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**OPEN-EDI**

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## Project Editor's Notes

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### 1. Coordination of this work with evolving ontology work and evolving standards in ebXML and UN/CEFACT

The contents of this work are being governed and aligned with work in both the academic and the standards community.

- The primary academic standards for this document are the series of REA Model papers contained on the following website:

<http://www.msu.edu/user/mccarth4/rea-ontology>

These papers are individually referenced in an informative annex that describes the REA model.

- The primary standards documents are:
  - **ebXML Business Process Overview**
  - **ebXML Business Process Worksheets**
  - **ebXML Catalog of Common Business Processes**
  - **eBTWG Business Collaboration Patterns and Monitored Commitments Specification**
  - **UN CEFACT Common Business Process Catalog Specification**
  - **UN CEFACT Modeling Methodology (UMM)**
  - **UN CEFACT UMM User Guide**

## 2. Work Plan

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WD	2002-09
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## 3. Standard ISO/IEC Presentation Format

Time/resource constraints did not permit the addition of standard ISO/IEC presentation of this draft. This work will be completed as part of further document preparation.

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## 0. FOREWORD

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technologies, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

This ISO/IEC 15944-4 working draft was prepared by the ISO/IEC Joint Technical Committee ISO/IEC JTC 1, *Information Technology*, Subcommittee SC32, *Data Management and Interchange*

## 1 Purpose And Justification

This working draft is motivated with two important ideas from the ISO Open-edi specifications as represented in 15944-1: Information Technology -- Business Agreement Semantic Descriptive Techniques - Part 1: Operational Aspects of Open-edi for Implementation:

*Rule 1: Business transactions require both information exchange and commitment exchange.*

*Rule 39: Conceptually a business transaction can be considered to be constructed from a set of fundamental activities. They are planning, identification, negotiation, actualization and post-actualization.*

These are powerful ideas, with important implications. To what are the participants in a business transaction committing? What must they plan and identify? Do they negotiate the commitments? How do the actualization and post-actualization activities relate to the commitments?

The precise answers to these questions come from the fields of law, economics, and accounting.

They are questions of **ontology** -- a formal specification of the concepts that exist in some domain of interest and the relationships that hold among them.<sup>1</sup> In this case, the domain of interest are law, economics and accounting in an extended sense -- not the internal accounting of one particular firm, but the accountabilities of each of the participants in an external business transaction.

An ontology differs from a database schema or object-oriented class model in at least three important ways: objective, scope and content. First, the objective of an ontology is to represent a conceptualization that is neutral in terms of technology, representation, and application. In other words, an ontology is not the same as, say, a UML software design, although it could be used to guide software designs. Second, the scope of an ontology is all applications in the domain, not just one. And finally, an ontology contains knowledge specifications where the meaning of the concepts represented is explicitly specified and constrained and where the rules to infer further knowledge are explicitly defined.

The economic and accounting ontology being used in ebXML and UN/CEFACT is entitled the **Resource-Event-Agent Ontology**, or **REA**<sup>2</sup>. REA is proposed here as a framework for specifying the concepts and relationships involved in business transactions and scenarios in the Open-edi sense of those terms.

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<sup>1</sup> Thomas Gruber (1993) "A Translation Approach to Portable Ontologies," *Knowledge Acquisition*, pp. 199-220

<sup>2</sup> Elements of REA are explained in an Informative Annex to this document.

REA is actually an elementary set of concepts derived from basic definitions in accounting and economics. These concepts are illustrated most simply with a diagram in Figure 1 which illustrates the simple Resource-Event-Agent structure that gives REA its name. A business transaction or exchange has two REA constellations joined together, noting that the two parties to a simple market transfer expect to receive something of value in return when they trade. For example, a seller, who delivers a product to a buyer, expects a requiring cash payment in return.

There are some specific points of synergy between the REA ontology and the ISO Open-edi specifications as represented in ISO/IEC 15944-1 *Business Agreement Semantic Descriptive Techniques - Part 1: Operational Aspects of Open-edi for Implementation*.

*Term 3.9: Commitment – The making or accepting of a right, obligation, liability, or responsibility by a person.*

Commitment is a central concept in REA. Commitments are promises to execute future economic events -- for example to fulfil an order by executing a delivery event.

*Rule 1: Business transactions require both information exchange and commitment exchange.*

REA firmly agrees with and helps give definition to this assertion. Reciprocal commitments are exchanged in REA via economic contracts that govern exchanges, while information exchange is tracked via business events that govern the state transitions of business objects that represent various economic phenomena.

*Rule 39: Conceptually a business transaction can be considered to be constructed from a set of fundamental activities. They are planning, identification, negotiation, actualization and post-actualization.*

For REA, actualization is the execution of economic events that fulfil commitments. Planning and identification involve persons with types of economic resources, events, and persons, while negotiation is finalized by an economic contract which is a bundle of commitments. The ebXML Business Process Group has also defined negotiation protocols that assist in forming commitments. The Open-edi set of activities and the REA economic concepts will help each other tie together all the activities into a cohesive business transaction, and then unite that transaction definition with its related information models.

*ISO/IEC 15944-1 Clause 8: Rules for specification of Open-edi scenarios and their components.*

The UN/CEFACT TMG notion of *collaboration patterns*, a topic that is the subject of ongoing work, strongly relates to Open-edi scenarios. Open-edi has many classification attributes (e.g., a 2x2x2 factoring as discussed in Figure 2x), while the UN-CEFACT notion is more specific. However, the two concepts are closely related. Some possible collaboration patterns that could be developed under UN/CEFACT TMG might be these: *Order-Fulfillment-Settlement, Drop-Shipment, Escalating-Commitments, Supplier-Cascade, and International-Shipment-and-Payment*, all of which could be developed as Open-edi

scenarios.

These Open-edi and REA correspondences and some others from UN/CEFACT TMG that relate to fundamental Open-edi concepts such as "value" and "person" are illustrated in table form in Figure 2.

Finally with regard to the preliminary agreement between Open-edi and REA, Figure 3 details how the two major sets of ideas that characterize the Open-edi work – the specification of Business Transactions and the configuration of Scenarios – correspond well at the aggregate level to what the REA ontology calls the accountability infrastructure and the policy infrastructure of its three-level architecture. Open-edi deals not only with business transactions, but also with their aggregates like supply chains just like REA does at the top level. A business transaction specifies in a descriptive sense actual business events: what has occurred or has been committed to. Conversely, a scenario is more prescriptive. It configures what could be or should be. The realm of both descriptions and prescriptions is important to Open-edi and to REA, and they can work well in developing standards for each.

In summary, there is a critical opportunity for developing coherence in worldwide standards for business level definitions of economic phenomena and enterprise integration points. UN/CEFACT Business Process Group's collaboration and coordination with ISO/IEC JTC 1/SC 32 is an important step.

## **2. SCOPE**

Collaborations among independent trading partners at the level defined by the BOV as defined in the Open-edi ISO/IEC specification (15944-1). This applies to both binary collaborations (buyer and seller) and mediated collaborations (buyer, seller, third-party).

### 3. Open-edi Ontology Requirements

#### 3.1 Ontology Definition

According to the most widely accepted definition from Tom Gruber “An ontology is a formal, explicit specification of a shared conceptualisation.”<sup>3</sup> The individual components of this meaning are each worth examining.

- *formal* = machine-readable
- *explicit specification* = concepts, properties, relations, constraints, and axioms are explicitly defined
- *of a shared* = consensual knowledge
- *conceptualization* = abstract model of some phenomenon in the real world

At present, the REA model is certainly an explicit specification of a shared conceptualization of economic phenomena in the accounting community. A formal, machine-readable specification is not part of the work plan proposed in this document; however, such extensions may follow in other standards work.

#### 3.2 Use of the “Independent” and “Trading Partner” Perspective in the Open-edi Ontology Work

In normal business use, the naming perspective for the ontological primitives would be that of the entrepreneur of one of the two trading companies engaged in collaborative commerce. The other trading partner would ordinarily have a mirror-image view. Thus a sale, a cash receipt, or a resource inflow for a particular entrepreneur would become a purchase, a cash disbursement, or a resource outflow for his or her trading partner. From this perspective, business events and their accompanying economic phenomena would be modelled twice, once in the database of each trading partner. However, for Open-edi purposes, or for that matter for any other independent modelling of business collaborations like the BRV level of the UMM, this redundancy is not acceptable, because it allows the states of the two representations to become inconsistent. This difference in naming perspective is explained below and illustrated in Figure 4 and Figure 5.<sup>4</sup>

Figure 4 illustrates three independent value chains for three different enterprises. Each company has a connected network of business processes that takes its initial input of resources (called factor inputs for their production functions) and transforms them via cumulative flows of goods, services, and cash into an output for that firm’s downstream

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<sup>3</sup> Thomas Gruber (1993) “A Translation Approach to Portable Ontologies,” *Knowledge Acquisition*, pp. 199-220

<sup>4</sup> Both of these figures were contributed by the Japanese delegation to SC 32, led by Katsuhiko Morita

customers. For Open-edi collaboration modelling, these internal processes are not relevant until a resource flow crosses enterprise boundaries as is illustrated for Enterprise #2 which accepts materials from Enterprise #1 and which delivers materials to Enterprise #3 (most probably in both cases for cash payments in return). The two dotted lines with double-headed arrows show these inter-enterprise events.

The independent or collaboration perspective of resource flows is anchored on the view of the eye outside of Enterprise #2. This view sees both exchanges as conceptually similar with flows of materials being requited by flows of funds. Such a perspective is quite different than that of the eye inside of Enterprise #2 which sees the flow between Enterprise #1 to Enterprise #2 as a “purchase” and the flow between Enterprise #2 and Enterprise #3 as a “sale.” Note that an eye inside of Enterprise #1 (not shown on diagram) would have modelled the “purchase” of Enterprise #2 as a “sale” of Enterprise #1, hence the redundancy and the inevitable inconsistency.

Business process modeling can take either of the perspectives shown by the eyes of Figure 4, but the independent perspective is clearly the choice for Open-edi. This leads to the concept of a business collaboration that is illustrated in Figure 5. Most generally, there is a value exchange between two Persons, with one assuming the role of a “buyer” (has money, wishes goods or services) and the other assuming the role of a seller (has goods or services, wishes money). It is also possible to anchor the independent view on time, with one event being the initiating flow and the requiting event being the responding flow. In either case, there is a possibility of having a third party in on the collaboration such as a shipment provider or an escrow agent. As will be explained in the next section of this document, Open-edi modelling assumes that all multiparty business transactions can be decomposed into an aggregate of bilateral transactions between two parties. For internal database purposes of corporate accountability, “trading partner perspective” terms are directly derivable from “independent perspective” terms.

### **3.4 The “Open-edi Business Transaction Ontology” (OeBTO)**

The prior two sections have demonstrated:

- That the components of the REA model are sufficiently well-defined, stable, and well-known that they can clearly serve as the basis for an ontological specification of the concepts involved in collaborative exchanges between trading partners; and
- That the components of that model must be viewed from the outside perspective of a modeller viewing the economic phenomena independently.

Because the primitive economic terms are being adopted here for use with the operational aspects of Open-edi from ISO/IEC 15944-1, the ontology to be defined will be termed the “Open-edi Business Transaction Ontology” (OeBTO). Its definition is:

A formal specification and definition of the concepts pertaining to business transactions and scenarios and the relationships that hold among these concepts.

From the definitional foundations of both ISO/IEC 15944-1 and the REA model, it follows that the OeBTO will follow these principles:

- As a business transaction ontology, a distinguishing characteristic of OeBTO is that in addition to information exchange, it incorporates commitment exchange among autonomous Persons.
- An OeBTO requires the use of clear and pre-defined rules, principles, and guidelines (see Clause 5.1 of 15944-1).
- An OeBTO is neutral in terms of technology, representation, and application.
- The scope of OeBTO covers all areas of business transactions (e.g., public/private, industry sectors, international, regional, etc.).
- The semantics of the concepts represented in the OeBTO are explicitly specified and constrained.

The accounting and economic primitives of this ontology and their relationship to various operational components of Open-edi are discussed in Section 4.

## 4. OeBTO PRIMITIVES

Figure 5 illustrates the high level view of an Open-edi collaboration. As a starting point for ontological definition, this collaboration space diagram anchors on the object answers to four fundamental questions:

- **Who** is involved in the collaboration (PERSONS) ?
- **What** is being exchanged in the collaboration (ECONOMIC RESOURCES) ?
- **When** (and under what trading conditions) do the components of the exchange occur (ECONOMIC EVENTS) ?
- **Why** are the trading partners engaged in the collaboration (DUALITY relationships between resource flows) ?

The normative infrastructure of the Open-edi Business Transaction Ontology (OeBTO) encompasses these essential question components, as explained in section 4.1 that follows. Section 4.2 illustrates the ontological components that result from typifying the OeBTO normative infrastructure, while section 4.3 deals with the non-normative extensions of claims and locations. Section 4.4 discusses the elaborate commitment structures of the OeBTO, and section 4.5 finishes this chapter by accounting for the extended ontology objects of scenarios and markets.

### 4.1 Resources, Events, Agents Plus Their Fundamental Relationships

Figure 6 illustrates the basic economic primitives of OeBTO. An actual value exchange in the collaboration space of Open-edi (Figure 5) between a buyer and a seller would involve two instances of this object pattern. A full example of this is shown in Figure 7 with a delivery of product followed by a payment of cash. In very general terms, a full economic exchange of value in collaboration space is defined as a Business Transaction in the Open-edi ontology. It is important to remember that Bilateral Collaborations between a buyer and a seller constitute the basic collaborative unit in Open-edi. These Bilateral Collaborations may be aggregated to Mediated Collaborations involving more than two Persons. However, these mediated collaborations may always be decomposed into binary components.

#### 4.1.1 Entity Definitions:

- An Economic Resource is a scarce good or service that possesses utility (economic value) and that is presently under the identifiable control of a particular individual or organization.
- An Economic Event most simply is an inflow or outflow of an economic resource. Economic Events reflect changes in economic resources resulting from exchanges, conversions, or transportation.
- A Person is an individual or organizational unit empowered to control the flow of Economic Resources (including his or her own labor) by engaging in Economic Events. The Person class may also include persons and agencies that are responsible for subordinates' participation in Economic Events. A subset of

*Person* is *Partner*; partners are persons who play the leading roles in business transactions as sellers and buyers (or alternatively, as producers and consumers of services).

#### 4.1.2 Relationship Definitions:

- A *resourceflow* relationship is an association between an Economic Resource and an Economic Event. From the independent perspective, *resourceflow* instances are matched in bi-directional fashion with each party both giving and taking in the same exchange.
- An *accountability* relationship is an association between a Person and an Economic Event. Economic Events normally have two accountability relationships with independent parties who have competing economic interests (that is, they are said to have an “arm’s length relationship with each other). One of these is specialized on the class diagram of Figure 9 as *from* and the other as *to*, indicating again the independent perspective of collaboration.
- A *duality* relationship is an association between two (or more) economic events where one is the economic or legal consideration for the other in an economic exchange. Dualities are needed for every binary component of mediated collaborations.
- A *custody* relationship is an association between a Party and an Economic Resource where physical possession is indicated.
- An *association* is a relationship between (among) two or more parties. *Association* relationships specialize to *responsibility* and *correspondence*. *Responsibility* associations indicate hierarchical orderings within an enterprise that are necessarily revealed to trading partners in a collaboration model. *Correspondence* associations link trading partners in a temporary or permanent one-to-one relationship.

#### 4.1.3 Addition of *Business Event* to Basic Pattern:

In Figure 8, the entity or object *Business Event* has been added to the basic OeBTM ontology pattern. A Business Event is an occurrence in time in collaboration space that Persons wish to plan, control, monitor, or evaluate. To bring about the occurrence of an Economic Event, it is often necessary to perform multiple Business Events. Business Events may also be aggregates of other, finer-grained Business Events. In a state machine sense where many elements of the Ontology are represented by Business Objects (representing Business Entity Types) with defined object states and defined object lifecycles, a Business Event can be defined more precisely as an event that causes a state change in one or more Business Objects.

## 4.2 EXTENSION OF THE ONTOLOGY INTO TYPES

Abstract concepts are information structures used to describe the intangible components of actual phenomena. For ontologists, this is an important distinction. In the OeBT ontology, type images” are used to represent the abstract structure of economic phenomena. For the construction of abstract concepts, the common abstraction mechanism of typification is used.

Typification captures descriptions that apply to a group of actual phenomena. For instance with two 15944-1 examples, the definition of “goods” as an economic resource might involve some notion of “consumption” while “rights” as an economic resource might not. Also important is that the definition of a “right” is preserved even when no actual rights exist in the universe of discourse. In Figure 9, the grouping and abstraction involved with these two examples is illustrated. The group “goods” would have “consumability” as part of its definition, and it could also have differential group operations as part of its definition (for example, the valuation of goods might involve depreciation while that of rights might involve amortization).

When type images are connected with each other as illustrated in the dotted associations of Figure 10, policy and planning artifacts often emerge, so this abstraction mechanism is especially important to the pre-actualization components (planning, identification, and negotiation) of an Open-edi Business Transaction. For example, parties often specify in advance the types of goods they desire to be shipped under different delivery categories by different types of shipping agencies. Under Open-edi, typification is strongly linked to the concept of **Scenarios** which are formal specifications of specific classes of business transactions designed for reusability.

Type images are needed for many entities in the ontology, but clearly the most important abstract classes are those for Economic Resources, Economic Events, and Persons. Typifications for Person and Economic Resource are shown in Figure 11 and in Figure 12. Each abstraction leads to an association with a type class, and the instances of that type may themselves be shown as decompositions or subclasses in the generalization plane. The example subtypes are not meant to be exhaustive. However, many of the category names are taken from ISO/IEC 15944-1, and their placement here gives them ontological definition.

### 4.2.1 Types for Persons

The class for Economic Agent Type in the REA ontology becomes **Business Role** in Open-edi. Figure 11 illustrates that there are three major subtypes for Person:

- **Partner** which itself further specializes to **Buyer** (has money, desires goods) and **Seller** (has goods, desires money).
- **Regulator** which represents Persons who impose external constraints on Business Transactions.
- **Third Party** which specializes to a number of other classes such as Escrow, Mediator, Guarantor, and Notary.

**Agents** are a special subtype in Open-edi who can act for any Person.

#### 4.2.2 Types for Economic Resource

Figure 12 illustrates the typification of Economic Resource. In very general terms, the major classes of economic resources to be considered for possible exchanges include the following:

- **Goods** which are tangible resources to include:
  - **Materials** including capital assets (like trucks), basic raw materials and natural resources (like steel or petroleum) plus sub-components of a larger assembled product (like seats for an automobile).
  - **Real Estate** like office buildings or warehouses.
  - **Funds** like money or marketable securities.
- **Services** which are the provision of value-adding activities by a provider to a consumer to include:
  - **Human Services** like temporary workers or consultants.
  - **Transportation Services** like packing/picking or actual shipments.
  - **Regulatory Services** such as the right to import/export or the right to do business in a certain segment or area.
  - **Warranty Services** such as the automatic provision of replacement goods under faulty judgments.
  - **Insurance Services** such as guaranteed payment under exigent circumstances.
- **Rights** which are intangible resources to include examples like **Intellectual Products (IPR)** and **Rights-of-way**.

Figure 12 also shows two recursive associations that are especially important in ontological terms because they reflect important aspects of economic reality. At both the type and instance level, an Economic Resource has a component structure. This means that its **value** is often derived from an assembly of other resources. For a product example, those components could be the physical material, its advertised cache, its delivered-to-the-door-status, and its warranty.

### 4.3 Locations and Claims

Figure 13 illustrates two non-normative additions to the basic Open-edi ontological framework.

- A Location designates the place where an Economic Event occurs if such information is needed. Locations also indicate the targeted delivery points for Economic Commitments. Location Types indicate instances like an approved kind of delivery warehouse or loading dock.
- An Economic Claim is an optional materialization of a temporal imbalance in a duality relationship where an Economic Event has occurred without its required correspondence to another Economic Event. An initial Economic Event *materializes* the claim, while the requiring Economic Event *settles* it. A common EDI document example of a claim is an invoice.

### 4.4 Adding Commitments to Economic Exchanges

In the Open-edi ontology, a Business Transaction pertains to the exchange of something of value as illustrated in the delivery-payment example of Figure 7. An additional key property of an Open-edi Business Transaction is that it involves commitment exchange, a circumstance modelled on top of the delivery-payment example in Figure 14. In economic terms however, commitments do not occur in isolation because partners simply do not agree to value exchanges without reciprocation. As illustrated at the top of Figure 14, commitments are bundled in contracts between persons where, for example, a commitment to deliver some product is reciprocated by a commitment to pay cash.

In Figure 15, the ex ante nature of commitments is illustrated further. At a minimum, an Open-edi commitment should specify the type of economic resource expected in the fulfilling economic event. For example, a catalog order chooses from a product list for delivery. Additionally, the commitment often will specify:

- the type of event to fulfil it (such as an expedited delivery or a purchase under wholesale pricing), and
- the type of business roles needed in the eventual exchange (such as a buyer, a seller, a seller agent, and a third-party escrow).

Commitments may less commonly specify location types like an approved class of warehouse.

Figure 16 adds Economic Commitment structures to the basic notion of an economic exchange. As mentioned previously, commitment is one of the defining features of Open-edi, so these structures are extremely important ontological components.

- An Economic Commitment is a promise to execute an Economic Event at some point in the future. The specification of an Economic Commitment may involve relationships with four type-level classes: Economic

Resource Type, Location Type, Economic Event Type, and Business Role. Economic Commitments may also have relationships with Economic Resource (*reserves*), Person (*involves*), and Location (*target*).

- A fulfills relationship is an association between an Economic Commitment and the Economic Event that executes that commitment.
- A reciprocal relationship is an association between Economic Commitments that each in turn individually fulfils compensating Economic Events.
- An Economic Contract is a bundle of reciprocating Commitments wherein two Parties agree to a future schedule of exchanges with compensating Economic Events. An Agreement is similar to a Contract, but it is not legally enforceable.
- An establishes relationship is an association between an Economic Contract and its pair of reciprocal Commitments.

Figure 17 illustrates the full addition of the “commitments to type specification” by combining Figures 15 and 16. Additionally, it extends the concept of a *Bilateral Collaboration* to that of a *Mediated Collaboration* by including the previously-defined *Third Party* subtype of *Person* as an essential ingredient of mediated collaborations. Figure 17 also indicates the essential roles of *Regulators* who are persons who constrain business transactions.

#### 4.5 Typifying Agreements and Business Transactions

Figure 18 and Figure 19 illustrate typification of Agreements and Business Transactions.

- Business Transactions are set in both Open Markets and Closed Markets, both of which are *overseen* by various Jurisdictions.
- Business Transactions are classed in different kinds of Scenarios such as the 2x2x2 basic trace model factoring shown in the cloud at the bottom of Figure 18.
- An Agreement can be decomposed into classes like Leases/Rentals, Service Agreements, Consignments, and Purchases. Agreements have Pricing Methods like reverse auctions, open and closed bids, and individual quotes. These methods can in turn be typified into classes (Pricing) like bid, auction, or matching.

The modelling specifications illustrated in Figure 6 through Figure 19 give specific conceptual definition to many of the Open-edi Business Transaction terms used in part 1 of 15944. In the following chapter, the behavioural use of these components is explained with explicit reference to the Open-edi notion of Business Transaction *phases*. According to 15944-1, a collaboration proceeds through the stages of planning, identification, negotiation, actualization, and post-actualization, and an ontologically-based state machine model of this progress is explained there.

## 5. State Machine Representations of an Open-edi Collaboration

### 5.1 Relating Ontological Components to the Open-edi Business Transaction Phases

From Open-edi 15944-1, Figure 20 enumerates the five identified phases of an Open-edi Business Transaction. This phase specification is one of the major contributions of that standard. Figure 21 adds the definition of Business Transaction Phases to the OeBTO primitives for a bilateral collaboration as specified in chapter 4. This figure also specifies that these phases have *Business Events* as components, illustrating the behavioural progress through each phase as marked by messages or events.

In Figure 23, the five phases are reiterated along with a specification of the types of Business Events that progress an overall Business Transaction through its linear stages. Business Events are activities that mark the explicit states that trading partners expose to each other as they complete an exchange. For example, supplying a quote on a listed product during negotiation may progress a Commitment from status (or state) “unspecified” to “proposed” while simultaneously marking a Resource-Type and an Event-Type as “specified.” If this Business Event of a supplying a quote was followed by a quote acceptance and then a payment terms acceptance, an Economic Contract might move into status “in-force” and then the entire Negotiation Phase might move into state “completed.” This completed negotiation would keep the entire Business Transaction in state “in progress,” whereas an unsuccessful negotiation might have moved the overall Business Transaction into state “aborted” or state “suspended.”

Figure 23 illustrates the approximate correspondence of the Open-edi Business Transaction phases with the categories of ontological components defined in chapter 4.

- Planning and Identification involve Business Events wherein potential buyers and sellers identify each other by matching on proposed types of resources to be exchanged and their actual trading partners.
- Negotiation involves Business Events wherein linked business partners cooperate on the abstract specification of their proposed exchange (its type of resources, events, and roles as stipulated in a contract).
- Actualization and Post-Actualization involve Business Events that aggregate to the performance of actual resource transfers (Economic Events) between the buyer and seller.

Figure 24 portrays the individual phases of a Business Transaction and the targeted object states that would signal to each business partner that that particular phase was now complete. Figure 25 illustrates some example states that could be defined for some of the Open-edi Ontology components defined thus far.

### 5.2 Actual State Machine Example

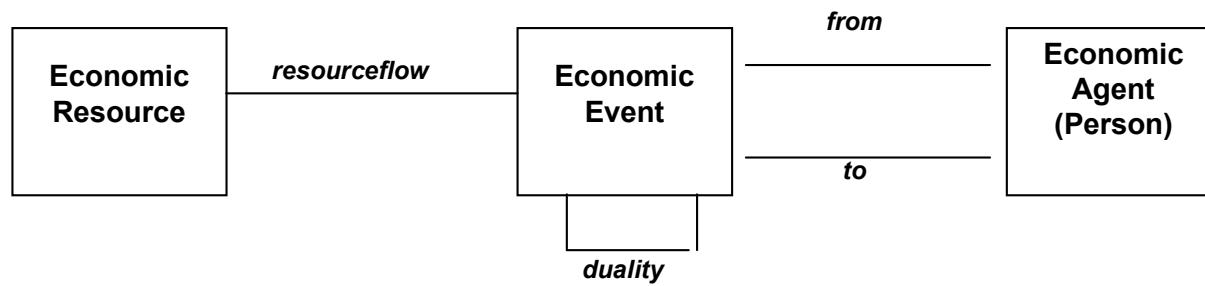
## **6.0 REA Appendix**

## 7.0 REFERENCES

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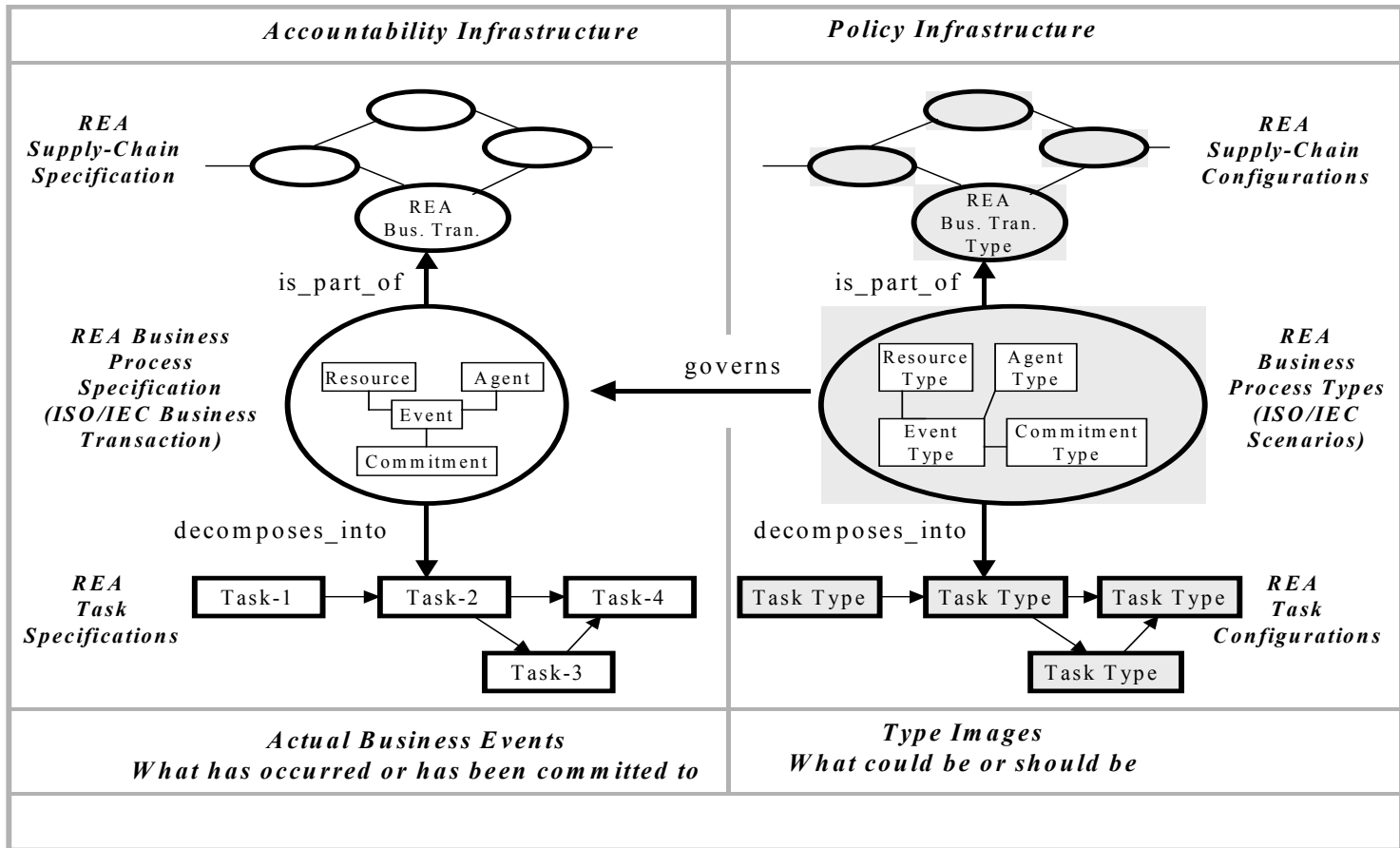
8.0 FIGURES



**Figure 1 – Basic Economic Primitives of the ISO Open-edi Ontology**

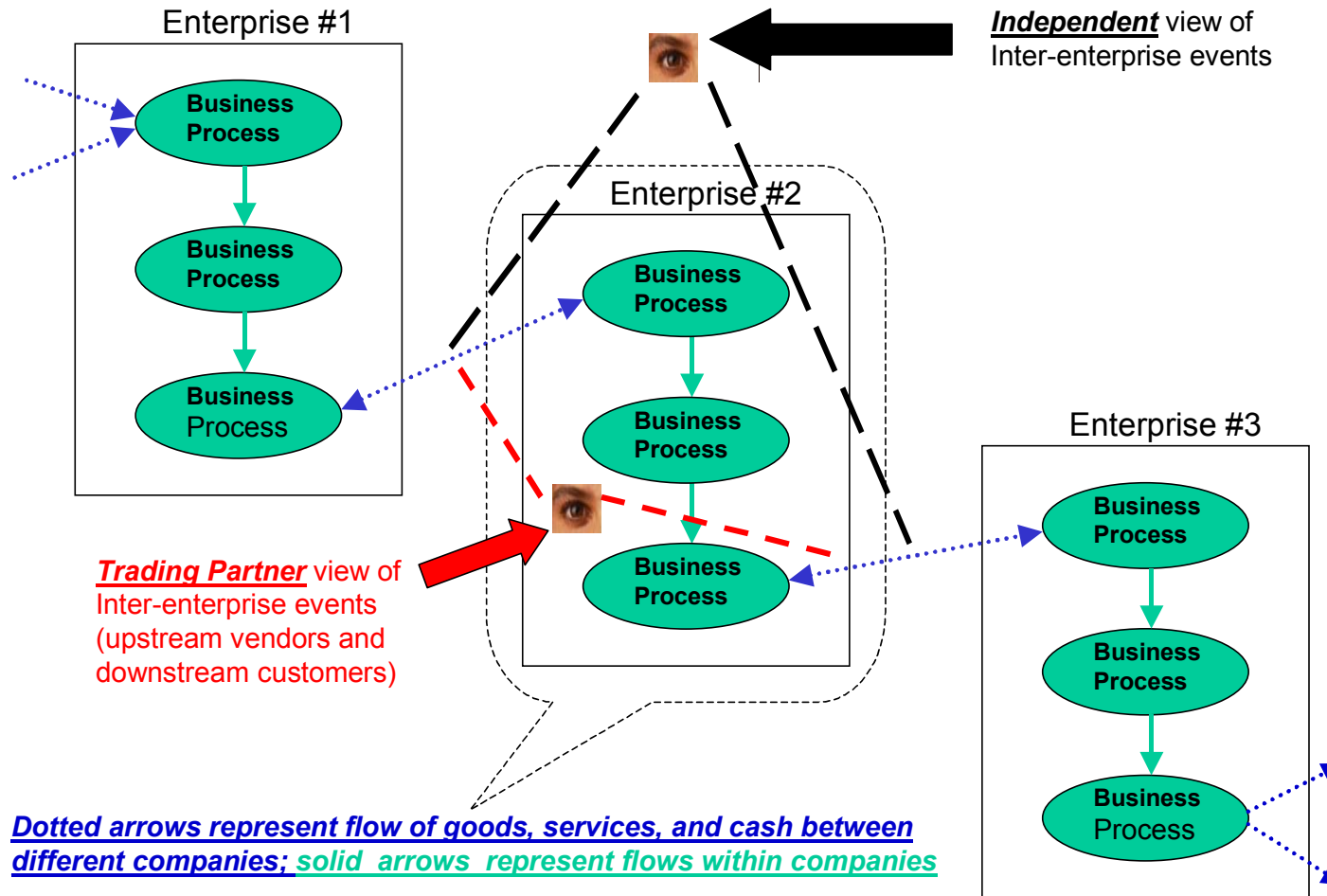
<u>OVERALL CONCEPT</u>	<u>ISO OPEN-EDI</u>	<u>REA ONTOLOGY</u>	<u>UN/CEFACT TMG, eXML &amp; eBTWG</u>
Emphasis on “economic value” as foundation for business process and business collaboration definitions	A <i>business transaction</i> pertains to the exchange of something of value	An exchange involves required <i>economic events</i> wherein one <i>economic resource</i> – which is something of value under the control of an enterprise – is exchanged for another <i>economic resource</i>	A business collaboration is an activity where “one thing of measurable value is created, either as a service performed or as a product created
Designated “actors” or agents who participate in the economic activities within or between business enterprises or who are responsible for the participation of others	<i>Person</i> is a legal or human entity having the ability to make commitments and to fulfill resulting obligations, and to be held accountable for those obligations	<i>Economic Agents</i> include persons and agencies who participate in the economic events of the enterprise or who are responsible for subordinates’ participation	<i>Partner</i> is an actor in a business collaboration
The ability to make and impart information about <i>commitments</i> as a critical component of e-commerce	A key property of a business transaction is that it involves <i>commitment exchange</i> among persons	A <i>commitment</i> is an agreement to execute an economic event in a well-defined future that will result in either an increase of resources or a decrease of resources	An economic commitment is an obligation to perform an economic event (that is, transfer ownership of a specified quantity of a specified resource type) at some future point in time
Pre-established patterns for different classes of e-commerce collaboration at the business or economic level	An <i>Open-edi Scenario</i> is a formal specification of a class of business transactions having the same business goal	A Scenario is a configuration of event types, resource types, commitment types, and agent types aggregated together to illustrate prototypical behavior	Run-time <i>Declarative Collaboration Patterns</i> are work items being developed based on the BRV components of the TMWG meta-model

**Figure 2 – Correspondence of ISO, REA, and UN/CEFACT**

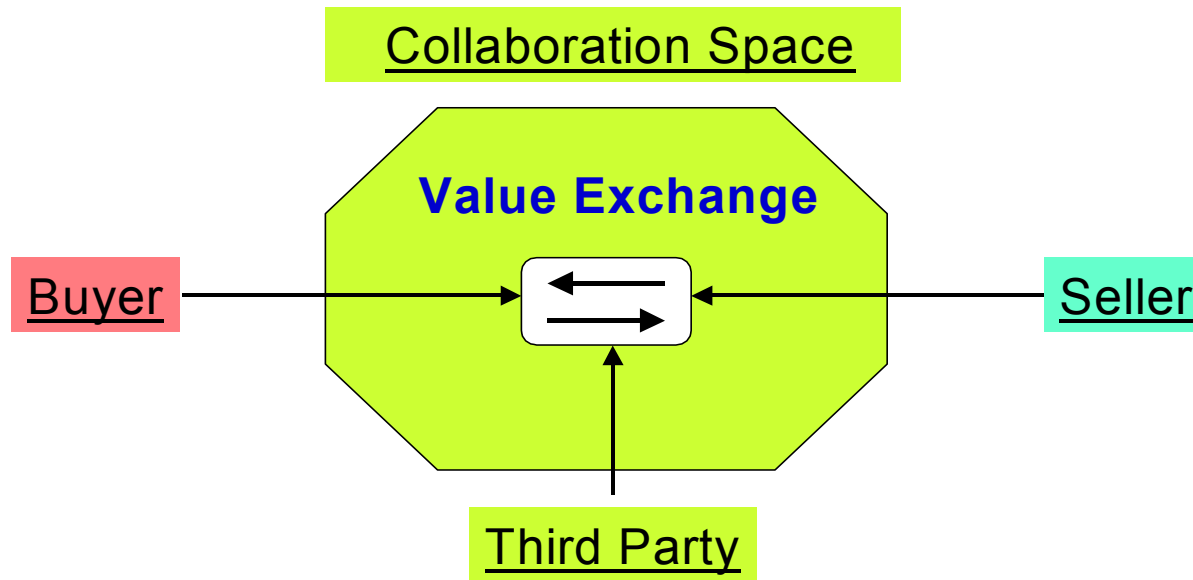


**Figure 3 – Structures for Business Transactions and Scenarios**

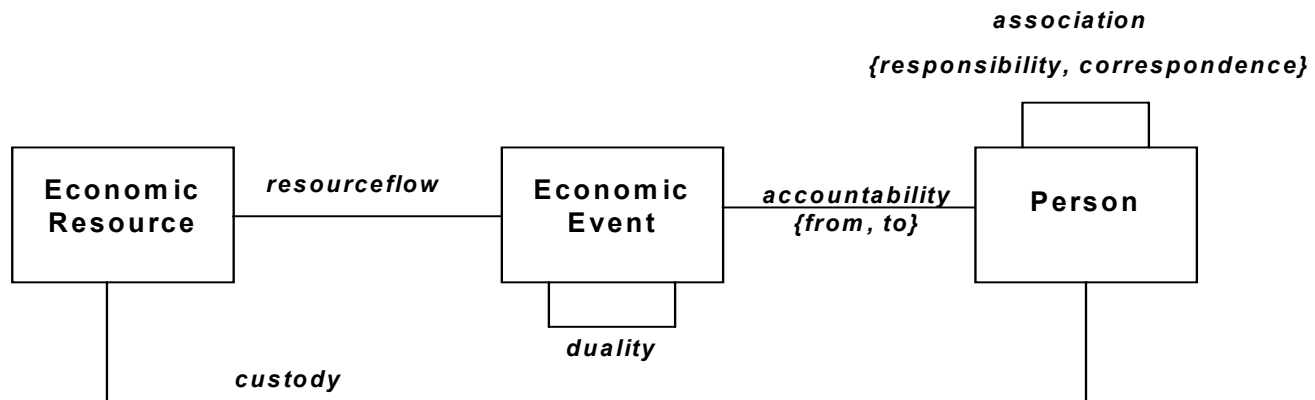
## Collaboration Perspective: **Trading Partner** vs. Independent



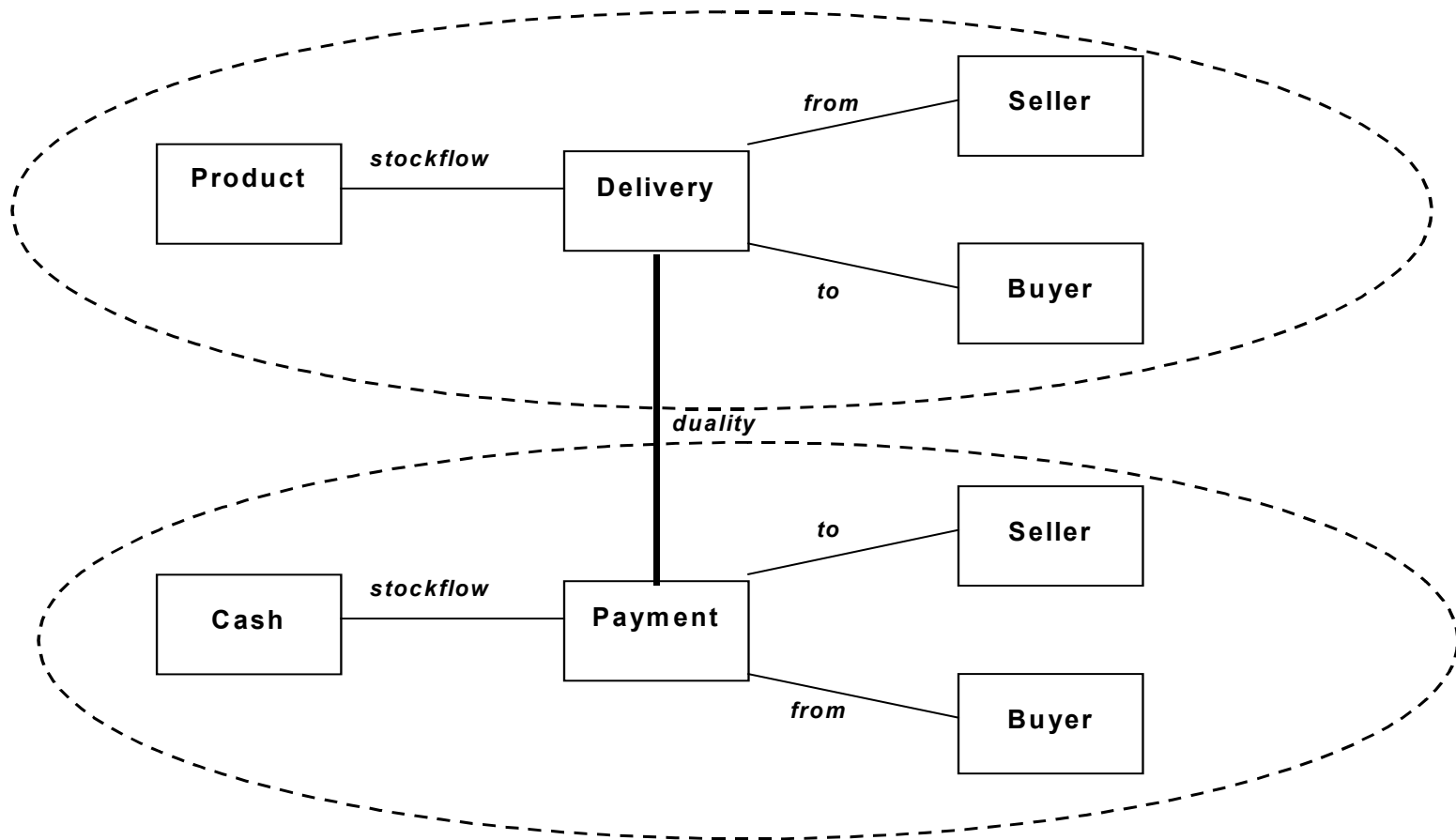
**Figure 4 – Different Views of Business Collaboration**



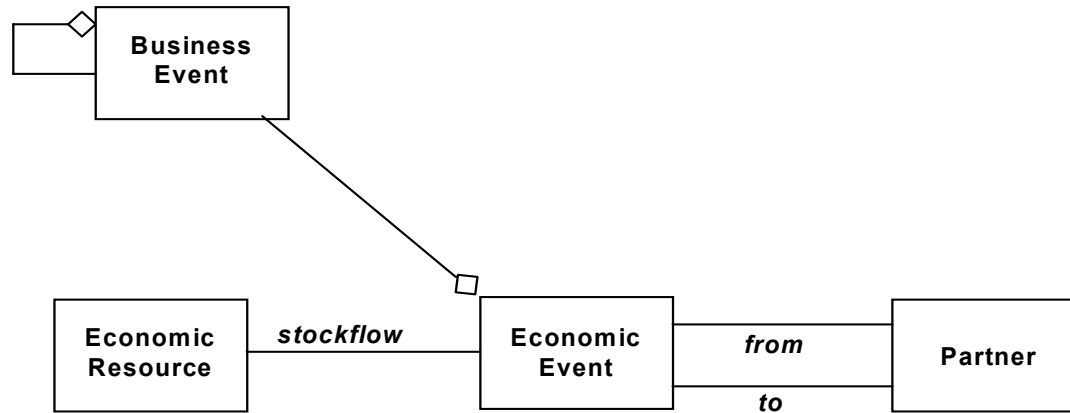
**Figure 5 – Concept of a Business Collaboration**



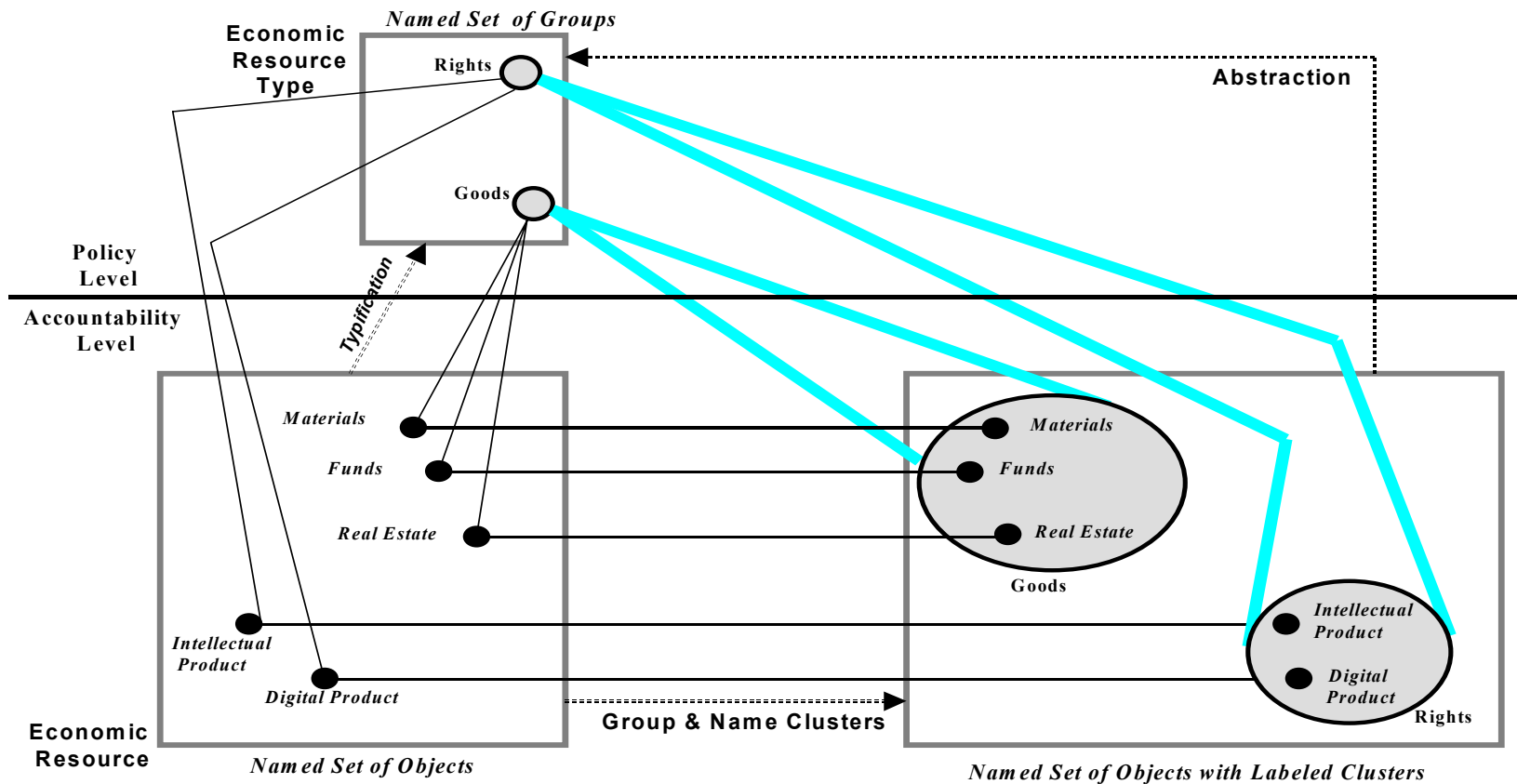
**Figure 6 – Basic Economic Primitives of the Open-edi Ontology**



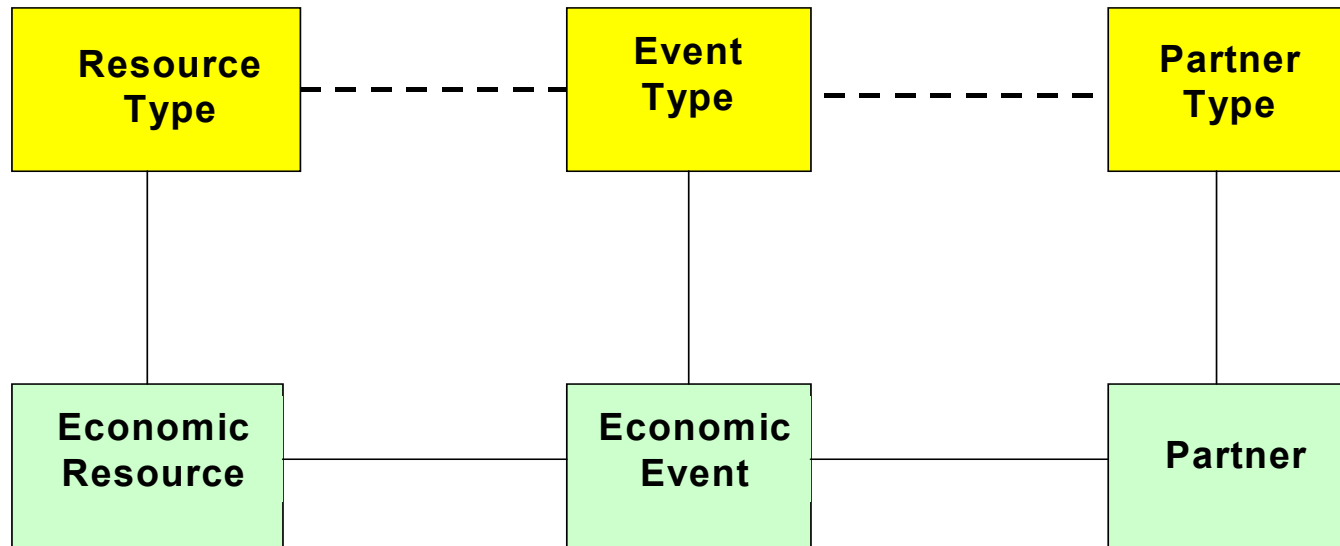
**Figure 7 – Exchange of Value in Collaboration Space Involves Two Symmetrical REA Object Clusters**



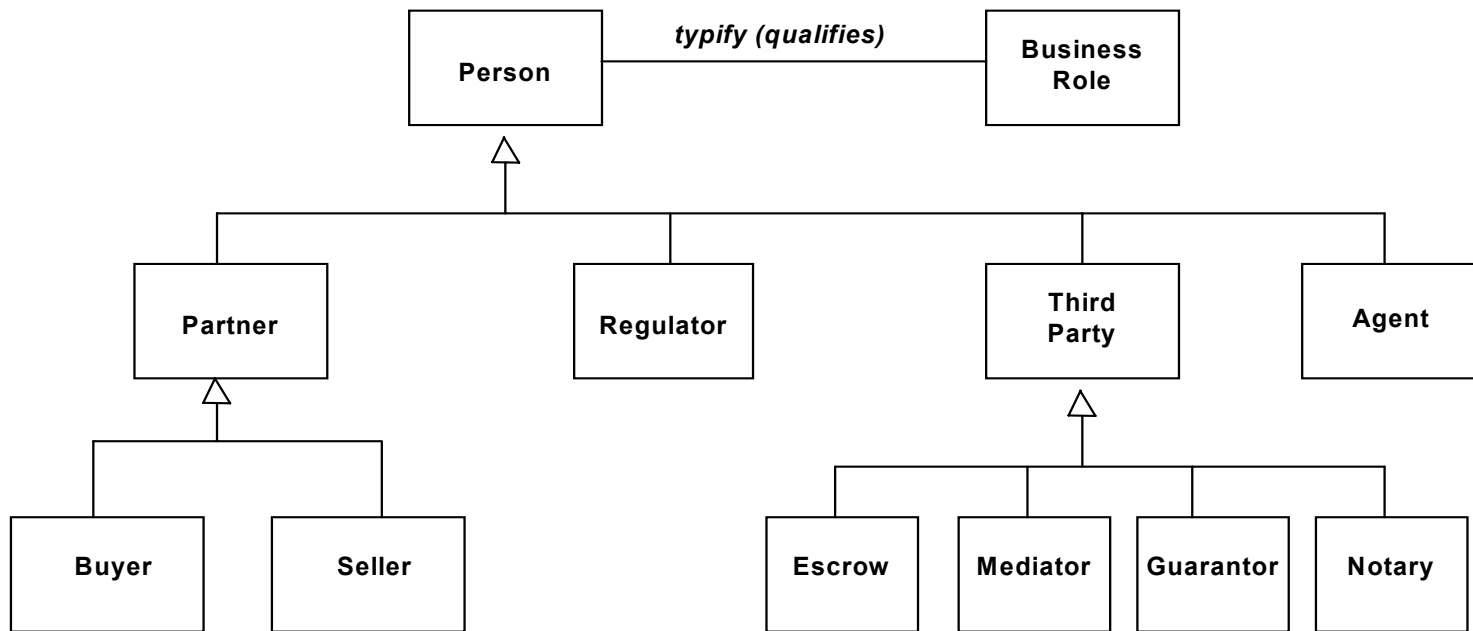
**Figure 8 -- Addition of Business Event to Basic Business Transaction Pattern**



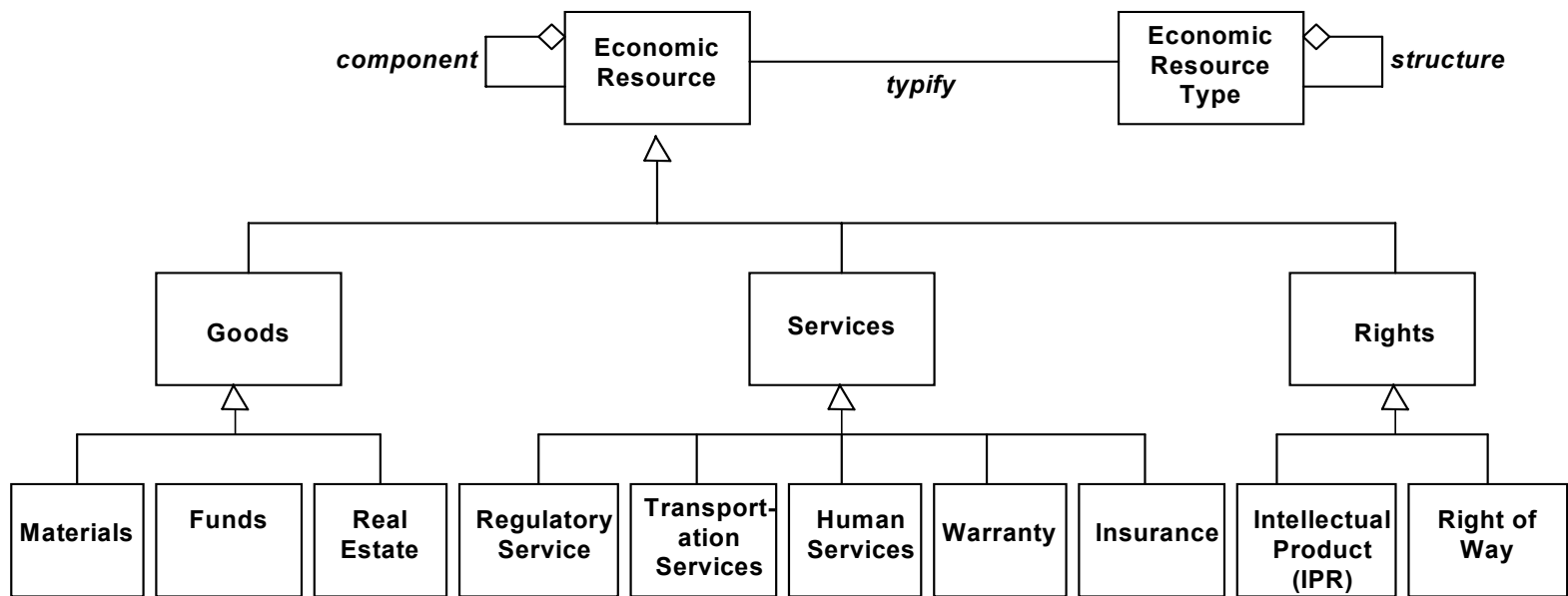
**Figure 9 – Abstract Specification with Typification**



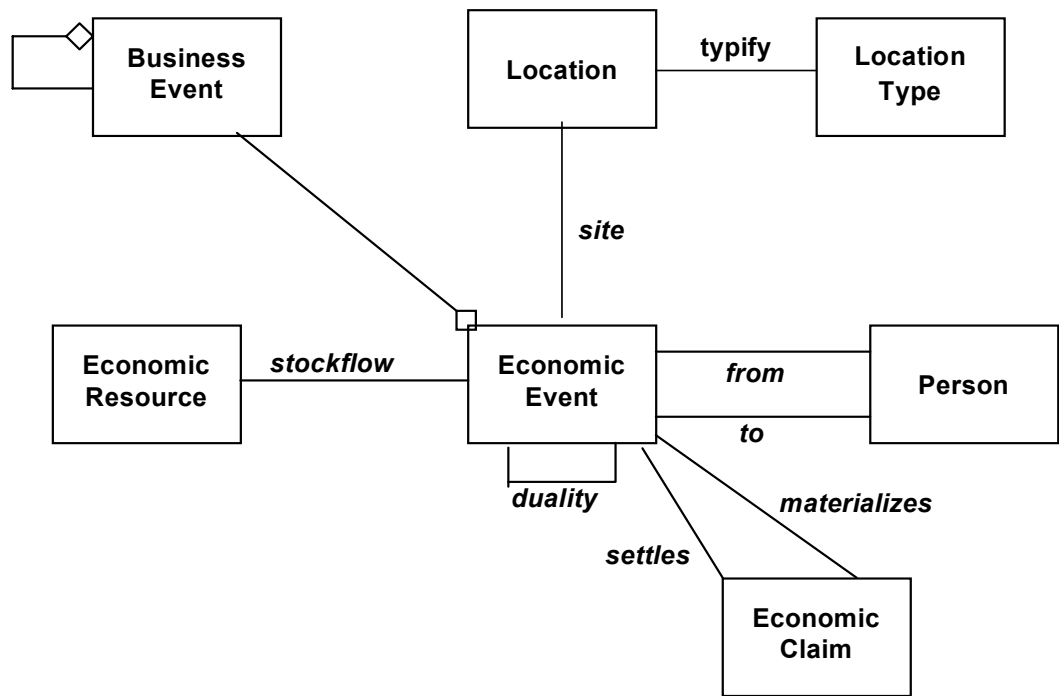
**Figure 10 – Type Connections for Policy and Planning**



**Figure 11 -- Subtypes and Roles of PERSON**



**Figure 12 -- Subtypes (possible) for ECONOMIC RESOURCE**



**Figure 13 -- Addition of Location and Economic Claim**

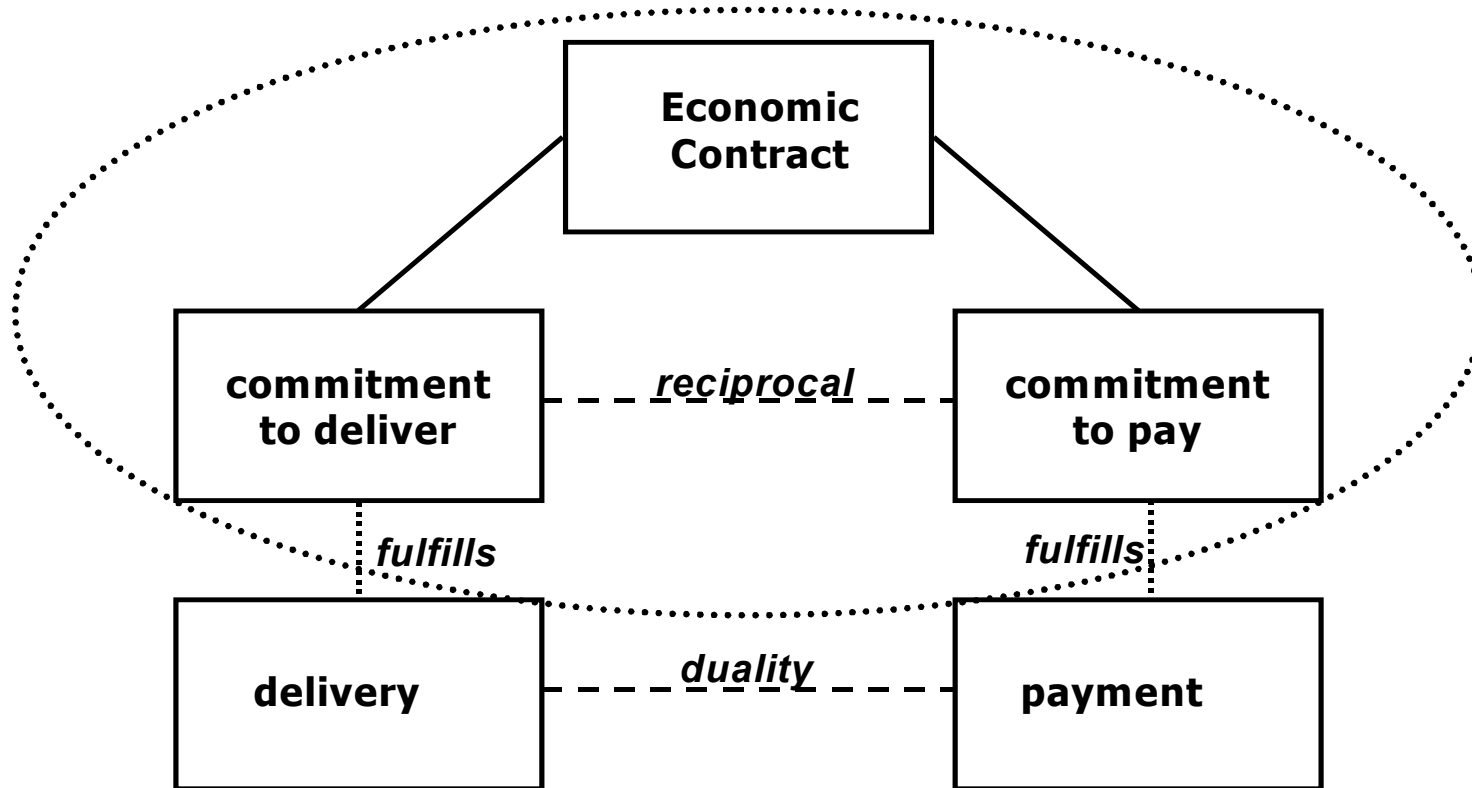
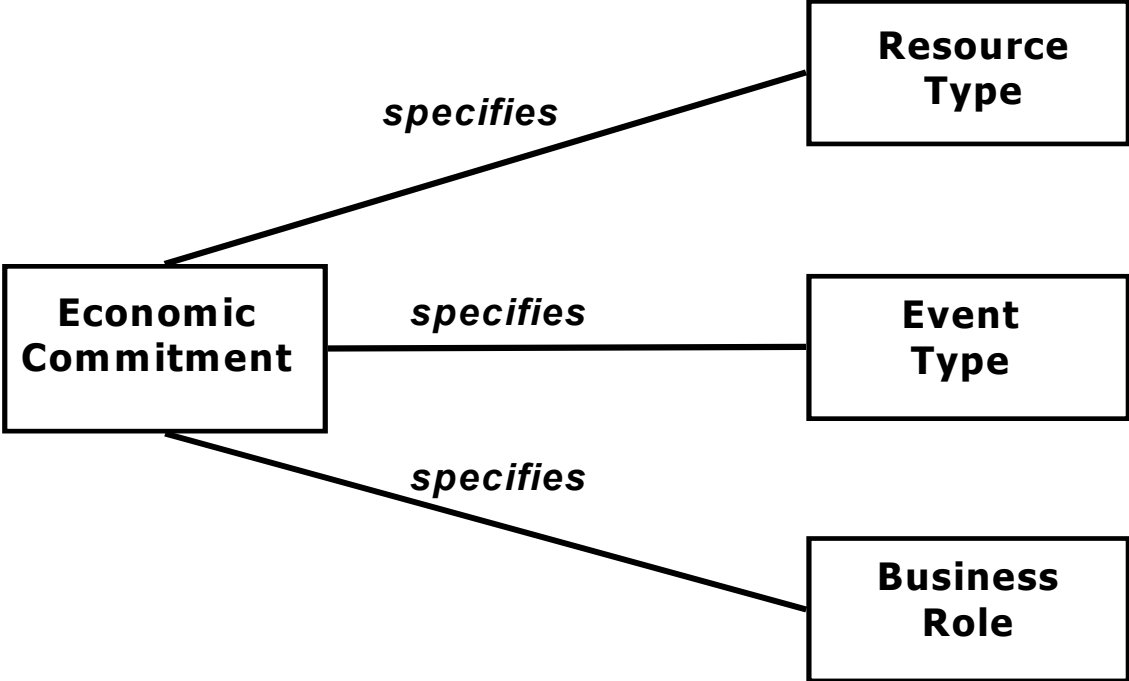
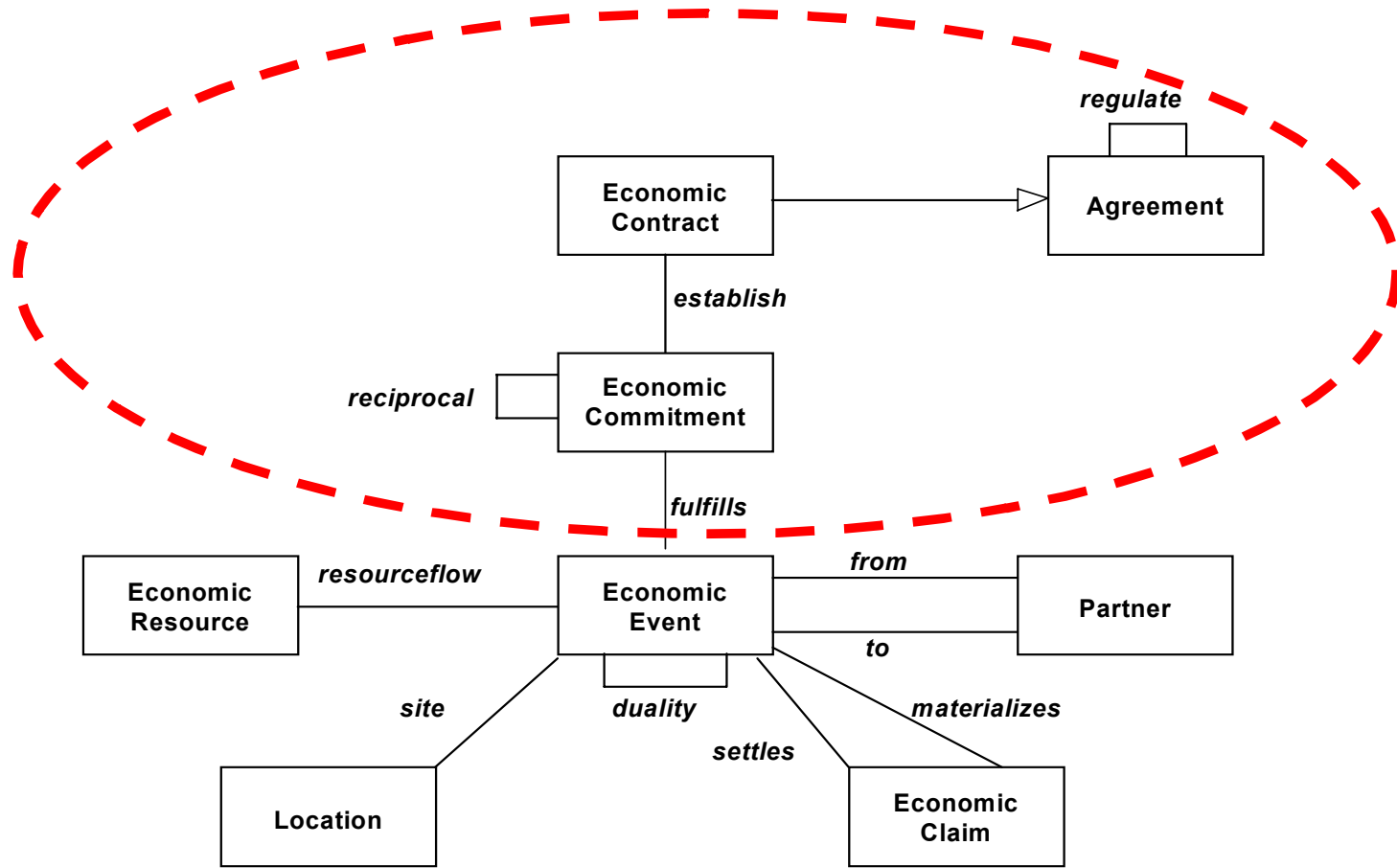


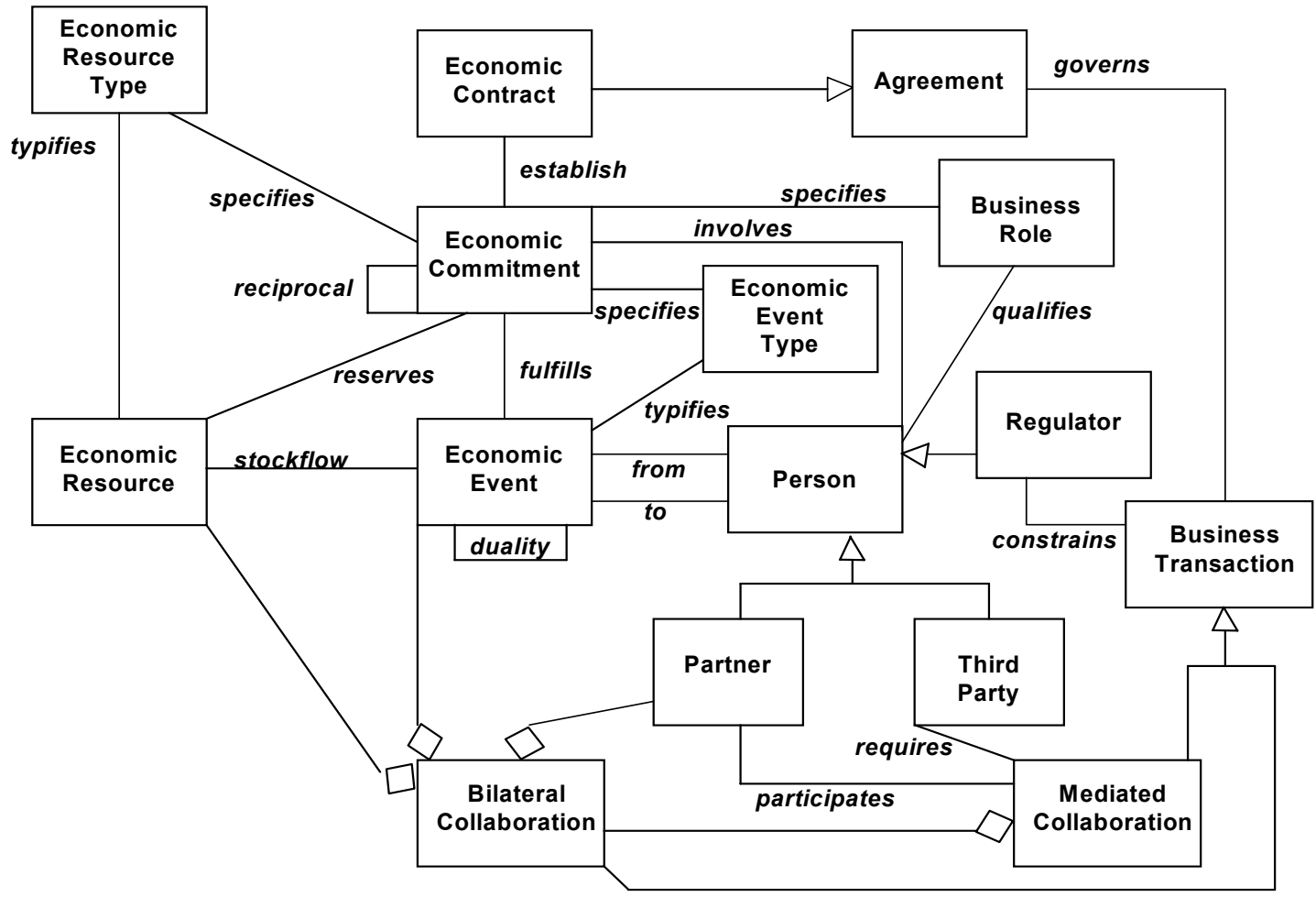
Figure 14 -- Contract as a Bundle of Commitments



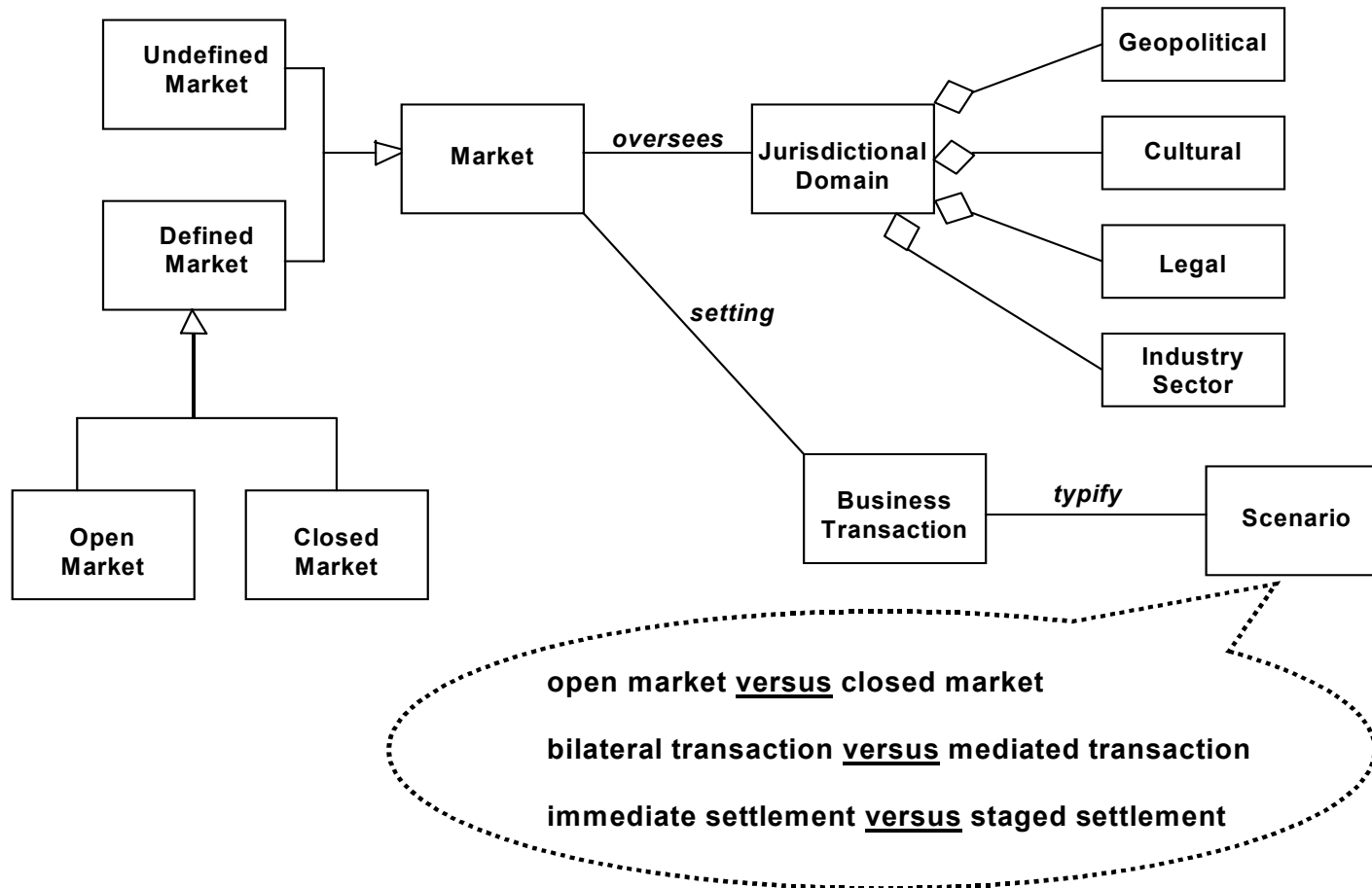
**Figure 15 – Abstract Specification of Commitments**



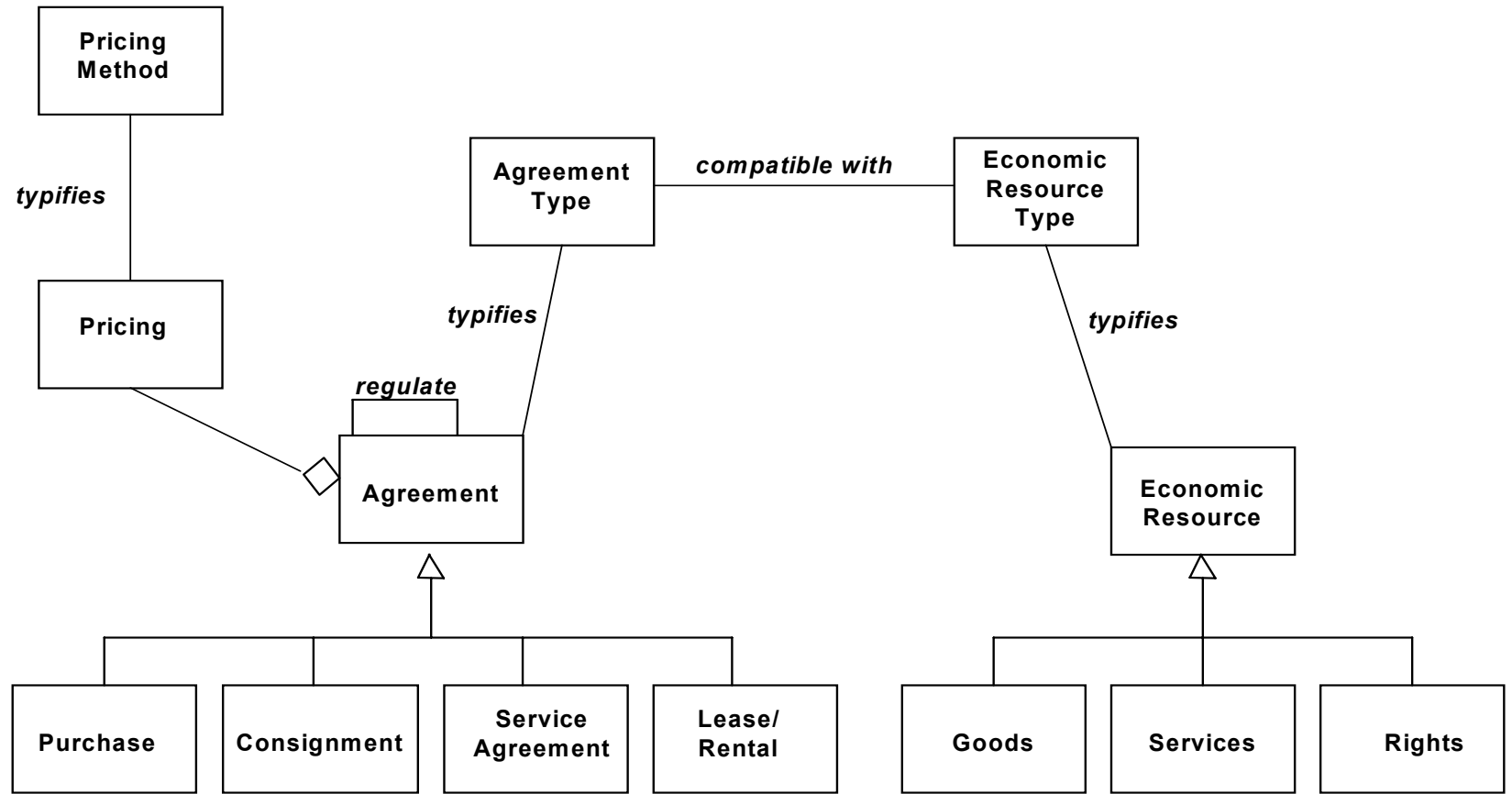
**Figure 16 – Business Transaction Model with Bundled Commitments**



**Figure 17 -- Collaboration with Commitment Structures**



**Figure 18 -- Addition of Markets and Scenarios for Business Transactions**



**Figure 19 -- Agreement Types with Pricing Methods**



