English human-annotated triplets - Hotel
Owner	 Paradigma Tecnológico
URL	POST: http://54.201.101.125/sparql/
Documentation	Fact Sheet
State	APPROVED
Description	22599 English triplets human-annotated triplets for domain of hotel with sentiment score
Resource Type:	paradigma
Graph Names URIs: 	http://www.eurosentiment.com/hotel/en/lexicon/paradigma/
Graph Names URIs - Suffixes:	[/lexicon]
Download Input cost	0.0 €
Language	 English
Domain	 Hotels
License	LRGPL
Free	<input checked="" type="radio"/> Yes
Original resource files:	http://54.201.101.125/files/48957c5d-456c-4d7a-abc9-3062c91dafE1
Customers	20

- Resource queries
- Fail resource queries

Legacy hotel domain sentiment lexicon



MarLemon Generator hlee:small (room) - Hotel



```
lee:sense/small_1 a lemon:Sense ;
    lemon:reference "01391351" ;
    lexinfo:partOfSpeech lexinfo:adjective ;
    lemon:context lee:sense/room_1 ;
    marl:polarityValue "-0.5"^^xsd:double ;
    marl:hasPolarity marl:negative .
```



Example Lexicon

```
le:hotel_en a lemon:Lexicon ;
  lemon:language "en" ;
  lemon:topic ed:hotel;
  lemon:entry lee:room, lee:Paris, lee:small.

lee:room a lemon:LexicalEntry ;
  lemon:canonicalForm [ lemon:writtenRep "room"@en ] ;
  lemon:sense [ lemon:reference wn:synset-room-noun-1;
    lemon:reference dbp:Room ] ;
  lexinfo:partOfSpeech lexinfo:noun .

lee:Paris a lemon:LexicalEntry ;
  lemon:canonicalForm [ lemon:writtenRep "Paris"@en ] ;
  lemon:sense [ lemon:reference dbp:Paris;
    lemon:reference wn:synset-room-noun-1 ] ;
  lexinfo:partOfSpeech lexinfo:noun .

lee:small a lemon:LexicalEntry ;
  lemon:canonicalForm [ lemon:writtenRep "small"@en ] ;
  lemon:sense lee:sense/small_1 ;
  lexinfo:partOfSpeech lexinfo:adjective .
```



Sentiment Analysis

```
<http://tripadvisor.com/myhotel#char=0,49>
    rdf:type nif:RDF5147String , nif:Context ;
    nif:beginIndex "0" ;
    nif:endIndex "49" ;
    nif:sourceURL <http://tripadvisor.com/myhotel.txt> ;
nif:isString "Like many Paris hotels, the rooms are too small" ;
marl:hasOpinion <http://tripadvisor.com/myhotel/opinion/1> .
```

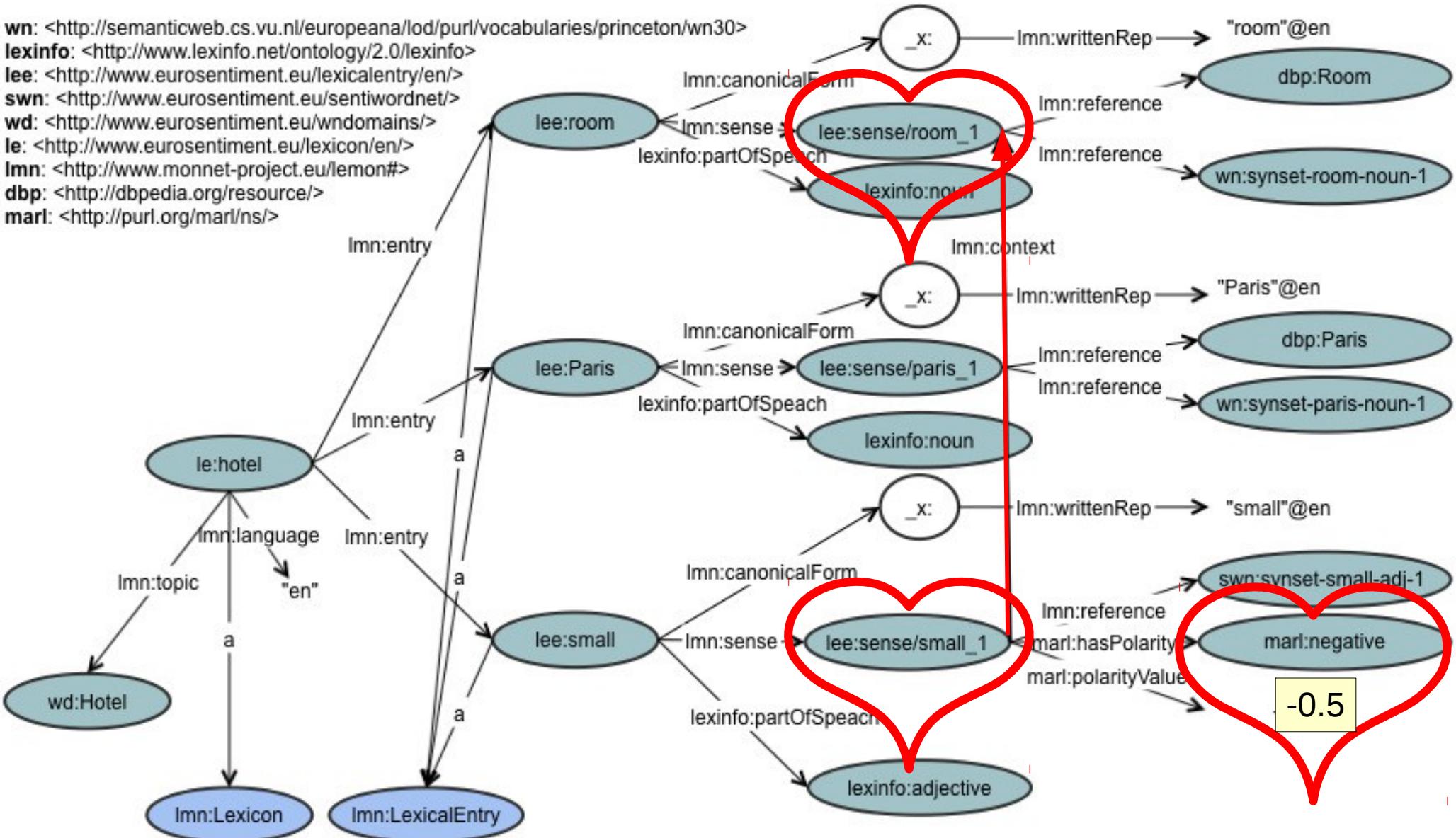
```
<http://tripadvisor.com/myhotel/opinion/1>
    rdf:type marl:Opinion;
    marl:describesObject dbp:Hotel ;
    marl:describesObjectPart dbp:Room ;
    marl:describesFeature "size" ;
    marl:polarityValue "-0.5" ;
    marl:hasPolarity: http://purl.org/marl/ns#Negative .
```

```
<http://eurosentiment.eu/analysis/1>
    rdf:type marl:SentimentAnalysis ;
    marl:maxPolarityValue "1" ;
    marl:minPolarityValue "-1" ;
    marl:algorithm "dictionary-based" ;
    prov:used le:hotel_en ;
    prov:wasAssociatedWith <http://dbpedia.org/resource/UPM> .
```

Example domain lexicon used by SA (Vulcu, 2014)



wn: <<http://semanticweb.cs.vu.nl/europeana/lod/purl/vocabularies/princeton/wn30>>
 lexinfo: <<http://www.lexinfo.net/ontology/2.0/lexinfo>>
 lee: <<http://www.eurosentiment.eu/lexicalentry/en/>>
 swn: <<http://www.eurosentiment.eu/sentiwordnet/>>
 wd: <<http://www.eurosentiment.eu/wndomains/>>
 le: <<http://www.eurosentiment.eu/lexicon/en/>>
 lmn: <<http://www.monnet-project.eu/lemon#>>
 dbp: <<http://dbpedia.org/resource/>>
 marl: <<http://purl.org/marl/ns/>>





Try it at ...

The screenshot shows a dark-themed web interface. At the top, a dropdown menu is open, showing the option "Sentiment dictionary - Spanish finances - Paradigma". Below the menu, there is a text input field containing the text "I feel good :)". At the bottom of the interface, there is a green button labeled "Analyze".

```
{
  "@context": "http://demos.gsi.dit.upm.es/eurosentiment/static/context.jsonld",
  "analysis": [
    {
      "@id": "http://www.gsi.dit.upm.es/ontologies/analysis#SAGA",
      "@type": [
        "marl:SentimentAnalysis"
      ],
      "marl:maxPolarityValue": 1.0,
      "marl:minPolarityValue": -1.0
    }
  ],
  "entries": [
    {
      "nif:isString": "I feel good :)",
      "opinions": [
        {
          "@id": "_:Opinion1",
          "marl:hasPolarity": "marl:Positive",
          "marl:polarityValue": 1.0,
          "marl:describesObjectFeature": "Overall"
        }
      ],
      "strings": [
        {
          "nif:anchorOf": ":)",
          "nif:beginIndex": 12,
          "nif:endIndex": 13,
          "opinions": [
            {
              "@id": "_:Opinion",
              "marl:hasPolarity": "marl:Positive",
              "marl:polarityValue": 1.0
            }
          ]
        }
      ]
    }
  ]
}
```

<http://demos.gsi.dit.upm.es/tomcat/SEAS/Controller>



Agenda

- Sentiment & Emotion Analysis
 - S & E models
 - Challenges
- Linked Data perspective
 - Vocabularies: Marl & Onyx
 - Service and Annotation - NIF
 - Lexical model: Lemon
 - Example
- Conclusions & next steps
 - W3C CG on LD models for E & S Analysis



Conclusions

- Adapt specification to use cases / req
- Going beyond text
 - Multimedia content, Social signs, ...
- Integration NIF services (Entity linking, ...)
- Application & adaptation to
 - other emotion models (affective tasks, such as emotion generation)
- Interoperability of E&S LR & tools

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