Candidate Tech: SWRL

W3C Workshop on Rules
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Interoperate with what?

• “Legacy” rules systems
  – Within rule “families”
    • E.g., ISO Prolog
  – Between rule “families”
    • E.g., RuleML

• The Non-Semantic Web
  – Standardize what?
    • HTTP/HTML/XML support?
    • XQuery as Functional/Logic Programming language?
    • Process languages? Web Services?

• The Semantic Web
The Semantic Web Requirement

• Rules for the Semantic Web
  – Conform to abstract principles
    • URI use, (perhaps) open world, XML syntax, distributability, layering/semantic compatibility
  – Conform to existing standards
    • RDF and OWL
    • SPARQL (not quite existing)
  – Various sorts of non-conformance
    • To a (small) subset of OWL (e.g., RDF, RDFS, DLP)
    • Different semantics (not just extensions)
OWL Compatibility

• Reuse existing ontologies
  – With their full expressivity
    • No shadow ontologies or radically incompatible extensions
    • OWL has (limited) rules!

• Augment existing ontologies
  – Extend OWL expressivity

• Four possibilities
  – Subset (DLP, Horn-SHIQ)
  – Hybrid (AL-Log, Carin, DL-Safe rules)
  – Superset (SWRL)
  – Alter (Classic style rules, other non-mon extensions)

• The first three are subsumed by SWRL*
SWRL

• Basic idea:
  – Horn rules where...
  – predicate functors are OWL-DL class, datatype, or property names
    • (class expressions can be used, in principle)
  – with first order semantics
    • (i.e., SWRL is a fragment of FOL)
  – XQuery inspired built-ins

• A hint:
  – rdfs:subClassOf and rdfs:subPropertyOf are syntactically restricted (material) implication
  – ruleml:imp generalizes these
Example DL KB

Computer ⊆ Product
Monitor ⊆ Product
Computer ⊆ ∃hasCPU.CPU
CPU ⊆ ∃hasSpeed.CPUSpeed
Customer ⊆ Person
SalesService = Service & ∃sells.Product
ExpensiveComputer = Compter & ∃hasPrice.HighPrice
AL-Log style

convenient(?cust, ?serv) :-
    livesIn(?cust, ?loc), fastDelivery(?serv, ?loc),
    Customer(?cust), SalesService(?serv).

(where no binary term appears in the OWL ontology, though they may be characterized by other AL-Log rules)
Carin style

discountAvailable(?cust, ?printer) :-
    previouslyBought(?cust, ?comp),
    sameBrand(?comp, ?printer),
    hasPrice(?comp, ?price),
    Customer(?cust), Printer(?printer),
    Computer(?computer), HighPrice(?price)
DL-Safety

• Given an OWL-DL ontology O and a Datalog program P:
  – A rule $r$ is *strongly DL-safe* if each variable in $r$ occurs in a non-DL atom in the rule body.
  – P is strongly DL-safe if all its rules are

SWRL in toto

- Only safety condition is standard Datalog safety
  - I.e., variables in the head must appear in the body
  - Merely syntactic; no expressive consequence
- No decision procedure
- No native reasoners (yet)
  - Translate-to-FOL & use full FOL reasoner (see Ian)
  - DL Safe rules covers a large (decidable) subset in a resolution framework
  - Convergence?
- Inferable rules (rule redundancy, specificity; query containment)
Some SWRLing Issues

• Syntax
  – The Semantic desperately needs a sane and extensible syntactic framework
  – Same-syntax semantic extensions won’t cut it

• OWL Full
  – Some parts easy, some parts hard
    • (Some parts undesirable!)

• N-ary predicates
• Non-mon features
• Modularity
• SWRL vs. SWRL FOL

4/2/2004
mindswap
maryland information and network dynamics lab semantic web agents project

- [http://www.w3.org/Submission/2004/SUBM-SWRL-20040521/](http://www.w3.org/Submission/2004/SUBM-SWRL-20040521/)
  - Reduces The SHIQ description logic to disjunctive datalog; defines a horn fragment of SHIQ; defines DL Safety; has decidable metamodeling; good stuff!

- [http://kaon2.semanticweb.org/](http://kaon2.semanticweb.org/)
  - Different approach to combining DL with Datalog which admits negation-as-failure for the rules

- [http://www.kr.tuwien.ac.at/staff/roman/asp_sw/](http://www.kr.tuwien.ac.at/staff/roman/asp_sw/)
  - Framework subsuming SWRL, plus pointers to more decidable subsets.

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