Managing the Normative Context of Composite E-services

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Abstract. As more and more companies provide their services over the Internet, the need to better understand and manage the normative context of composite services (including rights and responsibilities of all parties involved) becomes evident. Unfortunately the normative perspective of both individual and composite services seems to be left out from current e-service research and practice. Yet, this perspective of e-service provision is very important not only because of the possible legal consequences but also because of its implications on customer's trust. The main objective of this paper is to investigates the normative perspective of a composite e-service offered by independent as well as affiliated service providers. It proposes a formal model of the normative context investigates the problem of its management and defines the requirements for a value-added service that could be used both by customers and providers of composite e-services.

1 Introduction

"Let your customer do the work for you" is one of the new e-commerce strategies that is becoming increasingly popular in recent times. Consequently, more and more companies are entering the world of e-services, offering easy-to-use, Internet-based, applications that enable customers to perform a wide range of business transactions with the given company in their own time. When implemented properly, e-services not only create an added value for the customer, but also cut the cost of business interactions for the company by freeing its valuable resources.

As companies are gaining more and more experience in e-service provision their services are becoming increasingly complex. They have long moved from simple order and payment applications to provision of very sophisticated services such as for example integration of customer's value chain.

In addition to individual e-services offered by independent service providers, another very important trend has emerged in the form of composite e-services. Composite e-services enable flexible, on-demand, integration of individual e-services offered by different providers to meet the given business objective. This concept opens up new possibilities for cross-organisational integration through flexible business processes that consist of a number of coordinated e-services. Consequently, even the smallest providers can participate in composite e-services and cross-organisational business processes without sophisticated IT infrastructure.

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When it comes to the provision of composite e-services there are three business models that are currently in use. The first one sees a third-party service provider in charge of composition and provision of a composite e-service made of related but independent e-services. Thus the provider of the composite service is in charge of selection of individual services and their providers, as well as monitoring and coordination aspects. The second model involves self-regulatory and self-coordinated e-services where individual service providers take responsibility to coordinate their services with the others (see for example [1]).

This paper deals with the third model where customers (service users) are in charge of composition of complex-services. This model is likely to become more and more common especially with the companies using strategic alliance marketing to promote each others' products and services encouraging customers (through bonuses and discounts) to compose their related services. In many respects this is the most challenging concept among all three, as the typical customer does not usually have sophisticated tools or expertise to deal with complex services. At the same time, this customer has the ultimate choice not to proceed with a business transaction and will do just that in the case of any real or perceived problem.

Irrespectively of the chosen business model, the problem of e-service composition opens up a number of research and implementation challenges. Currently, there are many projects well under way to enable technical integration of independent e-services across different web-platforms. Equally important is the research problem of integration at the conceptual (modelling) level dealing with integration of business concepts.

There are several different aspects of service integration that require investigation at the conceptual level. For example [2] identifies four different perspectives: *the control-flow perspective* (that establishes the order individual services), *provider perspective*, *data exchange perspective* and *transactional perspective*. There is also a *temporal perspective* described in [3]. However, one of the important perspectives that is missing from current research and practical implementations is the *normative perspective.* This perspective includes modelling and management of normative context including rights and responsibilities of all parties involved in e-service provision. The normative perspective is crucial not only because of the legal implications but also because of its possible negative effects on customer trust that is so hard to establish and maintain in online world.

So how do e-services currently deal with this perspective? Simply by providing pages and pages of densely typed text including static terms and conditions for provision of a particular service usually followed by "I accept" or "Cancel" buttons. This is supposed to clearly communicate the normative context, yet in many cases customers have problems getting full information and more importantly understanding it, so they simply opt-out. On the other hand, if they decide to proceed with transaction, once they click on the "I accept" button they create a set of rights and obligations (normative context) for all parties involved. This may not be such a problem in the case of a simple e-service, however it could be very complex in the case of composite e-services offered by several affiliated service providers. Unfortunately, at this stage, there is no any support offered to customers to better manage their normative context. However, as composite services are getting more and more common, the problem of proper management of the normative context is likely to become even more important.

The main objective of this paper is to investigate the normative context of e-service provision including both individual and composite services with the following specific aims:

- to design a formal model of the normative context for both individual and composite e-services
- to investigate the problem of management of a normative context for both customers and service providers.
- to define the requirements for a value-added service (tool) for management of normative context and analyse if such a tool could be also offered as an e-service.

As a research framework, the paper proposes a simple model of an e-service lifecycle that consists of: *pre-service*, *service execution* and *post-service* phases and uses this model to analyse representation and management of the normative context for both individual and composite e-services.

The paper is organised as follows: Section 2 gives an overview of the related work. Section 3 introduces the e-service lifecycle that will be used as a framework for discussion of the normative perspective of e-services. Modelling of a normative context of single and composite e-services is described in Sections 4 and 5 respectively. Section 6 deals with the problem of management of the normative context and analyses the requirements for possible support that could be offered to customers and service-providers in a form of a value-added tool.

2 Related Work

In recent years, the area of e-service provision (and in particular e-service composition) has become increasingly relevant. As already mentioned, there are several research groups that deal with e-service integration both at technical and conceptual level (see for example [1], [2], [4], [5] etc.). At the modelling level, the emphasis seems to be mainly on the control flow and transactional perspectives of e-services. However, as already pointed out, the normative perspective of composite e-services is yet to be investigated.

Another related area of research is e-contracting in B2B. Lee [6] was one of the first researchers to propose the use of deontic logic to model electronic contracts. Later, the Reference Model of Open Distributed Processing (RM-ODP) [7] and in particular its component called the Enterprise View Point introduced a framework for modelling of contracts (including obligations, prohibitions and permissions) in an enterprise. Recent work in this area includes BCA (Business Contract Architecture) by [8], [9] and Agent –Based Electronic Contract Framework (ECF) by [10].

Although both B2B e-contracting systems and the normative perspective of e-services described in this paper, deal with formal modelling of deontic constraints there are several major differences. E-contracting systems deal with the B2B contracting process – including contract negotiation, drafting, verification, monitoring and enforcement. On the other hand, the process of generation of the normative context (rights and responsibilities) in e-services is different. Customers using composite e-services are presented with pre-defined set of explicit terms and conditions and they are not in a position to negotiate its content. However, terms and conditions are not

yet a normative context. Only when customer performs certain type of actions (click on the "I accept" button"), the combination of actions and the offered terms and conditions will result in the creation of the normative context for both customer and service provider. This situation is especially complex in the case of composite e-services when a customer deals with the number of service providers at the same time and is expected to fully understand rights and obligations resulting from their intended actions. Thus, the main emphasis of this work is to primarily help customers in B2C to manage the normative context of both individual and composite e-services.

Finally, it is important to mention the emerging standards such as WSDL (Web Service Description Language) [11] that provides an abstract description of a particular service including all necessary information to invoke a particular service. Another relevant area is work on Service Level Agreement (SLA) as it also deals with obligations of service providers. SLA represents a contract between an Application Service Provider and end-user that is used to regulate mainly technical side of service provision including a guaranteed level of system performance, specified level of customer support etc. For more information on SLAs see [12]. So far, developments in both areas focus more on the technical side of service delivery rather than the business oriented service modelling at the conceptual level that is the main focus of this paper.

3 E-service Lifecycle and Its Normative Perspective

Irrespectively of whether an e-service is individual or composite it is possible to distinguish among three different phases of its lifecycle that are relevant for the analysis of the normative perspective. These are: *pre-service*, *service provision* and *post-service* phases. This section gives a brief overview of all three phases:

3.1 The Pre-service Phase

During the *pre-service phase,* service providers advertise their services along with their respective terms and conditions. Visitors browse the offered services and make their selection. (Note that the marketing of e-services and the actual selection of service providers are out of the scope of this paper).

There are several problems that can occur during this phase both on customer and providers' sides and that are related to the normative perspective of an e-service. First of all, on the customer's side, an important problem related to terms and conditions is obvious lack of choice (flexibility). "Under contract law, the terms and conditions that are applied to a transaction need to be offered and accepted. Usually at least some aspects are likely to be expressly offered and accepted, although the courts might impute conventional terms of trade in any particular industry sector and are very likely to regard some terms as being implied. … An area of difficulty is the lack of consumer choice in such circumstances, because the only choice that exists is for consumer to accept the fixed terms and conditions or not do business" [13]. In addition to customer's lack of choice, another equally important problem is customer's lack of clear understanding of their rights and obligations even with regards to the *explicit* terms and conditions let alone the *implicit* ones (assumed to be known in a given business domain).

On the provider's side, they are required to clearly communicate customer's rights and responsibilities otherwise they may be held liable for provision of misleading information given by their terms and conditions. For example, in 1999, two computer manufacturing companies agreed to settle US Federal Trade Commission charges that they had disseminated misleading information to their consumers on their web site related to computer leasing plans and the total fees involved. The FTC investigators found out that both companies had included the required information on their Web pages, but "the important details, such as the number of payments and fees due at the signing of the lease, were placed in a small typeface at the bottom of a long Web page. A consumer who wanted to determine the full cost of leasing a computer would need to scroll through a number of densely filled screens to obtain enough information to make necessary calculations" [14].

From the normative perspective, it is important to observe that during pre-service phase, customers perform so called *informative* rather than *performative* actions. In other words, their actions do not generate any obligations for the customer to proceed with the service nor for the provider to offer the service. For example: customer clicks on the *Terms and condition* link and then on the "Cancel" button. The distinction between informative and performative actions, used in this paper, originates from the *Speech-act theory* (see [15]).

3.2 The Service Provision Phase

This phase is initiated by customer's very first performative action(s) (e.g. clicking on "I accept button"). Performative actions combined with terms and conditions given by service provider result in the creation of the *normative context* (specifying rights and responsibilities) for all parties involved. It is important to observe that service provision is a process rather than a single event. Therefore, even in the case of a very simple e-service, its provision may incorporate a number of both informative and performative actions.

In this paper, the normative context of an e-service is defined as a set of deontic constraints (obligations, permissions and prohibitions) that specify rights and responsibilities of all parties involved. Obviously, provision of a single service results in a number of deontic constraints as well as possible sanctions if actions are not performed as agreed. Deontic constraints are described in more details in the next section. The whole situation is even more complex in the case of composite services.

3.3 The Post-service Phase

The *post-service phase* deals with the analysis of the accumulated experience on service execution and is more relevant for service providers than customers. In the case of affiliated marketing strategies, data including deontic constraints and their fulfilment can be collected and analysed to evaluate the effectiveness of the partnership between affiliated service providers. This could be an integral part of the overall Customer Relationship Management (CRM) strategy for a given service provider.

4 Modelling of a Normative Context of a Single E-service

As already pointed out, the normative context of an e-service is defined as a set of deontic constraints. A formal model of obligations, permissions and prohibitions was first introduced by von Wright [16] in a form of formal logic called deontic logic. Later on it was widely used for modelling of organisational knowledge (see for example [5], [7], [9] etc). According to deontic logic, constrains include obligations, permissions and prohibitions, defined as follows. An *obligation* is a prescription that a particular behaviour is required. An obligation is fulfilled by the occurrence of the prescribed behaviour. A *permission* is a prescription that a particular behaviour is allowed to occur. A *prohibition* is a prescription that a particular behaviour must not occur. A prohibition is equivalent to there being an obligation for the behaviour not to occur. The original deontic logic didn't include the concept of time. It was later extended by [6] to include temporal constraints.

The formal model of the e-service normative context, proposed by this paper, is also founded in deontic logic. Here, deontic constraints are extended to include the following concepts: a set of *pre-conditions, period of validity*, and a set of *sanctions* for each deontic constraint.

Formally, a deontic constraint can be defined as:

Ci: Deontic-Constraint-Type (Role, Action) valid (tb, te) -> Si

where *Ci* represents a set of pre-conditions under which this deontic constraint becomes valid (effective). For unconditional constraints it is an empty set.

Deontic-Constraint-Type ¸ {P, O, F}

indicates one of the three types of deontic constraints. Thus, it can be a permission (P), obligation (O) or prohibition (F).

Role represents a legal party involved in service provision i.e. a customer or service provider.

Action is the *performative* action that the given role is obliged/permitted or prohibited to perform during the period of validity of the given deontic constraint.

(tb, te) is a time interval that represents the period of validity for a given constraint. *tb* is the time when a given constraint becomes effective (valid). In the case of obligations *te* is the deadline by which this constraint has to be satisfied. In the case of permissions and prohibitions *te* is the end of validity period. The period of validity for a given constraint will be initiated at the beginning of the service provisioning phase.

Si is a set of sanctions that is applicable only to obligations and prohibitions in the case if they are not fulfilled by the given deadline.

For example:

(Customer, Clicks-on-I-Accept, P1) :

***O** (Customer, buy-ticket-from-P1) valid (tb,tc) -> S1*

***where** tb=* Time*(Click-on-I-Accept) and*

te=tb+14 days and

S1: Customer will be charged 10% of the ticket price

The above is a conditional obligation with the condition being expressed as: *(Customer, Clicks-on-I-Accept, P1).* If and when this condition becomes satisfied, the corresponding obligation will take effect. Therefore, the above deontic constraint indicates that if *Customer* performs a performative action *Click-on-I-Accept* button on the web site of the provider *P1*, s/he is *obliged* to buy the ticket from this provider *within 14 days* otherwise *s/he* will be legally liable to pay a fee of 10% of the full ticket price.

It is important to observe that the above constraint is defined during the service pre-phase as a part of static terms and conditions for service provision. It is then instantiated (becomes effective) by the first performative action of the customer, during the service provisioning phase. The formal contract between the customer and the service provider will result in more even deontic constraints.

Formal modelling of terms and conditions for the provision of a single e-service may result in a large number of deontic constraints. *Deontic inconsistency* occurs when the same role is both *obliged* and *prohibited* or *obliged* and *forbidden* to perform the same action during the *same period of time*. Verification of deontic consistency is more complex (and relevant) for the service provider rather than for the customer (in a single e-service scenario) due to the large number of customers and their respective deontic constraints.

Obviously, deontic constraints have to be represented in a more user-friendly form, as customers cannot be expected to deal with formal models. A possible way to visualise deontic constraints could be a *deontic to-do* list that specifies not only constraints but also the associated performative actions. Deontic to-do list is an extension of a concept of a role widow that was originally introduced in [17] in the area of electronic contracting. Figure 1 depicts an example of deontic to-do list that is divided into 3 different areas that correspond to obligations (O), permissions (P) and prohibitions (F) assigned to a particular role for a given service *Si*. Within each area, each timeline has a corresponding time interval that indicates the period of validity of a gi-

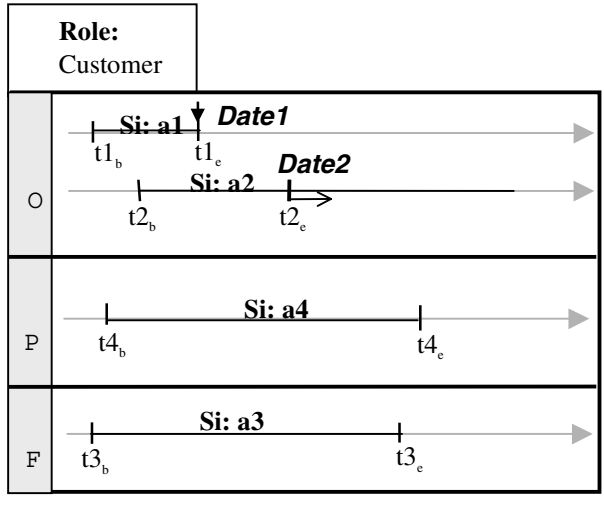


Fig. 1. An example of a deontic-to-do list for service Si

ven constraint. Deontic to-do list can be used to visualise both hard deadlines (e.g. action a1 *must* be completed by Date1) as well as soft deadlines (action a2 *should* be completed by Date2). It can be also used for verification of deontic inconsistency.

Simply, if time intervals associated with an obligation or permission for the given role and perfomative action, overlap with a prohibition defined for the same role and action there is a deontic inconsistency.

Deontic to-do list can be used on both customer's and provider's sides. On the customer side it could be used for visualisation, deontic verification and monitoring of the normative context. Thus it can help customer to better understand and manage the normative context of a given service. On the provider's side, it could be used active tracking of their rights and responsibilities including monitoring and query composition and execution. For example it could be used to determine for a given time interval all pending obligations and associated sanctions. This could be used not only in B2C but also in B2B commerce.

5 Normative Context of a Composite E-service

The normative context of a composite service is a combination of normative contexts of individual services. Its complexity is determined not only by the number of individual e-services, but also by the type of service providers and nature of their business relationship. Thus, we distinguish between composite services offered by independent or affiliated service providers.

5.1 Independent Composite E-services

If a customer combines individual independent e-service into a composite service the resulting normative context is a union of all deontic constraints from individual normative contexts. For example, a customer planning a trip purchases an airline ticket via one service provider, books a rental car through a car-rental agency and books a guided tour through a local tourist agency. All service providers in this example are independent and under no obligation to coordinate their activities in any way. In fact, they are not even aware that their services are a part of a composite e-service.

Thus, it is up to the customer to coordinate services and negotiate service delivery dates in accordance with the given (static) terms and conditions for each individual service. Obviously, deontic to-do list on the customer's site will include actions and corresponding deontic constraints for all different service providers. As they are independent the likelihood of deontic inconsistency between individual constraints is very low (and can be easily detected). However, the main problem on the customer's site is possible temporal inconsistency that can occur as the result of a coordination problem. For example, a customer is obliged to be at two different places at the same time or is obliged to pay the car rental without securing the air ticket. Therefore, it would be useful to have a coordination tool on the customer's side to help them schedule individual actions and obligations and even negotiate service delivery dates.

A coordination tool that could be used in this case is the *time map* [3]. The nodes of the time map correspond to the beginning/end time of individual e-services (i.e. customer's and providers' performative actions). Arcs are relative time values that

correspond to a distance between the corresponding two time points (e.g. duration of an e-service or time between two e-services). All arcs are labelled by temporal operators (e.g. "<") and some by relative time values indicating time limits (e.g. *"<d1"* means that the distance between two time points should be less than *d1*). An absolute time value attached to a node correspond to a deadline or estimated occurrence. To indicate repetitive time, a set of absolute time values is attached to a node. To distinguish temporal constraints (when services have to be completed by) from estimates (when services could be completed by), a darker font/colour is used. For example, Figure 2 indicates that the estimated duration of Si is less than d1 time. Service *Sj* must start before *Si*. Service *Sj* is expected to occur on *Date2*, *Date3* or *Date4*. Service *Sk* is expected to start after or at the same time (no earlier) when service *Si* ends. Service *Sk* must take no more than *d2* time to complete. Services *Sk* and *Sl* must start at the same time (i.e. *Date1*).

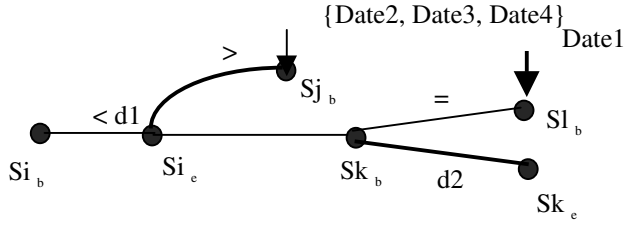


Fig. 2. An example of a time map

The time map can be used for scheduling of individual services (including negotiation of service delivery dates and times), verification of their temporal consistency and monitoring of service execution. It could be used as a complement to the deontic to-do list. For more details on modelling and verification of temporal constraints in e-services see [3]

5.2 Affiliated (Dependent) e-Services

Under the affiliated marketing strategy, one service provider advertises related services of another service provider. They may offer discounts or other special deals to customers who combine their services in a certain way. It is important to note that there is a third party service provider that combines individual services. Various marketing strategies are used to encourage customers to combine individual services, however services can still be used independently. For example, suppose that a local airline is affiliated with a car rental agency and a hotel chain and on its web site offers a promotional package "City Getaway" until the end of April 2003. Suppose they offer the following deal to their customers. All customers who purchase a local adult airfare to one of the capital cities in Australia by the end of April 2003, if they book a car through the affiliated rental agency within 48h after purchasing the ticket, will receive 15% discount on the standard rental fee. They will also receive a 10% discount coupon to be used in any of the restaurants of the affiliated hotel chain valid till the end of April 2003. This type of affiliation is quite common, especially in event management (organisation of conferences and major sporting events).

The normative context on the customer's side includes deontic constraints that combine performative actions of more than one service provider. On the other hand,

service providers deal with conditional obligations and permissions where the actions of one service provider become conditions for deontic constraints of another provider. Therefore, in addition to temporal interdependency between individual performative actions, there is deontic interdependency between deontic constraints of affiliated service providers. For example, service provider *B* is obliged to perform an action *aj* (e.g. give a discount for car-rental), only if the customer performed a set of performative actions (book a car within 48h after purchasing the ticket on provider *A's* web site).

A possible formal representation of this conditional constraint is given as follows:

(Customer, buy-ticket (Airline-A)) before 30-04-03 and

(Customer, book-car(car-rental-C1) and

Time (book-car (Car-rental-C) < Time (buy-ticket(Airline-A) + 48 h:

***O** (Car-rental-C1, give-discount(%15)) valid (tb, te)*

where: *tb* = *Time*(book-car (Car-rental)) and

te <= 30-04-03 is the agreed car pickup date/time.

Obviously, this conditional obligation will becomes active if customer's performative actions satisfy its conditions. Variables *tb* and *te* that specify validity of this obligation will be instantiated at the time action *book-car* is completed.

Therefore, service providers are expected to deal with both temporal interdependency (to track and coordinate relative performative actions both on the customer's web site and the sites of all affiliated service providers) as well as deontic interdependency (including mutual verification of deontic constraints). To be able to do it, all affiliated service providers will need to "share" the normative context created by the provision of the composite service (i.e. to be aware of customer's performative actions on the affiliated web site). That means they need to have access to a shared deontic to-do list or at least to exchange messages or use any other coordination awareness mechanism to detect events on the affiliated web site that will trigger their own obligations.

Formal representation of the normative context is only the first step towards efficient management of the normative context on both customer's and provider's web site. The following section deals with the problem of normative context management in more details.

6 Managing the Normative Context of a Composite E-service

As already pointed out in Section 3, it is possible to distinguish three different phases of an e-service lifecycle: pre-service, provision and post-service phases. Recall that the normative context gets created at the beginning of the second phase by customer's first performative action. Therefore, management of the normative context is relevant only during service provision and post-service phases. In this section we concentrate on the *service-provision phase*. Table 1 summarises the most important requirements for normative context management support during provision of both individual and composite e-services.

Table 1. The Main Support Requirements for Management of the normative context

Role / Service Type		Customer	Service Provider(s)
INDIVIDUL		• user-friendly visual representation of deontic constraints (e.g. deontic to-do list) • detection of possible temporal and deontic inconsistency of a set of deontic constraints (by using the time map and deontic to-do list) • event management including: automatic generation of reminders and alerts	• user-friendly visual representation of deontic constraints (e.g. deontic to-do list) for number of customers • detection of possible temporal and deontic inconsistency • event management including: automatic generation of reminders and alerts for all customers • exception handling including "what if" analysis tool
COMPOSITE	INDEPENDENT	• as in the case of individual services plus - integraton of normative contexts (i.e. integrated to-do list) - coordination tool (e.g. time map)	As in the case of individual service providers
	AFFILIATED	• as in the case of individual services extended to manage the increased number of roles and their performative actions	• as in the case of independent composite e-service plus: – awareness management – management of conditional deontic constraints

This table also illustrates new opportunities to create added value on top of an e-service being provided. This could be even taken one step further. Thus, provision of support for management of normative context could be even offered as another value-added service provided to the customers. However, provision of such a service would

open up a number of interesting research challenges that need to be solved before such a service could be implemented. First of all, it is necessary to consider which party could offer such a service. For example, in the case of individual services, it could be offered by the same e-service provider. In the case of composite e-services (both independent and affiliated), provision of such a value-added service is much more challenging due to the number of reasons. For example, it would require the "integration" of normative contexts offered by different (dependent or independent) providers. However, the first step towards integration is standardisation of the representation of the normative context for all providers. A possible solution for standardisation of the representation of the normative context, or at least the first step, could be through an extension of the existing Web Services Description Language (W3C, 2001) that is becoming widely recognised both by researchers and industry.

6 Conclusions

As more and more companies provide their services over the Internet, the need for better understanding and ultimately better management of the normative context of composite services (including rights and responsibilities of all parties involved) becomes evident. Unfortunately the normative perspective of both individual and composite services seems to be left out from current e-service research and practice.

Yet, the normative perspective of e-service provision is very important not only because of the possible legal consequences but also because of its implications on customer's trust.

This paper investigates the normative aspect of individual and composite e-services offered by independent and affiliated service providers. It also defines requirements for management of the normative context on both customer and provider(s) sides during the service execution phase.

However, there are many interesting research problems that should be further explored. First of all, user-friendly representation of the normative context is very important. The proposed model of deontic constrains and deontic to-do list is only a starting point in this direction. Another problem is related to data interoperability and possible standardisation of the deontic context. This would require dealing with the problem of ambiguities in terms and conditions and generalised expression of purpose such as "other services" or "for the performance of agency's functions' (as pointed out in [13]) as they cannot be easily translated into deontic constraints.

Finally, from the business perspective, it is necessary to investigate if full disclosure and standardised description of all terms and conditions (without "small prints" and "conditions apply " statements) is likely to affect provider's marketing strategy and ultimately its competitive position.

Research presented in this paper hopes to provide a starting point for further investigation of the management of the normative context of composite e-services.

Future work includes further analysis of terms and conditions from the perspective of a possible standardisation, analysis of the accumulated experience (in particular normative contexts) and creation of "deontic profiles" on the provider side.

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