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The muddy waters of public e-services - The use and misuse of the concept and how to get out of the maze

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Abstract

Electronic services or e-services are key concepts in e-Government. The availability and quality of such services are important indicators of e-Government maturity. However, we question whether all types of electronic interactions between citizens and government agencies really are e-services. We rather argue that our understanding of this concept is inadequate, and that our uncritical, inflationary use of "e-services" blurs important differences between unequal categories having distinct quality requirements. It creates problems when developing ontologies and makes it difficult to achieve better interoperability between systems. We thus propose a framework for categorizing electronic communication using some basic functions (service elements). In this way we can describe and model various types of interactions between citizens and public agencies based on a consistent set of these functions. Our point of departure is to examine the specific characteristics of various interactions between the government and citizens (or businesses) in a service delivery. As an illustration of how to use the framework, we describe some of the basic services in the EU e-Government benchmark measurement in terms of our vocabulary.

Keywords: service, e-service, e-Government, interoperability

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1 Introduction

1.1 Introduction and background

The service concept is widely used but entails much confusion. E-service is even worse; it is understood as almost all types of electronic communication between citizens and government. However, is the government offering us a "service" when we pay taxes or a business is reporting information decreed by law to public agencies, just because we are using the Internet? In the rather vague terminology used within the e-Government field, almost all types of interaction between public authorities and citizens are regarded as services. Such confusion also creates difficulties when defining ontologies to help achieve better interoperability between different e-Government

systems. Goldkuhl (2007) questions the use of service in all governmental tasks, while Alter (2008) points to the different definitions of service across communities. Baida et al.(2004) and Lee (2010), on the other hand, propose an ontology for describing services and service bundling.

A public "e-service" can be solely the electronic communication between a public agency and a user, such as, for example, information provision, completing an application form etc., or it may be one part of a longer interaction sequence that also includes the provision of a physical service (e.g. when applying for child care). The interaction may have been initiated by a user in order to obtain some value (good, benefit etc), or it may be to fulfil a duty obliging us to provide information, for example when paying taxes, reporting various types of information to public authorities, etc. An electronic interaction can replace a previously paper-based communication, or it can involve an "exclusive" new type of service, where the content in itself has a separate, original value, such as, for example, an interactive digital map, an electronic book from the library etc. What is called an "e-service" can also include a set of separate interactions including case handling, as is illustrated in the example of the Norwegian State Educational Loan Fund outlined in chapter 3. On the other hand, the public sector also has many functions which involve electronic interactions that should not qualify as services, such as mandatory collection of information from businesses or other organisations getting public support.

The aim of this paper is to develop a framework for describing and modelling the different types of communication and interaction patterns that are taking place when a public agency provides "e-services" to its various users and stakeholders. More specifically, the purpose of the paper is the following:

- To provide an overview of different descriptions of the e-service concept and possibly find a common understanding, based on a literature review
- To provide a basis for developing more systematic vocabularies (ontologies) for describing public services, which is necessary for achieving better semantic interoperability
- To acquire a more precise understanding of the characteristics of different services in order to be able to specify the quality requirements to a (e-)service; for example, the quality requirements for an online transaction are different from the quality requirements for downloading a book

The paper proposes a framework consisting of a set of basic functions (service elements) to be used when describing various types of "e-services", in order to help understanding the complexity of the concept. The framework has several dimensions, including i) the type or category of the interaction seen from the provider (e.g. communication, information exchange, transaction), ii) the purpose of the interaction (such as execution of authority, fulfilling obligations as a citizen or a business, applying for a benefit or to provide information), iii) the content or structure of the interaction, and iv) the result or effect of the interaction, seen from the receiver.

1.2 Methodology

Our paper is primarily conceptual, aiming to develop a framework for analysing public electronic services. The paper is rooted in the e-Government research field, but borrows from more general computer science, specifically semantic technologies and

ontology development. The discussions of the concept of 'service' is mainly drawn from business science and service management literature but also computer science, because there are few references to this in e-Government literature and not many papers rooted in the e-Government field discussing the service concept.

A literature study has been undertaken to ascertain the different definitions of the concepts 'service' and 'e-service' in current usage, based on the sources mentioned above. In particular, we have searched in the extensive e-Government Reference Library (EGRL 8.5)[1] for relevant studies discussing our topic, using the keywords 'service(s)', 'e-service(s)', and 'digital service(s)'. Our framework is based on the conceptualization of Goldkuhl and Røstlinger (2000), Goldkuhl and Person (2006) and furthermore Baida et al. (2004), Alter (2008), Lee (2010) and the four-stage breakdown of governmental e-services outlined by Wimmer (2002). We have also studied the (e-)service concept in various stage models for e-Government maturity as well as the European Commission's work on modelling public services (Core Public Service Vocabulary) as part of their ISA programme.

To illustrate the usefulness of our framework, we have analysed a selection of the 20 Basic Services that have been selected as part of the metrics of the 9th e-Government Benchmark Measurement (Cap Gemini, Rand Europe, Sogeti, & DTi, 2010).

1.3 Structure of the paper

The next session presents our literature review, where we discuss the concepts of 'service' and 'e-service'. We then discuss the 'e-service' concept in relation to stage models for e-Government maturity. Next, we present the current status of the EU's work on defining a vocabulary for public services, as part of the ISA Programme. We then outline our preliminary framework, which is applied on a subset of basic services from the EU e-Government benchmark metrics. Finally, we present our conclusions and suggest further research in this quite fundamental part of e-Government.

2 Understanding the 'service' and 'e-service' concepts

2.1 What is a service?

'Service' is a concept loaded with different meanings in different circumstances, mostly depending on who uses it. There exist a number of definitions of the concept 'service', both lexical and from other sources. Starting with encyclopaedia the word 'service' comes from the Latin word "servus" which means slave (Webster's, 1979). A first definition of service is the occupation or condition of a servant, corresponding nicely to how service is understood in computer science: A program that offers a service to other programs through a well-defined user interface, such as in Service–oriented architecture (SOA).

Webster's goes on to define service as i) work done or duty performed for another or others, ii) a branch or department of this [public employment] including the people working in it, iii) an activity carried out to provide people with the use of something, iv) the act or method of providing these or the quality of that which is provided, and v) the quality of that which is provided.

[1] see: http://faculty.washington.edu/jscholl/

From the above definition we can see that the concept 'service' is used to indicate an action and also the type of action (the act or method). The definition also covers the output of a service (the quality) and the organization acting to carry out the service. 'Service' first came into use in the 1930s in the U.S. Department of Commerce's Standard Industrial Classification (SIC) (Chesbrough & Spohrer, 2006).

The European Parliament passed the Service Directive, also known as the Bolkestein Directive, (Directive 2006/123/EC) in 2006, a directive that most likely will have substantial impact on the development of e-Government applications. However, the directive does not define 'service' but refers to the EU Treaty. Article 8 of the same directive does say that "Member States shall ensure that all procedures and formalities relating to access to a service activity and to the exercise thereof may be easily completed, at a distance and by electronic means, through the relevant point of single contact and with the relevant competent authorities." The directive here makes a distinction between the service itself and the means of obtaining it, in this case the means of electronic communication.

The Services Directive refers to Article 50 of the (Lisbon) Treaty (European Commission, 2009) for a definition: "Services shall be considered to be "services" within the meaning of this Treaty where they are normally provided for remuneration, in so far as they are not governed by the provisions relating to freedom of movement for goods, capital and persons. "Services" shall in particular include: a) activities of an industrial character; b) activities of a commercial character; c) activities of craftsmen; d) activities of the professions."

Hill (1977) defines service this way: "A service is a change in the condition of a person, or a good belonging to some economic entity, brought about as the result of the activity of some other economic entity, with the approval of the first person or economic entity". Although not very precise, this definition has been adopted by the U. S. government. This definition puts weight on the action rather than the substance or the quality.

Goldkuhl and Röstlinger (2000) discuss the determinant properties of services, often being contrasting to the properties of goods, and they reject the main characteristics of services that often are mentioned; being *intangible* (immaterial), *inseparable* (in production and consumption), *heterogeneous* (i.e. instantial variance) and *perishable*. They furthermore point to the fact that the criteria for service quality are dependent on how a service is apprehended, illustrating that a service can be defined differently as an activity, a benefit or a customer satisfaction. Following from that, they propose to distinguish between a service action (what the service provider does), a service result (what is done to the customer) and a service effect (what a customer experiences from the service, e.g. a satisfaction).

Vargo & Lusch (2004) are in line with Goldkuhl & Röstlinger in that the traditional understanding of services as being intangible, inseparable etc. is misleading and that these characteristics (a) do not distinguish services from goods, (b) only have meaning from a manufacturing perspective, and (c) imply inappropriate normative strategies. However, they differ in their conclusion and argue for a Service-dominant Logic where the relationship between services and goods is emphasized rather than the difference. In this view a good is an appliance used in service provision and service is the common denominator of exchange and therefore a hypernym to goods

(Lusch & Vargo, 2006). Although their conclusions differ, we find that Goldkuhl & Röstlinger and Lusch & Vargo agree on the main question.

Recognising the different takes on the service concept, Spohrer et al. (2007) have called for a unified Service Science to integrate across academic silos and to advance service innovation. They also emphasize the conceptual confusion of 'services' and argue that the change from products and tangible goods to more and more intangible assets calls for a broader perspective and the need for each party in the process to know the other party's knowledge in negotiating the service exchange. They also argue that service innovation is different from product innovation.

Grønroos (2006) points to the observation that customers are both co-producers and consumers of a service, and furthermore argue that a service-logic approach best fits the context of most goods-producing businesses today. This is similar to what is proposed by Vargo and Lusch (2004). They later formulate this as "the customer is always a co-creator of value" (Lusch & Vargo, 2006). They define *Service* "as the application of competences (knowledge and skills) by one entity for the benefit of another" (ibid.). This definition provides a new perspective for understanding economic phenomena, by implying that value is created collaboratively in interactive configurations of mutual exchange. They call these value-creation configurations *service systems*, including the participants, processes, and resources that interact to create value in service systems. So *value* and *value creation* are at the heart of a service and are critical to understanding the dynamics of service systems and to furthering service science. But they also underline that value is an elusive term, hard to define or describe precisely.

Baida (2006) makes a distinction between an "elementary" service (e.g. as the Internet enables integration of the elementary services of multiple suppliers into a seamless service bundle in cases where such co-operations were not possible up until the present time) and a "service bundle". His definition of an elementary service element is something that may be decomposed into smaller service elements, as long as the smaller elements can be offered to customers separately or by different suppliers. A service bundle is a complex service element, including one or more service elements, any of which may be either elementary or a bundle. Service bundles can also be called compound services.

Although public services do not resemble all different categories, we support the understanding that a "service" includes one or more actions, it should have a substantial content that provides some outcome (value) that is attractive for the receiver and implies an effect on the receiver, which also is in line with Hill (1977) . Without fully adopting Baida's definitions, we believe that the basic idea of elementary "services" (as functions or processes) is fruitful, implying that we should develop an ontology of elementary public "service processes". These may include both online electronic and physical activities, and also make a distinction between the two, as discussed in the Core Public Service Vocabulary model in Figure 1. The distinction between service action, service result, and service effect that Goldkuhl & Röstlinger (2000) make is also useful for our attempt to construct a framework for categorizing public e-services.

2.2 What is an e-service?

Moving from the real world to the electronic representation, we question whether we can use the same definition of 'e-service' as for 'service', the only difference being the means of service delivery to the user? Is it as easy as just adding an 'e'? In the e-Government literature, an e-service usually means that an external user (e.g. a citizen) can interact with a public agency through an ICT-based interface, most often based on web technology. For instance, Lee (2010), in his discussion of e-Government stage models, takes the notion of government services more or less for granted. Similarly, Tan et al. (2013) provide no definition, but equal web-mediated services with functions available at websites, and states two important aspects of web-enabled service quality: content functions and service delivery. Axelson and Ventura (2007) make a distinction between an e-form and e-service where they see the first as a part of the user interface of a web-based public e-service.

Rust and Kannan (2003) define e-services in general terms as "the provisioning of services over electronic networks", whereby electronic networks include not only the Internet but also electronic environments such as ATMs. They discuss the e-service concept from a business science view and their e-service concept is tightly coupled with e-Commerce. They do not make any attempt to distinguish e-services from services and do not discuss the possible differences between services and e-services.

In an analysis of the e-service literature, O'Sullivan et al. (2002) also ask "what is a service?" and recognize the difference between physical services and e-services, but without discussing them in depth. They assert that e-services exhibit minimal constraints on the time and location of request, contrary to most real-world services. They also emphasize the need to describe the non-functional properties (availability, channels, pricing strategies etc.)

Service quality is an important aspect of services and has also been used to try to clarify the concept of public e-services, as pointed out by Buckley (2003) and Zeithaml et al. (2002). However, most often the underlying premises for the service concept seem to be taken for granted and not problematized.

Baida et al. (2004) try to bridge the different definitions and approaches to the concept of 'service' from the three different communities of business science, information science, and computer science. 'Service' and 'e-service' as used in business science have very different meanings than the same concepts used in computer science. The former community naturally puts weight on business transactions and see 'e-services' as a natural outgrowth of e-Commerce. From a strict technological point of view, (e-)services are web-delivered software functionality, often in the form of "web services".

Rowley (2006) acknowledges that the theory and practice of e-services is still in its infancy, and that the provisional result is the absence of agreement on the definition. She thereafter goes on to define the concept 'e-services' as "…*deeds, efforts or performances whose delivery is mediated by information technology. Such e-service includes the service element of e-tailing, customer support, and service delivery*". Also this definition is based on a business science view, and it reflects the three main components involved: service provider, service receiver, and the channels of service

delivery. However, she does not say anything about services and thus makes no attempt to relate or differentiate these three concepts.

Goldkuhl (2007) questions the use of the term "service" in all governmental tasks and he asks whether the service perspective is compatible with all kinds of public authority. More precisely, he questions whether a public e-service is a real service to the citizen, in a strict sense: in what ways is a citizen served through an e-service? One of his next questions is what is meant by e-services. He links these questions to a study of a child care service and the work to develop a requirement specification for an electronic child care service. He shows how the lack of a proper understanding of 'e-service' led to problems with the requirement specifications and ultimately the e-service application itself. The citizen was mainly seen as an information provider and not as someone to whom a service was provided.

Alter (2008) also refers to three different disciplines, each with its own definitions of service: marketing, operations, and computer science. He proposes a service system as a useful fundamental unit for understanding, analysing, and designing services in all three disciplines. When discussing automated and non-automated services he emphasizes that the proposed frameworks for a service system does not make any assumptions about whether ICT is involved or not. From Alter's point of view, ICT or other technologies can be part of the service system.

Our literature review shows that there are no precise definitions of the 'e-service' concept. On the contrary, the concept is used and described in many ways, many of them misleading. The 'e-service' concept also has different meaning in various fields, for example a 'web service' holds a precise definition differing from how the concept of a public e-service is described. This shows the necessity of a closer investigation of the various meanings of the 'e-service' and how these can be described more precisely. We believe that Baida's approach based on elementary service functions is fruitful and worth pursuing. Furthermore we have used some of the concepts suggested by Lee (2010).

2.3 e-Services and stage models

A number of stage models have been developed with the purpose of modelling or predicting the progress of public electronic "services", by dividing the development of e-Government into several stages; see, for example, Layne & Lee (2001); Hiller & Belanger (2001); United Nations (2003). They all bear a deterministic characteristic in describing a development from simple provision of information to a more refined one-stop government.

Goldkuhl and Person (2006) have conducted a review of a number of these models, which they criticize: *"The evolutionary assumption is that the stages occur in this predescribed order; first stage I occur and then stage II and so on. [..] in practice these stages will occur simultaneously. The criticism of the quality assumptions is directed towards the assumption that stage IV is better than stage III and so on. ..[..] these stages represent different elements of e-Government rather than a quality progression."*. They suggest rather an alternative model consisting of three polarities (*informative* versus *performative*; *standardized* versus *individualized*; *separate* versus *coordinated*). We agree with Goldkuhl and Person in that the deterministic and linear character of stage models conveys a limited understanding of the complexity and

multidimensional character of various types of interactions that take place between public agencies ad citizens.

In a recent paper: "10 year retrospect on stage models of e-Government", Lee (2010) reports from a qualitative meta-synthesis of twelve e-Government stage models. He argues that these models seem to be incongruent with each other because they are based on different perspectives and they use somewhat different metaphors, presenting a difficulty not only in understanding different research results but also in planning future progresses for e-Government. A common frame of reference for e-Government stage models is presented, including nine elementary concepts (information, interaction, integration, transaction, streamlining, participation, transformation, involvement and, process, management) and two underlying perspectives (a citizen's view and a technological perspective).

Lee's (2010) review of the various stage models also illustrates the lack of a precise and unambiguous definition, which causes various problems when developing e-Government systems, not least when different systems have to exchange information, which we will discuss below. Thus, both scholars and others take a common understanding for granted, which is even worse, when using the comparison of e-service quality level without agreeing upon what they really measure.

2.4 e-Services and interoperability problems

The existing ambiguity in service and e-service definitions creates several problems. Even when humans speak, ambiguity may create some misunderstanding; however this ambiguity may be clarified due to the pragmatic nature of human communication. But when humans interact with computers, ambiguity will be still more problematic, because computers do not have the ability to resolve divergent understandings of a concept without programming instructions. The real problem comes with the machine-to-machine communication. In order for this to work, a common model must be implemented with its definitions, or the different vocabularies must be aligned. This model is usually called ontology in computer science, or as defined by Gruber (1993): "a formal explicit specification of a shared conceptualization".

Much effort has been put into developing more systematic vocabularies (ontologies) for describing public services, which is necessary to achieve better interoperability; see Wimmer (2002), W3C (2004), and OASIS (2006). In such work there is a clear need for more precise definitions of the key concepts that can describe and model the different activities and processes involved.

The Semantic Web is W3C's proposed method for making machines that communicate to interpret and "understand" information, in order to be able to act without specific instructions from the users (W3C, 2009). The Semantic Web and semantic technologies in general are thought to have a profound influence on the future development of the Internet (Berners-Lee et al. 2001). It will thus also have a significant impact on the future development of e-Government, not least the challenging interoperability issue recognized as one of the major barriers to more seamless electronic applications and an area with a substantial gap between plans and realities (Codagnone & Wimmer, 2007).

A 'Web service' is fairly well defined. It denotes "a software system designed to support interoperable machine-to-machine interaction over a network" having thus a much more precise and narrow definition (W3C, 2009). Tightly connected to web

services is the Service Oriented Architecture, a popular framework and hot topic in computer science. OASIS (2006) defines Service Oriented Architecture (SOA) as a paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. In SOA, a service is understood as "the capability to perform work for another or the specification of the work offered for another or the offer to perform work for another" (2006). In SOA, services are the mechanism by which needs and capabilities are brought together.

The European Commission has been working on interoperability issues in the public sector for many years. At present the programme ISA (Interoperability Solutions for European Public Administrations programme) aims to establish a common and formal specification of public services across the member countries. This work in progress is called the Core Public Service Vocabulary (CPSV). The CPSV is a "simplified, reusable and extensible data model that captures the fundamental characteristics of a service offered by public administration" (European Commission, 2013). The modelling of the CPSV is based on semantic web technology (W3C, 2009).

The work with establishing a common model for public services has been brought about partly as a result of the work with a European Interoperability Framework (EIF). The first version of the EIF presented the much used three-level interoperability model with the technical, semantic, and organizational interoperability levels (European Commission (IDABC), 2004). Version 2 of the EIF was published as an annex to the report "Towards interoperability for European public services" (European Commission, 2010) and added the political and legal levels to the existing three levels of interoperability. It also put forward specific recommendations regarding the work with interoperable public services, among these:

> Public administrations should develop a component-based service model, allowing the establishment of European public services by reusing, as much as possible, existing service components (Recommendation 9)

Following up this recommendation, the ISA programme established a working group for the Core Public Service Vocabulary:

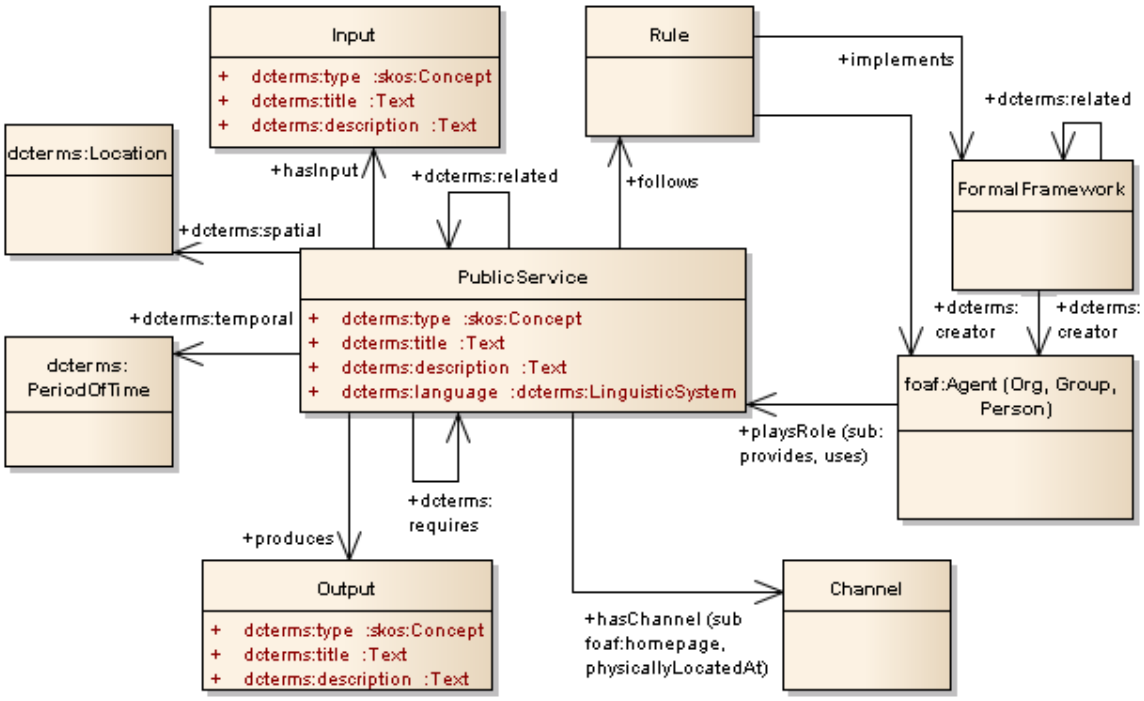

Figure 1: UML diagram for the Core Public Service Vocabulary (European Commission, 2013)

This conceptual model of a public service is quite generic and does not distinguish between physical and electronic services. The fundamental problem of relating and demarcating a 'service' and an 'e-service' is still left unsolved. On the other hand this general approach also opens up for modelling the different parts or elements of a service whether it is carried out electronically or not. The model specifies an input and an output part of the service. In many cases it would be possible to define what is now often called an electronic service, for example a digital form, as the input part of the service. It is important to note that this is just a proposal and not a final model. The model also corresponds quite well with Goldkuhl & Röstlinger's (2000) separation of 'service action' (the classes 'Public Service', 'Rule', 'Formal Framework', and 'Agent') and 'service result' and 'effect' (the class 'Output'). Interestingly, the working group at an earlier stage proposed to differentiate between 'output' and 'outcome', which would be in line with Goldkuhl & Röstlinger's separation between service result and service effect. This differentiation has since been removed from the model.

Semantic technologies call for a greater precision in defining concepts and their relations in what are usually called vocabularies or ontologies. Without such definitions, machines will be unable to act on the information because of ambiguities in the definition of concepts. The 'service/e-service' concepts are clear candidates for such ambiguities. However, the ISA model from the CPSV working group does not provide a solution for this ambiguity (European Commission, 2013), although the model can be used to separate an electronic input form from the actual service and thus reduce some of the existing ambiguity.

Baida et al. (2004) also underlines that understanding the various interpretations of 'service' is not enough to facilitate reasoning about services, as is done in Semantic Web initiatives. But as the formal model of a public service above shows, this can also leave important questions unanswered. Thus, in partly building on Baida et al. (ibid), we will suggest in the following chapters a framework for describing different types of electronic interactions that are called e-services and that can be used to refine models like the CPSV showed above.

3 A framework for categorizing e-services

From the literature review, we conclude that it may not be expedient to provide a definition that unambiguously specifies what shall qualify as an "e-service". Rather we think it is more fruitful to approach the problem of definition by looking at the characteristics of the different types of interaction between the government and the citizens or businesses and model these in a common framework. However, our understanding of an e-service corresponds to the common conceptualization of "service" as stated in section 2.1; it is a digital interaction between a user and a provider that offers a substantial content having some value that is attractive for the receiver. Following from that, public e-services should include activities that are favourable to the receiver, and the service description must include both the activity that is involved and the (intended) result. Furthermore, as many "e-services" are parts of physical (public) services, such links must be included in the description.

Even if a major part of the interaction between public agencies and citizens or private businesses will be digital, many of these interactions will be (an integral) part of a physical service provision, for example in sectors like education, health care, welfare work etc. Thus, in striving for this greater precision, it is necessary to examine the different parts of typical public service provisions, both digital interaction patterns and their possible physical counterparts. We need to identify and name these parts according to their role and function, and in particular see what parts of the interactions are lawful (either permitted or sanctioned). If the interaction consists mainly in completing an electronic form, it should be called something other than an e-service, and then include a reference (link) from the form to the corresponding (e-) service, including a link to relevant regulations. This is in line with the proposed Core Public Sector Vocabulary. It is important to define the different categories of digital interactions in order to be able to handle parts of the service provision automatically.

Below, we will outline a preliminary framework for describing some elementary electronic functions or operations that will be part of the compound or bundle "services" that are usually denoted as e-services. There are different ways of classifying publics services, for example the various maturity models that are developed; see Layne & Lee (2001), Wimmer's (2002), Andersen & Henriksen (2006) etc. Lee (2010) illustrates in his analysis that the different stage models use varying concepts when describing many functions and operations that are included in e-Government systems. He points out that e-Government development "stages" should not be mixed up with the different «service» types and complexity; for example, his "e-Governance" metaphor for most mature stage(s) will include different service categories.

The four-stage maturity model for e-Government service provision is a reference model and we have chosen to use Wimmer's (2002) 4-stage breakdown of the levels

of government "services" that may be delivered electronically, however supplemented with Lee's (2010) clarifications in mind. In this model she distinguishes between these levels*: information, communication, interaction,* and *transaction*. These or similar levels are found in many of the existing e-Government development models (Lee 2010), and they clearly illustrate the complexity in e-Government services. They are as follows:

1. Provide simple what-is, what-is-required and where-to-go information (*information provision*)
2. Possibility to contact people and to get further information (*communication*)
3. Downloading and submitting forms for applications for public services (*interaction or contracting*), which also may be part of a physical service
4. Handling a *complete transaction,* for example to fulfil an obligatory task, such as providing information to the tax authorities.

The three first functions correspond to the elementary concepts described by Lee (2010) (information, interaction, transaction). The last two; participation and involvement, however describe different aspects of what Wimmer classifies as "complete transaction", though he adds more complexity.

In our framework outlined below, we will regard these 3 levels as different categories of elementary electronic interactions between a service provider and a service receiver. Wimmer's breakdown, however, disregard among others the important case handling part of governmental service provision, or other complex interaction sequences. It also hides necessary support or infrastructure functions. We will thus propose two additional categories which include both functions:

5. *Complete interaction* processes, that is, case handling or other type of collaborative actions between public agencies and citizens. This category corresponds to Baida's (2006) definition of a service bundle.
6. *Support function* processes: for example Authentication, Single Sign On, e-Signature, e-Payment etc., which is similar to OASIS' definition of methods or functions (OASIS, 2006).

Goldkuhl and Røstlinger (2000) distinguish between a *service action* (what the service provider does), a *service result* (what is done to the customer) and a *service effect* (what a customer experiences from the service, e.g. a satisfaction). We believe that these dimensions are fruitful when describing a service delivery process. Our category *Purpose of an interaction, seen from the provider* corresponds to their "service action", while we have integrated their two categories "service result" and "service effect" into one "effect" dimension which we have called *Result and effect for the receiver,* describing the outcome for the receiver. Our *content and structure* dimension aims at describing the characteristics of the interaction, indicating whether it is a one-way or two-way dialogue, whether the interaction is static or dynamic, and whether it is regulated by law etc.

Table 1: A framework for different categories of digital interactions between government and citizens (or businesses)

Categories of digital interaction	**Purpose of an interaction, seen from the provider**	**Content/structure of the interaction**	**Result and effect for the receiver**
1. Simple *one-way information provision*	Provide documents to user for downloading	Static, structured information, e.g. brochures	No specific effect other than e.g. to get access to a standard (general) document etc.
2. *Two-way communication* and information provision	Provide specific information services on user request	Exchange of simple messages and specific information provision	No further effect other than the dialogue itself, as e.g. to obtain a specified document or communicate with specific actor. No execution of authority, no specific regulation
3. Dynamic, *secure interaction* between user and system	Initiate a well-defined data handling process, complete an electronic form	Dynamic, involves various types of data/	The effect is a change of state, e.g. to update information in a (public) database.
4. *Secure transaction* and *contraction*	Carry out a specific task , regulated by law, which may be part of public service provision	Formalized exchange of structured information according to regulation.	The effect is to establish a contractual relation between parties, e.g. to accept and sign a debt certificate. Commits the user regarding later action
5. *Complete transaction process*, e.g. case handling	Initiate and execute a complete set of tasks (e.g. complete case handling)	Formalized sequence of interactions & processes, according to regulation.	The effect is (final) decisions that affect/deal with the user, e.g.in case handling,
6. *Support functions*, e.g. Login/Single Sign On, e-Signature, epayment...	Execute a process that are necessary /required for executing a task	Formalized exchange of data, regulated by law : Part of infrastructure	No effect on its own, but mandatory functions when interacting with public agencies, e.g. authorize/ authenticate a secure transactions

Furthermore, Goldkuhl and Person (2007) suggest three polarities: informative versus performative; standardized versus individualized; and separate versus coordinated. We believe these polarities are useful categories, and these are partly included in our set of basic categories of digital interaction in the table above. Our first category, for example, is informative, standardized and separate; the third category is performative, individualized and separate; while the fifth is performative, individualized and coordinated. For space reasons these characteristics are not included in the table

An example is The Norwegian State Educational Loan Fund that provides an online application service for students to apply for grants. But this "e-service", actually includes several phases of interactions between the applicant and the Fund, and can be decomposed into several electronic processes, such as i) accessing and downloading general information and guidance material (type 2 interaction); ii) to log on to the application, using an authorized authentication service (type 6 support function); iii) to complete an online form and initiate the case handling process (type 5 complete transaction): furthermore iv) to be informed whether financial support will be granted or not (type 3 secure dynamic interaction); and v) to access the secure website and sign the debt certificate through a specific signature service (type 4 secure transaction). These basic processes were broken down into a number of interaction sequences between the applicants and the agency, a refinement that was necessary when designing the IS system(s) that automated these different processes.

In addition, we need to assign different quality requirements to these types of interactions, such as usability, accessibility, security level etc. Furthermore, we need to be specific on the type of actors involved, both on the provider side (public agencies, private service providers) and on the receiver side (citizens, private businesses etc.). In this way we will be able to specify and model the different types of interactions and transactions between public agencies and their users in a more precise way, including the legal requirements and premises as well as organisational conditions.

4 The framework applied to the EU's benchmarking measurement

As an illustration of the usefulness of our framework, we describe some of the basic "services" in the EU e-Government benchmark measurement in terms of our vocabulary. This benchmarking scheme was agreed upon in November 2000 and was a part of the eEurope initiative, later followed by the i2010 initiative (Cap Gemini et al., 2010). The main goal of this benchmarking was to monitor "the percentage of basic public services available online". These 20 "benchmark services" are divided into 12 services for citizens and 8 services for businesses. However, it is necessary to describe their characteristics more precisely in order to specify the quality requirements to a (e-)service. For example, the quality requirements for an online transaction are different from those needed for downloading a book.

In analysing these different types of "services", we must identify in detail the individual actions and functions that finally add up to a requested output for the user. Consequently, we must carefully examine if the "service" in question includes a set of (sub-)functions or activities and whether these should be explicitly stated. As an illustration, the "services" linked to obtaining a driver's license involves many steps and corresponding sub-services, carried out by both private and public agencies:

- you have to undertake driving lessons (a physical service provided by a business, not part of the e-service)
- there is a need to check your certificate of good conduct at the police (which may be requested online from a public agency)
- you need to present a health certificate, which may be requested online from another public agency
- you have to study and learn traffic rules and pass a theoretical exam (which may also be completed online)
- finally, you have to undertake a practical driving test (only a physical service)
- and a driver's license is issued if all the above requirements are met (at present issuing the license is a physical service, but in the future it could be an e-service)

In most European countries you can carry out many of these steps online, but it does not imply that we can obtain a driver's license through an "electronic service" as such. It merely means that we can describe and model this process in detail, and offer the citizens a smoother and more effective way of obtaining a driver licence by visualizing the connections between the electronic functions and the physical actions. It will also make the administrative task more efficient for the relevant public agencies.

We will therefore strongly argue that the uncritical use of the (e-)service concepts for all these interactions, as is frequently done in the e-Government literature, blurs

important differences between them, in that these are "services" of quite different categories with distinct quality requirements.

Below we will apply our framework to a selected number of the benchmark services found in the EU's e-Government benchmarkings, as they are found in many countries. We have simplified some of them for illustration purpose and we have chosen services that are common in many countries.

Table 2: The proposed framework applied to some of the 20 basic benchmark services in the European e-Government benchmarking metric.

Services for citizens	**Purpose**	**Type**	**Type of digital interactions**	**Content/structure of interactions**	**Result and effect for the receiver**
Income taxes	Fulfill obligation	6 5(3) 6	Dynamic, secure interaction	• Authentication • Secure Transactions • Signature	Approve tax filing data
Job search	Help citizens	2	Two-way communication	• Exchange of messages (searching, selecting...)	Receive job information /offer
Student grants	Provide a benefit or support	6 5 3 4	Complete case handling process, Signing debt certificate process	• Authenticate • Complete transaction process • Secure transaction • Sign debt. certificate	Accepted (or) refused application Enter into a contract Receive grant
Personal documents [Drivers licence, Passport,]	Provide physical and/or electronic document	6 3 5 3(4)	Compound service involving several agencies, both public and private	• Authenticate • Secure interaction • Complete transaction Process • Pass exam • Secure transactions	Receive passport/ driver license
Car registration	Provide phys./ digital document	6 4 6	Secure transaction and contraction	• Authenticate • Secure Interaction • Signature	Update car register Receive international car license
Announcement of moving	Update register	6 3	Secure transaction	• Authenticate • Secure Interaction • Signature	Update national register Receive verification
Application for a building permit	Fulfill obligation, Get permission	6 3 5 6	Compound service with complete case handling	• Authenticate • Secure interaction • Complete transaction process • Signature	Accepted (or) refused permission Receive completed documents
Declaration to the police	Support citizens interaction with police	6 3 6	Dynamic, secure interaction	• Authenticate • Secure interaction • Signature	Submit a crime report
Public libraries	Help citizens to find and loan books	6 2	Two-way communication.	• Authenticate • Information exchange	Retrieve electronic content

By breaking the different (e-)service elements into basic (unitary) functions or processes, as shown in the table above, we add more information about the digital interactions that are included in these different categories of "services", which will help us understand them in more detail. For instance, when a "service" involves exchange of information between different public agencies, we can use these basic functions to describe the various service elements in significant detail. It will then be easier to model them, also because these different service elements can be given distinct names. This type of modelling is essential to achieve a necessary level of interoperability, both within and across organizations providing such services. It is a prerequisite for developing a service *ontology*. It is also necessary in order to measure the quality of services and e-services. The CPSV model (figure 1) illustrates how to name the different parts constituting a service and the relationship between them. Our framework will help to identify these parts.

5 Conclusions and further research

This paper has demonstrated that the various and inconsistent definitions of 'e-service' are confusing and troublesome, and most often 'service' or 'e-service' are used without any further precise description. We will strongly argue that the uncritical use of the (e-)service concepts for all types of interactions, blurs important differences between them in that these are "services" of quite different categories with distinct quality requirements. This is not least the case in public documents and in benchmarking work, where precise concepts are crucial. We do also find different conceptualizations of the service concept, both within and across research disciplines.

Our literature review, along with the ongoing work with the Core Public Service Vocabulary, shows that consistent definitions are particularly important in the development of semantically enhanced systems. Consistent use of semantics is a prerequisite to increase levels of interoperability. Ontologies are attempts to carefully define parts of the data world and to allow mappings and interactions between data held in different formats (Berners-Lee et al., 2006). The gap between plans and realities in this important part of e-Government work (Codagnone & Wimmer, 2007) shows that this is not an easy task. A lot of vocabularies exist in different organizations, sectors and subject domains; what are missing are alignments, adaptions and adjustments.

As shown in chapter 4, we have demonstrated that our framework including six generic categories of interaction is useful in describing and modelling e-Government services. This categorization and breakdown of services is also essential for benchmarking purposes and the ability to evaluate service quality. Different categories of services have different expectations from the users and must thus be evaluated based on different criteria.

We therefore argue that there is a need to conduct a more systematic analysis of the different tasks and duties of the Government which may help us to acquire a better understanding and definition of different services and how they can be modelled when building interoperable online e-Government applications. More specifically there is a need for more research and work on developing service ontologies and how to measure the quality of services and e-services, for example in the areas of usability, reliability, responsiveness, security and so forth.

We are thus in line with Goldkuhl (2007), who argues for more reflective studies on the service dimension in e-services, and we claim that substantial parts of what are now called e-services are rather service descriptions, service interfaces, or service representations. There is an urgent need to properly define the key concepts in the e-Government field, and 'e-service' is one of these, in order to make progress in the work with interoperability. The e-service concept must be broken down into unitary elements which must be named accordingly, partly following Baida's (2006) definitions. In this way, we can ensure that we are talking about the same thing and that we can exchange data between systems without the risk of compromising the overall system.

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