

# From Terminologies to Ontologies – Advances in Knowledge Organization

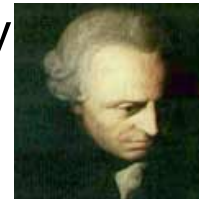
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# From Terminologies to Ontologies – Tools of Knowledge Organization

- Terminologies = structured (+/-) collections of concepts and terms in a certain language in a specific subject field
- Ontologies = formal, explicit (conceptual) models of object ranges in a computational representation
- Differences and commonalities
- Methods of organizing knowledge (personal and collective levels)
- Knowledge organization systems: all structured terminology system: classifications, thesauri, taxonomies, nomenclatures – they can be „ontologized“

# Philosophical Foundations and Historical Origins of Terminology Studies

- 17<sup>th</sup> and 18<sup>th</sup> centuries:
- Developing German as a language of science → Wolff
- Leibniz: ideal language of science
- Kant: constructionist concept theory
- 19<sup>th</sup> century: Bolzano, Hartmann, Brentano
- → Neo-Aristotelian Epistemology



# Philosophical Foundations and Historical Origins of Terminology Studies

- → Foundations of Modern Ontology and Psychology
- Foundations of Modern Logic: Frege
- Early 20<sup>th</sup> century: Brentano's school: Husserl, Meinong, Marty → philosophy of language and language theory
- Boltzmann, Mach, Carnap → Logical Positivism, Vienna Circle
- Bühler (semiotic language theory, new era of thought psychology)
- New wave of internationalist normative approaches to languages (planned languages, in particular Esperanto)
- M. Dewey: new approach to universal classification systems for indexing and retrieval in libraries and early documentation centers
- Industrialization + Globalization → generic need for standardization
- Long history of lexicography – innovations such as Schlomann

# Knowledge Organization

- Processes of organizing knowledge
  - What concept of knowledge? (Process or result, implicit/explicit, knowledge, etc.) -> Theories of knowledge
  - What concept of „organization“? (Process or result? – theories of organization)
- Psychological, cognitive concepts of knowledge (personal knowledge), concept theories, theories of categorization, prototype theory, etc.
- Linguistic theories (cognitive ling.), classification, computational ling.
- Cultural studies -> cultural knowledge, social theories (sociology of knowledge), organizing knowledge as a socio-economic process -> knowledge management
- Pedagogical concepts of knowledge (learning and knowledge acquisition), personal knowledge organization
- „epistemic-philosophical“ concepts of knowledge, systems theory
  - E.g. collective knowledge, knowledge as a result (Wissen vs. Erkenntnis!), objective knowledge (Karl Popper et al) – “logic of scientific discovery”, evolutionary epistemology, etc.
- Information science, library science – knowledge organization systems
- Computer science – digital libraries, ontologies, knowledge engineering
- Convergence through a cognitive turn of philosophy of science?

# Knowledge (organization) systems

- Cognitive knowledge systems
- collective knowledge systems, cultural systems, social systems, language and communication systems
- Formal knowledge systems, knowledge representation systems, “semantic systems” (Semantic Web)
- Applications:
  - Knowledge organization as part of knowledge management (Nonaka, Takeuchi, et al)
  - Knowledge organization as daily practice in libraries and information systems (for more than 2000 years)
  - Knowledge organization as formal representations in collective knowledge systems -> Semantic Web applications

# What is knowledge organization?

1. A part of information and library science, a part of philosophy of science and of epistemology, but also of knowledge management and knowledge engineering
  - Investigating and representing structures of knowledge
  - Epistemological aspects, cognitive science aspects
  - Linguistic and socio-cultural aspects (e.g. folk taxonomies)
  - Historical aspects (e.g. Leibniz, encyclopedism, administrative categorizations in ancient societies, history of science, etc.)
2. Practical work: creating and using knowledge organization systems (see further down)
3. Knowledge organization is also a crucial process in linguistic action (sprachliches Handeln) – Text organization both in reception and production

# Theoretical basis: systems theory

- Theory of social systems (e.g. Niklas Luhmann)
  - Sense/meaning as an axiomatic concept
  - communication as system, social expectations
  - Structure/event, reduction of social complexity
- Systems theory (control, intervention, social processes) by Helmut Willke
  - Point of departure for a theory of knowledge management
- Formal systems theory by Herbert Simon
  - Contributing to the foundations of Artificial Intelligence, Informatik
- Semiotic systems theories
  - Peirce, Cassirer, Eco
  - Communication as system (linguistic theories – Saussure, Chomsky, Halliday, etc.)
- Systems theories in cultural studies
  - Cassirer, Hansen, Sperber, etc.
- Systems theory in pedagogy, etc.



# Knowledge organization systems

- Covers all concept systems and terminologies used for ordering and retrieving knowledge (knowledge units, artifacts, etc.), such as
  - Classification systems
  - Thesauri
  - Indexing systems
  - Taxonomies
  - Nomenclatures
  - „Ontologies“
  - Etc.
- ..each having their own prototypical data models, purposes, traditions, but also many hybrid forms

# Functions of knowledge organization systems

1. Instruments of structuring and archiving the content of large scale collections
2. Structural components of information systems
3. Support of targeted retrieval of information based on conceptual search criteria
4. Search aids, visual navigation, query languages
5. Communication support tools (cross-lingual, cross-disciplinary, cross-cultural)
6. Instruments of corporate knowledge management
7. Learning support, orientation support, didactic tools

# Properties of knowledge organization systems

1. Conceptual structures (hierarchical and non-hierarchical structures)
2. Explicitation of conceptual links, definitions (mono- or multilingual)
3. Terminological and linguistic standardization
4. Increasingly formalized and digital (in particular as „ontologies“)
5. Different scales (from small KOS to large ones (more than 200.000 concepts))
6. Increasingly with visualized structures, interactive user interfaces
7. Static or *dynamic* (e.g. ontologies for modelling business processes in companies)

# „Ontologies“ as formal knowledge systems

- Computer science: From Ontology as a traditional field of philosophy (theory of being, existence, theory of objects, etc.) to formal, digitally represented concept systems/ knowledge systems
- Concepts are explicitly defined – terms are assigned
- Relations between concepts are explicitated
- Terms are standardized
- Logical application rules and constraints are specified
- Ontologies as knowledge representation systems

# Domain-specific knowledge organization systems

- Medicine, health, bio- and life sciences
- Business, trade
- Industry, engineering
- Natural sciences
- Administration, government
- Culture
- Pedagogy
- Linguistics
- Etc.

# General trends in knowledge organization

- Dynamization, flexibilization
- Networking, contextualization
- De-hierarchization
- Visualization
- Multi-functional
- Hybridization
- Formalization, automation
- Internationalization

# Problem Description

1. There is (still) a communication gap between formalized knowledge representations such as ontologies and users of information and communication systems, where such ontologies are used, also on user interfaces.
2. Although the Semantic Web has been designed primarily for machine-to-machine-communication, we need seamless natural language interaction workflows in (semantic) web services of any kind
3. While the Semantic Web is (still) essentially monolingual and the international lingua franca is English, there is a growing need for multilingual ontology resources as well as ontology-based translation services that overcome communication barriers arising from cultural-linguistic differences, lack of excellent command of English, need for high precision in communication, etc.

# Need for integration of diverse methods

- As expressed in standards and implemented in technologies, the following “traditions” increasingly merge:
  - Ontology engineering standards, frameworks, technologies
    - e.g. OWL (based on RDF), SKOS (also on RDF) (W3C), DOLCE/SUMO, description logic, frame logic, unified logic, annotation
    - Types of ontologies (e.g. domain o., upper o., application o., task o.)
    - Editors such as Protégé, Altova, OntoEdit, div. merging/annotation tools
  - Translation engineering standards
    - i.e. various paradigms in machine translation and computer-assisted translation (language-based, statistical MT, Transl. Memories, patterns)
  - Terminology and language engineering standards (as the pre-requisite for and interface between ontology and translation)
    - Terminology and lexical markup frameworks: TMF, LMF (ISO)
    - Markup languages such as TBX (language industry+ISO)
    - Lexical databases/ling.ontol: WordNet, Ontowordnet, EuroWordNet
    - Linguistic enrichment of ontologies (e.g. FrameNet)
    - Interaction mechanisms, translation of ontologies
    - Integration of multilingual ontologies in machine translation processes



# Diversity and interoperability

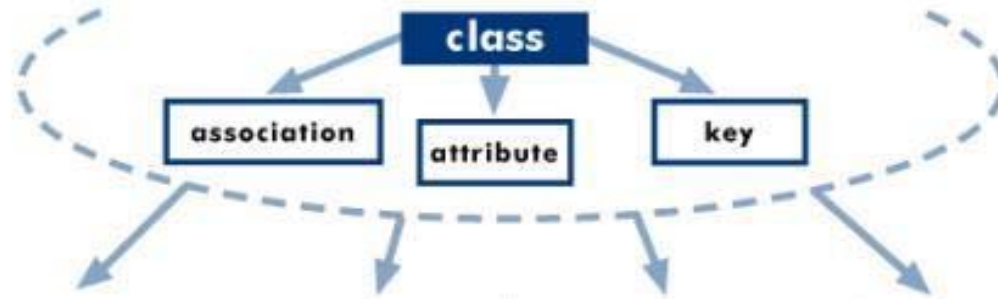
- Strong diversity of lexico-terminological resources
  - Data models, data structures + data semantics
  - Diversity of semantic, linguistic/cultural complexity and semantic depth/richness
- Diversity of user groups and their requirements
- Sheer quantity of resources
- Data interchange between organizations (within and across domains) as well as (distributed) data integration – early needs asking for immediate solutions



- History of data modeling
- History of interchange standards
- History of semantic interoperability management

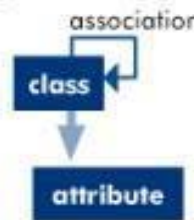
# Need for multi-level modeling architectures

meta-metamodel  
boxes are  
meta-meta-metadata

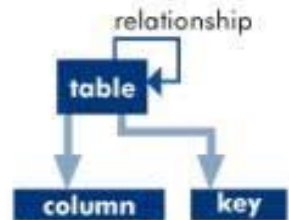


metamodel  
boxes are  
meta-metadata  
(meta-entities)

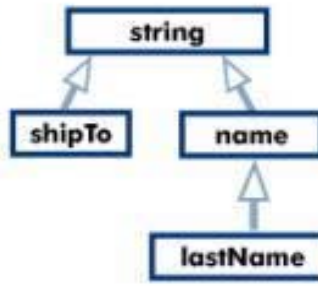
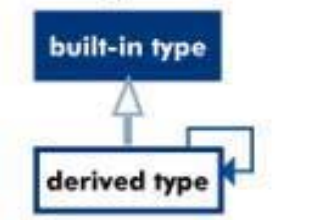
Object Metamodel



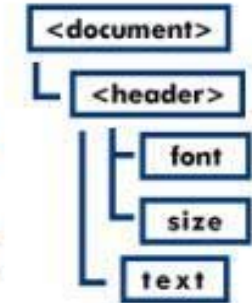
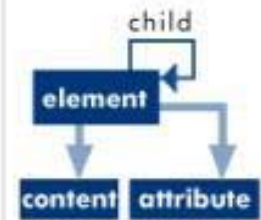
Relational Metamodel



Data Type Metamodel



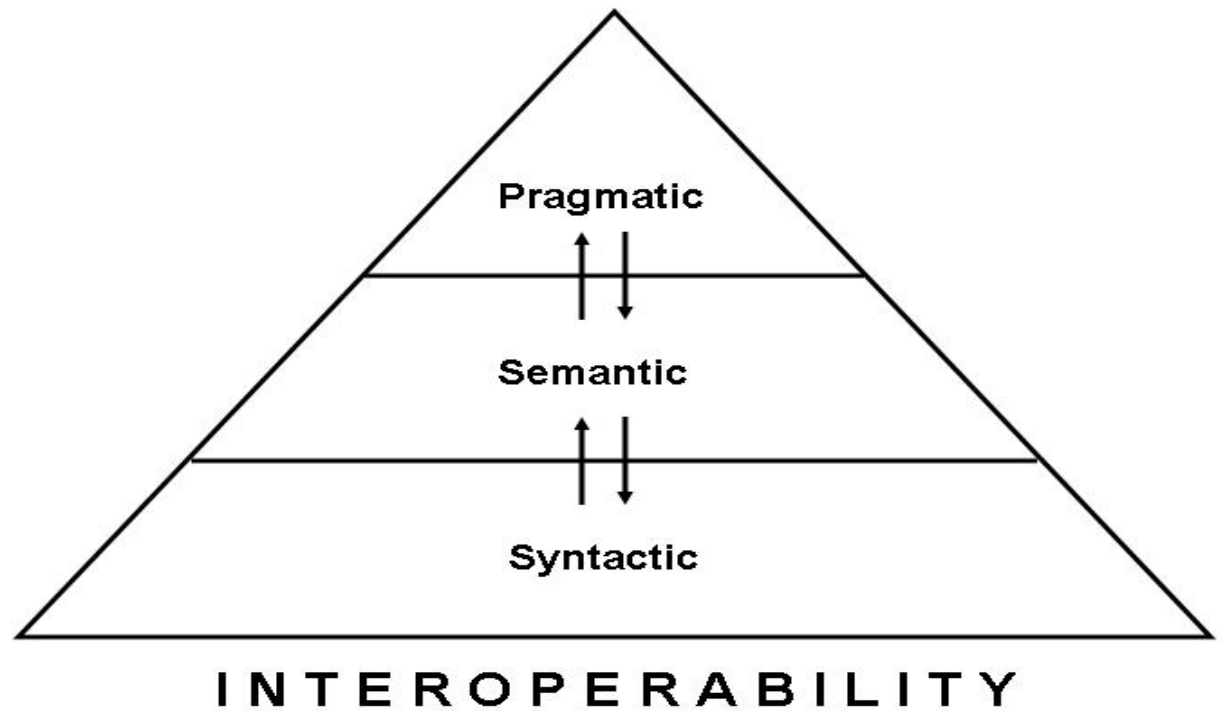
XML Metamodel



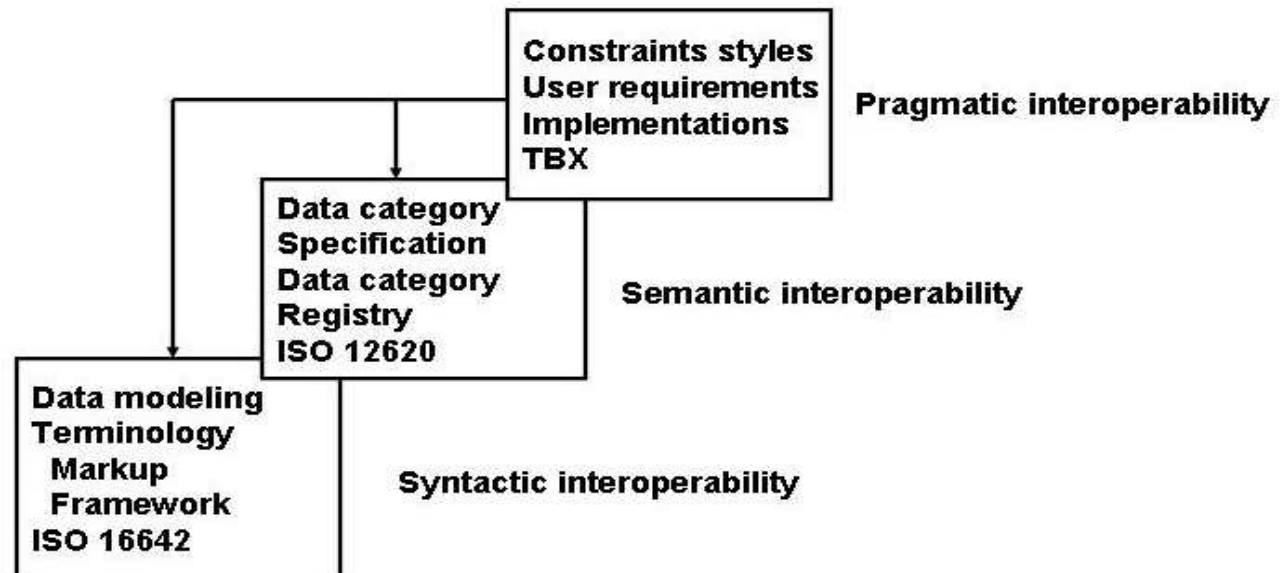
model  
boxes are metadata  
(entities, instances)

data

generic  
interoperability  
framework



terminological  
interoperability



# Developing the Terminology Markup Framework in order to cope with this complexity-diversity

- Based on empirical studies and practical user-driven requirements analysis
- Markup/representation/modeling: XML, XMLS, RDF, UML
- Open standards strategy (ISO TC 37)
  - ISO 12620 Data categories – meta-model element + semantics registry (RDF)
  - ISO 16642 Terminology Markup Framework (TMF) – meta-model architecture and specifications (UML)
  - ISO 12200 – Terminology Markup Language (XML)
    - Instance for language industry: TBX Termbase Exchange Format (XML)
    - Instance for lexicography/publishing: LexML ISO 1951
  - Lexical Markup Framework (LMF) (UML)
  - ISO 704 and ISO 1087 (foundational level)
  - ISO 15188 (workflow and collaborative issues)
  - Alignment with ISO 11179, W3C, OASIS, etc.

# Introduction to TBX

- TBX® stands for TermBase eXchange
- TBX is a Terminological Markup Framework (TMF) markup language
  - TMF is an ISO standard (16642)
- TBX is consistent with ISO 12200 (MARTIF)
- TBX is maintained by OSCAR ([www.lisa.org](http://www.lisa.org))
- The TBX specification is free
- Serving portability of resources across proprietary terminology management systems, as well as interoperability of application-specific resources

# TBX structure

- A TBX file is an XML document
- A TBX file consists of:
  - A header that describes the file
  - A set of entries, one per concept in the termbase
  - For each concept, a set of terms, grouped by language, that designate the concept
- A terminological concept entry (termEntry)
  - Can be multilingual
  - Can be monolingual

# TBX and Other Standards

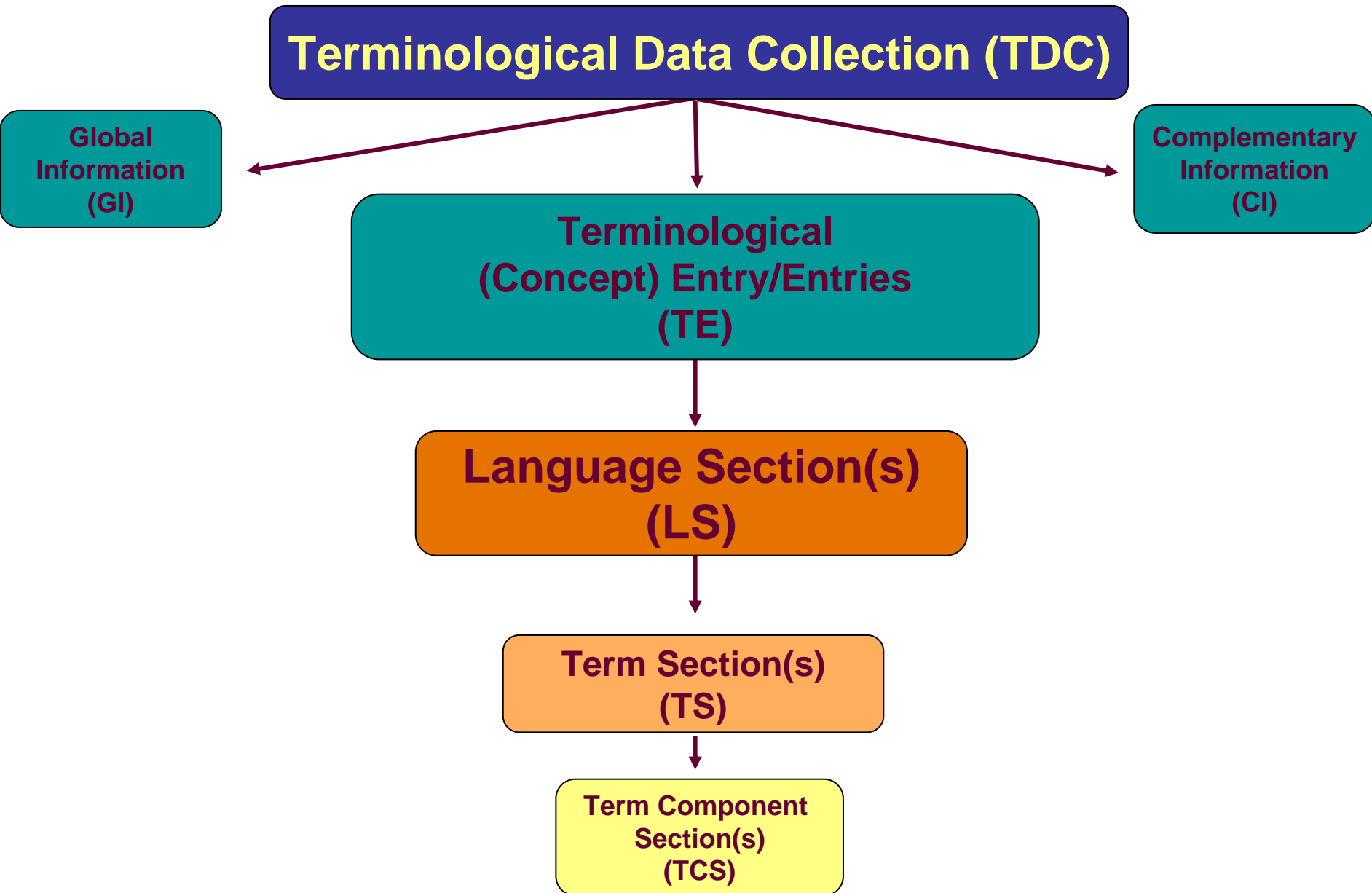
- (1) TBX and ISO 16642 (TMF)
- (2) TBX and ISO 12620 (Data Categories)
- (3) TBX and SKOS

# 1: TBX and ISO 16642

- TBX is a TML (Terminological Markup Language) of TMF (ISO 16642) (see Annex B)
- TBX maps to the TMF meta-model
  - A TBX file is a TDC (terminological data collection)
  - `martifHeader` provides GI (global information)
  - `termEntry`: TE (terminological entry)
  - `langSet`: LS (language section)
  - `tig/ntig`: TS (term section)
- A TMF DCS (Data Category Selection) in TBX is in XCS (eXtensible Constraint Specification) format
- TBX uses ISO 12200 for its XML style



# TMF Metamodel



# TMF and lexical resources

- In general, a terminological resource is organized into **concept entries**, each of which includes one or more terms designating a particular concept
- In general, a lexical resource is organized into **lexical entries**, each of which includes one or more senses of a particular lexical item (a word or phrase)
- A concept entry containing multiple terms can be split into multiple lexical entries, one per term, and multiple lexical entries associated with the same concept can be combined into one concept entry
- [Link to Lexical Markup Framework \(LMF\)](#)

## 2: TBX and ISO 12620

- All data categories in the default TBX DCS are taken from ISO 12620
- ISO 12620 is organized as an online registry and serves as a meta-ontology for resource modeling and for resource interoperability

# 3: TBX and SKOS

- A typical concept entry will contain a subject field to specify the domain of the concept.
- However, the subject field is typically some kind of hierarchy that is flattened into a string within TBX
- SKOS makes it possible to represent the subject field hierarchy as a hierarchy and then create a link within TBX

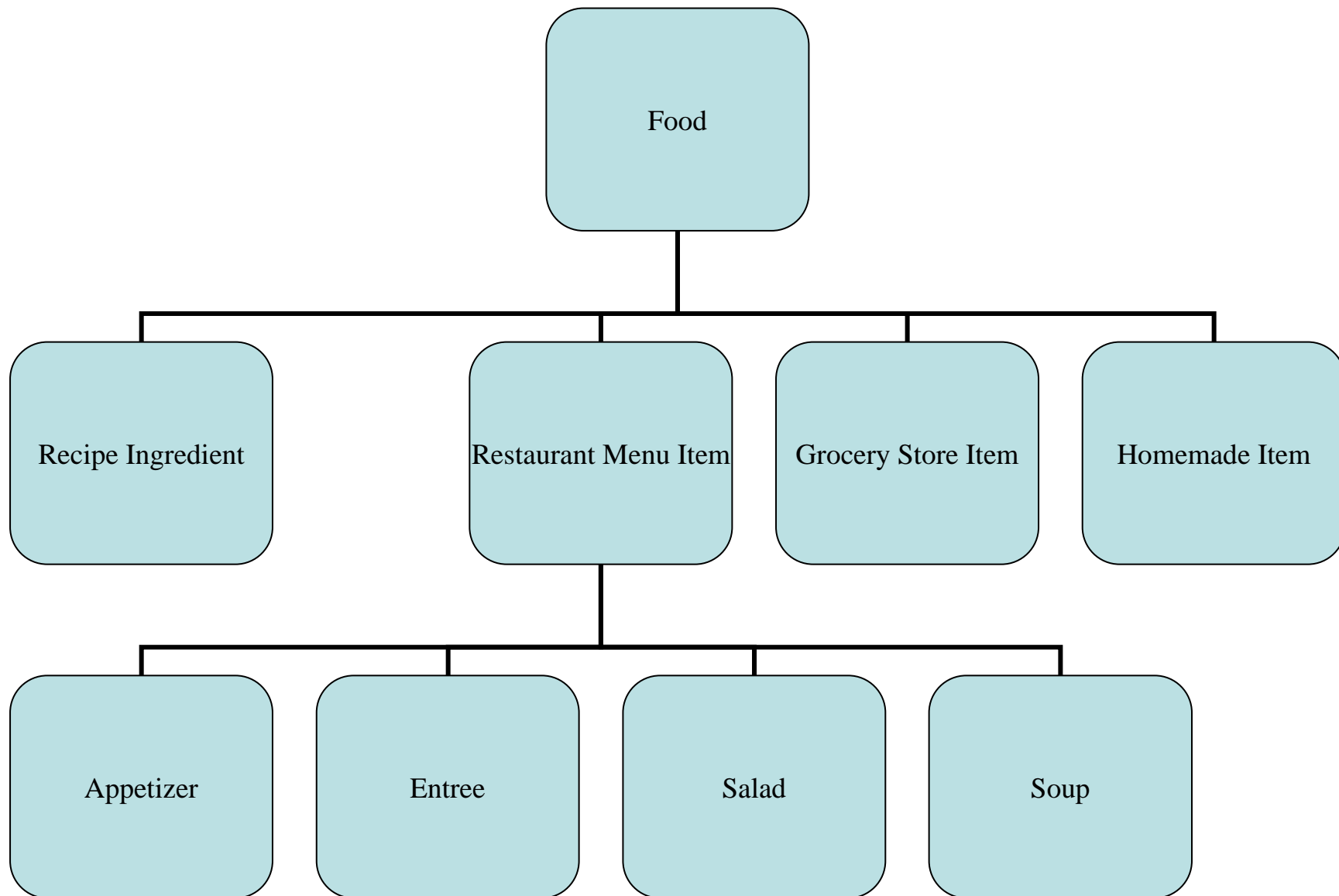
# Simple Knowledge Organization System (SKOS)

- “SKOS is an area of work developing specifications and standards to support the use of knowledge organisation systems (KOS) such as thesauri, classification schemes, subject heading lists, taxonomies, other types of controlled vocabulary, and perhaps also terminologies and glossaries, within the framework of the Semantic Web.”
  - <http://www.w3.org/2004/02/skos/> (Accessed on 3/17/06)

# Sample SKOS

- `<skos:Concept rdf:about="#s71">`
- `<skos:prefLabel>Food</skos:prefLabel>`
- `<skos:narrower rdf:resource="#s81"/>`
- `<skos:narrower rdf:resource="#s79"/>`
- `</skos:Concept>`
  
- `<skos:Concept rdf:about="#s81">`
- `<skos:prefLabel>Recipe Ingredient</skos:prefLabel>`
- `<skos:broader rdf:resource="#s71"/>`
- `</skos:Concept>`
  
- `<skos:Concept rdf:about="#s79">`
- `<skos:prefLabel>Restaurant Menu Item</skos:prefLabel>`
- `<skos:broader rdf:resource="#s71"/>`
- `</skos:Concept>`

# Visual Representation of SKOS

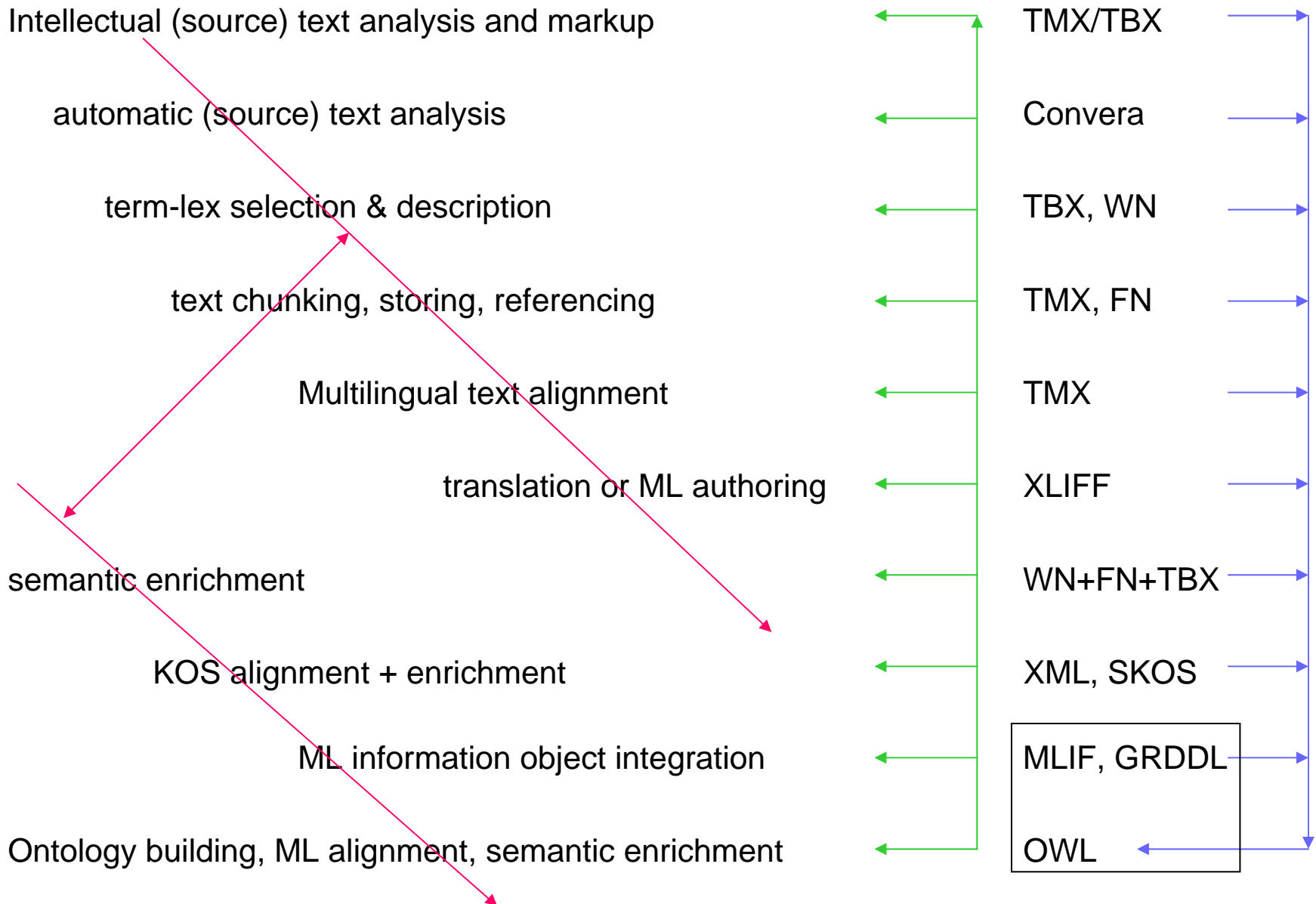


# Moving up (and down) the Ontology Spectrum

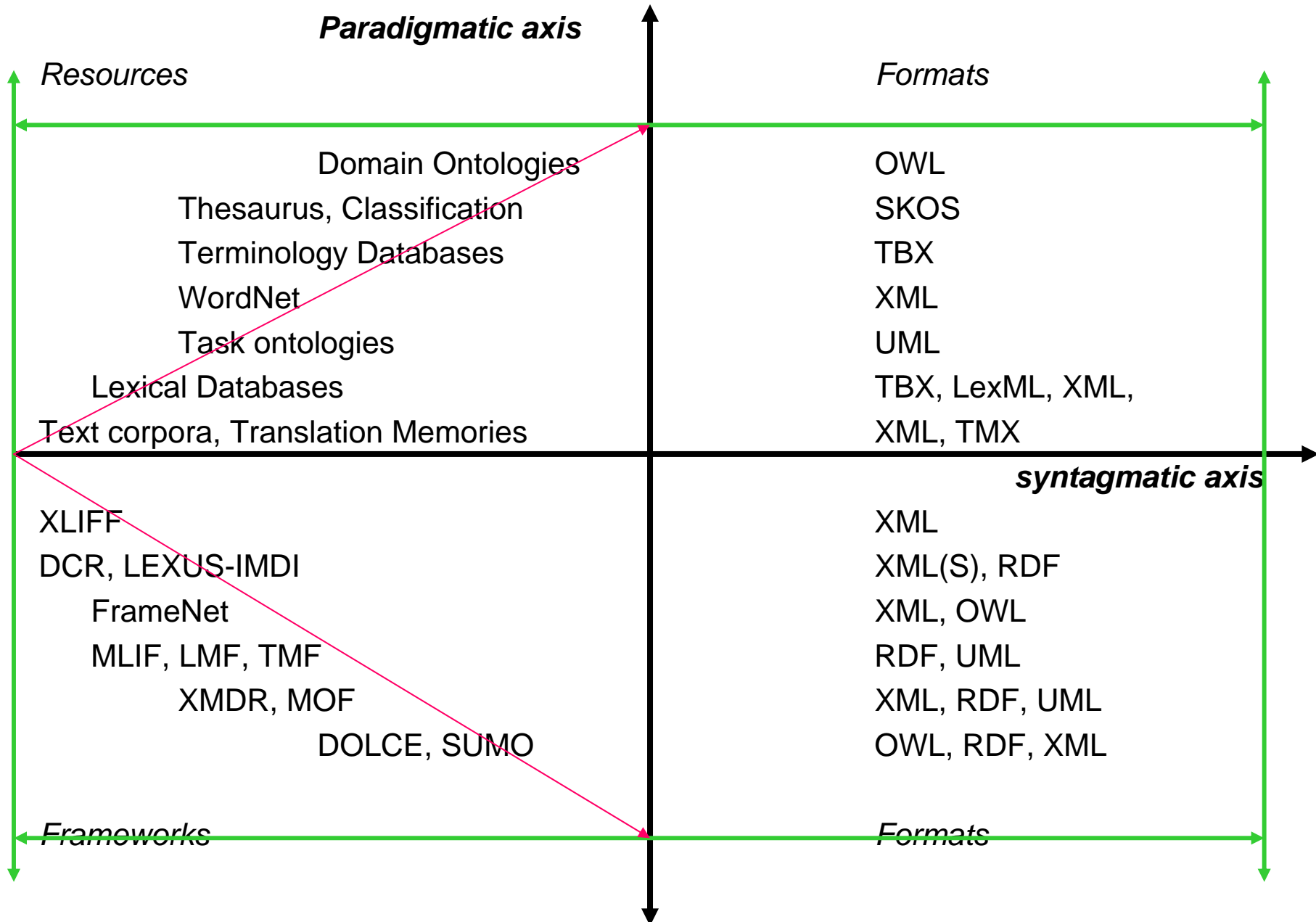
- The challenge: from linguistic-cultural diversity of discourse and free-form lexical structures to a unified, formalized, axiomatized ontology – and back, to support human understanding and social processes such as collaborative learning
- The method: an integrative, multi-level modelling approach specifying the steps in a process-oriented workflow framework (with variable, combinable steps depending on concrete needs) for
  - Gradual semantic enrichment
  - Gradual semantic formalization
  - Multi- and cross-lingual referencing/alignment for text management
  - Constant interaction between full texts and lex-term resources
- The technology: a multi-component workbench (i.e. Dynamont-WB incl. ProTerm/Convera as a central element), using GRDDL, XML, RDF, OWL, SKOS, WordNet + GlobalWordnet, MLIF (containing TBX, TMX, XLIFF, LMF, TMF, etc.), FrameNet, etc.
- The advantage: full exploitation of all types of languages resources (LR) and knowledge organization systems (KOS), providing a framework not only for their semantic enrichment and formalization as ontologies but also for ontology-based multilingual authoring, text generation and translation



# An Integrated Process<+>Component Model



# A Multidimensional Meta-Model: Resource-Format Matrix



# The global risk communication scenario

- Many projects since 1994 covering the following activities:
  - Thesaurus building
  - Creating multilingual terminology databases
  - Creating multilingual text corpora
  - Lexicographical glossary
  - Semantic enrichment (e.g. conceptual links, frame semantics)
  - Collection and analysis of relevant knowledge organization systems
  - Annotation of resources
  - Mark-up of resources (TBX, etc.)
  - Ontology building
  - Communication design

# From texts and terminologies to ontologies

- Using the Risk scenario
  - Termbase
    - Export XML
    - Domain Models – meta-models -> patterns
  - Text corpus
    - Term extraction – comparative testing ProTerm, MultiTerm Extract, MultiCorpora
    - Aligning with termbase
    - Convert to RDF
  - Ontology import -> editor
  - Mappings (GMT, XML, RDF, OWL, UML, comma delimited, RDB, for different kinds of lex-term resources, FN->OWL, etc.)
- The MULTH-WIN Project as an example of methods integration:



## Glossary

The following terms may help you navigate through this information kit.

### **Climate change**

Refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer).

### **Disaster**

A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

*A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.*

### **Disaster risk reduction (disaster reduction)**

The conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.

### **Early warning**

The provision of timely and effective information, through identified institutions, that allow individuals exposed to a hazard, to take action to avoid or reduce their risk and prepare for effective response.

- acceptable risk
- radio
- diversity
- biological hazard
- chemical hazard
- climate change
- carrying capacity
- cosmic radiation
- capture
- data processing
- data protection
- database
- aster
- aster aid

multtest

Project: Untitled.xdp

multtest

Entry level  
 Entry number: 3  
 ConceptID A3  
 RiskManagementCycle A. risk assessment and technology, E. Damage assessment

**EN English**  
**acceptable risk**

GramInfo noun phrase, sg, pl  
 Definition degree of human and material loss that is perceived by the community or relevant authorities as tolerable in actions to minimize cf. disaster cf. risk (TESEC-EUR-OPA-GEM 2001)  
 the level of loss a society or community considers acceptable given existing social, economic, political, cultural, technical and environmental conditions  
 Comment in engineering terms, acceptable risk is also used to assess structural and non-structural measures undertaken to reduce possible damage at a level which does not harm people and property, according to codes or "acceptable practice" based, among other issues, on a known probability of hazard (ISDR 2004)

**French**  
**risque acceptable**

GramInfo phrasnom, m, sg, pl  
 Definition 1er sens: un risque est acceptable en référence à un objectif de sécurité donné.  
 2ème sens: un risque est acceptable s'il est inférieur à un seuil (par exemple 10<sup>-6</sup> /an).  
 3ème sens : risque avec lequel on consent à vivre en contrepartie d'un bénéfice et dans la mesure où il est contrôlé. (ASR)

**German**  
**akzeptierbares Risiko**

GramInfo Nomphras, N, Sg, Pl -en  
 Definition die möglichen Verluste, Schäden, die ein Land, eine Gemeinschaft oder eine Person bereit ist auf sich zu nehmen, anstelle der für die Verringerung eines solchen Risikos erforderlichen Bereitstellung von Kapital und Ressourcen (EUD)  
 das akzeptierte Risiko entspricht den Verlusten, die eine Gesellschaft oder Gemeinde unter den existierenden sozialen, ökonomischen, politischen, kulturellen, technischen und Umwelt-Bedingungen als annehmbar einstuft, weil das Risiko als vernachlässigbar betrachtet wird, weil der mit dem Risiko verbundene Nutzen das Risiko akzeptabel macht oder weil eine (weitere) Risikoreduktion einen unverhältnismäßig großen Aufwand bedeuten würde. Das akzeptierte Restrisiko ist demnach auch das Risiko, das nach der Realisierung von Schutzmaßnahmen mit einem bestimmten Schutzgrad verbleibt. (BDR)

SemInfo: acceptable risk (R)  
 TOLERATE [ [ACTOR/VICTIM=], [DANGER [DAMAGE [SOURCE=], [DEGREE= ], [TARGET=], [COSTS=] ] ] ]

RelatedTermsAndExpressions: noun phrases:  
 annehmbares Risiko (N, Sg, Pl-en), akzeptables Risiko (N, Sg, Pl-en), akzeptiertes Risiko (N, Sg, Pl-en), tolerierbares Risiko (N, Sg, Pl-en)

## Senses of risk

e 1

ard, jeopardy, peril, **risk**, endangerment -- (a source of danger; a possibility of incurring loss or misfortune; "drinking alcohol is a health hazard")

=> danger -- (a cause of pain or injury or loss; "he feared the dangers of traveling by air")

=> causal agent, cause, causal agency -- (any entity that produces an effect or is responsible for events or results)

=> physical entity -- (an entity that has physical existence)

=> entity -- (that which is perceived or known or inferred to have its own distinct existence (living or nonliving))

e 2

peril, danger -- (a venture undertaken without regard to possible loss or injury; "he saw the rewards but not the risks of crime"; "there was a danger he would do the wrong thing")

=> venture -- (any venturesome undertaking especially one with an uncertain outcome)

=> undertaking, project, task, labor -- (any piece of work that is undertaken or attempted; "he prepared for great undertakings")

=> work -- (activity directed toward making or doing something; "she checked several points needing further work")

=> activity -- (any specific behavior; "they avoided all recreational activity")

=> act, human action, human activity -- (something that people do or cause to happen)

=> event -- (something that happens at a given place and time)

=> psychological feature -- (a feature of the mental life of a living organism)

=> abstraction -- (a general concept formed by extracting common features from specific examples)

=> abstract entity -- (an entity that exists only abstractly)

=> entity -- (that which is perceived or known or inferred to have its own distinct existence (living or nonliving))

e 3

risk of infection -- (the probability of becoming infected given that exposure to an infectious agent has occurred)

=> probability, chance -- (a measure of how likely it is that some event will occur; a number expressing the ratio of favorable cases to the whole number of cases possible; "the probability that an unbiased coin will fall with the head up is 0.5")

=> measure, quantity, amount -- (how much there is of something that you can quantify)

=> abstraction -- (a general concept formed by extracting common features from specific examples)

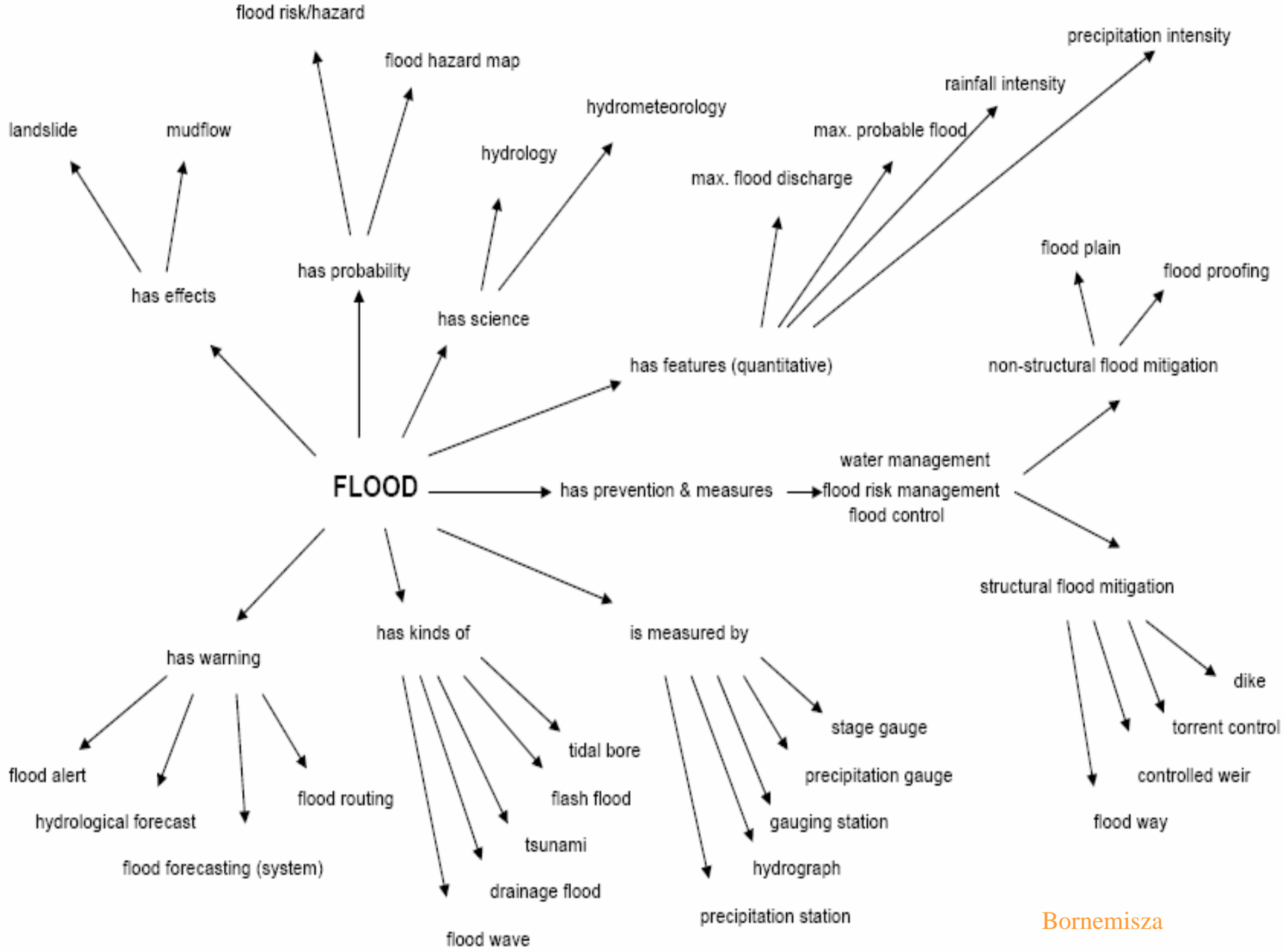
=> abstract entity -- (an entity that exists only abstractly)

=> entity -- (that which is perceived or known or inferred to have its own distinct existence (living or nonliving))

e 4

risk of exposure -- (the probability of being exposed to an infectious agent)

=> probability, chance -- (a measure of how likely it is that some event will occur; a number expressing the ratio of favorable cases to the whole number of cases possible; "the probability that an unbiased coin will fall with the head up is 0.5")





# Terminological frame semantics

- INTERVENTION (ACTOR(S), ACTIVITIES/PHASES):
- **RISK DETECTING (PRE-EVENT)**
- - **R-ASSESSMENT**
- - R-PERCEPTION (*X is risk*)
- - EXPERIENCE (statistics, case studies)
- - OBSERVATION (monitoring)
- - METHOD
- - SATELLITE
- - PROGNOSSES
- - R-ANALYSIS
- - R-FEATURES
- - SITUATION/CONTEXT (danger/hazard)
- - SIMULATION (course of events)
- - PROBABALISTIC METHODS (safety)
- - RELIABILITY
- - R-IDENTIFICATION (DAMAGE)
- - R-SOURCE
- - DAMAGE CAUSE
- - VULNERABILITY (DAMAGE TARGET)
- - SUSCEPTABILITY (capacity/people)

# Terminological frame semantics

I. Pre-event B. Public awareness and planning, II. In-event: C.  
Events and response

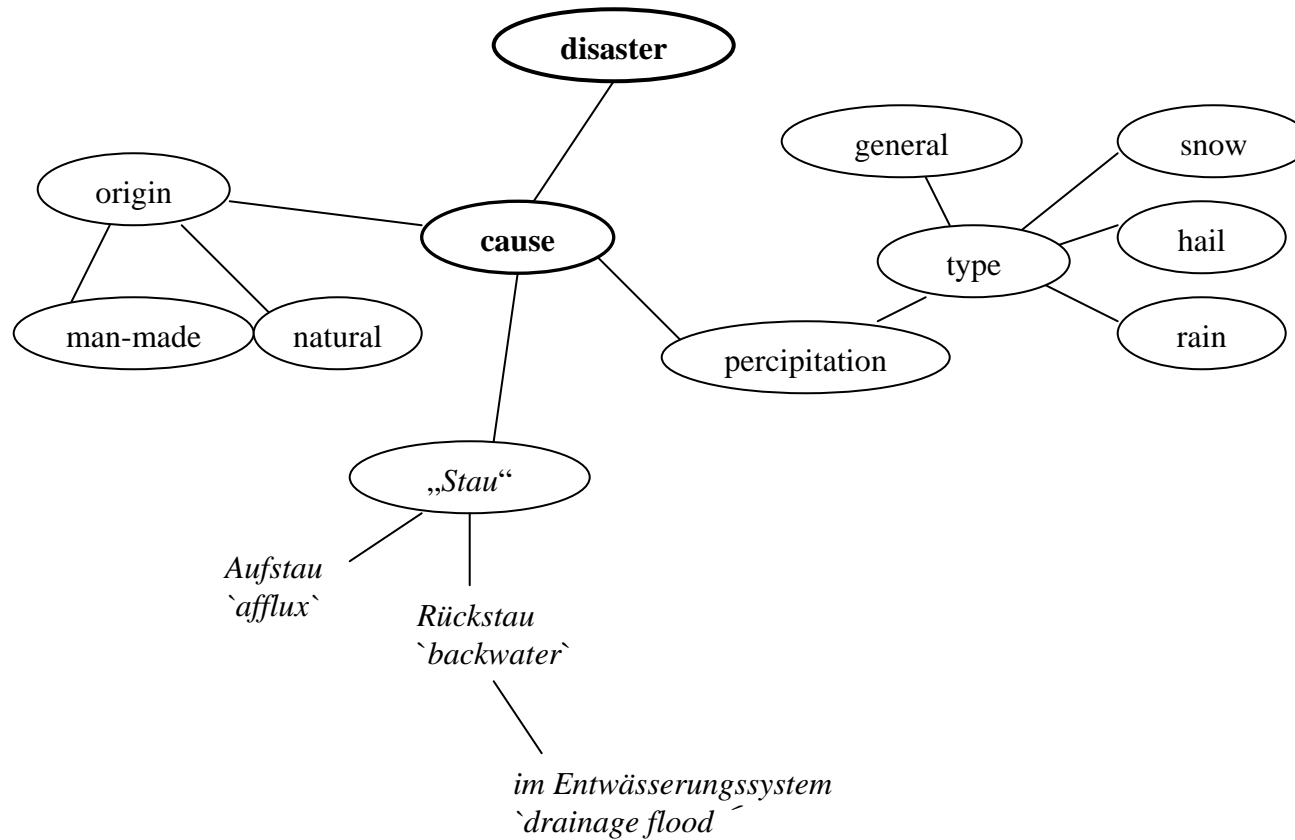
## **afflux/Hochwasser durch Aufstau**

BE [[TYPE=flood], [PLACE=], [TIME=]],  
HAVE [CAUSE [[ORIGIN=], [NIEDERSCHLAG [TYPE=]], [STAU  
[TYPE= *Aufstau*]]],  
DAMAGE [TARGET=, SOURCE=, DEGREE=]],  
HAPPEN [STATES=, PROCESSES=]]

## **backwater/Rückstau**

BE [[TYPE=flood], [PLACE=], [TIME=]],  
HAVE [CAUSE [[ORIGIN=], [NIEDERSCHLAG [TYPE=]], [STAU  
[TYPE= *Rückstau*]]],  
DAMAGE [TARGET=, SOURCE=, DEGREE=]],  
HAPPEN [STATES=, PROCESSES=]]

# Relationship modeling



p1:VENTURE\_1

p1:UNDERTAKING\_PROJECT\_TASK\_LABOR

p1:WORK\_1

p1:ACTIVITY\_1

p1:ACT\_HUMAN\_ACTION\_HUMAN\_A...



uri: p1:ACT\_HUMAN\_ACTION\_...

"something that people do or cause to happen"

uri: p1:ACTIVITY\_1

any specific activity or pursuit; 'they avoided all recreational activity'"any specific activity or pursuit; 'they avoided all recreational activity'"

uri: p1:WORK\_1

activity directed toward making or doing something; 'she checked several points needing further work'

uri: p1:UNDERTAKING\_PROJECT...

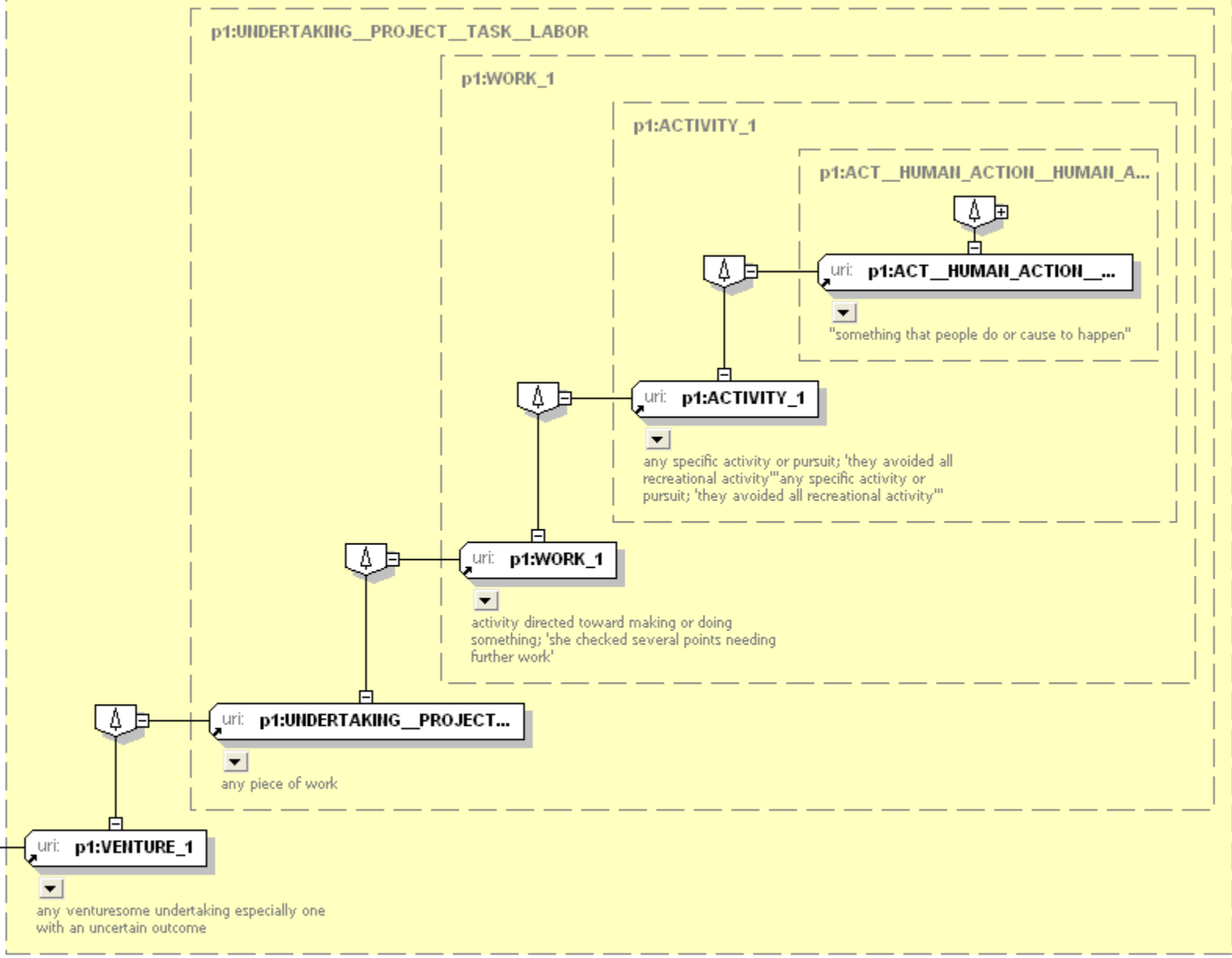
any piece of work

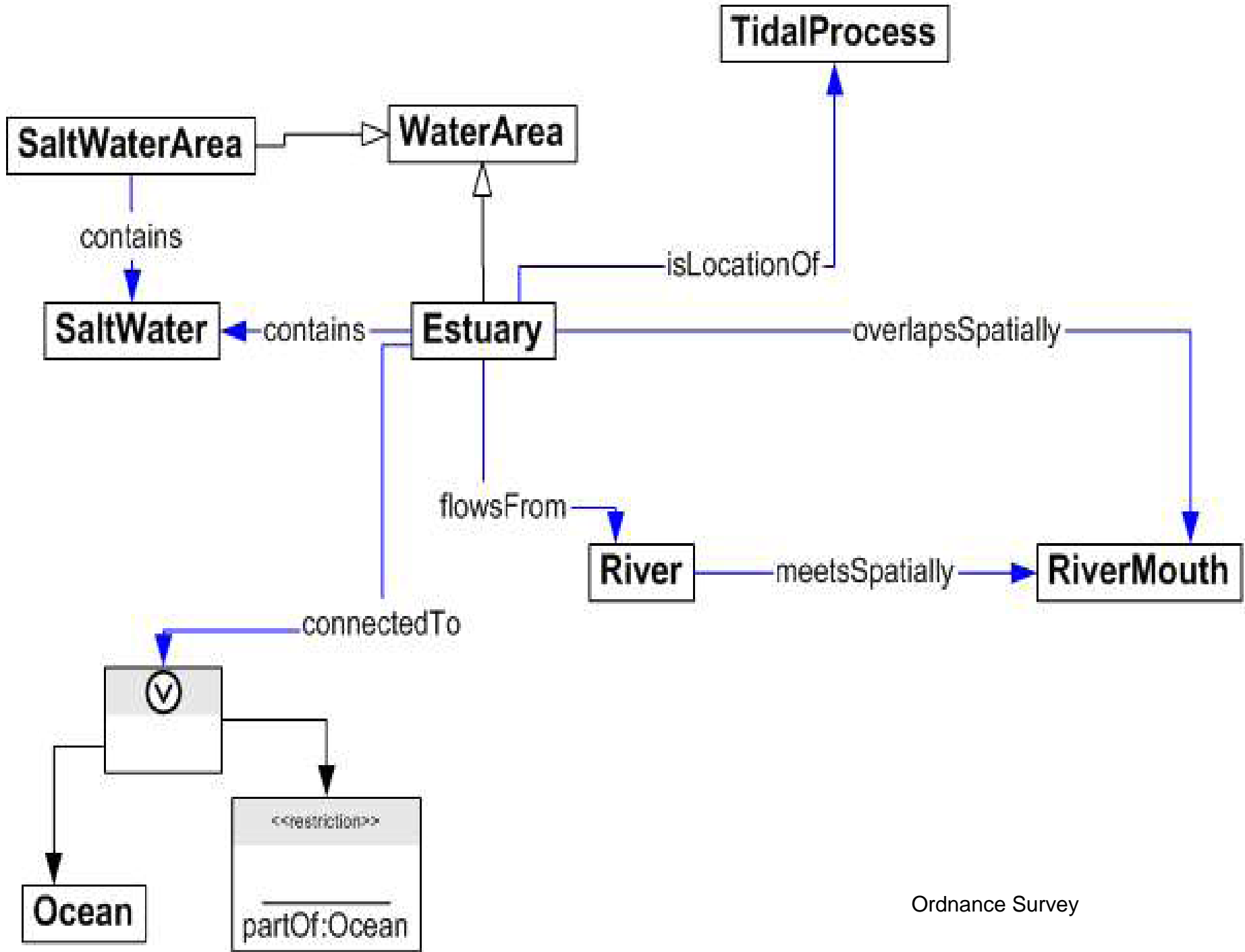
uri: p1:VENTURE\_1

any venturesome undertaking especially one with an uncertain outcome

uri: p1:RISK\_PERIL\_DANGER

a venture undertaken without regard to possible loss or injury; 'he saw the rewards but not the risks of crime'; 'there was a danger he would do this...'





```

- <rdfs:subClassOf>
  - <owl:Restriction>
    <owl:onProperty rdf:resource="#connectedTo"/>
  - <owl:someValuesFrom>
    - <owl:Class>
      - <owl:unionOf rdf:parseType="Collection">
        - <owl:Restriction>
          <owl:onProperty rdf:resource="#partOf"/>
          <owl:allValuesFrom rdf:resource="#Ocean"/>
        </owl:Restriction>
        <owl:Class rdf:about="#Ocean"/>
      </owl:unionOf>
    </owl:Class>
  </owl:someValuesFrom>
</owl:Restriction>
</rdfs:subClassOf>
</owl:Class>
<owl:Class rdf:ID="WaterArea"/>
<owl:Class rdf:ID="SaltWater"/>

```

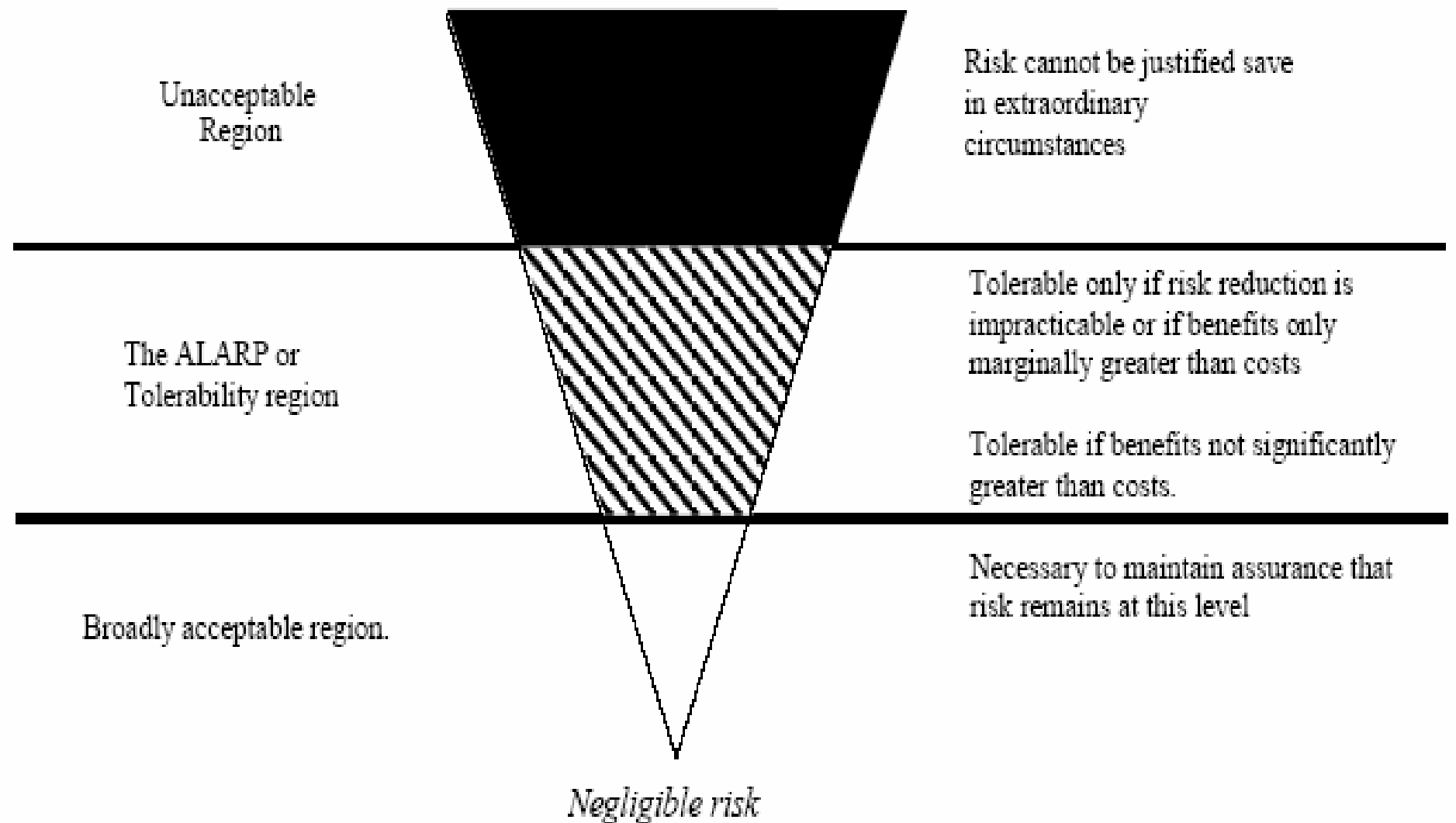
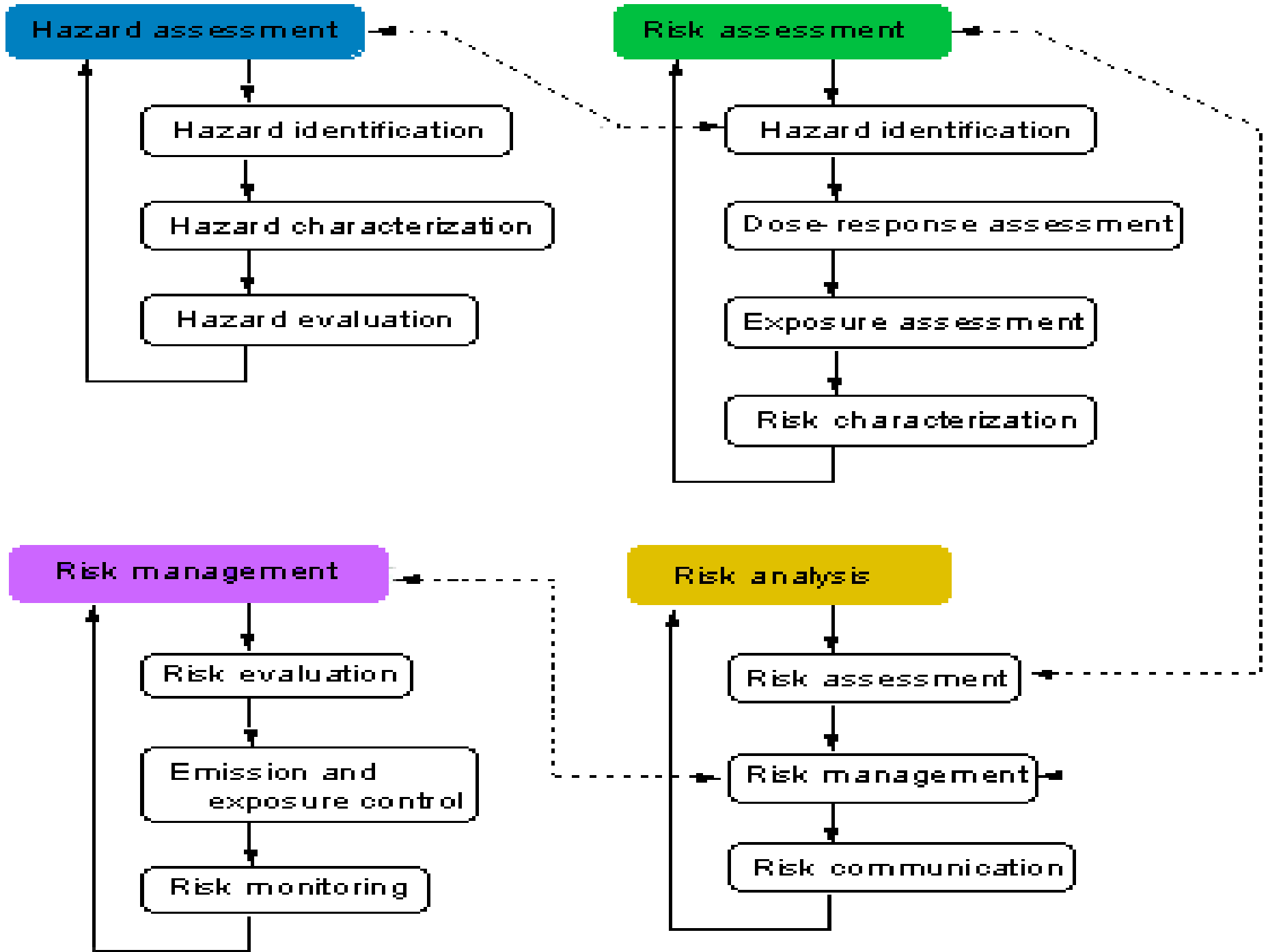
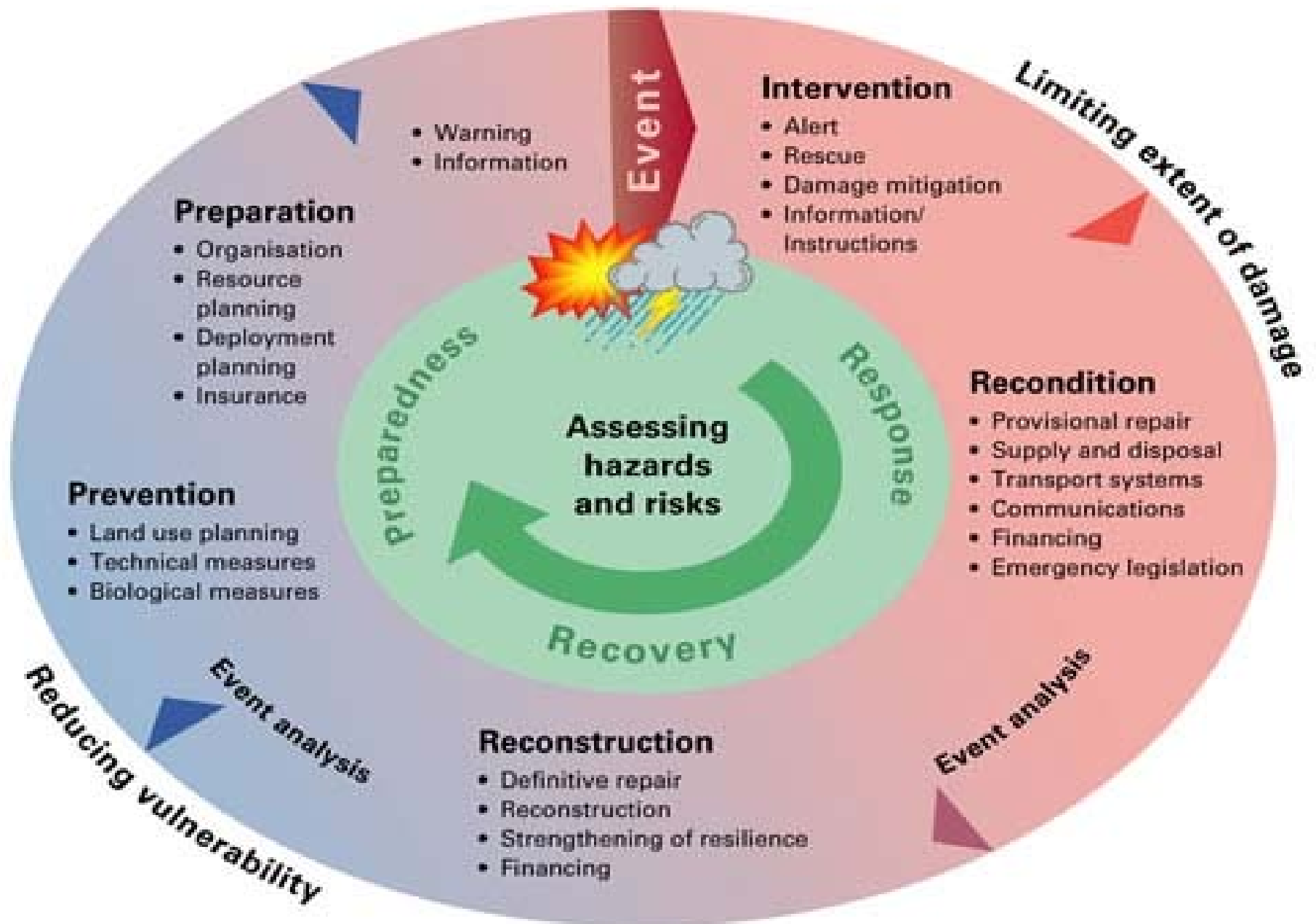


Figure 3.2 Acceptable risk levels and the ALARP principle







Systematic | Alphabetic

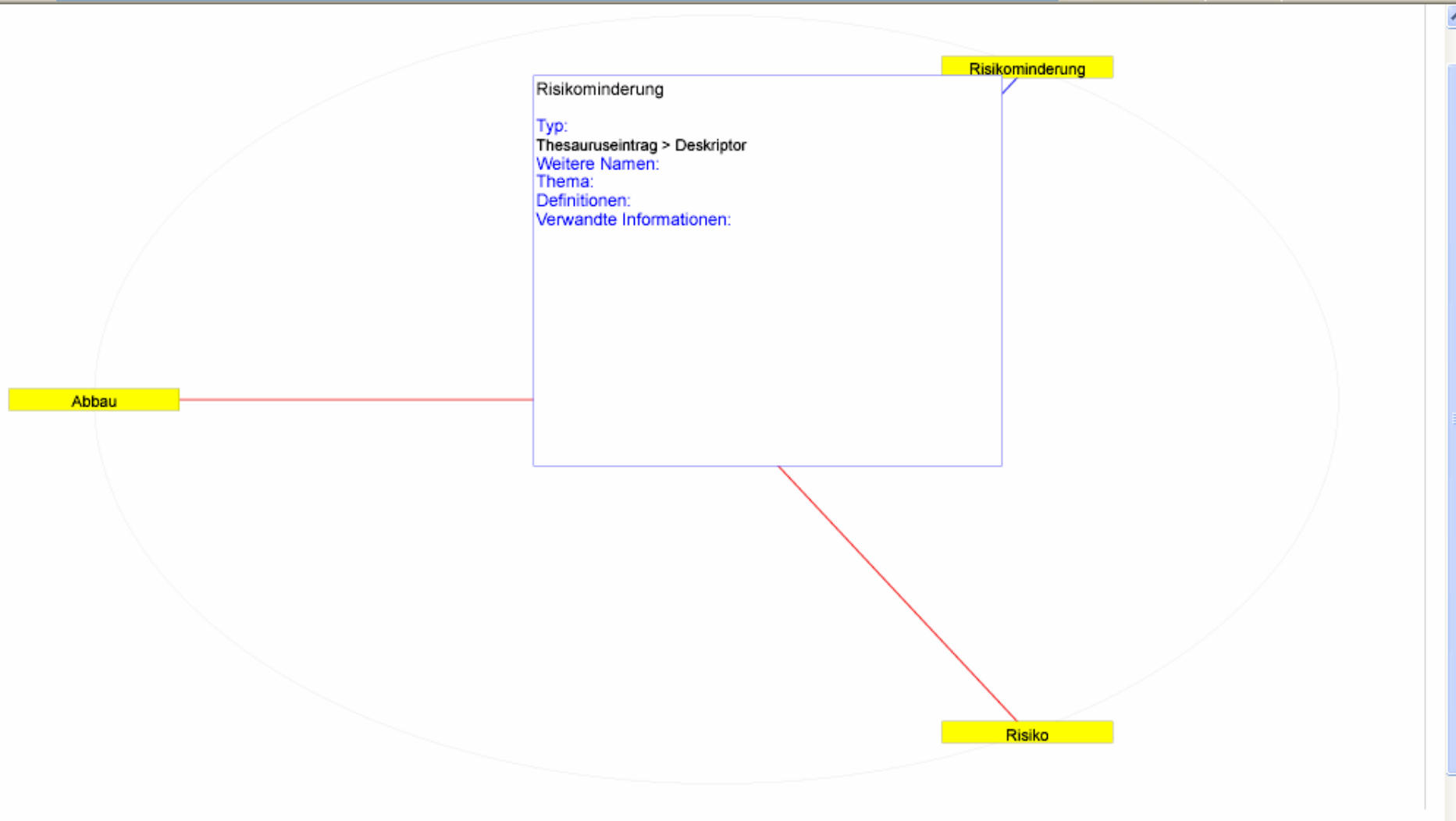
- lymph
- + metabolism
- + micro-organisms
- + [nature]
- + nutrient medium
- + pathogenic germs
- + population (ecological)
- + recolonization
- + reproduction
- seedling
- selection
- + self-purification
- upbringing
- + [Chemistry - Substances, Processes]
- + [Energy]
- + [Space]
- + [Recreation, Tourism]
- + [Society]
- + [Health, Nutrition]
- + [Trade Services]
- + [Hydrosphaere(Freshwater, Marine Water, Waters)]
- + [Information, Education, Culture]
- + [Land (Landscape, Geography)]
- + [Agriculture, Forestry, Animal Husbandry, Fishery]
- + [Lithosphere (Soil, Geological Processes)]
- + [Economics, Finance]
- + [Physical Aspects, Noise, Vibrations, Radiations]
- + [Products, Materials]
- + [Resources (Utilisation of Resources)]
- + [Risks, Safety]
  - anticipation of danger
    - precaution against disturbance
      - alarm and hazard defence planning
  - warning plan
  - biological safety
  - + catastrophe
  - + explosion
  - leakage

- Top Terms**
- ▣ [Administration, Management, Policy, Politics, Institutions, Planning]
  - ▣ [Risks, Safety]
- Broader Terms**
- ▣ planning
  - ▣ precaution against disturbance

alarm and hazard defence planning

## RISKS, SAFETY

hazard	S:5207	.. safety measure
. environmental hazard	S:5208	.. air safety
. hazard of pollutants	S:5209	.. biosafety
.. pollutant exposure	S:5210	.. civil safety
. natural hazard	S:5211	.. disaster contingency plan
. navigational hazard	S:5212	... environmental contingency planning
. nuclear hazard	S:5213	.. disaster relief
.. radiation exposure	S:5214	... disaster cleanup operation
. technological hazard	S:5215	... disaster control service
.. biotechnological hazard	S:5216	.. drought control
risk	S:5217	.. emergency plan
. cancer risk	S:5218	... risk exposure plan
. chemical risk	S:5219	... warning plan
. environmental risk	S:5220	.. emergency relief
. major risk	S:5221	... emergency relief measure
. natural risk	S:5222	.. environmental security
. nuclear risk	S:5223	.. flood control
. pollution risk	S:5224	.. industrial safety
. residual risk	S:5225	.. nuclear safety
. technological hazard	S:5226	.. occupational safety
.. biotechnological hazard	S:5227	.. prevention measure
		... damage prevention
		... disaster prevention



File Edit View RDF/OWL Tools Window Help

OWL Full

Instances allDifferent Ontologies

owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#ABSTRACT-LOCATION
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#ABSTRACT-LOCATION-OF
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#ATOMIC-PART
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#ATOMIC-PART-OF
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#COMPONENT
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#COMPONENT-OF
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#CONCEPTUAL-RELATION
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#CONSTANT-PARTICIPANT
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#CONSTANT-PARTICIPANT-III
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#CONSTITUTED-BY
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#CONSTITUTES
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#DEPEND-ON-OF
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#DEPEND-ON-SPATIAL-LOCATION-OF
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#DEPENDS-ON
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#DEPENDS-ON-SPATIAL-LOCATION
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#DESCRIPTIVE-DEPEND-ON-OF
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#DESCRIPTIVELY-DEPENDS-ON
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#DURATION
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#DURATION-OF
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#E-TEMPORAL-LOCATION
owl:ObjectProperty	http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#E-TEMPORAL-LOCATION-OF

main for Property

http://ontology.ip.rm.cnr.it/ontologies/DOLCE-Lite#Non-Physical-Endurant

xt RDF/OWL

DOLCE2.0-Lite-v3.owl.rdf

view Errors

This ontology is well-formed.

CAP NUM

# Concept Relations - some typologies

- Domain approaches
  - UMLS
  - Biomedical ontologies
  - SNS
  - FAO
- Generic approaches
  - In terminological knowledge engineering

# UMLS

isa

associated\_with

physically\_related\_to

part\_of

consists\_of

contains

connected\_to

interconnects

branch\_of

tributary\_of

ingredient\_of

spatially\_related\_to

location\_of

adjacent\_to

surrounds

traverses

functionally\_related\_to

affects

manages

treats

disrupts

complicates

interacts\_with

prevents

brings\_about

produces

causes

[associated\_with] (continued)

[functionally\_related\_to] (continued)

performs

carries\_out

exhibits

practices

occurs\_in

process\_of

uses

manifestation\_of

indicates

result\_of

temporally\_related\_to

co\_occurs\_with

precedes

conceptually\_related\_to

evaluation\_of

degree\_of

analyzes

assesses\_effect\_of

measurement\_of

measures

diagnoses

property\_of

derivative\_of

developmental\_form\_of

method\_of

conceptual\_part\_of

issue\_in

# Biomedical ontologies

- Barry Smith et al.
- OBO and related initiatives
- Three levels (binary relations):
  - <class, class>: for example, the *is\_a* relation obtaining between the class *SWR1 complex* and the class *chromatin remodeling complex*, or between the class *exocytosis* and the class *secretion*;
  - <instance, class>: for example, the relation **instance\_of** obtaining between this particular vesicle membrane and the class *vesicle membrane*, or between this particular instance of mitosis and the class *mitosis*;
  - <instance, instance>: for example, the relation of instance-level parthood (called **part\_of** in what follows), obtaining between this particular vesicle membrane and the endomembrane system in the corresponding cell, or between this particular M phase of some mitotic cell cycle and the entire cell cycle of the particular cell involved.



# Continuants vs. Processes, classes vs. instances

- $C, C1, \dots$  to range over continuant classes;
- $P, P1, \dots$  to range over process classes;
- $c, c1, \dots$  to range over continuant instances;
- $p, p1, \dots$  to range over process instances;
- $r, r1, \dots$  to range over three-dimensional spatial regions;
- $t, t1, \dots$  to range over instants of time.

# Primitive instance level

- **$c$  instance\_of  $C$  at  $t$**  - a primitive relation between a continuant instance and a class which it instantiates at a specific time
- **$p$  instance\_of  $P$**  - a primitive relation between a process instance and a class which it instantiates holding independently of time
- **$c$  part\_of  $c1$  at  $t$**  - a primitive relation between two continuant instances and a time at which the one is part of the other
- **$p$  part\_of  $p1$ ,  $r$  part\_of  $r1$**  - a primitive relation of parthood, holding independently of time, either between process instances (one a subprocess of the other), or between spatial regions (one a subregion of the other)
- **$c$  located\_in  $r$  at  $t$**  - a primitive relation between a continuant instance, a spatial region which it occupies, and a time
- **$r$  adjacent\_to  $r1$**  - a primitive relation of proximity between two disjoint continuants
- **$t$  earlier  $t1$**  - a primitive relation between two times
- **$c$  derives\_from  $c1$**  - a primitive relation involving two distinct material continuants  $c$  and  $c1$
- **$p$  has\_participant  $c$  at  $t$**  - a primitive relation between a process, a continuant, and a time
- **$p$  has\_agent  $c$  at  $t$**  - a primitive relation between a process, a continuant and a time at which the continuant is causally active in the process

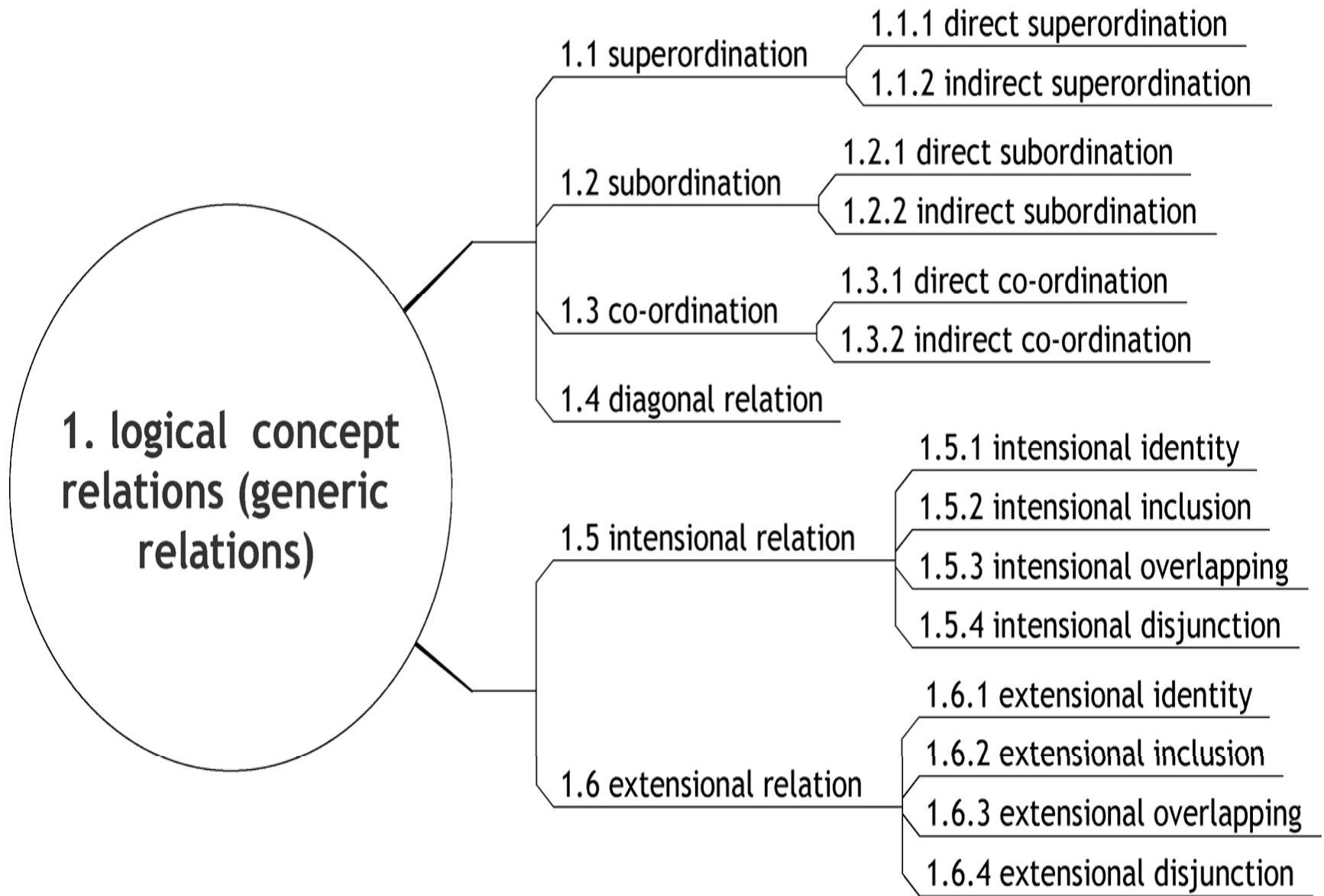
<b>SEMANTIC RELATION IN EUROWORDNET:</b>	<b>EXAMPLE:</b>
<b>SYNONYMY &amp; ANTONYMY</b>	
near_synonym (not in same synset)	tool <> instrument
antonym	good <> bad
<b>HYPONYMY</b>	
has_hyponym	vehicle > car
has_hyperonym	car > vehicle
<b>PART-WHOLE RELATIONS</b>	
has_meronymy	(for underspecified cases such as: has as parts)
has_holonymy	(for underspecified cases such as : is a part of)
has_mero_part	hand > finger
has_mero_member	fleet > ship
has_mero_made_of	book > paper
has_mero_portion	bread > slice
has_mero_location	desert > oasis
has_holo_part	finger > hand
has_holo_member	ship > fleet
has_holo_made_of	paper > book
<b>CAUSE RELATIONS</b>	
is_caused_by	(for underspecified cases)
causes	(for underspecified cases)
results_in	to kill > to die
for_purpose_of	to search > to find
enables_to	vision > to see
<b>SUBEVENT RELATIONS</b>	
is_subevent_of	to snore > to sleep
has_subevent	to sleep > to snore
<b>INVOLVED/ROLE RELATIONS</b>	
involved_agent	to bark > dog
role_agent	dog > to bark
involved_patient	to teach > learner
role_patient	learner > to teach
involved_instrument	to paint > paint-brush
role_instrument	paint-brush > to paint
involved_location	to swim > water
role_location	water > swim
involved_source_direction	to disembark > ship
role_source_direction	ship > disembark
involved_target_direction	rincasarse > casa
role_target_direction	casa > rincasarse
involved_result	to freeze > ice
role_result	ice > to freeze
involved_manner	shout > loudly
role_manner	loudly > shout

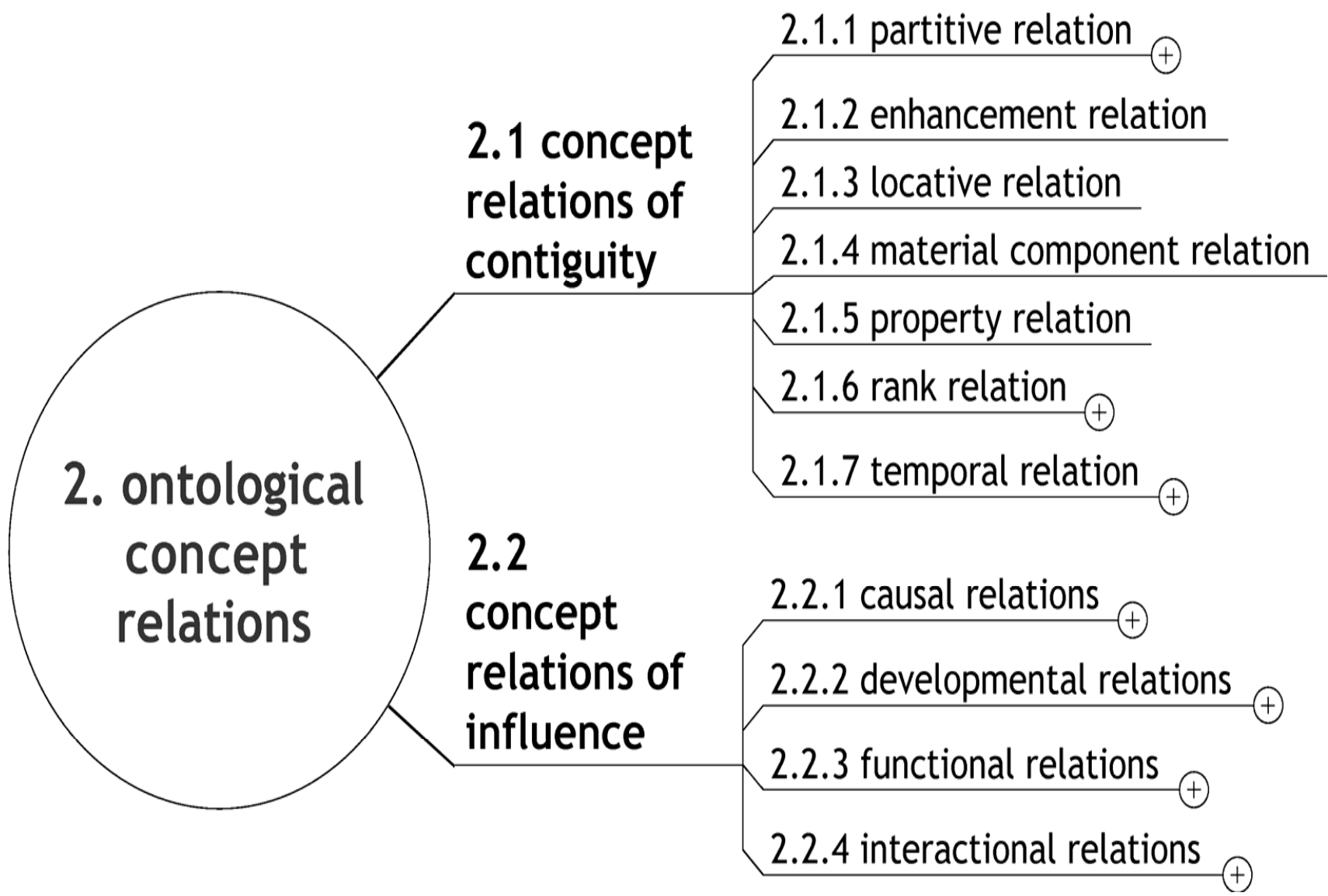
<b>Semantic Relations In SIMPLE</b>	<b>Examples</b>
<b>Formal Relations</b>	
is_a	(yacht, boat)
<b>Constitutive Relations</b>	
is_a_member_of	(senator, senate)
has_as_member	(flock, bird)
is_a_part_of	(head, body)
has_as_part	(airplane, wings)
instrument	(paint, brush)
relates	(kinship, brother)
resulting state	(die, dead)
is_a_follower_of	(marxist, marxism)
made_of	(bread, flour)
is_in	(oasis, dessert)
has_as_colour	(lemon, yellow)
constitutive activity	(bird, fly)
produces	(bird, egg)
produced_by	(honey, bee)
property of	(intelligence, intelligent)
concerns	(hepatitis, liver)
contains	(wineglass, wine)
quantifies	(bottle, liquid)
measured_by	(temperature, degree)
related_to	(second, two)
successor_of	(two, one)
has_as_effect	(storm, thunder)
typical_of	(distemper, dog)
causes	(measles, fever)
<b>Telic Relations</b>	
indirect_telic	(eye, see)
purpose	(send, receive)
object_of_the_activity	(book, read)

# Cont.

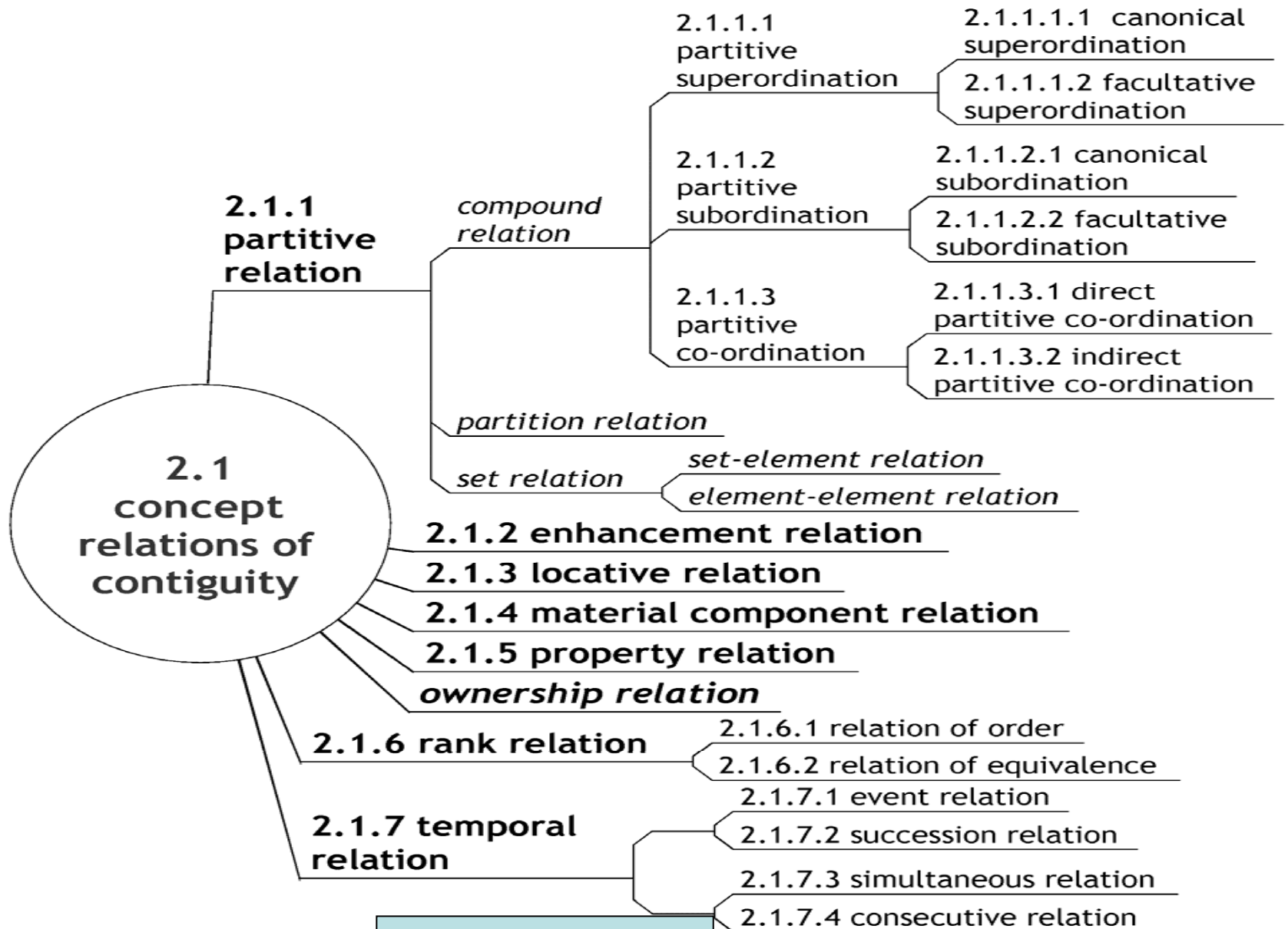
is_the_activity_of	(doctor, heal)
is_the_ability_of	(painter, pain)
is_the_habit_of	(smoker, smoke)
used_for	(crane, lift)
used_by	(lancet, surgeon)
used_against	(chemoterapi, cancer)
used_as	(wood, material)
<b>Agentive Relations</b>	
result_of	(loss, loose)
agentive_prog	(pedestrian, walk)
agentive_experience	(fear, feel)
caused_by	(infection, bacterion)
source	(law, society)
created_by	(book, write)
derived_from	(petrol, oil)

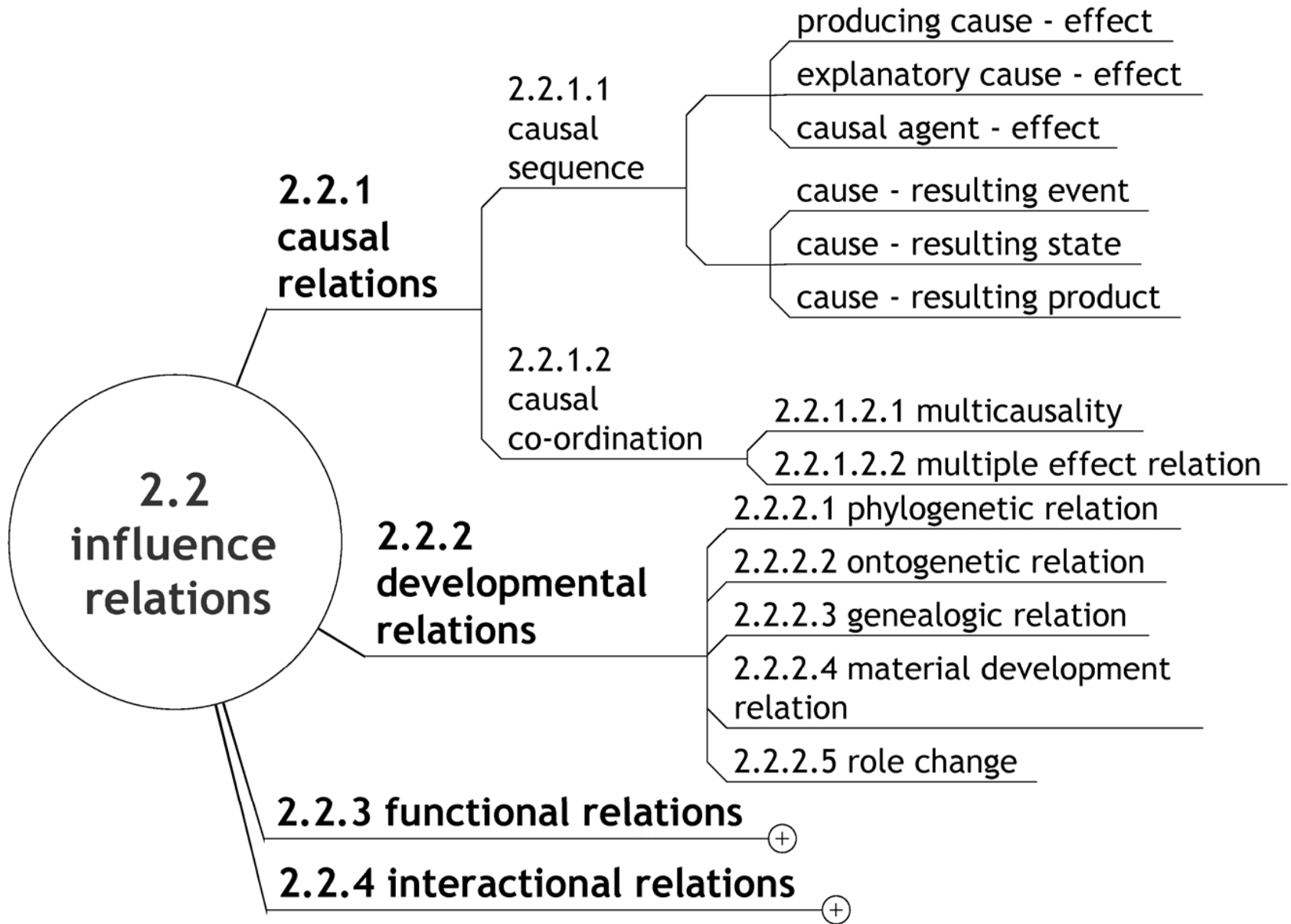
Terminological concept relation	Example
0. associative relation (unspecified relation)	motorist - pedestrian
1. generic relation (hyponymy)	vehicle - bicycle
2. partitive relation	
2.1 subpart-relation	bicycle - wheel
2.2 partition relation	bread - slice
2.3 material relation	book - paper
2.4 set-element relation	firm - employee
3. location relation	nacelle - control system
4. temporal relation	issue - acceptance - endorsement - payment
5. development relation	frogs egg - tadpole
6. causal relation	blow-deformation
7. purpose	brake - speed reduction ventilator - ventilation
8. origin relation	translator - translation bakery - bread drawer - draft
9. instrumental relation	
9.1 instrument-use	coffee machine - coffee making
9.2 instrument-result	coffee making - coffee
10. transmission relation (sender-receiver)	drawer - drawee

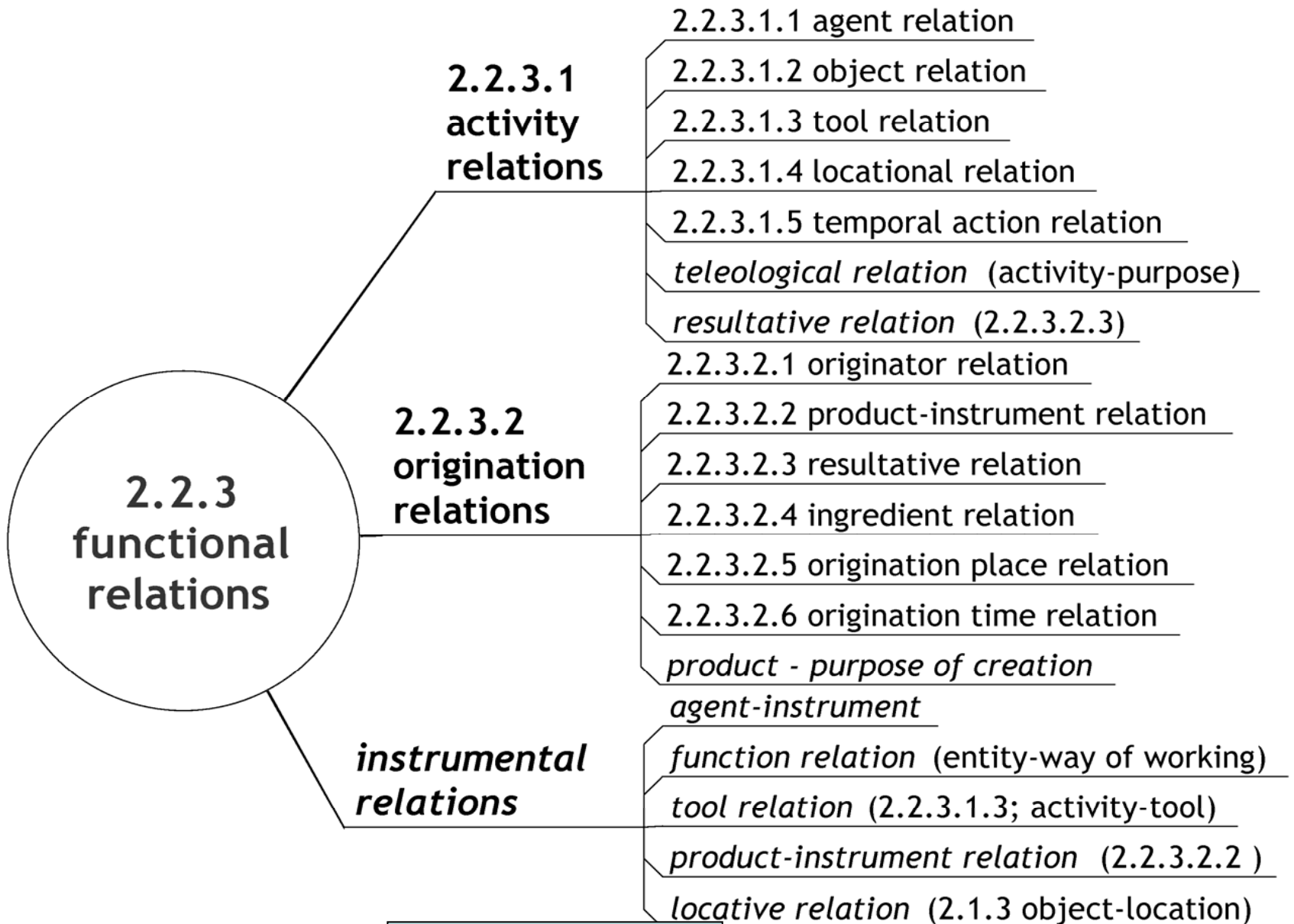


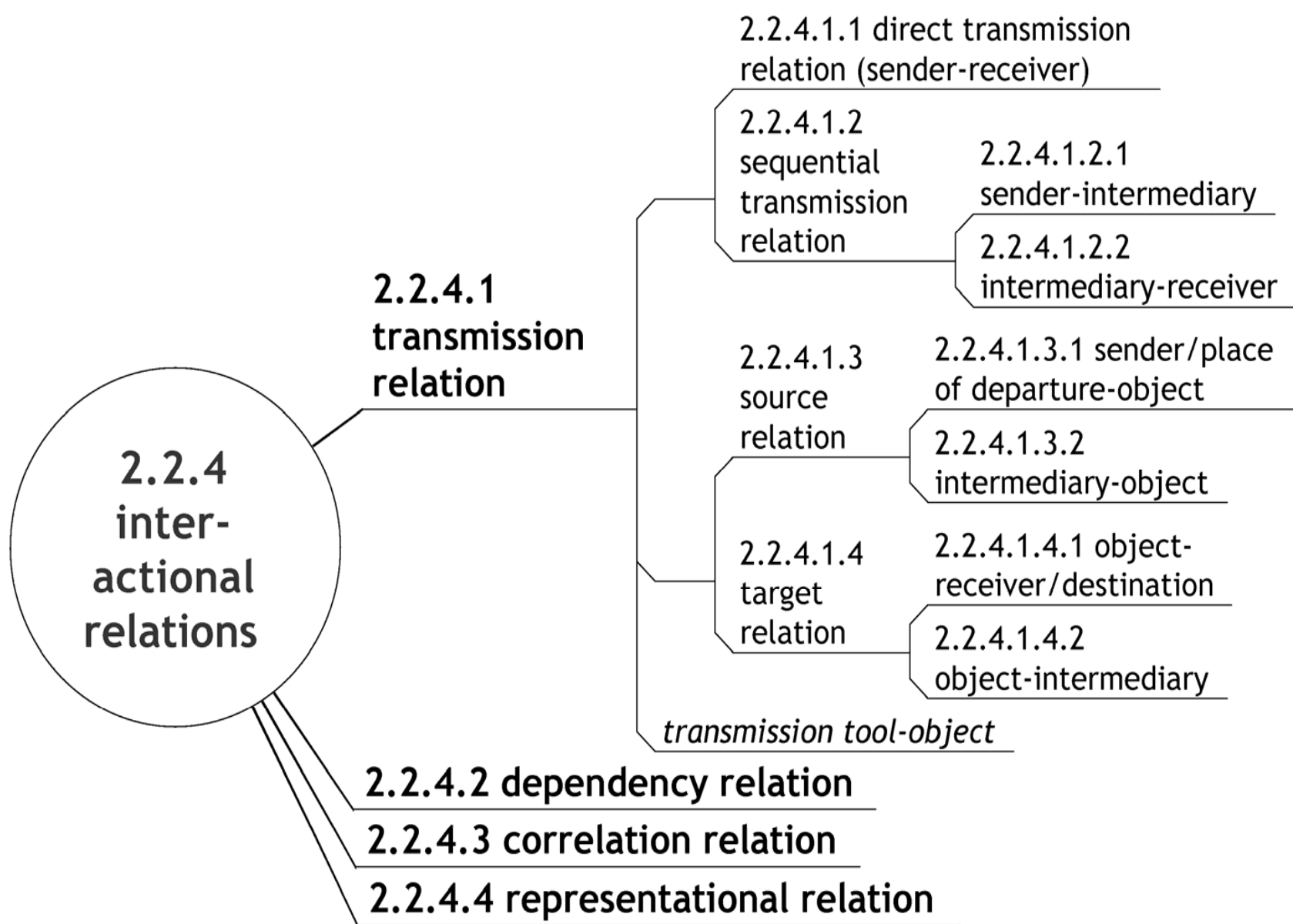


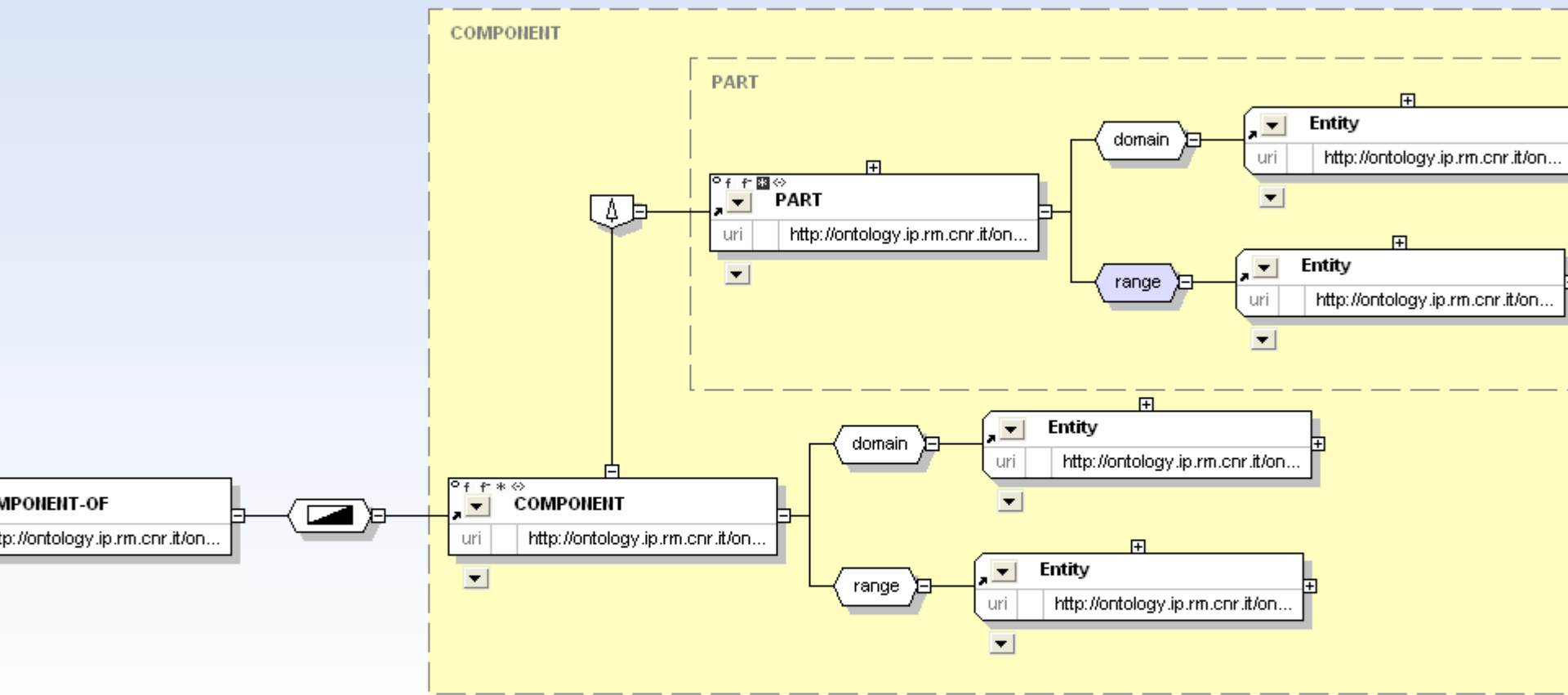










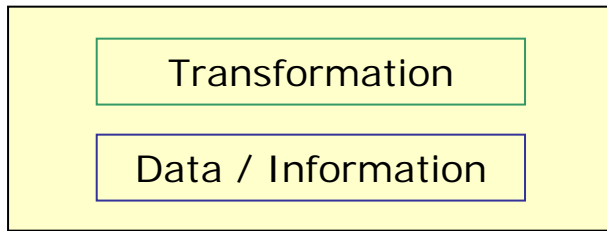


# ESA - EO Ontology Approach

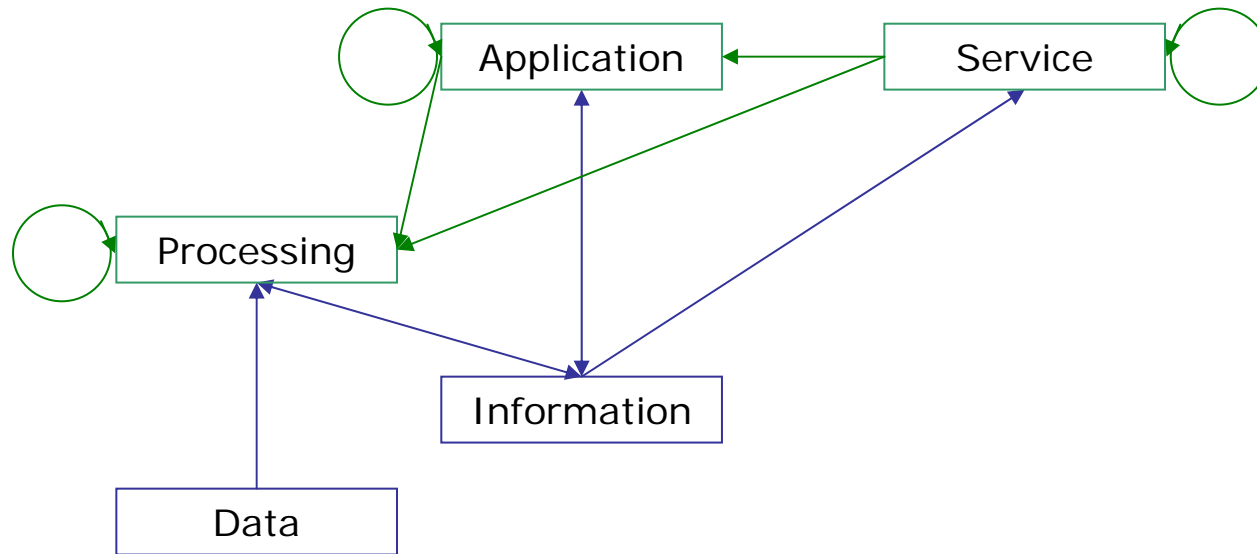
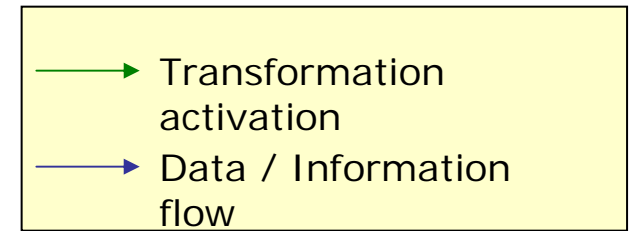
- Specify at high level the EO reality: [EO Ontology](#)
- Add classification vs. other domains: [Multi-domain Ontology](#)
- Derive a simplified, more abstract [Classification Ontology](#)
  - Supporting multiple domains
  - Providing equal visibility of all concepts
  - Using fixed concepts and relations
  - Permitting an implementation
    - as an “isolate” Web Service
    - with limited dependency from evolving reality / dynamic changes
- Verify its applicability (also to non-EO domains)

# EO Ontology

## Concepts

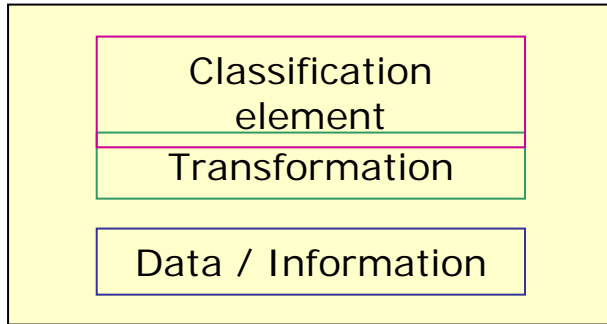


## Relations

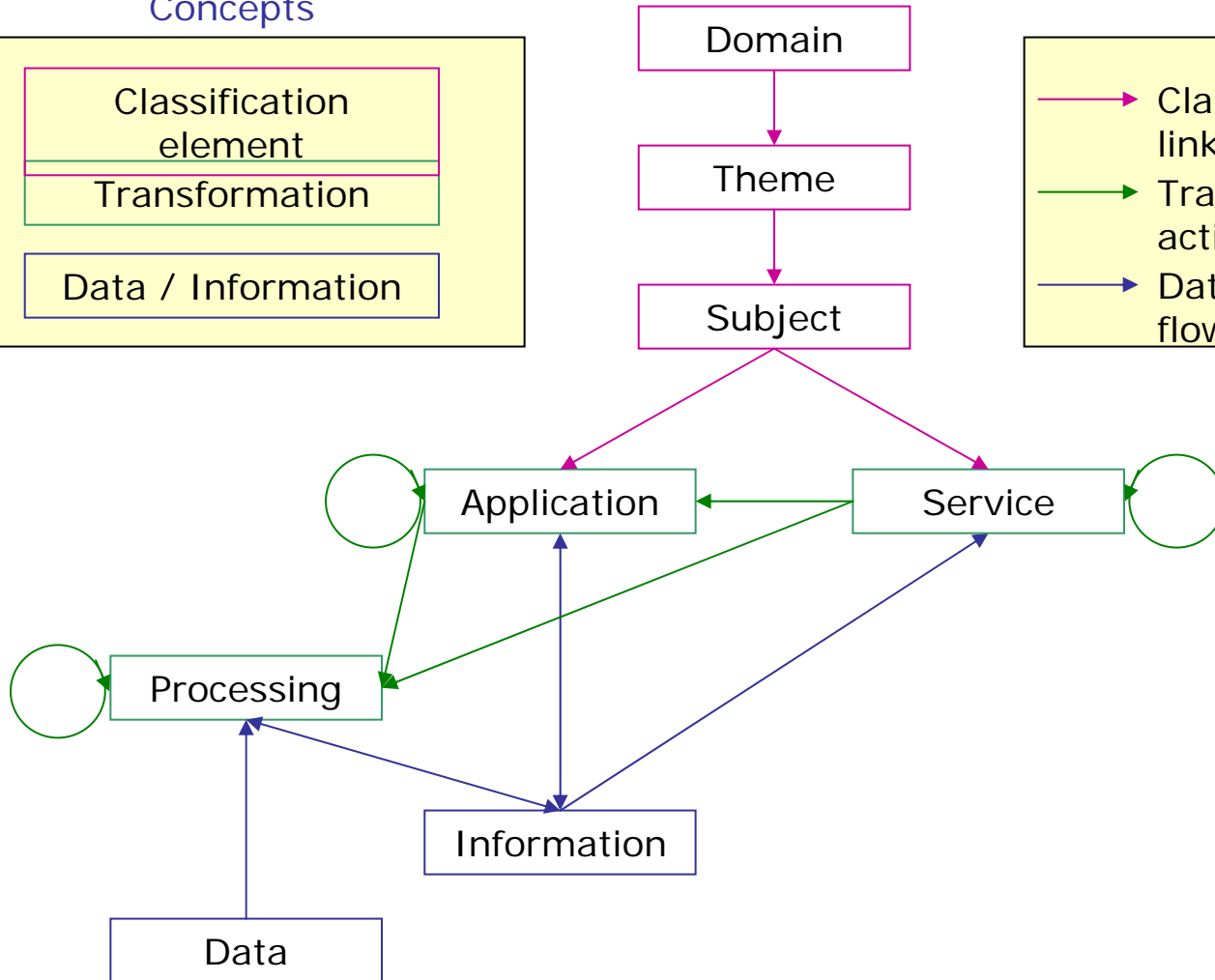
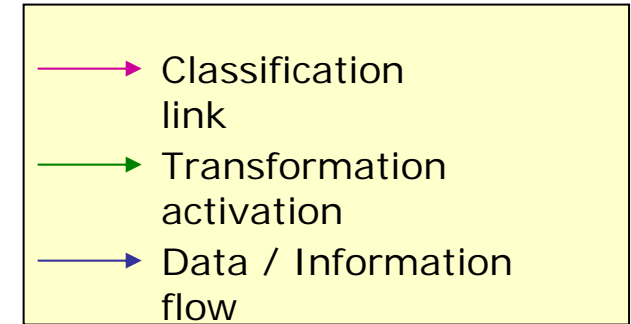


# Multi-domain Ontology

## Concepts

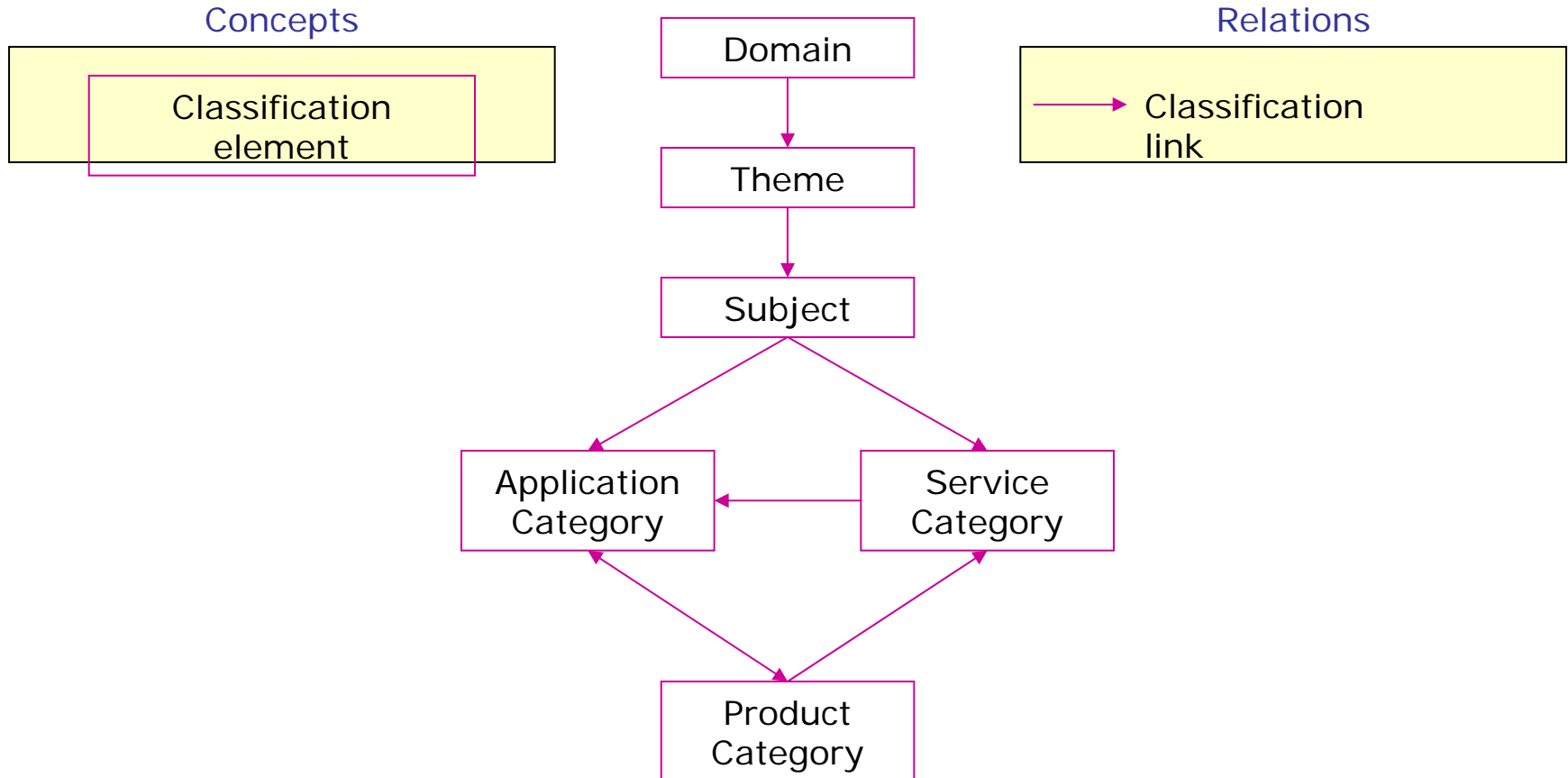


## Relations





# Classification Ontology





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## welcome to protégé

### news

**18th June 2009**

Protégé 3.4.1 patch release  
([download](#))

**16th June 2009**

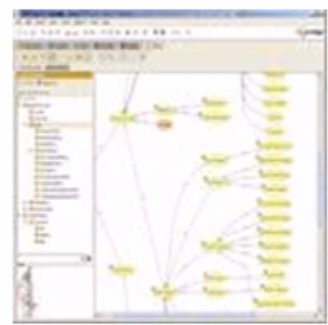
Protégé 4.0 released!  
([read more](#)) | ([download](#))

Protégé is a **free, open source** ontology editor and knowledge-base framework.

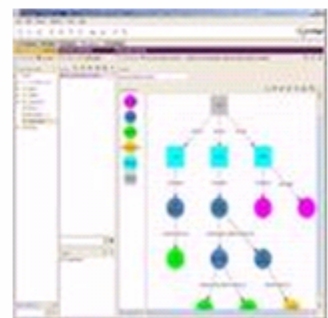
The Protégé platform supports two main ways of modeling ontologies via the **Protégé-Frames** and **Protégé-OWL** editors. Protégé ontologies can be exported into a variety of formats including RDF(S), OWL, and XML Schema. ([more](#))

Protégé is based on Java, is extensible, and provides a plug-and-play environment that makes it a flexible base for rapid prototyping and application development. ([more](#))

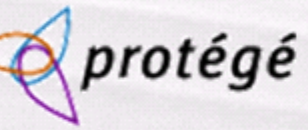
Protégé is supported by a **strong community** of developers and academic, government and corporate users, who are using Protégé for knowledge solutions in areas as diverse as biomedicine, intelligence gathering, and corporate modeling.



*go to protégé-owl*



*go to protégé-frames*



- Navigation
- Main Page
- All Categories
- All Properties
- All Templates
- All Forms
- Ontology Library
- Plugin Library
- Multi-upload
- Help

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Go Search

What links here

- page
- discussion
- view source
- history

## Welcome to the Protege Ontology Library!

This page is organized into the following groupings:

- [OWL ontologies](#)
- [Frame-based ontologies](#)
- [Ontologies in other formats \(e.g., DAML+OIL, RDF Schema, etc.\)](#)

If your ontology is available in multiple formats, please feel free to link to it from multiple sections.

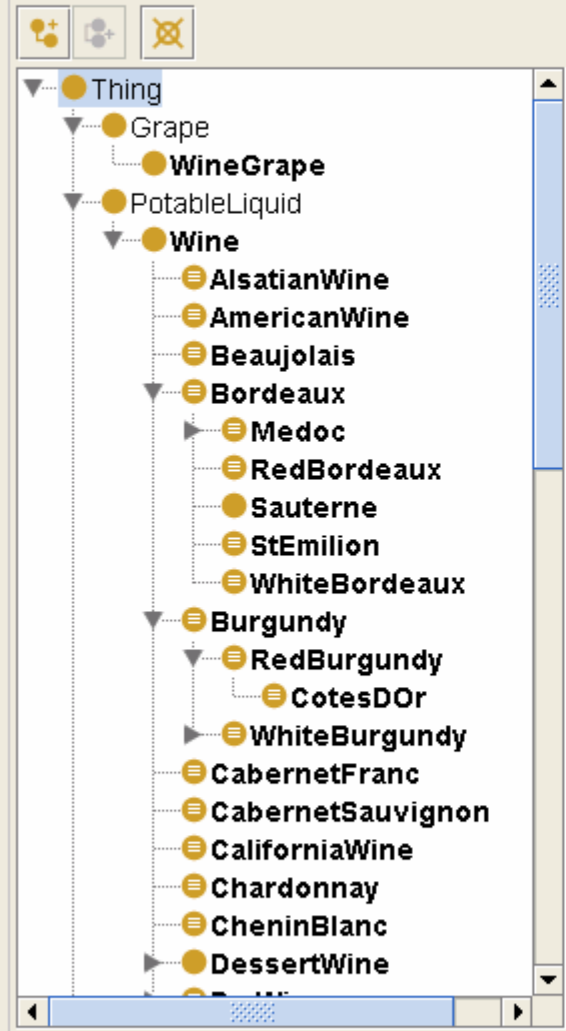
*Please make insertions in alphabetical order. Thank you !!!*

## OWL ontologies

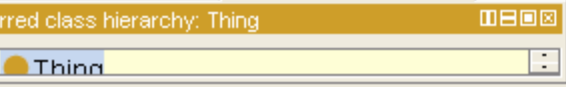
Information on how to open OWL files from the [Protege-OWL editor](#) is available on the main Protege Web site. See the [Creating and Loading Projects](#) section of the [Getting Started with Protege-OWL](#) Web page. Other ways to search for OWL ontologies include using Google: <http://www.google.com/search?q=filetype:owl+owl>, or the new Semantic Web search engine called [Swoogle](#).

- [AIM@SHAPE Ontologies](#): Ontologies pertaining to digital shapes. Source: [AIM@SHAPE NoE](#) -

Asserted Class Hierarchy: Thing



Inferred class hierarchy



Class Annotations Class Usage RDF/XML Rendering

Class Usage: Thing

- Usage for: Thing
- Beaujolais**
    - Beaujolais **subClassOf** madeFromGrape **max** 1 Thing
  - CabernetFranc**
    - CabernetFranc **equivalentTo** Wine
    - and** madeFromGrape **value** CabernetFrancGrape
    - and** madeFromGrape **max** 1 Thing
  - CabernetFrancGrape**
    - CabernetFrancGrape **types** Thing
  - CabernetSauvignon**
    - CabernetSauvignon **equivalentTo** Wine
    - and** madeFromGrape **value** CabernetSauvignonGrape
    - and** madeFromGrape **max** 1 Thing
  - CabernetSauvignonGrape**
    - CabernetSauvignonGrape **types** Thing
  - Chardonnay**
    - Chardonnay **equivalentTo** Wine

Class description Navigation view

Class Description: Thing

Equivalent classes +

Normal  Unscharfe Suche  Volltext

Navigation icons: up, down, search, print

- Risk\_Termbase
- acceptable risk
  - accident
  - flux
  - temperature
  - arm
  - bedo
  - ert

- Startseite
- Termini
- Katalog

Entry level  
ConceptID: A3  
RiskManagementCycle: A. risk assessment and technology, D. damage assessment and recovery

## EN English

### Term: acceptable risk

GramInfo: <noun phrase, sg, pl>  
Definition: degree of human and material loss that is perceived by the community or relevant authorities as tolerable in actions to minimize cf. disaster cf. risk  
Bibl Source: TESEC-EUR-OPA-GEM 2001  
Title: Glossary on Emergency Management  
Author: European Centre of Technological Safety (TESEC); EUR-OPA Major Hazard Agreement of Council of Europe  
Place: Kiev  
Year of Publication: 2001  
Definition: A technological activity that generates a risk for others can be termed acceptable if the activity respects ethical principles that are necessary for peaceful coexistence and/or if the activity renders social progress in a non-arbitrary way. A risk generating activity is acceptable in this sense if and only if the following holds: (1) all those who are subjected to the risk have given their informed consent to the activity and the conditions under which it is performed; (2) those who engage in such an activity without this informed consent can be held to full (unlimited, no caps) and unconditional (absolute) liability for any negative effects that the activity may cause to those who did

For more information on ontologies, knowledge organization systems, on our projects mentioned above, on further reading, related tools, etc.

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