BestMap: Context-Aware SKOS Vocabulary Mappings in OWL 2

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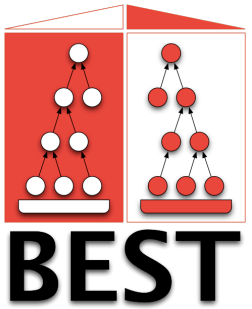
Overview

- Use Case
  - Access to court proceedings
- Vocabulary Mapping
- Requirements
- BestMap
- Discussion

BestPortal



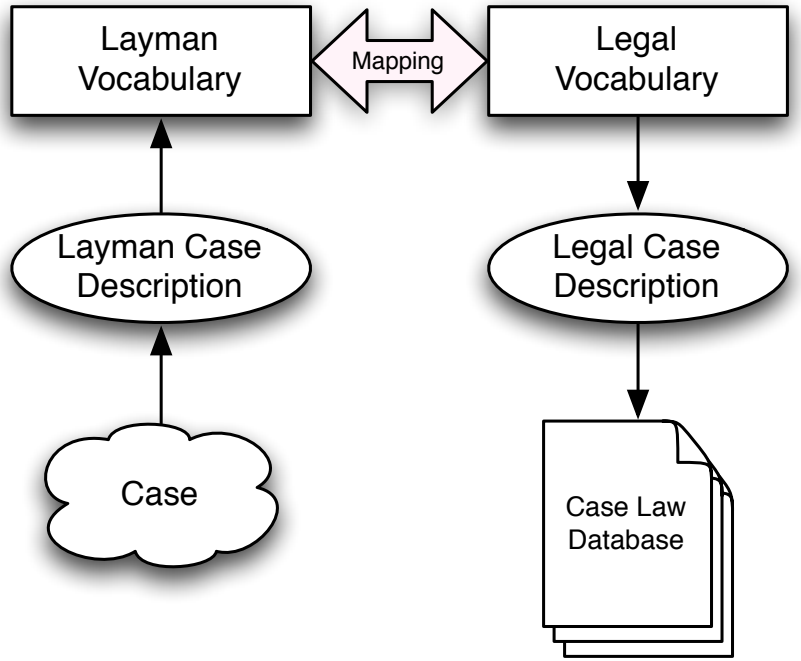
- BEST Project
  - "BATNA Establishment using Semantic Web Technology"
  - Best Alternative to a Negotiated Agreement
- Improve access to court proceedings
  - Netherlands Council of the Judiciary http://www.rechtspraak.nl
  - 50 thousand verdicts

"Does my case stand a chance in court?"

- Full text search is not enough
  - Laymen
  - Lawyers
- Lawyers have their own language: *legalese*
  - Bridge the gap between common sense and legal knowledge
- Knowledge-based solution too expensive
  - Modelling effort
  - Quality assurance
  - Legal theory: **definitions**

BestPortal: Requirements

- Translate **layman** description to **legal** terms
- Search using *fingerprints* of **legal** terms



- **Context** in which *layman* concepts co-occur in a case determines the applicability of a *legal* concept
- A mapping is **not** the definition of a concept

Vocabularies

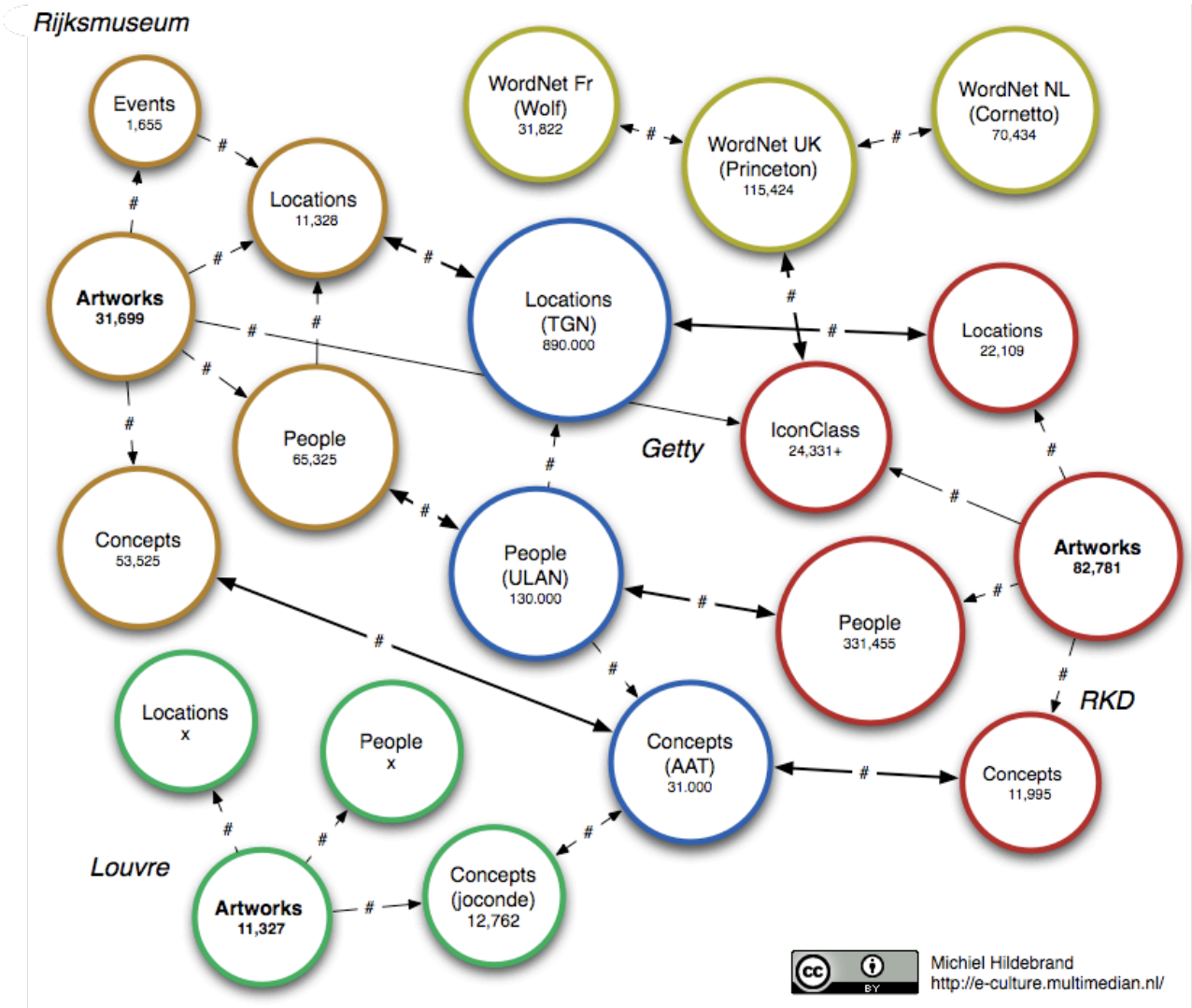
- Cultural Heritage
  - Museums, libraries
  - Huge repositories of (rich) information
  - Annotated using many different vocabularies (knowledge organization systems)
- Concept-based **information retrieval**
  - Europeana portal (http://www.europeana.eu)

Why Vocabulary Mapping

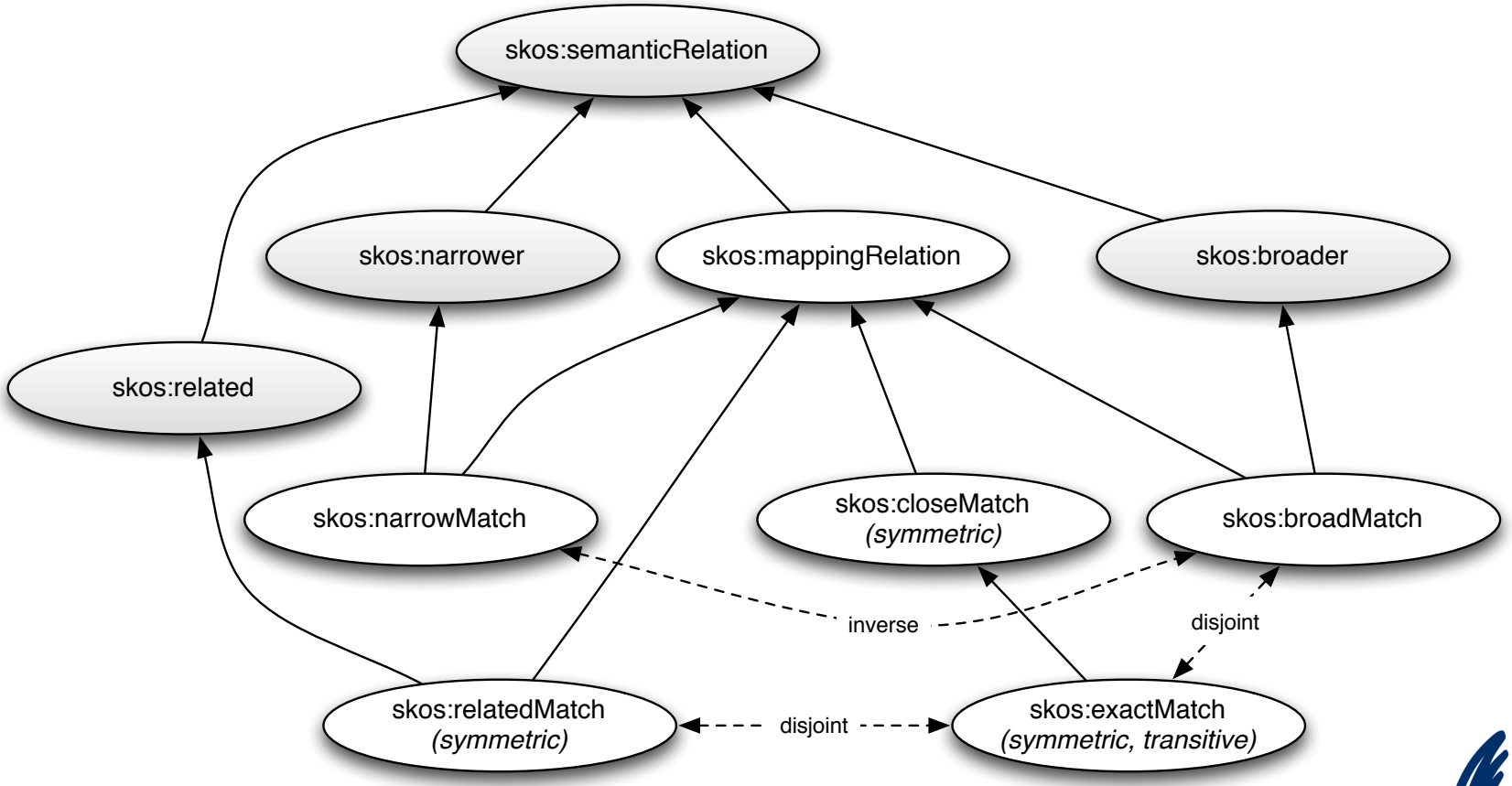
- Integrated access? Vocabulary mapping!
  - Format (XML to RDF)
    - e.g. via XSLT one-way transformation
  - Structure (VCard:Given + VCard:Family to foaf:name)
    - e.g. via SPARQL++, one-way transformation
  - Concepts (foaf:Person to lkif:Person)

- Simple Knowledge Organization System (SKOS)
  - Lifting existing KOS's to the Semantic Web
  - Every **skos:Concept** is an OWL *individual*
  - Lightweight **semantic** relations: *broader*, *narrower*, and *related*.
  - Lightweight **mapping** relations between **skos:ConceptSchemes**.

Europeana Datacloud



Mapping in SKOS



Information retrieval perspective **vs**. *lightweight semantics*

- No **many-to-many** mappings
  - Mapping only between *pairs* of concepts
  - Required for *re-indexing* and *search* across collections (Isaac et al. 2007)
- … fundamental issue
  - SKOS concepts and relations are '**intensional**'
  - What does a mapping then *mean*?
- Implicit assumption of **extensionality**

Extensional View

- SKOS relations
  - "Resources annotated by some concept should be retrievable via its broader concept."
- SKOS mappings
  - "Resources annotated by some concept should be retrievable via the concepts it is mapped to."

- … only means to assess *quality*

BestMap: Requirements

- Extensional perspective
  - Concepts as **annotations** on resources
- Compatibility
  - Integrated with SKOS
- Hierarchic mappings
  - Exploit **skos:broader** and **skos:narrower**
- Many-to-many mappings
  - Granularity
  - **Context** determines whether a mapping holds
- Flexible and Lightweight
  - A mapping is **not** the definition of a concept

Connecting to SKOS (1)

- Relation between :Resource and skos:Concept

$$:\text{about} \equiv inv(:\text{describes})$$

- Direct and indirect annotations

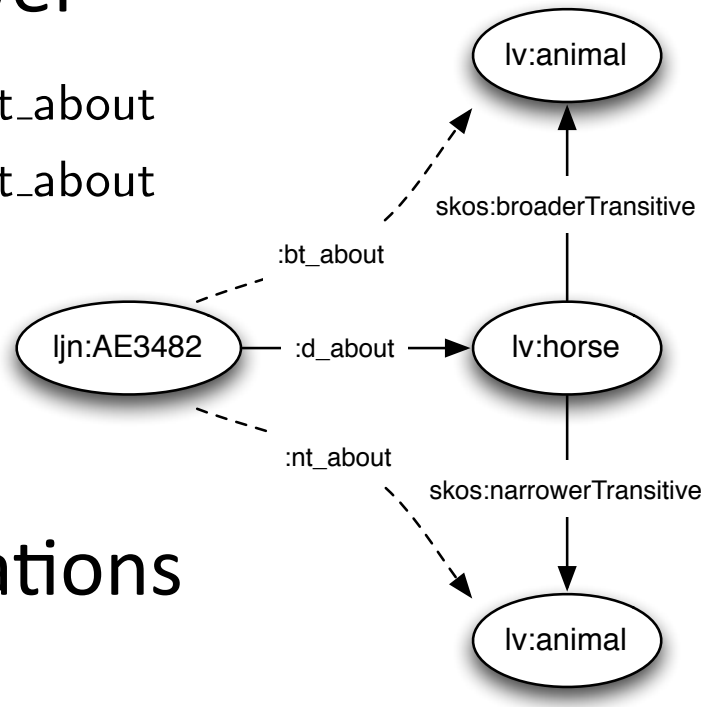
$$:\text{d\_about} \sqsubseteq :\text{about}$$
$$:\text{d\_describes} \sqsubseteq :\text{describes}$$
$$:\text{d\_describes} \equiv inv(:\text{d\_about})$$

Connecting to SKOS (2)

- Transitive broader/narrower

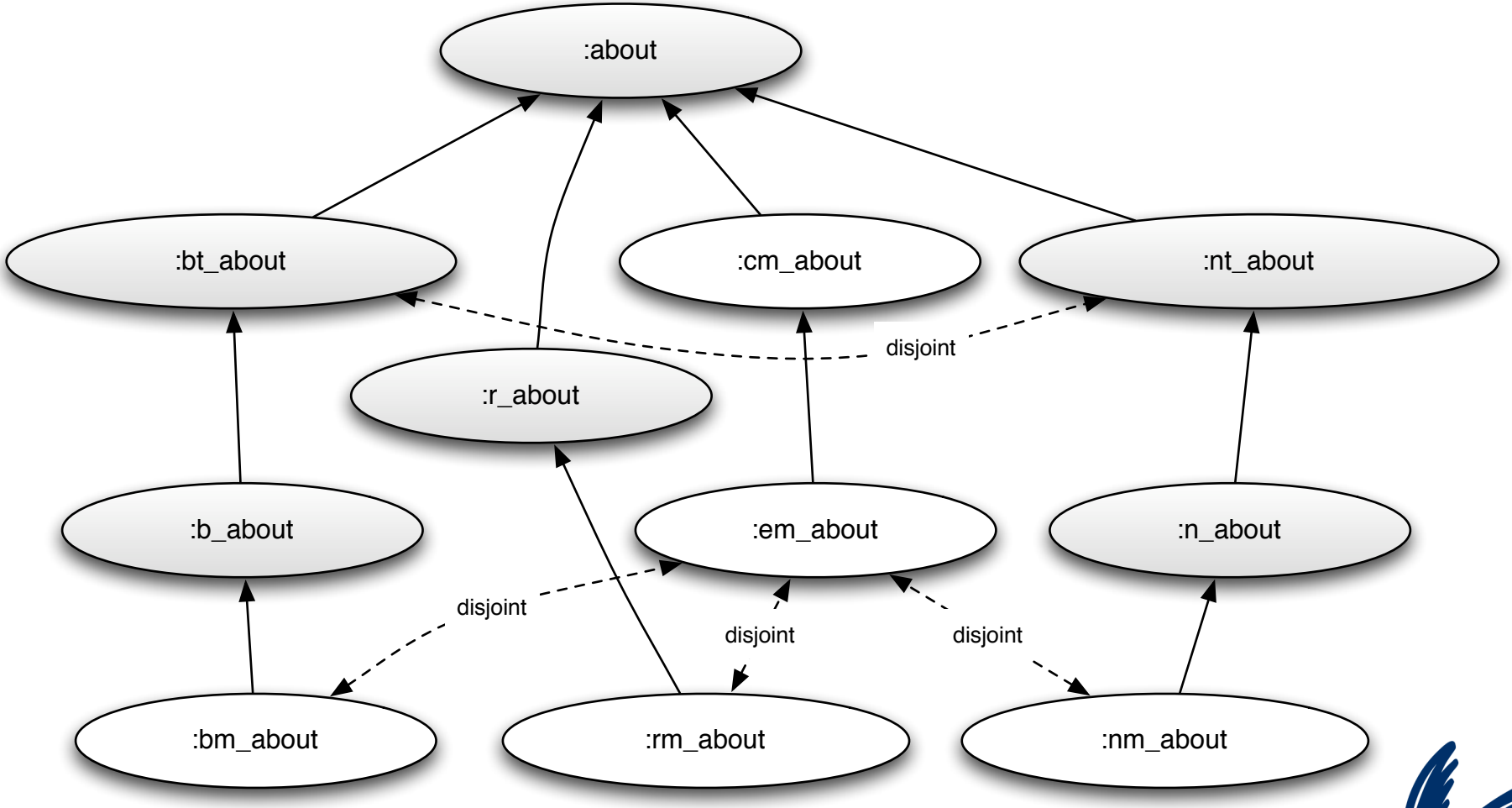
$$:d\_about \circ skos:broaderTransitive \sqsubseteq :bt\_about$$

$$:d\_about \circ skos:narrowerTransitive \sqsubseteq :nt\_about$$



- Similar for other SKOS relations

Connecting to SKOS (3)

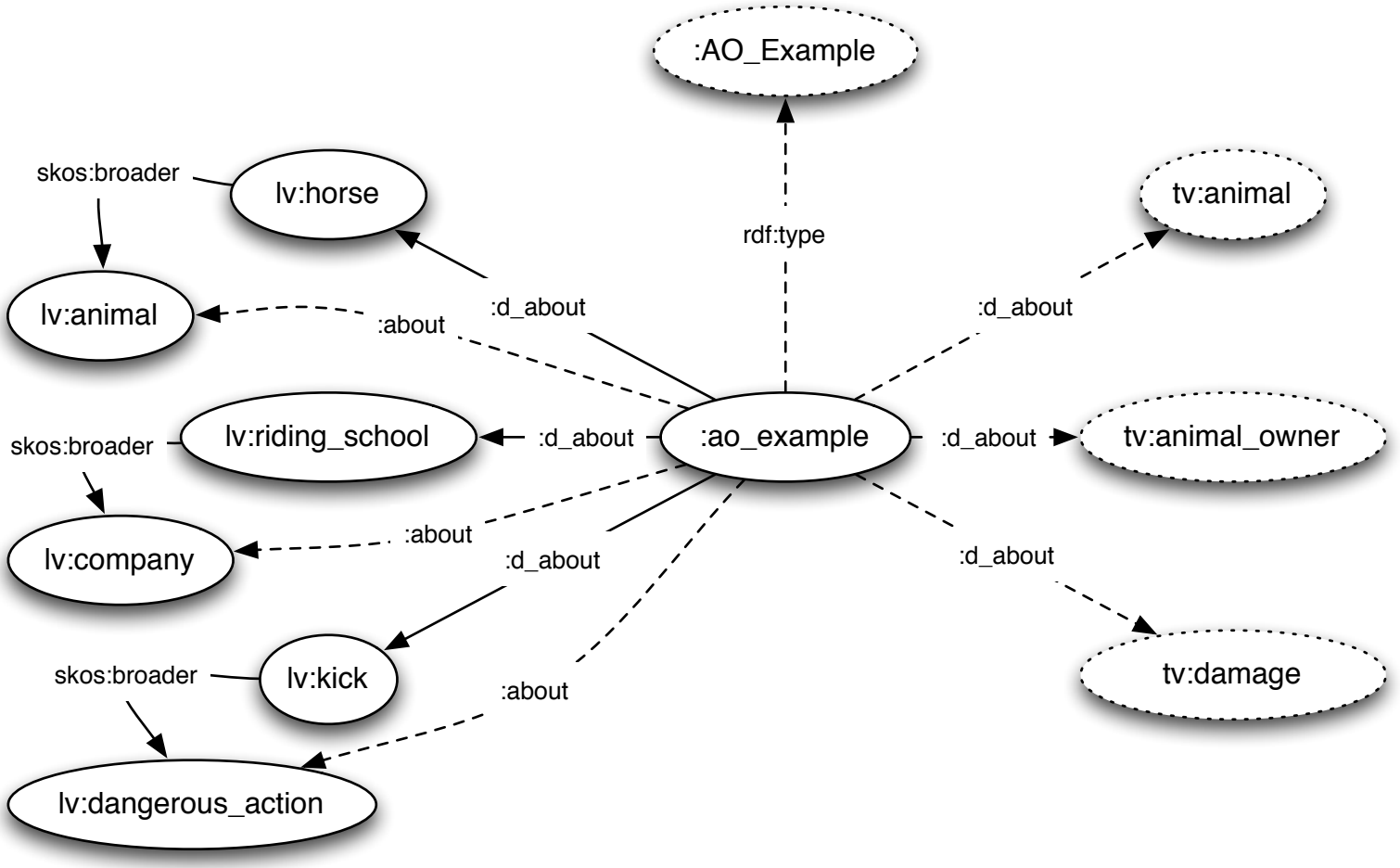


Mappings as OWL Classes

- A **mapping** class:
  - *Classifies* resources annotated using one vocabulary, and
  - *Infers* annotations using the other vocabulary
  - … it may be *directed*

$$\text{ex:AO\_Mapping} \equiv \text{:about } \textbf{value } lv{:}animal \sqcap \text{ :about } \textbf{value } lv{:}company \sqcap \text{ :about } \textbf{value } lv{:}dangerous\_action \sqsubseteq \text{ :d\_about } \textbf{value } tv{:}animal \sqcap \text{ :d\_about } \textbf{value } tv{:}animal\_owner \sqcap \text{ :d\_about } \textbf{value } tv{:}damage$$

Example


:AO_Example
rdf:type
skos:broader
lv:horse
lv:animal
:about
:d_about
tv:animal
:d_about
skos:broader
lv:riding_school
:d_about
:ao_example
:d_about
tv:animal_owner
skos:broader
lv:company
:about
:d_about
:d_about
skos:broader
lv:kick
:about
tv:damage
lv:dangerous_action

Discussion

- Extensible
  - Any OWL axiom may be used in a mapping (e.g. someValuesFrom etc.)
  - Reusable (partial) mappings
  - Exclude resources annotated with a particular concept
    - Negative property assertions
- Novel
  - “Reification” wrt. normal OWL ontologies
- Overcomes limitations of SKOS semantics
  - Makes explicit the extensional perspective that underlies SKOS semantics
  - Non-intrusive

Discussion

- OWL 1 vs OWL 2
  - Property chains
  - Disjoint properties
  - Negative property assertions
- The bad
  - Cannot enforce that the mapping holds between two distinct concept schemes
  - Property chains are not equivalent to super property

Future Work

- Apply BestMap to other domains
  - Legal assessment based on spatial plans
  - …
- Further development of BestPortal
  - Do the mappings actually work?
  - Structured mappings
    - (case frames)
  - Does BestPortal really improve access to court proceedings?
  - Connect to the linked data cloud