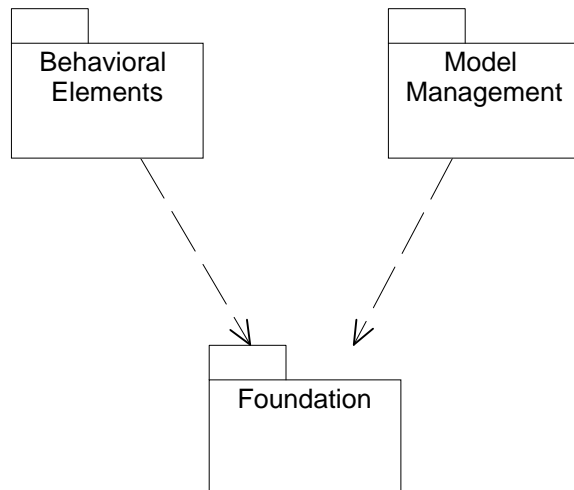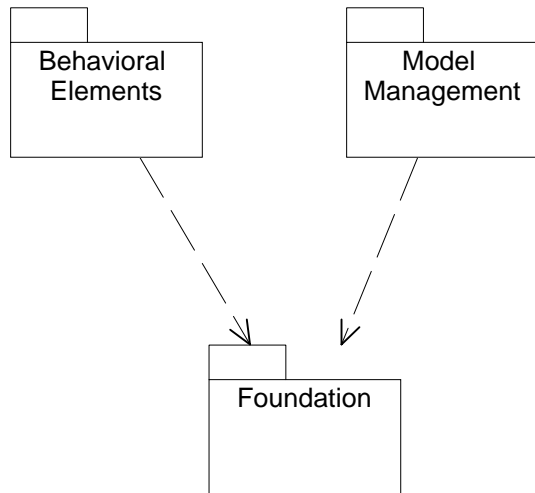**UML Metamodel   version 1.1   1 September 1997**

This is the metamodel of the Unified Modeling Language (UML). It describes the constituents of all well-formed models that may be represented in the UML, using the UML itself. See http://www.rational.com/uml for updates.

The metamodel is organized according to the following packages:

      Foundation
            Core
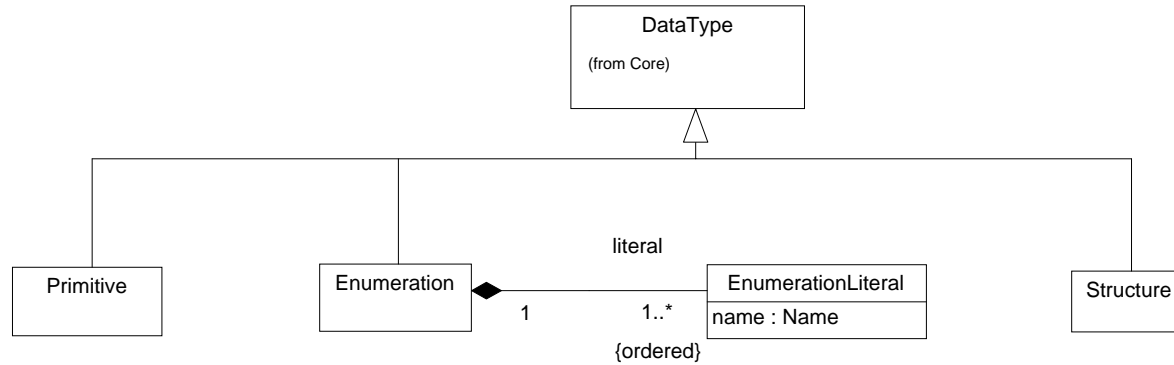   Auxiliary Elements
            Extension Mechanisms
            Data Types
      Behavioral Elements
            Common Behavior
            Collaborations
            Use Cases
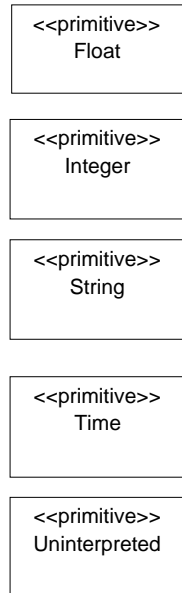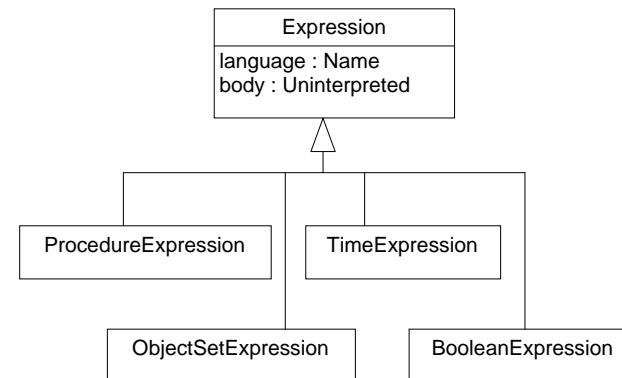   State Machines
      Model Management

Top-Level Packages

Behavioral Elements

Model Management

Foundation

DataTypes

DataType

(from Core)

Primitive

Enumeration

literal

EnumerationLiteral

name : Name

1   1..*

{ordered}

Structure

Primitives

<<primitive>>
Float

<<primitive>>
Integer

<<primitive>>
String

<<primitive>>
Time

<<primitive>>
Uninterpreted

Enumerations

<<enumeration>>
AggregationKind

<<enumeration>>
Boolean

<<enumeration>>
CallConcurrencyKind

<<enumeration>>
ChangeableKind

<<enumeration>>
EventOriginKind

<<enumeration>>
MessageDirectionKind

<<enumeration>>
OperationDirectionKind

<<enumeration>>
ParameterDirectionKind

<<enumeration>>
PseudostateKind

<<enumeration>>
ScopeKind

<<enumeration>>
SynchronousKind

<<enumeration>>
VisibilityKind

Geometry

body : Uninterpreted

GraphicMarker

body : Uninterpreted

Mapping

body : Uninterpreted

Name

body : String

Multiplicity

1

ranges   1..*

MultiplicityRange

lower : Integer
upper : Integer

Expression

language : Name
body : Uninterpreted

ProcedureExpression

TimeExpression

ObjectSetExpression

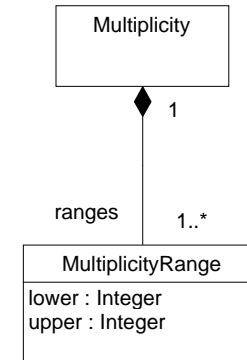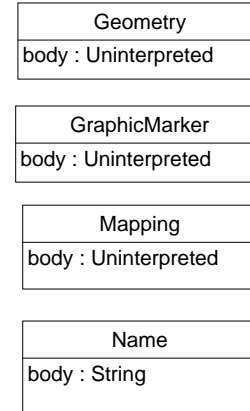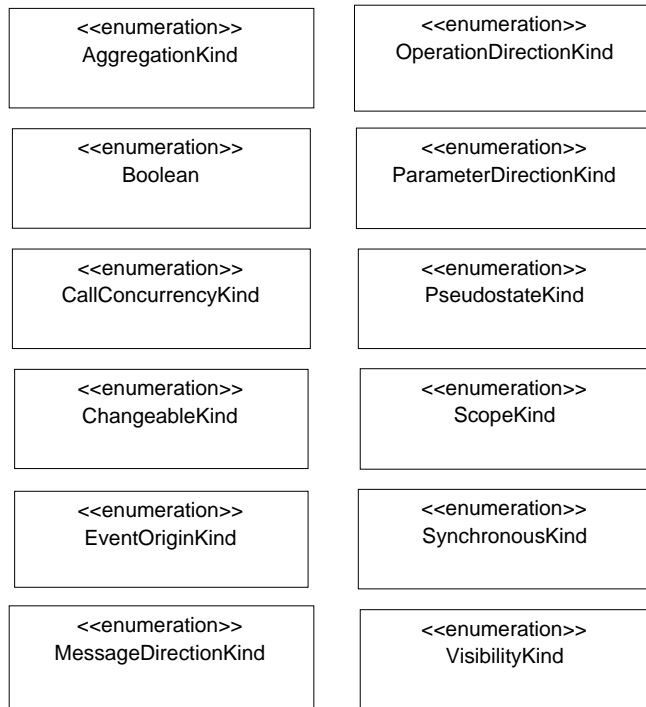BooleanExpression

Standard Elements

Stereotypes, tagged values, and constraints are the mechanisms of extensibility in the UML. Stereotypes extend the classes in the metamodel, tagged values extend the attributes of classes in the metamodel, and constraints extend the semantics of the metamodel. Certain stereotypes, tagged values, and constraints are predefined in the UML; others may be user defined.

Standard stereotypes	Standard tagged values	Standard constraints
becomes	documentation	association
bind	location	broadcast
callDependency	persistence	complete
constraint	responsibility	disjoint
classify	semantics	global
copy		implicit
create		incomplete
declassify		local
delete		or
derived		overlapping
document		parameter
enter state		vote
enumeration		
exit state		
extends		
facade		
file		
framework		
friend		
implementation class		
import		
inherits		
instance		
invariant		
library		
metaclass		
postcondition		
powertype		
precondition		
process		
requirement		
role		
self		
send		
stereotype		
stub		
subclass		
subtype		
system		
table		
thread		
top-level package		
type		
uses		
utility		

Collaborations

Namespace
(from Core)

Classifier
(from Core)

represented
Classifier

*

0..1

{or}

0..1

Operation
(from Core)

represented
Operation

*

Collaboration

constrainingElement

*

*

context

1

interaction

*

ModelElement
(from Core)

Interaction

1

1

/ownedElement

*

message
1..*

*

predecessor

*

*

activator

0..1

Message

*

action

0..*

1

Action

(from Common Behavior)

*

*

receiver

1

sender

1

Association
(from Core)

1

base

*

AssociationRole
multiplicity : Multiplicity

*

1

2..* connection

1

/connection

2..*

1

AssociationEnd
(from Core)

*

AssociationEndRole

base

*

1

1..*

/ownedElement

ClassifierRole
multiplicity : Multiplicity

*

base

1

Classifier
(from Core)

/type

1

availableFeature

*

Feature

State Machines: Main

ModelElement
(from Core)

context
0..1

behavior

StateMachine

*

0..1

0..1

Guard
expression : BooleanExpression

guard | 0..1

1

StateVertex

source

outgoing

transitions | *

Transition

substate

1

target

incoming

*

1..*

1

*

*

*

0..1

0..1

top
1

0..1 internalTransition

entry
0..1

effect

0..1

ActionSequence

{ordered}

*

Action

Pseudostate
kind : PseuostateKind

State

0..1

exit

0..1

action

0..1

0..1

0..1
0..*

parent

0..1

CompositeState
isConcurent : Boolean

SimpleState

SubmachineState

ModelElement
(from Core)

*

submachine

1

StateMachine

deferredEvent

0..*

Event

trigger

0..1

State Machines:
Activity Models

State Machines:
Events

```
                              ┌─────────────────────┐
                              │       Event         │
                              └─────────────────────┘
                                        △
        ┌───────────────┬───────────────┴────────────┬─────────────────────────┐
 ┌──────────────┐  ┌──────────────┐  ┌───────────────────────────┐  ┌───────────────────────────────────────┐
 │ SignalEvent  │  │  CallEvent   │  │  TimeEvent                │  │  ChangeEvent                          │
 └──────────────┘  └──────────────┘  ├───────────────────────────┤  ├───────────────────────────────────────┤
                                      │ duration : TimeExpression │  │ changeExpression : BooleanExpression  │
 occurrence    *   occurrence    *    └───────────────────────────┘  └───────────────────────────────────────┘

        1                  1
 ┌──────────────┐  ┌──────────────┐
 │   Signal     │  │  Operation   │
 │              │  │ (from Core)  │
 │(from Common  │  │              │
 │  Behavior)   │  │              │
 └──────────────┘  └──────────────┘
```
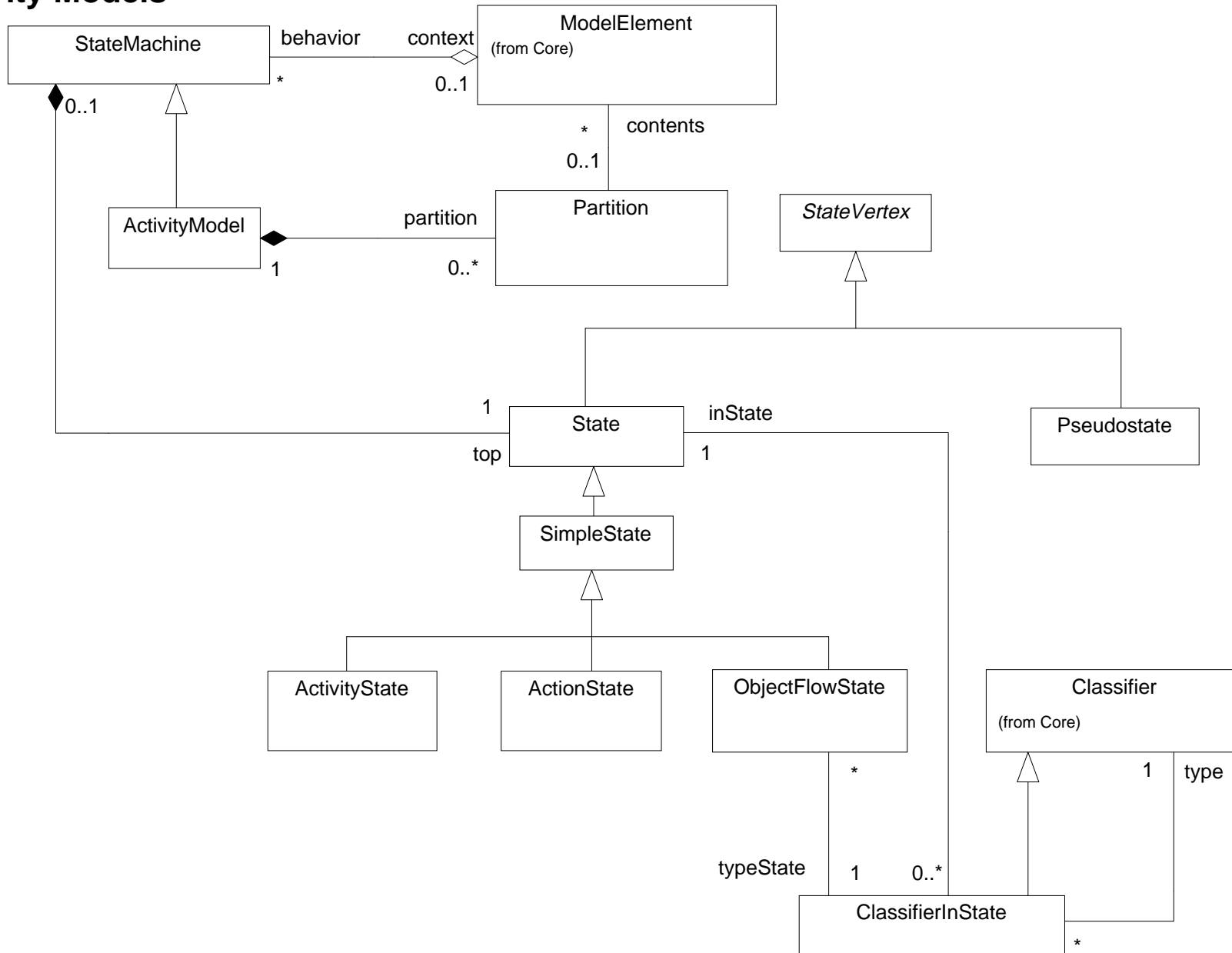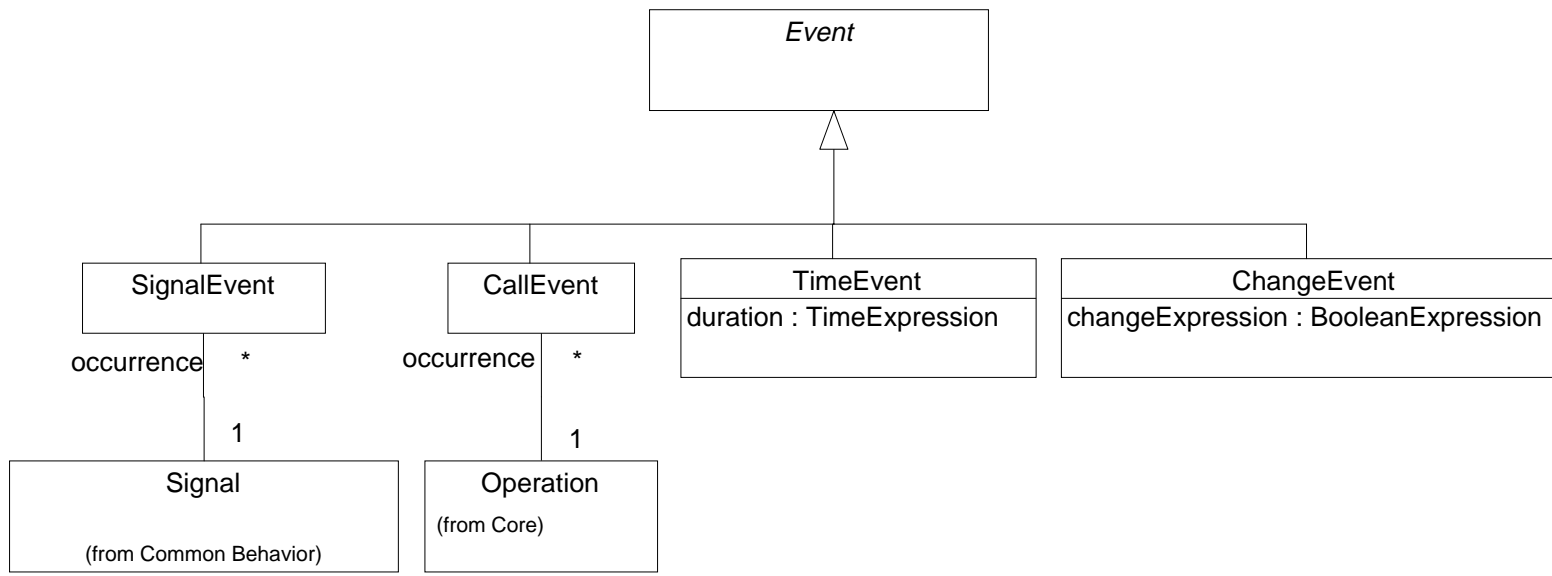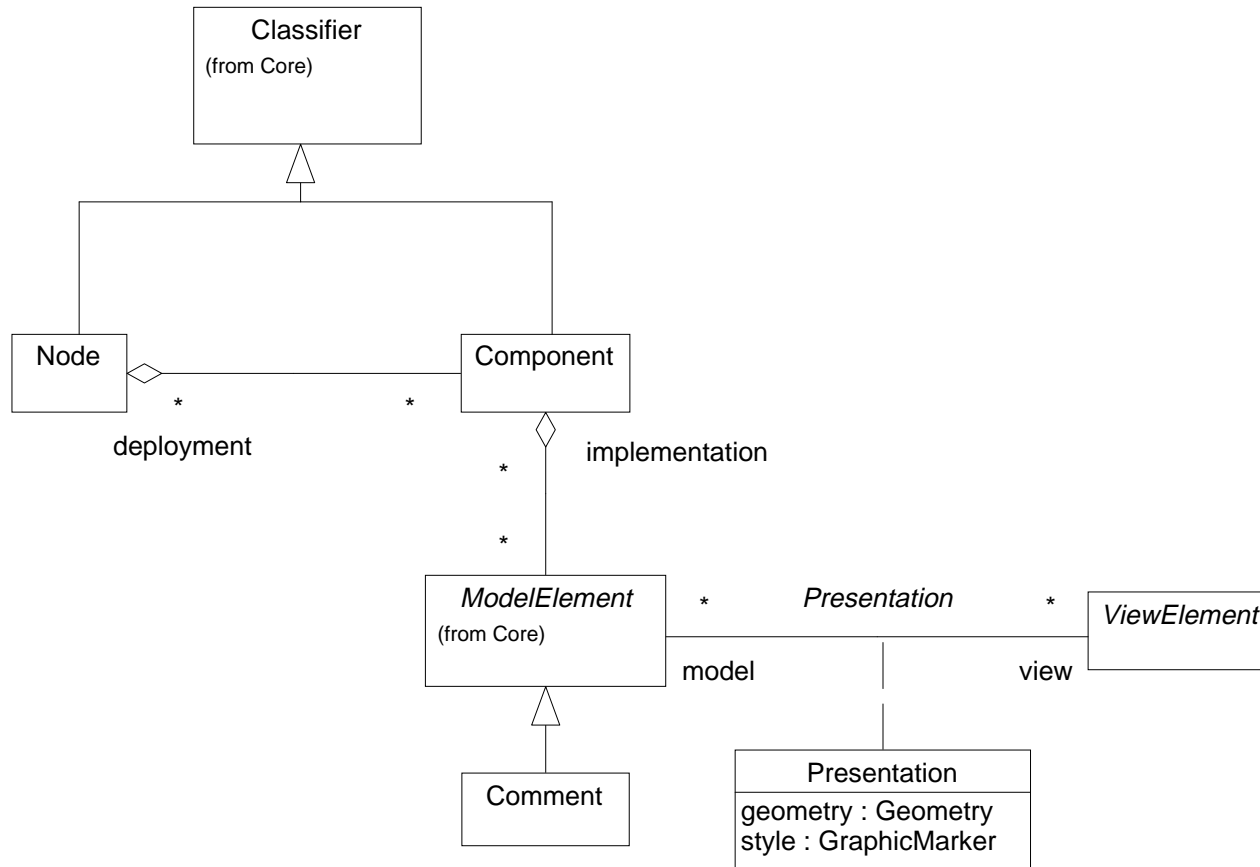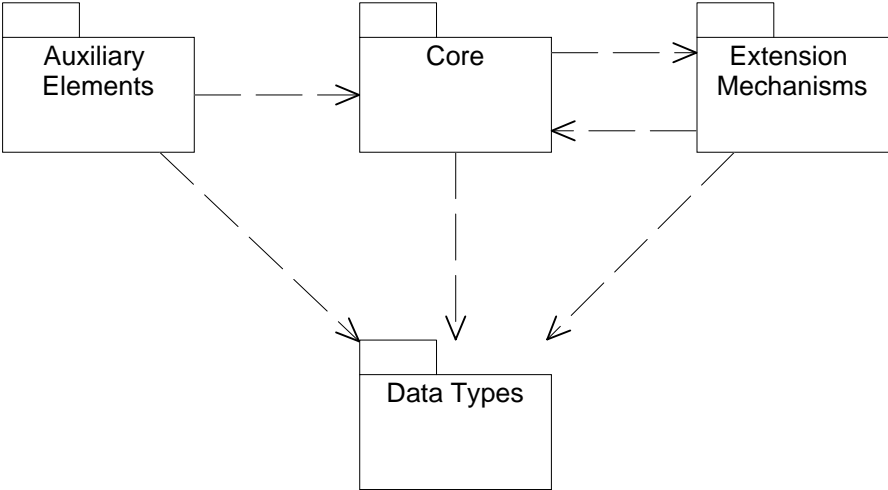
Auxiliary Elements: Dependencies
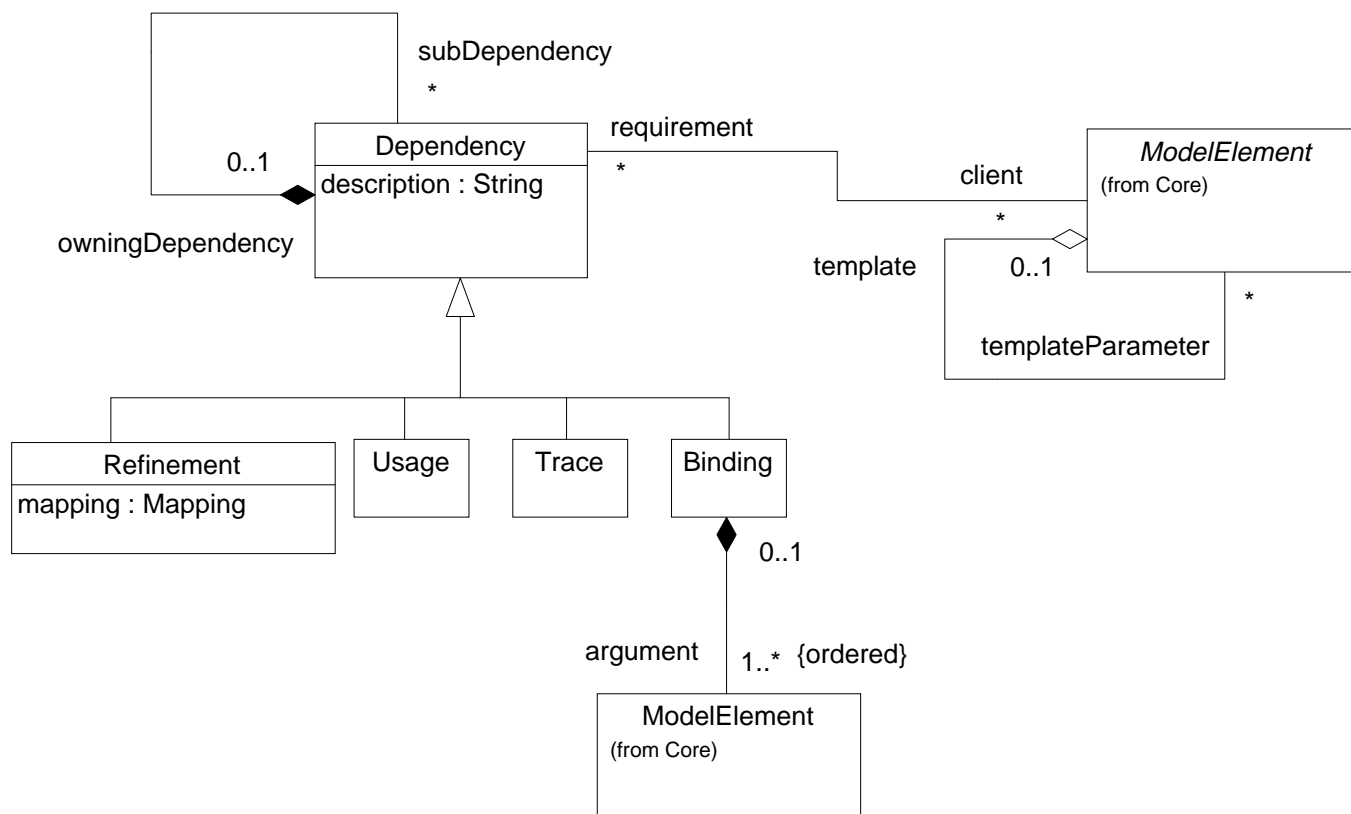
Auxiliary Elements:
Physical Structures and View Elements

```
Classifier
(from Core)
```

```
Node
```

```
Component
```

*

*

deployment

implementation

*

*

```
ModelElement
(from Core)
```

* Presentation *

```
ViewElement
```

model

view

```
Comment
```

```
Presentation
geometry : Geometry
style : GraphicMarker
```

Foundation Packages

```
┌──┐
│  └──────────┐        ┌──┐                    ┌──┐
│  Auxiliary   │        │  └──────────┐        │  └──────────┐
│  Elements    │ ──── ▷ │  Core        │ ─── ▷ │  Extension   │
│              │        │              │ ◁ ─── │  Mechanisms  │
└──────────────┘        └──────────────┘        └──────────────┘
        │                      │                       │
         ╲                     │                      ╱
          ╲                    ▼                     ╱
           ▷         ┌──┐
                     │  └──────────┐
                     │  Data Types  │
                     │              │
                     └──────────────┘
```

Extension Mechanisms
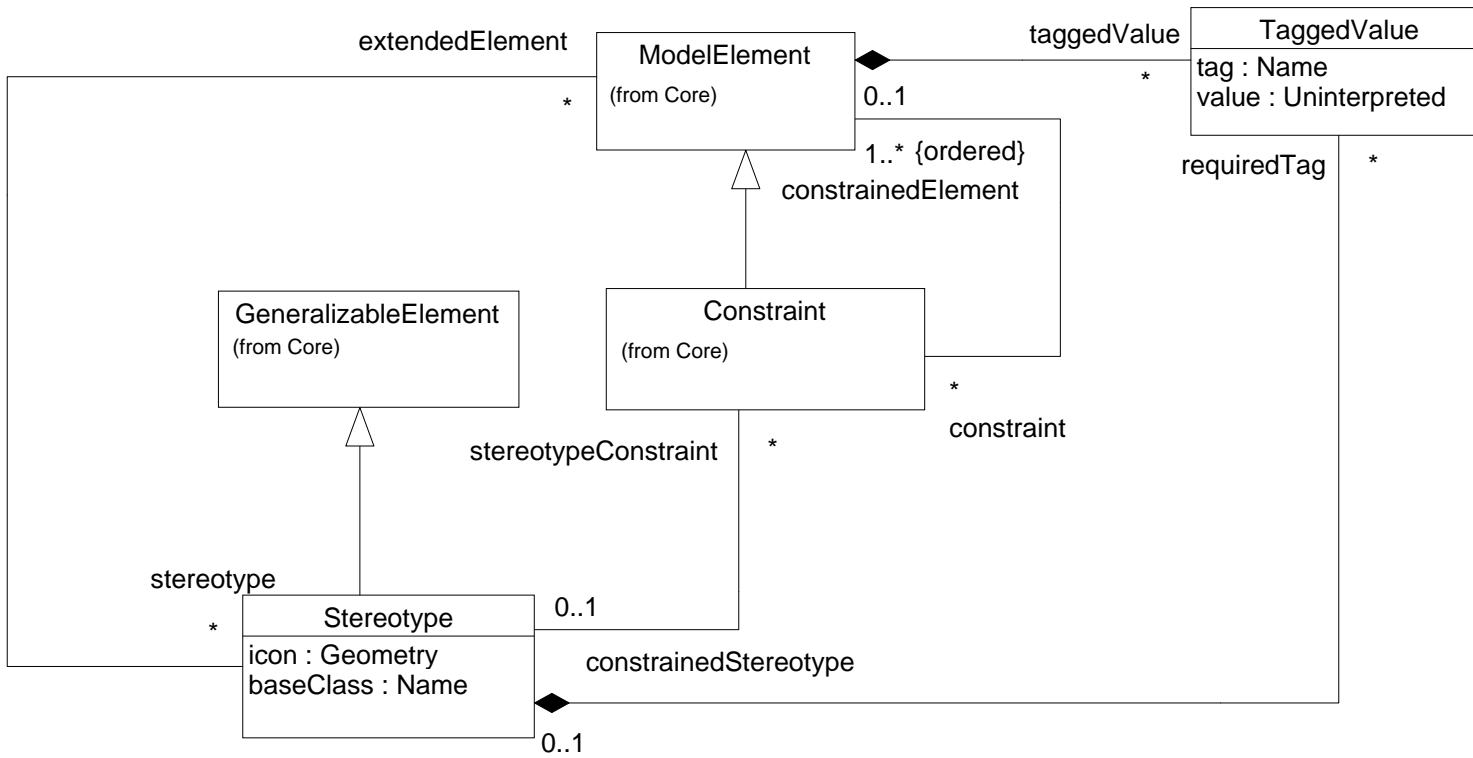
Common Behavior:
Instances and Links

ModelElement
(from Core)

Link

1   linkRole

LinkEnd

linkEnd

instance

Instance

value

1

*

AttributeLink

0..*

2 .. *

*

1

1

slot

*

*

*

Object

DataValue

Link

1..*   classifier

Classifier
(from Core)

1   attribute

Attribute
(from Core)

associationEnd

1

1   association

connection

Association
(from Core)

AssociationEnd
(from Core)

2..*

1

LinkObject

*   MessageInstance

*   *

*

receiver

sender

1

1

1   specification

Request

argument

Instance

*

Common Behavior:
Actions
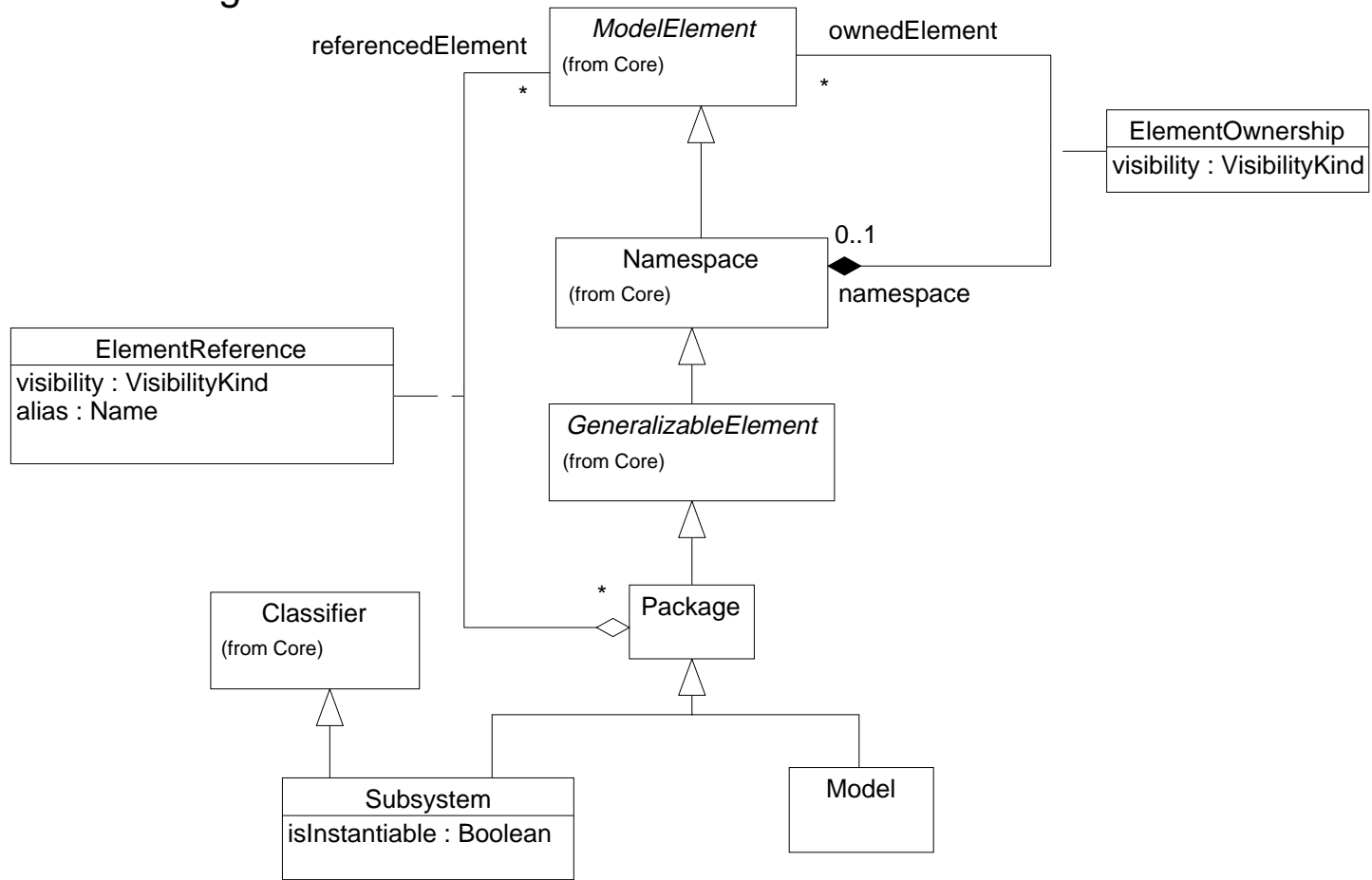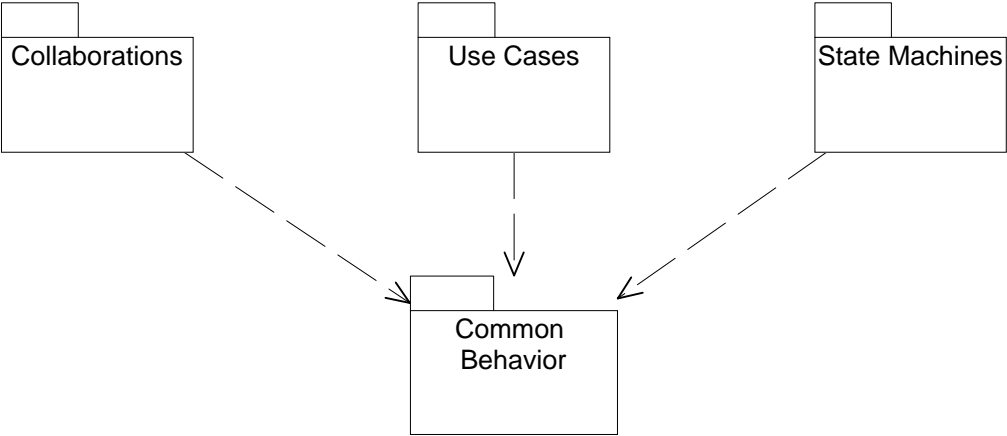
Common Behavior: Requests
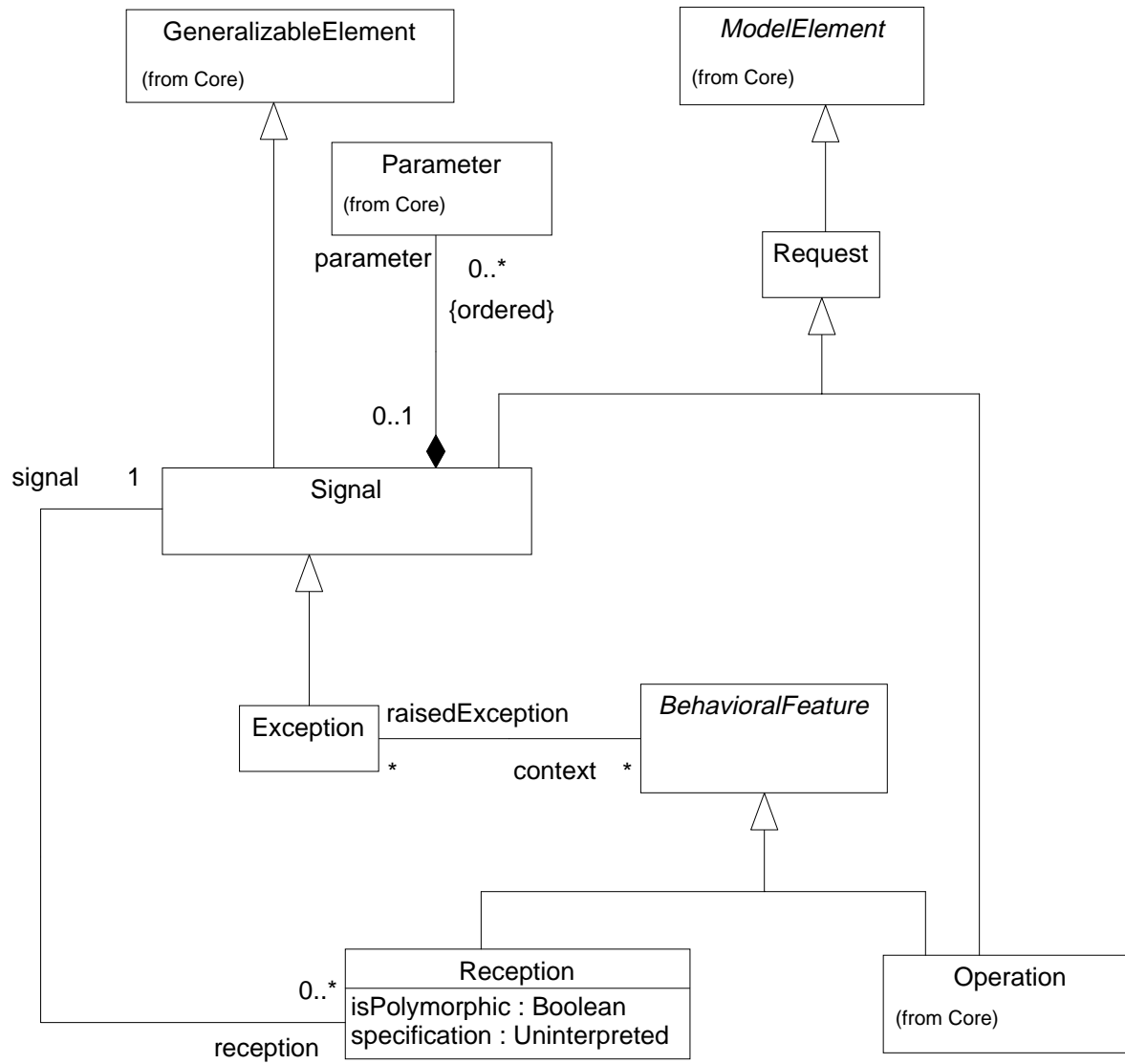
Core: Backbone
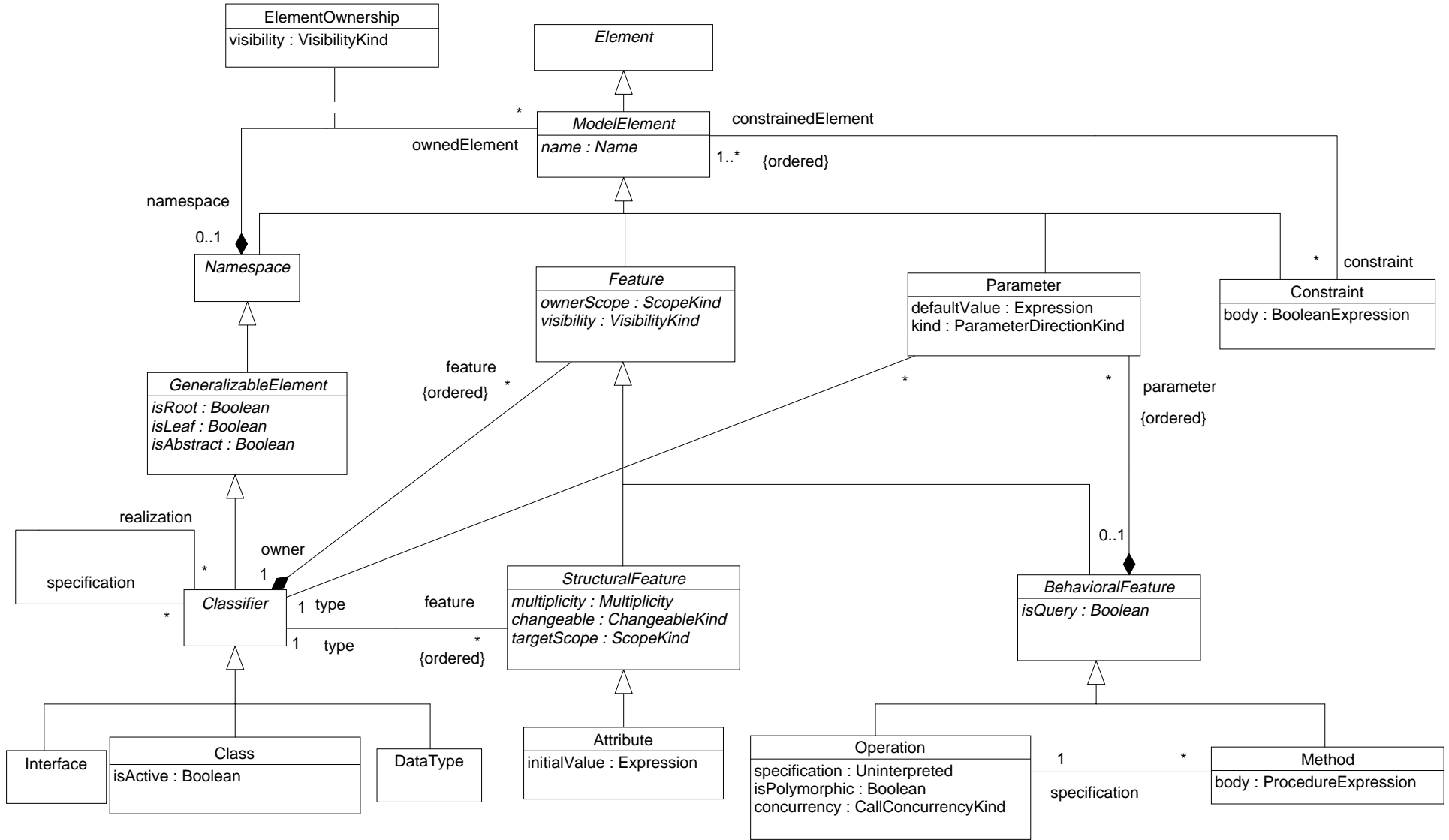
Core: Relationships
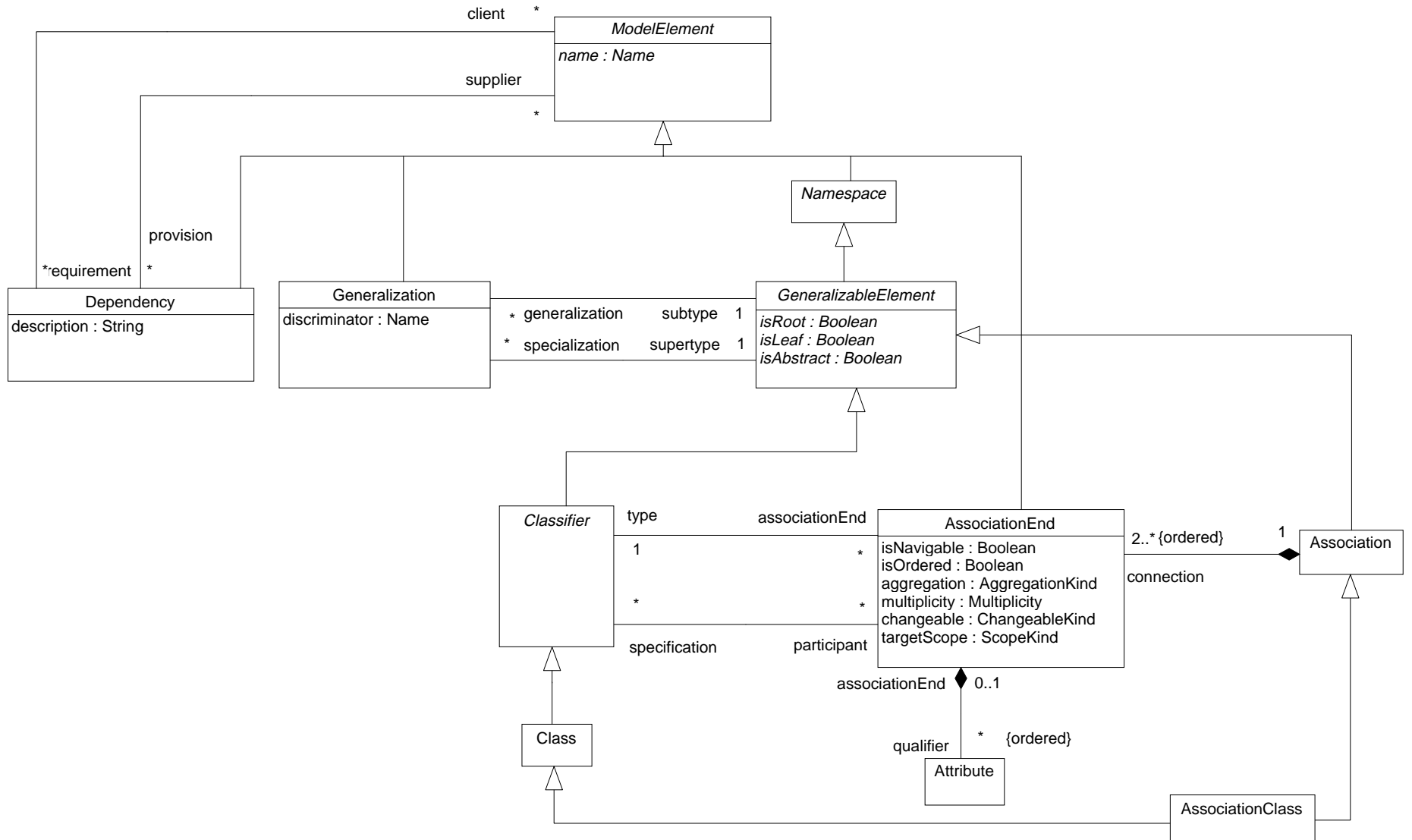
Model Management

Behavioral Elements Packages

Use Cases