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)

- Homepage
- Author
- Authorship
- Person
- Publication
- Publishing
- Work
- Publisher
- Standard
- XML Recommendation
- Standards body
- World Wide Web Consortium
- Tim Bray
Topic Maps – Example (III)
Topic Maps – Example (IV)
Topic Maps – Example (V)

- Homepage
- Person
- Work
- Publisher
- Publication
- Publishing
- Authorship
- Standard
- World Wide Web Consortium
- XML Recommendation
- Tim Bray
Topic Maps – Example (VIII)

- Homepage
- Author
- Authorship
- URI
- Person
- Work
- Publisher
- Publication
- Publishing
- Standards body
- XML Recommendation
- Tim Bray
- World Wide Web Consortium

instance-of
occurrence
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"/>
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>
Example:

```xml
<?xml version="1.0"?>
<!DOCTYPE topicMap
  PUBLIC "-//TopicMaps.Org//DTD XML Topic Map (XTM) 1.0//EN"
  "file://usr/local/home/gromit/xml/xtm/xtm1.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>
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:
```xml
<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>
Example:

```xml
  <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>
Example:
  - `<topic id="shakespeare">
    <baseName>
      <baseNameString>William Shakespeare</baseNameString>
      <!-- form for sorting (sort name) -->
    </baseName>
    <variant>
      <parameters>
        <topicRef xlink:href="#sort"/>
      </parameters>
      <variantName>
        <resourceData>shakespeare,william</resourceData>
      </variantName>
    </variant>
  </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>`
• **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:**
  ```xml
  <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>
• 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>`
• Example:
    - <topic id="hamlet">
      <occurrence id="hamlet-in-xml">
        <instanceOf>
          <topicRef xlink:href="#xml-version"/>
        </instanceOf>
        <resourceRef
      </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>
Example:

```xml
<occurrence id="hamlet-in-xml">
  <instanceOf>
    <topicRef xlink:href="#xml-version"/>
  </instanceOf>
</occurrence>
```
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


- XTM 1.0 specification

- 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