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Using Service Scenarios to Model Business Services

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ABSTRACT

The purpose of the paper is to present and evaluate the notion of service scenarios. A service is work done by a service executor in interaction with a service consumer. A service scenario is a model of a service system and the roles that are played by the actors participating and interacting during the execution of a service. The model represents the roles and the interactions between the participants. Service scenarios can be used to model specific services and roles played by human beings and IT systems in the execution of services. The use of service scenarios is demonstrated by means of a case study in a public library. The case study indicates that service systems should be understood as socio-technical systems in which service executors and service consumers co-create value in mutual interaction with each other and with a set of shared resources.

KEYWORDS

Business services. Services scenarios. Activity systems. Interaction. Co-creation.

1. INTRODUCTION

The purpose of the paper is to present the notion of service scenarios that can be used to model services as socio-technical systems in which service executors and service consumers co-create value in mutual interaction. The purpose is to support conceptual modeling of existing and envisioned business services and thereby facilitate analysis of and creative discussions about business services.

The value propositions of businesses and their information systems can be viewed as services offering support to consumers' creation of value (Cherbakov, Galambos et al. 2005; Maglio and Spohrer 2008). Such services can be viewed as systems in which actors act upon resources in interaction with service customers (Maglio, Srinivasan et al. 2006). In general, it is too simplistic to claim that a service creates value for its customer. The value is co-created in interaction with the customer (Vargo and Lusch 2008b).

Businesses engage in networks of services. Such networks are complex and it is necessary to model the involved services in order to design and deliver them in an effective, efficient, and flexible manner. Modeling techniques like use cases are somewhat service-oriented in the sense that a use case is a part of a system that is supposed to create value for its user (Jacobson, Booch et al. 1999; Kruchten 2000). However, use cases are based on insufficient assumptions that do not support rich modeling of a consumer's interaction with resources, human actors, and technology. Process modeling languages like BPMN (White 2004) and EPC (Dehnert 2002; Lübke, Lüecke et al. 2006) may be used to model service processes, but they cannot be used to model a work system composed of a combination of human actors and technology interacting mutually as well as with material and informational resources.

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As pointed out by Quartel et al. the service concept "[…] has so far not been used to its full potential due to the lack of a comprehensive conceptual framework." (Quartel, Steen et al. 2007). A service scenario can be used to represent the internal structure of a service provider, a service executor, a service consumer, and their shared resources. And it can be used to represent the potential relations (including interactions) between provider, executor, consumer, and shared resources. A service scenario can be viewed as a model that represents a service as a socio-technical work system. The executor of a service may comprise a combination of human beings and IT systems.

We use a case to study to illustrate the use of service scenarios for service modeling at a library. The case study indicates that service scenarios are useful tools creating insights into services and their strengths and weaknesses. Consequently, service scenarios can support service design in a useful manner. Furthermore, the case study indicates that service scenarios highlight important aspects of services. For example, service scenarios highlight service systems as socio-technical systems in which service consumers and service executors collaborate to co-create value in mutual interaction.

The paper focuses on services carried out by a combination of human beings and information technology. This implies that no attention is paid to the popular notion of web services. Web services represent an implementation approach rather than a conceptual modeling approach, and they do not facilitate modeling and execution of services that are fully or partially executed by human beings (Castati, Shan et al. 2003; Curbera, Khalaf et al. 2003; Ferris and Farrell 2003; Kreger 2003; Little 2003; Yang 2003; Papazoglou and Dubray 2004; Curbera, Duftler et al. 2005; Cao, Wang et al. 2006; Grefen, Ludwig et al. 2006; Maamar, Narendra et al. 2006; Jung, Park et al. 2007; Tsai, Huang et al. 2007; Hündling and Weske 2008; Zeng, Benatallah et al. 2008). Web services may be used to implement parts of a service scenario, but this is outside the scope of the present paper.

The contribution is a modeling approach that can be used to model the architecture of services and their execution. Existing service modeling approaches like COSMO (Quartel, Steen et al. 2007) and process modeling approaches like role-activity diagrams (Aburub, Odeh et al. 2007) and BPMN (White 2004) can be used to model service processes. Service scenarios can be used to supplement such approaches in terms of models of structural and architectural aspects of services highlighting the human and material operants that participate in service executions.

Section 2 contains a discussion of business services and their characteristics. Section 3 presents and discusses the notion of service scenarios. Section 4 reports from a case study in which service scenarios are used to model information search services in a public library. Section 5 discusses and analyzes services as socio-technical systems. Section 6 concludes the paper and suggests directions for future research.

2. BUSINESS SERVICES

Business systems are activity systems in which actors perform actions that involve shared resources. Actors perform actions in order to create value for customers and owners (Checkland 1981). Value can be created in terms of products or services (Alter 2006). Businesses perform relevant actions in order to create products, offer services, facilitate activities etc. A business has a repertoire of actions that it can easily perform. This repertoire is supported by the structure of the business and the capabilities of its actors. For example, a hospital performs activities like surgery and medication and a car factory assembles cars.

According to Alter, a work system is a socio-technical system in which human participants and/or machines perform a business process using information, technology, and other resources to produce products and/or services for internal or external customers (Alter 2006). Organizations typically contain multiple work systems and operate through them. A work system must be understood in terms of six elements: business process, participants, information, technology, products, and customers. Within the work systems approach, a work system is viewed as a socio-technical system.

The notion of a service is a business concept. Service-orientation represents an organizing principle in which everything offered by a business is thought of as a service. The inherent perspective of service-orientation is that a process is viewed as a set of services which are offered to consumers interacting with the services. The service itself may be the consumer of other services. Thus, a process is viewed as a network of interacting services and consumers.

Services have been studied in areas like, say, financial services (Dandapani 2004; Homann, Rill et al. 2004; Kumar and van Hilegersberg 2004; Mallat, Rossi et al. 2004; Pan and Vina 2004; Tas and Sunder 2004), health care services (Tan, Wen et al. 2005), and public services (Goldkuhl 2006; Janssen, Gortmaker et al. 2008). Across such diverse areas, the service concepts share the common characteristics that service is work done by one party for another party. Shared services are support processes from which many parties can benefit (Ulbrich 2006).

E-services are services executed exclusively by IT systems (Hoffman 2003; Shaw and Craighead 2003; Song 2003; Stafford 2003; Lind and Salomonson 2006; Lind, Forsgren et al. 2007). SOA (service oriented architecture) represents an organizing principle for networks of e-services or web services (Papazoglou and Georgakopoulos 2003; Papazoglou and Dubray 2004; Pahl 2007).

In general, e-services are based on a too restricted view on service execution. Sheth and Verna view a service as a provider-client interaction that creates and captures value (Sheth, Verna et al. 2006). An organization may offer services, using assets comprised of humans and software that interact with service clients. This implies that a service is executed by a combination of human beings and IT systems in interaction with the service's client.

COSMO is a conceptual framework in which services are viewed as common interactions, the results of these, and their mutual dependencies (Quartel, Steen et al. 2007). Services are seen as units of composition and decomposition. This implies that services are executed in interaction with other services, in networks in which the interactions are constrained by mutual dependencies. A service has a structure, a potential behavior, and available information influencing its potential interaction.

Maglio et al. characterize a service in terms of its provider, client, and target (Maglio, Srinivasan et al. 2006). The provider is comprised of an individual or an organization and a technology, operated by or owned by the provider . The client is an individual or an organization. The target is a resource that is transformed or operated on by the provider for the sake of the client. The target may comprise a combination of people, businesses, products, and information. This implies that the effect of a service should be explicitly understood in terms of the changes made to a target shared by the provider and the client.

Maglio and Spohrer view service as the application of competences for the benefit of another (Maglio and Spohrer 2008). Service science is the study of service systems, which are dynamic value co-creation configurations of resources, i.e. people, technology, organizations, and shared information. This implies that the client does much more than merely receive the result of a service in a passive manner. The client's actions contribute to the value-creation in a significant and active manner.

Vargo and Lusch focus on the competences of the operants involved, i.e. the actors participating when a service is executed (Vargo and Lusch 2008a). This implies that the human and technological actors acting as operants must possess the knowledge and skills that are necessary for the execution of a service.

OASIS's reference model for service-oriented architecture defines a service as the performance of work by a service provider for a service customer (OASIS 2006). A service provider may be the consumer of other services. A service enables access to capabilities using a prescribed interface that comprises the specifics how to access the underlying capabilities. There are no constraints as to what constitutes the underlying capability or how the service provider implements the access mechanism. Thus, the service could carry out its described functionality through one or more automated and/or manual processes, maybe invoking other available services. The implementation of a service is

typically hidden from the service consumer except for information and behavior visible through the service interface and information required by service consumers to decide whether or not a given service is relevant. This is known as service information hiding (Barros and ter Hofstede 1998). The effect of executing a service is a realization of one or more effects in terms of information delivered and/or changes to a shared state.

Kaner and Karni characterize service systems in terms of the following nine aspects (Kaner and Karni 2007). (1) The customers benefiting from or being affected by the system. (2) The goals and meaning of the system. (3) Inputs to the system; (4) Outputs from and effects of the system. (5) Processes performed by the system. (6) Human enablers, i.e. human resources possessing and/or operating the system. (7) Enablers, i.e. physical and technological resources, which aid in operating the system. (8) Information and knowledge resources that support the system. (9) The system's environment.

3. SERVICE SCENARIOS

The following service characteristics can be derived from the preceding discussion of service concepts. (1) Service is delivered by means of provider-client interaction. (2) Humans and technology may act as operants. (3) Value is co-created when provider and client are interacting. (4) Services are executed in networks of interacting services. (5) The provider and the client interact with a shared service target. (6) Service execution is constrained and supported by the interaction structures of the services involved. (7) Service execution is constrained and supported by the operant skills, potential behavior, and available information. (8) Service implementations are hidden from the clients by means of service information hiding.

A service scenario is a model of a service system and the roles played by the actors participating and interacting when a service is executed. Service scenarios can be used to model specific services as well as the roles played by human beings and IT systems in the execution of services. Service scenarios are based on characteristics (1)-(6) with the following modifications. The provider-client relation has been extended to a provider-executor-client relation. And the label "target" has been changed to "shared resources". Service scenarios do not focus on characteristics (7) and (8).

A service has a provider that offers the service, an executor that executes the service and a consumer that benefits from the service. The executor and the consumer perform a series of actions when a service is executed. Service scenarios distinguish between service providers and service executors in order to emphasize that a given service can be executed in several different ways by different executors. An executor performs a service for a consumer on behalf of a provider. Thus, three key actor types are involved in service-oriented business environments: provider, executor, and consumer. Providers, executors and consumers may share a set of resources.

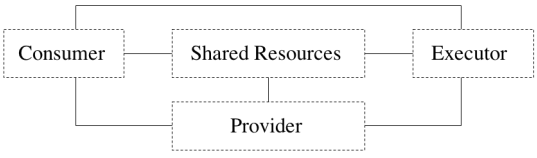

Figure 1 - Conceptual service scenario model

Figure 1 illustrates the elements and their potential relations (including interactions) in our conceptual service scenario model. An executor may be a set of persons and/or IT systems performing the work necessary to execute a service in interaction with a consumer. A provider possesses the right to offer a service and make it available to potential consumers. A consumer uses a service and benefits from its

effects. A consumer may be a set of persons and/or IT systems using a service in interaction with an executor according to a service-level agreement - a contract between a provider and a consumer.

The provider may interact with the consumer in order to negotiate conditions for access to services. This may include service-level agreements about price, payment, availability etc. The provider hires, builds, buys and organizes executors. If the executor is a person the provider may hire him or her. If the executor is an IT system it may be bought, rented or constructed by the provider.

When a service is executed the executor interacts with the consumer in terms of commands and exchange of resources. The executor and the consumer may interact with the shared resources. The executor may act as a consumer of other services.

The effect of executing a service is a realization of a set of effects in terms of resources delivered and/or changes to a set of shared resources.

Example. A bank (provider) may offer a service like "withdraw money from account" to bank customers (consumers) who have accounts with the bank. The execution of the service may include actions like "check pin code" and "dispose money" and it may be performed in different ways with different executors. (1) The service may be executed by software (executor) interacting with the customer through a web interface. (2) The service may be executed by a bank employee (executor) who interacts directly with customers (consumers) in one of the bank's departments. (3) The service may be executed by a combination of software (executor) and an ATM machine (executor) interacting with bank customers through an interface through which the customers can insert bank cards and enter, say, pin codes and amounts. Bank customers share access to accounts (shared resources) with the bank and with the executors of withdrawal services. When a "withdrawal" service is executed, the executor changes the balance of the account involved.

4. CASE STUDY

A case study was performed at a Danish public library in which an information search service offered to library users was changed (Bækgaard, Jørgensen et al. 2007). The case study was carried out as a part of a change project at the library. The purpose of the project was to identify and implement possible improvements of the library's information search services.

During the project, a number of analysis and design activities were carried out. User simulations were used to establish understanding of the current activities. Models of current activities were used to capture aspects of this understanding. Formulation of future stories and brainstorms were used to create visions about changed activities and new ways of using IT systems. Modeling of future situations were used to capture aspects of the visions.

Three services were modeled: the current information search service based on personal service, a future information service based on personal service, and a service based on self-service.

4.1. Current service

The executor of the current service comprises a librarian and a set of search systems. The service is based on communicative interaction between a library user and a librarian who engages in a dialogue about the library user's information needs, potential search terms, and the relevance of search results. The library user expresses his needs for information and the librarian uses his understanding of these needs to search for information resources via library databases and Internet-based search engines.

The librarian interacts with the search systems in a way that is visible for the library user. The library user can see the librarian's queries and the corresponding search results. There is an important element of cognitive activities where the user and the librarian try to understand the problem at hand, and where they consider possibilities and reflect upon formulations and search results.

The effect of the service can be characterized as follows. The librarian adds items (information resources) relevant for the library user to a resource object. For example, if an Internet search engine returns one or more relevant URLs, these are added to a digital text document using cut-and-paste, they are written on a piece of paper or the screen shots on which they appear are printed. This implies that a resource object is comprised of unrelated digital text documents and pieces of paper.

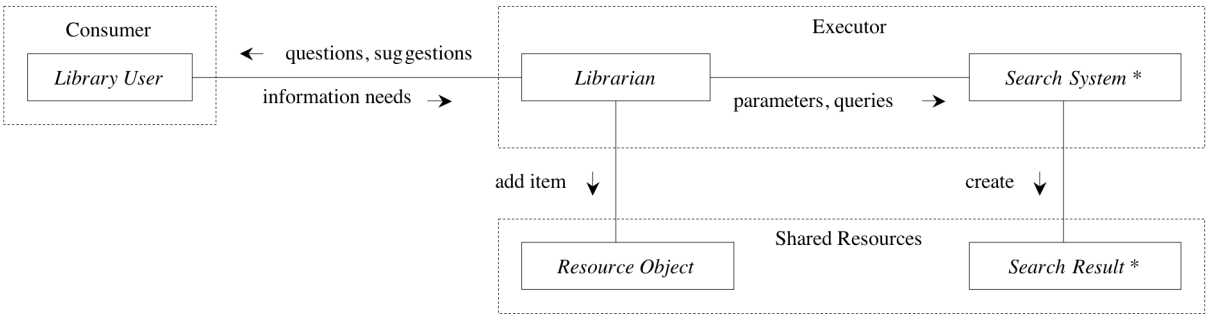

Figure 2 – Service 1 (current information search)

The diagram in Figure 2 represents the service in terms of a service scenario. The element Consumer is comprised of one element called Library User representing a library user. The element Executor is comprised of two elements. The element Librarian represents a librarian. The element Search System represents a search system. The star means that more than one specific search system may play this role.

The element Shared Resources is comprised of two elements. The element Resource Object represents the resource object in which the librarian records resources (URLs etc.) relevant for the library user. The element Search Result represents a query answer that is created by a search system. The star means that more than one specific search result may play this role. The search systems are parts of the executor, because the search results they produce are part of Shared Resources to which the library user has access.

The arrows in Figure 2 represent potential interactions. Librarian receives expressed information needs from Library User who in turn receives expressed questions and suggested interpretations from Librarian. Librarian formulates a set of search terms used as input to a search activity in which the librarian uses the search terms to ask a query to Search System. Library User and Librarian analyze and evaluate Search Result - a set of objects created by Search System (database, Internet search engine, etc.). Librarian uses “cut & paste” to copy relevant resources from an answer to the resource collection - a text document in which the selected resources from search answers are stored. Near the end of the service execution, Librarian formats Resource Object and enhances it with clarifying comments. Library User can see the shared resources that are comprised of Resource Object and Search Result.

There are a number of major problems with the current service execution. The librarian creates the resource object by means of cut-and-paste, handwriting, and printing operations. Consequently, the librarian creates the semantic integration of the search systems and the resource object. The IT systems do not support the integration in any way. Besides, the resource object itself is heterogeneous and it is not internally integrated, because it is composed of hand-written notes, printed screen-shots, and digital text documents. Finally, it is very difficult to reuse past search results and share the information represented by these among librarians and library users.

4.2. Future service

The future service is based on the same interaction between a library user and a librarian as the current service. The library user expresses information needs and the librarian asks questions and suggests interpretations. The librarian uses search systems to search for resources that are relevant for the library user. The librarian and the library user share the access to the search results and to the resource object in which relevant resources are recorded.

The future service differs from the current service in the following way. A piece of software called resource manager is added to the executor. It supports the maintenance of the resource object. When the librarian and the library user identify a relevant information resource (for example a URL) the librarian can use the resource manager to add the resource to the resource object. Rather than using cut-and-paste or paper-and-pencil to maintain the resource object, the librarian marks the relevant part of a search result and tells the resource manager to add the selection to the resource object that is now structured and fully digitalized.

Apart from simplifying the recording of relevant resources, the Resource Manager integrates the otherwise non-integrated search systems. The service has two effects. It produces a resource object with information resources and it records this object in a resource database which itself can be accessed as a search system.

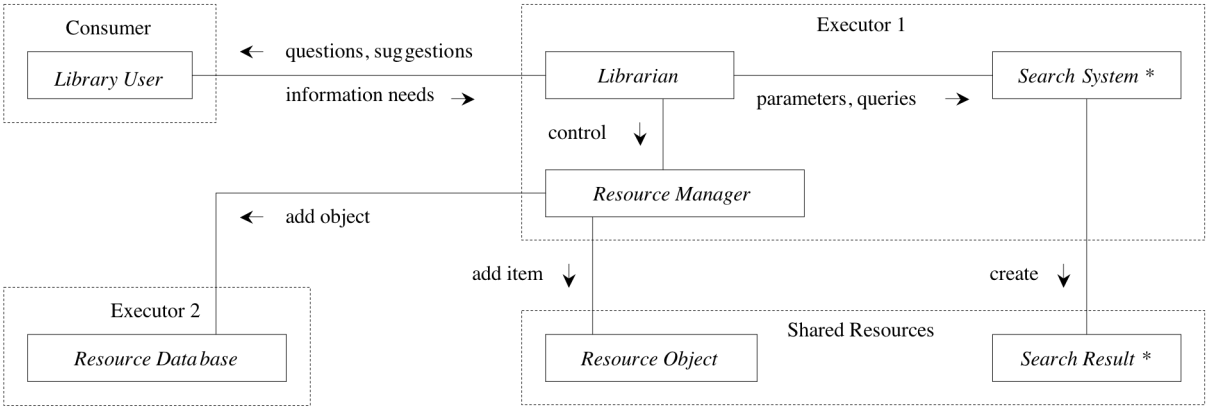

Figure 3 – Service 2 (future information search)

The diagram in Figure 3 represents the future service in terms of a service scenario. The service scenario in Figure 3 differs from the service scenario in Figure 2 in two important ways. First, an IT system called Resource Manager has been added to Executor 1. Librarian uses Resource Manager to add resource items to Resource Object. Librarian uses Resource Manager to select and modify selected resources that are used for updating Resource Object. This object is a structured and integrated digital document containing structured resource items. Second, Resource Manager stores the final version of Resource Object in Resource Database, which itself can be used as a search system. Consequently, Librarian can use Resource Database as a memory of past service executions that may be searched in future executions.

From the librarian's point of view the service is improved because of the better integration of search systems and the resource object. From the library user's point of the view the service is improved because of the integrated, digital resource object that is delivered as the effect of the service.

4.3. Future self-service

It is possible to give the library user remote access to the resource manager and thereby to offer a version of the service that is executed solely by IT systems. This implies that a library user interacts directly with search systems and with the resource manager. Consequently, the library user must perform the cognitive activities that are performed by a librarian in the previously discussed version of the service.

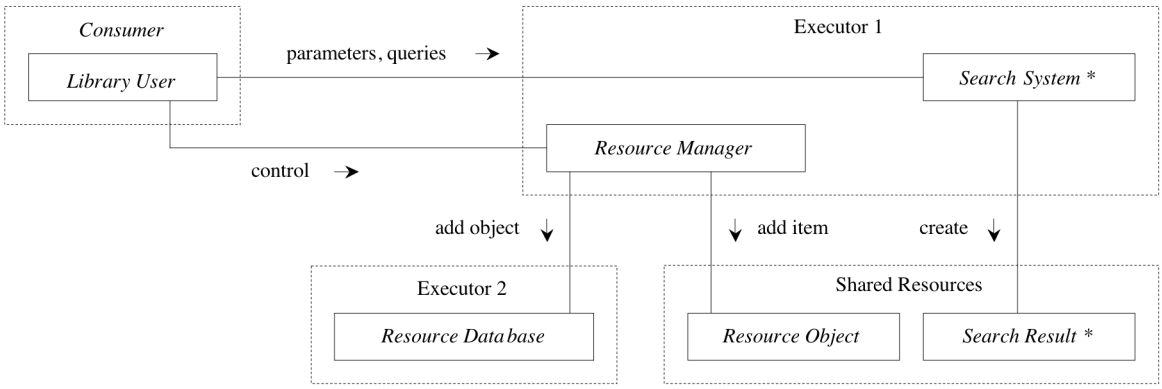

Figure 4 – Service 3 (future self-service)

The diagram in Figure 4 represents the future self-service in terms of service scenario. The service scenario in Figure 4 differs from the service scenario in Figure 3 in one important way. Library User interacts directly with Search System and with Resource Manager without the mediating help of Librarian.

From the librarian's point of view the service frees him or her from serving all library users. This may give the librarian more time to other work activities. However, a potential disadvantage is that the resource database may be "polluted" by resource objects of low quality. From the library user's point of the view the service can be executed any time without the library user having to be present at the library. However, a potential disadvantage is that the library user cannot benefit from the knowledge and experience of librarians.

5. SOCIO-TECHNICAL NETWORKS

The essence of a service is work performed in interaction between executors and consumers and their shared resources. The work is performed in socio-technical networks in which human beings, technology, and other material objects interact (Mumford 1983; Sawyer, Allen et al. 2003; Chae and Poole 2005; Doherty and King 2005; Lune-Reyes, Zhang et al. 2005; Doherty, Coombs et al. 2006). A service is executed by a combination of human beings and IT systems (Sheth, Verna et al. 2006; Vidgen and Wang 2006). The examples in the preceding section illustrates that services can be executed by a combination of humans beings and technology. The future self-service (Figure 4) is executed solely by IT systems, whereas the services in Figure 2 and Figure 3 are executed by a combination of human beings and IT systems.

Mathiassen and Sørensen characterize services as socio-technical systems in which "… configurations of people and IT artifacts interact to support work, communication, and decision-making" (Mathiassen and Sørensen 2008). They identify four types of information services: computational services, adaptive services, collaborative services, and networking services. In the library case, the librarian's use of the resource manager can be characterized as a computational service supporting the librarian's

creation of a resource object. The librarian's use of search systems can be characterized as networking services, where the librarian formulates a query that is answered by a search system and interpreted by the librarian. The information service offered to a library user in interaction with a librarian can be characterized as a collaborative service because of the complex negotiation between library user and librarian due to the high degree of uncertainty about the library user's information needs.

The notion of an actor should cover both human beings and technology even though human beings and technology are different in many important ways (Dreyfus and Dreyfus 1986). They share, however, the ability to perform business actions. Actors perform activities and interact with each other. Actors create and exchange material objects and information objects with or without the support of tools. Actors use information. Actors participate in events. Consequently, information systems are socio-technical activity systems in which human actors and information technology perform actions that involve information. When agency is interpreted in terms of structuration theory, technology cannot be attributed with actions, whereas the opposite is true from the point of view of actor network theory (Rose, Jones et al. 2005). The notion of hybrids of human beings and technology can be used to overcome some of the problems of agency. The idea is to study the common agency of hybrids rather than isolated of human beings and technology (McMaster and Wastell 2005; Ranerup 2007). The examples in Section 4 strongly suggest that the effect of a service should be attributed to a combination of interacting human beings and technology.

According to activity theory, human beings perform goal-directed actions directed towards objects (Leontiev 1978; Engeström 1991). Tools may mediate the actions. An activity is a set of coherent actions that are directed towards a goal. The methods with which an action is accomplished are called operations. Operations are related to conditions. The ordering of a product via a website can be viewed as an activity directed towards the goal of being the owner of the product. The activity is comprised of actions like "select product" and "pay". The actions are accomplished by operations that are related directly to material characteristics of the website. For example, the action "select product" can be accomplished by means of mouse and keyboard operations.

Activity theory can be used to describe some of the changes from the current to the future information search service. In Figure 2, "add item" is an action with the goal to add an item that describes an information resource to a resource object. The action is accomplished by operations like "select text", "add text to clip board", and "cut text into text document". In Figure 3, "add item" is an action that has the same goal as "add item" in Figure 2. However, the action in Figure 3 is accomplished by a very different set of operations. The intentional level (the action "add item") is not changed, but the changed set of operations facilitates a better integration of search systems and smooth recording of relevant resources.

The language-action perspective suggests that actions are more than material actions (Winograd and Flores 1986; Goldkuhl 2001; Ågerfalk and Eriksson 2006). When human beings express themselves through language they are not merely communicating. Communicative actions may involve promises about future actions. When a business employee accepts a costumer order, it is communicated to the customer. At the same time the acceptance involves a promise to ship to the customer within some period of time.

Activity theory focuses mainly on material actions and the language-action perspective focuses mainly on communicative actions. Like other actions, communicative actions are accomplished by operations that are inherently material. When a library borrower uses a website to reserve a book, the action can be viewed as a communicative action accomplished via material operations related to the use of the website.

Both the current and the future information search services are characterized by communicative actions in which the library user communicates with the librarian on order to express and clarify information needs and in order to evaluate search results and potential information resources. Even the future self-service implies communicative actions in the sense that the library user stores selected

information resources in the resource database that can be used by other library users and by librarians in future search sessions.

Communicative actions are inherently interactive. Therefore, the language-action perspective can be used to provide insight into the characteristics of services and service execution (Winograd and Flores 1986; Goldkuhl 2001). DEMO is another business ontology that is based on the notion of communicative actions. Business activity is viewed as a network of transactions (Dietz 2006). Each transaction represents an interaction between an actor that requests something and an actor that responds to the request. A complete service execution may be partially characterized in terms of a DEMO transaction as follows: the library user requests a service, the librarian executes it, and the librarian delivers the resulting resource object to the user. The three phases must be performed concurrently rather than sequentially as suggested by DEMO.

BAT is another business ontology that is based on the notion of communicative actions (Goldkuhl 1996; Goldkuhl and Lind 2004). BAT views business activity as interaction between two business parties. One party supplies services and/or products that are used by the other party. Business activity is viewed as interaction between business actors in terms of proposals, commitments, fulfillments, and assessments. Library information search services may be interpreted in terms of these phases. The proposal phase is comprised of the communicative actions through which the library user and the librarian clarify the information needs. In the commitment phase the librarian agrees to serve the library user. In the fulfillment phase the librarian uses search systems and creates the resource object. In the assessment phase the resource object is evaluated. The four phases must be performed concurrently.

Service execution is highly interactive in terms of executor-consumer interaction (Sheth, Verna et al. 2006; Payne, Storbacka et al. 2008; Vargo and Lusch 2008b). Service execution implies many types of interaction between consumers, executors and shared resources. At the intentional action-level a service scenario can be viewed as a model of an activity system in which the executor and the consumer perform actions and interact when a service is executed. They exchange and modify resources. The executor and the consumer interact with a shared service target (Maglio, Srinivasan et al. 2006).

Service-orientation is inherently a consumer-oriented approach (Rust and Miu 2006) in which value is co-created when executors and consumers interact (Maglio and Spohrer 2008; Payne, Storbacka et al. 2008; Vargo and Lusch 2008a; Vargo and Lusch 2008b). Service execution can be viewed as an encounter process (Payne, Storbacka et al. 2008). The future information search service (Figure 3) cannot be understood solely in terms of value being created by the librarian for the library user. The library user plays several active roles and participates in and contributes to the value-creating process. The library user interacts with the librarian by means of oral communication in which the user expresses information needs and the librarian suggests interpretations of the needs and asks clarifying questions. The librarian uses a software system called a resource manager to create and maintain a shared resource called resource object that is visible to the library user. The resource object contains the (partial) result of the librarian's search for information. During this search the librarian uses search systems like databases and Internet search engines. The results of these searches are visible to both the librarian and the user in terms of a shared resource called search result. The library user participates actively in the evaluation of search results and the resource object.

Vargo and Lusch describe a service system as a value proposition that participates in a value-creating process in which the consumer's contribution and evaluation of value are indispensable. Value cannot be created without active participation of the consumer (Vargo and Lusch 2008b). Services are about doing something together rather than merely producing output (Vargo and Lusch 2008a). Payne et al. emphasize that value-creation occurs when a customer is engaged in consumption or use rather than when something is manufactured (Payne, Storbacka et al. 2008). An isolated librarian cannot fully determine the value of an information search service. Only the library user can determine this value.

And the librarian's ability to use search systems in relevant manners is fully dependent on input, guidance, and evaluation from the library user. In the current information service (Figure 2) and the future information service (Figure 3) the librarian interacts with the library user. In the future self-service (Figure 4) the library user has overtaken the librarian's role. The future self-service can be represented by a revised version of the service scenario in Figure 3 in which Librarian was replaced by Library User in Executor 1. The operant role Search System can also be filled with many different IT-based search systems. Consequently, a service scenario should be viewed as a frame that can be configured in different ways by means of different operants.

The notion of co-creation can be used to analyze functional modeling approaches like root definitions and use cases. The method SSM uses root definitions to define human activity systems in terms of customers, actors, and transformation (Checkland 1981). The actors participate in a transformation process in order to serve the customers. In a complete root definition the underlying perspective (Weltanschauung), the owners, and the environment are characterized as well. A human activity system performs a transformation that affects a customer. In most cases the customer is supposed to benefit from the transformation that can be viewed as a business service. The idea is that there is a serving system and a system to be served. The serving system can be viewed as a service executor and the system to be served can be viewed as a service consumer. In the library case, the current service (Figure 2) can be characterized as a system transforming a library user's expressed information needs into a set of information resources that are supposed to satisfy the library user's needs. Root definitions do, however, have two serious limitations with respect to service modeling. They do not focus on co-creation. The served party (consumer) is outside the modeled system. This implies that the activities of the consumer are not treated as activities that co-create the value. And they focus solely on human activity. They do not focus on the roles played by IT systems in activities in service execution.

Use cases represent a functional view on a system (Jacobson, Booch et al. 1999; Kruchten 2000). A use case represents a system's function delivering values to one or more actors in its environment. Use cases can be modeled by use case diagrams and defined by means of use case specifications (Cockburn 2001). From a conceptual business action point of view, use cases and services have many similarities. A use case can be viewed as a coherent set of business actions offered by the system to its environment. A use case may activate other use cases during its own execution. A use case can be interpreted as a model of a service, where the executor is represented by the use case and the using actor represents the consumer. However, it is difficult to model the resources that are shared by executor and consumer if use cases are used to model services. Use cases focus solely on the functions they offer. They do not focus on shared resources. Service scenarios can be viewed as extensions to use cases that make it possible to model shared resources.

Service execution is carried out in networks of interacting services in which actors dynamically switch roles and act as executors in some situations and consumers in other situations (Quartel, Steen et al. 2007). Every service system is both a provider and a client of service connected by value propositions in value chains, value networks, or value-creating systems (Maglio and Spohrer 2008). A business can be viewed as a network of federated services - a network of interacting components (Cherbakov, Galambos et al. 2005). The future information search service (Figure 3) and the future self-service (Figure 4) contain two interacting service executors. In both cases the resource database acts as a service for the storing of information resources.The search systems in all three services can also be viewed as services even though they have not been modeled as such. In the future service from the library case (Figure 3) the librarian acts as an executor intending to serve the library user in some situations. And the librarian acts as a consumer that uses a service executed by a resource database.

Service information hiding can be used to support the necessary flexibility. It implies that each service only publishes the information that is necessary in order for a consumer to use the service (Barros and ter Hofstede 1998). According to Cherbakov et al. functional responsibilities should be distributed

among service components, each of which should have a well-defined capability where the function is separated from the implementation (Cherbakov, Galambos et al. 2005).

The COSMO framework supports conceptual service modeling (Quartel, Steen et al. 2007). COSMO supports modeling of the processes of service executors and service consumers in a manner that highlights the necessary interactions between the two parties. Besides, they use conceptual information structures to support modeling of the effects of services. This implies that the structure of a COSMO model is similar to the structure of a service scenario.

This does not imply that COSMO models and service scenarios are competing models. On the contrary, they are supplementing models. A service scenario highlights the three interacting parts of a service system (executors, consumers, shared resources) as a work-oriented work system in a structural manner. COSMO process models may be used to model the processes and interaction of executors and consumers, and COSMO information models may be used to model the shared resources. Without the structural picture offered by service scenarios, it is hard to use a COSMO model to communicate an overview of the totality of elements and interaction in a service system. In particular, it is hard to identify the shared resources and their roles in interactions from a COSMO model.

6. CONCLUSION

A service scenario represents a business service and the participating actors as an activity system in which the actors interact mutually and with shared resources. Three types of actors participate. A provider offers a service to a set of consumers. An executor performs the work that constitutes a service. A consumer benefits from a service and co-creates its value. When a service is executed a consumer interacts with an executor in the sense that they communicate and exchange resources. The consumer provides input that is necessary for the executor in order to perform the service. The effect of a service can be characterized by the resources delivered and changes made to shared resources.

The use of service scenarios have been demonstrated by means of a case study in which information search service has been modeled by means of service scenarios. The case study demonstrates that service scenarios highlight some of the essential characteristics of business services as socio-technical systems, characterized by interactivity, activity, co-creation of value, networking, and flexibility.

Future work includes more case studies in which the notion of service scenarios is evaluated and improved. Furthermore, future work includes analysis of process modeling languages and approaches as well as evaluation of their relevance for modeling the processes of consumers and executors. This includes analysis and evaluation of languages like BPMN (White 2004), EPC (Dehnert 2002; Lübke, Lüecke et al. 2006), action-oriented modeling (Ågerfalk and Eriksson 2004), action diagrams (Goldkuhl 1996), event-activity diagrams (Bækgaard 2004; Bækgaard 2007), action-oriented development (Rittgen 2006), role-activity diagrams (Odeh and Kamm 2003), resources-events-agents diagrams (Poels, Maes et al. 2007).

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