

On the Alignment of Goal Models and Business Models

Birger Andersson, Maria Bergholtz, Ananda Edirisuriya
Tharaka Ilayperuma, Paul Johannesson, Jelena Zdravkovic

Stockholms universitet/KTH
DSV
Forum 100
SE-164 40 Kista, Sweden

{ba, maria, si-ana, si-tsi, pajo, jzc}@dsv.su.se

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Abstract:

Business modeling can be used as a starting point for business analysis. A business model contains at its core information about resources, events, agents, and their relations. Using the concepts of the established Resource-Event-Agent (REA) ontology is, therefore, natural for a business modeller and analyst. The motivation of a business model can be found in the goals of an enterprise and those are made explicit in a goal model. This paper discusses the alignment of business models with goal models and proposes a method for constructing business models based on goal models. The method is based on a template and rules based approach. The outputs are business models that conform to the explicit goals of an enterprise. Main benefits are clear and uniform goal formulations, well founded business model designs as business models becomes more connected to strategic concerns, and increased traceability between models. An illustration of the application of the method is provided.

Key words: business modeling, goal modeling, REA ontology, model alignment

1 Introduction

It is increasingly recognized that when modeling enterprises and the ways they do business, a starting point should be to identify the main actors and the values transferred between them. This can be expressed in terms of business models. A business model is created in order to make clear who the actors are in a business case and explain their relations, which are formulated in terms of values exchanged between the actors. At its core all business models capture the relations between the economic concepts resource, agents, and the events that result in resource creation and distribution among agents.

Business modeling can be used as a starting point for an enterprise when setting out to model its processes. A natural way of working for a business analyst is to first establish in a business model what kinds of business elements, like actors, resources and resource exchanges that exist and later determine how they are to interact with each other in activities and processes. In (Andersson 2006a) it is argued that the design of a process model is motivated by business decisions made explicit in the business model. But if the design of a process model is motivated by a business model, what motivates the design of the business model?

In this paper, we argue that the motivation of a business model can be found in the goals of a business, which are made explicit in a goal model. Goal models and business models are parts of a chain of models, together with process models,

that have distinct purposes and describe different aspects of a business. A common view is that:

- Goal models are used in the earliest phases of business and information systems design, where they help in clarifying interests, intentions, and strategies of different stakeholders answering to the "why" of the business.
- Business models give a high level view of the activities taking place in and between organizations by identifying agents, resources and the exchange of resources between the agents. So, a business model focuses on the "what" of a business.
- Process models focus on the "how" of a business, as they deal with operational and procedural aspects of business communication, including control flow, data flow and message passing.

The main purpose of this paper is to propose a method that assists a business or systems designer in creating business models that conform to the explicit goals of an enterprise. In order to do this, the following questions need to be answered:

1. How can the gap between business models and goal models be bridged?
2. How can a designer exploit the relationships between business models and goal models?

For the first question, the gap can be bridged if a common denominator between the two types of models can be established. We propose this is done by requiring

that the components of a goal model be expressed in terms of business model notions, and a set of templates are suggested for this purpose. For the second question, we propose that the relationships are to be exploited in a method that takes as input a business model and a goal model and produces a new business model that conforms to the goal model. As business models fundamentally concerns resources, agents, and the events that lead to resource distribution among the agents we use the concepts of the well established Resource-Event-Agent (REA) ontology (Geerts 1982) for business modeling. Thus, the method proposed is applied on a business model expressed in REA terms transforming it into a model that takes into account the explicit goals of the enterprise. The main rationale behind the method is to facilitate the construction of business models that not only describe what entities exist in a business setting but also include motivations for why those entities are there. Some benefits are that business models becomes more closely connected to the strategic concerns of an enterprise (Gordijn 2006) and that it creates a possibility to validate the business models against the enterprise's goals.

The paper is structured as follows. Section 2 gives an introduction to business models and Section 3 provides an overview of goal models. A running example is also introduced. Section 4 addresses the first question above and shows how goal models can be related to business models by means of a number of templates for structuring information. Section 5 addresses the second question and presents a

method that transforms a given business model into a new business model based on a goal model. Its main points are illustrated through an application on the running example. Section 6 concludes the paper with a summary of its results and directions for further work.

2 Business Models

There exist a number of approaches, languages, and ontologies for business models in the literature, e.g., (TOVE 2002; Dietz 2005; Storey 2002; Uschold 1998; Gordijn 2000). For the purpose of this paper we will make use of one comprehensive and well established business model ontology - the REA (REA 1982).

The REA Ontology

The Resource-Event-Agent (REA) ontology was formulated originally in (McCarthy 1982) and has been developed further, e.g. (Geerts 1999; Geerts 2002; UMM 2003; Geerts 2006). 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. REA was originally intended as a basis for accounting information systems (McCarthy 1982) and focused on representing increases and decreases of value in an organization. REA has been extended to form a foundation for enterprise information systems architectures

(Hruby 2006), and it has also been applied to e-commerce frameworks (UMM 2003).

The core concepts in the REA ontology are Resource, Event, and Agent (also referred to as Economic Resource, Economic Event and Economic Agent). The intuition behind the ontology is that every business transaction can be described as an event where two actors exchange resources. To acquire a resource an agent has to give up some other resource. For example, in a goods purchase a buying agent has to give up money in order to receive some goods. The amount of money available to the agent is decreased, while the amount of goods is increased. Conceptually, two events are taking place here: one where the amount of money is decreased and another where the amount of goods is increased. This combination of events is called a duality and is an expression of economic reciprocity – an event increasing some resource is always accompanied by an event decreasing another resource. 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. A resource may have properties and associations to other objects, like the nutritional content of a pizza or the number of shops accepting a credit card. Such properties and associations are modeled by means of Features (Hruby 2006).

There are two types of economic events: exchanges and conversions, (Hruby 2006). An exchange occurs when an agent receives economic resources

from another agent and gives resources back to that agent. A conversion occurs when an agent consumes resources to produce other resources. The intuitive difference between exchanges and conversions is that exchanges are events external to agents whereas conversions are internal. Events often occur as consequences of existing obligations of an agent; in other words, events fulfill the commitments of agents. 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" (Geerts 1999), available to an agent. Thus, events take place because commitments exist between agents.

In (Andersson 2006b) the REA was compared to two other business ontologies (the e3value (Gordijn 2000) and the BMO (Osterwalder 1994)) in order to establish a common reference business ontology. One result of that comparison was a set of mappings between REA and *e³value* showing strong similarities between the concepts of the two ontologies. The BMO differed from the other two mainly in its scope.

Figure 1 represents graphically a REA based model of a real business case that will be used as a running example. It models the various economic events that associate a provider of Massively Multiplayer Online Games (MMOG), its customers and a business associate - an Internet Service Provider (ISP). The game provider is the principal agent responsible for producing the game content as well as selling and distributing its software on CDs to customers. To sell and distribute

games the game provider obtains the services from the ISP, who in turn receives payment as compensation. In order to play the game, the customers need Internet access, which they get from the ISP. They also need access to the game server, which they get from the game provider. The customers pay the ISP and the game provider for their service.

In figure 1, using a notation proposed in (Hruby 2006, p. 63) Agents are shown by rectangles, Events are shown by rounded rectangles, and Resources by labeled arrows between events. There are two types of events, exchanges or conversions, which are stereotyped accordingly.

Figure 1: Business model for the MMOG case

3 Goal Models

Goal models are used to capture and make explicit the goals of a business enterprise. They direct the enterprise towards concrete actions, and as a consequence, the elicited actions are firmly based on a business motivation. A goal is defined as a desirable business state the enterprise wants to reach.

As with business models, there exists a number of different goal models where some are used in Goal Oriented Requirements Engineering (GORE) for IT systems, for instance the KAOS model (Dardenne 1993), and some are used for business analysis, for instance i^* (Yu 1995). Since the purpose of our work is analysis and design of business models, we need a goal modeling approach that uses a small set of concepts that can be understood by business experts and that support the representation of vague, human-based intentions, actions and relations.

In this paper we consider the use of a goal model approach that supports analysis of strategic business goals such as i^* (Yu 1995), or the Business Motivation Model (BMM) (BRG 2005). The i^* technique focuses on modeling strategic dependencies among business agents, goals, tasks and resources. In each dependency relationship, a “depender” agent depends on a “dependee” agent for something called “dependum”, which can be a condition (that is, a goal), a task, or a resource. In a goal dependency, the depender does not care how a desired

condition is achieved. In contrast, a task dependency specifies a particular course of action, that is, how a goal is to be accomplished. In the following, we start our analysis from a principal agent perspective, meaning that the components of a goal model are formulated from the perspective of one single enterprise, called the principal agent. For this end we use the BMM, as the technique focuses on the business states an enterprise wishes to achieve, as well as on the actions that will enable the achievement of those states. The technique relies on the use of three major concepts – Ends, Means, and Influencers:

- An End is something the enterprise seeks to accomplish, without any indication of how it will be achieved. When an enterprise intends to describe ends in the form of desired qualitative business results, it uses the notion of goal. A goal is a statement about a condition of the enterprise to be achieved or sustained. A typical goal of a car-rental company could be “to provide leading customer service”.
- A Means represents any capability or instrument that may be used to achieve Ends. Means may be differently categorized. When formulated as a course of action, a means describes the realizations of desired goals. Thus, for the previously given goal example, a means for providing a leading customer service can be “hire experienced customer service personnel”. When a goal is described in a highly abstract manner, it is common to first divide it into sub goals down to the level where they can

be supported by concrete means. Means therefore represent leaf nodes in a goal tree.

- An Influencer is anything that may impact the achievement of means (and thereby goals). An influencer is either external to the enterprise (such as customers, competitors, environment, technology, etc.) or internal (for instance, resources or infrastructure). An influencer is neutral until its impact on means or goals is assessed. An impact may be categorized in different ways - a simple and commonly accepted classification is as strength or weakness for internal influencers, and as opportunity or threat for external ones (SWOT 1970).

In Figure 2, we illustrate the basic BMM elements and their relations using a small excerpt of a goal model for the MMOG case.

Figure 2: Excerpt of a goal model for the MMOG case

In the given example the goal “Level of player satisfaction shall be high” is analysed into two sub-goals – “Cost of game access shall be low” and “Games shall be attractive”. The latter is, as an illustration, supported by the means “Procure Innovative game stories from Customer“. The influencer “Increased interest in playing Computer games” is assessed as an external impact providing an opportunity for obtaining innovative game scenarios.

4 Bridging Goal Models and Business models

Relating Goal and Value Concepts

A common problem in goal modelling is that goals are difficult to formulate, that is, the formulations of goals and means often become loose and highly abstract. In (Weigand 2006), the authors argue that goal models become unfocused because goals range from the value propositions of an enterprise to general goals of economic sustainability. We suggest overcoming this problem by expressing goal model elements in terms of business model notions. As discussed, business models describe the use and exchanges of resources that are of economic value for the participating agents. This means that resources are the basis of an economically sustainable business model, that is, the goals are to provide agents with desired resources. Furthermore, after surveying a large number of goal models, we found that largely all means in these models concern the acquisition,

production, maintenance, or provisioning of resources, which may be described using REA notions. These observations motivate the following rules for formulating goals, means and influencers in BMM:

- A Goal is expressed as *a desired condition on one or more features of a resource*, from one particular agent's point of view. This agent is denoted the "principal agent" in this paper. One example from the MMOG case is "Level of player satisfaction (resource) shall be high (feature)". Formulating goals in this way make the expressions uniform.
- A Means is expressed as *a course of action on one or more business model components* (that is, resources, events, or agents) realising the desired conditions on resources stated by one or more goals. For the MMOG case, some examples of means may include "Outsource (exchange event) 50% of production of Game content (resource)", or "Procure (exchange event) Innovative game stories (resource) from Customer (agent)".
- An Influencer is expressed as *a condition that leads to support, refinement or removal of one or more means*. For example, an "Increased interest in playing computer games" supports the means (see Figure 2) for acquiring innovative game stories from customers.

A problem in goal models concerns the resolution of conflicts among goals and means. This is, as proposed in (Dardenne 1993) and (Yu 1995), typically solved by determining the conflicting goals and then evaluating which of the goals to

preserve by, for instance, categorizing their importance. In our goal-value analysis, we allow the discovery of goal conflicts at two levels – either as described previously at the goal model level, or at the business model, i.e., when the means are realised by including or excluding particular components in the business model. For example, if a means requires the occurrence of a particular economic event, while another requires the occurrence of an opposite or contradictory event, the business modeller will discover the conflict and its origin in the goal formulations.

Means Templates

Means play a key role in aligning a business model with a goal model. For that reason we propose more detailed rules, in the form of templates, for formulating means. As stated in the previous subsection, almost all means concern the acquisition, production, maintenance, or provisioning of economic resources by economic agents. In other words, means address the fundamental entities of business models. Means describes with whom the principal agent exchanges resources, what resources are exchanged, and what events there are that exchange, produce, or consume those resources. Thus, it becomes possible to formulate next to all means according to a small number of templates.

The general form of a template is a triplet, <Event, Resource, Agent>. For instance, in template 1 “offer resource to agent” below, offer corresponds to

Event, resource to Resource, and agent to Agent.

The following syntax is used. Each template has two parts, one compulsory and one optional, the optional written within square brackets. The optional part describes possible events that could be carried out in order to fulfill the event named in the compulsory part. Parentheses are used for grouping of alternatives. The components of the group are separated by a pipe sign ‘|’ with the standard exclusive-or interpretation. The ‘AND’ sign is used to indicate combination of parts with the meaning that parts combined must all be present in the means. Words in italics are non terminals and are replaced by actual goal model terms when formulating the means. An optional discriminator can be prepended to a resource filling the same function as a grammatical adjective. A “good book” is an example of an economic resource “book” prepended with the optional discriminator “good”.

The compulsory part contains the most important piece of information, while the optional part provides complementary information about the consequences of the compulsory part. A goal modeler may choose to fill in the optional part in order to provide complete information, but in many cases it is preferable to leave it out in order to make the goal model less complex.

The following nine means templates have been identified.

1. offer *resource* to *agent*

[AND (start using *conversion event* | start producing *resource* | start

procuring *resource* from *agent*]

[AND receive *resource* from *agent*]

This template addresses the business activity of exchanging economic resources between agents.

The compulsory part deals with the exchange event providing an economic resource to an agent. The first optional part addresses the origin of the resource and offers three alternatives: through an existing conversion event, through the initiation of a new conversion event in the principal agent to produce the resource, or through an exchange event that involves another agent. The second optional part specifies what economic resource is exchanged as a compensation for the resource provided by the principal agent.

2. stop offering *resource* to *agent*

[AND (stop procuring *resource* from *agent* | stop producing *resource*)]

This template addresses the issue of ceasing to provide a certain resource. The optional part of the template has an effect only if the principal agent stops offering the resource to every agent. In that case, the optional part says that this can be done by either stopping producing the resource or by stopping procuring it from another agent.

3. procure *resource* from *agent*

[AND (start using *resource* in *conversion event* | offer *resource* to *agent*)

AND provide *resource* to *agent*]

The compulsory part in this template is related to the procurement of a resource by the principal agent from another agent. The optional part describes the possible effects of the procurement of the resource. The resource procured may be used as an input for the production of a certain resource or it may be offered directly to the principal agent's customers.

4. stop procuring *resource* from *agent*

[AND (stop offering *resource* to *agent* | start producing *resource* in *conversion event*)]

This template addresses the issue of stopping the procurement of a resource from another agent. The possible effects of this is that the principal agent may have to start the production of the resource himself in order to be able to continue providing the resource to his customers or he may have to stop offering that resource. However, the optional part depends on whether the principal agent stops procuring the resource from all possible supplying agents or not. Depending on that, one of the alternatives in the optional part is chosen.

5. start producing *resource* in *conversion event*

[AND start offering resource to *agent*]

This template states that if the production of a resource is started then it must be offered to some agent.

6. stop producing *resource* in *conversion event*

[AND (start procuring *resource* from *agent* | stop offering *resource*)]

The compulsory part in this template deals with the issue of stopping the production of a resource. The optional part describes possible consequences of this. The first option is to start procuring the resource in order to offer it to other agents. The other option is to stop offering the resource altogether.

7. (increase | decrease) production of *resource* in *conversion event*

This template deals with the increment or decrement of the production of a resource. This is usually a percentage difference in production capacity. Means of this kind has normally no structural effect on the business model.

8. insource production of *resource* in *conversion event*

[AND (start | increase) producing *resource*

AND stop procuring *resource* from *agent*]

The compulsory part of this template takes care of the situation where the production of a resource is being insourced. If the production is insourced, then it will lead either to an increase of the production in an existing conversion event or to the introduction of a new conversion event to produce the resource.

9. outsource [fraction of] production of *resource* in *conversion event*

[AND (stop | decrease fraction of) production of *resource*

AND start procuring *resource* from *agent*

AND start providing *resource* to *agent*]

The compulsory part of this template is applicable to the situation where the production of a resource is outsourced, which will lead to either a decrease or stopping of production of the resource in the principal agent. In addition to that the principal agent must also start procuring the resource, whose production has been outsourced, and start providing a resource as compensation.

5 A Method for Creating a Goal Based Business Model

In this section, we discuss how business models should be aligned with goal models. For that purpose, we propose a method that takes as input a business model formulated in REA terms and a goal model and produces a new business model conforming to the goal model. In other words, a to-be business model is constructed using an as-is business model and a goal model as inputs. The main instruments used in the method are the means templates from the previous section and the transformation rules introduced below. The method has two main steps, where the first is about goal modeling and the second is about business modeling.

In the first step, it is the responsibility of a goal modeler to construct a goal model expressed in terms of business model notions, in particular the means shall be formulated according to the means templates. In the second step, it is the responsibility of a business modeler to make use of the means supplied by the

goal modeler by applying the transformation rules to them. For some means, the goal modeler may have filled in only the compulsory part of the means template and left out the optional part. In such cases, the business modeler will not have sufficient information for applying a transformation rule and she will have to first elicit the missing information and fill in the optional part of the means template.

The method can be summarized as follows:

1. The goal modeler constructs a goal model using the means templates
2. For each means the business modeler
 - complements the means by filling in the optional parts of its template when needed
 - applies the relevant transformation rule

Transformation rules

For each means template, there will be exactly one transformation rule telling how means of this template will influence the to-be business model. The means templates can be categorized into three main groups based on their effects on the to-be model: templates leading to the introduction of new business model components, templates leading to the deletion of certain business model components, and templates requiring changes at the process level (see chain of models in section 1). While the first two groups have a visible effect on the to-be business model, the effects of the means of the third group is not visible in this

model but will have an impact only on the process model.

The transformation rules given below have two parts, a primary and a secondary, related to the two components of the means templates, the compulsory and the optional. When applying a transformation rule on a means, it is assumed that the compulsory as well as the optional part of the corresponding means template have been filled in. Thus, both the primary and the secondary action of the transformation rules will always be applied. In the following, we show only the transformation rules corresponding to templates 1, 2, 3, 4 and 9 due to space restrictions.

1. offer *resource* to *agent*

[AND (start using *conversion event* | start producing *resource* | start procuring *resource* from *agent*)

AND receive *resource* from *agent*]

Primary action:

Add one *exchange event* for the *resource* from the principal agent to an existing or new *agent* in an existing or new duality.

Secondary action:

- a. Connect the new *exchange event* to a new *conversion event*, or
- b. Connect the new *exchange event* to an existing *conversion event*, or
- c. Add a new *exchange event* from the principal agent to a new or

existing *agent* from whom the *resource* is procured; and

- d. Add a new *exchange event* for receiving a resource from *agent* to the principal agent as a compensation for the *resource* offered by the principal agent.

2. stop offering *resource* to *agent*

[AND (stop procuring *resource* from *agent* | stop producing *resource*)

Primary action:

Delete the *exchange event* that concerns the transfer of the *resource* from the principal agent.

Secondary action:

- a. Delete the *exchange events* related to the procurement of the *resource*, or
- b. Delete the *conversion events* producing the *resource*

3. procure *resource* from *agent*

[AND (start using *resource* in *conversion event* | offer *resource* to *agent*)

AND provide *resource* to *agent*]

Primary action:

Add a new *exchange event* for the *resource* from the *agent* to the principal agent.

Secondary action:

- a. Connect a new *exchange event* to an existing or new *conversion event*.
- b. Add a new *exchange event* from the principal agent to a new or existing *agent* to whom the *resource* is offered;

4. stop procuring *resource* from *agent*

[AND (stop offering *resource* to *agent* | start producing *resource* in *conversion event*)]

Primary action:

Delete the duality with the *exchange event* that concerns the transfer of the *resource* from agent to the principal agent.

Secondary action:

- a. Delete the *exchange event* related to providing the *resource* to *agent* (in case of discontinuing the provisioning), or
- b. Add a new conversion event in the principal agent to produce the *resource* (in case the provisioning of the resource continues).

9. outsource [fraction of] production of *resource* in *conversion event*

[AND (stop | decrease fraction of) production of *resource*

AND start procuring *resource* from *agent*

AND provide *resource* to *agent*]

Primary action:

Add a new *agent* if necessary.

Secondary action:

- a. Delete the *conversion event* that produces the *resource*, and/or
- b. Add a new *exchange event* for receiving a *resource* from *agent* to the principal agent as a compensation for *resource* offered by the principal agent.
- c. Add a new *exchange event* for providing a *resource* from *agent* to the principal agent as a compensation for *resource* procured by the principal agent.

An Application of the Method

In this section we will apply the means templates and transformation rules from the previous sections using the Goal Model from section 3 and the Massively Multiplayer Online Games (MMOG) business model (figure 1) as inputs.

Figure 3 shows a goal model for the MMOG business scenario from the game provider's (the principle agent's) point of view. The figure describes the top goals, sub goals and their relationships. Each means in the goal tree is a leaf node. The means "Outsource CD delivery" supports the fulfilling of the goal "Delivery of CD shall be fast". The influencer "Availability of competitive transport services" is assessed to provide an opportunity to obtain low cost transport services.

In most cases economic resources are explicitly modeled in each means, for instance in Means 1: “Outsource CD delivery”, the resource affected is “CD delivery”. In mapping these means onto the corresponding templates it is, however, assumed that the explicitly present resources (and corresponding exchange events) are related to additional exchange events in the opposite direction (forming a duality), most commonly payment for receiving a good or service. In some cases other ways of providing compensation for a value transfer are present, such in the case of Means 2: “Offer Free trial games to customer”. Here the game provider offers the resource “Free trial games” to the Customer, and receives the resource “Attention” in return.

Figure 3: A goal model for the MMOG case

Method Application

In the running example we address all means stated in the goal model (figure 3). Each means is addressed by applying one transformation rule. According to the method this should be done in two steps: first selecting the means template and if needed complement the means with the optional part of the template, and secondly applying the transformation rule. Figure 4 shows the result of applying the method to the business model in figure 1.

Means 1: Outsource production of CD delivery

Step 1: Select template 9 and complement with the optional part.

Outsource production of *CD delivery* (resource) in *Transport CDs*

(conversion event)

AND stop production of *CD delivery* (resource)

AND start procuring *CD delivery* (resource) from *Shipper* (agent)

AND start providing *Payment* (resource) to *Shipper* (agent)

Step 2: Apply the transformation rule for template 9.

Primary action:

Introduce *Shipper* (agent) to outsource the *Transport CDs*

(conversion event).

Secondary action:

Delete conversion event *Transport CDs* in the *Game Provider*.

Add a new exchange event for procuring *Transport service* (resource) from *Shipper* to *Game Provider* (principal agent).

Add a new exchange event for *Payment* (resource) from *Game Provider* to *Shipper*.

The application of this transformation rule will lead to introducing a new agent *Shipper* to the model and to deleting the conversion event *Transport CDs* in the principal agent. It also leads to adding one exchange event to procure the *Transport service* from the *Shipper* and the reciprocal exchange event for the *Payment*. Those exchanges are added in a new duality. See ① in figure 4.

Means 2: Procure Innovative game stories from Customer

Step 1: Select template 3 and complement with the optional part.

Procure *Innovative game stories* (resource) from *Customer* (agent)

AND start using *Innovative game stories* (resource) in *Create Content* (conversion event)

AND provide *Payment* (resource) to *Customer* (agent)

Step 2: Apply the transformation rule for template 3.

Primary action:

Add a new exchange event for *Innovative game stories* (resource) from *Customer* (customer) to *Game Provider* (principal agent).

Secondary action:

Connect the new exchange event to *Create Content* (conversion event)

Add a new exchange event to make *Payment* (resource) from the *Game Provider* (principal agent) to the *Customer* (agent)

This means will lead to the addition of a new exchange event and a new duality for procuring Innovative game stories from the Customer. It will also add a new exchange event related to the Payment from Game Provider to Customer. Those exchanges will then be connected to the existing conversion event Create Content that uses these Innovative game stories to produce games. See ② in figure 4.

Means 3: Outsource 50% of production of Game content

Step 1: Select template 9 and complement with the optional part.

Outsource *50% of production of Game content* (resource) in *Create*

Content (conversion event)

AND decrease *50% of production of Game content* (resource)

AND start procuring *Game content* (resource) from *Customer* (agent)

AND provide *Payment* (resource) to *Customer* (agent).

Step 2: Apply transformation rule for template 9.

Primary action:

N/A

Secondary action:

Add a new exchange event to procure the 50% of production of *Game content* (resource) from *Customer* to the *Game provider* (principal agent).

Add a new exchange event to make the *Payment* (resource) from *Game Provider* (principal agent) to the *Customer*.

This means results in Game Provider using the customer agent for outsourcing 50% of the production of the Game content and decreasing the production of game content by 50% in the Create Content conversion event in the Game Provider. The nominal decrement of the production will not be visible as a structural change in the model. It will be addressed at the process level of the game provider's business. The outsourcing is visible in the model by means of the inclusion of a new duality consisting of two exchange events: one for procuring the Game content and the other for making the payment to the Customer. See ③ in figure 4.

Means 4: Offer Free trial games to Customer

Step 1: Select template 1 and complement with the optional part.

Offer *Free trial games* (resource) from *Customer* (agent)

AND start using *Distribute Games* (conversion event)

AND receive *Attention* (resource) from *Customer* (agent)

Step 2: Apply the transformation rule for template 1.

Primary action:

Add one exchange event for *Free trial games* (resource) from
Game Provider (principal agent) to *Customer* (agent)

Secondary action:

Connect a new exchange event to *Distribute Games* (conversion
event)

Add a new exchange event for receiving *Attention* (resource) from
Customer (agent) as a compensation for *Free trial games*
(resource) offered by the *Game Provider* (principal agent).

Offering free trial games to the customer will add new exchange events between game provider and customer for both offering free trial games and receiving customer attention as a compensation for that. See ④, in figure 4.

Figure 4: Extended business model for MMOG case.

6. Conclusion and discussion

This paper has addressed the problem of aligning business models with goal models. Although a business model may be formally correct and based on sound economic concepts (like the REA ontology) its validity in respect to an enterprise's goals cannot be guaranteed. To address this, a method was proposed that takes as input a goal model and an as-is business model and transforms it into a new business model that conforms to the goal model. The method relies on the existence of a link between goal and business models, which is primarily provided through the notion of means. The proposed approach offers a number of benefits:

- *Clear and uniform goal model formulation.* Formulating goals and means in terms of the business model concepts encourage precise expressions and clarify the relationships among the components of a goal model. Furthermore, this approach of formulating goals and means make goal models more uniform and objective in the sense that different designers will express a given goal or means in similar ways.

- *Well founded business model design.* The proposed method provides a way for designing business models that are firmly based on the goals and needs of an enterprise as expressed in a goal model.
- *Traceability.* It is possible to relate the components of a goal model to those of a business model as the goal model has to be formulated in terms of the notions in the business model. Furthermore, components of a business model are directly motivated by the goal model.

A number of issues need to be addressed in future work. One question is about the completeness of the means templates. We have argued that the template list covers a large part of the basic activities of an enterprise - acquire, provide, produce, or maintain resources. It is indeed possible to analyze the activities further and propose a more detailed list of means, e.g., "Provide" may be replaced by "Give access to over the web", or "Deliver at the door". Those templates would be more precise but also less general and it is an open issue how to strike the balance between these two properties. Another issue is about the formulation of the transformation rules, which in this paper was dependent on the syntax of the particular business model language that they operate upon. We have here used a notation proposed in (Hruby 2006) to express the REA concepts, and to fully express the rules involves going into the minute details of what a well-formed model using this notation amounts to. Should we have opted for a textual representation of the REA ontology the rule formulations could have

been different. Still another issue is the practical applicability of the approach and what support a designer would need to apply it, in particular how a designer should be assisted in applying the means templates.

Another practical question left for future research is that of changing/extending the REA ontology to accommodate goal modelling concepts. We have done some experiments extending the syntax of *e3value* (a business ontology with close similarities to REA) in the form of annotations to capture the relations between goal models and business models. The main rationale for this was to support the modeler by increasing traceability. The down side was that it introduced clutter into the business model. An open question is to decide precisely how to maintain traceability and, if using annotations, how to keep clutter at an acceptable level.

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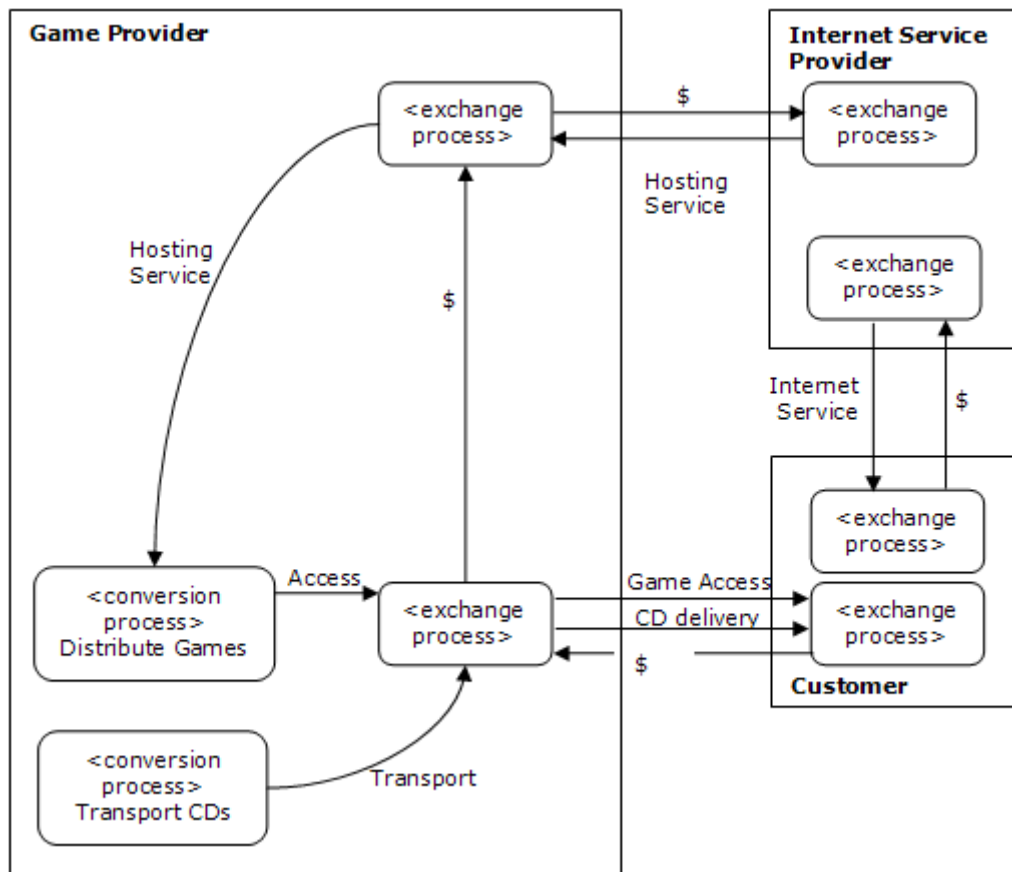


Figure 1: Business model for the MMOG case

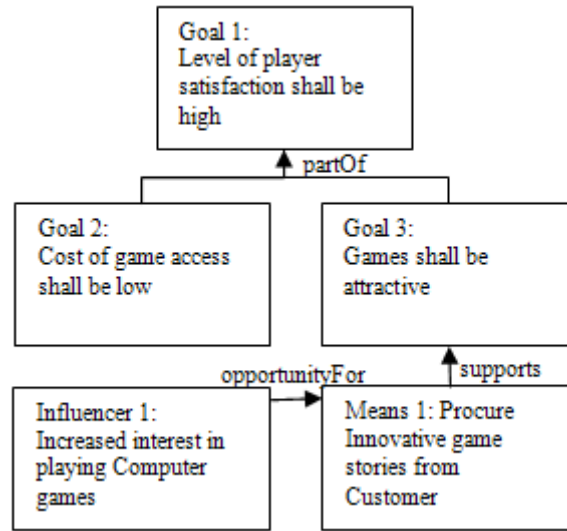


Figure 2: Excerpt of a goal model for the MMOG case

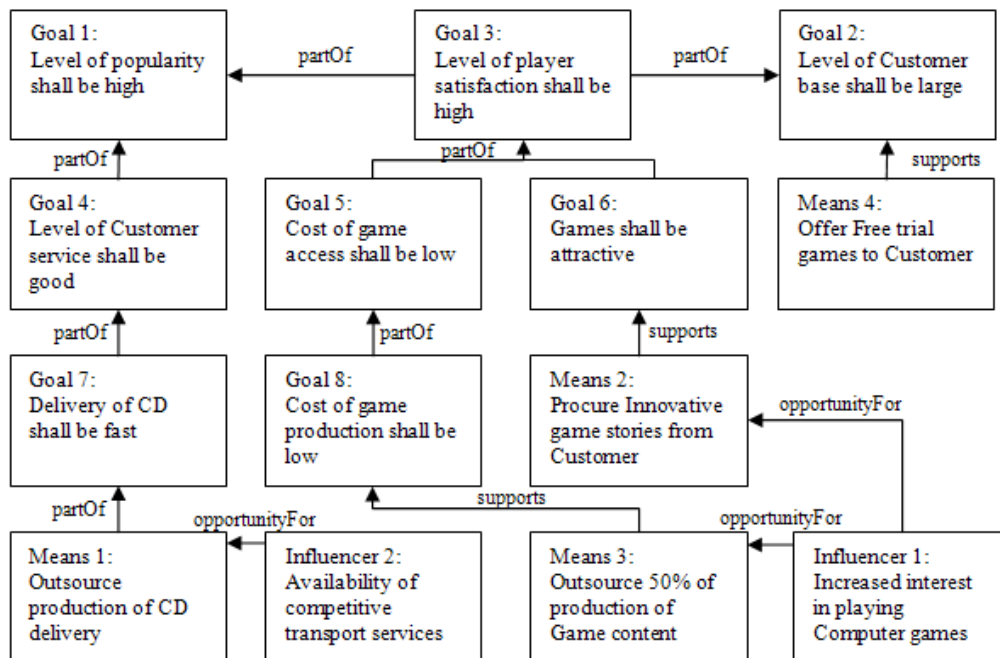


Figure 3: A goal model for the MMOG case

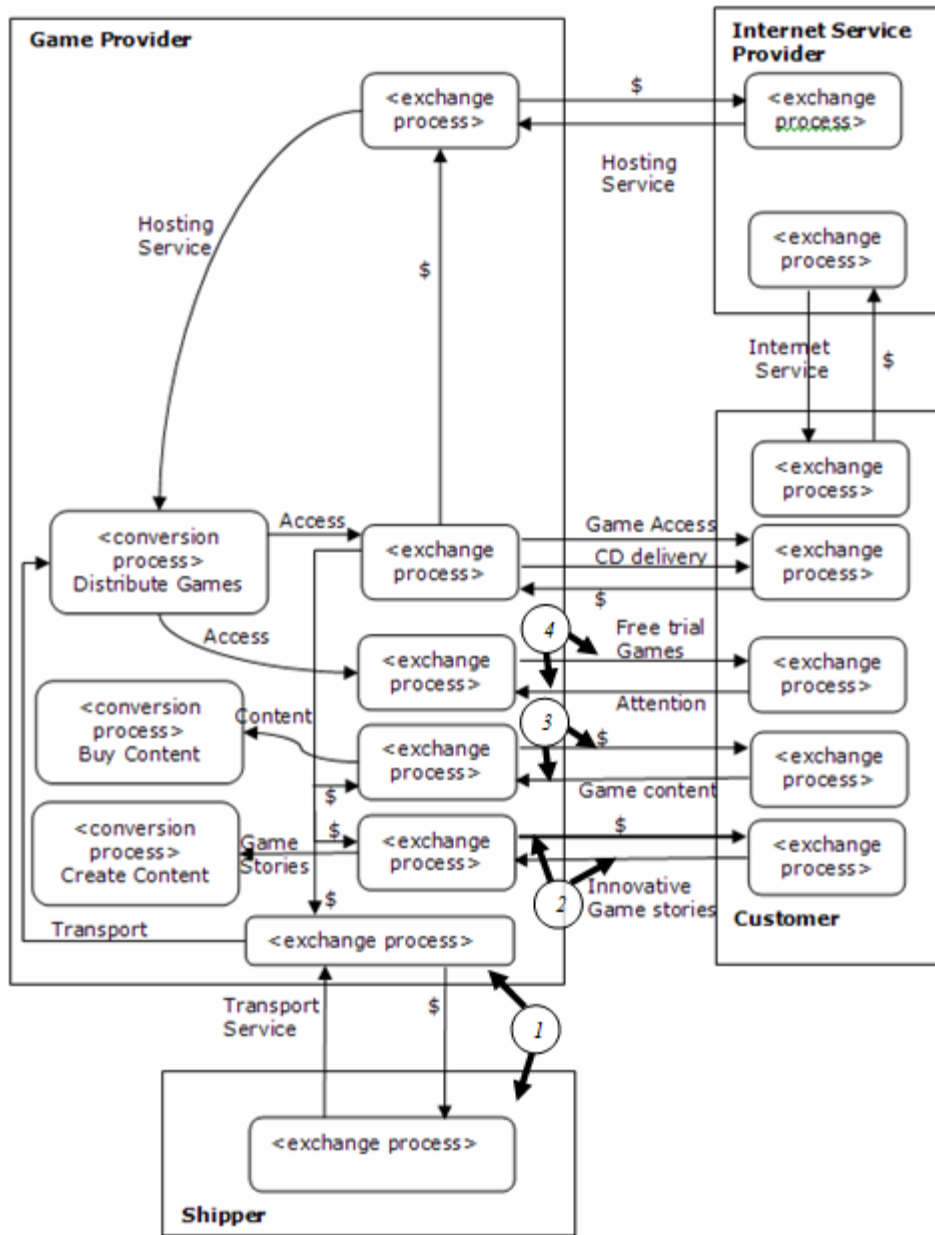


Figure 4: Extended business model for MMOG case.