

# Towards a Common Ontology for Business Models

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**Abstract.** To create an understanding of enterprises and the ways they do business, a starting point could be to identify the main actors and the values transferred between them. Business models are created in order to make clear who the business actors are in a business case and to make their relations explicit. The relations are formulated in terms of values exchanged between the actors. The purpose of the work reported in this paper is to create a better understanding of business models by identifying basic notions used in such models. It does so by constructing a common ontology based on three established business model ontologies: e<sup>3</sup>-value, REA, and BMO. By means of a careful analysis of these ontologies a conceptual schema is created that defines the common concepts. An example is worked out that explains how the common ontology should be understood.

## 1 Introduction

It is widely accepted that when modelling enterprises and the ways they do business, a starting point could be to identify the main actors and the values transferred between them. This can be performed in terms of business models. Business models are created in order to make clear who the business actors are in a

business case and to make their relations explicit. Relations in a business model are formulated in terms of values exchanged between the actors.

A business model is different from a process model, as a process model captures other kinds of relations between actors than those of a business model. For instance, a process model may contain information about time ordering between activities or flows of goods between actors.

The purpose of this paper is to identify the basic notions of business models by constructing a common business model ontology based on three established ontologies: e<sup>3</sup>-value, REA, and BMO. An ontology is an explicit, shared specification of a conceptualization and one use of ontologies is to define a Universe of Discourse [ibrow00]. In this paper the Universe of Discourse is business modelling. The rationale for creating such a common ontology is mainly theoretical, as it shows the commonalities and relationships between these ontologies and also highlights the differences between, such as differences in naming practice, abstraction level, and business rule semantics. Another benefit is that opportunities for extensions and revisions of the established ontologies are discovered and can be considered. Examples of novel business modeling concepts defined in the common ontology are rights, custody and evidence documents, all of which are introduced in order to refine the, from a business modeling point of view, central analysis of value transfers between actors.

This paper is structured as follows. As we aim to produce a common ontology, based on three ontologies, we briefly present their salient features in Section 2. Section 3 presents the common ontology with explanations. Section 4 discusses some open issues and suggests future work

## **2 Salient features of e<sup>3</sup>-value, REA and BMO**

The common ontology presented in this paper is based on three established business model ontologies: e<sup>3</sup>-value, REA, and BMO. These ontologies were originally developed for different and specific purposes, but there has also been recent work on expanding their applicability. REA was originally intended as a basis for accounting information systems [McCarthy82] and focused on representing increases and decreases of value in an organisation. However, REA has been extended to form a foundation for enterprise information systems architectures [Hruby06], and it has also been applied to e-commerce frameworks [UMM03]. e<sup>3</sup>-value focuses on modelling value networks of cooperating business partners and provides mechanisms for profitability analysis that help in determining whether a certain value network is sustainable [Gordijn04]. Extensions of e<sup>3</sup>-value have been suggested that incorporate process related aspects as well as risk management [Bergholtz05] and [Weigand06]. BMO differs from the two other ontologies by being much wider in scope. In addition to modelling exchanges of resources, BMO also addresses internal capabilities and resource planning. Furthermore, BMO incorporates marketing aspects describing value propositions as well as marketing channels [Osterwalder05].

## 2.1 The REA Ontology

The REA (Resource-Event-Actor) ontology was formulated originally in [McCarthy82] and developed further in a series of papers, e.g. [Geerts99]. Its conceptual origins can be traced back to traditional business accounting where the needs are to manage businesses through a technique called double-entry bookkeeping. This technique records every business transaction as a double entry (a credit and a debit) in a balanced ledger.

The core concepts in the REA ontology are Resource, Event, and Actor and the intuition behind the ontology is that every business transaction can be described as an event where two actors exchange resources. To get a resource an agent has to give up some other resource. For example, in a purchase a buying agent has to give up money to receive some goods. The amount of money available to the agent is decreased, while the amount of goods is increased. There are two events taking place here: one where the amount of money is decreased and another where the amount of good is increased. This repetition of events is called a duality. A corresponding change of availability of resources takes place at the seller's side. Here the amount of money is increased while the amount of goods is decreased. An exchange is when an agent receives economic resources from another agent and gives resources back to that agent; and vice versa. A conversion is when an agent consumes resources to produce other resources [Hruby06]. Events fulfill the commitments of actors. A commitment is defined as being "an agreement to execute an event in a well-defined future that will result in either an increase or a decrease of resources" available to an agent. Thus, events "happen" because there exists commitments between actors, and the duality relation between events exists because of a relation called reciprocity between commitments. Which commitment is related to which is established through an agreement.

## 2.2 The e<sup>3</sup>-value Ontology

The e<sup>3</sup>-value ontology [Gordijn00] aims at identifying exchange of value objects between the business actors. It also supports profitability analysis of the business model created. The basic concepts in e<sup>3</sup>-value are actors, value objects, value ports, value interfaces, value activities and value exchanges. An actor is an economically independent entity. An actor is often, but not necessarily, a legal entity. Examples: enterprises, end-consumers. A value object is something that is of economic value for at least one actor. Examples: cars, Internet access, stream of music. A value port is used by an actor to provide or receive value objects to or from other actors. A value port has a direction, in (e.g., receive goods) or out (e.g., make a payment) indicating whether a value object flows into or out of the actor. A value interface consists of in and out ports that belong to the same actor. Value interfaces are used to model economic reciprocity. A value exchange is a pair of value ports of opposite directions belonging to different actors. It represents one or more potential trades of value objects between these value ports. A value activity is an operation that could be carried out in an economically profitable way for at least one actor.

### 2.3 The Business Model Ontology

The Business Model Ontology (BMO) was originally proposed in [Osterwalder04] to provide an ontology that allows to accurately describing the business model of a firm. The BMO takes the perspective of a single enterprise, highlighting its environment and concerns for facing a particular customer's demands. It consists of nine core concepts: (i) Value Proposition that is an overall view of a company's bundle of products and services that are of value to the customer. (ii) Target Customer that is a segment of customers that a company wants to offer value to. (iii) Distribution Channel that is a means of getting in touch with the customer. (iv) Relationship that the kind of link a company establishes between itself and the customer. (v) Value Configuration that describes the arrangement of activities and resources that are necessary to create value for the customer. (vi) Capability that is the ability to execute a repeatable pattern of actions that is necessary in order to create value for the customer. (vii) Partnership that is a voluntarily initiated cooperative agreement between two or more companies in order to create value for the customer. (viii) Cost Structure that is the representation in money of all the means employed in the business model. (ix) Revenue Model that describes the way a company makes money through a variety of revenue flows.

## 3 A Common Ontology

In this section, we introduce ontology for business models. This common ontology is constructed using the concepts of  $e^3$ -value, REA and BMO as inputs to an analysis and subsequent synthesis. The method used in constructing the common ontology has been to survey all concepts, tabulate them and carry out an analysis to establish similarities and differences [Rosemann02, Wohed05].

We have aimed at including all of the concepts in REA and  $e^3$ -value except for a small number of peripheral concepts, i.e. concepts that occur in only one of the ontologies and are not central for the issue of value transfers. For BMO, we have covered only a small part of the ontology, as BMO is wider in scope than the other two ontologies and also goes into issues of internal organizational capabilities and resource planning. We have also introduced a small number of concepts that do not have any direct correspondences in the original ontologies. This has been done mainly in order to analyse the notions of value transfer and resource.

As the three original ontologies include concepts on the operational level as well as the knowledge level, the common ontology has to include both these levels. As described in [Fowler97], the operational level models concrete, tangible individuals in a domain. The knowledge level, on the other hand, models information structures that characterise categories of individuals at the operational level. For example, the ontology distinguishes between Resource types (categories of resources like car models) and Resources (specific, tangible things like concrete cars). Almost all classes on the operational level have a corresponding class on the knowledge level.

The following paragraphs contains the concepts in the common ontology and their meanings are given informally. The concepts from the original ontologies are mapped

on the concepts of the common ontology using the definitions given in their specifications, for a more extensive comparative analysis on the commonalities and differences between the investigated ontologies, see [Andersson06c].

#### *Actor*

An *Actor* is someone who is able to participate in events (event defined below).

#### *Resource, Feature, and Right*

A *Resource* is an object that is regarded as valuable by some actors. An actor views a resource as valuable because she can use it for producing other resources, for trading it with other actors, or for deriving some consumer experience. Essentially any object can be a resource. However, it is possible to identify some typical categories of resources like goods, information, and services. A resource may have properties and associations to other objects, like the weight of a pizza or the number of shops accepting a credit card. Such properties and associations are modelled by means of the class *Feature*.

Resources are furthermore related to rights. A *Right* on a resource means that an actor is entitled to use that resource in some way. An example is the ownership of a book, which means that an actor is entitled to read the book, give it to someone else, or even destroy it. Another example of a right is borrowing a book, which gives the actor the right to read it, but not to give it away or destroy it or use it in any other way. Fig. 1 shows the main classes: Resource, Feature and Right that are described in this section together with their relationships to other classes.

#### *Event, Transfer, and Conversion*

An *Event* changes a feature or a right of a resource. An event is associated to exactly one actor representing the perspective from which the event is viewed. This means that each event can be seen as either an increment or decrement event from the actor's perspective. An increment event changes a feature or a right of a resource in such a way that the resource becomes more valuable for the actor, while a decrement event causes a change that decreases the value of the resource. In order to model increments and decrements, an attribute *stockflow* of the class Event is introduced that can take one of the values in {use, consume, produce, give, take}. This corresponds to the stockflow relationship in REA [McCarthy82].

The class Event has two subclasses, *Transfer* and *Conversion* [Hruby06]. A transfer means that a right is transferred from one actor to another (for a more detailed analysis, see the next subsection). If the actor of the event receives the right to the resource, the event is a take event (represented by the stockflow attribute). If the actor gives up the right to the resource, the event is a give event. Similarly, a conversion event changes some feature of a resource. If this change means that a new resource is created or the value of an existing resource is increased, the event is a produce event. If the resource is completely consumed and no longer exists after the event, it is called a consume event. If the resource is used but continues to exist also after the event, it is called a use event. Use, consume, and give are decrement events, while produce and take are increment events. Fig. 2 shows the events, transfers, conversions and their relationships to other classes such as exchanges, interfaces, transactions, etc.

*Rights, Custody and Evidence Documents - Three components of a Transfer*

A Transfer from A to B can be viewed as consisting of three components:

- transferring rights on a resource from A to B
- giving custody of the resource to B
- transferring an evidence document (documenting the transferred right) from A to B

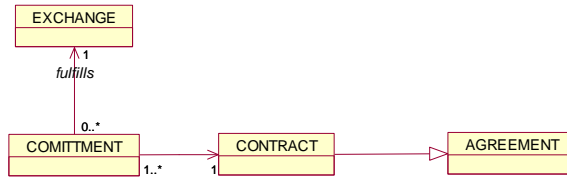
The second component of a Transfer is transferring the custody of the resource being exchanged from one actor to another. An actor has the *Custody* of a resource if he has immediate charge and control of the resource, typically physical access of the resource. If an actor has the custody of a resource, this does not mean that she has any rights on the resource. For example, a distributor may have the custody of some goods, but he is not allowed to use the goods in any way. Providing custody of a resource is essential in a value exchange, as the buyer is typically unable to exercise the rights she gets unless she has custody of the resource. In the common ontology, custody is modeled by means of the custody attribute of a Transfer.

A Transfer may also include the transfer of some evidence document that certifies that the buyer has certain rights on a resource. A typical example of an evidence document is a movie ticket that certifies that its owner has the right to watch a movie. While the first component, the transfer of right, always is included in a Transfer, the last two components are optional. For example, when buying a piece of land, the buyer is typically not given the custody of that resource. Clearly, evidence documents are not always provided in a value exchange. Furthermore, the provision of custody and evidence documents may be so trivial that it is not of interest to make them explicit. A related approach may be found in [Kartseva06] where the legal and economic aspects of a value object are presented. That approach, however, highlights the transfer of rights only, and does not go into the details of transfer of custody and evidence documents in addition to the transfer of rights.





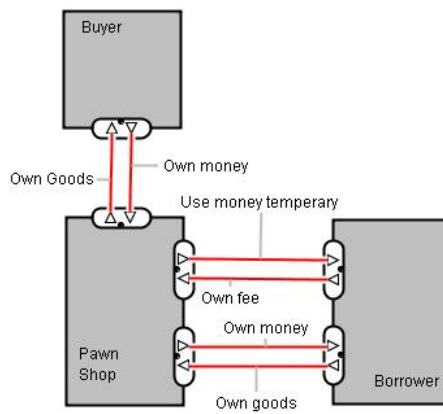




**Fig. 3.** Commitment, Contract and Agreement and their relationship to Exchange

### 4 Pawnshop Example

In this section, we introduce an example that illustrates most of the concepts in the common ontology.



**Fig. 4.** e<sup>3</sup>-value model for Pawnshop example

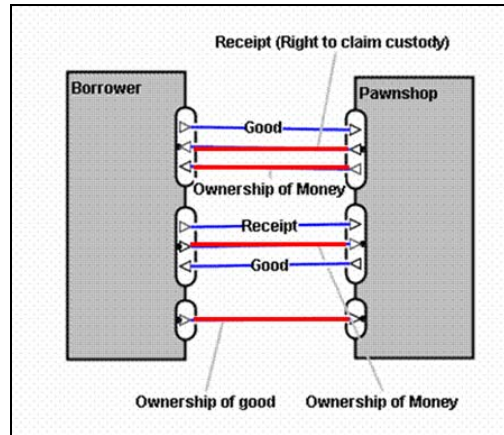


Fig. 5. Detailed model of pawnshop showing custody and evidence documents

Fig. 4 and Fig. 5 show high-level models of the pawnshop business case based on the graphical notation of  $e^3$ -value. The gray rectangles model actors, the rounded rectangles model interfaces, the triangles model value ports, and the lines model value transfers (see also sect. 2.2).

The business idea behind a pawnshop is to lend money to borrowers on a short-term basis accepting goods as collateral. A pawnshop and a borrower can make business according to two different Transactions. The first is that the borrower gets a time limited right to use the money and pays an interest; this is the case where the borrower returns the money and gets the collateral back. The second Transaction is that the borrower gets ownership of the money and the pawnshop gets ownership of goods, i.e. the collateral; this is the case where the borrower does not return the money and the pawnshop takes the collateral. While the model in Fig. 4 shows the rights transferred between agents, it does not include changes in custody. A more detailed model with changes in custody and taking evidence documents into account is given in Fig. 5 (this model deviates from  $e^3$ -value by distinguishing between different types of transfers). The goods are transferred to the shop that then has the custody of the goods while the borrower gets money and a receipt. If the customer does not come back to the shop before a set date, present his receipt and pays to get his goods back, then the ownership of the goods is transferred to the shop. The shop is then free to sell the goods.

The top arrow in the upper value interface represents the transfer of custody (logistic flow) of goods from the borrower to pawnshop and in return the borrower receives two rights from the pawnshop: ownership of money and the right to claim the goods back later (represented via the documentary evidence, a receipt). Notice that in this interface the customer gives up custody of the good and the pawnshop receives the same custody, however it does not get the right to use the good. The pawnshop has in fact an obligation to keep the good safe in case the borrower claims it back. There are no restrictions on what a customer can do with the receipt. He may sell it or give it away as he pleases since he has not given up his ownership of the goods but

only custody of it. A buyer of the receipt will buy the ownership rights of the goods and may approach the pawnshop and claim the custody on the goods.

The middle value interface represents the return of the money from borrower to pawnshop and the transfer of goods back from pawnshop to customer. This is represented by three transfers: one transfer of rights from borrower to pawnshop (meaning ownership right of money), one transfer of custody of goods from pawnshop to borrower (a logistic flow of goods), and the receipt being returned to the pawnshop (a logistic flow of documentary evidence without any transfer of rights).

The lower interface models the situation where the ownership right of the good is transferred from customer to pawnshop condition that the customer did not pay back in time, i.e. it is a transfer of right (ownership of good) from customer to pawnshop.

## 5 Summary and Concluding Remarks

In this paper we have presented a common ontology based on three business ontologies – the  $e^3$ -value, REA and BMO. We constructed the common ontology primarily in order to gain a better understanding of the original ontologies. The work has shown that there is a considerable overlap between them but that there are also differences, some obvious and some subtle.

When constructing the common ontology we focused on concepts that mainly concern communications and exchanges of values between business actors and, therefore, some concepts of the originals were not included in the common ontology. We have modelled a number of business scenarios using the common ontology and by doing so discovered differences between concepts in the original ontologies that at first might have been seen as identical. An example is that Economic resource in REA and Value object in  $e^3$ -value might seem identical to each other. However, they are different as can be seen by analysing what is happening in an Economic event. In an Economic event, something is transferred from one agent to another agent, but what is transferred is not an Economic resource, but the control of an Economic resource. For example, one Economic event may transfer the ownership of a car, while another Economic event lends the car. These Economic events concern the same Economic resource but transfer different rights on that resource. This motivates the introduction of Rights in the common ontology – in a Transfer, the right to a resource is transferred from one agent to another. In  $e^3$ -value, a Value exchange transfers a Value object from one agent to another. Therefore, Value object is mapped to the combination of Right and Resource in the common ontology. Similarly, the concept of a Transfer gave rise to the issue of what is transferred. To address this question, we analysed the concept into three sub-concepts; Custody, Documentary evidence and Right transfer and thereby extended the common ontology with concepts not present in the originals. One item for future research is to address more in detail those issues.

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