Preface

This volume contains the papers presented at ORE 2015: The 4th OWL Reasoner Evaluation Workshop held on June 6, 2015 in Athens (co-located with the 28th International Workshop on Description Logics). The committee decided to accept 11 papers (6 Evaluation and Benchmarks papers and 5 System papers). Each submission was reviewed by at least 3 program committee members.

OWL is a logic-based ontology language standard designed to promote interoperability, particularly in the context of the (Semantic) Web. The standard has encouraged the development of numerous OWL reasoning systems, and such systems are already key components of many applications.

The goal of ORE, the OWL Reasoner Evaluation workshop, is to bring together both the developers and users of reasoners for (subsets of) OWL 2, including systems focusing on both intensional (ontology) and extensional (data) query answering.

ORE 2015, as previous years, also included a competition in which OWL reasoners were faced with different reasoning tasks. The competition included six disciplines in which reasoners could compete: ontology classification, consistency checking, and realisation each for the OWL 2 EL and OWL 2 DL profiles. The tasks were performed on several large corpora of real-life OWL ontologies obtained from the web, as well as user-submitted ontologies which were found to be challenging for reasoners.

Acknowledgements

We thank all members of the program committee, competition organisers, additional reviewers, authors of the submitted papers, developers of the submitted reasoners and ontologies, and local organizers for their invaluable effort.

We also thank Andreas Steigmiller (Ulm University) for providing us with the competition framework and Konstantin Korovin (University of Manchester) who kindly provided us with the PC cluster for the competition, supported by the Royal Society grant RG080491.

We also gratefully acknowledge the support of our sponsors: B2i Healthcare (`https://www.b2international.com/`) and DBOnto (`http://dbonto.cs.ox.ac.uk/`).

We would also like to acknowledge that the work of the ORE organisers was greatly simplified by using the EasyChair conference management system (`http://www.easychair.org`) and the CEUR Workshop Proceedings publication service (`http://ceur-ws.org/`).

Last but not least, we also thank Yevgeny Kazakov who brought the certificates and betting slips, Despoina Trivela who dealt with the payment of the workshop T-shirts, and Bernardo Cuenca Grau and Yujiao Zhou who will most probably bring us a query answering track in ORE 2016 (this year they were almost there).

Organisers, PC Chairs

Michel Dumontier	Stanford University
Birte Glimm	University of Ulm
Rafael Gonçalves	Stanford University
Matthew Horridge	Stanford University
Ernesto Jimenez-Ruiz	University of Oxford
Nicolas Matentzoglu	University of Manchester
Bijan Parsia	University of Manchester

Local Organisers

Giorgos Stamou	National Technical University of Athens
Giorgos Stoilos	National Technical University of Athens

Program Committee

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Zhe Wang	Griffith University
Dmitriy Zheleznyakov	University of Oxford

ORE 2015 Competition

In addition to workshop paper submissions, ORE 2015 also included a competition in which OWL reasoners were faced with different reasoning tasks. The competition included six disciplines in which reasoners could compete: ontology classification, consistency checking, and realisation each for OWL EL and OWL DL profiles. The tasks were performed on several large corpora of real-life OWL ontologies obtained from the web, as well as user-submitted ontologies which were found to be challenging for reasoners.

The ORE competition results are available here: `http://dl.kr.org/ore2015/`

Participating Systems

TrOWL: `http://trowl.org/`
Konclude: `http://www.derivo.de/en/produkte/konclude/`
ELepHant: `https://code.google.com/p/elephant-reasoner/`
HermiT: `http://www.hermit-reasoner.com/`
MORe: `http://code.google.com/p/more-reasoner/`
ELK: `http://code.google.com/p/elk-reasoner/`
jcel: `http://jcel.sourceforge.net/`
FaCT++: `http://code.google.com/p/factplusplus/`
Jfact: `http://sourceforge.net/projects/jfact/`
Chainsaw: `http://sourceforge.net/projects/chainsaw/`
PAGOdA: `http://www.cs.ox.ac.uk/isg/tools/PAGOdA/`
Pellet: `https://github.com/ignazio1977/pellet`
Racer: `http://racer-systems.com/`

Framework

We used the same competition framework as in 2014. It is available from GitHub `https://github.com/andreas-steigmiller/ore-2014-competition-framework/`.

Datasets

The ORE 2015 data set contains more than 16,500 unique ontologies. The set comprises:

- the MOWLCorp (Manchester OWL Corpus), which was obtained through a Web Crawl, Google Custom Search API and user submissions (`http://mowlrepo.cs.manchester.ac.uk/datasets/mowlcorp/`),
- the Oxford Ontology Library (`http://www.cs.ox.ac.uk/isg/ontologies/`),
- a BioPortal (`https://bioportal.bioontology.org/`) Snapshot (June 2014),
- and user submitted ontologies such as BioKB, DMOP, FHKB, USDA, DPC, genomic-CDS, City-Bench, Cell ontology, DINTO, Virtual Fly Brain, GO, Drosophile Plenotype ontology.

The ontologies in the data set are binned by profiles. For the competition, the EL profile bin (8,805 ontologies) and the pure DL bin (7,704 DL ontologies that do not fall into one of the profiles) were used. Two further bins are obtained from these two bins by considering only the ontologies with an ABox (DL 2,439, EL 1,941 ontologies). The latter two are used for the realisation discipline, whereas the former ones are used for the classification and consistency checking disciplines.

Within these bins, the ontologies are further categorised by size (very small, small, medium, large, very large). A file list is then created by iterating over these categories (skipping categories that are already fully covered). From these file lists, the first X are used for the competition, where X is chosen such that most reasoners are able to finish within a time limit (7 hours for classification and realisation, 3 hours for consistency checking). For classification X is 250 (OWL DL) and 300 (OWL EL), for consistency checking and realisation X is 200 (OWL DL) and 250 (OWL EL).

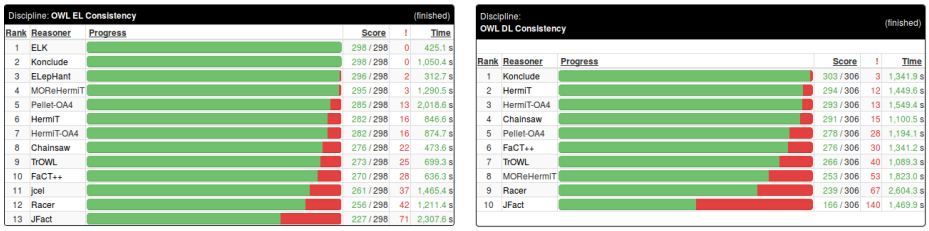
The whole data set is available for download at `http://zenodo.org/record/10791` and more details about the corpus can be found at `http://mowlrepo.cs.manchester.ac.uk/datasets/ore-2014/`.

Execution

The competition was executed live on June 9th with a PC cluster at the University of Manchester provided by Konstantin Korovin. The machines of the cluster were equipped with an Intel Xeon QuadCore CPU running at 2.33GHz and 12GB RAM, where 10GB could be used by the reasoners. The reasoners were executed on the machines (one reasoner per machine) by running them natively on the used Fedora 12 operating system (64bit) or within a Java Runtime Environment (Java version 1.6). A three minute time limit was given every reasoner for each ontology, where 2.5 min was allowed for reasoning, i.e., 0.5 min could additionally/separately be used for parsing of the ontology and serialization of the result. Expected results were determined by a majority vote between the hash codes of the normalised results of those reasoners that terminated within the time limits. In case of a draw, one hash code was randomly chosen and declared as the expected hash code.

Results

Figures 1-3 shows the results of the ORE 2015 live competition. The competition queries are available from `https://zenodo.org/record/11133/`



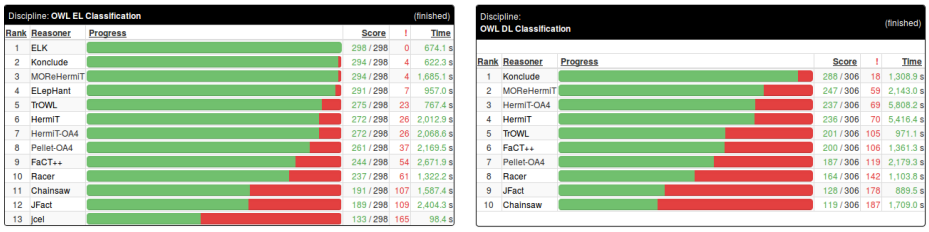
Discipline: **OWL EL Consistency** (finished)

Rank	Reasoner	Progress	Score	!	Time
1	ELK		298 / 298	0	425.1 s
2	Konclude		298 / 298	0	1,050.4 s
3	ELepHant		296 / 298	2	312.7 s
4	MOReHermiT		295 / 298	3	1,290.5 s
5	Pellet-OA4		285 / 298	13	2,018.6 s
6	HermiT		282 / 298	16	846.6 s
7	HermiT-OA4		282 / 298	16	874.7 s
8	Chainsaw		276 / 298	22	473.6 s
9	TrOWL		273 / 298	25	699.3 s
10	FaCT++		270 / 298	28	636.3 s
11	jcel		261 / 298	37	1,465.4 s
12	Racer		256 / 298	42	1,211.4 s
13	JFact		227 / 298	71	2,307.6 s

Discipline: **OWL DL Consistency** (finished)

Rank	Reasoner	Progress	Score	!	Time
1	Konclude		303 / 306	3	1,341.9 s
2	HermiT		294 / 306	12	1,449.6 s
3	HermiT-OA4		293 / 306	13	1,549.4 s
4	Chainsaw		291 / 306	15	1,100.5 s
5	Pellet-OA4		278 / 306	28	1,194.1 s
6	FaCT++		276 / 306	30	1,341.2 s
7	TrOWL		266 / 306	40	1,089.3 s
8	MOReHermiT		253 / 306	53	1,823.0 s
9	Racer		239 / 306	67	2,604.3 s
10	JFact		166 / 306	140	1,469.9 s

Fig. 1. Results of the consistency checking disciplines (OWL EL & DL)



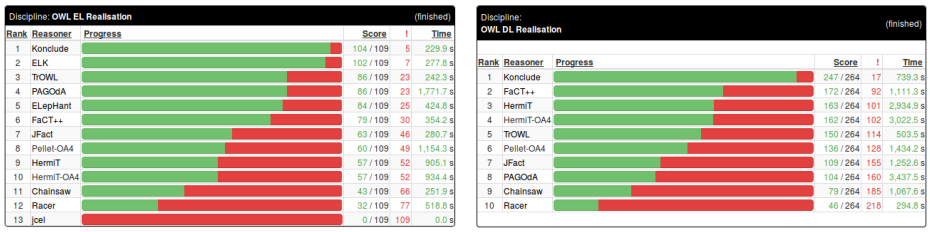
Discipline: **OWL EL Classification** (finished)

Rank	Reasoner	Progress	Score	!	Time
1	ELK		298 / 298	0	674.1 s
2	Konclude		294 / 298	4	622.3 s
3	MOReHermiT		294 / 298	4	1,685.1 s
4	ELepHant		291 / 298	7	957.0 s
5	TrOWL		275 / 298	23	767.4 s
6	HermiT		272 / 298	26	2,012.9 s
7	HermiT-OA4		272 / 298	26	2,068.6 s
8	Pellet-OA4		261 / 298	37	2,169.5 s
9	FaCT++		244 / 298	54	2,671.9 s
10	Racer		237 / 298	61	1,322.2 s
11	Chainsaw		191 / 298	107	1,587.4 s
12	JFact		189 / 298	109	2,404.3 s
13	jcel		133 / 298	165	98.4 s

Discipline: **OWL DL Classification** (finished)

Rank	Reasoner	Progress	Score	!	Time
1	Konclude		288 / 306	18	1,308.9 s
2	MOReHermiT		247 / 306	59	2,143.0 s
3	HermiT-OA4		237 / 306	69	5,808.2 s
4	HermiT		236 / 306	70	5,416.4 s
5	TrOWL		201 / 306	105	971.1 s
6	FaCT++		200 / 306	106	1,361.3 s
7	Pellet-OA4		187 / 306	119	2,179.3 s
8	Racer		164 / 306	142	1,103.8 s
9	JFact		128 / 306	178	889.5 s
10	Chainsaw		119 / 306	187	1,709.0 s

Fig. 2. Results of the classification disciplines (OWL EL & DL)



Discipline: **OWL EL Realisation** (finished)

Rank	Reasoner	Progress	Score	!	Time
1	Konclude		104 / 109	5	229.9 s
2	ELK		102 / 109	7	277.8 s
3	TrOWL		86 / 109	23	242.3 s
4	PAGOdA		86 / 109	23	1,771.7 s
5	ELepHant		84 / 109	25	424.8 s
6	FaCT++		79 / 109	30	354.2 s
7	JFact		63 / 109	46	280.7 s
8	Pellet-OA4		60 / 109	49	1,154.3 s
9	HermiT		57 / 109	52	905.1 s
10	HermiT-OA4		57 / 109	52	934.4 s
11	Chainsaw		43 / 109	66	251.9 s
12	Racer		32 / 109	77	518.8 s
13	jcel		0 / 109	109	0.0 s

Discipline: **OWL DL Realisation** (finished)

Rank	Reasoner	Progress	Score	!	Time
1	Konclude		247 / 264	17	739.3 s
2	FaCT++		172 / 264	92	1,111.3 s
3	HermiT		163 / 264	101	2,934.9 s
4	HermiT-OA4		162 / 264	102	3,022.5 s
5	TrOWL		150 / 264	114	503.5 s
6	Pellet-OA4		136 / 264	128	1,434.2 s
7	JFact		109 / 264	155	1,252.6 s
8	PAGOdA		104 / 264	160	3,437.5 s
9	Chainsaw		79 / 264	185	1,067.6 s
10	Racer		46 / 264	218	294.8 s

Fig. 3. Results of the realisation disciplines (OWL EL & DL)