Presentation of the KRR team

Theme Connected Intelligence,
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Theme Connected Intelligence

1 Knowledge Representation & Reasoning

2 Multi-Agents & Services

3 Virtual Communities & Social Networks

how to process, represent and reason on knowledge in distributed and open environments such as, in particular, the Web?

how to coordinate and adapt agents and services deployed in open, decentralized, dynamic and large scale systems?

how to integrate individual and collective concerns In user centered cooperative environments?

Support the interconnection of physical, digital and social worlds in an open and decentralized context.

K.R.R

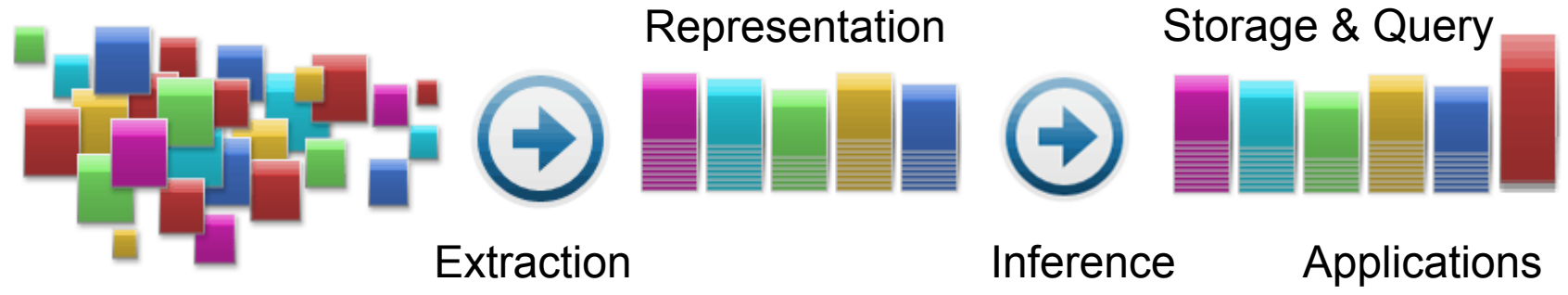**Knowledge Representation & Reasoning**

« **Knowledge representation and reasoning** is the field of artificial intelligence (AI) dedicated to representing information about the world in a form that a computer system can utilize to solve complex tasks » (Wikipedia)

What we do in KRR

Representation

Storage & Query

Extraction

Inference

Applications
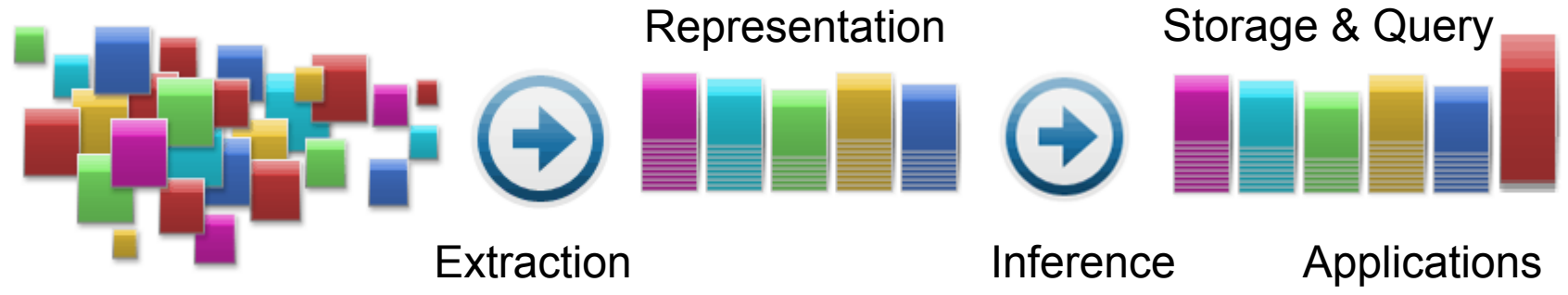
The Knowledge Pipeline

What we do in KRR

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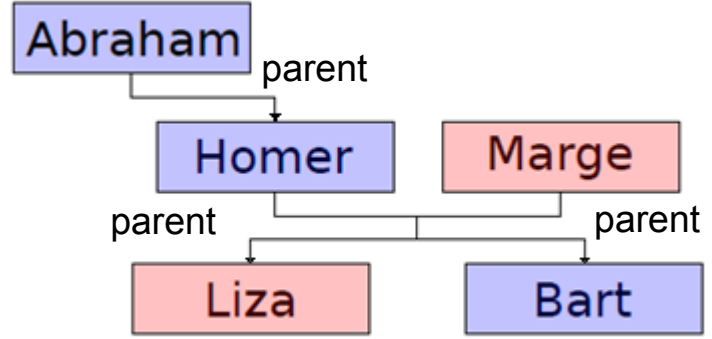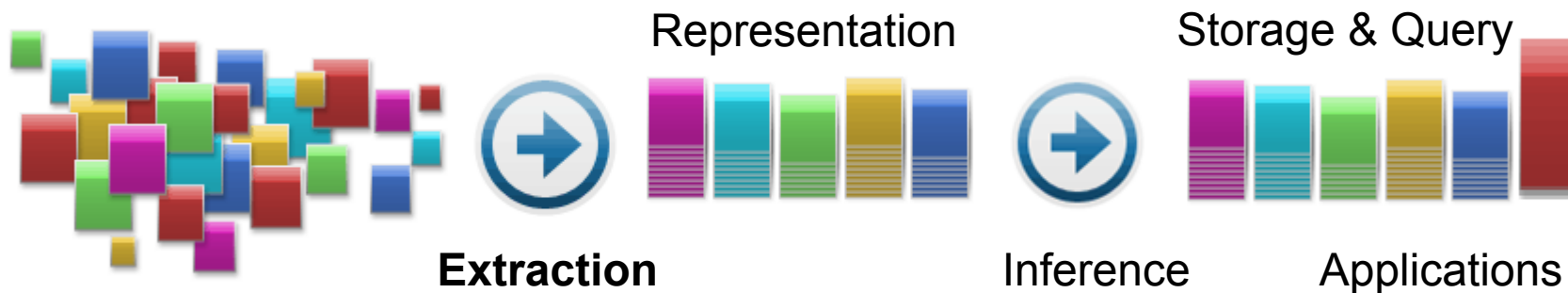
What is called knowledge?

RDF: resource description framework

- Subject-Predicate-Object

- Resources distributed on the Web

- Form a edge-labelled directed graph

- Description logics: inference, consistency

Abraham

parent

Homer

Marge

parent

parent

Liza

Bart

What we do in KRR: extraction

Representation

Storage & Query

Extraction

Inference

Applications

Information Extraction: from Data to Knowledge

- Extract knowledge from text [Elsahar et al.]@ESWC2017

- Extract user comments from the Web [Subercaze et al.]@WI2015

- Convert XML, JSON to RDF [Lefrançois et al.]@EKAW2016 demo

- Structure data from Wikipedia: measurements [Subercaze]@ESWC2017

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What we do in KRR: representation

Representation

Storage & Query

Extraction

Inference

Applications
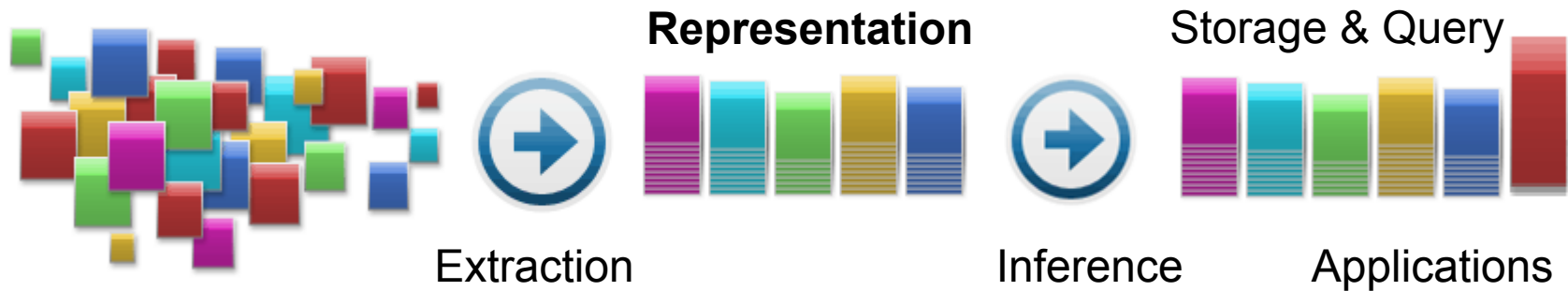
Representing Knowledge

- Custom Datatypes support for RDF [Lefrancois et al.]@ESWC2016

- Context representation [Giménez-Garcia el al.]@EKAW2016-poster, [Sorici et al.]@C&EE2016 (with MAS)

- Multi-level Networked Knowledge [Klai et al.]@IJMSO2016,MEDI2016

- Ontology design [Lefrancois&Zimmermann]@IC2015-demo

What we do in KRR: inference

Representation

Extraction

Inference

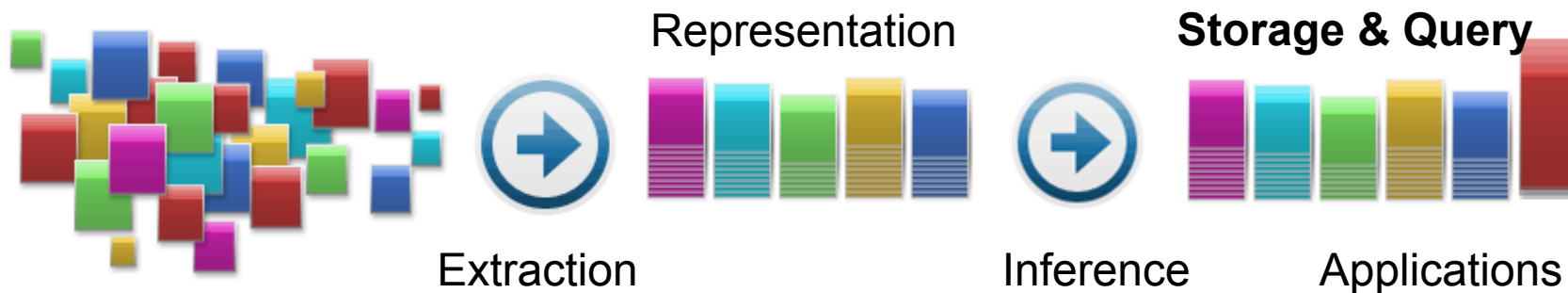Storage & Query

Applications
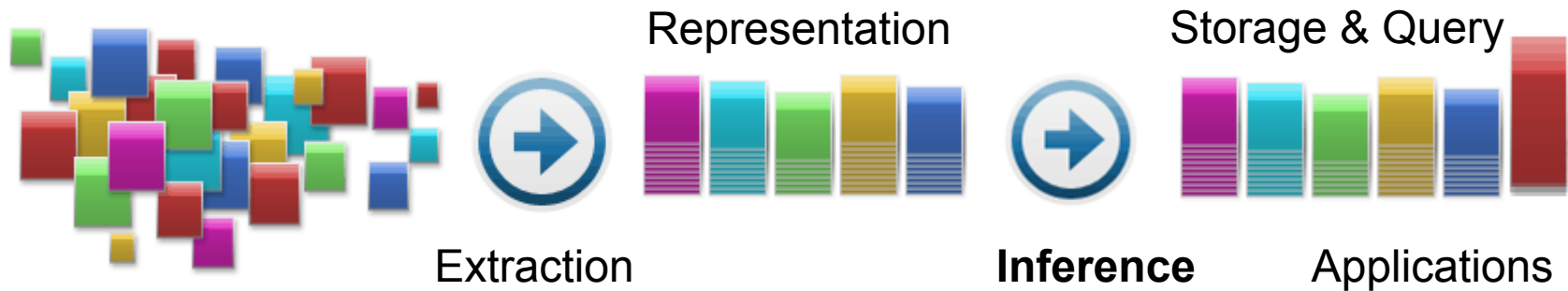
Inference: deducting new facts

- RDFS and RDFSPlus reasoning
  [Subercaze et al.]@VLDB2016

- Stream reasoning
  [Chevalier et al.]@SIGMOD2016 demo

- Knowledge revision
  [Gravier et al.]@JAISE2016

Abraham

Homer   Marge

Liza   Bart

grandparent
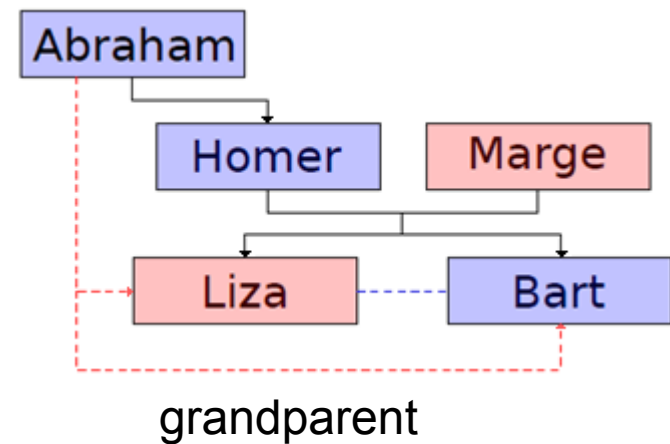
What we do in KRR: storage & query

Representation

Storage & Query

Extraction

Inference

Applications

Storage & Query

- Stream Query Processing
    - Continuous query for RDF [Gillani et al.]@SSDBM2016
    - Query aware distributed processing [Gillani et al.]@EDBT Workshops

- Complex event processing [Calvier et al.]@COOPIS2016, [Gillani et al.]@DEBS2015, [Gillani et al.]@DEBS2016

- Stream Programming [Subercaze et al.]@VLDB2017 demo

What we do in KRR: applications

Representation

Storage & Query

Extraction

Inference
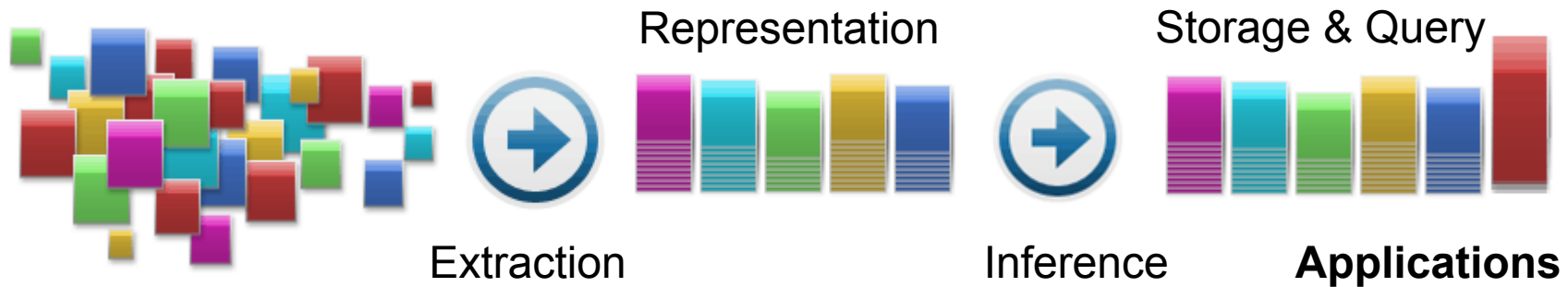
Applications

Applications

- Question Answering systems (Action Marie Curie (ITN): WDAqua) [Both et al.;Singh et al.]@ESWC2016

- Question Generation (PhD Tanguy Raynaud)

- Semantic Relatedness [Dieffenbach et al.]@WIMS2016,SEMANTiCS2016, [Subercaze et al.]@ACL2015

- Smart Grids [Lefrancois et al.]@ESWC2016, [Gillani et al.]@EDBT2014-workshop

- Transportation [Ciortea et al.]@IoT2016,WoT2016 [Kem et al.]@EWGT2016 [Bakerally et al.]@ESWC2016-demo [Petersen et al.]@ICSC2016

# Reasoning activity in KRR@LaHC

Contributions

- Two reasoners. Design & implementation.

  - **Slider**: incremental reasoning. RDFS

  - **Inferray**: fast in-memory. RDFS, RDFSPlus

Slider

Jules Chevalier, Julien Subercaze, Christophe Gravier, Frédérique Laforest: **Slider: An Efficient Incremental Reasoner**. SIGMOD Conference 2015: 1081-1086
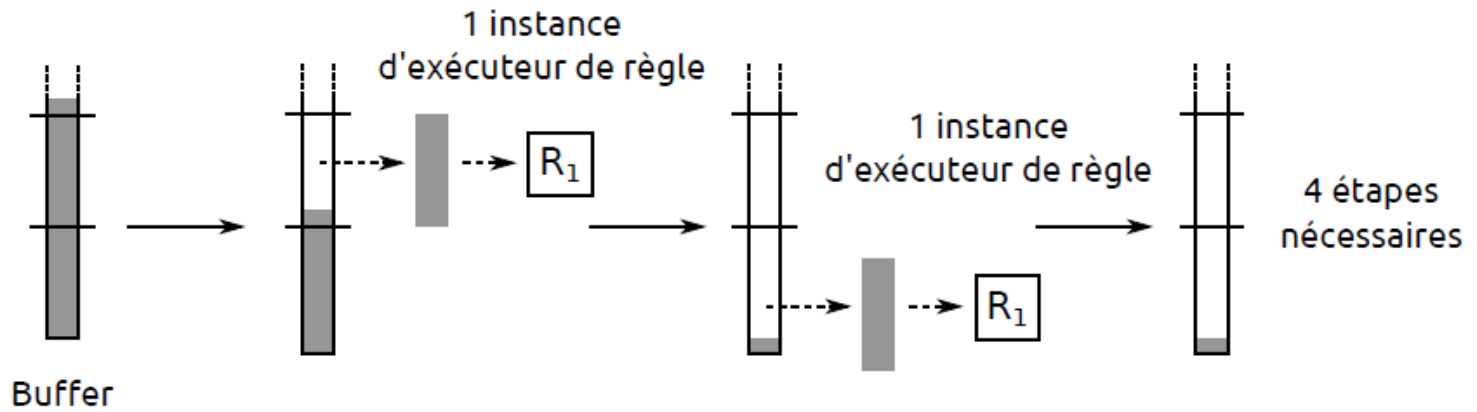
Jules Chevalier, Julien Subercaze, Christophe Gravier, Frédérique Laforest:**Incremental and Directed Rule-Based Inference on RDFS**. DEXA (2) 2016: 287-294
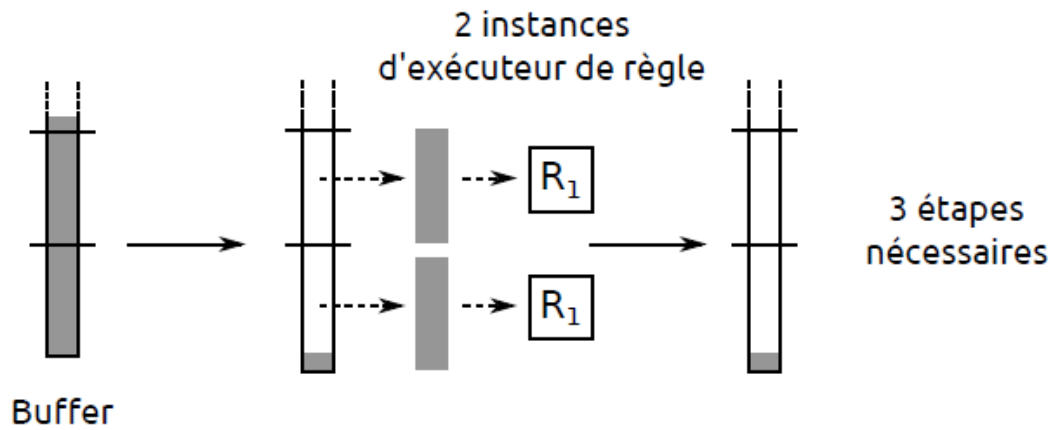
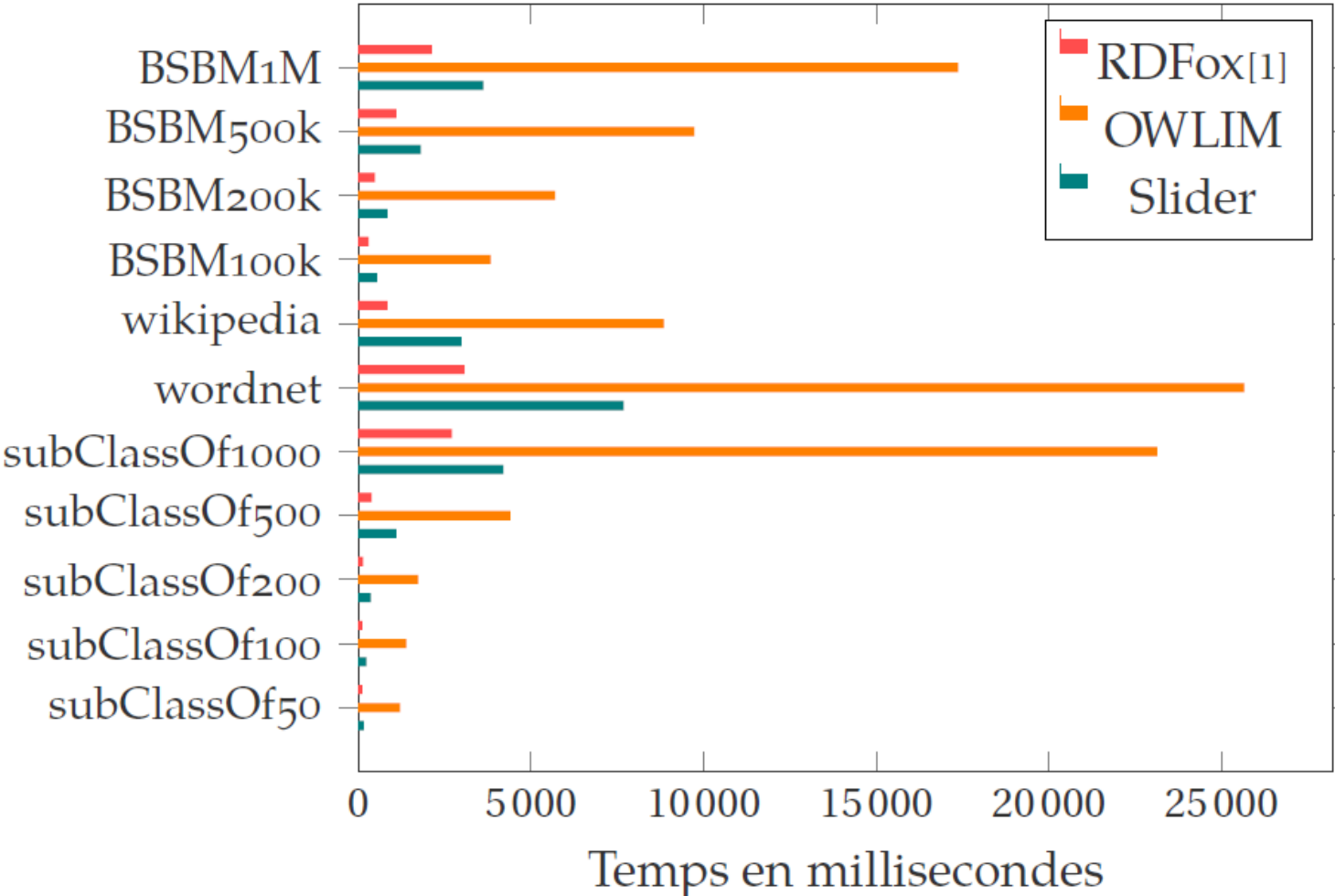# Stream reasoning - Slider
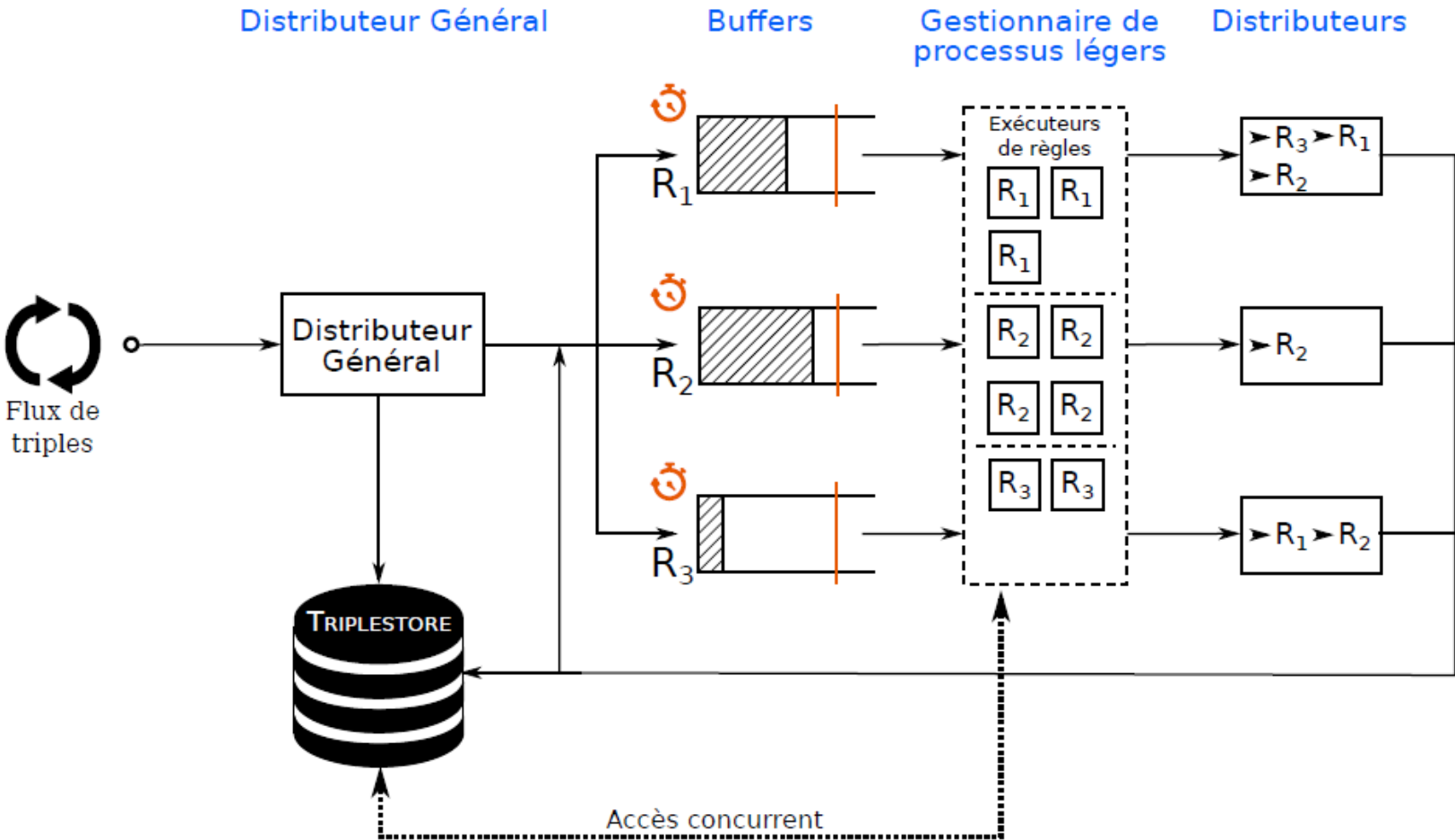
Parallelism

Slider - Performance

Inferray

Julien Subercaze, Christophe Gravier, Jules Chevalier, Frédérique Laforest:**Inferray: fast in-memory RDF inference**. PVLDB 9(6): 468-479 (2016)

Features

- In memory forward chaining for RFDS/RDFSPlus

- Using vertical partitioning for storage

- Sort-merge-join for materialization

Contributions

- Hardware friendly memory layout

- Fast sorting algorithm for pair of 64-bit integer

- Fast and scalable transitivity closure

Benchmark – time in ms

Type	Dataset	Fragment	Reasoners		
			Inferray	OWLIM	RDFox
Synthetic	LUBM_1M	RDFS-Plus	**19**	1,324	69
	LUBM_5M	RDFS-Plus	**114**	3,907	322
	LUBM_10M	RDFS-Plus	**540**	6,175	855
	LUBM_25M	RDFS-Plus	**1,092**	12,493	1,920
	LUBM_50M	RDFS-Plus	**1,984**	31,187	4,077
	LUBM_75M	RDFS-Plus	**2,047**	48,233	6,939
	LUBM_100M	RDFS-Plus	**2,514**	72,098	10,613
Real-world	Wikipedia	RDFS-Plus	**310**	3,033	342
	Yago Taxonomy	RDFS-Plus	**3,085**	29,747	3,204
	Wordnet	RDFS-Plus	**232**	5,692	860

Open source solutions

- https://github.com/JulesChevalier/slider

- https://github.com/jsubercaze/inferray

Questions ?