Service Meta-data

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Abstract: *Service meta-data plays the crucial role in the process of service specification. They can help companies to create transparent categorization of the services which is leading to more efficient methods of service searching and understanding their meaning and relevance. In the paper is presented an example of service meta-data usage for visualization of the service execution context.*

Visualization process uses service associations gathered from information flow and provides a tool for depicting the impact of the service changes on the surrounding environment.

Key words: service, Service Oriented Architecture, SOA, meta-data

1. Introduction

Life-cycle model of delivering IS in SOA defined in Hauptvogel (2013a) consists of stages, which are described in detail in the PhD thesis. Each phase includes the description of the output elements which are also called service meta-data. These output elements can be used for definition of the service execution context. For context definition is crucial identification phase from the life-cycle model of delivering IS in SOA, because it is modeled in the contextual layer. It also defines the business entities which are associated to the service. Meta-data used for service execution context handling should be recorded in the service catalog. Handling of the context is necessary for the subsequent service categorization.

The aim of this paper is to describe the importance of the meta-data usage in the process of delivering services. In the thesis Hauptvogel (2013b) has been proposed to derive the structure of the meta-data from the various phases of the life-cycle model of delivering IS in SOA. This structure forms the basis for categorization of services.

1.1 Paper structure

Introduction to the research problem is described in the chapter 2. In the next chapter is described the problem of service context handling. Problem of the service context handling has been taken out from the real case study from the environment of the telecommunication operator. This leads to the chapter 4, where is presented real example of service meta-data usage for visualization of the service context and to use them to record the flow of information, and provide a tool for depicting the impact of the service changes on the surrounding environment.

For further research I am proposing the study of semantics in the service environment. According to Bibliography entry meta-data can play an important role for service semantics.

1.2 Research method

Both theoretical as well as practical experience approaches have been used during creation of this paper. Practical experience gained from observing reality through induction helped to formulate theoretical concepts used in the guidance pattern. These concepts were applied through deduction back to the reality and verified there, thus full Kolb (1979) experimental cycle has been completed. The solution described in the research has been verified in the practice on projects related to the system integration in a complex environment of the telecommunication operator.

2. Inputs

Papazoglou (2012) has defined that meta-data is information describing the data sources, data schema, domain data, business data, and the like. In an environment of services is the primary aim of

the meta-data to improve the specification, visibility and better categorization of the services. This is leading to more efficient methods of searching for required services and to understand their meaning and relevance.

According to Ahmed (2001) we distinguish following types of meta-data:

- *meta-data based on annotations* – this type of meta-data are represented by the notes appended to the documents. These notes can have different purpose, for example research, teaching and so on.
- *meta-data based on sources* – this type of meta-data is used to associate specific properties to their values (These specific properties can represent name, weight, code, color, and so on)
- *meta-data based on entities* – represents the data of the entities, their relationships and the source information of to those entities.
- *structural mapping* – these data are used for referencing documents and creation of the associations between them

The meta-data based on sources plays an important role in service design. To allow better categorization of the services, it is important to choose an appropriate and consistent meta-data structure divided into groups (such as: technology, functional, logical, quality of services, etc.)

Categorization of the services is needed to build transparent service catalog. Transparent catalog is essential for effective governance of the services. In Vorisek (2011) are introduced different approaches for service categorization. Erl (2007) has introduced another type of categorization of the services, which represent the main service models used in SOA projects:

- *Entity Service* – represents business oriented service with functional boundaries related to one or more associated business entities. Such service is considered as a service with high level of re-use and thus can be used across multiple business processes.
- *Task Service* – also known as services representing business processes or services representing business tasks. The main difference is the definition of the functional ability.
- *Utility service* – represents service that provides complementary functionality across business systems and resources. Such services can represent capabilities like logging events, handling notifications, and treatment of the exceptions.

The categorization defined by Erl (2007) form the basic structure of the service catalog and can be easily implemented in the enterprise. The service categorization needs to serve enterprise purposes. In the chapter 4 is presented example of meta-data usage for service categorization in the service catalog.

3. Execution context and service meta-data

Execution context of the service is one of the principal concepts from the Reference model for Service oriented architecture (SOA) defined by Oasis (2006). It is represented by the set of infrastructure elements, process entities, policy assertions and agreements that are identified as part of a service interaction. Due to fact that execution context of the service is insufficiently covered by current methodologies, which was identified in my thesis, I am proposing to use service meta-data in the execution process handling for recording of the service execution context.

Following example shows the complexity behind handling of the service execution context in the corporation. Example analyzes the simple service “creation of a new customer” in the environment of the telecommunication operator at different levels of abstraction. From the perspective of the enterprise the customer represents a business entity. This business entity will have its image at different levels of abstraction. This image will be different every time, and thus with decrease of the rate of abstraction, the more comprehensive picture of this entity will be. But it is clear that between these images on different levels of abstraction exists associations, which build the execution context of the service.

- *Conceptual* – at this level the service is defined as the creation of a new customer account
- *Industry specific* – for each industry general rules defined for that sector can be applied (for example the Telecommunication Application Map TAM (2009) document describes general rules for the telecommunication operator environment). Creation of the customer belongs to

"Customer management domain", which contains an additional 16 sub-regions. For simplification our imaginary company handles customer in following areas:

- Customer Order Management – manage the end to end life-cycle of a customer request for services.
- Billing Account Management – provides functionality necessary to create and edit a customer's billing account
- Customer Service / Account Problem Resolution – handles the processes of customer support dealing with the service or billing related problems (trouble ticketing)

- *Enterprise* – at this level are specified information system (IS) falling into areas defined on the higher level (Industry specific). In reality number of such IS will be generally higher and thus it raises the whole complexity of the desired capabilities required to fulfill creation of the new customer.
- *Solution (logical level)* – at this level is defined an impact on all IS defined at the previous level or a need for creation of new IS is raised. This level of abstraction should be sufficient to define the cost required for the fulfillment of desired solution.
- *Physical (technological level)* – this level represent a physical realization of the capability in specific IS.

In identifying phase of the service its context is created, which can be captured through meta-data, which should be recorded in the service catalog. Recording the context of services is necessary for the subsequent categorization of services. In other phases of the life-cycle of delivering IS in SOA further meta-data will appear that shape the service itself. One of such life-cycle models is described in Hauptvogel (2013a).

Service goes through various levels of abstraction, from contextual to physical, changing its properties and increasing its complexity. Service as understood and defined by business representatives may have impact on more IS/ICT systems and individuals can be represented by the composition of several implemented services. It is therefore necessary that on physical level it is evident in what context is service handled.

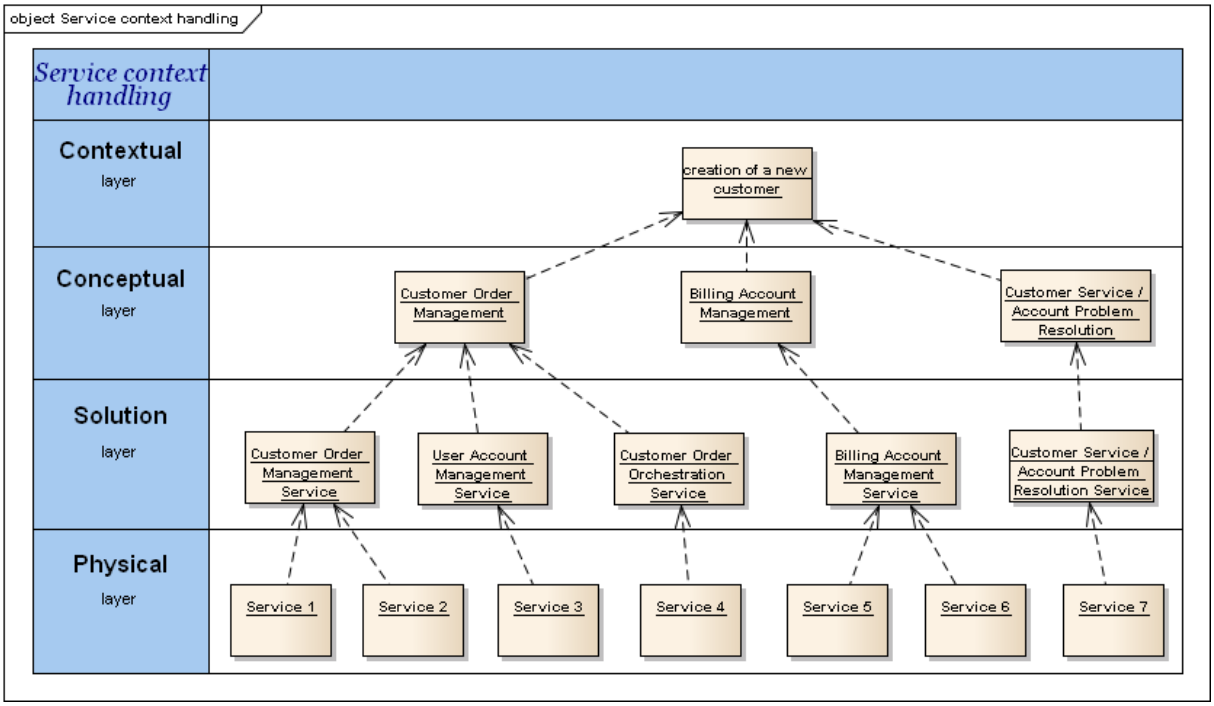

Figure 1: Example of service context handling in telecommunication environment

Figure 1 shows the definition of one service on contextual level and its impact on the formation of services at other levels of abstraction. Abstraction layers are used from Zachman's enterprise framework (top four abstraction levels are used: Contextual, Conceptual, Logical and Physical). Figure shows that the complexity of the effects of adding a new service into the enterprise increases when

reducing the level of abstraction. It means that in complex environment the realization of the business service at the physical layer can be quite huge. Note that services on the physical level have only symbolic names it is due to fact that each environment is different. In ideal case the names will be mapped one to one to logical ones, but due to market competition the customization of the reference models is done to make the result unique. Of course with each customization rises also the complexity.

To track the changes there are shown dependencies (displayed with oriented links) between the images of services at different levels of abstraction. These dependencies create a context in which individual changes in specific IS are carried out on a physical level. This means that the service is starting to take shape even before the actual design and service contract are created. In this case we are not talking about the real service, but about a candidate for a service.

For carrying out the service execution context are crucial the transitions between conceptual, logical and physical layer, because these transitions also forms the transition between business and IT representatives.

4. Service meta-data usage example

In this section is described an example of the service meta-data usage. This usage is taken out from real use case.

A set of documents used within the service design phase has been defined within the service specification process. Set of documents include the definition of document templates used for various specification and the definition of standardized message format used for service communication. Specifying standardized message format is one of the fundamental tasks handled by the integration platform. When designing a standardized message format it has been necessary to adhere to the principles of simplicity, clarity and flexibility. Message structure is designed to contain the business data necessary for the communication between systems, as well as meta-data of the communication.

The aim of service meta-data is to capture the service context and to use them to record the flow of information, and provide a process of service governance created by the platform.

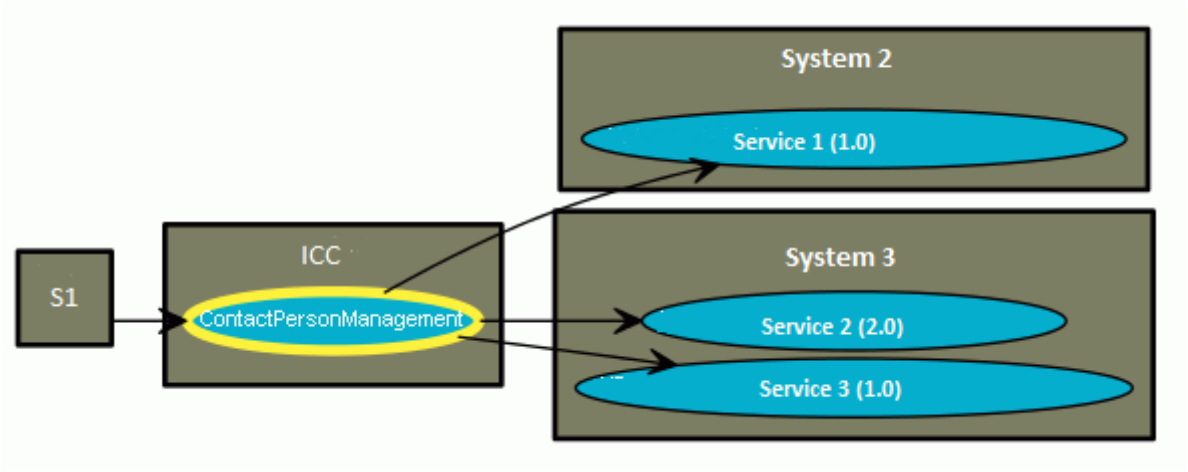

Figure 2: Example of meta-data usage to visualize service associations

Usage of simple application which works with service meta-data can help to dynamically display information in the graphical form. This application is used to analyze the impact of changes to services as well as changes to the system. Furthermore, the application uses meta-data to analyze the flow of information between services.

Figure 2 shows an example of service meta-data usage for dynamic displaying of active service's associations. By associations of active service is meant the list of system consuming the active service and the list of services which provide capabilities consumed by the active service. The services are represented by blue oval and systems are represented by gray rectangles. Active service is highlighted by yellow boundary. Such representation allows immediate detection of potential changes to service and its surroundings (represented by other services or systems). In the application, you can adjust the depth to which we want to analyze the links. Figure Figure shows only one level of the depth. This means that it evaluates only the immediate surroundings of the active service. It

means only services directly communicating with active service. User is able to click also on another services displayed on the schema. After clicking this service becomes automatically active and application shows the surrounding of the newly selected service.

On figure 3 is an example of meta-data usage to visualize system associations. Systems are shown in gray rectangles. Active system is highlighted by yellow border. If user click in the generated diagram on a different system, he automatically becomes the active and application automatically display the surrounding of newly selected system. In this way we can identify the immediate surroundings and to:

- systems that consume services exposed chosen system
- systems whose service selected system consumes

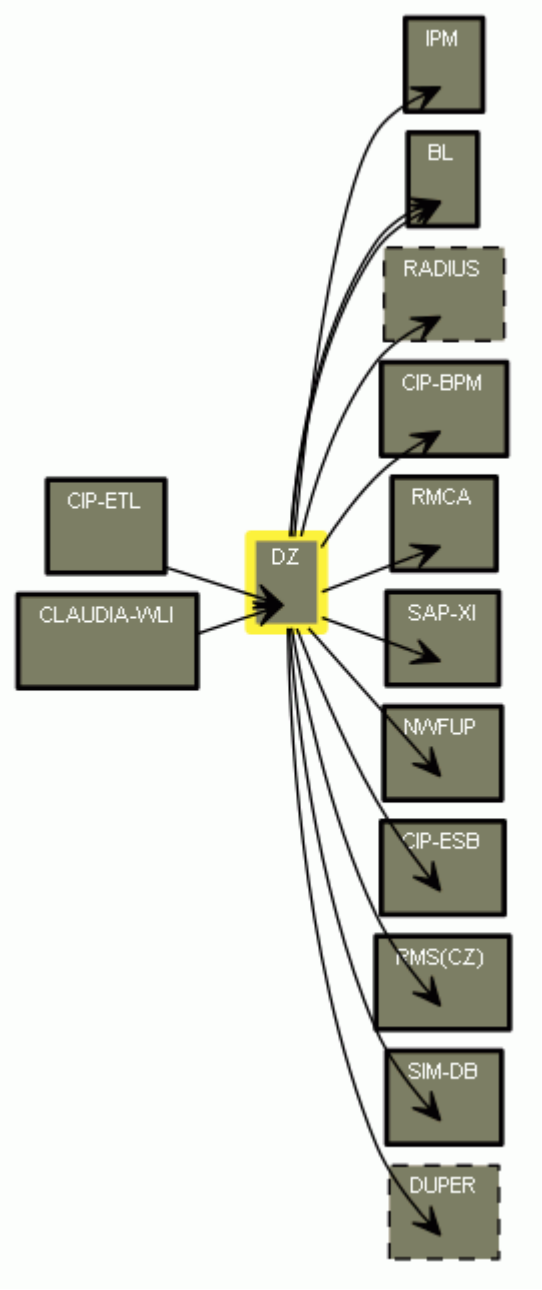

Figure 3: Example of meta-data usage to visualize system associations

The important difference between usage of meta-data to dynamically display the service associations and usage of modeling tools to visualize static service associations is the up-to-date information provided by dynamical generation.

5. Conclusion

In the service oriented environment the primary aim of the meta-data is to improve the specification, visibility and better categorization of the services. It is leading to more efficient methods of searching for required services and to understand their meaning, relevance and the execution context of the service.

In the paper I have presented example of service meta-data usage for visualization of the service context. I have shown the results received from application which has been handling meta-data recorded in service catalog to dynamical show the flow of information realized between services, and provided a tool for depicting the impact of the service changes on the surrounding environment.

For further research I am proposing the study of semantics in the service environment. For service semantics meta-data can play an important role.

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