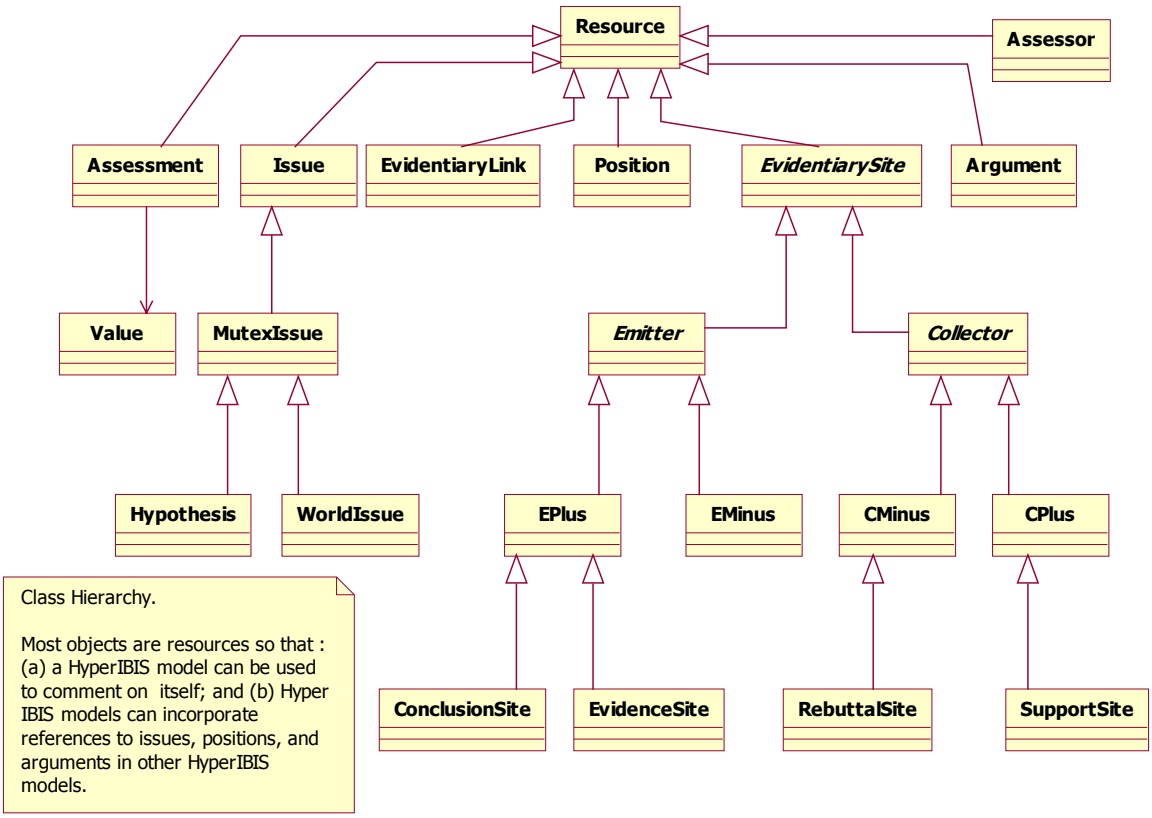
Introduction

The HyperIBIS architecture extends the standard IBIS model to support inference about belief and expected utility in formal argument models using an open hypertext architecture.

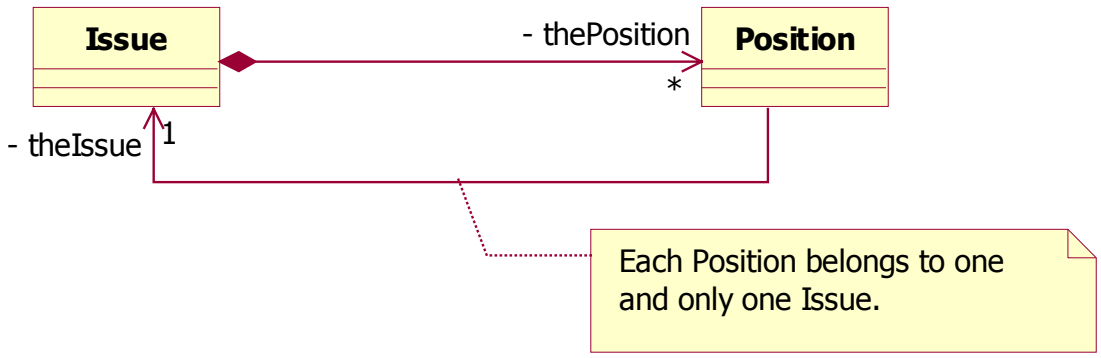
Traditional IBIS models provide a formal model of argument following the work of Toulmin for the United Nations in the 1950s. The HyperIBIS model extends this work by incorporating both an open hypertext model, so that any addressable web resource may be interpreted as evidence in an argument, and by developing the notion of beliefs, assumptions, value judgements, and expected utility as an elaboration of the basic IBIS graph.

This package provides a non-normative abstract model for the HyperIBIS architecture. This non-normative abstract model is meant to inform specific implementations of the HyperIBIS architecture without requiring a decomposition into a specific object model. A concete implementation of the HyperIBIS architecture has been developed as part of the Cognitive Web effort. The Cognitive Web is a semantic web effort focused on collaborative, process-oriented decision-making.

Class hierarchy

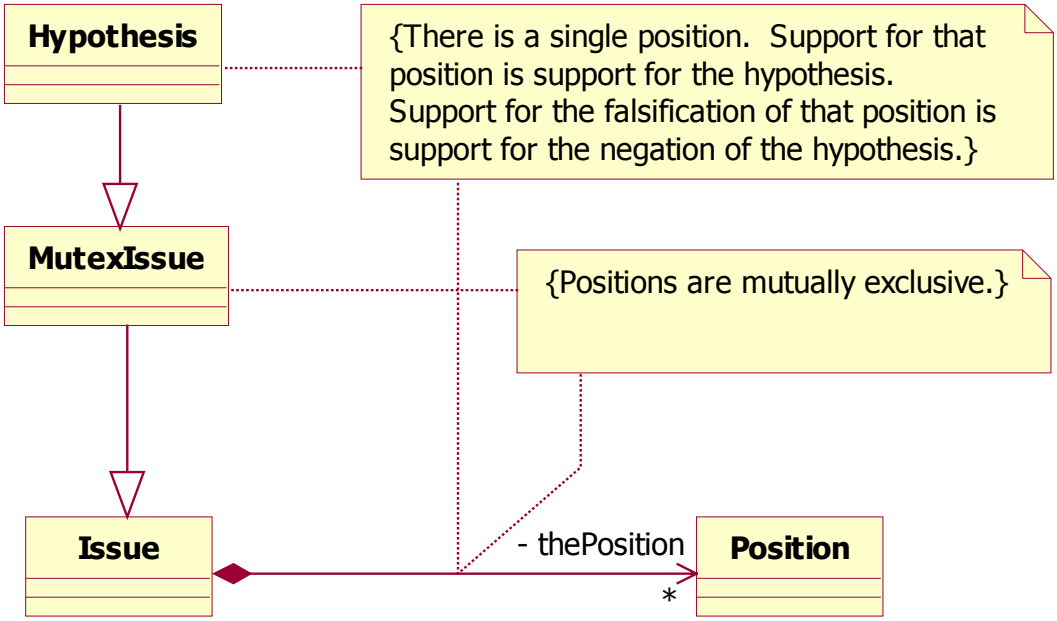


Issues have positions



Each issue essentially asks a question. The positions on that issue enumerate possible answers to that question.

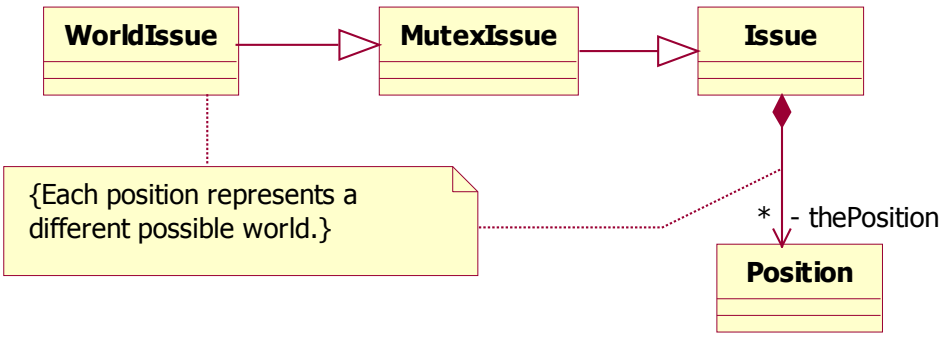
Mutex issues and hypotheses



Positions on issues may be conditionally dependent. For example, an Issue may be declared to have mutually exclusive positions -- this is known as a MUTEX issue.

A Hypothesis is a special case of a MUTEX Issue which is constrained to have only two possible truth states. Since each position already has two truth states (support for the position and support for its falsification), a hypothesis is modeled using a single position.

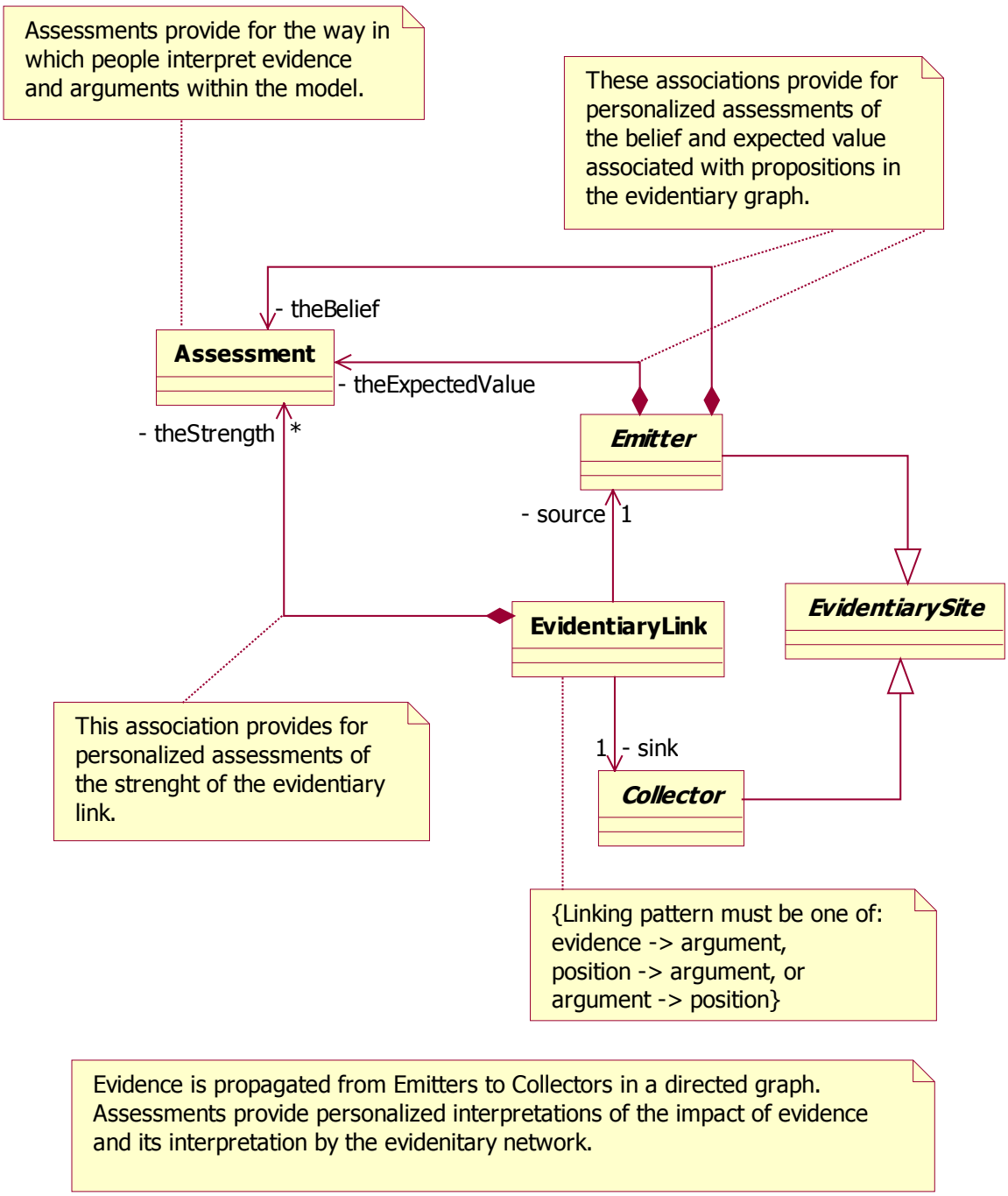
World issues



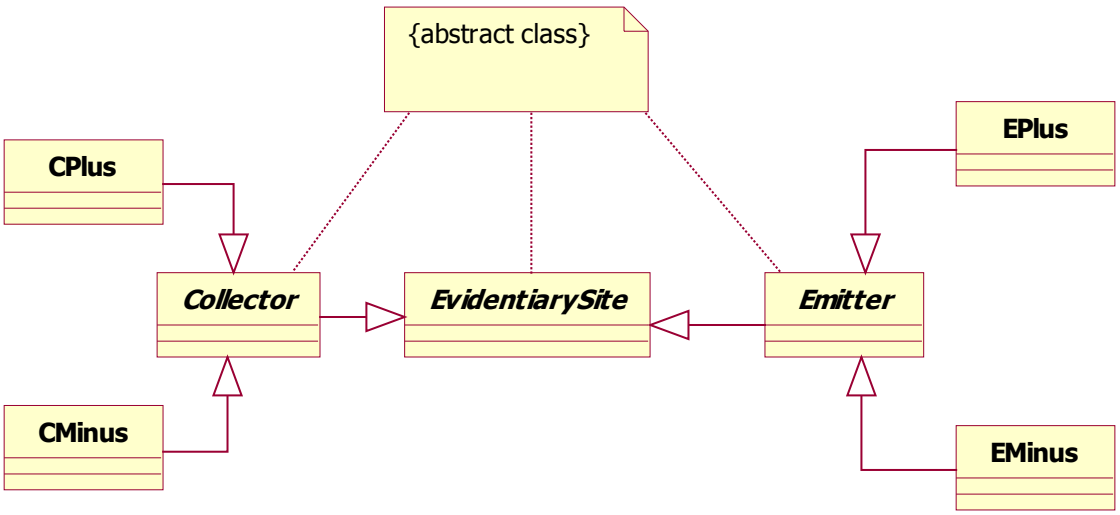
World issues support systematic reasoning about sets of coherent assumptions, know as worlds. A world issue asks the question, "Which world is true?" The positions on a world issue each represent a different possible world. The emitters of the positions on a world issue are used as evidence supporting or rebutting different arguments so as to create an IBIS model that is conditionally dependent on the specific world that is currently believed.

Inference algorithms may automatically detect the most likely world based on the existing evidence. Alternatively, users may perform what if analysis by making the assumption that a particular world is true, and then seeing the impact of that assumption of the evidence and expected value as propagated through the evidentiary network.

Evidentiary links



Kinds of evidentiary sites

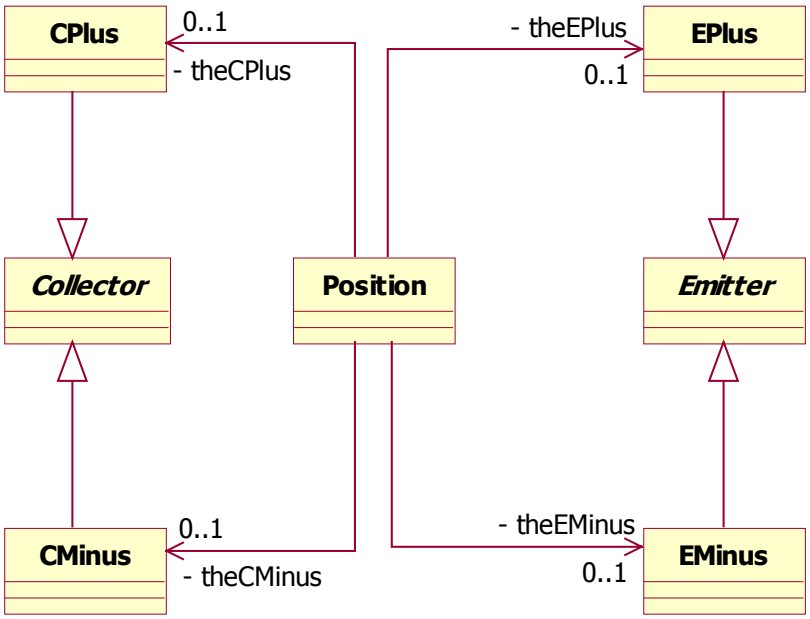


Every emitter or collector handles only negative or positive evidence. As a result, there are four concrete kinds of evidentiary sites. They are:

CPlus (c+) : collects evidence that supports some proposition.
CMinus (c+) : collects evidence that supports the falsification of some proposition.

EPlus (e+) : distributes combined evidence based on the truth of some proposition.
EMinus (e-) : distributes combined evidence based on the falsification of some proposition.

Each position has four evidentiary sites (c+, c-, e+, e-).

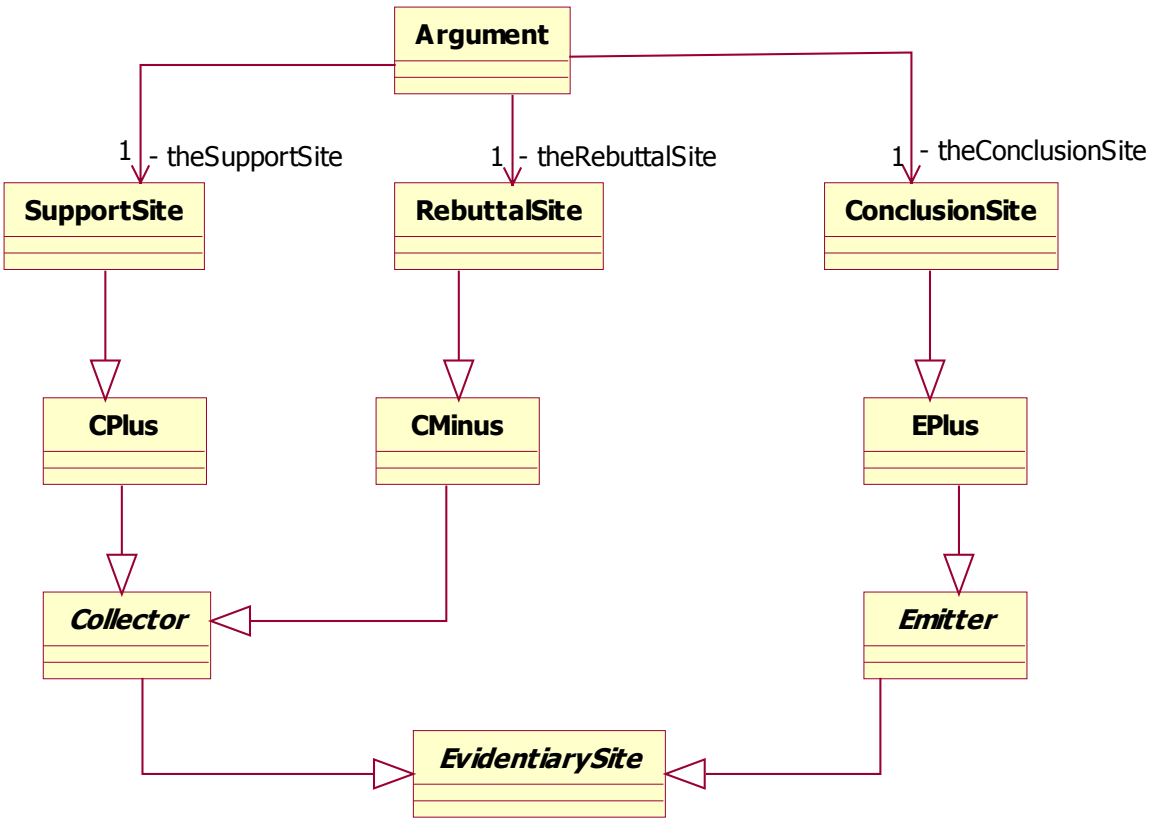


Each position has four evidentiary sites:

CPlus (c+) : collects evidence that supports the truth of the position.
CMinus (c-) : collects evidence that supports the falisification of the position.

EPlus (e+) : distributes evidence based on the truth of the position.
EMinus (e-) : distributes evidence based on the falisification of the position.

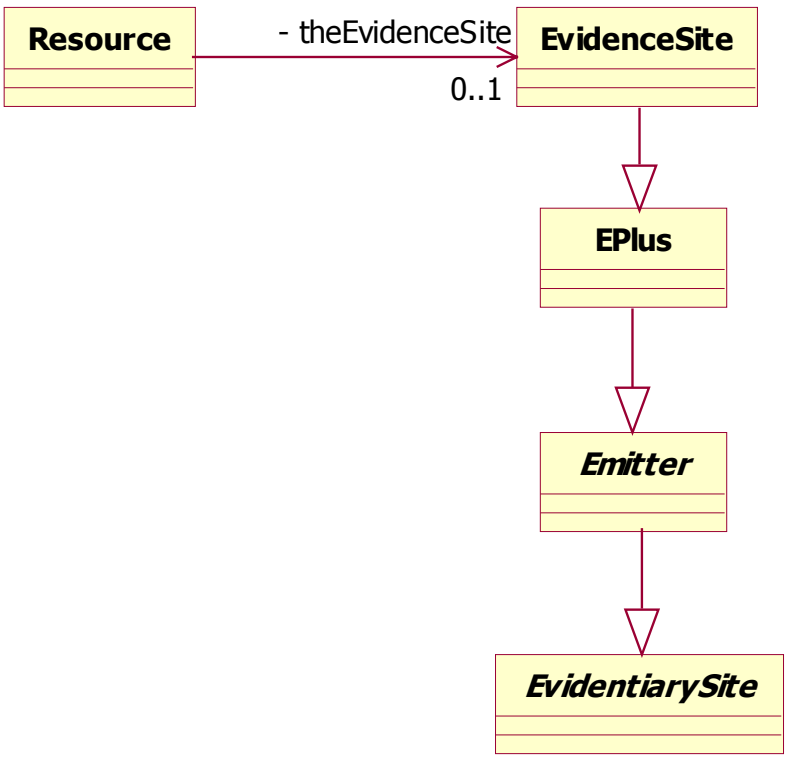
Each argument has three evidentiary sites (c+, c-, e+).



Each argument has three evidentiary sites:

SupportSite (c+) : collects evidence that supports the argument.
RebuttalSite (c-) : collects evidence that defeats the argument.
ConclusionSite (e+) : distributes evidence based on the truth of the argument.

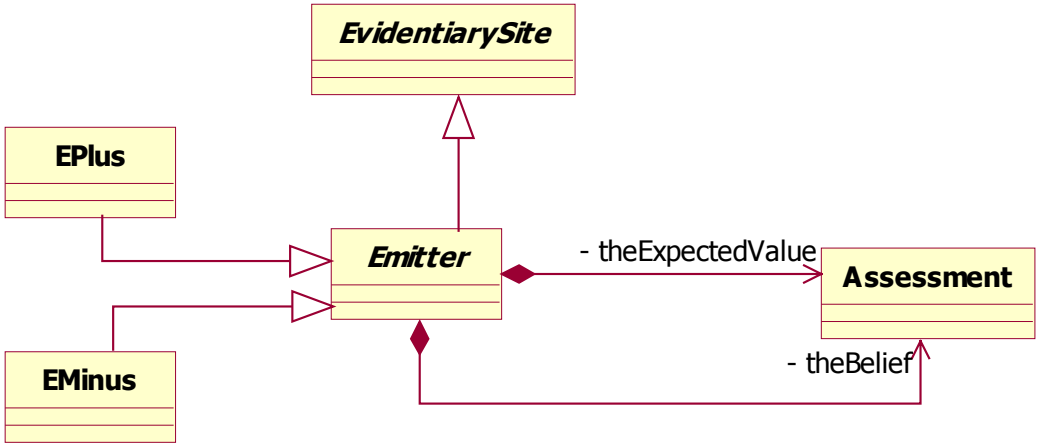
Each resource may have one evidentiary site (e+).



Hypertext is incorporated into the HyperIBIS architecture by associating an evidentiary site with a resource. This makes it possible to link any resource as evidence supporting positions in the IBIS model.

Fine-grained annotations should be handled using an appropriate out-of-line resource indicator model, such as the XPointer specification.

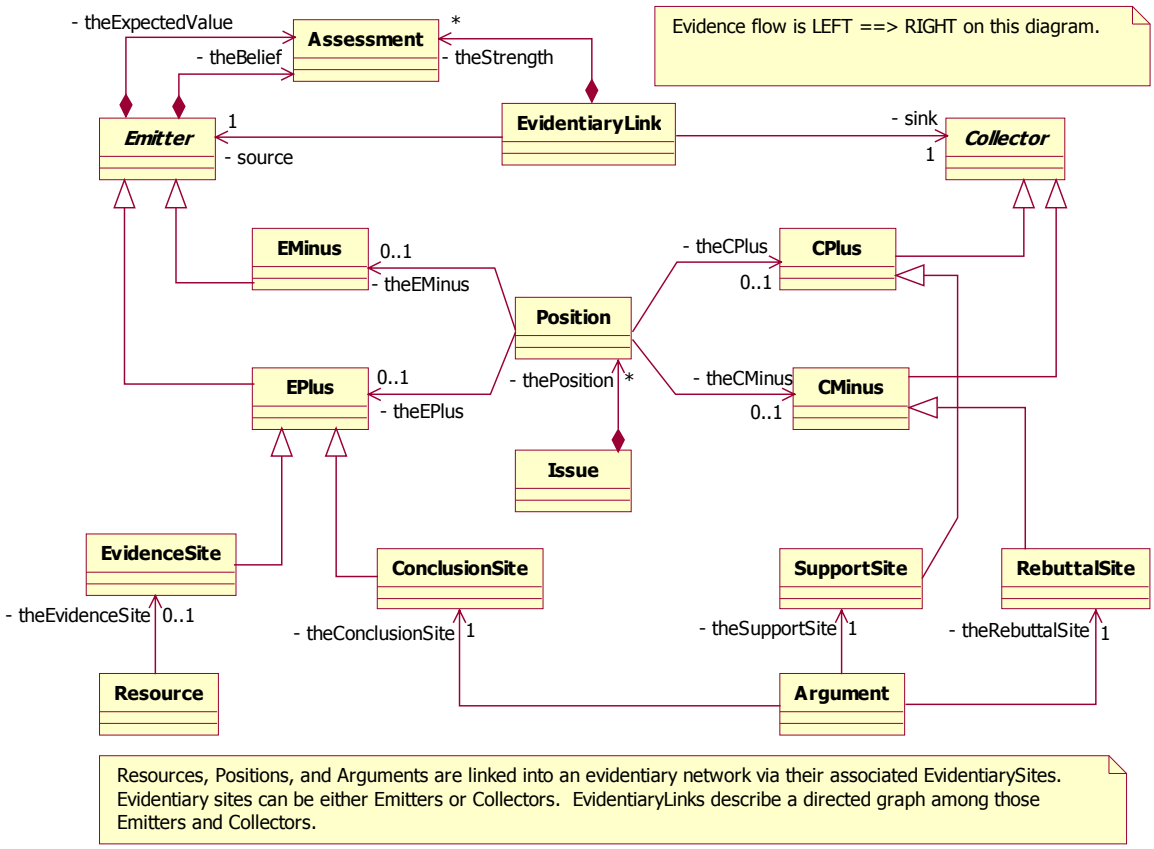
Attributes of evidentiary sites.



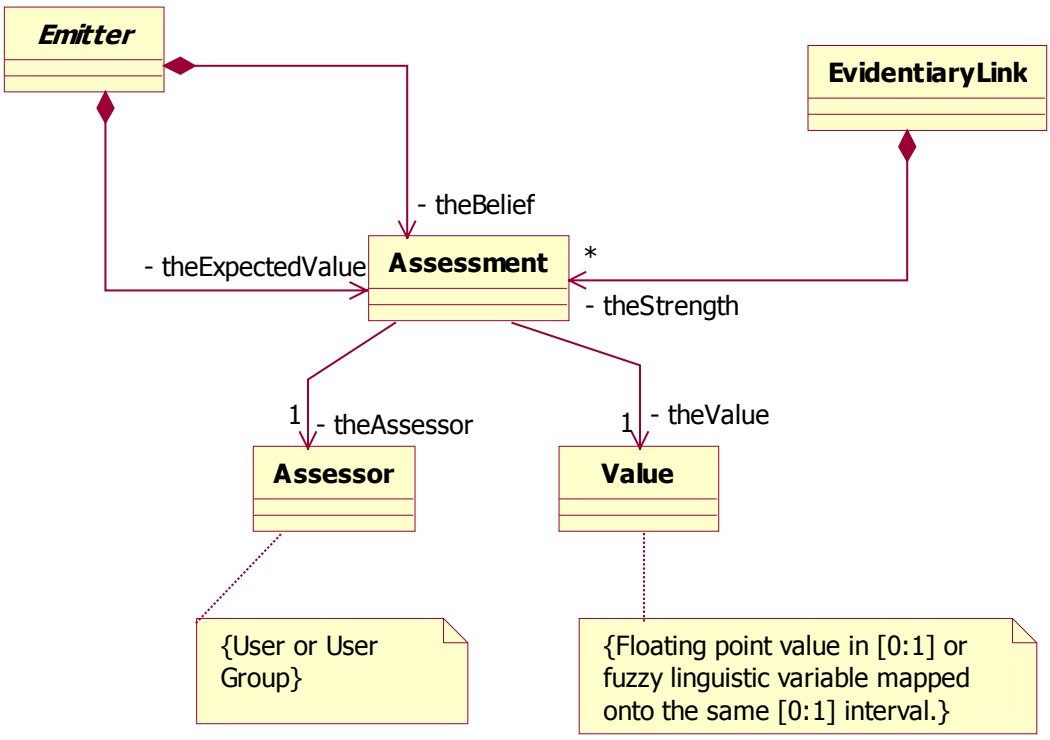
Each emitter is associated with optional assessments of the belief that the proposition represented by that emitter is true, and the expected value that is associated with the world state in which that proposition is true.

Note that the meaning of belief and expected value depends on whether they are attached to the positive or negative emitter. The position emitter denotes the proposition that the associated resource, position, or argument is true. The negative emitter (e-) denotes the proposition that the associated position is false (negative emitters only occur on positions).

The evidentiary graph.



Assessments are scoped.



Assessments are associate floating point values with evidentiary links or evidentiary sites within the scope of some user or user group. There are three kinds of assessments:

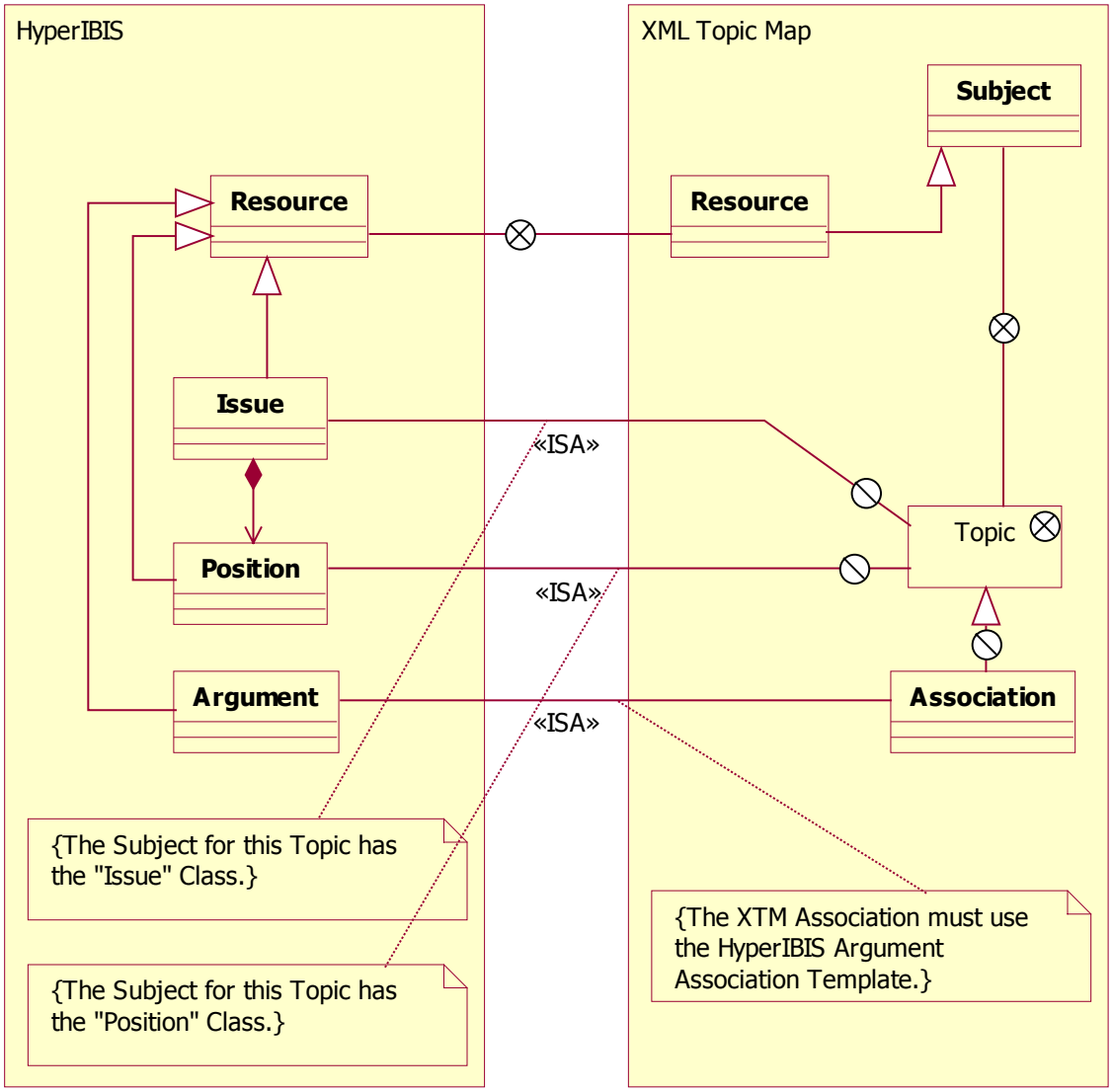
(1) An assessment associated with an evidentiary link that gives the strength of that link.
(2) An assessment associated with an emitter that gives the belief in the proposition represented by that emitter.
(3) An assessment associated with an emitter that gives the expected value if the proposition represented by that emitter is true.

It is important that different people, or groups of people, are able to make differing assessments concerning the strenght of evidentiary links so that the true variety of belief concerning the structure and qualitative dimensions of the model may be represented. Critical thinking behaviors should provide a means to identify divergent assessments and use that conflict as a means to guide further development of the model.

NOTE: This architecture does not support expressing assessments as a function of time or of the domain types of the evidence whose impact is being propagated.

Relationship to XTM abstract model.

This is the diagram that I am the least comfortable with. Please ignore the (X) marks. The have to do with extracting the HyperIBIS abstract model from a modeling unit that used to include a representation of the XTM non-normative abstract model.



This diagram illustrates the basic identity relationships between the HyperIBIS Abstract Model and the XTM Abstract Model. The defined relationships make it possible to use XTM to store metadata about the main entities in the HyperIBIS abstract model.

This diagram DOES NOT attempt to define the HyperIBIS abstract model in terms of the XTM abstract model so it is not possible to interchange a HyperIBIS model using XTM on the basis of these defined correspondences.

This diagram DOES NOT attempt to define how a common implementation of the HyperIBIS and XTM models might be achieved.