e^3*forces*: Analyzing Strategic Considerations of Actors in Networked Value Constellations

Vincent Pijpers, Jaap Gordijn

Free University

FEW/Business Informatics

De Boelelaan 1081a

1081 HV Amsterdam

The Netherlands

pijpersv@few.vu.nl, gordijn@cs.vu.nl

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Abstract

Increasingly organizations are participating in *networked value constellations*, which are networks where organizations, enabled by information technology, jointly create value and satisfy customer needs. However, participating in a networked value constellation increases the problem of correctly *understanding* the organization, which is necessary to design (cross)-organizational IT support. Therefore, business modeling approaches for networked constellations, such as e^3*value*, BMO, and REA, have been developed. In this paper, we extend these business modeling approaches to understand the *strategic rationale* behind business models. We propose the business modeling technique e^3*forces* to understand strategic motivations of organizations. Furthermore we utilize e^3*forces* to (1) analyze if the *business strategy* of an organization is *consistent* with its *strategic position* in the constellation and (2) analyze the *impact* of deploying IT on forces in the environment of actors in a constellation. To develop and assess e^3*forces* a case study was conducted in the Dutch aviation industry.

Keywords: Environmental forces, business ontology, strategy

1. Introduction

The arise of the Internet has reshaped the world in which organizations do business. No longer are organizations bound by geographic limitations; organizations are enabled to operate and compete on a worldwide platform. As a result, organizations are increasingly participating in worldwide *networked value constellations*, which are collections of organizations which jointly satisfy a complex consumer need (Tapscott, Ticoll, & Lowy, 2000) and are enabled by, and heavily rely on, *information technology* to coordinate process execution and service provisioning.

Although participating in a networked value constellation may aid in *increasing profits*, it also increases the *problem* of obtaining correct, deep and shared *understanding* of the constellation (and thus of the participating organizations) due to the vast number of dynamic dependencies between actors (Gordijn & Akkermans, 2003a). In a multi-enterprise setting, as a networked value constellation is, achieving *shared understanding* is made difficult by the own culture and corresponding "language" organizations tend to have. Shared understanding is however essential to arrive at a sustainable constellation and corresponding cross-organizational *IT support*.

To create understanding in a multi-actor setting, such as a constellation, *ontologies* are beneficial. Ontologies, in general, create shared understanding of *various features* in a *multi-stakeholder* setting (Borst, Akkermans, & Top, 1997). With the aid of ontology it becomes possible to *rigorously define* and *conceptualize* networked value constellations in such that clear and unambiguous (graphic) models can be made and (semi-) automatic analysis can be conducted.

Following this ontology approach, a number of conceptually founded approaches have been developed in recent years for modeling and exploring networked value constellations. To our best knowledge there is however no conceptually founded approach to analyze *strategic considerations* of organizations participating in a networked value constellation. The organization dependency technique (Tillquist, John, & Woo, 2002) and i* (eye-star) (Yu, 1997) are approaches that try to model goals and motivations of actors in a network, but both approach goals and motivations from an operational and/or agent based perspective. Therefore it is currently not possible to analyze, using semi-formal reasoning, (1) if the position of an organization participating in a networked value constellation is consistent with its business strategy and, (2) how IT/IS deployment affects the strategic position of organizations, even though the impact of business strategies on IT and IT on business strategies has been stressed by multiple authors (eg. Henderson & Venkantraman, 1993; Bakos & Tracy, 1986). For this reason we propose the *e^3forces* ontology which focuses on strategic considerations for organizations participating in a networked value constellation. The strategic considerations used in *e^3forces* are based on the business strategy on environmental forces as outlined by Porter (Porter, 1980, 1985). In this paper we will demonstrate, with the aid of an industry strength case study, how *e^3forces* can be used to:

1. Evaluate if the strategic position of an organization, within a networked value constellation, is coherent with the chosen business strategy of the organization.
2. Analyze how deployment of IT/IS can influence the environmental forces of organizations participating in a networked value constellation.

This paper is structured as follows: First we present the theoretical background relevant for this paper. Next we discuss research methodology and present the case study. Subsequently we will present and discuss the

e^3*forces* ontology. Hereafter we will present and discuss the two applications of the e^3*forces* ontology. Finally we will present conclusions and consider further research directions.

2. Theoretical Background

2.1. *Business Ontologies*

In previous work we have argued that during the development of a networked value constellation the constellation should be analyzed from at least three different perspectives (Gordijn & Akkermans, 2003b; Nuseibeh, Kramer, & Finkelstein, 1994): (1) *The information system perspective*, which represents the *information systems architecture* supporting the networked value constellation. Emphasis is here on the interoperability between various information systems of enterprises. (2) *The business process perspective*, which shows the *operational organization* of intra-enterprise activities (control&data flow, resource allocations, etc) and the cross-organizational *coordination* of these activities. (3) *The business value perspective* - on which we focus in this paper - which illustrates which companies participate in the networked value constellation, as well as *what* of *economic value* is transferred between each other, and what is requested in return. The perspective is e.g. used to understand and evaluate economic sustainability for each participating enterprise. Effectively, the value perspective provides the business rationale for the other two perspectives. The following business modeling ontologies are worth mentioning: (1) BMO, developed by Osterwalder and Pigneur (2004), with the purpose of expressing the business logic of firms, (2) REA, developed by Geerts and McCarthy (1999), which takes an accounting view on the economic relationship between various economic entities; (3) e^3*value*, developed by Gordijn and Akkermans (2001), which considers value transfers between actors in the networked value constellation.

Although the business value ontologies mentioned above are suitable for what they are designed for, there is a part of the business value perspective which is not considered by these ontologies; *strategic considerations*. The listed ontologies focus on *how* networked value constellations are structured, not *why* actors are motivated to participate in networked value constellations. The “how” and the “why” of the business are however unavoidably connected in the business strategy of an organization (Ceddon, Lewis, & Shanks, 2004; Johnson & Scholes, 2002). The business strategy of an organization states *how* an organization utilizes its resources and competences and *why* in terms of competitive advantage in a changing environment (Johnson & Scholes, 2002). Although some authors suggest that business models are able to capture *all* aspects related to business strategy, thereby considering (networked) business models and business strategies as equivalent (Ceddon et al., 2004), we consider a business model to capture only specific aspects of an organization’s business strategy (Ceddon et al., 2004).

2.2. *Business strategy*

In current business literature at least two distinctive, yet complementary, schools on the rationale behind business strategies can be found. One school focuses on *internal competences* of an organization. The other school considers the *environment* of an organization as an important strategic motivator. The first school considers the inside of an organization to determine the best strategy. This school is rooted in the belief that an organization should focus on its *unique resources* (Barney, 1994) and *core competences* (Prahalad & Hamel, 1990). According to this school, the best path to ensure the continuity of the organization is to *focus* on the unique resources and core competences the organization possesses. The second school originates from the work of Porter (Porter, 1980, 1985), and successors (Tapscott et al., 2000). It believes that *forces in the environment* of an organization determine the strategy the organization should chose. An organization should *position* itself such that competitive advantage is achieved over the competition and threats from the environment are limited. Due to space considerations we only consider the second school in the *e³forces* ontology, the first school (core competences) is discussed in (Pijpers & Gordijn, 2007).

2.3. The e³value ontology

The aim of this paper is to provide an ontologically well founded motivation for business value models of networked value constellations in terms of business strategies. Since we use *e³value* ontology as the basis for the *e³forces* ontology we summarize *e³value* below (for more information, see (Gordijn & Akkermans, 2003b)). The *e³value* ontology provides modeling constructs for representing and analyzing a network of enterprises, exchanging things of economic value with each other. The methodology is ontologically well founded and has been expressed as UML classes, Prolog code, RDF/S, and a Java-based graphical *e³value* ontology editor as well as analysis tool has been developed (Gordijn & Akkermans, 2003b). We use an educational example (see Fig. 1) to explain the ontological constructs.

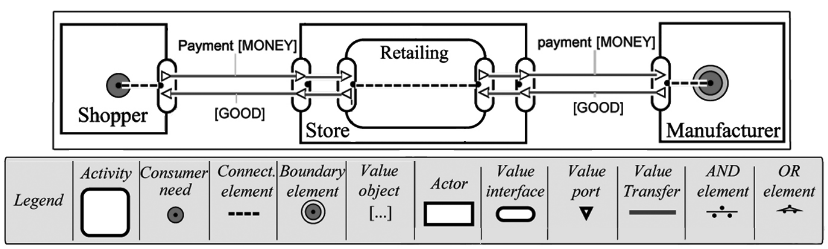

Figure 1: Educational example

- *Actors* (often enterprises or final customers) are perceived by their environment as economically independent entities, meaning that actors can take economic decisions on their own. The Store and Manufacturer are examples of actors.
- *Value objects* are services, goods, money, or even experiences, which are of economic value for at least one of the actors. Value objects are exchanged by actors.
- *Value ports* are used by actors to provide or request value objects to or from other actors.
- *Value interfaces*, owned by actors, group value ports and show economic reciprocity. Actors are only willing to offer objects to someone else, if they receive adequate compensation in return. Either all ports in a value interface each precisely exchange one value object, or none at all. So, in the example, Goods can only be obtained for Money and vice versa.

- *Value transfers* are used to connect two value ports with each other. It represents one or more potential trades of value objects. In the example, the transfer of a Good or a Payment are both examples of value transfers.
- *Value transactions* group all value transfers that should happen, or none should happen at all. In most cases, value transactions can be derived from how value transfers connect ports in interfaces.
- *Value activities* are performed by actors. These activities are assumed to yield profits. In the example, the value activity of the Store is Retailing.
- *Dependency paths* are used to reason about the number of value transfers as well as their economic values. A path consists of *consumer needs, connections, dependency elements* and *dependency boundaries*. A consumer need is satisfied by exchanging value objects (via one or more interfaces). A connection relates a consumer need to a value interface, or relates various value interfaces internally, of a same actor. A path can take complex forms, using AND/OR dependency elements. A dependency boundary represents that we do not consider any more value transfers for the path. In the example, by following the path we can see that, to satisfy the need of the Shopper, the Manufacturer ultimately has to provide Goods.

3. Research Methodology

3.1. Ontology approach

By analyzing strategic motivations of organizations in a networked value constellation with the aid of an ontology our research approach represents a *breach* from both *traditional* quantitative and qualitative modes of scientific research on information systems on two aspects (Baida, Gordijn, Akkermans, Saele, & Morch, 2006):

1. On the theoretical level ontologies are used as a tool for rigorous theory articulation, since ontologies *formally* and *conceptually* “explain” a real world domain. As a theory, a formal ontology is typically *not* expressed in terms of variables as is common in quantitative social and business research. Ontologies are usually *formalized qualitative theories* concerning conceptual constructs shared by a community of practice in a domain. Although this does not imply (at least not necessarily) that they are congruent with the interpretivist or naturalist perspectives common in qualitative research.
2. Qualitative and quantitative approaches have in common that they assume that scientific goals lie in (different forms of) explanation. In contrast, our ontology approach is more tailored toward *problem solving* and *designing innovation* in business practice. Ontologies are better seen as a model based approach, whereby the quality and success of the model is assessed in terms of whether it is good enough to help in problem solving.

During our research the primarily use of the case study is to develop the *e^3forces* ontology. We have used the case study to aid with *formalizing qualitative theories* concerning conceptual constructs (see point 1). The secondary use of the case study was to *demonstrate* how the *e^3forces* ontology can be utilized. The *e^3forces* is utilized to analyze consistency between an organization business strategy and strategic position. This is consistent with the “ontology approach” to use ontologies for *problem solving* (see point 2), which includes problem analysis.

3.2. *Case Study: Dutch Aviation Constellation*

To develop and test the e^3*forces* ontology we conducted a case study at the Dutch aviation industry, in which multiple organizations cooperate to offer flights to and from the Netherlands. From the large number of actors in the Dutch aviation constellation we have chosen only *key players* for further analysis. The key players were identified with the help of a "power/interest matrix" (Johnson & Scholes, 2002). *Power* is defined as the capability to influence the strategic decision making of other actors (Johnson & Scholes, 2002). An actor can do so when s/he is able to influence the capacity or quality of the products/services offered by others to the environment. *Interest* is defined as the active attitude and amount of activities taken to influence the strategic choices of other actors. The matrix axis' have the value high and low. Actors with high interest and high power are considered key players (Johnson & Scholes, 2002). As a result, we identified the following key actors:

- *Amsterdam Airport Schiphol*, hereafter referred to as "AAS", is the common name for the organization NV Schiphol Group, who owns and is responsible for the operations of the actual airport Schiphol. "AAS" 's core business activity is to provide infrastructural services, in the form of a physical airport and other necessary services, to various other actors who exploit these facilities.
- *AirFrance-KLM*, hereafter referred to as "KLM", is a recent merger between "AirFrance" and "KLM". "KLM" is responsible for the largest share of flights to and from "AAS". The core business of "KLM" is to provide (hubbed) air transportation to customers such as passengers and freight transporters.
- *Air Traffic Control the Netherlands*, hereafter referred to as "ATC", is responsible for guiding planes through Dutch airspace, which includes the landing and take-off of planes at "AAS" which is called "Air Traffic Management" and is "ATC" 's the core business.

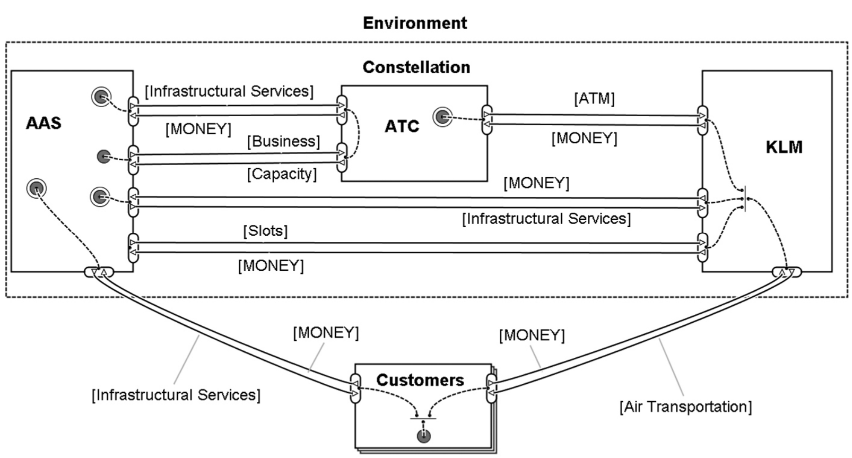

Figure 2: The Dutch Aviation Constellation

Fig. 2 shows the introductionary e^3*value* model for the Dutch aviation constellation. We have added the market segment "Customers" to show the constellation's end users. The model shows the dependencies between the actors in the constellation. It can be seen that "AAS" provides multiple value objects to "KLM" and "ATC".

In addition, “ATC” provides value objects to “AAS” and “KLM”. “KLM” requires both the value objects of “AAS” and “ATC” to provide their value objects to the market segment “Customers”.

4. The *e^{3}forces* ontology

The *e^{3}forces* ontology extends existing business value ontologies by modeling their strategic motivations that stem from environmental forces. Because an ontology is a formal specification of a shared conceptualization, with the purpose of creating shared understanding between various actors (Borst et al., 1997), most concepts are based on broadly *accepted* knowledge from either business literature (eg. Porter, 1980; Johnson & Scholes, 2002) or other networked value constellation ontologies (eg. Gordijn & Akkermans, 2001; Osterwalder, 2004). Although the *e^{3}forces* ontology is closely related to the *e^{3}value* ontology, with the advantage that consistency is easily achieved and both models could be partly derived from one another, they *significantly differ*. The focus of *e^{3}value* is on value transfers between actors in a constellation and their *profitability*. Factors, other then *value transfers*, which influence the relationship between actors are not considered in the *e^{3}value* ontology. In contrast, the *e^{3}forces* ontology *does* consider *factors in the environment* which influence the constellation. Instead of focusing on value transfers, *e^{3}forces* focuses on the strategic position of a constellation in its environment. Below, we introduce *e^{3}forces's* constructs followed by a UML class diagram:

Constellation. A constellation is a *coherent* set of two or more actors who cooperate to create value to their environment (Tapscott et al., 2000). As in *e^{3}value*, actors are independent economic (and often also legal) entities (Mintzberg, 1979; Johnson & Scholes, 2002). Obviously, we need a criterion to decide whether an actor should be in a constellation or not. For each of the actors in the constellation it holds that if the actor would seize its core business, then all other actors would not be able to execute a certain share (roughly 50% or more) of their core business or a certain share would no longer be valuable. The required share expresses the supposed coherence in the constellation. For example, “AAS”, “KLM” and “ATC” form a constellation because if one of the actors would seize its activities the other actors would not be able to perform their core business, or their core business would loose its value. In an *e^{3}forces* model the constellation itself shows up as a dashed box that surrounds the actors it consists of. The actors are related using value transfers, cf. *e^{3}value* (Gordijn & Akkermans, 2001, 2003b).

Market. A constellation operates in an *environment* consisting of *markets* (Johnson & Scholes, 2002; Porter, 1980). Markets are sets of actors in the environment of the constellation (modeled as a layered rectangle). The actors in a market 1) are *not part* of the constellation 2) operate in the *same industry* as the constellation 3) are considered as *peers*; they offer similar or even equal value objects to the world 4) are in terms of *e^{3}value* value transfers cf. (Gordijn & Akkermans, 2001) (*in)directly related* to actors in the constellation (Porter, 1980). For instance “Carriers” form a market, because they include all carriers not part of the Dutch aviation constellation, have economic relationships with actors in the constellation, are in the same industry and, carriers offer similar value objects to their environment. Note that although “KLM” is a carrier they are not part of the “Carrier” market, because they are already part of the constellation. The organizations are grouped in a market because by considering sets of organizations, we abstract away from the individual and limited (Porter, 1980) influence on actors in the constellation of many single organizations. Therefore, the notion of "market" is motivated by the need to reduce modeling and analysis complexity. By doing so, we consider forces between *actors in the constellation* and *specific markets in the environment*, rather than the many forces between actors in the constellation and each *individual* actor in the environment.

Dominant Actor. A market may contain *dominant actors*. Such actors have the power to influence the market and thus actors in the constellation. If a market is constructed out of a single large organization and a few small organizations, then it is the large organization who determines the strength of a market and is it less relevant to consider the small organizations. Usually dominant actors posses a considerable large share of the market. What is "considerable large" depends on the industry in which the analysis is performed. For instance in the market of operation systems Microsoft (over 70% market share) is a dominant actor, while Toyota can be considered a dominant actor in the automotive industry with only 13% market. Dominant actors are modeled as a rectangle within a market.

Submarket. It is possible to model *submarkets* of a market. A submarket is a market, but has a special type of value object that is offered or requested from the constellation. For instance, low cost carriers are a submarket of the carrier market. A submarket is shown in the interior of a market.

Force. Markets in the environment of a constellation influence actors in the constellation, by exercising a force, which is expressed by a "strength" arrow. Such an arrow is shown near an e^3*value* value transfer. In the following sections, we illustrate specific forces, as derived from Porter's five forces model (Porter, 1980).

Industry. An industry unites all actors shown in an e^3*forces* model. So, the actors of the constellation, and actors in a (sub)market are all in an *industry*.

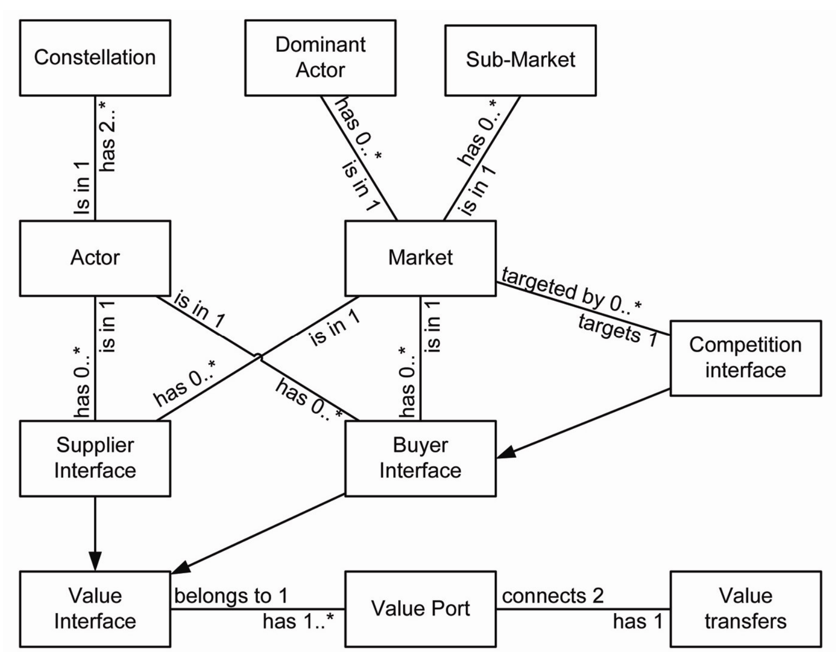

Figure 3: UML class diagram e^3*forces*

4.1. *Modeling Porter's five forces using e^3forces*

Using the *e^3forces* ontology, we model various forces between actors and markets. Porter distinguishes five kinds of forces (Porter, 1980, 1985): *bargaining power of suppliers*, *bargaining power of buyers*, *competitive rivalry among competitors*, *threat of new entrants* and *threat of substitutions*.

Bargaining power of suppliers. Suppliers are those organizations which are part of the *environment* of a constellation (because they do not satisfy the previously discussed "coherence" criterion) and *provide* value objects to actors in the constellation (Johnson & Scholes, 2002). For the case at hand, suppliers are e.g. "Airplane Manufacturers". Suppliers influence actors in a constellation by threatening to alter the configuration of goods/services, to increase the price or to limit availability of products (Johnson & Scholes, 2002; Porter, 1980). These are changes related to the value objects and/or their transfers between actors and their environment. So, a first step is to elicit (important) suppliers for each actor part of the constellation. Suppliers are identified by finding organization which *provide* value objects *to* the constellation, but who are *not* part of the constellation.

Next the strength of the bargaining power of the suppliers in relationship to the actors in the constellation must be analyzed. According to (Porter, 1980), five factors determine the strength of a supplier market: (1) The *concentration* of (dominant) suppliers. (2) The *necessity of the object* provided by the suppliers. (3) The *importance of actors* in the constellation to the suppliers. (4) The *costs of changing* suppliers. (5) Threat of *taking over* an actor in the constellation.

Analyzing these factors, the relative strength of the power of a supplier market is determined for each transfer (connected to an actor in the constellation), and is shown as a *strength arrow* along the lines of the connected value transfers (which are the transfer of the value object provided by the supplier market to the actor in the constellation *and* the transfer of the value object provided as a compensation (e.g. money)). Note that since we model the power the supplier market exercises over an actor in the constellation, the strength arrow always points from the supplier's interface of the market *toward* the buyer interface of the actor in the constellation. The relative strength of the arrow is based on the analysis of the supplier market given above. Also note that a market can be a *supplier market*, a *buyer market*, a *competition market* or *any combination*, since markets can have *supplier interface(s)* and/or *buyer interface(s)*, depending on the role. A supplier interface is, via value transfers, connected to a buyer interface of an actor in the constellation.

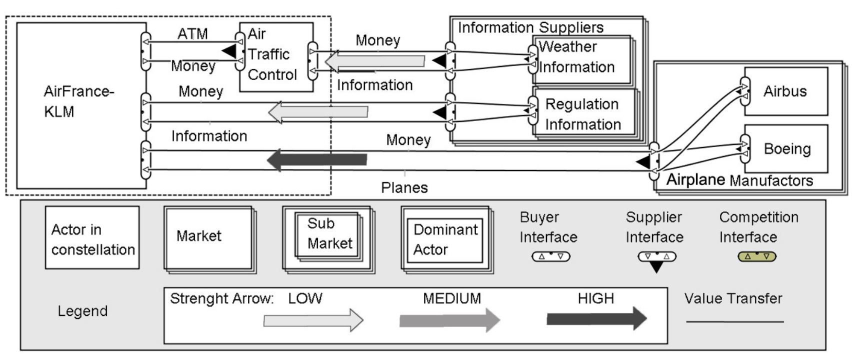

Figure 4: *e^3forces* – Suppliers

Fig. 4 demonstrates some supplier forces for the case at hand. For example "Airplane Manufacturers" is a supplier market to "KLM", having two dominant actors: "Boeing" and "Airbus". This market exercises a power of high strength because: a) there is a concentration of dominant suppliers, b) the value object is essential to "KLM", and c) "KLM" is only one of many buyers. Due to lack of space, we can not explain each power relation in a more detailed way.

Bargaining power of buyers. Buyers are environmental actors that *acquire* value objects from actors in the constellation (Johnson & Scholes, 2002). Buyers can exercise a force because they negotiate down prices, bargain for higher quality, desire more goods/services and, try to play competitors against each other (Porter, 1980, 1985). All this is at the expense of the profitability of the actors in the constellation (Porter, 1980, 1985). Buyer markets have value transfers with actors in the constellation similar to supplier markets. After eliciting possible buyer markets, the strength of the power they exercise is analyzed. According to (Porter, 1980), seven factors determine the strength of buyer markets: (1) The *concentration* of (dominant) buyers. (2) The number of *similar value objects* available. (3) The availability of *alternative resources* of supply. (4) The *costs of changing* supplier. (5) The *importance of the value object* to the buyer. (6) *Low profits* on the products offered to buyers. (7) The threat of *taking over* by the buyer.

Similar to supplier markers, by analyzing these factors the relative strength of the power of a buyer market is determined for each transfer (connected to an actor in the constellation), and is shown as a *strength arrow* along the lines of the connected value transfer.

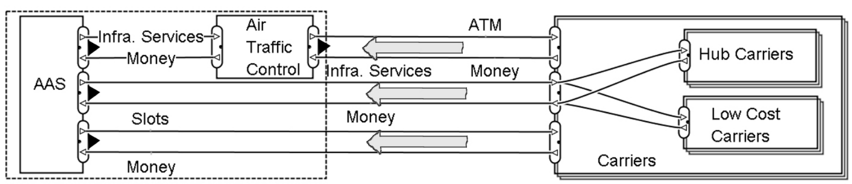

Figure 5: e^3*forces* - Buyers

In Fig. 5, two actors of the constellation are given: "AAS "and "ATC". One buyer market (carriers) is modeled, in which two submarkets are present ("Hub Carriers" and "Low Cost Carriers"). "ATC" provides a service to the entire carrier market, resulting in a low strength. "AAS" provides "Infrastructural Service" to "Carriers", but these services slightly differ for "Hub Carriers" and "Low Cost Carriers". Consequently, both submarkets are connected to the buyer interface of the entire market. This buyer market is in turn connected to the supplier interface of the "AAS".

Competitive rivalry. An additional force is exercised by *competitors*; actors that operate in the same industry as the constellation and try to satisfy the same needs of buyers by offering the same value objects to buyer markets as the constellation does (Johnson & Scholes, 2002). Competitors are a threat for actors because they try to increase their own market share, influence prices and profits and influence customer needs; in short: they create competitive rivalry (Porter, 1980, 1985).

So far, forces exercised by markets on actors in the constellations have been expressed along the lines of *direct* value transfers between markets and actors. Such a representation can not be used anymore for modeling competitive rivalry. In case of competitive rivalry, (competitive) markets aim to transfer same value objects to the same buyer markets as the actors in the constellation do. Consequently, competitive rivalry is represented as: a) value transfers of a constellation's actor to a *buyer* value interface of a (buyer) market, *and* b) *competing* transfers of a competition market to the *same* buyer interface of the market. The extent of competitive rivalry is expressed by incorporating a *strength arrow* that points from the competition market toward the *buyer market*. This is because competitive rivalry, as expressed by the strength arrow, is located at the *buyer market*, and *not* at the actor in the constellation (Porter, 1980). The buyer interface of a market for which competition occurs is called the "competition" interface, and is explicitly stated. Also, it is worthwhile to show dominant actors for a competitive market; these are considered the most important competitors. To decide upon the strength of the competitive force, seven factors are used (Porter, 1980): (1) The *balance* between competitors. (2) *Low growth rates*. (3) *High fixed costs* for competitors. (4) *High exit barriers*. (5) *Differentiation* between competitors. (6) *Capacity augmented* in *large increments*. (7) Competitors *sacrificing profitability*.

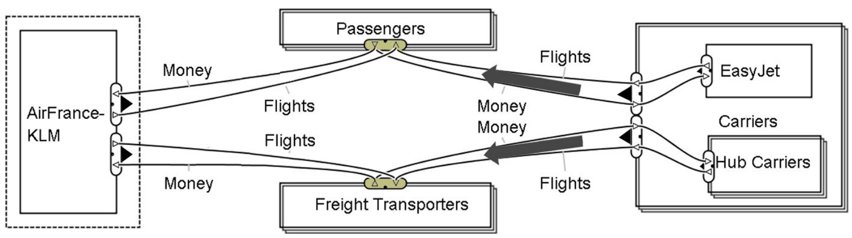

Figure 6: e^3*forces* – Competitors

Fig. 6 shows that the constellation "KLM", has two buyer markets; "Freight Transport" and "Passengers". In the competition market "Carriers" a *submarket* is modeled and a dominant *actor*. The submarket "Hub Carriers" is connected with its own supplier interface, and via an interface of the total market, to the buyer market "Freight Transport". This indicates that this *submarket* is responsible for the competitive rivalry at the buyer market and not the entire carrier market. Furthermore, the dominant actor modeled, "EasyJet", is connect to the "Passengers" buyer market. This indicates that this particular actor is responsible for a large amount of the competitive rivalry at the "Passengers" buyer market.

Threat of new entrants. Potential entrants are actors who can become competitors, but who are currently *not*, or who do not exist yet (Johnson & Scholes, 2002; Porter, 1980). Consequently, we consider new entrants as a *future* competitive market. To determine the threat of a potential entrant, the following aspects need to be analyzed (Porter, 1980): (1) The *economics of scale* needed to become profitable. (2) The *capital required* to facilitate the entry in an industry. (3) The extent of *access to distribution channels* are accessible. (4) The *experience and understanding of the market* of the new entrant. (5) The *possibility of retaliation* by existing organizations in an industry. (6) *Legal restraints* which place boundaries on potential entrants. (7) The difficulty of *differentiating* from existing organizations.

Potential entrants are modeled (as rounded squares) *within* a competitive market and labeled after the potential entrant. Furthermore, the potential entrant has a supplier interface which is connected to the relevant supplier interface of the competition market. The threat of a potential entrant is expressed by a strength arrow, which originates at the potential entrant and point toward the supplier interface of the entire competition market. The strength of the arrow is based on the analysis of potential entrants given above.

Threat of substitutions. Actors may offer *substitutions*, so different value objects, to a buyer market, yet satisfy the same need of the buyers (Johnson & Scholes, 2002; Porter, 1980). Substitution markets are seen as competitive markets who offer different value objects, as an alternative to objects offered by actors in the constellation, to the *same* buyer markets. Substitution markets are modeled in the same way as competition markets, but value objects of actors in the constellation and of the substitution markets differ. In brief, the strength of the arrow is determined by the likelihood that the substitution will reduce the market share of the constellation for this buyer market (Porter, 1980, 1985).

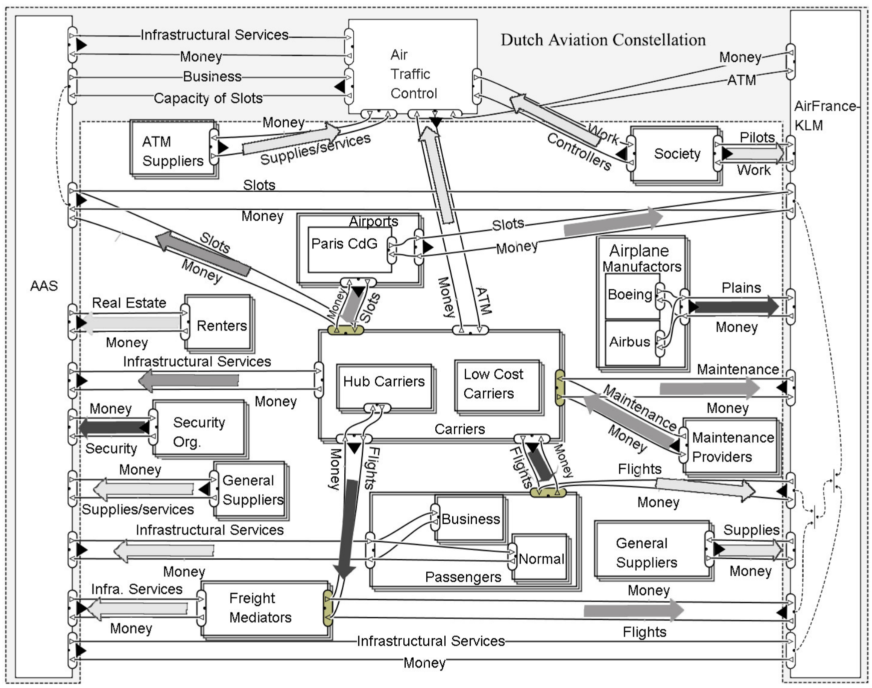

Figure 7: e^3*forces* - Dutch Aviation Constellation

4.2. e^3*forces for the Dutch aviation section*

Fig. 7 shows the complete e^3*forces* model for the Dutch aviation constellation. As can been seen is the constellation constructed out of "AAS", "KLM" and, "ATC". For all these actors we have modeled suppliers, buyers and competitors. Due to space considerations we have disregards, substitutions and potential entrants. The aim of the e^3*forces* ontology is to understand strategic considerations of actors in a constellation in terms of environmental forces. Is this possible? With the aid of the e^3*forces* model we are able to understand that:

1. As a result of the high competitive rivalry at "KLM" 's buyer markets (See Fig. 7), "KLM" needs to reduce costs per unit through economics of scale (eg. increase capacity) to remain profitable (Porter, 1980). For achieving this goal "KLM" partly depends on services provided by "AAS" and "ATC", as seen by the dependency relations between the actors, which we have introduced in the model to facilitate dependency-tracing reasoning (see e.g. e^3*value* (Gordijn & Akkermans, 2003b) for examples of such reasoning). This motivates "KLM" desire for improved inter-organizational operations.
2. "AAS", although in a constellation with "KLM", provides value objects to competitors of "KLM"; possibly leading to conflicts. Furthermore, due to the high rivalry between carriers and their medium

strength, there is pressure on the profits margins of the value objects offered by “AAS” to the carriers (See Fig. 7). Therefore “AAS” is also exploiting other buyer markets (eg. “Renters”) to generate additional profits. Finally, “AAS” partly depends on “ATC”, which motivates their desire for better inter-organizational operations.

3. “ATC” is dependent on by “AAS” and “KLM”, but is in a luxury position due to the monopoly it possesses. “ATC” however only has one buyer: “AAS” (See Fig. 7). Therefore “ATC” is willing to cooperate with “AAS” and “KLM” to improve operations and increase profits.

5. Utilizing *e³forces* to determine correct strategic position

Typically, due to various reasons, networked value constellations change overtime; think of mergers, bankruptcies and acquisitions. These changes can lead to new configurations of the networked value constellation; resulting in different roles, or positions, of the various actors within the networked value constellation. Therefore the *actual position* in, or configuration of, the networked value constellation might not be as intended by a participating organization. The position in a networked value constellation is however part of *how* an organization wants to execute its business strategy, therefore it is for the organization’s best interest that its position within a networked value constellation is consistent with the business strategy of the organization (Porter, 1980; Johnson & Scholes, 2002).

To analyze if the new position of an organization in a (changing) networked value constellation is consistent with the business strategy of an organization we utilize *e³forces*. As a starting point we take an *e³value* model since it shows how an organization creates value and thus executes its business strategy. Due to space considerations we isolate an actor in the *e³value* model. By means of the *e³forces* ontology we will analyze the influence of *environmental forces* on the isolated actor and determine the actor’s *strategic position*. Hereafter we analyze if the *strategic position* of the actor within the networked value constellation is *consistent* with its *business strategy*.

5.1. Step 1: From *e³value* to *e³forces*

The first step is to migrate from the *e³value* model (Fig. 2) to the *e³forces* model for the isolated actor. As stated earlier the *e³forces* ontology is originally intended to model the environment of a *constellation* instead of a single organization. Due to space limitations we only consider “AAS”, therefore the constellation in this *e³forces* model equals one organization. The following steps, starting from an *e³value* model, result in an *e³forces* model:

1. First we focus in on “AAS” and only consider economic relationships between “AAS” and other actors. To accomplish this, all value transfers in the *e³value* model which are not connected to “AAS” are removed.
2. Typically, *e³forces* does not consider the influence of *individual actors*, but considers the influence of groups of actors; *markets*. By considering markets (groups of organizations), *e³forces* abstracts away from *individual* and *limited* (Porter, 1980) influences of single organizations. Therefore individual actors in the *e³value* model are placed within their corresponding market. For example “KLM” is placed as a dominant actor in the “Carrier” market. There are however exceptions, as will be seen later.

3. Next, we identify (additional) *supplier* and *buyer markets* following the guidelines provided in Sec. 4.1 and model them accordingly (including their strength).
4. Subsequently we extend the *e^3forces* model with *competitors*. We incorporate competition by following the provided guidelines in section 4.1. Due to space purposes we only consider competition at the "Carriers" market and consider competitors in the broadest sense; competitors are either existing competitors, potential entrants or substitutions, since these three groups try to meet the same needs of buyers as "AAS" and try to increase their market share whilst reducing that of AAS (Porter, 1980).

The *e^3forces* model (Fig. 8) shows which suppliers and buyers influence the business of "AAS" and to what extent (their strength). The position of "AAS" within these environmental forces is considered to be the strategic position (Porter, 1980). The model also shows two actors - "ATC" and "Security Organizations" - who are considered to be strong forces. These actors have a greater influence on "AAS" in comparison to the other actors. "ATC" is modeled as an actor not as a market, this is because they posses a monopoly position; there is simply no market, only this actor. Furthermore, in the competition market three dominant actors are present with whom "AAS" is in competition. There are in reality more, but due to space reasons a selection was made.

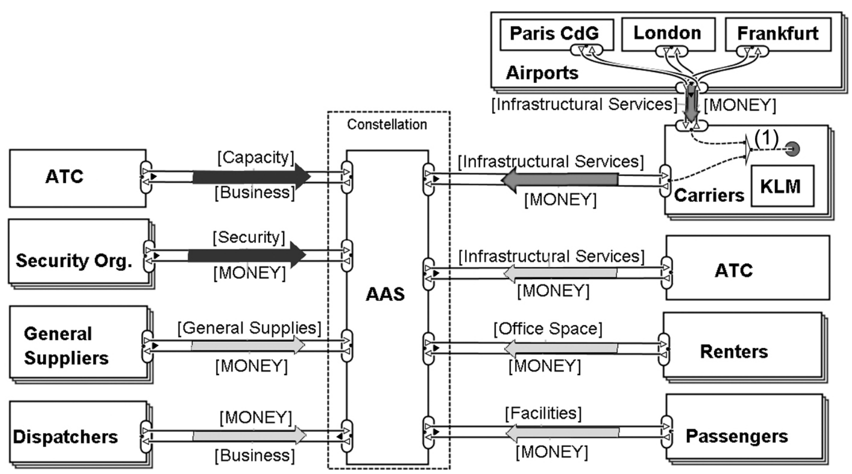

Figure 8: *e^3forces* - AAS

5.2. *Step 2: Analyzing the position of AAS*

To analyze the *strategic position* of "AAS" in regard to its *business strategy*, we must classify the business strategy as one of Porter's four *basic* strategies (Porter, 1985, 1980). "AAS" 's business strategy is outlined in "Mainport Schiphol" (Schiphol Group, ATC The Netherlands, & KLM, 2005) and can be classified as *differentiate*. The second step should therefore answer the following two questions: (1) Is "AAS" able to *differentiate* itself from the competition while being part of the current networked value constellation? (2) Does the *strategic position* of "AAS" aid in creating competitive advantage over the competition?

5.2.1. *Question 1: Differentiation?*

To analyze if "AAS" *differentiates* itself from the competition - "London Heathrow", "Paris Charles De Gaulle" and "Frankfurt" - we compare them on *product price* and *product configuration* since these are the factors on which organizations are able to differentiate themselves from competitors (Johnson & Scholes, 2002).

Product price. Table 1 shows the *prices of the product* offered by the various actors. The table shows that the prices do not differ much. "AAS" is even slightly cheaper than the competitors. This is consistent with "AAS"'s "differentiate" strategy. Although this is not graphically visible in the e^3*forces* model, it should be able to include an evaluation function in the model (at (1) in Fig. 8). This function could (semi)-automatically, instead of manually, evaluate the price differences between the organization and its competitors. In addition, the evaluation function could determine to what extent the price difference is consistent with the organization's business strategy.

Airport	Schiphol	Paris CdG	London Heat.	Frankfurt
Airport fairs	447	291	400	405
Taxes	94	338	271	155
Total	541	630	371	560

Table 1: Prices Infrastructural Services

Product Configuration. Evaluating the *product configurations* is also performed manually and not visualized in the e^3*forces* model, but the evaluation function discussed in the previous section could be extended to also evaluate the differences in product configuration.

Airports offer *infrastructural services* to the carrier market. This is an entire set of services and products offered. Carriers use the key indicators "year capacity" and "peak hour capacity" to compare airports (Adler & Berechman, 2001). Table 2 provides the numbers.

Airport	Schiphol	Paris CdG	London Heat.	Frankfurt
Year Capacity	403.000	516.000	470.000	463.000
Peak Hour capacity	104/408	105	87	78/82

Table 2: Key Indicators of Airports for Carriers

"AAS" 's Mainport concept does however not solely consider the airport as an isolated structure; an airport is only one part of area where people live, work and recreate. Therefore AAS does not only need to compete on an "airport" level, but is must provide passengers and carriers with an environment in which people are willing to work and live. Although these factors are mainly relevant for passengers, these factors are also relevant to carriers; passengers are the customers of the carriers. People compare airports on the following key indicators (Furuichi & Koppelmans, 1994): convenience, comfort and accessibility (see Table 3. The first two are measured by the customer rating performed by SkyTrax (SkyTrax, 2005). The third key indicator is based on the access of the airport by car and public transportation.

Airport	Schiphol	Paris CdG	London Heat.	Frankfurt
Customer Rating	8^{th} place	> 10^{th} place	> 10^{th} place	> 10^{th} place
Accessibility	Good	Good	Medium	Good

Table 3: Key Indicators of Airports for Passengers

The goal of this analysis was to determine if "AAS" is able to execute its "differentiation" strategy within the existing networked value constellation. The analysis supports this notion. "AAS" is able to differentiate itself from the competition by offering better service and access to passengers while remaining competitive on the capacity and price level.

5.2.2 Question 2: Correct Strategic Position?

In this section we analyze if the *strategic position* of "AAS", as modeled in the *e³forces* business model, is consistent with "AAS" 's business strategy. Again we look at the *price* and *configuration* of the product of AAS as offered to the carrier market and again is the evaluation performed manually, but via (semi)-formal reasoning it should be possible to perform the evaluation automatically.

Product Price.

- When analyzing the *supplier* markets it can be seen that "ATC" and "Security Organizations" are *strong forces*. Therefore they can demand high prices for their product (Porter, 1985). There are however additional factors to consider. In Porters analysis of an organization's environment (the five forces) governmental institutions are neglected. Due to its monopoly position, "ATC" is, via governmental institutions, bound by various laws and regulations. Therefore only "Security Organizations" has a negative impact on the product price of "AAS". Financial data supports that security is one of the larger costs of "AAS".
- When analyzing the *buyer* markets it can be seen that there are no strong forces and that there is only one *medium* strong force: "Carriers", with the dominant actor "KLM". This implies that the "Carriers" market can influence the product price, but due to mutual dependency this influence is limited (Porter, 1985). Financial data supports that AAS is dependent on "KLM"; over 50% of the revenues of AAS in the "Carriers" marker comes from "KLM". However, large parts of "AAS" 's profits originate in businesses other than provided to "Carriers". This implies that the "Carriers" market is not the most profitable market, which can be partly explained by its medium strength.
- The *competitive rivalry* on the "Carriers" market is *medium*. There are a number of dominant actors in the airport market, as seen in the model, with whom "AAS" has to compete for market share. Because there is medium competitive rivalry, there is some pressure on the profits margins, resulting in a need for growth by the competing organizations (Porter, 1980).

Based on the analysis above it can be concluded that the *strategic position* of "AAS", in regard to the "Carrier" market, *is consistent* with its *differentiation strategy*. On the *supply side* there is only one organization who pressures the profits margins, since the second organization ("ATC") is a non-profit organization. On the *buyer* and *competition side* it can be seen that the medium strength of the "carrier" market and the medium competitive rivalry pressure the profits. Although there is some room to compete on the product price, competing on the product configuration, as chosen by "AAS", is so far supported by the strategic position of "AAS" in its environment.

Product Configuration. To analyze the strategic position of "AAS" in regard to its product configuration we look at how supplier, buyers and competition influence the key indicators (see Sec. 5.2.1) relevant for carriers and passengers.

- On the *supplier* side, "AAS" depends on "ATC", "Security Organizations" and "General Suppliers" to provide products and services. The first two are *strong forces*, which results in a situation in where both suppliers have a large influence on the product offered by “AAS”, which is not desirable for “AAS”. This is however only true in regard to the key indicators relevant for carriers (see Sec. 5.2.1). For the key indicators relevant for passengers “AAS” is mainly dependent on itself and only partly dependent on “Security Organizations” and “General Suppliers”.

- On the *buyer* side, “AAS” is influenced by the “Carriers” market; AAS has to tune its product to the needs of the carriers. Because carriers are a *medium force*, they have the power to demand and thus influence the configuration of the product as offered by “AAS” (Porter, 1980). This is however only true in regard to the key indicators relevant for carriers (see Sec. 5.2.1). For the key indicators relevant for passengers “AAS” is hardly influenced by passengers due to their *weak strength*, as seen in the e^3*forces* model.
- The *competition* has influence on the key indicators relevant to carriers because when competitors increase their capacity “AAS” must follow to remain competitive. Increasing capacity is however a long and difficult track for all airports. The competition has little to no influence on the key indicators relevant for passengers.

Based on the analysis above, it can again be concluded that the *strategic position* of “AAS”, in regard to the “Carriers” market, *is consistent* with its *differentiation strategy*. Although, the strong supplier forces “ATC” and “Security Organizations” and the medium buyer force “Carriers” limit the possibility of “AAS” to differentiate on the key indicators relevant to carriers, “AAS” is hardly influenced by the forces in its environment to differentiate on the key indicators relevant to passengers. Therefore, the strategic position of “AAS” enables “AAS” to differentiate on product configuration from its competition.

In this section we have demonstrated how to utilize e^3*forces*, and also e^3*value*, to (1) understand the *strategic position* of an organization within environmental forces in its environment and, (2) analyze if the business strategy as chosen by an organization is *consistent* with its role in the networked value constellation. The results showed that we were able, with the aid of the ontologies e^3*value* and e^3*forces*, to determine if the role of an organization in the networked value constellation is consistent with the business strategy as chosen by the organization.

6. Utilizing e^3*forces* to analyze the influence of IS on an organizations business strategy

The distance between an organization’s IT and its business strategy might seem far, yet as early as the 1980’s the relationship has been stressed (eg. Bakos & Tracy, 1986). Business model ontologies such as e^3*value*, BMO, REA and e^3*forces* create *shared* and *deep understanding* of an organization’s business which information system analysts can use to designing processes and IT accordingly (Weigand et al., 2007). Although it must be noted that such business modeling ontologies are most relevant in the *early phases* of requirements engineering (Yu, 1997).

In this section we will demonstrate how e^3*forces* can be used to reason about the effects of deploying IT/IS on an organization’s business strategy. Because IT/IS is rather broad, we focus on deploying electronic marketplaces, which is an inter-organizational information system which allows buyers and suppliers to exchange information about prices and product offerings (Bakos, 1991). The *general effects* of deploying electronic marketplaces on buyer and seller relationships from a business (strategy) perspective were analyzed by Bakos (1991), but analyzing *where* (eg. which markets) and *how* (eg. limitations enforced by forces) electronic marketplaces can be exploited in a *specific situation* was not considered.

To illustrate we use the well known e-ticket system. Before the introduction of the e-ticket system most tickets were sold directly and in packages to "mediators" (eg. travel organizations) and very few directly to passengers. In this situation mediators were a medium strong force because there was more a concentration of (dominant) buyers and they were needed by carriers to sell tickets to passengers. Such a situation is not preferable by "KLM" (one of the carriers), because medium strong forces can negatively influence the business of "KLM" (Porter, 1980). Deploying electronic marketplaces at these two markets should change the strength of the "mediator" market and the "passenger" market. *Theoretically* electronic marketplaces are most beneficial for buyer markets because they reduce searching costs and provide buyers with a wider range of price and product offerings, making the deployment of electronic marketplaces by a supplier not a profitable option (Bakos, 1991). There are however also *advantages* for suppliers; electronic marketplaces can *reduce costs* and enable suppliers to target a *wider range* of buyers (Bakos, 1991). The *biggest effects* of an e-ticket system are indeed that cost can be reduced and that it enables carriers to directly sell tickets to passengers. The last effect has resulted in a considerable *reduction* of the strength of "mediators" since buyers are no longer dominant or grouped. It even became possible to neglect "mediators" (eg. EasyYet).

Comparing the e^3*forces* model from before (see Fig. 9, where we focus in on "KLM") and after (see Fig. 7), shows that the deployment of the e-ticket system has affected the relationship between "KLM" and "mediators". The relationship has become *minimal* and the strength of mediators is so *low* that they are no longer included in Fig. 7. In contrast, the relationship between passengers and KLM, still with low strength, remained relevant to model. The example shows that utilizing e^3*forces* aids in *understanding* the *impact* of IT deployment on the environment of "KLM" (and thus the constellation). For information system developers it is important to understand that the environment (context) has changed and that the users of the e-ticket system are primarily passengers and secondary mediators.

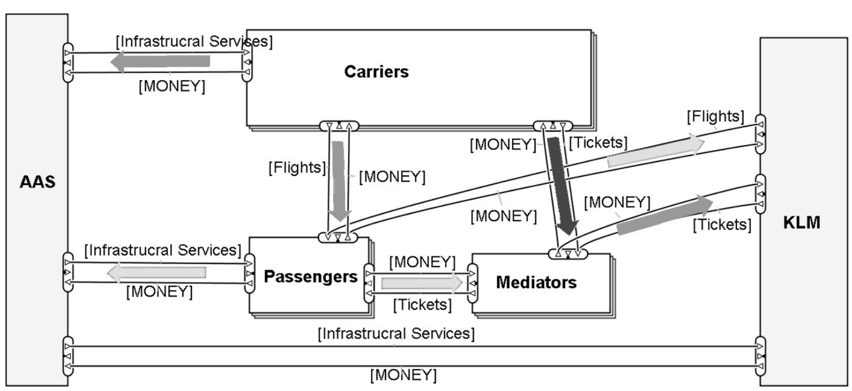

Figure 9: e^3*forces* - KLM before e-tickets

7. Conclusion

By using the e^3*value* ontology and Porter's Five Forces framework as a basis, we have used *existing* and *accepted* knowledge on networked value constellations and environmental influences on business strategies to create a *solid theoretic base* for the e^3*forces* ontology. This solid theoretical base has lead to a clear model of (1) the *value transfers within* the constellation, but more important: (2) the value transfers *between* actors in the constellation and *markets in the environment* of the constellation and, (3) the *strength of forces*, created by the markets, which influence actors in the constellation.

Furthermore, the solid theoretic base of e^3*forces* enabled us to reason about strategic consideration of organizations participating in a networked value constellation; as demonstrated by the industrial strength case study. With the aid of this case study we were able to demonstrate that the e^3*forces* ontology could be used to (semi-formally) reason about (1) *dependencies between actors* and the *configuration* of the networked value constellation by considering the question of "*why*", (2) analyze the *consistency* between the actual *strategic position* of an organization in a networked value constellation and its *business strategy*, (3) analyze the *impact* of deploying (cross)-organizational IT/IS on the *relationship* and *strength* between organizations in a networked value constellation and various markets in the environment of the constellation.

In this paper we relied on the business strategy literature developed by Porter. As indicated earlier, there are other views on business strategy (for example the "Resource-Based Theory" outlined by Barney (1994)). A first step has already been made by Pijpers & Gordijn (2007) to utilize these other views on business strategy for purposes similar to this paper. Further research is however required to determine the relationship between the e^3*forces* ontology proposed in this paper and other views on business strategy and their corresponding ontologies.

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