

Why the Semantic Web needs approximate reasoning

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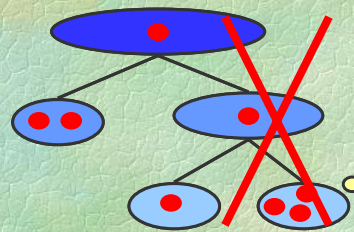
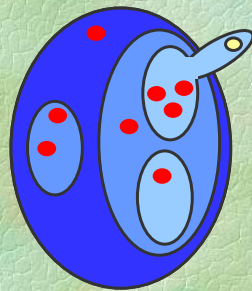
Current inference is exact

- "yes" or "no"
- not: **"almost"**, **"yes, except for a few"**, etc
(think of subClassof)
- This was OK, because
until now, ontologies were clean:
 - hand-crafted
 - well-designed
 - carefully populated
 - well maintained
 - etc

Ontologies will be sloppy

- made by non-experts
- made by machines:
 - scraping from
 - file-hierarchies,
 - mail-folders
 - bookmarks
 - todo-lists & phone-books on PDA's
 - machine learning from examples

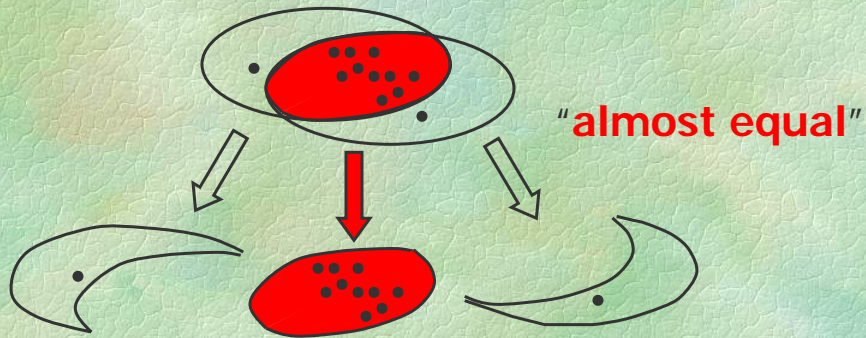
Ontologies will be sloppy



almost subClassOf

Combined ontologies need **fuzzy** inference

Mapping ontologies is almost always messy
post-doc \approx young-researcher



Current inference is abrupt

■ nothing..... yes!

we want **gradual** answers:



■ **anytime computation**



- agent can decide how good is good enough (human or machine)

■ **deadline computation**

- pay for quality
- load balancing

Semantic Web Use Case for approximation:

- **Search:** query α instances
- **Approximation:**
 - fewer answers
 - more answers (\emptyset)
 - close matches
 - anytime answering

Semantic Web Use Case for approximation:

- **Data integration:**
(instances+schema)^{*} α instances+schema
- **Approximation:**
 - closely similar classes
 - anytime answering (P2P)

Semantic Web Use Case for approximation:

■ Personalisation & recommending:

instances+profile α instances
(profile = concepts or instances)

■ Approximation:

- fewer answers
- more answers
- close matches (both concepts and instances)

Semantic Web Use Case for approximation:

■ Web service selection:

query + service-instances α service-instance

■ Approximation:

- close matches

Semantic Web Use Case for approximation:

- **Query answering:**
query + instances + knowledge α answer
- **Approximation:**
 - find relevant but not deductively valid answers
 - reduce/increase answer set
 - anytime answering

Reduction of use-cases to reasoning methods

- **Realisation** (*"member of"*)
instance x ontology α concept
- **Subsumption:** (*"subclass-relation"*)
concept x concept α bool
- **Mapping** (*"similar to"*):
concept x concept α $\{=, \sqsubseteq, \sqsupseteq, \perp, \sqcap\}$
- **Retrieval** (*"has member"*)
concept α instances
- **Classification** (*"locate in hierarchy"*)
concept x ontology α \langle upper, lower \rangle

Reduction of use-cases to reasoning methods

	realisation	classification	mapping	retrieval
search		☑		☑
browse	☑	☑		☑
integrate	☑	☑	☑	
personalise, recommend	☑	☑		☑
service selection		☑		☑
service composition		☑		
question answering				☑

Reduction of use-cases to reasoning methods

- Goal:
find approximation methods for the reasoning methods
- Notice:
many reasoning methods can be reduced to satisfiability
- Goal:
find approximation methods for satisfiability