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An Evaluation of Loading Time for Tableaux Based Inference Engine for Extensional Version Based Ontology

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Abstract— In WWW, the growth of information is rapidly increased. It is difficult to access and maintain the necessary information based on user requirement. Inference engine is useful to derive necessary information by its reasoning mechanism. Most of the reasoner is able to performing well for small ontology. For large and extensional ontology, data size is increases rapidly in real world application. The main aim of paper is to evaluating performance of various inference engines with an important parameter; loading time for extensional version based ontology and check suitability requirement. The derived statistics can be useful to adopt inference engine for extensional version based ontology for different domain.

Keywords— ***Inference Engine, Load Time, OWL-DL, Performance.***

I. INTRODUCTION

Semantic Web is "an extension of the current web, in which information is given well-define meaning, better enabling computers and people to work in cooperation [1]". Ontologies are important pieces of semantic web which useful for information sharing and proving a platform which is convenient for human and machine understandable format. Inference engine is a part of foundational system for a computer which has reasoning ability based on some inference rules. Web reasoners are used to infer new knowledge based on existing one such as Pellet, Hermit and Fact++. Many important parameters are necessary to evaluate the performance of inference engine[2,3]. Load time is one of the major parameter which plays an important role in performance of reasoners in real world application. Load time is the total time to storing a set of ontology in repository including the parsing time with storing time. It is difficult to analyze performance of inference engine which contain complex and large ontology sets for different domains. The main aim of paper is to prepare result based on some statistics and evaluate load time for ontology with some other parameters for different inference engine.Some standard benchmark practices are adopted from LUBM [4], WINE, VICODI. Large numbers of instances are increasing day by day. It is difficult for DL reasoners to load such type of ontology and improve the performance. So our aim is to study and generate some statistics which provide help to adopts inference engine based on requirement. Three most tableaux based DL reasoners are used.

II. INFERENCE ENGINES

A. PELLET

Pellet is an open-source Java OWL DL reasoner. It supports expressivity of SROIQ (D). It supports SWRL rules. It can be used in conjunction with both Jena and OWL API libraries and also provides a DIG interface. It can be used in conjunction with both Jena and OWL API libraries. Pellet API having different functionality like types of validation, Consistency checking for ontologies, classify taxonomy, an entailments checking and answer a subset of RDQL queries. It supports full expressivity OWL DL including reasoning about nominal's.

B. HERMIT

HermiT is a new OWL reasoner based on a novel "hyper-tableau" calculus [5]. It support expressivity of SHIQ(D). It's freely available to use non-commercial purpose. It takes an input and various reasoning task are perform like to consistency checking, identify the subsumption relationships between classes and more. It also allow to computes partial order of classes that occurs in OWL. Hermit is a different type of reasoner compared to Pellet and FaCT. It implements hyper-tableau reasoning algorithm that is much less deterministic than existing tableau algorithm.

C. FACT++

FaCT++ [6] an improved version of FaCT [7] employs tableaux algorithms for SHOIQ(D) description logic and implemented in C++ but has very limited user interface and services as compared to other reasoner. It not supports for rules. The strategies followed are absorption, model merging, told cycle elimination, ordering the heuristics synonym replacement, and classification of taxonomy.

III. EVALUATE THE PERFORMANCE

A. About Version Based Ontology

Analyzed the performance by evaluate load time for large extensional version based ontology for variety of inference engine. Basis of that considered large extensional dataset of benchmark like LUBM[7], WINE, VICODI Ontologies.

1) LUBM ontology:

The Lehigh University Benchmark (LUBM) [8] was explicitly designed for OWL benchmarks. We have modelled scenarios based in a major university such as LUBM adapted from the original Lehigh benchmark, LUBM. It is a university database where the number of universities, departments, and students can vary and it's having set of benchmark query with its own a-box generator. It include version of LUBM_0, LUBM_1, LUBM_2, LUBM_3.

2) WINE ontology:

WINE ontology is benchmark for OWL DL ontology. We use three benchmark query based on a-box [9]. It describes class of wine and restriction between them. It include version of WINE_0 to WINE_10.

3) VICODI Ontology:

The main goal of VICODI ontology is to enhance human understanding for digital content over internet. It's give environment which provide search management for digital content. It include version of VICODI_0, VICODI_1, VICODI_2, VICODI_3, VICODI_4.

B. RESULT: Statistics Table Based On Evaluated Result

These test were executed on an Intel(R) core(TM)2 duo cpuT6400@2GHz,with 3 GB RAM ,running on Windows Vista, Java SE 1.6, Protege_4.1. For the performance evaluation considering incremental version based ontologies for various domain. Our main focus is on loading time of ontology with respect to time issue. We considered 3 standard benchmark of extensional version based ontology [7].

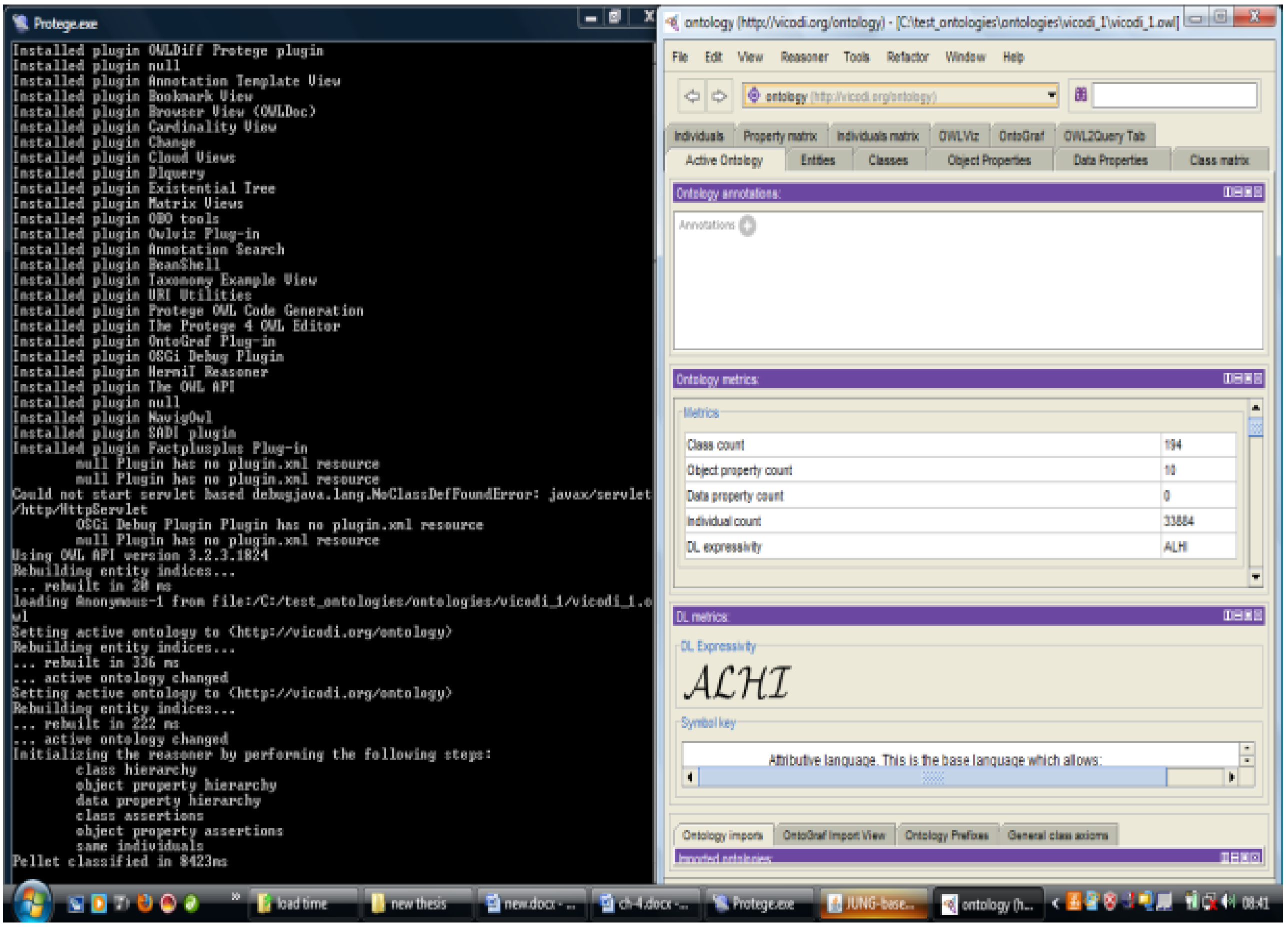

Fig-1Protégé GUI

The loading time evaluation with some other parameter was performed for different version based ontology is given below. Main focus is to measure the loading time for different version based ontology for different domain. Fig. 2 compares loading time with respect to increases the data size of ontology for LUBM ontologies for all inference engines. Fig. 3 compares loading time with respect to increases the data size of WINE ontologies for all inference engines. Fig. 4 compares loading time with respect to increases the data size of VICODI ontologies for all inference engines.

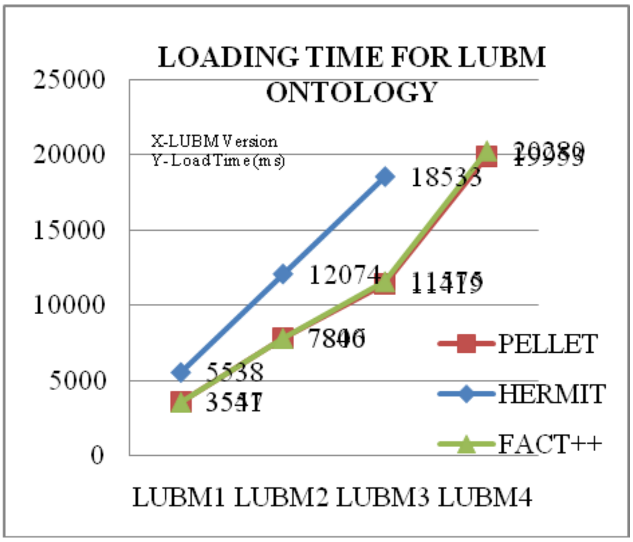

Fig-2 Loading times for different version of LUBM ontology for variety of inference engine

As shown in Fig. 2 above, it can be concluded that Pellet and Fact++ reasoners loading time is almost same. On other hand Hermit not able to load large ontology and generate error "OutOfMemoryError"

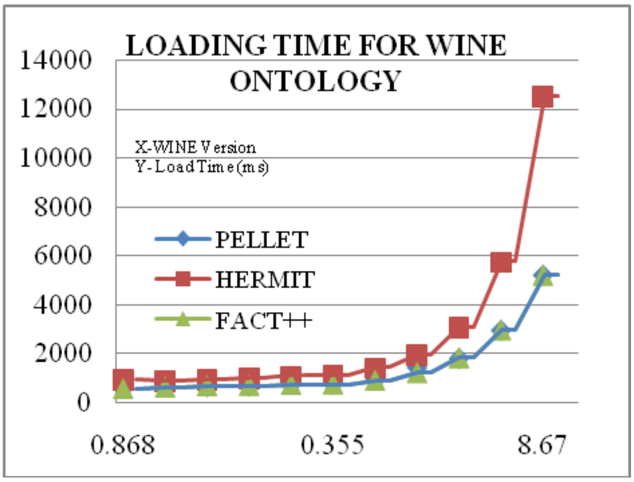

Fig-3 loading times for different version of WINE ontology for variety inference engine

As shown in Fig. 3 above, it can be concluded that Pellet and Fact++ reasoners loading time is almost same. But Hermit takes more time to load large ontology.

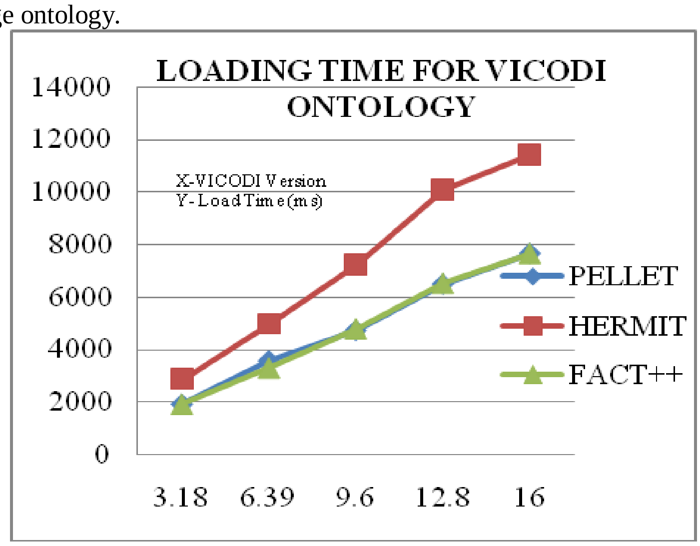

Fig-4 Loading time for different version of VICODI ontology for variety of inference engine

As shown in Fig. 4 above, it can be concluded that loading time for Pellet and Fact++ reasoner is almost same and better for different version of dataset. As data size is increases Hermit reasoner takes more time.

TABLE-1: GENERATE OUTPUT FOR FEW PARAMETER IN DIFFERENT VERSION BASED ONTOLOGY FOR DIFFERENT DOMAIN

INFERENCE ENGINE	DIFFERENT VERSION OF ONTOLOGIES	DATA SIZE(MB)	DOMAIN	LOADING TIME	A/C/OP/DP/I
PELLET	LUBM1	6.74	University	3557ms	100786/43/25/7/17174
	LUBM2	15.4	University	7846ms	230304/43/25/7/38334
	LUBM3	22.7	University	11419ms	337370/43/25/7/55664
	LUBM4	32.1	University	19953ms	478028/43/25/7/78679
HERMIT	LUBM1	6.74	University	5538ms	100786/43/25/7/17174
	LUBM2	15.4	University	12074ms	230304/43/25/7/38334
	LUBM3	22.7	University	18533ms	337370/43/25/7/55664
	LUBM4	32.1	University	OutOfMemoryError	478028/43/25/7/78679
FACT++	LUBM1	6.74	University	3541ms	100786/43/25/7/17174
	LUBM2	15.4	University	7800ms	230304/43/25/7/38334
	LUBM3	22.7	University	11575ms	337370/43/25/7/55664
	LUBM4	32.1	University	20280ms	478028/43/25/7/78679
PELLET	Wine_0	0.868	WINE	561ms	930/142/13/0/162
	Wine_1	0.142	WINE	624ms	2037/242/13/0/483
	Wine_2	0.194	WINE	639ms	3145/141/13/0/805
	Wine_3	0.249	WINE	671ms	4253/141/13/0/1127
	Wine_4	0.301	WINE	717ms	5361/141/13/0/1449
	Wine_5	0.355	WINE	734ms	6469/141/13/0/1771
	Wine_6	0.628	WINE	904ms	12009/141/13/0/3381
	Wine_7	1.14	WINE	1420ms	23089/141/13/0/6601
	Wine_8	2.2	WINE	1794ms	45249/141/13/0/13041
	Wine_9	4.35	WINE	2949ms	89569/141/13/0/25921
	Wine_10	8.67	WINE	5211ms	178209/141/13/0/51861
HERMIT	Wine_0	0.868	WINE	952ms	930/142/13/0/162
	Wine_1	0.142	WINE	873ms	2037/242/13/0/483
	Wine_2	0.194	WINE	936ms	3145/141/13/0/805
	Wine_3	0.249	WINE	983ms	4253/141/13/0/1127
	Wine_4	0.301	WINE	1077ms	5361/141/13/0/1449
	Wine_5	0.355	WINE	1123ms	6469/141/13/0/1771
	Wine_6	0.628	WINE	1420ms	12009/141/13/0/3381
	Wine_7	1.14	WINE	1950ms	23089/141/13/0/6601
	Wine_8	2.2	WINE	3089ms	45249/141/13/0/13041
	Wine_9	4.35	WINE	5757ms	89569/141/13/0/25921
	Wine_10	8.67	WINE	12542ms	178209/141/s13/0/51861
FACT++	Wine_0	0.868	WINE	546ms	930/142/13/0/162
	Wine_1	0.142	WINE	609ms	2037/242/13/0/483
	Wine_2	0.194	WINE	670ms	3145/141/13/0/805
	Wine_3	0.249	WINE	686ms	4253/141/13/0/1127
	Wine_4	0.301	WINE	717ms	5361/141/13/0/1449

	Wine_5	0.355	WINE	733ms	6469/141/13/0/1771
	Wine_6	0.628	WINE	889ms	12009/141/13/0/3381
	Wine_7	1.14	WINE	1201ms	23089/141/13/0/6601
	Wine_8	2.2	WINE	1810ms	45249/141/13/0/13041
	Wine_9	4.35	WINE	2948ms	89569/141/13/0/25921
	Wine_10	8.67	WINE	5195ms	178209/141/13/0/51861
PELLET	Vicodi_0	3.18	VICODI	1919ms	54080/194/10/0/16942
	Vicodi_1	6.39	VICODI	3572ms	107733/194/10/0/33884
	Vicodi_2	9.6	VICODI	4727ms	161386/194/10/0/50826
	Vicodi_3	12.8	VICODI	6489ms	215039/194/10/0/67768
	Vicodi_4	16	VICODI	7659ms	268692/194/10/0/84710
HERMIT	Vicodi_0	3.18	VICODI	2855ms	54080/194/10/0/16942
	Vicodi_1	6.39	VICODI	4961ms	107733/194/10/0/33884
	Vicodi_2	9.6	VICODI	7223ms	161386/194/10/0/50826
	Vicodi_3	12.8	VICODI	10090ms	215039/194/10/0/67768
	Vicodi_4	16	VICODI	11429ms	268692/194/10/0/84710
FACT++	Vicodi_0	3.18	VICODI	1934ms	54080/194/10/0/16942
	Vicodi_1	6.39	VICODI	3308ms	107733/194/10/0/33884
	Vicodi_2	9.6	VICODI	4805ms	161386/194/10/0/50826
	Vicodi_3	12.8	VICODI	6537ms	215039/194/10/0/67768
	Vicodi_4	16	VICODI	7675ms	268692/194/10/0/84710

IV. CONCLUSIONS

The semantic web is new emerging technology which improves the web and its use. Loading time is important parameter which storing the benchmark data to its repository. In this paper, inference engine performance is evaluated for large version based ontology in which focuses on loading time parameter which affects the performance of DL reasoners. For small version ontology, all inference engine able to load it efficiently. But for large and extensional version, performance of inference engine for loading time is inconsistent. As per Fig. 2, 3, 4 and Table -1, we conclude that Pellet and Fact++ gives better & quite similar result compare with Hermit. There result can be useful to choosing an inference engine for different version based ontologies for different domain.

REFERENCES

[1] Berners-Lee, T. and Hendler, J. and Lassila, O, "*The semantic web*" Scientific American, may, 2001.

[2] T. Liebig, H. Pfeifer, F. von Henke, "*Reasoning Services for an OWL Authoring Tool: An Experience Report*", in: Proceedings of the 2004 International

[3] Y. Guo, Z. Pan, and J. Heflin. "*LUBM: A Benchmark for OWL Knowledge Base Systems*",Journal of Web Semantics 3(2), 2005, pp158-182.

[4] Y. Guo, Z. Pan, and J. He.in. "*LUBM: A benchmark for OWL knowledge base systems*". Journal of Web Semantics, 2005. xsbbook/, 1999.

[5] Rob Shearer, Boris Motik, and Ian Horrocks, "*HermiT: A Highly-E_cient OWL Reasoner*", Oxford University Computing Laboratory, Oxford, OX1 3QD, UK.

[6] I. Horrocks, U. Sattler, "*A tableaux decision procedure for SH*OIQ", In: Proceedings of Nineteenth International Joint Conference on Artificial Intelligence. (2005).

[7] "*The FaCT System*", International conference on Analytic Tableaux and Related Methods (TABLEAUX'98)", pp 307-312, vol 1397, Springer-Verlag, (1998).

[8] Youyong Zou, Tim Finin and Harry Chen, "*F-OWL: an Inference Engine for the Semantic Web*", 2003.

[9] J¨urgen Bock, Peter Haase, Qiu Ji, Raphael Volz "*Benchmarking OWL Reasoners*".

[10] Simone A. Ludwig, "*Comparison of a Deductive Database with a Semantic Web reasoning engine*", Elsevier B.V., 2010.

[11] Grigiris Antoniou and Frank van Harmelen, "*A sementic web prior*", 2004.

