Context Mediation as a Linked Service

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Background and Motivation The past few years have seen important advances in the domain of Semantic Web Services (SWS), especially in data mediation. Most work in the area has focused on the semantic alignement of input/output concepts at design time, and on schema-level integration [1]. Correct communication is not guaranteed even when two services are connected to each other with compatible input/output concepts. Indeed, conceptually compatible data may not be usable when data representation and scaling conflicts occur. To address this problem, which we refered to as the *contextual heterogeneity* problem, we rely on the Minimal Service Model [2] and operate with Linked Services as SWS that offer explicit semantics. In this paper, we present our Mediation as a Service (MaaS) architecture and demonstrate its applicability with a running scenario and a prototype.

Mediation as a Service The overall idea of this paper is to provide an architecture, accessible as a service and that enables on-the-fly mediation over compatible services based on the automated discovery and injection of mediation services at runtime, i.e. services able to convert data from one context to an other, at runtime. Such an architecture requires, at design time, (1) to provide enough semantic information to make data interpretation explicit, and at runtime, (2) to identify data that could be subject to diverging interpretations and (3) to trigger mediation mechanisms to perform data transformation. We rely on semantic descriptions of services, expressed with the MSM model associated with the Quantities, Units, Dimensions and Data Types ontologies [3]. These semantic annotations bring us means to formally describe exchanged data and their contextual sensitivity, but also to add information concerning any additional restrictions about the data to be exchanged. We attach input and output data (Message Parts) of our services to concepts of our domain ontology (e.g. Price) and to sets of meta-attributes that represent their contextual sensitivity (e.g. currency unit, VAT rate, etc.).

Fig. 1 illustrates the operational steps of our architecture with a purchase order scenario. We consider a user, who wants to buy products from Moon via the
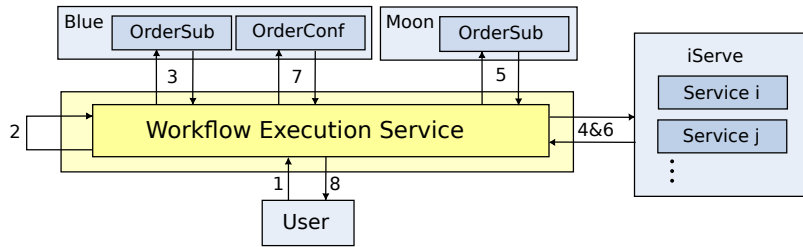
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[3] http://www.qudt.org/

Fig. 1. our MaaS architecture

Blue seller service. Our MaaS architecture builds around a service called Work-flow Execution Service (WES), which takes as input a workflow representation and the input data required for the composition (step 1). The WES handles runtime analysis of the data exchanged and their contextual sensitivity in order to detect context heterogeneity issues (step 2). For each data flow of the composition, it extracts contextual information from the descriptions of involved services. Between each service execution (steps 3, 5 and 7), if the contextual information presents an incompatibility, the WES generates discovery queries at runtime to find services that can alleviate these incompatibilities. These queries are send to the iServe [4] platform, a Linked Service warehouse, which returns the most relevant service to perform the mediation task, e.g. unit conversion service (steps 4 & 6). This service is transparently injected within the workflow.

Discussion In this paper, we define an architecture for Mediation as a Service (MaaS). Our system provides a way to automatically interconnect services that are compatible and to perform context-based data mediation at runtime. Our approach benefits from the respect of the service-oriented paradigm (promoting loose coupling, service reuse and composition), through the design of a Mediation as a Service architecture available as a generic Linked Service interface, the independence from workflow languages and the use of standard service description for semantic annotation. In our architecture, the WES automatically generates discovery queries when detecting contextual heterogeneity. This could serve as a basis for a truly generic and extensible infrastructure for solving runtime mediation problems.

References

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[4] http://iserve.kmi.open.ac.uk/