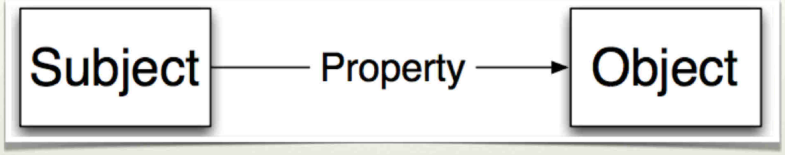
Gilles Sérasset

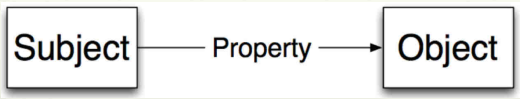
Lexical Linked Data : the DBnary dataset

+ Hands On exercises



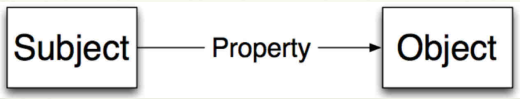
Easy RDF

What is RDF ?



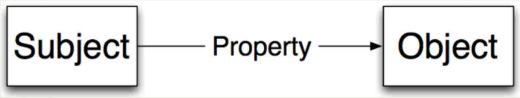
- **RDF**
  - Basic ingredient is a tuple (triple)
  - The **subject** is a "Resource", named with an URI or IRI
  - The **relation** is a property, named (the very same way)
  - The **object** is either a ressource, or an immediate value (typed or not)

What is RDF ?



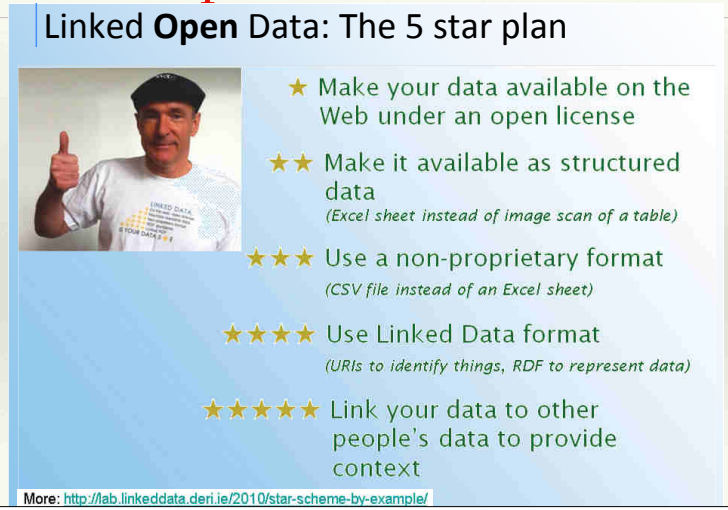
- **OWL / RDFS**
  - Classes (types of resources) may be described formally, along with their properties
  - Relations may be described formally (transitivity, symmetry, etc.)
  - With these formal properties, one may automatically infer new properties (formal reasoning)

What is RDF ?



- **RDF vs XML**
  - There is no such thing as “document”
  - No more border between data “inside" or “outside” a dataset
  - Several point of view may be used in the same time (in XML, only one document tree)
  - One may access data “on demand”, without knowing any “xpath” (no notion of “position” in a document…)

Linked Open Data for Dummies



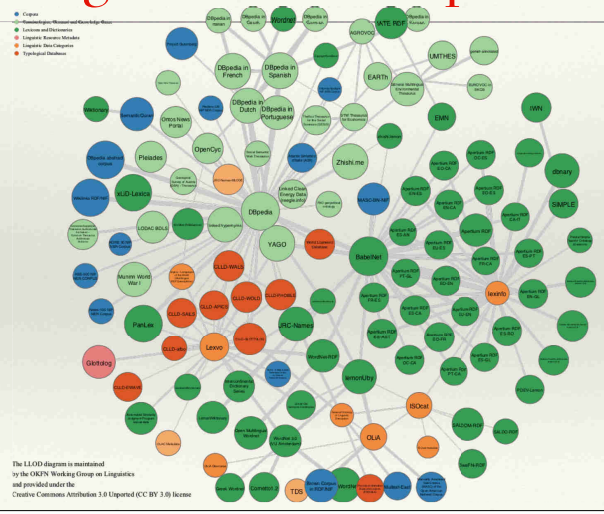
Linked Open Data for Dummies

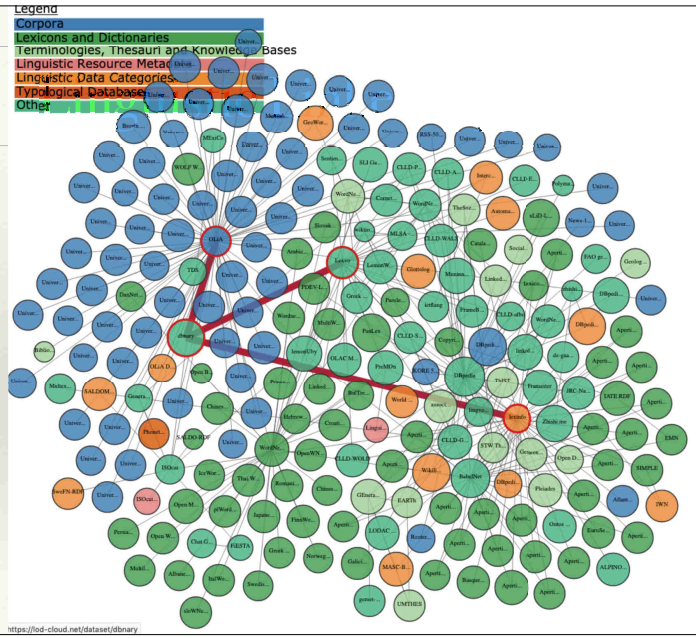
- Data is a huge graph where
  - all resources are dereferencable (URI = URL)
    - ex : http://kaiko.getalp.org/dbnary/fra/chat
  - with content negotiation
    - If you are a human, you’ll get a readable description of the graph node (HTML)
    - If you are a robot, you’ll get a parsable describetion of the node (RDF-XML, JSON, N3, TURTLE, …you decide !)

Linked Open Data for Dummies

- All resources are available through SPARQL requests
  - allows structured selections
  - allows the export of data as we want it to be (he who can do more can do less…)
- SPARQL may even query different datasets in the same query (even if they are in different servers)
  - Allows for interlinking datasets
  - You may use data that does not fit into your machine

Linguistic Linked Open Data





The DBnary Dataset

DBnary is to Wiktionary
What
DBpedia is to Wikipedia

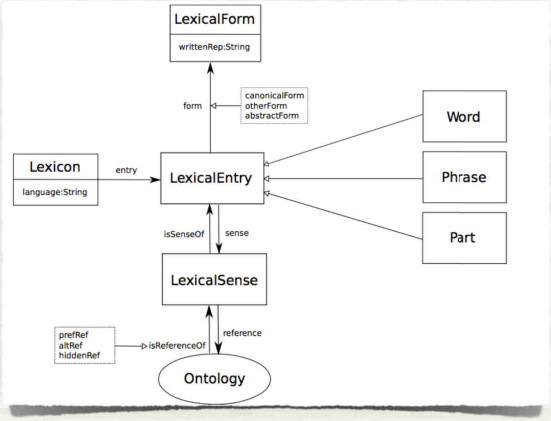
The DBnary Dataset

- Lexical data extracted from **21** different Wiktionary language editions
- Extracted data is available as Linked Data
  - → uses: `ontolex` (+ few dbnary ext.), `lexinfo`, `lexvo` and `OLiA`.
  - → w3c draft proposal for lexical linked data

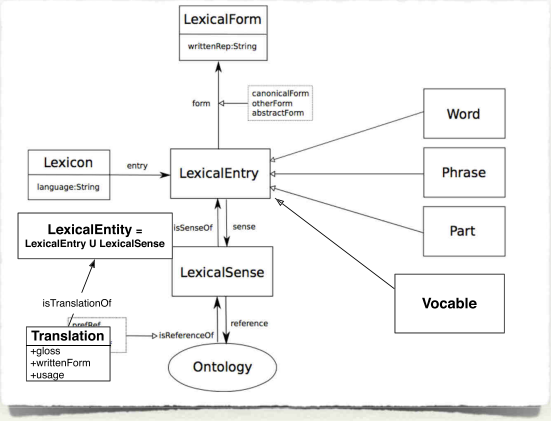
The DBnary Dataset

- **Core data**
  - Lexical Entries, Lexical Senses and Translations
- **Additional data**
  - Semantically enriched Relations
    - Translations are attached to their source Lexical Sense when possible
    - Lexico-semantic relations are also attached to their source Lexical Sense
  - Morphology
    - Extensive representation of morphology (a set of “lemon:otherForm”)

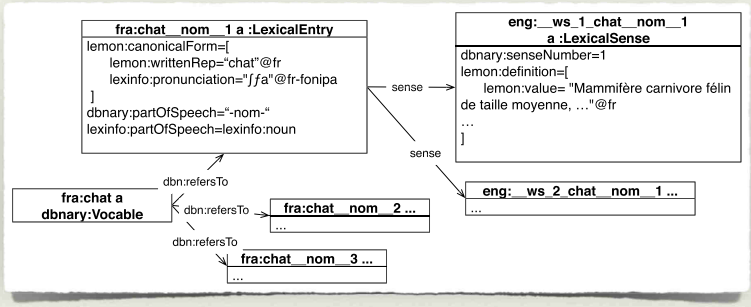
The DBnary Dataset



The DBnary Dataset



Example: core data



Example: core data

Pages

```
fra:chat   a                 dbnary:Page ;
           dbnary:refersTo   fra:chat__nom__1 , fra:chat__nom__2 … .

deu:Katze  a                 dbnary:Page ;
           dbnary:refersTo   deu:Katze__Substantiv__1 .
```

Example: core data

Lexical Entries

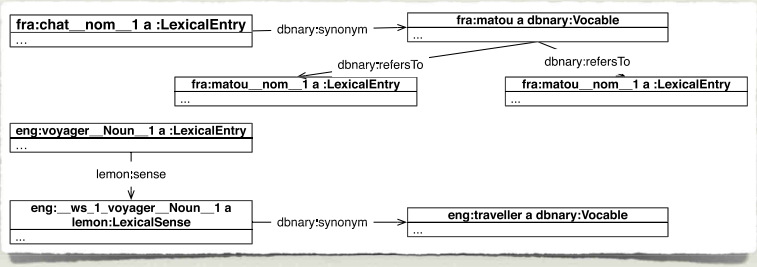
```
fra:chat__nom__1  a                 lemon:LexicalEntry , lemon:Word ;
        dbnary:hypernym             fra:félidé ;
        dbnary:hyponym              fra:chat_des_sables , fra:chat_à_pieds_noirs , … ;
        dbnary:partOfSpeech         "-nom-" ;
        dbnary:synonym              fra:Raminagrobis , fra:minet , fra:matou … ;
        dcterms:language            lexvo:fra ;
        lemon:canonicalForm         [ lemon:writtenRep        "chat"@fr ;
                                      lexinfo:number          lexinfo:singular ;
                                      lexinfo:pronunciation   "ʃa"@fr-fonipa
                                    ] ;
        lemon:language              "fr" ;
        lemon:lexicalVariant        [ lemon:writtenRep  "béarnais : gat"@fr ] ;
        lemon:sense                 fra:__ws_8_chat__nom__1 , fra:__ws_4_chat__nom__1 , … ;
        lexinfo:partOfSpeech        lexinfo:noun .
```

Example: core data

Lexical Senses

```
fra:__ws_1_chat__nom__1
        a                   lemon:LexicalSense ;
        dbnary:senseNumber  "1"^^<http://www.w3.org/2001/XMLSchema#string> ;
        lemon:definition    [ lemon:value  "Mammifère carnivore félin de taille moyenne, …"@fr ] ;
        lemon:example       [ dbnary:exampleSource  "H. G. Wells, La Guerre dans les airs, 1908,
traduit par Henry-D. Davray & B. Kozakiewicz, Mercure de France, 1921, page 335"@fr ;
                              lemon:value           "Soudain, d'un seul élan, cela se précipita sur
lui, avec un miaulement plaintif et la queue droite. C'était un jeune chat, menu et décharné, qui
frottait sa tête contre les jambes de Bert, en ronronnant."@fr
                            ] ;
        lemon:example       [ dbnary:exampleSource  "Octave Mirbeau, Contes cruels : Mon
oncle"@fr ;
                              lemon:value           "Entre autres manies, mon oncle avait celle de
tuer tous les chats qu'il rencontrait. Il faisait, à ces pauvres bêtes, une chasse impitoyable, une
guerre acharnée de trappeur."@fr
                            ] ;
        lemon:example       [ dbnary:exampleSource  "Erckmann-Chatrian, Histoire d'un conscrit de
1813, J. Hetzel, 1864"@fr ;
                              lemon:value           "[…] le chat gris, un peu sauvage, nous
regardait de loin, à travers la balustrade de l'escalier au fond, sans oser descendre."@fr
                            ] .
```

Example: core data

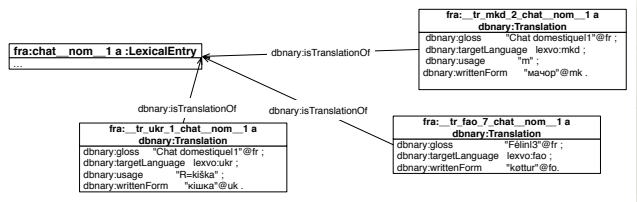


Example: core data

Lexico-semantic relations

```
fra:chat__nom__1  a                lemon:LexicalEntry , lemon:Word ;
        dbnary:hypernym            fra:félidé ;
        dbnary:hyponym             fra:chat_des_sables , fra:chat_à_pieds_noirs , … ;
        dbnary:synonym             fra:Raminagrobis , fra:minet , fra:matou … ;
        dcterms:language           lexvo:fra ;
        …
        lexinfo:partOfSpeech       lexinfo:noun .

deu:__hypo_45_Katze__Substantiv__1
        a                  rdf:Statement ;
        rdf:object         deu:Schwarzfußkatze ;
        rdf:predicate      dbnary:hyponym ;
        rdf:subject        deu:Katze__Substantiv__1 ;
        dbnary:gloss       "3" .

deu:__hyper_11_Tiger__Substantiv__1
        a                  rdf:Statement ;
        rdf:object         deu:Katze ;
        rdf:predicate      dbnary:hypernym ;
        rdf:subject        deu:Tiger__Substantiv__1 ;
        dbnary:gloss       "2" .
```

Example: core data



Example: core data

Translations

```
fra:__tr_pol_6_chat__nom__1
        a                        dbnary:Translation ;
        dbnary:gloss             "Chat mâle|2"@fr ;
        dbnary:isTranslationOf   fra:chat__nom__1 ;
        dbnary:targetLanguage    lexvo:pol ;
        dbnary:writtenForm       "kot"@pl .

fra:__tr_jpn_1_chat__nom__1
        a                        dbnary:Translation ;
        dbnary:gloss             "Chat domestique|1"@fr ;
        dbnary:isTranslationOf   fra:chat__nom__1 ;
        dbnary:targetLanguage    lexvo:jpn ;
        dbnary:usage             "R=neko" ;
        dbnary:writtenForm       "猫"@ja .

fra:__tr_ita_6_chat__nom__1
        a                        dbnary:Translation ;
        dbnary:gloss             "Félin|3"@fr ;
        dbnary:isTranslationOf   fra:chat__nom__1 ;
        dbnary:targetLanguage    lexvo:ita ;
        dbnary:writtenForm       "felina"@it .
```

Example: Additional data

Enhanced translations

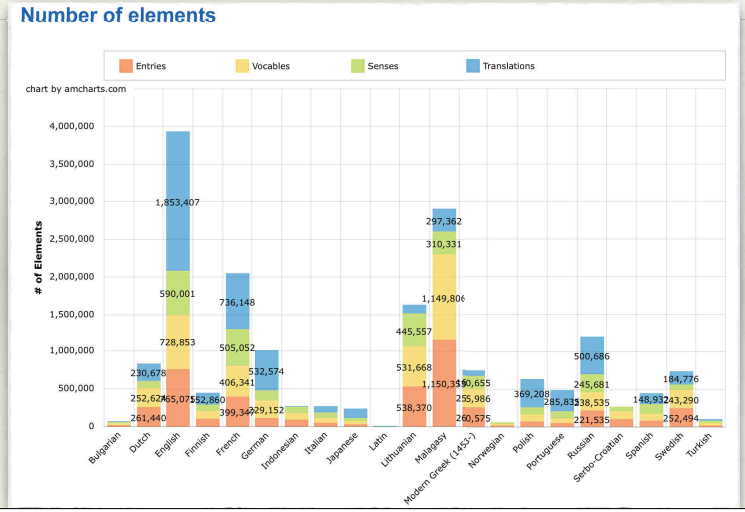
```
fra:__tr_pol_6_chat__nom__1
        dbnary:isTranslationOf   fra:__ws_2_chat__nom__1 .

fra:__tr_jpn_1_chat__nom__1
        dbnary:isTranslationOf   fra:__ws_1_chat__nom__1 .

fra:__tr_ita_6_chat__nom__1
        dbnary:isTranslationOf   fra:__ws_3_chat__nom__1 .
```

Example: Additional data

Morphology

```
deu:Katze__Substantiv__1
        lemon:otherForm  [ olia:hasCase      olia:Accusative ;
                           olia:hasNumber    olia:Plural ;
                           lemon:writtenRep  "die Katzen"@de
                         ] ;
        lemon:otherForm  [ olia:hasCase      olia:Accusative ;
                           olia:hasNumber    olia:Singular ;
                           lemon:writtenRep  "die Katze"@de
                         ] ;
        lemon:otherForm  [ olia:hasCase      olia:DativeCase ;
                           olia:hasNumber    olia:Plural ;
                           lemon:writtenRep  "den Katzen"@de
                         ] ;
        lemon:otherForm  [ olia:hasCase      olia:DativeCase ;
                           olia:hasNumber    olia:Singular ;
                           lemon:writtenRep  "der Katze"@de
                         ] ;
        …
        lemon:otherForm  [ olia:hasCase      olia:Nominative ;
                           olia:hasNumber    olia:Singular ;
                           lemon:writtenRep  "die Katze"@de
                         ]
```

Size of the data



Size of the data

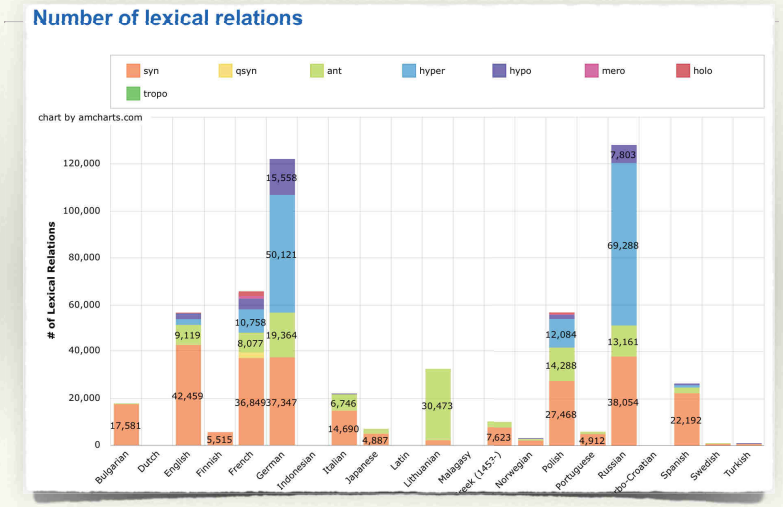
Table 1

Language	Pages	Entries	Senses	Translations
Bulgarian	27 093	18 785	18 214	14 181
Dutch	252 624	261 440	90 734	230 678
English	728 853	765 075	590 001	1 853 407
Finnish	99 575	104 514	92 942	152 860
French	406 341	399 347	505 052	736 148
German	229 152	119 917	135 883	532 574
Indonesian	85 737	90 674	89 356	7 347
Italian	60 212	51 367	73 177	88 013
Japanese	35 493	36 073	41 550	128 097
Latin	1 455	1 467	1 969	5 436

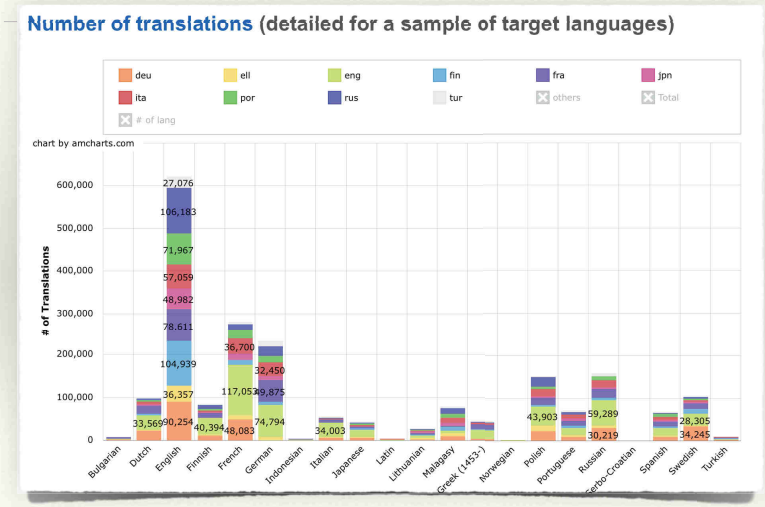
Size of the data

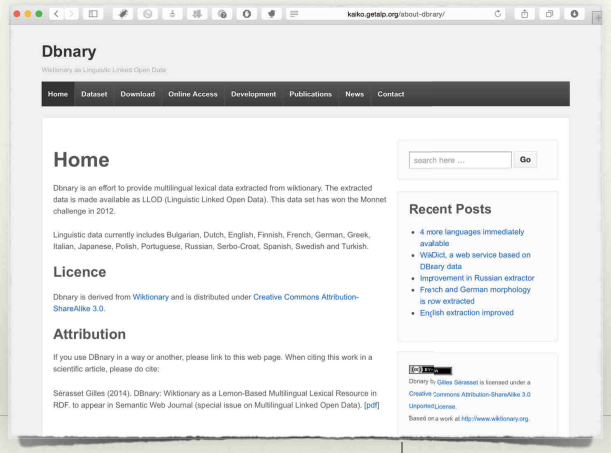
Language	Pages	Entries	Senses	Translations
Lithuanian	531 668	538 370	445 557	121 553
Malagasy	1 149 806	1 150 353	310 331	297 362
Modern Greek (1453-)	255 986	260 575	160 655	76 982
Norwegian	19 070	18 007	22 226	3 972
Polish	90 750	73 397	101 913	369 208
Portuguese	55 516	56 150	97 398	285 835
Russian	238 535	221 535	245 681	500 686
Serbo-Croatian	101 373	106 399	66 123	605
Spanish	92 484	88 202	120 068	148 932
Swedish	243 290	252 494	65 296	184 776
Turkish	26 465	25 643	35 991	14 238
Total	**4 731 478**	**4 639 784**	**3 310 117**	**5 752 890**

Size of the data



Size of the data





The DBnary website

Presentations, download, online access, tips and news

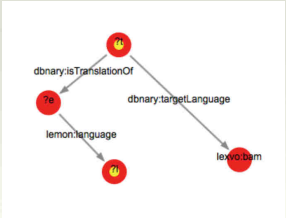
The DBnary website

- http://kaiko.getalp.org/about-dbnary/
  - Dataset presentation, news, tips
- http://kaiko.getalp.org/fct
  - Facetted browser
- http://kaiko.getalp.org/sparql
  - Sparql endpoint
- http://kaiko.getalp.org/dbnary/fra/chat
  - Resolvable URIs for Linked Data (with content negociation)

The SPARQL endpoint

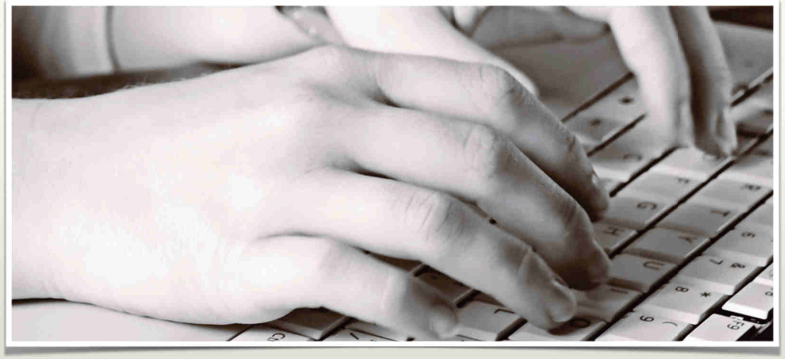
Example: counting translations to Bambara, grouped by source language

```
PREFIX lexvo: <http://lexvo.org/id/iso639-3/>
PREFIX dbnary: <http://kaiko.getalp.org/dbnary#>
PREFIX lemon: <http://www.lemon-model.net/lemon#>

SELECT count(?t) , ?l
WHERE {
  ?t dbnary:targetLanguage lexvo:bam ;
  dbnary:isTranslationOf ?e .
  ?e lemon:language ?l
}
```



The SPARQL endpoint

- The extracted data is updated
  - AS SOON AS DUMPS ARE RELEASED
- Downloadable Turtle files are up to date
- The online data (fct, sparql) is usually out of sync with Turtle files



Lorem Ipsum Dolor

Hands on exercices

Warning

- All the tools we will see now are standard Semantic Web Tools
- None of them are made for lexical data, nor for linguists or digital humanities specialists
- All of them are usable as is because DBnary is linked data
- Many other tools are available

Facetted browsing

OPENLINK SOFTWARE

Facets | Description | Metadata | Settings

About: dbnary-fra:corpus__nom__1 Goto Sponge NotDistinct Permalink

An Entity of Type : ontolex:Word, within Data Space : kaiko.getalp.org associated with source document(s)

Type: ontolex:Word Command: Start New Facet Go

Attributes	Values
rdf:type	ontolex:LexicalEntry ontolex:Word
ontolex:canonicalForm	dbnary-fra:__cf_corpus__nom__1
lexinfo:partOfSpeech	lexinfo:noun
lime:language	fr
ontolex:sense	dbnary-fra:__ws_4_corpus__nom__1 dbnary-fra:__ws_1_corpus__nom__1 dbnary-fra:__ws_2_corpus__nom__1 dbnary-fra:__ws_3_corpus__nom__1 dbnary-fra:__ws_5_corpus__nom__1
dbnary:partOfSpeech	-nom-
dct:language	lexvo:fra
vartrans:translatableAs	dbnary-deu:Textkorpus__Substantiv__1 dbnary-spa:corpus__sustantivo_masculino__1 dbnary-deu:Corpus__Substantiv__1 dbnary-fin:korpus__Substantiivi__1
is dbnary:isTranslationOf of	dbnary-fra:__tr_deu_1_corpus__nom__1 dbnary-fra:__tr_deu_2_corpus__nom__1 dbnary-fra:__tr_ita_1_corpus__nom__1 dbnary-fra:__tr_fin_1_corpus__nom__1 dbnary-fra:__tr_deu_3_corpus__nom__1 »more»
is dbnary:describes of	dbnary-fra:corpus
is vartrans:translatableAs of	dbnary-deu:Textkorpus__Substantiv__1 dbnary-deu:Komplex__Substantiv__1 dbnary-deu:Korpus__Substantiv__1 dbnary-deu:Corpus__Substantiv__1

SPARQL

SPARL for Dummies

A SPARQL query comprises, in order:

- *Prefix declarations*, for abbreviating URIs
- *Dataset definition*, stating what RDF graph(s) are being queried
- A *result clause*, identifying what information to return from the query
- The *query pattern*, specifying what to query for in the underlying dataset
- *Query modifiers*, slicing, ordering, and otherwise rearranging query results

```
# prefix declarations
PREFIX foo: <http://example.com/resources/>
...
# dataset definition
FROM ...
# result clause
SELECT ...
# query pattern
WHERE {
    ...
}
# query modifiers
ORDER BY ...
```

Let's simplify :

- most useful prefixes are known…
- we will only query the DBnary graph

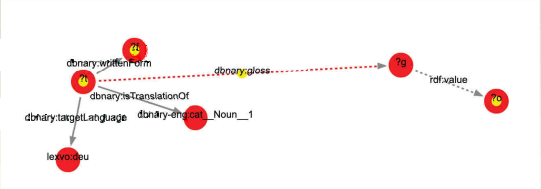
Hence, no PREFIX, nor FROM sections

My first SPARQL queries

- connect to http://kaiko.getalp.org/sparql
- Type in :

```
SELECT DISTINCT ?t, ?f, ?o WHERE {
 ?t dbnary:isTranslationOf dbnary-eng:cat__Noun__1 ;
 dbnary:targetLanguage lexvo:deu ;
 dbnary:writtenForm ?f .
 OPTIONAL {?t dbnary:gloss / rdf:value ?o}
}
```

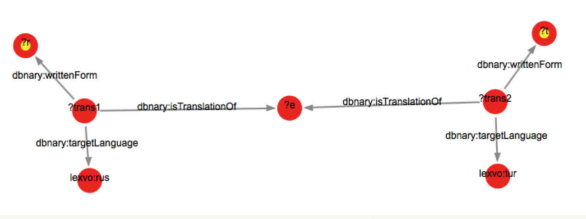
- Before submitti
- hint : draw the



My first SPARQL queries

Create a draft Russian-Turkish word list

```
SELECT DISTINCT ?r, ?t WHERE {
 ?trans1 dbnary:isTranslationOf ?e ;
 dbnary:targetLanguage lexvo:rus ;
 dbnary:writtenForm ?r .
 ?trans2 dbnary:isTranslationOf ?e ;
 dbnary:targetLanguage lexvo:tur ;
 dbnary:writtenForm ?t .
}
```



SPARQL for stats

```
Select ?g ?p count(?p) as ?count where {
  Graph ?g { ?s ?p ?o }
} group by ?p ?g
  order by desc (?g) desc(?count)
```

Try it on the DBnary SPARQL endpoint :

http://kaiko.getalp.org/sparql

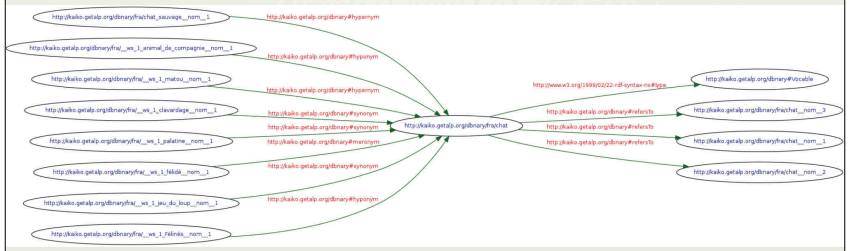
SPARQL - Hands On Exercices

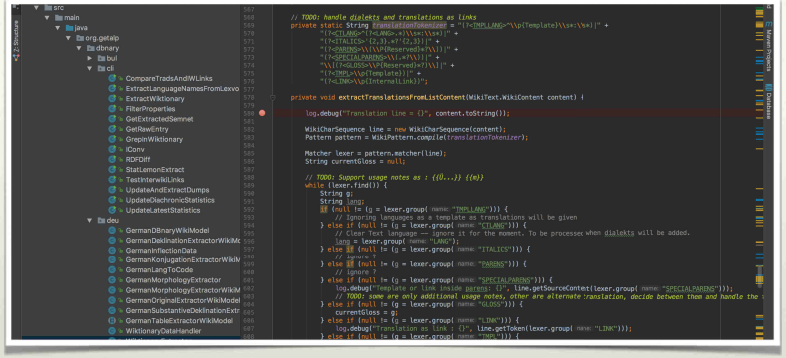
- How may LexicalEntries are monosemous ?
- Getting a string-string set of translations to Wolof ?
- Getting the most polysemous entries in DBnary ?
- How many translations available in greek Wiktionary ?
- Other questions ?

Cheat sheets

```
PREFIX lexvo: <http://lexvo.org/id/iso639-3/>
PREFIX dbnary: <http://kaiko.getalp.org/dbnary#>

SELECT (count(?t) as ?count)
FROM <http://kaiko.getalp.org/dbnary/ell>
WHERE { ?t a dbnary:Translation . }
```

Drawing the graph (?)





Lorem Ipsum Dolor

The DBnary extractor

Tools and frameworks for wikimedia extraction programs

The DBnary extractor

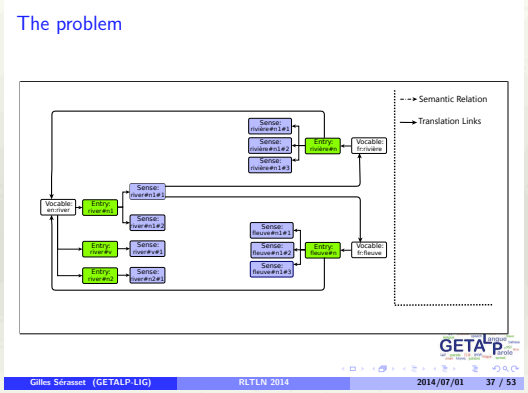
- One program per language
- Different strategies depending on wiktionary edition
  - simple regex on the source (sometimes buggy)
  - extended regex on the parsed source (nested markup)
  - scala parser combinators on the source
  - programs to “execute” some parts of the page
  - catching some events during page execution
  - …

Lorem Ipsum Dolor

Enhancing Extracted Data

Example: attaching translations to their correct word sense

RNTLN 2014



Lexsema a semantic swiss knife

Semantic similarities, unsupervised WSD with different similarity measures and meta-heuristics, supervised WSD,

Lexsema API

- A Java API for semantic similarity
  - A set of maven modules
  - Easily usable in your projects
  - still in alpha stage (quite reliable, but no documentation)
- developed mainly by Andon Tchechmedjiev

Lexsema API

org.getalp.lexsema-ontolex

1. Abstract API for the core model
2. SparQL query generation API
3. Generic core model querying (File, TDB, Remote endpoint)

org.getalp.lexsema-ontolex-dbnary

1. DBNary extended model
2. DBNary Querying

Lexsema API

org.getalp.lexsema-io

1. Load evaluation corpora (Semeval/Semcor, etc…)
2. Load lexical resource
3. Processing chain for raw text [DKPro/UIMA-fit]
4. Load gold standard data (WSD, CL-WSD)
5. Evaluate task results
6. Write task results
7. Preprocess and merge lexical resources (e.g. stemming definitions)
8. Generate dictionaries from resources

Lexsema API

org.getalp.lexsema-translation

1. Provide a unified API for MT services
2. Bing Translate Wrapper
3. Provide literal disambiguated target-word translations (dbnary cl-wsd)

org.getalp.lexsema-util

1. Caching API (REDIS, Memory)
2. DBNary Querying

Lexsema API

org.getalp.lexsema-similarity

1. Representation of abstract document structure (Text, Sentence, Word, Sense)
2. Generation of semantic signatures
3. Filtering of semantic signatures
4. Enrichment of semantic signatures (e.g. from Word2Vec model)
5. Semantic Similarity between senses in the same language
6. Semantic similarity between senses in different languages

Lexsema API

org.getalp.lexsema-ml

1. Function / Set Function API
2. Continuous optimization (e.g. Gradient Descent)
3. Score Matrix API
4. Generic Matrix Filtering
   - FFT
   - Value Normalization
   - Dimensionality Reduction
5. Dimensionality Reduction
   - Linear: PCA, SVD, FastICA, NeuralICA, NMF
   - Non-linear: Tapkee Wrapper – LLE, KPCA, ISOMAP, MDE, etc

Lexsema API

org.getalp.lexsema-wsd

1. Word Sense Disambiguation API

2. Parameter Estimation

3. Sense raking regularization

4. Algorithms:

- Simplified Lesk
- Windowed Exhaustive Enumeration
- Simulated Annealing
- Genetic Algorithm
- Cuckoo Search
- Bat Search

Lexsema API

org.getalp.lexsema-wsd-supervised

1. Feature Extraction from Annotated corpora

2. Supervised Classification [Weka]

Example 1: Accessing DBnary

```
public static final String ONTOLOGY_PROPERTIES = "data" + File.separator + "ontology.properties";
    public static void main(String[] args) throws […]{
        Store store = new JenaRemoteSPARQLStore("http://kaiko.getalp.org/sparql");
        StoreHandler.registerStoreInstance(store);
        OntologyModel model = new OWLTBoxModel(ONTOLOGY_PROPERTIES);
        DBNary dbnary = (DBNary) LexicalResourceFactory.getLexicalResource(DBNary.class, model, new Language[]
{Language.ENGLISH});
        Vocable v = null;
        try {
            v = dbnary.getVocable(args[0]);
            logger.info(v.toString());
            List<LexicalEntry> entries = dbnary.getLexicalEntries(v);
            for (LexicalEntry le : entries) {
                logger.info("\t" + le.toString());
                logger.info("\tRelated entities:");
                List<LexicalResourceEntity> related = dbnary.getRelatedEntities(le, DBNaryRelationType.synonym);
                for (LexicalResourceEntity lent : related) {
                    logger.info("\t\t" + lent.toString());
                }
                logger.info("\tSenses:");
                for(LexicalSense sense: dbnary.getLexicalSenses(le)){
                    logger.info("\t\t" + sense.toString());
                }
                logger.info("\tTranslations:");
                List<Translation> translations = dbnary.getTranslations(le);
                for (Translation translation : translations) {
                    logger.info("\t\t" + translation.toString());
                }
            }
        } catch (NoSuchVocableException e) {
            e.printStackTrace();
        }
    }
```

Example 1: Accessing DBnary

```
VocableImpl(vocable=cat, language=ENGLISH)
  ENGLISH LexicalEntry|cat#noun|
    Related entities:
      VocableImpl(vocable=guy, language=ENGLISH)
      VocableImpl(vocable=felid, language=ENGLISH)
       [...]
      VocableImpl(vocable=lion, language=ENGLISH)
   Senses:
      LexicalSense|__ws_1_cat__Noun__1|{'An animal of the family Felidae:'}
      LexicalSense|__ws_1a_cat__Noun__1|{'A domesticated subspecies (Felis silvestris
catus) of feline animal,

commonly kept as a house pet.'}
      LexicalSense|__ws_1b_cat__Noun__1|{'Any similar animal of the family Felidae, which
includes lions, tigers, bobcats, etc.'}
       [...]
      LexicalSense|__ws_9_cat__Noun__1|{'A vagina, a vulva; the female external
genitalia.'}
   Translations:
      TranslationImpl(gloss=domestic species@en, translationNumber=-1, writtenForm=gato,
language=PORTUGUESE)
      TranslationImpl(gloss=member of the family ''Felidae''@en, translationNumber=-1,
writtenForm=felino, language=PORTUGUESE)
      TranslationImpl(gloss=member of the subfamily Felinae@en, translationNumber=-1,
writtenForm=Kleinkatze, language=GERMAN)
      TranslationImpl(gloss=member of the family ''Felidae''@en, translationNumber=-1,
writtenForm=felina, language=CATALAN)
language=FINNISH)
```

Example 2: Text similarity

```
public final class TextSimilarity {
    private static Logger logger = LoggerFactory.getLogger(TextSimilarity.class);

    public static void main(String[] args) {

        if (args.length <2) {
            usage();
        }
        StringSemanticSignature signature1 = new StringSemanticSignatureImpl(args[0]);
        StringSemanticSignature signature2 = new StringSemanticSignatureImpl(args[1]);

        SimilarityMeasure similarityMeasure = new TverskiIndexSimilarityMeasureBuilder()
                .alpha(1d).beta(0).gamma(0).computeRatio(false).fuzzyMatching(false).normalize(true).r
egularizeOverlapInput(true).build();
        double sim = similarityMeasure.compute(signature1, signature2);
        String output = String.format("The similarity between \"%s\" and \"%s\" is %s",
signature1.toString(), signature2.toString(), sim);
        logger.info(output);
    }

    private static void usage() {
        logger.error("Usage -- TextSimilarity \"String1\" \"String2\"");
        System.exit(1);
    }
}
```

Example 2: Text similarity

```
java -jar org.getalp.lexsema-examples-allinone.jar \
                org.getalp.lexsema.examples.TextSimilarity "The king is dead" "Long live the king"
```

```
INFO [main] (TextSimilarity.java:25) - The similarity between " The king is dead" and " Long
live the king" is 0.25
```

Example 3: Crosslingual text similarity

```
public class CrossLingualTextSimilarity {
    private static Logger logger = LoggerFactory.getLogger(CrossLingualTextSimilarity.class);

    public static void main(String[] args) throws IOException, InvocationTargetException,
NoSuchMethodException, ClassNotFoundException, InstantiationException, IllegalAccessException {
        if(args.length<4){
            usage();
        }
        Language source = Language.fromCode(args[0]);
        Language target = Language.fromCode(args[1]);
        StringSemanticSignature signature1 = new StringSemanticSignatureImpl(args[2]);
        signature1.setLanguage(source);
        StringSemanticSignature signature2 = new StringSemanticSignatureImpl(args[3]);
        signature2.setLanguage(target);
        Translator translator = new GoogleWebTranslator();
        SimilarityMeasure similarityMeasure = new TverskiIndexSimilarityMeasureBuilder()
                .fuzzyMatching(true).alpha(1d).beta(0d).gamma(0d).normalize(true).regularizeOverlapIn
put(true).build();
        SimilarityMeasure crossLingualMeasure = new
TranslatorCrossLingualSimilarity(similarityMeasure, translator);
        double sim = crossLingualMeasure.compute(signature1, signature2);
        String output = String.format("The similarity between \"%s\" and \"%s\" is %s",
signature1.toString(), signature2.toString(), sim);
        logger.info(output);
    }
}
```

Example 3: Crosslingual text similarity

```
java -jar org.getalp.lexsema-examples-allinone.jar \
                org.getalp.lexsema.examples.CrossLingualTextSimilarity en fr \
                "Long live the king" "Longue vie au roi"
```

```
INFO [main] (CrossLingualTextSimilarity.java:40) - The similarity between "
Long live the king" and " Longue vie au roi" is 1.0
```

Example 4: WSD

```
// Load and segment the text
TextLoader textLoader = new RawTextLoader(new StringReader(args[0]), new EnglishDKPTextProcessor());

// Connect to DBnary
Store store = new JenaRemoteSPARQLStore("http://kaiko.getalp.org/sparql");
StoreHandler.registerStoreInstance(store);
OntologyModel model = new OWLTBoxModel(ONTOLOGY_PROPERTIES);
DBNary dbnary = (DBNary) LexicalResourceFactory.getLexicalResource(DBNary.class, model, new
Language[] {Language.ENGLISH});

LRLoader lrloader = new DBNaryLoaderImpl(dbnary, Language.ENGLISH).loadDefinitions(true);

// Define similarity measure
SimilarityMeasure similarityMeasure =
        new TverskiIndexSimilarityMeasureBuilder()
                .distance(new ScaledLevenstein()).alpha(1d).beta(0.0d).gamma(0.0d)
                .fuzzyMatching(true)
                .build();
ConfigurationScorer configurationScorer =
        new ConfigurationScorerWithCache(similarityMeasure);

// Choose a meta heuristic for WSD
Disambiguator disambiguator = new CuckooSearchDisambiguator(1000,.5,1,0,configurationScorer,true);
```

Example 4: WSD

```
System.err.println("Loading texts");
textLoader.load();
for (Document document : textLoader) {
    System.err.println("\tLoading senses...");
    lrloader.loadSenses(document);
    System.err.println("\tDisambiguating... ");
    Configuration result = disambiguator.disambiguate(document);
    for(int i=0;i<result.size();i++){
        Word word = document.getWord(i);
        if(!document.getSenses(i).isEmpty()) {
            String sense = document.getSenses(i).get(result.getAssignment(i)).getId();
            logger.info("Sense " + sense + " assigned to " + word);
        }
    }

    System.err.println("done!");
}
disambiguator.release();
```

Example 4: WSD

```
java -jar org.getalp.lexsema-examples-allinone.jar \
     org.getalp.lexsema.examples.TextDisambiguation \
    "I would like to take some time to congratulate you for your victory"
```

```
INFO [main] (TextDisambiguation.java:68) - Sense LexicalSense|__ws_9g_take__Verb__1|{'To accept,
as something offered; to receive; not to refuse or reject; to admit.'} assigned to ENGLISH
LexicalEntry|take#verb|

INFO [main] (TextDisambiguation.java:68) - Sense LexicalSense|__ws_2f_time__Noun__1|{'A person's
youth or young adulthood, as opposed to the present day.'} assigned to ENGLISH LexicalEntry|
time#noun|

INFO [main] (TextDisambiguation.java:68) - Sense LexicalSense|__ws_1_congratulate__Verb__1|{'to
express one's sympathetic pleasure or joy to the person(s) it is felt for'} assigned to ENGLISH
LexicalEntry|congratulate#verb|

INFO [main] (TextDisambiguation.java:68) - Sense LexicalSense|__ws_1_victory__Noun__1|{'An
instance of having won a competition or battle.'} assigned to ENGLISH LexicalEntry|victory#noun|
```

To infinity and beyond!

Axies

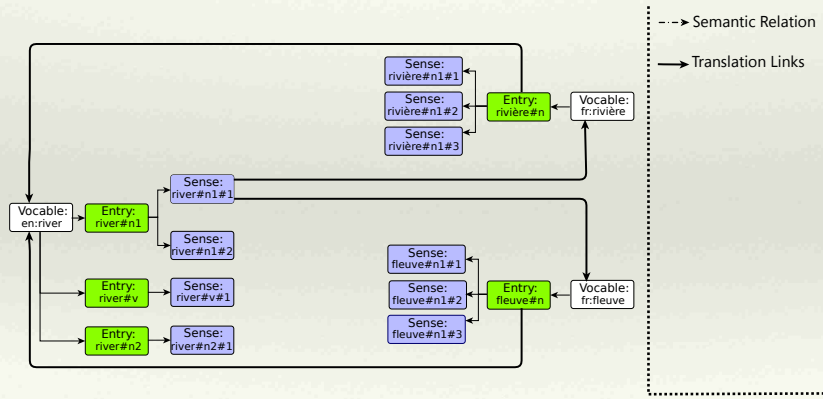
The corner stone towards linguistic felicity in pivot based multilingual lexical resources

Axies = Interlingual acceptions

- A lexical architecture defined in 1994
  - G. Sérasset. Interlingual Lexical Organisation for Multilingual Lexical Databases in NADIA. In M. Nagao, editor, COLING-94, volume 1, pages 278–282, August 1994.
- "Interlingual acceptions" —> Axies
  - A simpler name for the same concept in the "Papillon" project.

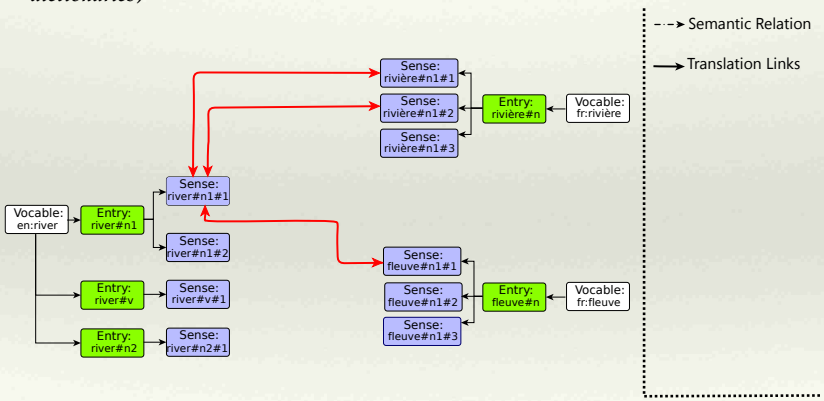
Axies: illustration

Existing multilingual data (multi-bilingual dictionaries)



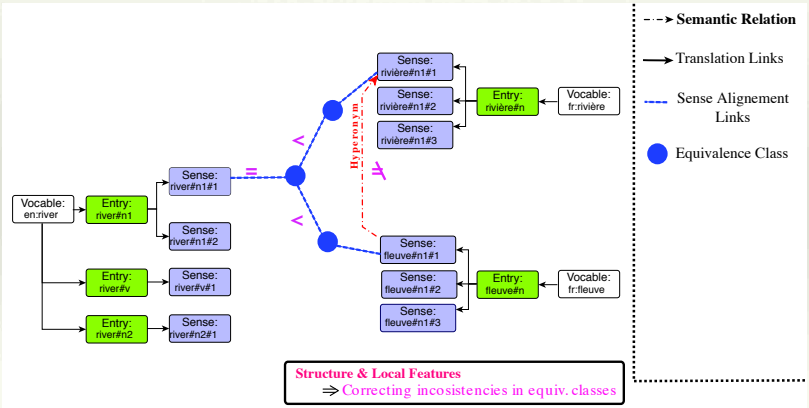
Axies: illustration

Better non existing multilingual data (multi-bilingual bidirectional dictionaries)



Axies: illustration

Even better multilingual data (multilingual dictionaries)



Understanding translation relations

- Hypothesis :
  - A translation relation is the observation of the realisation of different relations between word senses
    - equivalence relation
    - inclusion relation (order relation)
-

Understanding translation relations