e3service - A structured methodology for generating needs-driven IT-service bundles in a networked enterprise

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ABSTRACT

IT-services should not only be considered from a technical perspective, but should also be seen as *commercial* services that satisfy a *consumer need*. Examples include well-known services such as Internet access or an email box. Typically, to satisfy a complex consumer need, a *bundle* of elementary services is required. In such a bundle, each elementary service can be offered by a different supplier. A key problem is then how to actually find service-bundles that satify customer needs as close as possible. Because IT-service bundles can be automatically provisioned online immediately after ordering, finding a service bundle satisfying a need should preferably also happen automatically. To this end, we propose the $e^3service$ ontology, which offers constructs from service marketing, but in a computational way, such that automated reasoning support can be developed to match consumer needs with IT-services. This paper presents the $e^3service$ ontology and explains it by a case study in the postal industry

Categories and Subject Descriptors

H.4 [**Information Systems Applications**]: Miscellaneous

General Terms

IT service bundling, ontology, value-based requirements engineering

Keywords

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1. INTRODUCTION

In recent years, the notion of customizable bundles of IT-services to satisfy complex needs from specific consumers has gained interest. Consider a daily-life example of obtaining internet services from Internet Service Providers (ISPs). Often, the proposition of an ISP is actually a bundle consisting of more elementary services such as IP-based access, an email box, space to host a website, telephony, and access to newsgroups. However, the consumer may prefer a different, perhaps a smaller, bundle; for instance *only* IP-based access plus email plus IP-telephony. Such a bundle then more closely matches the consumer need compared to the original -fits for all- full-service bundle.

Additionally, IT-services are increasingly offered by a networked value constellation, rather than just a single enterprise [17]. By doing so, suppliers can utilize their core competencies, while still satisfying a consumer need. In the ISP-example, the offered bundle can be a multi-supplier bundle: IP-access is then provided by a telecom operator, an email box is offered by a commercial enterprise utilizing economies of scale, as can hold for website hosting, which may be offered by yet another enterprise.

We perceive automatically composing and provisioning such a needs-driven, multi-supplier IT-service bundle as a key problem. In a future scenario we foresee, a consumer would ideally state to the web his IT-needs, and the web (or some intermediate party) responds with a list of candidate multi-supplier IT-service bundles. After selection of a specific bundle by the consumer, the IT-services in the bundle should be provisioned automatically.

Guidelines on creating customized service bundles have already been studied in business literature, most notably by [10],[14],[15] . Yet, these guidelines are aimed at services in general and not specifically at IT-services. More importantly, they lack conceptualization and formalization which means that it is difficult to systematically and (semi-) automatically reason about service bundles. Such reasoning is important, because IT-services, as illustrated by the ISP example, are bought and provisioned online, *enabled by* information technology. To adequately facilitate this buying and provisioning process, the elicitation of IT-needs, as well as the selection of *commercial* IT-services that can be provisioned to satisfy such needs, should by supported by information technology as much as possible.

The contribution of this paper is an ontology about *consumer* needs, called $e^3service$. The ontology relates a need to available IT services, which are in a service catalog. Moreover, we propose a *gradual* process from need elicitation and statement (essentially the 'problem statement') to a bundle of IT-services (the 'solution'), recognizing that consumers often have already parts of a service bundle in mind, if they articulate their needs. In other words: need (and problem) statement does usually not happen context-free, but already

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includes knowledge about the kind of available services (solutions) in the market. This phenonema is also known in design and problem solving theory (see e.g. [9]).

It is important to know that we understand IT-services really as *commercial* services: economic activities, deeds and performances of a mostly intangible nature [15], with a focus on those services that can be ordered and provisioned (nearly) online. This is in contrast with web services and related standards such as BPSS [1], BPEL4WS [4], WSCI [5], and WS-Coordination [8], to name only a few: these services are mainly intended to arrive at a cross-organizational computing platform to facilitate interoperability on a more *technical* level.

This paper is structured as follows. In section 2, we present a comprehensive overview of the bundling reasoning process. As this paper focuses only on a part of the reasoning process, namely consumer-oriented reasoning, we present in section 3 an ontology to represent consumer needs, wants, demand and benefits. In section 4 we apply this ontology to a real-life case study performed in the postal industry, to reason about potential service bundles. In section 5, we discuss related work on IT-service bundling. Finally, in section 6 we present our conclusions.

2. E³SERVICE; A STRUCTURED APPROACH TOWARDS CREATING SERVICE BUNDLES BASED UPON COMPLEX CONSUMER NEEDS

The high-level steps of *e³service* are presented in figure 1. We make an explicit distinction between two processes needed for the bundling reasoning: the *creation* of service catalogs (that should happen on beforehand), and reasoning *with* these catalogs about feasible *bundles* on a per consumer-need basis.

1. *Create a service catalog.* This has to be done *before* we can actually reason about service bundles themselves. The aim is to build per-supplier catalogs that describe the services and the needs which can be satisified by these services. Obviously, the catalogs will be used by the service bundling reasoning itself (see step 2). Building this catalog requires three steps:

   1.1 Eliciting suppliers, and for each supplier, eliciting the IT-services they offer. The outcome of this task is a -per supplier- list of commercial IT-services. These IT-services should as fine-grained as possible, nevertheless it should still be *commercially* feasible to provision each service in its own right.

   1.2 Formalizing each IT-service from a *consumer* perspective. As we will see later on, this comprises an understanding of the consumer need that is satisfied by the IT-service, ultimately in terms of benefits (being features of an IT-service, such as a mail box size in case of an e-mail service). Also, this step explores consumer-side constraints: these constraints represent which supplementary benefits can (not) be provided given a stated consumer need, by offering to the consumer additional services.

   1.3 Formalizing each IT-service from a *supplier* perspective. In this step we reason about bundles of services by reviewing supplier oriented motivations and constraints for bundling. For instance, a VoIP service puts certain constraints on the QoS-attributes of an internet access service (a technical constraint but important for the allowed bundles). As an example of a commercial constraint, Apple only allows downloaded songs to be played within their own I-tunes environment. The important reason to distinguish supplier-driver constraints from consumer-driven constraints is that supplier-driven constraints exist *independently* from the needs of an end-consumer.

2. *Generate bundles of services, using the service catalogs.* As can be seen in figure 1, we create service-bundles in two steps:

   2.1 Deriving an initial set of service bundles that covers a consumer need. This step is enabled by step 1.2. The *e³service* ontology we propose in section 3 has been designed such that reasoning about this set of bundles becomes possible.

   2.2 Narrowing down the set of service bundles to those that are feasible and desirable from a supply side perspective. This step is enabled by step 1.3.

In the remainder of this paper, we will walk through each of the steps depicted in figure 1 to show how we arrive from a set of individual IT-services and a customer need, to a bundle of IT-services that together satisfies the customer need.

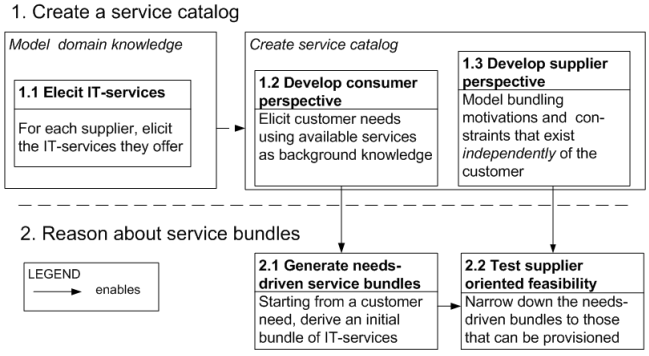

Figure 1: steps taken to arrive at a bundle of IT-services

3. CONCEPTS FOR DEVELOPING THE CONSUMER PERSPECTIVE

In this section, we discuss the concepts necessary for reasoning about service bundling from a customer perspective. A more elaborate version of this discussion can be found in [2].

3.1 Elementary service

An elementary service is the entity which is of economic value to the end-consumer, and which is provisioned by a

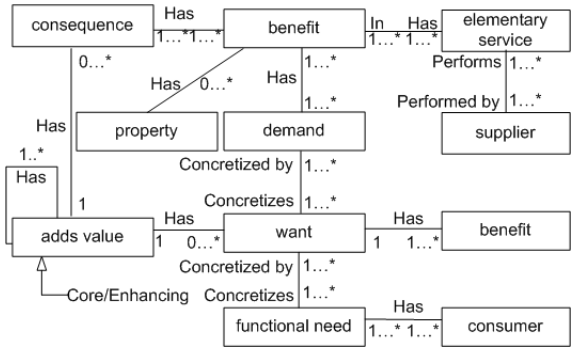

Figure 2: needs ontology

supplier. It is the smallest unit that, from a commercial point of view, can be meaningfully obtained from a supplier. Typically, elementary services are listed in a service catalog of a supplier. The notion of 'elementary service' allows for connecting the consumer-oriented e3service ontology to supplier-oriented ontologies (see e.g. [3]).

EXAMPLE: 'e-mail hosting'. Note that a specific property of e-mail hosting, 'mailbox size', is not an elementary service , since it cannot be provisioned in its own right, but is always connected to the e-mail service it belongs to.

3.2 The need/want/demand-hierarchy

The need/want/demand-hierarchy is a view on marketing as proposed by [6] and later by [13], that emphasizes a gradual transition from a need - a high level problem statement - to a set of elementary services that together provide a solution for that need.

3.2.1 Functional need

A functional need represents a problem statement or goal, independently of considering a solution direction. We stress a separation of problem and solution here, since a need can usually be covered by multiple solutions [6]. So, to avoid overlooking other promising solutions, we need to avoid a bias towards one of these solutions when defining a need. *EXAMPLE:* 'communicating with family abroad'. This need statement does not include a notion of a solution yet; in other words, nothing is said about how the communication will be done.

3.2.2 Want

In the e^3*service* ontology, a want is something that can be offered by a single supplier, with the constraint that this is commercially feasible. We emphasize this notion of a single supplier because ideally, we want to enable each organization in the networked enterprise to focus on his/her core competencies. Bundling is then about meaningfully combining these single-supplier elementary services into one multi-supplier service bundle, to satisfy a consumer need. *RELATIONS:* Concretizes: a want concretizes a functional need by specifying an initial solution direction for a problem statement. A need can be concretized into multiple alternative wants since a certain problem can be resolved though multiple solutions. *EXAMPLE:* A want satisfying the functional need of 'communicating with family abroad' is 'e-mail hosting'. An alternative want is 'instant messaging'.

3.2.3 Demand

A demand represents a want as provisioned by a specific supplier. As such, a demand differs from a want because a demand provides supplier-specific values to the properties of a want (see example). We use a strict distinction between wants and demands, because they actually refer to two different steps in the reasoning process about bundles.

Since a want is defined independently from a specific supplier, it enables us to reason about the means we employ to satisfy the need, without having a specific supplier in mind already. In a second step, we reason about which supplier is satisfying a want by taking the demands into account. Without explicitly separating these steps, a consumer would be forced to choose directly between suppliers, with the danger that the consumer loses sight of what the commonalities and differences between their offered solutions are. Now, the consumer first focuses on choosing certain features (e.g. web-based access in the case of an e-mailing service) that he is interested in, *independently* of who actually provisions these features. So, in sum, the seperation between wants and demands allows us to *match* a customer preference - indicated on a want level - to a specific IT-service -the demand - satisfying this preference.

RELATIONS: Concretizes: A demand concretizes a want if it specifies the generic want, for instance e-mail hosting, for a specific supplier. A want has generally one or more demands, meaning that one or more suppliers can satisfy a want.

EXAMPLE: 'Gmail' (from Google) is a demand that specifies the want 'e-mail hosting'. For example, 'Gmail' may have a distinguishing property 'mail-box size' that would be different from the 'mail-box size' offered by 'Hotmail'.

3.3 Benefits, consequences and value derivations

3.3.1 Benefit

Benefits describe properties that are of economic value to the consumer in the sense of value in use [16]. In other words, benefits provide an increase of economic utility to the consumer, through something functional, social (e.g. status) or otherwise. This is in contrast to the notion of value in exchange [16], which indicates the amount of revenue generated by selling such a property. To understand the value of a elementary service for a particular entity, the notion of value in exchange is convenient for the supplier, whereas value in use is more appropriate for the consumer.

RELATIONS: A want (and a demand also) *has* one or more benefits.

- A single want has one or more benefits. Benefits of a want do however not have specific values, as benefits exist independently of a specific supplier. For instance, the specific size (e.g. 1 GB) of a mailbox is not specified, it is only specified that a mailbox has a size.
- A single demand has one or more benefits. Since a demand is specific for a supplier, benefits of a demand do have specific values. For instance, in the case of the size of a mailbox, the size (e.g. 1 GB) would be specified for the specific supplier.

EXAMPLE: In case of an e-mailing service, a specific benefit could be 'customized domain'. A customized domain allows for customizing an e-mail address, so instead of

art.vandelay@someunchangebledomain.com a customized e-mail address would be art@vandelay.com. A customized domain is a benefit because an e-mail service with a customized domain gives the consumer more status, heightented stature being a measure of more value in use.

3.3.2 Consequence

This concept represents the subjective added value for the end-consumer that is gained directly through obtaining a benefit provided by a service. Deriving consequences from benefits is based upon the laddering-technique from means-end chaining [12].Deriving a consequence from a benefit is done by asking the question 'what happens when we consume a elementary service in which benefit X is contained?'.

RELATIONS: has

- A benefit has one or more consequences. Multiple benefits can point to the same consequence. A consequence contributes to a functional need.
- A want has zero or more consequences. Sometimes, a want - being something that can viably be delivered by a single supplier from a commercial point of view - possesses added value independently from the benefits contained within it. So, when deriving a consequence from a want X, one asks the following question: 'what happens when want X is consumed'?

EXAMPLE: The benefit 'web-based e-mailing access' allows for the consequence of 'cost-effective communication'. 'cost-effective communication' ultimately contributes to satisfying the need of 'communicating with family abroad'.

3.4 Incorporating dependencies between wants

The notion of dependencies, as discussed in [7], indicates that two services are related to one another. This relation can exist from a supplier perspective; for instance a paid e-mail service cannot be delivered without some basic administrative services such as billing. Yet, such a dependency can also exist from a consumer perspective; for instance a spam filter adds value for the consumer when bundled with an e-mail hosting service. In this section, we discuss such consumer-oriented dependencies.

3.4.1 Adds value

As benefits have consequences (in terms of economic value for the consumer), the wants, that actually aggregate benefits from several demands, implicitly also have consequences. We will illustrate this aggregation of benefits on a want-level further when we discuss the case study in section 4. For the discussion of this concept, it is sufficient to know that wants have benefits and as such, also consequences.

In our ontology, an adds-value relationship exists between pairs of wants/consequences. This relationship connects want A to the consequence of want B, to show that want A and B are related. The consequence from want B then indicates *why* this relationship is present, by showing what subjective added value is gained through consuming want B. (see example for a concrete explanation).

In our ontology, we incorporated two such relationships (adapted from [7]):

- Core/Enhancing(C/E). This relationship indicates that a service B is able to provide added value when bundled with a certain core service A. A constraint in this dependency is that service B cannot be acquired independently from service A.
- Optional Bundling (OB) - similarly to C/E, this relationship indicates that service B possibly adds value to A. Yet, in case of an OB relation, services A and B can also be acquired seperately.

RELATIONS: An Adds value relationship *contains* a single want and a single consequence. This pair represents a commercially feasible offering, plus part of the subjective value gained from consuming a benefit contained within this offering.

has Adds value has a relationship with one or more other adds value relationships. By this, we mean that a relationship exist between two or more pairs of wants and consequences. With this relationship, we inidicate that when want A is acquired, the consequence from want B might also be of interest to the customer.

EXAMPLE: The pair 'e-mail ' (want)/'local access to mail' (consequence) is in a Core/Enhancing relationship with pair 'spam-filter' (want)/'reduction in number of unwanted e-mails' (consequence). By means of this relationship, we indicate that the want 'e-mail' is related to the consequence 'reduction in number of unwanted e-mails' from the want 'spam filter', where the consequence from latter want indicates *why* this relationship exists. Note that a Core/Enhancing relationship is present, because an acquisition of a spam-filter only makes sense in combination with an e-mail service.

4. E³SERVICE IN PRACTICE; A REAL-LIFE CASE STUDY IN BUNDLING DIRECT MAIL SERVICES

In this section we show how the $e^3service$ -ontology is applied to a real-life case study in the postal industry, to generate bundles of IT-services that are tailored to a customer need. First, we briefly introduce our case study and discuss *why* service bundling is of interest for the case at hand. After this, we will walk through steps 1.1 and 1.2 to illustrate the development of service catalog from a *customer* perspective. Finally, we will show how this catalog can be used to generate bundles of IT-services based upon a customer need.

4.1 The Direct Mail case; enhancing mailings by service bundling

Due to deregulation of the European postal industry, incumbent postal companies operating on the European market have to differentiate themselves in order remain profitable. The dutch subsidiary of TNT, the industry partner with whom we carried out this case study, traditionally is one such incumbent postal company.

In an attempt to differentiate themselves from other postal companies, TNT developed a set of online mailing services that ranges from the ability to design customized stamps online to an online support service that can aid you in creating designs. Amongst these online mailing services, there is a service that allows a Small to Medium sized Enterprise (SME) to set up a Direct Mail initiative online. This Direct Mail service allows an SME to specify the design a mailing online and to upload an address list for the recipients of the mailing. Following this, TNT prints the design and physically delivers it to the specified recipients.

The Direct Mail service is somewhat straighforward however. Currently the Direct Mail service only allows SME's to send around customized A-5 sized cards while additional services that could enhance the mailing, such as the option of designing a customized stamp, are never explicitly offered to SME's in combination with the Direct Mail service. Instead these additional services exist independently of the Direct Mail service, with each service having its own seperate location on the website of TNT.

This straightforwardness of the Direct Mail service is somewhat in conflict with the mailing needs of some SME's. They feel that in order to generate sufficient response, their mailing should stand out from others and that a single A5-sized card hardly accomplishes this. In order to capture these SME's, TNT has decided that it should provide an option to enhance mailings. TNT would like to accomplish this by bundling the basic Direct Mail service with its other online mailing services, such as the customized stamp mentioned before. Ideally it envisions that an SME goes to TNT's website, states its mailing needs in an online wizard and that, based upon these needs, a bundle of mailing services is presented that matches the mailing needs of the SME. In the following sections, we will apply $e^3service$ to the mailing services of TNT with the purpose of (1) facilitating the creation of such a wizard and (2) to show how the discussed needs ontology works in practice.

4.2 Step 1.1. Elicit IT-services

By means of this first step in $e^3service$, the individual services on which the bundling analysis will be performed are made explicit. When explicating the individual services, the key point in our approach is to consider services from a *value* viewpoint. This means that we abstract away from the inner workings of a service, such as detailed process descriptions, and instead focus upon the benefits a service provides for the customer. The main reason for considering services from a value viewpoint is that $e^3service$ is mainly used for an exploration of what customers value about services. As such we leave out detailed descriptions of the inner workings of a service because they typically become important in a *later* phase of the bundling analysis.

Through value modeling, we elicit the following services from TNT: (1) the customized Direct Mail card (2) customized stamp and (3) DM-advice. In this case, we performed this elicitation by creating an initial value model based upon documentation from TNT. This value model was then validated with a domain expert from TNT, who was actively involved in the improvement of TNT's online direct mail service. Additionally, we modelled mailing services from another supplier: (1) an alternative customized card service and (2) printing additional material such as brochures or vouchers.

We chose to take these third party mailing services into consideration, because they provide for a broader coverage of mailing needs. As such, this inclusion increases the likelihood that an SME will actually set up a mailing intiative through the website of TNT. For TNT, this inclusion of third party mailing services can further be advantageous because (1) it can offer its own services in combination with third party services, thus providing an opportunity for sales increase and (2) it can enter into a profit-sharing agreement, where TNT receives a certain percentage of the income received from each customer it refers. For the third party supplier of mailing services, the profit-sharing agreement is adventaguous because it would receive additional customers through TNT.

Please note that due to space restrictions, we cannot show the value model in this paper; instead, we directly incorporated mentioned services in the service catalog depicted in figure 3.

4.3 Step 1.2. Create a service catalog: Develop customer perspective

4.3.1 *Populate the service catalog with demands and find the benefits contained within them*

The first step is to populate the service catalog with the services modeled in step 1.1. These services are actually similar to demands, since they are the services as provisioned by the specific suppliers. Next, we add the benefits as contained in the demands. Benefits are elicited by reviewing the specific properties of a service that provide the customer with more value in use. For instance, the property design template is a benefit because it saves an SME time when it sets up a mailing initiative.

However we did not yet model these benefits in the first step. So, we should now make the benefits in the populated catalog explicit for each of the demands modeled in step 1.1. The benefits 'format option', 'paper finish', 'online design lettertype' and 'design template' from the demand customized card (TNT) are an an example of this explication. This again illustrates that a demand is not the same as a benefit, since "'format options"' cannot be viably delivered on its own. The resulting explication of benefits and the demands that contain them, can be found in figure 3.

4.3.2 *Derive wants*

On the basis of the demands, we elicit wants. We first abstract away from the *specific values* that the suppliers give to their benefits. So, for instance, in the case of a 'format option' we abstract away from the supplier-specific property of providing you with the A3, A4, or A5 formatting options. We create such a supplier-independent properties to enable the customer to fill in its preferences, *independently* of having to consider supplier-specific services that can satisfy these preferences. We will illustrate this further in section 4.4.

After having made this abstraction, the services that contain these benefits become the wants. If there are multiple similar services available from multiple suppliers, there will be a merge of these multiple services into a single want. For instance, a demand 'customized card' as provisioned by the specific suppliers TNT and Logiprint becomes a want 'customized card', *independently* of these suppliers. This single want will then also inherit the benefits from these different demands. To illustrate this, consider the want 'customized card' in figure 3. This want contains not only the benefits from TNT's customized card service, but also the benefits from a different supplier, namely Logiprint.

4.3.3 *Using consequences to show how benefits contribute to satisfying a functional need*

Next, we derive the consequences from the benefits by asking the question: 'What happens when we consume a service in which this benefit is contained?'. To illustrate, take the benefit 'target audience' from our 'mailing addresses busi-

ness' service modeled in figure 3. By specifying the target audience during the consumption of this service, an SME would be able to send their mailing to a specific set of prospects. As such, the consequence of this benefit would be that it enables an SME to send around a mailing more effectively when compared to choosing prospect addresses at random.

By using the consequences we can now derive a set of needs. We do this in three steps. First, we consider which goal each consequence achieves individually; these goals then become needs. In this case,an example would be that through the consequence 'create a mailing', the need 'make an announcement to existing clients' can be can be satisfied.

However, we cannot always define a need based upon a *single* consequence. Therefore, we also need to review which groupings of consequences - from *different* wants - enable us to define needs. An example in this case study would be the grouping of the consequences 'create mailing' and 'reach business prospects' for satisfaction of the need 'attract business prospects'.

Finally, there could be cases in which we are not able to define a new need on basis of a consequence. In the service catalog from this case study (figure 3), examples of such consequences are 'specifying size of cards' and an 'specifying lettertype' neither of which achieve new goals on their own terms. However, we *can* usually show that these consequences positively *contribute* to satisfying a need. For instance, the consequence 'specifying lettertype' allows SME's to choose a font that existing customers associate with their housestyle, which might have a positive influence on the mailing actually being read. Note that this last step is different from the second step of grouping consequences together. This is because grouping implicates that the wants to which these consequences belong *must* all be acquired for satisfaction of a certain need, whereas this last step only indicates that certain consequences could positively influence a need. Of course, this positively-contributes-to relation is only valid in case the want in which the benefit is contained is actually acquired.

4.3.4 *Define relationships between wants*

Now that we have defined both the wants and the consequences, we can define the 'adds value'-relationships from our ontology. As explained, this relationship actually exists between two pairs of concepts; A pair want/consequence from service A, and a pair want/consequence from service B.

An example from the case of such an adds-value relationship is the Core/Enhancing(C/E)-relationship that exists between the want 'customized card' and the consequence 'design support' from the want 'Direct mail advice'. Here, the C/E-relationship indicates that when a 'customized card' is acquired, 'design support' might be something that could also be valuable to the customer. When the customer then indicates that (s)he is interested in 'design support', the additional want 'direct mail advice' can be offered in combination with a 'customized card'.

Note that in this example, a C/E relationship is present because the want 'Direct Mail advice' is only useful when a SME actually creates a set of customized cards. This is different from the Optional Bundling(OB) relationship, since Optional Bundling indicates that two services can be sold together but can also be acquired individually. For example, consider the OB-relationship that exists between the customized card and customized stamp. This relationship indicates that a customized stamp might add value to the customized card, where the consequence from the customized stamp - more personalized mailing - explains why a relationship exists. Yet, for acquisition of a customized stamp it is not necessary to first acquire a customized card. This is why an OB-relationship exists between a customized card and a customized stamp, and not an C/E-relationship.

4.4 Step 2.1: Generate needs-driven service bundles

In this section, we will illustrate how the service catalog from figure 3 can be used to generate bundles of services that are tailored to a customer need. To this end, we will walk through a scenario in which there are two SME's that consider setting up a mailing initiative: (1) A pianotuner, who is moving and wants to make his new address known to his existing clientele, and (2) A start-up store who wants to create awareness.

Now, the pianotuner would start at the need 'make announcement to existing clients' to create an announcement that he is moving, while the start-up store would start at the need 'attract consumer prospects' to create awareness amongst prospect customers.

The next step is to review the consequences belonging to these needs. Considering the pianotuner, we yield the consequence 'create mailing'. The exclusive start-up will, besides the consequence 'create mailing', also yield another consequence: 'reach consumer prospects'. In the service catalog (figure 3), this combination of consequences satisfying the need 'attract consumer prospects' is indicated by the AND annotation.

By considering the wants that these consequences belong to, we can now find two initial bundles of wants. Respectively for the pianotuner and the start-up store, we arrive at the bundles [customized card] and [customized card, mailing addresses consumer]

The next step is to expand these initial bundles with additional wants by reviewing the adds-value relationships from the service catalog. The notion of a consequence is then used to evaluate whether an additional want should be included in this expansion.

To illustrate consider the want 'customized card'. When reviewing the adds value relationships that this want possesses (see figure 3), we can make an initial expansion of the want 'customized card' to the set [customized card, customized stamp, additional material, direct mail advice]. Consequently, our SME's can use the consequences from the services other than 'customized card' to decide upon the exact subset of this initial expansion.

The exclusive store will probably have an interest in enhancing his mailing, since it should stand out from other mailings to achieve his main purpose: attracting consumers. In this case, we assume that that the exclusive store is interested in 'design support' and a 'more personalized mailing'. Since these are the consequences that belong to the wants 'direct mail advice' and 'customized stamp' respectively, we now arrive at the bundle [customized card, customized stamp, design support, mailing addresses consumer] for the exclusive store. The pianotuner would not have much use for additional services to enhance his mailing since it mainly serves a practical purpose; informing his existing customers.

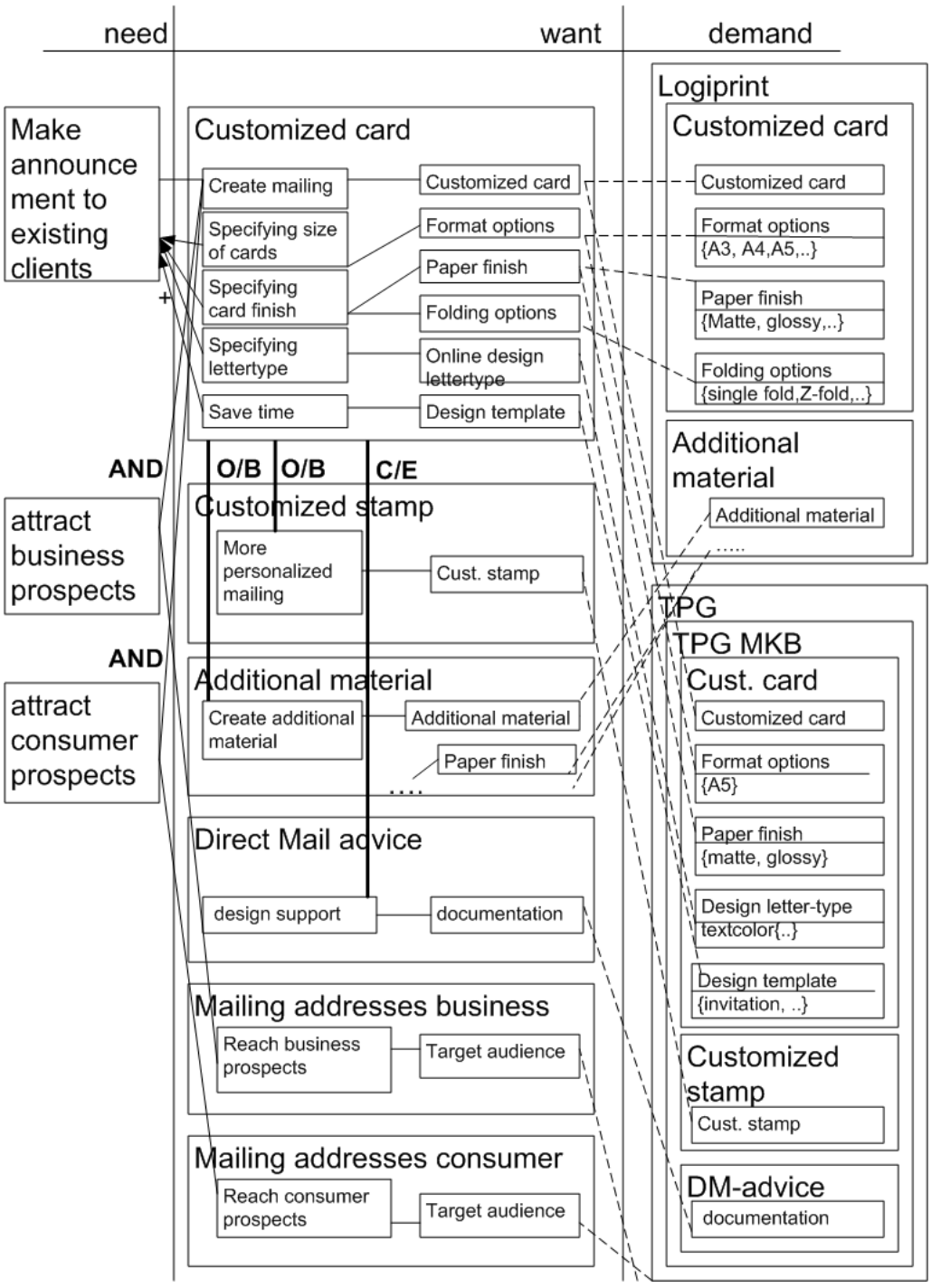

Figure 3: customer-driven dependencies between services

He will therefore remain at the bundle [customized card].

Next, we review the specific benefits from these wants in more detail. We need to do this because we have not yet reviewed all benefits from the wants and as such, also not how these benefits contribute to satisfying a need. In our example, we assume that the pianotuner is interested in a customized card where he can select a design template, since he mainly interested in getting a message across. Additionally, we assume that the exclusive shoe store is interested in sending around an A4-sized mailing, so that a coupon can be printed on the mailing for a one-time discount. Also, the shoe store would like to have their mailing folded.

Now that we have inventoried the wants from the SME's and the specific benefits desired, the last step is to review which actual service offerings from specific suppliers provision services conforming to these wants and desired benefits. For the pianotuner, we arrive at the bundle [customized card(TNT)], since TNT can provide him with a design template. Concerning the shoe store, we arrive at the bundle [customized card(logiprint), customzied stamp(TNT), design support(TNT), mailing addresses consumer (TNT)]

5. RELATED WORK

The *Business Motivation Model* (BMM) [11] is a model representing *ends* (goals, objectives) that are to be achieved by *means*. It abstracts away from implementation issues such as the business processes necessary to provide for the means. In comparison to our work, BMM does not explicitly assist in deriving consumer needs from a set of IT-services. Also, it does not take a multi-supplier perspective.

Serviguration [7] (service configuration) provides computer supported reasoning about general service bundles. Case studies in the realm of electricity supply and healthcare have shown that by using this methodology, meaningful bundles of services can generated semi-automatically [7]. Moreover, given the -per case study- supplier-oriented service catalogue started with, in principle a significant amount of different bundles are possible (millions), which *serviguration* reduced by its reasoning process to a few relevant bundles (tenths), based on stated consumer needs, and supplier-oriented relationships (and constraints) between elementary services. So, serviguration is a good first attempt to arrive at automated configuration of a networked value constellation, in which a series of suppliers satisfy an need by bundling services. However, serviguration concentrates on conceptualizing services mainly from a *supplier* perspective and while it does have a ontology for taking consumer needs into account, this needs ontology is rudimentary. Most importantly, the needs ontology from serviguration does not include the concept of a benefit, while this inclusion is important to differentiate between two apparently similar service offerings.

6. CONCLUSIONS

In this paper, we have shown how a catalog of IT-services can be created in a structured manner by applying a formal ontology. Also, we have presented how we can reason about creating IT-service bundles on the basis of such a catalog. Additionally, this paper clarified that there is a difference between what is offered to the consumer, being the the services, and the features the consumer is interested in, being the demands. Usually, there is a mismatch between the set of benefits contained by a *service*, and the benefits contained by a *demand*.

Currently, we are working on software support for the e^3*service* ontology.

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