Applying Semantic Web Services to Virtual Travel Agency Case Study

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ABSTRACT

Online travel agencies and services provide a straightforward means for travelers to manage and book their itineraries from the convenience of their own homes or offices. As online traveling services becomes more sophisticated, it becomes increasingly possible to avoid visiting brick and mortar travel agencies even for more complex traveling needs. However, clients often must visit a multitude of travel related web sites in order to check recent developments in prices, convenience of connections, synchronize flights with airport transport etc. To overcome these limitation the Virtual Travel Agency (VTA) case study proposes applying Semantic Web services and the Web Service Modelling Execution Environment (WSMX).

Categories and Subject Descriptors

D.2.11 [**Software Architectures**]: languages, domain specific architectures, patterns

Keywords

Semantic Web Services, Service Oriented Architecture, Case study, Virtual Travel Agency (VTA)

1. INTRODUCTION

This paper describes a prototype of a VTA application demonstrating how the application of Semantic Web and Semantic Web service technology makes it possible for individual customers to organize and book their itineraries. The application allows users to impose various requirement on particular steps of their journey such as flight booking, organizing airport shuttle or train and hotel reservation. User might impose restrictions on the price of the tickets, time frame between the flight and the train or shuttle, hotel location within his destination place, etc. Services are tailored on-the-fly by the web application and place no cost burden on the travel agency. To create such tailored services through traditional software design is time consuming and likely to be uneconomic.

In our VTA case study we use WSMX[1] as a run-time environment for Semantic Web services. Enhancing Web Services with semantic descriptions provides a foundation for their semi-automatic discovery, composition, invocation and interoperation enabling seamless interactions between them [2] and keeping human interaction to a minimum. Research on WSMX aims to assess the viability of WSMO[2] framework and to provide a reference implementation of the system. WSMO constituents such as Goals, Mediators, Ontologies and Web services are expressed in WSML[3]. WSMX is composed of loosely-coupled components that carry out various tasks related to WSMO. Some of the main components of WSMX are Service Discovery, Data Mediation, Process Mediation, Service Selection, and Communication Manager.

2. PROTOTYPE DESCRIPTION

The prototype executes a VTA case study leveraging Semantic Web services technology in terms of WSMO framework. This approach has several advantages over purely syntactical XML-based interaction solutions including its ability to express partners' complex behaviours in terms of WSMO Choreography [3], mediation between data and process representations, and dynamic discovery. In a nutshell, semantic descriptions provide a foundation for logic reasoning about service description and behaviour. This section presents the necessary steps to set up semantically-enabled interaction, the description of the developed prototype, and benefits stemming from the semantic integration.

In order to semantically integrate a client with the VTA provider's Web services, both the capability and the behaviour of the interacting parties have to be semantically described. The client expresses the requested functionality and expected behaviour (choreography) in terms of WSMO Goal, while the capability and choreography offered by the provider is described as a WSMO Web service.

The following preliminary steps have to be taken:

- **Creating WSMO Goals**. The requirements and behaviour of the client has to expressed as WSMO Goal. In VTA case, Goals are based on a template approach where the Goal structure is defined but actual input values can be provided during the run-time by the client. The web application provides forms where user can specify his requirements and input values.

[1]Web Services Execution Environment (WSMX) - http://www.wsmx.org

[2]Web Services Modeling Ontology (WSMO) - http://www.wsmo.org

[3]Web Services Modeling Language (WSML) - http://www.wsmo.org/TR/d16/d16.1/v0.21

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- **Creating WSMO Web service**. Provider's Web services has to be semantically described, which includes lifting arbitrary XML messages to the semantic level by the ontology conceptualization and describing message exchange patterns (choreographies) using the Ontologized Abstract State Machines formalism of WSMO Choreography.
- **WSML grounding to WSDL.** Bidirectional mappings between XML and WSML have to be provided.
- **Ontology mapping.** Since it is likely that interacting partners use different ontologies it is necessary to provide appropriate bidirectional mappings. WSMX takes a semi-automatic approach to this problem. Mappings between the ontologies are created during design-time by using a Data Mediation Mapping tool. This tool gives a hint of the most likely mappings by analyzing both naming convention and structure of concepts. The human's role is to ensure accuracy of these mappings and to adjust them if necessary.

Figure 1 presents this VTA scenario. The client communicates with the VTA portal via the HTTPS protocol, which provides a secure communication channel. The VTA portal allows the itineraries goals to be expressed using web forms for which appropriate WSMO Goal templates are populated with the actual values and conditions. Once a WSMO Goal with actual values is created it can be sent to WSMX.

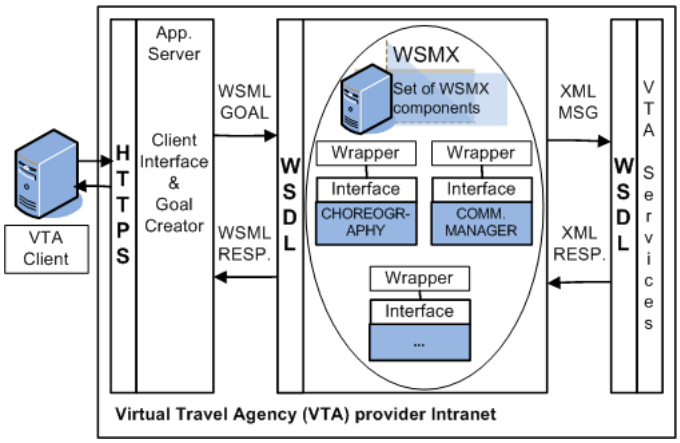

Figure 1: Architecture of the prototype

WSMX acts as a transparent, intermediary layer between interacting parties. All semantic descriptions are provided on top of existing provider's syntactic services, making providers unaware of this semantic layer. No changes are involved in providers' services and native data formats are preserved. User's desires are expressed via web forms that are mapped to appropriate Goal separating him from WSML representation.

Once these semantic descriptions are in place, the merits of Semantic Web services and WSMX can be leveraged. WSMO Choreography allows the declaration of a complex requirement on the actions that client is willing to take or provider is willing to provide. For instance, the client might express through the web forms interface his goal to book a flight from Dublin to Munich on a given data below certain price, then to arrange a shuttle or train from the airport and finally to make a reservation in the hotel situated within 5 km range from the city center. This goal is mapped to the WSMO Goal template, that is populated with input instances like origin and destination airport, final destination and requirements regarding the hotel. Then this Goal is submitted to WSMX, where provider matching this Goal is discovered and according to Goal and Web service choreography communication is carried out. The choreography specifies the execution path of the given partner, which boils down to message exchange patterns. To ensure that the given message exchange is legal, logic formulas are utilized as the transition guards before the given message can be dispatched or received.

Serious advantages of our platform can be also identified in the area of mediation both on the data and process level. The client and discovered Web service might use a different conceptualization in their ontologies which leads to ambiguities that may hamper if not make unfeasible their communication. Data and process Mediation allows these mismatches to be overcome and enable partner communication despite of their data and behaviour differences.

The Data Mediator executes bidirectional mappings between the ontologies, using mapping rules previously defined. The Process Mediator [1] tackles mismatches in partners' choreographies employing logic reasoning in order to evaluate transition rules and determinate if the mismatches can be mitigated. Whilst from the client point of view all required data is sent in a single message, on the VTA Web services side it is the contrary, i.e. there are specialized entrypoints, to which, parts of the client's messages has to be delivered.

3. CONCLUSIONS

We believe that developed prototype for VTA case study is a viable, efficient and dynamic approach. The system allows the expression of goals by the client using web forms that in turn are mapped to WSMO Goals which allows them to be executed by WSMX. User does not have to visit multiple web sites, but can use one portal that aggregates multiple tourist services and can be extended with new ones.

4. ACKNOWLEDGEMENTS

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Keywords: e-Tourism; Semantic Grid; Semantic Web; Web service; Agent. 1 Introduction. Tourism has become the world's largest industry, composing of numerous enterprises such as airlines, hoteliers, car rentals, leisure suppliers, and travel agencies. The World Tourism Organization predicts that by 2020 tourist arrivals around the world would increase over 200% [1]. In this huge industry, e-Tourism representing almost 40% of all global e-Commerce [2] is facing a need of the next generation infrastructure to support more innovative and sophisticated tasks like dynamic packaging, travel plan In accordance with the present invention, there are provided nucleic acids encoding human metabotropic glutamate receptor subtypes and the proteins encoded thereby. In a particular embodiment, the invention nucleic acids encode mGluR1, mGluR2, mGluR3 and mGluR5 subtypes of human metabotropic glutamate receptors. In addition to being useful for the production of metabotropic glutamate receptor subtypes, these nucleic acids are also useful as probes, thus enabling those skilled in the art, without undue experimentation, to identify and isolate related human receptor subunits. In addition to disc 5. Uk: Travel websites replace agents as most popular way to book a holiday May 2006. 6. T. Andreasen and H. Christiansen "Counterfactual exceptions in deductive database queries" Proceeding of 12th European Conference on on Artificial Intelligence (ECAI'96) pp. 340-344 August 1996. 7. A. Balmin T. Papadimitriou and Y. Papakonstantinou "Hypothetical queries in an olap environment" Proceedings of 26th International Conference on Very Large Data Bases (VLDB'00) pp. 220-231 September 10-14 2000.Â 24. M. Zaremba M. Moran and T. Haselwanter "Applying semantic web services to virtual travel agency case study" Proceedings of 3rd European Semantic Web Conference (ESWC'06) June 11-14 2006.