Exploring Web Services from a Business Value Perspective

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Abstract

Emerging web services technologies provide an open infrastructure for automated business interaction, thereby creating new opportunities for business actors to collaborate within a networked constellation of enterprises via the Internet. The basis for a viable network of web services (the supporting information system of such a networked constellation of enterprises) is a value model that shows sound value propositions to all actors involved. Requirements engineering techniques can be developed to support: (1) exploring alternative business models, and (2) evaluating alternatives on their economic viability, leading into the design and implementation of technical systems. In this paper we present a Business-oriented Approach Supporting web Services Idea Exploration (BASSIE), which exploits the synergy between the agent- and goal-oriented i framework and the value-based e^3value framework. The approach iterates between exploration of structural alternatives and qualitative evaluation using i*, and quantitative modeling and evaluation of business value using e^3value. The approach is illustrated with a real-life case study in digital music distribution.*

1. Introduction

Web services technology is increasingly important for automated business interaction and application integration between enterprises. Web services add a thin SOAP/WSDL/UDDI layer on top of software components, which allows these components to interoperate using the Internet as a transport mechanism.

So far, the research on web services has taken a rather technical perspective, such as the development of standards and technologies. The main goal is to arrive at truly distributed computing, without having the need for enterprises to know each other in advance, and thus to beforehand agree about specific protocols and arrangements for integration of their software components. However, to actually use web services as the glue between enterprises, it is important to understand *how* and *why* these enterprises have to cooperate from a business perspective in the first place. Only then it is appropriate to consider web services technology for inter-enterprise integration.

To this end, we propose a Business-oriented Approach Supporting web Services Idea Exploration *BASSIE* that utilizes goal-oriented requirements engineering and value modeling to understand and explain a constellation of enterprises, cooperating with each other, and potentially using web services to do so. The approach starts with articulating the strategic business goals of the enterprises that want to cooperate – e.g., profitability, market share etc. It then focuses on devising alternatives for reaching those goals – thus taking a goal-oriented approach – for which we use modeling and evaluation techniques from the *i** framework [18]. We complement this goal-oriented approach with a value-based approach, using techniques from the e^3value framework [5] to construct a value model for each alternative and evaluate whether that model is satisfactory for each enterprise involved in the network constellation – i.e., whether they all gain an economic profit. Our method creates a link between strategic (profitability) goals set by enterprises and the way in which they create value in order to reach those goals. The result is a sound understanding of a constellation of enterprises and a good starting point for the design of web services to arrive at interoperability.

In the requirements engineering community, the emphasis has been on a single system or single enterprise environment, which is not sufficient for *networked* constellations of enterprises. On the other hand, the business community (e.g., [16]) has studied networked value constellations extensively, but is lacking a sufficiently thorough and conceptual approach with a good business strategic starting point from which it leads to business process definitions to eventually arrive at the technical design and implementation of a web services system. As such, *BASSIE* aims to add to existing RE-techniques the *network constellation* perspec-

tive, and to the business community the *conceptualization* perspective.

BASSIE provides detailed guidelines on the use of *i** and e^3value modeling and evaluation techniques. In [13], *BASSIE* is presented in detail, showing several iterations of exploring multiple alternatives, from a strategic business value viewpoint, to the business process viewpoint, and the information systems (web services) viewpoint. In this paper, we focus on illustrating the strategic business value viewpoint.

The paper is structured as follows. Section 2 presents the background on digital music distribution – the real-life case study we use to illustrate the approach. We then introduce the two frameworks integrated into our methodology, namely *i** and e^3value, in Section 3. Section 4 illustrates *BASSIE* through the case study, and reflects on the lessons learned during the construction of our method (Section 4.3). The paper ends with related work on the topic of web services requirements engineering from a business perspective (Section 5), and our conclusions (Section 6).

2. The Digital Music Value Constellation

We consider the business challenges for music distribution arising from Internet radio. For each time an Internet radio station plays a musical recording to one listener, it has to pay a clearance fee to one or more rights societies. A rights society (e.g., the Society of Composers, Authors and Music Publishers of Canada, SOCAN) represents the rights of musicians and producers (rights holders) by collecting clearance fees from radio stations and re-partitioning them among the rights holders.

Traditionally, rights societies have a national focus, representing rights holders within a single country, partly because ethereal radio stations stay within geographical boundaries. This changes with the emergence of Internet radio, and the liberalization of the rights clearance market – any rights society may now have members from any country. It is uncertain whether the current music rights clearance value model is able to generate significant average fees for the rights holders, and whether it results in a monetary profit for all business actors involved. Web services technology, which enables automated interaction among dynamically configured business actors, offers opportunities for the redesign of the business relationships among actors within the digital music rights clearance domain.

To come to such a redesign of the current music rights clearance model, issues at several levels need to be analyzed and addressed. At the business level we are concerned with how value is created, distributed, and consumed; rights societies keep existing members and attract new members by generating a revenue for them, while staying competitive and profitable for themselves in an international rights clearance market. At the business process level, operational activities by various actors need to coordinated and streamlined – e.g., efficient identification of rights societies for each right holder. Finally, at the information systems level, an effective information system is needed to support the exchange of play reports and clearance requests among Internet radio stations and rights societies. The case study in Section 4 addresses the issues from a business value perspective. For an illustration of *BASSIE* dealing with the issues at the other levels we refer to [14].

3. Two Underlying Frameworks

BASSIE draws on the complementary use of a goal-oriented approach and a scenario-path approach as proposed in the User Requirements Notation (*URN*), an ITU-T standards proposal in the Z.150 series of recommendations.

3.1. Goal-Oriented Exploration of Strategic Actors

The *i** framework [18] provides a goal- and agent-oriented approach for exploring possible alternatives for creating new or improving existing business or information system situations. The framework consists of two parts: (1) modeling concepts for the visualization of strategic actor networks showing alternatives for how they depend on each other, and how they address their internal interests and concerns in order to achieve them, and (2) evaluation techniques for analyzing which alternative sufficiently addresses these interests and concerns most satisfying. The *i** framework provides a means for combining all issues of concern to be addressed into one or more models, and analyzing the influence of specific issues on other issues. *i** modeling was first applied to business model analysis in [19].

3.2. Value-Based Requirements Engineering

The e^3value framework [5] provides an approach for exploring business ideas from an economic value perspective, thus focusing on value-based requirements issues specifically. It contains modeling constructs, based on the Use Case Maps (*UCM*) notation [2], for creating a value model that shows how objects of economic value are created, distributed and consumed in a network of multiple actors. e^3value is a scenario-based framework, allowing the evaluation of various scenarios of the same value model. An e^3value model does not indicate the sequence of activities within the model, but indicates how the exchanges of objects of value depend on each other. It describes steps in which one or more value models are constructed and evaluated on their economic viability from three viewpoints:

(1) business value, (2) business process, and (3) information system. The business value viewpoint focuses on how value is created, using economic reciprocity as the main rationale; actors are only willing to offer value objects when they receive sufficient compensation in return. The business process viewpoint spotlights how a business idea is put into operation by showing the operational process flow and operational expenses. The information system viewpoint shows its main software components and their interactions, as well as its operational and investment expenses.

4. *BASSIE*

The key idea of *BASSIE* is to use *i** modeling constructs to devise alternatives for achieving the strategic goals within a network of depending actors. *i** provides a qualitative approach for constructing and evaluating models that show the relations between a wide range of issues of concern (from strategic business requirements to functional and non-functional system requirements). However, because we are aiming to create an economically viable network of actors we need a means for quantitative evaluation of alternatives on their economic viability. For this we use e^3value.

The outline of our iterative exploration approach is to first create an *i** model of the current situation (if it exists), or a new model (based on a new idea), and then create an e^3value model based on that *i** model. The e^3value model is evaluated on its ability to create value for each actor involved. The quantitative e^3value evaluation results are then imported into the *i** model as checkmark labels, in order to allow a qualitative evaluation of the model to determine whether the outcome of the strategic profitability goals have a negative or positive influence on other strategic goals. Based on this qualitative evaluation, the overall viability of the model is determined. If an alternative is viable from a business value perspective, it is then explored from other points of view (business process viewpoint and after that information system viewpoint) in a similar manner, using a combination of *i** and *UCM*. If an alternative is not viable, a new alternative is devised and evaluated, using the knowledge gained from previous iterations, following the same steps described above, until a viable alternative is discovered.

4.1. Current Rights Clearance Model

In our case study, we start with an existing situation, thus the first step in our exploration is to evaluate the current rights clearance model to see whether it generates sufficient revenues for each actor involved. If the model is profitable, there is no need to change the model.

4.1.1 Model Construction

The *i** model in Figure 1 shows the actors as they are currently organized in the rights clearance business. The central concept in *i** is that of strategic actors, and how they depend on each other to achieve what they want. The generic concept of *actor* may be further specified as an agent or a role. An *agent* is a concrete actor with specific capabilities. A *role* is an abstract characterization of an actor's responsibilities and behavior within a context. For example, in Figure 1, the actor *Listener* plays the role of *Internet radio listener*. In this role it depends on *Internet radio streamer*, played by *Internet radio station*, for a *Radio stream*, which is represented as a resource dependency. A *resource* is a physical or information entity with its availability as its main concern. *Dependency* links indicate which agent or role depends on which other agent or role for what. By listening to that stream, *Internet radio listener* creates an audience. Therefore, *Internet radio streamer* depends on *Internet radio listener* for the goal *Audience be listening* to be reached. A *goal* is a condition or state of affairs that an actor would like to achieve.

Internet radio station is not allowed to make a musical recording public without the approval (*Right to make public*) of the rights holders of that recording. Therefore, *Internet radio station* buys, in exchange for a *Clearance fee*, the *Right to make public* from *Rights society*, which plays the role *Rights clearance provider* in which it performs the task *Clear right to make music public* – a task is a specific procedure performed by an agent or a role – to clear the rights with the corresponding *Rights holder* agents it represents. Then, *Rights society*, in its role as *Fee re-partitioner*, receives these *Collected fees* and distributes a *Re-partitioned fee* to every *Rights holder* by carrying out the task *Re-partition fees among rights holders*. *Rights society* has a strategic goal *Interests of musicians and producers be defended*, which is decomposed into two tasks internal to the two roles it plays, and two strategic soft goals internal to the agent itself. *Decomposition* links define the sub-components of tasks and goals.

A *Rights holder*, played by both *Producer* and *Musician* agents, holds rights to a musical recording and performs the task *Sell right to make public*. They receive a *Re-partitioned fee* from *Fee re-partitioner* based on the individual shares they own in exchange for the *Right to make public* their music. *Musician* and *Producer* both depend on *Rights society* for receiving a *Significant [Re-partitioned fee]*, which is a soft goal. A *soft goal* is a non-functional (quality) attribute that, unlike a (hard) goal, has no clear-cut criteria for successful achievement. The soft goal *Significant [Re-partitioned fee]* has no hard criteria for determining when it is reached; it is subjective for each *Musician* or *Producer* agent as to when a *Re-partitioned fee* is perceived to be significant.

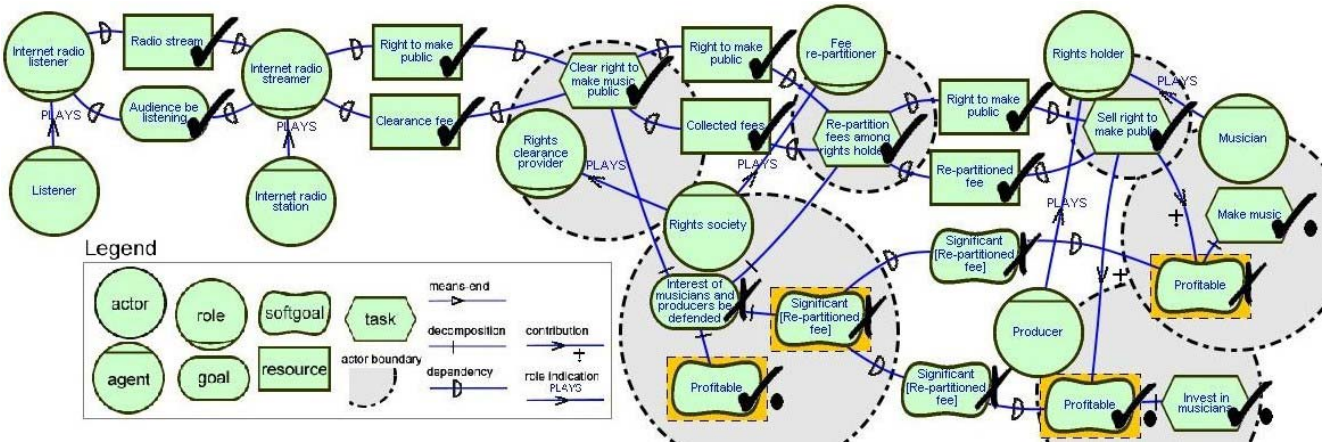

Figure 1. i^* model of the current digital music value chain

By performing the task *Sell right to make public* in their role as *Rights holder*, both *Musician* and *Producer* agents positively contribute to their being *Profitable*, which is a strategic soft goal decomposed from their high-level strategic tasks (*Make music* and *Invest in musicians* respectively). A *contribution* link describes the positive or negative impact of one element on another.

Some questions about the model arise in respect to its economic viability, which we cannot answer without the use of a quantitative evaluation approach. Is *Rights society* able to create significant fees for the rights holders, while keeping enough profit for itself?

Figure 2 depicts a e^3value model of the current rights clearance situation to allow a quantitative evaluation for analyzing its economic viability. In an e^3value model, an *actor* is an independent economic, often legal, entity that performs one or more value activities. A special actor, called a *market segment*, represents a group of actors who value objects equally. Figure 2 shows that a *Listener* listens to the *Radio stream* of an *Internet radio station* – actors within the *Listener* market segment equally value the object *Radio stream* – thus creating an *Audience*. A *value object* is a service, a product, or even an experience that is of economic value to at least one of the actors within a value model. *Audience* is of value to the radio station because it can play advertisements in exchange for a fee. Note that an advertisement company buying air time for its advertisements from *Internet radio station* is omitted because of irrelevance to the value evaluation of the rights clearance process.

Internet radio station performs the value activity *Stream radio over the Internet*. A *value activity* represents a task carried out by an actor that adds value and produces one or more value objects. *Radio stream* is of value to *Listener*. For every track per *Listener* played by the *Internet radio station* it has to pay a *Clearance fee* to the *Rights society* representing the rights holders of that track. *Rights society* performs two value activities: (1) *Clear right to make music public*, and (2) *Re-partition fees among rights holders*.

In order to perform the first value activity it requires a *Clearance fee* from *Internet radio station* at its value in port, in exchange for the *Right to make public* at its out port. An actor uses a *value port* to provide to (out port), or request value objects from (in port) other actors. A potential value object trade, which is represented by a *value exchange*, is the exchange of a *Clearance fee* from *Internet radio station* to *Rights society*. However, *Internet radio station* is only willing to provide a *Clearance fee* for something of value (i.e., *Right to make public*) in return (economical reciprocity). A *value interface* indicates such a willingness by grouping value ports that provide value objects an actor is willing offer with value ports that request other objects that actor wants to receive in return. At value interface level, the exchange of value objects is atomic; either all exchanges occur as specified or none at all. A value interface does not indicate the temporal ordering of objects to be exchanges on its ports, and it may also contain several in ports and out ports.

The second value activity carried out by *Rights society* involves re-distributing the *Collected fees* as a *Re-partitioned fee* to the *Producer* and *Musician* agents involved. In exchange for this fee, *Rights society* receives the *Right to make public*, which it needs to carry out the task *Clear right to make music public*.

The *value scenario* in Figure 2, which shows how value exchanges depend on each other, consists of a *scenario path* coming from a *start stimulus* (a *Listener* performing the activity *Listen to Internet radio*) to an *end stimulus* (*Musician* and *Producer* performing *Sell right to make public*). A scenario results in several paths when using an *OR-fork*, or can split in multiple sub-paths when using an *AND-fork*.

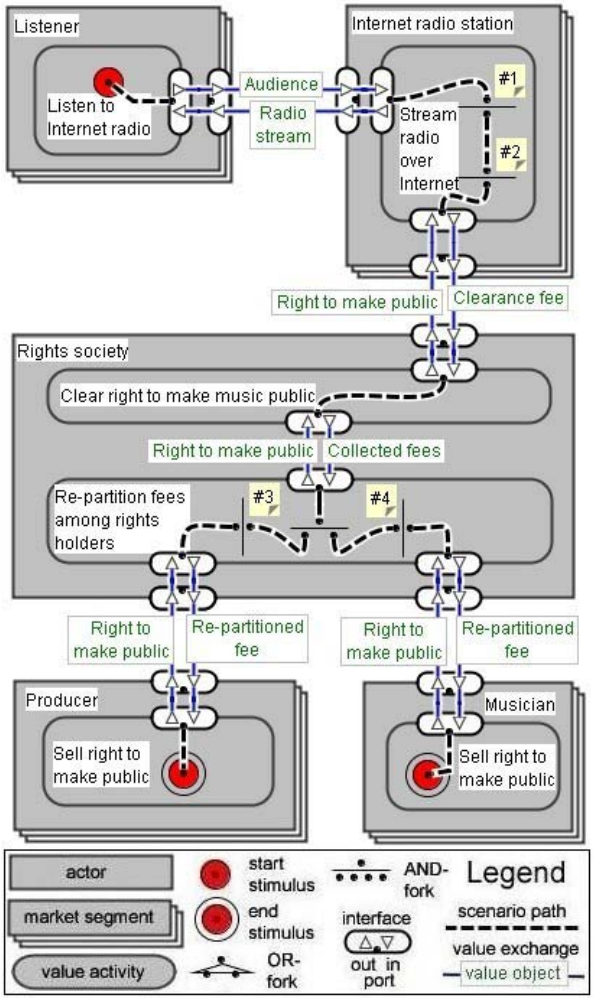

Figure 2. e^3value model of the current digital music value chain

The model in Figure 2 is derived from the *i** model in Figure 1 using *BASSIE* guidelines in the following steps:

1. An *i** agent is converted into an e^3value actor (if it involves a single agent) or a market segment (if it involves multiple agents that assign the same value to objects) with the same name

2. The dependencies between *i** roles played by *i** actors are translated to value interfaces at the boundary of the matching actors in the e^3value model

3. Value interfaces at actor boundary are related via value exchanges between the matching e^3value actors and market segments in the opposite direction as dependencies between the corresponding *i** roles

4. Tasks internal to *i** roles are mapped to value activities internal to the matching actors and market segments in the e^3value model

5. The dependencies of tasks internal to *i** roles are converted into value interfaces and added to the matching value activities

6. Value activities are related to other value interfaces via value exchanges in the opposite direction as the dependencies of tasks internal to *i** roles

Dependencies between *i** agents cannot be converted to e^3value constructs, since these represent the strategic rationale behind the network of business actors. For detailed guidelines that describe how to deal with exceptions we refer to [14].

4.1.2 Model Evaluation

The objective of evaluating the e^3value model is to determine whether all actors involved gain value from the current rights clearance model. Then, the evaluation results of the e^3value model are imported into the *i** model in order to verify the model's viability – whether the strategic goals of all agents in the *i** are *satisficed*, and how possible *denied* goals negatively affect other (sub)goals and dependencies in the model.

In order to carry out the quantitative evaluation of the e^3value model, the number of instances of the actors in the e^3value market segments has to be specified, as well as the number of scenario occurrences, and valuation functions for the value ports requesting or offering money objects. This is done based on known figures (taken from the Society of Composers, Authors and Music Publishers of Canada (SOCAN) [15]), and assumptions made for yet unknown factors (see Table 1). We assume SOCAN is the only rights society that represents Canadian artists. We focus on Canadian radio stations and music listeners only. With the valuation functions, and the figures and assumptions from Table 1, we can calculate the profitability sheet for each of the actors. Figure 3 depicts the profitability sheet of *Rights society*, generated with the $e^3editor$ tool, showing that it receives a profitable CAN$ 3,000 per month. The rights holders, however, fail to receive a significant average fee (*Musician* CAN$ 0.16 and *Producer* CAN$ 24 respectively).

The properties in Table 1 that are followed by a '#' and a number between brackets are represented in Figure 2 by an AND-fork. *Internet radio station* has two such AND-forks annotated #1 and #2. The first one makes a conversion from a stream to a track, since the radio stations will be charged per track; it models that each one hour stream results in 12 tracks played. Because we are exploring the situation of the national rights society in Canada, which only represents

Property	Value
No. of potential listeners (high-speed Internet connections)	3,300,000 (2002)
No. of estimated listeners	330,000 (10%)
No. of occurrences per month	20 (1 occurrence = 1 hour music stream)
No. of Internet radio stations	150
No. of rights societies	1 (SOCAN)
No. of tracks per 1 hour music stream (#1)	12 (music only channel)
Percentage of Canadian songs played (#2)	25%
Clearance fee per track per listener per stream	CAN$ 0.00136
Fee for collecting & re-partitioning 1 clearance fee	11% of clearance fee
No. of musicians	74,500
No. of producers	500
No. of producers per track (#3)	1
No. of musicians per track (#4)	8
Fraction of fees to musicians	50%
Fraction of fees to producers	50%

Table 1. Assumptions for current model involving SOCAN

the rights of Canadian musicians and producers, it is necessary to define which part of all played music has Canadian rights holders. Therefore, AND-fork labeled #2 represents that 25% of all music played in Canada is that of Canadian artists. Furthermore, because we assume on average 1 *Producer* and 8 *Musician* actors are involved in each recording, the collected fees should be re-partitioned accordingly. The cardinalities of the actors in these market segments are modeled by AND-forks labeled #3 and #4, respectively, which both reside within the *Rights society* market segment. The incoming fee for 1 track results in outgoing fees for 8 *Musician* actors and for 1 *Producer*.

The e^3value evaluation results are imported as *i** checkmark labels *Satisficed* (✓), *Weakly satisficed* (✓.), and *Denied* (✗) into the *i** model as evaluation starting points in Figure 1 (indicated by a striped square filled with yellow), and propagated through the model using a qualitative labeling algorithm [3]. The resulting labels show that the inability of *Producer*, *Musician* and *Rights society* to get any significant profits influences their ability to reach their strategic tasks and goals. This indicates that the current existing music rights clearance model is not viable for several actors involved when it comes to clearing fees for Internet radio stations. Our conclusion is that we should come up with an alternative rights clearance model that is more economically viable.

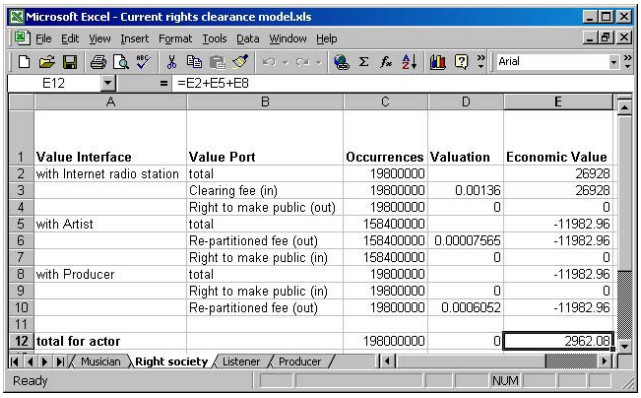

Figure 3. Profitability sheet of the Rights society actor

4.2. Seeking Business Model Alternatives

The main problem with the current model is that no significant profitability can be established when it comes to clearing rights for Internet radio stations. To solve this, the number of listeners should significantly increase. One way to do this is to collect fees in an international, rather than a national, context. This, however, introduces the need for a national rights society to collaborate with rights societies from other countries. Additionally, international regulations are planning to liberalize the music rights clearance market so that any rights holder can use the services of any rights society from any country. This also requires an international and competitive approach for the rights societies. The focus of our next alternative should therefore be to create a model that (1) increases the number of Internet radio listeners for which clearance fees should be paid, and (2) copes with international issues. We will try to achieve this by adding a new actor, namely a *Clearing coordinator*.

Internationalizing the rights clearance market creates new problems for radio stations – how to find the rights society that clears rights for a specific artist, group, or track. It does not necessarily have to be the rights society from the country of origin of an artist to be the one that clears the rights for that artist; it could be any rights society residing in any country in the world. To make it possible for radio stations to find the rights society that does clear the rights for a specific artist, rights societies should cooperate through a negotiation process. To make such negotiation process possible we need a common infrastructure so that rights societies can communicate and cooperate in a standardized way. This common infrastructure will be provided

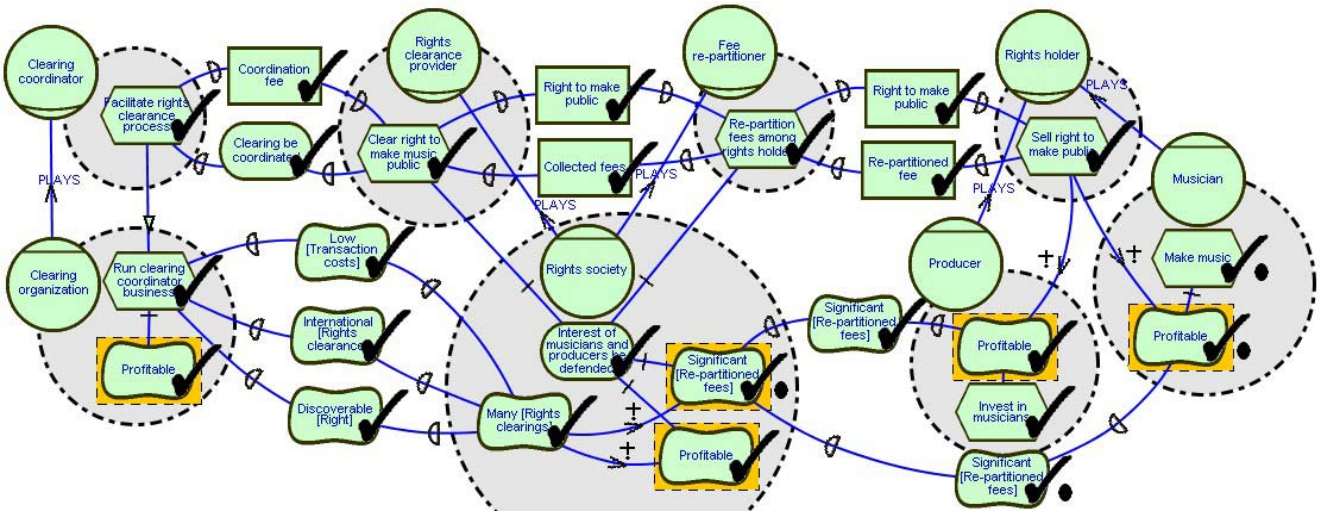

Figure 4. i^* model of the clearing coordinator alternative

by the newly introduced *Clearing coordinator* actor, which is facilitated by web services technology at the information system level.

4.2.1 Model Construction

Figure 4 depicts the i^* model of the clearing coordinator alternative. The role *Clearing coordinator*, which is played by *Clearing organization*, acts as a facilitator for the rights clearance process. *Clearing coordinator* strives to satisfice the goal *Clearing be coordinated* by performing the task *Facilitate rights clearance process* in exchange for a *Coordination fee* received from *Rights clearance provider*. This task is an ends for *Clearing organization* to achieve its high-level strategic task *Run clearing coordinator business*.

Also, some new dependencies from *Rights society* to *Clearing organization* are introduced. The soft goal *Discoverable [Right]* shows that *Rights society* depends on *Clearing organization* for enabling an *Internet radio station* to find the right *Rights society*. *International [Rights clearance]* illustrates that *Rights society* depends on *Clearing organization* to operate on an international scale. Finally, *Clearing organization* is also depended upon to provide *Low [Transaction costs]*. These three dependencies all determine how *Many [Rights clearings]* are processed. A high number of rights clearings positively influences the *Profitability* of *Rights society* and its ability to generate *Significant [Re-partitioned fees]*.

The e^3value model derived from the i^* model in Figure 4 is shown in Figure 5. It also shows the newly introduced *Clearing organization* actor performing the value activity *Facilitate rights clearance process*. Furthermore, *Rights society* is now a market segment, because the model now represents a liberal, international music rights clearance, which involves several competing rights societies.

4.2.2 Model Evaluation

The key change in the value model is that the number of listeners is extensively grown because of the international focus – 153,300,000 high-speed Internet connections worldwide, of which 10% make up the estimated number of listeners [13]. Furthermore, the fee for facilitating one rights clearing is 5%, and the fee for collecting & re-partitioning one clearance fee is 6% per occurrence, because we assume that *Rights society* will pay for the clearing coordination and not the *Internet radio station* or *Rights holder*. We assume world-wide 15,000 Internet radio stations to be active, and 10% of all music played world-wide to be Canadian music.

With these changed figures we evaluate the e^3value model, from which we can conclude that with a monthly income of about CAN$ 25,000, this alternative is quite profitable for the *Clearing organization*. However, this alternative is even more profitable for *Rights society*, with a monthly revenue of about CAN$ 30,000. The alternative also results in quite a significant monthly fee for *Producer* of about CAN$ 445 – a spectacular increase of more than 1800%. On the other hand, a fee of CAN$ 3 still does not represent a noteworthy average fee for *Musician*, in spite of the same increase in revenue as *Producer*.

Importing the e^3value evaluation results in the i^* model in Figure 4, and propagating these checkmark labels shows that almost every goal, task, and soft goal is marked *Satisficed*, except for *Musician*; its *Profitable* soft goal and the *Make music* task are both *Weakly satisficed*. The soft goal *Significant [Re-partioned fee]* internal to *Rights society* is

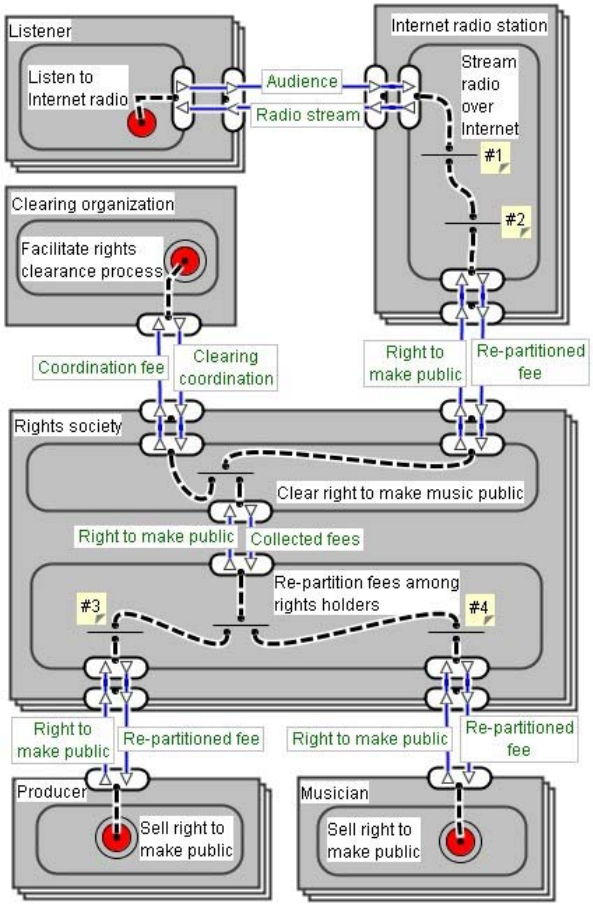

Figure 5. e^3value model of the clearing coordinator alternative

also assigned the checkmark label *Weakly satisficed*.

It seems that we need to explore additional alternatives to construct a model that offers the *Musician* agent a significant average fee for allowing its music to be made public through Internet radio, but it may be hard to do so (see [14]). Nevertheless, in the clearing coordinator alternative, certain (main-stream) musicians will receive a significant fee because their music is played much more often than the average, thus not fully denying the *Profitable* soft goal to be achieved. Also, this alternative allows rights societies to compete fairly on a free rights clearing market.

4.3. Discussion

In developing *BASSIE*, we studied business cases from three domains: digital music distribution, transaction information aggregation, and direct mail. Two of them are from real-life organizations. The example we use to illustrate our approach in this paper is based on an extensive study by the second author on the exploration of new opportunities for the Dutch rights society SENA, triggered by the increasing number of Internet radio stations streaming music via the Internet [9]; the value models originate from that report. The figures used to perform the e^3value evaluation of those models are taken from the Canadian rights society SOCAN [15], as the SENA figures are proprietary. While constructing and validating our approach, we learned some important lessons, which we used to improve our the method.

Lesson 1: The first alternative for a value model is hardly ever viable. Devising a value model that is profitable for each actor involved requires in-depth knowledge of the domain, and about the reasons why certain models are not viable in that domain.

Remedies. A way to gain this knowledge is to iteratively explore alternatives. Alternatives that do not seem viable after evaluation provide knowledge about what needs to be changed in order to construct a viable model (checkmark labels in the evaluated *i** not labeled *Satisficed* indicate this). This knowledge is used to devise a model that is more likely to be viable in the next iteration of the approach.

Lesson 2: An alternative that is profitable may still be infeasible. In [14] we show an alternative for the music rights clearance model in which a central clearing organization acts as a proxy between Internet radio station an rights society. This alternative's e^3value evaluation results in the same conclusions drawn for the clearing coordinator alternative's profitability. However, based on the *i** evaluation this alternative seems infeasible because it introduces a dependency that makes the rights society critically rely on the central clearing organization to run its business, an unacceptable vulnerability.

Remedies. We use *i** to assess and draw final conclusions about the overall viability of an alternative, since it allows a general, qualitative evaluation of alternatives. e^3value is used to focus on the economic issues specifically.

Lesson 3: It is not always possible to construct a value model in which all actors involved make an average profit. The exploration of different alternatives for clearing rights to make music public through Internet radio, indicates that different value models are possible. None of the alternatives seem profitable for all the actors involved, however. Rights societies do want to cope with clearing rights for Internet radio stations, so they do need a value model for realizing this.

Remedies. The only remedy is to implement this model when no better alternative is at hand. The clearing coordinator alternative realizes significant revenues for the rights society, which is the most important actor. Musicians do not receive a significant average fee, but certain (main-stream) musicians will receive a significant fee.

5. Related Work

Although the main focus in web services literature is on technical issues, some research is done on web service requirements engineering from a business perspective. Most of this research starts at business *process* level stating the business activities web services support, instead of from a business strategy perspective indicating the strategic business goals to be reached using web services.

For example, the *DysCO* framework allows exploration of concepts like business-to-business cooperation, e-service aggregation, and dynamic re-configuration of business roles [12]. Its aim is to reconcile the need for flexibility in business relationships with the need for stability and reusability of business processes. *DysCO* is not goal-oriented and therefore does not allow reasoning about the business strategic goals from which business processes are derived.

Work by Terai et al. provides a framework for coordinating web-based services based on business models [17]. They provide a means for constructing and linking business activities to web services activities. This framework also starts from a business process perspective and therefore also omits reasoning about business strategic goals.

The Rapid Service Development (*RDS*) method defines an integrated approach for the development of e-business services, with a particular focus on business-to-business transactions [4]. This framework allows modeling both business and technical concepts of electronic business services, but it does not provide a clear bridge between the business and technical design spaces. *RDS* also underexposes the early-phase requirements that capture the original business idea, and it does not contain evaluation techniques for determining the economic viability of service ideas.

Papazoglou et al. describe a design method for web services and business processes [11]. It provides (1) a framework for identifying web services and their relationships, and (2) guidelines for web services design from both functional and non-functional perspectives. The method allows describing business process objectives, plus it also states the importance of generating revenues with web services operating between organizations; it includes rating and billing models. However, the method does not contain a profitability evaluation. It aims at developing web services from a business process and service perspective rather than from a business stakeholder and strategic perspective.

Van de Kar et al. provide a design approach that investigates relationships between business models and services [10]. It describes a revenue model, which indicates actors involved and the service fees they pay and receive. They, however, do not provide techniques for profitability evaluation. Also they ignore the operational and technical costs of the activities performed to create revenues, as well as the strategic goals to be reached with the provided services.

Ardagna et al. describe a method that allows designers to evaluate and select the minimum-cost implementation alternative of a web-based system [1]. It provides a means for estimating cost implications of architectural choices through a sequence of steps for going from requirements analysis to physical implementation. This method, however, only focuses on the expenses made with technically implementing and operational running web-based systems; it omits costs made from a business process viewpoint. Also, it does not address the issue of revenue creation from a business value perspective.

Other research that combines goal-oriented and value-based approaches by Zlatev et al. [21] and Gordijn et al. [8] does not allow modeling and evaluating how the business actors involved in a networked constellation depend on each other for reaching their strategic goals. For instance, an end-consumer could depend on an Internet radio station to reach the goal of listening to music. Also, this research omits the visualization and analysis of multiple alternatives for reaching the same strategic goals. Both aspects are vital since web services systems typically involve several business actors that depend on each other, and for which more than one viable implementation alternative exist. Our methodology does allow to address these issues.

6. Concluding Remarks

Companies are increasingly trying to reach business strategic goals (e.g., economic profitability) in networked constellations of enterprises, using enabling web services technology as an infrastructure for automated business interaction. Based on a well thought-out business idea, these companies should be able to create, analyze and select an profitable implementation alternative for the supporting web services system of such a networked constellation. For this they need a requirements engineering approach that starts at articulating and analyzing the strategic business goals, before other issues, such as supporting business processes and information systems, are addressed.

By combining two frameworks that both focus on different aspects – *i** aims at strategic goals and intentions, and e^3value focuses on added economic value – our approach enforces a wide outlook on the alternatives explored; these used frameworks seem to connect and complement each other very well. Exploring an alternative from two additional viewpoints, analyzing operational and technical issues in a detailed manner is useful in analyzing the overall viability of an alternative. Our approach provides a means to do just that (see [14]). Finally, the iterative flow of steps makes *BASSIE* a very efficient and light-weight approach for exploring ideas for networked business constellations in which knowledge from previous infeasible alternatives is used to construct new alternatives.

Besides improving and validating *BASSIE*, future research could be to extend our methodology to go from business requirements to an architectural design of the supporting web services system. Our approach describes steps for describing the global components within the web services system [14] using the Use Case Maps (*UCM*) notation [2], but on a conceptual level, not detailed enough to use as a design for implementation. Also, looking into how other frameworks may be used to evaluate implementation alternatives from a specific perspective, such as we used e^3value to assess their economic viability from a business value perspective, might be a topic for further research. Finally, integrating the existing tools *OME3* [20] and $e^3editor$ [7], which support modeling and evaluating *i** and e^3value models respectively, might allow automated model checking for consistency between the different types of *i** and e^3value models.

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