Ontology-based Visual Querying with OptiqueVQS: Statoil and Siemens Cases*

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Abstract. In this demo, we present an ontology-based visual query system, namely OptiqueVQS, for querying static and dynamic data sources. The demo will be based on industrial scenarios provided by Statoil ASA and Siemens AG.

Keywords: Visual query formulation, Ontology, Stream, Sensors, OBDA

1 Motivation

The operational efficiency and effectiveness of business processes rely on domain experts' agility in interpreting data into actionable business information. In a typical value creation scenario, domain experts depend on IT experts to extract and deliver relevant data by translating their information needs into extract-transform-load (ETL) processes. Such a workflow is too time intensive, heavy-weight and inflexible; therefore, domain experts need to extract and analyse the data of interest directly. Although querying is an essential instrument for meeting ad hoc information needs, domain experts do not necessarily have technical skills and knowledge on databases and formal query languages, such as SQL and SPARQL, to extract data. In this context, visual methods for query formulation undertake the challenge of making querying independent of users' technical skills and knowledge on the underlying textual query language and data structure [4].

To this end, we have developed an ontology-based visual query system, namely OptiqueVQS [17,19,15,1], to enable domain experts to formulate queries on their

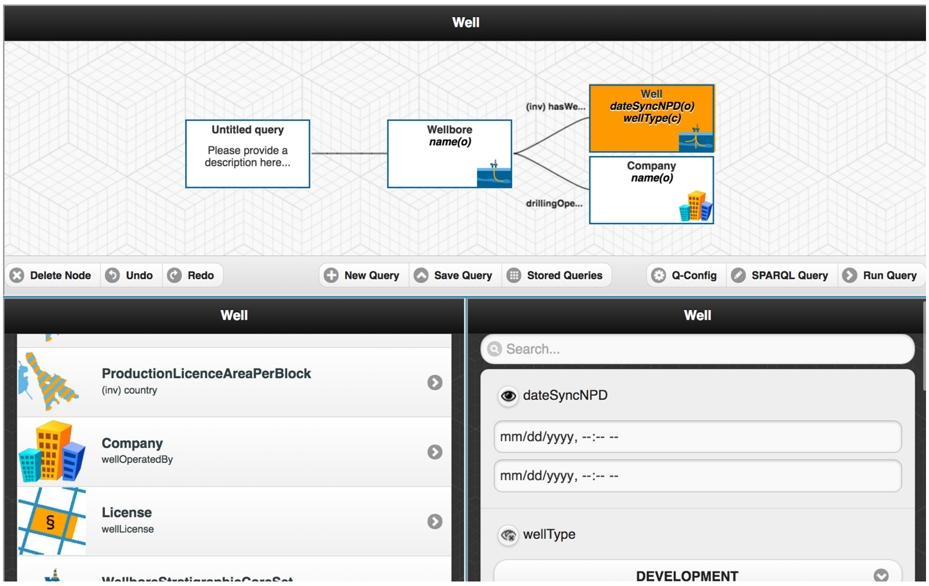

Fig. 1. OptiqueVQS interface – querying static data.

own with respect to an expressive and intelligible domain vocabulary provided by an ontology. OptiqueVQS allows querying static and dynamic data (i.e., stream-temporal) and has been developed within an industrial project, called Optique [5,7,8,10,11]. Optique offers an end-to-end ontology-based data access (OBDA) platform for Big Data. OBDA technologies [14] virtualise data sources into RDF and enable in-place access to legacy data (e.g., relational) over ontologies without duplicating or migrating data into triple stores.

In this demo, we present OptiqueVQS over two industrial scenarios, involving static and dynamic data, provided by Statoil ASA [9] and Siemens AG [12,6] respectively.

2 System Overview

OptiqueVQS is a visual query system (VQS), which is a system of interactions rather than a visual query language (VQL) with a formal syntax and notation [16]. It combines multiple representation and interaction paradigms in a widget-based architecture to address a broad range of user and task types. One can formulate tree-shaped conjunctive queries with aggregation. Expressivity is intentionally compromised for the sake of usability; more precisely, frequently used query types presenting less complexity to the users are of priority.

Figure 1 and Figure 2 are examples for querying static [18] and dynamic data [19] sources respectively. OptiqueVQS generates SPARQL for static data and STARQL [13] for dynamic data. Users formulate queries by selecting concept-relationship pairs from a menu-based widget, and constraining and selecting

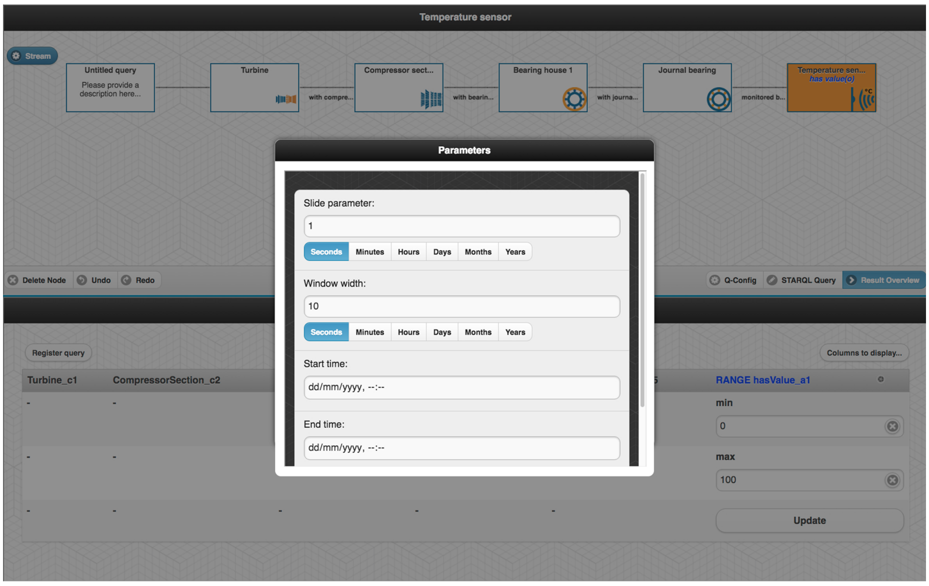

Fig. 2. OptiqueVQS interface – querying dynamic data.

attributes from a form-based widget (see Figure 1). Formulated queries are presented as trees, where typed variables appear as nodes and object properties appear as arcs. Dynamic properties are coloured in blue and when one is selected users could provide parameters such as slide and window and can select predefined templates (see Figure 2).

The main component of OptiqueVQS's backend is a graph projector [19]. This component uses a technique to extract a suitable graph-like structure from a set of OWL 2 axioms [3,2] and feeds OptiqueVQS's widgets in order to enable a graph-based navigation over an ontology during query formulation. A data sampler component is used to enrich the underlying ontology with additional axioms to capture values from data that are frequently used and rarely changed. This allows presenting attributes in different types, such as sliders, multi-select boxes, date pickers etc, with respect to the underlying data. Moreover, backend harvests the query log for ranking and suggesting query extensions as a user formulates a query [15].

Finally, a set of user experiments with casual users [17] and domain experts [18,19] has been conducted. The results have revealed high efficiency and effectiveness.

3 Demonstration Scenario

This demo will be based on anonymised Siemens relational stream sensor data gathered from different appliances, such as steam turbines and generators, and on a public fragment of Statoil data regarding the petroleum activities.

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