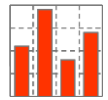
BENCHWARE

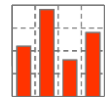


Introduction to Database Load (DBL) Performance Tests with Oracle

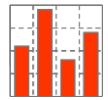
Technical Presentation

September 2014

Contents

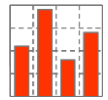


Why measure Database Load performance?



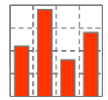
- Projects need understandable key performance metrics for capacity planning
  - Commit rate respectively transaction rate (LGWR stress test)
  - Database insert service time
  - Throughput of bulk load (LGWR stress test)
  - Time windows for certain load operations
  - Impact of disaster recovery infrastructure to application performance
    - Database mirroring with DataGuard
    - Host based mirroring, e.g. with ASM
    - Storage based mirroring

What is measured?



- Typical Oracle insert operations
- System throughput
  - Rows per second [rps]
  - Transactions per second [tps]
  - SQL response time [s]
  - REDO rate [MBps]
  - REDO service time [s]
- Scalability
  - Throughput per process for n = {1, 2, 4, 8, …, n}
- Efficiency of
  - All platform layers
  - LGWR performance
  - Disaster recovery infrastructure

Overview of DBL performance tests with Benchware test codes

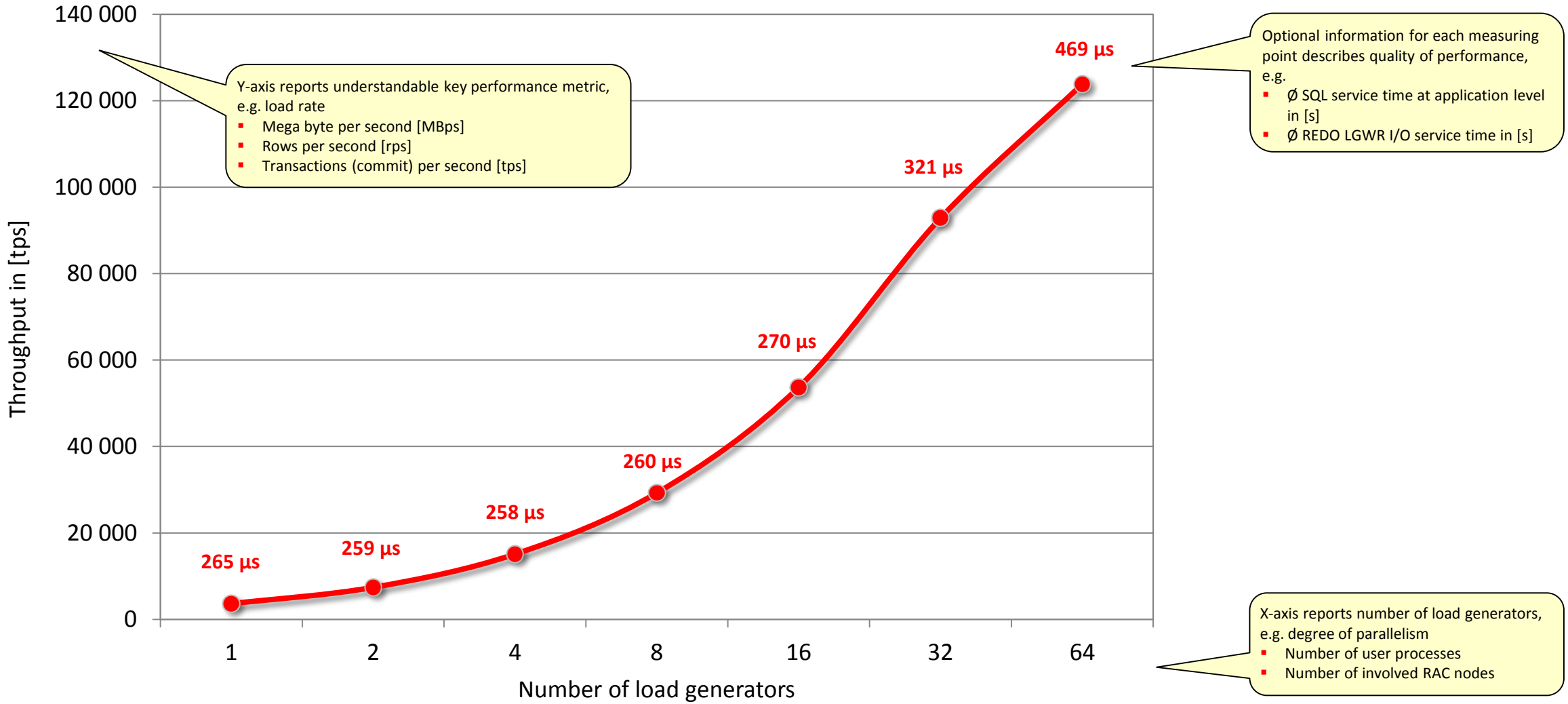


Database Performance Buffer cache data load	Test Code for DEFAULT Storage	Test Code for DB Flash Cache	Test Code for Cell Flash Cache
▪ Buffer cache OLTP insert (LGWR commit stress test) PL/SQL commit optimization	DBL-12	-	-
▪ Buffer cache OLTP insert (LGWR commit stress test) without PL/SQL commit optimization	DBL-32	-	-

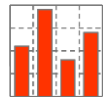
Database Performance Data load un-compressed	Test Code for DEFAULT Storage	Test Code for DB Flash Cache	Test Code for Cell Flash Cache
▪ Direct bulk load	DBL-22	-	-

Monitoring DBL performance tests

All load profiles from single process to saturation



Monitoring DBL performance tests



- Key Performance Metrics
  - Load Rate in rows per second [rps]
  - Load rate in transactions per second [tps]
  - Throughput and service time of REDO LGWR process

Ø SQL service time:
- Measured at application level

Run	Tst	Code	#N	#J	#T	TX size [rpt]	CPU busy [%]	Throughput rows/sec [rps]	Throughput txn/sec [tps]	SQL service time [s]	Physical write [iops]	Physical write [bps]	Physical write [MBps]	REDO size [MBps]	REDO writes [iops]	REDO svt [ms]	REDO sync writes	REDO sync svt [us]	Elap time [s]
43	9	DBL-11	1	1	1	2	1	7.287E+03	3.643E+03	2.650E-04	5969	895	40	10	1934	85	1	3147	223
	10	DBL-11	1	2	1	2	1	1.484E+04	7.420E+03	2.595E-04	10551	1967	81	20	1978	89	5	330	219
	11	DBL-11	1	4	1	2	2	3.023E+04	1.512E+04	2.578E-04	14276	4170	164	41	1642	109	5	727	215
	12	DBL-11	1	8	1	2	3	5.856E+04	2.928E+04	2.607E-04	17877	9646	326	80	996	194	9	981	222
	13	DBL-11	1	16	1	2	5	1.074E+05	5.372E+04	2.703E-04	17083	35605	734	147	455	473	16	653	242
	14	DBL-11	1	32	1	2	11	1.857E+05	9.286E+04	3.218E-04	83686	126915	1781	254	241	1059	1179	25916	280
	15	DBL-11	1	64	1	2	16	2.477E+05	1.238E+05	4.686E-04	145357	167971	2366	340	127	2158	76897	28997	323

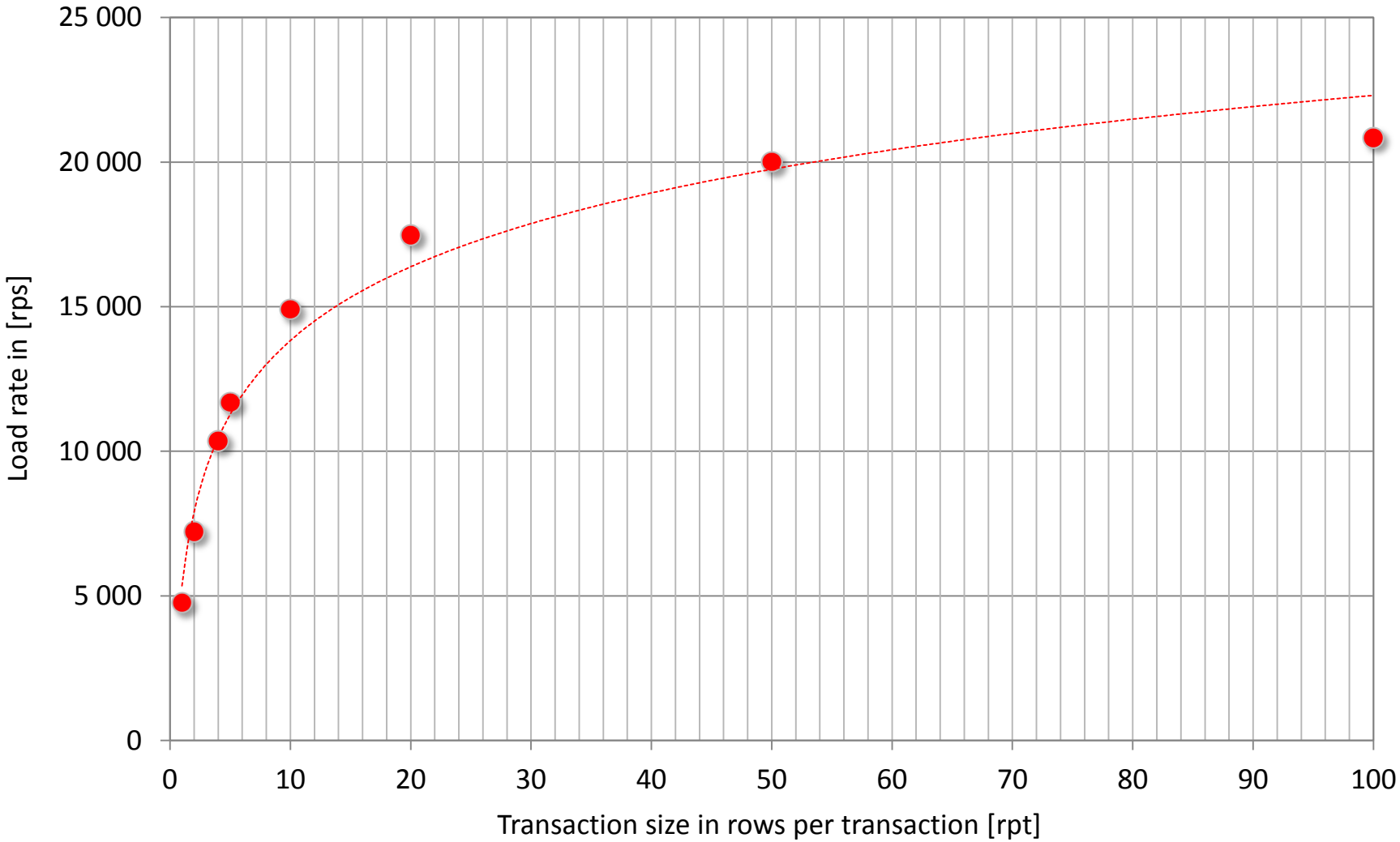
Transaction size:
- Number of rows per commit
- If 0, bulk load with one commit after complete load

Throughput:
- In rows per second [rps]
- In transactions per second [tps] which is equal to #commit per second

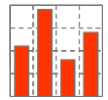
LGWR service time
- I/O size varies

Example of DBL performance test results

Database transactional load via buffer cache, single process, different transaction size



Example of DBL performance test results



Database transactional load, single process, different transaction size

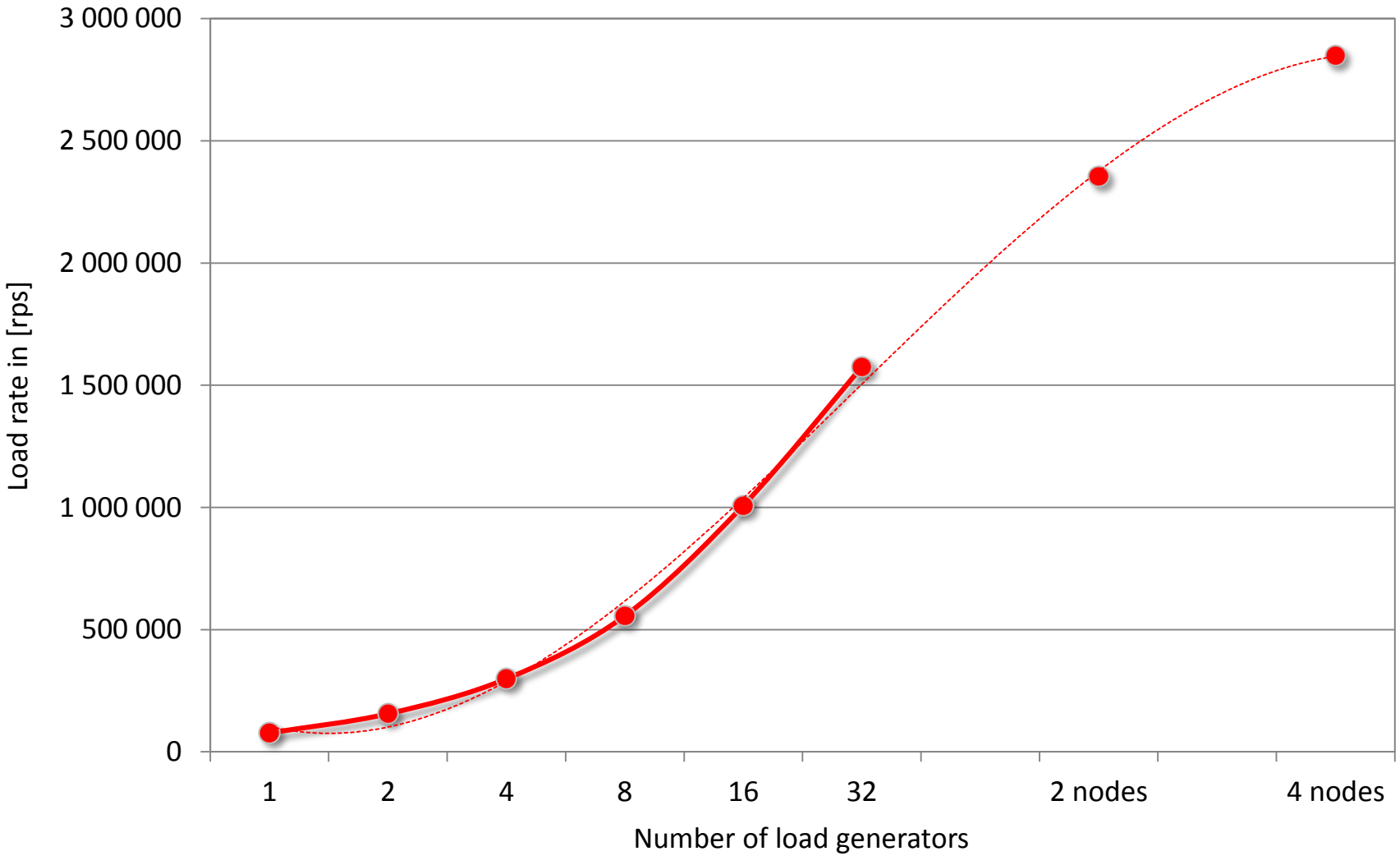
Run	Tst	Code	#N	#J	#T	TX size [rpt]	CPU busy [%]	Throughput rows/sec [rps]	Throughput txn/sec [tps]	SQL service time [s]	Physical write [iops]	Physical write [dbps]	Physical write [MBps]	REDO size [MBps]	REDO writes [iops]	REDO svt [ms]	REDO sync writes	REDO sync svt [us]	Elap time [s]
43	1	DBL-12	1	1	1	1	1	4.762E+03	4.762E+03	2.052E-04	6206	640	33	8	2026	119	2	1114	315
	2	DBL-12	1	1	1	2	1	7.222E+03	3.611E+03	2.687E-04	5944	847	39	10	1929	86	3	499	225
	3	DBL-12	1	1	1	4	1	1.035E+04	2.588E+03	3.678E-04	5394	1171	48	12	1716	62	1	2105	157
	4	DBL-12	1	1	1	5	1	1.169E+04	2.338E+03	4.105E-04	5187	1306	53	13	1651	56	1	766	139
	5	DBL-12	1	1	1	10	1	1.491E+04	1.491E+03	6.320E-04	4452	1607	63	16	1376	46	1	1415	109
	6	DBL-12	1	1	1	20	1	1.747E+04	8.740E+02	1.054E-03	3079	1829	70	18	872	44	2	604	93
	7	DBL-12	1	1	1	50	1	2.006E+04	4.010E+02	2.299E-03	1813	2053	78	20	409	52	1	472	81
	8	DBL-12	1	1	1	100	1	2.083E+04	2.080E+02	4.378E-03	1167	2157	80	20	214	70	1	515	78

Legend:

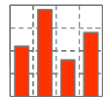
Run	benchmark run id	#N	number of RAC nodes	[rps]	rows per second	[iops]	i/o operations per second	[s]	time in seconds
Tst	benchmark test id	#J	number of load generators (jobs)	[tps]	transactions per second	[dbps]	database blocks per second	[ms]	time in milli seconds
Code	benchmark test code	#T	number of threads (PX)	[ops]	operations per second	[MBps]	mega byte per second	[µs]	time in micro seconds

Example of DBL performance test results

Database bulk load



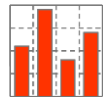
Example of DBL performance test results



Database bulk load

Run	Tst	Code	#N	#J	#T	TX size [rpt]	CPU busy [%]	Throughput rows/sec [rps]	Throughput txn/sec [tps]	SQL service time [s]	Physical write [iops]	Physical write [dbps]	Physical write [MBps]	REDO size [MBps]	REDO writes [iops]	REDO svt [ms]	REDO sync writes	REDO sync svt [us]	Elap time [s]
44	1	DBL-22	1	1	1	0	1	7.767E+04	0.000E+00	9.937E+01	519	7036	99	14	21	661	2	434	206
	2	DBL-22	1	2	1	0	1	1.561E+05	0.000E+00	9.988E+01	964	14051	198	28	29	648	3	894	205
	3	DBL-22	1	4	1	0	2	2.991E+05	0.000E+00	1.030E+02	2094	27739	386	54	42	749	6	2322	214
	4	DBL-22	1	8	1	0	3	5.565E+05	0.000E+00	1.100E+02	4162	54027	736	101	49	1116	8	3670	230
	5	DBL-22	1	16	1	0	5	1.008E+06	0.000E+00	1.221E+02	14974	98745	1340	184	40	1861	17	11245	254
	6	DBL-22	1	32	1	0	8	1.575E+06	0.000E+00	1.540E+02	41355	148529	2049	287	44	2746	32	26631	325
	12	DBL-22	2	64	1	0	12	2.354E+06	0.000E+00	1.986E+02	35881	227379	3105	429	159	2593	66	7887	435
	18	DBL-22	4	128	1	0	14	2.848E+06	0.000E+00	3.447E+02	41633	273747	3746	519	241	5783	10943	533631	719

Summary



Reviewing Database Load (DBL) Performance

- Database Load performance is important for both: OLTP and DWH systems
- Benchware proofs real world database load performance for Oracle databases
  - Deliver representative key performance metrics for capacity planning
  - Validate performance of disaster recovery infrastructures

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