

Services as Activities: Towards a Unified Definition for (Public) Services

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Abstract. We present a novel definition of services (in particular, *public services*) which sees each of them as the sum of all *activities* that realize a public authority's *commitment* to make *available* to individuals, businesses, or other public authorities some *capabilities* intended to answer their *needs*, giving them some possibilities to *control* how and when such capabilities should be manifested.

1. Introduction

In a recent paper [1], Nardi and colleagues considered different ways of characterizing services, and proposed an ontology that explicates and harmonizes the different perspectives. They analyzed the basic phases of the service lifecycle, namely *offering*, *negotiation*, and *delivery*, emphasizing the different role of *relationships* between service providers and customers in each of such phases, and showing how the notions belonging to the various service perspectives can be mapped to such ontology. They refrained however from proposing a specific definition for the term 'service', considering it as a case of *systematic polysemy*, in which the same name is used to denote different –although related– notions.

This is certainly true, but still there is the urgent practical need of reducing this polysemy as much as possible, trying to capture the core notions that underlie the way we talk of services in our everyday language. In Europe, this need emerges in particular for *public* services, which in principle should be accessible to all European citizens in a homogeneous way, but in practice reflect the idiosyncrasies of the various public administrations. For instance, according to the 2016 ISA European workprogramme¹ for the semantic interoperability of public administrations,

¹ https://ec.europa.eu/isa/library/isa-work-programme/index_en.htm

² <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0123>

“There is still no standard way of describing and documenting European public services. The understandings of services and service implementations are different and even the basic definition of what constitutes a public service differs. Furthermore, there is a lack of an overview of what types of services already exist, often resulting in redundant work and inefficiencies”.

On the other hand, an important strategic document such as the European Services Directive² adopts a relatively simple definition of (economic) services, namely:

" 'service' means any self-employed economic *activity*, normally provided for remuneration" (Article 4, our emphasis)

Another definition, oriented towards public services, is reported in the recent “Study of the new generation of eGovernment Services”³:

"Public services are *activities* that are publicly funded and arise from public policy and that are for the collective benefit of the public, accountable to and governed by a political process. This includes both administrative and human services." (our emphasis)

Both these definitions suggest that services are *activities* of a certain kind, although the exact nature of such activities is not clarified. In this paper we go back to the original challenge –coming up with a *unifying* service definition– by presenting an ontological account of *services as activities*. Such proposal leverages on the early foundational work by Ferrario and Guarino [2], which sees a service as a complex temporal entity consisting of a *service commitment* and the corresponding process. While in that work we stressed the role of service commitment, considering its mere existence as sufficient for the existence of a service, here we focus our attention on other aspects of services, such as *capability*, *availability*, and *control*. As we shall see, *all* these will become essential ingredients of our service definition.

2. Services as activities: clarifying the ambiguities

According to Ferrario and Guarino, behind every service there is a commitment to perform *actions* of a certain kind. For instance, behind a mobile phone service there is a commitment to perform phone connection actions. Of course, at a *microscopic* level of analysis, each of such actions *may* be considered as a service, but this is not the notion of service people use in their everyday speaking: people subscribe to *one* telephone service, which offers them the possibility to activate multiple phone connections. Each of these connections is part –so to speak– of *the same* service. This means that, while analyzing services, we should first of all distinguish *core service actions* from *activities* involving such actions. We shall say that a *service provision* is an activity resulting from the aggregation of multiple service actions for the benefit of a single customer. In turn, a *service* is an aggregation of service provisions, possibly

² <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006L0123>

³ https://joinup.ec.europa.eu/community/opengov/og_page/ogs-study

involving multiple customers. In this way, we can have a single entry in a service catalog that refers to a unique service, independently of the number of actual service provisions and the number of core service actions involved in each of such provisions. In other words, to capture the everyday notion of service we need to move from the microscopic to the *mesoscopic level of analysis* [3], at which multiple service actions of the same kind are aggregated in a coherent whole. It is such coherent whole that, in our opinion, deserves to be called a service.

To better understand the issue, consider the definition of public service proposed by the latest version of the Core Public Service Vocabulary Application Profile (CPSV-AP)⁴:

"A Public Service is a *mandatory or discretionary set of acts* performed, or able to be performed, by or on behalf of a public organization. Services may be for the benefit of an individual, a business, or other public authority, or groups of any of these. The capacity to act exists whether it is used or not, and the term 'benefit' may apply in the sense of enabling the fulfillment of an obligation." (our emphasis)

This definition is still in agreement with the previous ones (since an activity can be understood as a set of acts), with the difference that here the nature of such acts is clarified a bit more. Unfortunately, however, it leaves open whether the single acts belonging to the set that constitutes a public service concern a single *service provision*, for the benefit of a single customer, or rather a single *service offering*, addressed to multiple customers. Consider for instance a public nursery service: each service provision addressed to a parent or a family consists of a sequence of acts performed by a public organization for the benefit of an individual, or a group of individuals (the family). So, a single service provision would count as a public service according to this definition. In this case, a public service identifier may be the registration number formally issued once the nursery request is processed.

On the other hand, a single service provision is probably not the kind of 'Public service' we have in mind: indeed, especially from the point of view of a service catalog, what we need is being able to list public services described by a single *service offering*, addressed to multiple customers. Note that a service understood in this way would still satisfy the definition above, since it may be seen as a (large) set of acts performed by a public organization for the benefit of an individual. However, in this case the service identifier would be rather different, since it should be somehow attached to the service offering.

⁴ <https://joinup.ec.europa.eu/asset/cpsv-ap/description>

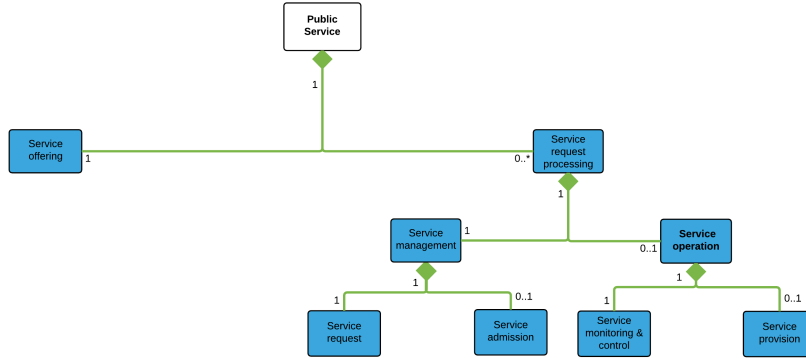


Fig. 1. Public service as a sum of activities

We can conclude that the CPSV-AP definition, as well as the previous definitions of services as activities, fails in offering a way to identify and count services, because of the ambiguity between *service* and *service provision*. A way to solve this ambiguity, accounting for the different nature of these two notions and their mutual relationships is described in Fig. 1. A public service, intended as a sum of acts (and therefore as an activity), is composed in turn by two main kinds of activities: a *service offering* activity and a number of *service request processing* activities, one for each service request. In turn, service request processing includes *service management* activities, such as those needed to handle *service requests* and decide about *service admission*, and *service operation* activities, such as the actual *service provision* and the *monitoring & control* activities. A unique service offering⁵ activity is required to exist for each public service, while zero or more service request processing activities may exist. In this way, the identifier of the service offering can be taken as the identifier for the whole service, which is seen as a sum of activities that may *include* multiple service provisions, but can't coincide with a single service provision.

3. Services as activities: towards a definition

Having clarified the possible ambiguity between *service* and *service provision*, let us now discuss how a definition of service can be articulated. Assuming that a service is, intuitively, a sum of acts ultimately aiming at producing something useful for somebody, what are the essential elements that distinguish a service from an arbitrary sum of such acts? In the past, we have insisted that an essential element is the presence of a *commitment* [4], arguing that a service exist, at a certain time, if a service commitment exist. Now we believe that this position should be revised, since, especially in the light of public services, we realize further essential elements should be accounted for. In short, the following conditions should hold in order for a service to exist:

⁵ Note that, properly speaking, what is offered under this view is a service provision and not a service. So 'service offering' actually means 'offer of service provision'.

1. Prior *commitment* to do the service actions. In the case of public services, such prior commitment arises from public policy, aimed at capturing citizen's needs.
2. Concrete *capability* to honor the service commitment, namely the *actual power* to execute the service actions, within a given *performance*. Such actual power presupposes having *access* to the necessary *resources* and having the *freedom* to execute the actions. The actual execution of a service action is an *exploitation* of the associated capability.
3. Actual service *availability* to customers, resulting from offering activities implemented to *expose* the service through suitable *service access channels*.
4. Finally, actual possibility for the customer(s) to *control* the service, being able (through suitable *service control* channels) to invoke or stop it and monitor its execution on the basis of the *service levels* agreed with the provider.

In the light of these considerations, our refined definition of (public) service is as follows:

A public service is an aggregation of all activities that realize a public authority's commitment to make available to individuals, businesses, or other public authorities some capabilities intended to answer their needs, giving them some possibilities to control how and when such capabilities are manifested.

Note that this definition marks a radical difference with respect to the previous definition proposed by Ferrario and Guarino, since in this case the commitment is not *part* of the service, although the service still depends on it. Moreover, now the commitment does not concern directly the execution of core service actions, but rather the availability of certain capabilities. In this way we can see the actions done to make the service available to customers, including those concerning the offering phase, as proper parts of the service.

Some UML models resulting from the definitions above have been developed recently, in the framework of ongoing projects on cloud services and public services. Space (and time) reasons don't allow us to present them. We only comment here two aspects that deserve further work.

A first comment is about the ontological nature of activities. Of course, an option is to consider them as perdurants in the classic sense. In this case, they would correspond to what in DOLCE are called *processes*. This choice is however not particularly amenable for our purposes, since perdurants in DOLCE are entities frozen in time, which cannot change. This would force us to model services only as historical entities, after they have ceased to be present. On the contrary, the idea of services as activities relies on the intuition that such activities are typically *ongoing*, and can genuinely change in time by acquiring new temporal parts. That's why we are working on a new approach to the ontology of processes, which sees them as *variable embodiments* [5] of events.

A second comment concerns the connection between this approach and the one presented by Nardi and colleagues, which is mainly focused on *service relationships*. Why don't relationships occur in our new model? The answer is that they are implicit-

ly there, as the *focus* of the various activities shown in the model (see [6] for a recent discussion on the interplay of events and relationships).

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References

- [1] J. C. Nardi, R. de A. Falbo, J. P. A. Almeida, G. Guizzardi, L. F. Pires, M. J. van Sinderen, N. Guarino, and C. M. Fonseca, “A commitment-based reference ontology for services,” *Information Systems*, vol. 54, no. C, pp. 263–288, Dec. 2015.
- [2] R. Ferrario and N. Guarino, “Commitment-Based Modeling of Service Systems,” in *IESS 2012, International Conference on Exploring Services Science*, Lecture Notes in Business Information Processing. vol. 103, M. Snene, Ed. Berlin Heidelberg: Springer Verlag, 2012, pp. 170–185.
- [3] N. Guarino, “Services and Service Systems under a Mesoscopic Perspective,” in *Service Dominant Logic, Network and Systems Theory, and Service Science*, E. Gummesson, C. Mele, and F. Polese, Eds. Napoli: Service Dominant Logic, 2013.
- [4] R. Ferrario and N. Guarino, “Towards an Ontological Foundation for Services Science,” in *First Future Internet Symposium, Vienna, Austria, September 28-30, 2008: Revised Selected Papers.*, Springer Lecture Notes in Computer Science. vol. 5468, J. Domingue, D. Fensel, P. Traverso, and P. Traverso, Eds. Springer, 2009, pp. 152–169.
- [5] K. Fine, “Things and their parts,” *Midwest Studies In Philosophy*, 1999.
- [6] N. Guarino and G. Guizzardi, “Relationships and events: towards a general theory of reification and truthmaking,” *LECTURE NOTES IN COMPUTER SCIENCE*, vol. 10037, no. 18, pp. 237–249, 2016.