How to Add a User Interface on Top of an External SPARQL Endpoint: Case Nobel Prize Sampo

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Abstract

This paper discusses and demonstrates how to create an intelligent user interface (UI) on top of an external SPARQL endpoint, when only an open SPARQL API is available. As a case study, the *Nobel Prizes & Laureates* Linked Open Data (LOD) service provided by the Nobel Foundation and the Sampo-UI framework for faceted search, browsing, and data analyses are considered. To show how this can be done easily, the semantic portal Nobel Prize Sampo, available online and on GitHub, is described and the lessons learned are discussed.

Keywords

linked data, user interface, semantic portal, SPARQL

1. Introduction: Adding a User Interface on a SPARQL endpoint

As more and more Linked Open Data (LOD) are published via SPARQL endpoints, the challenge of creating User Interfaces (UI) that are easy for searching, browsing, and analyzing the LOD has become ever more important. This paper presents lessons learned [1] in applying the Sampo-UI framework [2, 3] to create an UI on top of an external SPARQL endpoint. Key features of the Sampo-UI include: 1) The UI is created in a *declarative fashion* by modifying a set of JSON configuration files [3]. 2) Based on the Sampo model [4], the *data service is completely separated* from the UI design via the SPARQL API only, which makes it possible to create UIs for external endpoints. The UI is adapted to the underlying data model (ontologies) by tweaking SPARQL queries. 3) To facilitate extremely quick prototyping, an *existing "vanilla" Sampo-UI application is used as a starting point* and adapted to the new application by modifying the configuration files and SPARQL queries.

The Sampo-UI framework provides means for configuring dataset access and UI perspective definitions, thus making it conceptually applicable for declarative UI creation over any external knowledge graph that is accessible through a SPARQL endpoint. The practical application of the Sampo UI framework up to now has been mainly in the development of semantic portals within the Finnish Linked Open Data Infrastructure for Digital Humanities initiative[1] [5, 4], where the UI developers had the possibility of influencing the decisions on the data storage system implementation (e.g., setting up the SPARQL endpoint, choosing the SPARQL engine and additional support tools, such as text search index). The work of this paper demonstrates the possibility of adapting Sampo-UI also for situations when the SPARQL endpoint is available externally and only the endpoint access and UI components can be configured to ensure the functionality of the data portal.

Semantics 2025: Posters and Demos, September 03–05, 2025, Vienna, Austria
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As an example, we developed and made available a Sampo-UI based portal on top of the Nobel Prizes SPARQL endpoint[2] that works with the original Nobel Prizes data maintained by the Nobel Prize Foundation. Experiences are discussed of developing the Nobel Prize Sampo portal configurations and adjustments to the Sampo-UI environment that have been necessary to enable its application in the externally available data environment.

2. Related Work

Sampo-UI is not the only available tool for building web applications based on SPARQL endpoints. For example, Metaphactory[3] [6] is a commercial platform with a wide range of features to curate, visualize, and explore knowledge graphs. Although Metaphactory has powerful features, it is neither open source nor free. An example of a free and open source tool is the Linked Data Reactor (LD-R)[4] [7]. LD-R provides a starting point for creating a web application that can be configured to view, browse, and edit knowledge graphs. FERASAT [8] is a tool built on top of LD-R to provide faceted search and visualization features.

The Nobel Prizes dataset itself has been the subject of numerous studies and presentations. In addition to the official Nobel Prizes portal[5] maintained by the Nobel Prize Foundation, a demo portal was created in the Metaphactory environment, as well[6]. The demonstration portal described in this paper is developed based on the original data from the Nobel Prize SPARQL endpoint integrating on-the-fly the data from other Linked Data resources (as e.g., Wikidata), as well as by relying on a fully open source Sampo-UI framework in its creation. The end users of this demo portal would appreciate also the University perspective (cf. Section 4) not included in other presentations.

3. UI Logic of the Sampo-UI Framework

Sampo-UI aims to create a kind of generic "standard" UI logic model for LOD applications, based on the basic concepts of classes, their properties, and instances in a Knowledge Graph (KG). The landing page of a Sampo portal[7] based on the Sampo-UI tool[8] contains a series of *application perspective* windows that allow one to search, browse, and analyze the underlying KG from different perspectives, based on the classes of the KG. A perspective for a class contains a faceted search engine whose facets are based on the properties of the class; by making selections on the facets, a corresponding subset of individuals of the class is retrieved as the search result, and hit counts on the facet categories are updated to guide the search. The result set can then be analyzed on different tabs, e.g., on a map or timeline or using graphs. At any point, an individual can be chosen for a closer look at its *instance page* that provides comprehensive linked data about the individual. Here it is also possible to analyze and visualize data about the individual by using separate tabs.

4. Nobel Prize Sampo: Demonstration

We built the Nobel Prize Sampo portal over the existing Nobel Prize dataset, using only the SPARQL access to the KG, as well as other Linked data sets, where appropriate. The Nobel Prize dataset schema is visualized in Figure 1 using the data schema presentation service of the ViziQuer tool; cf. [9]. To create the portal, we select its three main *perspectives*: the Nobel Prizes, the Laureates, and the Universities, with which the laureates are affiliated, based on the respective data classes.

[2]Nobel Prizes data services: https://www.nobelprize.org/about/developer-zone-2/
[3]Documentation is available at https://help.metaphacts.com/resource/Help:Documentation.
[4]The source code of LD-R is available at https://github.com/ali1k/ld-r. Unfortunately, LD-R is apparently not currently maintained actively, as at the time of writing in June 2025 the last commit to the repository is from 2022.
[5]Nobel prizes: https://nobelprize.org
[6]Welcome to metahactory: https://nobelprize.metaphacts.cloud/resource/StartPage
[7]Sampo portal series: https://seco.cs.aalto.fi/applications/sampo/
[8]Code on Github https://github.com/SemanticComputing/sampo-ui; project homepage https://seco.cs.aalto.fi/tools/sampo-ui/

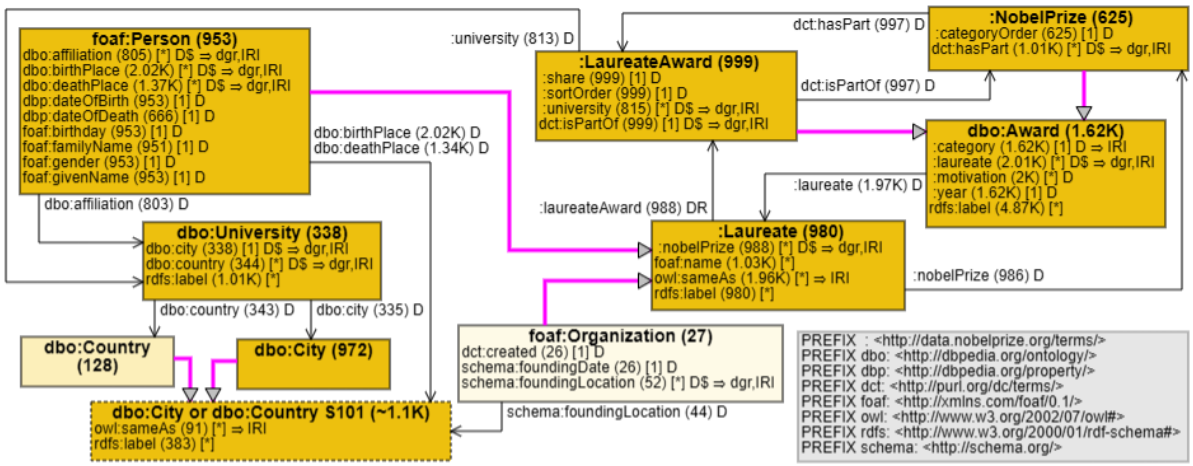

Figure 1: Data schema of the Nobel Prize dataset using ViziQuer [9]

Each perspective can have a number of (filterable and synchronized) views (such as a table, a map, a pie or bar chart). The Nobel Prize Sampo portal has table views for each of the three perspectives, along with country, category, and prize count distribution as well as country map views for Laureates, year and category distributions for Nobel Prizes, and laureate award count distribution for Universities. The search facets in the perspectives include name and award motivation text searches, affiliation, and prize category multi-choice selections for laureates, and similar facets in the other perspectives.

The data fields used in the UI presentation and search facets come from the properties of the data classes associated with perspectives; sometimes property paths or even dedicated SPARQL queries are used in the UI field and facet definition. This has allowed to create rich presentation views from the Nobel Prize dataset itself, such as textually presented field of all prize laureates, their shares, and motivation in the Nobel Prize perspective, and to include the data from other sources such as the laureate image and country coordinate data from Wikidata (based on Wikidata links available through owl:sameAs property). The individual laureate presentations also include further information from Wikidata, such as occupation, other awards, OpenAlex identifiers, and given TED talks.

The implemented portal with all three perspective definitions and respective instance pages is available online[9]. Figure 2 shows the table view of a sample perspective of Nobel Prize laureates.

5. Nobel Prize Sampo: Experience

The core part of the portal *implementation* has been the creation of configurations of the main portal and the involved perspectives, including presentation information for views/tabs, properties (data fields), and facets, as well as SPARQL queries for the retrieval of instance and its field information within the perspective and for selection of data specific to different views/tabs.

Providing the above information allows to obtain a decent demonstration portal for exploring the Nobel Prize data. Still, for a portal with fully working Sampo-UI functionality outside its usual application context (e.g., the data stored in a local repository supported by a SPARQL engine of particular type), a number of challenges have arisen, and have been dealt with by adapting the open source code of the original Sampo-UI system. Some of the code adaptations that have enabled the full Nobel Prize Sampo portal functionality include the following, cf. [1]:

- addition of universal text search functionality based on SPARQL query standard REGEX capabilities (in addition to the possibility to use FUSEKI JENA full text indexes when available)
- changes to the underlying SPARQL queries for handling null/unknown property values in facets, with a recommendation to provide different SPARQL templates for different SPARQL engines

[9]Nobel Prize Sampo portal: https://nobel-prize-sampo.lumii.lv

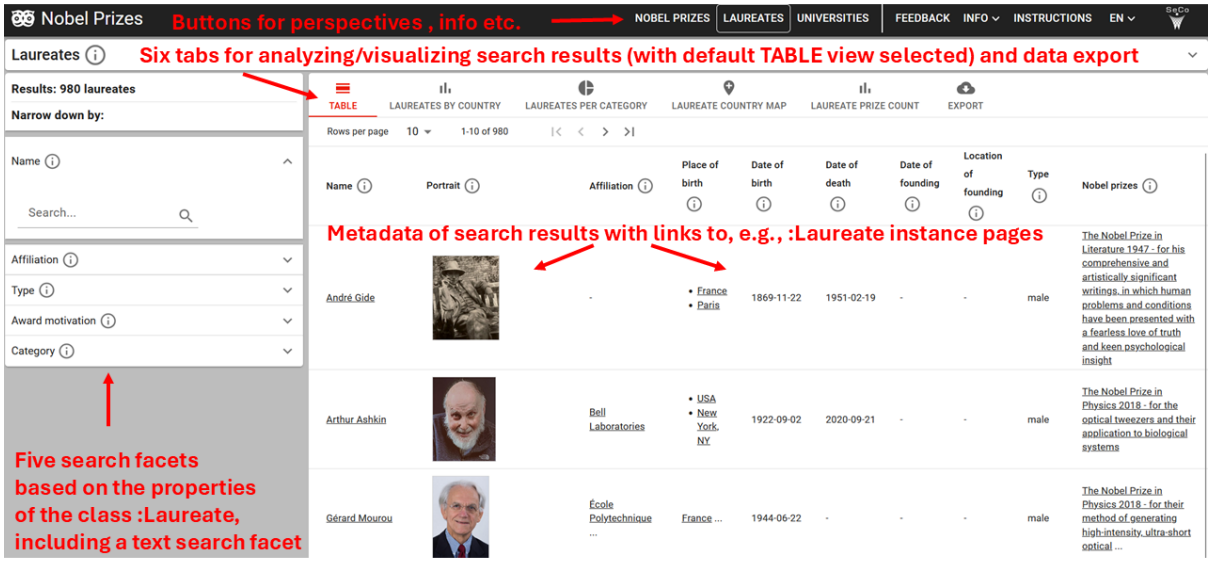

Figure 2: A view of the Laureates perspective in the Nobel Prize Sampo portal

- introduction of SPARQL query pipeline mechanism for view data creation to provide a more reliable solution for on the fly data integration from multiple SPARQL endpoints compared to SPARQL SERVICE clause alternative that was found to be unreliable for federated queries
- addition of the possibility to use OpenStreetMaps[10] for the map view visualization in addition to Mapbox[11] that is proprietary and require account creation
- re-arranging of ORDER BY clauses in the SPARQL query templates to widen the scope of SPARQL engines that serve the table data in correct order
- changes to enable correct handling of resource URIs that have percent-encoded non-ASCII characters into ASCII character set

Full code adjustments of the Sampo-UI system along with the specific Nobel Prize Sampo portal configuration are available on GitHub[12] from where a running version of the portal can be set up locally. A running and maintained public version of the Nobel Prize Sampo portal is available online.

6. Conclusions

The Sampo-UI tool has been shown to be usable in creating a user interface on a given external knowledge graph that is outside the control of the developer of the UI. Furthermore, Sampo-UI has demonstrated the capability to integrate efficiently the data from various connected linked data sources, such as the Nobel Prize data set and Wikidata, thereby exploiting efficiently the Linked Open Data paradigm of bringing together decentralized enriching information.

The open source availability of the Sampo-UI allows to extend its functionality to meet the needs of a particular application scenario, and the additional configurations and the code created in this demonstration allows both for easy extending or modifying the created Nobel Prize Sampo portal example, and for reusing the code solutions in other situations of UI creation, including those of creating UIs over existing external SPARQL endpoints. Since Sampo-UI is a system of potential interest for

[10] https://www.openstreetmap.org
[11] https://www.mapbox.com
[12] Code on GitHub: https://github.com/LUMII-Syslab/sampo-ui-nobel-prize

different UI creators, an environment enabling easy integration of updates supplied by different users, including the ones described in this paper, into it would be relevant and is work in progress as part of the Finnish national research infrastructure initiative FIN-CLARIAH/DARIAH.fi for Digital Humanities.

We also look forward to automating the creation of SAMPO-UI configurations based on annotated data schema description along the lines of [10, 11], or some related approach.

Acknowledgments

This work has been partially supported by a Latvian Science Council Grant lzp-2024/1-0665 "What is in your Knowledge Graph?". Sampo-UI development is supported by the Research Council of Finland based on the European Union NextGenerationEU instrument.

Declaration on Generative AI

The authors have not employed any generative AI tools.

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