Expressive and Scalable Query-based Faceted Search over SPARQL Endpoints

Sébastien Ferré
Team LIS, Data and Knowledge Management, IRISA/Univ. Rennes 1

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INSTITUT DE RECHERCHE EN INFORMATIQUE ET SYSTEMES ALÉATOIRES

UMR IRISA LIS

Semantic Search

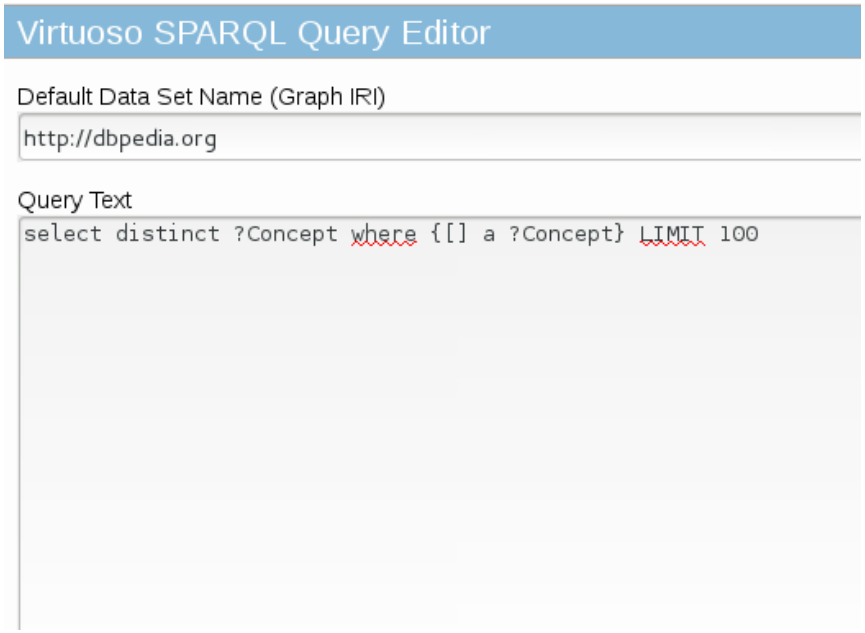
Semantic search is one of the cornerstone of the Semantic Web

- *What's the point building all those ontologies and linked data if one cannot explore and query them effectively?*
- Good news: we now have loads of data
  - public SPARQL endpoints, Linked Open Data, RDB wrappers
  - no more a "chicken-and-egg problem": *We have the chickens and we need to get more eggs out of them!*
- Bad news: user-side semantic search remains difficult
  - mostly canned queries sent programmatically by apps
  - SPARQL editors remain the tools of choice
    - ★ SPARQL is expressive, scalable, a standard

Difficulties with SPARQL for Users (1/2)

SPARQL has a formal syntax and semantics that needs to be learned

- like for programming languages



- with arcane error messages

```
Virtuoso 37000 Error SP030: SPARQL compiler, line 4: syntax error at '.' before '}'
```

We've just lost $>$ 90% *of potential users !*

Difficulties with SPARQL for Users (2/2)

The vocabulary of the target endpoint must be known

- precise URIs of classes and properties

```
SELECT DISTINCT ?film ?country
WHERE { ?film a dbpedia-owl:Film ;
            dbpedia-owl:actor dbpedia:Johnny_Depp ;
            dbpedia-owl:country ?country }
LIMIT 100
```

- any vocabulary error generally entails empty results with no explanation

film	country

This makes semantic search tedious, and causes frustration

Alternatives to SPARQL

How to make semantic search more usable ?

- Interactivity
  - semantic browsers: from entity to entity
    - ★ e.g. Fluidops
  - query builders: syntax-based (graphical) editors
    - ★ e.g. SemanticCrystal, Atomate it!
  - faceted search: guided filtering of sets of entities
    - ★ e.g. Ontogator, mSpace, /facet, gFacet, VisiNav, SemFacet, OpenLink
- Natural language (NL)
  - spontaneous NL + parsing + mapping
    - ★ e.g. PowerAqua, CASIA
  - controlled NL (CNL) + autocompletion
    - ★ e.g. Ginseng, ACEWiki

Required Properties and Existing Limits

- expressivity = covering users' information needs
  - generally, *the more usable, the less expressive*
  - only a small subset of SPARQL 1.1 is covered
- guidance = assisting users in their search
  - most often concept-based (coarse-grained)
  - instance-based (fine-grained) $\Rightarrow$ lower expressivity
- readability = speaking users' language
  - high expressivity $\Rightarrow$ only NL is readable
- scalability = scaling to largest endpoints
  - interactivity $\wedge$ fine-grained guidance $\Rightarrow$ lower scalability
- portability = working on new users' endpoints
  - many require manual configuration

We need them all for an effective semantic search !

Our Approach (implemented as SPARKLIS)

Our approach combines:

1. faceted search + structured queries
   - to reconcile guidance and expressivity
   - QFS = Query-based Faceted Search [ISWC'11]
2. requests to SPARQL endpoints for results and increments
   - to provide scalability and portability
3. NL verbalization of queries
   - to reconcile expressivity and readability

Not to be confused with

- query builders:
  - + fine-grained guidance, + NL verbalization
- NL interfaces:
  - no free input: − parsing, − mapping
  - more flexible guidance than auto-completion

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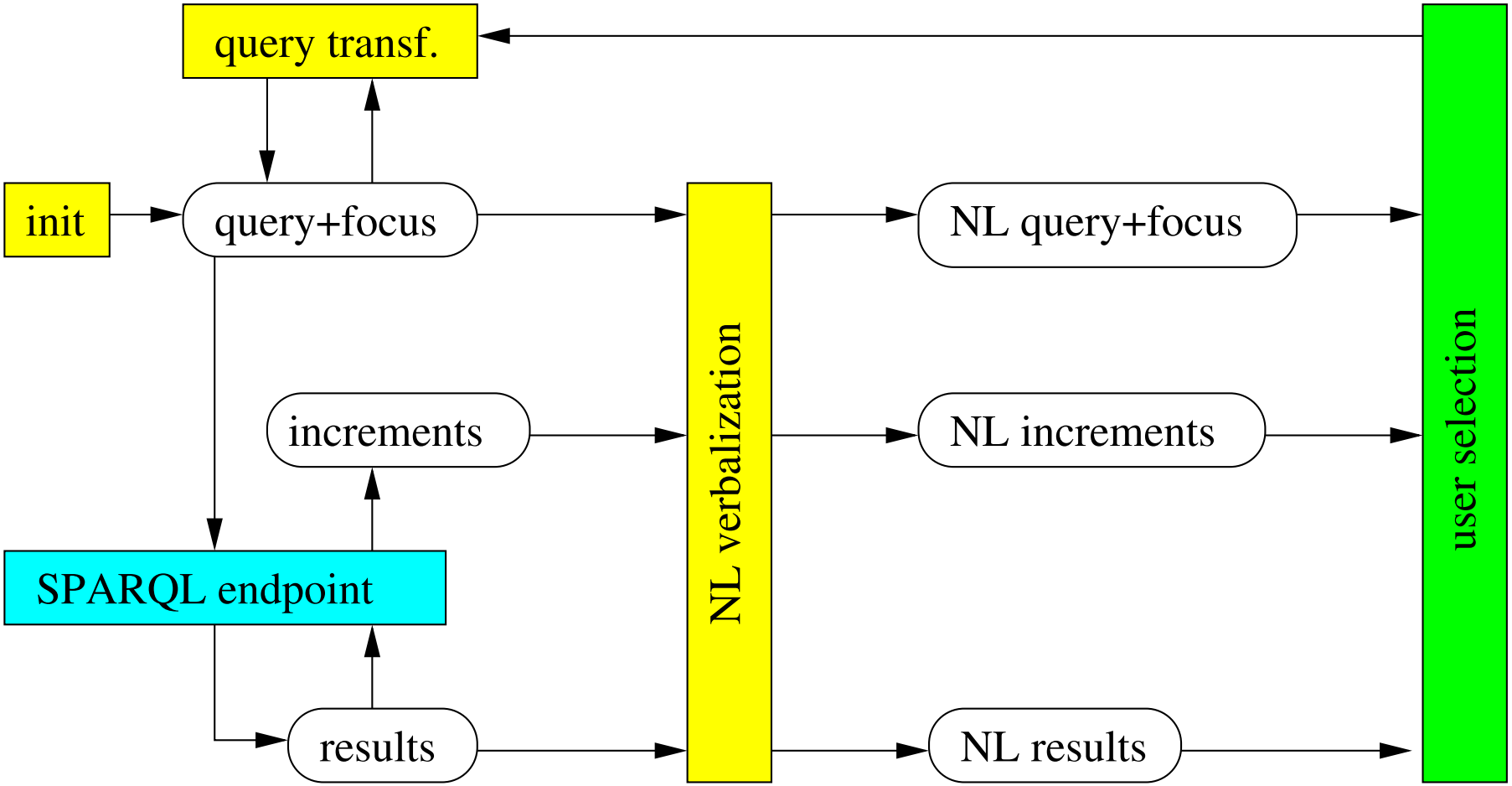
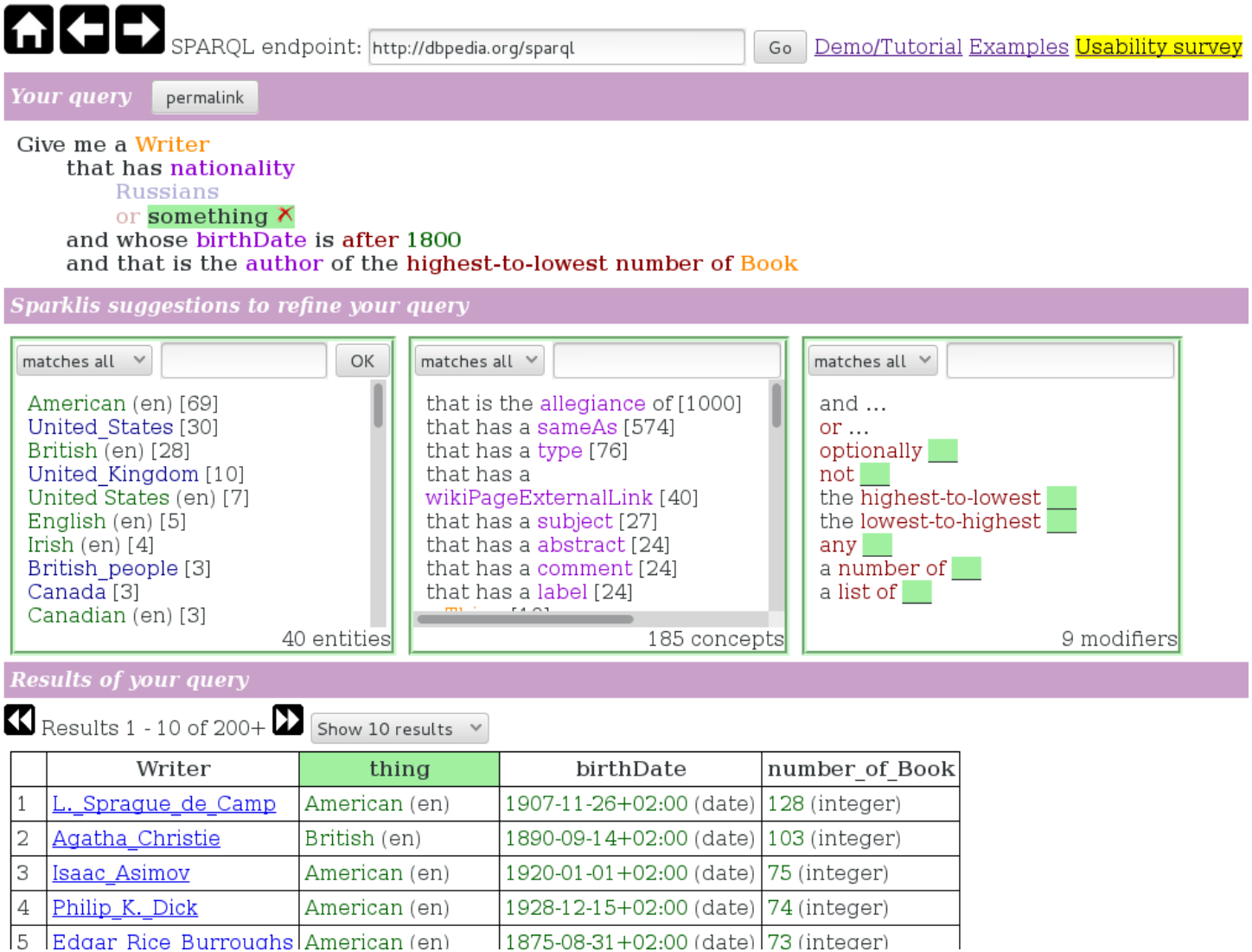
SPARKLIS' Architecture

How does it work ?



Note: the focus is an "insertion point" in the query

SPARKLIS' Screenshot



	Writer	thing	birthDate	number_of_Book
1	L._Sprague_de_Camp	American (en)	1907-11-26+02:00 (date)	128 (integer)
2	Agatha_Christie	British (en)	1890-09-14+02:00 (date)	103 (integer)
3	Isaac_Asimov	American (en)	1920-01-01+02:00 (date)	75 (integer)
4	Philip_K._Dick	American (en)	1928-12-15+02:00 (date)	74 (integer)
5	Edgar_Rice_Burroughs	American (en)	1875-08-31+02:00 (date)	73 (integer)

A Few Technical Hints

"The devil is in the details"

1. the internal representation of queries is intermediate between NL and SPARQL
   - a compiler technique to simplify translations (both ways) and query transformations
2. only partial results for the sake of scalability (`LIMIT 200`)
   - increments are computed over those partial results
   - an intelligent autocompletion is used to ensure guidance completeness
3. special increment computation when blank nodes in results
   - because blank nodes cannot be injected into SPARQL queries

Evaluations

Using SPARKLIS in Firefox 19.0.2 on a Linux laptop

- expressivity
  - covers SPARQL 1.1 – expressions – named graphs
  - covers all QALD questions
- scalability
  - responsive on `http://dbpedia.org/sparql`
  - QALD questions can be answered in 30s (avg) by a trained user
- guidance and readability (i.e. usability)
  - training is necessary, but is usually short (online video = tutorial)
  - survey (12 questions): SPARQL-aware (10/12) vs non-IT (7/12)
  - most complex question: *Give me all bridges crossing the Saint Laurence river, ordered by decreasing length, and with an optional depiction.* (success for 4/6 subjects)
- portability
  - only standards: HTML5/CSS3/JS + SPARQL HTTP requests (280kb)
  - main limit: half endpoints do not allow cross-domain requests

Kinds of Questions Covered by SPARKLIS

- fact retrieval
  - *Give me the homepage of Forbes.*
- result lists
  - *Which rivers flow into a German lake ?*
- tables
  - *Give me Tim Burton's films with their optional release date, and their budget in decreasing order.*
- analytics (OLAP)
  - *Give me the average runtime of films per European country, and per release date.*
- overviews
  - *What about songs from the sixties ?*

Conclusion

In Summary:

- Query-based Faceted Search (QFS) over SPARQL endpoints
  - expressivity of SPARQL
  - guidance of faceted seach
  - readability of NL
  - scalability and portability of SPARQL endpoints

Available as a mature Web app:

- SPARKLIS – `http://www.irisa.fr/LIS/ferre/sparklis/`
  - used by *GenOuest bioinformatics platform* (France), *Database Center for Life Science* (Japan), *XSB* (USA) on their own endpoints

Help!

Help me improve it by filling in the survey
...and by asking non-IT people to do so !