Towards a Reuse of Product Related Concepts for Service Data Management – an Ontology Approach

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Abstract: With a growing customization, automation and standardisation of IT services a systematic management of data on IT services becomes a pressing issue for researchers and practitioners alike. We propose Service Data Management as a cross-functional data view on services and their delivery. To this end we develop a first draft of an ontological model of common concepts of IT services. For simple IT services, established standards from the world of physical products may be surprisingly useful in the domain of service management.

1 Introduction and Motivation

Current industry trends suggest that the evolution of IT services will follow the path of utilities. Market leaders confirm that the average outsourcing deal becomes more selective and shorter as customers choose multiple suppliers for their portfolio of externally sourced IT services. These services signify a departure from the so far predominant "one-of-a-kind" model of service delivery. Not surprisingly, service providers strive to achieve greater productivity through extensive automation of customization, provisioning, and monitoring of IT services. IT service providers thus face a challenge similar to that of industrial enterprises: to establish an integrated management of service data across different stages of the service value chain [BWF04]. Similar to as product data management (PDM), service data management enables providers to manage services throughout their lifecycle and across different functions, such as engineering, offering, selling, delivering and controlling services. This integration requires a shared model of IT services [FA03] that maps the common concepts of divergent representation of services for different functions of service management.

Services are traditionally seen as distinct from products because of their intangible nature and the integration of customers in service delivery. The current development towards mass-customized IT services, however, increases the similarity to products. Consequently, SDM may leverage established concepts for managing product data. While only a small subset of current IT services, web services provide an extreme example of such productized services. Our approach therefore aims at services, which rely on information technology, which we call IT services. The dynamic nature of the field has lead to a plethora of definitions, concepts, and models of IT services. One key

driver of this diversity is the variety of tools used for supporting and automating specific functions of service delivery. The key challenge for SDM is thus to identify the common concepts used in the approaches applied in this field. We therefore argue that developing an ontology of IT services might be best suited to identify shared and distinct concepts of these models and standards.

Such an ontology can be useful as a common understanding of IT services and for translating between the product and service worlds [FE01]. Furthermore, by mapping existing approaches we are able to empirically evaluate and extend the IT service ontology for missing but practically relevant concepts [RG02]. In doing so it is possible to derive requirements for integrating and adapting PDM systems and developing SDM.

2 Related Research

Ontologies are widely used within the fields of artificial intelligence, knowledge management, semantic web and information systems [FE01]; [RG02]; [RGI04]; [SZ99]. As a philosophical dicipline, ontology stands for the analysis of the existence of things, their structure and relationships. The main goal of ontological analysis within information systems research, however, is to identify and define domain-specific concepts, their intension and extension as well as their relationships [SZ99]. For example the Bunge-Wand-Weber-ontology is widely used to evaluate modeling languages or to support the development of domain information models [RGI04]. Therefore ontologies are applied to agree on the structure and semantics of certain domains of interest [FE01]. We build on this stream of resarch in proposing an ontology of shared concepts and their relations for the domain of IT services. Furthermore, various approaches in the area of semantic web and web services employ ontologies to enable semantic operations in machine-to-machine interaction, e.g. automated web service discovery for service composition [An04]; [An05]. As these approaches express concepts and relations that are relevant to particular aspects of IT services we intend to incorporate findings from this stream of research into our more general understanding of IT services.

3 A Basic IT Service Ontology Model

To derive necessary concepts for an IT services ontology, we extend Rosemann and Greens approach of developing a meta-model for the BWW-ontology [RG02]. While Rosemann and Green use a meta-model approach to refine the BWW-ontology our goal is to identify main concepts of IT services and their relationships. Following Rosemann and Green, we use Entity-Relationship-Models to represent our concepts [RG02].

3.1 Main Issue: Service Level Agreements

Service generally do not exhibit search characteristics that customers can inspect prior to acquiring a serviceKa01. Service level agreements (SLA) define the outcome, responsibilities and conditions of delivering an IT service. SLAs are critical competitive

instruments because providers can use them to signal their commitment to achieving high quality deliveryBu02. Moreover, the intangible nature of services makes contractual SLAs a key instrument for specifying the roles and responsibilities of client and provider within the delivery of a service [SMJ00]. SLAs thus play a double role in the lifecycle of IT services. Firstly, they are a key element of selling, negotiating and customizing IT services [An01]. Secondly, they represent key data for service management by serving as inputs to service provisioning, service monitoring, and escalation management [LKD03].

3.2 Towards an Ontology Meta-Model for IT Services

In the following we present a first draft of a meta-model of an ontology of IT services that incorporates concerns of service sales and procurement as well as service delivery. We demonstrate the application of the model by identifying gaps in current standards for each of the domains. For the purpose of demonstration we choose BMEcat [SLK05] as a standard for describing tangible goods and product data and WSLA [LKD03] as an approach for representing SLAs from a service delivery point of view. While our research is still in progress, we suggest IT services should comprise at least the concepts depicted in Figure 1.

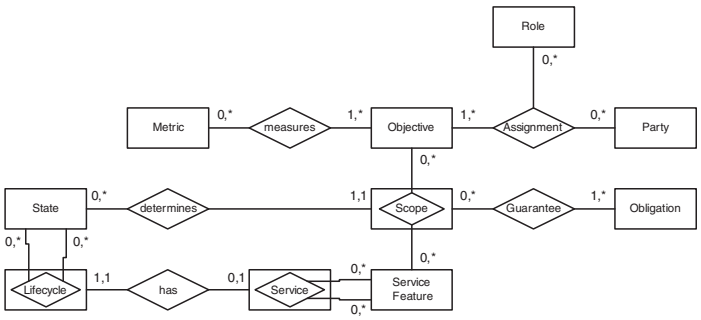

Figure 1. Meta Model of Concepts for describing IT Services based on [SMJ00], [LKD03], [BWF04]

The fundamental concept is *Service Feature*, which characterizes the description of a single functionality (e.g. internet access or a project manager capability). We introduce a compositional element called *Service to represent complex services comprising more than a single functionality*. A *Service* has a *Lifecycle* composed of *State*s which determine the *Scope* of certain *Objective*s. The *Lifecycle* allows an up-front specification of possible *States* a service exhibit, e.g. an implementation phase. The *Scope* specifies *Objectives* relevant to individual states of the service. Within the implementation phase, for example, no objectives for availability may apply. An *Objective* encapsulates the description of a specific service quality, e.g. at least 98 percent availability per month for internet access. Furthermore it is necessary to assign such *Objectives* to a certain *Party*, which fulfils a certain *Role* (e.g. responsible or have to be informed) in this *Assignment*. Again the *Scope* of such an *Objective* guarantees one or more *Obligation*s, e.g. a 20% reduction of fees in case the availability objective is not met. Finally, the concept Metric

represents mechansisms for controlling *Objective*s. In sum, we argue that those concepts are required to describe IT services and their SLAs. Therefore, as a first approximation, SDM systems should allow basic operations on these concepts.

3.3 Example: Describing Quality in Service Catalogues

In the following we apply this ontology to map between BMEcat as an existing standards for product data management and WSLA as an approach to describe SLAs for web services as a specific example of IT services [LKD03]; [SLK05]. While WSLA may serve well for managing the provisioning and delivery of web services, other standards prevail for more general business purposes such as sales and procurement. Moreover, service providers are increasingly called to present a catalogue of their services [An01] which could be done using BMEcat as a widely used approach to describe catalogues. Consider this example: a hosting service allows customer to select an availability level of either 97 or 99.9 percent, both associated with different service fees. The service is available only within specified service hours. Furthermore, the client must not connect to the hosted applications with more than 1,000 concurrent users.

A service catalogue presents the features of a service and the associated choices for service quality. In our ontology the options for service quality, such as the availability option as well as the maximum number of users, is represented as an *Objective.* The corresponding WSLA concept is *ServiceLevelObjective* [LKD03]. Translating a configurable *Objective* like availability into BMEcat suggests mapping it as a procurement option available to clients. The BMEcat-concept for modeling such options is *CONFIG_FEATURE* [SLK05]. Therefore, the options of our example could be modelled as *CONFIG_FEATURE*s of the *Service Feature* "Availability" [SLK05]. The number of concurrent users in WSLA is again a *ServiceLevelObjective.* In the case, however, the client party is *Obliged* to fulfil the objective [LKD03]. Such a client-side *Obligation* may be mapped to *FEATURE* in BMEcat but there is no corresponding concept to *Assignment* as BMEcat has a provider-centric view. Therefore it is not possible to model client-side *Obligations*, which are important for specifying service level agreements though [BWF04]; [LM00]. The service hours in our example map to *State*s in our model (within or without service hours) in the hosting services *Lifecycle*. In WSLA you can map both states to the concept *Validity* in the context of a *ServiceLevelObjective* which describes applicability of an objective. In BMEcat States could be modeled again as FEATURE but without the ability of describing their impact on the validity of *Objectives.*

4 Findings and Outlook

Our ontological analysis helps to identify the opportunities for mapping such standards to specialised systems and standards for service management and delivery. The example shows that PDM standards like BMEcat may suffice for supporting the sales and procurement of simple IT services with negligiable customer integration. By utilizing existing tools for describing product structures and attributes combined with languages

for describing solely service oriented aspects, it is possible to tap existing findings in the area of product data management. The ontological analysis, however, also identifies the limitations of the reuse of PDM concepts for service data management. By doing so, it is possible to exactly define those unique aspects of IT services that warrant specific models and standards for IT services. Beside evaluating our ontology with existing IT services, our next steps are focusing on extending the ontological model and formally specifying the semantics between the concepts. Such a corroborated ontological model of shared concepts of IT services and their relationships may spawn further research, for example the automatic sales configuration of service level agreements by choosing service features in a catalogue, the mapping UDDI concepts to BMEcat concepts for configuring web services, or the development of extensions to BMEcat for managing complex service offerings.

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