The Legal Knowledge Interchange Format (LKIF)

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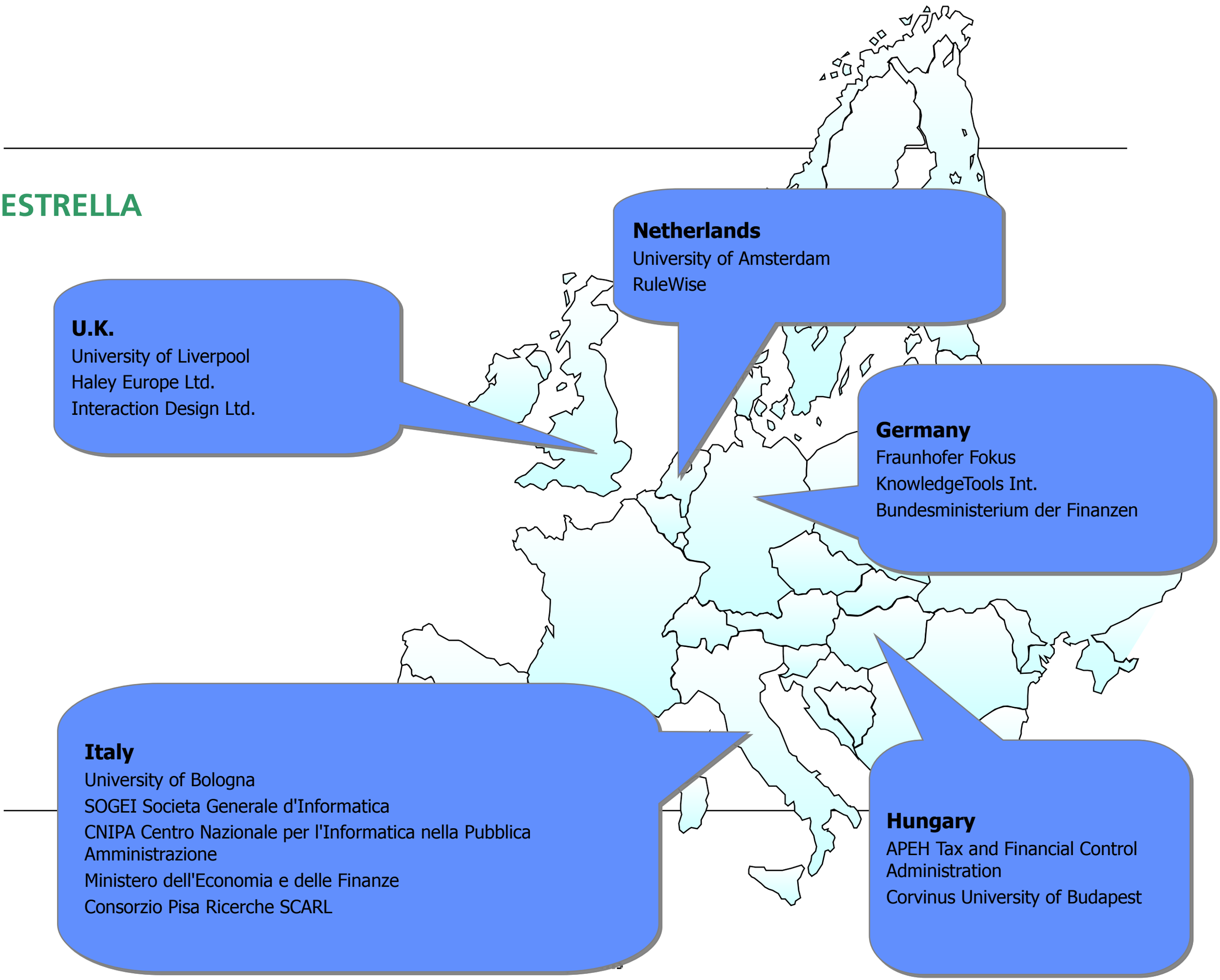
ESTRELLA


Netherlands
University of Amsterdam
RuleWise
U.K.
University of Liverpool
Haley Europe Ltd.
Interaction Design Ltd.
Germany
Fraunhofer Fokus
KnowledgeTools Int.
Bundesministerium der Finanzen
Italy
University of Bologna
SOGEI Societa Generale d'Informatica
CNIPA Centro Nazionale per l'Informatica nella Pubblica Amministrazione
Ministero dell'Economia e delle Finanze
Consorzio Pisa Ricerche SCARL
Hungary
APEH Tax and Financial Control Administration
Corvinus University of Budapest

Motivation

- Increasing complexity and quantity of legislation and regulations, reflecting the complexity of modern technology and a global economy
- Bureaucracy costs for small and medium size companies currently reduce their profits by 50%.
- Legitimacy and credibility of government endangered by the increasing difficulty of citizens and businesses to understand their legal rights and obligations

The Role of Legal Knowledge Systems (LKS)

- Legal knowledge systems (LKS) are the key technology for managing the complexity of legislation
- LKS enable new online e-government services requiring the application of complex legislation (tax benefits, social security administration, …)
- LKS can give citizens and businesses immediate access to a personalized and transparent assessment of their rights and obligations.

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LKS Dissemination Problem – Need for Standards

- Although LKS have a proven track record …
- Public administrations are understandably reluctant to invest heavily in closed, proprietary solutions.
- The further acceptance and dissemination of legal knowledge technology is severely hampered by the lack of an open, standard interchange format for legal knowledge bases.

ESTRELLA's Solution: The Legal Knowledge Interchange Format

- Builds upon World-Wide Web standards (XML, RDF, OWL, …)
- Is defined as an XML schema
- LKIF documents are XML documents which are instances of this schema
- Includes a reusable OWL ontology of basic legal concepts

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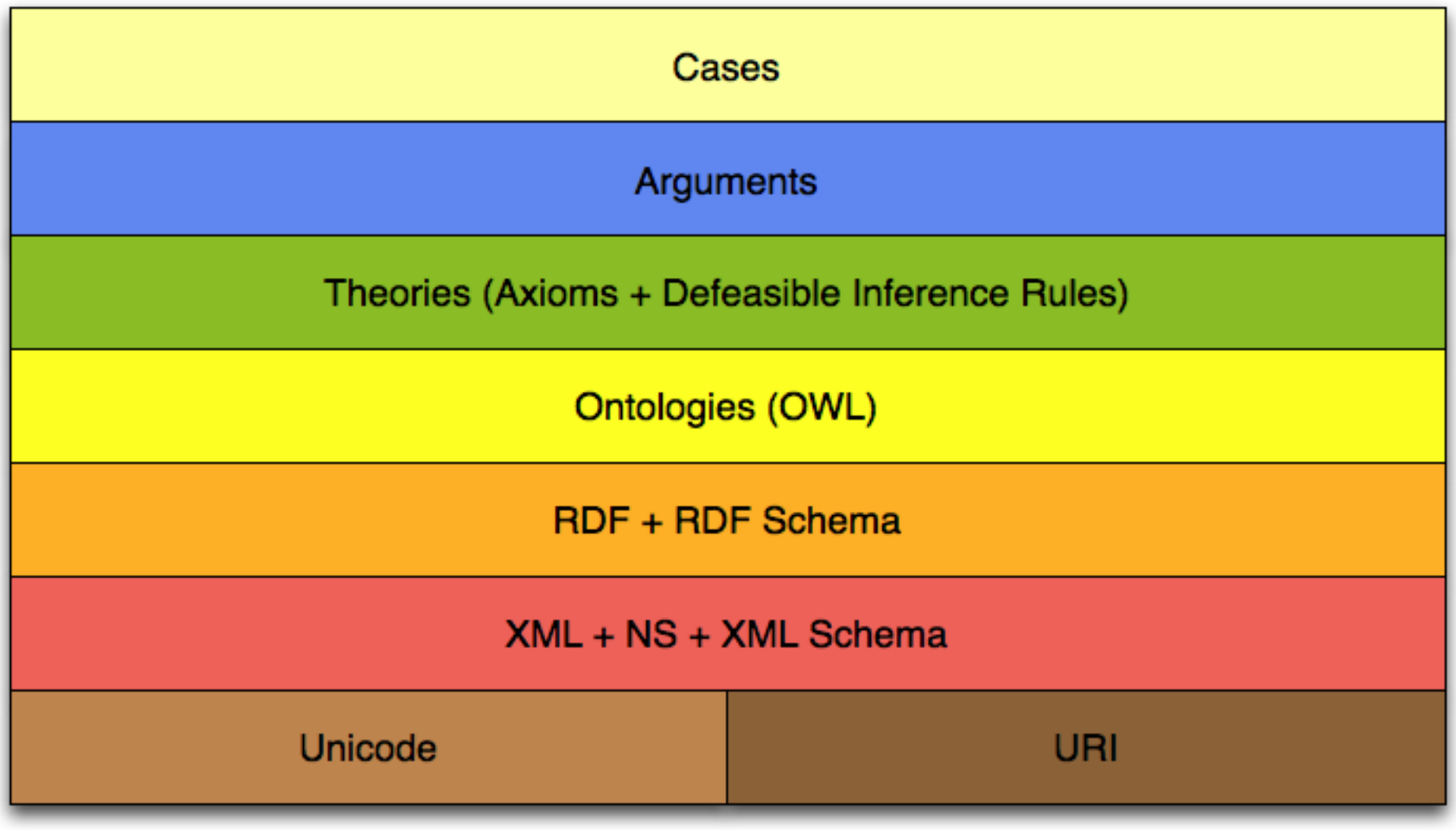
LKIF Stack, Builds on the “Semantic Web”



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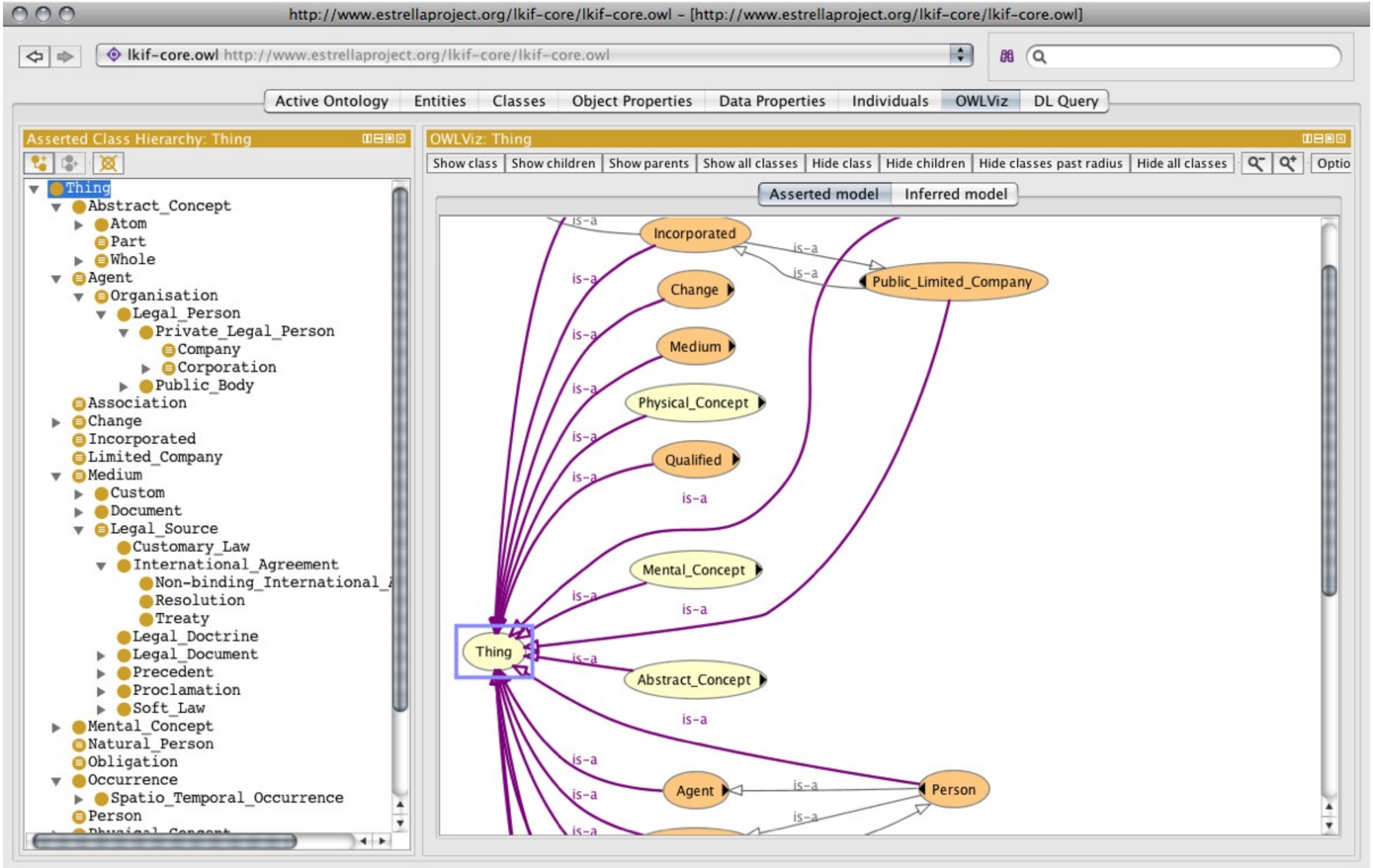
Modeling Ontologies

- In computer science, an "ontology" is an advanced kind of entity-relationship data model.
- Ontologies enable standardized terminology.
- Ontologies can help to reduce the complexity of legislation, by facilitating the reuse of concepts
- Ontologies in LKIF are modeled using the Web Ontology Language (OWL), a World-Wide Web standard.
- Many high-quality software tools exist for developing and using OWL ontologies.

The LKIF Ontology of Basic Legal Concepts



Axiomatization of Theories in LKIF

- A theory is an infinite set of propositions
- Theories are **axiomatized** by a language, a set of axioms and a set of inference rules.
- Language – a set of predicate symbols, can be declared using an OWL ontology
- Axioms – well-formed formulas of propositional or predicate logic
- Inference rules – are **defeasible** in LKIF

Legal Rules are Modeled as Inference Rules in LKIF

- Rules are "reified" objects with properties, e.g. date of enactment
- Rules are subject to exceptions
- Rules can conflict
- Some conflicts can be resolved using rules about rule priorities, e.g. lex superior
- Rules can be excluded from being applicable by other rules

Example LKIF Rules

rule s1601-BGB.
Person1 is obligated to support Person2
given
Person1 is in direct lineage to Person2

rule s1589a-BGB.
Person1 is in direct lineage to Person2
given
Person1 is an ancestor of Person2

rule s91-BSHG.
s1601-BGB excludes "Person1 is obligated to support Person2"
given
"Person1 is obligated to support Person2" would cause Person1 undue hardship

Modeling Legal Argument

- Legal reasoning is **not** only deduction from rules and facts:
  - Input: rules, facts
  - Output: legal assessment (e.g. liable, guilty, entitled)
- Rather, legal reasoning is in general a **modeling** process [Fiedler, 1985]
  - Input: issue or claim
  - Output: theory of rules and facts, arguments, legal assessment

General moral principals and judgments about the morality of specific acts are constructed together, in an iterative process of mutual adaptation

[Rawls, 1951]

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One’s attention must shift back and forth (“Hin- und Herwandern des Blickes”) between the evidence and legal sources when trying to subsume facts under legal terms.

[Engisch, 1960]

Legal reasoning is not primarily deductive, but rather a modeling process of shaping an understanding of the facts, based on evidence, and an interpretation of the legal sources, to construct a theory for some legal conclusion.

[Bing, 1982]

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"There can be no final and exhaustive definitions of concepts, even in science.... We can only redefine and refine our concepts to meet the new situations when they arise."

[Hart, 1983]

"The task essentially includes the choice, shaping and logical construction of the appropriate legal rules as well as the pertinent statements of facts in mutual interdependence. .. The process is not reduced to the application of deductive logic to given premises, but essentially consists in constructing a logical fabric."

[Fiedler, 1985]

"Legal reasoning is a form of *theory construction*. … A judge rendering a decision is constructing a theory of [the law and facts of] a case. … A lawyer's job is to construct a theory of the case too, and one that just happens to coincide with his client's interests."

[McCarty, 1997]

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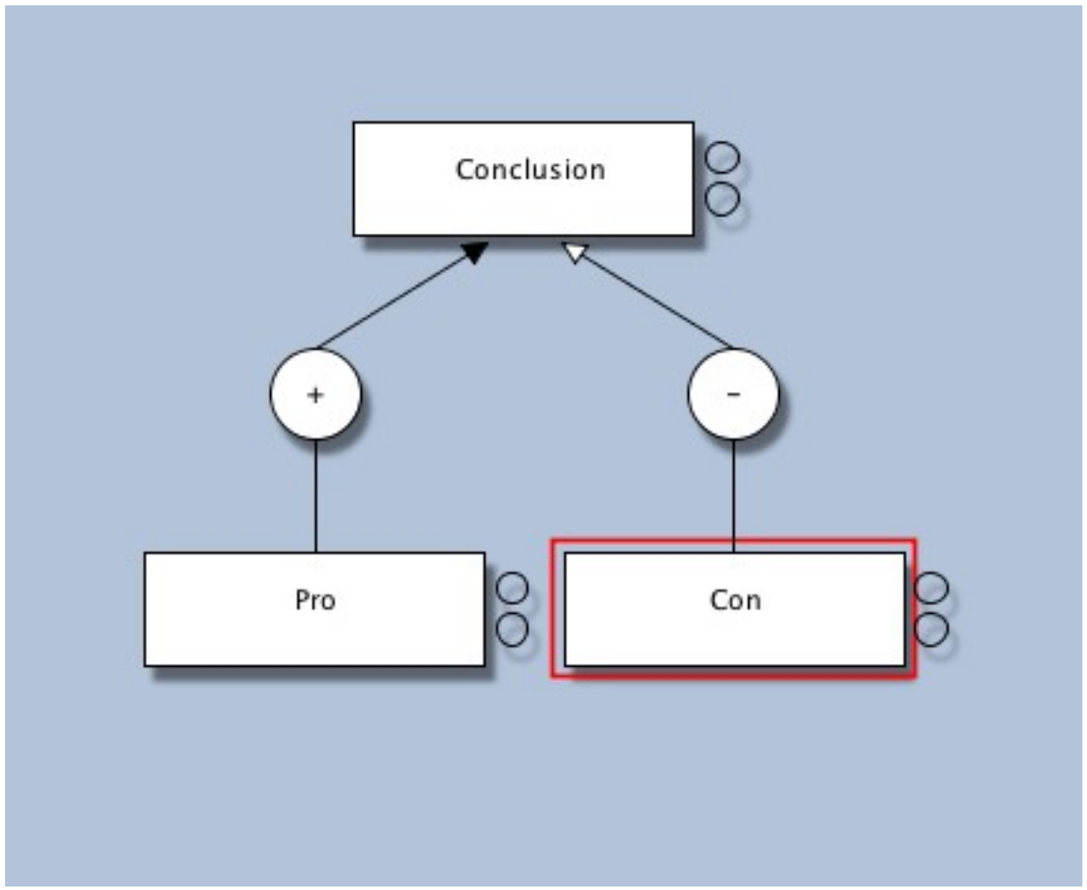
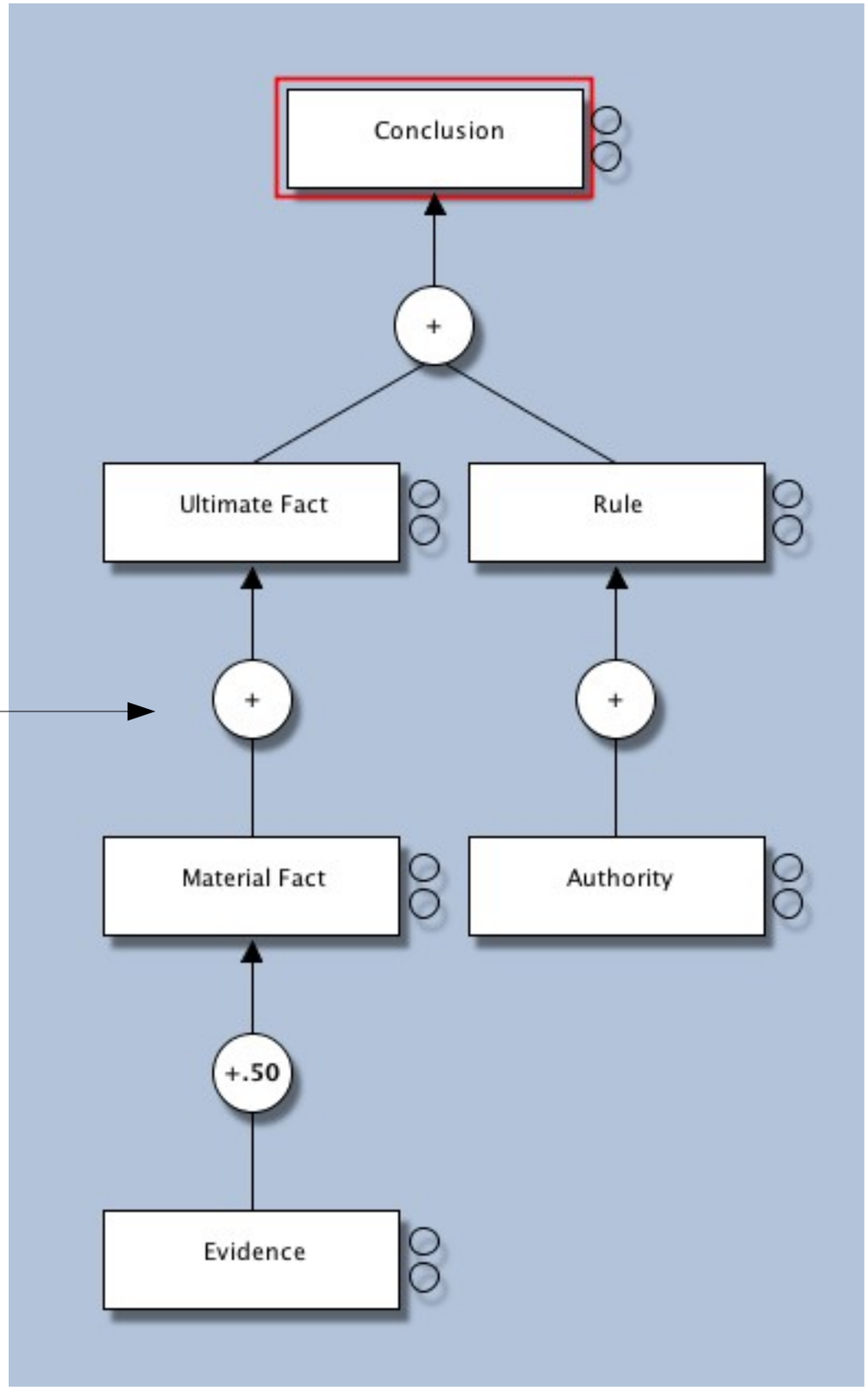

Conclusion
+
-
Pro
Con

Defendant drove a vehicle through the park.

Subsumption

Defendant pushed a baby carriage through the park.

Witness testimony



Vehicles are forbidden in the park.

Legal code section

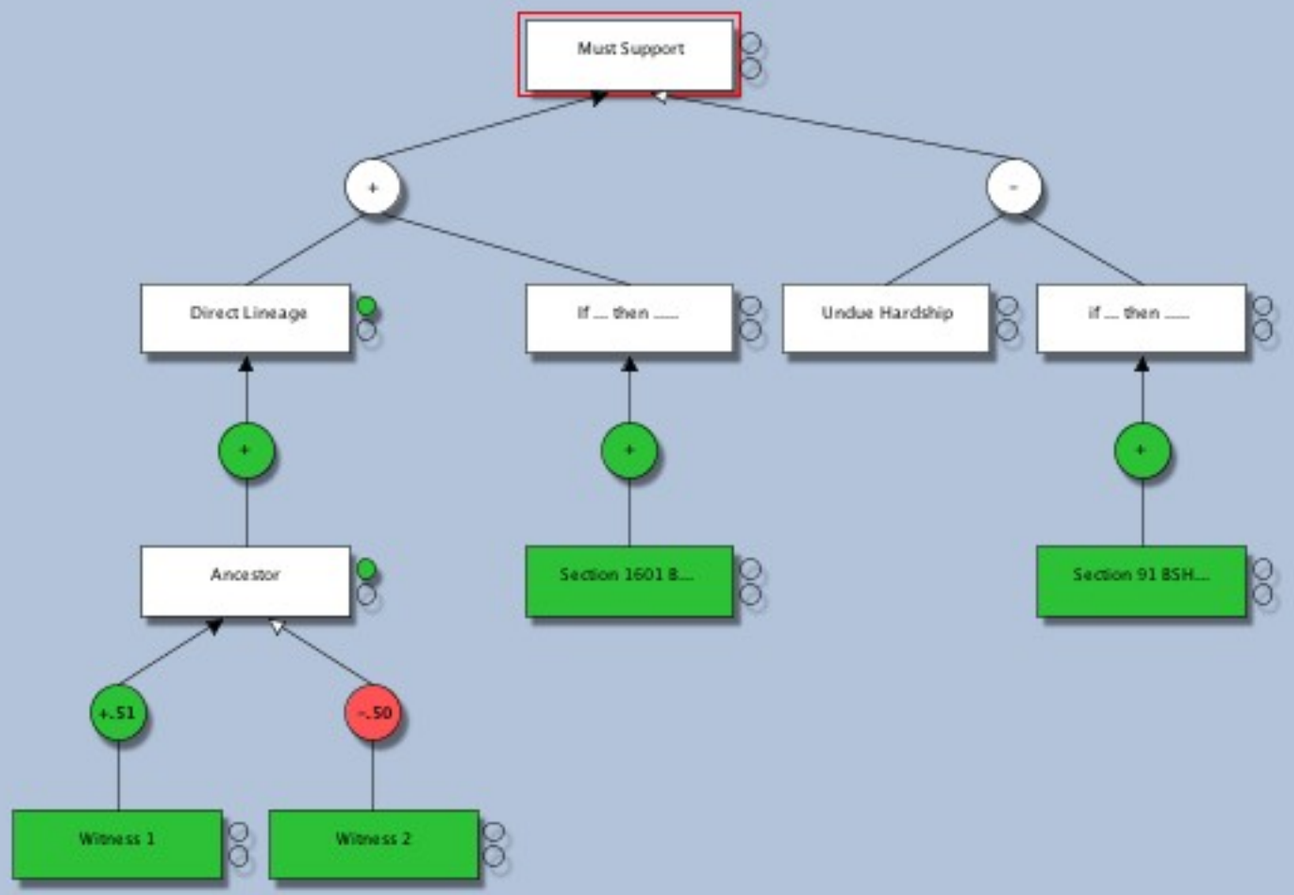
Carneades – /Users/tgo/Documents/Manuscripts/Digitale Staat 2008/Figs/FamilyLaw1.xml

File Edit Insert

Zoom: 54%

graphs

New Graph



search

Must Support
Direct Lineage
Ancestor
If ... then ...
Section 1601 BGB
Undue Hardship
if ... then ...

add argument | delete

id: s1

content: Must Support

status: (•) stated ( ) questioned ( ) assumed true ( ) assumed false ( ) accepted ( ) rejected

acceptable: [ ] statement [ ] complement

proof standard: ( ) scintilla of evidence (•) dialectical validity ( ) best argument ( ) preponderance of evidence ( ) clear & convincing evidence ( ) beyond reasonable doubt

Validation of LKIF – Pilot Applications

- Italian Legislative Decree No 48 of April, 18, 2005, implementing EU Directive 2003/48/EC.
- Hungarian VAT tax legislation
- European Directive 90/434/EEC, the "Merger Directive".

Validation of LKIF – Translators

- RuleWise. UML classes ⟶ OWL concepts
- Haley Rules ⟷ LKIF rules
- KnowledgeTools ⟷ LKIF arguments
- AlexGold ⟷ LKIF rules

LKIF Reference Inference Engine – Carneades

- Carneades provides tools supporting a variety of legal reasoning and argumentation tasks, including:
  - argument construction from defeasible rules, precedent cases, ontologies and testimonial evidence
  - argument evaluation, applying proof standards and respecting the distribution of the burden of proof
  - argument mapping and visualization
- Carneades supports all of LKIF
  - Ontologies – Description Logic Programming subset of OWL
  - Rules
  - Arguments
  - Case-based Reasoning – Bench-Capon and Wyner's reconstruction HYPO and CATO
- Carneades is Open Source
  - Available at http://carneades.berlios.de

Future Work

- Further pilot applications
- Better documentation (user manual, tutorials, etc.)
- Graphical user interfaces: desktop application and web application
- Further dissemination activities (user group, …)
- Standardization (DIN, CEN, … ?)

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Conclusions

- LKIF is a rich interchange format for legal knowledge systems
- LKIF is an open, non-proprietary format, free for anyone to use
- LKIF builds on World-Wide Web standards
- LKIF consolidates the state-of-the-art of over 20 years of AI and Law research
- No commercial system yet supports all of LKIF or provides comparable expressiveness
- Carneades is a free, open source inference engine for LKIF
- Further work is needed to promote, document and standardize LKIF

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Discussion