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# Knowledge Representation for the Semantic Web

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Slides 7 – 02/09/2010

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# Slides are based on

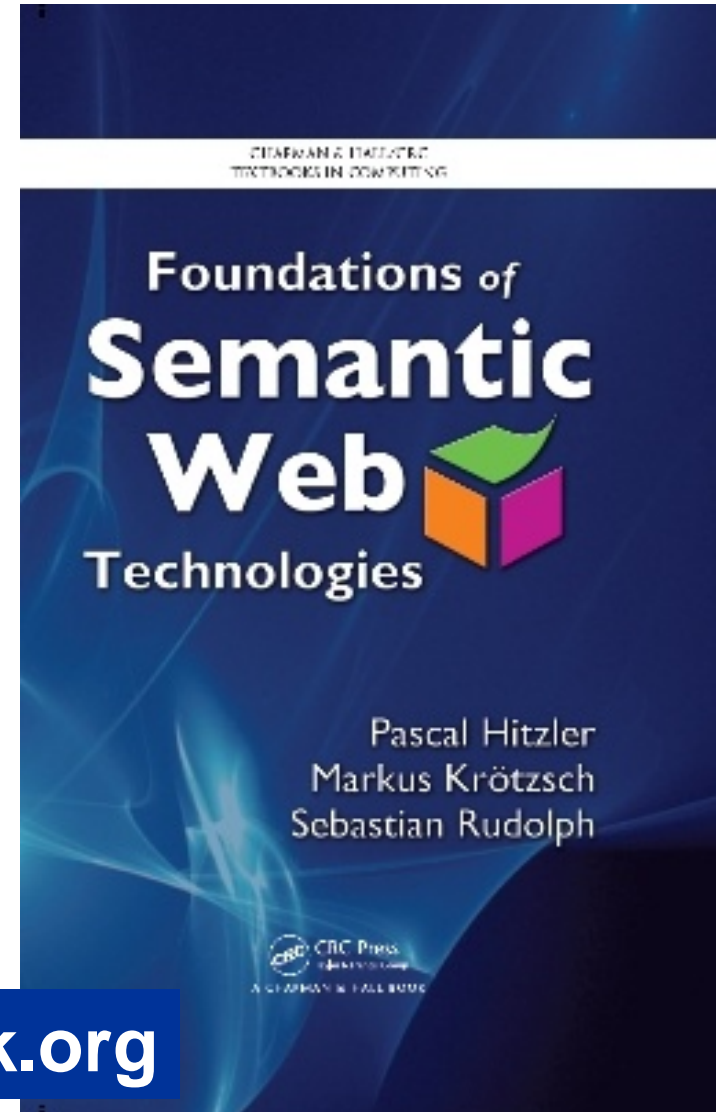
**Pascal Hitzler, Markus Krötzsch,  
Sebastian Rudolph**

**Foundations of Semantic Web  
Technologies**

**Chapman & Hall/CRC, 2010**

**Flyer with special offer is available.**

**<http://www.semantic-web-book.org>**



**From Horridge, Parsia, Sattler, From Justifications to Proofs for Entailments in OWL. In: Proceedings OWLED2009.**

<http://sunsite.informatik.rwth-aachen.de/Publications/CEUR-WS/Vol-529/>

Person  $\sqsubseteq$   $\neg$ Movie

RRated  $\sqsubseteq$  CatMovie

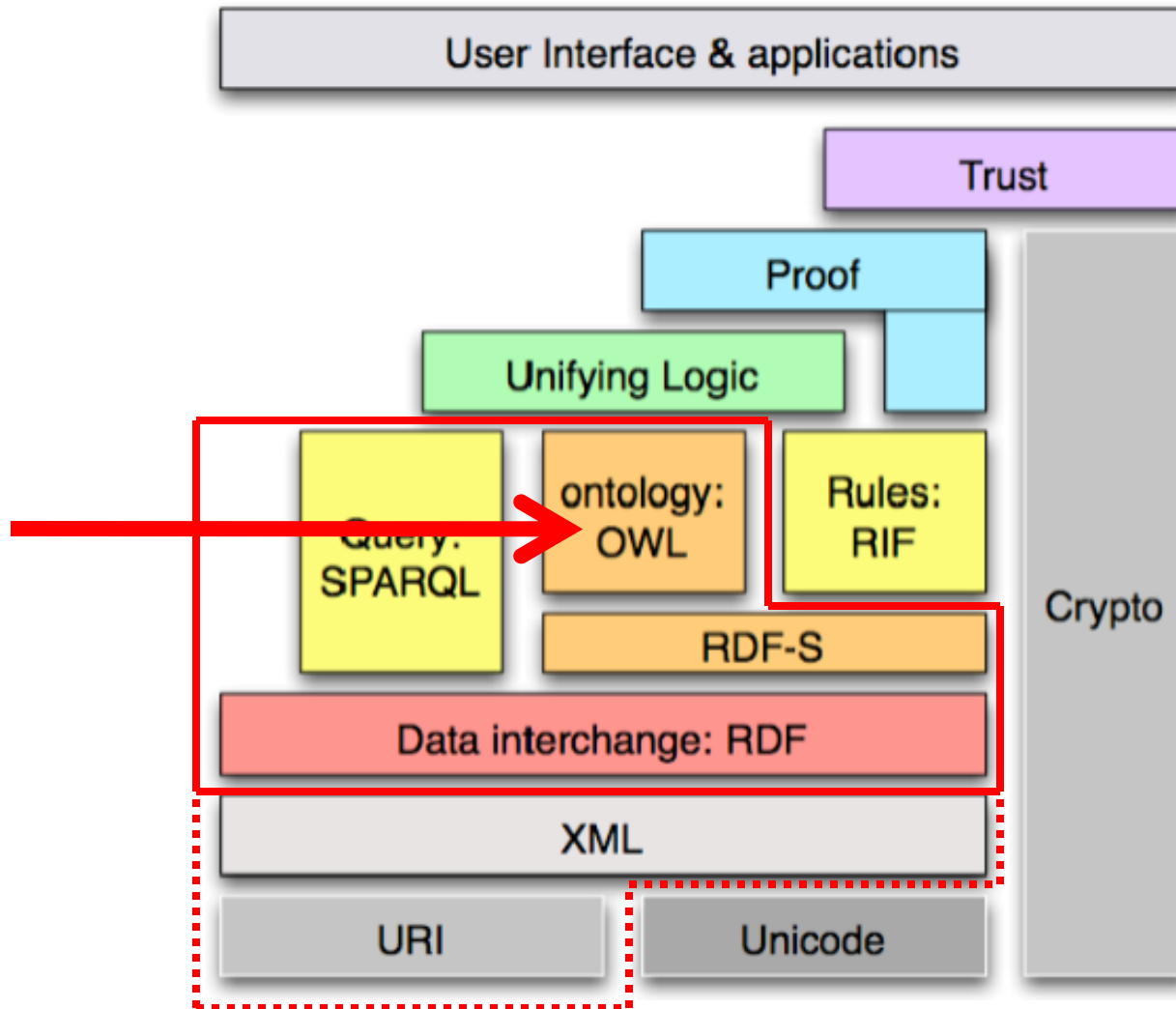
CatMovie  $\sqsubseteq$  Movie

RRated  $\equiv$  ( $\exists$ hasScript.ThrillerScript)  $\sqcap$  ( $\forall$ hasViolenceLevel.High)

Domain(hasViolenceLevel, Movie)

**Fig. 1.** A justification for Person  $\sqsubseteq \perp$

# Today: The Description Logic EL++



- The OWL 2 spec describes three profiles (fragments, sublanguages) which have polynomial complexity.
  - OWL EL (the description logic EL++)  
we will talk about this next
  - OWL QL (the description logic DL Lite<sub>R</sub>)  
forthcoming class presentation
  - OWL RL (the description logic DLP)  
skipped
    - inspired by intersecting OWL with Datalog
    - implemented e.g. in Oracle 11g

- ***Pushing the EL Envelope.*** Franz Baader, Sebastian Brandt, and Carsten Lutz. In Proc. of the 19th Joint Int. Conf. on Artificial Intelligence (IJCAI 2005), 2005
  - this introduces EL++
- ***Pushing the EL Envelope Further.*** Franz Baader, Sebastian Brandt, and Carsten Lutz. In Proc. of the Washington DC workshop on OWL: Experiences and Directions (OWLED08DC), 2008
  - this extends EL++. If people talk about EL++ better check if the extended version is meant.

- **EL**
  - **existential quantification**  $\exists$
  - **conjunction**  $\sqcap$
  - **top concept**  $\top$
  - i.e. it's a fragment/sublanguage of ALC
- **EL+**
  - **bottom concept**  $\perp$  (this allows e.g. disjoint classes)
  - **role chains**  $R \circ S \sqsubseteq T$
  - **datatypes**
- **EL++**
  - **nominals with one individual**  $\{o\}$
- **EL++ extended**
  - **reflexive roles**
  - **range of roles** (domain is already in EL)

note: a global syntactic restriction applies to guarantee polynomiality

- **IF**
  - $R_1 \circ \dots \circ R_n \subseteq S_1$
  - $S_1 \subseteq \dots \subseteq S_n$
  - $\text{range}(S_n) \subseteq C$
- **THEN**
  - there are  $R_{n+1}, \dots, R_m$  with
  - $R_n \subseteq R_{n+1} \subseteq \dots \subseteq R_m$  and
  - $\text{range}(R_m) \subseteq C$

- **Work on EL++ initiated a research branch into polynomial description logics.**
- **Breakthrough was the classification of the SNOMED commercial ontology.**
  - <http://www.ihtsdo.org/snomed-ct/>

- **Most well-known reasoner: CEL**  
<http://lat.inf.tu-dresden.de/systems/cel/>
  - performs *classification* only:  
computation of the class hierarchy of all named classes
- **Pellet also has a specialized algorithm implemented**
- **It's currently still unclear how to reason efficiently with nominals (and thus with ABoxes).**

- See <http://www.w3.org/TR/owl2-profiles/>