

# **SKOS Core Tutorial DC-2005 Madrid**

**Alistair Miles**  
CCLRC Rutherford Appleton Laboratory

***Tutorial 5: SKOS  
15 September 2005***

- SKOS
  - <http://www.w3.org/2004/02/skos/>
  - Simple Knowledge Organisation System(s)
- SKOS Core
  - <http://www.w3.org/2004/02/skos/core/>
  - Goal: Simple, flexible, extensible, machine-understandable representation for...
    - Thesauri
    - Classification Schemes
    - Taxonomies
    - Subject Headings
    - Other types of 'controlled vocabulary'...



- Development and status
- SKOS Features
- Extending SKOS Core
- Other topics:
  - SKOS Core and DCMI metadata terms
  - SKOS Core and OWL
  - HTTP



- SKOS Core is maintained by W3C SWBPD-WG
- Public, consensus-driven, design by open community
- All discussion in public, via [public-esw-thes@w3.org](mailto:public-esw-thes@w3.org)
- Review proposals for change every 2-3 months  
<http://www.w3.org/2004/02/skos/core/proposals>
- Publish revised working drafts  
<http://www.w3.org/TR/swbp-skos-core-guide>  
<http://www.w3.org/TR/swbp-skos-core-spec>



- Completed second review
- Plan 3<sup>rd</sup> review November 2005
- Change management policy  
<http://www.w3.org/TR/swbp-skos-core-spec/#secChange>
- *unstable, testing, stable*
- Most at *testing*, some at *unstable*
- Feedback on all aspects of work presented here welcome!  
[public-esw-thes@w3.org](mailto:public-esw-thes@w3.org)
- Translations most welcome!  
<http://www.w3.org/2004/02/skos/core/translations>

- SKOS Core is an application of the *Resource Description Framework*
  - *RDFS Classes and RDF Properties*
- ...This tutorial will be demonstrating how to use the classes and properties of the SKOS Core Vocabulary to express the basic structure and content of a concept scheme as an RDF graph



# Concept Schemes

- ‘Concept scheme’ is a blanket term for...
  - Thesauri
  - Classification Schemes
  - Taxonomies
  - Subject Headings
  - Terminologies
  - Other types of controlled vocabularies...
- Defined as...
  - *‘A set of concepts, optionally including statements about semantic relationships between those concepts.’*



- Why choose RDF as the basis for a standard?

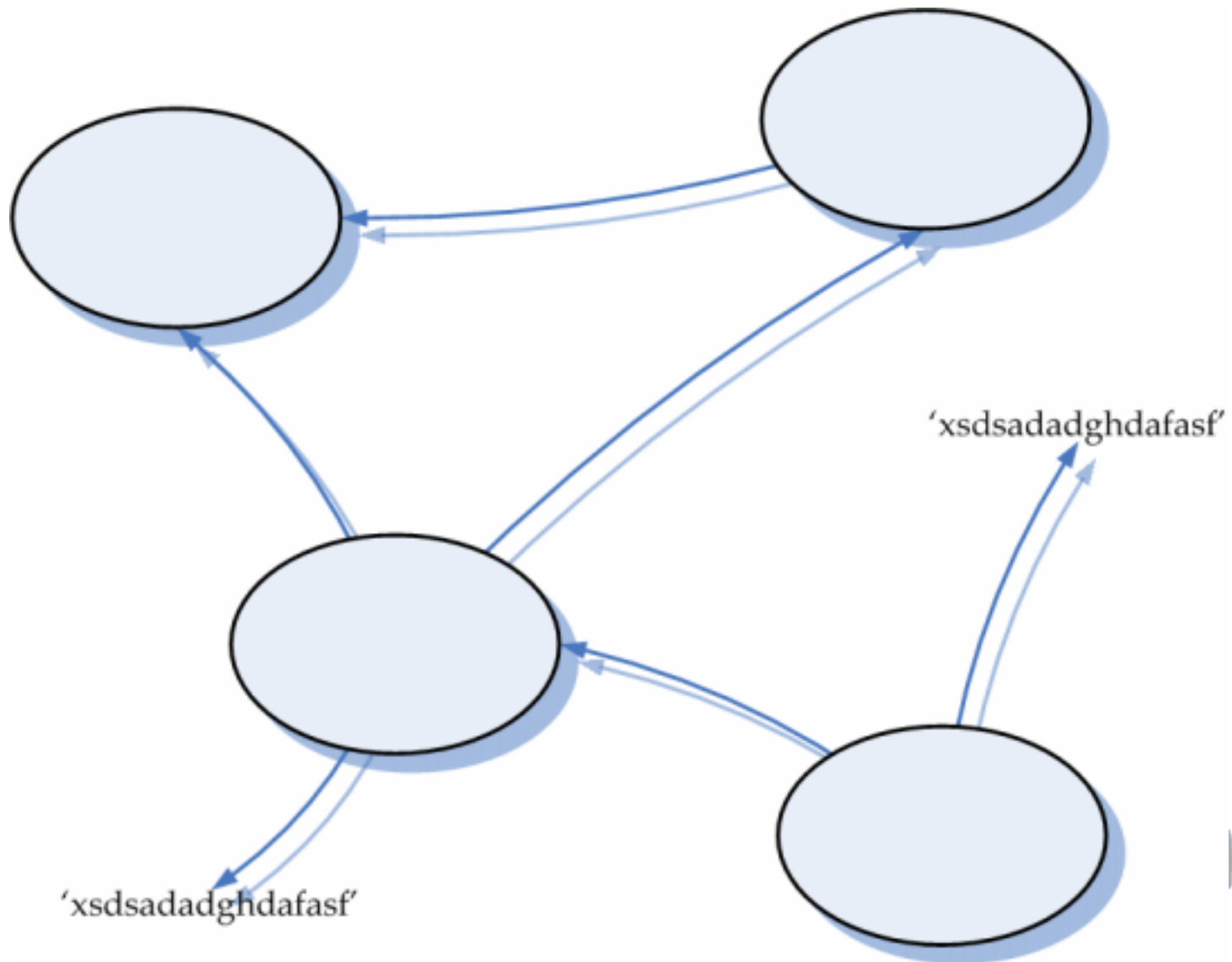
## Most compelling reasons...

1. Ease of combination with other meta-information standards
  - (KOS data is re-used in a great variety of contexts, in combination with DCMI terms and many others)
2. Flexibility and ease of extension, to cope with variations in structure and style
  - Variations between KOS types (e.g. 'thesaurus' vs. 'classification scheme') and within KOS types (compare e.g. the AAT or GEMET with ISO2788)



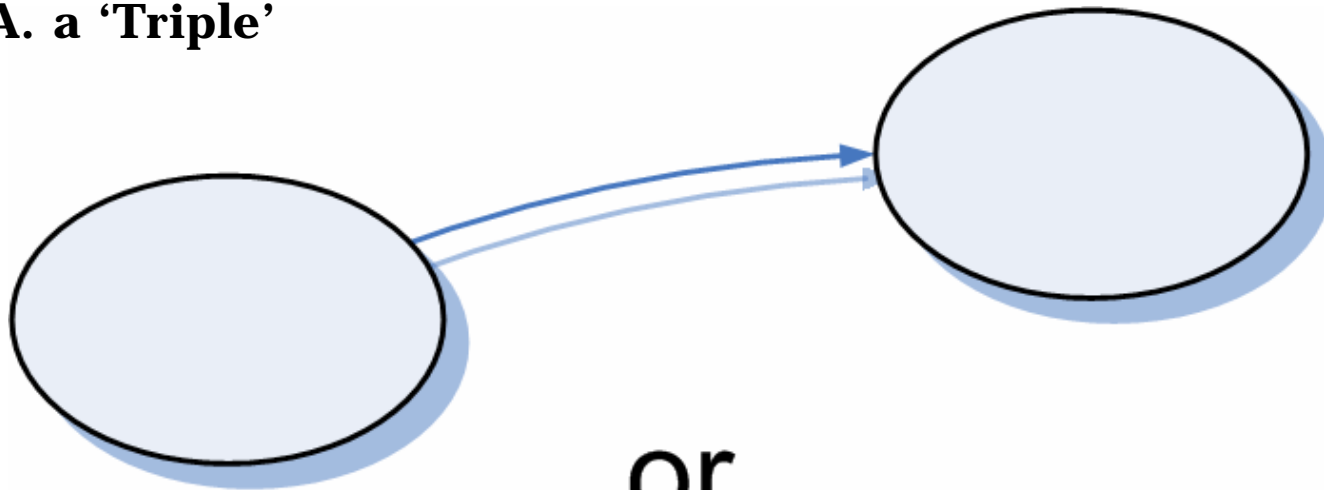


# Quick RDF: a 'Graph'

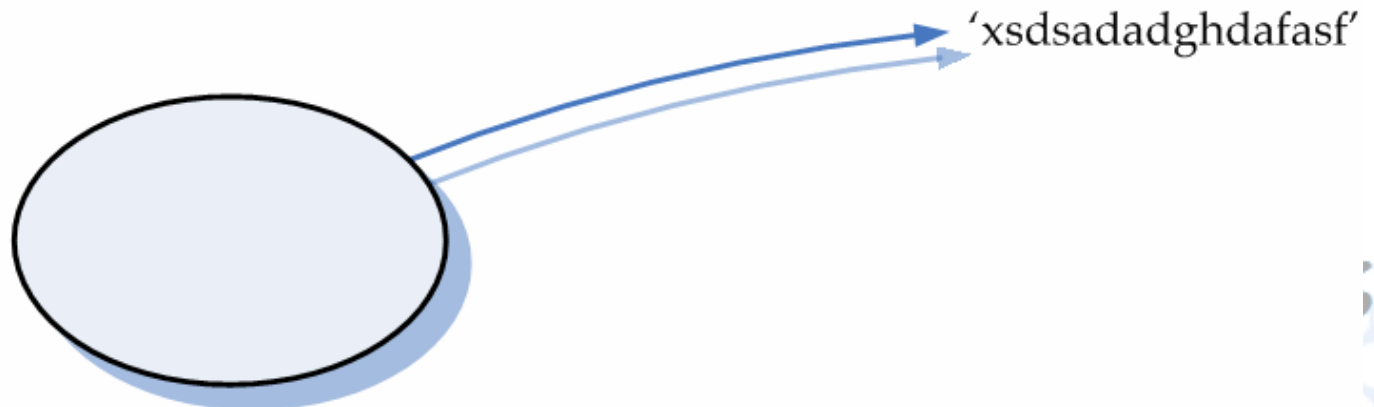


# Quick RDF: a 'Statement'

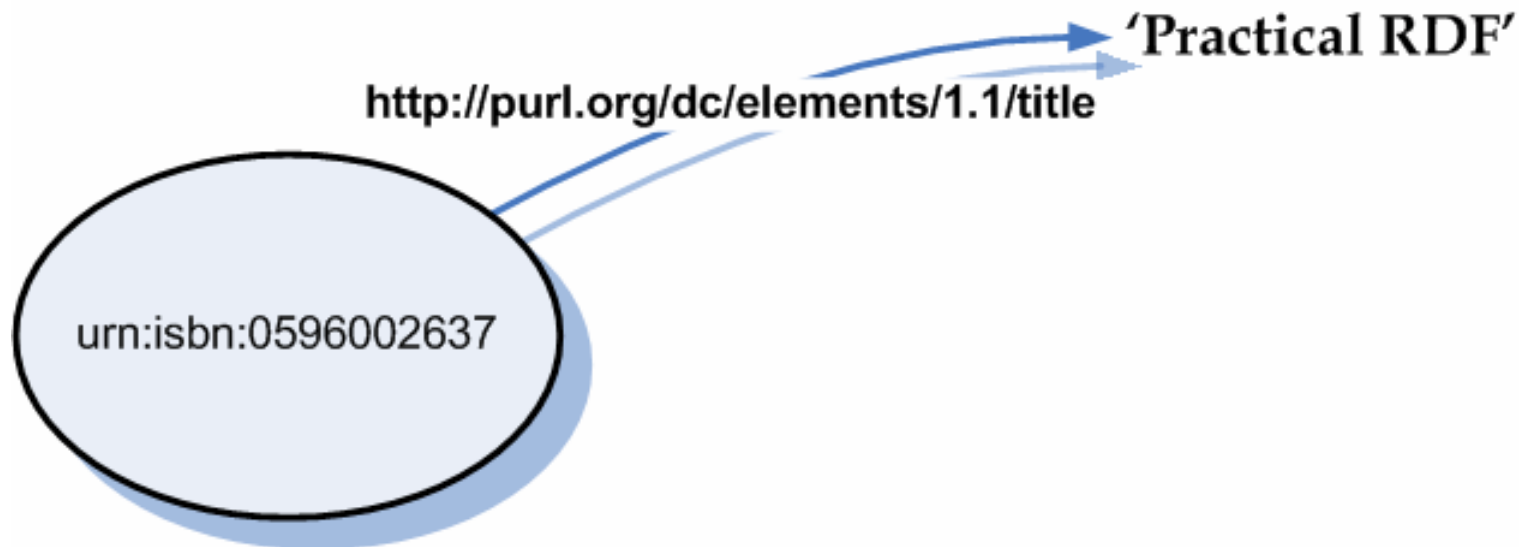
**A.K.A. a 'Triple'**



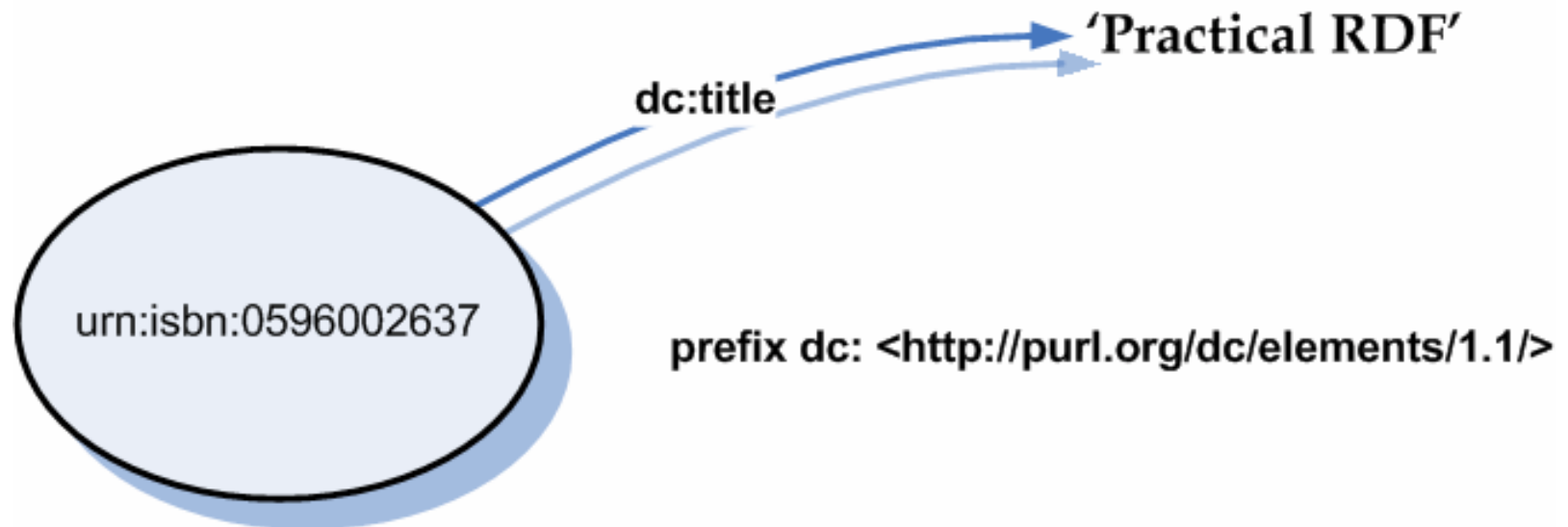
or...



# Quick RDF: URIs for Naming

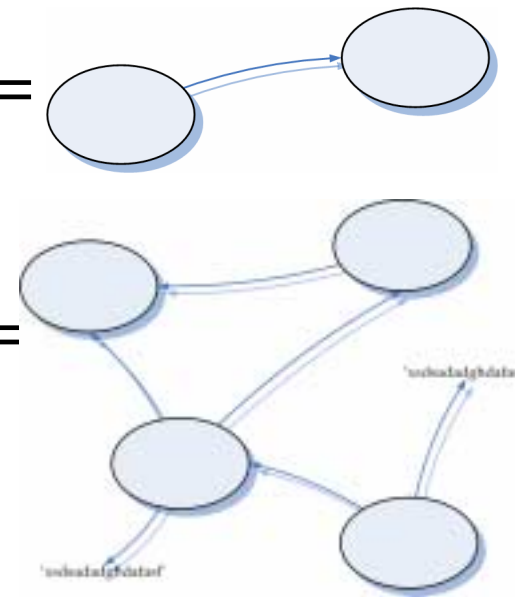


# Quick RDF: QNames

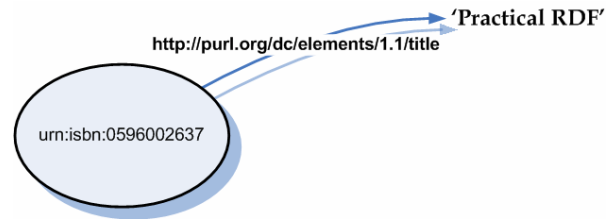


# Quick RDF: Lingo

- *Resource* = thing
- *Literal* = string of characters  
(?lang, ?datatype)
- *Statement* = *Triple* = (s, p, o) =
- *Property* = (... , **p**, ...)
- *Graph* = a set of *Statements* =
- *RDF Description* (of some thing) = a set of *Statements*  
(about that thing)



# Quick RDF: Serialisation



## N-Triples

```
<urn:isbn:0596002637> <http://purl.org/dc/elements/1.1/> 'Practical RDF'.
```

## Turtle

```
@prefix dc: <http://purl.org/dc/elements/1.1> .  
<urn:isbn:0596002637> dc:title 'Practical RDF' .
```

## RDF/XML

```
<rdf:RDF  
  xmlns:rdf='http://www.w3.org/1999/02/22-rdf-syntax-ns#' '  
  xmlns:dc='http://purl.org/dc/elements/1.1/'>  
  
  <rdf:Description rdf:about='urn:isbn:0596002637'>  
    <dc:title>Practical RDF</dc:title>  
  </rdf:Description>  
  
</rdf:RDF>
```

## XHTML 2.0

```
<head xmlns:dc='http://purl.org/dc/elements/1.1/'>  
  <meta about='urn:isbn:0596002637' property='dc:title'>Practical RDF</meta>  
</head>
```

**Aah...**

# Story So Far (1)...

- Goal
  - To express the content and structure of concept schemes in a machine-understandable way
- Development
  - Open, collaborative, consensus-driven
- Status
  - May evolve within defined change management policy
- Technology
  - Resource Description Framework (RDF)
- RDF
  - Graphs, statements (triples), resources, properties, literals...





# Features...



# Controlled Vocabulary

## Love

Strong feelings of attraction towards, and affection for, another adult, or great affection for a friend or family member.

## Awe

A feeling of great respect sometimes mixed with fear or surprise.

## Joy

A feeling of bliss and great happiness.

1. Identify
2. Describe
3. Publish

- Step 1: Identify concepts...

<http://www.example.com/concepts#love>

<http://www.example.com/concepts#awe>

<http://www.example.com/concepts#joy>

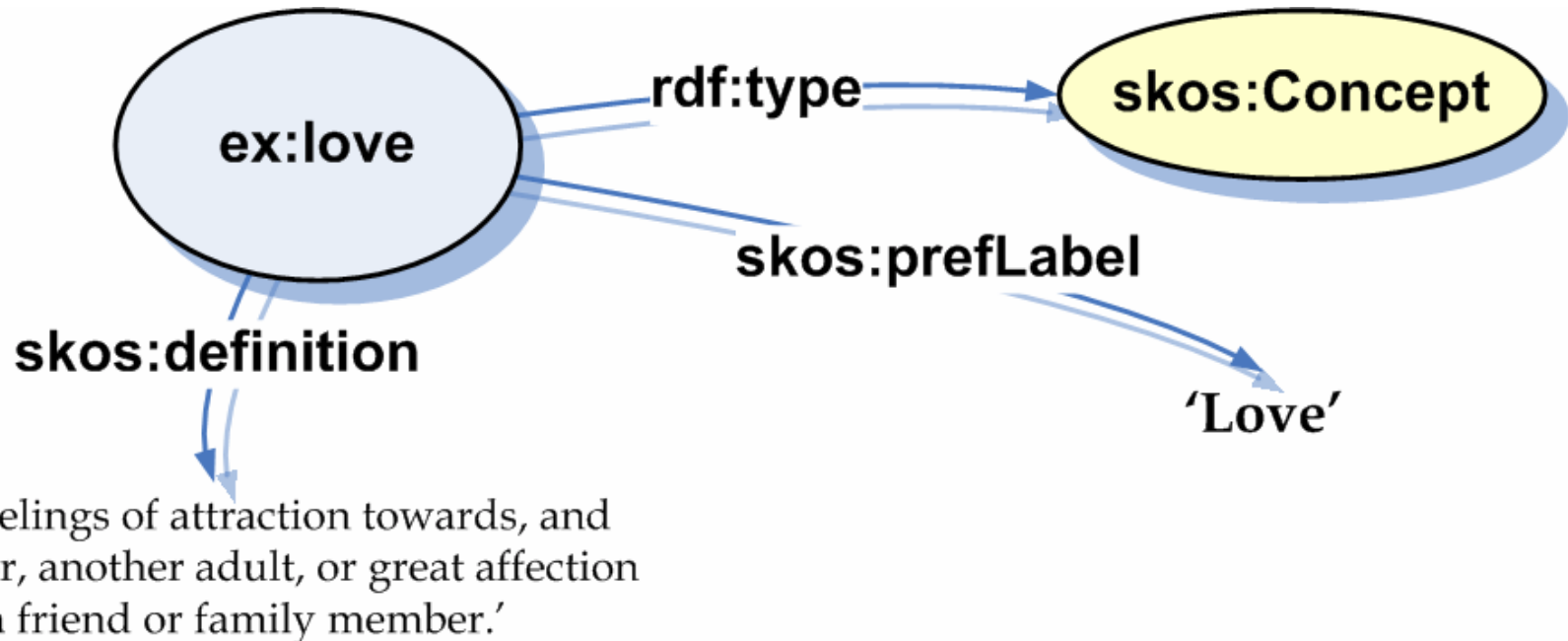
- N.B. Could just as well be

<http://foo.bar.org/1234/5678>

urn:

info:

- Step 2: Describe...



```
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .  
@prefix ex: <http://www.example.com/concepts#> .  
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

- Step 3: Publish...

- One way is to:

- Create an RDF/XML serialisation (concepts.rdf)
    - Put this file on an HTTP server  
(<http://www.example.com/concepts>)

- Another way is to:

- Load statements into a dedicated RDF server (Joseki, Sesame, Kowari ...)



- N.B. SKOS Core is oriented towards the identification and description of concepts.

# Thesaurus (USE/UF)

Love

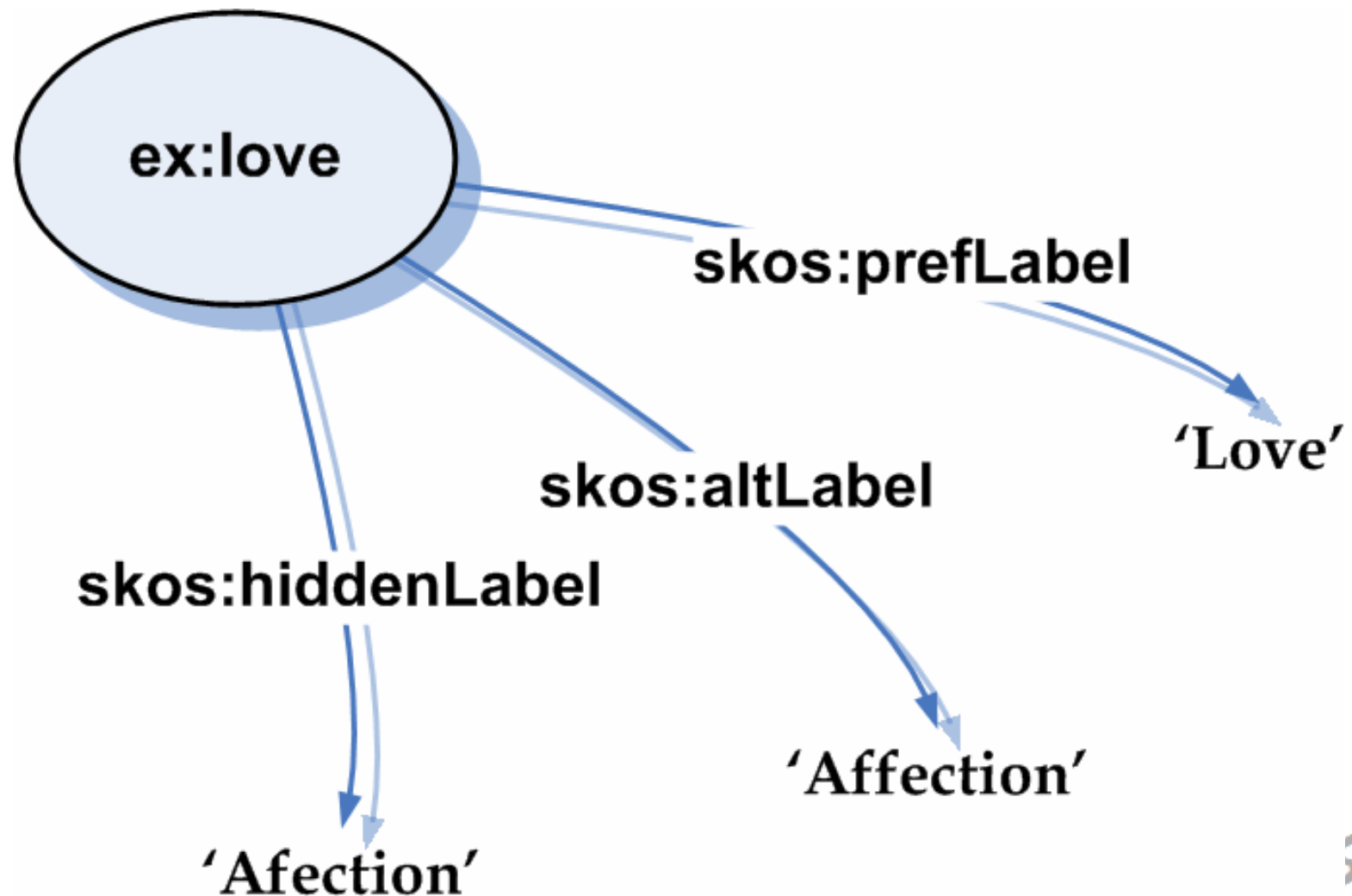
UF Affection

Affection

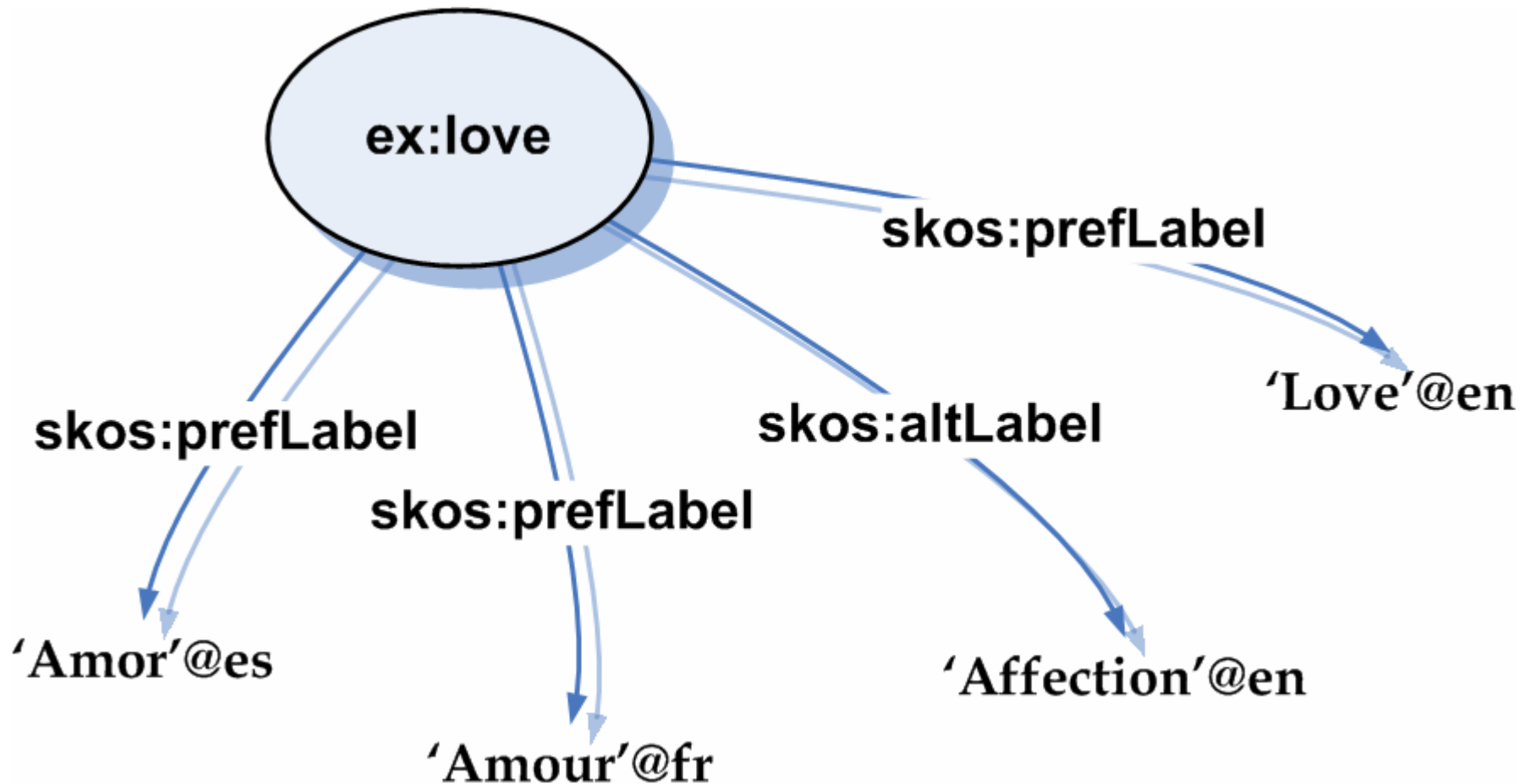
USE Love



# Lexical Labels

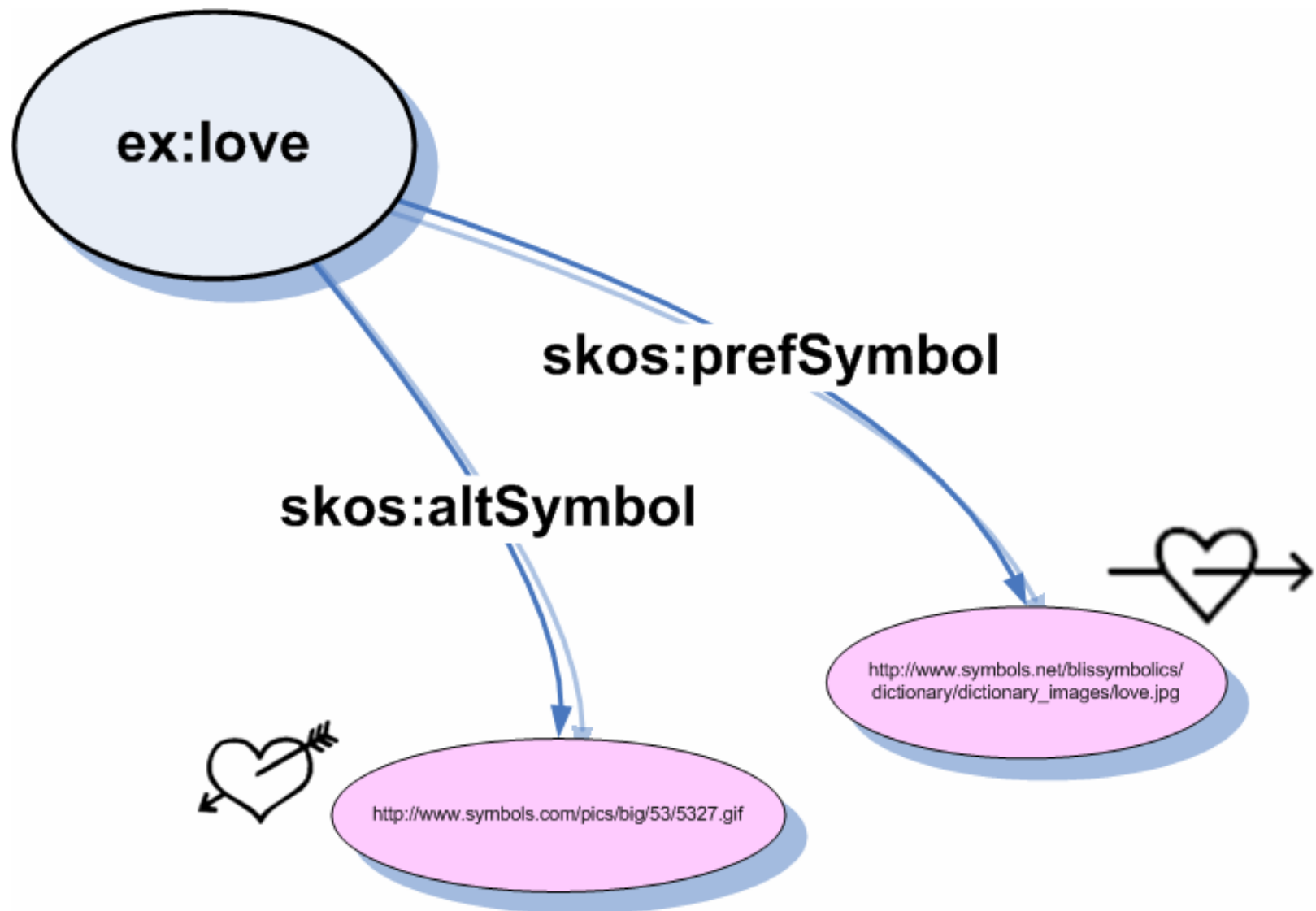


# Multilingual Labels



**N.B.** No more than one **skos:prefLabel** per language

# Symbolic Labels



# Thesaurus (BT/NT)

Love

BT Emotion

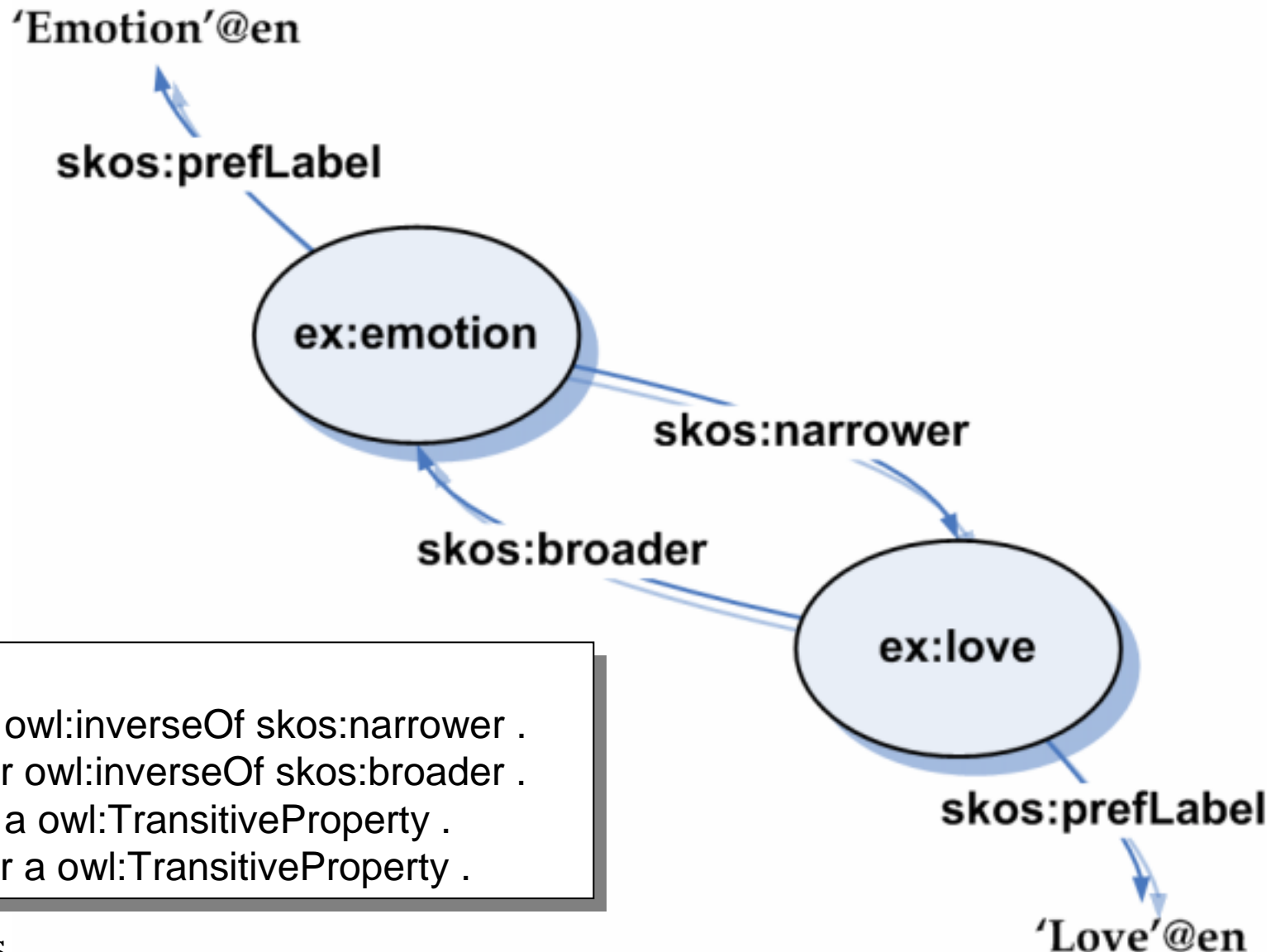
Emotion

NT Love

NT Awe

NT Joy

# Broader/Narrower



## N.B.

skos:broader owl:inverseOf skos:narrower .  
 skos:narrower owl:inverseOf skos:broader .  
 skos:broader a owl:TransitiveProperty .  
 skos:narrower a owl:TransitiveProperty .

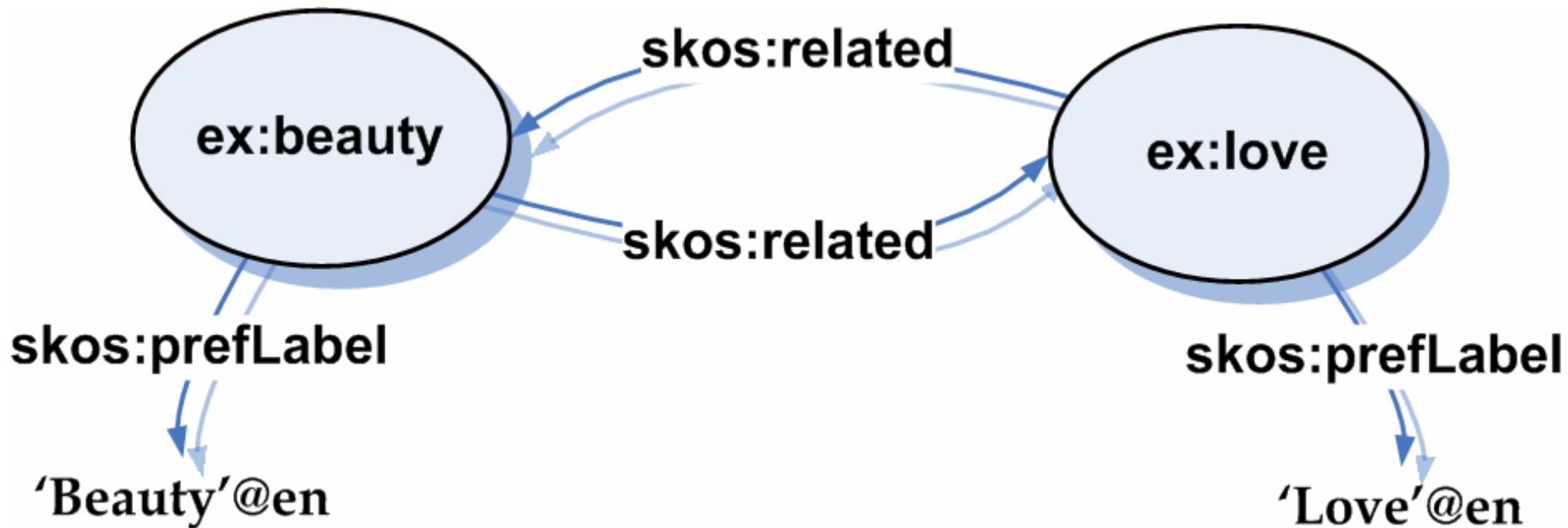
# Thesaurus (RT)

Love

RT Beauty

Beauty

RT Love



**N.B.**

**skos:related** is an **owl:SymmetricProperty**.

# Aah...



# Story So Far (2)...

- Basic Structure
  - skos:Concept
- Lexical Labelling
  - skos:prefLabel, skos:altLabel, skos:hiddenLabel
- Symbolic Labelling
  - skos:prefSymbol, skos:altSymbol
- Documentation
  - skos:definition
- Semantic Relations
  - skos:broader, skos:narrower, skos:related



# Features...



# Documentation Properties

- **skos:note**  
e.g. 'Anything goes.'
- **skos:definition**  
e.g. 'A long curved fruit with a yellow skin and soft, sweet white flesh inside.'
- **skos:example**  
e.g. 'A bunch of bananas.'
- **skos:scopeNote**  
e.g. 'Historically members of a sheriff's retinue armed with pikes who escorted judges at assizes.'
- **skos:historyNote**  
e.g. 'Deleted 1986. See now Detention, Institutionalization (Persons), or Hospitalization.'
- **skos:editorialNote**  
e.g. 'Confer with Mr. X. re deletion.'
- **skos:changeNote**  
e.g. 'Promoted "love" to preferred label, demoted "affection" to alternative label, Joe Bloggs, 2005-08-09.'

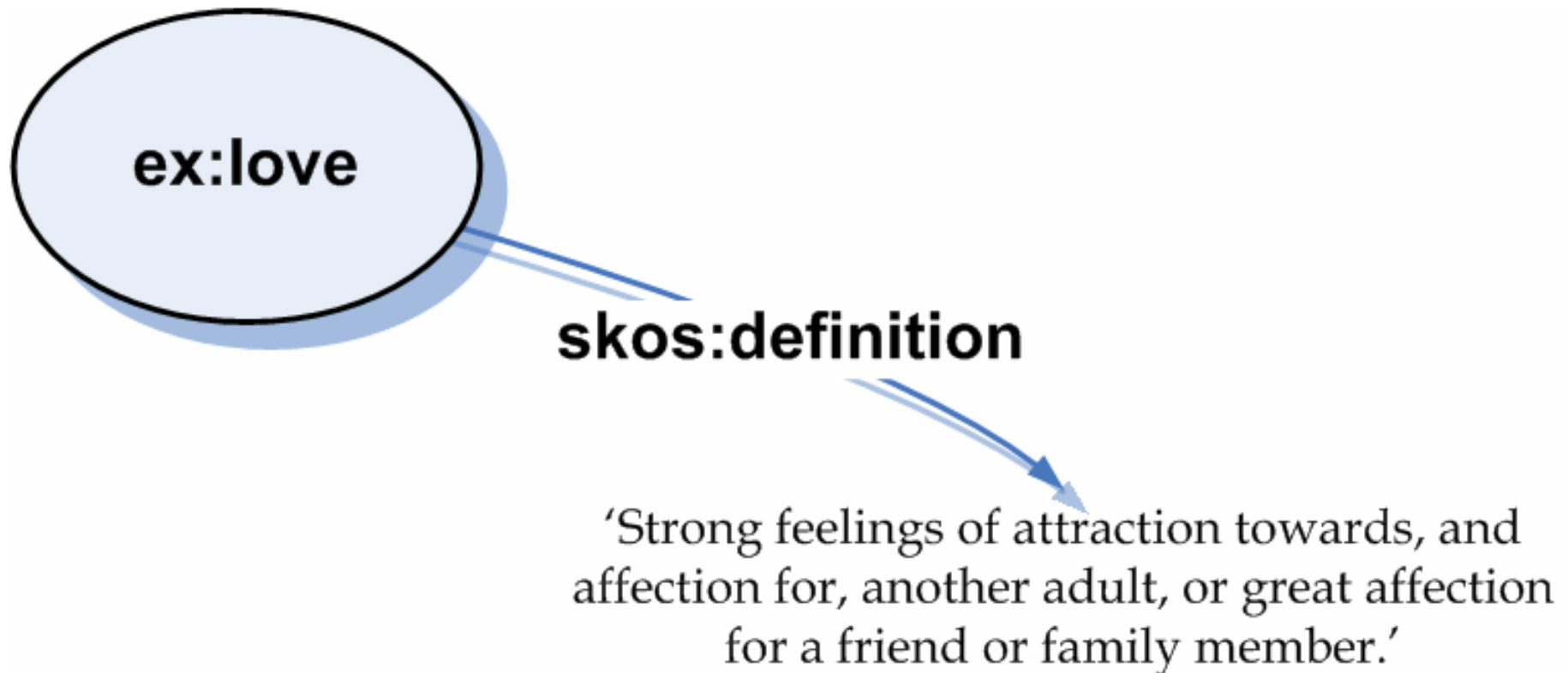
# Documentation as...

## Allowed patterns:

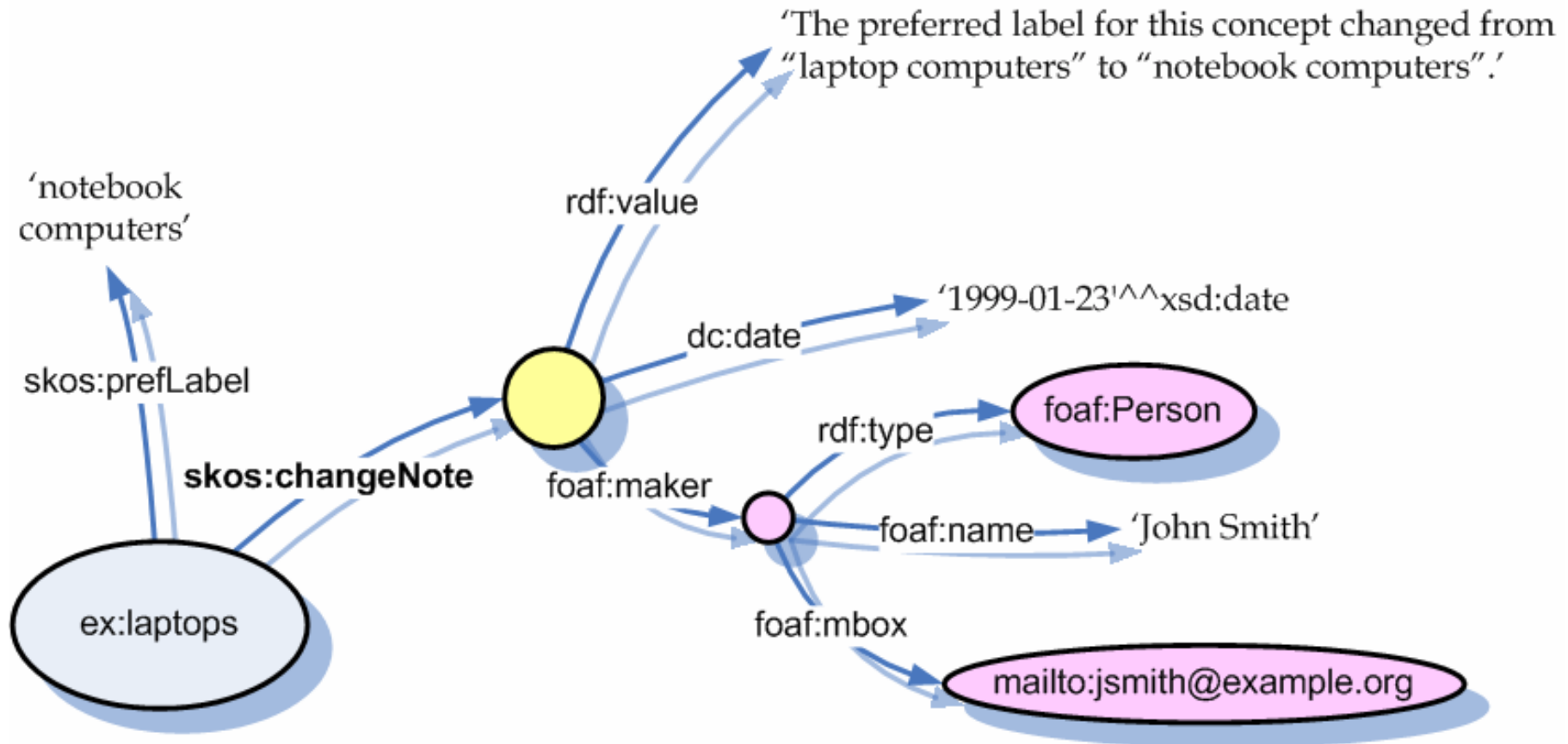
1. Documentation as an **RDF Literal**
2. Documentation as a **Related Resource Description**
3. Documentation as a **Document Reference**



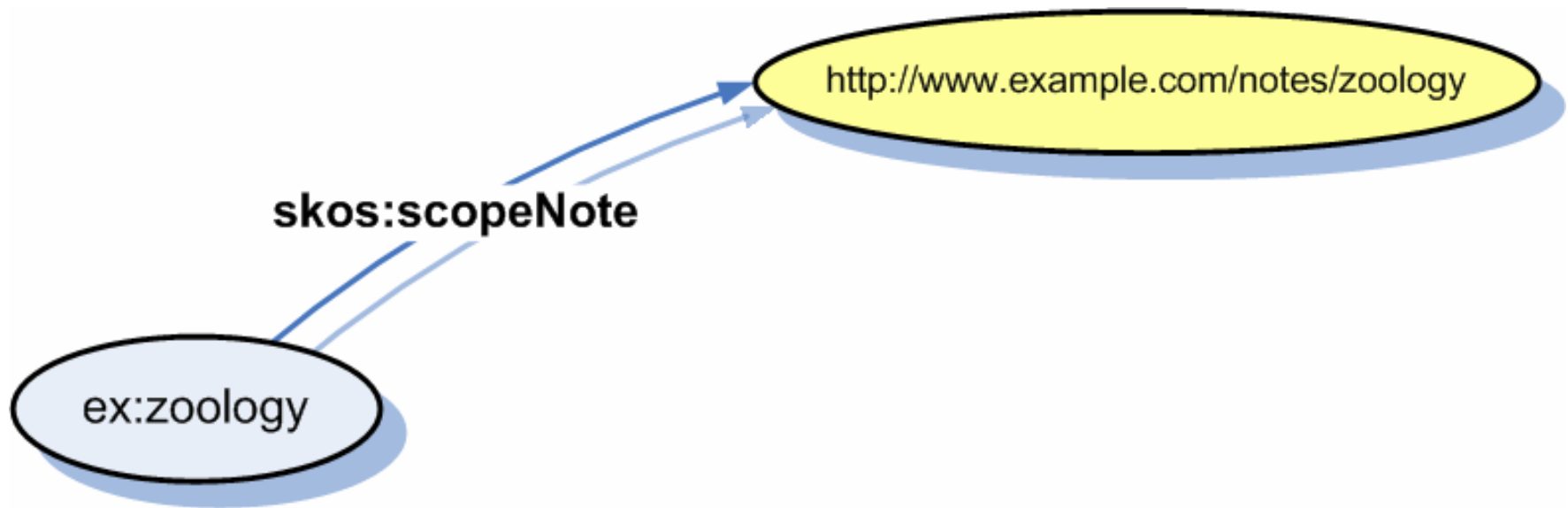
# ...RDF Literal



# ...Related Resource Description



# ...Document Reference



# Documentation as...

## Allowed patterns:

1. Documentation as an **RDF Literal**
2. Documentation as a **Related Resource Description**
3. Documentation as a **Document Reference**

**... N.B. this takes SKOS Core outside OWL DL ...**

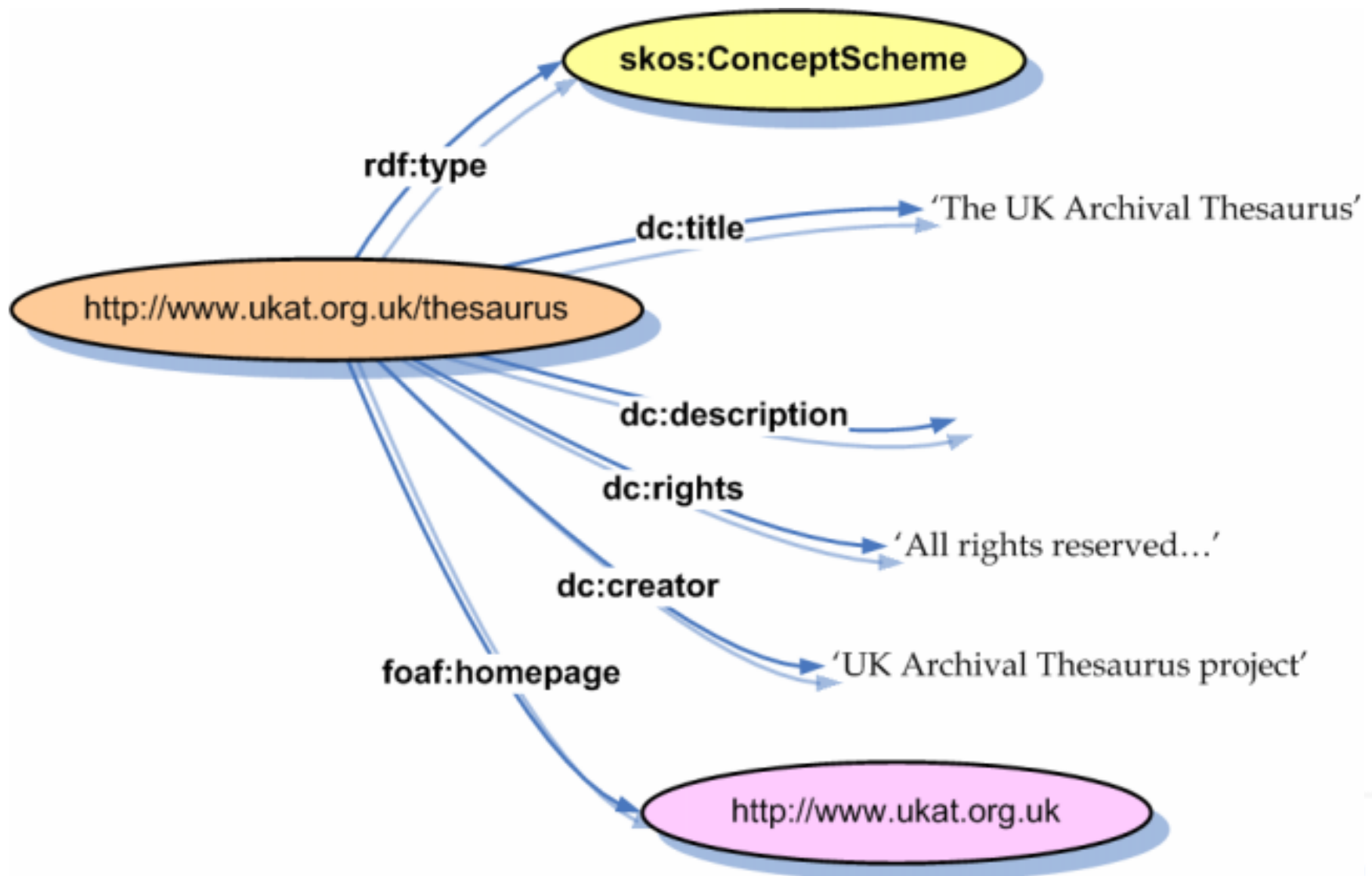




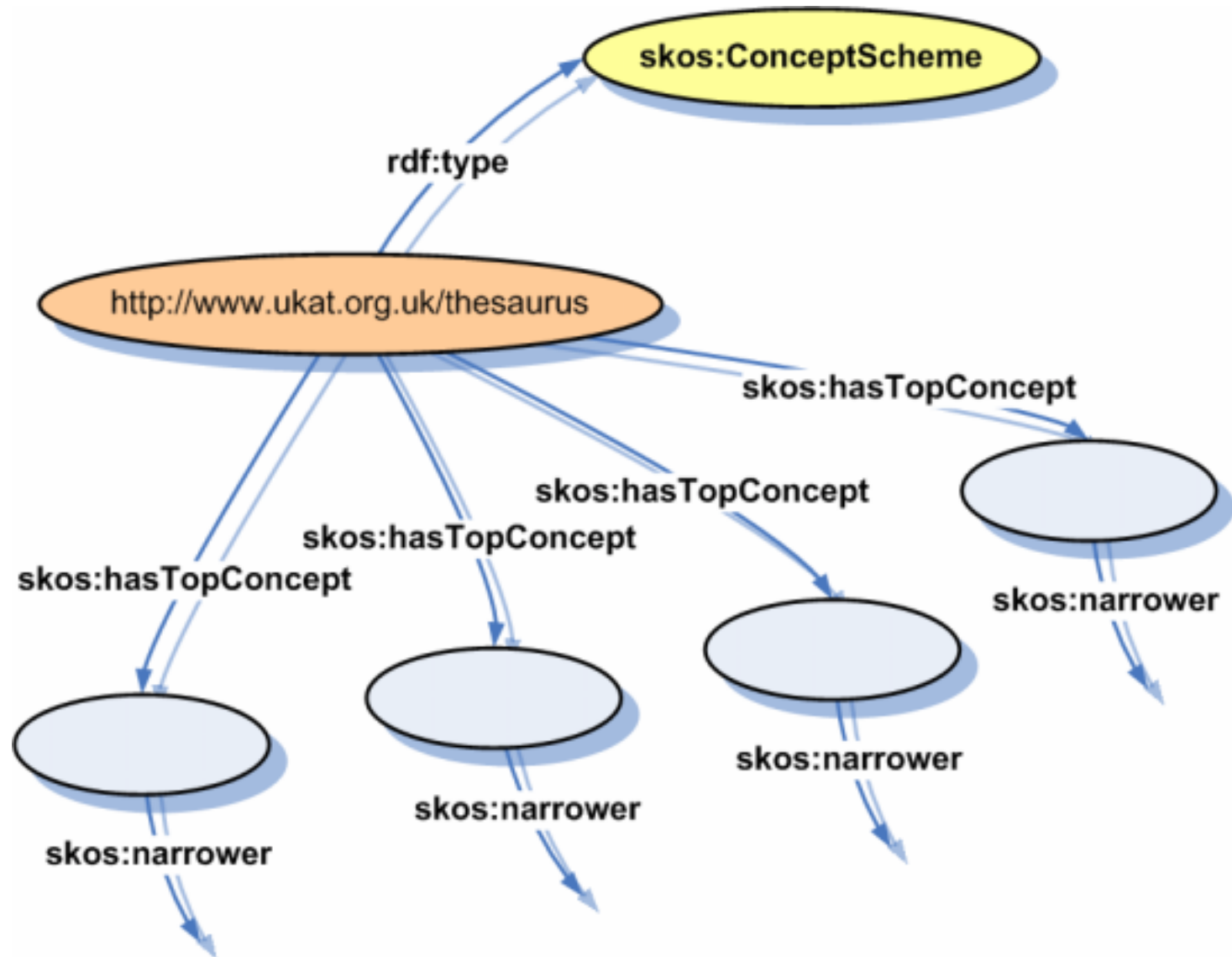
# Concept Schemes

- Organise a set of concepts into a **concept scheme**

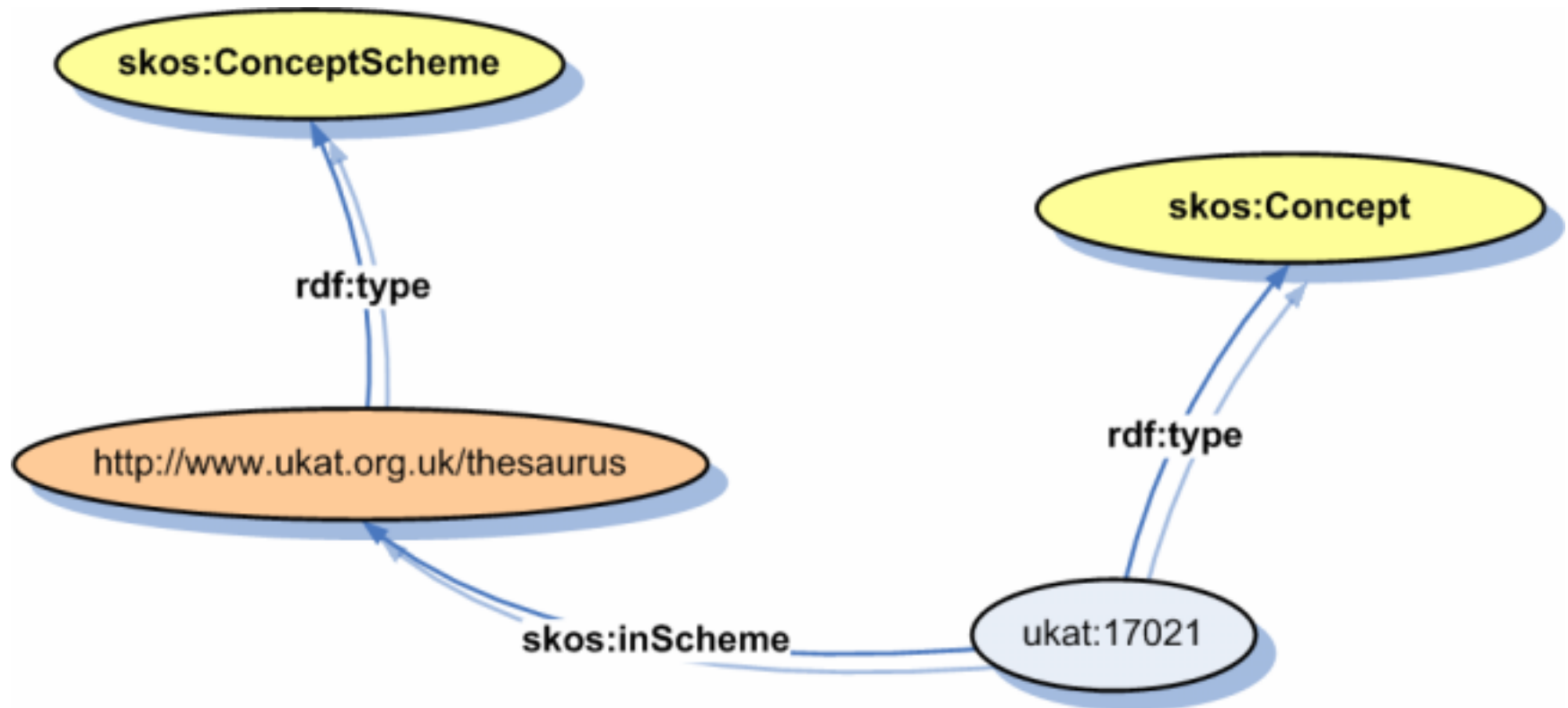
# Concept Scheme



# Top Concepts



# Concepts in Scheme



```
@prefix ukat: <http://www.ukat.org.uk/thesaurus/concept/> .
```

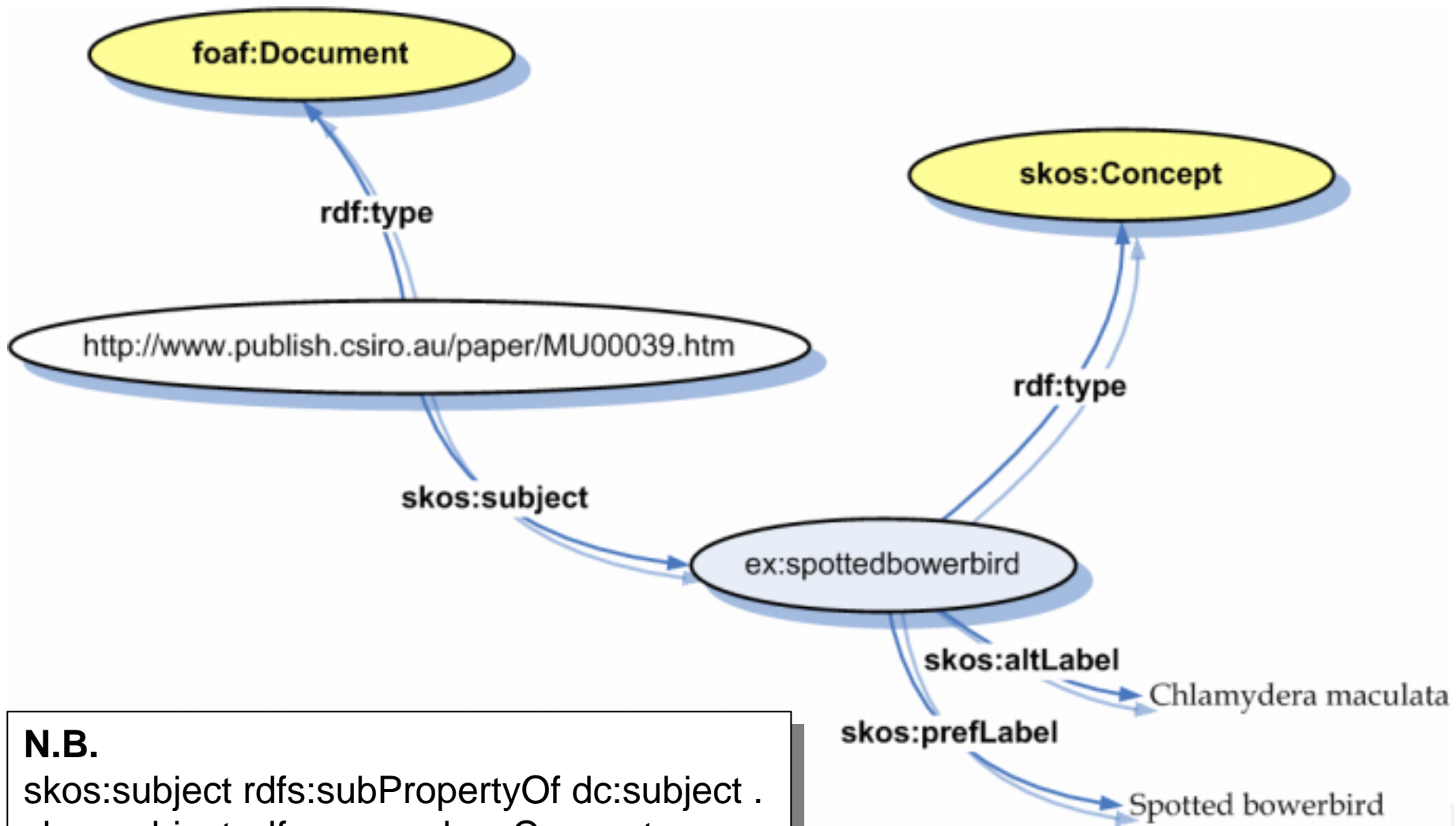


# Subject Indexing

- Simple functionality based on dc:subject

# Spotted Bowerbird

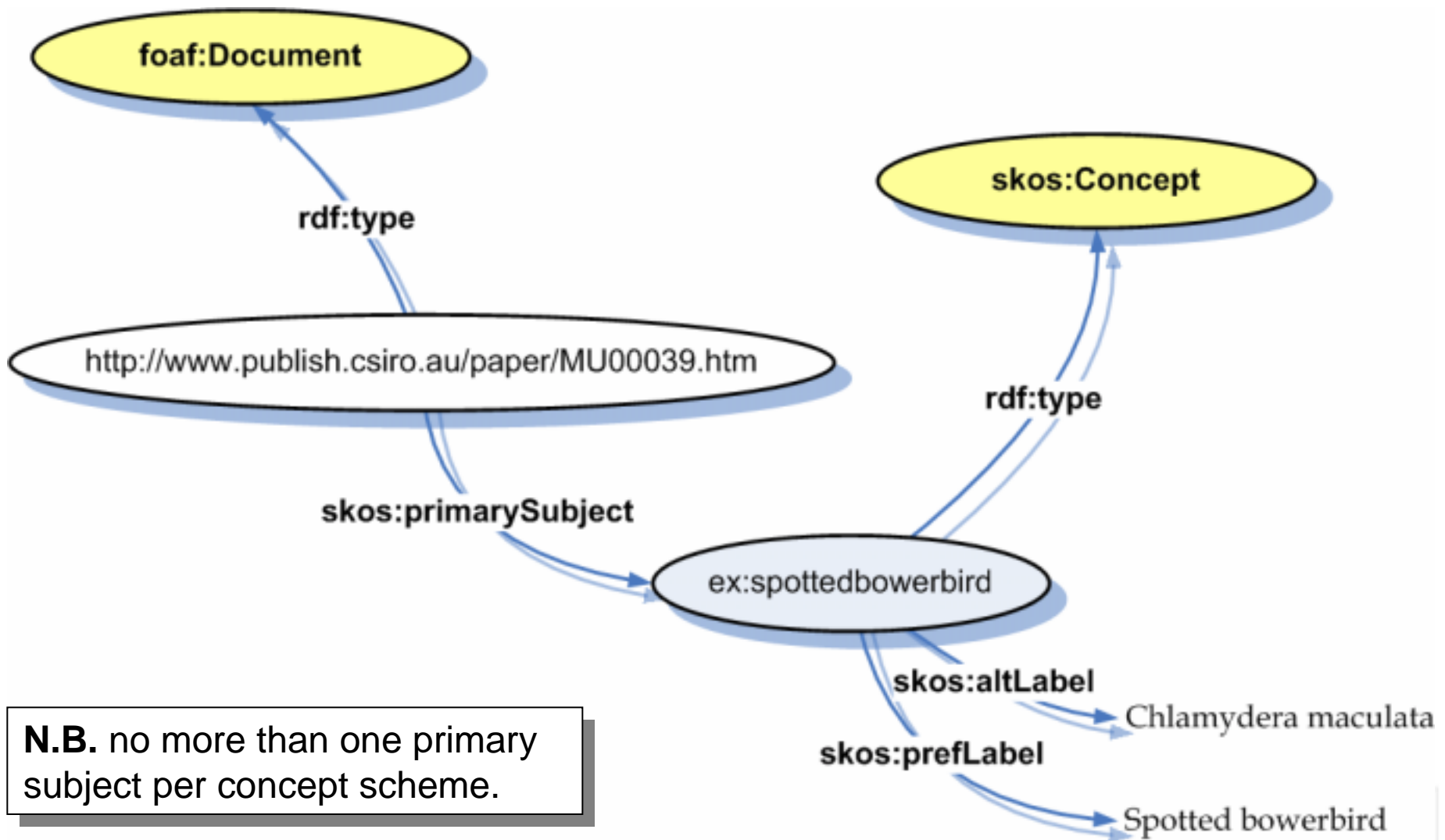




## N.B.

`skos:subject rdfs:subPropertyOf dc:subject .`  
`skos:subject rdfs:range skos:Concept .`

# Primary Subject





# Subject Inverses

- `skos:isSubjectOf`
  - inverse of `skos:subject`
- `skos:isPrimarySubjectOf`
  - inverse of `skos:primarySubject`



# Subject Generality

- Subject generality rule:

```
{
  ?d skos:subject ?x .
  ?x skos:broader ?y .
}
=>
{
  ?d skos:subject ?y .
}
```

I.e. if a document is about 'bowerbirds' and 'birds' is broader than 'bowerbirds', then the document is about 'birds' too.

Use to implement simple query expansion.



# Node Labels

<milk by source animal>

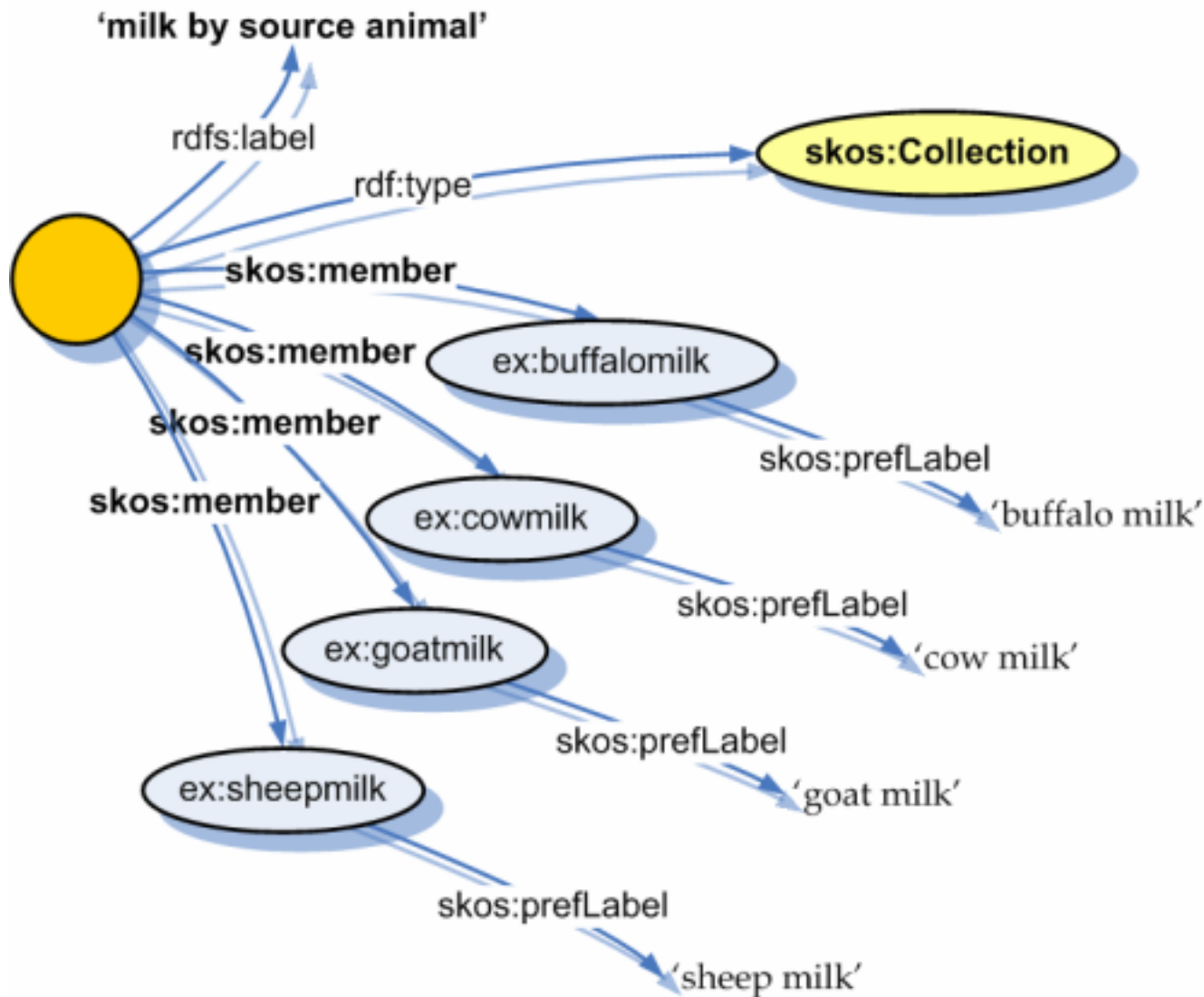
buffalo milk

cow milk

goat milk

sheep milk

# Meaningful Collections



# Node Labels in Hierarchy

milk

<milk by source animal>

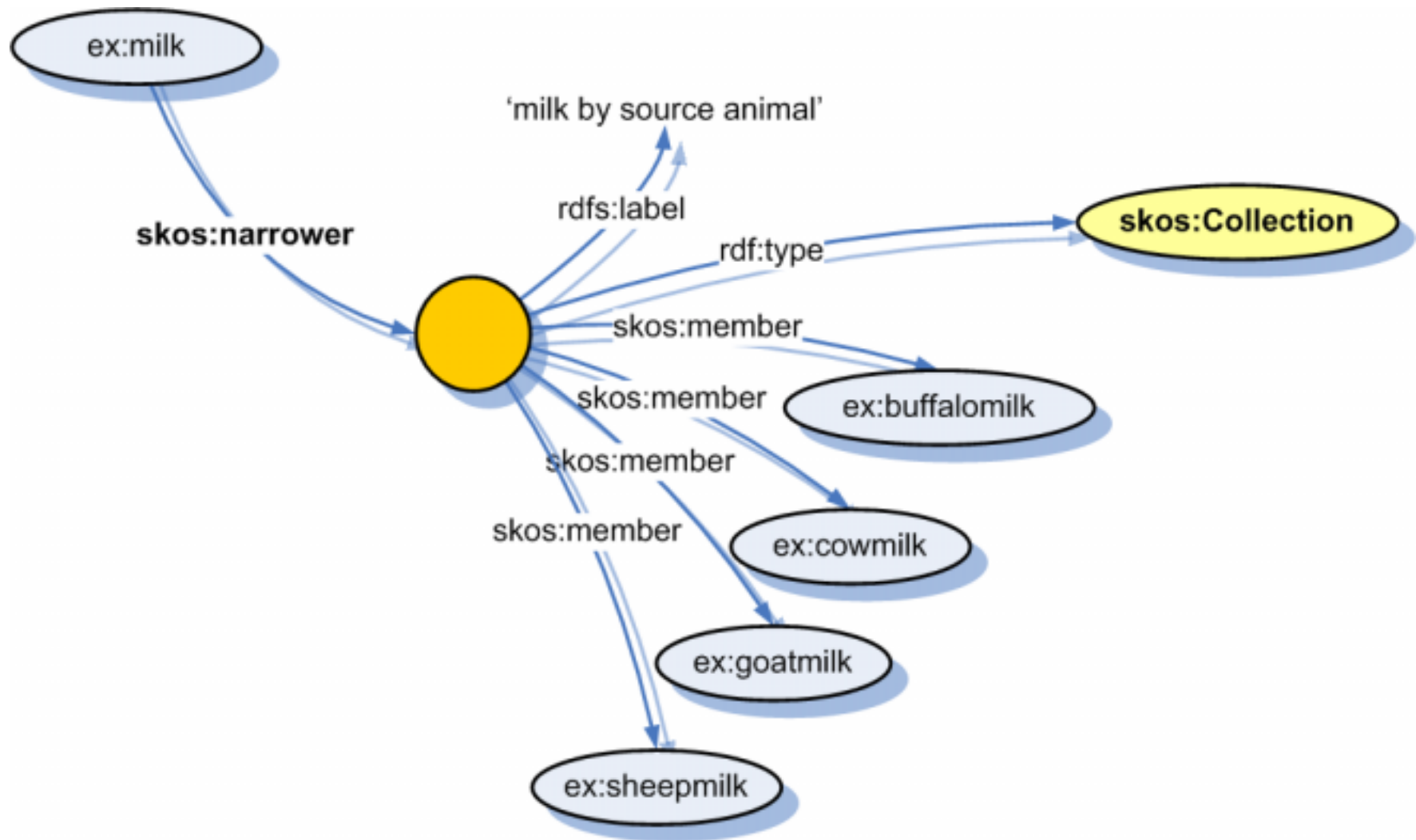
buffalo milk

cow milk

goat milk

sheep milk

# Collectable Properties



# Nested Node Labels

chairs

- <chairs by form>

  - armchairs

  - easy chairs

- <chairs by form: back form>

  - heart-back chairs

  - oval-back chairs

**N.B.**

A member of a collection may be a concept or another collection.

# More on Collections...

- See SKOS Core Guide for...
  - Meaningfully ordered collections
  - Nested ordered/unordered collections
  - Rules for collections
  - Rules for collectable properties





**Aah...**

# Story So Far (3)...

- Documentation Properties
  - skos:note, skos:definition, skos:example, skos:scopeNote, skos:historyNote, skos:editorialNote, skos:changeNote
- Documentation Patterns
  - ...as RDF Literal, as Related Resource Description, as Document Reference
- Concept Schemes
  - skos:ConceptScheme, skos:hasTopConcept, skos:inScheme
- Subject Indexing
  - skos:subject, skos:isSubjectOf, skos:primarySubject, skos:isPrimarySubjectOf
- Node Labels and Guide Terms
  - skos:Collection, skos:OrderedCollection, skos:member, skos:memberList



# HTTP Publishing

- You may use any type of HTTP URI as an identifier for a concept ...
  - ‘#’ is OK, e.g.  
<http://www.example.com/concepts#love>
  - ‘/’ is OK, e.g.  
<http://www.example.com/concepts/love>
- (N.B. httpRange-14 is resolved)
  - <http://lists.w3.org/Archives/Public/www-tag/2005Jun/0039>

- HTTP Behaviour for ‘#’
  - N.B. you can’t actually GET <http://www.example.com/concepts#love>
  - Current practice in semantic web community: <http://www.example.com/concepts> should respond to GET with ...
    - Response code 200 (success)
    - Content-type: application/rdf+xml
    - A message that describes all concepts in the namespace

- HTTP Behaviour for ‘/’
  - <http://www.example.com/concepts/love> must respond to GET with ...
    - Response code 303 (**redirect** see other)
  - What you should be redirected to is an open question ...
    - HTML document?
    - RDF document?
    - XHTML 2.0 document with embedded RDF?
    - Content negotiable resource?
  - I suggest ...
    - Content negotiable resource, supporting at least application/rdf+xml and preferably also text/html, describing the concept

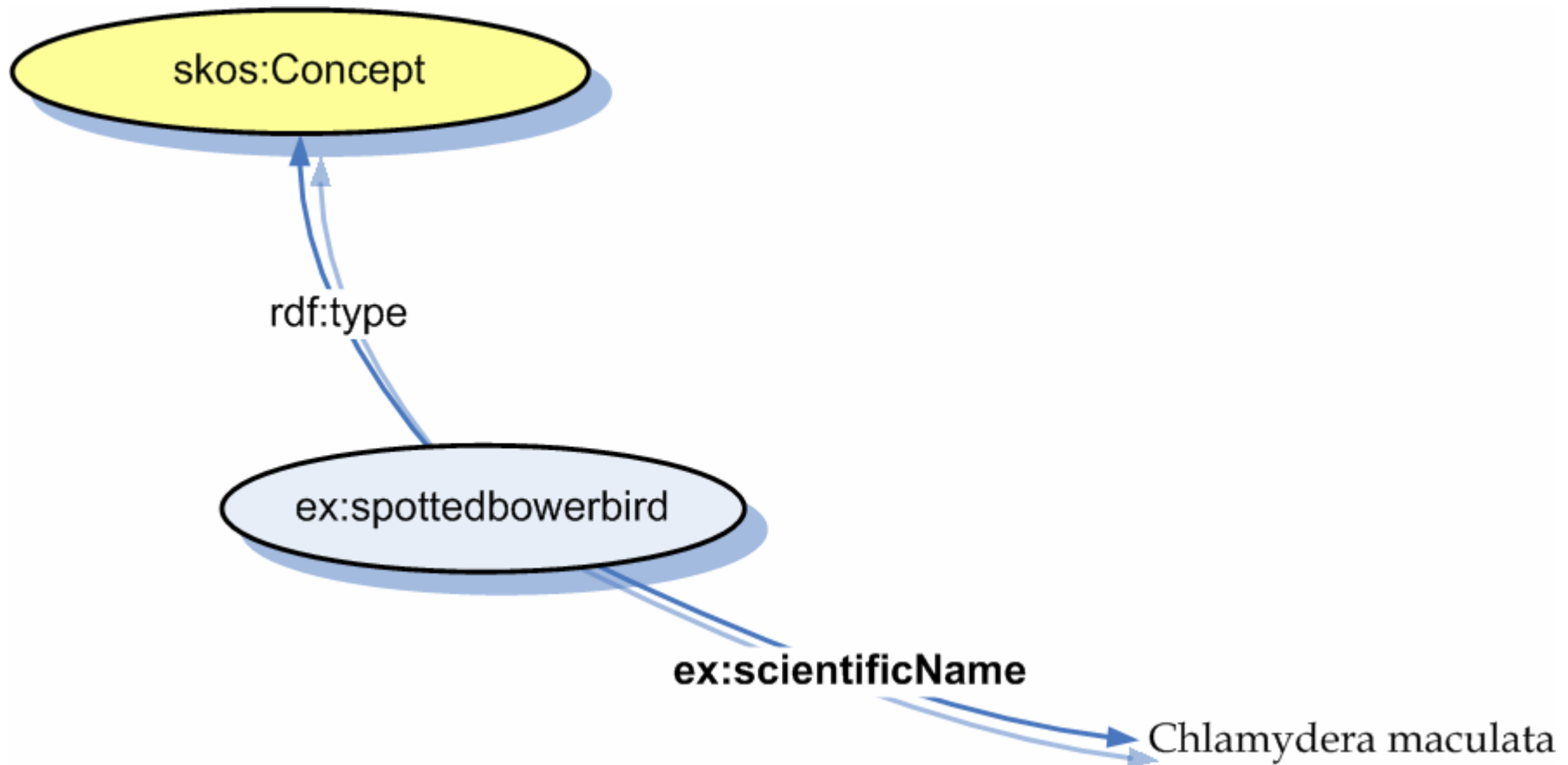


# Extensions Intro

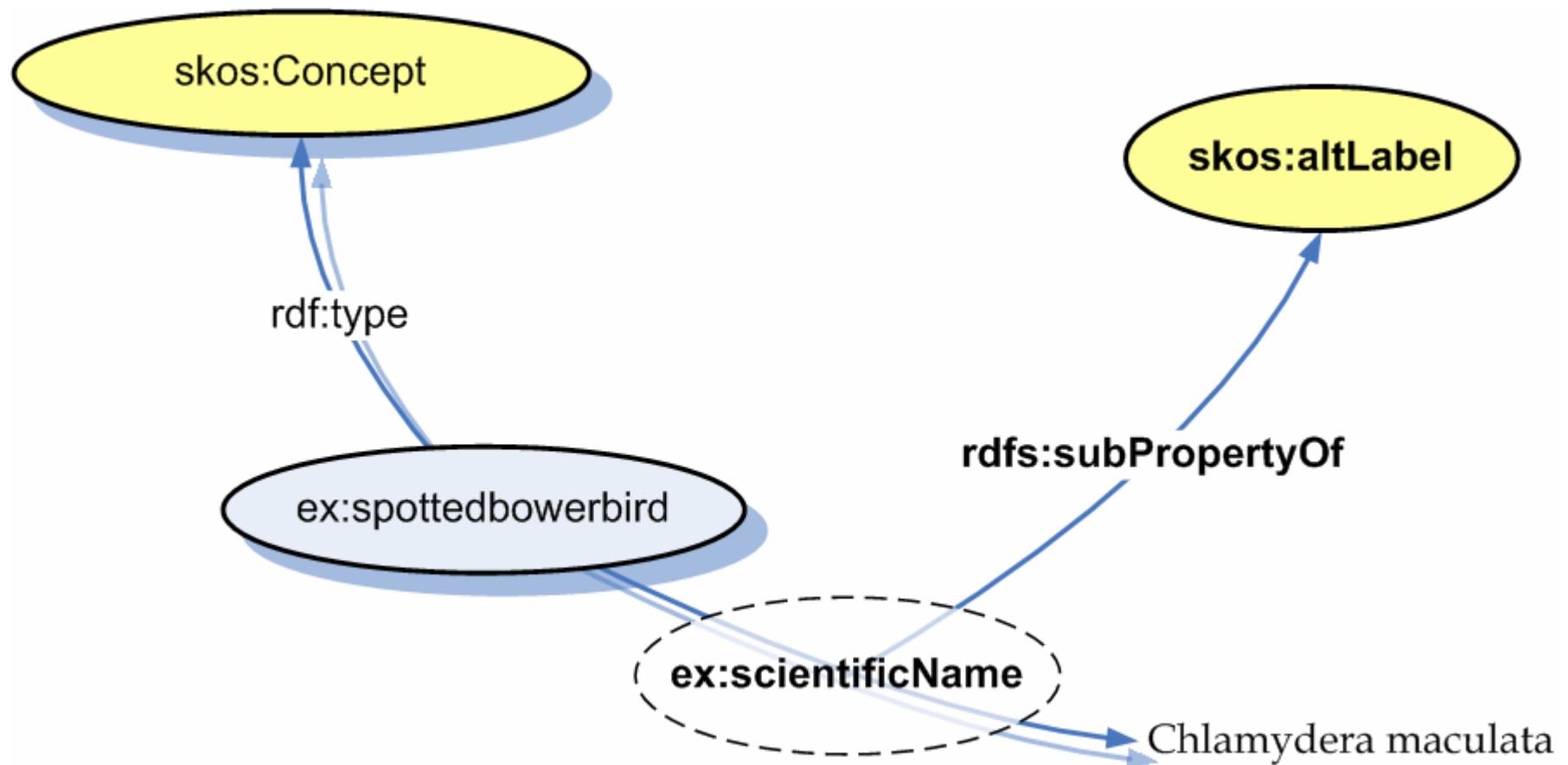
- SKOS Core can be **extended** by **refining** the classes and properties of the SKOS Core Vocabulary ...



# Labelling

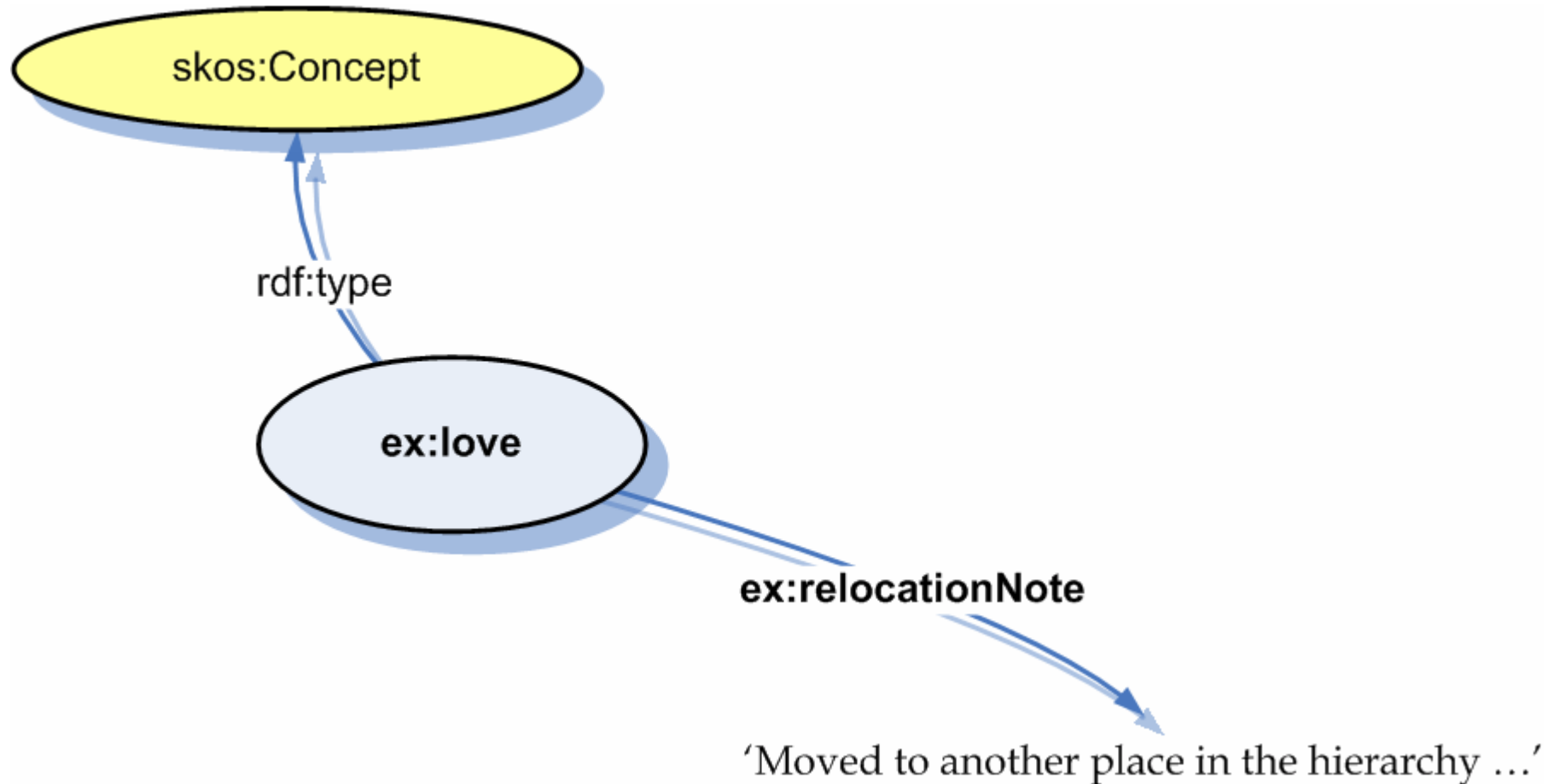


# Labelling

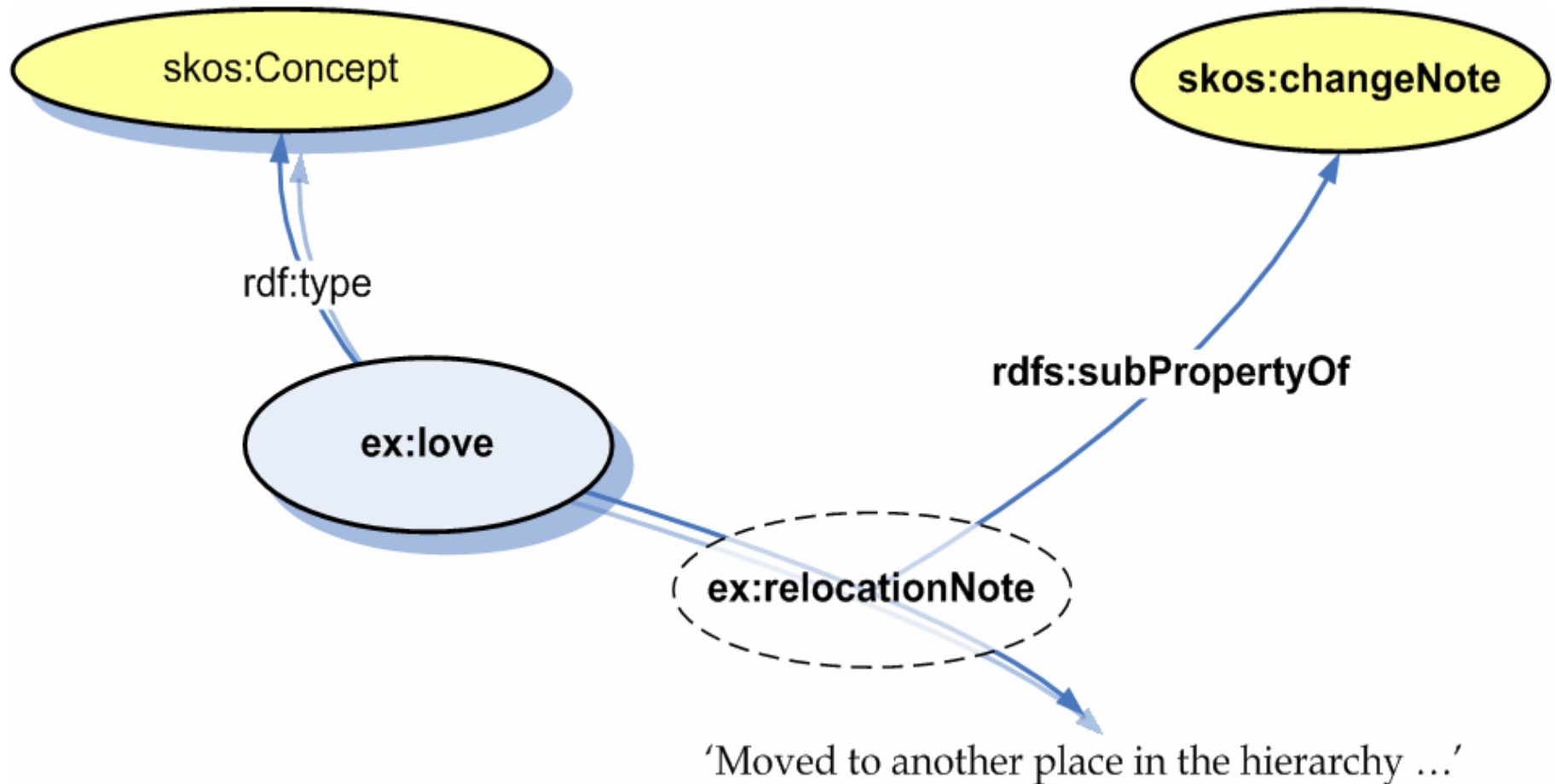




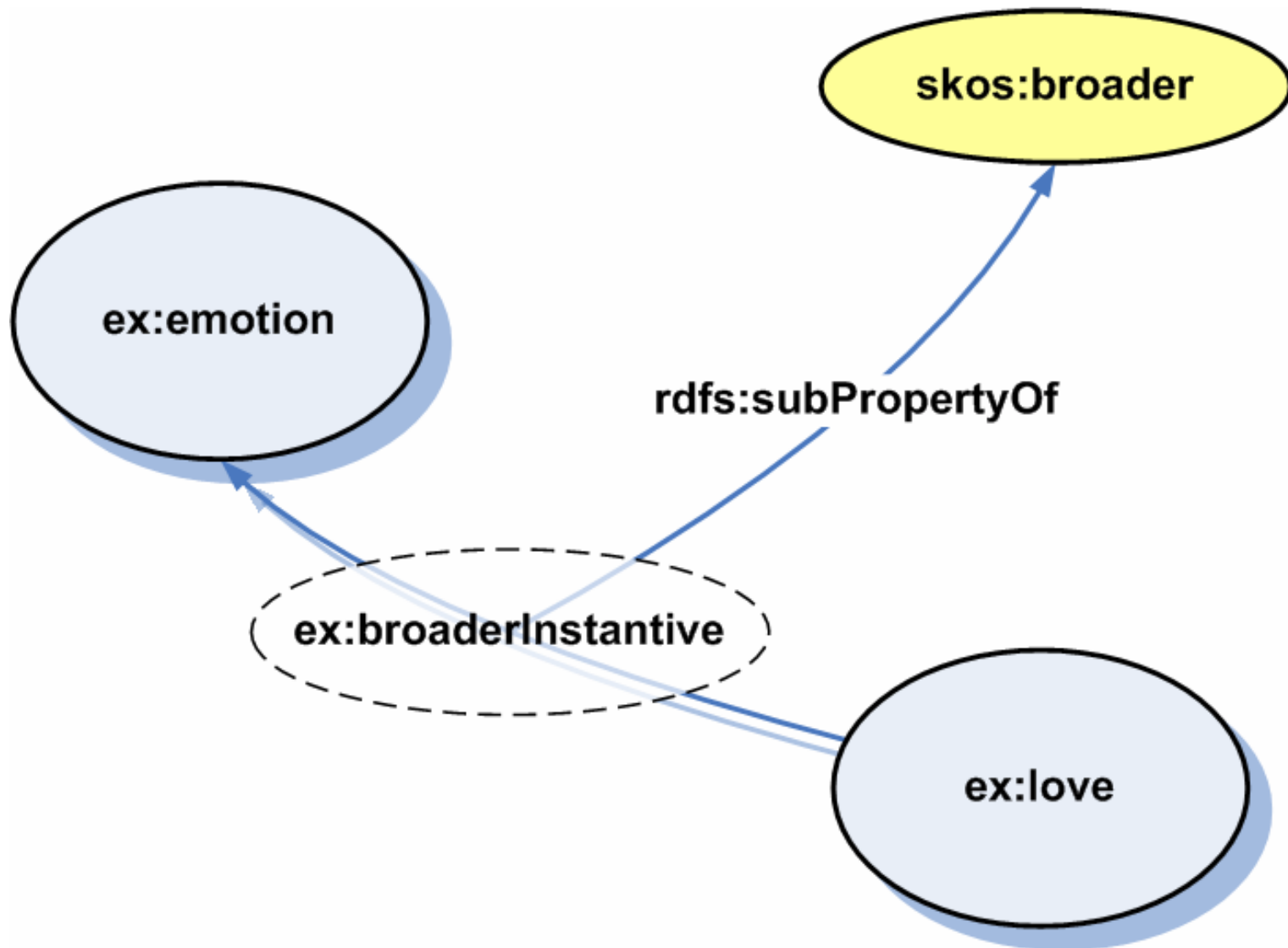
# Documentation



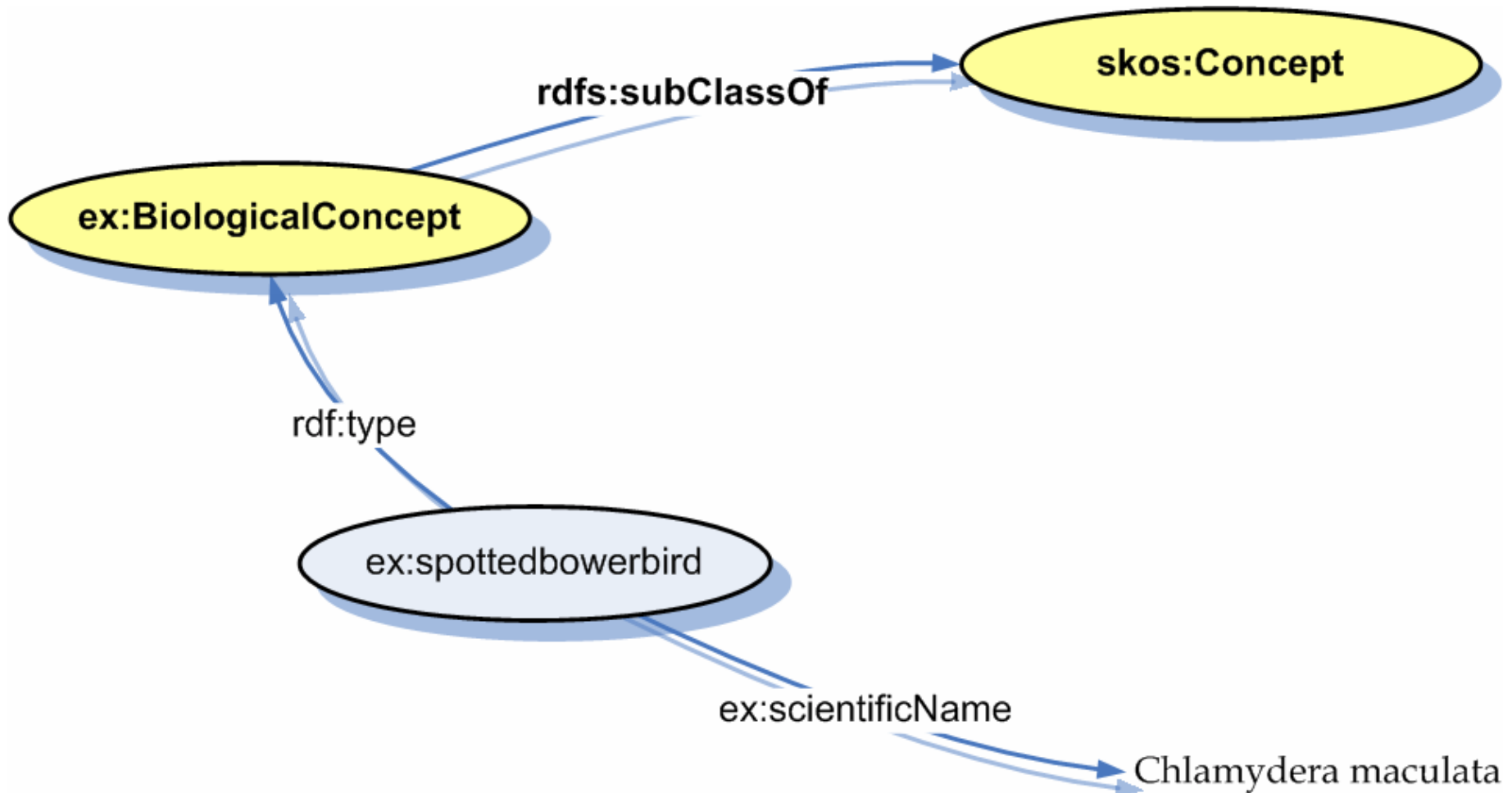
# Documentation



# Semantic Relations



# Classes of Concept



# Fundamental Facets

- E.g. AAT ...
  - Physical Attributes
  - Styles and Periods
  - Agents
  - Activities
  - Materials
  - Objects

# Fundamental Facets

- Model fundamental facets as disjoint classes of concept ...

# Fundamental Facets

```
# standard namespace prefixes

ex:PhysicalAttributesConcept a rdfs:Class;
    rdfs:subClassOf skos:Concept .

ex:StylesAndPeriodsConcept a rdfs:Class;
    rdfs:subClassOf skos:Concept .

ex:AgentsConcept a rdfs:Class;
    rdfs:subClassOf skos:Concept .

ex:ActivitiesConcept a rdfs:Class;
    rdfs:subClassOf skos:Concept .

ex:MaterialsConcept a rdfs:Class;
    rdfs:subClassOf skos:Concept .

ex:ObjectsConcept a rdfs:Class;
    rdfs:subClassOf skos:Concept .
```



# Fundamental Facets

```
# standard namespace prefixes
# Example of using the classes ...
ex:300024978 a ex:AgentsConcept;
  skos:prefLabel 'People'.
# Declare disjointness ...
ex:PhysicalAttributesConcept
  owl:disjointWith ex:StylesAndPeriodsConcept;
  owl:disjointWith ex:AgentsConcept;
  owl:disjointWith ex:ActivitiesConcept;
  owl:disjointWith ex:MaterialsConcept;
  owl:disjointWith ex:ObjectsConcept .
```



# Weighted Semantic Relations

```
# standard namespace prefixes

# Declare the bits we need ...

ex:WeightedRelation a rdfs:Class;
  rdfs:subClassOf rdf:Statement .

ex:weight a rdf:Property;
  rdfs:domain ex:WeightedRelation;
  rdfs:range xsd:integer .

# Now use them ...

[] a ex:WeightedRelation;
  rdf:subject ex:love;
  rdf:predicate skos:related;
  rdf:object ex:joy;
  ex:weight '56' .
```



# Compound Concepts

- MESH ‘qualified concepts’ e.g. ...
  - Calcimycin [standards]
  - Leukemia [complications]

# Compound Concepts

```
# Declare some bits ...

ex:CompoundConcept a rdfs:Class;
  rdfs:subClassOf skos:Concept .

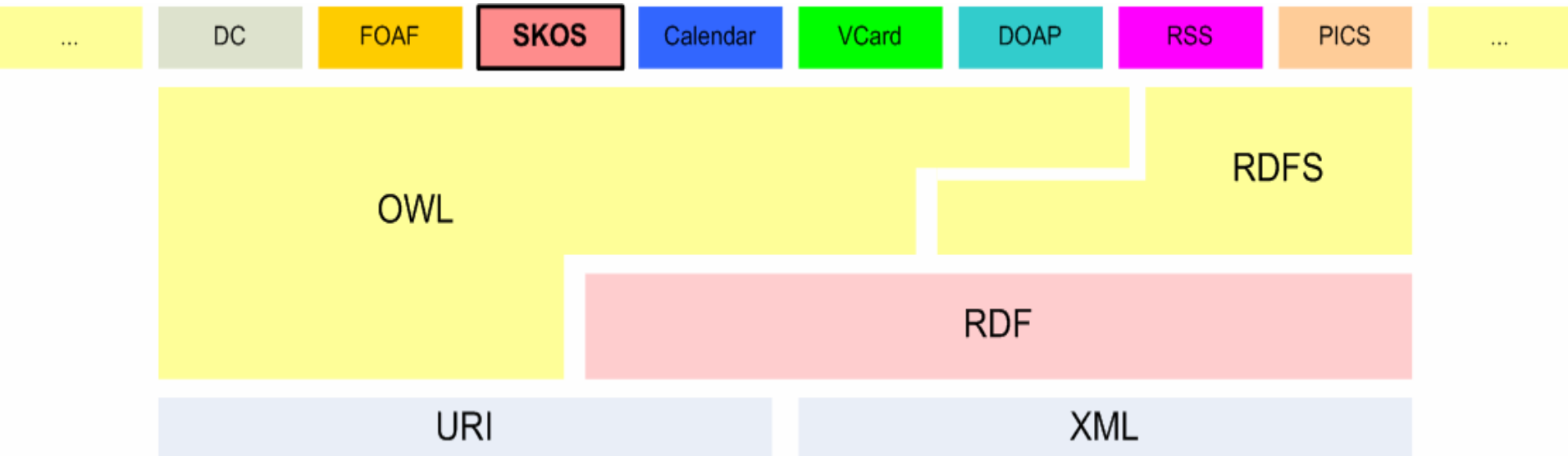
ex:main a rdf:Property;
  rdfs:domain ex:CompoundConcept;
  rdfs:subPropertyOf skos:broader .

ex:qualifier a rdf:Property;
  rdfs:domain ex:CompoundConcept;
  rdfs:subPropertyOf skos:broader .

# Now use them ...

<http://www.example.com/someDocument>
  skos:subject [
    a ex:CompoundConcept;
    ex:main ex:Calcimycin;
    ex:qualifier ex:standards;
  ].
```

# Semantic Web



# SKOS Core and RDFS/OWL

- Disjoint?
  - Should `skos:Concept` be disjoint with ...
    - `rdf:Property` ?
    - `rdfs:Class` ?
    - `owl:Class` ?
- DL?
  - Should SKOS Core be an OWL DL ontology?
    - Means not allowing flexibility in range of documentation props



# Story So Far (4)

- HTTP Publishing
- Extension by Refinement
- SKOS Core and OWL



- Goals, development, status and nature of SKOS Core
- SKOS Core features
- HTTP, extensions & OWL



## SKOS Core Homepage

<http://www.w3.org/2004/02/skos/core>

## SKOS Core Guide

<http://www.w3.org/TR/swbp-skos-core-guide>

## SKOS Core Vocabulary Specification

<http://www.w3.org/TR/swbp-skos-core-spec>

## Mailing list

<mailto:public-esw-thes@w3.org>

<http://lists.w3.org/Archives/Public/public-esw-thes/>

## This presentation

<http://isegserv.itd.rl.ac.uk/cvs-public/skos/press/dc2005/tutorial.ppt>

## Diagrams used in this presentation (feel free to re-use)

<http://isegserv.itd.rl.ac.uk/cvs-public/skos/press/dc2005/img/>

Thanks for listening ☺

