Architecture of Business Modeling

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The roadmap for developing business rules specifications of the Object Management Group's Business Rules Special Interest Group has five RFPs, one of which is the Business Modeling RFP[1]. The goal of this writing is to frame and structure the subject of business modeling to support a decision in the OMG about factoring the Business Modeling RFP into several RFPs.

Following a series of presentations and discussions about business modeling in the summer of 2003, a joint meeting of the Business Rules Special Interest Group and the Business Enterprise Integration Domain Task Force adopted this working definition of a business model:

> **business model** collection of related architectures or blueprints of, by, and for business people, aimed toward capturing (i.e., describing and/or prescribing) the essential workings of the business (not IT capabilities per se) from a purely business perspective. A business model provides comprehensive answers to the six basic interrogatives: What? How? Where? Who? When? Why? In doing so, the business people intend to provide a sufficient understanding of the business that may be used in a variety of ways to solve business problems as perceived by business people, one of which is providing business requirements for information systems.[2]

Business processes are a prominent, recurring theme in business modeling. The BR SIG and BEIDTF joint meeting adopted this working definition of a business process:

> **business process** category of **business model** that focuses on the transformative aspect of the business – that is, value chains or sequences of functions that take raw materials or other resources and transform them in such a way to add value for people inside and/or outside the business.[2]

[1] The five Business Rules RFPs are: Business Semantics of Business Rules, br/03-06-03, issued June 2003; Production Rule Representation, bei/03-09-03, issued September 2003; Business Modeling, discussion underway; Business Rules Management, start 2004; Business Rules for Legacy Transformation, start 2004.

[2] Joint BR SIG/ BEIDTF meeting, Boston, Massachusetts, September 9, 2003.

Scope and Objectives of the Business Modeling RFPs

The Business Modeling RFP(s) will request a metamodel for modeling any kind of human work activity, in any domain, in language familiar to domain experts. The perspective of the business models contemplated by the Business Modeling RFP(s) is that of the business owner or planner.

While projects to create these business models are likely to be motivated by a desire to specify, design and build information systems to support the business, the business models contemplated focus on the business itself, rather than the information system. In focusing on the concerns of business owners and planners, the business models contemplated are independent of implementation considerations, record-keeping systems (automated or manual), or technologies that might be used. Limiting the scope of the business models in this way has the dual advantages of simplifying the modeling process and preserving the ability to use the resultant models with alternative implementation approaches and technologies, as with the OMG's Model Driven Architecture™ (MDA). Business models may describe parts of the business and rules that are not related to an information system as well as those that are. There are uses of business models that transcend system development.

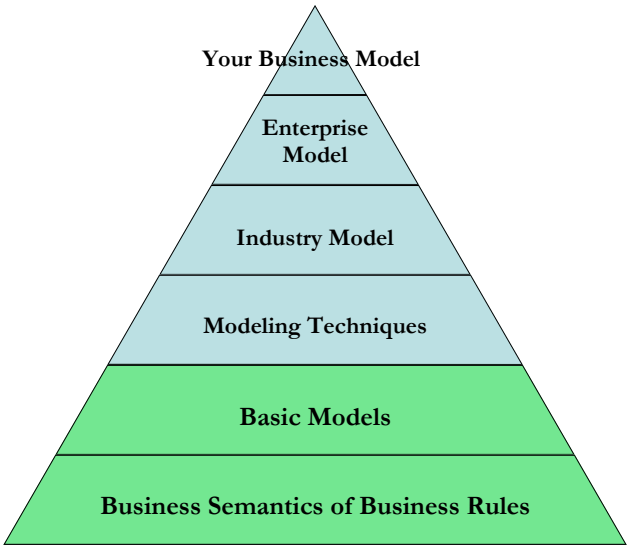
A key objective of OMG Business Modeling is to help bridge the gap between business and IT, to support model driven system development. While the business models contemplated are expressed in language familiar to domain experts – "business people" – they are also rigorously mapped to formal logics and are constructed on the OMG's Meta Object Facility™ (MOF) technology. This combination of natural language expression, formal logic, and MOF allows business people to express their domain in their own language and it allows IT professionals to use software programs to interchange, interpret and process the expressions. As such, these business models can effectively serve as Computation Independent Models (CIM) in the MDA.

In recent meetings of the OMG's Business Enterprise Integration Task Force several different approaches to business modeling were presented. A goal of the Business Modeling Metamodel is to support with generic building-block capabilities approaches similar to these as well as other approaches. To this end, it is the objective of the Business Modeling RFP(s) to support definition and reuse of specialized vocabularies and modeling techniques at many levels. Widely applicable generic modeling techniques need to be defined and then specialized to different industries or applications. Individual companies and even different groups within a company need to be able to tailor these vocabularies and techniques to their own needs. This will require means to import and reuse vocabularies and the ability for users to define their own meta-languages based on familiar terminology of their domain, retaining a basic linguistic and logical model underneath.

Overall Structure of the Business Modeling Metamodel

To achieve the desired generality and flexibility, a layered approach is taken the Business Modeling Metamodel (BMM). Packages that are relatively independent of one another can together provide the needed range of expressivity and flexibility. These independent packages are termed "basic models" in this paper. Generic capabilities will provide common semantics and promote model interchange and tool interoperability across business modeling techniques.

The pyramid below illustrates the layered approach. The bottom two layers, shown in green, represent the Business Semantics of Business Rules (BSBR) metamodel now being developed and



the proposed OMG Business Modeling Metamodel, called Basic Models. The upper layers could be provided by vendors of modeling techniques, industry groups, or company-wide semantic integration initiatives. The Your Business Model layer at the top represents a particular model for a particular project or purpose, which leverages the other layers.

A particular decomposition has been done for the sake of discussion, and is shown in the UML structure charts at the end of this paper. The remainder of this paper discusses the overall plan of the decomposition and each basic package.

At the bottom is the foundational Business Semantics of Business Rules (BSBR) package with its Business Vocabulary and Business Rules sub-packages. The BSBR contains the linguistic and logical foundation for all of the other packages. The Business Vocabulary provides the linguistic capabilities for business modeling, fully mapped to formal logic. The Business Rules package adds the capability to formularize logical expressions in natural language using terms contained in the Vocabulary. The other packages define standard terms, facts and rules about the basic subject, specialize BSBR meta-concepts, or extend the BSBR metamodel with additional meta-concepts.

The Basic Models Package

Developing the Basic Models package shown above and in the center of the first diagram at the end of this paper is the objective of the Business Modeling RFP(s). The Basic Models package contains seven sub-packages. Six of the sub-packages in Basic Models each correspond to a basic model. Each of these packages is presumed to contain a metamodel adequate to model the basic model subject generally. The six basic models – Business Domain, Business Process, Location, Business Organization, Event, and Business Motivation – address the six interrogatives and are thought to be sufficient to support virtually any business modeling need[3]. Metamodels describing standard associations between the six basic models is contained in the Constructs package. The seven static structure diagrams given at the end of this paper of the Basic Models sub-packages are only suggestive. They are notional UML diagrams intended to illustrate the types of concepts and relationships supposed to be contained in each basic model. The normative requirements and contents of each basic model will be defined in the Business Modeling RFP(s) and submissions. They will ultimately be defined in terms of the BSBR metamodel, not UML.

Different vendor modeling techniques can each be specified in their own package, represented generically by the package named A Business Modeling Technique. Any number of technique packages can be defined. The set of OMG standard modeling capabilities represented in the Basic Models package will make developing new techniques easier and with a greater level of

[3] The assumption about the sufficiency of these six basic packages is based on the Zachman Framework for Enterprise Architecture. See www.zifa.com. This sufficiency is not formally proved, but is based on Zachman's heuristics.

interoperability due to their common use of the Basic Models and BSBR, which is, in turn, built on MOF.

The Business Rule Management package contains the metamodel for managing the vocabulary as a whole, and sets of vocabularies, and (potentially large) collections of business rules, including versioning, responsibility, effectivity, and traceability. The Model Management package contains the metamodel for managing versions and collections of business models or rules.

Fortunately, there is existing work involving most of the basic models that can be drawn upon to assemble the complete array of basic model packages in a practical timeframe. The BSBR RFP has been issued, and initial responses are due in January 2004. Much relevant work on business processes is contained in the OASIS Business Process Execution Language (BPEL), and the OMG Business Process Definition Metamodel. A goal of OMG Business Modeling is to make the Business Process package suitable as the specification for BPEL Abstract, as well as for the Business Process abstractions of OMG Business Modeling. The UML has action semantics. Work is underway in the OMG to revive the Business Organization Structure work, and this work could inform the design of the Business Organization package. Several models of time are available for the Time package in Event. The Location package can draw upon existing work in 2D and 3D spatial and geographic modeling, and on modeling postal addresses. The Business Rules Group has done important work on a Business Motivation model. The BRG and others have done good work on the subject of Rule Management that can be adapted. The MOF Facility work can be helpful for Model Management. A generic Business Domain metamodel can be built that can be tailored to the needs to different business domains, to provide domain-standard vocabularies and rules for modeling different businesses with inter-domain compatibility to help standardize customer, supplier, and partner interactions in the domain.

Constructs

The Constructs package provides a metamodel of generally useful standard linkages between the six basic models, together with their rules. These linkages might be included: (process initiation, event), (process completion, event), (activity, role), (process, input), (process, output), (policy, event), (policy, state), (policy, role), (state, event, activity), (activity, place, time), and others. A few of the many possibilities are shown on the Constructs diagram, to illustrate the approach.

Business Semantics of Business Rules

The BSBR is the foundation for business modeling. BSBR provides a general linguistic metamodel that is mapped to formal logics, especially first order predicate logic, modal logic, basic arithmetic, and set theory. The BSBR metamodel has two parts: a Vocabulary metamodel and a Business Rules metamodel. The BSBR metamodel is mapped to MOF for model interchange. The BSBR RFP can be found on the OMG Web site at www.omg.org/cgi-bin/doc?br/03-06-03.

Business Vocabulary

The Business Vocabulary metamodel provides a means for users to define a vocabulary for their purposes, capturing the terms and facts that describe the subject matter of the vocabulary. The Business Vocabulary metamodel defines concepts, each of which can have lexical symbols (terms) in different natural languages that can be used by different speakers to refer to the concepts. The concept of a semantic community is included, being defined by a set of concepts understood and

shared by members of the semantic community. The concept of a speech community is included, wherein speakers share a language and set of symbols with which to communicate shared concepts. This powerful metamodel provides support for a very wide range of multi-lingual modeling and model translation.

The linguistic constructs permitted by the BSBR Vocabulary metamodel are mapped by BSBR to formal logics. The range of logics supported admits a very wide range of logical capability with sufficient syntactic "sugar" to enable users to define a rich, natural-sounding vocabulary for any domain in any natural language. The BSBR metamodel is represented as a MOF model, enabling interchange of BSBR models using XMI and storage of BSBR models in MOF repositories. The logical underpinnings of the BSBR language make it possible to perform inference and logical transformations in accordance with the principles of Model Driven Architecture, to derive from the business models consistent structural components for information system designs.. These characteristics make the BSBR a potent tool for MDA. Building the Business Modeling metamodel on top of BSBR will multiply its potency.

The packages that depend on BSBR can use it in several ways to build their basic model. The vocabulary of the basic model can be defined using BSBR Vocabulary capabilities. Categorization types can be defined in the basic model to define a basic metamodel using the Vocabulary capabilities. Or BSBR meta-objects can be specialized to the needs of a basic model. Finally, the BSBR metamodel itself can be extended to include other meta-object types.

Business Rules

The BSBR Business Rules metamodel enables users to write logical expressions involving the terms and facts of a Vocabulary. These expressions incorporate quantifiers, logical operators, and performatives to denote constraints and derivations between Vocabulary elements. Sets, bags, and modal logic are available for business rule constructs. As in the Vocabulary, the linkage between linguistics and logic in the Business Rules provides for natural sounding yet formally rigorous rules to be expressed.

Business Domain

The Business Domain represents the static schema of a particular domain. The Business Domain package is a place holder for a standard vocabulary and related rules of the domain, in the language of the domain. In each business modeling application, a Business Domain package appropriate for the project would be provided or developed as part of the project. The Business Domain package needs to provide a generic definition of state that can be used by modeling techniques that need state information.

A generic Business Domain package could be developed, specifying types for general business usage, as illustrated very schematically in the Business Domain package diagram. Use of the generic Business Domain package would provide a degree of standardization between domains based on the package that would promote inter-domain compatibility and interoperability. Standardized Business Domain packages could be developed by and for a particular industry that wishes to standardize their business nomenclature and promote collaboration within the industry and its business partners. A Business Domain could be a very technical kind of business, such as the business of specifying software architecture, or designing networks, in which case the Business Domain might contain a standard structural metamodel for specifying a software architecture or

network design. It is expected that organizations representing different domains will provide the Business Domain package for their domain, not necessarily through the OMG process. Interested members of the OMG Domain Technical Committee may wish to organize to develop special Business Domain packages for their purposes, which could become adopted OMG specifications.

The capability of BSBR to import one vocabulary into another and to define different vocabularies for shared concepts in the same or different languages provides powerful mechanisms for projects to build their vocabulary from vocabularies used by their industry, their regulators, or other departments or sites within their own company.

Business Process

The Business Process package contains the metamodel for describing processes. Processes are described in terms of input, activity, output, including process precedence and rules governing process branching, looping, and synchronization. Times, places, or who or what performs the activities of the process are not included at this level (these connections are made in the Constructs package). The Business Process package incorporates action semantics to support a declarative logical specification of business processing activities, independent of how or by whom the actions are actually performed. What causes the initiation of a process is not covered in the Business Process package, but rather the connection between business processes and events is defined in the Constructs package, possibly based on event-condition-action rules supported by the Event package.

Location

The Location package contains the metamodel for describing geographic locations, business sites, geographic areas, volumes, and perimeters, political subdivisions and boundaries, and logical connections between them. The connections signify logistics paths for communication between sites, whether by post, voice or data network, or transport carrier, including business (not technical) requirements or assumptions for such paths. A two dimensional geospatial model is needed, and, for some applications, three dimensional. A metamodel for world postal addresses is needed. The Location package adds spatial logic and reasoning capability to models.

Business Organization

The Business Organization package contains the metamodel for describing organizational units, the relationships between them, the roles performed by each unit. Persons may possibly be modeled here as a type of organizational unit. Hierarchy, partnerships, and federations are part of the model. The Business Organization metamodel also needs to allow users to describe lines of authority in organizations and approval chains, including alternate approval paths.

Event

The Event package contains the metamodel of time, including calendars, clocks, timers, time periods and time intervals, and relationships between them. The Time package adds temporal logic capability to models. Event also contains the metamodel of business events, including rules about their temporal ordering or partial ordering in the business activity cycle, and support for defining event-condition-action rules.

Business Motivation

The Business Motivation package contains the metamodel for describing business ends and means, goals, objectives, strategies, tactics, plans, policies, laws, regulations and related elements, and rules that govern the relationships.[4]

Model Management

The Model Management package contains the metamodel for dealing with models as a whole, including model versions, change management, storing, retrieving, merging, splitting, and interchanging models. The configuration management elements of Model Management are reused by the Business Rule Management package.

Business Rule Management

The Business Rule Management package needs to contain the metamodel for managing collections of vocabulary elements and rules. Management issues that need to be addressed include versioning, effectivity, traceability, responsibility and change authorization, classification and indexing for effective retrieval of large vocabularies and rule bases, verification and validation of vocabulary entries and rules for consistency and conflict. The Business Rule Management RFP is a separate RFP on the BR SIG Roadmap.

Summary and Conclusion

This paper has presented the Business Modeling metamodel as an integrated whole, decomposed into several more-or-less independent packages for discussion. How we go about building it through the OMG technology adoption process is a matter for discussion by the BR SIG and the BEIDTF. The functionality of the packages presented in this paper might be developed under separate RFPs, or combined into fewer, larger RFPs. The BSBR RFP is in progress. What other RFPs to issue remains an open question, hopefully to be resolved by the end of 2003 so work can proceed. There is also the matter of sequencing of the RFPs, which do to in parallel and which to do serially. Particular vendors may wish to develop sub-packages of the Business Modeling package that support their approach and promote interoperability of their tools; these will depend on the basic model packages, so would need to be done later. The trade off is that with more RFPs, each individual RFP is easier to manage, but RFPs tend to take on a life of their own, and the outcome of having them well integrated and coordinated is more uncertain. Identifying all the packages and defining their boundaries and interfaces will help get several RFPs through the OMG process with their collective integrity intact. With fewer, larger RFPs, or one very large one, a well-integrated result may be more certain of attainment, but the work would need to be very carefully managed and facilitated. The overall time required for the whole roadmap is also a consideration. What difference would different approaches make? Some middle ground will likely be the best choice, with fewer than nine RFPs for the remainder of the work (beyond BSBR), but more than one.

[4] The Business Motivation package diagram is adapted from the Standard Model for Business Rule Motivation developed by the Business Rules Group.

Acknowledgements

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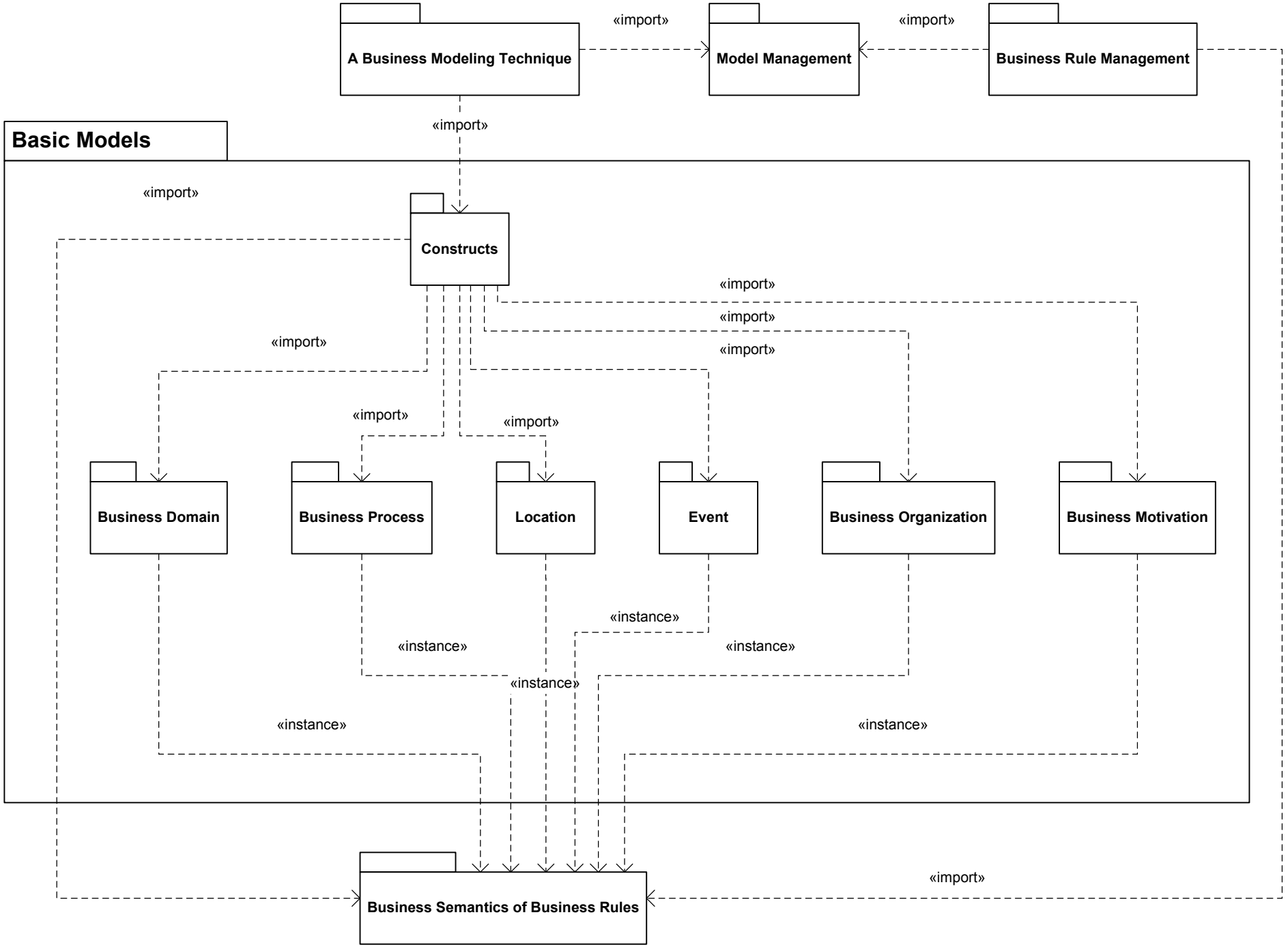
A Business Modeling Technique
«import»
Model Management
«import»
Business Rule Management
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Basic Models
«import»
Constructs
«import»
«import»
«import»
«import»
«import»
«import»
Business Domain
Business Process
Location
Event
Business Organization
Business Motivation
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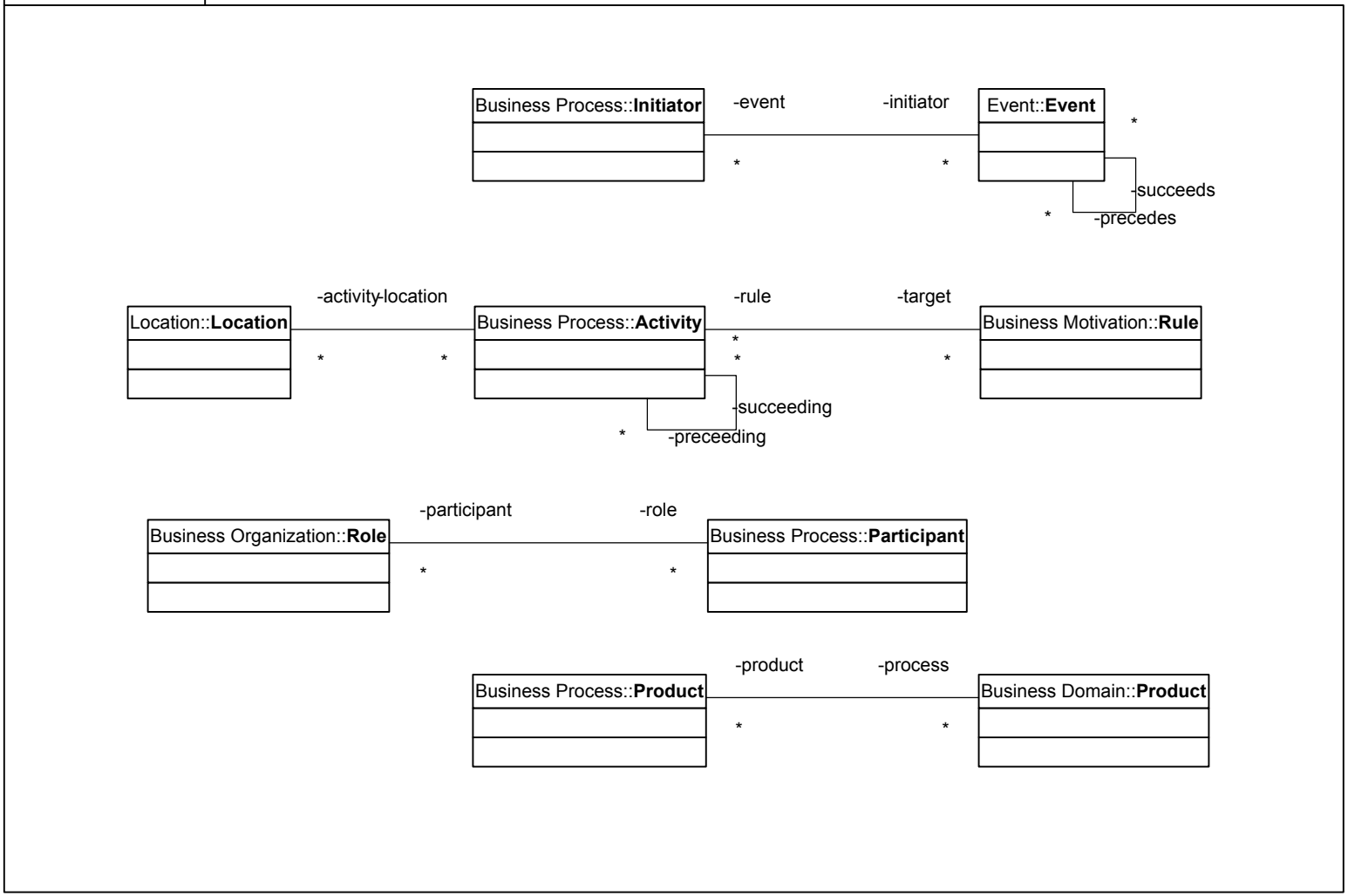
Business Semantics of Business Rules

Constructs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-initiator
Event::**Event**
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-activity-location
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Location::**Location**
Business Process::**Activity**
Business Motivation::**Rule**
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-succeeding
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-participant
-role
Business Organization::**Role**
Business Process::**Participant**
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-product
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Business Process::**Product**
Business Domain::**Product**
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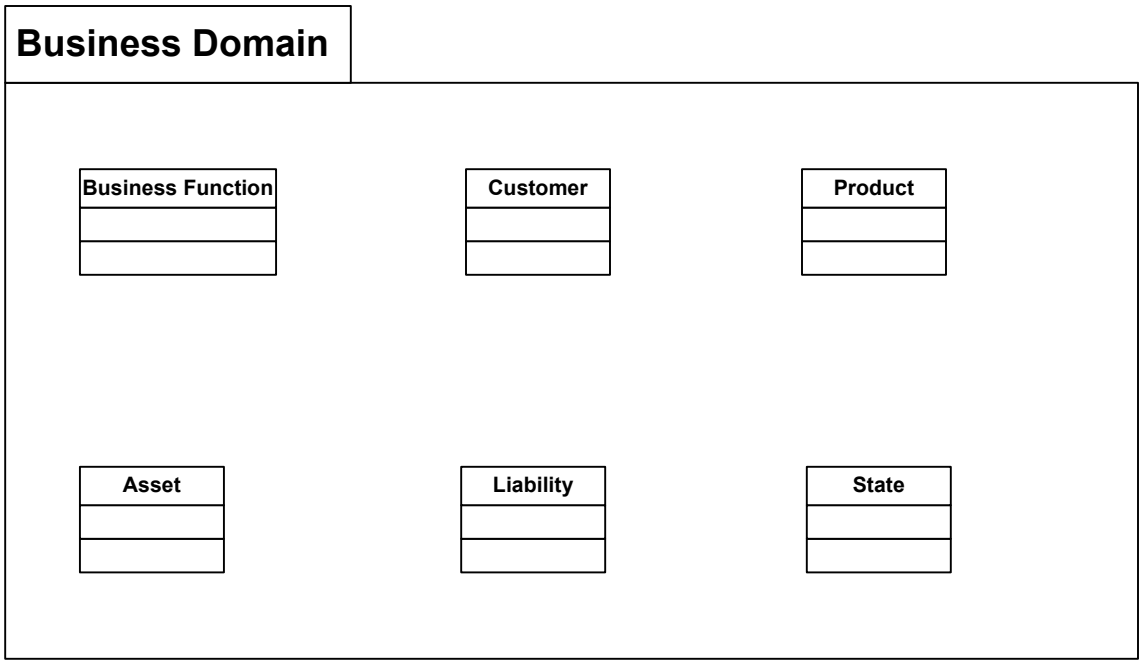
Business Domain
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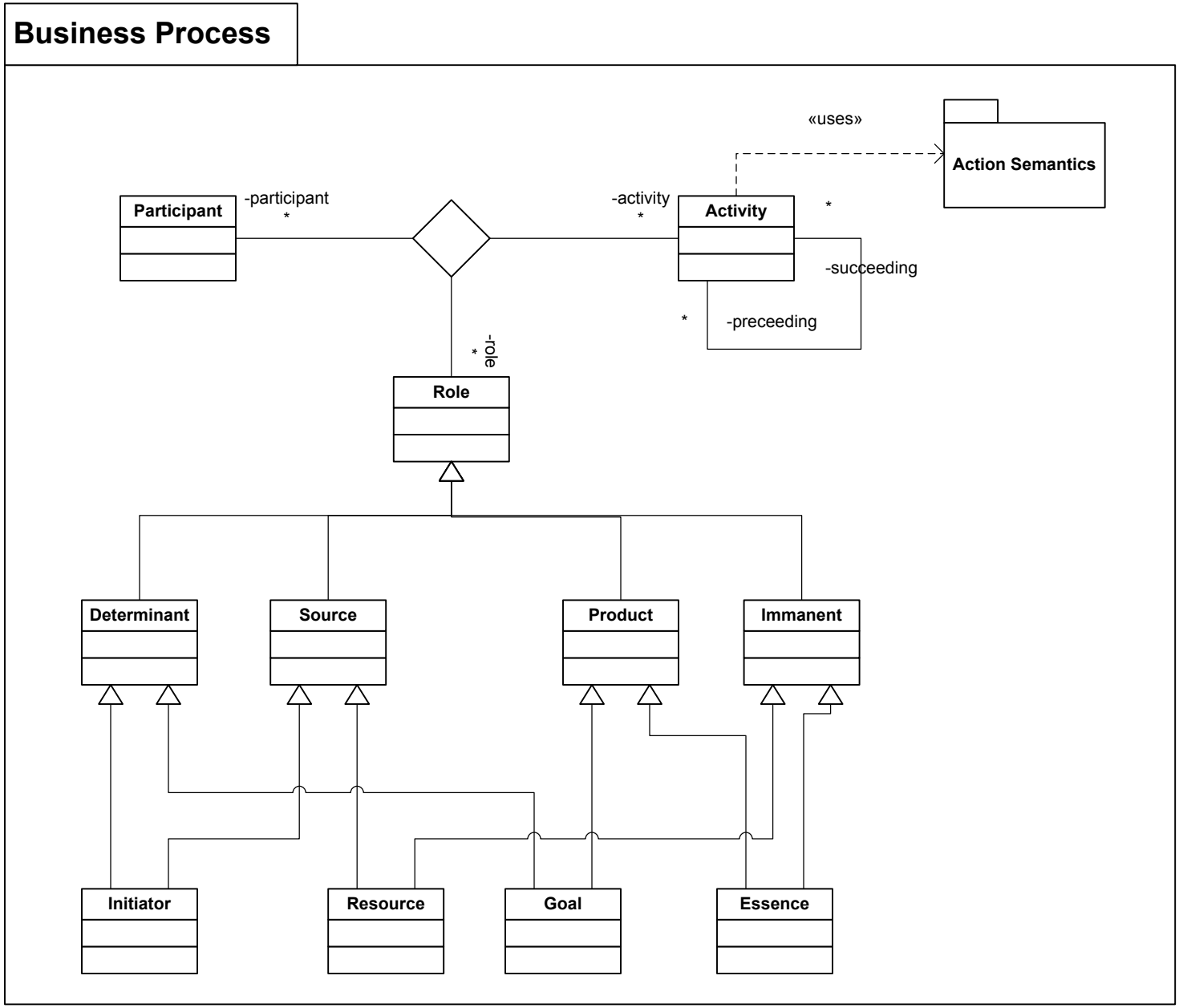
Product
Asset
Liability
State


Business Process
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Action Semantics
Participant
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Activity
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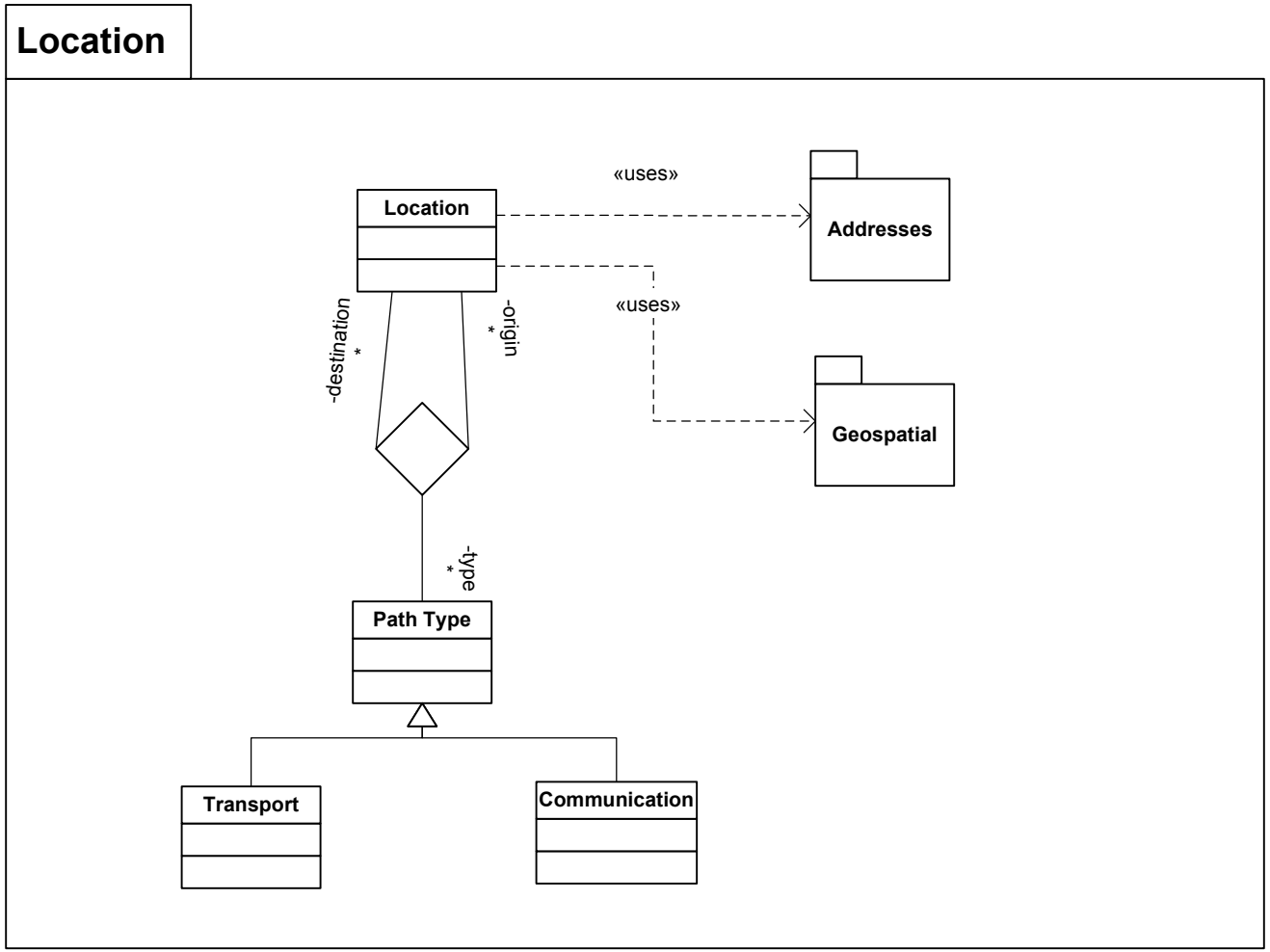
Role
Determinant
Source
Product
Immanent
Initiator
Resource
Goal
Essence


Location
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Geospatial
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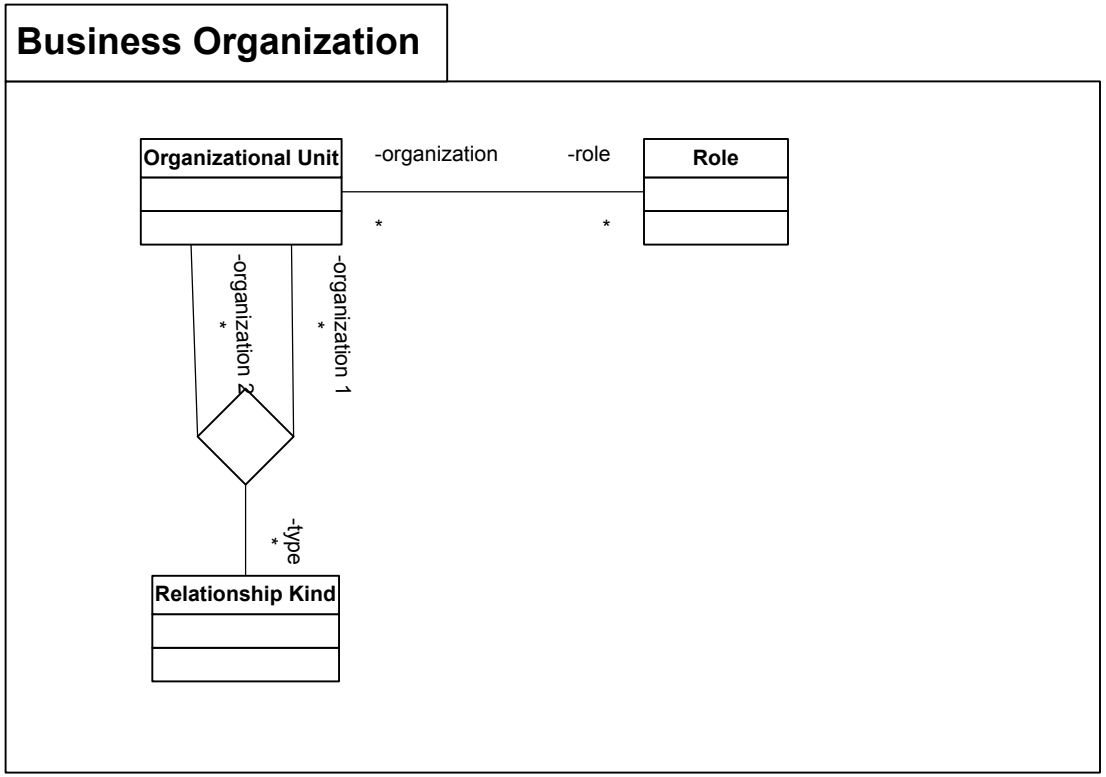
Path Type
Transport
Communication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Organizational Unit
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Role
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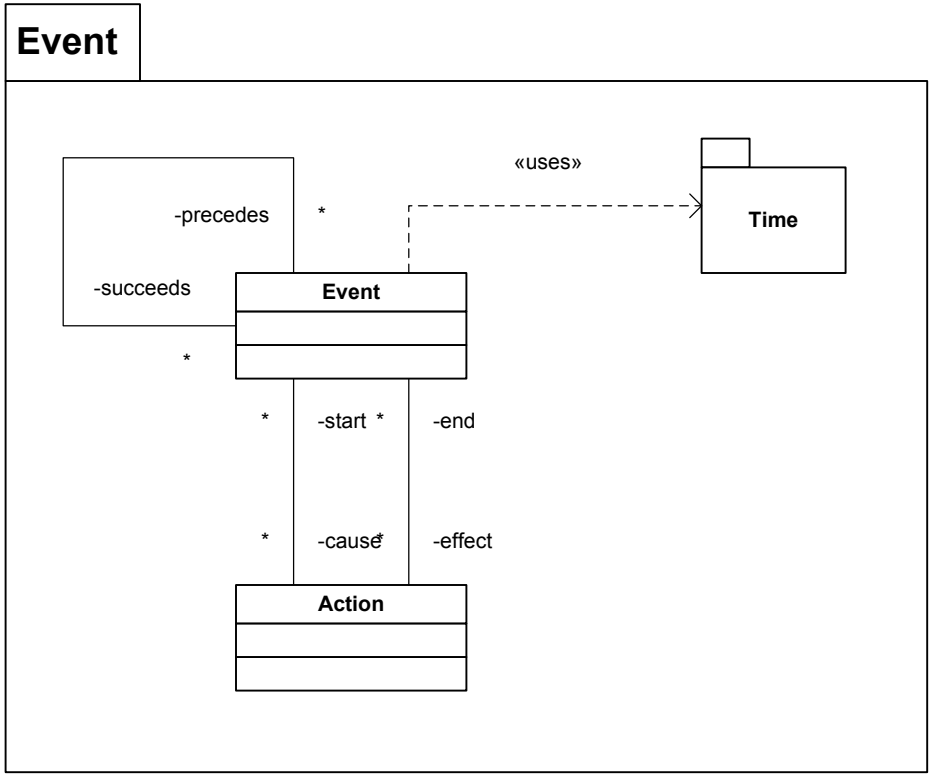
Relationship Kind


Event
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Time
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Event
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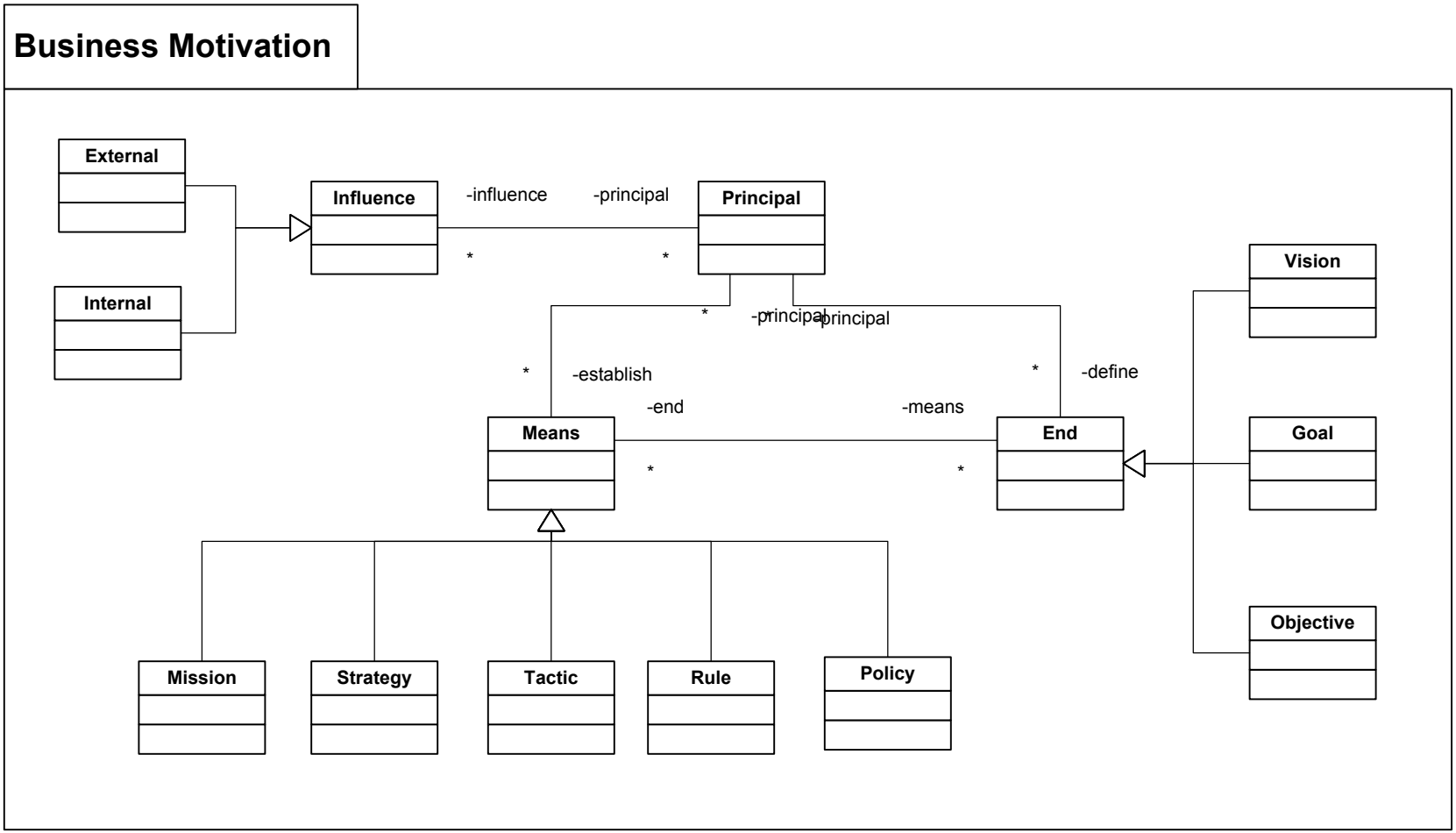
Action


Business Motivation
External
Internal
Influence
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Principal
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principal
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End
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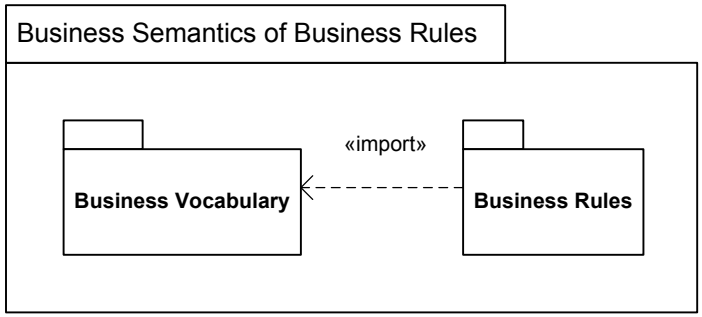
Vision
Goal
Objective
Mission
Strategy
Tactic
Rule
Policy


Business Semantics of Business Rules
«import»
Business Vocabulary
Business Rules