API4KB

Design Principles

State of the Art
OMG Technical Meeting – Berlin, June 2013

Requirements (summary)

- Problem:

  ## Provide uniform, transparent access to Hybrid Knowledge Bases

  - Simple, static KBs

  - Working Memories with (re)active reasoners

  - Federated KBs with loosely coupled, heterogeneous reasoners

  - ...

Hybrid KBs

- Composite KBs
  - Ontologies
    T/R-box + A-box

  - Rulebases
    Rules + Facts

  - Predictive Models
    Models + Datasets

  - Business Processes
    Processes + Instances

Reasoners

Model Base   Fact Base

KB Manager
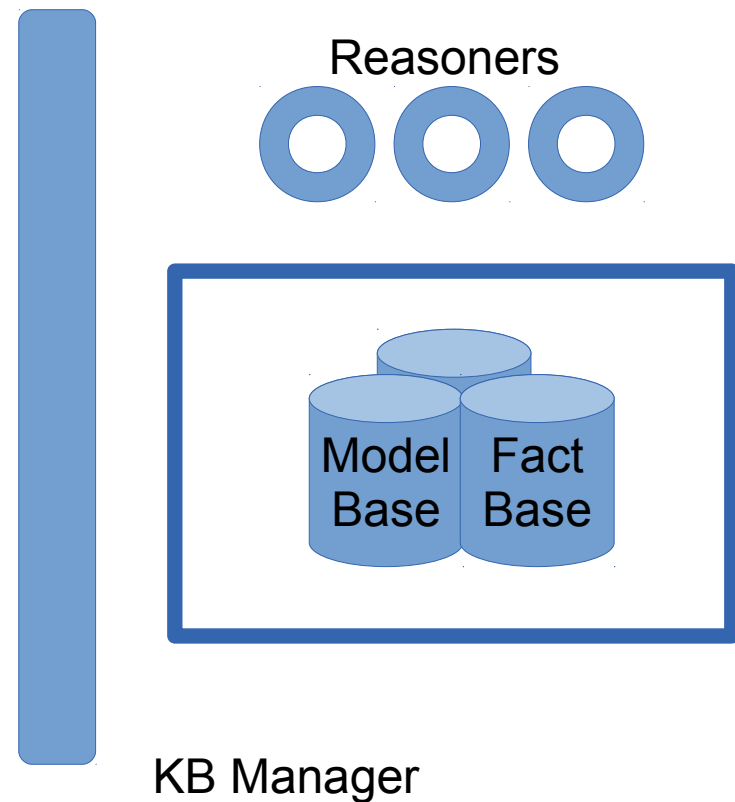
Related Standards

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

- **Graph Queries**
  - GQL
  - Linked Data API

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

- **Terminologies**
  - CTS2

- **Agents**
  - FIPA

API Design Principles

- Support Multiple Bindings

  – Library

  – Service

  – SOAP / REST

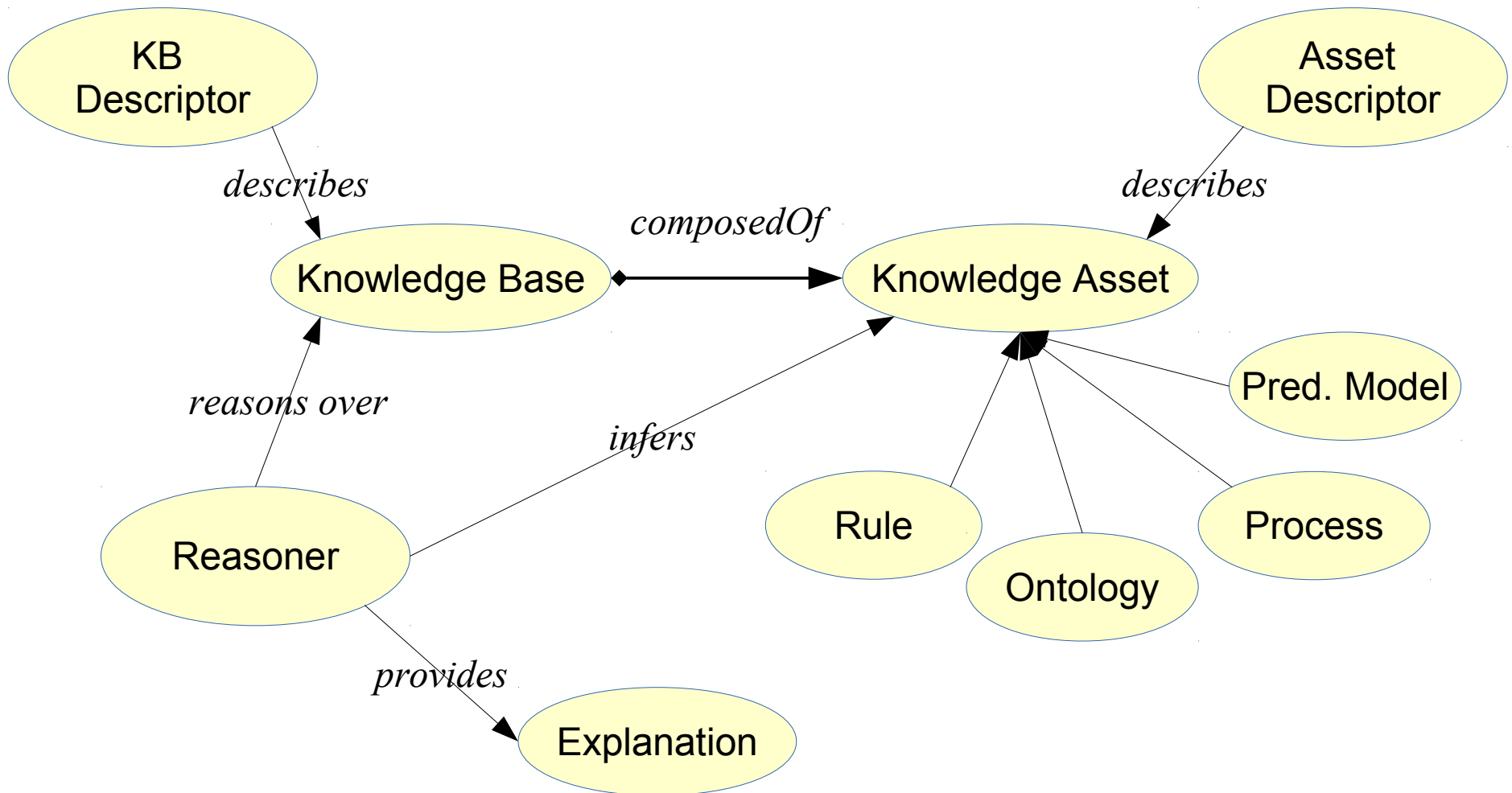 – Agent capabilities

  – ...

API Design Principles

- ## Asynchronous
  - *Potentially, very time consuming...*

- ## "Best effort"
  - *Client(s) may not know the current state of the KB*

- ## Idempotent
  - *Multiple clients may issue the same request*

- ## Mediated
  - *KBs are managed by (active) components / agents*
    - *Security, Access control, Integrity, ...*

APIs

- # KB Configuration
  Setup KB infrastructure

- # KB Construction
  Manipulate content ("Knowledge Assets")

- # Reasoning
  Trigger reasoners

- # Querying
  Add/retrieve information

- # Metadata
  Discover metrics and capabilities

Abstract Model

Capabilities

- Describe the features of a KB
  - Expressivity
  - Complexity
  - Decidabiltiy
  - Inference modalities
  - Supported language features
  - Supported models
  - ....
- Modalities
  - Declared   : what a KB could potentially do
  - Available   : what a KB can do at a given moment
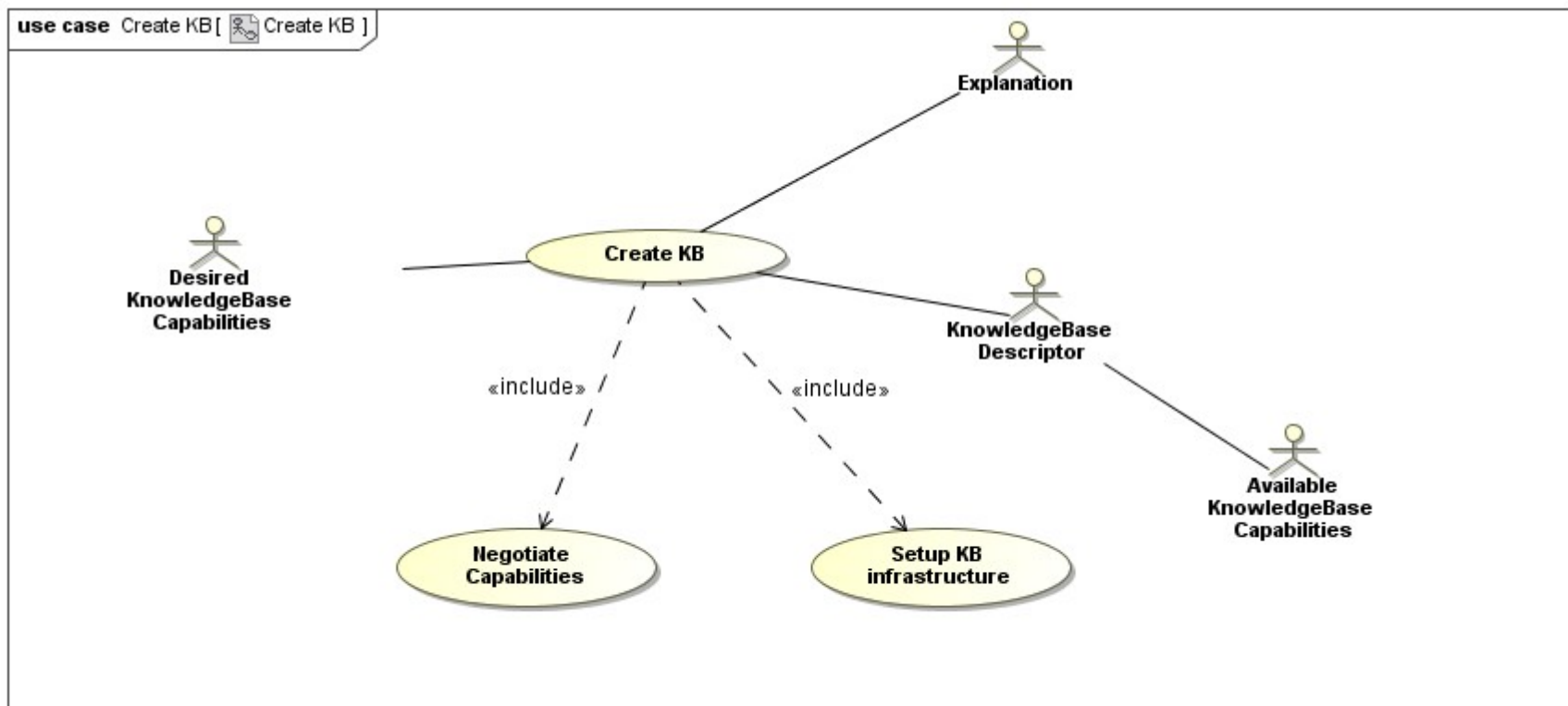 - Required   : what a KB should be able to do
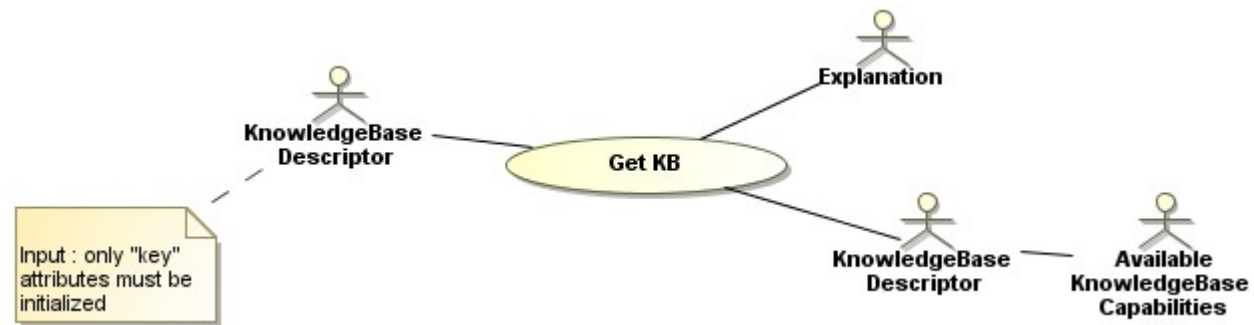 -

KB Configuration APIs

KB Configuration APIs

- Setup KB Infrastructures
  - Data Stores
  - Reasoners
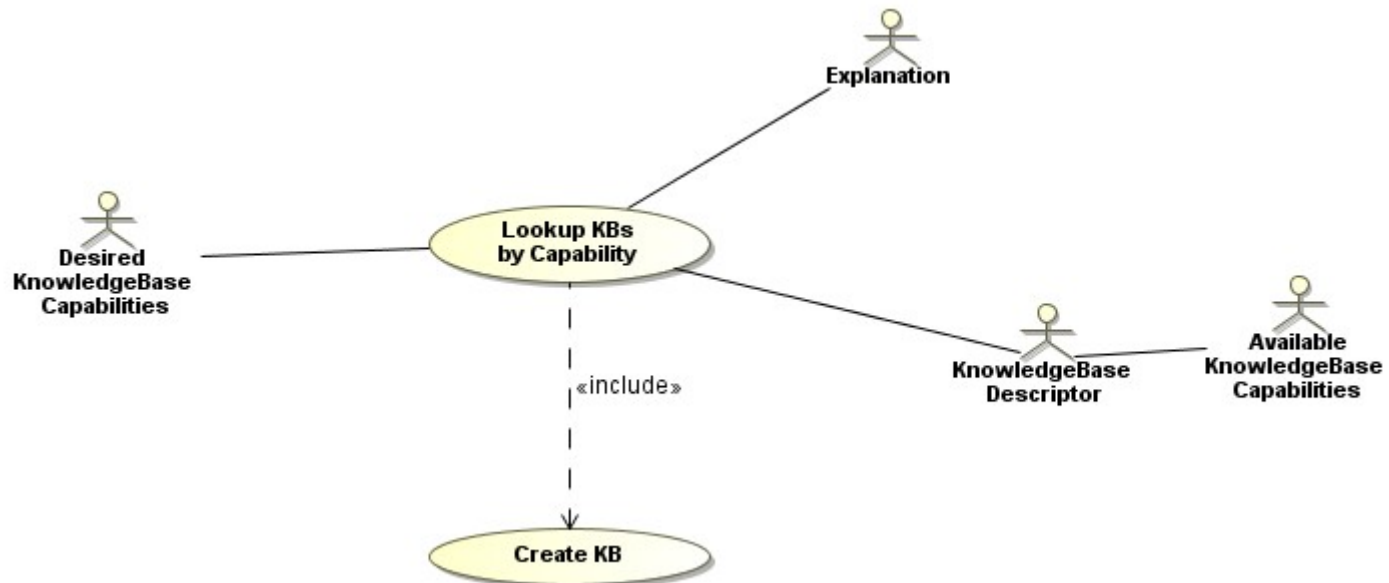 - Orchestration Components

Create KB

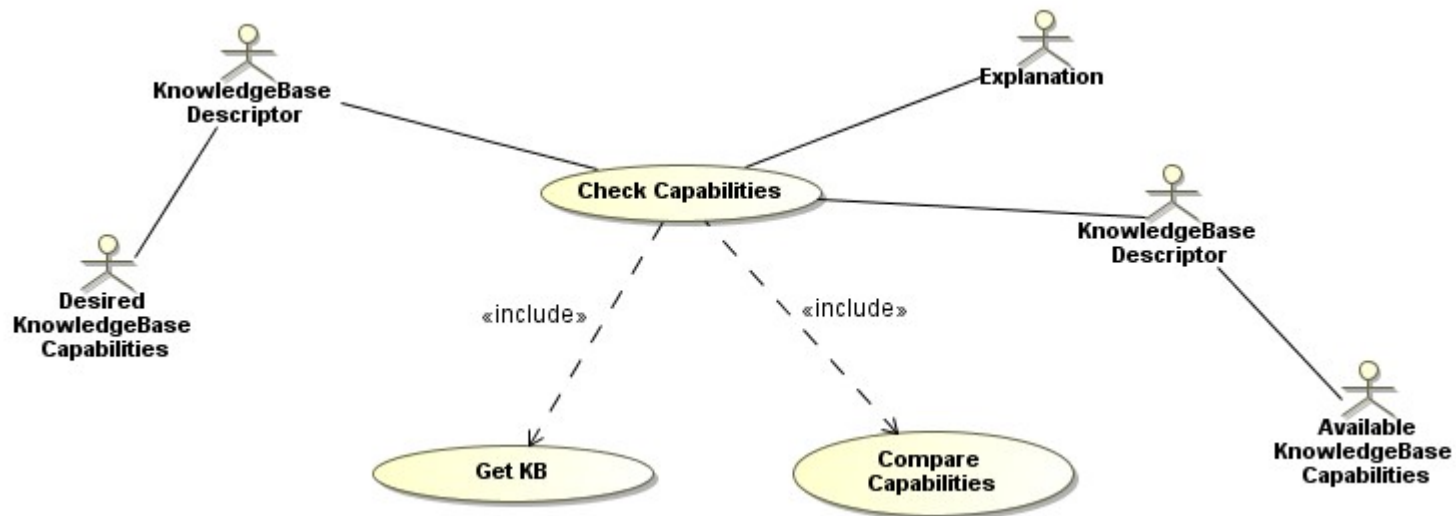Tries to create a new KB, with agreed-upon capabilities

Get KB

Retrieves a KB, given its Identifier(s)
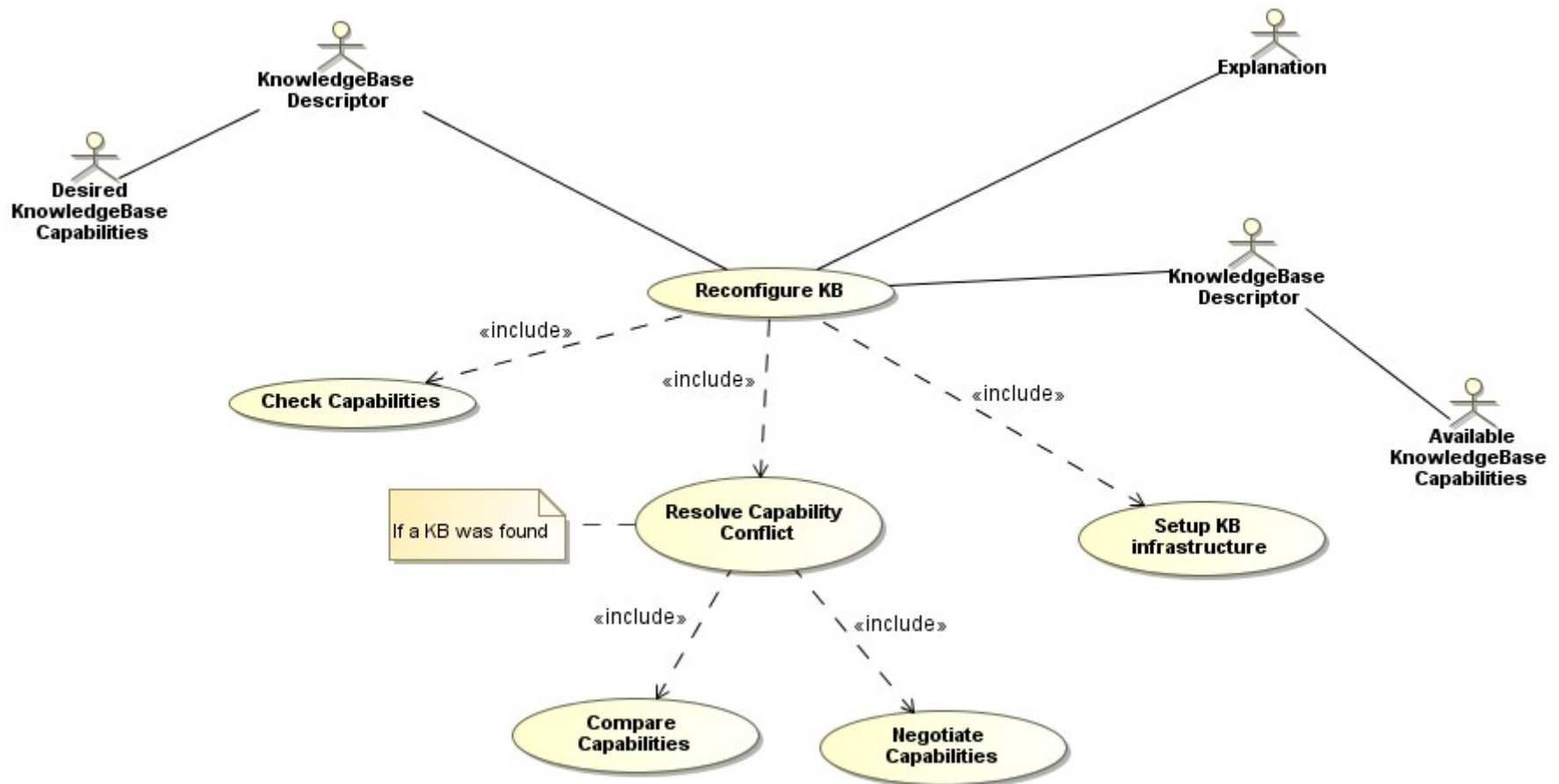
Get KB by Capabilities

Looks up KB(s) supporting the desired capabilities. If none exists, it may create one.

Check KB Capabilities

Verifies whether a given KB has the desired capabilities or not

Reconfigure KB

Tries to ensure that a KB has the desired capabilities
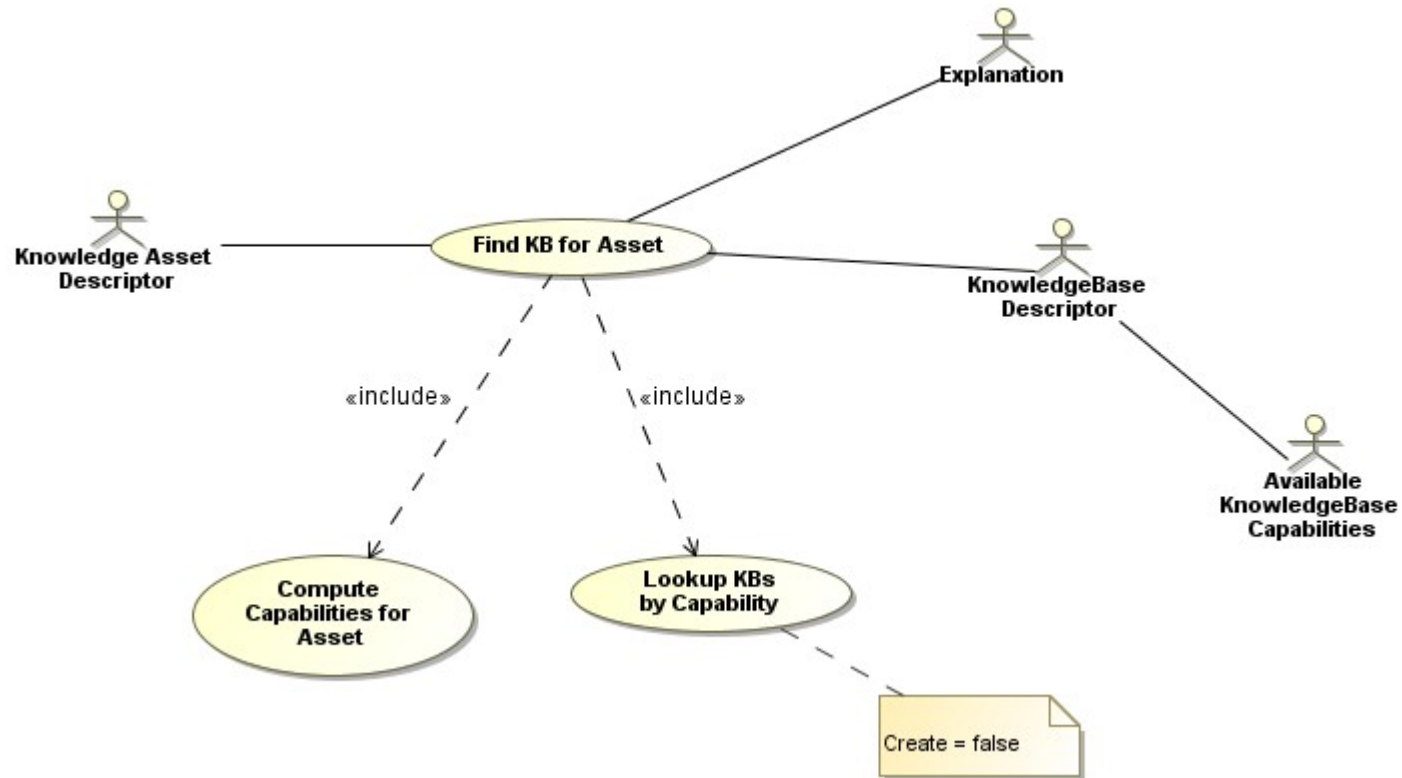
KB Asset Management APIs ("CRUD")
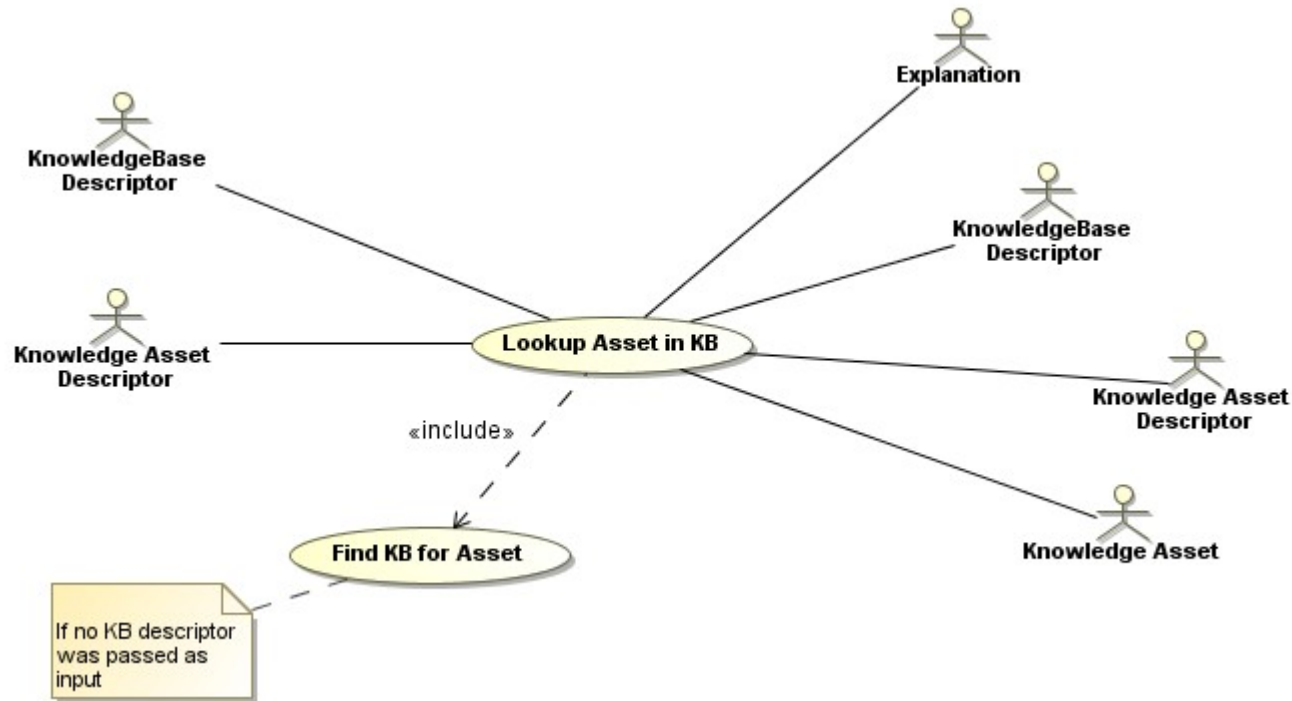
Asset Management APIs

- Parse and Translate Assets
  - Convert between different formats
  - Exact vs Approximate

- Load Assets into KBs
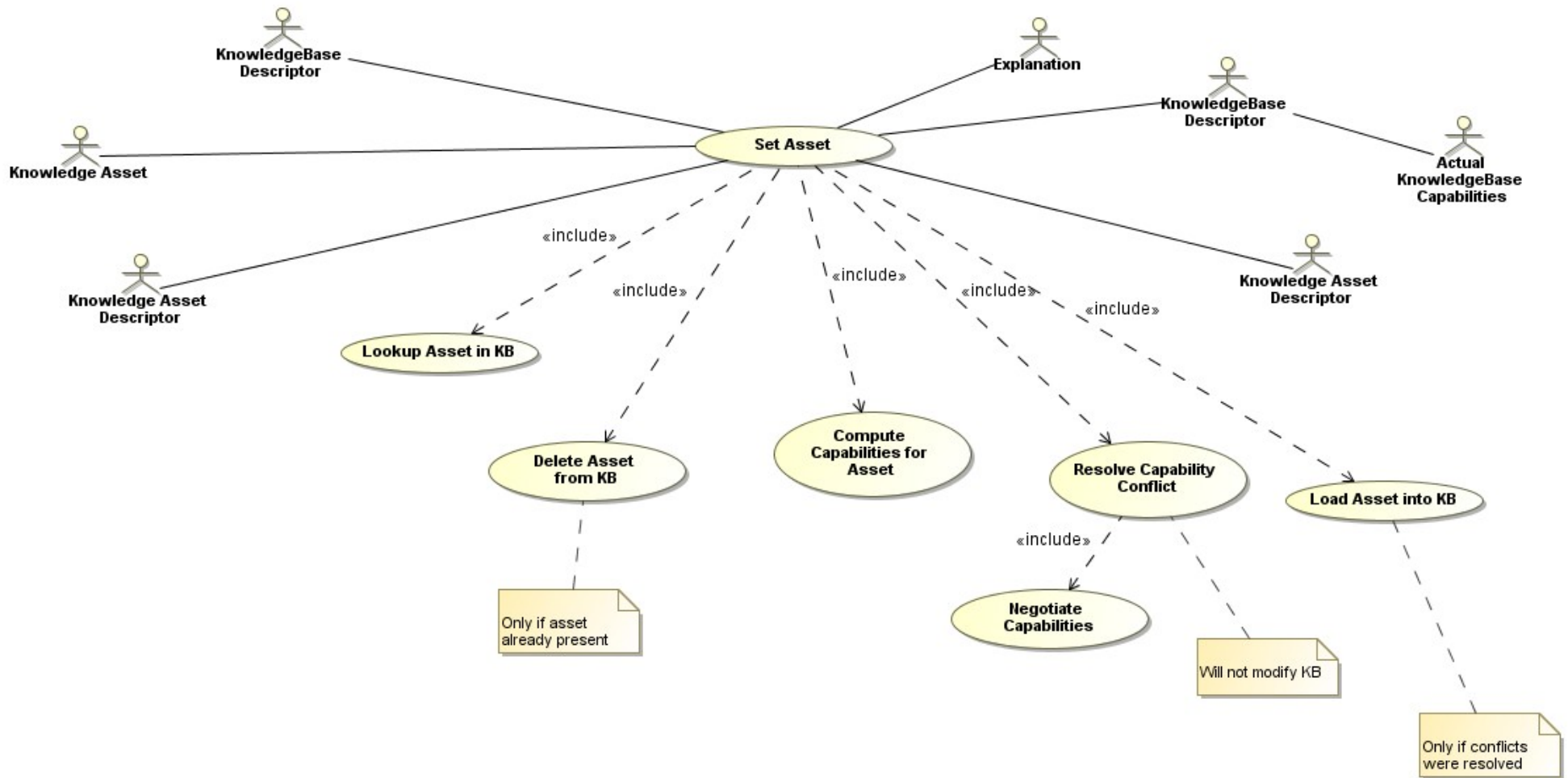
Find Compatible KBs

Find KBs which could potentially support an Asset
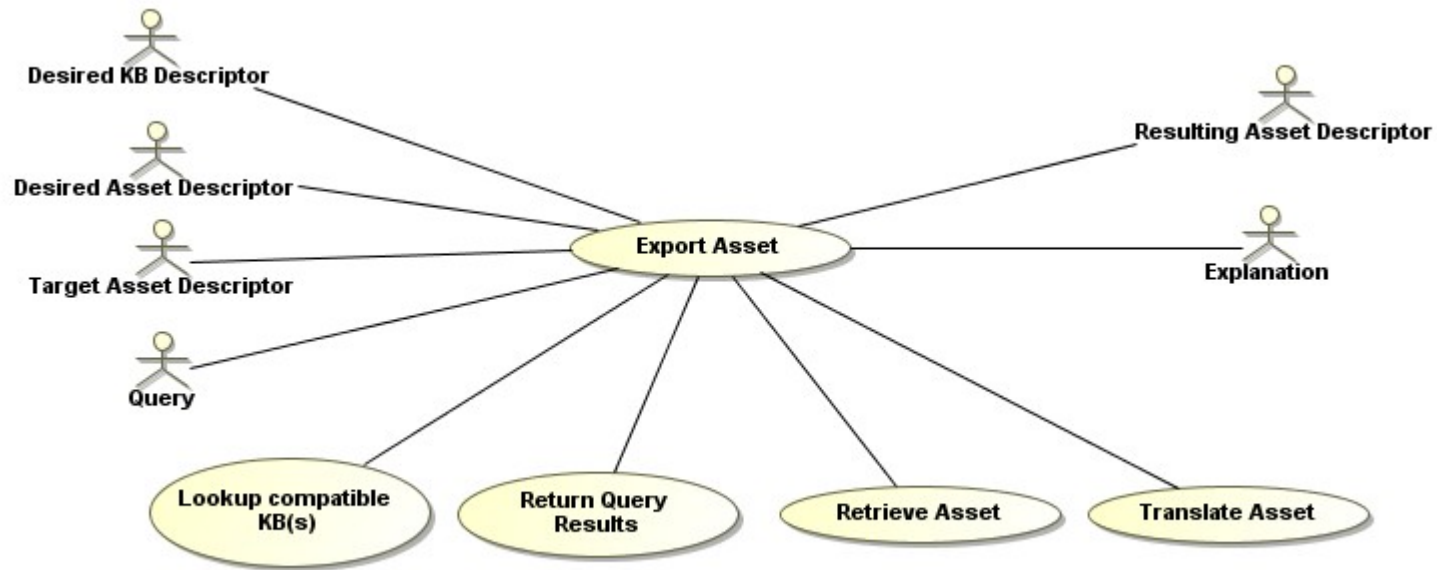
Lookup (Read) Asset

Find KB(s) which contain a given Asset descriptor, then extract the actual Asset

Set Asset

Tries to ensure that the given Asset is loaded in the given KB

Export Asset

Tries to deliver an Asset to a location, in the desired format

CRUD Mapping

- Create
  - → Set when Asset is not already present

- Delete
  - → Replace Asset with "nil" version

- Update
  - → Set when Asset is already existing
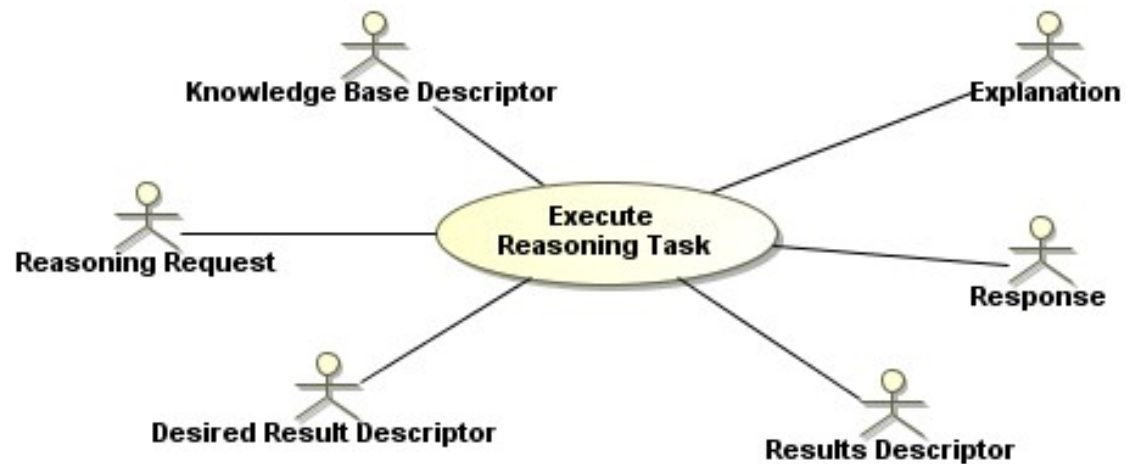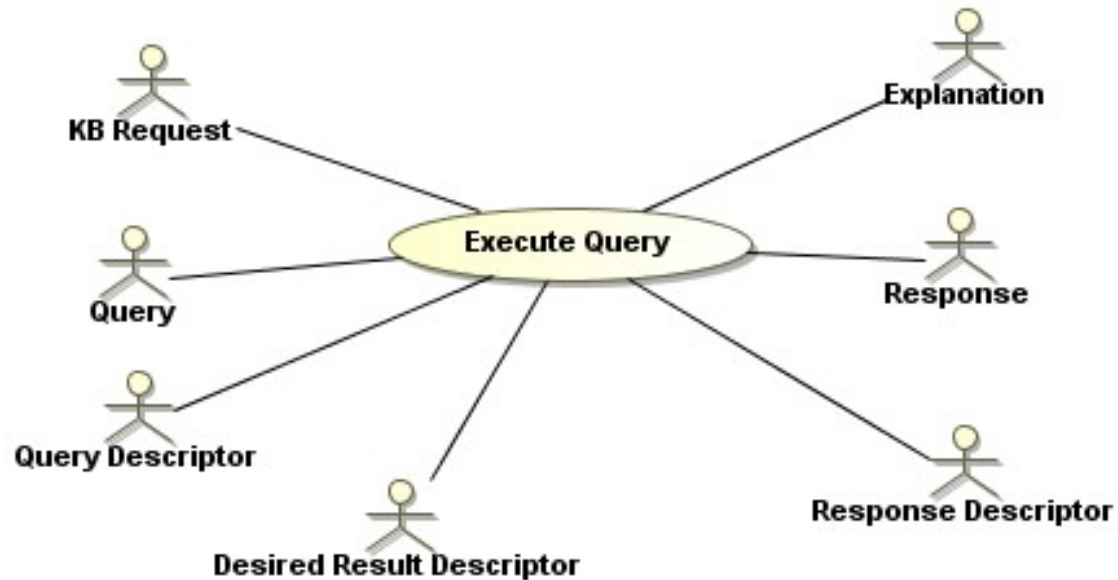
Reasoning APIs

Reasoning APIs

- Execute common reasoning tasks
  - Consistency check
  - Classification
  - Inference
- Execute queries
  - Agent communication performatives

Launch Reasoner

Triggers any reasoner(s) and possibly materializes the results before returning them
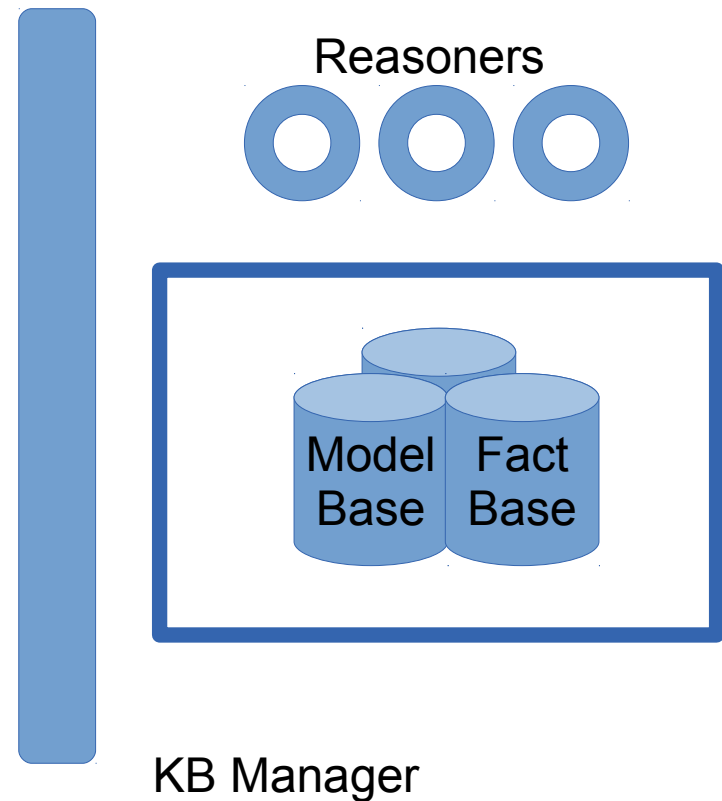
Execute Query

Dispatches, interprets and executes a query. Results may be materialized

Basic Scenario

- Setup KB using agreed-upon capabilities
  - API Binding : Instantiation and Composition
- Add/Export supported Assets
  - May require translation
  - API Binding : manage assets
- Query / Reason
  - API Binding : reasoner invocation

Reasoners

Model Base   Fact Base

KB Manager

State of the Art

- Done
  - Structured Use Cases
  - Modular APIs (draft)
  - Abstract Architecture
- Next Steps
  - Capability model
  - Reference implementation

Acknowledgments

- R. Bell
- R. Burkhart
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- A. Giurca
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- H. Solbrig
- B. Teegan
- E. Wallace
- ...

Information and contacts

- API4KB Wiki
  www.omgwiki.org/API4KB/

- Weekly calls on Mondays at 12 EDT