Enterprise Ontology Based Service Definition

Antonia Albani[1], Linda Terlouw[2], Gde Hardjosumarto[3], and Jan L.G. Dietz[4]

[1] Delft University of Technology
Information Systems Design
Mekelweg 4, 2628 CD Delft, The Netherlands
and
University of St. Gallen
Institute of Information Management
Müller-Friedberg-Strasse 8, 9000 St. Gallen, Switzerland
a.albani@tudelft.nl

[2] ICRIS B.V.
Martinus Nijhoffhove 2
3437 ZR Nieuwegein
The Netherlands
linda.terlouw@icris.nl

[3] Delft University of Technology
Information Systems Design
Mekelweg 4, 2628 CD Delft, The Netherlands
gde.hardjosumarto@alloptions.nl

[4] Delft University of Technology
Information Systems Design
Mekelweg 4, 2628 CD Delft, The Netherlands
j.l.g.dietz@tudelft.nl

1 Introduction

Economists and business scientists have been debating about the *'service'* notion for more than two centuries [9]. Often, the definitions in business literature limit the service notion to the delivery of immaterial goods. The adoptation of the notion of 'service' by computer scientists and IT practitioners has been more recent. In both the business science field [19, 10, 14, 12] and the computer science field [16, 15, 13, 17] a service is regarded as an interaction between a requesting party (often called consumer or customer) and an offering party (often called provider or supplier). The offering party is able to produce a certain value that is requested by the other party. But even with this common notion a precise definition and mutual understanding of the term service is missing. Let us have a look at the definition given by the Open Group [13]. It states that "a *service* is a logical representation of a repeatable business activity that has a specified outcome (e.g., check customer credit; provide weather data, consolidate drilling reports), is self-contained, may be composed of other services, and is a 'black-box' to consumers of the service". This definition is as vague as the other definitions and one could discuss every single statement of the definition. E.g., what is a business activity? The Open Group mentions 'check customer credit' or 'provide weather data' as business activities, but are these really business activities or are they only computational acts? What about a business activity concerning the 'manufacturing of a car'? Such a business activity has a completely different granularity as the ones mentioned in the definition. What is self-contained? If a service is composed of other services is it still self-contained? What is precisely meant by a black-box when a service is also defined to be an activity? What about communication activities e.g., to call the service or to accept/reject the requested result?

According to the Ψ-theory [4, 7], the theory that underlies the notion of *Enterprise Ontology* [4], the operation of organizations is all about communication between and production by social actors. Is not the main concern of service-orientation to support the operation of an organization and therefore also to support the communication between and production by social actors? Because the Ψ-theory describes the interaction between the requesting party and the offering party in a very formal way, it provides a perfect basis for formalizing the notion of service.

2 The Ψ-theory

The Ψ-theory finds its roots in the scientific fields of Language Philosophy, in particular the Language Action Perspective (LAP) [8, 11], and in Systemic Ontology [1]. It focuses on the use of language to achieve agreement and mutual understanding [18]. By applying the Ψ-theory one can disentangle the essential knowledge of the construction and the operation of the organization of an *enterprise*. This essential enterprise model is called the Enterprise Ontology. The

theory consists of four axioms and one theorem. A complete overview of the theory is available in the book [4] and the papers [5, 2, 6, 3].

The first axiom, the operation axiom, focuses on the different types of acts that actors in organizations (people, also called subjects) perform and the results of these acts. It states the following [4]:

Axiom 1 *Actors perform two kinds of acts: production acts and coordination acts. These acts have definite results: production facts and coordination facts respectively. By performing production acts, actors contribute to bringing about the function of the organization. By performing coordination acts, actors enter into and comply with commitments regarding production acts. An actor is a subject fulfilling an actor role. Actor roles are elementary chunks of authority and responsibility.*

The second axiom, the transaction axiom, further looks into the coordination acts. It states the following [4]:

Axiom 2 *Coordination acts and production acts always occur in particular patterns. These patterns are paths through one universal pattern, called transaction. The result of carrying through a transaction is the creation of a production fact.*

A transaction evolves in three phases, the *order* phase (O-phase), the *execution* phase (E-phase) and the *result* phase (R-phase), see Fig. 1. Two actor
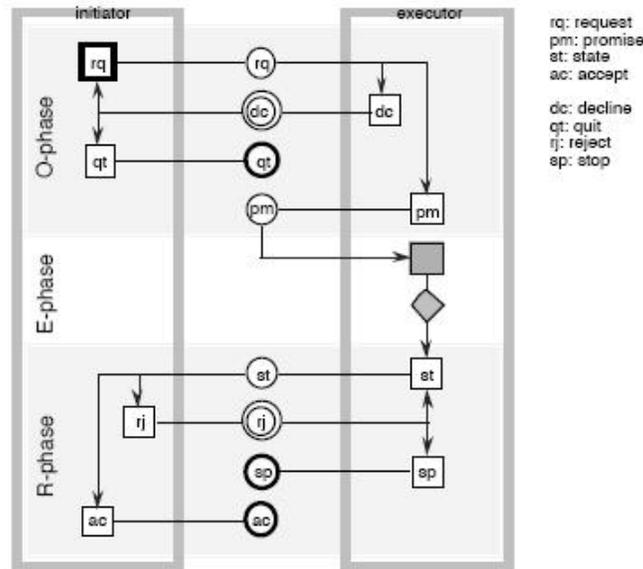

Fig. 1. Standard transaction pattern

roles are involved in such a transaction, the *initiator*, who starts and completes

the transaction, and the *executor*, who performs the production act. In the order phase the initiator and the executor try to reach agreement about the intended result of the transaction, i.e., the production fact that the executor is going to create as well as the intended time of creation. In the execution phase this product is created by the executor, and in the result phase both actors try to reach agreement about the fact that has been produced. The so-called *basic transaction pattern* consists of the request, promise, state, and accept coordination acts. The *complete transaction pattern* is constituted by the standard pattern and four *cancellation patterns*. Cancellation patterns concern the revocation of a request act, promise act, state act, or accept act.

The third axiom, the distinction axiom, is concerned with the different abilities of a human being that are involved in the activities they perform. The axiom states the following [4]:

Axiom 3 *Three distinct human abilities play a role in the performance of coordination acts and production acts: the forma, informa and performa abilities.*

We just explain this distinction by means of the production acts. The forma ability is concerned with the form aspects of information in terms of information transmission and storage. This type of production acts are known as *datalogical acts*. Transactions that contain a datalogical act are called *datalogical transactions* (D-transactions). The informa ability states that information can be reasoned, computed or deduced. Those activities are known as *infological acts* and the corresponding transactions are called *infological transactions* (I-transactions) if they include this type of production act. The performa ability concerns making decisions, judgements, or creating material things such as products. This is what we call *ontological acts* or *ontological transactions* (B-transactions) respectively.

We just presented three of the axioms of the Ψ-theory. Together with the composition axiom, which we did not discuss, they provide the basis for the organization theorem. This theorem provides a concise, comprehensive, coherent, and consistent notion of enterprise, such that the (white-box) model of an enterprise may rightly be called its ontological model [4]. It states the following [4]:

Theorem 1 *The organization of an enterprise is the layered integration of three aspect organizations: the B-organization, the I-organization, and the D-organization.*

The *B-organization* concerns the essence of the enterprise. It consists of actors who directly contribute to the enterprise's goals and functions by performing ontological production acts. These actors are known as *B-actors* and are able to perform B-transactions. The *I-organization* embraces the content aspects of information and knowledge in the enterprise [4]. Actors in the I-organization, who are called *I-actors*, bring changes to information and knowledge by performing infological production acts. In other words, I-actors perform I-transactions. The *D-organization* deals with the documentation of information in the enterprise and only takes into account the form of information. To achieve this, actors in

the D-organization perform datalogical production acts and thus D-transactions. These actors are known as *D-actors*.

3 The Notion of 'Service'

Our notion of service is based on the standard transaction pattern as introduced in Fig. 1. Though a service has many similarities with a transaction in the Ψ-theory, they are not equal. While the transaction includes all acts of the initiator and the executor, the service concept emphasizes more on the executor than the initiator side. We therefore define a service as a part of a transaction rather than a whole transaction.

Definition 1. *A service is a universal pattern of coordination and production acts, performed by the executor of a transaction for the benefit of its initiator, in the order as stated in the standard pattern of a transaction (see Fig. 1). When implemented it has the ability to get to know the coordination facts produced by the initiator and to make available to the initiator the coordination facts produced by itself.*

When looking at the standard transaction pattern, everything except the coordination acts of the initiator (request, quit, reject and accept) are part of the service. But in order to communicate with the executor of the service, the initiator needs to be aware of the standard transaction pattern. Additionally, we call a service a *composite service*, if the executor of a service is also initiator of another service. This happens exactly then, when a transaction is enclosed in some other transaction. This definition of a service just given is a very generic one, since it holds for two kinds of actors, *human actors* and *IT systems* and three kinds of production acts, namely *datalogical*, *infological* and *ontological*.

Services executed by human actors or IT systems only differ in the way they are implemented; human services are implemented by human beings, whereas IT services are implemented by IT systems. IT systems assist human actors in their activities. For both human actors and IT systems we can distinguish between communication acts and production acts on the datalogical, infological, and ontological level as described in the organization theorem (though at ontological level machines can only act as delegates for responsible human actors, because machines can never reach true social understanding and cannot create really new, original things).

The basic concept of dealing with coordination and production aspects between an initiator and an executor party as defined in Ψ-theory and in the generic service definition given above allow us to distinguish between six different types of services: *ontological-, infological-*, and *datalogical-human services* and *ontological-, infological-*, and *datalogical-IT services*. All service types conform to the definition of service given above, following the same service pattern and the described abilities. They only differ in the way they are implemented, either by human actors or by IT systems and in the different kinds of coordination and production acts, namely ontological, infological and datalogical.

References

[1] M. A. Bunge. *Treatise on Basic Philosophy, vol. 4, A World of Systems.* D. Reidel Publishing Company, Dordrecht, The Netherlands, 1979.

[2] J. L. G. Dietz and A. Albani. Basic notions regarding business processes and supporting information systems. *Requirements Engineering*, 10(3):175–183, 2005.

[3] J. L. G. Dietz and J. Hoogervorst. Enterprise ontology and enterprise architecture, how to let them evolve into effective complementary notions. *GEAO Journal of Enterprise Architecture*, 2(1), 2007.

[4] Jan L. G. Dietz. *Enterprise Ontology: Theory and Methodology.* Springer, 2006.

[5] Jan L. G. Dietz and Jan A. P. Hoogervorst. Enterprise ontology in enterprise engineering. In *SAC*, pages 572–579, 2008.

[6] Jan L.G. Dietz. The deep structure of business processes. *Commun. ACM*, 49(5):58–64, 2006.

[7] Jan L.G. Dietz. Enterprise ontology - understanding the essence of organizational operation. *Enterprise Information Systems VII*, pages 19–30, 2006.

[8] F Flores and J.J. Ludlow. Doing and speaking in the office. *Decision Support Systems, Issues and Challenges*, pages 95–118, 1980.

[9] Jean Gadrey. The characterization of goods and services: An alternative approach. *Review of Income and Wealth*, 46(3):369–87, September 2000.

[10] Faiz Gallouj and Olivier Weinstein. Innovation in services. *Research Policy*, 26(4-5):537 – 556, 1997.

[11] G Goldkuhl and K Lyytinen. A language action view of information systems. In *Proceedings of the Third International Conference on Information Systems (ICIS'82)*, pages 13–29, Ann Arbor, MI, USA, 1982.

[12] Susan Meyer Goldstein, Robert Johnston, JoAnn Duffy, and Jay Raod. The service concept: the missing link in service design research? *Journal of Operations Management*, 20(2):121–134, 2002.

[13] The Open Group. Service oriented architecture, 2006. `http://www.opengroup.org/projects/soa/doc.tpl?gdid=10632`.

[14] Christopher W.L. Hart. The power of unconditional service guarantees. *Harvard Business Review*, 66(4):54–62, 1988.

[15] OASIS. Oasis, 2006. `http://www.oasis-open.org/`.

[16] OMG. Service oriented architecture sig, 2006. `http://soa.omg.org/`.

[17] W3C. W3c, 2006. `http://www.w3c.org/`.

[18] Hans Weigand. The language/action perspective. *Data & Knowledge Engineering*, 47(3):299–300, 2003.

[19] Valarie A. Zeithaml, Leonard L. Berry, and A. Parasuraman. The nature and determinants of customer expectations of service. *Journal of the Academy of Marketing Science*, 21(1):1–12, January 1993.