Commoditisation as a Criterion for Semantic Service Provisioning

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Abstract: Service provisioning by means of ontologies-based business integration and semantic technology is an important issue in business informatics today. This paper transfers the concept of commodity services from economics to application services in IT. Furthermore, the ongoing commoditisation trend will be stated as a top-level criterion towards the decision which application services within an IT-landscape are suitable towards semantic service provisioning.

1 Problem Statement

The globalisation of everyday business and increasing international trade are leading to a growing need to improve national and international, inter-company and intra-company service collaborations and transactions in various business-to-business (B2B), business-to-government (B2G) and business-to-customer (B2C) usage scenarios. Thereby, services capture an essential amount of business transactions (gross domestic products) in industrialised nations and over years, it has been possible to detect an ongoing trend towards the growing interest in the automation of service provisioning processes (e.g. [HP88] and [DCM+09]).

As a result, new disciplines, e.g. service sciences [MKS10], are dealing with holistic considerations towards the development and implementation of services. Particularly, the provisioning of services by the means of ontologies-based business integration offer an important advantage through the promise of high innovations at low costs through the absence of human intervention in the provisioning process. It should be emphasised that comprehensive concepts and languages for technical implementation of semantic service provisioning have already been described in scientific publications, e.g. [FKM08] and [KTS+08].

The ongoing interest in ontologies-based business integration leads to the ubiquitous, heavy, paralleled use of standards and ontologies in electronic collaborations and is known as ‘semantic variety’, as it not only generates different syntactical requirements, but also, more importantly, creates the challenge in understanding the meaning of a service partner's message. The consequences of semantic variety are mismatching and misunderstanding in electronic transactions, which is termed ‘semantic ambiguity’. Too often, this results in the disruption of the electronic information chain and thus leads to negative cost, time and quality effects [RFP08].

Furthermore, the use-case scenarios and samples presented in various publications to fit the requirements of semantic service provisioning are usually limited to reservation services or simple procurement transactions. This is an important first step but our critique is that the promises to implement all types of application services are unrealistic, if more complex services are considered. This explains why we cannot find many success stories in practice.

As a result, the mentioned problems lead to a lack of confidence in semantic service provisioning and a lack of access in practise. For this reason, the success of semantic service provisioning appends in decision support regarding the increasingly asked questions on which electronic services are suitable for semantic service provisioning. The purpose of this paper is to examine a top-level criterion towards the automation of Service Provisioning by the use of ontologies-based business integration and semantic technologies.

The paper is structured as follows: Section 2 defines the required terms and concepts of semantic service provisioning, while in Section 3 commodity services as a type of service are introduced. Furthermore, Section 4 outlines an investigation of scientific publications, and states a hypothesis about the limitations of semantic service provisioning. Finally, section 5 concludes the results and gives an outlook on our further research.

2 Semantic Service Provisioning

The required terms within service provisioning concepts have been defined by [HHV+07] as follows:

- A business service serves a well-defined business goal and is based on an agreement between two business partners named as service provider and service requester.
- An application service implements a part or a whole service using interfaces and operations of an IT application landscape.

Figure 1 shows the business service implementation pictured by a class diagram of the UML.

Figure 1: Business service implementation

Furthermore, application services can be classified into atomic services and composed services [KTS+08]. Atomic services are the smallest and most addressable elements published via interfaces, while composed services are built from a combination of atomic and already composed services, published via an interface. Figure 2 shows the application service structure as an UML class diagram.

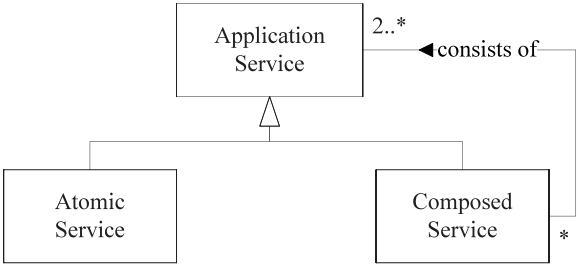

Figure 2: Application service implementation

We define service provisioning as publishing and execute application services (AS) by service providers, whereas, service requesters are able to discover, select and compose these application services under negotiation of a service-level agreement between both partners. Figure 3 shows the mentioned service provisioning scenario as an UML activity diagram.

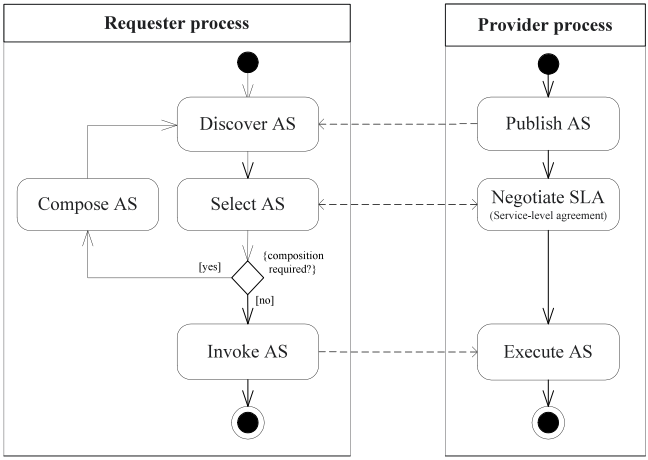

Figure 3: Service provisioning scenario [BFK+08]

Subsequently, semantic service provisioning is defined as service provisioning by the use of ontologies-based business integration and semantic application services (SAS), shown in Figure 4 as an UML activity diagram.

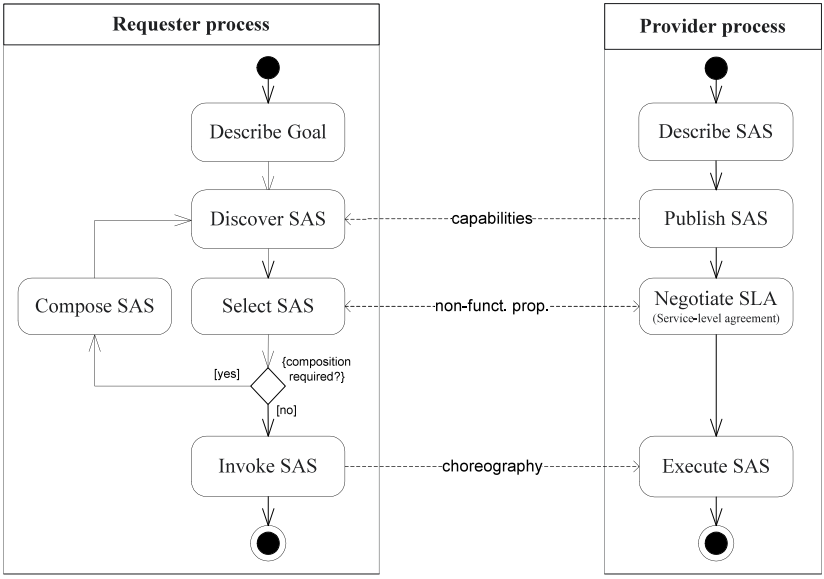

Figure 4: Semantic service provisioning scenario [BFK+08]

For the implementation of semantic service provisioning, methods capable of discovering and selecting relevant application services automatically – based on capabilities and non-functional properties – are essential. Additionally, semantic service composition via recurring discovering, and a binding and invocation during application run-time is required [KTS+08].

To this day, researchers have been publishing several suggestions to enable the implementation of semantic service provisioning. E.g. the Web Service Modelling Ontology (WSMO) fulfils the mentioned requirements, particularly with regards to the physical implementation of semantic service provisioning [FLP+08].

3 Commodity Services

Nowadays, products are getting more and more similar in quality and price. This means that, today, many products like gas, electricity, and fuel do not have any differences in terms of competitive differentiation. Scientific investigations, e.g. [Co01] and [HSB09], investigated this phenomenon and came to the conclusion that suppliers are more and more frequently dealing with the so-called 'commoditisation problem'.

As a result, more and more customers are not able to find objective and subjective differences between homogeneous products from different suppliers. Thereby, from today's perspective, in a strict sense, a commodity's only competitive differentiator is the price. The publication [Ho08] discusses the reasons and after-effects of commoditisation comprehensively.

With this general trend towards homogenisation, business services are also increasingly confronted with the commoditisation problem [Br05]. In this sense, commodity business services are services with no specific customer preferences for a particular supplier.

According to [Br05] a business service – in addition to being immaterial – has a specific value in all of the following dimensions:

1. The strength of **integration** of the service requester within the service fulfilment.
2. The **individualisation** of the service per customer.
3. The amount of **interaction** (communication) and associated behavioural uncertainty between service requester and service provider.

Figure 5 classifies different business services within those dimensions. Furthermore, commodity services are positioned within the cube where all dimensions have a low value.

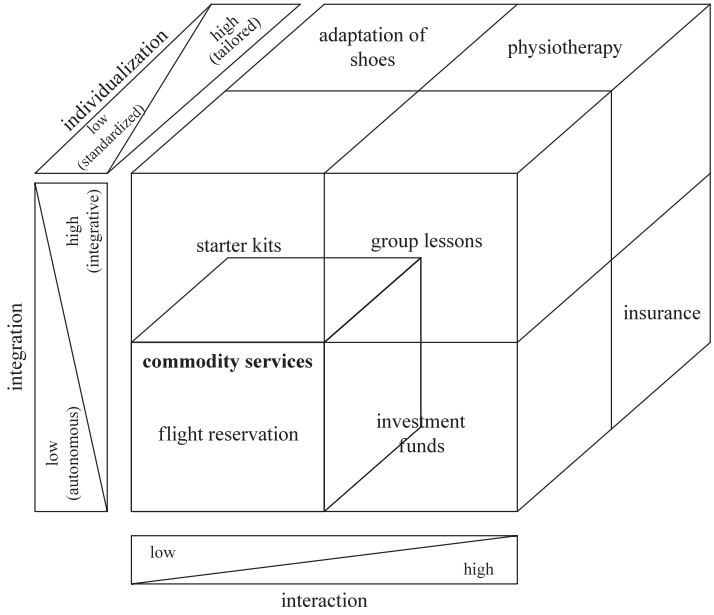

Figure 5: Commodity service classification [Br05]

The commoditisation within the service sector is reflected in the fields, covered and influenced by IT infrastructure and architecture [Br05]. Today, frequently used application services, e.g. bank transactions, telephone and mail services, car rental, hotel reservations and flight reservations are perceived as commodities. Therefore, e-business and collaboration are strong enablers for increasing service commoditisation.

Consequently as mentioned in Section 3, business services are implemented using one or more application services. Those application services provide the properties of business services and can also be classified within the service dimensions shown in Figure 5. Due to this we define:

> *A commodity application service is an application service that implements a part or a whole commodity business service.*

Furthermore, the business service dimensions explain the application service context in more detail as it follows:

Integration: Integration describes the service requester's degree of intervention to fulfil an application service. Therefore, the depth of engagement within the provisioning process towards service enabling has to be valued.

Individualisation: Application services differ in their degree of individualisation per service requester. Therefore, [Ri07] distinguishes between customised services on demand and repeatable services as available. Beyond that, with a high degree of standardisation in business functionality and IT enabling the perceived risk of a provisioned application services decreases in the eye of a service requester.

Interaction: Interaction specifies the amount of communication and interaction between service requester and service provider within the service provisioning process. Therefore, the uncertainty about the service properties (hidden characteristics), the hidden intentions of service provider and service requester, and the effort and accuracy (hidden actions) of service providers, result in behavioural uncertainties and leads to a high degree of communication and interaction.

4 Commoditisation as a Criterion for Semantic Service Provisioning

In general, semantic service provisioning has to achieve a high quality of service (QoS) at low costs.

According to this objective we state the following hypotheses:

1. Commodity application services may be provisioned autonomously[1]
2. Non-commodity application services may not be provisioned autonomously

To verify our hypotheses, we have investigated examples in scientific publications from well-known research efforts, demonstrating their semantic service provisioning approaches. Based on the business service dimensions described in Section 3 and publications, e.g. [Co01, Br05, Ho08, and HSB09], the applied use-case scenarios and running examples within the publications were examined and classified as commodity or non-commodity application services. Below, selected examples are listed:

- [KTS+08] based on a business-to-business (B2B) wholesale model on an Austrian Internet service provider that is specialised on services like domain registration, web hosting and messaging services. The provisioned application services fulfil standardised business transactions within the World Wide Web and could be classified as commodity services.
- [FKM08] introduces an example where service providers offer purchasing and shipment options for products through an e-marketplace. Thereby, services within the presented domain are perceived as commodity services.

[1] By the use of semantic service provisioning

- [BFK+08] used a media shop as running example that sells media products such as books, CDs, and DVDs online, using web service technology. The reseller has a warehouse where the media products are stored, and from where the products are dispatched by external express shipping companies to the customers. Furthermore, the media shop outsources the credit card payment process. The provisioned application services fulfil standardised business transactions within the World Wide Web and could be classified as commodity services.
- [BCP08] present a process model of an electronics store service that sells electronic items like notebooks or digital cameras. Thereby, services within the presented domains are perceived as commodity services. [2]
- [MP09] reference example consists in providing a virtual travel agency service, which offers holiday packages to potential customers, by combining three separate existing services: a flight booking service, a hotel booking service, and a service that provides maps. Services within the publication are perceived as commodity services. [3]

In conclusion, the provisioned application services within the mentioned publications could be classified as commodity services with a low value in integration, individualisation and interaction. Currently, it seems, that commoditisation is a strong **indicator** that semantic service provisioning probably operates well with commodity application services and is related to business areas that are confronted with the ongoing commoditisation.

5 Summary and Further Researches

Today, the inherent technical problems of semantic service provisioning have been highlighted in research without an investigation which application services are suitable for an autonomous provisioning process. This is becoming a particular problem as semantic service provisioning is not limited in enabling previously unseen application services to be discovered, selected, composed and invoked autonomously at run-time.

Within an application service request, semantic provisioning faces semantic variety and semantic ambiguity. For this reason, by selecting a non-optimal or, in severe cases, a wrong application service, the service requester will not risk fulfilling further transactions. Furthermore, a semantic provisioning can take a large amount of resources – under certain conditions even too many resources to be able to deal with it during run-time – and probably miss the required quality of service (QoS) at high costs.

[2] The publication focuses on semantics-based composition-oriented discovery of Web services
[3] The publication focuses on synthesis and composition of Semantic Web Services

To handle those problems the presented approach transfers the concept of commodity business services from economics to IT and constitutes 'commoditisation' as a criterion for semantic service provisioning. Therefore, based on the commoditisation criteria for application services, a presented classification method detects commodity application services with the use of the service dimensions integration, individualisation and interaction.

In an empirical evaluation, service examples from academic publications dealing with semantic service provisioning could be identified as commodity application services and are consequently suitable towards semantic service provisioning.

However, a more detailed scientific and practical evaluation is necessary in order to learn more about the precise classification criteria and the limitations of semantic service provisioning in general.

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