Practical TMRAPping

A tutorial

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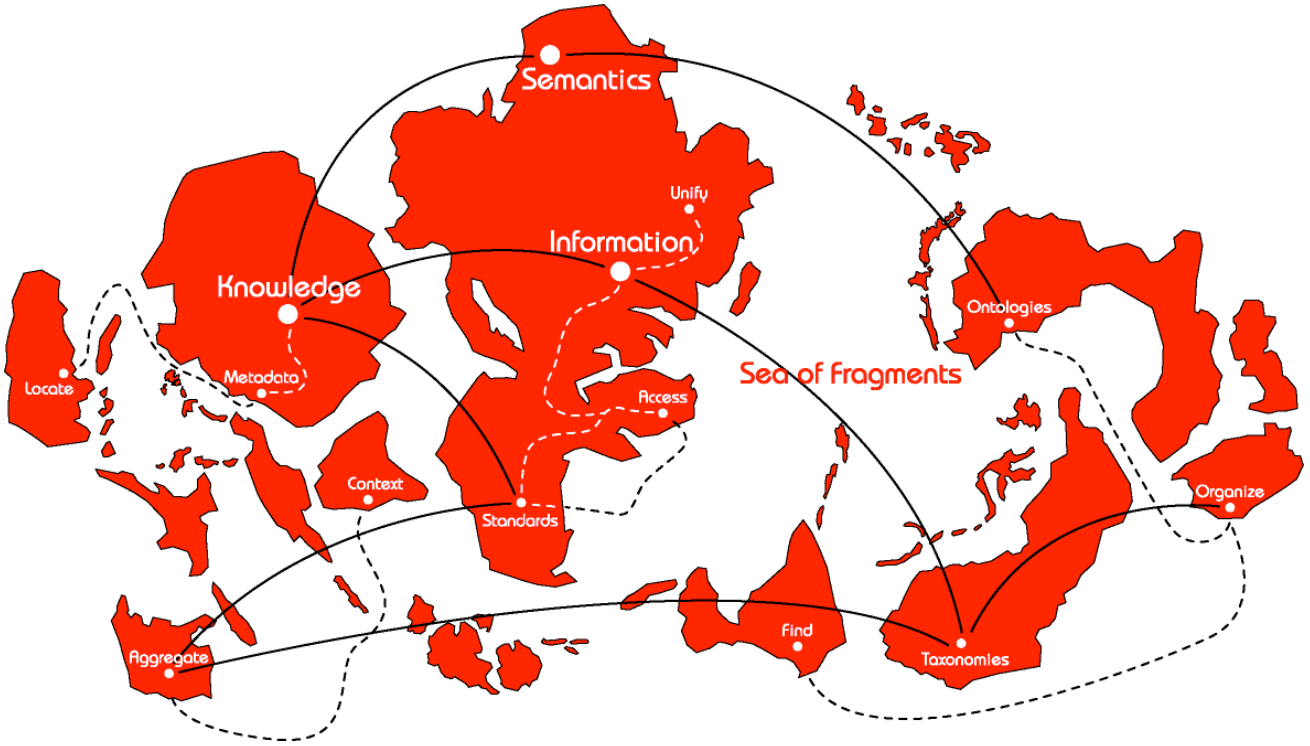

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Agenda

- **Introduction**
  - use cases
  - status
- **Understanding TMRAP**
  - the basics
  - the requests
- **The HTTP binding**
  - examples
- **TM/XML**
  - examples
- **The HTTP binding**
  - examples

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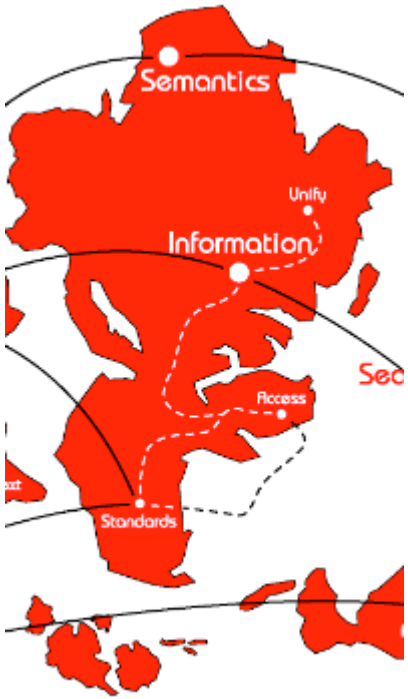
What you will learn

- **This tutorial assumes you already know**
  - Topic Maps
  - tolog
  - XTM and LTM
  - HTTP and Web Services in general
- **It will teach you**
  - how TMRAP works conceptually
  - how to work with the returned XML data
- **It will *not* teach you**
  - how to do client programming
  - this will depend on your environment...

Introduction

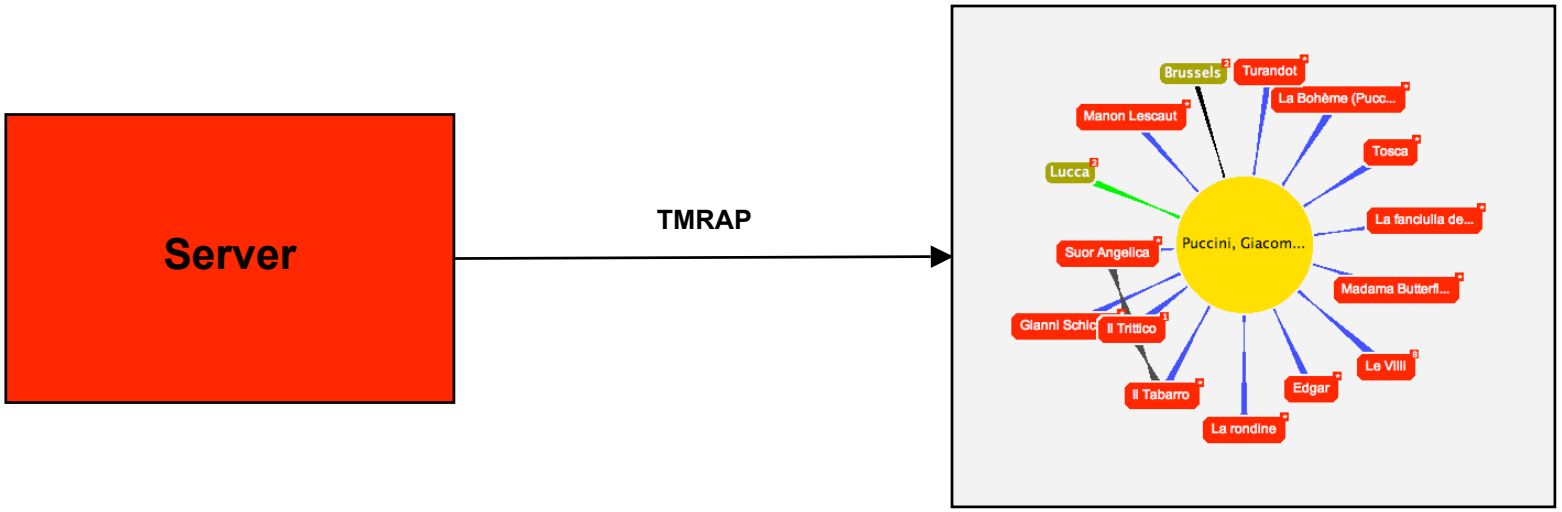


Use cases

Status

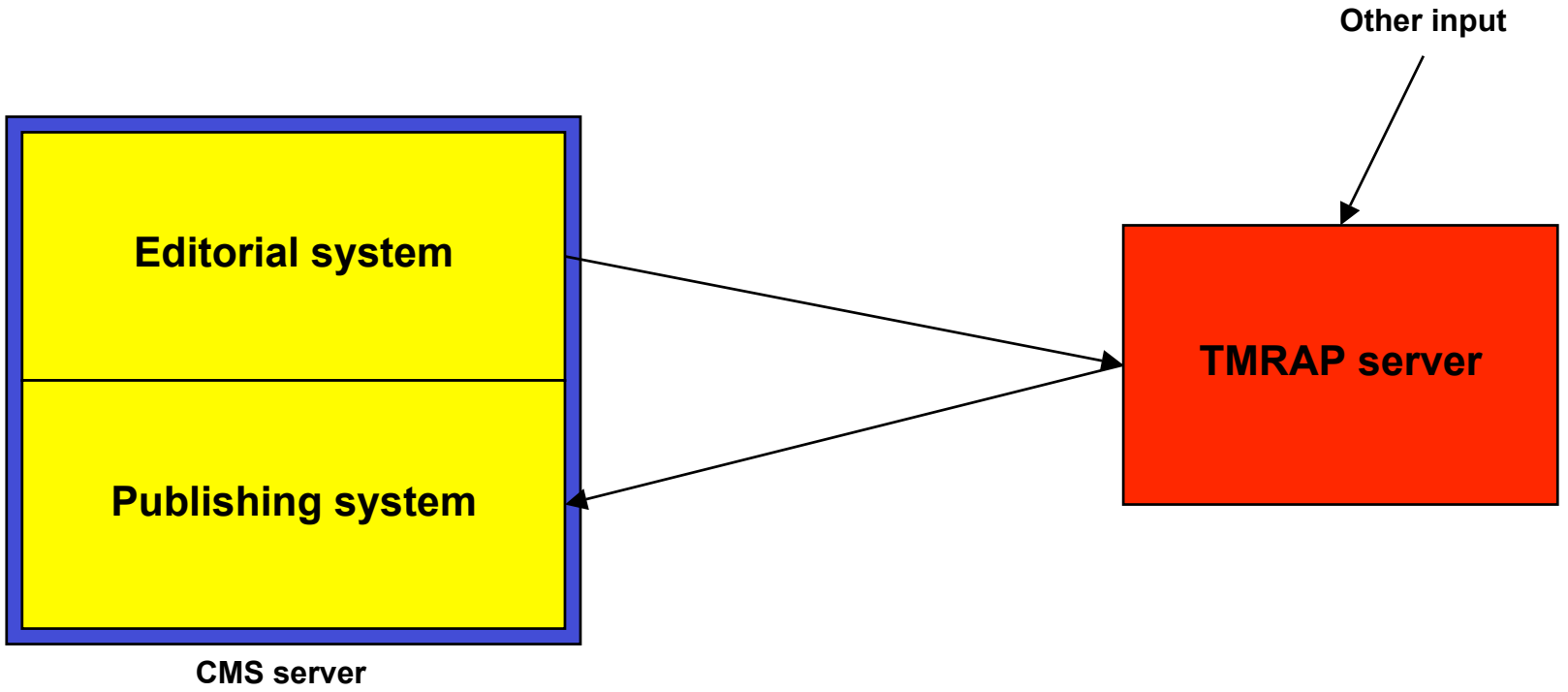
The Vizigator

- **The Vizigator uses TMRAP**
  - the Vizlet runs in the browser (on the client)
  - a fragment of the topic map is downloaded from the server
  - the fragment is grown as needed



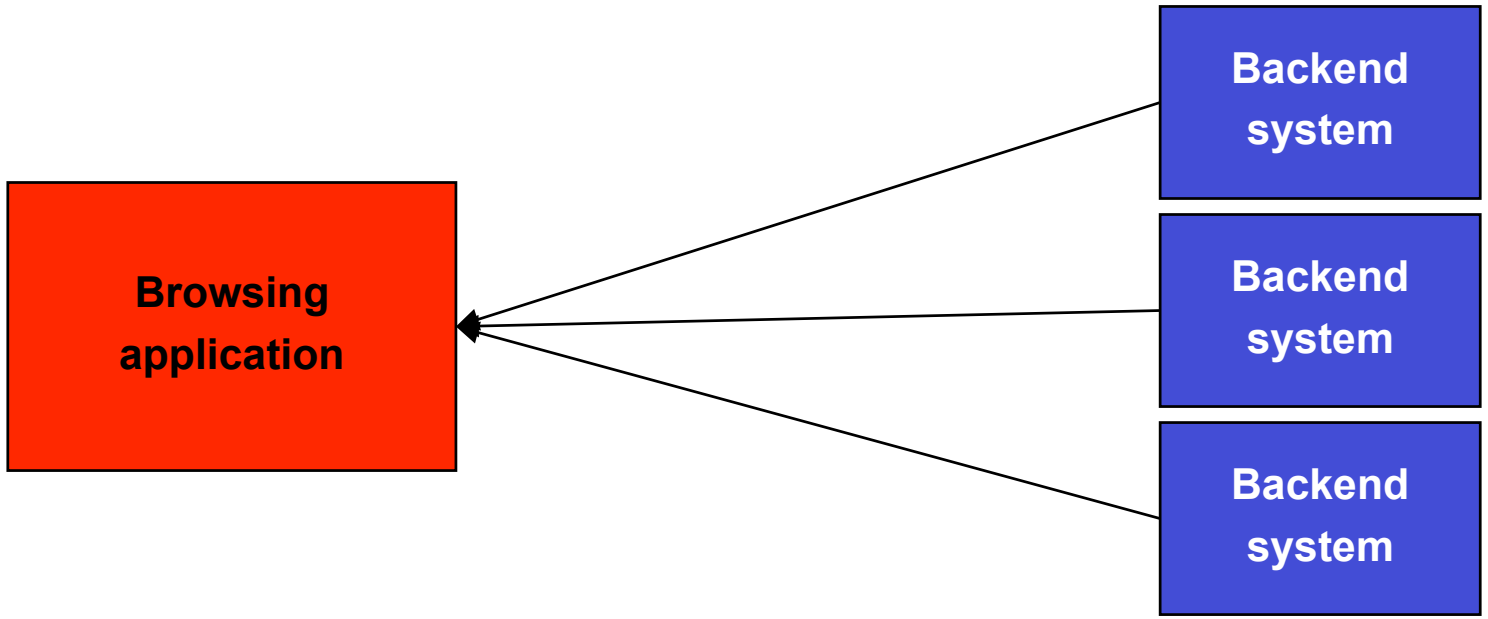
CMS integration

- **TMRAP can be used to integrate CMSs that are not Java-based**
  - events in the CMS trigger update requests to the TMRAP server
  - the end-user interface retrieves Topic Maps data via TMRAP



Building temporary topic maps

- **The Amsterdam police has built a prototype of this**
  - investigators can use TMRAP to extract related fragments from various systems
  - these are integrated into a single, temporary topic map that can be browsed to see the connections



Towards seamless knowledge

- **As the number of portals multiplies, the amount of overlap increases…**
- **Take these three portals as an example:**
- **forskning.no** (Research Council web site aimed at young adults)
- **forbrukerportalen.no** (Public site of the Norwegian Consumer Association)
- **matportalen.no** (Biosecurity portal of the Department of Agriculture)

forskning.no: Genmodifisert mat - Opera

File Edit View Navigation Bookmarks Mail Window Help

http://www.forskning.no/Temaer/genmodifisert_mat

Go 100%

forskning.no

gå til forsiden bøker kontakt oss abonner på nyhetsbrev les om forskning.no hva er...? minidokumentaren portretter

kultur
samfunn
helse
miljø
teknologi
hav og fiske
jord og skog
naturvitenskap

i fokus

Forskningsåret 2003
Det er ikke sunt å pynte seg - og annen god lærdom fra biologien
Det meste av det menneskelige er oss fremmed
Frankenfood, nazister og knokler på vidvanke
Noen kommer, noen går
Norge - moralens høyborg
Penger, privatisering og allmenn paranoia
Sorte hull, mørk energi og universets undergang
Været 2003 - mot normalt?

Genmodifisert mat

[illegible].03.2004

Sykdomsutbrudd av genmodifisert mais?

Professor Terje Traavik ved Genøk har gått ut med foreløpige funn som antyder at et sykdomsutbrudd i en filippinsk landsby kanskje kan kobles til genmodifisert mais. Saken har skapt furore verden over.

mer →

10.03.2004

Britene sier ja til genmodifisert mais

Storbritannia har gitt grønt lys for å dyrke genmodifisert mais på britisk jord. Dette er en historisk avgjørelse, selv om britene stiller en rekke betingelser til dyrkingen.

mer →

08.03.2004

Advarer mot genmanipulerte organismer

Et panel av amerikanske forskere mener vi vet for lite om konsekvensene når vi slipper genmanipulerte organismer ut i naturen. Nå oppfordrer de til større forsiktighet.

mer →

25.02.2004

Ja eller nei til genmodifisert mat?

"To be or not to be?" er ikke det heteste spørsmålet i Storbritannia for tiden. Det er snarere ja eller nei til genmodifisert mat. Etter lekkasje fra en regjeringskomité har spekulasjonene tatt av i pressen.

les mer om

hører til under
Bioteknologi
Mat fra havet
Mat fra landbruket
Mat

beslektede fag
Bioteknologi
Akvakultur
Medisinsk bioteknologi
Jordbruksproduksjon
Husdyrproduksjon

flere ressurser

personer
Odd Arne Olsen
Terje Traavik

institusjoner
Norsk Institutt for genøkologi (Genøk)

Genmodifisert mat - Opera

File Edit View Navigation Bookmarks Mail Window Help

http://forbrukerportalen.no/Forbrukerportalen/Emner/genmodifisert_mat

Go 100%

kart over nettstedet :: om forbrukerrådet :: ledig stilling :: nyhetsbrev :: in english ::

FORBRUKERRÅDET

søk i
alt innhold
etter
søk

sentrale emner ::

Barn, ungdom
Bil
Bolig
Båt
flere...

Forbruker-rapporten
Slik klager du
Clearing house
Lover, regelverk
Forbrukerundervisning

sentralt innhold

Tester
Kontrakt/skjema
Ofte stilte spørsmål
Klageveilederen

kontakt oss ::

Tlf 815 58 200 (0,39 pr min)
(kl. 09.00 - 15.00)
Kontakt
Forbrukerrådet
Tips Forbruker-rapporten

her er du ::

Til forsiden
Landbruk
Forbrukerundervisning
Genteknologi
Mat
Genmodifisert m...

Genmodifisert mat ::

tips en venn utskriftsformat

Forbrukerrådet ønsker økt bevissthet knyttet til fordeler og ulemper med genmodifisert mat hos allmennheten, næringsaktørene, politikere og myndigheter i inn- og utland. Vi arbeider også for å etablere forbrukervennlige merkeregler av genmodifisert mat.

EU forbyr fortsatt gen-mat
18.12.2003

EU har foreløpig avvist en søknad om import av et genmodifisert matvareprodukt.

› mer

Internasjonal motstand mot USAs GMO-rettssak
25.07.2003

Forbrukerorganisasjonene i EU og USA har nylig gått ut med en sterk samlet oppfordring til den amerikanske regjeringen om å trekke saken mot EU om genmodifiserte organismer (GMO).

› mer

FN setter regler for gen-mat
02.07.2003

I Roma er eksperter på matsikkerhet fra verdens land nettopp blitt enige om retningslinjer for godkjenning av genmodifisert mat. Det er også vedtatt krav til overvåking og merking av slik mat.

› mer

- Kan ikke garantere ren øko-mat
27.06.2003

Matportalen: Genmodifiserte matvarer - Opera

File Edit View Navigation Bookmarks Mail Window Help

http://matportalen.no/Matportalen/Emner/gmo

Go Google search 100%

Forsiden Kart over nettstedet Om matportalen Kontakt oss English Nyhetsbrev

Matportalen

Fra jord og fjord til bord

Søk i Matportalen

søk

Sentrale emner

- Kjøtt
- Fisk og sjømat
- Frukt og grønt
- Melk og meieriprodukter
- Egg
- Korn og brød
- Annen mat
- Drikke

Finn innhold

- Trygg mat
- Syk av maten?
- Genmodifiserte matvarer
- Kostholdsråd
- Landbruk
- Fiskeri og havbruk
- Næringsmiddelindustri
- Økologisk mat
- Fremmedstoffer
- Tilsetningsstoffer
- Mat internasjonalt
- Tilsyn og kontroll
- Biologiske gifter/biotoksiner

Redaksjonen
E-post til redaksjonen

Denne tjenesten er designet og utviklet av CREUNA

Genmodifiserte matvarer

Utskriftsvennlig versjon

Det kan være vanskelig nok å velge en flaske ketchup i butikken. Flaskene er forskjellige når det gjelder form, pris, mengde og innhold. Hva gjør du den dagen du i tillegg kan velge mellom ketchup laget av vanlige tomater og ketchup laget av genmodifiserte tomater?

Det er satt strenge krav til godkjenning og merking av genmodifiserte produkter i Norge, og hittil har ingen genmodifiserte produkter blitt godkjent som matvare eller som ingrediens i matvarer. Norge importerer imidlertid mat fra land som har godkjent bruk av genmodifiserte matvarer. Det er derfor stor sannsynlighet for at de kan havne i butikkhyllene.

Den enkelte forbruker har rett til å velge om han eller hun vil kjøpe og spise genmodifisert mat. For å kunne gjøre slike valg, er det nyttig å vite litt om hva genteknologi og genmodifisert mat er: Hvorfor genmodifiseres planter, dyr og bakterier? Hvilke fordeler, ulemper eller farer er det med genmodifisering? Kan det være farlig å spise genmodifisert mat?

- Hva er genmodifisert mat?
- Gener og genteknologi
- Genmodifisering - nye muligheter?
- Genmodifisering - på ville veier?
- Kan genmodifisert mat være farlig?
- Genmodifisering - norske lover og internasjonale avtaler
- Genmodifisering - forskning og etikk

Les mer om genmodifisering:

Bioteknologinemda
Miljøverndepartementet Genteknologi
Forbrukerportalen.no Genmodifisert mat
Direktoratet for naturforvaltning Genmodifiserte organismer
Grønn hverdag Gennytt

I FOKUS

Genmodifisert mat - gjeldende norsk regelverk
Artikkel, 18.09.2003
Merkekrav til genmodifisert mat er gitt i Statens næringsmiddeltilsyns rundskriv 4039 : Rundskriv til forskrift om merking mv av næringsmidler - midlertidige retningslinjer vedrørende merking av genmodifiserte næringsmidler og næringsmiddelingredienser, se også Presisering av rundskriv om merking av genmodifisert mat.
Les mer

Genmodifisert mais like trygg

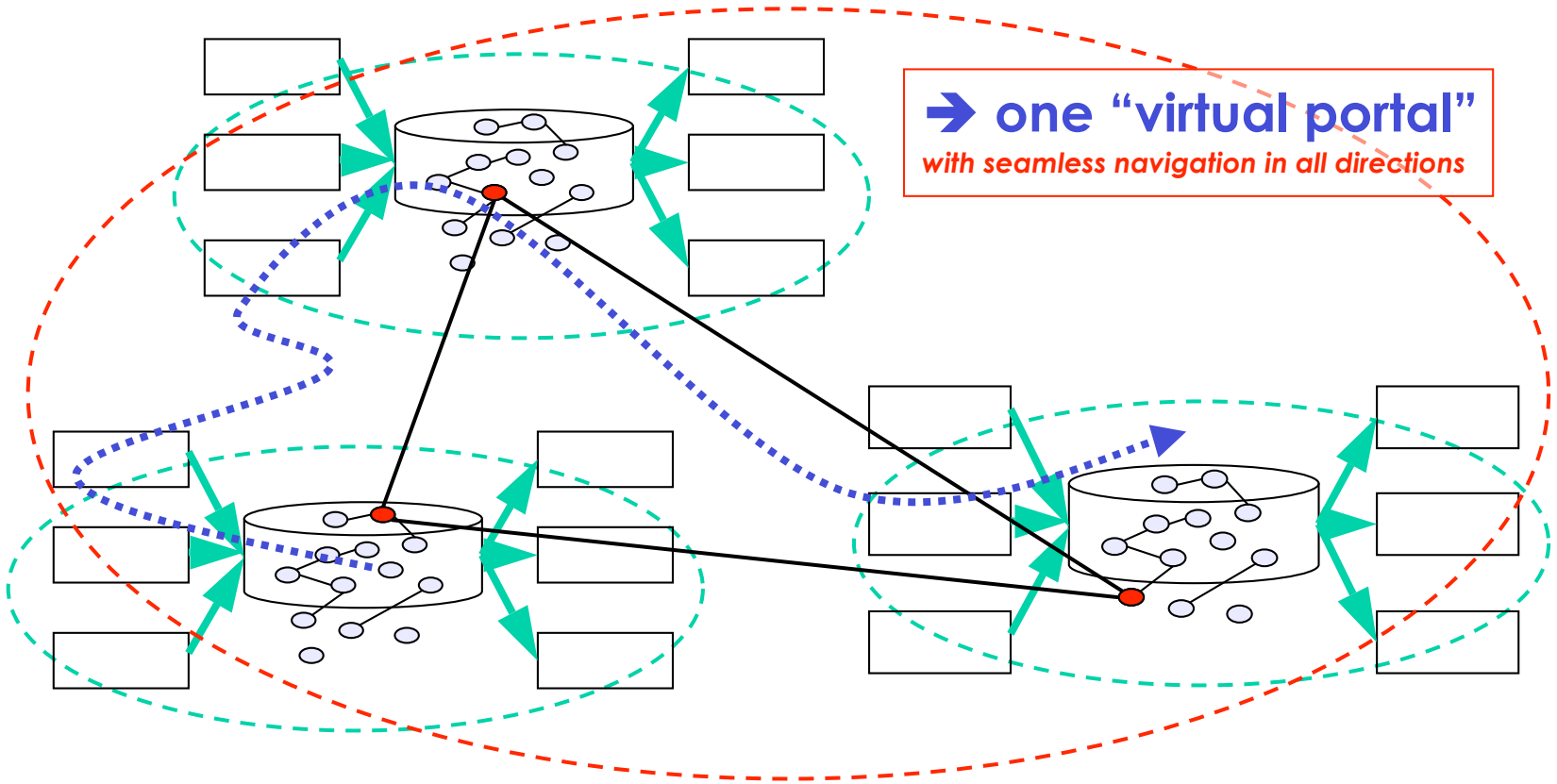
Du er her :

Forsiden
Genmodifiserte matvarer

Fokuserer på:

Artikkel
Ingen GMO-overskridingar i fôr i 2002
Genmodifiserte plantesorter er forbudt å dyrke i Norge
Hvete neste store genmodifiserte såvare på markedet
Godkjenning av første genmodifiserte avlinger utsatt
Kraftig reduksjon i feltforsøk med genmodifiserte vekster i EU.
Bred debatt om genmodifisert mat
Genmodifisert mat - gjeldende norsk regelverk
Høring trace and label
Monsanto trapper ned i Europa
Genmodifisert mais like trygg
Hva er genmodifisert mat?
Gener og genteknologi
Genteknologi - nye muligheter?
Genmodifisering - på ville veier?
Kan genmodifisert mat være farlig?
Genmodifisering - norske lover og internasjonale avtaler
Genmodifisering - forskning og etikk
Økning i økologisk landbruksareal i fjor
Gir klartegn for genmodifisert mais
Vil ha genmodifisert mat i Storbritannia
Bra GMO-merking i Sverige
Danmark klar med GMO-strategi
Genmodifisert mat på fremmarsj
EU-kommisjonen slår tilbake om GMO
Støtter EU i striden om genmat
Funn av GMO i økologisk fjørefôr
Brudd i samtalene om GMO
GMO-merking kan gi mindre valgfrihet
Lite genmodifisert materiale i norsk fôr
Funn av genmodifisert materiale i økologisk fôr
Skjerpede GMO-regler i EU
Genmodifisert mat
Genmat øker bruk av sprøytemidler
EU opphever ikke forbud mot genmat

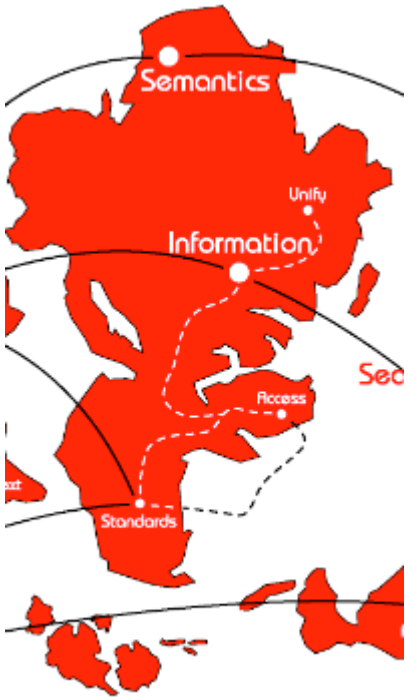
Three semantic portals – One common subject



Current status

- **TMRAP implemented in the OKS**
  - implementation not 100% complete
  - extended as needed
  - was partly extended for this tutorial (to be released in OKS 3.2)
- **Other applications built based on TMRAP**
  - Vizigator
  - TMBuilder (by Cerpus)
  - Amsterdam Police prototype
  - ...
- **No other implementations at the moment**

TMRAP



Basics

Understanding TM/XML

The requests

TMRAP basics

- **Abstract interface**
  - that is, independent of any particular technology
  - coarse-grained operations, to reduce network traffic
- **Protocol bindings exist**
  - plain HTTP binding
  - SOAP binding
- **Supports many syntaxes**
  - XTM 1.0
  - LTM
  - TM/XML
  - custom tolog result-set syntax

TM/XML

- **Non-standard XML syntax for Topic Maps**
  - defined by Ontopia (presented at TMRA'05)
  - implemented in the OKS
- **XSLT-friendly**
  - much easier to process with XSLT than XTM
  - can be understood by developers who do not understand Topic Maps
  - dynamic domain-specific syntaxes instead of generic syntax
  - predictable (can generate XML Schema from TM ontology)

get-topic

- **Retrieves a single topic from the remote server**
  - topic map may optionally be specified
  - syntax likewise
- **Main use**
  - to build client-side fragments into a bigger topic map
  - to present information about a topic on a different server

get-topic

- **Parameters**
  - **identifier:** a set of URIs (subject identifiers of wanted topic)
  - **subject:** a set of URIs (subject locators of wanted topic)
  - **item:** a set of URIs (item identifiers of wanted topic)
  - **topicmap:** identifier for topic map being queried
  - **syntax:** string identifying desired Topic Maps syntax in response
  - **view:** string identifying TM-Views view used to define fragment
- **Response**
  - topic map fragment representing topic in requested syntax
  - default is XTM fragment with all URI identifiers, names, occurrences, and associations
  - in default view types and scopes on these constructs are only identified by one <*Ref xlink:href="..."/> XTM element
  - the same goes for associated topics

Syntax identifiers

- XTM 1.0 application/x-xtm
- LTM text/x-ltm
- AsTMa= text/x-astma
- TM/XML text/x-tmxml
- tolog text/x-tolog

get-topic-page

- **Returns link information about a topic**
  - that is, where does the server present this topic
  - mainly useful for realizing the portal integration scenario
  - result information contains metadata about server setup

get-topic-page

- **Parameters**
  - **identifier:** a set of URIs (subject identifiers of wanted topic)
  - **subject:** a set of URIs (subject locators of wanted topic)
  - **item:** a set of URIs (item identifiers of wanted topic)
  - **topicmap:** identifier for topic map being queried
  - **syntax:** string identifying desired Topic Maps syntax in response
- **Response is a topic map fragment**

```
[oks : tmrap:server = "OKS Samplers local installation"]
[opera : tmrap:topicmap = "The Italian Opera Topic Map"]
  {opera, tmrap:handle, [[opera.xtm]]}
tmrap:contained-in(oks :  tmrap:container, opera : tmrap:containee)
tmrap:contained-in(opera : tmrap:container, view : tmrap:containee)
tmrap:contained-in(opera : tmrap:container, edit : tmrap:containee)
[view : tmrap:view-page %"http://localhost:8080/omnigator/models/..."]
[edit : tmrap:edit-page %"http://localhost:8080/ontopoly/enter.ted?..."]
[russia = "Russia" @"http://www.topicmaps.org/xtm/1.0/country.xtm#RU"]
```

get-tolog

- **Returns query results**
  - main use is to extract larger chunks of the topic map to the client for presentation
  - more flexible than get-topic
  - can achieve more with less network traffic

get-tolog

- **Parameters**
  - **tolog:** tolog query
  - **topicmap:** identifier for topic map being queried
  - **syntax:** string identifying desired syntax of response
  - **view:** string identifying TM-Views view used to define fragment
- **Response**
  - if syntax is “tolog”
    - an XML representation of the query result
    - useful if order of results matter
  - otherwise, a topic map fragment containing multiple topics is returned
    - as for get-topic

add-fragment

- **Adds information to topic map on the server**
  - does this by merging in a fragment
- **Parameters**
  - **fragment:** topic map fragment
  - **topicmap:** identifier for topic map being added to
  - **syntax:** string identifying syntax of request fragment
- **Result**
  - fragment imported into named topic map

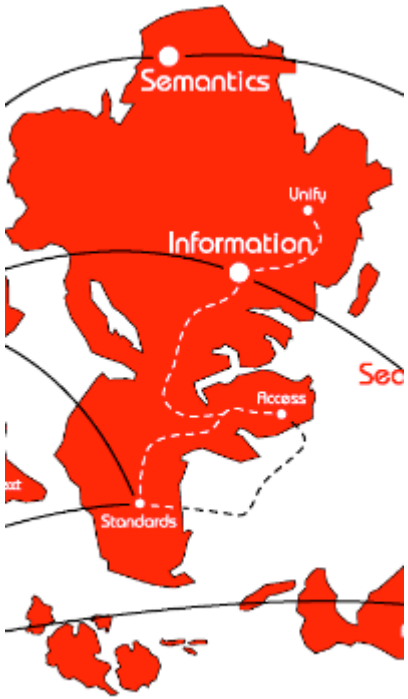
update-topic

- **Can be used to update a topic**
  - add-fragment only adds information
  - update sets the topic to exactly the uploaded information
- **Parameters**
  - **topicmap**: the topic map to update
  - **fragment:** fragment containing the new topic
  - **syntax:** syntax of the uploaded fragment
  - **identifier:** a set of URIs (subject identifiers of wanted topic)
  - **subject:** a set of URIs (subject locators of wanted topic)
  - **item:** a set of URIs (item identifiers of wanted topic)
- **Update happens using TMSync**
  - to learn more about this, attend my talk tomorrow (1430-1500)

delete-topic

- **Removes a topic from the server**
- **Parameters**
  - **identifier:** a set of URIs (subject identifiers of wanted topic)
  - **subject:** a set of URIs (subject locators of wanted topic)
  - **item:** a set of URIs (item identifiers of wanted topic)
  - **topicmap:** identifier for topic map being queried
- **Result**
  - deletes the identified topic
    - includes all names, occurrences, and associations

HTTP binding



Basics

How to use

HTTP binding basics

- **The mapping requires a base URL**
  - e.g http://localhost:8080/tmrap/
- **This is used to send requests**
  - http://localhost:8080/tmrap/*method*?*param1=value1&...*
  - GET is used for requests that do not cause state changes
  - POST for requests that do
- **Responses returned in response body**

Exercise #1: Retrieve a topic

- **Use the get-topic request to retrieve a topic from the server**
  - base URL is http://localhost:8080/tmrap/
  - find the identifying URI in Omnigator
  - just print the retrieved fragment to get a look at it
- **Note: you must escape the "#" character in URIs**
  - otherwise it is interpreted as the anchor and not transmitted at all
  - escape sequence: %23
- **Note: you must specify the topic map ID**
  - otherwise results will only be returned from loaded topic maps
  - in other words: if the topic map isn't loaded, you get no results

Solution #1 (in Python)

```
import urllib

BASE = "http://localhost:8080/tmrap/tmrap/"
psi = "http://www.topicmaps.org/xtm/1.0/country.xtm%23RU"

inf = urllib.urlopen(BASE + "get-topic?identifier=" + psi)
print inf.read()
inf.close()
```

Solution #1 (response)

```
<topicMap xmlns="http://www.topicmaps.org/xtm/1.0/"
        xmlns:xlink="http://www.w3.org/1999/xlink">
  <topic id="id458">
    <instanceOf>
      <subjectIndicatorRef xlink:href="http://psi.ontopia.net/geography/#country"/>
    </instanceOf>
    <subjectIdentity>
      <subjectIndicatorRef xlink:href="http://www.topicmaps.org/xtm/1.0/country.xtm#RU"/>
      <topicRef xlink:href="file:/.../WEB-INF/topicmaps/geography.xtmm#russia"/>
    </subjectIdentity>
    <baseName>
      <baseNameString>Russia</baseNameString>
    </baseName>
  </topic>
```

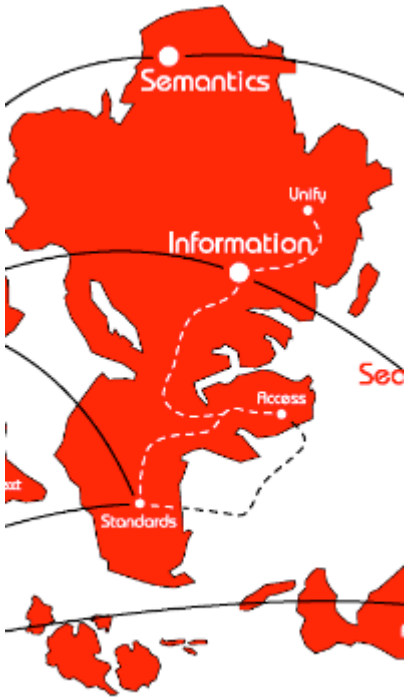
Processing XTM with XSLT

- **This is possible, but unpleasant**
  - the main problem is that the XML is phrased in terms of Topic Maps, not in domain terms
  - this means that all the XPath will talk about “topic”, “association”, ... and not “person”, “works-for” etc
- **The structure is also complicated**
  - this makes queries complicated
  - for example, the XPath to traverse an association looks like this:

```
//xtm:association
  [xtm:member[xtm:roleSpec / xtm:topicRef / @xlink:href = '#employer']
          [xtm:topicRef / @xlink:href = concat('#', $company)]]
  [xtm:instanceOf / xtm:topicRef / @xlink:href = '#employed-by']
```

ontopia

Learning TM/XML



How it works

General principles of TM/XML

- **Fixed structure**
  - document element is topic map
  - level below is topics
  - level below is properties of topics
  - no more levels
- **Element types generated from the types of the objects**
  - person topics get “person” elements, etc
  - PSIs turn into QNames (foo:bar)
  - IDs turn into normal element type names

Fragment structure

```
<topicmap ...>
  <topic-type id="...">
    <tm:identifier>...</tm:identifier>
    <iso:topic-name>
      <tm:value>...</tm:value>
    </iso:topic-name>
    <occurrence-type>...</occurrence-type>
    <association-type role="role-type" topicref="..."
                                  otherrole="role-type"/>
  </geography:country>
</topicmap>
```

Exercise #2: Retrieve a topic in TM/XML

- **Use the get-topic request to retrieve a topic from the server**
  - base URL is http://localhost:8080/tmrap/
  - find the identifying URI in Omnigator
  - just print the retrieved fragment to get a look at it
  - syntax identifier for TM/XML is “text/x-tmxml”

Solution #2 (in Python)

```
import urllib

BASE = "http://localhost:8080/tmrap/tmrap/"
psi = "http://www.topicmaps.org/xtm/1.0/country.xtm%23RU”
syntax = “&syntax=text/x-tmxml”

request = BASE + "get-topic?identifier=" + psi + syntax
inf = urllib.urlopen(request)
print inf.read()
inf.close()
```

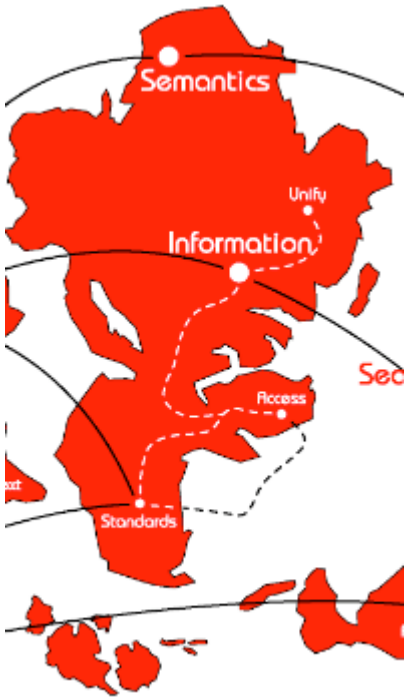
Solution #2 (response)

```
<topicmap ...>
 <geography:country id="id458">
  <tm:identifier>http://www.topicmaps.org/xtm/...</tm:identifier>
   <iso:topic-name>
     <tm:value>Russia</tm:value>
   </iso:topic-name>
   <geography:located-in scope="psi.ontopia.net:geography"
     role="geography:container" topicref="id345"
     otherrole="geography:containee"></geography:located-in>
   <opera:takes-place-in scope="psi.ontopia.net:music
     psi.ontopia.net:geography" role="geography:place"
     topicref="risurrezione" otherrole="music:opera"></opera:takes-place-in>
 <!-- ... -->
</geography:country>
</topicmap>
```

Exercise #3: Presenting topics

- Make an XSLT stylesheet that presents composer topics
- Use TMRAP to get TM/XML fragments to try it out with

TMRAP in more depth



Understanding fragments

Using more requests

Understanding fragments

- **The default fragments are defined as “stub”s**
  - this means you get the requested topic only
  - all referenced topics are stubs
  - this means we only have their identity; nothing more
- **This is not what you want for displaying a topic**
  - in this case you want the names of all associated topics as well
  - (otherwise you can’t display the associations)
  - to do this, use “&view=names”

Exercise #4: Displaying topics properly

- Improve the composer stylesheet so it also displays the names of associated topics

ontopia

How to build a web site from this

- **Write one XSLT stylesheet per topic type**
- **Write a script that for each topic types**
  - does a query to extract the identifiers of all topics of each type,
  - then retrieve the fragment for each topic, and
  - run the XSLT stylesheet on it
- **Ensure that there is linking logic in your stylesheet that matches the file names that your script produces**

How you would do it for real

- **In a real setting there would be an application hosted on a server**
  - in practice this could be ASP.NET, Zope (Python), PHP, ...
- **Pages would be built dynamically**
  - fragments would be loaded from the topic map and presented dynamically
  - caching could happen in front of the application, in front of the TMRAP server, or both
- **So many of the concerns on the previous slide would not apply**
  - however, to avoid having to get into the detail of a client platform we choose a simplified approach here

get-tolog

- **As described earlier, this request has two modes**
  - fragment mode, which produces a fragment (in XTM or TM/XML), and
  - tolog mode, which produces an XML representation of the result set
  - tolog mode is the default
- **In fragment mode**
  - only single-column queries are allowed,
  - every value must be a topic, and
  - the result is a fragment containing all the queried topics
- **In tolog mode**
  - there are no restrictions on queries, and
  - a special “tolog” XML syntax is used to represent the result set

The “tolog” syntax

```
<result ...>
 <head>
  <column>COMPOSER</column>
  <column>OPERA</column>
 </head>
 <body>
  <row>
   <value>
    <x:subjectIndicatorRef
     l:href="http://en.wikipedia.org/wiki/Verdi"/>
   </value>
   <value>28</value>
  </row>
```

Exercise #5: Create a composers page

- **Should list all composers by name**
  - get the necessary data using get-tolog
  - try out both fragment mode and tolog mode

Performance issues

- **Neither of the two approaches we've found so far will actually allow us to produce the composer page + individual pages efficiently**
  - with fragments: we only get the composer topics, not the names of associated topics
  - with tolog: it's possible to get the data here, but very awkward, as we have to explicitly ask for everything
  - we need better control over what is returned
- **The solution is, once again, views**

Views supported by get-tolog

- **In tolog mode**
  - **stub** the default, gives just identities of returned topics
  - **name** gives just names of returned topics
  - **full** produces full fragments, just like in fragment mode
  - **full-name** also full fragments, but now including a name for associated topics
- **This allows us to return exactly the XML we need, in one operation**

Exercise #6: Create a composer site

- **With a single TMRAP request**
  - create an overview page of composers, plus
  - one page for each composer
- **This can be done with ... what ...?**

Updating the topic map

- **add-fragment**
  - always adds to the topic map (no existing data removed)
- **update-topic**
  - updates the chosen topic to only have the uploaded data
- **delete-topic**
  - removes a topic from the topic map

Exercise #7: Adding a new composer

- **Use TMRAP to add a new composer to the topic map**
  - this is easiest to do with opera.hytm, because you can use IDs

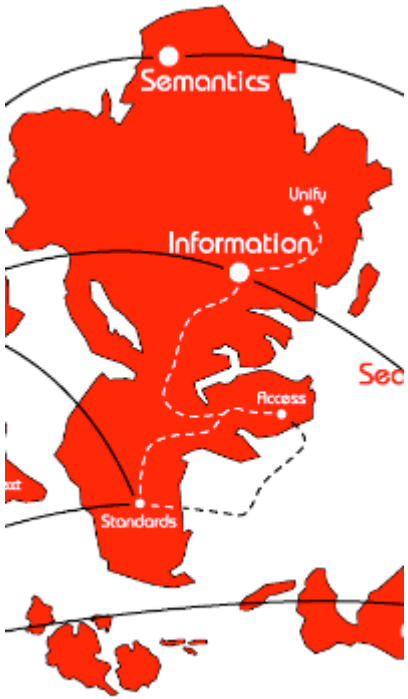
Exercise #8: Correcting the composer

- Let's assume we got some information about the composer wrong, and correct it

Exercise #9: Covering our tracks

- And now, let's remove this composer to clean up the topic map

Conclusion



Conclusion

More information

Conclusion

- **TMRAP is a versatile generic web service interface**
  - not bound to the OKS, but only implemented in the OKS
  - has a dependency on tolog at the moment, but could support TMQL
- **Allows many different kinds of applications to be built**
  - pure presentation applications as well as updates
- **Takes Topic Maps away from simple, monolithic applications**

More information

- **Original TMRAP vision**
  - Seamless Knowledge: Spontaneous Knowledge Federation using Topic Maps (Pepper & Garshol)
  - http://www.ontopia.net/topicmaps/materials/Seamless%20Knowledge%20with%20TMRAP.ppt
- **TMRA'05 paper**
  - paper: http://www.garshol.priv.no/download/text/tmrap.pdf
  - slides: http://www.informatik.uni-leipzig.de/~tmra05/PRES/LMGa.pdf
- **OKS documentation**
  - Developer's Guide included