API4KB

Proposals and Challenges

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  - Roy Bell
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  - Harold Boley
  - Adrian Giurca
  - Elisa Kendall
  - James Odell
  - Adrian Paschke
  - Harold Solbrig

So far, 50+ people have shown interest and provided feedback

- .... You?
Part I

Hybrid Knowledge Bases
Hybrid Knowledge Bases

”Knowledge” in a broad sense

› Declarative vs plus Operational
› Qualitative vs plus Quantitative

- Knowledge
  › Concepts/Relations
  › Rules
  › Processes
  › Predictive Models
  › ....

- Data
  › Individuals (A-box)
  › Facts
  › Traces
  › Data Sets
  › ....
Example: Semantic BPM in Prova

1. OMG BPMN (+ Semantics) (CIM)
2. BPEL (PIM)
3. RuleML Rule Responder (PIM)
4. Prova Rule Engine (PSM)

SBPMN -> BPEL+

% receive query and delegate it to another party
rcvMsg(CID,esb, Requester, acl_query-ref, Query) :-
  responsibleRole(Agent, Query),
  sendMessage(Sub-CID,esb,Agent,acl_query-ref, Query),
rcvMsg(Sub-CID,esb,Agent,acl_inform-ref, Answer),
... (other goals)...
sendMsg(CID,esb,Requester,acl_inform-ref,Answer).
Example: Hybrid Knowledge Bases in Jboss Drools
Example: Semantic Event Processing in Government

1. Map ontologies to s/w dev env
2. Execute against known channels
3. Analyze data for new / revised classifications, data criteria etc
4. Use models to revise ontology + rule parameters
5. Define & run self-analysis rules

Ontology Development

IT Development

Data
- Events
- Event Patterns
- Inferences
- Decisions

TIBCO BusinessEvents

Protege

TIBCO Spotfire

Business / analysis

Analytics Models Development

Execution

Distributed fact

Archive / Backing store

JMS

Rules + Cont Queries

Rules

Rules + Decision Engines

Courtesy of Paul Vincent (Tibco)
Part II

Use Cases
Clinical Decision Support Systems

- Inspired by Health e-Decision Standardization Initiative
  http://wiki.siframework.org/Health+eDecisions+Homepage

- The National Health Coordinator expects a **uniform application of clinical guidelines** to be applied by the different, local healthcare providers running Clinical Decision Support Systems

- Clinical guidelines might be expressed as rules, processes, or a combination thereof
  - Usually include **predictive models** and/or **semantic classifications**

- Local knowledge bases will need to be **updated**
  - The new artifact will integrate with existing rules/processes

- The data, kept by the local providers, may be using different formats

- Many actors would **query/invoke** the (updated) knowledge base
Environmental Decision Support Systems

- Inspired by a project from the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)
- Similar initiatives in Spain (http://www.novedar.com) and USA (http://www.ifossf.org)

Water Treatment Plants require continuous monitoring and control. They are being equipped with sensors, generating data which must be processed in (soft) real time for decision support

- The automation modules installed on the plants submit data to a remote, loosely coupled knowledge-based service to be analysed
- The remote EDSS can generate commands and send them back to the plant
- The data must also be delivered to a (decoupled) monitoring system which verifies the legal aspects
Legal Decision Support Systems

- Inspired by the LegalRuleML initiative

- The norms and principles that regulate many contexts (from Web applications to daily life) derive from legal texts, whose interpretation is often discretionary
  - Judgments provide information about arguments and interpretations in concrete, reference cases...
  - ... but they are subject to variations in time and context

- Legal ”reasoning” requires non-monotonic (defeasible and deontic) temporal inference, over concepts defined in appropriate ontologies, with argumentation and metadata reference to external knowledge sources.
Part III

API4KB
Knowledge **Artifacts** are becoming more easily available

Hybrid **Knowledge Bases** allow to combine them

Hybrid **Engines** make use of that Knowledge
  - Provide distributed reasoning capabilities
  - World-wide infrastructure for intelligent agents

**Problem:**

How can a “third party” make use of this?
  - Without making assumptions on the content of the KB!
  - Without making assumptions on the inference processes!
API4KB : Related Initiatives

- **Rules and Queries**
  - RuleML
  - SparQL
  - RIF
  - SWRL
  - ...

- **Graph Queries**
  - Graph Query Lang
  - Linked Data API
  - ...

- **Ontologies**
  - ODM
  - RDF API
  - OWL API
  - OntoCat
  - OWLIM
  - ...

- **Terminologies**
  - CTS2
  - IEPV
  - ...

- **Agents**
  - FIPA
  - ...

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API4KB Initiative Roadmap

- Publish RfP (✔)
- Collect a Use Case Library (⊙)
  - Define the scope for the standard
- Design the specification (⊙)
- Provide Reference Implementations (✖)
API4KB vision:

- **Adaptive Services**
  - Client's request may be specific
    - e.g. a SPARQL query
  - The service provider will try to approximate (best effort) the request
  - Even if the KB/reasoner does not support it natively
    - → Semantics
    - → Metamodels
    - → Translations
    - ...

...
API4KB Principles / 2

API4KB vision:

- Transparency w.r.t provider
  - Abstract Knowledge Content
  - Abstract Reasoner Capabilities
  - The Client should be unaware of the service provider's nature
    - (Unless they explicitly want to)

- Transparency w.r.t coupling
  - Strongly Coupled (library)
  - Loosely Coupled
  - Decoupled
APIs expose common services
API4KB Actors / 2

- Universal Meta-API
  - expose *metadata*
  - expose configuration *options*
API4KB Requirements

- Parsing and Storing
  - Knowledge “Content” vs Knowledge ”Format”
  - Import
  - Export

- Reasoning
  - Check : Consistency and Validation
  - Infer  : Ontology- vs Rule- based
  - Report : Metrics
  - Explain : Truth maintenance and Justification
  - Reconcile : Input Data vs Knowledge Base(s) vs Reasoner(s)
API4KB Meta-API architecture

- XACML-inspired
  - Internal access control
  - Dispatch
API4KB API architecture

- Current topic for discussion

- "Knowledge-managing" agents
  - Protocols
    - Negotiation
    - Access
API4KB: Next Steps

- Create a significant, public, Use Case Library
  - → Contributions from the community and interested parties are welcome

- Design the core APIs
  - → Bring together experts from different fields: ontologies, rules, etc. to harmonize the existing, base standards

- Select the appropriate binding(s) for implementation
  - → Evaluate interface meta-models
References and Contacts

- **API4KB Wiki:**
  - [http://www.omgwiki.org/API4KB/doku.php](http://www.omgwiki.org/API4KB/doku.php)

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Questions?

Thank you for your attention!