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THE DNA OF B2B

*E-business
Collaboration Modeling
Metamodel*

Version 2

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Executive Summary

Business partners must collaborate if they are to remain competitive. A high level of collaboration is possible when business partners link their business processes through an interface of network computer e-business services that enforce commercial trading agreements modeled as collaborative exchanges of business information, in agreed sequences and within agreed timeframes. A commercial trading agreement is modeled as a business collaboration model expressed with the Unified Modeling Language (UML) and the Object Constraint Language (OCL). The UML is a language expressive enough to specify the structure and behavior of objects that interact in any conceptual domain of discourse. A collaboration model, however, is a specification of the structure and behavior of objects interacting at business partner interfaces, a specialized domain of discourse. This document describes an extension to UML to include business collaboration domain specific syntax and semantics. This extension is termed the E-business Collaboration Metamodel. The metamodel is organized into the following views so that each collaboration model can be viewed from a number of perspectives:

- **The Business Operations Map (BOM) metamodel**—the partitioning of business processes into business areas and business categories.

- **The Business Requirements View (BRV) metamodel**—the view of a business collaboration model that captures the requirements of a business collaboration protocol.

- **The Business Operational View (BOV) metamodel**—the view of a business collaboration model that specifies the contract formation process for various types of commercial contracts.

- **The Functional Service View (FSV) metamodel**—the view of a business collaboration model that specifies the electronic formation of commercial contracts using an electronic medium.

- **The Implementation Framework View (IFV) metamodel**—the view of a business collaboration model that specifies specific network protocols necessary to communicate business information necessary for contract formation.

These perspectives support an incremental model construction methodology and provide levels of specification granularity that are suitable for communicating the model to business practitioners, business application integrators and network application solution providers.

Preface

Business collaboration models specify interoperable business processes that allow business partners to collaborate. These models are specified using the Unified Modeling Language (UML) and the Object Constraint Language (OCL). This document describes the UML metamodel extension for specifying business collaboration models.

There are a number of reasons to use the UML and the OCL to specify these models.

- The UML provides a visual language that eases the construction and interpretation of e-business collaboration models.

- The UML provides an extension mechanism so that domain specific, object-oriented metamodels can be easily defined.

- The OCL is a programming language independent method for expressing integrity and well-formedness constraints in metamodels and models.

- The UML can be persisted using XMI—an XML application. Models are easy to share and translate using tools that provide XMI support.

Purpose of the Document

The purpose of this document is to define a business collaboration metamodel. The metamodel is used to enforce the syntax and semantics of business collaboration models so that tools can be built to construct and applications can be built to execute, compliant models.

Intended Audience

The UML is a rich modeling language that is expressive enough to construct object models for many purposes, from many viewpoints and within many contexts. UML modelers who need to specifically construct business collaboration models must use this document to check the integrity and compliance of their models. If an automated integrity and compliance checker assists these modelers then that program must check these models against the metamodel specified in this document.

Prerequisites

It is assumed that the audience will be familiar with or have knowledge of the following technologies and techniques:

- Business collaboration modeling techniques and principles.

- The UML syntax and semantics, the UML metamodel and the UML extension mechanism.

- The OCL syntax and semantics.

Scope of the Document

This document specifies a metamodel for constructing business collaboration models.

Style Conventions

This document uses typographical and language conventions to convey specific meanings.

Typographical Conventions

The use of a *bold/italic font* indicates a UML or business collaboration metamodel entity name.

Language Conventions

This specification adopts the conventions expressed in the IETF's[1] RFC 2119 "Key Words for Use in RFCs to Indicate Requirement Levels." The key words "MUST," "MUST NOT," "REQUIRED," "SHALL," "SHALL NOT," "SHOULD," "SHOULD NOT," "RECOMMENDED," "MAY," and "OPTIONAL" in this document are to be interpreted as described in RFC 2119.

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Acknowledgments

ISO: The following terms are borrowed from the ISO Standard specification for Open-EDI:

- Business Operational View (BOV)

- Functional Service View (FSV)

The definition of these terms has been modified to be more specific to modeling e-business collaborations. This document also introduces another modeling view that is extracted from the ISO FSV definition.

- Implementation Framework View (IFV)

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[1] http://www.ietf.org/

Telecommunications Management Forum (TMF): The following terms are derived from the TMF documents:

- Business Operations Map (BOM). This is a generalization of the Telecom Operations Map (TOM) defined by the TMF. A BOM is a super-category of an industry specific business operations map such as the TOM.

- The Fabricate, Assurance and Billing (FAB) business areas used to create the top-level nodes for services industries.

Supply Chain Council: The following terms are taken from the Supply Chain Council documents:

- Business Operations Map (BOM). This is a generalization of the Supply Chain Operations Reference (SCOR) model defined by the Supply Chain Council. A BOM is a super-category of a domain specific business operations map such as SCOR.

- The Plan, Source, Make, Deliver business areas are used to create top-level nodes for Discrete or Continuous Goods Supply Chains.

Edifecs[2]**:** Edifecs is administering the creation of the Business Collaboration Framework (BCF). The BCF is a collection of documents that prescribe the policy, architecture and specifications for executing business processes for e-business.

- For general questions send e-mail to: support@edifecs.com

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[2] http://www.edifecs.com/

1 Introduction

Business partners collaborate by linking their planning and execution business processes. This allows each partner to derive business efficiencies and to react quicker to customer demand. Business execution processes span the end-to-end flow of products and information from consumer demand through product sourcing and back to final product consumption. In discrete or continuous goods industries, collaboration is a series of source, make and deliver business processes[3] executed by each business partner in the collaboration. Service industries collaborate in a series of fulfill, assure and bill business processes[4] executed by each business partner in the collaboration.

Business partners implement business process links through an interface of network computer e-business services that enforce commercial trading agreements modeled as collaborative exchanges of business information in agreed sequences and within agreed timeframes. A commercial trading agreement is modeled either as a Commercial Transaction (CT) or a Business Collaboration Protocol (BCP). A CT is a request/response exchange of business information between the initiator of the transaction and the responder to the transaction request. A BCP is a choreograph of CTs where either party to a trading agreement can initiate and respond to commercial transactions until the terms of their agreement are met. For example, creating a purchase order can be a CT where all the terms of an offer are accepted in a response or it can be a BCP where the terms of an offer are accepted piecemeal in multiple responses.

Business processes are partitioned, arranged and interrelated using a Business Operations Map (BOM) to promote human understanding and to facilitate specific business model configurations (e.g. build-to-order and build-to-stock). The map and associated process models are incrementally constructed using the Business Collaboration Framework (BCF) modeling methodology (BCF#12). The BCF is a collection of documents that prescribe the policy, architecture and specifications for executing e-business processes.

Process models are expressed using the Unified Modeling Language (UML) and the Object Constraint Language (OCL) both of which are standards maintained by the Object Management Group[5] (OMG). The UML is a language expressive enough to specify the structure and behavior of objects that interact in any conceptual domain of discourse. A collaboration model, however, is a specification of the structure and behavior of objects interacting at business partner interfaces, a specialized domain of discourse. The UML metamodel (the

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[3] Taken from the Supply Chain Operations Reference (SCOR) model found at http://www.supply-chain.org.
[4] Taken from the Telecom Operations Map (TOM) found at http://www.tmforum.org.
[5] http://www.omg.org/

model that defines the UML modeling language) is extended to include domain specific syntax and semantics using extension mechanisms known as *stereotyping*. The business collaboration metamodel is thus defined as an extension of the UML metamodel by extending the UML stereotype syntax and semantics with the syntax and semantics of the business process domain. Collaboration models are then constructed using the syntax of the metamodel. Tools and applications that support the syntax and semantics of the business collaboration metamodel will be able to support the construction and execution of business processes that execute on the Internet.

This document is a precise definition of the UML metamodel extension that facilitates the expression of a business processes as an object-oriented model. This extended metamodel is termed the E-business Collaboration Metamodel. The metamodel is organized into the following views so that each collaboration model can be viewed from a number of perspectives:

- **The Business Operations Map (BOM) metamodel**—the partitioning of business processes into business areas and business categories.

- **The Business Requirements View (BRV) metamodel**—the view of a business collaboration model that captures the use case scenarios, inputs, outputs, constraints and system boundaries for commercial transactions and their interrelationships.

- **The Business Operational View (BOV) metamodel**—the view of a business collaboration model that captures the semantics of business information entities and their flow of exchange between roles as they perform business activities.

- **The Functional Service View (FSV) metamodel**—the view of a business collaboration model that specifies the network component services and agents and their message (data) exchange as interactions necessary to execute and validate a business process.

- **The Implementation Framework View (IFV) metamodel**—the view of business collaboration model that specifies specific implementation framework, network protocol message formats and guidelines. These messages are exchanged when networked computer e-business services and agents execute business processes.

These perspectives support an incremental model construction methodology and provide levels of specification granularity that are suitable for communicating the model to business practitioners, business application integrators and network application solution providers.

The BRV, BOV and FSV of a collaboration model are network communications protocol neutral. The IFV of a collaboration model is, however, specific to particular network communications protocols. The IFV of a collaboration model will be defined in a future version of this document.

2 The Business Operations Map Metamodel

The Business Operations Map (BOM) of a business collaboration model specifies the use case scenarios, input and output triggers, constraints and system boundaries for business areas, business processes, business collaboration protocols, commercial transactions and their interrelationships. Business processes are partitioned, arranged and interrelated using a BOM to promote human understanding and to facilitate specific business model configurations (e.g. build-to-order and build-to-stock).

This section specifies the abstract syntax and semantics of the BOM model and model management packages. The abstract syntax of models is defined using stereotypes and tagged values. The semantics of models are specified using the truth semantics of well–formed formulae expressed with OCL expressions and with natural language.

2.1 Model Abstract Syntax

2.1.1 Stereotypes and Tagged Values

Figure 2.1 specifies the modeling elements, and their interrelationships, that are used to express the structure and behavior of objects in a BOM model. Each element and interrelationship permitted in a BOM is defined in the metamodel specified in this section of the document.
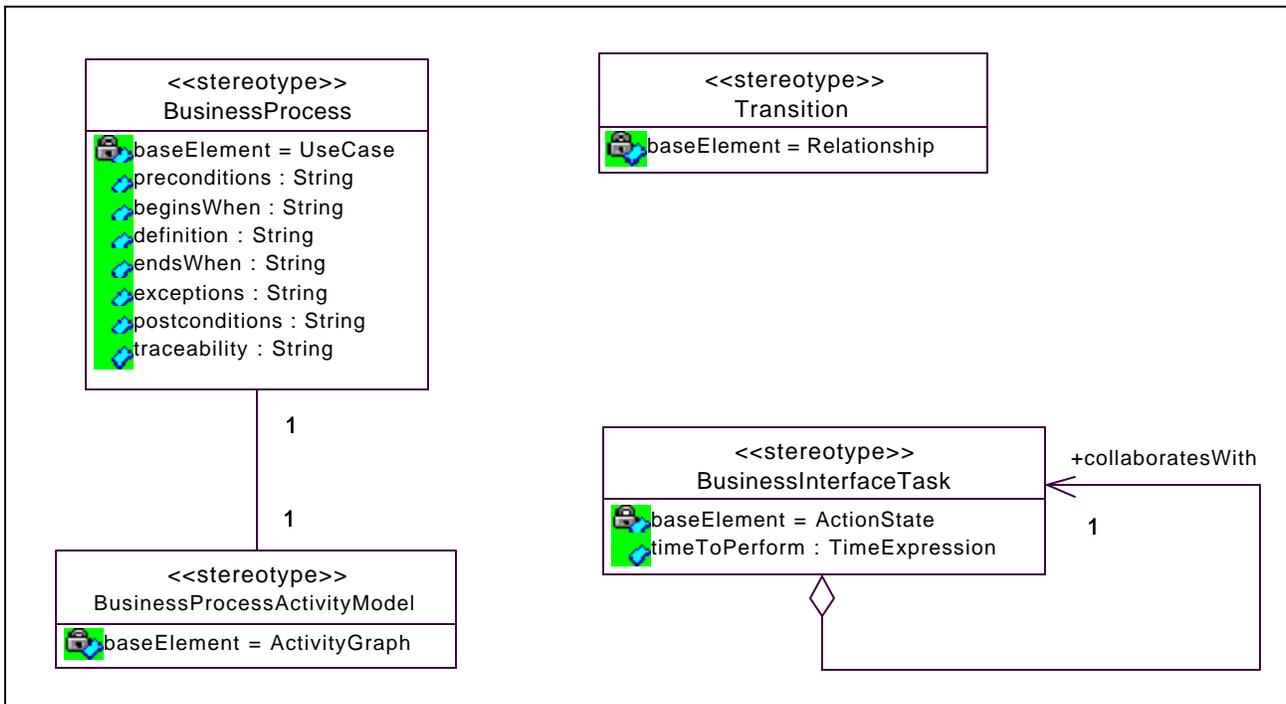
Figure 2.1   BOM Abstract Syntax

BusinessProcess

A business process is a use case that is used to gather requirements about business processes. Inputs to the business process must be specified in the preconditions and outputs from the business process must be specified in the post-conditions.

Tagged Values:

*precondition*s

Preconditions are constraints that must be satisfied starting the use case.

beginsWhen

Describe the initial event from the actor that starts a use case.

definition

A set of simple sentences that state the actions performed as part of the use case. Include references to use cases at extension points.

endsWhen

Describe the condition or event that causes normal completion of the use case.

*exception*s

List all exception conditions that will cause the use case to terminate before its normal completion.

postconditions

Post-conditions are constraints that must be satisfied ending the use case.

traceability

An explicit list of requirements, identified by category, that are either partially or completely satisfied by this use case.

BusinessProcessActivityModel

A business process activity model specifies the behavioral aspects of a business process. The model specifies a flow of control between tasks.

BusinessInterfaceTask

A business interface task is a task that is performed by one business partner in collaboration with another business partner performing another business interface task. A business process is decomposed into business tasks and business interface tasks.

Tagged Values:

timeToPerform

A task is work that is performed with respect to time. There may be a specific time within which the task must be performed.

Associations:

collaboratesWith

A business interface task is performed in collaboration with another business interface task. For examples, a "create purchase order" task is performed in collaboration with a "create sales order" task.

Transition

A transition is a directed relationship between a client (source) use case and a supplier (target) use case. This relationship specifies a process transition to a target business process use case triggered by the completion of a source business process (a state in which all the post-conditions of the use case are satisfied) or triggered by an activity state transition within the client (source) use case. The transition occurs only when transition conditions are satisfied.

Tagged Values:

triggerEvent

The activity state transition within the client (source) use case definition activity graph that triggers the transition to the supplier (target) use case.

transitionConditions

transitionConditions are constraints that must be true in order for the transition to the supplier (target) use case to occur. These conditions must be testable values on the business data entities visible to the client (source) use case and its definition activity graph.

ConcurrentTransition

A flag indicating that the transition occurs on an internal activity transition within the client (source) activity graph. Both the client (source) and supplier (target) will continue concurrently.

Associations:

Source

A transition describes the trigger event and conditions occurring in the client (source) use case.

target

The supplier (target) use case is executed when the trigger event and transition conditions occur within the client (source) use case.

2.1.2 Well-formedness Rules

The following well-formedness rules apply to the BOM metamodel:

1. The *collaboratesWith* association must be navigable from the client use case to the supplier use case only.

2. Business collaboration activity models must have one initial state and at least one end state.

2.2 Model Semantics

The semantics of each element of the BOM metamodel is defined in this section.

Figure 2.2 illustrates the interrelationships between the BOM modeling elements.
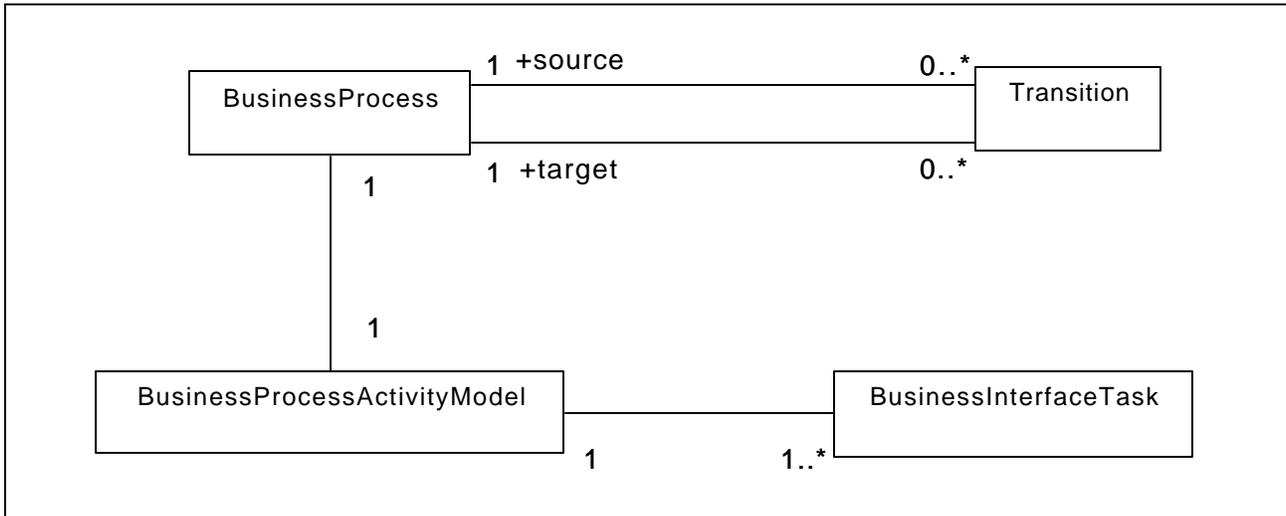
Figure 2.2   BOM Illustration

A business process is a sequence of business tasks performed by one business partner alone, and business interface tasks performed two or more business partners. A business collaboration activity model should only contain activity states that are either business interface task specifications or that are interpreted as business tasks.

Each task can be further decomposed into activities. Business process can be decomposed into sub-processes using the «include» association stereotype defined in the UML.

A transition relationship specifies a change in state of a business process that is triggered by the completion of some part of the business process. A transition relates a source business process and a target business process. The direction of the transition is from the source to the target.

2.3 Model Management Abstract Syntax

The BOM model management organizes business process use cases and business process activity models into a framework of business areas and process areas. These modeling elements are organized as logical, business area and sub-process categories arranged in a framework for understanding their interrelationships. This framework is termed a BOM.

2.3.1 Stereotypes and Tagged Values

Figure 2.3 shows the metamodel for managing the BOM model. The modeling elements used to manage and organize these three specifications are defined in this section.
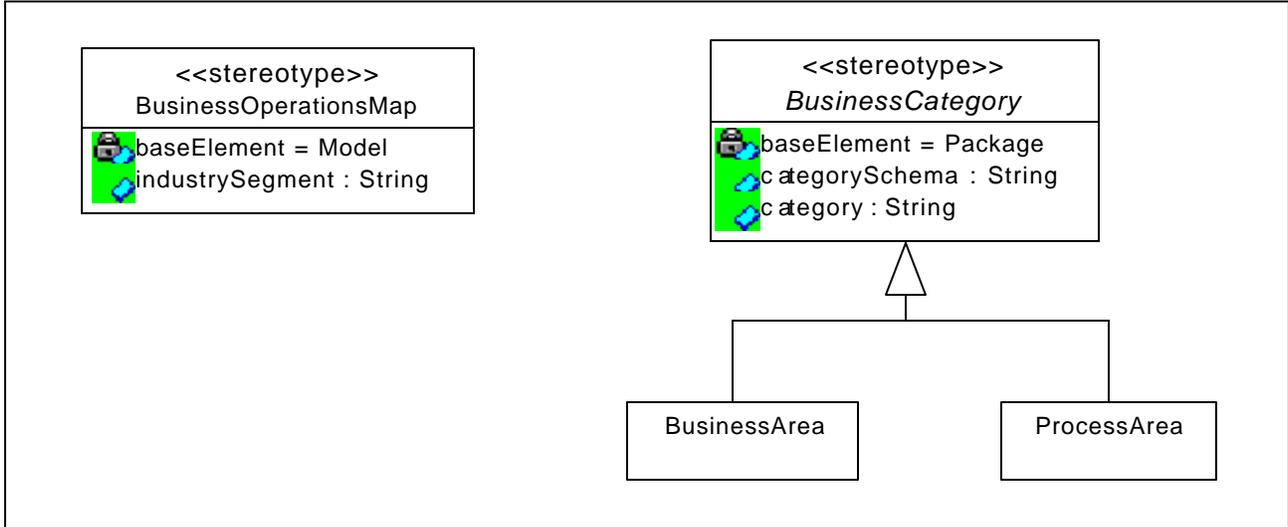
Figure 2.3　　　**BOM Model Management Abstract Syntax**

The following stereotypes and tagged values are contained in the BOM management metamodel:

BusinessOperationsMap

A Business Operations Map is a framework for understanding business area sub-process interrelationships. This framework is termed a Business Operations Map (BOM).

BusinessArea

A business area is a category of decomposable business process areas. A business area collates business processes areas.

BusinessCategory

A business category is an abstraction category for reusing tag-values. A business category collates sub-categories.

Tagged Values:

categorySchema

The name of the categorization schema used to reference use cases.

category

The category identifier used to reference a business area or business process set of use cases.

ProcessArea

A process area is a category of business processes and commercial transactions. A process area collates business processes and commercial transactions.

2.3.2 Well-formedness Rules

The following well-formedness rules apply to the business operational map metamodel package:

1. A BOM must contain at least one business area.

2. A business area must contain at least one process area.

3. A process area must contain at least one business process.

2.4 Model Management Semantics

The semantics of each element of the BOM model management metamodel is defined in this section.

Figure 2.4 illustrates the interrelationships between the BOM model management elements.
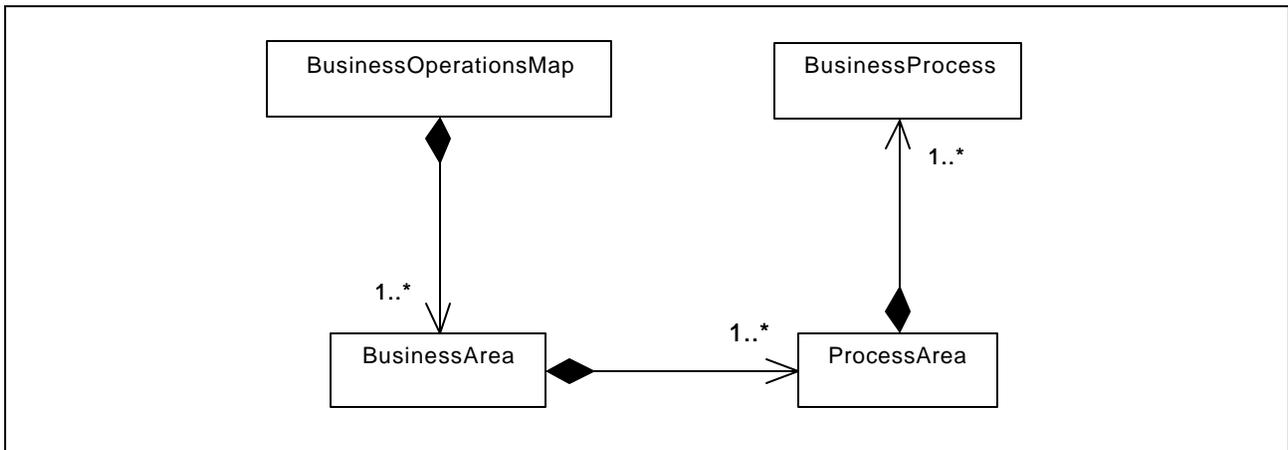
Figure 2.4   BOM Model Management Illustration

A business operations map comprises business areas. The Supply Chain Council[6] defines plan, source, make and deliver business areas in their Supply Chain Operations Reference (SCOR) model. The model describes business processes in the Discrete and Continuous Goods Supply Chain. The Telecommunications Management Forum[7] defines fulfill, assure and bill business areas in their Telecom Operations Map (TOM). The map describes business processes in the Services industry.

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[6] http://www.supply-chain.org.
[7] http://www.tmforum.org.

Business areas comprise process areas. A process area is an interrelated collection of business processes that implement a particular business model. Business areas such as "Deliver stocked product" and "Deliver make-to-order products" are two different business models that use many of the same business processes.

3 The Business Requirements View Metamodel

The Business Requirements View (BRV) of a business collaboration model specifies the use case scenarios, input and output triggers, constraints and system boundaries for Commercial Transactions (CTs), Business Collaboration Protocols (BCPs) and their interrelationships.

This section specifies the abstract syntax and semantics of the BRV of the CT and BCP model and model management packages. The abstract syntax of models is specified using stereotypes and tagged values. The semantics of models are specified using the truth semantics of well–formed-formulae expressed with OCL expressions and with natural language.

3.1 Model Abstract Syntax

3.1.1 Stereotypes and Tagged Values

Figure 3.1 specifies the modeling elements and their interrelationships that are used to express the structure and behavior of objects in the BRV of a CT and BCP model. Each element and interrelationship permitted in a BRV is defined in the metamodel specified in this section of the document.
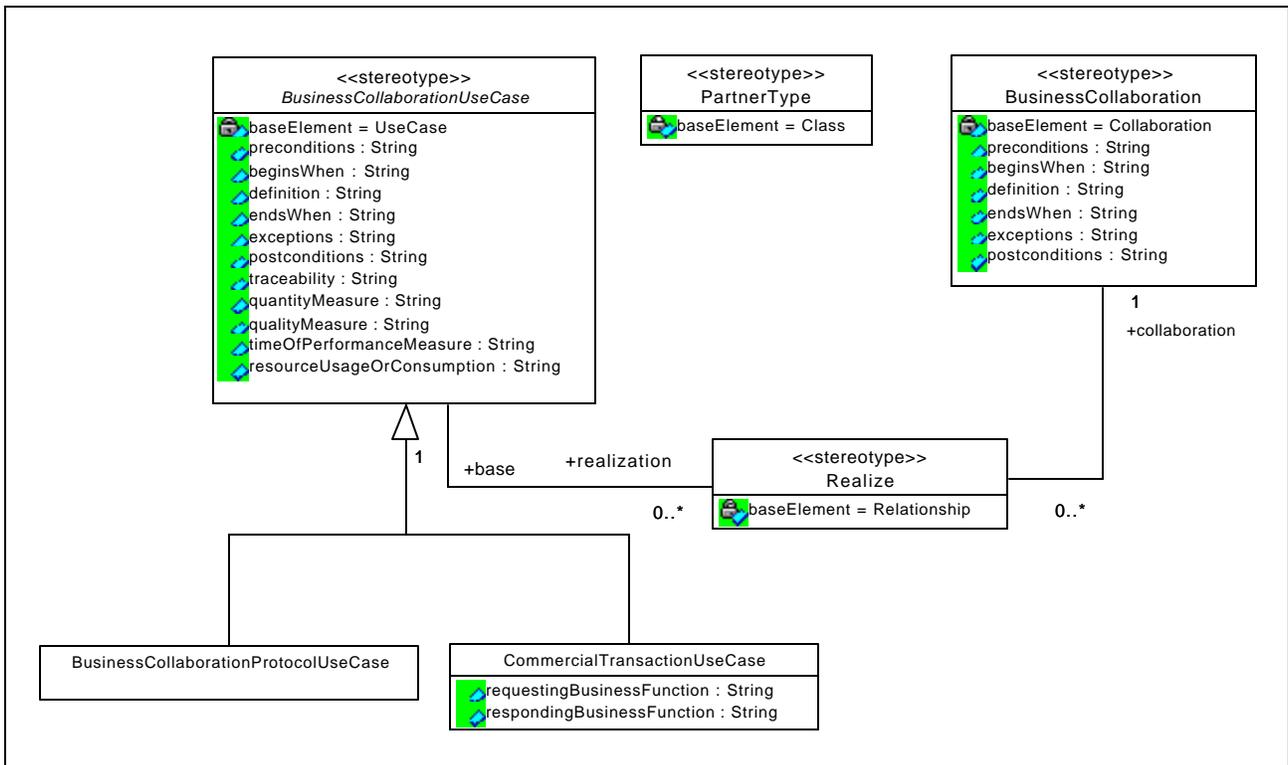
Figure 3.1   BRV Abstract Syntax

BusinessCollaborationProtocolUseCase

A business collaboration protocol use case is used to gather requirements for e-business collaboration protocol specifications.

BusinessCollaboration

A business collaboration model specifies the input and output relationships between business collaboration use cases and Agents. Agents provide input triggers to use cases and business collaboration use cases can provide input triggers and output triggers to and from other business collaboration use cases.

A business collaboration model captures business information constraints imposed by a specific partner type collaboration. For example, sending a business document to a U.S. government agency requires a Standard Industry Classification (SIC) code to be included with the business information.

Tagged Values:

*precondition*s

Conditions that must be true before starting the use case.

beginsWhen

Describe the initial event from the actor that starts a use case.

definition

A set of simple sentences that state the actions performed as part of the use case. Include references to use cases at extension points.

endsWhen

Describe the condition or event that causes normal completion of the use case.

*exception*s

List all exception conditions that will cause the use case to terminate before its normal completion.

postconditions

Conditions that must be true before ending the use case.

BusinessCollaborationUseCase

A business collaboration use case is an abstraction for a business collaboration protocol use case and a commercial transaction use case. The abstraction permits the reuse of the business collaboration realization relationship.

Tagged Values:

*precondition*s

Conditions that must be true before starting the use case.

beginsWhen

Describe the initial event from the actor that starts a use case.

definition

A set of simple sentences that state the actions performed as part of the use case. Include references to use cases at extension points.

endsWhen

Describe the condition or event that causes normal completion of the use case.

*exception*s

List all exception conditions that will cause the use case to terminate before its normal completion.

postconditions

Conditions that must be true before ending the use case.

traceability

An explicit list of requirements, identified by category, that are either partially or completely satisfied by this used case.

Associations:

realization

A business collaboration is a realization of a business collaboration use case.

CommercialTransactionUseCase

A commercial transaction use case is used to gather requirements for commercial transaction specifications.

Tagged Values:

requestingBusinessFunction

The business function that is implemented by the requesting business partner who is performing a role with respect to the use case, e.g. Procurement.

respondingBusinessFunction

The business function that is implemented by the responding business partner who is performing a role with respect to the use case, e.g. Fulfillment.

Realize

A relationship between a business collaboration use case and the realization of a use case.

Associations:

base

The base use case for the collaboration in the realization relationship.

collaboration

The collaboration realization for the base use case.

PartnerType

A partner type is an actor in a business collaboration use case. Partner types are Manufacturer, Distributor, Retailer, End User, Carrier and Financier.

3.1.2 Well-formedness Rules

The following well-formedness rules apply to the business requirements view metamodel package:

1. All associations between partner types and business use cases must specify the partner type as the source of the association and the source association end must have a name that is the role of the partner type with respect to the commercial transaction use case to which it interfaces.

2. A commercial transaction use case may not be used in an «extend» association.

3. Commercial transaction use cases may not be the source of an «include» association.

4. Compliant models must have all use cases stereotyped as «BusinessCollaborationProtocolUseCase», to at least be either the source of an «include» association or the target of an «extend» association.

5. The name of the association between a partner type and a use case must be the name of input/output triggers of the use case.

6. All partner types in the model (classes stereotyped «PartnerType») must be defined as partner types, e.g. Manufacturer, Distributor, Reseller, Carrier, Financier and End User.

3.2 Model Semantics

The semantics of each element of the BRV metamodel is defined in this section.

Figure 3.2 illustrates the interrelationships between the BRV modeling elements.
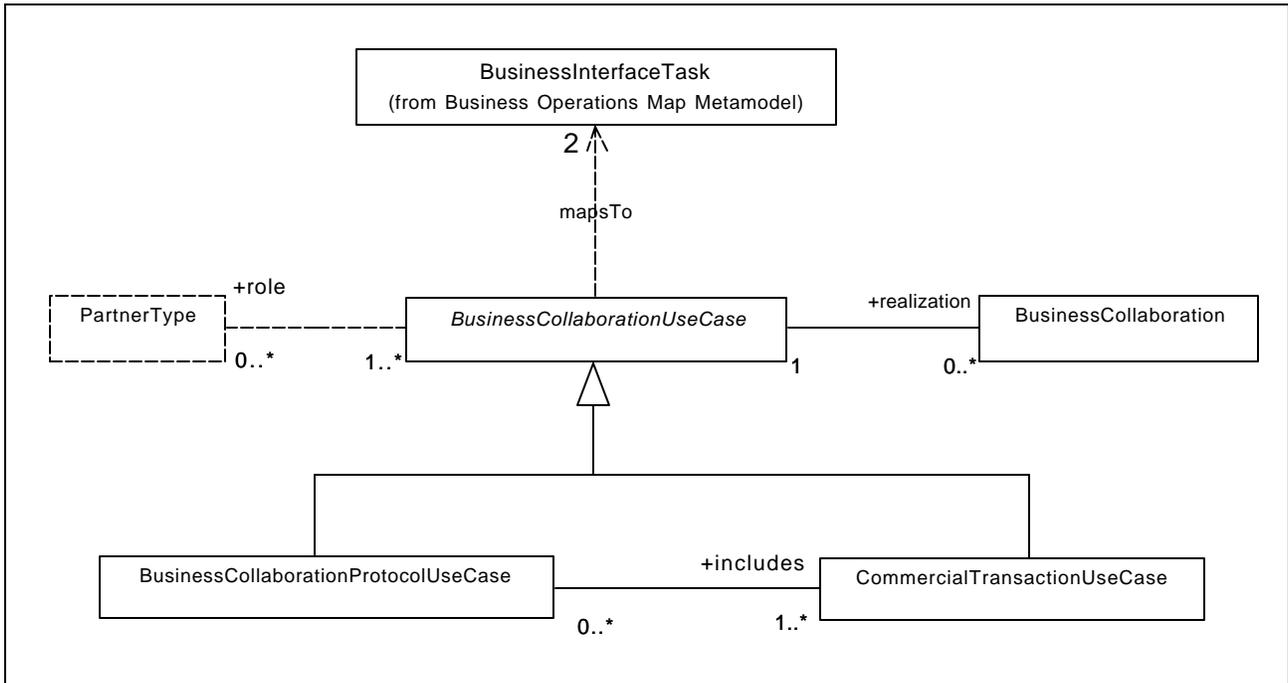
Figure 3.2   BRV Illustration

A business collaboration use case maps to two business interface tasks specified in a Business Operations Map. One task is the originator of a commercial contract and the other is a responder to the commercial contract. The business collaboration use case can either be a business collaboration protocol specification or a commercial transaction specification.

A commercial transaction specifies an initiating business partner starting the contract formation process by communicating a business document request to a responding business partner. A responding partner accepts the conditions of the commercial contract in zero or more returning business signals (e.g. an Acknowledgment of receipt) followed by an optional responding business document (e.g. an Acknowledgment of acceptance)[8].

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[8] Business Collaboration Protocol = (Request Signal* Response?) +

A business collaboration protocol choreographs commercial transactions when the contract formation process requires a number of requesting and responding business document exchanges. For example the creation of a purchase order request can be specified as a business collaboration protocol that choreographs both a purchase order and notification of acceptance commercial transactions. In these instances the responding business partner does not accept the entire purchase order offer in a response to the initial commercial transaction request. Instead the partner communicates line item acceptance of the purchase order using many notifications of acceptance over an agreed period. The contract is formed when the initiating business partner is able to reconcile all the notifications of acceptance with the original purchase order request.

A partner type performs a specific role in business collaboration. The partner roles are not employee or organization titles.

A business collaboration use case should capture both the requirements for forming commercial contracts and the requirements for auditing the formation of commercial contracts. A commercial transaction models the start and end of a commercial contract formation process. This is not always sufficient to capture the start and end of an auditable commercial formation process. For example, an offer and acceptance contract is formed once an originating partner receives the agreed "acceptance document." The fact that the sending partner does not receive a verification of proper receipt for an acceptance business document is immaterial to the formation of the contract. It may be important, however, if the sending partner wishes to retain an audit trail of the process for a receiving party to verify proper receipt of the business document.

3.3 Model Management Abstract Syntax

The BRV model can be a business collaboration protocol use case model or a commercial transaction use case model, together with business collaborations.

3.3.1 Stereotypes and Tagged Values

Figure 3.3 shows the metamodel for managing the BRV model. The modeling elements used to manage and organize these modeling elements are defined in this section.

| <<stereotype>> |
| BusinessRequirementsView |
| baseClass = "Model" |
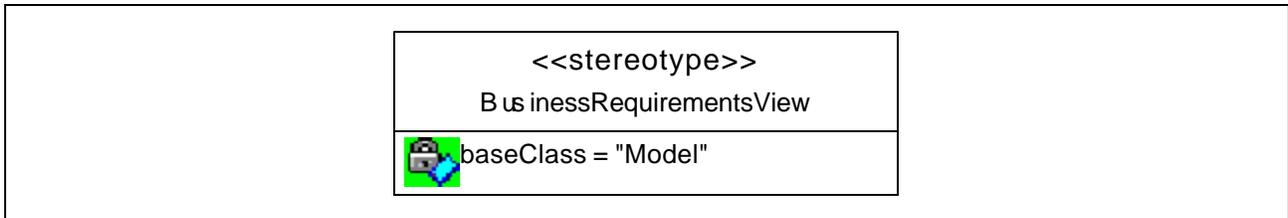
Figure 3.3   **BRV Model Management Abstract Syntax**

The following stereotypes and tagged values are contained in the BRV model management metamodel:

BusinessRequirementsView

The Business Requirements View specifies the requirements for one or more business collaborations.

3.3.2 Well-formedness Rules

The following well-formedness rules apply to the business requirements view metamodel package:

1. A business requirements view model contains only one business collaboration use case.

3.4 Model Management Semantics

The semantics of each element of the BRV model management metamodel is defined in this section.

Figure 3.4 illustrates the interrelationships between the BRV model management and model elements.
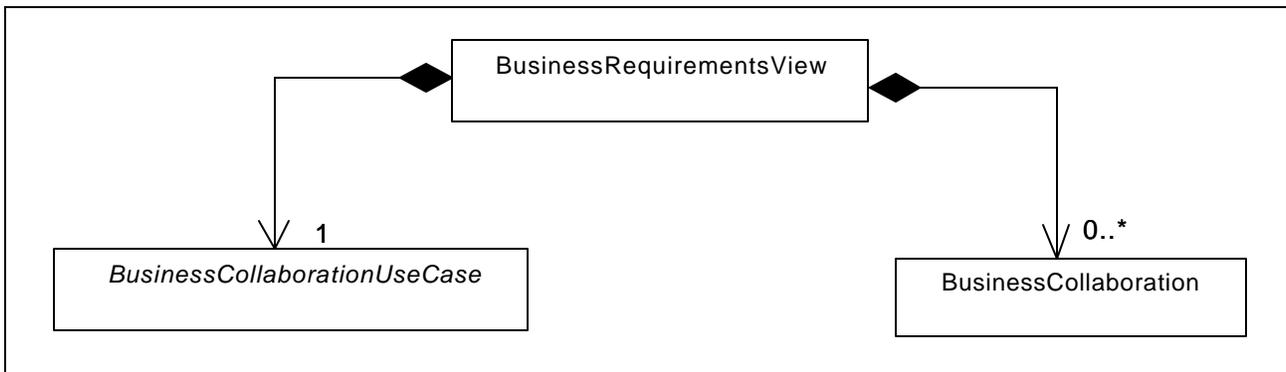
Figure 3.4   BRV Model Management Illustration

A business requirements view is a model of the requirements of a single business collaboration use case and its realizations as business collaborations.

4 The Business Operational View Metamodel

The BOV of a business collaboration model specifies the flow of business information[9] between business roles as they perform business activities. The business collaboration specification can be formal as in the formation of offer/acceptance commercial contracts as well as informal as in the announcement of new products.

This section specifies the abstract syntax and semantics of the BOV of the CT and BCP model and model management packages. The abstract syntax of models is specified using stereotypes and tagged values. The semantics of models are specified using the truth semantics of well–formed-formulae expressed with OCL expressions and with natural language.

4.1 Model Abstract Syntax

The syntax of e-business collaboration models comprises stereotypes and tagged values. The semantics of e-business collaboration models are specified using the truth semantics of well–formed-formulae (specified as OCL expressions) and with natural language.

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[9] The use the term "business information" is intentional as the BRV of a business process must capture the semantics of business information exchanged and not the data format or storage format of the information that is specified in the FSV.

4.1.1 Stereotypes and Tagged Values

Figure 4.1 specifies the modeling elements and their interrelationships that are used to express the structure and behavior of objects in the BOV of a CT and BCP model. Each element and interrelationship permitted in a BOV is defined in the metamodel specified in this section of the document.
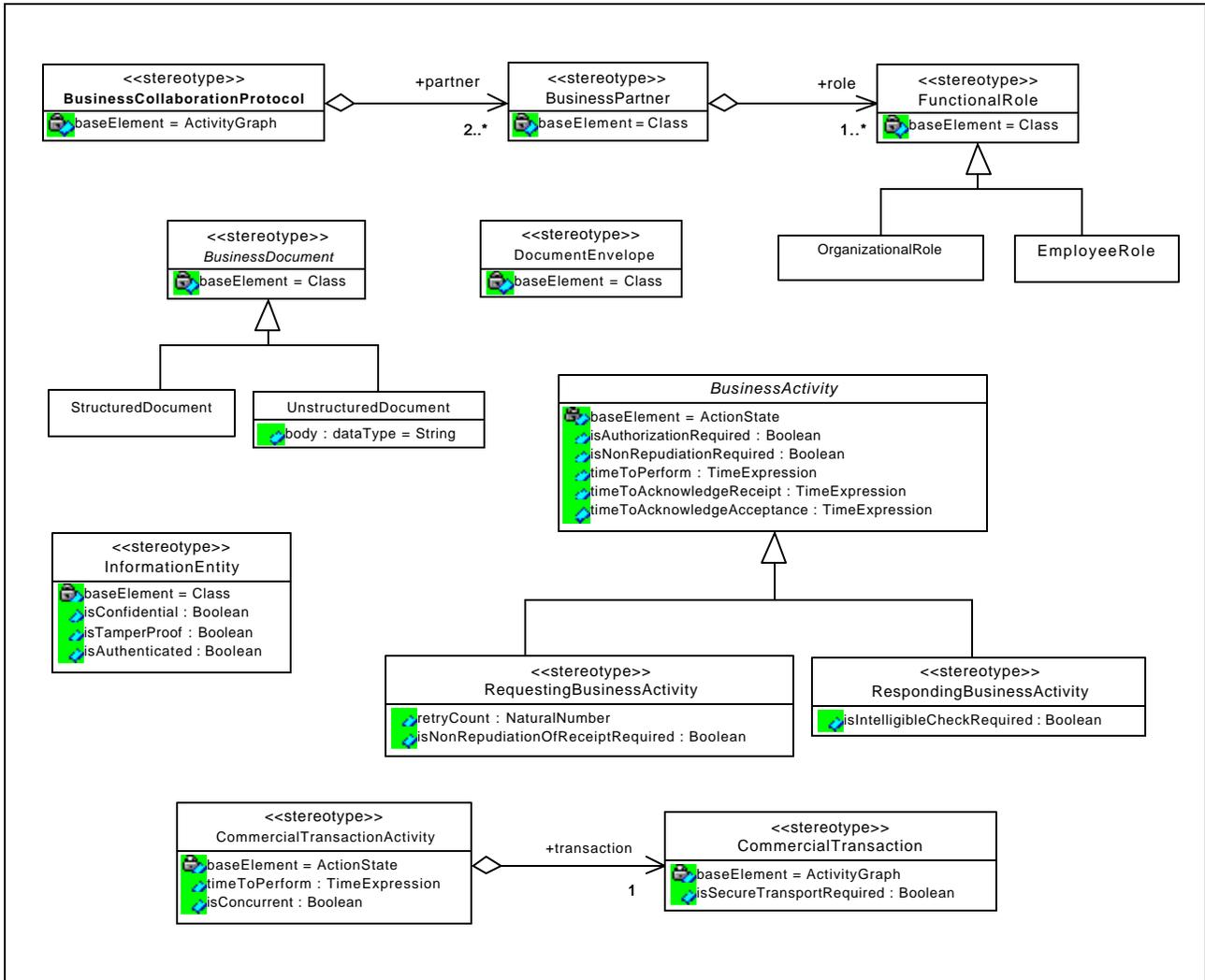
Figure 4.1   BOV Abstract Syntax

BusinessActivity[10]

The business activity is the state of a business action executed by a partner role during commercial transaction. This is an abstract class that is not a stereotype.

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[10] A business activity is derived from the UML Action State model element. This enables multiple exit and entry transitions for the requesting and responding activity states. A business activity is *not* derived from the UML Call State model element that typically models the behavior of an operation. An Activity state does not have an internal transition, exit action or a do activity. The entry action of a Call State is a single call action.

Tagged Values:

IsAuthorizationRequired

If a partner role needs authorization to request a business action or to respond to a business action then the sending partner role must sign the business document exchanged and the receiving partner role must validate this business control and approve the authorizer. A responding partner must signal an authorization exception if the sending partner role is not authorized to perform the business activity. A sending partner must send notification of failed authorization if a responding partner is not authorized to perform the responding business activity.

isNonRepudiationRequired

If non-repudiation of origin and content is required then the business activity must store the business document in its original form for the duration mutually agreed to in a trading partner agreement. A responding partner must signal a business control exception if the sending partner role has not properly delivered their business document. A requesting partner must send notification of failed business control if a responding partner has not properly delivered their business document.

This property provides the following audit controls:

Verify sending role identity (authenticate)[11]—Verify the identity of the sending role (employee or organization). For example, a driver's license or passport document with a picture is used to verify an individual's identity by comparing the individual against the picture.

Verify content integrity[12]—Verify the integrity of the original content sent from a partner role i.e. check that the content has not been altered by a 3rd party while the content was exchanged between partners.

timeToPerform

Both partners agree to perform a commercial transaction within a specific duration. A responding partner must exit the transaction if they are not able to respond to a business document request within the agreed time-out period. A sending partner must retry a commercial transaction if necessary or must send notification of failed business control (possibly revoking a contractual offer) if a responding partner does not deliver their business document within the agreed time period. The time to perform is the duration from the time a business document request is sent by a requesting partner role until the time a responding business document is "properly received[13]" by the requesting partner role. Both partners agree that the business signal document or business action document specified as the document to return within the time to perform is the "Acceptance Document[14]" in an on-line offer/acceptance contract formation process.

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[11] The BCF specifies digital signatures for partner-to-partner non-repudiation of origin and content.
[12] The BCF specifies MD5 or SHA-1 message digest algorithms and asymmetric encryption to provide content integrity.
[13] "Properly received" is legally defined in a trading partner agreement. Refer to the "Create Trading Partner Agreement" commercial transaction specification in the BCF.
[14] This is not a business acceptance document.

TimeToAcknowlegeReceipt

Both partners agree to mutually verify receipt of a requesting business document within specific time duration. A responding partner must exit the transaction if they are not able to verify the proper receipt of a business document request within the agreed time-out period. A sending partner must retry a commercial transaction if necessary or must send notification of failed business control (possibly revoking a contractual offer) if a responding partner does not verify properly receipt of a business document request within the agreed time period. The time to acknowledge receipt is the duration from the time a business document request is sent by a requesting partner until the time a verification of receipt is "properly received" by the requesting business partner. This verification of receipt is an auditable business signal and is instrumental in contractual obligation transfer during a contract formation process (e.g. offer/accept).

timeToAcknowledgeAcceptance

Both partners agree to the need for a business acceptance document to be returned by a responding partner after the requesting business document passes a set of business rules. The time to acknowledge business acceptance of a requesting business document is the duration from the time a requesting partner sends a business document until the time an Acknowledgment of acceptance is "properly received" by the requesting partner. A responding partner must exit the transaction if they are not able to acknowledge business acceptance of a business document request within the agreed time-out period. A sending partner must retry a commercial transaction if necessary or must send notification of failed business control (possibly revoking a contractual offer) if a responding partner does not acknowledge acceptance of a business document within the agreed time period.

RequestingBusinessActivity

A requesting business activity is a business activity that is performed by a partner role requesting commerce from another business partner role.

Tagged Values:

isNonRepudiationOfReceiptRequired

Both partners agree to mutually verify receipt of a requesting business document and that the receipt must be non-reputable. A receiving partner must send notification of failed business control (possibly revoking a contractual offer) if a responding partner has not properly delivered their business document.

Non-repudiation of receipt provides the following audit controls:

Verify responding role identity (authenticate) [15]—Verify the identity of the responding role (individual or organization) that received the requesting business document.

Verify content integrity[16]—Verify the integrity of the original content of the business document request.

retryCount

Both partners agree to the number of times to retry a transaction when a time-out exception condition is signaled. This parameter only applies to time-out signals and not business process controls or document content exceptions.

---

[15] The BCF specifies digital signature for partner-to-partner non-repudiation of origin and content.
[16] The BCF specifies MD5 or SHA-1 message digest algorithms and asymmetric encryption to provide content integrity.

RespondingBusinessActivity

A responding business activity is a business activity that is performed by a partner role responding to another business partner role's request for commerce.

Tagged Values:

isIntelligibleCheckRequired

Both partners agree that a responding partner role must check that a requesting document is not garbled (unreadable, unintelligible) before verification of proper receipt is returned to the requesting partner. Verification of receipt must be returned when a document is "accessible" but it is preferable to also check for garbled transmissions at the same time in a point-to-point synchronous business network where partners interact without going through an asynchronous service provider.

InformationEntity

An information entity realizes structured business information that is exchanged by partner roles performing activities in a commercial transaction. Information entities include or reference other information entities through associations.

A secure information entity is an information entity with security controls. Security controls must be specified when information must be secured within an enterprise until it is accessed by an authorized partner role.

These parameters on this model element must be specified in a manner that ensures document integrity by maintaining a "chain-of-custody" from the sender to the intended recipient of the business information.

Tagged Values:

isConfidential

The information entity is encrypted so that unauthorized parties cannot view the information.

isTamperProof

The information entity has an encrypted message digest that can be used to check if the message has been tampered with. This requires a digital signature (sender's digital certificate and encrypted message digest) associated with the document entity.

isAuthenticated

There is a digital certificate associated with the document entity. This provides proof of the signer's identity.

StructuredDocument

A structured document is an information entity container.

UnstructuredDocument

An unstructured document is any document that is not comprised of document entities.

Tagged Values:

dataType

This property specifies the document type. It is recommended that a registered MIME type be used for this property (refer to http://www.iana.org) for registered MIME types. Partners can agree to use their own experimental MIME types.

OrganizationalRole[17]

Only an organization performs a particular role in an e-business collaboration. An employee does not perform these activities.

FunctionalRole[18]

A partner role is a functional role, an employee role or an organizational role. Either an employee role or an organizational role can perform a functional role.

An organizational role must be performed by a conforming network component that provides a business service.

EmployeeRole[19]

An employee for business/legal reasons can only perform an employee role. Usually the details of the employee must be captured and stored/transmitted to another partner for auditing/liability purposes when the two partner roles are not in the same organization.

CommercialTransaction

A commercial transaction is a set of business information and business signal exchanges between two commercial partners that must occur in an agreed format, sequence and time period. If any of the agreements are violated then the transaction is terminated and all business information and business signal exchanges must be discarded. Commercial transactions can be formal as in the formation of on-line offer/acceptance commercial contracts and informal as in the distribution of product announcements. Commercial transactions can comprise sub-transactions.

Tagged Values:

isSecureTransportRequired

Both partners must agree to exchange business information using a secure transport channel. The following security controls ensure that business document content is protected against unauthorized disclosure or modification and that business services are protected against unauthorized access. This is a point-to-point security requirement. Note that this requirement does not protect business information once it is off the network and inside an enterprise. The following are requirements for secure transport channels:

---

[17] Specifying an organizational role is a FSV requirement to model a network component design that can support an organization performing the specified business activity. An employee cannot perform this activity.
[18] Specifying a partner role is a FSV requirement to create a network component design that can support an employee as well as an organization when performing the specified business activity.
[19] Specifying an employee role limits the number of network component configurations that must be considered in the FSV of the model. Only specify an employee role if only an employee can perform the specified business activity.

Authenticate sending role identity[20]—Verify the identity of the sending role (employee or organization) that is initiating the role interaction (authenticate). For example, a driver's license or passport document with a picture is used to verify an individual's identity by comparing the individual against the picture.

Authenticate receiving role identity—Verify the identity of the receiving role (employee or organization) that is receiving the role interaction.

Verify content integrity[21]—Verify the integrity of the content exchanged during the role interaction, i.e. check that a 3rd party has not altered the content.

Maintain content confidentiality[22]—Confidentiality ensures that only the intended, receiving role can read the content of the role interaction. Information exchanged during role interaction must be encrypted when sent and decrypted when received. For example, envelopes are sealed so that only the recipient can read the content.

BusinessCollaborationProtocol

A business collaboration protocol choreographs one or more commercial transaction activities. A business collaboration protocol is not a transaction and should be used in cases where transaction rollback is inappropriate. For example, a buying partner may send a purchase order request to a selling partner. The selling partner may partially accept the purchase order and thus complete the transaction but may only return shipping information on part of the order. The buying partner is sent any number of later notifications regarding the outstanding portions of the order until the order is completely reconciled.

partner

The partners that collaborate are enumerated so that they can be associated with the roles that they provide in each of the commercial transaction activities.

BusinessPartner

The business partners that participate in business collaborations are enumerated for each business collaboration protocol. Partners provide the initiating and responding roles in the protocol.

role

The roles provided by each of the partners in the business collaboration protocol. A partner provides each initiating and responding role in a commercial transaction activity.

CommercialTransactionActivity

A commercial transaction activity is a business collaboration protocol activity that executes a specified commercial transaction. The commercial transaction activity can execute more than one instance of the commercial transaction at a time if the *isConcurrent* property is *true*.

---

[20] The BCF specifies digital certificates and SSL to verify the identity of sending (and receiving) roles (individuals and organizations).
[21] The BCF specifies digital certificates and SSL to provide point-to-point content integrity.
[22] The BCF specifies digital certificates and SSL for point-to-point encryption and decryption.

Tagged Values:

timeToPerform

Both partners agree to perform a commercial transaction activity within a specific duration. The originating partner must send a failure notification to a responding partner upon time out. A responding partner simply terminates its activity. The time to perform is the duration from the time a commercial transaction activity initiates the first commercial transaction until there is a transition back to the initiating commercial transaction activity. Both partners agree that the business signal document or business action document specified as the document to return within the time to perform is the "Acceptance Document[23]" in an on-line offer/acceptance contract formation process.

transaction

This property relates a specific commercial transaction to a commercial transaction activity. The commercial transaction activity executes instances of the commercial transaction.

isConcurrent

If the commercial transaction activity is concurrent then more than one commercial transaction can be open at one time. If the commercial transaction activity is not concurrent then only one commercial transaction activity can be open at one time.

DocumentEnvelope

A document envelope is a container for structured and unstructured business documents.

4.1.2 Well-formedness Rules

The following well-formedness rules apply to the business operational view metamodel package:

BusinessActivity

1. If non-repudiation is required then the input or returned business document must be a tamper-proofed entity.

2. If authorization is required then the input business document and business signal must be an authenticated or a tamper-proofed secure entity.

3. The time to acknowledge receipt must be less than the time to acknowledge acceptance if both properties have values.

   timeToAcknowlegeReceipt < timeToAcknowlegeAcceptance

4. If the time to acknowledge acceptance is null then the time to perform an activity must either be equal to or greater than the time to acknowledge receipt.

5. The time to perform a transaction cannot be null if either the time to acknowledge receipt or the time to acknowledge acceptance is not null.

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[23] This is not a business acceptance document.

6. If non-repudiation of receipt is required then the time to acknowledge receipt cannot be null.

7. The time to acknowledge receipt, time to acknowledge acceptance and time to perform cannot be zero.

8. If non-repudiation is required at the requesting business activity, then there must be a responding business document.

9. The time to acknowledge receipt, time to acknowledge acceptance and time to perform properties must be specified for both the requesting and responding business activities.

RequestingBusinessActivity

10. There must be one input transition whose source state vertex is an initial pseudo state.

11. There must be one output transition whose target state vertex is a final state specifying the state of the machine when the activity is successfully performed.

12. There must be one output transition whose target state vertex is a final state specifying the state of the machine when the activity is not successfully performed.

13. There must be one output transition to an object state that in turn has one output transition to a responding business activity.

14. There must be zero or one input transitions from an object state that in turn has one input transition from a responding business activity.

RespondingBusinessActivity

15. There must be one input transition from an object state that in turn has one input transition from a requesting business activity.

16. There must be zero or one output transition to an object state that in turn has an output transition to a requesting business activity.

Object Flow State

17. The source and target of an object flow state must not be the same business activity.

18. The source and target of the requesting object flow state must be opposite to the source and target of the responding object flow state.

Information Entity

19. The associations on an information entity must be aggregation relationships with other information entities to form a partonomy, a hierarchical decomposable arrangement of business document parts.

20. The information entity associations must only be navigable from a containing entity to an element entity (has-part relationship).

21. Constraints on an information entity association must be specified on the role of the part (supplier) with respect to the whole (client).

22. The client and supplier of an entity association must not be the same entity.

Business Collaboration Protocol

23. A business partner cannot provide both the initiating and responding roles of the same commercial transaction activity.

4.2 Model Semantics

The semantics of each element of the BOV model metamodel is defined in this section.

Figure 4.2 illustrates the interrelationships between the BOV model elements.
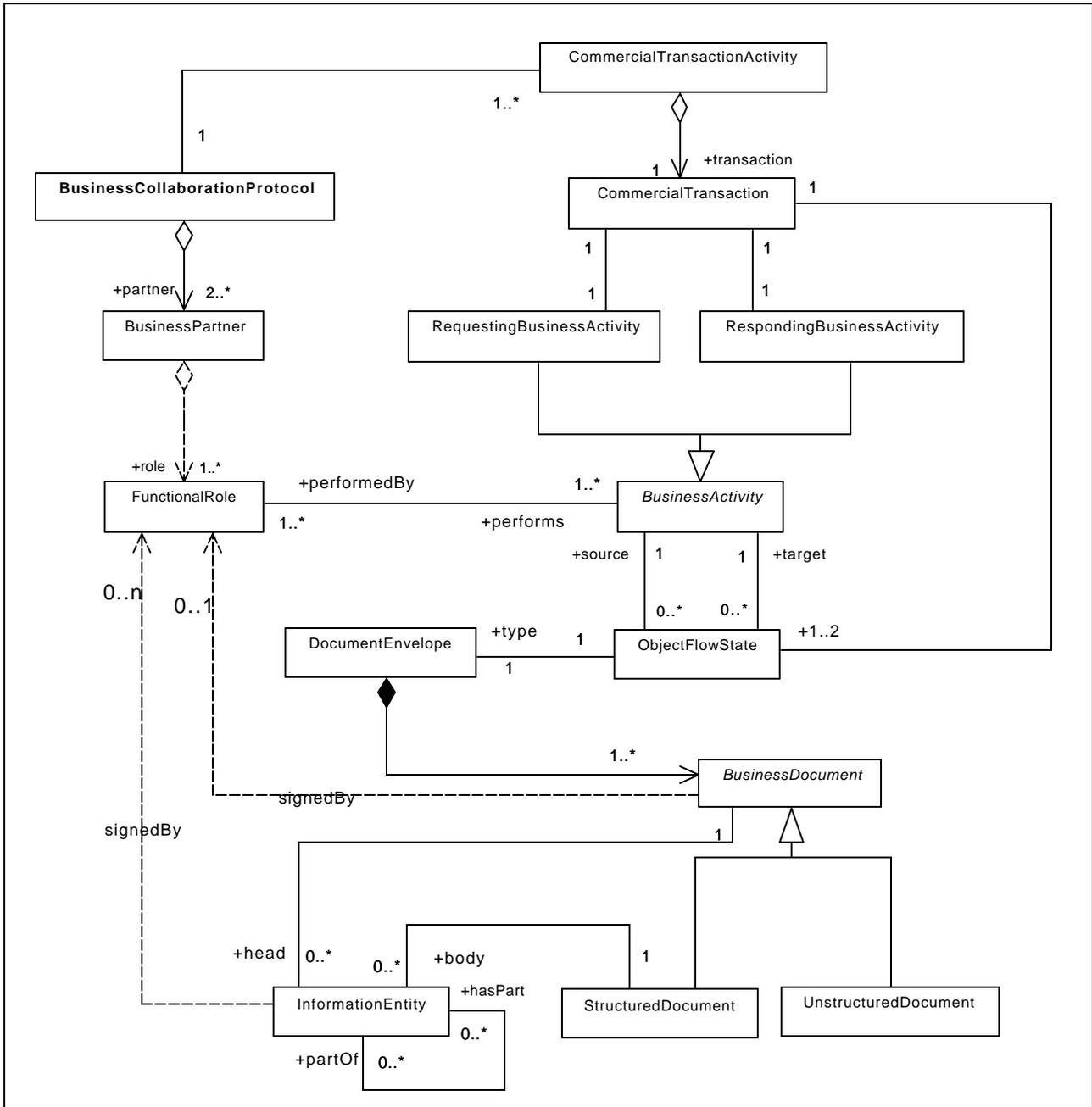
Figure 4.2   BOV Illustration

4.2.1 Business Activities

A business activity is an activity performed by a partner role participating in a commercial transaction. There are two business activities in a commercial transaction each of which is performed by one of two partners engaged in a commercial endeavor. A business partner that is initiating the commercial transaction performs a requesting business activity. A business partner that is responding to a request to engage in a commercial transaction performs a responding business activity.

A commercial transaction specifies either a synchronous or asynchronous flow of control between two activities. The commercial transaction is a unit of work. All of the interactions in a commercial transaction must succeed or the transaction must be rolled back to a defined state before the transaction was initiated.

There are two business signals that can be asynchronously returned to the initiator of the commercial transaction: a business signal to verify proper receipt of a business document request and a business signal to non-substantively confirm the acceptance of a requesting business document for business processing.

If any of the time-out parameters are exceeded, a time-out exception must be thrown. If the *retryCount* property on the responding business activity is greater than zero then the commercial transaction must be re-initiated (or a notification of failed business control—possibly revoking a contractual offer—must be sent). All business signals and business documents returned after the transaction was initiated and up until the time-out exception must be discarded. The recurrence property specifies the number of times a commercial transaction must be initiated. If the recurrent property value is 3 then the commercial transaction can be initiated a total of 4 times (the first initiation plus 3 retries). The time to perform property specifies the time to perform a single commercial transaction.

A responding partner simply terminates if a time out is thrown. This prevents responding commercial transactions from hanging indefinitely.

A partner role that initiates an asynchronous commercial transaction does not need to receive any business signals. A partner role that initiates a synchronous commercial transaction must be able to receive business signals and must block until the flow of control is returned. This should not preclude the initiation and execution of multiple concurrent commercial transactions, however.

If any business exceptions (includes negative receipt and acceptance Acknowledgments) are signaled then the commercial transaction must terminate. The commercial transaction must not be re-initiated even if the *retryCount* parameter is not zero. Commercial transactions must only be retried if a time-out exception is thrown.

There are two business signals that are used for on-line commercial contract formation and auditing:

- Acknowledge receipt business signal. The UN/EDIFACT model Trading Partner Agreement (TPA) suggests that a partners should agree on the point at which a message can be "said" to be properly received and this point should be when a receiving partner can "read" a message. They suggest this should be the point after which a message passes a structure/schema validity check. Note that this is not a necessary condition for verifying proper receipt, only accessibility is. The property *isIntelligibleCheckRequired* allows partners to agree that a message should be "readable" before its receipt is verified[24].

- Acknowledge acceptance business signal. The UN/EDIFACT model TPA suggests that partners should agree on the point at which a message can be "said" to be accepted for business processing and this point should be after the contents of a business document have passed a business rule validity check. For example, if 100,000,000,000 copies of a single book are ordered from Amazon it can be assumed it will fail some business rule check. These business rules are often found in trading contracts.

Figure 4.3 and Figure 4.4 (see following landscape pages) show the valid activity states for requesting and responding partner roles respectively. The behavior of each role is determined by the values specified for each business activity.

Business modelers may find it convenient to develop commercial transaction design patterns to facilitate the development of their specifications (refer to BCF#8, "E-business Collaboration Design Patterns," for definitions). The following six property-value conventions for commercial transactions have proven useful in the application of the metamodel to existing business requirements:

1. Business Transaction
2. Request/Confirm
3. Query/Response
4. Request/Response
5. Notification
6. Information Distribution

---

[24] This is the convention specified for RosettaNet commercial transactions.

These conventions are applied by stereotyping the requesting business activity with the following syntax:

Transaction	Stereotype
Business Transaction	«ServiceTransactionActivity»
Request/Confirm	«RequestConfirmActivity»
Query/Response	«QueryResponseActivity»
Request/Response	«RequestResponseActivity»
Notification	«NotificationActivity»
Information Distribution	«InformationDistributionActivity»

Table 4.1   Property-Value Conventions for Commercial Transactions
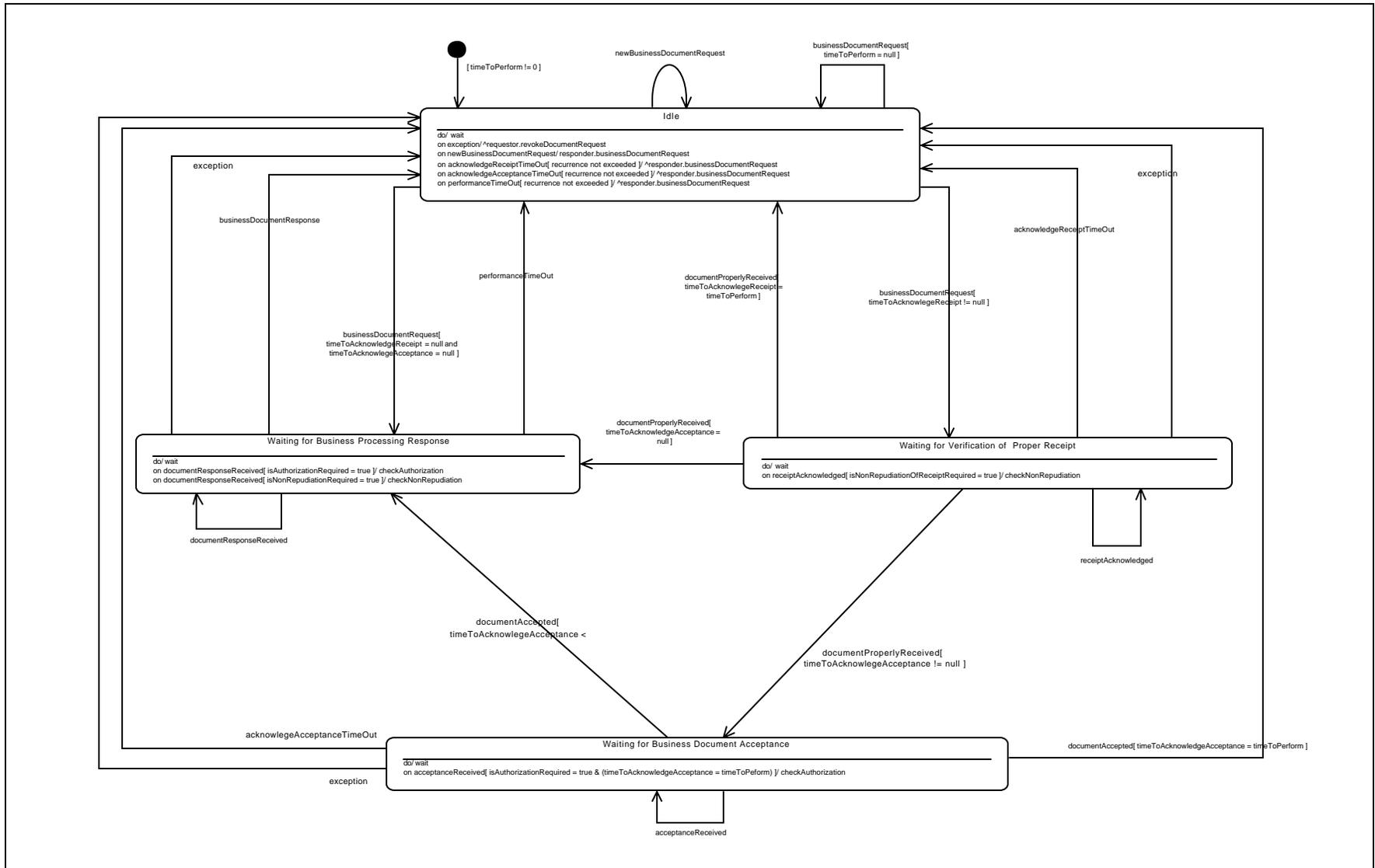
Figure 4.3   **Requesting Business Activity States**

Figure 4.4   **Responding Business Activity States**

Table 4.2 specifies the property-values for requesting business activities for each of the commercial transaction stereotypes.

	TIME TO ACKNOWLEDGE RECEIPT	TIME TO ACKNOWLEDGE ACCEPTANCE	TIME TO PERFORM	AUTHORIZATION REQUIRED	NON-REPUDIATION OF ORIGIN AND CONTENT	NON-REPUDIATION OF RECEIPT	RECURRENCE
Business Transaction	2 hrs	6 hrs	24 hrs	true	true	true	3
Request/ Confirm	null	null	24 hrs	false	false	true	3
Request/ Response	null	null	4 hrs	false	false	null	3
Query/ Response	null	null	4 hrs	false	false	null	3
Notification	24 hrs	null	24 hrs	false	true	true	3
Information Distribution	24 hrs	null	24 hrs	false	false	false	3

Table 4.2   Property-Values for Requesting Business Activities

Table 4.3 specifies the property-values for property-values for responding business activities business activities for each of the commercial transaction stereotypes.

	TIME TO ACKNOWLEDGE RECEIPT	TIME TO ACKNOWLEDGE ACCEPTANCE	TIME TO PERFORM	AUTHORIZATION REQUIRED	NON-REPUDIATION OF ORIGIN AND CONTENT
Business Transaction	2 hrs	6 hrs	24 hrs	true	true
Request/ Confirm	2 hrs	null	24 hrs	true	false
Request/ Response	null	null	4 hrs	false	false
Query/ Response	null	null	4 hrs	false	false
Notification	24 hrs	null	24 hrs	false	false
Information Distribution	24 hrs	null	24 hrs	false	false

Table 4.3   Property-Values for Responding Business Activities

It is recommended that the following stereotype be used on the responding business activity when authorization is required for a responding activity to respond to a business document request:

Business Activity	**Stereotype**
Authorized Activity	«AuthorizedActivity»

Table 4.4   Stereotype on the Responding Business Activity

Another convention that makes the application of these stereotypes easier, is to only stereotype the requesting business activity when a symmetrical business relationship is designed. With this convention the time to perform, time to acknowledge receipt, time to acknowledge acceptance, non-repudiation and authorization requirements are assumed symmetrical and thus applicable equally to both the requesting and responding business activities.

4.2.1.1 TIME-OUT EXCEPTIONS

A time-out parameter must be specified whenever a requesting partner expects one or more responses to a business document request. A requesting partner must not remain in an infinite wait state. There must be a time-out parameter specified for each expected response. There are four possible responses and hence four potential time-out specifications:

Acknowledge Receipt—The time a responding role has to acknowledge receipt of a business document.

Non-Substantive Acknowledge Business Acceptance—The time a responding role has to non-substantively acknowledge business acceptance of a business document.

Substantive Acknowledge Business Acceptance—The time a responding role has to substantively acknowledge business acceptance of a business document.

Perform Transaction—The time a commercial transaction has to complete.

The time-out value for each of the time-out parameters is absolute, i.e. not relative to each other. All timers start when the requesting business document is sent. The timer values must comply with the well-formedness rules in the previous section.

If the retry count is not zero and a time-out condition is signaled for any of the expected responses then the original business document must be resent from the initiating partner role. The original business document must be sent even if responding Acknowledgments have already been received.

If an initiating partner receives a response after a time-out condition is signaled and the original business document has already been resent then this must be ignored. A responding partner that receives a business document from a retry must terminate their responding transaction for the previous business document and the retry request must be serviced.

Upon sending a business document retry, it MUST be guaranteed that the sending party resends an identical business document, save for a timestamp. Otherwise, a receiving partner must be capable of rolling back an incoming business document at any point in time through the acknowledgment interval, acceptance interval, and back-end processing interval.

When the time to perform an activity equals the time to acknowledge receipt or the time to acknowledge business acceptance then the highest priority time-out exception must be used when the originator provides a reason for revoking their original business document offer. The time to perform exception is lower priority than the time to acknowledge business acceptance, which is in turn lower priority than the time to acknowledge receipt.

4.2.1.2 BUSINESS PROTOCOL EXCEPTIONS

A business protocol exception terminates the business transaction. The following are business protocol exceptions:

1. Negative Acknowledgment of receipt—The structure/schema of a message is invalid. Note that when Acknowledgment of receipt is not used, invalid structure/schema results in a syntax exception.

2. Negative Acknowledgment of acceptance—The business rules are violated.

3. Performance exceptions—The requested business action cannot be performed.

4. Sequence exceptions—The order or type of a business document or business signal is incorrect.

5. Syntax exceptions—There is invalid punctuation, vocabulary or grammar in the business document or business signal.

6. Authorization exceptions—Roles are not authorized to participate in the commercial transaction.

7. Business process control exceptions—Business documents are not signed for non-repudiation.

A responding role that throws a business protocol exception signals the exception back to the requesting role and then terminates the commercial transaction. A requesting role that throws a business protocol exception terminates the transaction and then sends a notification revoking the offending business document request. The requesting role cannot send a business signal to the responding role.

4.2.1.3 PATTERN PROPERTY MODIFICATION RULES

1. The following rules apply when modifying design pattern properties:

2. If the convention for a time property value is greater than zero then it cannot be changed to NA.

3. If the convention for a time property value is NA then it cannot be changed. This is because the change would add or remove a role interaction that is not allowed, as it will change the convention.

4. The non-repudiation values specified in the convention cannot be changed except that both Query/Response and Request/Confirm can be changed to non-repudiation required. Changing any of the other non-repudiation values would change the semantic meaning of the commercial transaction.

5. The Authorization Required property can only be changed to false. It cannot be changed to true if it is already set to false according to the convention.

4.2.2 Requesting Business Activity

Preconditions and post-conditions may be specified when there are structure or content constraints that apply to the document when it is used in a particular commercial transaction. Preconditions are specified in the guard of a transition from the initial pseudo state to a requesting business activity. Post-conditions are specified in the guard of a transition from a requesting business activity to state vertex that is the state of the machine when the business activity is successfully performed.

4.2.3 Object Flow State

Object flow states specify the business document flow between roles as they perform business activities. Each object flow state has a source and target business activity.

An object flow state has a type that is a document envelope. An envelope contains one or more structured or unstructured business documents. A business document is signed if non-repudiation of origin and content is required. A detached signature is used to provide non-repudiation of origin and content of a business document as it pertains to the entire document. The signature must be part of the business document for authorization as the content of the document is authorized.

Structured business documents contain information entities. Information entities contain other information entities. Containment is modeled using UML associations.

4.2.4 Business Collaboration Protocol

Business Collaboration Protocol will be specified in a future version of this document.

4.2.5 BOV-to-BRV Mapping

A BOV model is the business operational view of a business process that meets the requirements of a business process as described in a BRV model. Figure 4.5 illustrates the elements of the BOV metamodel that map to elements of the BRV metamodel.
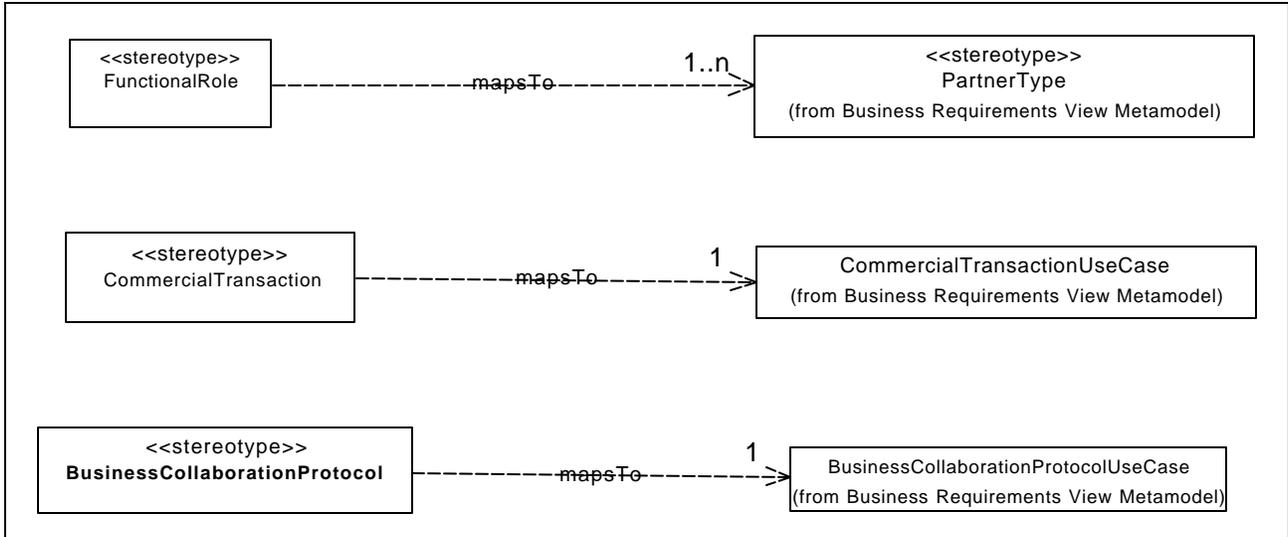
Figure 4.5   BOV-to-BRV Syntax Map

A functional role in the BOV is a refinement of a partner type performing a particular role as described in a commercial transaction use case. A commercial transaction is an activity graph that is a refinement of a commercial transaction use case. Functional roles are modeled in a commercial transaction activity graph and partner types and their roles are modeled in a use case model. The conditional constraints on business information that are described in BRV collaborations are described using business information entity constraints and business activity constraints.

A business collaboration protocol activity graph is a refinement of a business collaboration protocol use case.

4.3 Model Management Abstract Syntax

Business collaboration models specify business process participants interacting while executing a business process. A complete business collaboration model must comprise the following kinds of modeling elements: business process information, business process participants, and business process flow. The specific modeling elements used to manage and organize these three modeling elements are described in this section.

4.3.1 Stereotypes and Tagged Values

Figure 4.6 shows the metamodel for managing business collaboration models. The modeling elements used to manage and organize these three specifications are described in this section.

<<stereotype>>

BusinessOperationalView

baseElement = Model
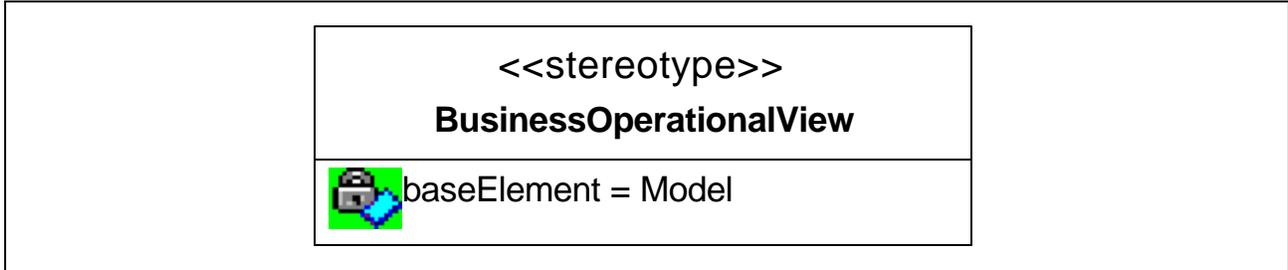
Figure 4.6   BOV Model Management Abstract Syntax

The following stereotypes and tagged values are contained in the business operational view management metamodel:

BusinessOperationalView

The business operational view of an e-business collaboration model comprises diagrams and specifications that show the flow of business data entities between roles as they perform business activities.

4.3.2 Well-formedness Rules

The following well-formedness rules apply to the business operational view metamodel package:

BusinessOperationalView

1. A business operational view must comprise one commercial transaction or business collaboration protocol state machine.

4.4 Model Management Semantics

The semantics of each element of the BOV model management metamodel is defined in this section.

Figure 4.7 illustrates the interrelationships between the BOV model management and model elements.
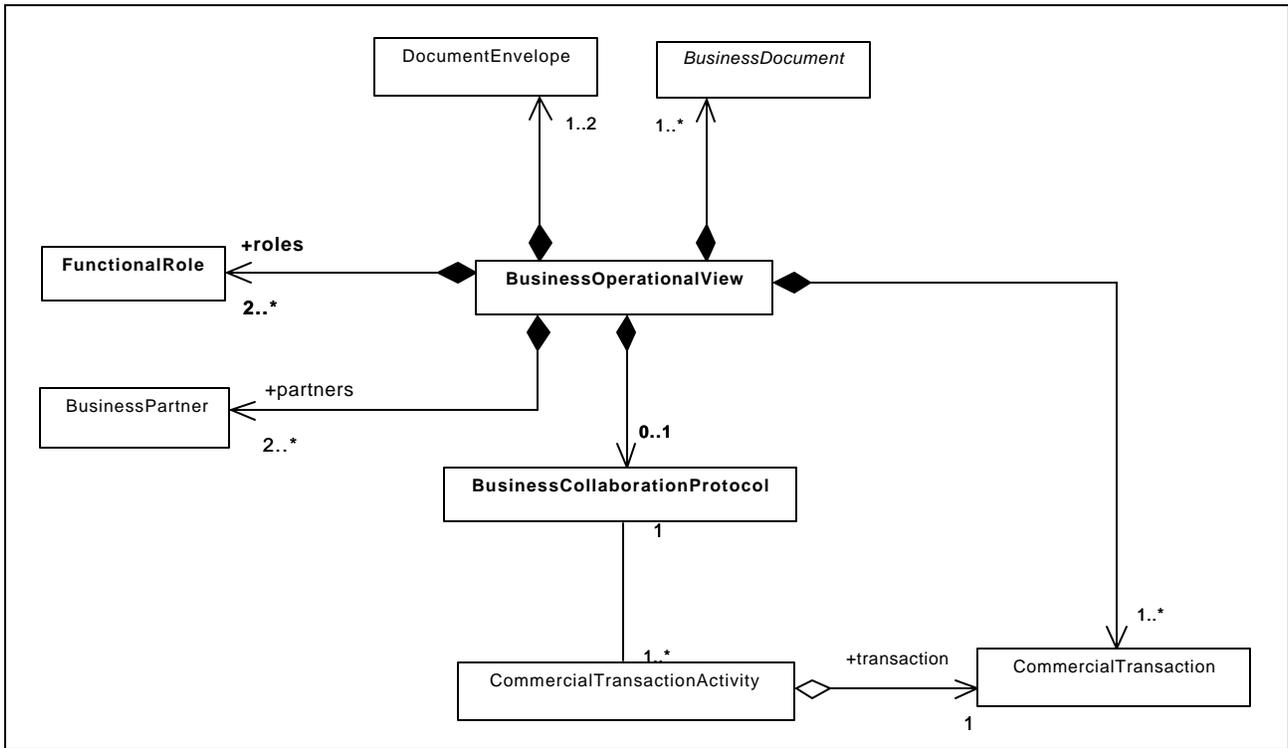
Figure 4.7   BOV Model Management Illustration

The Business Operational View contains all the objects and activity graphs in the BOV model. A BOV model can comprise zero or one business collaboration protocol specifications and can comprise one or more commercial transaction specifications.

5 The Functional Service View Metamodel

The Functional Service View (FSV) of the e-business collaboration metamodel captures the syntax and semantics of business actions and their exchange between network components that provide business services. The FSV's metamodel specifies the elements of an execution process (Service Collaboration) that comprises business transaction exchange between network component business services as a result of the execution of business activities. The functional service model is a reification of the business operational view model.

The first part of this section specifies the syntax and semantics of execution processes. The second part of this section specifies the organizational management elements of these execution process models.

5.1 Model Abstract Syntax

5.1.1 Stereotypes and Tagged Values

Figure 5.1 specifies the modeling elements and their interrelationships that are used to express the structure and behavior of objects in the FSV of a Commercial Transaction and Business Collaboration Protocol model. Each element and interrelationship permitted in a FSV is defined in the metamodel specified in this section of the document.

Functional Service View Metamodel (Collaboration Elements)

```
          <<stereotype>>                           EnterpriseComponent
         BusinessTransaction
 baseElement = Class                      perform(a : RequestingBusinessTransaction)
 isNonRepudiationRequired : Boolean       perform(a : RequestingBusinessTransaction) : RequestingBusinessTransaction
 isAuthenticationRequired : Boolean       return(a : RespondingBusinessTransaction)
 timeToPerform : TimeExpression           isValid(a : BusinessTransaction) : Boolean
 timeToAcknowledgeReceipt : TimeExpression  isAcceptable(a : BusinessTransaction) : Boolean
 timeToAcknowledgeAcceptance : TimeExpression
```

```
        <<stereotype>>                           <<stereotype>>
   RequestingBusinessTransaction           RespondingBusinessTransaction
 recurrence : NaturalNumber                isIntelligibleCheckRequired : Boolean
 isNonRepudiationOfReceiptRequired : Boolean
```

```
        <<stereotype>>                           <<stereotype>>
      NetworkComponent                         ServiceCollaboration
 baseElement = Class                       baseElement = Collaboration
 isSecureTransportRequired : Boolean
```

```
                                              <<stereotype>>
                                              BusinessService
       <<stereotype>>                    callTransaction(a : RequestingBusinessTransaction)
          Agent                          request(a : RequestingBusinessTransaction)
                    +forService          signal(a : BusinessSignal)
 return(a : BusinessTransaction)         response(a : RespondingBusinessTransaction)
 transfer(a : BusinessTransaction)   1   return(a : RespondingBusinessTransaction)
                                         checkProcessControls()
                                         checkSecurityControls()
```

```
      <<stereotype>>                           BusinessMessage
     MessageEnvelope
 baseElement = Class                      <<>>baseElement = Class
```

```
      <<stereotype>>                         BusinessSignalMessage
   BusinessActionMessage
                                          baseElement = Class
```

Figure 5.1   FSV Abstract Syntax

Agent

An agent is a network component that must implement protocols up to the agent layer of the e-business network application, communications model.

Associations:

forService

An agent acts on behalf of a service.

Operations:

return(a:BusinessActionMessage)

Return a business action message to this agent. This agent becomes the owner of the business action. The argument may not be null.

transfer(a: BusinessActionMessage)

Transfer a business action message to this agent. This agent becomes the owner of the business action. The argument may not be null.

BusinessService

A business service is a network component that responds to business transaction requests initiated by other services.

Operations:

callTransaction(a: RequestingServiceTransaction)

This operation will be specified in a future version of this document.

response(a:BusinessAction)

Response to a timed (synchronous) business action request.

request(a:BusinessAction)

Request to perform a business action. This request can be timed or asynchronous.

signal(a:BusinessAction)

Asynchronous signal returned for security, auditing and execution control.

return(a:BusinessAction)

Return a business transaction from an enterprise component after a business action has been performed.

checkProcessControls()

Requests the Business Service to validate the current state of the current business transaction.

checkSecurityControls()

Requests the Business Service to validate the security controls of the current business transaction.

Associations:

transactions

The *ServiceTransactions* that support this *BusinessService.*

ServiceTransaction

A *ServiceTransaction* is a mutually binding interaction between an initiating service and a responding service.

Tagged Values:

isNonRepudiationRequired

If non-repudiation of origin and content is required then the business activity must store the business document in its original form for the duration mutually agreed to in a trading partner agreement. A responding partner must signal a business control exception if the sending partner role has not properly delivered their business document. A requesting partner must send notification of failed business control if a responding partner has not properly delivered their business document.

This property provides the following audit controls:

Verify sending role identity (authenticate)[25]—Verify the identity of the sending role (employee or organization). For example, a driver's license or passport document with a picture is used to verify an individual's identity by comparing the individual against the picture.

Verify content integrity[26]—Verify the integrity of the original content sent from a partner role i.e. check that the content has not been altered by a 3rd party while the content was exchanged between partners.

timeToPerform

Both partners agree to perform a commercial transaction within a specific duration. A responding partner must exit the transaction if they are not able to respond to a business document request within the agreed time-out period. A sending partner must retry a commercial transaction if necessary or must send notification of failed business control (possibly revoking a contractual offer) if a responding partner does not deliver their business document within the agreed time period. The time to perform is the duration from the time a business document request is sent by a requesting partner role until the time a responding business document is "properly received[27]" by the requesting partner role. Both partners agree that the business signal document or business action document specified as the document to return within the time to perform is the "Acceptance Document[28]" in an on-line offer/acceptance contract formation process.

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[25] The BCF specifies digital signatures for partner-to-partner non-repudiation of origin and content.
[26] The BCF specifies MD5 or SHA-1 message digest algorithms and asymmetric encryption to provide content integrity.
[27] "Properly received" is legally defined in a trading partner agreement. Refer to the "Create Trading Partner Agreement" commercial transaction specification in the BCF.
[28] This is not a business acceptance document.

timeToAcknowlegeReceipt

Both partners agree to mutually verify receipt of a requesting business document within a specific time duration. A responding partner must exit the transaction if they are not able to verify the proper receipt of a business document request within the agree time-out period. A sending partner must retry a commercial transaction if necessary or must send notification of failed business control (possibly revoking a contractual offer) if a responding partner does not verify properly receipt of a business document request within the agreed time period. The time to acknowledge receipt is the duration from the time a business document request is sent by a requesting partner until the time a verification of receipt is "properly received" by the requesting business partner. This verification of receipt is an auditable business signal and is instrumental in contractual obligation transfer during a contract formation process (e.g. offer/accept).

timeToAcknowledgeAcceptance

Both partners agree to the need for a business acceptance document to be returned by a responding partner after the requesting business document passes a set of business rules. The time to acknowledge business acceptance of a requesting business document is the duration from the time a requesting partner sends a business document until the time an Acknowledgment of acceptance is "properly received" by the requesting partner. A responding partner must exit the transaction if they are not able to acknowledge business acceptance of a business document request within the agreed time-out period. A sending partner must retry a commercial transaction if necessary or must send notification of failed business control (possibly revoking a contractual offer) if a responding partner does not acknowledge acceptance of a business document within the agreed time period.

Associations:

requestingAction

The *BusinessActionMessage* that initiates this *ServiceTransaction*.

respondingAction

The *BusinessActionMessage* that is the response to *theRequestingAction* Not all requesting actions require a response message. In this case a "non-substantive" Acknowledgment is sufficient.

receiptAcknowledgment

A *BusinessSignalMessage* that affirms receipt of a *BusinessActionMessage*.

exceptions

BusinessSignalMessages that report control or process exceptions.

acceptanceAcknowledgment

An acceptanceAcknowledgment is a *BusinessSignalMessage* that affirms the acceptance of a action request. This business signal is an acceptance from a legal viewpoint. Through this acceptance mechanism, responsibility for the transaction is transferred to the responding business service.

NetworkComponent

A *NetworkComponent* is a logical computing component in a distributed network environment.

Tagged Values:

isSecuredTransportRequired

Both partners must agree to exchange business information using a secure transport channel. The security controls ensure that business document content is protected against unauthorized disclosure or modification and that business services are protected against unauthorized access. This value is derived from the *isSecuredTransportRequired* property of the *CommercialTransaction* in the BOV.

BusinessMessage

A *BusinessMessage* is a document or information that is exchange between business processes.

Associations:

header

Message header that contains security, signature and dictionary reference information.

MessageEnvelope

A *MessageEnvelope* is container used to route *BusinessActionMessages.*

Associations:

header

Message header that contains security, signature and dictionary reference information.

body

One or more business messages that are carried with this envelope.

prototype

Identification of the message envelope prototype.

BusinessActionMessage

A *BusinessActionMessage* is a specialized *StructuredMessage* used to convey *BusinessDocuments (*from BOV*)* between two business processes via a network component.

BusinessSignalMessage

A *BusinessSignalMessage* is used to convey control and exception conditions between two business processes.

Associations:

forAction

References the *BusinessActionMessage* that this *BusinessSignalMessage* correlates to. Signals are returned to an initiating service by a responding service.

RequestingServiceTransaction

A *RequestingServiceTransaction* is the initial business transaction within a *CommerialTransaction*.

Tagged Values:

recurrence

Specifies the number of attempts a *RequestingServiceTransaction* may be sent in response to a control exception. Control exceptions are those that were generated as a result of a control failure (e.g. TimeOut, Authentication, etc.).

isNonRepudiationOfReceiptRequired

The *isNonRepudiationOfReceiptRequired* is derived from the RequestingBusinessActivity (BOV) and indicates that both partners agree to mutually verify receipt of a requesting business document and that the receipt must be non-reputable.

RespondingServiceTransaction

A *RespondingServiceTransaction* is the responding business transaction within a *CommercialTransaction* to a particular *RequestingServiceTransaction*.

Tagged Values:

isIntelligibleCheckRequired

Both partners agree that a responding partner role must check that a requesting document is not garbled (unreadable, unintelligible) before verification of properly receipt is returned to the requesting partner.

ServiceCollaboration

A ServiceCollaboration comprises a set of interactions (service request) between network components, which comprises one business collaboration (from BOV).

Associations:

components

References the *NetworkComponent* that participates in this collaboration.

interactions

References the *BusinessTransactions* that are exchanged between the *NetworkComponents.*
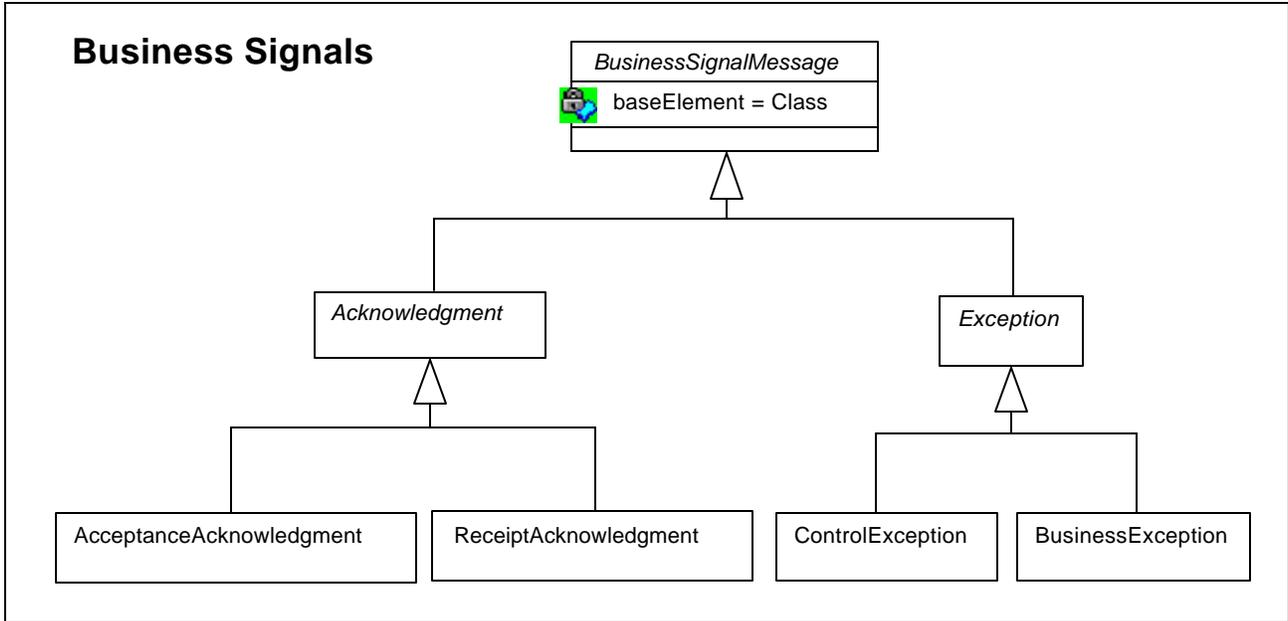
Business Signals

Figure 5.2   FSV Abstract Syntax (Business Signals)

Acknowledgment

An Acknowledgment is an asynchronous business signal that acknowledges some aspect of a received business action message (request). The Acknowledgment is sent to the service from which the business action message was received.

AcceptanceAcknowledgment

An acceptance Acknowledgment business signal is returned to the initiating service if the business action message (request) content is valid with respect to the responding services business rules and the responding service is willing to perform further processing activities with this content. The initiating service must not assume that the responding service will act on a request that has not been accepted by the responding service. A trading partner agreement must agree that a receiving service has "legally" accepted a business action request (*BusinessActionMessage*) when the *BusinessActionMessage* has been "accepted" by the receiving service. At this point there is transference of legal responsibility for the fulfillment of this request by the receiving service. This signal is required if the correlating *ServiceTransaction* has the **timeToAcknowledgeAcceptance** attribute set to a duration greater than zero.

BusinessSignal

A business signal is an object that is transmitted asynchronously back to an activity that initiated the transfer of business process execution control.

ControlException

A *ControlException* signals an error condition in the management of a *ServiceTransaction* within a *ServiceCollaboration*. This signal is asynchronously returned to the initiating service that originated the request. This exception must terminate the *ServiceCollaboration*. These errors deal with the mechanisms of message exchange such as verification, validation, authentication and authorization and will occur up to message acceptance. Typically the rules and constraints applied to the message will have only dealt with structure, syntax and message element values.

ProcessException

A *ProcessException* signals an error condition in a business activity. This signal is asynchronously returned to the initiating service that originated the request. This exception must terminate the *ServiceCollaboration*. These errors deal with the mechanisms that process the *ServiceTransaction* and will occur after message verification and validation. Typically the rules and constraints applied to the message will deal the semantics of message elements and the validity of the request itself and the content is not valid with respect to a responding service's business rules. This type of exception is usually generated after an *AcceptanceAcknowledgment* has been returned.

ReceiptAcknowledgment

Acknowledges the receipt of a *BusinessActionMessage*. This business signal is returned by the responding service to acknowledge the receipt of a *BusinessActionMessage* if it is syntactically and structurally valid. A trading partner agreement must agree that a receiving service has "legally" received a business action request (*BusinessActionMessage*) when the *BusinessActionMessage* can be "read" by the receiving service. This signal is required if the correlating has the **timeToAcknowledgeReceipt** attribute set to a duration greater than zero.

5.1.2 Well-formedness Rules

The well-formedness rules that apply to the FSV metamodel package will be specified in a future version of this document.

5.2 Model Semantics

The semantics of each element of the FSV metamodel is defined in this section.

Figure 5.3 illustrates the interrelationships between the FSV modeling elements.
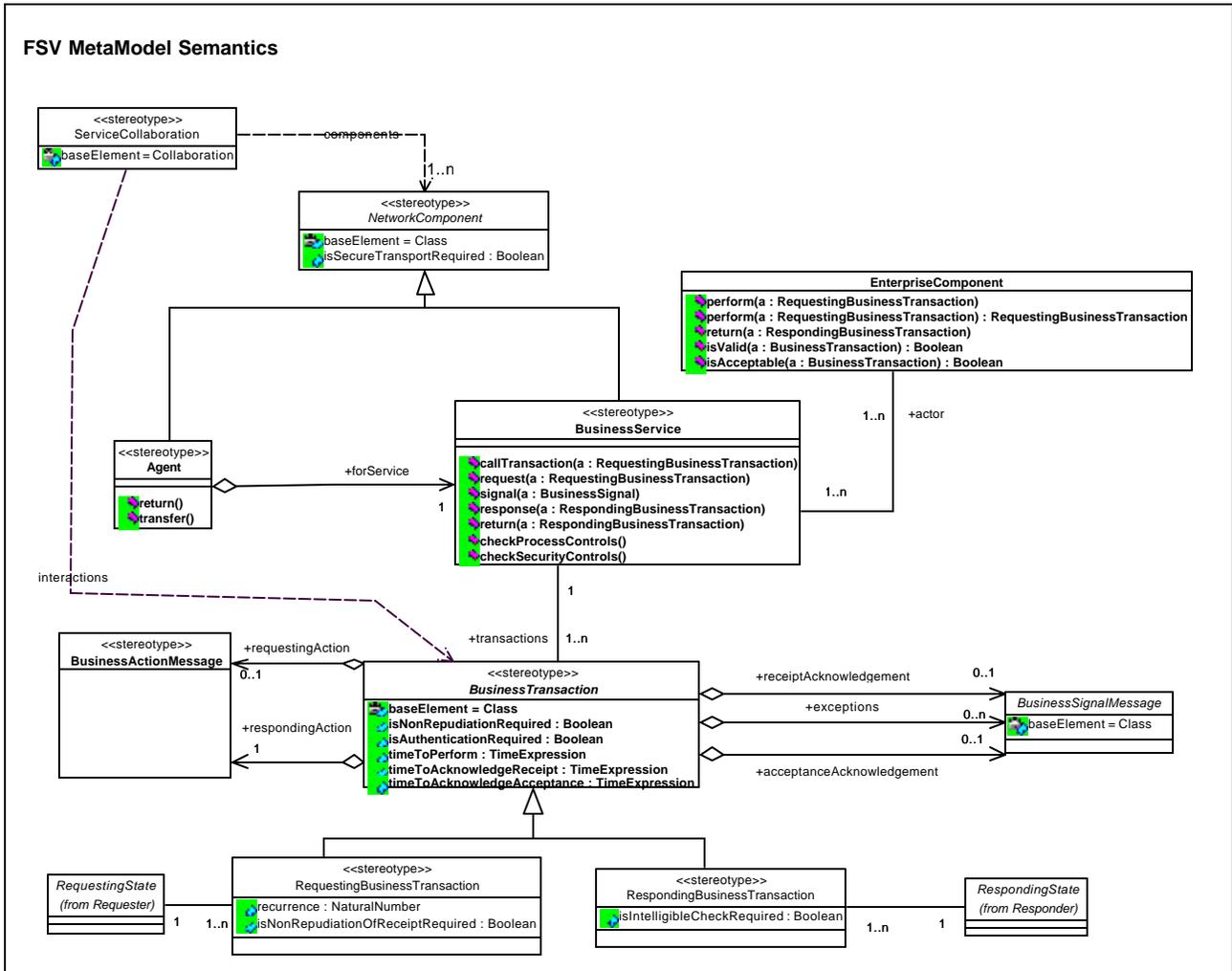
Figure 5.3   FSV Model Semantics

5.2.1 Agent

An agent acts on behalf of a service. An agent can be a user agent such as a web browser but may also be an agent acting on behalf of another service. An agent is a network component that must implement protocols up to the agent layer of the e-business network application, communications model. An agent has no network identity as a business service component. A user agent acts as an intermediary between a business service and an employee.

5.2.2 BusinessService

A business service is a network component that responds to business transaction requests initiated by other services. A business service implements protocols in all of the layers of the e-business network application, communication model. Business services monitor the execution of service collaborations. A service component has network identity as a business service.

5.2.3 ServiceTransaction

A *ServiceTransaction* is a mutually binding interaction between an initiating service and a responding service. There may be zero or more business signals exchanged during the interaction that can be used for security, auditing and process control. A set of business transactions as defined by a *CommercialTransaction* (from BOV) is a unit of work. Both services in the *CommercialTransaction (CT)* must agree to the CT's conclusion or both sides must roll back to a state before the initial *RequestingServiceTransaction* was initiated.

A timed *ServiceTransaction* is a synchronous transaction that must complete within the specified time. An asynchronous transaction is a one-way exchange of a business action.

5.2.4 NetworkComponent

A network component is a logical computing component in a distributed network environment. Network transport security is specified and enabled by the network component.

5.2.5 BusinessMessage

A *BusinessMessage* is an information document that is exchange between business processes. The message header provides for security, signature and dictionary reference information.

5.2.6 MessageEnvelope

A *MessageEnvelope* is used to define routing information and privacy properties for one or more *BusinessActionMessage* that is contained within the message envelope. The *MessageEnvelope* is the highest level of containment for information that is exchange between two business processes.

5.2.7 BusinessActionMessage

A *BusinessActionMessage* is a specialized *StructuredMessage* used to convey *BusinessDocuments* (from BOV) between two business processes via a network component.

5.2.8 BusinessSignalMessage

A *BusinessSignalMessage* is a specialized *StructuredMessage* used to convey control and exception conditions between two business processes as it relates to a particular *BusinessActionMessage* request. A *BusinessSignalMessage* is transmitted asynchronously back to a business process that initiated the transfer of business process execution control.

5.2.9 RequestingServiceTransaction

A *RequestingServiceTransaction* is the initial business transaction within a *CommerialTransaction*. When a CommercialTransaction fails, the rollback is to the state of the system and business process as it was just before the initiation of the transaction. If the recurrence property is set to a positive value the request is tried again until the count is decremented to zero. Retrys only occur on the receipt of a control exception, which may an indicator that the failure could have been technical in nature. If the exception was a process exception then the recurrence counter is not applicable, since the exception was generated due to the failure of a business rule and must be redress by higher-level processes.

If a *isNonRepudiationOfReceiptRequired* is true, this indicates that both partners agree to mutually verify receipt of a requesting business document and that the receipt must be non-reputable. A receiving partner must send notification of failed business control (possibly revoking a contractual offer) if a responding partner has not properly delivered their business document.

Non-repudiation of receipt provides the following audit controls:

Verify responding role identity (authenticate) [29]—Verify the identity of the responding role (individual or organization) that received the requesting business document.

Verify content integrity[30]—Verify the integrity of the original content of the business document request.

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[29] The BCF specifies digital signature for partner-to-partner non-repudiation of origin and content.
[30] The BCF specifies MD5 or SHA-1 message digest algorithms and asymmetric encryption to provide content integrity.

5.2.10 *RespondingServiceTransaction*

A *RespondingServiceTransaction* is the responding business transaction within a *CommercialTransaction* to a particular *RequestingServiceTransaction*. Typically all *CommercialTransaction* are defined in *RequestingServiceTransaction/ RespondingServiceTransaction* pairs. If the *isIntelligibleCheckRequired* property is true then both partners agree that a responding partner role must check that a requesting document is not garbled (unreadable, unintelligible) before verification of properly receipt is returned to the requesting partner. Verification of receipt must be returned when a document is "accessible" but it is preferable to also check for garbled transmissions at the same time in a point-to-point synchronous business network where partners interact without going through an asynchronous service provider.

5.2.11 *ServiceCollaboration*

A *ServiceCollaboration* specifies the interactions between network components. It specifies the conditions and/or constraints by which interactions are executed.

Message Model Semantics

Figure 5.4 specifies the semantics for the definition of business messages.
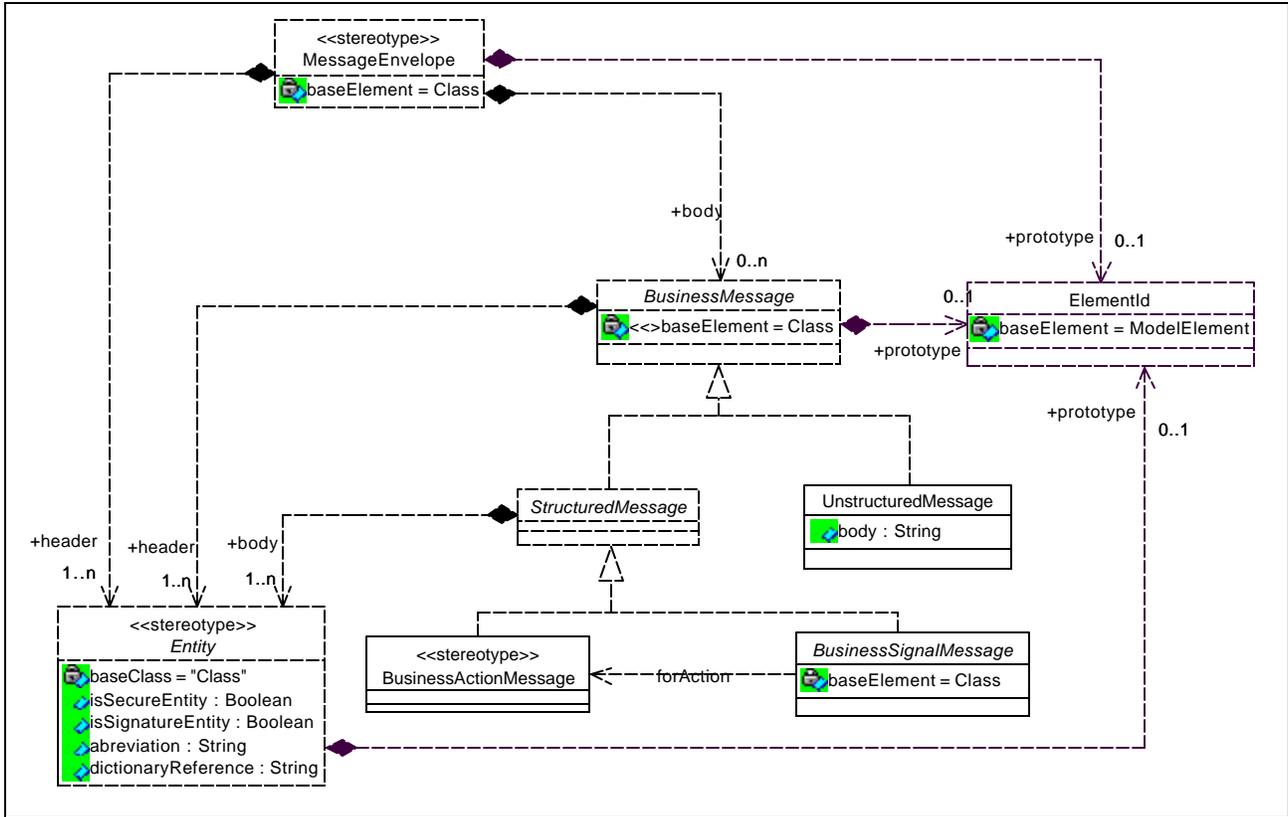
Figure 5.4   FSV Message Model Semantics

5.2.12   *BusinessActionMessage*

The *BusinessActionMessage* specifies the business activity that processes a business request and the header and body of the message. The *BusinessActionMessage* maps to the business document that was defined in the BOV and defines process routing and security constraints

5.2.13   *ElementId*

The *ElementId* identifies the dictionary prototype template, which defines the *MessageEvelope*, BusinessMessage and the Entities used in the construction of the message.

5.2.14   *InformationEntity*

An Entity is the basic element for specifying information elements. Along with the name and type, it specifies privacy and security for the information.

5.2.15 MessageEnvelope

A *MessageEnvelope* is the highest level container for transporting business documents between business processes via network components.

5.2.16 BusinessActionMessage

A *BusinessActionMessage* is a specialization of a *StructuredMessage* used to invoke a business process in the receiving system.

5.2.17 BusinessSignalMessage

A *BusinessSignalMessage* is a specialization of a *StructuredMessage* used to convey control and process exceptions occurring in a business process in the receiving system to a business process in the initiating system.

5.2.18 UnstructuredMessage

An *UnstructuredMessage* is a specialization of a *BusinessMessage* used to transport arbitrary bit streams such as would be the case for images, video and audio.

5.2.19 StructuredMessage

A *StructuredMessage* is a specialization of a *BusinessMessage* used to transport structured information.

5.3 Model Management Abstract Syntax and Semantics

The following stereotypes and tagged values are contained in the functional service view management metamodel. Figure 5.5 illustrates the interrelationships between the FSV model management and model elements.
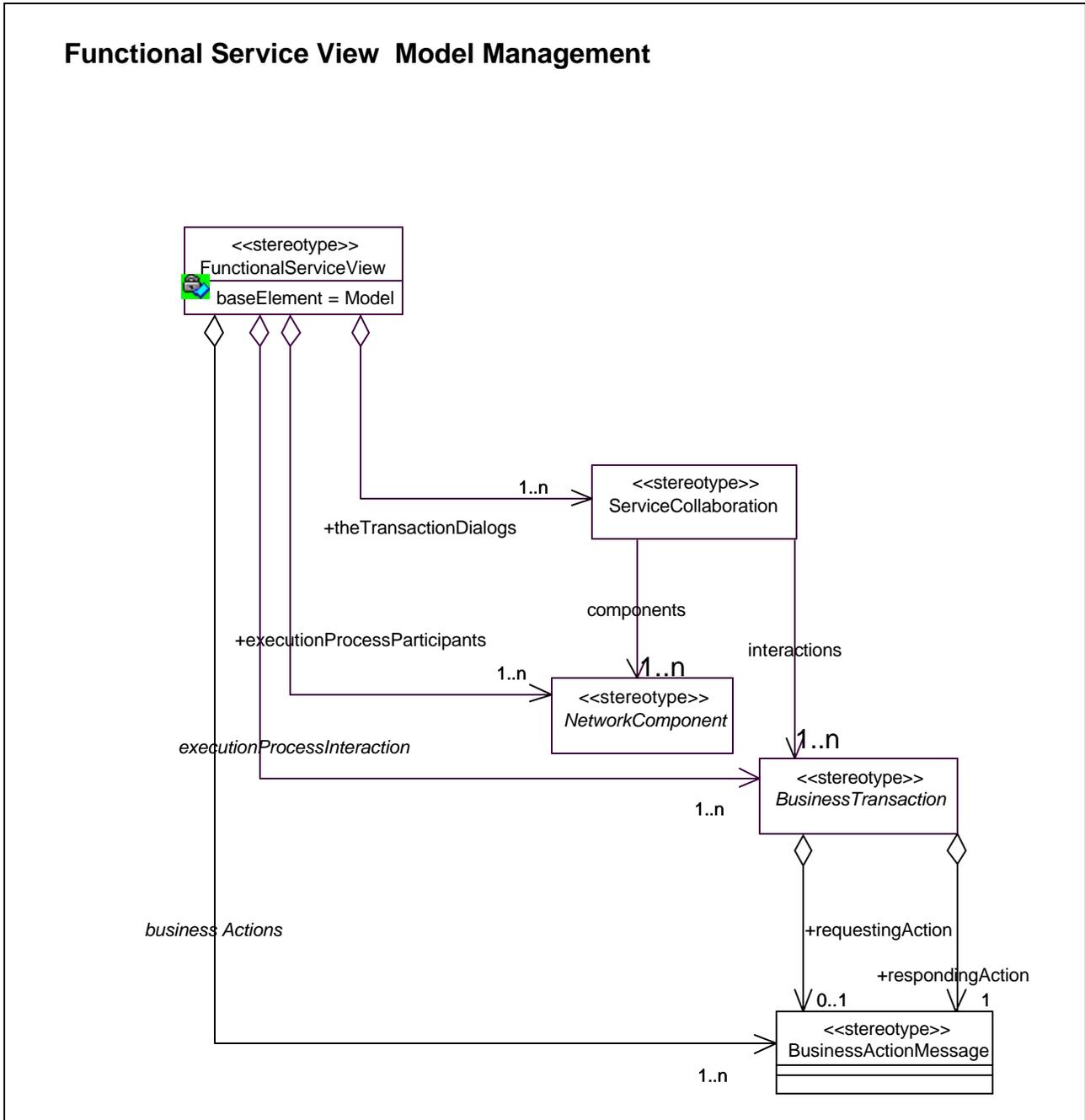

Figure 5.5   FSV Model Management Illustration

6 Model Notation

This section defines the notation used to specify business collaboration models and the diagrams used to view the model. The model is viewed through a number of static and dynamic diagrams that are constrained versions of those provided by the UML.

6.1 Stereotype Notation

Model elements are indicated with stereotype keywords in guillemets («stereotype name»). A stereotype keyword name in a model must be syntactically equivalent to the class name of the respective stereotype class in the metamodel.

The following are special stereotyped icons for extension elements. These icons are taken from the "UML Extension for Business Modeling," version 1.1, 1 September 1997[31].
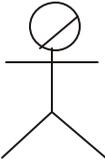
Icon	Stereotype
	PartnerType
	BusinessCollaboration
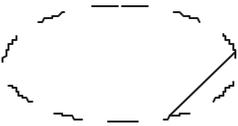
Table 6.1   Stereotyped Icons for Extension Elements

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[31] Can be found at http://www.rational.com and http://www.omg.org/.

6.2 Model Diagrams

The following model diagrams are used to view business collaboration models:

6.2.1 Business Operations Map Diagrams

6.2.1.1 **PROCESS AREA DIAGRAM**

A process area diagram is a constrained form of a UML use case diagram. Figure 6.1 is an example of a process area diagram.

A process area diagram illustrates a sequence of business processes modeled as use cases. Business processes are sequenced from left-to-right or from right-to-left of the diagram (a convention taken from the Supply Chain Operations Reference Model[32]). The flow convention is useful to communicate a flow of products *down* the Supply Chain and a flow of product demand *up* the Supply Chain. The flow of products is from left-to-right of the diagram and the flow of product demand is from right-to-left of the diagram.

```
          <<Transition>>                        <<Transition>>


    (  )  <──────  (  )  <──────  (  )

<<BusinessProcess>>       <<BusinessProcess>>       <<BusinessProcess>>
 Reserve Inventory and     Receive Enter and        Process Inquiry and Quote
 Determine Delivery Date    Validate Order
```
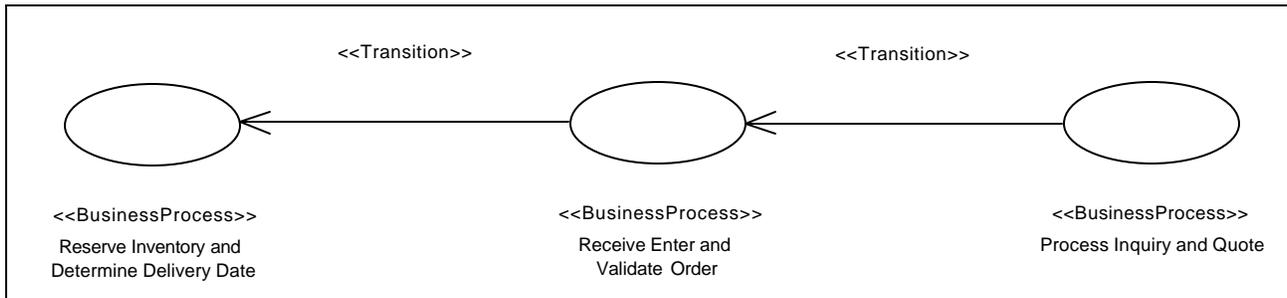
Figure 6.1   Example of Process Area Diagram

Business information in a business process use case preconditions and post-conditions can be listed above and below each use case icon respectively. This will provide a diagram similar to those in the Supply Chain Operations Reference Model.

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[32] Refer to http://www.supply-chain.org/.

6.2.1.2 **BUSINESS PROCESS ACTIVITY DIAGRAM**

A business process activity diagram is a constrained form of a UML activity diagram. Figure 6.2 is an example of a business process activity diagram.
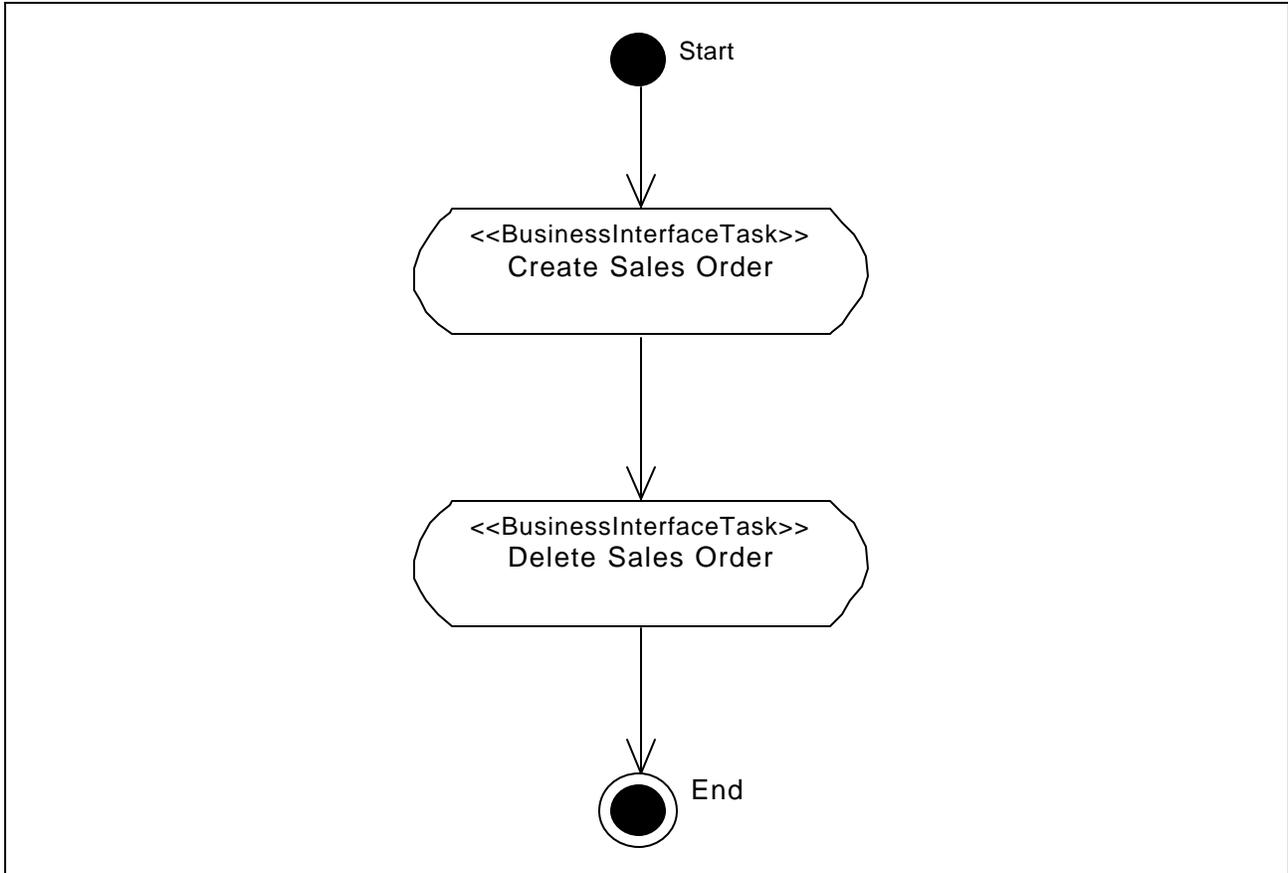

Figure 6.2 **Example of Business Process Activity Diagram**

A business process activity diagram illustrates a sequence of business tasks and business interface tasks. Business tasks are UML activities interpreted as business tasks.

6.2.2 Business Requirements View Diagrams

6.2.2.1 BUSINESS USE CASE DIAGRAM

A business use case diagram is a constrained form of a UML use case diagram. Figure 6.3 is an example of a business use case diagram.
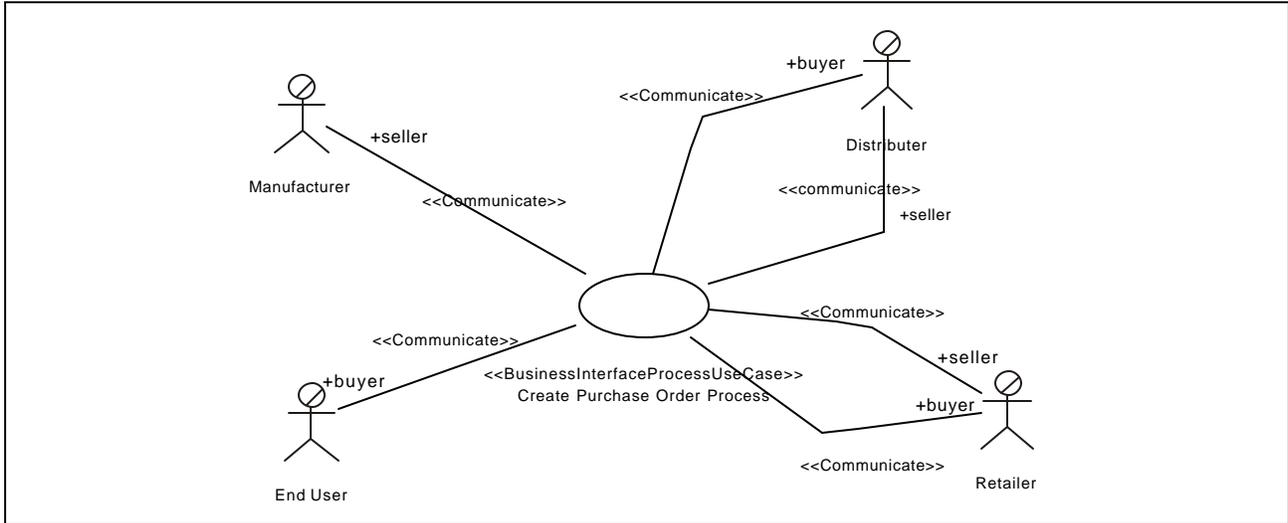

Figure 6.3   Example of Business Use Case Diagram

A business use case diagram illustrates the partner types that collaboratively execute a business collaboration protocol or commercial transaction. The diagram also illustrates each partner types' role in the use case.

6.2.2.2 **BUSINESS COLLABORATION DIAGRAM**

A business collaboration diagram is a constrained form of a UML use case diagram. Figure 6.4 is an example of a business collaboration diagram.
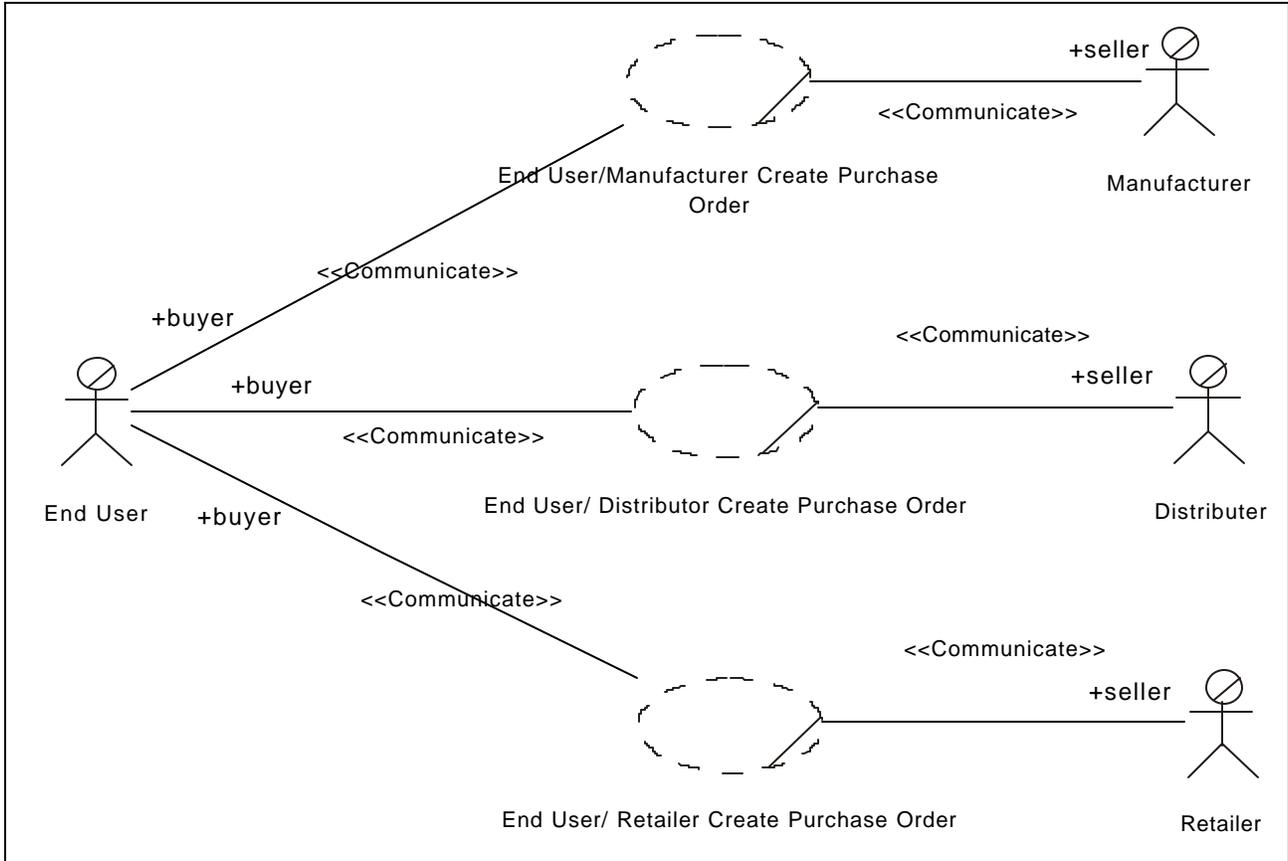

Figure 6.4   Example of Business Collaboration Diagram

A business collaboration diagram illustrates a particular configuration of business partner collaboration to document business information requirements that are not applicable to the general business use case from which the collaboration is realized. For example, sending a business document to a U.S. government agency requires a Standard Industry Classification (SIC) code to be included with the business information.

6.2.3 Business Operational View Diagrams

6.2.3.1 COMMERCIAL TRANSACTION

A commercial transaction is an activity graph. Figure 6.5 is an example of a commercial transaction diagram. Note that the object flow is modeled as state transitions in this diagram due to a limitation of Rational Rose®, a UML modeling tool used to create the models. This state notation should be replaced with the object flow notation as soon as possible.
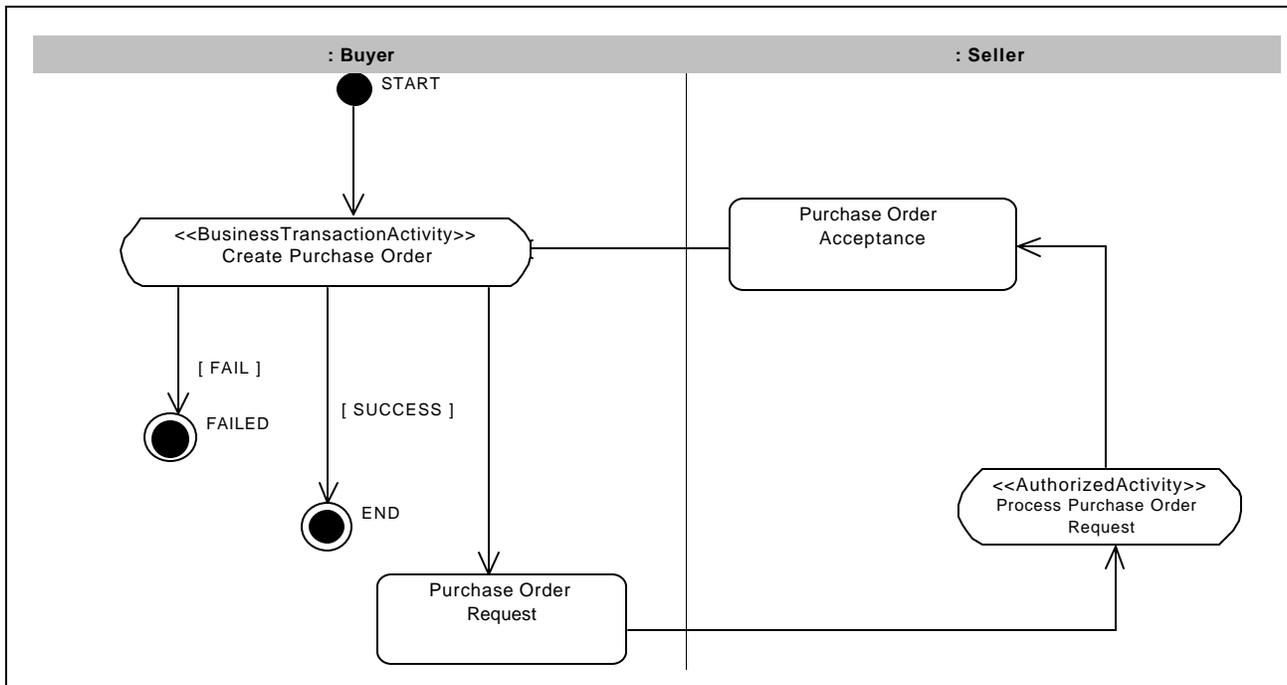

Figure 6.5   Example of Commercial Transaction Diagram

6.2.3.2 **BUSINESS COLLABORATION PROTOCOL DIAGRAM**

Figure 6.6 is an example of a commercial transaction diagram. A business collaboration protocol is an activity graph. There are no conditionals or synchronization states in the model. Those states do not apply to an interface process but rather to an internal enterprise decision process.
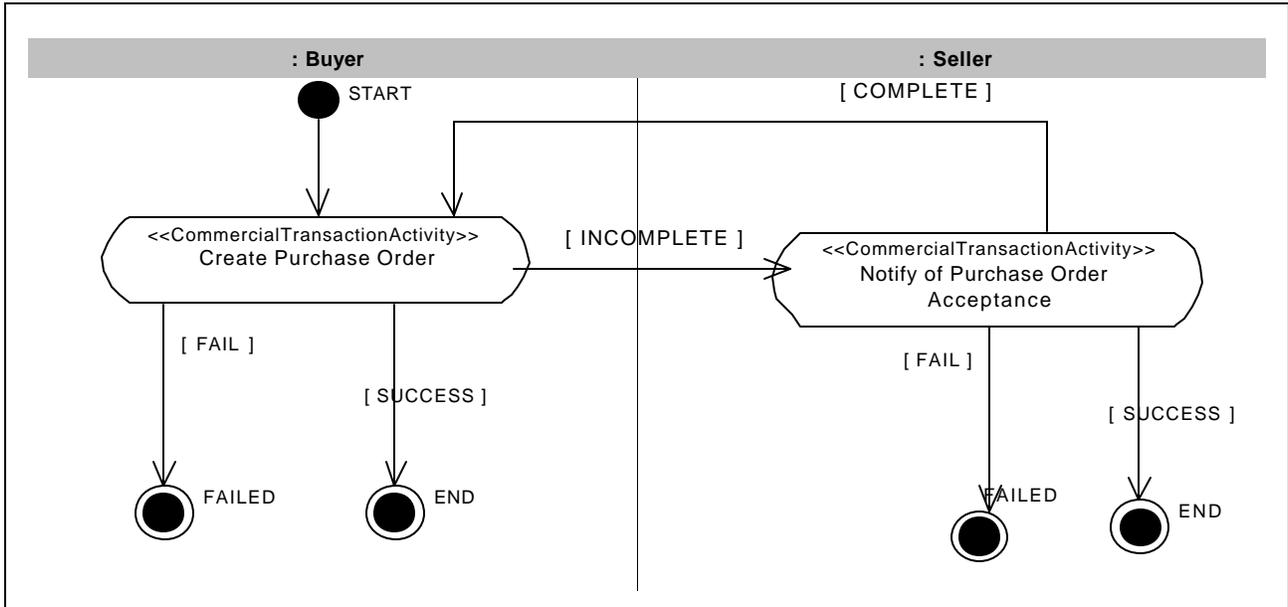

Figure 6.6   Example of Business Collaboration Protocol Diagram

6.2.4 Functional Service View Diagrams

Functional Service View Diagrams will be specified in a future version of this document.

6.2.5 Implementation Framework View Diagrams

Implementation Framework View Diagrams will be specified in a future version of this document.

ibliography

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