BENCHWARE

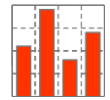
Performance Baseline of Exadata X4-2

Part IV: Database Load (DBL) Performance

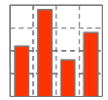
Technical Presentation

June 2014

Contents



Introduction to Database Load (DBL) Performance Tests



- Why measure database load performance?
- What is measured?
- How is database load performance measured?
- Overview Benchware DBL performance test for Oracle
- Monitoring Benchware DBL performance tests

- Look at www.benchware.ch/methodology for detailed information

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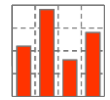
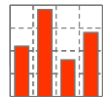


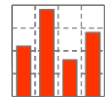
System Configuration



Server configuration for load generation

Server	X2-2	X3-2	X4-2
CPU Type	X5675	E5-2690	E5-2697 V2
#sockets	2	2	2
#cores	12	16	24
#threads	24	32	48
Memory capacity [GByte]	96	512	512
Performance Numbers from other Benchmarks			
SPECint_base_rate_2006 (throughput)	367	630	806
Cluster			
#server within cluster	4	8	8
Software			
Operating System	Oracle Lx	Oracle Lx	Oracle Lx
Oracle Database System	11.2	11.2	11.2
Benchware Performance Suite	8.6	8.6	8.6

System Configuration



Oracle Capacities and Licensing on Exadata Storage Systems

Storage Capacities, raw, 1 Exadata Storage Server	X2-2	X3-2	X4-2
▪ Flash in [GByte]	384	1’600	3’200
▪ High Performance HDD in [TByte]	7.2@15K	7.2@15K	14.4@10K
▪ High Capacity HDD in [TByte]	36@7.2K	36@7.2K	48@7.2K
Ratio of Flash capacity in percentage of HDD capacity	1%	4.5%	6.7%

Exadata has:
- No flash storage, but flash cache
- Auto tiering technology
- Service time is not guaranteed

Oracle Storage Server License	X2-2	X3-2	X4-2
Oracle license cost (list price 13th of February 2014)			
▪ Eighth Rack	-	180’000	180’000
▪ Quarter Rack	360’000	360’000	360’000
▪ Half Rack	840’000	840’000	840’000
Software license cost in [USD] per 1 TByte Capacity	3’333	3’333	2’500

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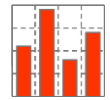
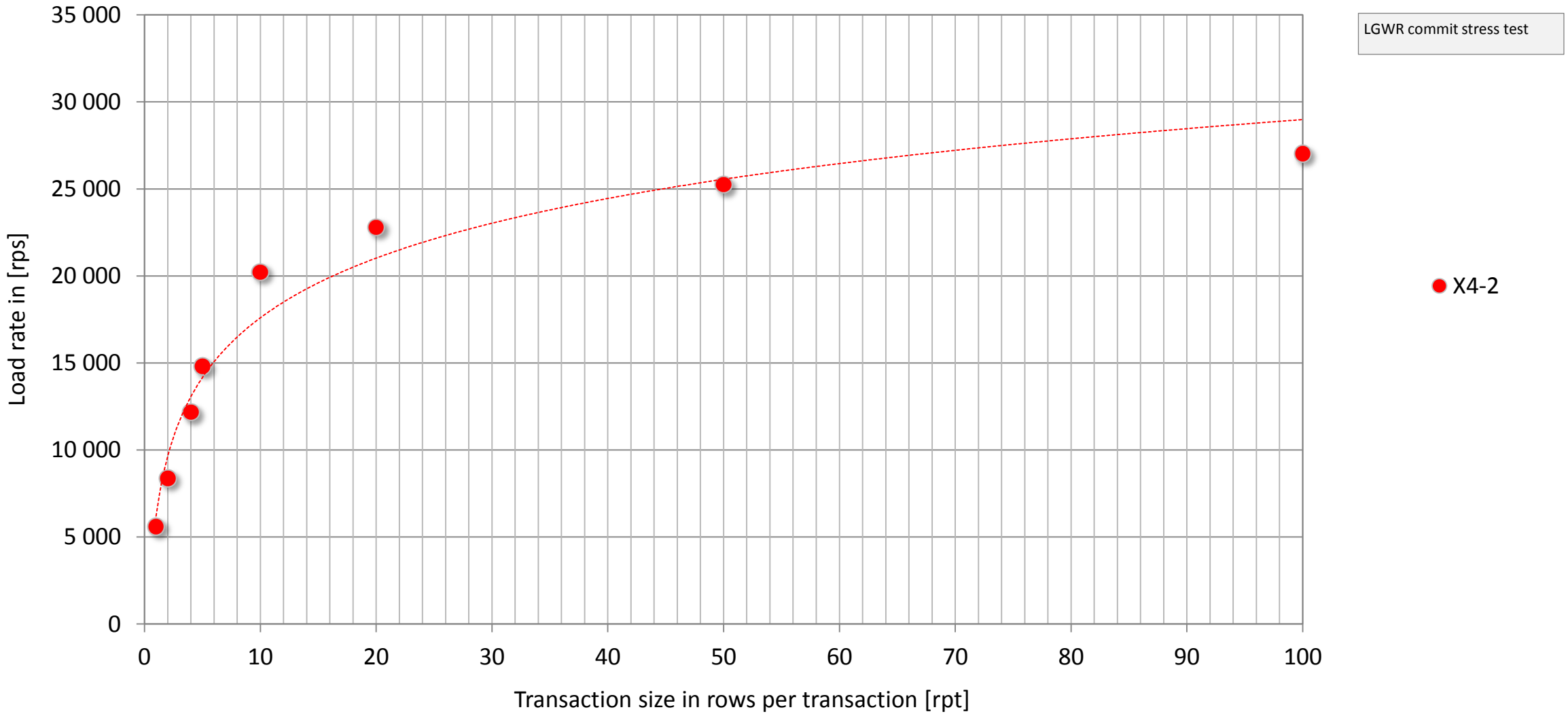


Database Load Benchmark Results

Oracle conventional load: 1 user process, different transaction size



Database Load Benchmark Results

Oracle conventional load: 1 user process, different transaction size

Exadata X4-2 FR HC

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]
7	1	DBL-11	1	1	1	1	2	5.609E+03	5.609E+03	1.682E-04	3511	1185	20	10	3063	69	2	277	312
	2	DBL-11	1	1	1	2	2	8.360E+03	4.180E+03	2.211E-04	3357	1441	24	11	2843	72	2	447	314
	3	DBL-11	1	1	1	4	2	1.218E+04	3.044E+03	2.971E-04	3216	1788	30	14	2591	73	1	654	308
	4	DBL-11	1	1	1	5	2	1.480E+04	2.961E+03	3.252E-04	3271	2019	34	17	2581	75	3	180	304
	5	DBL-11	1	1	1	10	1	2.022E+04	2.021E+03	4.789E-04	2942	2554	43	22	2008	89	3	311	303
	6	DBL-11	1	1	1	20	1	2.280E+04	1.140E+03	8.369E-04	2210	2753	46	23	1147	112	1	480	307
	7	DBL-11	1	1	1	50	2	2.524E+04	5.050E+02	1.898E-03	1715	3068	50	25	527	136	8	170	307
	8	DBL-11	1	1	1	100	1	2.702E+04	2.700E+02	3.501E-03	1490	3257	53	27	296	156	3	128	310

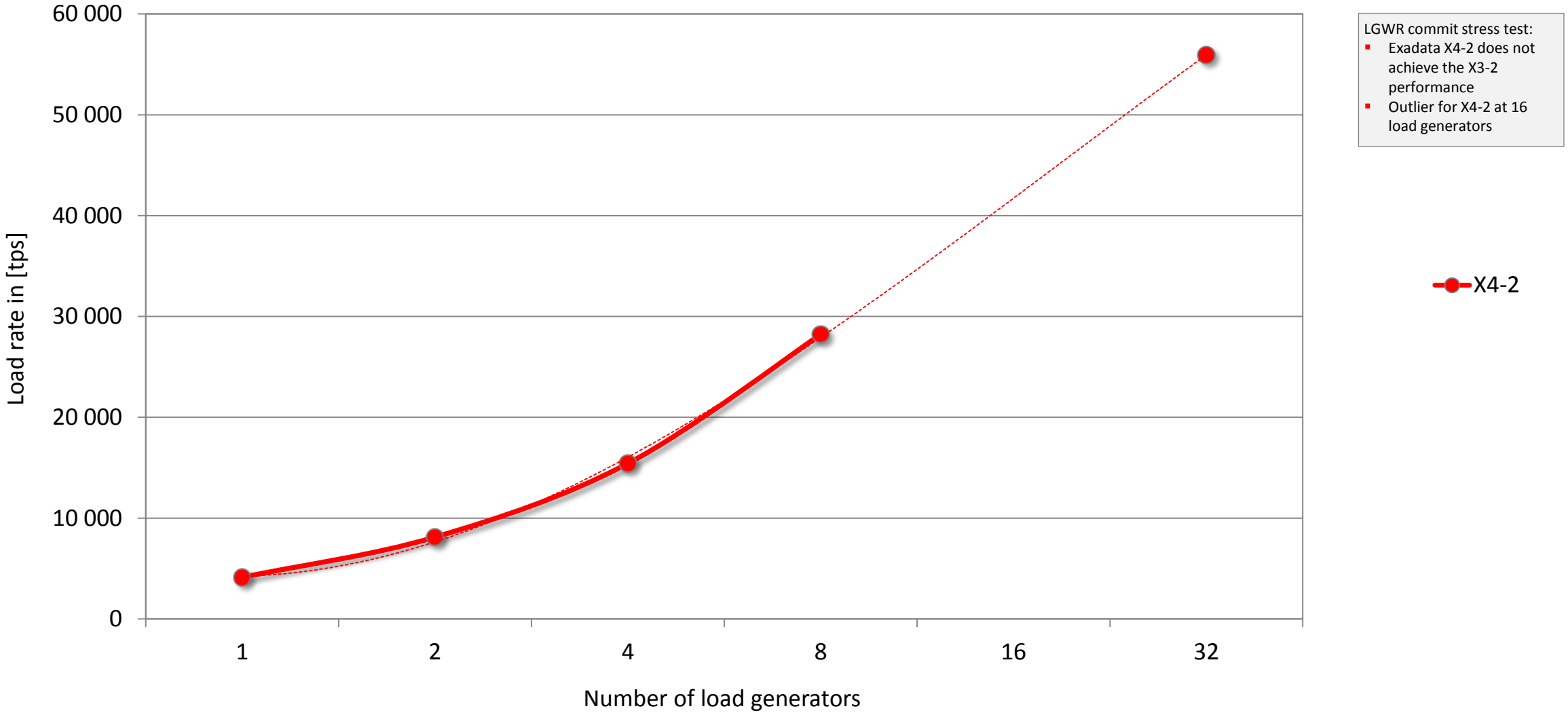
Legend:

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

One user process is capable to fire 5'600 insert transactions (commits) per second!

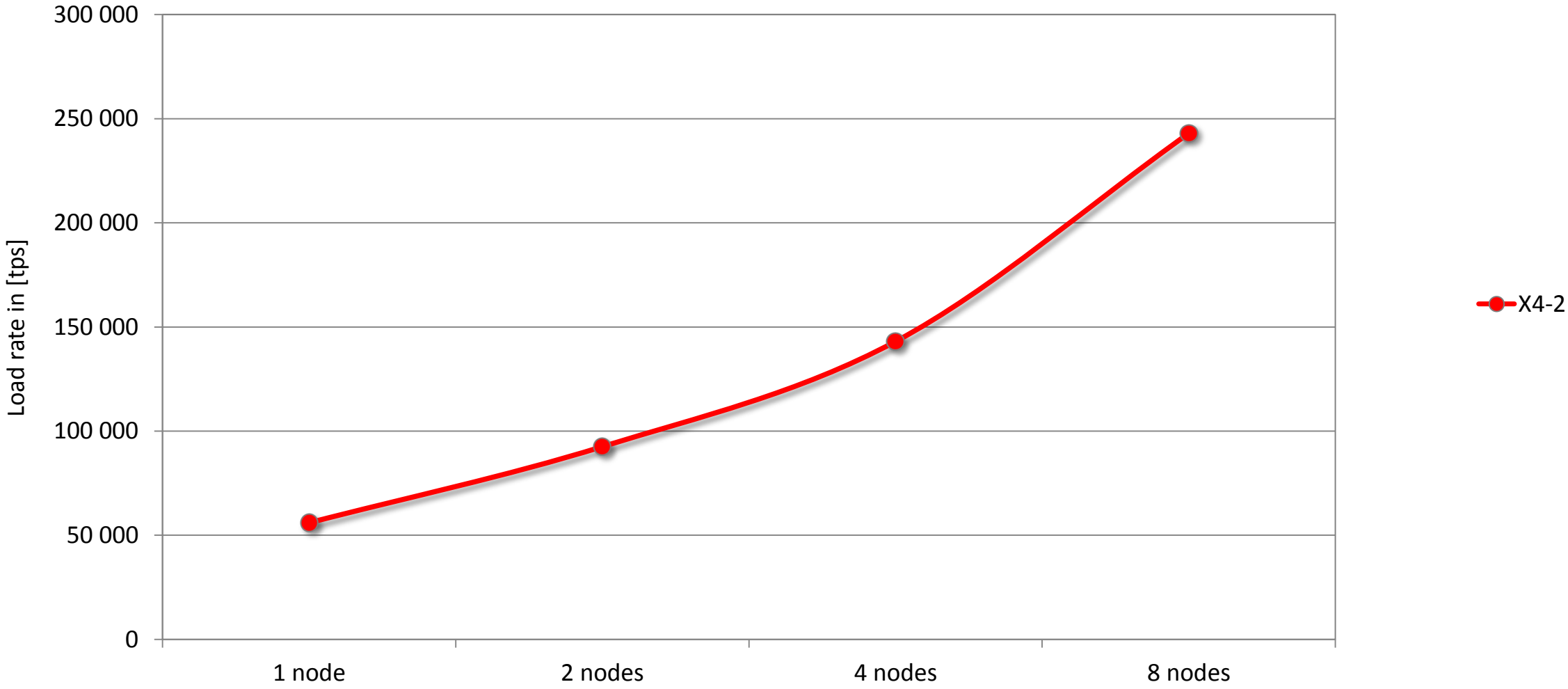
Database Load Benchmark Results

Oracle conventional load: 1 DB server, 2 rows per transaction



Database Load Benchmark Results

Oracle conventional load: Cluster, 2 rows per transaction



Database Load Benchmark Results

Oracle conventional load: Cluster, 2 rows per transaction

Exadata X4-2 FR HC

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]
7	17	DBL-11	1	1	1	2	2	8.251E+03	4.125E+03	2.302E-04	3348	1348	23	11	2928	69	2	220	303
	18	DBL-11	1	2	1	2	2	1.623E+04	8.117E+03	2.342E-04	5096	2834	46	22	2535	87	6	187	308
	19	DBL-11	1	4	1	2	2	3.084E+04	1.542E+04	2.428E-04	8774	11493	135	42	2281	102	5	300	308
	20	DBL-11	1	8	1	2	4	5.645E+04	2.823E+04	2.601E-04	22919	44424	429	78	1886	127	11	364	310
	21	DBL-11	1	16	1	2	7	4.941E+04	2.471E+04	6.004E-04	61511	69513	615	68	1709	147	18	433	339
	22	DBL-11	1	32	1	2	12	1.118E+05	5.592E+04	5.208E-04	116829	136283	1225	154	564	386	286	24630	304
	23	DBL-11	1	64	1	2	10	8.324E+04	4.162E+04	1.077E-03	79240	105057	940	115	1000	241	8025	35351	455
	24	DBL-11	2	64	1	2	20	1.850E+05	9.249E+04	5.551E-04	206295	241767	2154	255	1523	333	1587	28558	348
	25	DBL-11	2	128	1	2	17	1.577E+05	7.884E+04	1.064E-03	151733	197986	1773	218	1641	296	14628	30703	478
	26	DBL-11	4	128	1	2	29	2.653E+05	1.326E+05	6.662E-04	277853	329430	2957	366	2393	470	22579	30210	474
	27	DBL-11	4	256	1	2	30	2.860E+05	1.430E+05	1.104E-03	271634	349430	3141	395	2797	355	58538	34491	514
	28	DBL-11	8	256	1	2	50	4.875E+05	2.438E+05	6.575E-04	475629	544453	4965	672	3685	626	50830	36320	450
	29	DBL-11	8	512	1	2	41	3.862E+05	1.931E+05	1.194E-03	333182	406721	3740	532	3124	617	######	48015	605

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
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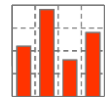
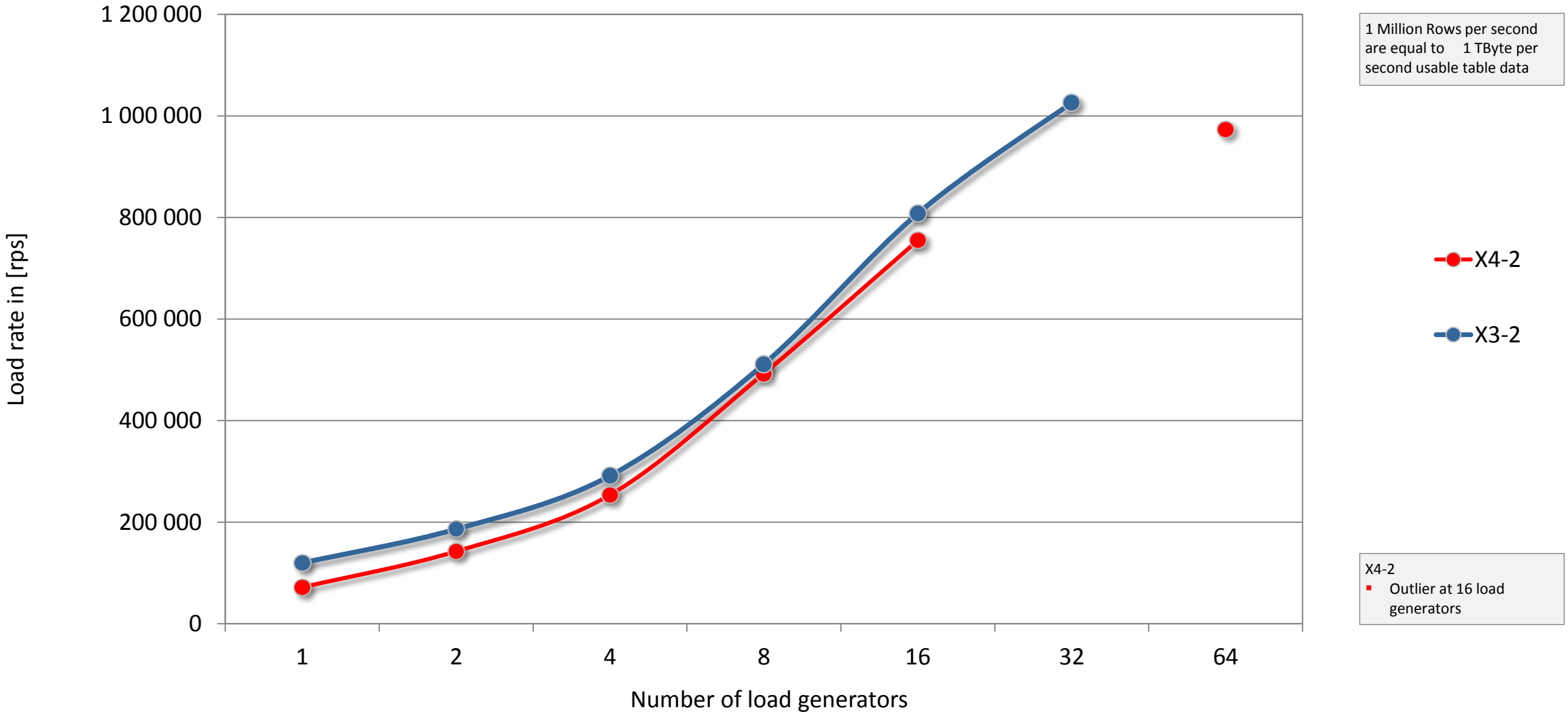


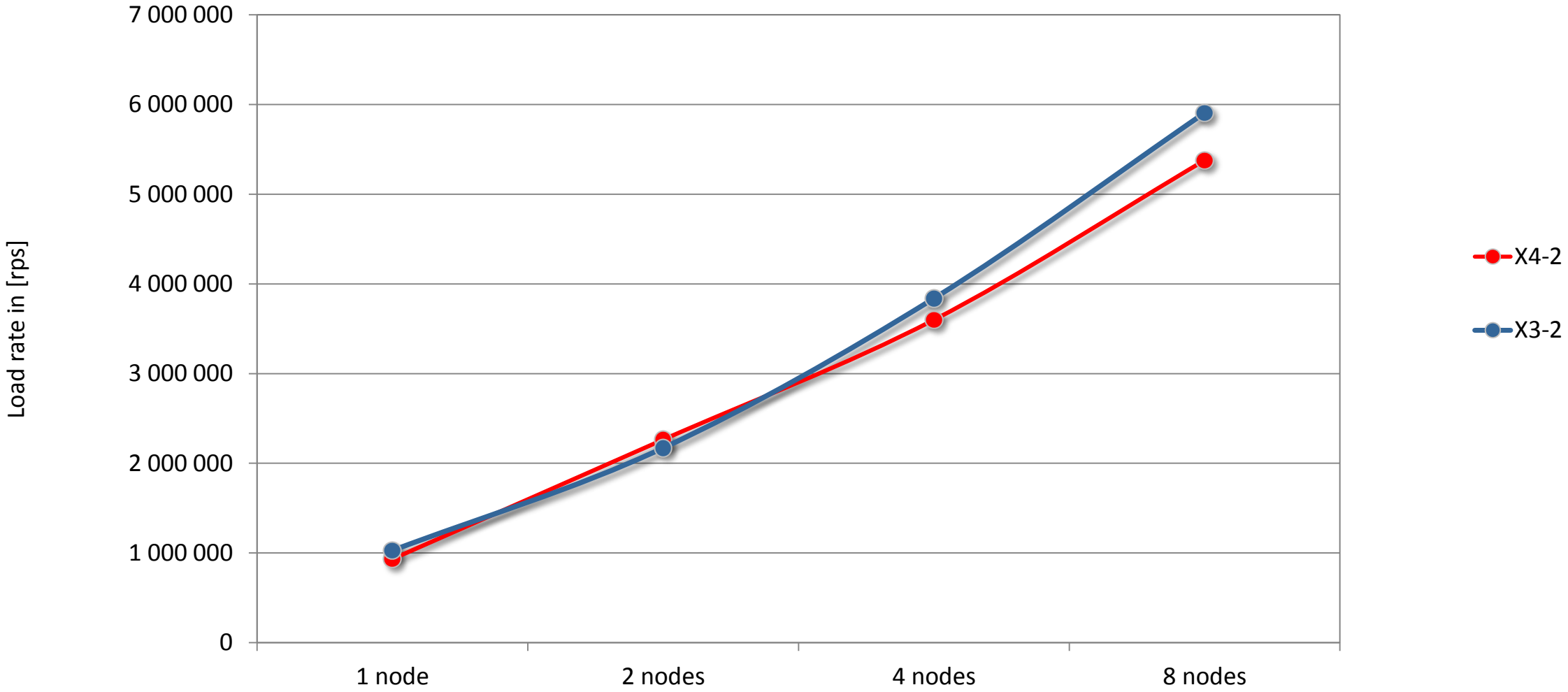
Database Load Benchmark Results

Oracle bulk load: 1 DB server



Database Load Benchmark Results

Oracle bulk load: cluster



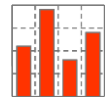
Database Load Benchmark Results

Oracle bulk load: cluster

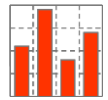
Exadata X4-2 FR HC

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]
7	43	DBL-22	1	1	1	0	1	7.166E+04	1.000E+00	1.111E+00	651	5118	53	13	146	160	37	18	307
	44	DBL-22	1	2	1	0	1	1.425E+05	1.000E+00	1.128E+00	1253	10170	106	25	262	139	17	78	308
	45	DBL-22	1	4	1	0	2	2.537E+05	2.000E+00	1.233E+00	2607	18617	193	46	491	128	12	130	307
	46	DBL-22	1	8	1	0	3	4.927E+05	4.000E+00	1.297E+00	5087	37328	384	89	715	127	12	348	308
	47	DBL-22	1	16	1	0	5	7.549E+05	6.000E+00	1.785E+00	8136	58920	605	139	953	135	18	425	306
	48	DBL-22	1	32	1	0	7	8.301E+05	7.000E+00	3.682E+00	10033	66733	682	155	1108	143	36	514	312
	49	DBL-22	1	64	1	0	8	9.732E+05	8.000E+00	6.683E+00	12987	79718	810	181	1085	157	155	74253	312
	50	DBL-22	2	64	1	0	13	2.050E+06	1.600E+01	2.610E+00	25473	163430	1691	376	1952	164	309	77992	309
	51	DBL-22	2	128	1	0	16	2.263E+06	1.800E+01	5.137E+00	32404	182872	1863	413	1755	194	1588	118658	313
	52	DBL-22	4	128	1	0	22	3.584E+06	2.900E+01	2.807E+00	43279	284673	2937	656	3618	167	687	92883	308
	53	DBL-22	4	256	1	0	23	3.599E+06	2.900E+01	6.319E+00	47589	290551	2976	659	3349	184	2047	120689	315
	54	DBL-22	8	256	1	0	29	5.378E+06	4.300E+01	2.700E+00	60134	419289	4313	979	5253	216	3461	164485	315
	55	DBL-22	8	512	1	0	31	5.250E+06	4.200E+01	6.288E+00	65538	421635	4325	964	4742	232	8082	198128	316

Contents



Reviewing Database Load Benchmark Results



Summary

	Metric			X4-2 FR
Buffer Cache OLTP Insert, PL/SQL optimized				
▪ Throughput, 1 process	[tps]			4’125
	[µs]			230
▪ Maximum throughput, 1 DB Server	[tps]			55’920
	[µs]			521
▪ Maximum throughput, Cluster	[tps]			243’800
	[µs]			658
Bulk load, un-compressed				
▪ Maximum throughput, 1 process	[rps]			71’660
▪ Maximum throughput, 1 DB Server	[rps]			97’320
▪ Maximum throughput, Cluster	[rps]			5’378’000

swiss precision in performance measurement

www.benchware.ch

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