

AToMS (Asian Topic Maps Summit) 2007

# **What is Topic Maps, and Standards, Case examples, etc.**

December 12, 2007

Motomu Naito                      motom@green.ocn.ne.jp  
Knowledge Synergy Inc. (<http://www.knowledge-synergy.com>)

Michihiko Setogawa              setogawa@mac.com  
Hitachi Systems & Services (<http://www.hitachi-system.co.jp/>)

## **Table of Contents**

- 1 . Introduction: Background and Purpose
- 2 . Subject-based classification
- 3 . Basic concepts of Topic Maps
- 4 . Standardization activity
- 5 . Case example
- 6 . Demo
- 7 . Information resources of Topic Maps
- 8 . Summary

# 1 . Introduction: Background and Purpose

## • **Back ground**

- Information Tsunami
  - The amount of information explodes with evolution of IT
  - Various information is existing on various server and client separately
- Search engine can not solve the Information Tsunami?
  - The limit of information processing based on character string and the keyword
  - The polysemy problem has not solved yet
  - Jumble of good and bad
- We want to access to required information, when required
  - the processing which understood the meaning of word is required
  - Systematization and organization of information is required
- However, the "view", the "timing", and "granularity" varies with a position, a situation, a man and etc.
- Topic Maps and related technologies can be used for solving above problems.

## • **Purpose**

- To explain those technology and trend of standards, applications, etc.
- To apply them to some application in order to demonstrate the usefulness of them

# 2 . Subject-based classification

## Compare to Topic Maps to Other technology

There are several way for subject-based classification

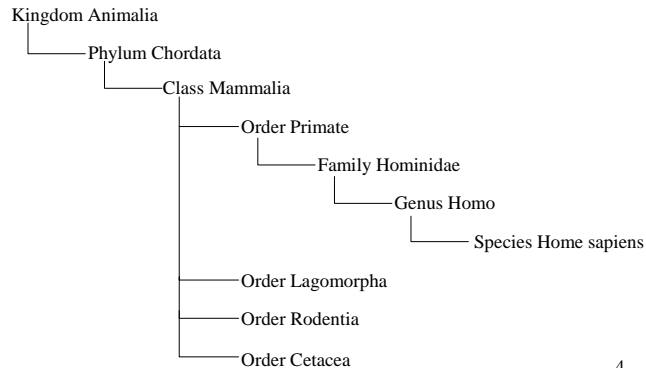
- (1) Taxonomy
- (2) Thesauri
- (3) Topic Maps
- (4) Ontology

## 2 . Subject-based classification

### (1) Taxonomies

- Hierarchical classification of Subjects (Concepts)
- Relationship between Subjects (Concepts) is only Broader-Narrower

Example



4

## 2 . Subject-based classification

### (2) Thesauri

- Hierarchical classification of Subjects (Concepts)  
BT: Broader Term - NT: Narrower Term
- SN: Scope Note  
Explanation of meaning of words
- RT: Related Term
- AT: Antonym
- SY: Synonym
- USE: Preferred term
- UF (Use For) : Not preferred term
- TT: Top Term
- Example of standards: ISO 2788, ISO 5964

5

## 2 . Subject-based classification

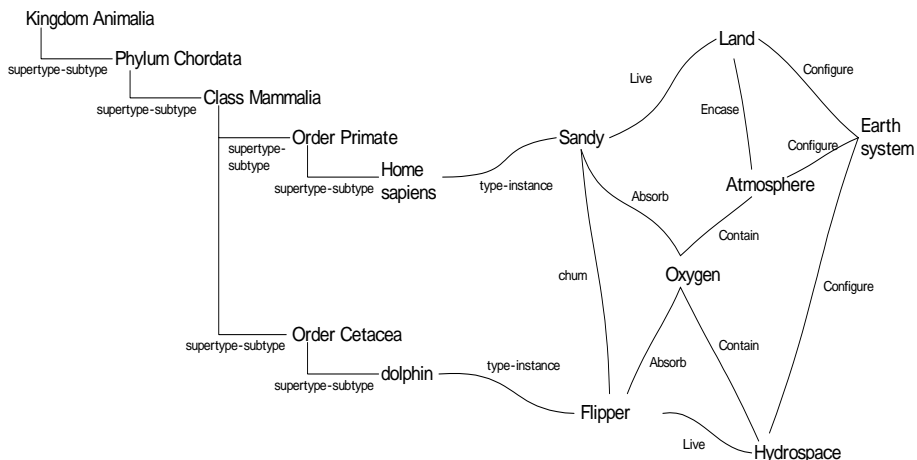
### (3) Topic Maps - No.1

- Set of Topics and Associations
- User can freely define any relationship
- Possible to link subjects to related information resource
- Subject identification mechanism  
Not name but URI(IRI)
- Scope function
- Subject-based merge function
- Reification can be done easily

6

## 2 . Subject-based classification

### (3) Topic Maps - No.2



7

## 2 . Subject-based classification (cf.) Ontology

- There are various definitions
- In both computer science and information science, an ontology is a data model that represents
  - (a) a set of concepts within a domain and
  - (b) the relationships between those concepts
- It is used to reason about the objects within that domain

( Source: Wikipedia, Ontology (computer science) )

8

## 3 . Basic concepts of Topic Maps

- (1) Index of back of book
  - Provide access method to information in the book other than TOC
- (2) Unified index
  - If there is an index across many books, it must be convenient



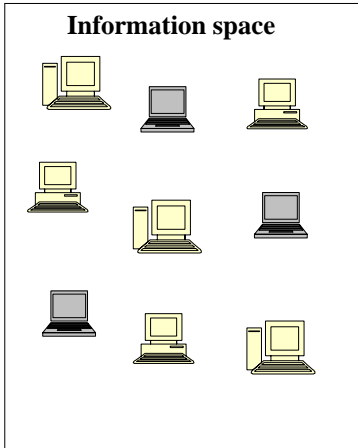
### INDEX

ISO	...	book1	70-71, 234-236
		book2	45, 120-131
OASIS	...	book1	41-45, 211-228, 308
		book2	16-33, 88-90, 267
		book3	52-65, 155-158
W3C	...	book1	26, 69, 274-275
			:
			:

9

### (3) Digital information

- We wish to build index for digital information
- ### Topic Maps



### Index for digital information

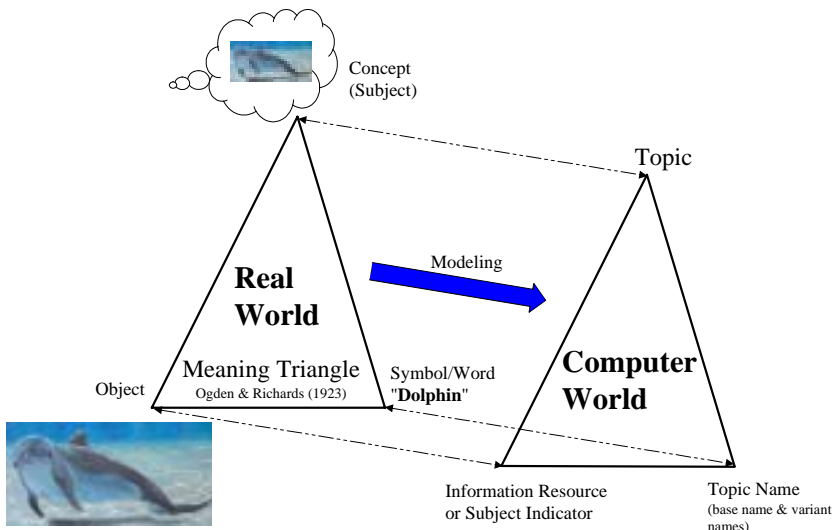
ISO ... URL1, URL2,  
 OASIS ... URL3, URL4,

:

-----  
 Topic Maps ... URL-a, URL-b,  
 PSI ... URL-c, URL-d,  
 XML ... URL-e, URL-f

:

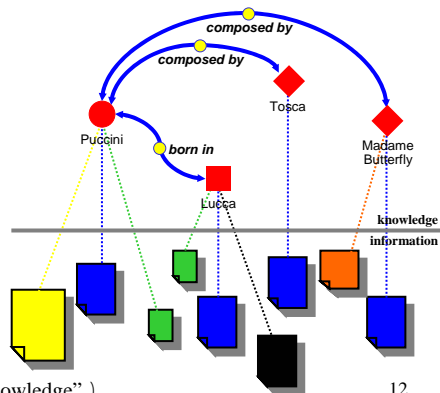
## Modeling of Meaning Triangle in Computer



# The Basic Model of Topic Maps

- **Some pool of information or data**
  - any type, format, or location
- **A knowledge layer, consisting of:**
- **Topics**
  - a set of topics representing the key subjects of the domain in question
- **Associations**
  - representing relationships between subjects
- **Occurrences**
  - links to information that is somehow relevant to a given subject
- **= The TAO of Topic Maps**

*P.S.  
Topics, associations and occurrences have types,  
and all types are also topics...*



(Source: Steve Pepper, "Towards Seamless Knowledge" )

12

## Syntax (XTM)

### Example of Topic

```
<topic id="ichizo">
  <instanceOf>
    <topicRef xlink:href="#person"/>
  </instanceOf>
  <instanceOf>
  </instanceOf>
  <baseName>
    <scope>
      <topicRef xlink:href="#ja"></topicRef>
    </scope>
    <baseNameString>内藤 一藏</baseNameString>
  </baseName>
  <baseName>
    <scope>
      <topicRef xlink:href="#en"></topicRef>
    </scope>
    <baseNameString>Ichizo Naito</baseNameString>
  </baseName>
</topic>
```

### Example of Association

```
<association>
  <instanceOf>
    <topicRef xlink:href="#married-couple"/>
  </instanceOf>
  <member>
    <roleSpec>
      <topicRef xlink:href="#husband"/>
    </roleSpec>
    <topicRef xlink:href="#ichizo"/>
  </member>
  <member>
    <roleSpec>
      <topicRef xlink:href="#wife"/>
    </roleSpec>
    <topicRef xlink:href="#fumi"/>
  </member>
</association>
```

13

## Syntax (LTM)

### Example of Topic

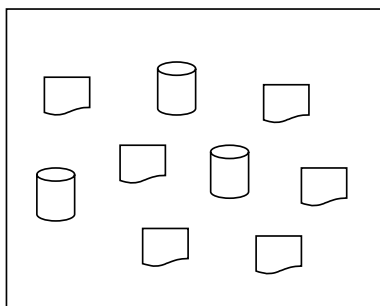
[ichizo : person = "Ichizo Naito" / en  
= "内藤 一蔵" / ja

@["http://www.knowledge-synergy.com/psi/family-tree\\_0\\_9#person-id-ichizo"](http://www.knowledge-synergy.com/psi/family-tree_0_9#person-id-ichizo)]

### Example of Association

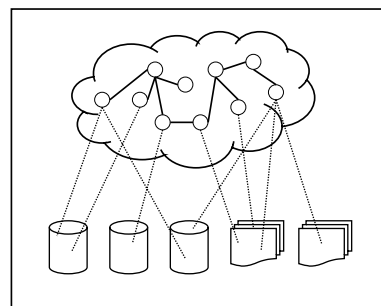
married-couple( ichizo : husband, fumi : wife )

## Organization of information using TM



### At present

Emmense information is existing separately



### Organization of information using Topic Maps

Topic Maps is independent from  
information resources  
Topic Maps can be shared, exchanged and  
circulate itself



## Published Subjects

Published Subjects is a mechanism which enable person and computer to identify subjects (topics). And it is permanently published on networks and is aimed at making easy share/exchange Topic Maps.

- It is included in Topic Maps standard
- It allocate URI (IRI) to subject, and make possible to identify subjects
- On the occasion of merge of Topic Maps, it is used to identify topics (subjects)
  - The topic which have same subject is merged
- It provides a subject identifying mechanism to Computer and Human
- It is applicable both information resource and things in real world
- Any one can publish published subjects
- A good thing will survive

16

## Example of PSI (Subject : Abscisic acid)

[http://www.fao.org/aos/agrovoc#c\\_3](http://www.fao.org/aos/agrovoc#c_3)

*This is a published subject indicator (PSI) conforming to the OASIS Published Subjects Standard*

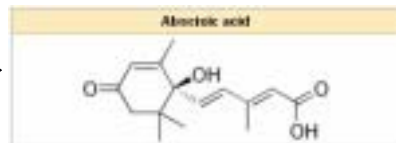
**Subject: Abscisic acid**

**PSID:**

[http://www.fao.org/aos/agrovoc#c\\_3](http://www.fao.org/aos/agrovoc#c_3)

**Definition:**

Abcisic Acid (ABA), also known as abscisic II and dormin, is a plant hormone. It was given its names because it was once thought to be pivotal in abscission and in bud dormancy.

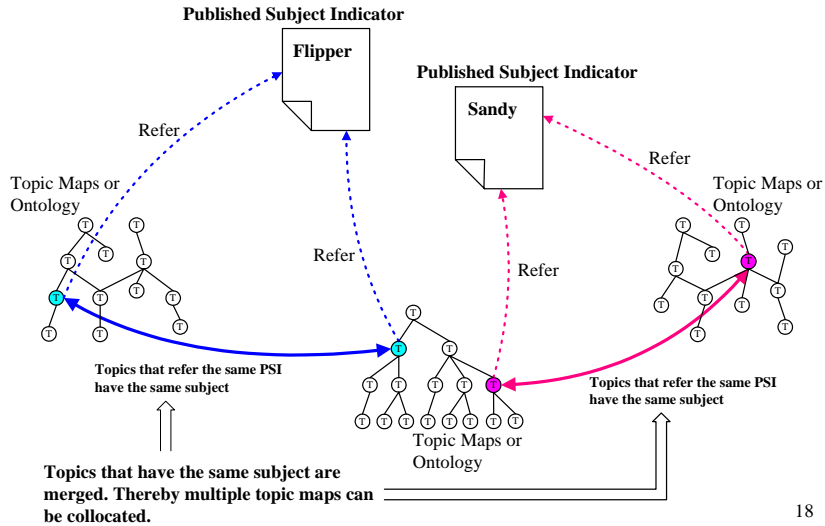


### Existing PSI

- ISO 639 Published Subjects for language code (<http://www.oasis-open.org/committees/download.php/1444/language.xtm>)
- ISO 3166 Published Subjects for country code (<http://www.oasis-open.org/committees/download.php/1442/country.xtm>)
- XTM (XML Topic Maps) Core Published Subjects (<http://www.topicmaps.org/xtm/1.0/core.xtm>)

17

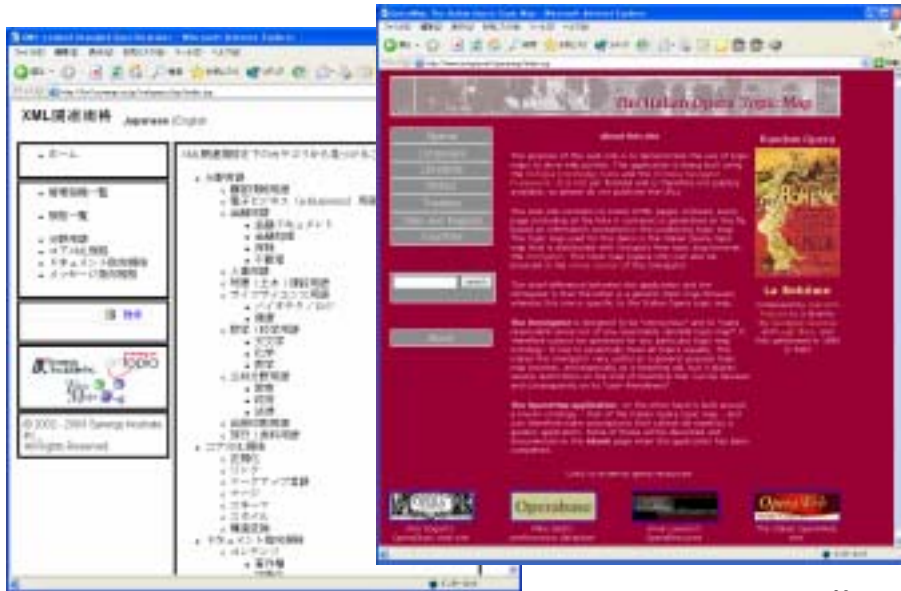
# Integration of information/knowledge based on subjects



# Ex: Visualization of Topic Maps



## Ex: Topic Maps based Web pages



20

## 4 . Standardization activity (1)

### (1) ISO/IEC 13250: Topic Maps

- Part 1: Overview and Basic Concepts  
WD Editor: Steve Pepper, Patrik Durusau, Motomu Naito
- Part 2: Data model  
IS (2006.8.15) Editor: Lars Marius Garshol, Graham Moore
- Part 3: XML Syntax (XTM)  
IS (2007.3.15) Editor: Graham Moore, Lars Marius Garshol
- Part 4: Canonical syntax  
FCD Editor: Lars Marius Garshol, Jaeho Lee
- Part 5: Reference model  
CD approved Editor: Patrick Durusau, Steven R. Newcomb
- Part 6: Compact syntax  
CD Editor: Gabriel Hopmans, Sam Oh, Lars Heuer
- Part 7: Graphical notation  
WD Editor: Jaeho Lee, Graham Moore

21

## Standardization activity (2)

### (2) ISO/IEC 18048: Topic Maps Query Language(TMQL)

CD approved Editor: Robert Barta, Lars Marius Garshol

### (3) ISO/IEC 19756: Topic Maps Constraint Language (TMCL)

CD approved Editor: Dmitry Bogachev, Graham Moore,  
Mary Nishikawa

### (4) ISO/IEC 29111: Expressing Dublin Core Metadata using Topic Maps

WD Editor: Steve Pepper, Sam Oh

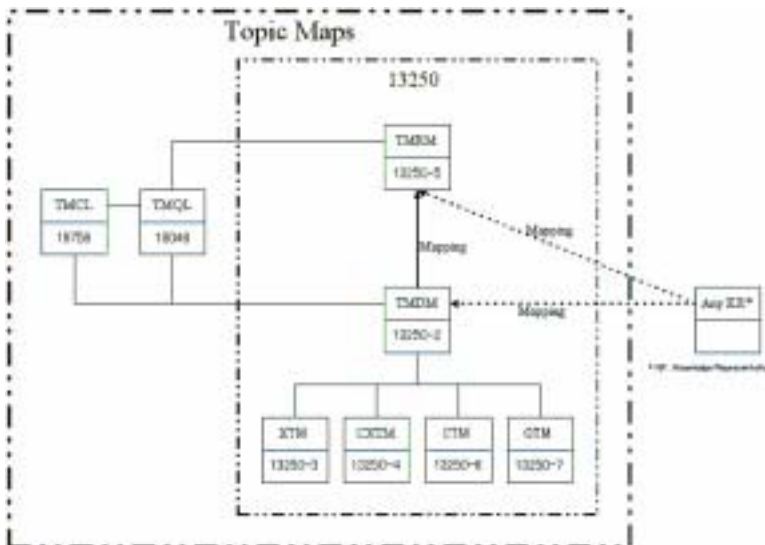
### (5) Distributed repository mechanism for Published Subjects

NP Editor: Steve Pepper

- \* NP: New Work Item Proposal
- \* WD: Working Draft
- \* CD: Committee Draft
- \* FCD: Final Committee Draft
- \* FDIS: Final Draft for International Standard
- \* IS: International Standard

## ISO/IEC 13250 part1 Overview and Basic Concepts

Relationship between Topic Maps related standard



## ISO/IEC 13250 part2 Topic Maps Data Model (TMDM)

- TMDM defines the abstract structure of Topic Maps.
- TMDM uses W3C Infoset formalizm and defines 7 information items and 18 named properties as data model

Information Items	topic map	topic	topic name	variant	occurrence	association	association role
Named Properties							
associations							
datatype							
item identifiers							
occurrences							
parent							
player							
reified							
reifier							
roles							
roles played							
scope							
subject identifiers							
subject locators							
topic names							
topics							
type							
value							
variants							

24

## ISO/IEC 13250 part3 XML Syntax (XTM)

- ISO/IEC 13250-3 defines the XML Topic Maps 2.0 (XTM) interchange syntax for topic maps.
- The syntax based on XML, XPointer, and IRIs.
- The allowed syntactical expressions in XTM documents are constrained using a RELAX-NG schema for XTM 2.0 and prose.
- And their interpretation is defined using 13250-2.
- The semantics of this syntax is defined by 13250-2.

25

## **ISO/IEC 13250 part4 Canonicalization (CXTM)**

- ISO/IEC 13250-4 defines the CXTM format,
- It also specifies how CXTM files are produced from topic maps by means of a transformation from the TMDM to the XML Infoset [XML Infoset].

## **ISO/IEC 13250 part5 Reference model**

- ISO/IEC 13250-5 defines an abstract model of topic maps that supports the definition of path languages for higher level models for topic maps.
- The requirements for such models is also defined.
- 13250-5 underlies ISO/IEC 18048 Topic Maps Query Language (TMQL) and ISO/IEC 19756 Topic Maps Constraint Language (TMCL).

## **ISO/IEC 13250 part6 Compact syntax (CTM)**

- ISO/IEC 13250-6 defines a compact syntax (CTM) as an alternative to the more verbose XML syntax defined in ISO/IEC 13250-3.
- CTM (Compact Topic Maps) is a text-based notation for representing topic maps.
- It provides a simple, lightweight notation that complements the existing XML-based interchange syntax defined in [XTM]
- And it can be used for
  - manually authoring topic maps;
  - providing human-readable examples in documents;
  - serving as a common syntactic basis for TMCL and TMQL.

28

## **ISO/IEC 13250 part7 Graphical notation (GTM)**

- ISO/IEC 13250-7 defines a graphical notation for the representation of topic maps.
- It can be used in designing, explaining, teaching or other circumstances where a non-syntax representation of a topic map.

29

## **ISO/IEC 18048: Topic Maps Query Language(TMQL)**

- ISO/IEC 18048 defines a formal language for accessing information organized according to the Topic Maps paradigm.
- It also provides syntax to form valid query expressions and also an informal and a formal semantics for every syntactic form.

## **ISO/IEC 19756: Topic Maps Constraint Language (TMCL)**

- ISO/IEC 19756 defines a data model for representing constraints on instance of the TMDM
- And defines the formal semantics for the interpretation of different constraint types.
- It also defines a syntactic form that can be used to represent the model structures.
- ISO/IEC 19756 expresses constraints using topic map constructs and the interpretation of these constraints as TMQL.



## **ISO/IEC 29111: Expressing Dublin Core Metadata using Topic Maps**

- This Technical Report defines a standard way of expressing Dublin Core metadata using ISO/IEC 13250 Topic Maps.

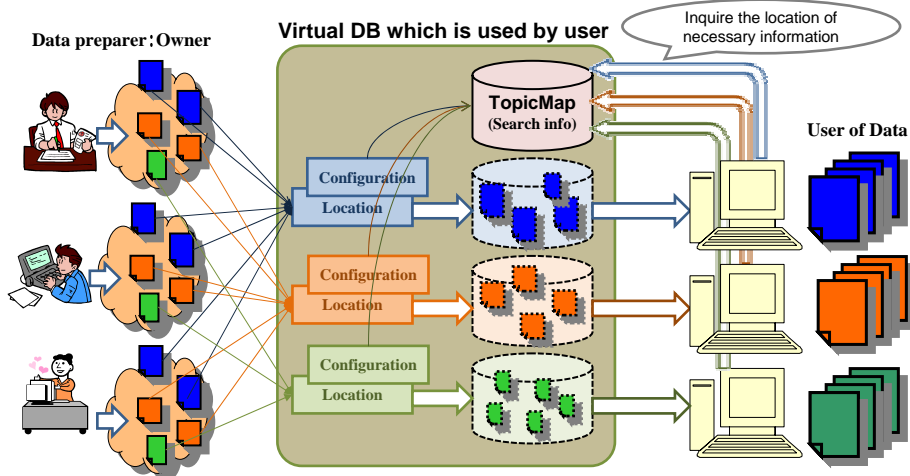
- Its purpose is to ensure a uniform approach to the application of Dublin Core among users of Topic Maps and thus enable seamless integration and improved knowledge aggregation.

-It covers both the general case of expressing Dublin Core metadata sets and the specific case of assigning Dublin Core metadata to topic maps.

## **5 . Case example in Japan**

- Reference Model
- Personal Semantic Indexing
- Knowledge Concierge system
- Time and Space data retrieval, analysis system
- Topic Maps for physics e-Learning
- Topic Maps for Navigation in Museum
- Topic Maps for medical words
- Knowledge Management Environment for Software Life Cycle
- Topic Map for Knowledge of Cultural Heritage
- Semantic-augmented support in Spatial-Temporal Multimedia Blog Contents Management
- Botanical Art Topic Map
- Family Tree Topic Map
- Presentation Topic Map

# Reference Model



- Referring to the registry, demanders can collect and use necessary information on the net at any time, any form. (Any time, Any form, Any data on the Net.)
- Demanders access information indirectly through topic maps, instead of getting it from owners directly and storing it their own DB.
- Owner of information manage the information which he prepared by himself.
- According to topic maps, information can be used for various purposes. (Write Once, use many times.)<sup>34</sup>

## Proposing Reference Model (1)

### 1. Separate use of date from data input

- ✓ Data is prepared according to the procedure of each site.
- ✓ Configuration and attributes of item of preparing data should follow fixed set of rules.
- ✓ Date is not prepared for specific use goal.

### 2. Searching Virtual DB, users of data refer the necessary data in the data owners' site

- ✓ Using Virtual DB, users of data search the location where the data which meet their goal exist.
- ✓ In location search of data, the following information and attributes are used:
  - logical information such as data configuration (for example what kinds of items are included etc.), the creation cycle and so on.
  - attributes such as the creation date and the main body (organization etc.) of real data
- ✓ Users of data can process and compile the data from owners according to their own purposes
- ✓ By their **own judgments and responsibilities**, the owners of data can select the audiences who are **disclosed the data. (own data can be secured by own)**

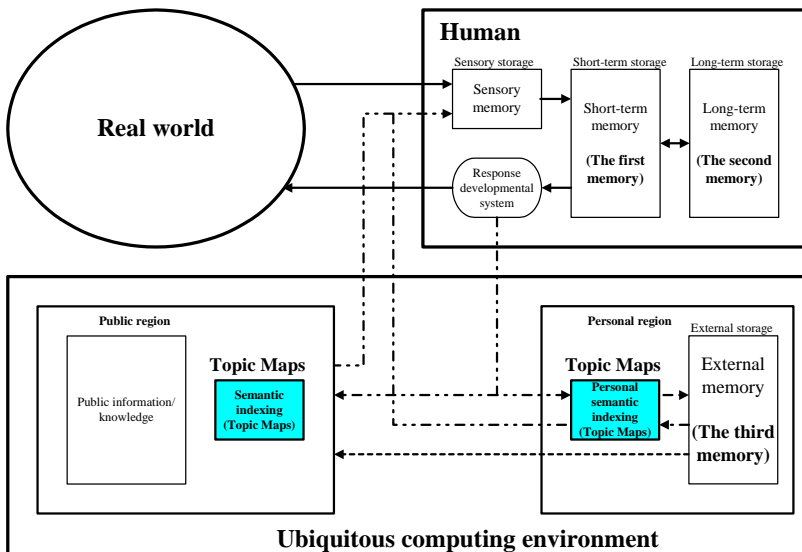
## Proposing Reference Model (2)

### 3. By objective audit trail, rightness of the data is certified by the owners of the data themselves

- ✓ After proper users are checked, the owner of data can disclose the data which is certified the authenticity by the owners themselves to the users.
- ✓ It is desirable to be verified and certified the authenticity of data by the objective neutral third party.
- ✓ By the certifications of the third parties, the repudiations of the owners themselves are avoidable.
- ✓ In other words, regarding the data which is provided by the owners, the third party certify the following things:
  - when and which data is prepared by whom

## Personal Semantic Indexing

Three-store memory model with Ubiquitous computing and Topic Maps



## Personal Semantic Indexing

Three-store memory model for human.

Ubiquitous computing environment enable us to externalize our personal information and knowledge. We can use the Ubiquitous computing environment as our third memory.

By putting personal information and knowledge on the Ubiquitous computing environment, it enables us to access them always anywhere more seamlessly and smoothly.

Topic Maps enable us to make semantic indexing on the third memory.



38

## Case example (Topic Map 2007)

Topic Maps 2007 (The First International Topic Maps User Conference) No.1

- City portal for Bergen
- Government Administration Services in Norway
- Automated Classification (Automatic creation of TM parts)
- IndiPix (Topic Maps for finding Films)
- Terrorist Ontologies in OWL and Topic Maps
- Korean Folk Music (Pansori) Retrieval System using TM
- Topic Mapped Enterprise (Production management)
- TM in Flexible E-learning and Collaborative Knowledge Creation
- From tag clouds to Topic Maps
- Bridging Information Science and Learning Theory using TM
- Publishing Large Collection of Artworks using TM in Finnish National Gallery
- Topic Maps based application for systemized knowledge

39

## Case example (Topic Map 2007)

Topic Maps 2007 (The First International Topic Maps User Conference) No.2

- Findability improvement of Pharmaceutical Formulary using TM
- Topic Maps Portals for real life
- Tax Map: Topic Maps Application for tax payer
- Enterprise knowledge map : toward subject centric computing
- Using TM and SharePoint for Enterprise Information Integration for Norwegian Post Office (Posten)
- Topic Map for OOXML
- Topic Maps based Portal System for Mountain Knowledge

## Case example (TMRA 2007)

Third International Conference on Topic Maps Research and Applications No.1

- Pan-European eGovernment Resource Network (eGRN)  
Separate node exchange their data through ATOM-based feeds which carry topic map fragments

Session: Applied Topic Maps in Industry and Administration

- Convergence of classical search and semantic technologies in chemical industry
- Ontology Powered Portal for Telecom Operators
- A Citizen's Portal for the City of Bergen

Session: Visualization and Representation of Topic Maps

- TMchartis : Tool Ser for Designing Multiple Visualization for TM
- Open Educational Topic Maps: A Text-oriented Perspective
- Using TM for Visually Exploring Various Data Sources

## Case example (TMRA 2007)

Third International Conference on Topic Maps Research and Applications No.2

Session: Collaborative Topic Maps Applications

- Topincs Wiki
- Bookmap: TM Based Web Application for Organizing Bookmarks

Session: Demonstrations

- Fuzzy.com v2 distributed global tagging
- A TM Templates for Software Development Support
- Topic Maps Wiki Project Kick-off

Session: Information Integration with Topic Maps

- Knowledge-Oriented Middleware Using Topic
- Large Scale KR of Distributed Biomedical Information
- Versioning of Topic Map Templates and Scalability

42

## Case example (TMRA 2007)

Third International Conference on Topic Maps Research and Applications No.3

Session: Topic Maps based Social Software

- Toward a Topic Maps Amanuensis
- Cooperative Building of Multi-Points of view TM with Hypertopic
- Towards holistic knowledge creation and interchange:  
Socio-semantic collaborative tagging

Session: Topic Maps Engines

- Ruby Topic Maps
- ZTM - a TMDM Management System for the Web

Session: Information Management with Topic Maps

- KAIFIA: Knowledge Assisted Intelligent Framework for Info Access
- On Path-Centric Navigation and Search Techniques for Personal Knowledge Stored in TM

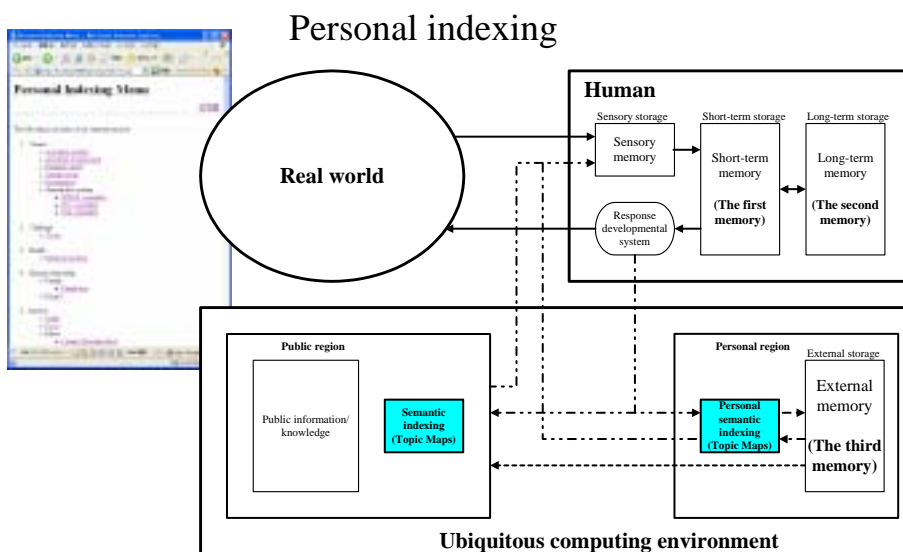
43

## Case example in the world

- BrainBank Learning
- topic map for ONI
- Topic Maps 4 E-Learning (TM4L)
- EU ADNOM (Administrative Nomenclature) Project
- Taxonomy Management, Metadata Management
- Semantic Portal in Norway  
(Ministry of Education, Research Council, Consumers Association, Conservative Party,  
Ministry of Agriculture, Ministry of Justice, Ministry of Culture, Henrik Ibsen Semantic Portal )
- bibMap
- New Zealand Electronic Text Centre, Online archive

44

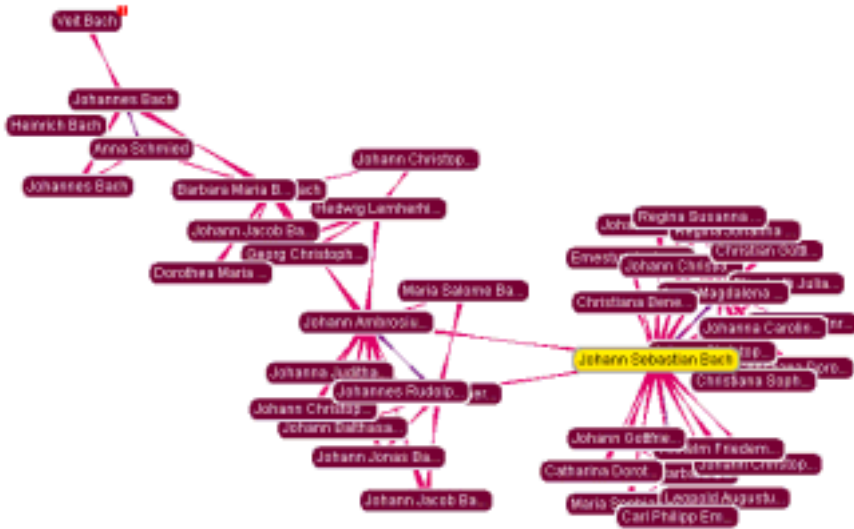
## 6 . Demo (1)



45

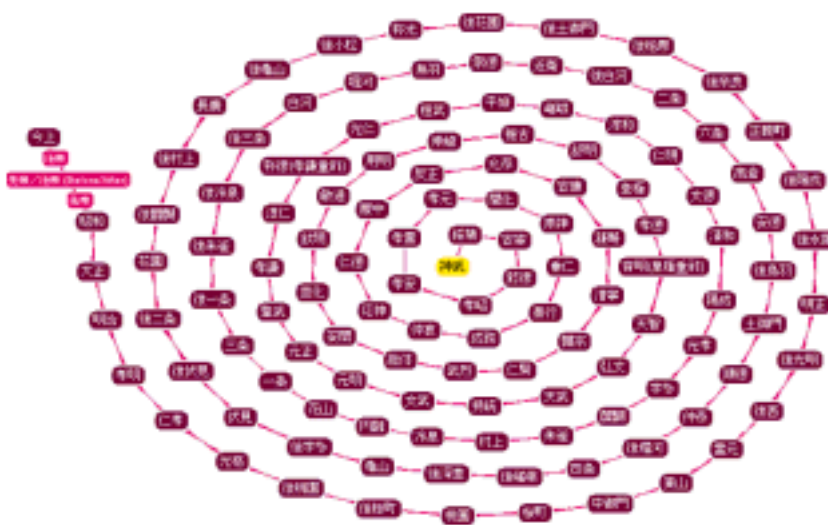
# Demo (2)

## J.S.Bach's Family tree



# Demo (3)

## Emperor's family tree





## 7 . Information resources of Topic Maps (1)

### (1) Event

- Topic Maps 2008  
(2008.4.2-4 Oslo, Norway)
- TMRA 2008  
(International Conference on Topic Map Research and Applications)  
(2008.10.15-17 Leipzig, Germany )
- AToMS (Asian Topic Maps Summit) 2008

### (2) Web site

- ISO SC34 WG3 ( <http://www.isotopicmaps.org> )
- Knowledge Synergy (<http://www.knowledge-synergy.com>)
- TopicMaps.jp (<http://www.topicmaps.jp/blog/>)
- Ontopia AS (<http://www.ontopia.net>)
- Larsblog (<http://www.garshol.priv.no/blog/>)
- Fuzzy.com (<http://www.fuzzy.com/tag/?id=2238>)
- TOPICMAPS.COMMUNITY (<http://www.topicmaps.com/tmc/>)
- NetworkedPlanet (<http://www.networkedplanet.com/>)
- Ligent (<http://www.ligent.net/company.jsp?id=105&bundle=274>)

## Information resources of Topic Maps (2)

### (3) Book

- Motomu Naito, Michikiko Setogawa etc., “An Introduction to Topic Maps”, TDU, ISBN4-501-54210-1
- Leveraging the Semantics of Topic Maps, Lutz Maicher, Alexander Sigel, Lars Marius Garshol (Eds.), Springer, ISSN 0302-9743, ISBN978-3-540-71944-1
- Charting the Topic Maps Research and Applications Landscape, Lutz Maicher, Jack Park (Eds.), Springer, ISSN 0302-9743, ISBN3-540-32527-1

### (4) Free tools

- Omnigator (<http://www.ontopia.net>)
- TM4L (<http://compsci.wssu.edu/iis/NSDL/>)
- Topincs (<http://www.cerny-online.com/topincs/>)

## 8 . Summary

- Topic Maps can be used for many different purposes in industry, public sector, and academia
  - The principal applications are in semantic indexing, information integration, knowledge management, e-learning, etc.
- Topic Maps is ISO standard
  - Guarantee of the persistence of user's data
  - Independent from software product and vender
- Possible to make contents bottom up and increase gradually
- Possible to make contents distributed manner
- Possible to use existing contents effectively
- No need reconstruction of existing contents

# Thank you!