Requirements for the Service Process Lifecycle

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Abstract: Services are an increasingly important part of modern economies. They are provided by service processes that are an important subtype of business processes. Therefore, the life cycle used for business processes may also be applied to service processes. However, the properties of service processes and the services provided require to extend the lifecycle of service processes. Therefore, the properties of service processes and services are analyzed and the resulting requirements for the process lifecycle identified.

Introduction

Services are becoming more and more important in today's economies. This applies not only for pure services such as transportation etc. but also for material products that are augmented by services such as maintenance, consulting, training etc. By augmenting products with services, enterprises stabilize their revenues [1]. Often, services are used by the customer as a substitute for owning or using goods[2]. This allows enterprises to concentrate on their core competencies and outsource non-strategic activities to service providers. Thus, service orientation allows increasing the division of labor. The interest in services has grown rapidly and led to the term services science[3] [4].

Many attempts to characterize services exist [5] and there is a long-lasting debate about the characteristics of services [6], [7]. Most definitions, see a service[1] as the value provided to the customer through a set of interactions and impacts on the input from the customer. A service is defined by a service process as shown in **Fig. 1**. Thus the service process is the detailed specification of a service. Service processes intensely interact with the customer [5] [8]. Production processes differ from service processes: The customer only perceives the output of a production process: he selects it and pays for it [9].

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[1] It is important to note, that the services discussed here are <u>not</u> services which are part of so-called service-oriented architectures (SOA) [27]. A service in the context of SOA is a special kind of interface for an encapsulated unit of software [31] and thus something completely different than the services discussed here.

The service process is implemented and executed by the service provider. The input to the service process from the customer may be in form of information, belongings or even the person of the customer itself [10]. The service and service process are designed to reach a goal which has been defined by the stakeholders, especially the customer and the service provider. The service, its goal, the service process, the customer, the service provider and the resources are embedded into an environment which is source of legal compliance requirements etc.. All together they constitute a service system [11] [12].
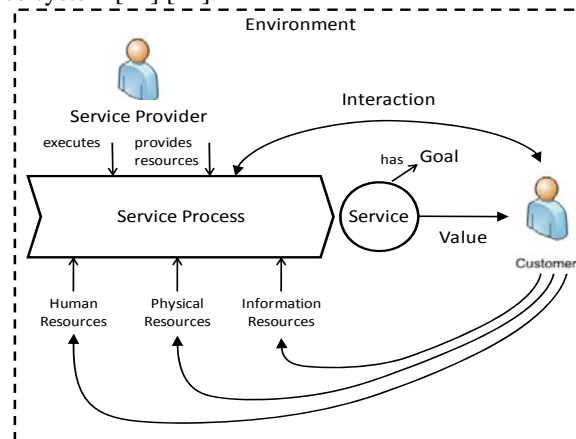

Fig. 1. Service processes in a service system

Services processes and the services provided by them have a number of special properties. These properties do not require a completely different business process lifecycle but extensions to the standard phases of the life cycle. Therefore this paper analyzes these properties and identifies the requirements resulting from these properties. The paper starts with a discussion of related work. Then the special properties of service processes and services are identified and analyzed. Based on this analsis, the requirements for the lifecycle of service processes are identified. A conclusion and outlook on further work is given at the end of the paper.

Related work

There are a number of approaches for structuring the lifecycle of service processes. The newest and most advanced one [13] proposes a structure for lifecycle of service (processes). Its eight stages are based on the phase model developed in [14]. Four of the eight stages are assigned to service design, the other to service management. Service design contains the definition of the design attributes, setting the design performance standards, the generation and evaluation of the design concepts and the development of the design details. Service management contains the implementation of the design, the measurement of the performance, the assessment of customer satisfaction and the identification of steps for improving the performance. However,

important steps such as testing and deployment are missing. Furthermore, the structure of the lifecycle is not deduced from the properties of services.

A very often cited approach is the one from Lovelock et Wirtz [2]. Nine topics relevant to service design are separated by the line of interaction that separates the customer from the service provider and the line of visibility that separates the actions visible to the customer from those that are not. Although this approach offers a very detailed support during service design, it does not cover the other phases of the software process lifecycle. It is based on the so-called service blueprinting [15]. In the approach of Meier and Massberg [16] an integrated view of the service life cycle is developed and a configurator for services presented. However, the process-oriented nature of services is neglected. A method for the conceptual design of services is presented in [17]. They are created by determining the attributes of abstract objects belonging to 9 classes: customers, goals, input, outputs, processes, human enablers, physical enablers, information enablers and environment.

Furthermore, there are approaches that only support one phase of the service process lifecycle. The operation phase of service processes is discussed in [18]. The application of an composite product development process to the development of service processes is shown in [19].The approach of Cauvet and Gwladys [20] is strongly modelling oriented. It shows how to compose business processes from so-called business services. However, only the design phase is considered.

Service processes and their properties

There are a number of crucial differences between service and business processes [21]. First, there are intense interactions with the customer: Service processes show long encounters, during which customers interact directly[2]. There may be duties of the customer that are critical for success or failure of the service process. For example, it may be necessary that the customer provides some information to allow the further proceding of the process. It is important to emphasize that a service process must describe the interaction between customer and service provider. A second important property is, that service processes differentiate two areas, front stage and back stage[2]. The front stage contains the activities of the customer and the service provider's activities that are visible to the customer. The back stage contains the activities not visible to the customer. The third important property is, that service processes need to represent the handover of resources and information from the customer to the service provider and the restitution vice versa. Furthermore, service processes are often cross-organizational. A top-level service process that is responsible for providing the service to the customer coordinates a number of sub processes.

Services and their properties

Services show a number of special properties that strongly influence the design and the whole lifecycle of service processes. These are the inseparability of production and consumption, the lack of suitability for storage, and the perishing of services.

The inseparability of production and consumption means, that a service can only be produced in the moment it is needed. This inseparability has a far-reaching consequence: you cannot put services on stock. Therefore, a service can not be measured in its quality before it is produced. Thus, you have to "trust" the provider of service that he will provide the service in the quality promised. This is trust may be established, if you already cooperated with the service provider. However, in most cases you do not know the service provider in advance. Therefore, you have to create surrogates for trust. An surrogate are certificates confirming that the service process has been appropriately set up to provide a high quality service. For example, if your computer does not work, you look for a service provider who has been certified by the computer's manufacturer to be capabable to perform the repair. Furthermore, the inseparability of production and consumption also increases the necessity for service recovery and back up mechanisms. In the case of service failure there is no possibility to quickly replace the failed service by a service from the stock. Therefore, service recovery and backup mechanisms should be available to remedy the service process and to minimize the effects on the customer. Thus, customer irritation and possible high direct and indirect costs by penalties and reduced customer loyalty can be avoided.

The second important property of a service is, that not only the service itself is important for the customer but also the potential to provide it. That means not only the repair of computer is important but also the possibility to hand in the computer for repair at certain times and the capability of the service provider to repair the computer in a defined amount of time. This potential of the service provider is described as service level agreement. The level of service availability strongly influences the pricing of the service. The service provider has to keep ready resources to provide the service if requested. Therefore cost are created even if the service is not requested and these costs have to included in the price of the service.

Extensions to the life cycle for service processes

The definition of the lifecycle for service processes is based on the lifecycle proposed in [22] and other approaches. It contains the design phase, the deployment phase, the operation and the evaluation phase.

Design phase

Especially the design phase has to take into account the properties identified above. The intense interaction with the customer during the service process requires to modell interactions as first-class objects to facilitate flexibility and reuse and to avoid

later disputes (see Table 1). Therefore the formalization of an interaction has to define the type and number of contacts with a customer and the information exchanged during these contacts. For example, the first interaction with a customer may require, that the customer and its equipment is unambigously identified. Furthermore, criteria for the appropriate execution of interactions may be defined, such as a response time to customer requests.

	Properties inducing requirements to the process life cycle					
	Service processes				Services	
	Intense interaction with the customer	Front / back stage	Handover and restitution of resources	Cross-organizational	Inseparability of production and consumption	Both service and potential to provide the service is important
					Trust or certification needed	Service recovery and backup	
Design	Interactions should be modelled as first-class objects	Activities have to be differentiated according to front stage or backstage.	Protocols for handover and restitution of resources should be modelled as first-class objects	Process design has to be coordinated with other organizations, consistent usage of terms across has to be enforced	Certification of the process design according to accepted standards such as ISO 20000	Integration of service recovery and backup routines into process design	Service level agreements have to be respected during service process design
Deployment	The interaction partners on client side have to be identified	Appropriate ressources of the client have to be identified	Deployment has to be coordinated across different organizations	The certified process may not be changed during deployment	Fall-back systems etc. have to be allocated and prepared	Appropriate resources have to be allocated
Operation	Interactions have to be logged	The handover and restitution has to be logged	Process status has to be tracked across different organizations	Feedback and quality control mechanisms have to be operated too. Example: Incident-Management	Broken services should be remedied and the time for repair has to be logged	The availabililty of service has to be logged
Evaluation	The logs have to be analzed and checked for mal-formed interactions	The logs have to be analzed for violations of the handover and restitution protocols	Process tracing has to be established across different organizations	Required mechanismens such as continous improvement mechanisms have to be operated.	The logged down-times have to be compared with the SLAs	The logged service availability has to be compared with the SLAs

Table 1: Requirements for the service process lifecycle

When modelling the activities of the service process, they have to be differentiated whether they are front or back stage activities. If they are front stage activities, an appropriate interaction with the customer may have to be assigned to the activity.

Also the handover and restitution of resources has to be appropriately represented during the design phase. Therefore, the design of the service process should contain clearly defined and reuseable protocols for handover and restitution These protocols should clarify how resources are requested from the customer, taken under the responsibility of the service provider and finally given back to the customer in a clearly documented manner. By this means, later disputes with customer and other process participants can be avoided. The cross-organizational nature of service processes requires that the design of the service process has not only to be coordinated with the customer but also with the suppliers of sub-services.

As analyzed above, the quality of services cannot be determined in advance, because they are produced in the moment they are consumed. Therefore, the certification of the service process is an important means to convince the customer that the service provider will be able to provide the service in the quality requested. Such a certificate is based on the compliance with rules and structures assuring an adequate service quality [23]. An example for such a surrogate is the certification of ISO 20000 compliance [24], which is an important competitive advantage for a service provider.

The inseparability of production and consumption impedes to put services on stock. Therefore, in cause of failure, it is not possible to replace a broken service by a service from stock. Thus, the design phase has also to establish appropriate recovery and backup procedures to remedy the broken service as fast as possible.

Furthermore, the design of service process hat to take into account that sufficient capacities of resources are available and the availability and continuity of the service is assured according to the service level agreements made with the customer. If the service provider uses suppliers providing sub-services, the contracts with these suppliers have to be taken into account as well. Often there is a "chicken-egg-problem": As long as the underpinning contracts with the suppliers are not made, the service provider is in danger to violate the contract with the customer. If the contracts with the suppliers are made first, and the contract with the customer is not made, needless subservices have been bought.

Beyond these requirements induced by the properties of service processes and services, the so-called industrialization of services is an important goal for service process design. The goal is to provide services in the same manner mass-produced goods are fabricated. That means economies of scale shall be created by using standardized services. However, in analogy to material goods standardization reduces the flexibility to fulfill individual customer requirements. Therefore, component-oriented approaches are proposed to provide flexibility and standardization at the same time[21].

Deployment phase

Due to the intense interaction with the customer within the service process, the interaction partners on client and supplier-side have to be identified during

deployment. The abstract role definition of the process model defined in the design phase have to be suplemented by concrete persons in the participating organizations. The same applies for the resources handed over and restituted during the service process. It should be possible to reset the customer's belongings into the state they had at handover.

The appropriate resources of the client have to be identified. The cross-organizational nature of many service processes requires also an deployment across organizational boundaries. Particular attention has to be paid to the synchronization of the deployment procedures to avoid the clash of different process versions.

The certification of the designed process requires a sealing of the process during deployment. No changes may be performed to avoid the loss of the certificate. To fulfill the service level requirements concerning availability and reliability, appropriate resources and fall-back systems have to be allocated and prepared.

Operation phase

During operation of the service process, it is important to log a number of informations to proof to the customer that the service level agreements have been met. First, the availability and reliability of the service have to be logged, this includes broken services and the time for repair needed. Underlying causes of service failure should be analyzed to prevent the failure from reappearing in the future. Also all interactions have to be logged to proof, that customer requests have been answered in time or that the customer has not provided input as defined. The same applies for the handing over and restitution of resources At the end of the service process, the customer's resources have to be returned to the customer. This should be done using special procedures assuring that formal requirements such as receipts, protocols etc. are used and an appropriate documentation is created[25] which proofs the restitution of the resources.

Because broken services cannot be simply replaced by one from stock, the service process providing the broken service has to remedied whenever possible to minimize the effects on the customer. To do so, appropriate backup and recovery procedures have to be applied. In the case of failures, service level agreements may play an important role which customer has to be supported first. There may be different service level agreements for different customers defining much shorter recovery times for one customer. Thus, this customer should be supported first.

A special challenge is the tracking of the process status, because the process is cross-organizational. Finally, many service process certificates such as ISO/IEC 20000 [24] require, that quality control and improvement mechanisms are activated during the operation phase to allow a later evaluation and improvement of the process.

Evaluation phase

The evaluation phase is also influenced by the special properties of service processes and services. The service provider has to be able towards the customer, that

all service level agreements have been met. Furthermore, the information about failures shall be used to identify actions for improving the service process. Therefore, the availability and reliability achieved and the failures occurred have to be compared with the service level agreement, mal-formed interactions shall be traced and and violations of the handover and restitution protocols shall be discovered. The dispersion of the logging information to different organizations make its collection difficult.

Conclusion and outlook

The offering of services and the augmenting of products with services is a key success factor to maintain and increase the competitiveness of enterprises. Service processes, which provide services, are a subtype of business processes which requires a number of extensions to the standard business process lifecycle. The need for these requirements is founded in special properties of the service processes and the services provided. Service processes contain an intense interaction with the customer and resources of the customer are handed over and restituted. Furthermore, service processes are often cross-organizational, because service processes are composed of a number of sub-processes which provide sub-services. Also the special properties of services influence the service process lifecycle: most important are the inseparability of production and consumption of a service and the fact, that not only the service, but also the potential to provide a service offers value to a customer.

Based on the analysis of the special properties of service processes and services, requirements for the standard business process life cycle have been identified. All phases of the life cycle are impacted. For example, in the design phase, interactions and protocols for handover and restitution of resources have to be integrated into the process modelling. During the deployment phase, appropriate resources of the client needed for execution have to be identified. The operation phase is characterized by an intense logging which is founded in the immaterial nature of services and the need to provide proofs of correct service provisioning to the customer. This elaborate log information is analyzed and used for identifying improvements of the service process as required from many service certificates.

Further work will introduce a more detailed and formally based representation of the service process lifecycle. Especially the description of the information flows will be crucial to provide an effective management of services based on the lifecycle introduced here.

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