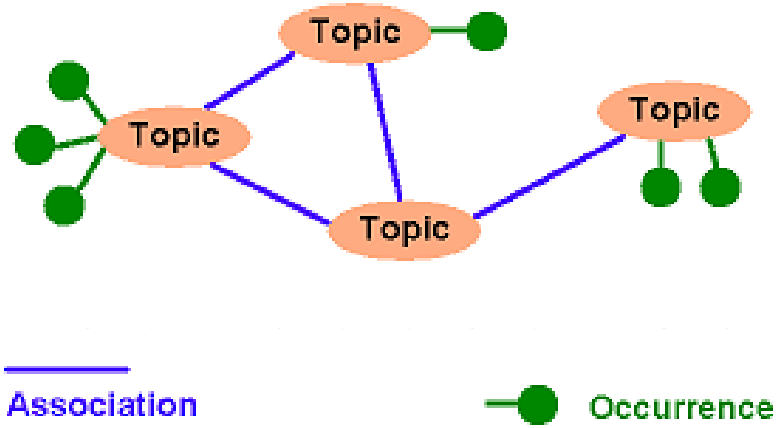
Topic Maps

Information Engineering

Introduction

- **Topic Maps** is an ISO standard for the representation and interchange of knowledge, with an **emphasis on the findability of information**. The standard is formally known as **ISO/IEC 13250:2003**.
- A **Topic Map** can represent information using **topics** (representing any concept, from people, countries, and organizations to software modules, individual files, and events), **associations** (which represent the relationships between them), and **occurrences** (which represent relationships between topics and information resources relevant to them)

Introduction



- Topics, associations, and occurrences can be **typed**, but the types must be defined by the creator of the topic maps.
- Topic Maps have a standard XML-based interchange syntax called **XML Topic Maps (XTM)**, as well as a de facto standard **API called Common Topic Map Application Programming Interface (TMAPI)**, while query and schema languages are being developed within ISO.

What Topic Maps Do

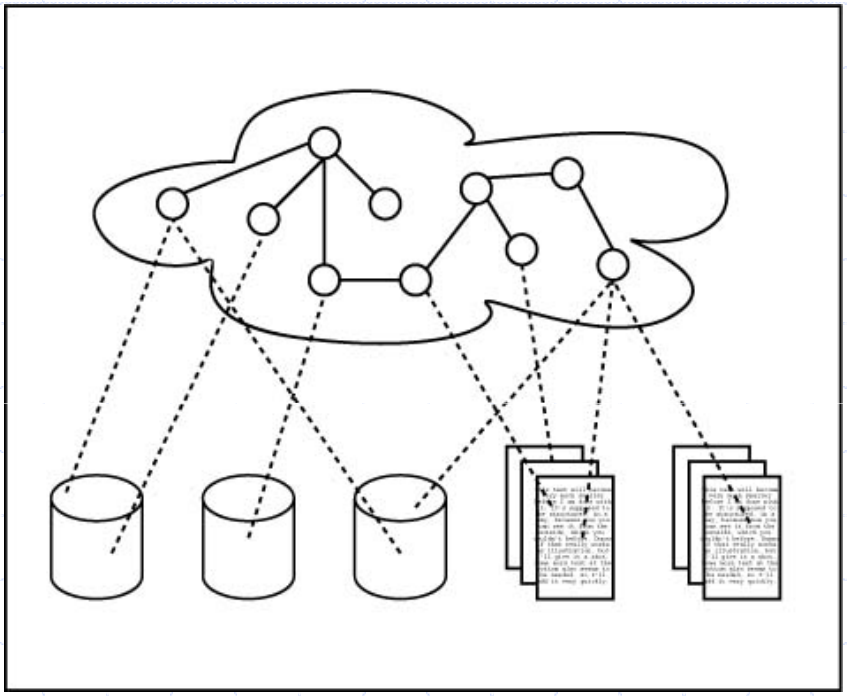
XML is usually used into an organization for one of two purposes:

- either to **structure the organization's documents** or
- to make that organization's **applications talk to other applications**.

These are both useful ways of using XML, but they **will not help anyone find the information** they are looking for

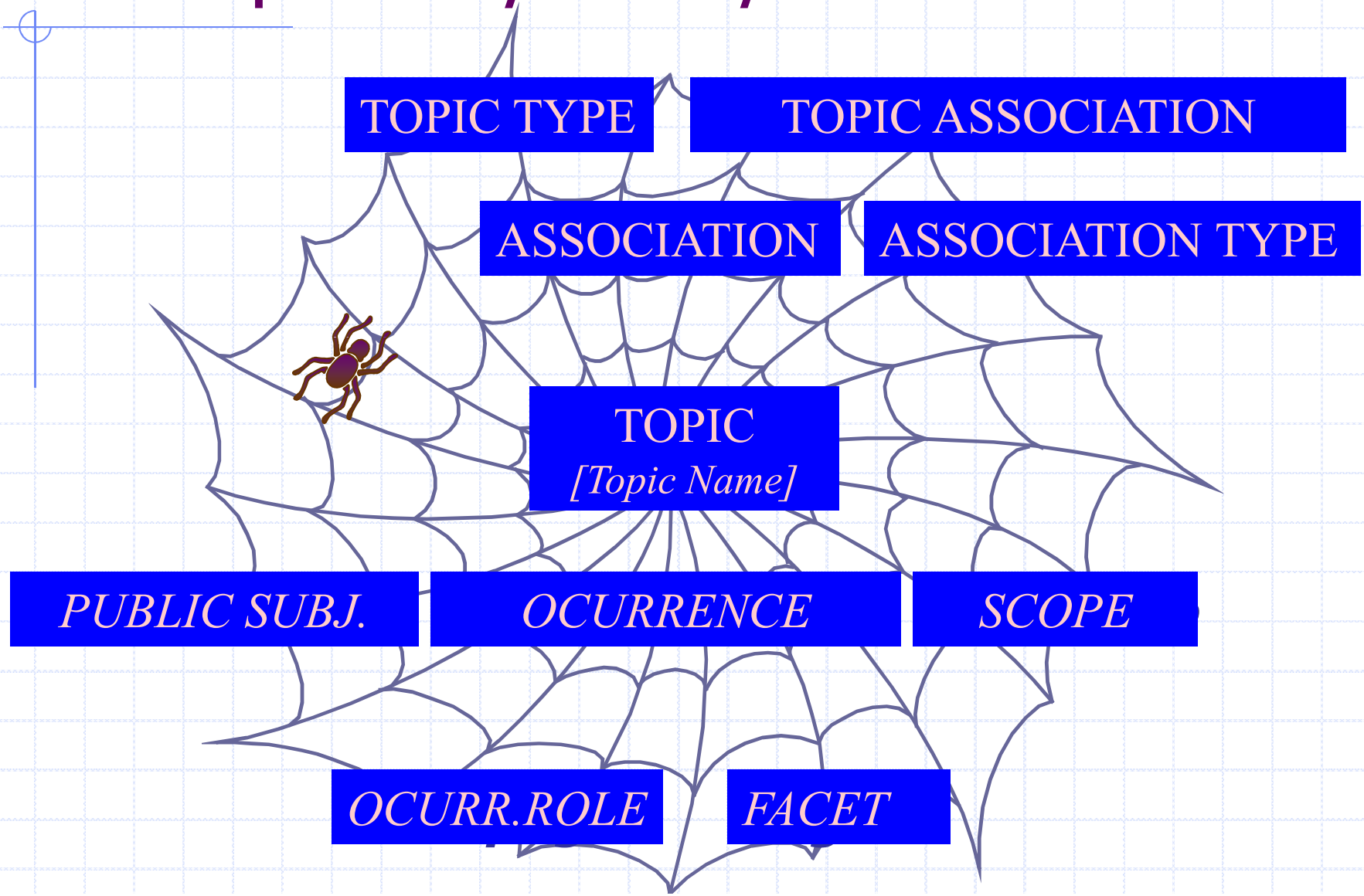
Something was needed that **collects the key concepts** in the organization's information **and ties it all together.**

What Topic Maps Do

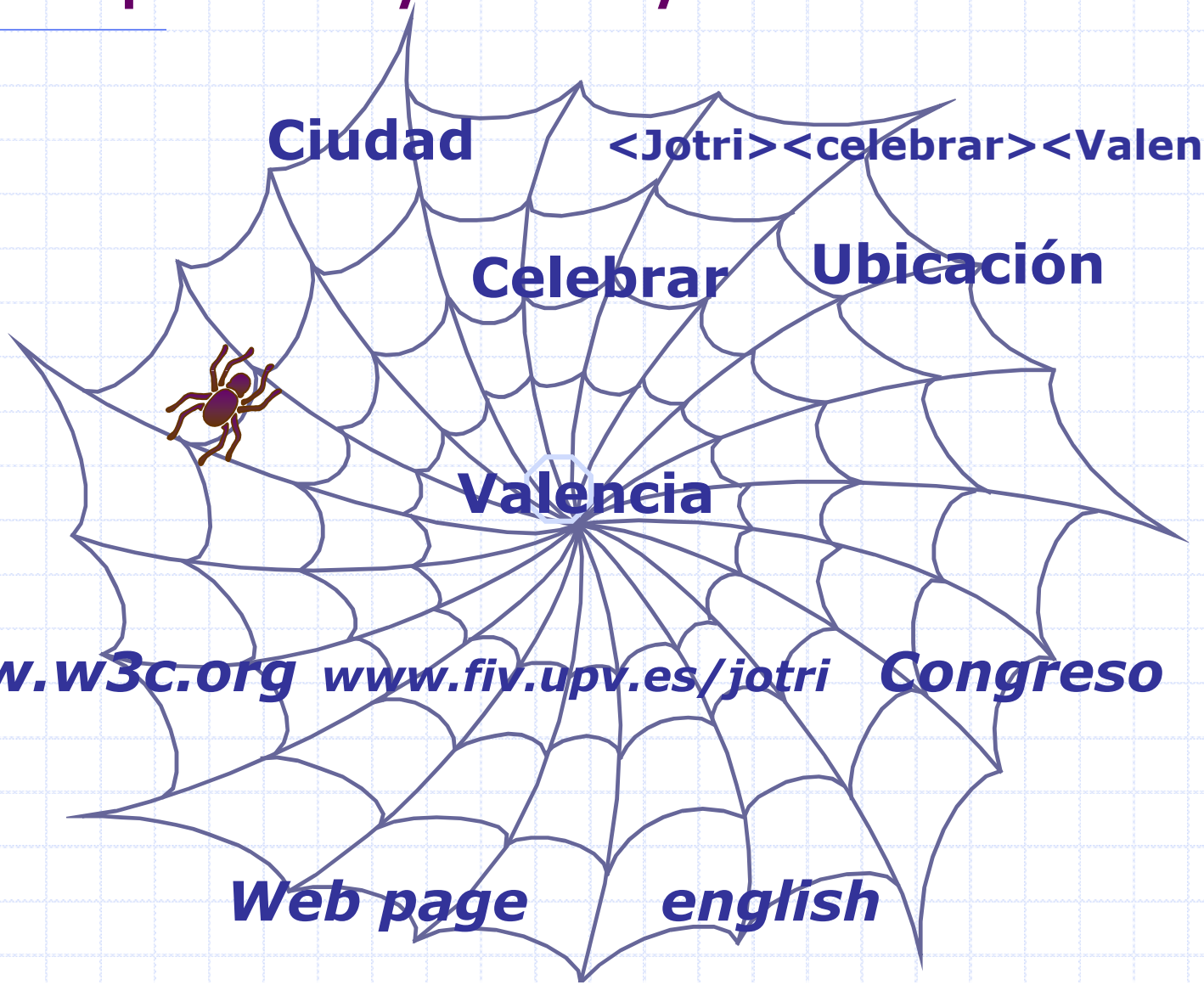


With topic maps you create an **index of information which resides *outside* that information**, as shown in the diagram above. The topic map (the cloud at the top) describes the information in the documents (the little rectangles) and the databases (the little "cans") by linking into them using URIs (the lines)

Example: *Topic Maps*



Example: *Topic Maps*



Elements in the *opic Maps*

- Elements and examples:
  - ***Topic*** i.e. <Valencia>, <España>
  - ***Topic Type*** i.e. <city>, <country>
  - ***Association*** <Valencia> <is_located_in> <España>
  - ***Association type*** <is_in> (or <located>)
  - ***Association role type*** <city><in_located_in><country>
  - ***Scope*** (domain related to the theme) *theme* <Geography>
  - ***Occurrence*** (i.e. http://www.fiv.upv/jotri/)
  - ***Occurrence type*** (i.e. WebPage) [filter by facets]
  - ***Public Subject*** (i.e. http://www.w3c.org/

How topic maps work I - Topics

At the heart of topic maps are ***topics*** (*these are the circles in the diagram*), which represent the things the topic map is about.

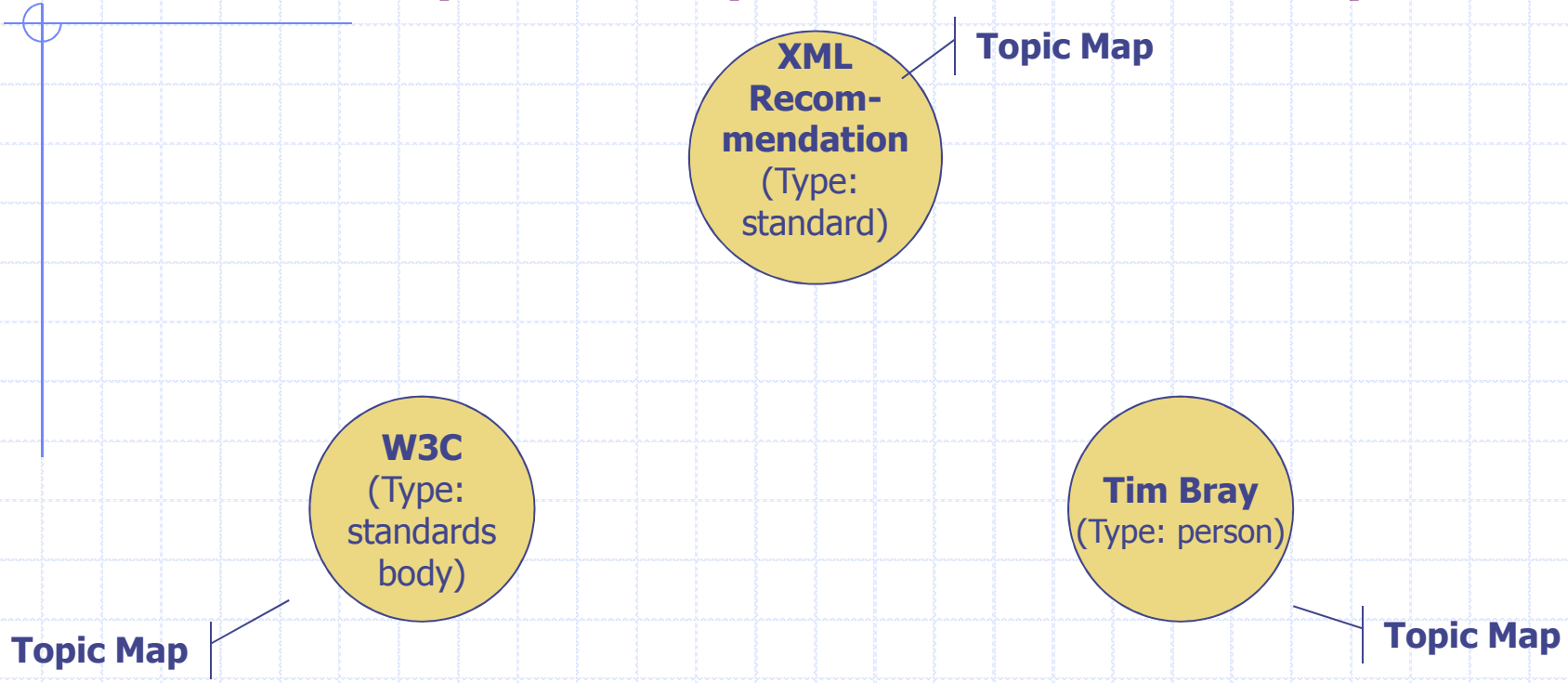
E.g. In a topic map about XML, one might expect to find terms (topics) such as '**XML Recommendation**', '**W3C**', and '**Tim Bray**'.

Topics may have **types**, and reasonable types for the example topics might be '**standard**', '**standards body**', and '**person**'.

Types in topic maps, however, are themselves topics, which means that anyone creating a topic map can choose what topic types, association and role types, and occurrence types they want to use.

This model is infinitely extensible and adaptable and can capture just about any kind of information.

How topic maps work I - Topics

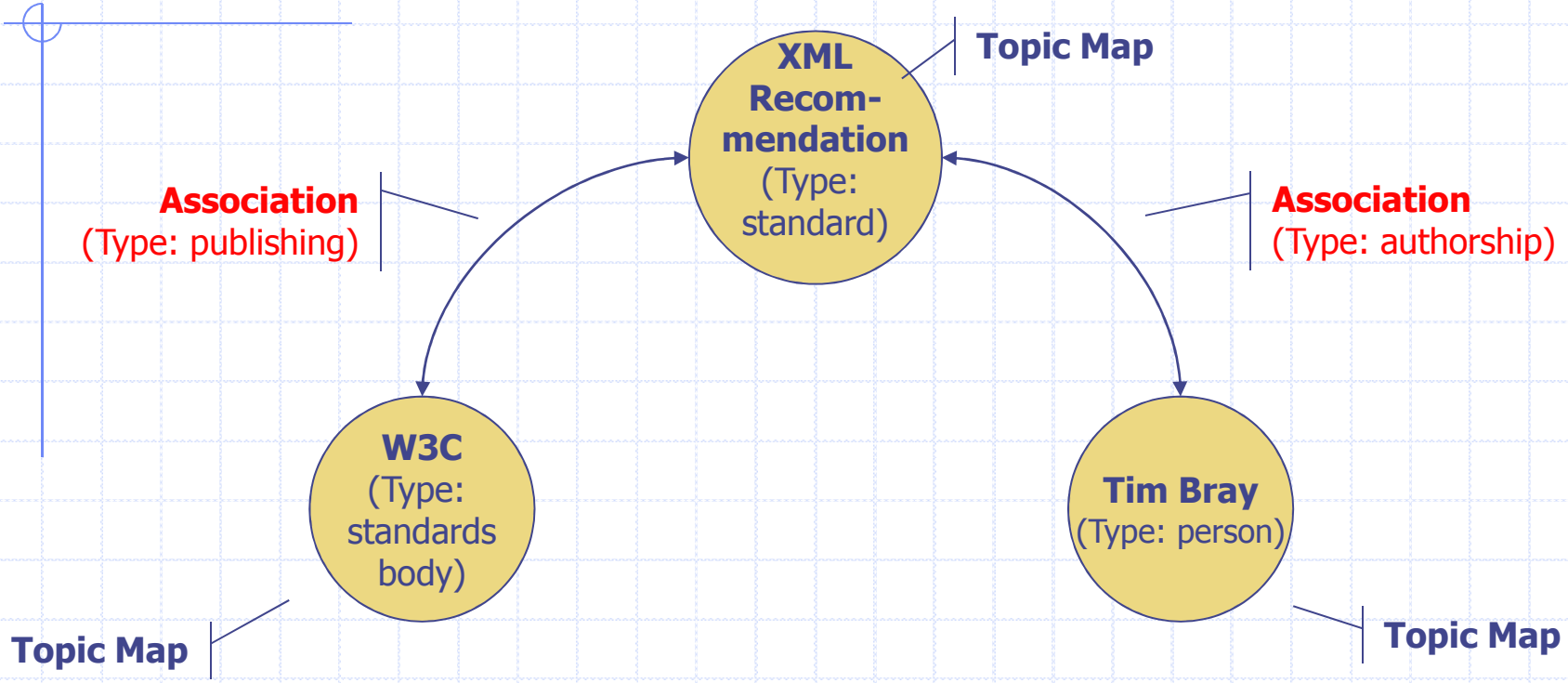


How topic maps work II - Associations

The relationships between the topics, which in topic maps is modeled with **associations** (*the lines between the topics*).

Associations are typed, which means that we can say that the **relationship** between the '*XML Recommendation*' and the '*W3C*' is one we might call of type 'publishing', while the relationship between the '*XML Recommendation*' and '*Tim Bray*' is one of type 'authorship'

How topic maps work II - Associations

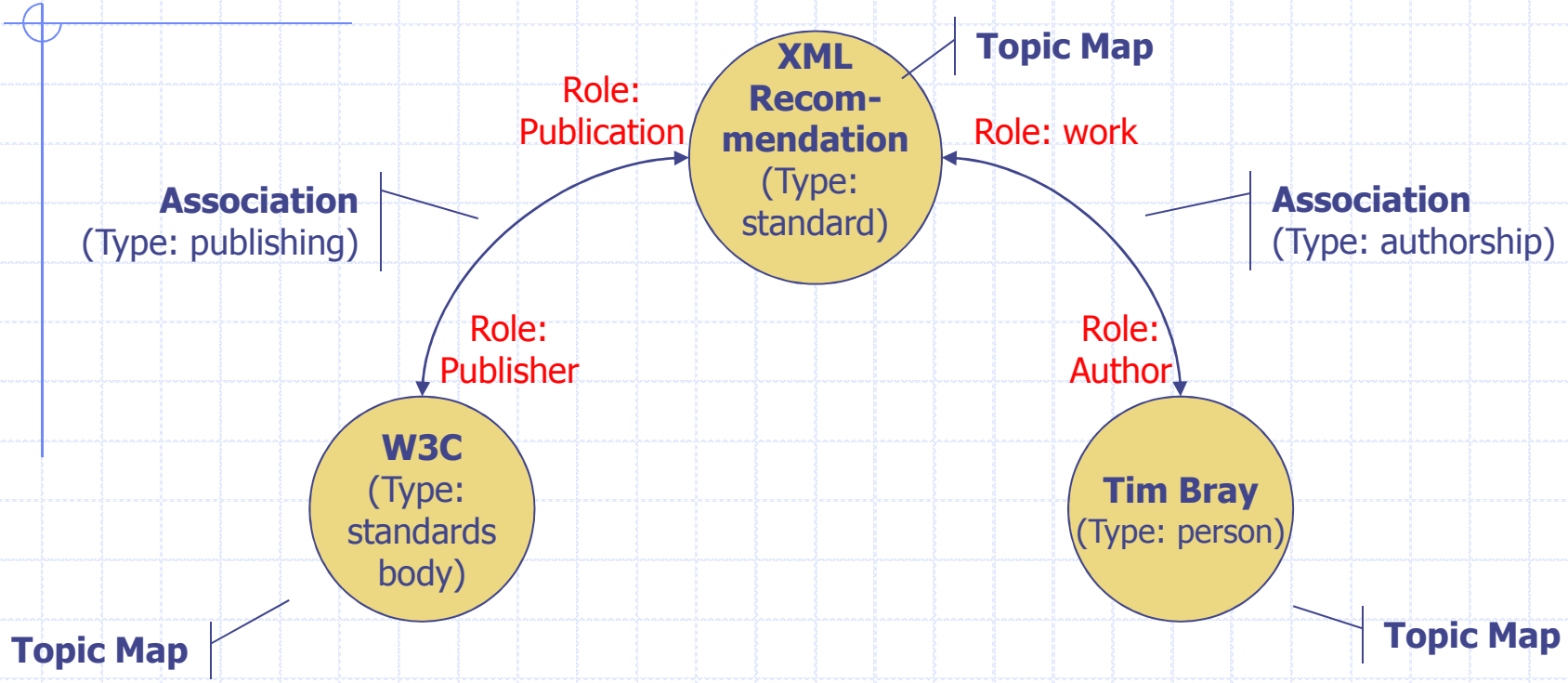


How topic maps work III – Association Roles

Associations have one unusual feature.

Each topic involved in the association is said to play a ***role***, which is defined by its ***role type***. So in the '*authorship*' association 'Tim Bray' plays the role of '**author**' while the 'XML Recommendation' plays the role of '**work**'

How topic maps work III – Association Roles

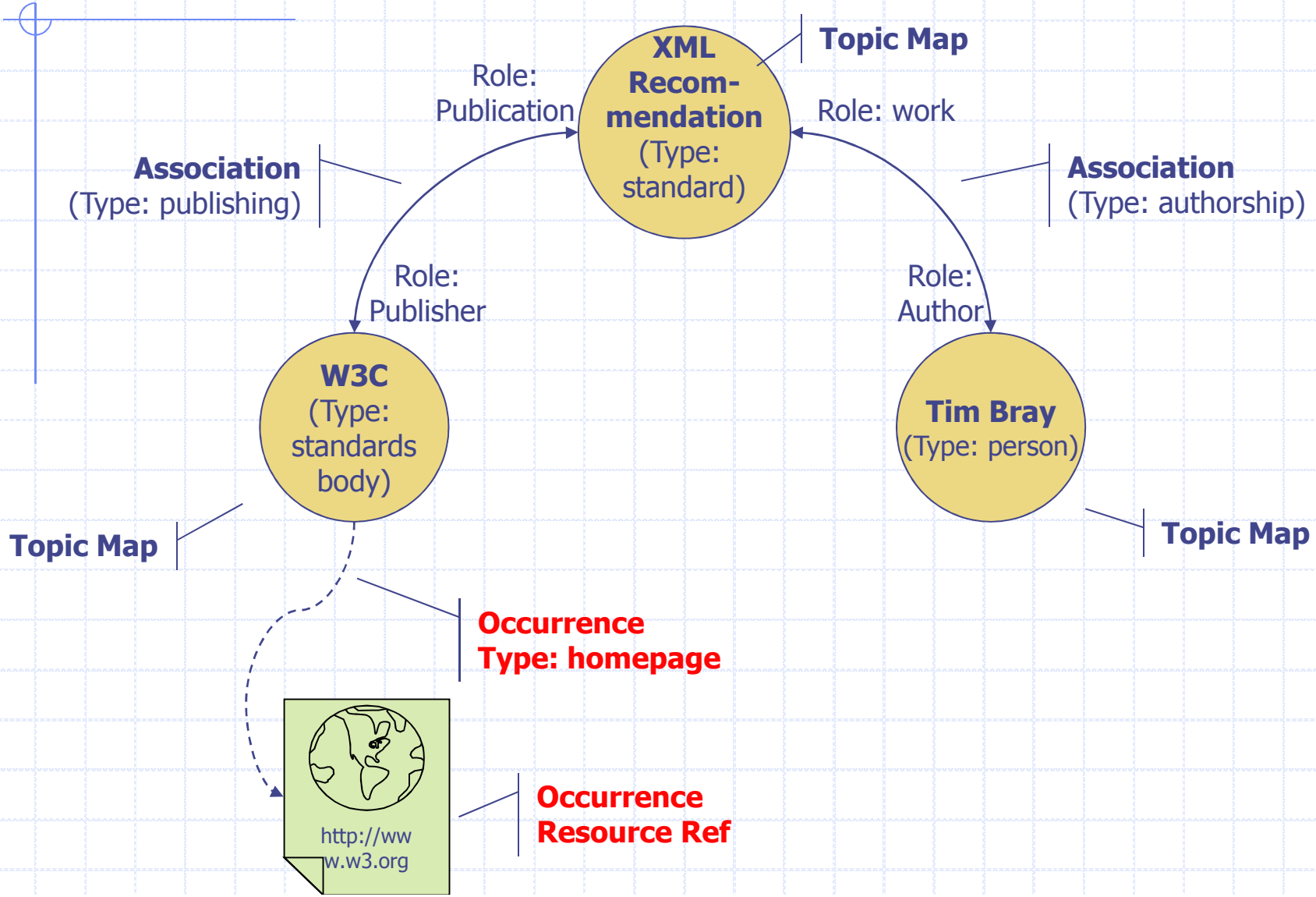


How topic maps work III – Occurrences

Occurrences, are information resources relevant to a topic. For 'Tim Bray', occurrences might be: his home page, a portrait, a CV, for 'W3C' its web page etc.

Since occurrences may also be typed, these different kinds of resources can be distinguished.

How topic maps work III – Occurrences



How topic maps work IV – Code

To create a topic map for the example above we can start by defining **topics** for the three **topic types**.

```
<topicMap xmlns="http://www.topicmaps.org/xtm/1.0/"
        xmlns:xlink="http://www.w3.org/1999/xlink">

 <topic id="person">
  <baseName>
   <baseNameString>Person</baseNameString>
  </baseName>
 </topic>

 <topic id="standards-body">
  <baseName>
   <baseNameString>Standards body</baseNameString>
  </baseName>
 </topic>

 <topic id="standard">
  <baseName>
   <baseNameString>Standard</baseNameString>
  </baseName>
 </topic>
</topicMap>
```

How topic maps work V – Code

```
<topic id="xml-rec">
  <instanceOf>
    <topicRef xlink:href="#standard"/>
  </instanceOf>
  <baseName>
    <baseNameString>The XML
      Recommendation</baseNameString>
  </baseName>
</topic>

<topic id="tim-bray">
  <instanceOf>
    <topicRef xlink:href="#person"/>
  </instanceOf>
  <baseName>
    <baseNameString>Tim Bray</baseNameString>
  </baseName>
</topic>

<topic id="homepage">
  <baseName>
    baseNameString>Homepage</baseNameString>
  </baseName>
</topic>
```

```
<topic id="w3c">
  <instanceOf>
    <topicRef xlink:href="#standards-body"/>
  </instanceOf>
  <baseName>
    <baseNameString>World Wide Web
      Consortium</baseNameString>
  </baseName>

  <occurrence>
      <instanceOf>
            <topicRef xlink:href="#homepage"/>
      </instanceOf>
      <resourceRef xlink:href="http://www.w3.org"/>
  </occurrence>
</topic>
```

The next step is to add one topic to be used as an **occurrence** type and our three **instance topics**, complete with names and occurrences.

The **order** of topic elements in topic maps is **irrelevant**.

How topic maps work VI – Code

```
<topic id="authorship">
  <baseName>
    <baseNameString>Authorship</baseNameString>
  </baseName>
</topic>

<topic id="author">
  <baseName>
    <baseNameString>Author</baseNameString>
  </baseName>
</topic>

<topic id="work">
  <baseName>
    <baseNameString>Work</baseNameString>
  </baseName>
</topic>
```

For reasons of space, the other associations are not included.

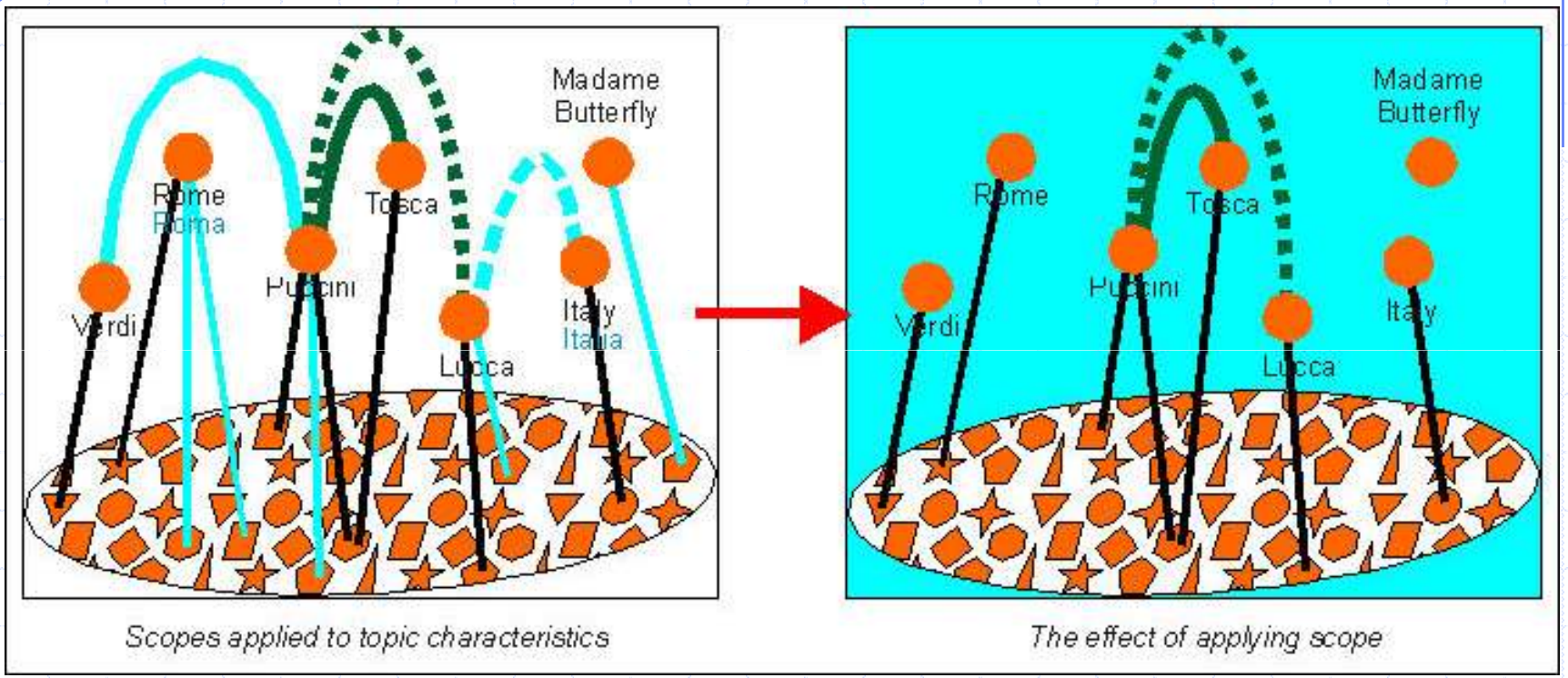
```
<association>
  <instanceOf>
    <topicRef xlink:href="#authorship"/>
  </instanceOf>

  <member>
    <roleSpec>
      <topicRef xlink:href="#author"/>
    </roleSpec>
    <topicRef xlink:href="#tim-bray"/>
  </member>

  <member>
    <roleSpec>
      <topicRef xlink:href="#work"/>
    </roleSpec>
    <topicRef xlink:href="#xml-rec"/>
  </member>
</association>
```

How topic maps work VII – Scope

Scope, can be attached to any name, occurrence, or association in a topic map. **Users** can then **choose** to see all information in all scopes, or only those in particular scopes, basically **tailoring their view** of the world as they want to see it.

```
<topic id="city-of-rome">
 <baseName>
  <scope>
   <subjectIndicatorRef
     xlink:href="http://www.topicmaps.org/xml/1.0/language.xtm#en"/>
  </scope>
  <baseNameString>Rome</baseNameString>
 </baseName>
 <baseName>
  <scope>
   <subjectIndicatorRef
     xlink:href="http://www.topicmaps.org/xml/1.0/language.xtm#it"/>
  </scope>
  <baseNameString>Roma</baseNameString>
 </baseName>
</topic>
```

How topic maps work VIII – Scope



How topic maps work IX – Facets

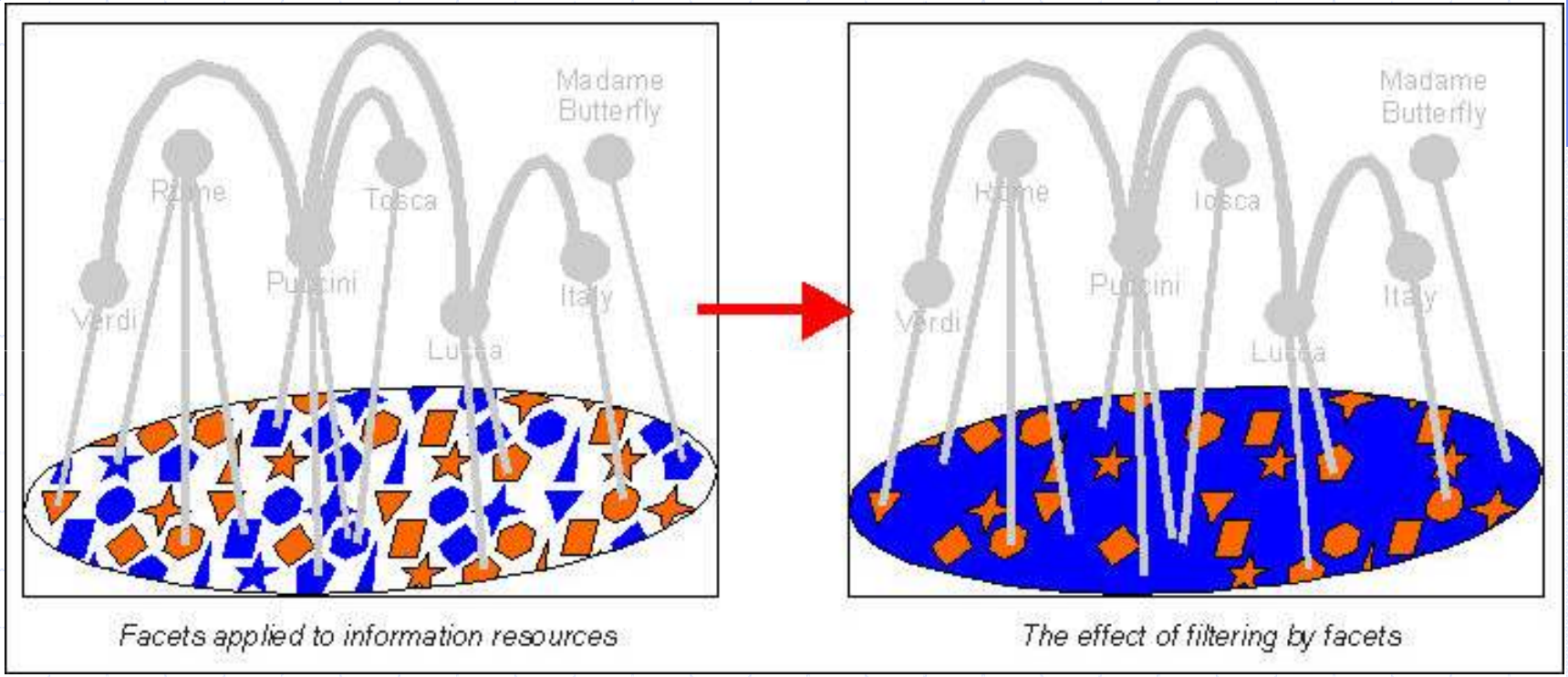
Facets basically provide a mechanism for assigning property-value pairs to **information resources**.

A facet is simply a property; its values are called **facet values**.

This could include properties such as ‘language’, ‘security’, ‘applicability’, ‘user level’, ‘online/offline’, etc.

These properties can be **used to create query filters** producing restricted **subsets of resources**, for example those whose ‘language’ is ‘Italian’

How topic maps work X – Facets



Facets applied to information resources

The effect of filtering by facets

How topic maps work XI – *Subject identifiers* & *indicators*

A topic may have any number of ***subject identifiers*** **(URIs)** (<subjectIdentity>...</subjectIdentity>) which identify the subject the topic is about.

These URIs should point to resources which describe the subject to a human; the resources are known as ***subject indicators***. (<subjectIndicatorRef>)

This allows **subjects** to be **uniquely identified** across topic maps and the entire web.

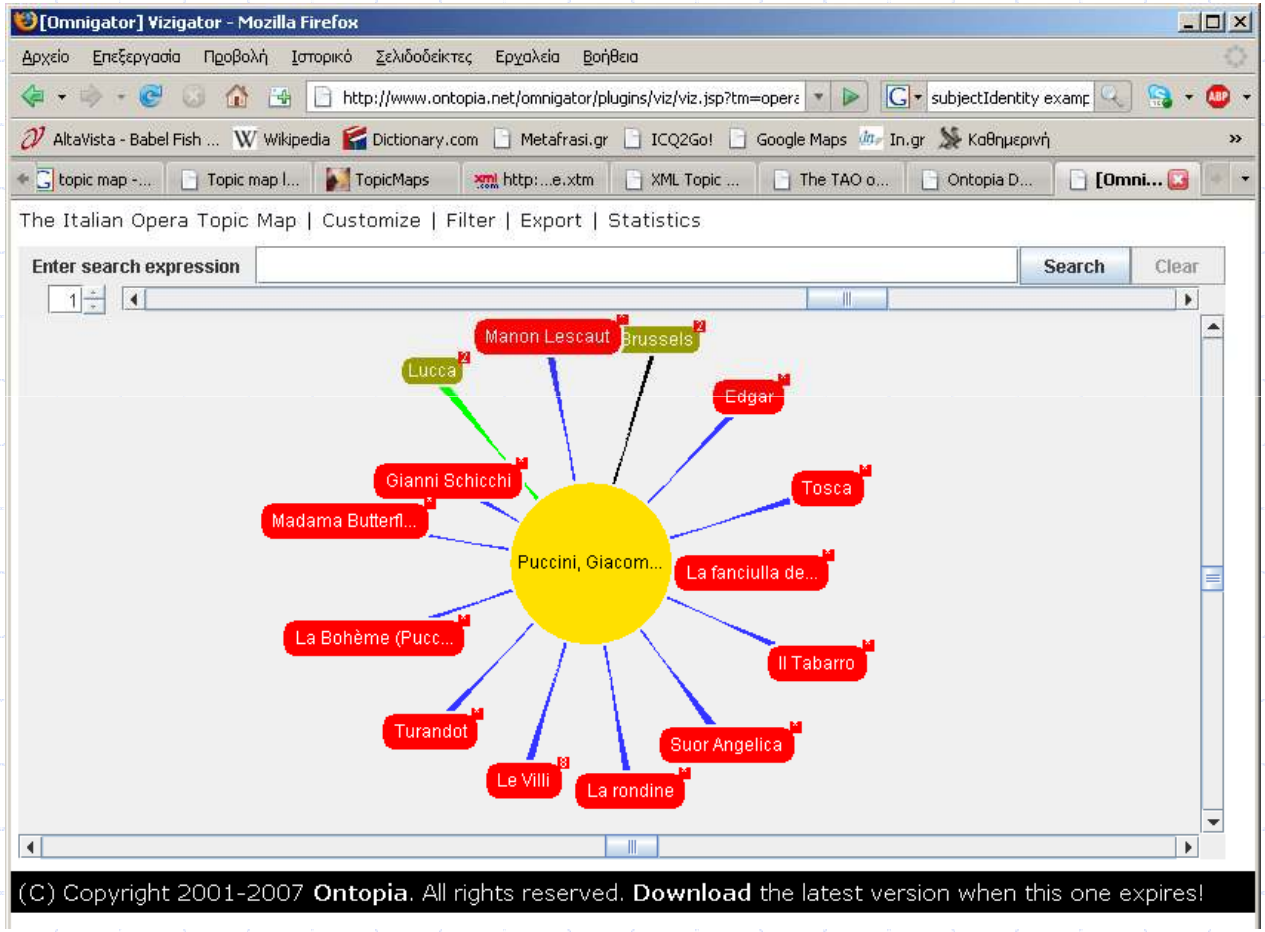
This **unambiguous identification** of subjects **is used** in topic maps **to *merge* topics** that, through these identifiers, are known to have the same subject.

Two topics with the same subject are replaced by a new topic that has the union of the characteristics (names, occurrences, and associations) of the two originals. There is in fact a well-defined procedure for automatically merging topic maps based on this rule.

E.g.

```
<topic id="dk">
  <subjectIdentity>
    <subjectIndicatorRef xlink:href="http://www.topicmaps.org/xtm/1.0/country.xtm#dk"/>
  </subjectIdentity>
</topic>
```

Topic Map Visualization (I)



Omnigator Topic Map Browser: http://www.ontopia.net/omnigator

Topic Map Visualization (II)

http://www.ontopia.net/operamap/theatres.jsp

Conclusions

- Topic maps **make information findable** by giving every concept in the information its own identity and **providing multiple redundant navigation paths** through the information space.
- These paths are semantic, and all points on the way are clearly identified with names and types that tell you what they are. This means you **always know where you are**.
- Charles Goldfarb (father of SGML) called topic maps "**the GPS of the information universe**".
- Topic maps also help by making it possible to **relate together information** that comes **from different sources** through merging and published subjects.

Resources

- XML Topic Maps (XTM) 1.0 Specification (http://topicmaps.org/xtm/)
- ISO/IEC 13250 Topic Maps, Second Edition (http://www.y12.doe.gov/sgml/sc34/document/0322_files/iso13250-2nd-ed-v2.pdf)
- What are Topic Maps (tutorial) (http://www.xml.com/pub/a/2002/09/11/topicmaps.html)
- The TAO of Topic Maps (tutorial) (http://www.ontopia.net/topicmaps/materials/tao.html)
- Various resources about TM (http://www.topicmap.com/)