

Combining Graph exploration and fragmentation for scalable RDF query processin technical report

Abdallah khelil (abdallah.khelil@ensma.fr)

Watdiv

10M

	C1	C2	C3	F1	F2	F3	F4	F5	L1	L2	L3	L4	L5	S1	S2	S3	S4	S5	S6	S7
gStore	6.256	6.276	6.27	6.22	6.533	6.283	6.63	6.236	6.231	7.809	6.228	6.228	6.272	6.203	6.223	6.211	6.217	6.201	6.237	6.197
QDAG	0.71	0.563	5.22	0.207	0.18	0.42	0.29	0	0	0.103	0	0.194	0.218	0	0.257	0.326	0.248	0.23	0.181	0
Virtuos	0.281	0.525	37.024	1.167	0.15	0.81	0.44	0.118	0.001	0.91	0.001	0.006	0.002	0.917	0.002	0.012	0.056	0.002	0.101	0.001

100M

	C1	C2	C3	F1	F2	F3	F4	F5	L1	L2	L3	L4	L5	S1	S2	S3	S4	S5	S6	S7
SGBD	111.458	97.473	100.496	93.47	122.075	101.406	105.355	102.73	106.248	91.318	100.098	107.831	104.03	102.02	98.904	96.831	101.649	107.053	103.376	105.573
gStore	4.22	5.46	27.23	0.906	0.609	4.2	2.56	0	0.423	2.49	0	1.168	1.248	0	2.62	0.276	3.021	0.233	0.556	1.709
virtuoso	2.568	8.473	99.201	0.055	2.51	0.564	2.086	0.526	0.259	0.28	0.023	0.416	4.43	0.789	0.168	0.053	0.138	0.004	0.163	0.001

LUBM

10M

SGBD	1	2	3	4
gStore	12.351	12.325	18.175	12.39
QDAG	0.486	2.387	4.976	0.489
Virtuoso	24.4135802	4.163385	2.65253215	24.3374233

20M

SGBD	1	2	3	4
gStore	26.043	26.334	32.214	25.31
QDAG	0.986	4.277	8.996	0.984

40M

SGBD	1	2	3	4
gStore	13.704	13.753	14.038	13.769
QDAG	2.064	8.203	17.67	2.054

Watdiv queries

C1	<pre>SELECT ?v0 ?v4 ?v6 ?v7 WHERE { ?v0 <http://schema.org/caption> ?v1 . ?v0 <http://schema.org/text> ?v2 . ?v0 <http://schema.org/contentRating> ?v3 . ?v0 <http://purl.org/stuff/rev#hasReview> ?v4 . ?v4 <http://purl.org/stuff/rev#title> ?v5 . ?v4 <http://purl.org/stuff/rev#reviewer> ?v6 . ?v7 <http://schema.org/actor> ?v6 . ?v7 <http://schema.org/language> ?v8 . }</pre>
C2	<pre>SELECT ?v0 ?v3 ?v4 ?v8 WHERE { ?v0 <http://schema.org/legalName> ?v1 . ?v0 <http://purl.org/goodrelations/offers> ?v2 . ?v2 <http://schema.org/eligibleRegion> <http://db.uwaterloo.ca/~galuc/wsdbm/Country5> . ?v2 <http://purl.org/goodrelations/includes> ?v3 . ?v4 <http://schema.org/jobTitle> ?v5 . ?v4 <http://xmlns.com/foaf/homepage> ?v6 . ?v4 <http://db.uwaterloo.ca/~galuc/wsdbm/makesPurchase> ?v7 . ?v7 <http://db.uwaterloo.ca/~galuc/wsdbm/purchaseFor> ?v3 . ?v3 <http://purl.org/stuff/rev#hasReview> ?v8 . ?v8 <http://purl.org/stuff/rev#totalVotes> ?v9 . }</pre>
C3	<pre>SELECT ?v0 WHERE { ?v0 <http://db.uwaterloo.ca/~galuc/wsdbm/likes> ?v1 . ?v0 <http://db.uwaterloo.ca/~galuc/wsdbm/friendOf> ?v2 . ?v0 <http://purl.org/dc/terms/Location> ?v3 . ?v0 <http://xmlns.com/foaf/age> ?v4 . ?v0 <http://db.uwaterloo.ca/~galuc/wsdbm/gender> ?v5 . ?v0 <http://xmlns.com/foaf/givenName> ?v6 . }</pre>

F1	<pre> SELECT ?v0 ?v2 ?v3 ?v4 ?v5 WHERE { ?v0 <http://ogp.me/ns#tag> <http://db.uwaterloo.ca/~galuc/wsdbm/Topic172> . ?v0 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> ?v2 . ?v3 <http://schema.org/trailer> ?v4 . ?v3 <http://schema.org/keywords> ?v5 . ?v3 <http://db.uwaterloo.ca/~galuc/wsdbm/hasGenre> ?v0 . ?v3 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://db.uwaterloo.ca/~galuc/wsdbm/ProductCategory2> . } </pre>
F2	<pre> SELECT ?v0 ?v1 ?v2 ?v4 ?v5 ?v6 ?v7 WHERE { ?v0 <http://xmlns.com/foaf/homepage> ?v1 . ?v0 <http://ogp.me/ns#title> ?v2 . ?v0 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> ?v3 . ?v0 <http://schema.org/caption> ?v4 . ?v0 <http://schema.org/description> ?v5 . ?v1 <http://schema.org/url> ?v6 . ?v1 <http://db.uwaterloo.ca/~galuc/wsdbm/hits> ?v7 . ?v0 <http://db.uwaterloo.ca/~galuc/wsdbm/hasGenre> <http://db.uwaterloo.ca/~galuc/wsdbm/SubGenre55> . } </pre>
F3	<pre> SELECT ?v0 ?v1 ?v2 ?v4 ?v5 ?v6 WHERE { ?v0 <http://schema.org/contentRating> ?v1 . ?v0 <http://schema.org/contentSize> ?v2 . ?v0 <http://db.uwaterloo.ca/~galuc/wsdbm/hasGenre> <http://db.uwaterloo.ca/~galuc/wsdbm/SubGenre42> . ?v4 <http://db.uwaterloo.ca/~galuc/wsdbm/makesPurchase> ?v5 . ?v5 <http://db.uwaterloo.ca/~galuc/wsdbm/purchaseDate> ?v6 . ?v5 <http://db.uwaterloo.ca/~galuc/wsdbm/purchaseFor> ?v0 . } </pre>
F4	<pre> SELECT ?v0 ?v1 ?v2 ?v4 ?v5 ?v6 ?v7 ?v8 WHERE { ?v0 <http://xmlns.com/foaf/homepage> ?v1 . ?v2 <http://purl.org/goodrelations/includes> ?v0 . ?v0 <http://ogp.me/ns#tag> <http://db.uwaterloo.ca/~galuc/wsdbm/Topic71> . ?v0 <http://schema.org/description> ?v4 . } </pre>

	<pre> ?v0 <http://schema.org/contentSize> ?v8 . ?v1 <http://schema.org/url> ?v5 . ?v1 <http://db.uwaterloo.ca/~galuc/wsdbm/hits> ?v6 . ?v1 <http://schema.org/language> <http://db.uwaterloo.ca/~galuc/wsdbm/Language0> . ?v7 <http://db.uwaterloo.ca/~galuc/wsdbm/likes> ?v0 . } </pre>
F5	<pre> SELECT ?v0 ?v1 ?v3 ?v4 ?v5 ?v6 WHERE { ?v0 <http://purl.org/goodrelations/includes> ?v1 . <http://db.uwaterloo.ca/~galuc/wsdbm/Retailer28001> <http://purl.org/goodrelations/offers> ?v0 . ?v0 <http://purl.org/goodrelations/price> ?v3 . ?v0 <http://purl.org/goodrelations/validThrough> ?v4 . ?v1 <http://ogp.me/ns#title> ?v5 . ?v1 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> ?v6 . } </pre>
L1	<pre> SELECT ?v0 ?v2 ?v3 WHERE { ?v0<http://db.uwaterloo.ca/~galuc/wsdbm/subscribes> <http://db.uwaterloo.ca/~galuc/wsdbm/Website18627> . ?v2 <http://schema.org/caption> ?v3 . ?v0 <http://db.uwaterloo.ca/~galuc/wsdbm/likes> ?v2 . } </pre>
L2	<pre> SELECT ?v1 ?v2 WHERE { <http://db.uwaterloo.ca/~galuc/wsdbm/City107> <http://www.geonames.org/ontology#parentCountry> ?v1 . ?v2<http://db.uwaterloo.ca/~galuc/wsdbm/likes> <http://db.uwaterloo.ca/~galuc/wsdbm/Product0> . ?v2 <http://schema.org/nationality> ?v1 . } </pre>
L3	<pre> SELECT ?v0 ?v1 WHERE { ?v0 <http://db.uwaterloo.ca/~galuc/wsdbm/likes> ?v1 . ?v0<http://db.uwaterloo.ca/~galuc/wsdbm/subscribes> <http://db.uwaterloo.ca/~galuc/wsdbm/Website50122> . } </pre>
L4	<pre> SELECT ?v0 ?v2 WHERE { ?v0 <http://ogp.me/ns#tag> <http://db.uwaterloo.ca/~galuc/wsdbm/Topic132> . ?v0 <http://schema.org/caption> ?v2 . } </pre>

	} }
L5	SELECT ?v0 ?v1 ?v3 WHERE { ?v0 <http://schema.org/jobTitle> ?v1 . <http://db.uwaterloo.ca/~galuc/wsdbm/City24> <http://www.geonames.org/ontology#parentCountry> ?v3 . ?v0 <http://schema.org/nationality> ?v3 . } }
S1	SELECT ?v0 ?v1 ?v3 ?v4 ?v5 ?v6 ?v7 ?v8 ?v9 WHERE { ?v0 <http://purl.org/goodrelations/includes> ?v1 . <http://db.uwaterloo.ca/~galuc/wsdbm/Retailer52462> <http://purl.org/goodrelations/offers> ?v0 . ?v0 <http://purl.org/goodrelations/price> ?v3 . ?v0 <http://purl.org/goodrelations/serialNumber> ?v4 . ?v0 <http://purl.org/goodrelations/validFrom> ?v5 . ?v0 <http://purl.org/goodrelations/validThrough> ?v6 . ?v0 <http://schema.org/eligibleQuantity> ?v7 . ?v0 <http://schema.org/eligibleRegion> ?v8 . ?v0 <http://schema.org/priceValidUntil> ?v9 . }
S2	SELECT ?v0 ?v1 ?v3 WHERE { ?v0 <http://purl.org/dc/terms/Location> ?v1 . ?v0 <http://schema.org/nationality> <http://db.uwaterloo.ca/~galuc/wsdbm/Country14> . ?v0 <http://db.uwaterloo.ca/~galuc/wsdbm/gender> ?v3 . ?v0 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://db.uwaterloo.ca/~galuc/wsdbm/Role2> . } }
S3	SELECT ?v0 ?v2 ?v3 ?v4 WHERE { ?v0 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://db.uwaterloo.ca/~galuc/wsdbm/ProductCategory14> . ?v0 <http://schema.org/caption> ?v2 . ?v0 <http://db.uwaterloo.ca/~galuc/wsdbm/hasGenre> ?v3 . ?v0 <http://schema.org/publisher> ?v4 . } }
S4	SELECT ?v0 ?v2 ?v3 WHERE { ?v0 <http://xmlns.com/foaf/age> <http://db.uwaterloo.ca/~galuc/wsdbm/AgeGroup1> . ?v0 <http://xmlns.com/foaf/familyName> ?v2 . }

	<pre> ?v3 <http://purl.org/ontology/mo/artist> ?v0 . ?v0 <http://schema.org/nationality> <http://db.uwaterloo.ca/~galuc/wsdbm/Country1> . } </pre>
S5	<pre> SELECT ?v0 ?v2 ?v3 WHERE { ?v0 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://db.uwaterloo.ca/~galuc/wsdbm/ProductCategory7> . ?v0 <http://schema.org/description> ?v2 . ?v0 <http://schema.org/keywords> ?v3 . ?v0 <http://schema.org/language> <http://db.uwaterloo.ca/~galuc/wsdbm/Language0> . } </pre>
S6	<pre> SELECT ?v0 ?v1 ?v2 WHERE { ?v0 <http://purl.org/ontology/mo/conductor> ?v1 . ?v0 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> ?v2 . ?v0 <http://db.uwaterloo.ca/~galuc/wsdbm/hasGenre> <http://db.uwaterloo.ca/~galuc/wsdbm/SubGenre83> . } </pre>
S7	<pre> SELECT ?v0 ?v1 ?v2 WHERE { ?v0 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> ?v1 . ?v0 <http://schema.org/text> ?v2 . <http://db.uwaterloo.ca/~galuc/wsdbm/User145869> <http://db.uwaterloo.ca/~galuc/wsdbm/likes> ?v0 . } </pre>

LUBM queries

Q1	<pre> SELECT ?x WHERE { ?x <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://swat.cse.lehigh.edu/onto/univ-bench.owl#GraduateStudent>. ?x <http://swat.cse.lehigh.edu/onto/univ-bench.owl#takesCourse> <http://www.Department0.University0.edu/GraduateCourse0>. } </pre>
Q2	<pre> SELECT ?x WHERE { ?x <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://swat.cse.lehigh.edu/onto/univ-bench.owl#Publication>. ?x <http://swat.cse.lehigh.edu/onto/univ-bench.owl#publicationAuthor> <http://www.Department0.University0.edu/AssistantProfessor0>. } </pre>
Q3	<pre> SELECT ?x WHERE </pre>

	{ ?x <http://swat.cse.lehigh.edu/onto/univ-bench.owl#memberOf> <http://www.Department0.University0.edu>. }
Q4	SELECT ?x WHERE { ?x <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://swat.cse.lehigh.edu/onto/univ-bench.owl#GraduateStudent>. ?x <http://swat.cse.lehigh.edu/onto/univ-bench.owl#takesCourse> <http://www.Department0.University0.edu/GraduateCourse0>. }