The SPARQLING system for SPARQL queries over GRAPHOL ontologies

Sara Di Bartolomeo[b], Gianluca Pepe[b],
Valerio Santarelli[a,b], Domenico Fabio Savo[a,b]

(a) Sapienza Università di Roma
⟨lastname⟩@diag.uniroma1.it

(b) OBDA Systems
⟨lastname⟩@obdasystems.com

Abstract. In this demo we present the SPARQLING system for SPARQL query building based on the GRAPHOL visual language for ontologies. The characterizing feature of SPARQLING is the idea to preserve and take advantage of the native diagrammatic representation of GRAPHOL ontologies, allowing the user to navigate it, and to construct a graph-based representation of the query over it through a simple point-and-click mechanism. The system then automatically transforms the graphical query into the SPARQL syntax.

1 Introduction

In computer science, an ontology is the formal conceptualization of a domain of interest, and its purpose it to favor sharing and integration of knowledge among information systems and to provide an abstract representation of the domain which is understood and agreed upon by ontology designers and domain experts.

Ontologies commonly are formalized through languages such as Description Logics [4] (DLs) or the W3C standards RDF(S)[1] and OWL 2[2]. Typically however, it is rare to encounter people in industrial settings who possess the skills to interpret the logic-based formulas used in such languages. This represents a significant issue in the adoption of ontologies in these settings, because it creates a bottleneck in the ontology design phase, where ontology engineers must work with domain experts. To mitigate this problem, numerous graphical languages for ontologies [5, 7, 10] have been proposed in recent years, and among the latest of these efforts is GRAPHOL [6, 11]. The main features of GRAPHOL are that it presents an entirely graphical syntax based on Entity-Relationship diagrams, it has a formal DL-based semantics, and is able to fully capture OWL 2. The effectiveness of GRAPHOL as the language for representing ontologies has been validated in several recent and ongoing research and instrustrial projects [2, 3].

Ontologies, aside from acting as a conceptualization of a domain, are gaining steam as a means to access and manage data. In fact, triple stores are now commonly used to

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[1] http://www.w3.org/TR/rdf-primer-20040210/

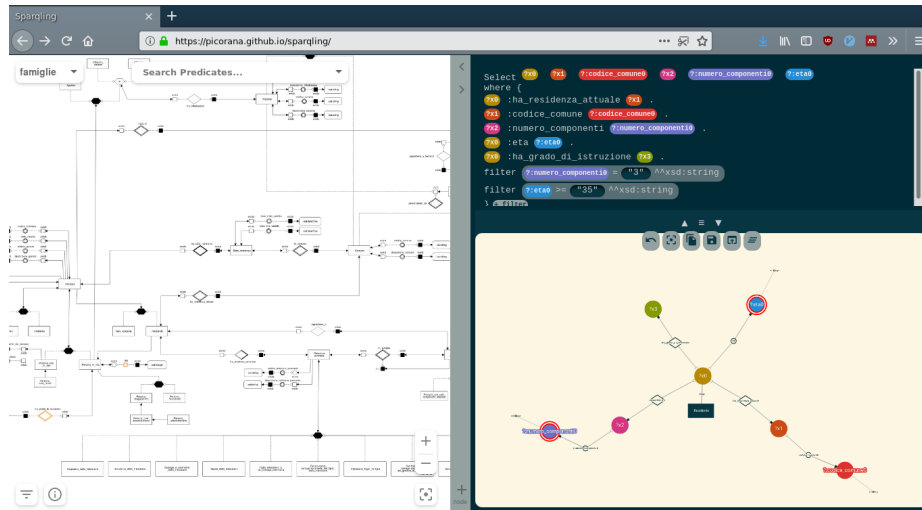[2] http://www.w3.org/TR/owl2-primer

Fig. 1. The user interface of the SPARQLING system.

manage (Linked) enterprise data [15], and semantic technologies such as ontologies are used to manage legacy data stores [12]. In these settings, the standard query language for triple stores and ontologies is SPARQL[3]. SPARQL, while simpler in structure than traditional query languages such as SQL, still suffers from the same drawback as traditional ontology languages, i.e., it is not easily understood by people who lack specific training or background. Going back to the idea of using graphical solutions to support usability, there have been several proposals for visual SPARQL query building systems in recent years, from those that allow query formulation in natural language or through context-sensitive completion mechanisms [9, 13], to those that provide support for constructing graph-based representations of the SPARQL query [1, 8, 14].

In this demonstration, we present the latest of these systems, SPARQLING. SPARQLING is a web application that allows to build SPARQL queries based on the GRAPHOL language, whose characterizing feature is the idea to preserve and take advantage of the native diagrammatic representation in GRAPHOL of the ontology. Through SPARQLING's interface, the user can navigate the ontology and formulate a graph-based representation of a SPARQL query over it through a simple point-and-click mechanism. To illustrate the main features of SPARQLING, we will invite attendees of the demo to experiment it on the Base Register of Individuals, Families, and Cohabitation (BRIFC) ontology, developed during a joint project between Sapienza University of Rome, OBDA Systems, and the Italian National Institute of Statistics (Istat) [3].

SPARQLING is an open-source project, available on Github[4], and is supported by OBDA Systems[5].

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[3] https://www.w3.org/TR/rdf-sparql-query/

[4] https://github.com/picorana/painless_sparql

[5] https://www.obdasystems.com/

2 The SPARQLING System

SPARQLING is a web-based application for constructing SPARQL queries by exploiting the GRAPHOL representation of the ontology. The development of SPARQLING originates in systems for Ontology-based Data Management [12], hence it currently supports the conjunctive query fragment of SPARQL. As shown in Figure 1, the system interface is divided in three main sections, which we describe briefly.

The main area contains the GRAPHOL diagrams. Through the tools in this area, the user can navigate and inspect the ontology along with its documentation. The GRAPHOL representation allows the user to clearly perceive its structure and content, facilitating the task of constructing the query over the ontology. Indeed, the mental process of writing a query is natural when looking at a GRAPHOL diagram because it recalls the act of tracing a path on it. Through the interaction with the GRAPHOL diagram the user builds the ontology query, whose visual representation, called *query graph* is provided in the second area. This representation has the structure of a graph, to naturally recall SPARQL's basic graph patterns, where nodes represent subjects or objects of each triple pattern, and edges represent predicates. To provide a visual correspondence with GRAPHOL, the graphical representation of the ontology predicates in the query graph is the same as in GRAPHOL. The third section shows the SPARQL representation of the query, which the user can inspect or modify. Each change in the SPARQL query is immediately mirrored in the query graph, and viceversa, to keep the two versions constantly aligned. The user can choose to interact with both representations of the query, or only with one of the two, according to his preference.

To add a triple to the basic graph pattern of the query, the user double clicks on a predicate symbol in the GRAPHOL diagram. According to the specific predicate symbol, the corresponding edge and nodes are automatically added to the query graph. Actions on specific nodes of the graph are performed through contextual menus that appear by right clicking on a node.

The application is developed in JavaScript, using the Cytoscape.js library[6] for the rendering of the GRAPHOL diagram and the query graph, and the cola.js library[7] for the force-directed layout of the query graph.

3 Application scenario and Demo Section Overview

We demonstrate the SPARQLING system through the Base Register of Individuals, Families, and Cohabitation (BRIFC) ontology, developed in Graphol during a joint project between Sapienza University of Rome, OBDA Systems, and the Italian National Institute of Statistics (Istat) [3].

The BRIFC ontology depicts a portion of the domain of the Italian Integrated System of Statistical Registers of Istat, which acts as the base for Istats production surveys. The ontology is composed of two modules: the first regarding people, their family relationships, and their level of education; the second regarding the Italian territory and citizen residential data. In the project, the ontology was developed in support of the

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[6] http://js.cytoscape.org/
[7] http://ialab.it.monash.edu/webcola/

adoption of the OBDM approach for data access and quality checking. The experimentation has confirmed the effectiveness of this approach for these purposes, and of GRAPHOL as a means of representation of the ontology both in the design phase and in the deployment phase. Currently, we have given way to the experimentation of the SPARQLING system as the tool for the production of SPARQL queries in the project.

During the demo, attendees will interact with the SPARQLING system, inspecting the GRAPHOL BRFIC ontology and experiencing how the SPARQL query construction process is simplified through the use of the system interface. We will also show how SPARQLING can interact with the SPARQL endpoint in the Mastro system[8] for OBDM.

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[8] www.obdasystems.com/mastro