Finnish National Ontologies for the Semantic Web - Towards a Content and Service Infrastructure

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Content

- Why a semantic web infrastructure is needed?
  - Problem
  - Theses for the solution
- FinnONTO – Finnish Semantic Web Infrastructure Project
  - Goals
  - Solutions
  - First results

The Problem

- Four Facts
  - Semantic Web = next generation WWW
  - Ontologies = the ”silver bullet” of the Semantic Web
  - Finnish ontologies = there were none
  - Something should be done about it!
- If shared ontologies are not available, then
  - machine semantics on the web cannot be created,
  - the web will not be interoperable,
  - content creation work will be duplicated, and
  - web applications are more difficult and expensive to create.

Theses Underlying FinnONTO (1)

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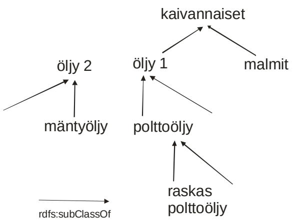
- The Semantic Web needs a content infrastructure
  - like traffic needs roads
  - like energy service needs power stations & network
  - like telecommunication needs GSM etc. systems
- Major components of the infrastructure
  - shared **reference ontologies**
  - **ontology services**
  - international **standards**



Theses Underlying FinnONTO (2)

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- Thesauri -> ontologies
  - Human readability -> machine understandability
- National ”ontologization” should be started
  - Content interoperability between different domains needed
  - Core ontologies should be maintained publicly
    - » Supports wide commitment to their usage
  - Core ontologies should be free and Open Source
    - » Supports wide usage and interoperability
- Business opportunities can be based on the infrastructure
  - Application specific ontologies
  - Semantic web applications

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FinnONTO-project

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- Goal
  - Demonstrate benefits of a national semantic web infrastructure
  - Start an inter-organizational process towards it
- Time table
  - 9/2003-10/2005 and 10/2005-5/2007
- Organization
  - 28 public organizations & companies
    - » provide content and funding
  - 5 university labs, most research done by SeCo
- Volume
  - next year 0,8Me/year

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Three Major Goals

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- **1.** Develop open source **core ontologies**
  - General Finnish Thesaurus YSA
    -> General Finnish Ontology YSO
  - Other related ontologies
- **2.** Provide public **ontology services**
  - ONKI Server
- **3. Application demonstrations**: Semantic portals
  - Eating our own ”dog food”

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1. Develop Core Open Source Ontologies

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- Motto: Thesauri -> Ontologies
- YSO Finnish Upper Ontology
- Other related core ontologies
  - Places
    - » Including historical place name/are development
  - Actors
    - » People, companies, organizations, …
  - Domain specific ontologies
    - » Cultural concepts, photography, history, health, …

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Case: YSO Finnish Upper Ontology

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- Basis: ~23.000 terms of YSA Thesaurus, 179 domains
  - Typical thesaurus (LT/NT, RT, …)
  - Taxomies only partialle developed
  - Widely used by human indexers in different domains
- Our experience of using thesauri on the semantic web
  - Not enough: lightweight ontologies and manual work is needed!
    - » Examples will be given
  - For semantic searching and browsing

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Making YSA into an ontology YSO

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- The process
  - 1. Transformation into RDF(S)/OWL
    - » Mechanical transformation into a Protege-2000 project
    - » Result: objects with following semantic properties:
      - Labels in different languages
      - Larger/Narrower term LT/NT
      - Related term RT
  - 2. Hyponymy construction by hand: solving basic semantical problems
    - » Terminology construction
    - » Disambiguating individuals from classes
    - » Disambiguating concept meanings
    - » Disambiguating LT/NT meanings
    - » Ensuring subclass transitivity
  - 3. Enriching the ontology
    - » Disambiguating RT meanings
    - » Ontology population

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Terminology Construction

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- Two basic choices
  - Terms attached to ontology concepts
    - » Problem:
      - lots of terms may refer to a concept
        - E.g. different languages
      - term usage may be context dependent
        - E.g. conventions used in organizations
  - Separate modular terminologies (our choice)
    - » Problem:
      - managing different terminologies

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Disambiguating Individuals from Classes

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- An example from YSA thesaurus
  - ”Halley comet” LT ”comet”
  - Problem: ”Halley comet” is an individual of the class ”comet” but the machine does not know this
    - » There can be many comets with properties inherited from the class ”comet” (and its super classes)
    - » There cannot be several ”Halley comets”
    - » An individual cannot belong to several classes but classes can
      - This is a convention e.g. in Protege

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Disambiguating Concepts

- An example from YSA thesaurus
  - Term ”johtaminen” (directing) can mean
    - » Directing an organization
    - » Directing a musical performance
    - » Leading electricity
    - » Leading to some place (e.g. a road)
    - » …
  - Problem: semantic confusion for the machine
    - » E.g., what to retrieve for keyword ”johtaminen”
  - Solution: represent different meanings by different concepts
    - » At least major semantic distinctions should be made

Disambiguating LT/NT Meanings

- LT/NT relation has many meanings
  - the machine cannot disambiguate them although humans can
- An example from YSA thesaurus
  - ”hospital” LT ”health care institution”
    ”comet” LT ”solar system”
  - Problem of semantical confusion:
    - » ”hospital” subClassOf ”health care institution”
      - OK: hospitals inherit properties of health care institutions
    - » ”comet” subClassOf ”solar system”
      - WRONG: a comet is not a solar system and does not have own planets etc.
- Solution:
  - ”hospital” subClassOf ”health care institution”
    ”comet” partOf ”solar system”

Ensuring Subclass Transitivity

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- An example from YSA thesaurus
  - ”fuel oil” LT ”oil”
    ”pine oil” LT ”oil”
    ”oil” LT ”diggings”
  - Problem: ”pine oil” is not ”diggings” but ”fuel oil” is
    - » The machine cannot understand the difference although humans can
- Solution
  - Differentiate multiple meanings of ”oil”
  - Create two subClassOf hierarchies

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Disambiguating RT relations

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- Example from YSA:
  - ”Solar wind” RT ”Northern lights”
- Solution approach:
  - Identify a small set of generic role relations
  - Use frames (cf. e.g. FrameNet):
    - Events are of central importance
    - Event types can be characterized by a set of roles
      - E.g. selling/buying event may have roles Agent, Recipient, Location
      - Terms sell/buy refer to the same event
- For example:
  - ”Solar wind” RT ”Northern lights”
    -> ”causes1” source ”Solar wind”
    result ”Northern lights”
- This work will be first tested in domain specific applications

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2. Ontology Server ONKI

- Problem
  - A single authority cannot manage large multi-domain ontologies
    - » E.g., maintaining YSA is difficult
  - Ontologies have to be developed collaboratively by domain expert groups
    - » However, this leads to organizational difficulties
- Support is needed for
  - distributed **development**,
  - **versioning**,
  - **publishing**, and
  - **usage** through the web.
- Solution: ONKI server with its services
  - Support development and publishing processes
  - Support usage as web services

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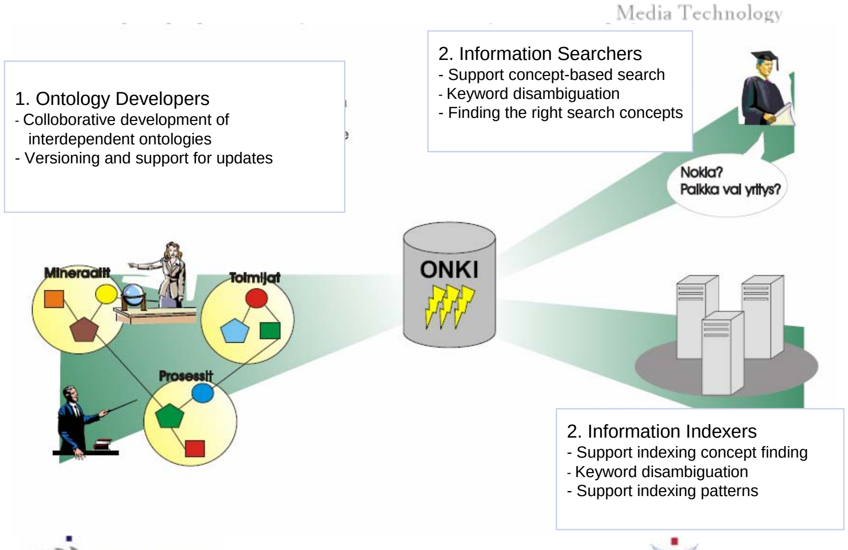
ONKI Services & User Groups



Collaborative Ontology Development in ONKI

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- Basic workflow
  - Each inter-related ontology in maintained by a domain expert group DEG
    - » DEG maintains its own concepts as an ontology
    - » DEG publishes new versions of it in ONKI
    - » Each concept is ”owned” by one DEG
  - Other groups can ”borrow” concepts from their owners by using ”proxies”
    - » Properties can be inherited from the home ontology
    - » Concepts can be modified locally
  - When an owner of a concept modifies her ontology
    - » changes are documented as instances of changes (an ontology)
    - » changes are stored in ONKI when a new version is committed there
  - When a borrower wants to update his ontology to match a new version of a dependent ontology
    - » change history can point out possible problems to her and
    - » can help her in making the needed updates
- Design and implementation is underway

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ONKI Browser: A Use Example

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- **Setting**
  - **A legacy cataloging system in a museum**
  - **The museum is convinced that cultural ontologies are needed for indexing collection artifacts**
  - **”How can be start producing semantic metadata in practice?”**
- **Problem:**
  - **How to *find* right up-to-date labels, URIs, etc. for metadata?**
  - **How to *transfer* them easily into the database?**
- **Solution:**
  - **Using ONKI as a web service**
    - **» Search & browsing functions**
    - **» Copying URIs etc. data into the local system**

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Step 1: Typing in ”maalau..”

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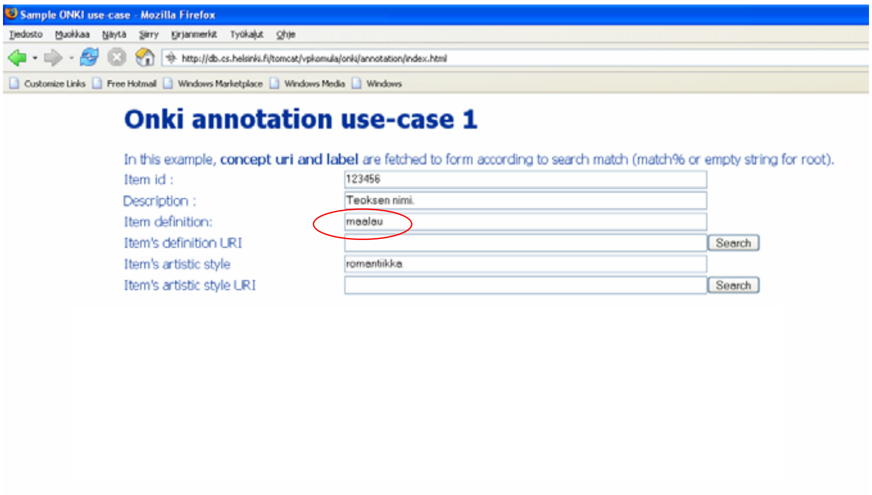

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Step 2: Autocompleting the input semantically (search)

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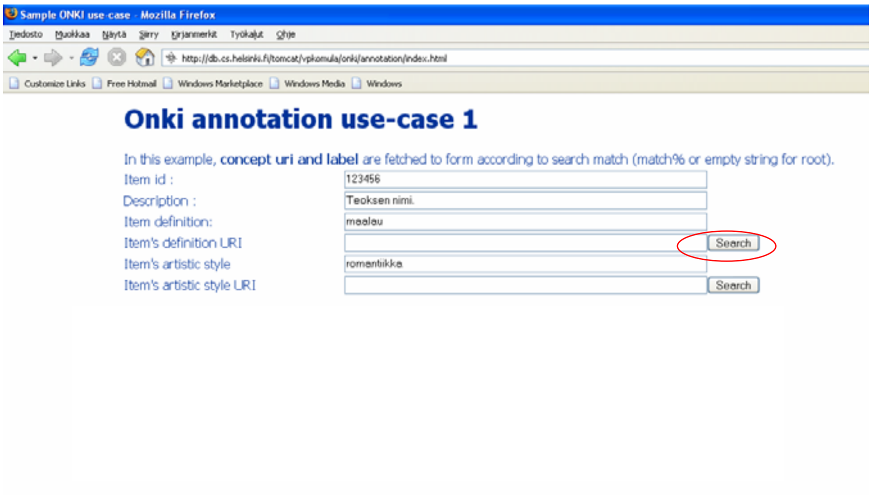

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Step 3: ONKI Browser opens with matching MAO concepts: select one

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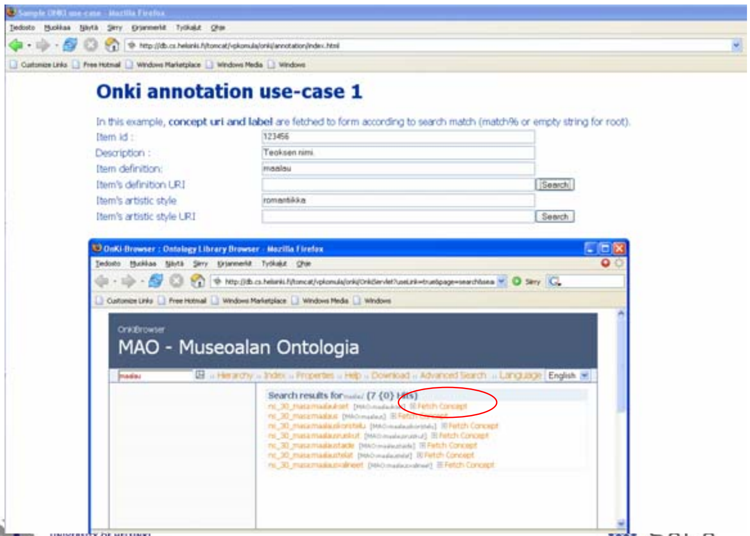

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Step 4: Label & URI copied into the cataloging system

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3. Pilot Applications

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- eCulture
  - MuseumFinland
    – Finnish Museums on the Semantic Web
    - » http://www.museosuomi.fi
  - CultureSampo
    – Finnish Culture on the Semantic Web
- eGovernment
  - Suomi.fi
    - » http://www.museosuomi.fi/suomifi
- eHealth
  - National health portal
  - Sosiaaliportti.fi
- eLearning
  - YLE Kaffi (2000 video clips + 4500 artifacts)
    - » http://www.museosuomi.fi/orava
  - Opintoluotsi.fi (educational resources)
  - Tiedonportti.fi (library resources)

A new application award
Semantic Web Challenge
http://challenge.semanticweb.org

nordic digital excellence in museums
nodem forum & award

Online semantic portal demos

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Thank you

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- Questions?

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