

The SILK System: Scalable and Expressive Semantic Rules

Benjamin Grosf*, Mike Dean, and Michael Kifer

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* Vulcan, Inc., benjaming@vulcan.com,
<http://www.mit.edu/~bgrosof/>

<http://silk.semwebcentral.org>



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SILK & Hyper LP: Overview

- A KR Language and KR System with reasoner, UI, interchange
 - Syntax & semantics, forward & backward inferencing, Java API, translators
- Goal: Expressiveness + Semantics + Scalability + Web
- Focus: Defaults and Processes
- Largest rule research program in the US (that we are aware of)
 - Begun in 2008, part of Vulcan's Project Halo, primarily via contractors
- *Hyper LP* KR combines new features
 - Defaults and Weakened Classical, cf. generalized Courteous LP and Hypermon. map.
 - External Actions and Events and Queries, cf. generalized Production LP

with previous advanced features

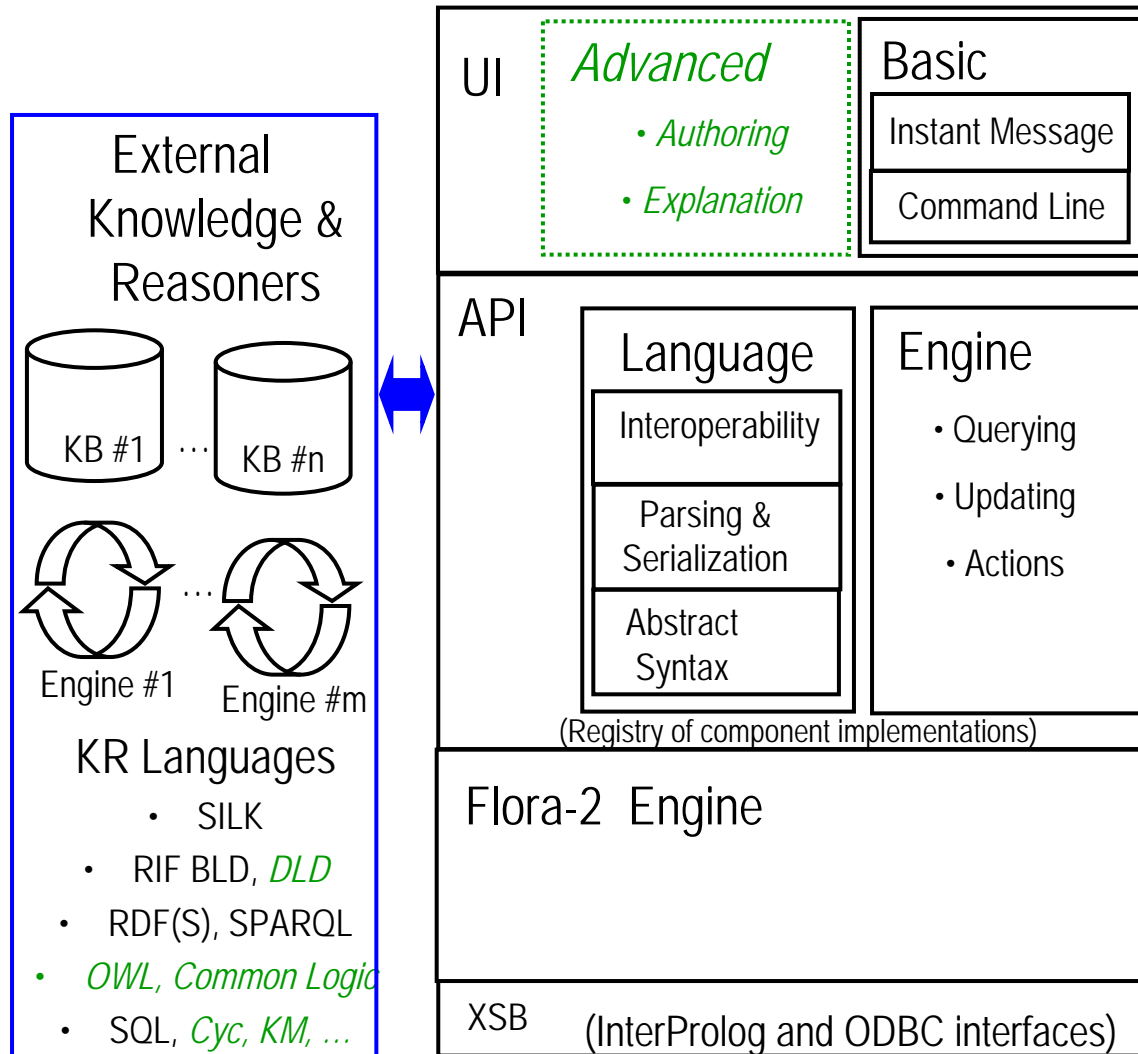
- Higher-order and Frames, cf. Hilog and F-Logic
- Webized syntax, cf. RIF/RuleML and OWL/RDF
- Closed-World, cf. well-founded unstratified NAF
- Good Efficiency of reasoner performance
- Equality, Functions, and misc. other less glamorous features
- Status: prototype engine, language spec, and theory for expressive core
 - V1 adds Higher-Order Defaults to FLORA-2
 - Extensive requirements analysis, use cases, benchmarking; ReCyc translation
 - V2 in development adds more features and Java API (See ISWC-2009 Demo!)



SILK & Hyper LP Overview (cont.'d)

- **Radically extends the KR power of W3C OWL, SPARQL, and RIF – and of SQL**
 - Defaults and robust conflict handling – *cope with knowledge quality and context*
 - Higher-order and flexible meta-reasoning – *elevate meta-data to meta-knowledge*
 - Actions and events, cf. production rules and process models – *activate knowledge*
- **Raises the KR abstraction level for business users (SMEs) and NL KA/UI**
- **Use cases in business policies, ontology mapping, e-commerce, biomed, ...**
- **Redefining the KR playing field for Semantic Web, business rules, and rule-based process management**
 - Defaults and Higher-Order – yet retain computational web scalability
 - Escape from Glass Bubble– yet retain grade-AAA model-theoretic semantics
- **Motto: “Transforming Knowledge”**
 - Composes a set of KR transformations for ...
 - Expressive extensions – language and semantics
 - Translations between KR/syntaxes, for interchange
 - Reuse of previous algorithms and implementations
- **<http://silk.semwebcentral.org>**

SILK V2 Architecture and V3 Directions



- V2 Functionality
 - Higher-order defaults reasoning, combines many other advanced KR features
 - SILK and external KR language support integrated tightly with reasoning engine

- *Future Items*
 - *Meet Process req.'s*
 - *More UI is key: graphical, limited NL*
 - *Integrate with AURA*
 - *SILK KR: truth maintenance, probabilistic & constraints, parallelization*

- Test Sets Focus
 - Defaults, Process
 - AP esp. Bio

Features Comparison – More Systems & Stds

Level	Groups of Features	<i>SILK1</i>	<i>Flora</i>	<i>RIF-BLD</i>	<i>Jena</i>	<i>Onto-broker</i>	<i>Jess</i>	<i>IBM C.R.</i>	<i>DLV</i>	<i>SQL</i>	<i>SPA-RQL</i>	<i>Common Logic</i>	<i>OWL2 RL</i>	<i>OWL2 DL</i>
Basic	Horn chain. etc.	Y	Y	Y	Y	Y	Y	Y	Y	R.	R.	Y	R.	R.
Advanced	<i>(Level summary)</i>	Most!	lots	some	some	some	some	some	some	some	some	some	some	some
	Equality	Y	Y	Y	R.	R.	R.	N	Y	R.	R.	Y	R.	Y
	Functions	Y	Y	Y	N	N	N	Y	Y	N	N	Y	N	N
	Frames etc.	Y	Y	R.	R.	R.	R.	R.	R.	R.	R.	R.	R.	R.
	Closed-World	Y	Y	N	N	Y	R.	R.	most	R.	R.	N	N	N
	Higher-Order	Y	Y	N	N	N	R.	N	N	R.	R.	Y	R. bit	R. bit
	Actions	Dev.	N	N	N	N	Y	Y	N	N	N	N	N	N
	Base Defaults	Y	N	N	N	N	N	Y	N	N	N	N	N	N
	Webized	Dev.	R.	Y	Y	R.	R.	R.	R.	N	Y	Y	Y	Y
Hyper	<i>(Level summary)</i>	1st!	N	N	N	N	N	N	N	N	N	N	N	N
	H-O. Defaults	Y	N	N	N	N	N	N	N	N	N	N	N	N
	Weak. Classi.	Dev.	N	N	N	N	N	N	N	N	N	N	N	N
<u>Misc.</u>		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Other Expres.	Dev.	inherit.	-	-	-	events	-	disju.	R.	R.	classical	-	classic.
	Efficiency	good	good	NA	fair	good	fair	poor	good	NA	NA	NA	NA	NA

- Summarizes detailed analysis of 40 KR expressive features, 17 systems.
- Notes: Dev. = Developing, R. = Restricted; C.R.=Common Rules; disju.=disjunctive.

Test Case: Modeling River Pollution Using Disparate Data Inputs

1. **RDF:** import RDF streaming sensor data about fish counts on river stretches. The data reflects drastic declines on some stretches. We also import an RDF ontology about FishCounts, Stretches, Rivers, etc.
2. **External SPARQL Query:** obtain RDF data from SPARQL endpoint (dbpedia.org) about ?river1 flowsInto ?river2. Our query is implemented using a SILK external predicate.
3. **RIF-BLD:** load RIF-BLD rules (not expressible in RDF) about transitivity of flowsInto.
4. **ODBC:** execute ODBC query of emergency responder information and email addresses.
5. **SILK-FOL:** load FOL axioms expressing multiple causes of pollution (i.e. OR)
6. **SILK Defeasible Reasoning:** use the preceding data to infer toxic discharge and affected rivers.
7. **Persistent Query:** triggered by inference of toxic discharge, it queries ODBC and sends emails to emergency responders via external action predicate

How You can be Involved

- **General Contact: Benjamin Grosf** benjaming@vulcan.com
 - Suggest design, use cases, experts, cooperations
- **Visit the SILK webpage and sign up for the mailing list so you'll be alerted of announcements about SILK**
 - URL: <http://silk.semwebcentral.org>
 - Mailing list: silk-announce@semwebcentral.org (very low volume)
- **Provide comments on SILK language design**
 - Initial public draft in early 2010; selected earlier reviewers starting Nov. 2009
 - Plan to propose a RIF extension with defaults and actions
 - Corresponding to a large expressive subset of SILK
- **Try out SILK software**
 - Prototype, free for research use
 - V2 release in 2010; selected earlier users of the alpha starting Nov. 2009
 - Upcoming: refereed demos of SILK at ISWC-2009 and RuleML-2009