



Chapter III

Topic Maps





Topic Maps

- ISO standard (ISO/IEC 13250) for an implementation-independent representation of knowledge about resources, their subjects and interrelationships
- topic maps consist of topics (concepts), associations (relationships) and occurrences (relevant information resources)
- as opposed to RDF that aims at machine-processable metadata, topic maps are used to structure knowledge for human readers, with an emphasis on the findability of information
- stem from glossaries, classification systems and thesauri, but provide more expressiveness
- can be used to develop ontologies which may be even mapped to RDF, but are not part of the semantic web effort of the W3C



Fundamental Concepts

- topic -> fundamental entity in the context of the modeled knowledge domain
- topic name -> topic identifier (base name, display name and sort name)
- topic occurrence -> instances and roles (occurrence role type)
- public subject descriptor -> unique topic descriptor
- associations -> relationships between topics and their roles (association role)
- scope -> specifies the extent of the validity
- facet -> attribute-value-pair that describes a topic in more detail

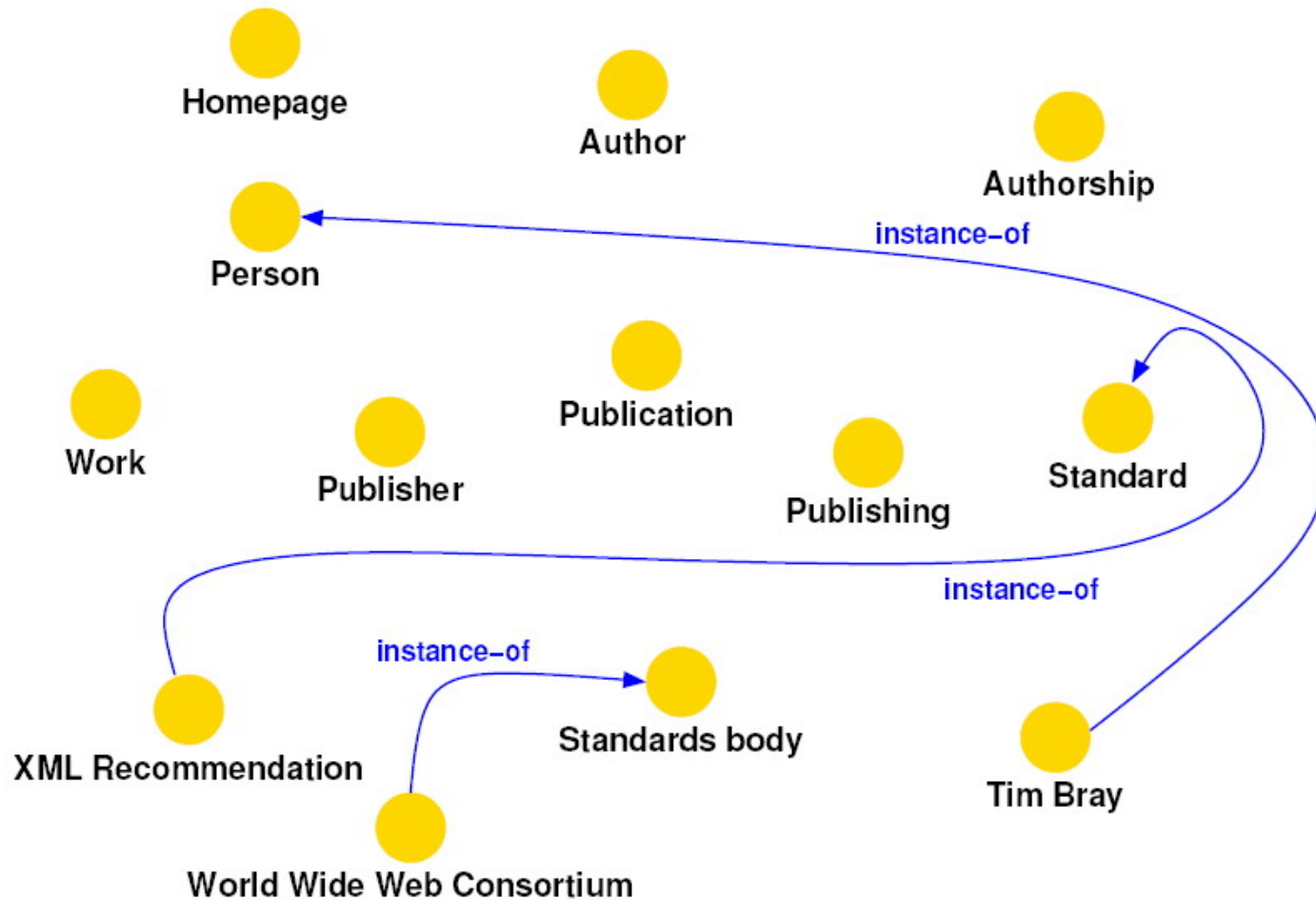


Topic Maps – Example (I)



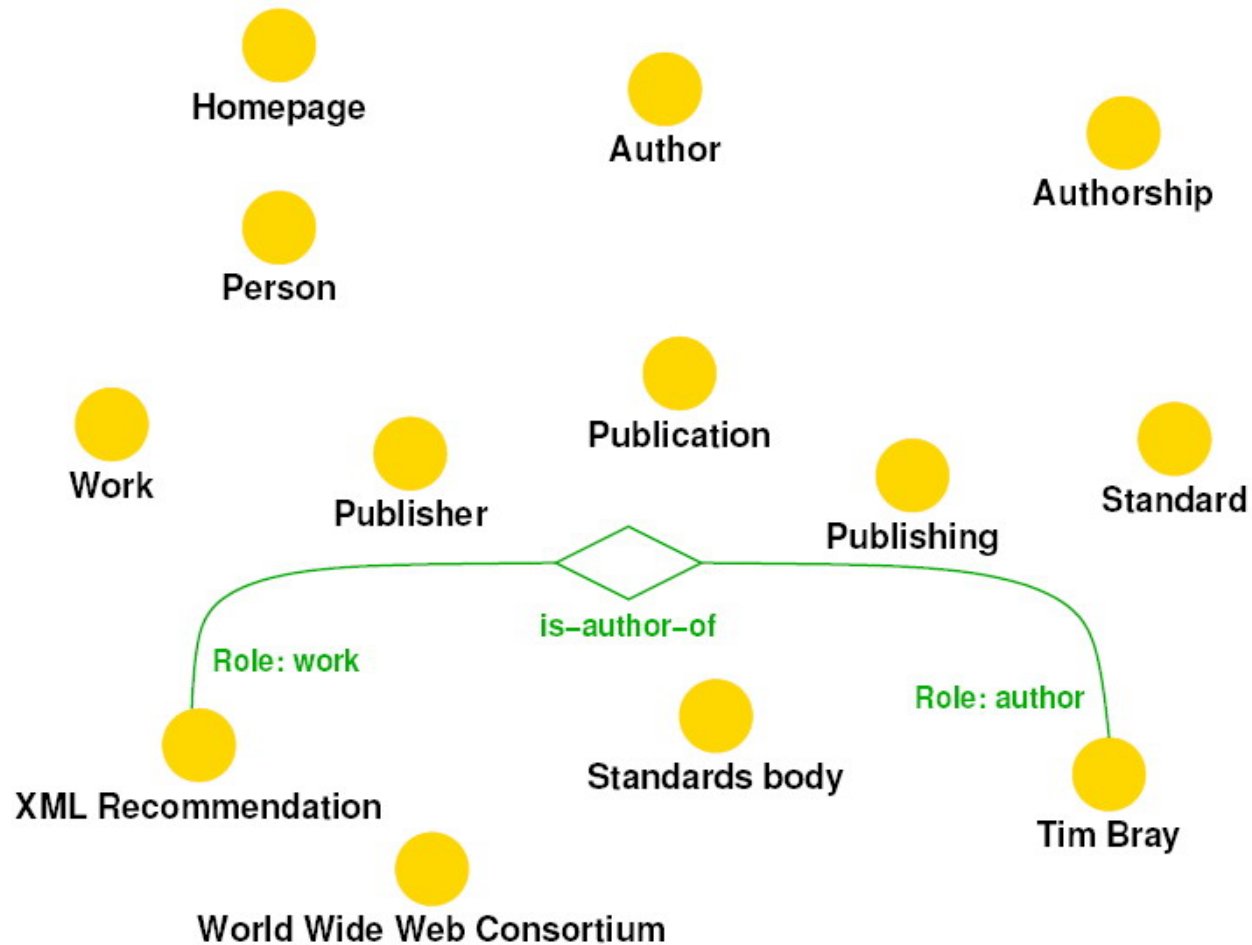


Topic Maps – Example (II)



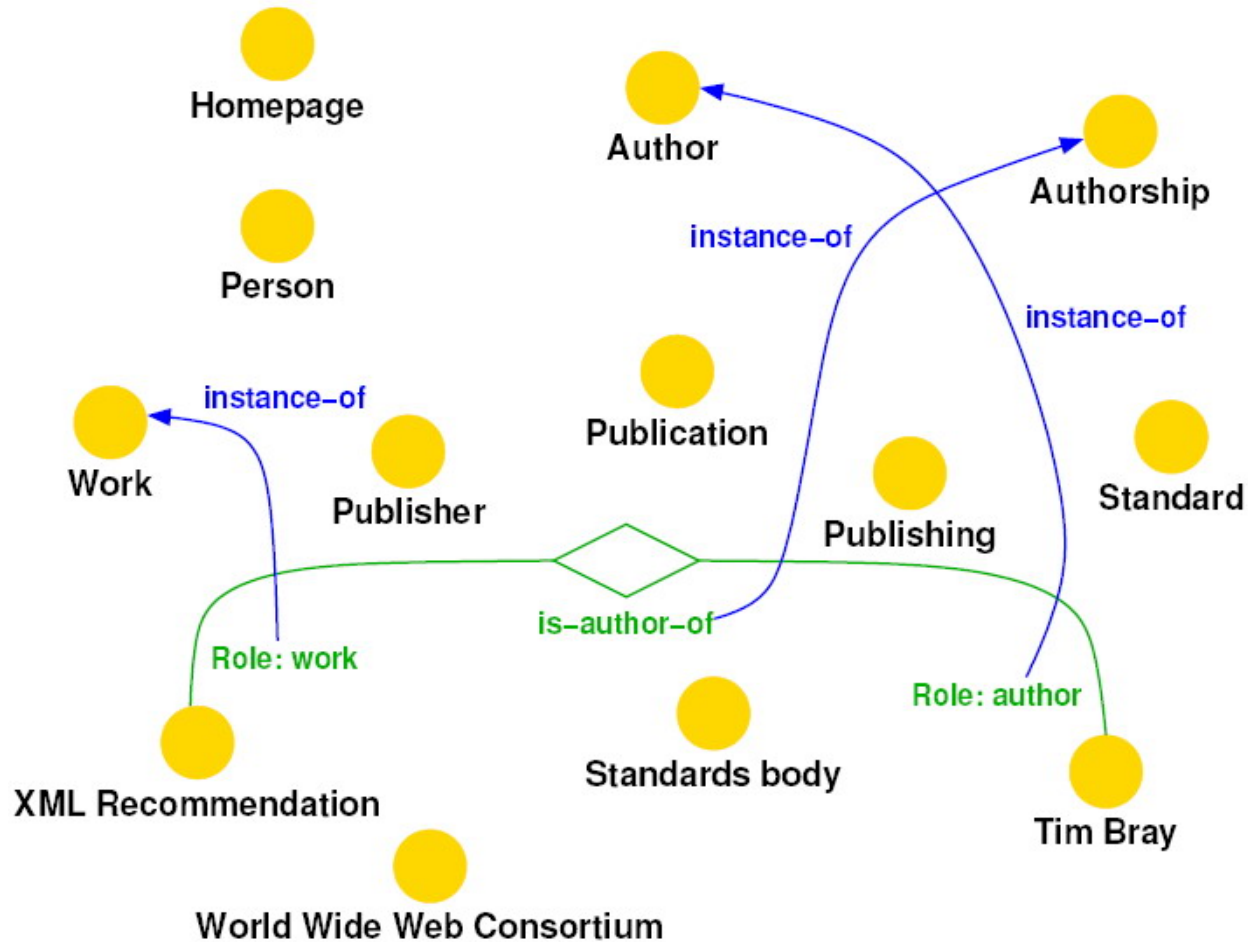


Topic Maps – Example (III)



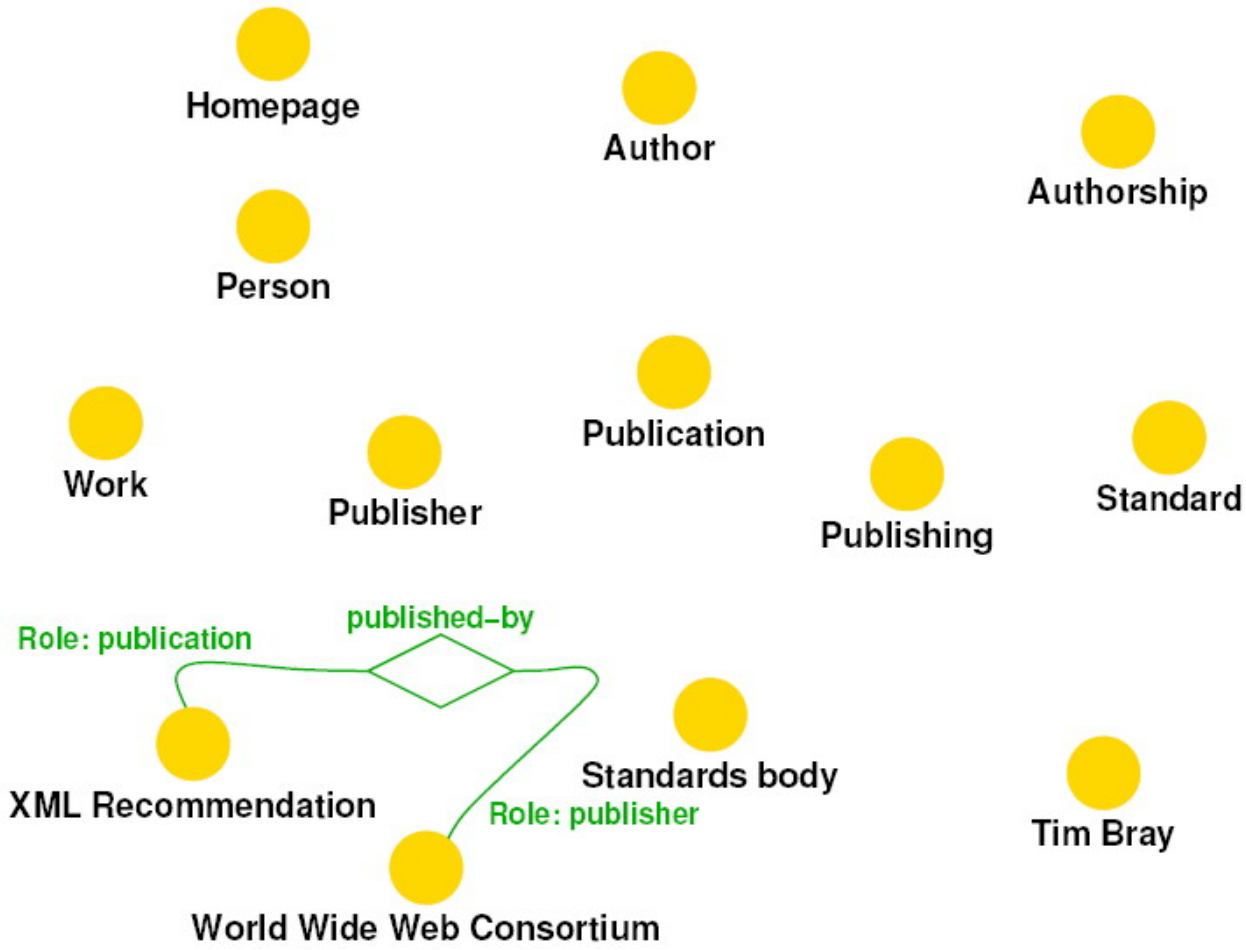


Topic Maps – Example (IV)



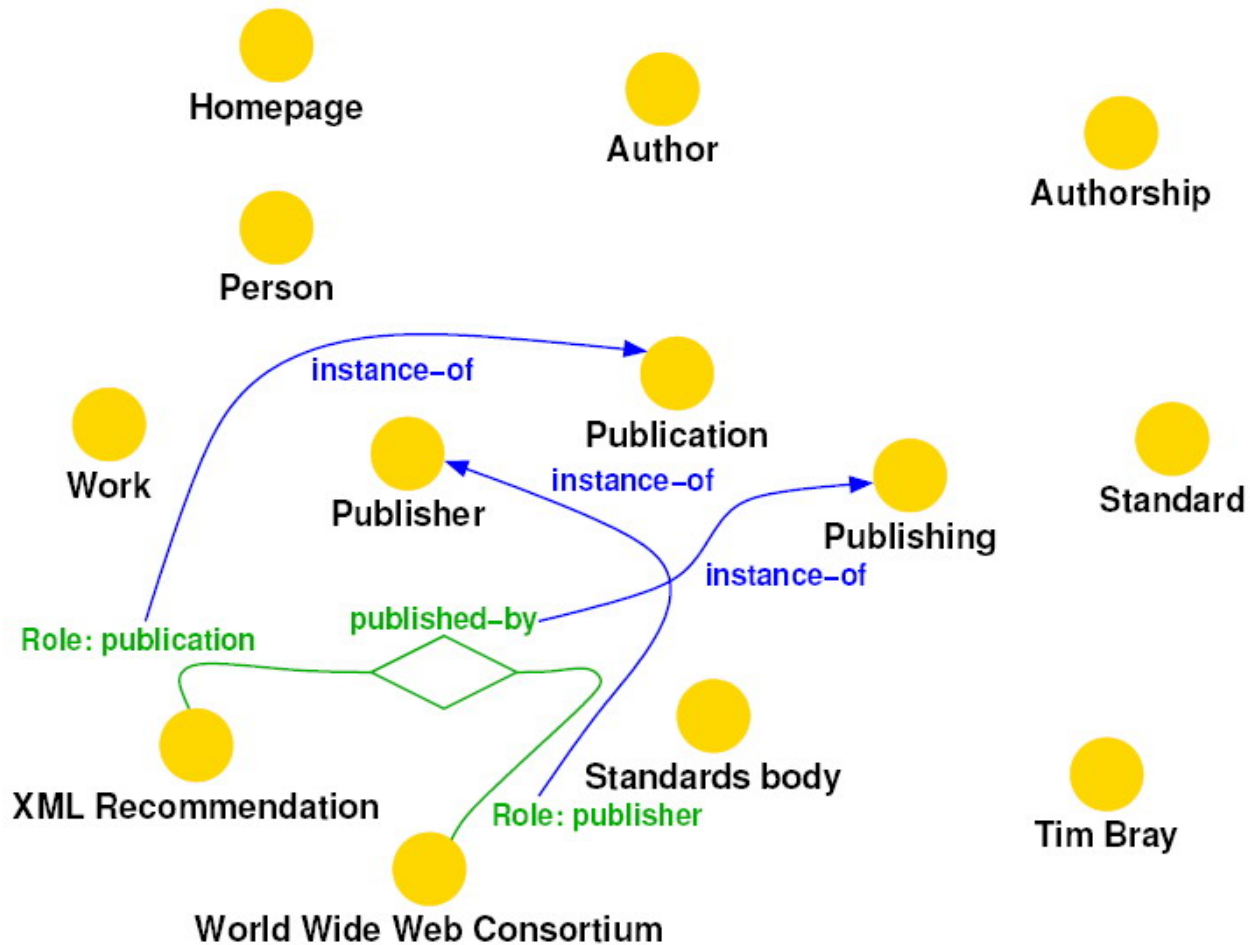


Topic Maps – Example (V)



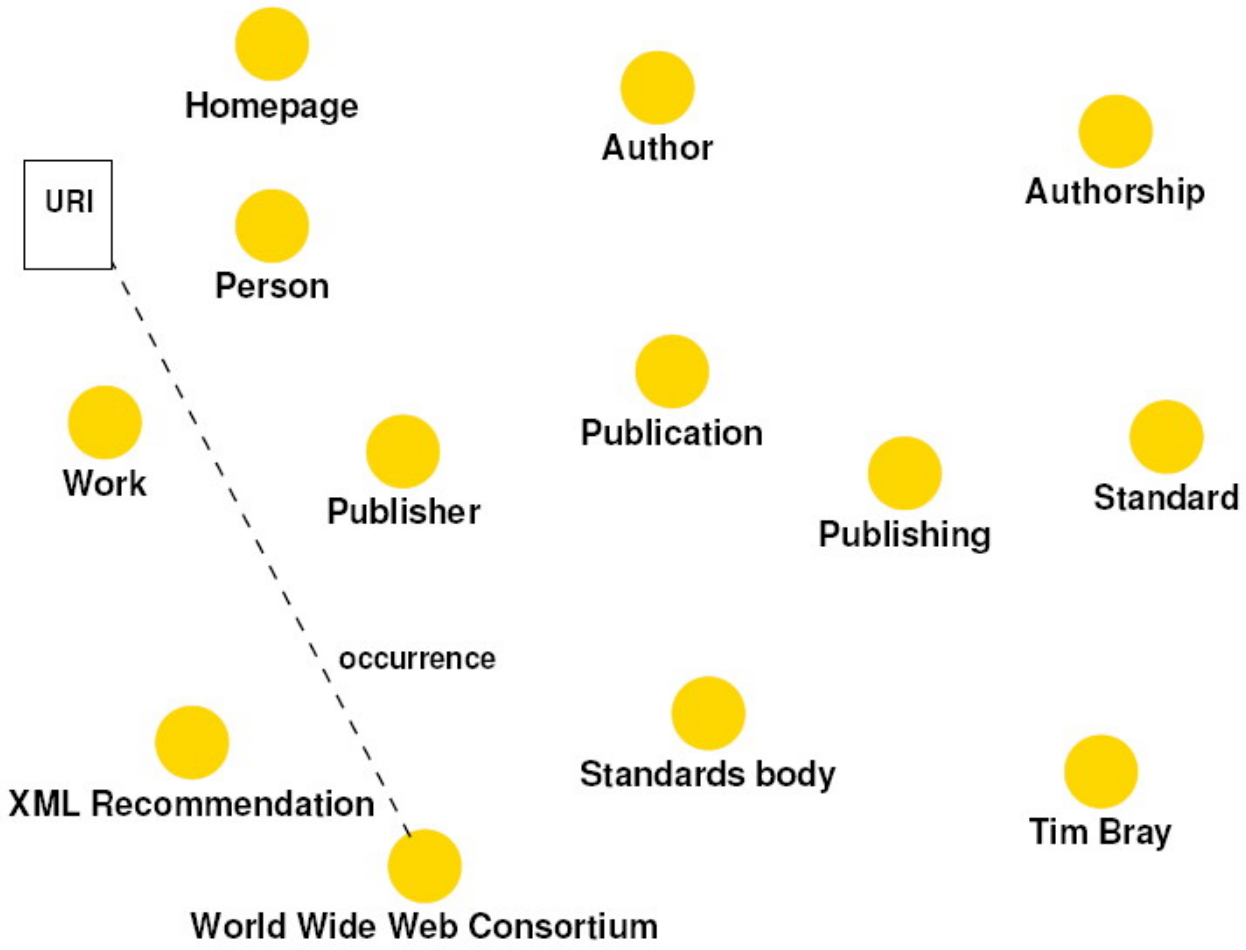


Topic Maps – Example (VI)



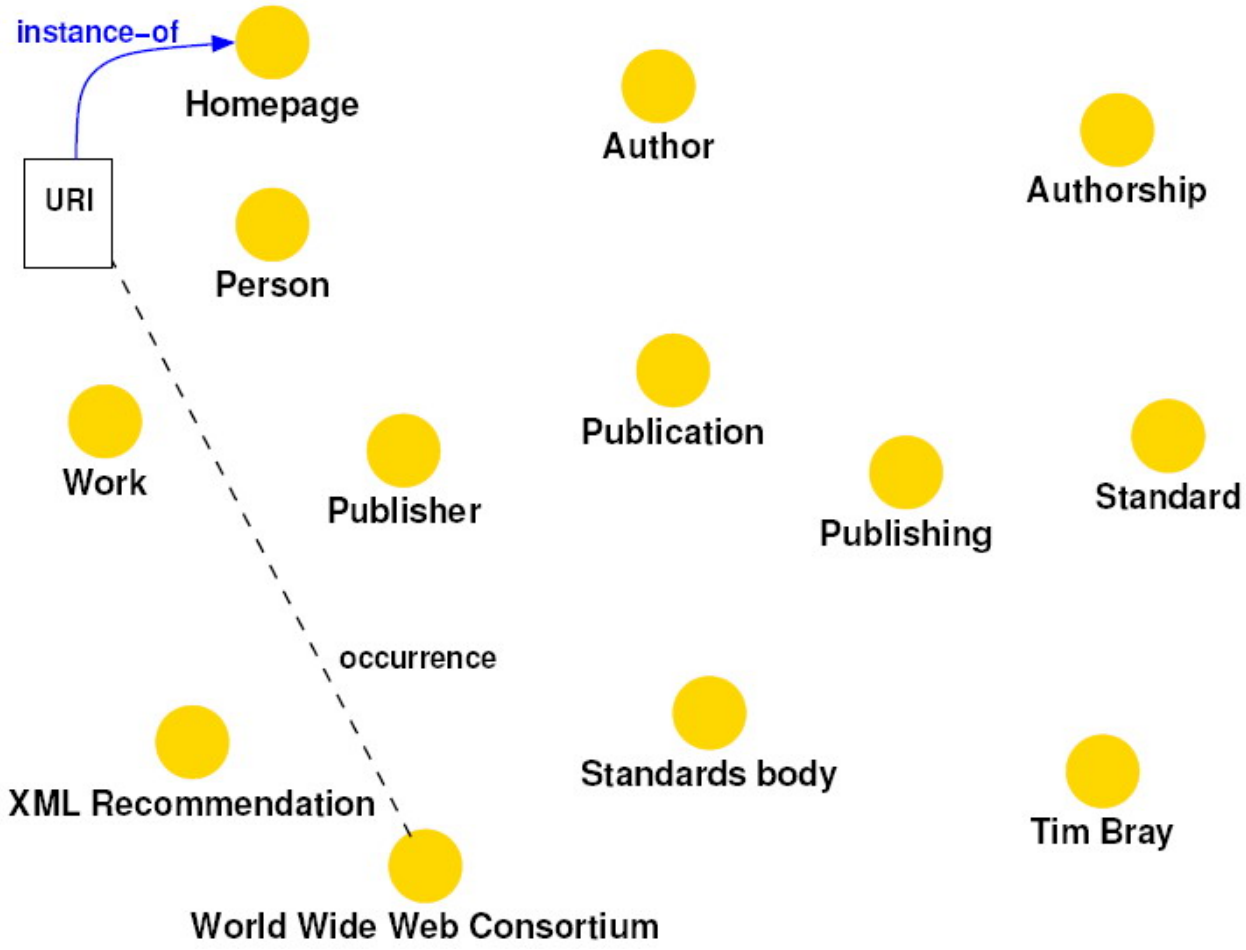


Topic Maps – Example (VII)



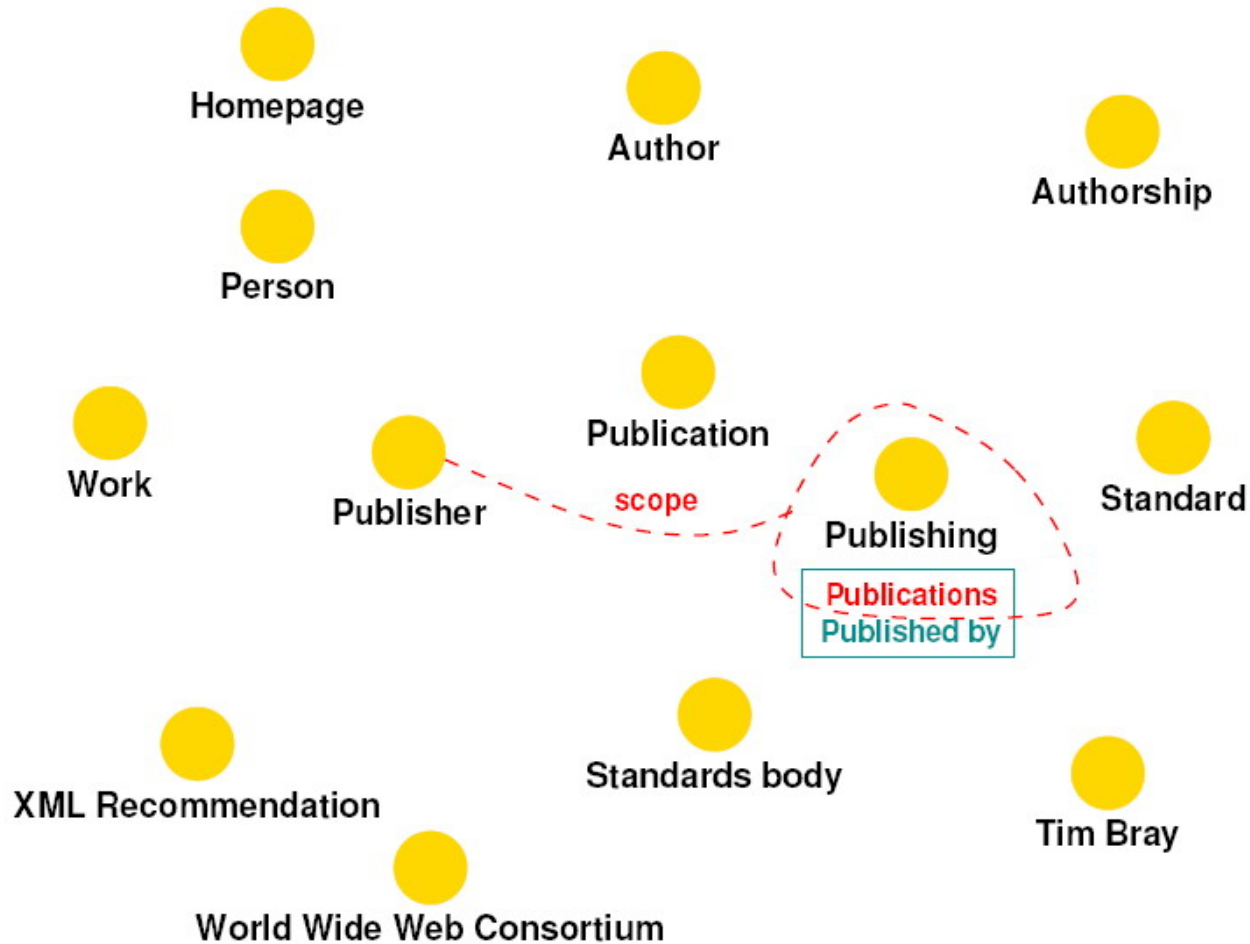


Topic Maps – Example (VIII)



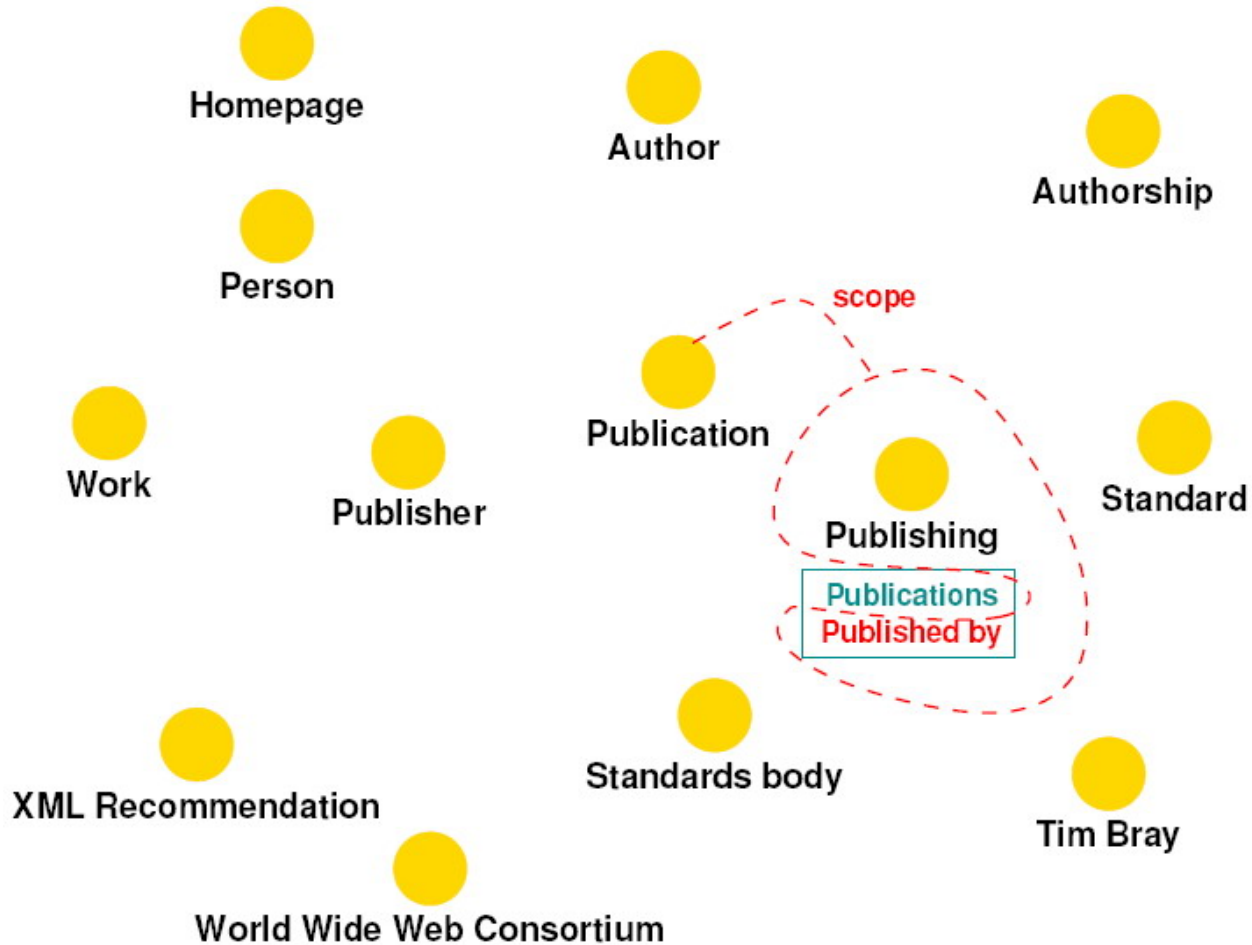


Topic Maps – Example (IX)



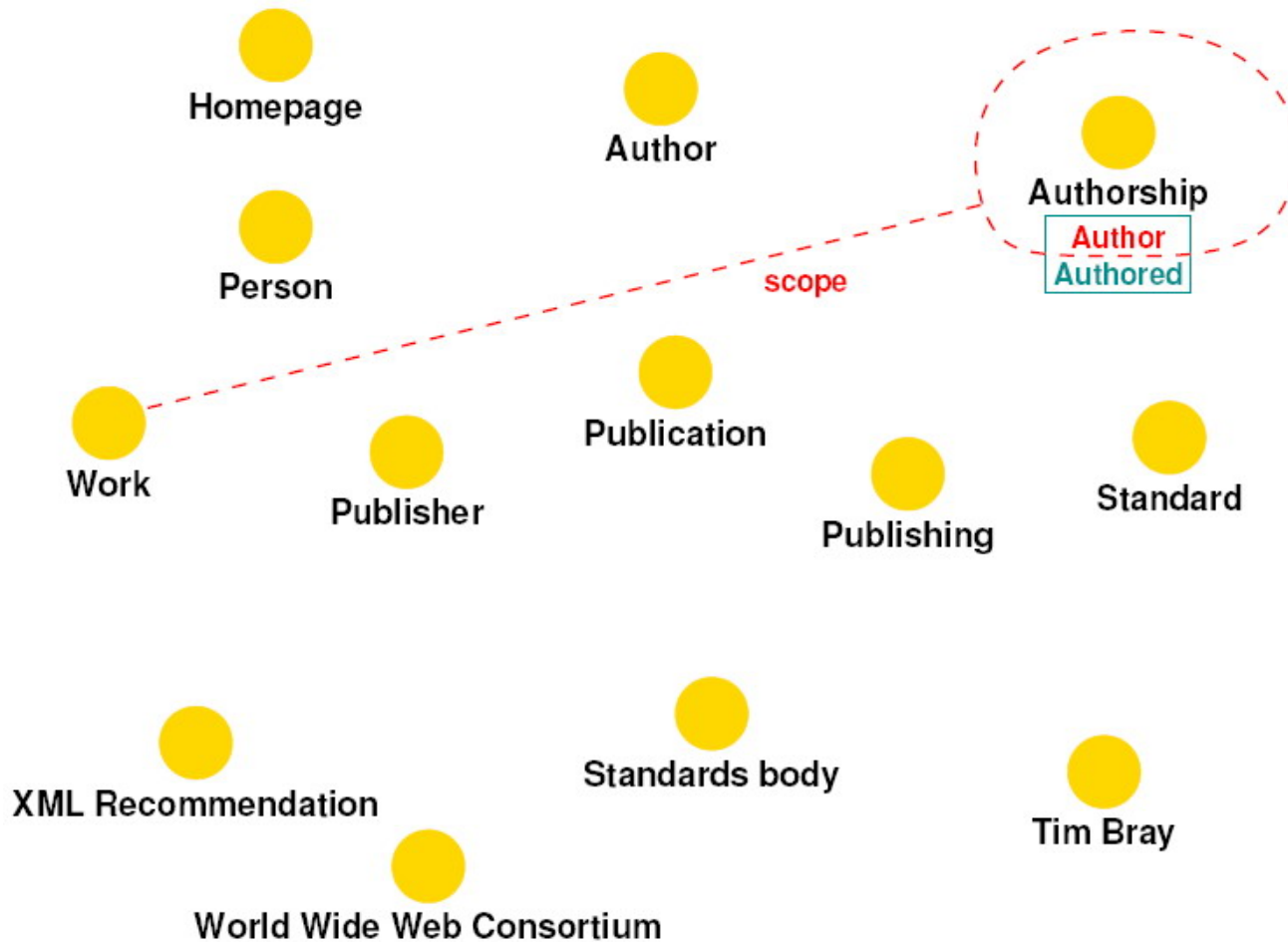


Topic Maps – Example (X)



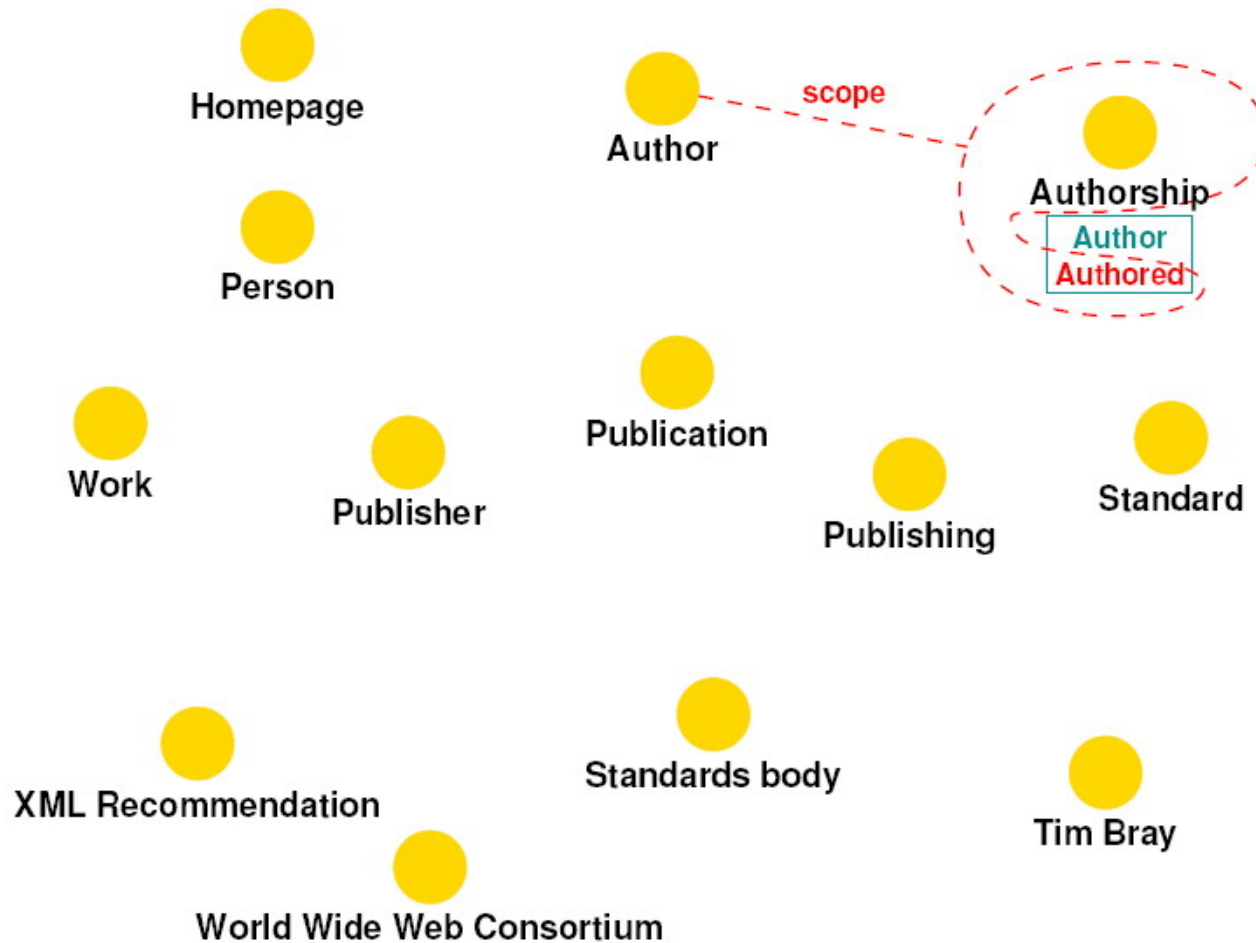


Topic Maps – Example (XI)



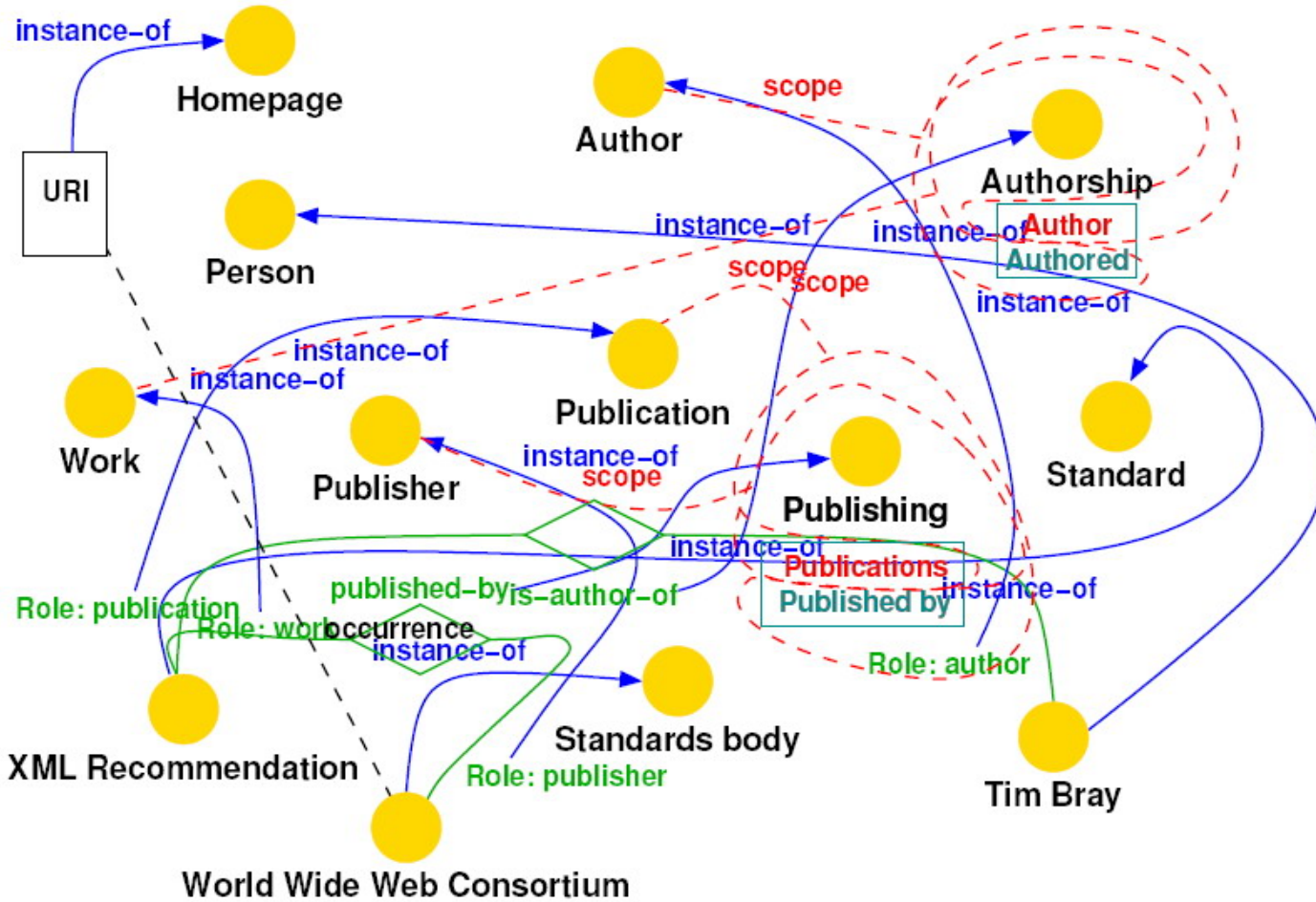


Topic Maps – Example (XII)





Topic Maps – Example (XIII)





XTM – XML Topic Maps

- are an abstract model and XML grammar for the exchange of web-based topic maps created by the TopicMaps.Org Authoring Group (2001)
- design goals:
 - ease of use
 - support for a wide range of applications
 - standards compatible
 - ideally no optional features
 - short and concise specification
 - XTM documents shall be easy to create, read and understand



XTM Syntax Overview (I)

- **topicRef**: reference to a topic element
- **subjectIndicatorRef**: reference to a subject indicator
- **scope**: reference to topic(s) that comprise the scope
- **instanceOf**: points to a topic representing a class
- **topicMap**: topic map document element
- **topic**: topic element
- **subjectIdentity**: subject reified by topic
- **baseName**: base name of a topic
- **baseNameString**: base name string container
- **variant**: alternate forms of base name



XTM Syntax Overview (II)

- **variantName**: container for variant name
- **parameters**: processing context for variant
- **association**: topic association
- **member**: member in topic association
- **roleSpec**: points to a topic serving as an association role
- **occurrence**: resources regarded as an occurrence
- **resourceRef**: reference to a resource
- **resourceData**: container for resource data
- **mergeMap**: merge with another topic map



XTM - topicRef

- **Synopsis:**
 - The <topicRef> element provides a URI reference to a topic. The target of a <topicRef> link must resolve to a <topic> element child of a <topicMap> document that conforms to this XTM specification. The target <topic> need not be in the document entity of origin.
- **Content Model:**
 - <!ELEMENT topicRef EMPTY>
- **Attributes:**
 - <!ATTLIST topicRef
 - id ID #IMPLIED
 - xlink:type NMTOKEN #FIXED 'simple'
 - xlink:href CDATA #REQUIRED>
- **Example:**
 - <topicRef xlink:href="http://www.topicmaps.org/xtm/1.0/language.xtm#en"/>



XTM - subjectIndicatorRef

- Synopsis:
 - The <subjectIndicatorRef> element provides a URI reference to a resource that acts as a subject indicator.
- Content Model:
 - <!ELEMENT subjectIndicatorRef EMPTY>
- Attributes:
 - <!ATTLIST subjectIndicatorRef
id ID #IMPLIED
xlink:type NMTOKEN #FIXED 'simple'
xlink:href CDATA #REQUIRED>
- Example:
 - <subjectIndicatorRef
xlink:href="http://www.shakespeare.org/plays.html#hamlet"/>



XTM - scope

- **Synopsis:**
 - The <scope> element consists of one or more <topicRef>, <resourceRef>, or <subjectIndicatorRef> elements. The union of the subjects corresponding to these elements specifies the context in which the assignment of the topic characteristic is considered to be valid.
- **Content Model:**
 - <!ELEMENT scope (topicRef | resourceRef | subjectIndicatorRef)+>
- **Attributes:**
 - <!ATTLIST scope
 - id ID #IMPLIED>
- **Example:**
 - <scope>
 - <topicRef xlink:href="#tragedy"/>
 - <topicRef xlink:href="#theatre"/>
 - </scope>



XTM - instanceOf

- **Synopsis:**
 - The `<instanceOf>` element specifies the class to which its parent belongs, via a `<topicRef>` or `<subjectIndicatorRef>` child element.
- **Content Model:**
 - `<!ELEMENT instanceOf (topicRef | subjectIndicatorRef) >`
- **Attributes:**
 - `<!ATTLIST instanceOf`
`id ID #IMPLIED>`
- **Example:**
 - ```
<topic id="hamlet">
 <instanceOf>
 <subjectIndicatorRef xlink:href="http://www.shakespeare.org/plays.html"/>
 </instanceOf>
</topic>
```



# XTM – topicMap (I)

- Synopsis:
  - The <topicMap> element is the parent of all <topic>, <association>, and <mergeMap> elements in the topic map document.
- Content Model:
  - `<!ELEMENT topicMap (topic | association | mergeMap)*>`
- Attributes:
  - `<!ATTLIST topicMap`  
    id ID #IMPLIED  
    xmlns CDATA #FIXED 'http://www.topicmaps.org/xtm/1.0/'  
    xmlns:xlink CDATA #FIXED 'http://www.w3.org/1999/xlink'  
    xml:base CDATA #IMPLIED>





# XTM – topicMap (II)

- Example:

```
- <?xml version="1.0"?>
 <!DOCTYPE topicMap
 PUBLIC "-//TopicMaps.Org//DTD XML Topic Map (XTM) 1.0//EN"
 "file:///usr/local/home/gromit/xml/xtm/xtml.dtd">
 <topicMap xmlns='http://www.topicmaps.org/xtm/1.0/'
 xmlns:xlink='http://www.w3.org/1999/xlink'
 xml:base='http://www.shakespeare.org/hamlet/'>
 <!-- topics, associations, and merge map directives go here -->
 </topicMap>
```



# XTM - topic

- **Synopsis:**
  - The <topic> element specifies the name and occurrence characteristics of a single topic.
- **Content Model:**
  - `<!ELEMENT topic (instanceOf*, subjectIdentity?, (baseName | occurrence)*)>`
- **Attributes:**
  - `<!ATTLIST topic`  
`id ID #REQUIRED>`
- **Example:**
  - `<topic id="hamlet">`  
`<instanceOf>`  
`<topicRef xlink:href="#play"/>`  
`</instanceOf>`  
`<!-- base names and occurrences go here -->`  
`</topic>`



# XTM - subjectIdentity

- Synopsis:
  - The <subjectIdentity> element specifies the subject that is reified by a topic, via <resourceRef>, <subjectIndicatorRef>, and/or <topicRef> child elements.
- Content Model:
  - <!ELEMENT subjectIdentity (resourceRef?, (topicRef | subjectIndicatorRef)\*)>
- Attributes:
  - <!ATTLIST subjectIdentity  
id ID #IMPLIED>
- Example:
  - <topic id="dk">  
  <subjectIdentity>  
    <subjectIndicatorRef  
      xlink:href="http://www.topicmaps.org/xtm/1.0/country.xtm#dk"/>  
  </subjectIdentity>  
</topic>



# XTM - baseName

- **Synopsis:**
  - The <baseName> element specifies a topic name in form of a <baseNameString> child element.
- **Content Model:**
  - <!ELEMENT baseName (scope?, baseNameString, variant\*)>
- **Attributes:**
  - <!ATTLIST baseName  
id ID #IMPLIED>
- **Example:**

```
<topic id="shakespeare">
 <baseName>
 <baseNameString>William Shakespeare</baseNameString>
 </baseName>
</topic>
```



# XTM – baseNameString (I)

- Synopsis:
  - The <baseNameString> element is a string that represents the base name of its ancestor <topic> parent.
- Content Model:
  - `<!ELEMENT baseNameString (#PCDATA)>`
- Attributes:
  - `<!ATTLIST baseNameString  
id ID #IMPLIED>`



## XTM – baseNameString (II)

- Example:

```
- <topic id="written-by">
 <baseName>
 <baseNameString>written by</baseNameString>
 </baseName>
 <baseName>
 <scope>
 <topicRef xlink:href="#author"/>
 </scope>
 <baseNameString>author of</baseNameString>
 </baseName>
</topic>
```



# XTM – variant (I)

- Synopsis:
  - The <variant> element is an alternate form of a topic's base name appropriate for a processing context specified by the variant's <parameters> child element. Among these contexts may be sorting and display.
- Content Model:
  - `<!ELEMENT variant (parameters, variantName?, variant*)>`
- Attributes:
  - `<!ATTLIST variant`  
`id ID #IMPLIED>`



## XTM – variant (II)

- Example:

```
- <topic id="shakespeare">
 <baseName>
 <baseNameString>William Shakespeare</baseNameString>
 <!-- form for sorting (sort name) -->
 <variant>
 <parameters>
 <topicRef xlink:href="#sort"/>
 </parameters>
 <variantName>
 <resourceData>shakespeare,william</resourceData>
 </variantName>
 </variant>
 </baseName>
</topic>
```





# XTM - variantName

- **Synopsis:**
  - The `<variantName>` element provides the resource to be used as a variant of a base name.
- **Content Model:**
  - `<!ELEMENT variantName (resourceRef | resourceData)>`
- **Attributes:**
  - `<!ATTLIST variantName  
id ID #IMPLIED>`
- **Example:**
  - `<variantName>  
    <resourceData>shakespeare,william</resourceData>  
</variantName>`



# XTM – parameters (I)

- Synopsis:
  - The <parameters> element consists of one or more <topicRef> or <subjectIndicatorRef> elements. The union of the subjects corresponding to these elements specifies an additional processing context in which variant names in the variant's subtree are considered to be appropriate.
- Content Model:
  - `<!ELEMENT parameters (topicRef | subjectIndicatorRef)+>`
- Attributes:
  - `<!ATTLIST parameters`  
`id ID #IMPLIED>`



## XTM – parameters (II)

- Example:

```
- <topic id="shakespeare">
 <baseName>
 <baseNameString>William Shakespeare</baseNameString>
 <!-- form for sorting (sort name) -->
 <variant>
 <parameters>
 <topicRef xlink:href="#sort"/>
 </parameters>
 <variantName>
 <resourceData>shakespeare,william</resourceData>
 </variantName>
 </variant>
 </baseName>
</topic>
```



# XTM – association (I)

- Synopsis:
  - The <association> element asserts a relationship among topics that play roles as members of the association.
- Content Model:
  - `<!ELEMENT association (instanceOf?, scope?, member+)>`
- Attributes:
  - `<!ATTLIST association id ID #IMPLIED>`



# XTM – association (II)

- Example:

```
- <association id="will-wrote-hamlet">
 <instanceOf>
 <topicRef xlink:href="#written-by"/>
 </instanceOf>
 <member>
 <roleSpec><topicRef xlink:href="#author"/></roleSpec>
 <topicRef xlink:href="#shakespeare"/>
 </member>
 <member>
 <roleSpec><topicRef xlink:href="#work"/></roleSpec>
 <topicRef xlink:href="#hamlet"/>
 </member>
</association>
```



# XTM - member

- **Synopsis:**
  - The <member> element specifies all topics that play a given role in an association. The <roleSpec> element specifies the role played by these topics.
- **Content Model:**
  - <!ELEMENT member (roleSpec?, (topicRef | resourceRef | subjectIndicatorRef)+)>
- **Attributes:**
  - <!ATTLIST member id ID #IMPLIED>
- **Example:**

```
<member>
 <roleSpec><topicRef xlink:href="#work"/></roleSpec>
 <topicRef xlink:href="#hamlet"/>
</member>
```



# XTM - roleSpec

- Synopsis:
  - The `<roleSpec>` element specifies the role played by a member in an association.
- Content Model:
  - `<!ELEMENT roleSpec (topicRef | subjectIndicatorRef)>`
- Attributes:
  - `<!ATTLIST roleSpec`  
`id ID #IMPLIED>`
- Example:
  - `<roleSpec>`  
`<topicRef xlink:href="#work"/>`  
`</roleSpec>`



# XTM – occurrence (I)

- **Synopsis:**
  - The <occurrence> element specifies a resource supplying information relevant to a topic.
- **Content Model:**
  - `<!ELEMENT occurrence (instanceOf?, scope?, (resourceRef | resourceData))>`
- **Attributes:**
  - `<!ATTLIST occurrence  
id ID #IMPLIED>`





## XTM – occurrence (II)

- Example:

```
- <topic id="hamlet">
 <occurrence id="hamlet-in-xml">
 <instanceOf>
 <topicRef xlink:href="#xml-version"/>
 </instanceOf>
 <resourceRef
xlink:href="http://www.uwaterloo.ca/relander/XML/hamlet.xml"/>
 </occurrence>
</topic>
```



# XTM – resourceRef (I)

- Synopsis:
  - The <resourceRef> element provides a URI reference to a resource:
    - 1. as occurrences of topics (in <occurrence> elements)
    - 2. as addressable subjects (in <member>, <mergeMap>, <scope>, and <subjectIdentity> elements)
    - 3. as variant names of topics (in <variantName> elements)
- Content Model:
  - <!ELEMENT resourceRef EMPTY>
- Attributes:
  - <!ATTLIST resourceRef
    - id ID #IMPLIED
    - xlink:type NMTOKEN #FIXED 'simple'
    - xlink:href CDATA #REQUIRED>



## XTM – resourceRef (II)

- Example:

```
- <occurrence id="hamlet-in-xml">
 <instanceOf>
 <topicRef xlink:href="#xml-version"/>
 </instanceOf>
 <resourceRef
xlink:href="http://www.uwaterloo.ca/relander/XML/hamlet.xml"/>
</occurrence>
```



# XTM – resourceData (I)

- Synopsis:
  - The <resourceData> element contains information in the form of character data that may be
    - 1. an occurrence of a topic, or
    - 2. a variant form of a base name.
- Content Model:
  - `<!ELEMENT resourceData (#PCDATA)>`
- Attributes:
  - `<!ATTLIST resourceData`  
`id ID #IMPLIED>`



## XTM – resourceData (II)

- Example:

```
- <topic id="hamlet">
 <occurrence>
 <instanceOf>
 <topicRef xlink:href="#date-of-composition"/>
 </instanceOf>
 <resourceData>1600-01</resourceData>
 </occurrence>
</topic>
```



# XTM – mergeMap (I)

- Synopsis:
  - A <mergeMap> element references an external <topicMap> element through an xlink:href attribute containing a URI. It is a directive to merge the containing topic map and the referenced topic map.
- Content Model:
  - `<!ELEMENT mergeMap (topicRef | resourceRef | subjectIndicatorRef)*>`
- Attributes:
  - `<!ATTLIST mergeMap`
    - `id ID #IMPLIED`
    - `xlink:type NMTOKEN #FIXED 'simple'`
    - `xlink:href CDATA #REQUIRED>`



## XTM – mergeMap (II)

- Example:

```
- <mergeMap xlink:href="http://www.shakespeare.org/plays.xtm">
 <topicRef xlink:href="#shakespeare"/>
 <topicRef xlink:href="#drama"/>
</mergeMap>

<mergeMap xlink:href="http://www.shakespeare.org/biography.xtm">
 <resourceRef
xlink:href="http://www.shakespeare.org/biography.xtm"/>
</mergeMap>
```



# Resources

- Geroimenko, V.; Chen, C. (2005): Visualizing the Semantic Web. XML-Based Internet and Information Visualization. Springer.
- XTM 1.0 specification
  - <http://topicmaps.org/xtm/index.html>
- XTM 2.0 draft
  - <http://www.isotopicmaps.org/sam/sam-xtm/>
- Topic Map Data Model
  - <http://www.isotopicmaps.org/sam/sam-model/>
- Topic Map Designer – free editor and graph viewer
  - <http://www.topicmap-design.com/>
- more tools
  - <http://topicmap.com/topicmap/tools.html>