Graal

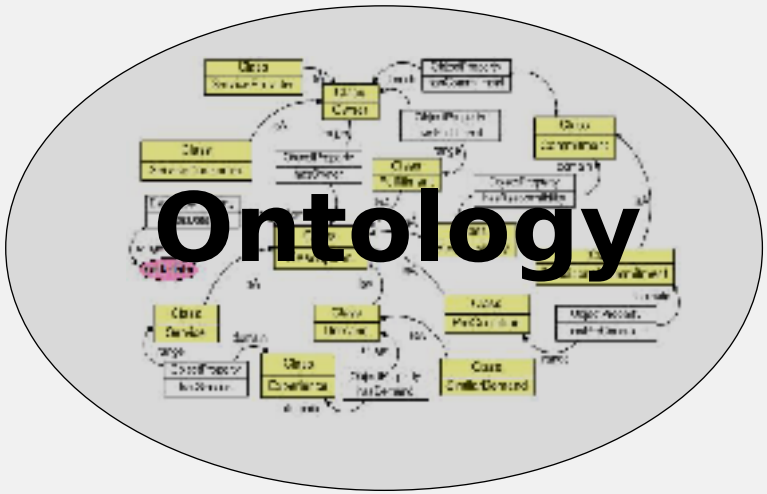
Plate-forme logicielle pour l'OBDA
ADT Quasar

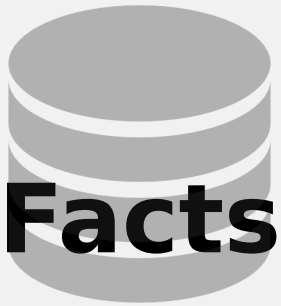
2015

Clément Sipieter
GraphIK team

Ontology-mediated Query Answering

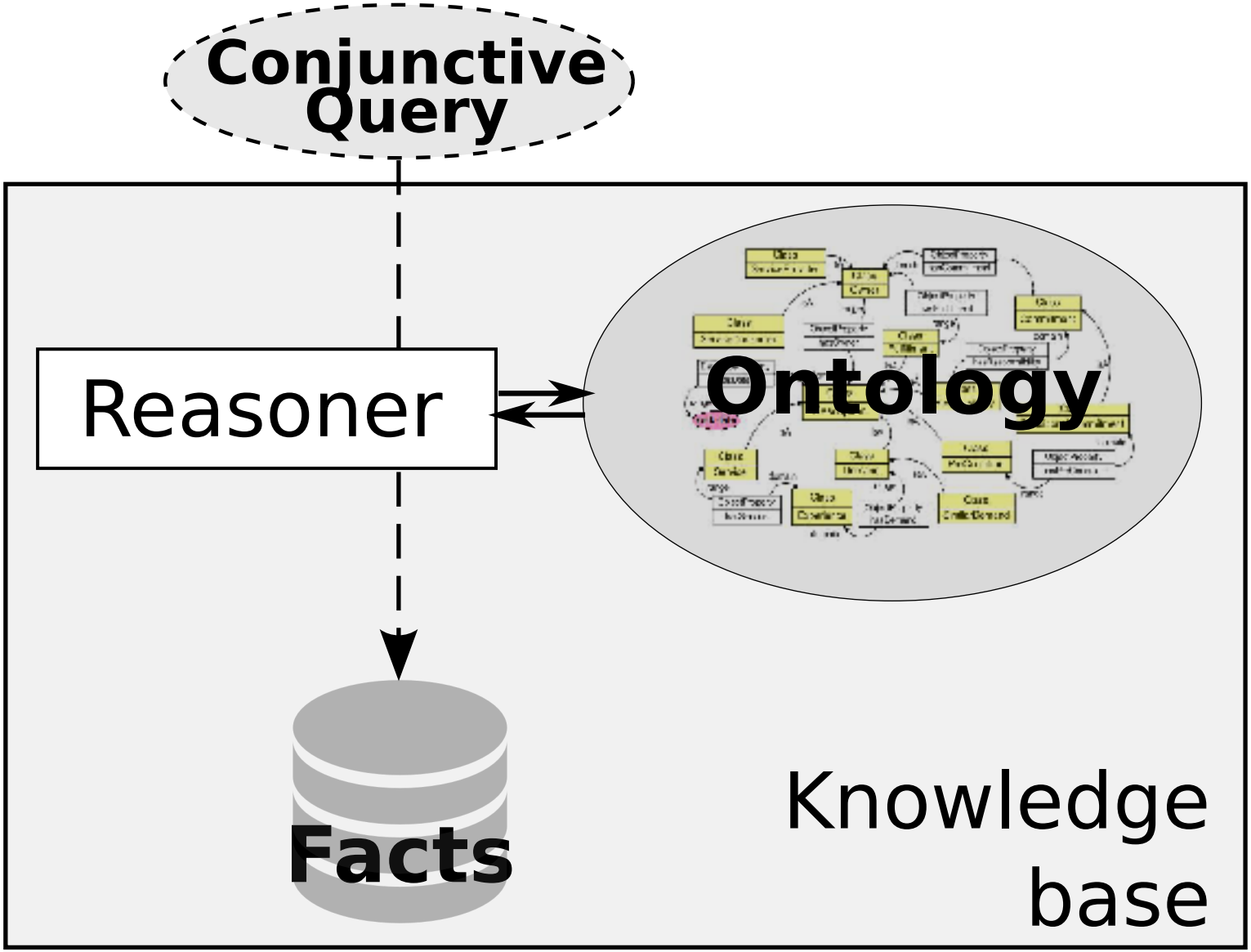
Conjunctive Query





Knowledge base

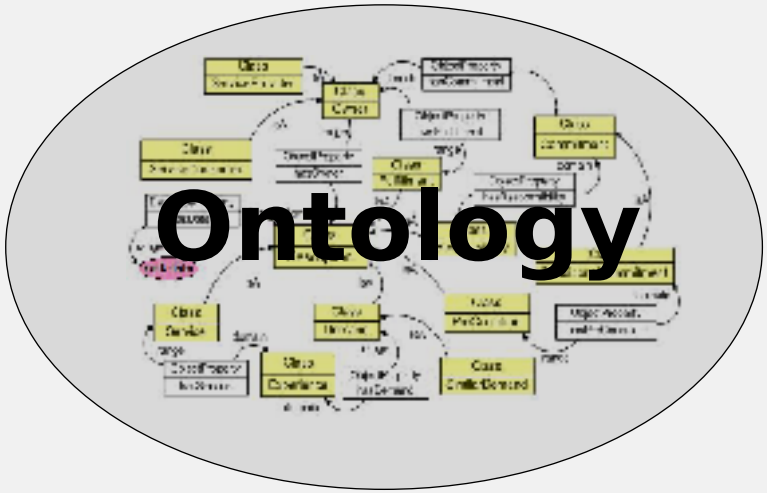
Ontology-mediated Query Answering

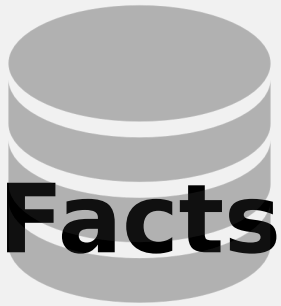


Forward Chaining

Conjunctive Query

Forward-chaining





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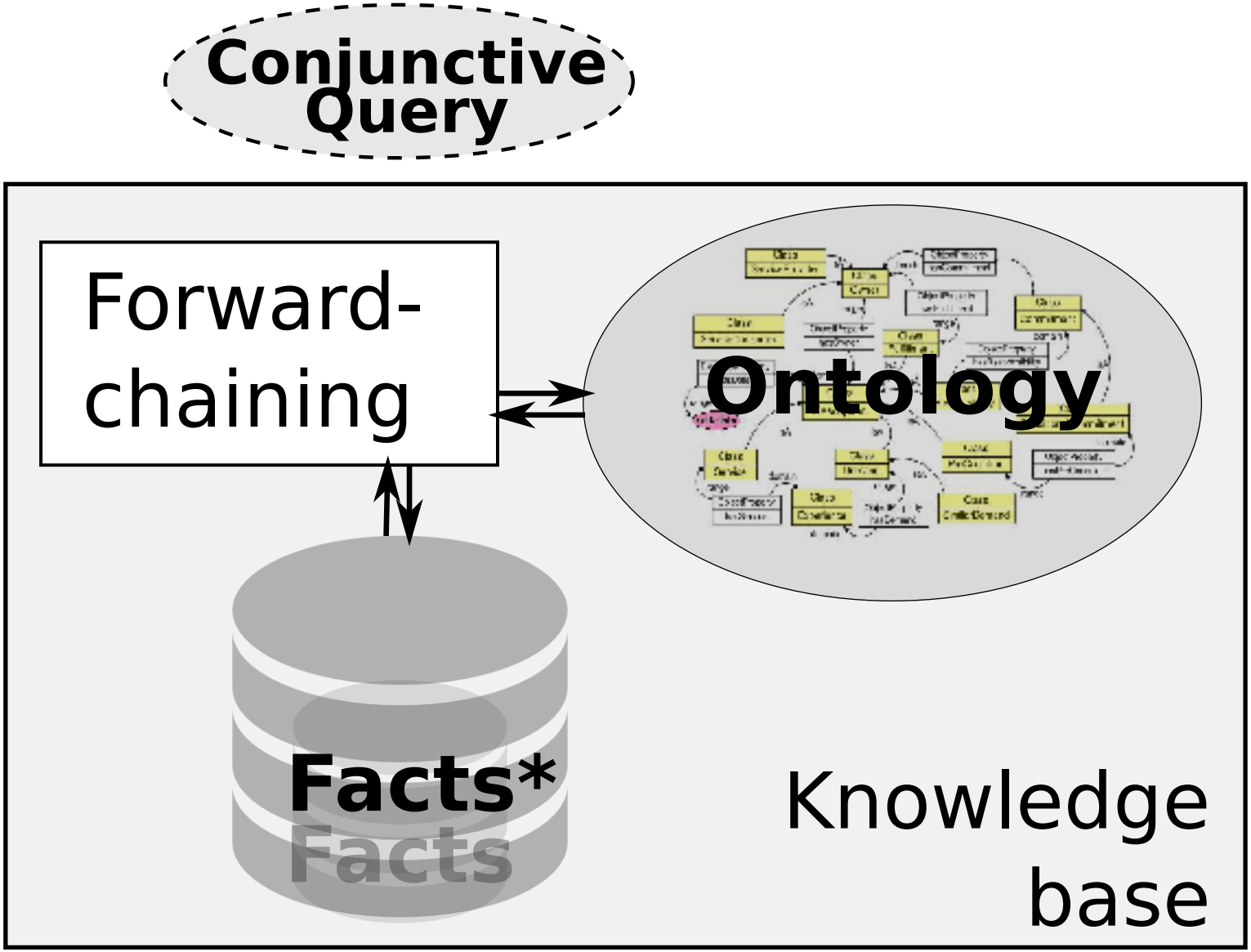

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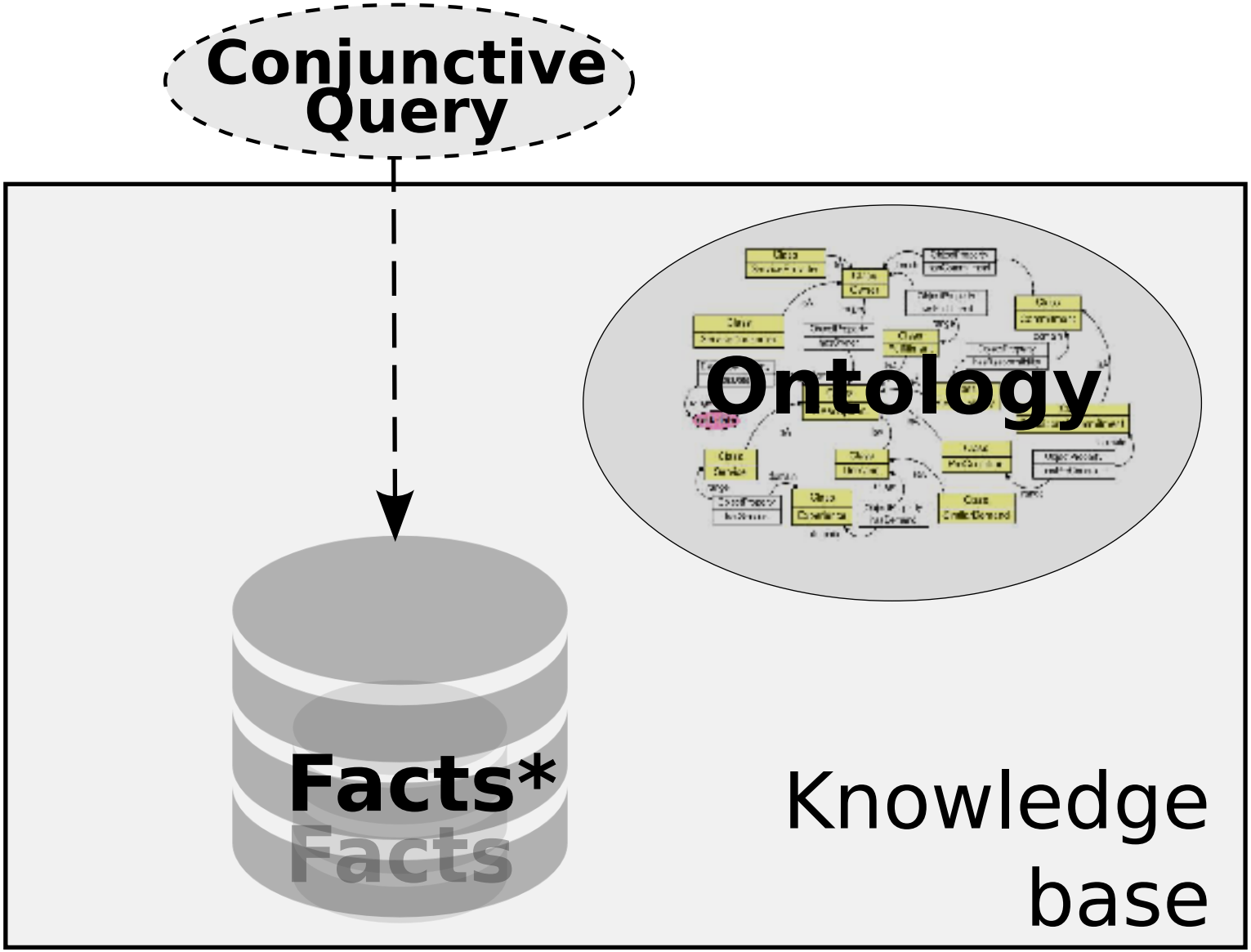
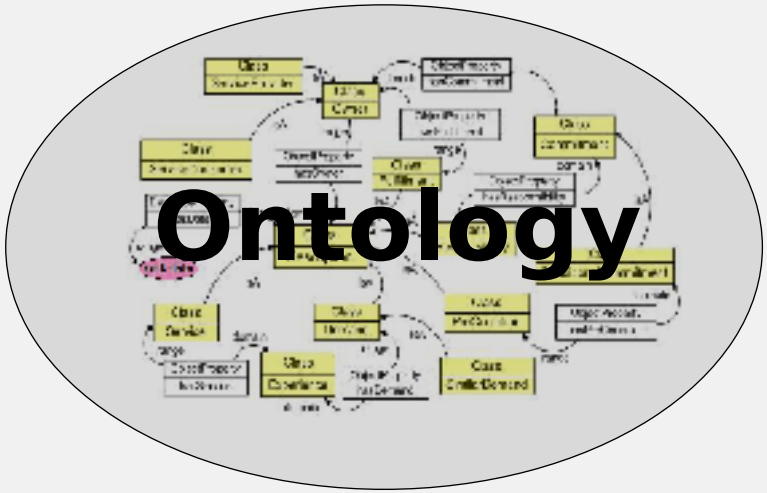


Backward Chaining

Conjunctive Query

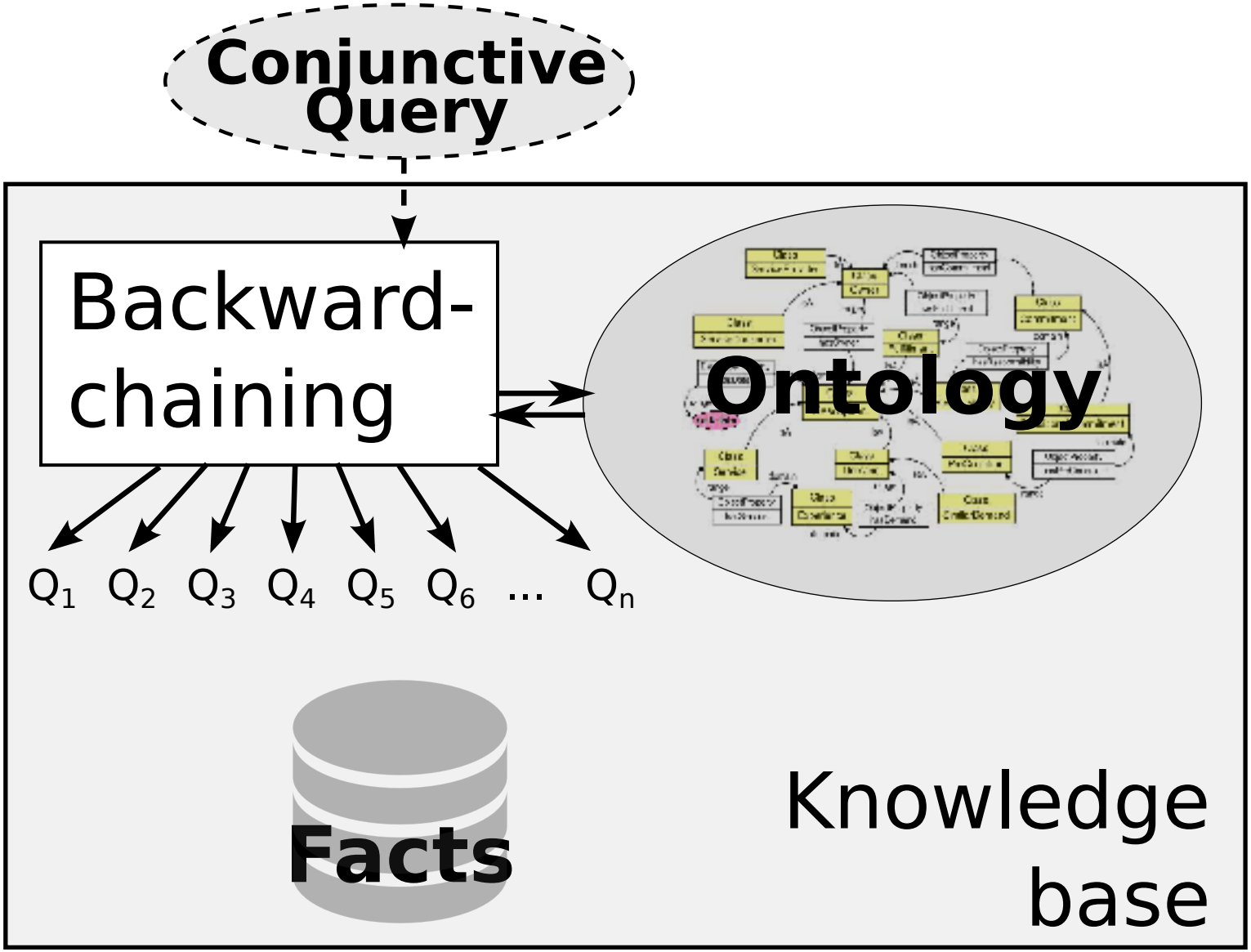
Backward-chaining



Facts

Knowledge base

Backward Chaining



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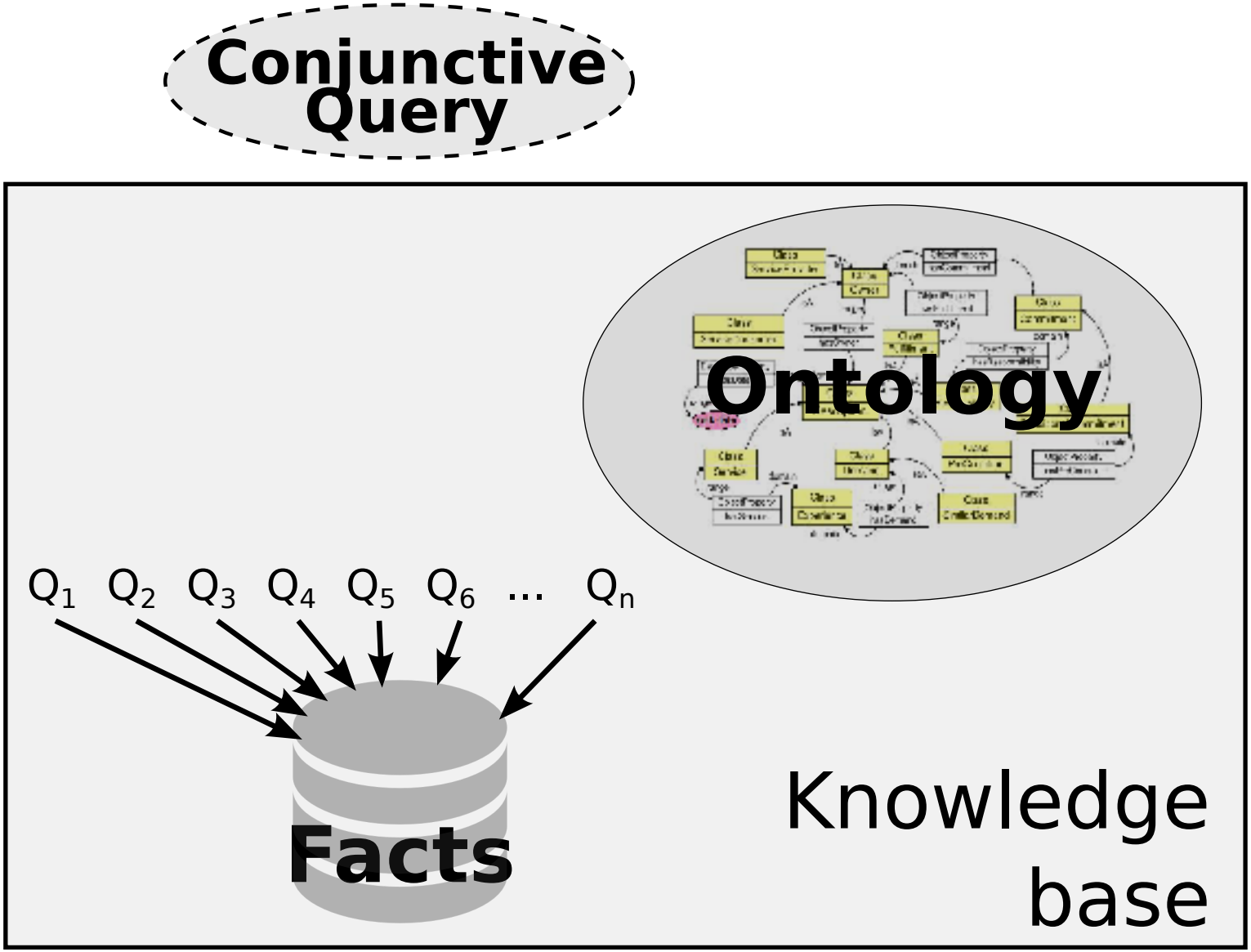

Règles existentielles

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- Equality rules
  $\forall x \forall y \forall z\ (motherOf(y, x) \wedge motherOf(z, x) \rightarrow y = z)$

Objectifs

INTERNE

Développement unifié

Bibliothèque d'algorithmes

EXTERNE

Équipes de recherche

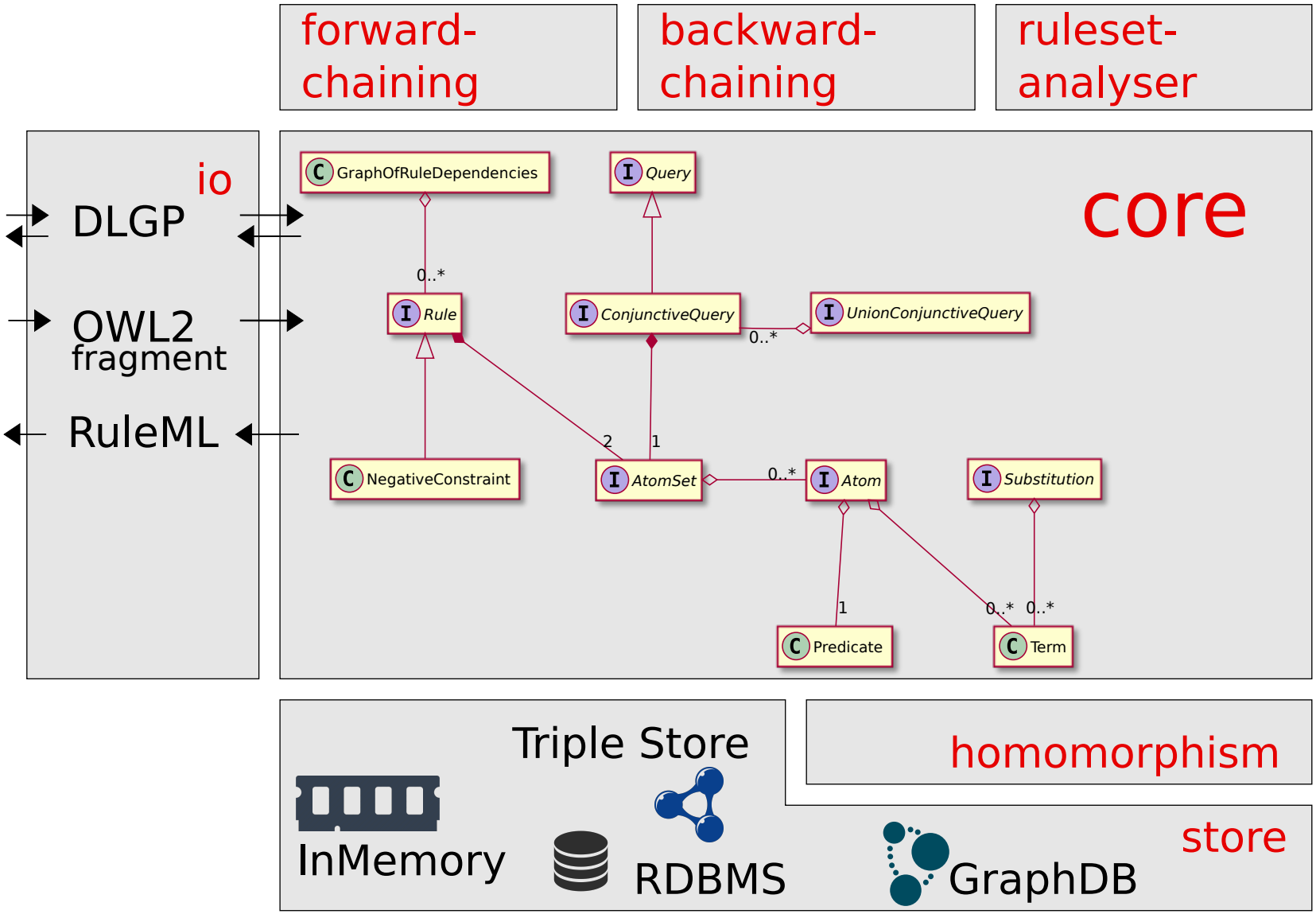
Développements externe

Benchmarks

Tableau d'avancement

Tâche	$t_0 + 4$	$t_0 + 6$	$t_0 + 12$	$t_0 + 18$	$t_0 + 24$
T1 : Fonctionnalités de base	T1.1 : Spécifications				
		T1.2 : Implémentation (v0)			
T2 : Définition des formats et traductions		T2.1 : DLP étendu			
		T2.2 : Traductions RDFS			
				T2.3 Traductions OWL2	
T3 : Fonctionnalités avancées				T3.1 Implémentation de T2.1 et T2.2 (v1)	
					T3.2 Implémentation de T2.3 (v2)
				T3.3 : Tests de V0 sur benchmarks et optimisations	
T4 : Site web et diffusion			Site web + V0		
				V1	
					V2

Graal - General architecture



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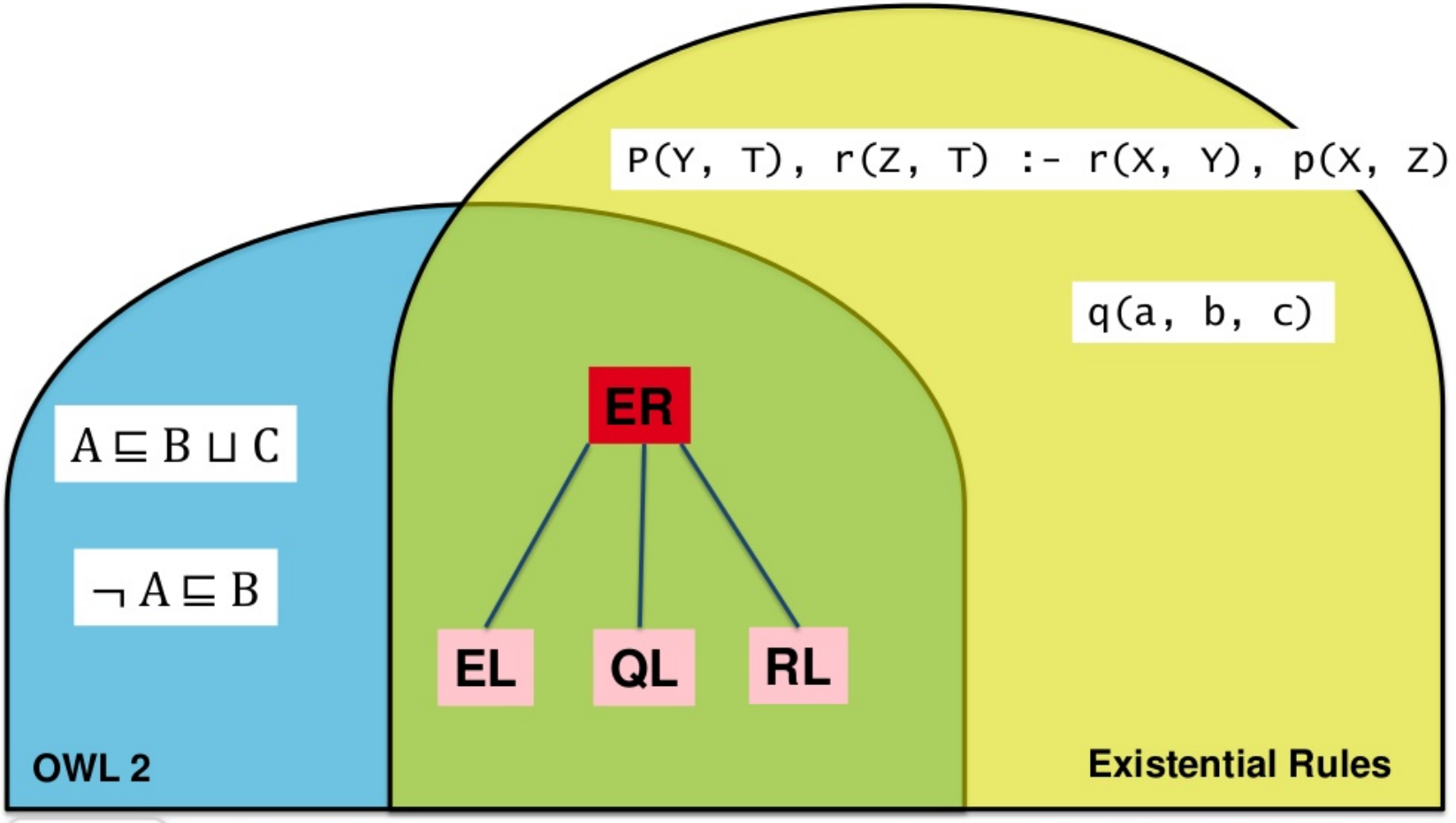
OWL2 to Dlgp2



OWL2 to Dlgp2

Dlgp v1

```
% Facts
fatherOf(bob, alice).
fatherOf(X, alice), parents(X, dan, carol).

% Rules
fatherOf(Y,X), motherOf(Z,X) :- parents(X,Y,Z).
parents(Y,U,V), parents(Z,R,S) :- parents(X,Y,Z).

% Constraint
! :- fatherOf(X,Y), motherOf(X,Z).

% Equality Rule
Y = Z :- motherOf(Y,X), motherOf(Z,X).
```

OWL2 to Dlgp2

Dlgp v2

```
@prefix gen: <http://genealogy.com/>
@prefix p: <http://people.com/>
@prefix xsd: <http://www.w3.org/2001/XMLSchema#>

% Facts
gen:fatherOf(p:bob, <http://people.com/alice>).

% Literals
p:age(p:alice, "13"^^xsd:integer).
p:age(p:alice, 13).
```

OWL2 to Dlgp2

translations

EquivClass expressions		
Class		
C	C	$C(x)$
Intersection of Class Expressions		
ObjectIntersectionOf$(C_1, \ldots, C_k)$	$C_1 \sqcap \ldots \sqcap C_k$	$\Phi_{C_1}(x) \wedge \ldots \wedge \Phi_{C_k}(x)$
Existential Quantification		
ObjectSomeValuesFrom(p, C)	$\exists p \cdot C$	$\exists y\,(\Phi_p(x, y) \wedge \Phi_C(y))$
Individual Value Restriction		
ObjectHasValue(p, i)	$\exists p \cdot \{i\}$	$\Phi_p(x, i)$
Self-Restriction		
ObjectHasSelf(p)	$\exists p \cdot$ Self	$\Phi_p(x, x)$
Minimum Cardinality - Restricted to n = 0 or 1		
ObjectMinCardinality$(0, p, C)$	$\geq 0pC$	Thing(x)
ObjectMinCardinality$(1, p, C)$	$\geq 1pC$	$\exists y\,(\Phi_p(x, y) \wedge \Phi_C(y))$
Enumeration of Individuals - Restricted to n = 1		
ObjectOneOf(i)	$\{i\}$	$x = i$

OWL2 to Dlgp2

Démo

https ://graphik-team.github.io/graal/

Graal Homepage

Home | Documentation | Publications | Experiments | Downloads | Sources

Graal is a Java toolkit dedicated to querying knowledge bases within the framework of **existential rules**, aka Datalog+/-. It is an open source library published under CeCILL v2.1 license (GPL compatible).

The main features of Graal are the following:

- a basic layer that provides **generic interfaces** to store and query various kinds of data without considering the rules;
- **saturation** algorithms, which apply rules on the data in a forward chaining manner;
- **query rewriting** algorithms, which reformulate a conjunctive query into a set (or 'union') of conjunctive queries;
- utility tools:
  - a format called **Dlgp** (for 'datalog+') and its parser;
  - a tool called **Kiabora**, which performs a structural analysis of an existential rule set to determine its decidability properties; it also allows to decompose rules;
  - a translator from **OWL 2** to **Dlgp**;
  - a translator from **Dlgp** to **RuleML**.

Existential rule framework

Existential rules allow to assert the existence of not-yet-known individuals. The existential rule framework is also known as an extension to Datalog, called **Datalog+/-**.

It is particularly relevant to **ontology-mediated query answering**. In this framework, a knowledge base is composed of facts (or data) and of ontological knowledge expressed by existential rules (including rules with

Perspectives

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  - inf-homomorphisme
  - SPARQL Rules
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- **Distribution** - Tutoriels