Ontology-based Information Visualization in Integrated UIs

Heiko Paulheim
SAP Research
Bleichstrasse 8, 64283 Darmstadt
heiko.paulheim@sap.com

Lars Meyer
SAP Research
Bleichstrasse 8, 64283 Darmstadt
lars.meyer@sap.com

ABSTRACT

This demo presents the *Semantic Data Explorer*, which visualizes linked data contained in different integrated applications. It presents a conceptual graphical view of data, which can be combined with user interfaces of legacy applications to facilitate a *hybrid view*.

ACM Classification Keywords

D.2.2 Software Engineering: Design Tools and Techniques—*User Interfaces*; H.5.2 User Interfaces: Graphical user interfaces (GUI); I.3.6 Methodology and Techniques: Interaction Techniques

General Terms

Design, Human Factors

Author Keywords

Visualization, Linked Data, UI Integration, User Experience

INTRODUCTION

Today, information is often contained in different applications which are not integrated with each other. The task of finding relevant information in those applications resembles the search for a needle not only in one haystack, but in multiple, heterogeneous haystacks.

UI integration approaches, such as portals and mashups [2], can provide valuable insights by coupling those applications, but they do not provide a unified view on the data contained therein. On the other hand, *linked data* [1] can provide such a unified view, and reasoning can be employed to explicate implicit information. As linked data facilitates integration on the data, not the user interface level, it is difficult to combine with the potentially powerful UIs of legacy applications.

This demo shows an approach which combines both ideas: integrating user interfaces with a unified linked data view, the *Semantic Data Explorer* (SDE). We present a user study showing that information search can be improved significantly by this approach.

IUI'11, February 13–16, 2011, Palo Alto, California, USA.
ACM 978-1-4503-0419-1/11/02.

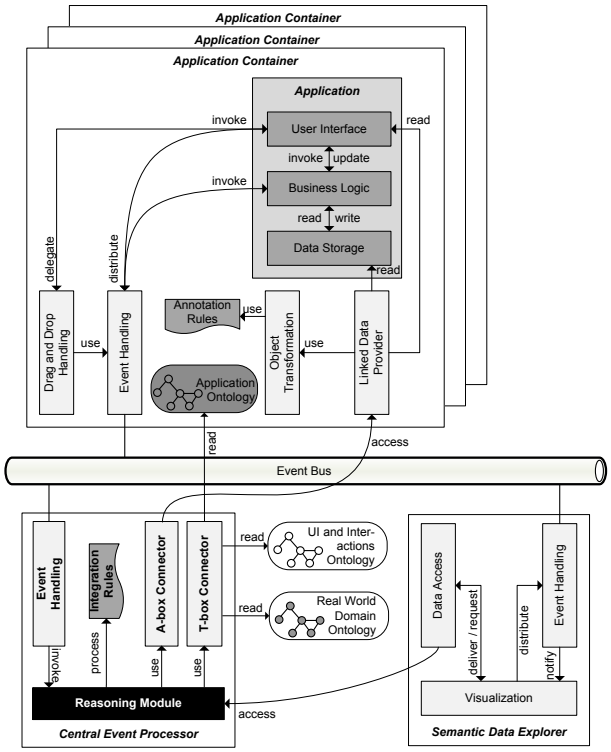

Figure 1. Overview on the architecture of our framework. Each integrated application runs in a container, which provides information as linked data and is connected to a message exchange bus. The Semantic Data Explorer visualizes that data by directly interfacing a reasoner.

PROTOTYPE

Figure 1 depicts the overall architecture of our UI integration framework, including the SDE. The framework uses semantically annotated events and different ontologies for tightly integrating different, heterogeneous applications, running in containers. Those containers provide services for event exchange, managing drag and drop across applications, and transforming and providing application data as linked data.

A central event processor, based on a reasoner, works as an indirection between the individual applications, thus enforcing loose coupling. Its decisions are based on integration rules defining the possible interactions between the integrated applications, and on different ontologies. The instance data used by the reasoner is directly retrieved from the application containers' linked data providers. Details on the framework and its implementation can be found in [5].

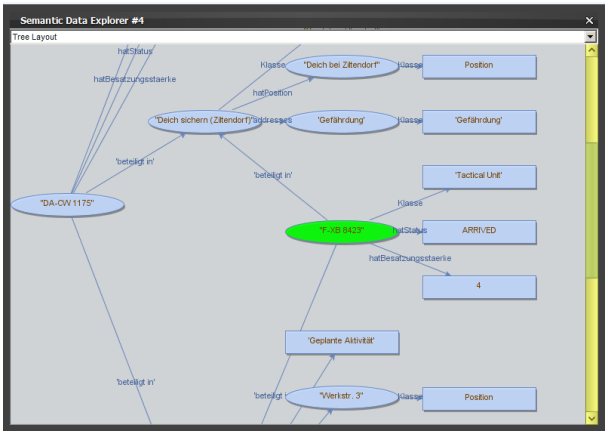

Figure 2. Screen shot of the Semantic Data Explorer (SDE)

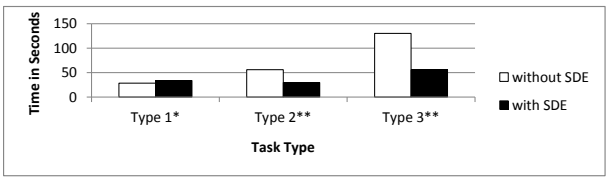

Figure 3. Average task completion times in seconds for the different types of tasks (*: p<0.05, **: p<0.01).

The SDE accesses the applications' data indirectly by interfacing the central reasoner, which delivers a unified view on the data, including inferred implicit information. The data is visualized as a semantic network, as shown in figure 2. The visualization is coupled with the original applications, i.e., selecting an object in an application highlights the corresponding node in the semantic network, and vice versa. Users can drag and drop objects from integrated applications to the SDE and navigate through the semantic network created[1].

EVALUATION

To validate the usefulness of our approach, we conducted a user study in the field of emergency management, using the emergency management system *SoKNOS* [4] as a basis. We measured the task completion time, the error rate, as well as the user experience based on the questionnaire described in [3], giving insight into five user experience criteria: attractiveness, perspicuity, efficiency, stimulation, and novelty.

A group of 22 volunteer users (age 22 to 52, 19 male, 3 female) had to perform twelve tasks of three different types of complexity. The tasks were divided into two blocks, one block with and one block without using the SDE. Both the order of blocks and the assignment of the tasks to the blocks was varied. The questionnaire had to be filled out after completing each block.

While there were no significant deviations concerning the error rate, a highly significant performance improvement could

[1]A video showing a step by step demo can be seen at `http://soknos.de/index.php?id=470&L=0`

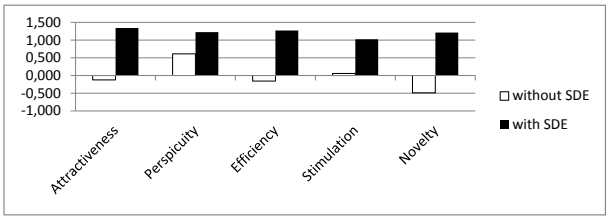

Figure 4. Results of the questionnaires on user experience (best: +3, worst: -3). All differences are statistically significant with p<0.01.

be observed for the more complex type 2 and 3 tasks (with a small degradation for the simple type 1 tasks), as shown in figure 3. Furthermore, the user experience was significantly better with the use of the SDE for all five criteria, as shown in figure 4. The evaluation furthermore showed that those results are also significant for the subgroup of participants who had no or only little experience with ontologies and semantic networks.

CONCLUSION AND FUTURE WORK

The evaluation of the Semantic Data Explorer shows that hybrid views combining linked data with legacy UIs can add a significant value to integrated UIs, even for end users that are not particularly trained. Future Work will concentrate on different forms of visualization, especially on personalized and domain-specific views of linked data. Further evaluations will concentrate on larger data sets and on simulated stressful situations, e.g., by introducing strict time limits for each task.

REFERENCES

1. C. Bizer, T. Heath, and T. Berners-Lee. Linked Data - The Story So Far. *International Journal on Semantic Web and Information Systems*, 5(3):1–22, 2009.

2. F. Daniel, J. Yu, B. Benatallah, F. Casati, M. Matera, and R. Saint-Paul. Understanding UI Integration: A Survey of Problems, Technologies, and Opportunities. *IEEE Internet Computing*, 11(3):59–66, 2007.

3. B. Laugwitz, T. Held, and M. Schrepp. Construction and Evaluation of a User Experience Questionnaire. In A. Holzinger, editor, *HCI and Usability for Education and Work, 4th Symposium of the Workgroup Human-Computer Interaction and Usability Engineering of the Austrian Computer Society (USAB 2008)*, volume 5298 of *Lecture Notes in Computer Science*, pages 63–76. Springer, 2008.

4. H. Paulheim, S. Döweling, K. Tso-Sutter, F. Probst, and T. Ziegert. Improving Usability of Integrated Emergency Response Systems: The SoKNOS Approach. In *Proceedings "39. Jahrestagung der Gesellschaft fr Informatik e.V. (GI) - Informatik 2009"*, volume 154 of *LNI*, pages 1435–1449, 2009.

5. H. Paulheim and F. Probst. Application Integration on the User Interface Level: an Ontology-Based Approach. *Data & Knowledge Engineering Journal*, 69(11):1103–1116, 2010.