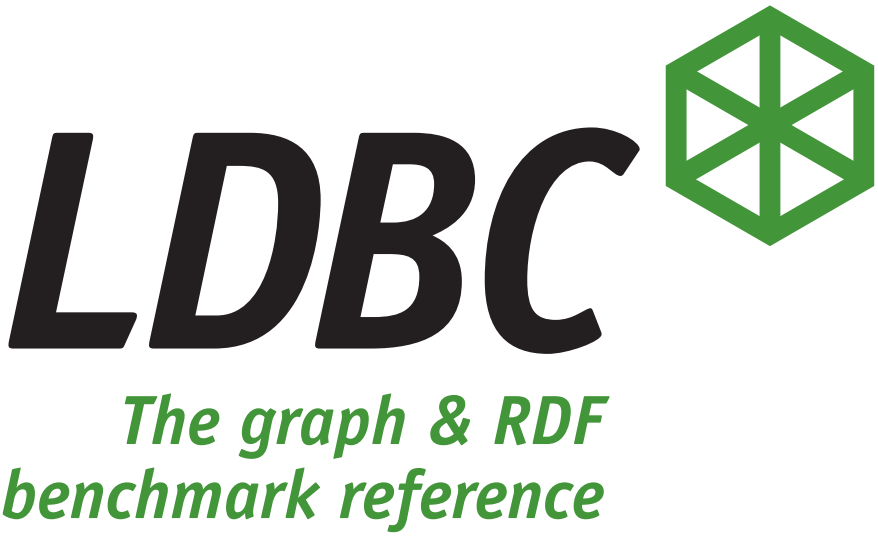

Full Disclosure Report of the LDBC Social Network Benchmark

An Implementation of the LDBC Social Network Benchmark's Interactive Workload over GraphDB

February 15, 2023

General Terms

Executive Summary

GraphDB is a proprietary RDF triplestore graph database written in Java, developed by Sirma AI AD, trading as Ontotext. GraphDB supports path traversal queries and provides connectors for Elasticsearch, Lucene, and Solr. It comes in two offerings: a free and an enterprise version. This document describes an implementation of the LDBC Social Network Benchmark's Interactive workload in GraphDB using the enterprise version. The data schema follows the RDF triples data model with a provided ruleset. The implementation uses SPARQL queries and communicates with the database using the RDF4J HTTP Client.

Declaration of Audit Success

This report contains an audited LDBC benchmark run. The results have been gathered by an independent and impartial auditor who has validated the implementation of the queries, successfully run the ACID tests associated with the claimed isolation level (read committed), and verified the overall system's configuration conformance to the description of the benchmark and its strict requirements.

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Table of Contents

1 System Description and Pricing Summary

1.1 Details of machines driving and running the workload

1.1.1 Machine overview

The details below were obtained from the Amazon Web Services console.

Table 1.1: Machine Type and Location

Cloud provider	Amazon Web Services
Machine region	N. Virginia (us-east-1)
Common name of the item	r6id.8xlarge
Operating system	22.04-Ubuntu

This benchmark used two `r6id.8xlarge` instances, one for the driver and one for the SUT placed in an AWS Placement group with the cluster strategy to reduce network latency[1]. This is shown in Figure 1.1.

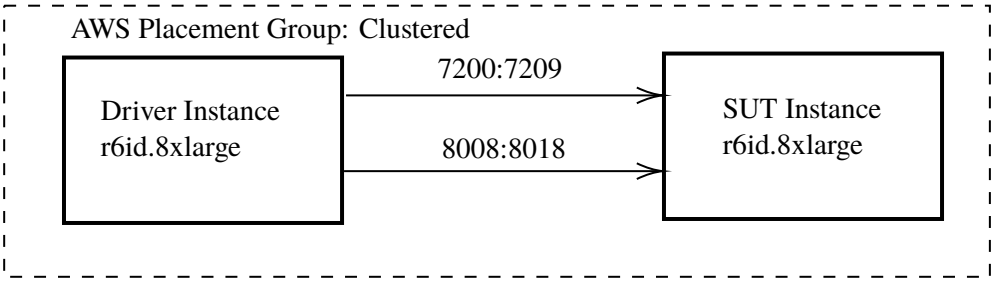

Figure 1.1: Overview of benchmark setup

1.1.2 CPU details

The details below were obtained using the command `cat /proc/cpuinfo` (Listing A.1) issued from the machine instance and the datasheet of the used CPU type.

Table 1.2: CPU details summary

Type	Intel® Intel Xeon® Platinum 8375C CPU
Total number	1
Cores per CPU	16
Threads per CPU	32
CPU clock frequency	2.90GHz
Total cache size per CPU	L1 cache: 2560KiB L2 cache: 40MiB L3 cache: 54MiB

1.1.3 Memory details

The total size of the memory installed is 256GiB and the type of memory is DDR4 with frequency 3200MHz. This information was obtained using the `sudo lshw -c memory` command (Listing A.2) issued from the virtual machine instance.

[1] https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/placement-groups.html#placement-groups-cluster

1.1.4 Disk and storage details

Disk controller or motherboard type was not obtainable from the virtual machine instance. The storage consists of 1 x 1900GB NVMe SSD, formatted with `ext4` filesystem. The storage size and type is from the Amazon Web Services website `https://aws.amazon.com/ec2/instance-types/r6i/` (accessed: January 29, 2023).

The 4KB QD1 write performance was measured with the `fio` command and the output (Listing A.4) showed an average of 9 257 IOPS.

1.1.5 Network details

The benchmark was run using two `r6id.8xlarge` instances, both deployed in the same availability zone. Both instances where assigned security groups to open port 7200. The `r6id.8xlarge` instances use the Elastic Network Adapter provided by Amazon. This information was obtained using the `lshw -class network` command (Listing A.3). On each instance, the firewall was disabled to minimize performance impact of the firewall during the benchmark.

1.1.6 Machine pricing

The system pricing summary is included in the table below. The pricing of the AWS machine instance is the price for a 3-year reserved dedicated instance machine without upfront payment using the EC2 Instance savings plan [2].

Table 1.3: Pricing summary

Item	**Price**
r6id.8xlarge reserved instance machine in AWS (standard 3-year term)	30 222 USD
Ontotext Subscription license 3 years (GraphDB EE, 4vCPU)	36 000 USD
Maintenance including 24/7 enterprise support fee (3-year term)	150 000 USD
Total cost of ownership	216 222 USD

1.1.7 System availability

The latest software version of GraphDB (version 10.1.1) was made available on 23 November, 2022. This version was deployed to the machine described in this section.

[2] `https://aws.amazon.com/savingsplans/compute-pricing/`

2 Dataset Generation

2.1 General information

This audited execution used the pre-generated LDBC SNB datasets available from the CWI/SURF data repository.[1] The format used is the TTL (RDF Turtle) serializer. These datasets were generated using the `v0.3.5` Datagen version.

Scale factor 10 is used for validation, while scale factor 30 is used for performance measurements.

2.2 Data loading and data schema

Before loading the data, a repository must be created using the GraphDB web interface, GraphDB workbench. The following configuration was used to create the repository:

- Disable owl:sameas = true
- Enable context index = true
- Enable literal index = true
- Entity id size = 40
- Custom ruleset = rdfsPlus-snb-bidir.pie (see Listing A.5)

Afterwards, the RDF Turtle files are imported into the database using the `importrdf` tool provided with the GraphDB installation, invoked with `./importrdf preload -f -i SNB-SF30 ../../social_network_ttl_sf30/.`

Data loading times are shown for scale factor 30 in the table below. Values were retrieved using the output of the `importrdf` tool. The columns show how much time it took to preload them in the database and to reinfer the data using Listing 2.1.

Listing 2.1: Reinfer command

```
1 INSERT DATA { [] <http://www.ontotext.com/owlim/system#reinfer> [] }
```

Table 2.1: Data loading times

Scale factor	TTL loading time (s)	Reinfering time (s)	Total time (s)
30	8 735	3 519	12 254

The repository was copied into an AWS S3 Storage bucket. Before each new deployment of the SUT, the data was copied to the SUT to reduce loading times.

[1] https://github.com/ldbc/data-sets-surf-repository/

3 Test Driver Details

The software versions used are described below as well as the amount of read and write threads used by the driver.

Table 3.1: Summary of test artifacts and main configuration parameters

Driver version	v1.2.0	https://github.com/ldbc/ldbc_snb_interactive_driver/releases/tag/v1.2.0
Implementations version	v1.0.0	https://github.com/ldbc/ldbc_snb_interactive_impls/releases/tag/1.0.0
LDBC SNB specification version	v0.3.6	https://arxiv.org/pdf/2001.02299v3.pdf
Driver read threads	1, 2, 4	
Driver write threads	1, 2, 4	

3.1 Driver implementation

A test driver adaptation for the SUT was provided by the test sponsor and available in the LDBC SNB Interactive implementations repository[1].

The SUT-specific test driver class `com.ldbc.impls.workloads.ldbc.snb.graphdb` extends the class `com.ldbc.driver.Db` provided in the LDBC SNB Interactive driver package. Internally, the `GraphDBInteractive` relies on the

3.2 Benchmark configuration

The driver applied time compression ratio values of

- TCR=11 for scale factor 30, 1 read thread, 1 write thread,
- TCR=5 for scale factor 30, 2 read threads, 2 write threads, and
- TCR=2.8 for scale factor 30, 4 read threads, 4 write threads.

The complete configuration files for the different number of threads are shown in Listings A.6–A.8, and are also included in the attached supplementary materials.

The used Java JVM configuration for the database is:

- Garbage collector: `-XX:+UseG1GC`
- Min heap size: `-Xms80g`
- Max heap size: `-Xmx80g`
- GraphDB Memory upper bound parameter[2]: `-Ddefault.min.distinct.threshold=100m`

At startup, these configuration parameters are passed to the system as follows:
`./graphdb -XX:+UseG1GC -Xmx80g -Xms80g -Ddefault.min.distinct.threshold=100m.` [3]

[1] https://github.com/ldbc/ldbc_snb_interactive_impls/tree/7c57d8fac01d532c017b1f83c1f04177b7c0332f/graphdb

[2] https://graphdb.ontotext.com/documentation/10.0/configuring-a-repository.html

[3] https://graphdb.ontotext.com/documentation/10.0/quick-start-guide.html#java-virtual-machine-settings

4 Performance Metrics

The performance metrics reported here show benchmark runs with scale factor 30 using different number of read and write threads. The performance summary tables below highlight key performance characteristics.

Table 4.1: Summary of results for scale factor 30, 1 read and 1 write thread(s)

Benchmark duration	Benchmark operations	Throughput	Query on-time compliance
02h 03m 03.184s	22 444	3.04 $\frac{\text{operations}}{\text{second}}$	95.38%

Table 4.2: Summary of results for scale factor 30, 2 read and 2 write thread(s)

Benchmark duration	Benchmark operations	Throughput	Query on-time compliance
02h 03m 0.257s	49 911	6.76 $\frac{\text{operations}}{\text{second}}$	96.86%

Table 4.3: Summary of results for scale factor 30, 4 read and 4 write thread(s)

Benchmark duration	Benchmark operations	Throughput	Query on-time compliance
02h 03m 28.523	90 129	12.16 $\frac{\text{operations}}{\text{second}}$	99.0%

During the benchmark run, the query executions shown in the tables below were observed using different number of threads. Columns (except for Query and Total count) show duration values with millisecond (*ms*) precision. The notation $\mathbf{P_i}$ is used for the i^{th} percentile among all observed execution run times of a given query type. After each benchmark result table a table with the percentage of late operations per query type is shown. Note that the calculation of the start times of the late operations are done using the microsecond precision.

Table 4.4: Detailed performance benchmark results for scale factor 30 in *milliseconds* using 1 read and 1 write thread(s)

Query	Total count	Min.	Max.	Mean	P_{50}	P_{90}	P_{95}	P_{99}
Query1	165	1	9 385	7 478.41	8 498	8 973	9 037	9 180
Query2	117	23	384	300.34	308	350	358	379
Query3	40	890	1 050	952.45	955	971	979	1 050
Query4	120	2	637	466.53	474	548	561	631
Query5	60	10 172	52 234	37 469.75	37 028	47 528	49 188	51 756
Query6	13	3 658	4 560	4 084.85	4 163	4 281	4 281	4 560
Query7	89	1	65	4.52	2	6	18	49
Query8	478	19	64	36.09	35	48	51	58
Query9	11	23 296	27 541	25 819.27	25 937	27 400	27 400	27 541
Query10	117	1	2 033	1 601.42	1 654	1 855	1 882	2 012
Query11	215	51	76	60.85	60	69	70	73
Query12	98	17	1 489	686.29	591	1 126	1 231	1 347
Query13	226	1	9	4.53	4	6	7	9
Query14	88	1	36 040	1 462.06	152	351	423	31 583
Short1	2 253	1	5	1.04	1	1	1	2
Short2	2 253	0	71	7.83	6	12	19	44
Short3	2 253	0	35	4.05	2	7	17	28
Short4	2 255	0	3	0.29	0	1	1	1
Short5	2 255	0	2	0.18	0	1	1	1
Short6	2 255	1	3	1.02	1	1	1	2
Short7	2 255	2	4	2.08	2	2	3	3
Update1	1	176	176	176.00	176	176	176	176
Update2	693	26	68	28.33	28	29	29	33
Update3	980	26	72	28.07	28	29	29	31
Update4	31	32	59	34.52	34	35	35	59
Update5	2 068	26	68	28.24	28	29	30	33
Update6	341	31	78	34.38	33	37	39	64
Update7	634	32	74	35.51	34	40	42	49
Update8	80	27	64	29.01	29	30	30	32

Table 4.5: Detailed query on time results for scale factor 30 using 1 read and 1 write thread(s)

Query	Total count	Total late count	Late count percentage
Query1	165	69	41.82
Query2	117	89	76.07
Query3	40	24	60.00
Query4	120	54	45.00
Query5	60	16	26.67
Query6	13	7	53.85
Query7	89	50	56.18
Query8	478	295	61.72
Query9	11	7	63.64
Query10	117	62	52.99
Query11	215	124	57.67
Query12	98	58	59.18
Query13	226	135	59.73
Query14	88	46	52.27
Short1	2 253	0	0.00
Short2	2 253	0	0.00
Short3	2 253	0	0.00
Short4	2 255	0	0.00
Short5	2 255	0	0.00
Short6	2 255	0	0.00
Short7	2 255	0	0.00
Update1	1	0	0.00
Update2	693	0	0.00
Update3	980	0	0.00
Update4	31	0	0.00
Update5	2 068	0	0.00
Update6	341	0	0.00
Update7	634	0	0.00
Update8	80	0	0.00
Total	22 444	1 036	4.62

Table 4.6: Detailed performance benchmark results for scale factor 30 in *milliseconds* using 2 read and 2 write thread(s)

Query	Total count	Min.	Max.	Mean	P_{50}	P_{90}	P_{95}	P_{99}
Query1	362	2	9 435	7 254.37	8 210	8 942	9 066	9 299
Query2	255	9	415	312.89	319	368	374	405
Query3	89	883	1 115	976.91	981	1 016	1 026	1 046
Query4	262	2	716	500.84	501	593	616	668
Query5	131	1	53 974	39 579.63	39 166	49 046	50 584	53 760
Query6	30	3 515	4 852	4 107.17	4 131	4 565	4 638	4 852
Query7	196	1	63	3.18	1	6	7	40
Query8	1 048	12	60	25.14	22	37	42	51
Query9	24	14 660	30 239	26 575.54	26 880	29 249	29 788	30 239
Query10	255	1	2 119	1 692.50	1 722	1 943	2 001	2 076
Query11	471	46	108	63.31	63	74	75	80
Query12	214	3	1 761	757.21	637	1 264	1 366	1 645
Query13	496	0	10	4.73	5	6	7	10
Query14	192	2	40 972	1 751.17	167	450	4 582	33 598
Short1	5 009	1	30	1.03	1	1	1	2
Short2	5 009	0	76	8.06	6	13	19	45
Short3	5 009	0	44	4.19	3	7	16	29
Short4	5 016	0	28	0.35	0	1	1	1
Short5	5 016	0	2	0.21	0	1	1	1
Short6	5 016	1	32	1.02	1	1	1	2
Short7	5 016	2	9	2.12	2	3	3	3
Update1	1	86	86	86.00	86	86	86	86
Update2	1 583	26	71	28.59	28	29	30	58
Update3	2 197	26	94	28.53	28	29	30	56
Update4	59	32	77	36.61	34	35	65	73
Update5	4 701	26	90	29.04	28	29	33	56
Update6	622	31	78	34.70	33	38	41	68
Update7	1 439	31	86	36.05	34	41	45	68
Update8	193	27	42	28.54	28	29	30	33

Table 4.7: Detailed query on time results for scale factor 30 using 2 read and 2 write thread(s)

Query	Total count	Total late count	Late count percentage
Query1	362	56	15.47
Query2	255	157	61.57
Query3	89	36	40.45
Query4	262	101	38.55
Query5	131	19	14.50
Query6	30	11	36.67
Query7	196	77	39.29
Query8	1 048	464	44.27
Query9	24	8	33.33
Query10	255	103	40.39
Query11	471	197	41.83
Query12	214	74	34.58
Query13	496	189	38.10
Query14	192	76	39.58
Short1	5 009	0	0.00
Short2	5 009	0	0.00
Short3	5 009	0	0.00
Short4	5 016	0	0.00
Short5	5 016	0	0.00
Short6	5 016	0	0.00
Short7	5 016	0	0.00
Update1	1	0	0.00
Update2	1 583	0	0.00
Update3	2 197	0	0.00
Update4	59	0	0.00
Update5	4 701	0	0.00
Update6	622	0	0.00
Update7	1 439	0	0.00
Update8	193	0	0.00
Total	49 911	1 568	3.14

Table 4.8: Detailed performance benchmark results for scale factor 30 in *milliseconds* using 4 read and 4 write thread(s)

Query	Total count	Min.	Max.	Mean	P_{50}	P_{90}	P_{95}	P_{99}
Query1	649	3	9 879	7 017.26	7 636	8 608	8 778	9 150
Query2	456	7	454	322.31	325	377	395	430
Query3	160	883	1 189	1 009.89	1 011	1 069	1 081	1 125
Query4	469	2	774	516.05	512	612	638	701
Query5	235	1	66 236	42 657.00	42 052	53 646	55 632	60 198
Query6	53	3 563	5 151	4 305.57	4 313	4 879	4 922	5 136
Query7	352	1	67	3.68	2	6	9	31
Query8	1 877	12	6 757	34.92	26	53	65	84
Query9	44	15 174	32 174	27 452.11	28 343	29 771	30 009	32 174
Query10	456	2	2 383	1 750.77	1 789	2 032	2 119	2 230
Query11	844	50	139	74.55	73	89	96	113
Query12	384	3	1 877	826.21	704	1 375	1 586	1 770
Query13	889	0	53	5.60	5	7	10	26
Query14	344	2	56 100	1 711.03	168	502	1 050	37 734
Short1	9 031	1	3 384	1.72	1	1	1	3
Short2	9 031	0	4 906	9.48	6	14	21	50
Short3	9 031	0	11 183	6.89	3	8	20	33
Short4	9 122	0	4 903	2.03	0	1	1	3
Short5	9 122	0	2 575	0.73	0	1	1	2
Short6	9 122	1	2 567	1.58	1	1	1	3
Short7	9 122	2	2 479	2.96	2	2	3	4
Update1	5	64	85	71.60	66	85	85	85
Update2	2 785	26	11 260	53.98	28	30	43	103
Update3	3 983	26	11 610	41.12	28	31	44	87
Update4	90	31	55	34.57	33	37	45	55
Update5	8 515	26	7 955	37.74	28	34	53	100
Update6	935	31	9 515	81.49	33	42	58	1 567
Update7	2 656	31	18 453	78.54	34	44	54	301
Update8	367	27	307	31.26	29	32	45	76

Table 4.9: Detailed query on time results for scale factor 30 using 4 read and 4 write thread(s)

Query	Total count	Total late count	Late count percentage
Query1	649	31	4.78
Query2	456	81	17.76
Query3	160	14	8.75
Query4	469	40	8.53
Query5	235	13	5.53
Query6	53	9	16.98
Query7	352	39	11.08
Query8	1 877	238	12.68
Query9	44	2	4.55
Query10	456	31	6.80
Query11	844	90	10.66
Query12	384	42	10.94
Query13	889	105	11.81
Query14	344	30	8.72
Short1	9 031	0	0.00
Short2	9 031	0	0.00
Short3	9 031	0	0.00
Short4	9 122	0	0.00
Short5	9 122	0	0.00
Short6	9 122	0	0.00
Short7	9 122	0	0.00
Update1	5	0	0.00
Update2	2 785	29	1.04
Update3	3 983	30	0.75
Update4	90	0	0.00
Update5	8 515	88	1.03
Update6	935	8	0.86
Update7	2 656	24	0.90
Update8	367	2	0.54
Total	90 129	946	1.05

5 Validation of the Results

The scale factor 10 data set was used for validating the correctness of the implementation over the SUT. The validation data set of size 150 038 was created with the SNB Interactive reference implementation over Neo4j, running the Community Edition of version 5.2.0. The system with the driver configuration shown in Listing A.9 successfully returned the expected result sets for the queries of the benchmark.

6 ACID Compliance

6.1 Transaction isolation level

The benchmark was executed using the *Read committed* isolation level setting of the SUT, which is conforms to the minimum isolation level required by the SNB Interactive specification.

6.2 SNB Interactive ACID test results

The ACID test implementations were reviewed to conform to the ACID test specifications, with all specified test cases implemented. Furthermore, test execution was successful, passing the tests required for the *read committed* isolation level.

6.3 Recovery and durability

6.3.1 Recovery

Durability tests were using the regular benchmark workload with scale factor 30 and started at `22:02 UTC`. Both server machines where shutdown using the command `sudo shutdown -rf 00:02`, forced rebooting (ungracefully) both machines 2 hours after start of the benchmark, with 14 917 completed operations. The database server process was manually started again after the crash and it was ready in 17 seconds.

6.3.2 Durability

From the driver log, the last update operations before the crash were obtained using the commands below.

```
$ grep LdbcUpdate1 LDBC-SNB-results_log.csv |tail -n 1
LdbcUpdate1AddPerson|1674602166042|1674602166042|184|0|1347529331840
$ grep LdbcUpdate2 LDBC-SNB-results_log.csv |tail -n 1
LdbcUpdate2AddPostLike|1674604848078|1674604848078|27|0|1347529555343
$ grep LdbcUpdate3 LDBC-SNB-results_log.csv |tail -n 1
LdbcUpdate3AddCommentLike|1674604847694|1674604847694|27|0|1347529555311
$ grep LdbcUpdate4 LDBC-SNB-results_log.csv |tail -n 1
LdbcUpdate4AddForum|1674604770534|1674604770534|34|0|1347529548881
$ grep LdbcUpdate5 LDBC-SNB-results_log.csv |tail -n 1
LdbcUpdate5AddForumMembership|1674604845774|1674604845774|27|0|1347529555151
$ grep LdbcUpdate6 LDBC-SNB-results_log.csv |tail -n 1
LdbcUpdate6AddPost|1674604736802|1674604736802|35|0|1347529546070
$ grep LdbcUpdate7 LDBC-SNB-results_log.csv |tail -n 1
LdbcUpdate7AddComment|1674604833798|1674604833798|32|0|1347529554153
$ grep LdbcUpdate8 LDBC-SNB-results_log.csv |tail -n 1
LdbcUpdate8AddFriendship|1674604703394|1674604703394|27|0|1347529543286
```

From the logs, the last completed updates were retrieved for each update. The log entries include the operation name, actual and scheduled start time, the execution time, the delay between scheduled and actual start times, and the initial query start time without the scale factor multiplier (this latter one is included in the last column). Using this information, the query parameters were obtained from the initial CSV files generated by the Datagen using the initial query start time and the type number of the operation using the commands below.

```
$ grep -rnw '/opt/temp-test-data/social_network-sf30-numpart-1/' -e '1347529331840|.*|1|.*'
updateStream_0_0_person.csv:1:1347529331840|0|1|35184372252737|Bingbing|Yang|female
    |632966400000|1347529331840|14.102.131.33|Firefox|340|zh;en|Bingbing35184372252737@gmail.com;
    Bingbing35184372252737@playful.com|6;782;973;1172;1176;1193;1198;1454
;1766;2807;2827;6358;7015;11376;11742|2210,2008|913,2009;917,2009;920,2009;910,2009
$ grep -rnw '/opt/temp-test-data/social_network-sf30-numpart-1/' -e '1347529555343|.*|2|.*'
/opt/temp-test-data/social_network-sf30-numpart-1/updateStream_0_0_forum.csv
    :4346:1347529555343|1342383135409|2|32985348845264|32985350079077|1347529555343
$ grep -rnw '/opt/temp-test-data/social_network-sf30-numpart-1/' -e '1347529555311|.*|3|.*'
/opt/temp-test-data/social_network-sf30-numpart-1/updateStream_0_0_forum.csv
    :4345:1347529555311|1345186780975|3|32985348883392|17592366524125|1347529555311
$ grep -rnw '/opt/temp-test-data/social_network-sf30-numpart-1/' -e '1347529548881|.*|4|.*'
/opt/temp-test-data/social_network-sf30-numpart-1/updateStream_0_0_forum.csv
    :4299:1347529548881|1268970090309|4|35184374243803|Album 12 of Faisal Bakhsh|1347529548881|2199023340731|5115
$ grep -rnw '/opt/temp-test-data/social_network-sf30-numpart-1/' -e '1347529555151|.*|5|.*'
/opt/temp-test-data/social_network-sf30-numpart-1/updateStream_0_0_forum.csv
    :4343:1347529555151|1339700792439|5|26388283354581|30786325618933|1347529555151
$ grep -rnw '/opt/temp-test-data/social_network-sf30-numpart-1/' -e '1347529546070|.*|6|.*'
/opt/temp-test-data/social_network-sf30-numpart-1/updateStream_0_0_forum.csv
    :4282:1347529546070|1262609401041|6|35184407105746||1347529546070|27.106.7.201|Firefox|uz|About Mohandas
    Karamchand Gandhi, en India and Pakistan. He was assassinated on 30 J|84|66776|8796094098365|0|1021
$ grep -rnw '/opt/temp-test-data/social_network-sf30-numpart-1/' -e '1347529554153|.*|7|.*'
/opt/temp-test-data/social_network-sf30-numpart-1/updateStream_0_0_forum.csv
    :4337:1347529554153|1342292271730|7|35184453785217|1347529554153|31.220.139.97|Internet Explorer|cool
    |4|32985348897498|50|-1|35184453785215|
$ grep -rnw '/opt/temp-test-data/social_network-sf30-numpart-1/' -e '1347529543286|.*|8|.*'
/opt/temp-test-data/social_network-sf30-numpart-1/updateStream_0_0_forum.csv
    :4264:1347529543286|1345804678679|8|26388279202692|32985348837383|1347529543286
```

To check whether the graph entities in the driver log entries were persisted in the database, custom read queries were executed after database restart. The queries returned the data that was committed according to the logs, so the system passed this check. These additional test queries are included in the supplementary materials.

7 Supplementary Materials

The table below shows the list of supplementary materials. These materials are made available with this full disclosure report to allow the reproducibility of results.

Table 7.1: Supplementary materials

File	Purpose
`results-sf30-{1-thread,2-threads,4-threads}.tar.gz`	Driver output files for the selected scale factors
`interactive-benchmark-sf30-{1,2,4}.properties`	Driver configurations
`interactive-validate.properties`	Results validation driver settings
`recovery-queries/recovery-query-*.rq`	Recovery queries used for the recovery tests
`ldbc_snb_interactive_impls-7c57d8f.zip`	LDBC SNB Interactive repository at commit 7c57d8f
`ldbc_acid-23f21fe.zip`	LDBC ACID repository at commit 23f21fe
`graphdb-10.1.1-dist`	Installer package of database

The attachment directory structure is as follows:

```
attachments
├── results-sf30-1-thread.tar.gz
├── results-sf30-2-threads.tar.gz
├── results-sf30-4-threads.tar.gz
├── graphdb-10.1.1-dist.zip
├── ldbc_snb_interactive_impls-7c57d8f.zip
├── ldbc_acid-23f21fe.zip
├── recovery_queries
│   ├── recovery-query-1.rq
│   ├── recovery-query-2.rq
│   ├── recovery-query-3.rq
│   ├── recovery-query-4.rq
│   ├── recovery-query-5.rq
│   ├── recovery-query-6.rq
│   ├── recovery-query-7.rq
│   └── recovery-query-8.rq
├── interactive-benchmark-sf30-1.properties
├── interactive-benchmark-sf30-2.properties
├── interactive-benchmark-sf30-4.properties
└── interactive-validate.properties
```

A Appendix

A.1 CPU details

Listing A.1: Output of the `cat /proc/cpuinfo` command for one core

```
processor : 0
vendor_id : GenuineIntel
cpu family  : 6
model   : 106
model name  : Intel(R) Xeon(R) Platinum 8375C CPU @ 2.90GHz
stepping  : 6
microcode : 0xd000331
cpu MHz   : 2900.000
cache size  : 55296 KB
physical id : 0
siblings  : 32
core id   : 0
cpu cores : 16
apicid    : 0
initial apicid  : 0
fpu   : yes
fpu_exception : yes
cpuid level : 27
wp    : yes
flags   : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse sse2 ss ht
      syscall nx pdpe1gb rdtscp lm constant_tsc rep_good nopl xtopology nonstop_tsc cpuid aperfmperf
     tsc_known_freq pni pclmulqdq ssse3 fma cx16 pcid sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes
     xsave avx f16c rdrand hypervisor lahf_lm abm 3dnowprefetch invpcid_single ssbd ibrs ibpb stibp ibrs_enhanced
     fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms invpcid avx512f avx512dq rdseed adx smap avx512ifma clflushopt
     clwb avx512cd sha_ni avx512bw avx512vl xsaveopt xsavec xgetbv1 xsaves wbnoinvd ida arat avx512vbmi pku ospke
     avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg tme avx512_vpopcntdq rdpid md_clear flush_l1d
     arch_capabilities
bugs    : spectre_v1 spectre_v2 spec_store_bypass swapgs mmio_stale_data
bogomips  : 5800.00
clflush size  : 64
cache_alignment : 64
address sizes : 46 bits physical, 48 bits virtual
power management:
```

A.2 Memory details

Listing A.2: Output of the `lshw -c memory` command

```
  *-memory
       description: System Memory
       physical id: 8
       slot: System board or motherboard
       size: 256GiB
     *-bank
          description: DIMM DDR4 Static column Pseudo-static Synchronous Window DRAM 3200 MHz (0.3 ns)
          physical id: 0
          size: 256GiB
          width: 64 bits
          clock: 3200MHz (0.3ns)
```

A.3 Network details

Listing A.3: Output of the `lshw -class network` command

```
    *-network
    description: Ethernet interface
    product: Elastic Network Adapter (ENA)
    vendor: Amazon.com, Inc.
    physical id: 5
    bus info: pci@0000:00:05.0
    logical name: ens5
    version: 00
    serial: 0e:46:bc:87:7f:a3
    width: 32 bits
    clock: 33MHz
    capabilities: pciexpress msix bus_master cap_list ethernet physical
    configuration: broadcast=yes driver=ena driverversion=5.15.0-1019-aws ip=172.31.2.73 latency=0 link=yes
     multicast=yes
    resources: irq:0 memory:febf8000-febf9fff memory:febfa000-febfbfff memory:fe800000-fe8fffff
```

Listing A.4: Output of the `fio` command

```
iotest: (g=0): rw=write, bs=(R) 4096B-4096B, (W) 4096B-4096B, (T) 4096B-4096B, ioengine=sync, iodepth=1
fio-3.28
Starting 1 process
iotest: Laying out IO file (1 file / 2048MiB)
Jobs: 1 (f=1): [W(1)][100.0%][w=36.3MiB/s][w=9288 IOPS][eta 00m:00s]
iotest: (groupid=0, jobs=1): err= 0: pid=62375: Sun Jan 29 11:30:42 2023
  write: IOPS=9255, BW=36.2MiB/s (37.9MB/s)(2048MiB/56648msec); 0 zone resets
    clat (nsec): min=25871, max=72084, avg=29717.08, stdev=1562.32
     lat (nsec): min=25918, max=72919, avg=29764.37, stdev=1564.09
    clat percentiles (nsec):
     |  1.00th=[28544],  5.00th=[28800], 10.00th=[28800], 20.00th=[29056],
     | 30.00th=[29056], 40.00th=[29312], 50.00th=[29312], 60.00th=[29312],
     | 70.00th=[29568], 80.00th=[29824], 90.00th=[30336], 95.00th=[33536],
     | 99.00th=[36608], 99.50th=[37632], 99.90th=[41728], 99.95th=[42240],
     | 99.99th=[44288]
   bw (  KiB/s): min=36432, max=37272, per=100.00%, avg=37029.10, stdev=180.60, samples=113
   iops        : min= 9108, max= 9318, avg=9257.27, stdev=45.15, samples=113
  lat (usec)   : 50=100.00%, 100=0.01%
  fsync/fdatasync/sync_file_range:
    sync (usec): min=72, max=210, avg=77.76, stdev= 3.32
    sync percentiles (usec):
     |  1.00th=[   76],  5.00th=[   77], 10.00th=[   77], 20.00th=[   77],
     | 30.00th=[   77], 40.00th=[   77], 50.00th=[   78], 60.00th=[   78],
     | 70.00th=[   78], 80.00th=[   78], 90.00th=[   80], 95.00th=[   85],
     | 99.00th=[   95], 99.50th=[   96], 99.90th=[   97], 99.95th=[   98],
     | 99.99th=[  102]
  cpu          : usr=1.80%, sys=13.58%, ctx=1048579, majf=0, minf=11
  IO depths    : 1=200.0%, 2=0.0%, 4=0.0%, 8=0.0%, 16=0.0%, 32=0.0%, >=64=0.0%
     submit    : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
     complete  : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
     issued rwts: total=0,524288,0,0 short=524287,0,0,0 dropped=0,0,0,0
     latency   : target=0, window=0, percentile=100.00%, depth=1

Run status group 0 (all jobs):
  WRITE: bw=36.2MiB/s (37.9MB/s), 36.2MiB/s-36.2MiB/s (37.9MB/s-37.9MB/s), io=2048MiB (2147MB), run=56648-56648
    msec
```

```
36
37 Disk stats (read/write):
38   nvme1n1: ios=0/1572787, merge=0/1048530, ticks=0/41250, in_queue=41251, util=99.85%
```

A.4 Custom Ruleset

Listing A.5: Content of `import.conf` the rulesets

```
1  Prefices
2  {
3    rdf : http://www.w3.org/1999/02/22-rdf-syntax-ns#
4    rdfs : http://www.w3.org/2000/01/rdf-schema#
5    owl : http://www.w3.org/2002/07/owl#
6    onto : http://www.ontotext.com/
7    xsd : http://www.w3.org/2001/XMLSchema#
8    psys : http://proton.semanticweb.org/protonsys#
9    pext : http://proton.semanticweb.org/protonext#
10   snvoc: http://www.ldbc.eu/ldbc_socialnet/1.0/vocabulary/
11 }
12
13 Axioms
14 {
15   <rdf:type> <rdf:type> <rdf:Property>
16   <rdf:subject> <rdf:type> <rdf:Property>
17   <rdf:predicate> <rdf:type> <rdf:Property>
18   <rdf:object> <rdf:type> <rdf:Property>
19   <rdf:first> <rdf:type> <rdf:Property>
20   <rdf:rest> <rdf:type> <rdf:Property>
21   <rdf:value> <rdf:type> <rdf:Property>
22   <rdf:nil> <rdf:type> <rdf:List>
23   <rdfs:subClassOf> <rdfs:domain> <rdfs:Class>
24   <rdf:subject> <rdfs:domain> <rdf:Statement>
25   <rdf:predicate> <rdfs:domain> <rdf:Statement>
26   <rdf:object> <rdfs:domain> <rdf:Statement>
27   <rdf:first> <rdfs:domain> <rdf:List>
28   <rdf:rest> <rdfs:domain> <rdf:List>
29   <rdfs:domain> <rdfs:range> <rdfs:Class>
30   <rdfs:range> <rdfs:range> <rdfs:Class>
31   <rdfs:subClassOf> <rdfs:range> <rdfs:Class>
32   <rdf:rest> <rdfs:range> <rdf:List>
33   <rdfs:comment> <rdfs:range> <rdfs:Literal>
34   <rdfs:label> <rdfs:range> <rdfs:Literal>
35   <rdf:Alt> <rdfs:subClassOf> <rdfs:Container>
36   <rdf:Bag> <rdfs:subClassOf> <rdfs:Container>
37   <rdf:Seq> <rdfs:subClassOf> <rdfs:Container>
38   <rdfs:ContainerMembershipProperty> <rdfs:subClassOf> <rdf:Property>
39   <rdfs:isDefinedBy> <rdfs:subPropertyOf> <rdfs:seeAlso>
40   <rdf:XMLLiteral> <rdf:type> <rdfs:Datatype>
41   <rdf:XMLLiteral> <rdfs:subClassOf> <rdfs:Literal>
42   <rdfs:Datatype> <rdfs:subClassOf> <rdfs:Class>
43   <owl:equivalentClass> <rdf:type> <owl:TransitiveProperty>
44   <owl:equivalentClass> <rdf:type> <owl:SymmetricProperty>
45   <owl:equivalentClass> <rdfs:subPropertyOf> <rdfs:subClassOf>
46   <owl:equivalentProperty> <rdf:type> <owl:TransitiveProperty>
47   <owl:equivalentProperty> <rdf:type> <owl:SymmetricProperty>
48   <owl:equivalentProperty> <rdfs:subPropertyOf> <rdfs:subPropertyOf>
```

```
  <owl:inverseOf> <rdf:type> <owl:SymmetricProperty>
  <rdfs:subClassOf> <rdf:type> <owl:TransitiveProperty>
  <rdfs:subPropertyOf> <rdf:type> <owl:TransitiveProperty>
  <rdf:type> <psys:transitiveOver> <rdfs:subClassOf>
  <owl:differentFrom> <rdf:type> <owl:SymmetricProperty>
  <xsd:nonNegativeInteger> <rdf:type> <rdfs:Datatype>
  <xsd:string> <rdf:type> <rdfs:Datatype>
  <rdf:_1> <rdf:type> <rdf:Property>
  <rdf:_1> <rdf:type> <rdfs:ContainerMembershipProperty>
}

Rules
{

  Id: rdfs7

    a b c
    b <rdfs:subPropertyOf> d [Constraint b != d]
  -------------------------------------
    a d c


  Id: rdfs8_10

    a <rdf:type> <rdfs:Class>
  -------------------------------------
    a <rdfs:subClassOf> a


  Id: proton_TransitiveOver

    a <psys:transitiveOver> b
    c a d
    d b e
  -------------------------------------
    c a e


  Id: proton_TransProp

    a <rdf:type> <owl:TransitiveProperty>
  -------------------------------------
    a <psys:transitiveOver> a


  Id: proton_TransPropInduct

    a <psys:transitiveOver> a
  -------------------------------------
    a <rdf:type> <owl:TransitiveProperty>


  Id: owl_invOf

    a b c
    b <owl:inverseOf> d
  -------------------------------------
    c d a
```

```
107
108
109   Id: owl_invOfBySymProp
110
111     a <rdf:type> <owl:SymmetricProperty>
112   ------------------------------------
113     a <owl:inverseOf> a
114
115
116   Id: owl_SymPropByInverse
117
118     a <owl:inverseOf> a
119   ------------------------------------
120     a <rdf:type> <owl:SymmetricProperty>
121
122
123   Id: owl_EquivClassBySubClass
124
125     a <rdfs:subClassOf> b [Constraint b != a]
126     b <rdfs:subClassOf> a [Cut]
127   ------------------------------------
128     a <owl:equivalentClass> b
129
130
131   Id: owl_EquivPropBySubProp
132
133     a <rdfs:subPropertyOf> b [Constraint b != a]
134     b <rdfs:subPropertyOf> a [Cut]
135   ------------------------------------
136     a <owl:equivalentProperty> b
137
138
139   Id: rule_snb_knows_bidirectional
140     p <snvoc:knows> rel [Constraint p != fr]
141     rel <snvoc:hasPerson> fr [Constraint p != fr]
142   ---------------------------
143    fr <snvoc:directKnows> p
144    p <snvoc:directKnows> fr
145
146 }
```

A.5 Benchmark configuration

Listing A.6: Contents of `interactive-benchmark-sf30-1.properties` used for scale factor 30

```
endpoint=http://172.31.9.165:7200/repositories/SNB-SF30
queryDir=queries/

printQueryNames=false
printQueryStrings=false
printQueryResults=false

status=1
thread_count=1
name=LDBC-SNB
mode=execute_benchmark
results_log=true
time_unit=MILLISECONDS
time_compression_ratio=11
peer_identifiers=
workload_statistics=false
spinner_wait_duration=1
help=false
ignore_scheduled_start_times=false

workload=org.ldbcouncil.snb.driver.workloads.interactive.LdbcSnbInteractiveWorkload
db=com.ldbc.impls.workloads.ldbc.snb.graphdb.interactive.GraphDBInteractive

warmup=5500
operation_count=22500

ldbc.snb.interactive.updates_dir=/opt/temp-test-data/social_network-sf30-numpart-1/
ldbc.snb.interactive.parameters_dir=/opt/temp-test-data/substitution_parameters-sf30/
ldbc.snb.interactive.short_read_dissipation=0.2

# Supported scale factors are 0.1, 0.3, 1, 3, 10, 30, 100, 300, 1000
ldbc.snb.interactive.scale_factor=30

# *** For debugging purposes ***

ldbc.snb.interactive.LdbcQuery1_enable=true
ldbc.snb.interactive.LdbcQuery2_enable=true
ldbc.snb.interactive.LdbcQuery3_enable=true
ldbc.snb.interactive.LdbcQuery4_enable=true
ldbc.snb.interactive.LdbcQuery5_enable=true
ldbc.snb.interactive.LdbcQuery6_enable=true
ldbc.snb.interactive.LdbcQuery7_enable=true
ldbc.snb.interactive.LdbcQuery8_enable=true
ldbc.snb.interactive.LdbcQuery9_enable=true
ldbc.snb.interactive.LdbcQuery10_enable=true
ldbc.snb.interactive.LdbcQuery11_enable=true
ldbc.snb.interactive.LdbcQuery12_enable=true
ldbc.snb.interactive.LdbcQuery13_enable=true
ldbc.snb.interactive.LdbcQuery14_enable=true

ldbc.snb.interactive.LdbcShortQuery1PersonProfile_enable=true
ldbc.snb.interactive.LdbcShortQuery2PersonPosts_enable=true
ldbc.snb.interactive.LdbcShortQuery3PersonFriends_enable=true
ldbc.snb.interactive.LdbcShortQuery4MessageContent_enable=true
```

```
ldbc.snb.interactive.LdbcShortQuery5MessageCreator_enable=true
ldbc.snb.interactive.LdbcShortQuery6MessageForum_enable=true
ldbc.snb.interactive.LdbcShortQuery7MessageReplies_enable=true

ldbc.snb.interactive.LdbcUpdate1AddPerson_enable=true
ldbc.snb.interactive.LdbcUpdate2AddPostLike_enable=true
ldbc.snb.interactive.LdbcUpdate3AddCommentLike_enable=true
ldbc.snb.interactive.LdbcUpdate4AddForum_enable=true
ldbc.snb.interactive.LdbcUpdate5AddForumMembership_enable=true
ldbc.snb.interactive.LdbcUpdate6AddPost_enable=true
ldbc.snb.interactive.LdbcUpdate7AddComment_enable=true
ldbc.snb.interactive.LdbcUpdate8AddFriendship_enable=true
```

Listing A.7: Contents of `interactive-benchmark-sf3-2.properties` used for scale factor 30

```
endpoint=http://172.31.9.165:7200/repositories/SNB-SF30
queryDir=queries/

printQueryNames=false
printQueryStrings=false
printQueryResults=false

status=1
thread_count=2
name=LDBC-SNB
mode=execute_benchmark
results_log=true
time_unit=MILLISECONDS
time_compression_ratio=5
peer_identifiers=
workload_statistics=false
spinner_wait_duration=1
help=false
ignore_scheduled_start_times=false

workload=org.ldbcouncil.snb.driver.workloads.interactive.LdbcSnbInteractiveWorkload
db=com.ldbc.impls.workloads.ldbc.snb.graphdb.interactive.GraphDBInteractive

warmup=12500
operation_count=50000

ldbc.snb.interactive.updates_dir=/opt/temp-test-data/social_network-sf30-numpart-2/
ldbc.snb.interactive.parameters_dir=/opt/temp-test-data/substitution_parameters-sf30/
ldbc.snb.interactive.short_read_dissipation=0.2

# Supported scale factors are 0.1, 0.3, 1, 3, 10, 30, 100, 300, 1000
ldbc.snb.interactive.scale_factor=30

# *** For debugging purposes ***

ldbc.snb.interactive.LdbcQuery1_enable=true
ldbc.snb.interactive.LdbcQuery2_enable=true
ldbc.snb.interactive.LdbcQuery3_enable=true
ldbc.snb.interactive.LdbcQuery4_enable=true
ldbc.snb.interactive.LdbcQuery5_enable=true
ldbc.snb.interactive.LdbcQuery6_enable=true
ldbc.snb.interactive.LdbcQuery7_enable=true
ldbc.snb.interactive.LdbcQuery8_enable=true
```

```
ldbc.snb.interactive.LdbcQuery9_enable=true
ldbc.snb.interactive.LdbcQuery10_enable=true
ldbc.snb.interactive.LdbcQuery11_enable=true
ldbc.snb.interactive.LdbcQuery12_enable=true
ldbc.snb.interactive.LdbcQuery13_enable=true
ldbc.snb.interactive.LdbcQuery14_enable=true

ldbc.snb.interactive.LdbcShortQuery1PersonProfile_enable=true
ldbc.snb.interactive.LdbcShortQuery2PersonPosts_enable=true
ldbc.snb.interactive.LdbcShortQuery3PersonFriends_enable=true
ldbc.snb.interactive.LdbcShortQuery4MessageContent_enable=true
ldbc.snb.interactive.LdbcShortQuery5MessageCreator_enable=true
ldbc.snb.interactive.LdbcShortQuery6MessageForum_enable=true
ldbc.snb.interactive.LdbcShortQuery7MessageReplies_enable=true

ldbc.snb.interactive.LdbcUpdate1AddPerson_enable=true
ldbc.snb.interactive.LdbcUpdate2AddPostLike_enable=true
ldbc.snb.interactive.LdbcUpdate3AddCommentLike_enable=true
ldbc.snb.interactive.LdbcUpdate4AddForum_enable=true
ldbc.snb.interactive.LdbcUpdate5AddForumMembership_enable=true
ldbc.snb.interactive.LdbcUpdate6AddPost_enable=true
ldbc.snb.interactive.LdbcUpdate7AddComment_enable=true
ldbc.snb.interactive.LdbcUpdate8AddFriendship_enable=true
```

Listing A.8: Contents of `interactive-benchmark-sf30-4.properties` used for scale factor 30

```
endpoint=http://172.31.9.165:7200/repositories/SNB-SF30
queryDir=queries/

printQueryNames=false
printQueryStrings=false
printQueryResults=false

status=1
thread_count=4
name=LDBC-SNB
mode=execute_benchmark
results_log=true
time_unit=MILLISECONDS
time_compression_ratio=2.8
peer_identifiers=
workload_statistics=false
spinner_wait_duration=1
help=false
ignore_scheduled_start_times=false

workload=org.ldbcouncil.snb.driver.workloads.interactive.LdbcSnbInteractiveWorkload
db=com.ldbc.impls.workloads.ldbc.snb.graphdb.interactive.GraphDBInteractive

warmup=22000
operation_count=90000

ldbc.snb.interactive.updates_dir=/opt/temp-test-data/social_network-sf30-numpart-4/
ldbc.snb.interactive.parameters_dir=/opt/temp-test-data/substitution_parameters-sf30/
ldbc.snb.interactive.short_read_dissipation=0.2

# Supported scale factors are 0.1, 0.3, 1, 3, 10, 30, 100, 300, 1000
ldbc.snb.interactive.scale_factor=30
```

```
33
34 # *** For debugging purposes ***
35
36 ldbc.snb.interactive.LdbcQuery1_enable=true
37 ldbc.snb.interactive.LdbcQuery2_enable=true
38 ldbc.snb.interactive.LdbcQuery3_enable=true
39 ldbc.snb.interactive.LdbcQuery4_enable=true
40 ldbc.snb.interactive.LdbcQuery5_enable=true
41 ldbc.snb.interactive.LdbcQuery6_enable=true
42 ldbc.snb.interactive.LdbcQuery7_enable=true
43 ldbc.snb.interactive.LdbcQuery8_enable=true
44 ldbc.snb.interactive.LdbcQuery9_enable=true
45 ldbc.snb.interactive.LdbcQuery10_enable=true
46 ldbc.snb.interactive.LdbcQuery11_enable=true
47 ldbc.snb.interactive.LdbcQuery12_enable=true
48 ldbc.snb.interactive.LdbcQuery13_enable=true
49 ldbc.snb.interactive.LdbcQuery14_enable=true
50
51 ldbc.snb.interactive.LdbcShortQuery1PersonProfile_enable=true
52 ldbc.snb.interactive.LdbcShortQuery2PersonPosts_enable=true
53 ldbc.snb.interactive.LdbcShortQuery3PersonFriends_enable=true
54 ldbc.snb.interactive.LdbcShortQuery4MessageContent_enable=true
55 ldbc.snb.interactive.LdbcShortQuery5MessageCreator_enable=true
56 ldbc.snb.interactive.LdbcShortQuery6MessageForum_enable=true
57 ldbc.snb.interactive.LdbcShortQuery7MessageReplies_enable=true
58
59 ldbc.snb.interactive.LdbcUpdate1AddPerson_enable=true
60 ldbc.snb.interactive.LdbcUpdate2AddPostLike_enable=true
61 ldbc.snb.interactive.LdbcUpdate3AddCommentLike_enable=true
62 ldbc.snb.interactive.LdbcUpdate4AddForum_enable=true
63 ldbc.snb.interactive.LdbcUpdate5AddForumMembership_enable=true
64 ldbc.snb.interactive.LdbcUpdate6AddPost_enable=true
65 ldbc.snb.interactive.LdbcUpdate7AddComment_enable=true
66 ldbc.snb.interactive.LdbcUpdate8AddFriendship_enable=true
```

A.6 Validation configuration

Listing A.9: The contents of `interactive-validate.properties`

```
1  endpoint=http://172.31.3.23:7200/repositories/SNB-SF30
2  queryDir=queries/
3
4  printQueryNames=false
5  printQueryStrings=false
6  printQueryResults=false
7
8  status=1
9  thread_count=1
10 name=LDBC-SNB
11 mode=validate_database
12 results_log=false
13 time_unit=MILLISECONDS
14 time_compression_ratio=0.001
15 peer_identifiers=
16 workload_statistics=false
17 spinner_wait_duration=0
```

```
help=false
ignore_scheduled_start_times=true

workload=org.ldbcouncil.snb.driver.workloads.interactive.LdbcSnbInteractiveWorkload
db=com.ldbc.impls.workloads.ldbc.snb.graphdb.interactive.GraphDBInteractive

operation_count=10000
validate_database=validation_params.csv

ldbc.snb.interactive.parameters_dir=test-data/substitution_parameters/
ldbc.snb.interactive.short_read_dissipation=0.2

# Supported scale factors are 0.1, 0.3, 1, 3, 10, 30, 100, 300, 1000
ldbc.snb.interactive.scale_factor=10

# *** For debugging purposes ***
ldbc.snb.interactive.LdbcQuery1_enable=true
ldbc.snb.interactive.LdbcQuery2_enable=true
ldbc.snb.interactive.LdbcQuery3_enable=true
ldbc.snb.interactive.LdbcQuery4_enable=true
ldbc.snb.interactive.LdbcQuery5_enable=true
ldbc.snb.interactive.LdbcQuery6_enable=true
ldbc.snb.interactive.LdbcQuery7_enable=true
ldbc.snb.interactive.LdbcQuery8_enable=true
ldbc.snb.interactive.LdbcQuery9_enable=true
ldbc.snb.interactive.LdbcQuery10_enable=true
ldbc.snb.interactive.LdbcQuery11_enable=true
ldbc.snb.interactive.LdbcQuery12_enable=true
ldbc.snb.interactive.LdbcQuery13_enable=true
ldbc.snb.interactive.LdbcQuery14_enable=true

ldbc.snb.interactive.LdbcShortQuery1PersonProfile_enable=true
ldbc.snb.interactive.LdbcShortQuery2PersonPosts_enable=true
ldbc.snb.interactive.LdbcShortQuery3PersonFriends_enable=true
ldbc.snb.interactive.LdbcShortQuery4MessageContent_enable=true
ldbc.snb.interactive.LdbcShortQuery5MessageCreator_enable=true
ldbc.snb.interactive.LdbcShortQuery6MessageForum_enable=true
ldbc.snb.interactive.LdbcShortQuery7MessageReplies_enable=true

ldbc.snb.interactive.LdbcUpdate1AddPerson_enable=true
ldbc.snb.interactive.LdbcUpdate2AddPostLike_enable=true
ldbc.snb.interactive.LdbcUpdate3AddCommentLike_enable=true
ldbc.snb.interactive.LdbcUpdate4AddForum_enable=true
ldbc.snb.interactive.LdbcUpdate5AddForumMembership_enable=true
ldbc.snb.interactive.LdbcUpdate6AddPost_enable=true
ldbc.snb.interactive.LdbcUpdate7AddComment_enable=true
ldbc.snb.interactive.LdbcUpdate8AddFriendship_enable=true
```