

15 The Topic Map Metamodel

The Topic Maps Meta-Model is defined based primarily upon ISO 13250-2 Data Model [TMDM] and to a lesser degree ISO 13250-3 XML Syntax. The TMDM provides the most authoritative definition of the abstract syntax for Topic Maps. The following discussion assumes a basic understanding of Topic Maps.

15.1 Topic Map Constructs

Some of the primary elements in the TM meta-model are shown in Figure 36. Topic Maps are composed of a set of Topics and a set of Associations defining multi-way relations among those Topics.

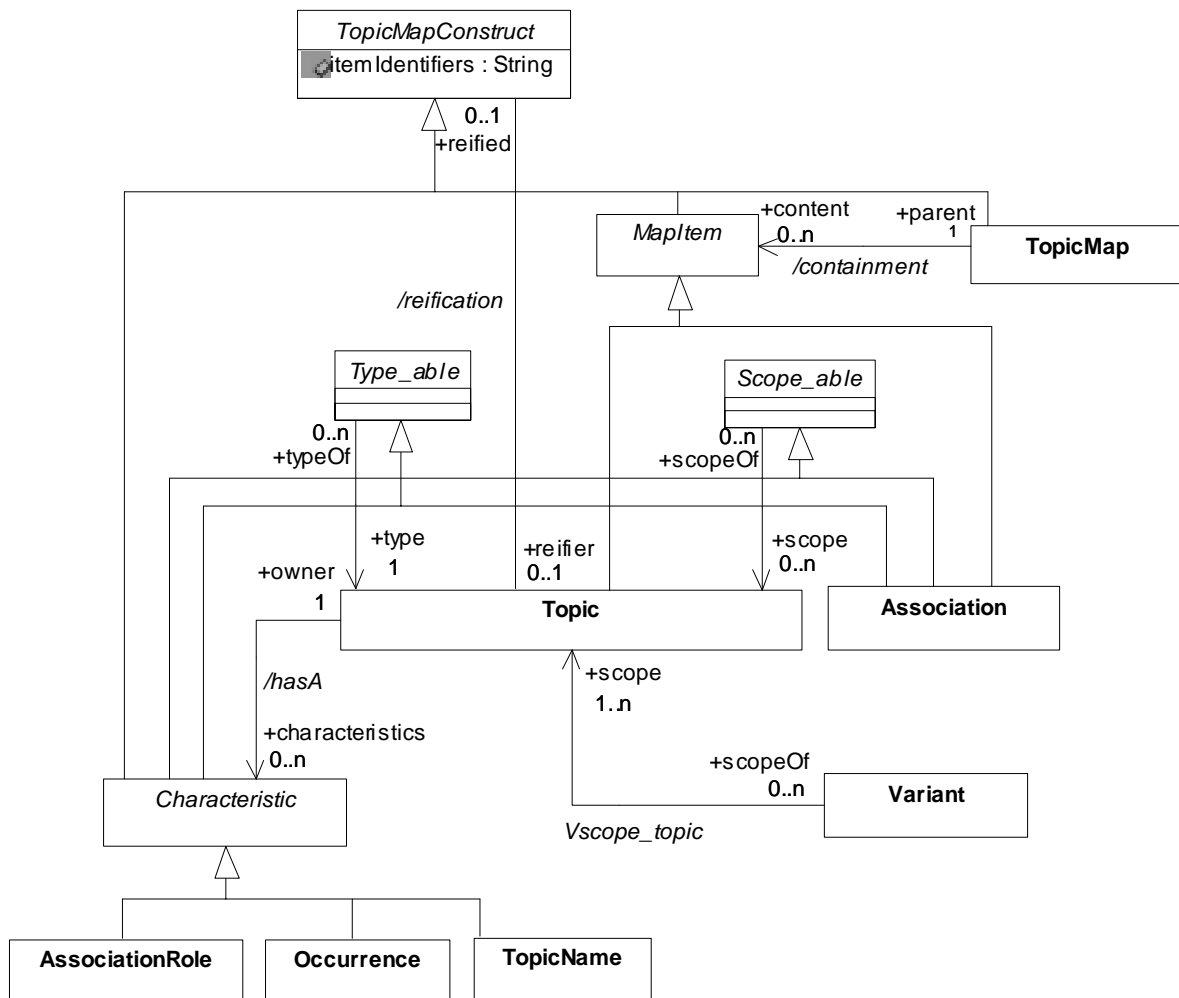


Figure 36 Primary Elements in the Topic Map Metamodel

Each Topic is about a single Subject. Subjects in TM may be anything physical or conceptual. A machine addressable Subject will have a locator (e.g. a URL) while non-machine addressable subjects will have an identifier (e.g. the URL of a page about the subject or a URN). Topics are roughly equivalent to RDF Resources, describing elements in a world of discourse. Note that this similarity does not include RDF Literals that in TMs are not normally considered Topics.

15.1.1 TopicMapConstruct

Description

TopicMapConstructs are the abstract collection of elements that are part of any Topic Map. All first class elements are a sub-type of Topic Map Construct and may optionally have a Source Locator.

Attributes

- itemIdentifiers [0..n] : string. Each instance is identifying.

Associations

- reifier[0..1]: Topic – An optional Topic that reifies a TopicMapConstruct, by having the construct as its subject. Derived by a Topic subjectIndicator referencing a TopicMapConstruct.

Constraints

- It is an error for two different Topic Map Constructs to have source locators that are equal, expressed as the following OCL

```
context TopicMapConstruct inv:
    TopicMapConstruct.allInstances()->
    forAll(v_tmc1, v_tmc2 | v_tmc1.itemIdentifiers->
        forAll(v_sl1 | not(v_tmc2.itemIdentifiers-> includes(v_sl1)))
    )
```

Semantics

The itemIdentifiers assigned to a TopicMapConstruct allows references to it. ItemIdentifiers may be freely assigned to TopicMapConstructs based upon source syntax or other implementation defined methods.

15.1.2 TopicMap

Description

A Topic Map represents a particular view of a set of subjects. It is a collection of MapItems.

Similar Terms

RDF Graph, Ontology

Attributes

None.

Associations

- content[0..n]: MapItem – the set of instances of MapItem that are part of this TopicMap, derived from the union of topics and associations.
- topics [0..n]: Topic – the set of Topics that are contained in this topic map.

- associations [0..n]: Association – the set of Associations that are contained in this topic map.

Constraints

None.

Semantics

A TopicMap itself does not represent anything, and in particular has no subject associated with it. It has no significance beyond its use as a container for Topics and Associations and the information about subjects they represent.

15.1.3 MapItem

Description

MapItems are those TopicMapConstructs that make up the contents of a Topic Map; they are those constructs that a topic map can directly contain.

Attributes

None.

Associations

None.

Constraints

None.

Semantics

MapItems are an abstract class of items that may be part of a topic map.

15.1.4 Topic

Description

Topic is the fundamental MapItem in a Topic Map. The class diagram for Topic is shown in Figure 37. Each Topic represents a Subject in the domain of discourse.

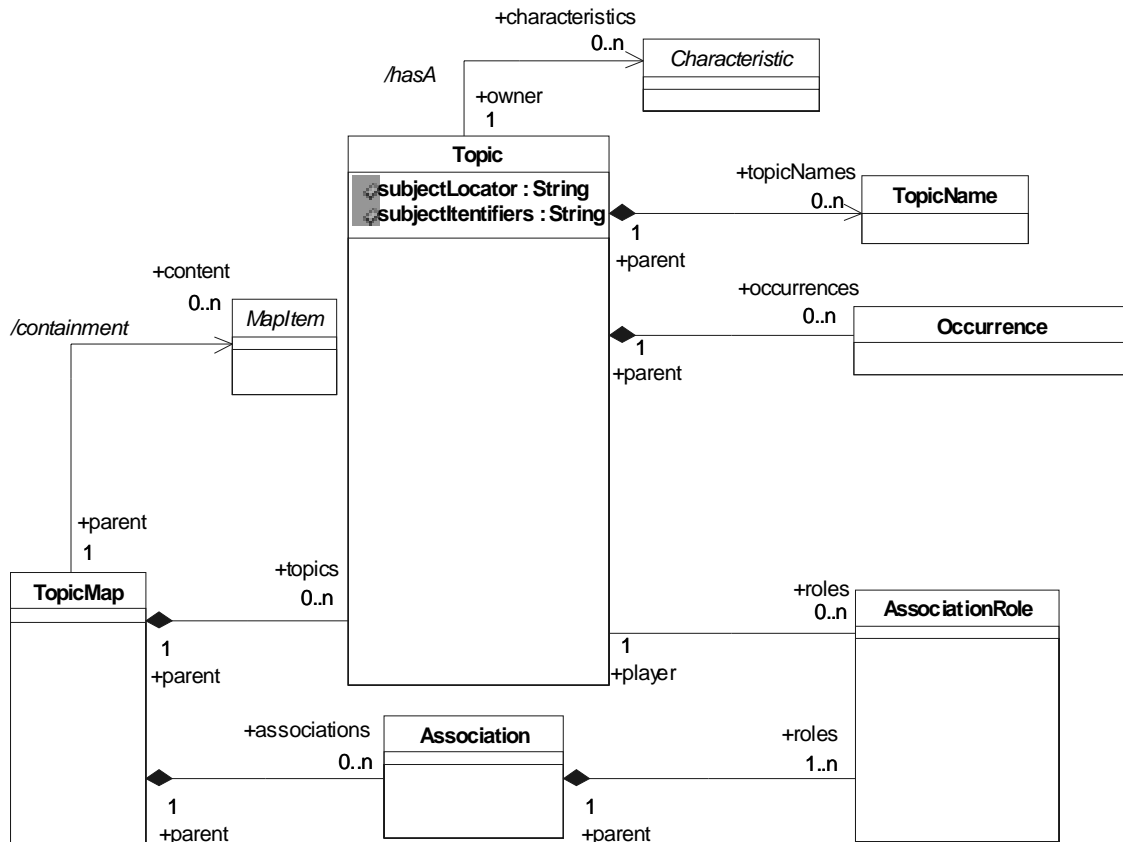


Figure 37 The Topic Class

Similar Terms

Node, Resource, Entity

Attributes

- subjectLocator[0..1]: string – an optional resource reference that locates a machine addressable subject.
- subjectIdentifiers[0..n]: string – the set of 0 or more resource references that identify a machine addressable indicator of a non-machine addressable subject.

Associations

- parent[1]:TopicMap – the required TopicMap that this Topic is part of.
- roles[0..n]: AssociationRole – the collection of AssociationRoles that are the roles that this Topic plays in Associations.
- occurrences[0..n]: Occurrence – the set of 0 or more occurrences for this Topic.
- topicNames[0..n]: TopicName – the set of 0 or more topic names for this Topic.
- characteristics[0..n]: Characteristic – the derived set of characteristics for this topic; it is the union of topicNames,

occurrences, and roles

- reified[0..1]: TopicMapConstruct – A TopicMapConstruct may optionally be reified, becoming the subject of a Topic. A TopicMapConstruct is reified if it is another Topic's subjectIdentifier.

Constraints

- All topics must have a value for at least one of subject identifiers or subject locator that is neither the empty set nor null, expressed in the following OCL.

context Topic inv:

```
self.subjectIdentifiers->notEmpty() or  
self.subjectLocator->notEmpty()
```

Semantics

Each instance of Topic is associated with exactly one Subject. A subject indicator, subject identifier or a subject locator identifies that subject. The Topic Map Data Model defines these terms in part as:

- A **subject indicator** is an information resource that is referred to from a topic map in an attempt to unambiguously identify the subject of a topic to a human being.
- A **subject identifier** is a locator that refers to a subject indicator.
- A **subject locator** is a locator that refers to the information resource that is the subject of a topic.

Topic maps contain only subject identifiers and subject locators, both of which refer to a subject indicator.

15.1.5 Association

Description

An Association is a multi-way relationship between one or more Topics. Associations must have a type and may be defined for a specified scope.

Similar Terms

Relation, Property

Attributes

None.

Associations

- parent[1]:TopicMap – the required TopicMap that this Association is part of.
- roles [1..n]:AssociationRole – An instance of Association is required to be linked to at least one instance of AssociationRole

Constraints

None

Semantics

The relationship defined by an Association is a relationship among the included Topic's subjects, rather than the Topics themselves.

15.2 Scope and Type

These ‘_able’ abstract classes are intended as a concise mechanism to give a specific set of meta-classes in the TM meta-model the capability to be typed and scoped; those meta-classes are shown in Figure 36.

15.2.1 Scope_able

Description

Scope_able defines an abstract class that provides the TM scoping mechanism. Subclasses of Scope_able may have a defined scope of applicability.

Similar Terms

Context, Provenance, Qualification

Attributes

None.

Associations

- scope[0..n]: Topic – the topics which define the scope.

Constraints

None.

Semantics

If the scope association is empty, then the Scope_able items have the default scope.

15.2.2 Type_able

Description

Type_able defines an abstract class that provides the typing mechanism. Subclasses of Type_able must define types. Elements in TM are singly typed. A typed construct is an instance of its type. Type describes the nature of the represented construct.

Similar Terms

Type, isA, kindOf

Attributes

None.

Associations

- type [1..1]: Topic – the required topic which defines at most a single type.

Constraints

None.

Semantics

Typing is not transitive.

See also: Section 15.4 discussing published subjects.

15.3 Characteristics

Characteristics model the attributes of a Topic. They include the topic's names, topic occurrences and the roles that a topic plays in associations.

Each Topic has a set of Characteristics. Characteristics, as shown in Figure 36, include Association Roles, Occurrences and Topic Names.

Topic Names and Variant Names are human understandable labels for the Topic. While the primary Topic Name, termed a Base Name, is required to be a UNICODE string, variant names may include many data types not normally considered as 'names' such as icons, images or audio.

15.3.1 Characteristic

Description

Characteristic is the abstract base class of all Topic characteristics. It is a TopicMapConstruct, and must have a type and may be limited to a defined scope.

Similar Terms

Property, Attribute, Slot

Attributes

None.

Associations

None.

Constraints

None.

Semantics

Characteristic is an abstract class defining those items which may be characteristics of a Topic. It has no additional semantics.

15.3.2 AssociationRole

Description

An Association is composed of a collection of roles, which are played by Topics. The AssociationRole captures this relation. A Topic in an Association plays a particular part or role in the Association. This is specified in an Association Role. The Association and Association Role construct is similar to a UML Association or to an RDF Property.

Similar Terms

Role, UML Association End, UML Property

Attributes

None.

Associations

- parent[1]: Association – the required Association which the AssociatioRole is part of.
- player[1]: Topic – the required Topic that plays this role in the parent Association.

Constraints

None.

Semantics

An AssociationRole is the representation of the participation of subjects in an association. The association role has a topic playing the role and a type that defines the nature of the participation of the player in the association. The roles and associations are representing the relationships between the participating Topic's subject, rather than the topics themselves.

15.3.3 Occurrence

Description

An Occurrence is a Characteristic that is very similar to an attribute. Occurrences are Scope_able and Type_able. The value of the occurrence is specified by the locator role in the association with the abstract meta-class Resource, as shown in Figure 38 . The interpretation of the Resource is defined by its concrete specializations.

Similar Terms

Attribute, Slot

Attributes

- value[1]:string – If the datatype is IRI, a locator referring to the information resource the occurrence connects with the subject, otherwise the string is the information resource.
- datatype[1]:string – A locator identifying the datatype of the occurrence value.

Associations

None.

Constraints

None.

Semantics

It may be mistakenly inferred by the name 'Occurrence' that this Characteristic refers only to instances of a Topic. This is not the case. An Occurrence may be any descriptive information about a Topic, including instances, and may represent any characteristic of a Topic, including an 'occurrence' or instance of the subject. Occurrences are semantically similar to UML Attributes.

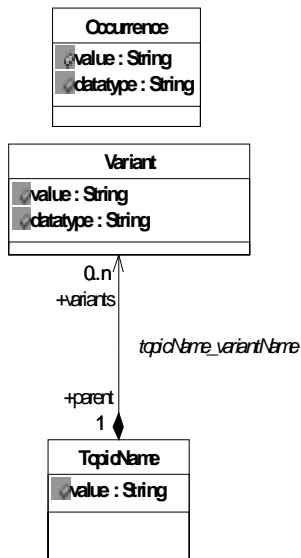


Figure 38 Topic Name Class

15.3.4 TopicName

Description

A TopicName is intended to provide a human readable text name for a topic.

Similar Terms

Label, Comment, Description (Brief)

Attributes

- value: String – The Base Name for this Topic; the string is UNICODE.

Associations

- variants[0..n]: VariantName – Zero or more variations of the TopicName.

Constraints

None.

Semantics

The term ‘name’ should not be misconstrued to imply uniqueness. Neither the topic name, nor its variants, are identifying; they serve only as human readable labels.

15.3.5 VariantName

Description

VariantName allows alternative names for a Topic to be specified. These names may be any format, including text, documents, images or icons. VariantNames must have scope.

Similar Terms

Label, Comment, Description (Brief), Icon

Attributes

- value[1]:string – If the datatype is IRI, a locator referring to the information resource the occurrence connects with the subject, otherwise the string is the information resource.
- datatype[1]:string – A locator identifying the datatype of the occurrence value.

Associations

- scope[1..n] : Topic – The topics which define the scope .

Constraints

- A VariantName is restricted to being a composite part of a TopicName. It cannot exist as a standalone construct as constrained by the topicName_variantName association multiplicity.

Semantics

Like TopicName variant names are not identifying.

15.4 Published Subjects

A Core set of Topic instances, termed Published Subjects, has been defined as part of the TM standard. These topics represent special instances of the TM meta-model and any implementation of the TM meta-model should handle these items as special, reserved topics with meanings as defined in Section 7 of the Topic Map Data Model [TMDM].

In summary, they represent five key areas:

- Types and Instance –Types and their instances are related by three subjects representing the type-instance association and, the type and instance association roles. A type is an abstraction that captures characteristics common to a set of instances. A type may itself be an instance of another type, and the type-instance relationship is not transitive.
- Super and Sub Types – Types may be arranged into a type hierarchy using the supertype-subtype association and, supertype and subtype association roles. The supertype-subtype relationship is the relationship between a more general type (the supertype) and a specialization of that type (the subtype). The supertype-subtype relationship is transitive.
- Special Variant Names – Display and Sort are two special types of variant names appropriate for human display and sorting.
- Uniqueness – A unique topic characteristic can be used to definitively identify a topic.
- Topic Map Constructs –Subjects that represent the reification of topic map constructs, such as association, associations-role or occurrence.
- These published subjects are identified by uri with base <http://psi.topicmaps.com/iso13250/>, called in the ODM by the QName prefix ‘tmcore:’.

15.5 Example

Figure 39 depicts a simple instance model of the TM meta-model. The model depicted represents the following statements:

- A Personal Car is a Car (which may be owned by a Person).
- A Car is a Vehicle (which may have a Color).
- Carl is a person that owns a Personal Car that is red.

The parenthetical statements are not directly represented in Topic Maps.

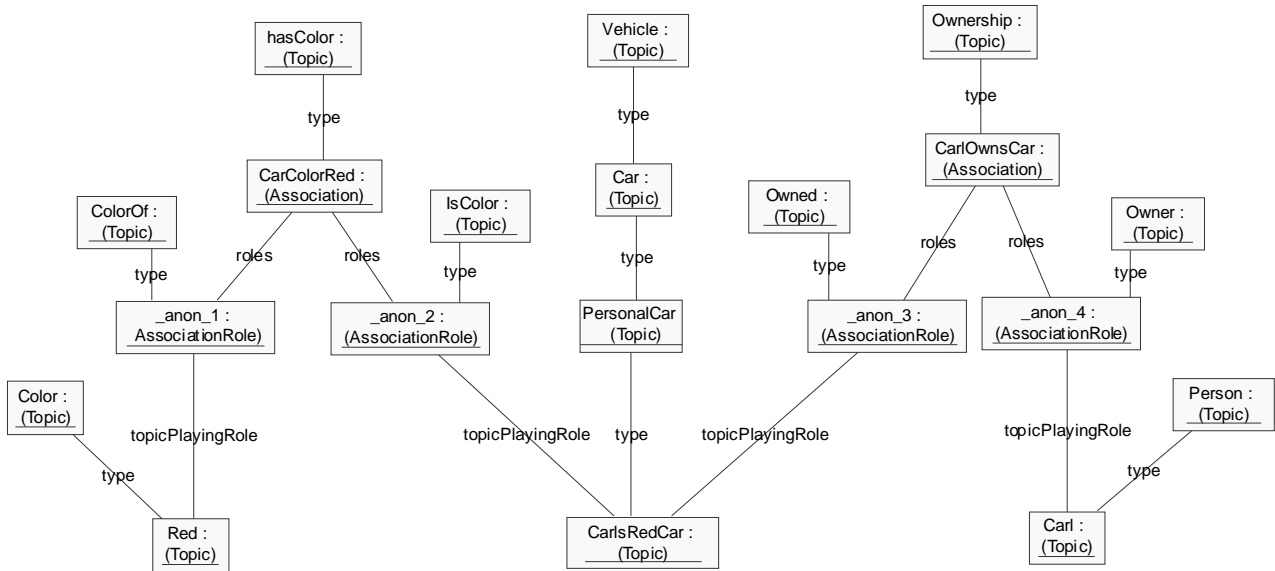


Figure 39 Instance of Topic Map Metamodel

