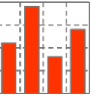


Performance Baseline of Exadata X4-2

Part II: Server (SRV) Performance

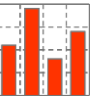
Technical Presentation

June 2014



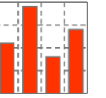
- 1 Introduction to Server (SRV) Performance Tests**
- 2 CPU and Server Configuration
- 3 Server Benchmark Results – In-Memory SQL Operations
- 4 Reviewing Server Benchmark Results

Introduction to Server (SRV) Performance Tests



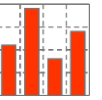
- Why measure server system performance?
- What is measured?
- How is server system performance measured?
- Overview Benchware SRV performance test for Oracle
- Monitoring Benchware SRV performance tests

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



- 1 Introduction to Server (SRV) Performance Tests
- 2 CPU and Server Configuration**
- 3 Server Benchmark Results – In-Memory SQL Operations
- 4 Reviewing Server Benchmark Results

CPU and Server Configuration



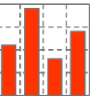
CPU architecture

CPU	X2-2	X3-2	X4-2
CPU Type	X5675	E5-2690	E5-2697 V2
CPU Launch date	Q1 2011	Q1 2012	Q3 2013
Intel Generation	Westmere	Sandy Bridge	Ivy Bridge
Clock rate [GHz]	3.06	2.9	2.7
Max number of sockets	2	2	2
#cores per socket	6	8	12
Multithreading	2-fach	2-fach	2-fach
Performance Numbers from other Benchmarks			
SPECint_base2006 (speed)	40.8	54.3	88.1
Oracle CPU speed in sys.aux_stats\$	2'795	1'751	3'074

Remark:

- Oracle has an internal estimation about CPU speed in sys.aux_stats\$, but none estimation about CPU throughput.
- This value does not correlate with SPECint_base2006

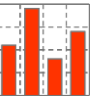
CPU and Server Configuration



Server configuration

Server	X2-2	X3-2	X4-2
CPU Type	X5675	E5-2690	E5-2697 V2
CPU Launch date	Q1 2011	Q1 2012	Q3 2013
#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
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

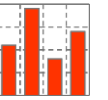
CPU and Server Configuration



Oracle Licensing

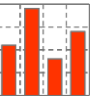
Oracle Enterprise Edition, 1 Exadata Database Server	X2-2	X3-2	X4-2
#cores	12	16	24
Oracle core license factor	x 0.5	x 0.5	x 0.5
Oracle license cost <small>(list price 13th of February 2014)</small>			
<ul style="list-style-type: none"> ▪ Enterprise Edition (47'500) ▪ Real Application Cluster (23'000) ▪ Partition Option (11'500) ▪ Diagnostic Pack (5'000) ▪ Tuning Pack (5'000) 	285'000 138'000 69'000 30'000 30'000	380'000 184'000 92'000 40'000 40'000	570'000 276'000 138'000 60'000 60'000
Total Oracle license cost	552'000	736'000	1'104'000

Oracle Database Server License Cost	X2-2	X3-2	X4-2
Oracle license cost <small>(list price 13th of February 2014)</small>			
<ul style="list-style-type: none"> ▪ Eighth Rack ▪ Quarter Rack ▪ Half Rack ▪ Full Rack 	- 1'104'000 2'208'000 4'416'000	736'000 1'472'000 2'944'000 5'888'000	1'104'000 2'208'000 4'416'000 8'832'000

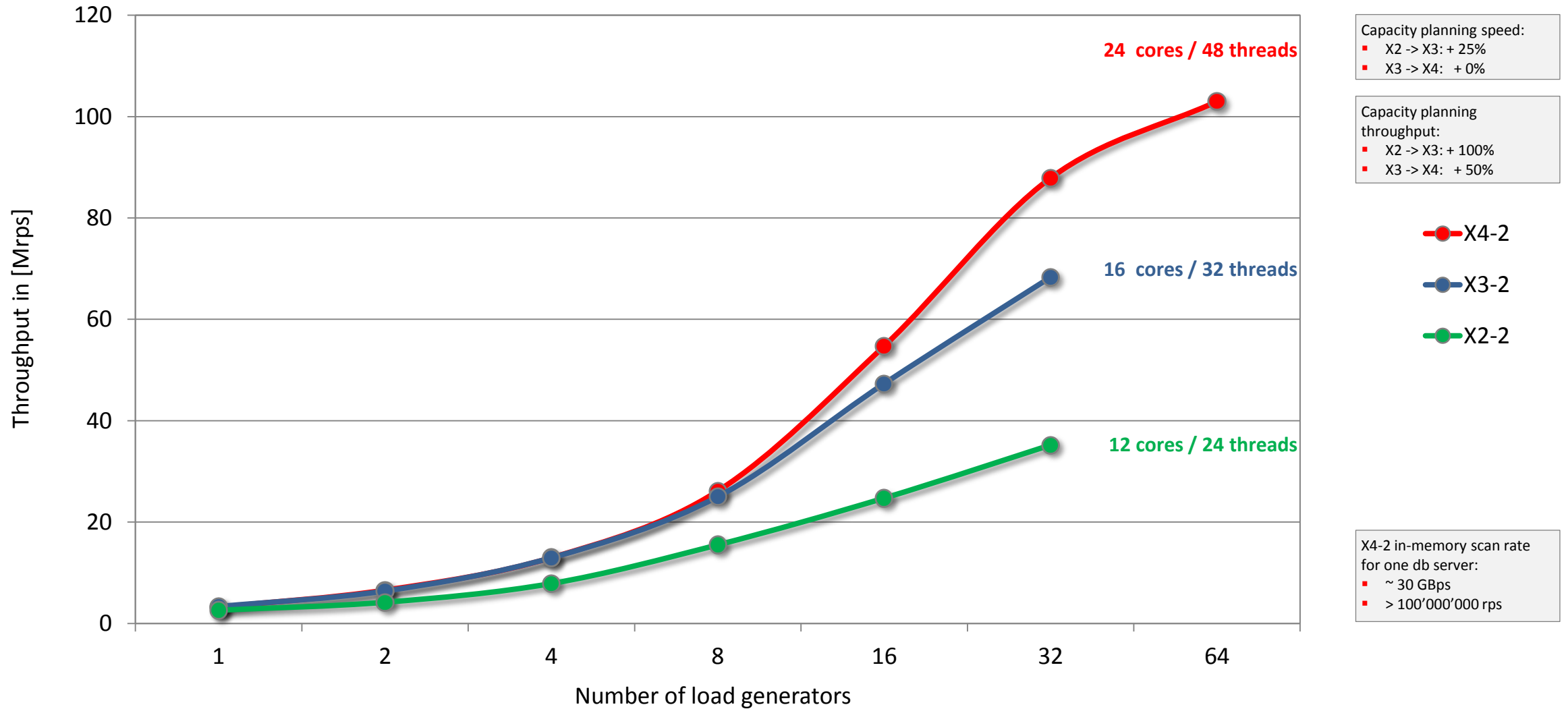


- 1 Introduction to Server (SRV) Performance Tests
- 2 CPU and Server Configuration
- 3 Server Benchmark Results – In-Memory SQL Operations**
- 4 Reviewing Server Benchmark Results

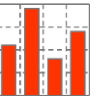
Server Benchmark Results



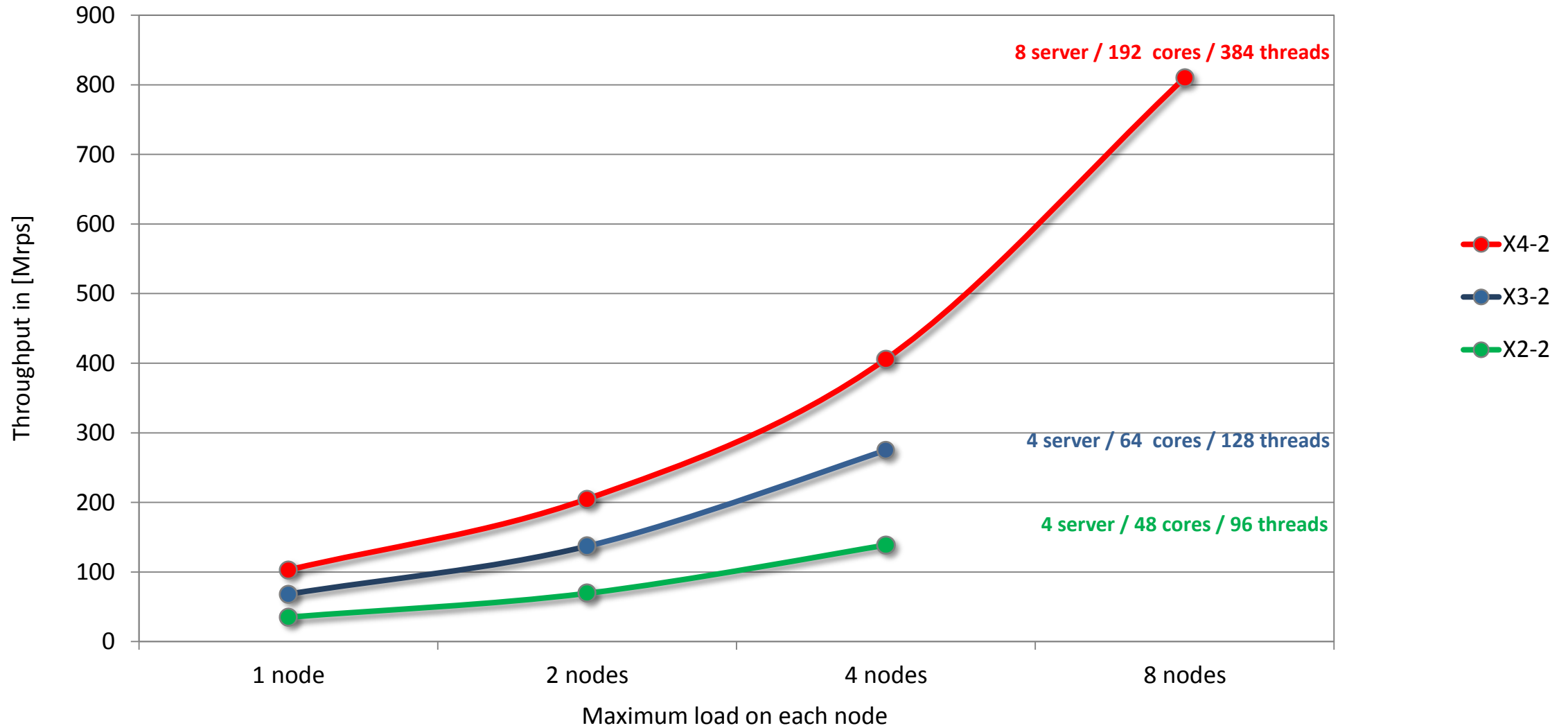
Oracle in-memory SQL: full table scan, 1 DB Server



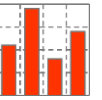
Server Benchmark Results



Oracle in-memory SQL: full table scan, Cluster



Server Benchmark Results



Oracle in-memory SQL: full table scan, 1 DB Server

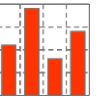
Exadata X4-2 FR

Run	Tst	Code	#N	#J	#T	CPU busy [%]	CPU user [%]	CPU sys [%]	CPU idle [%]	Throughput rows/sec [rps]	Throughput txn/sec [tps]	SQL service time [s]	Buffer lread [dbps]	Buffer pread [dbps]	Elap time [s]
6	2	SRV-11	1	1	1	1	1	0	99	3.197E+06	2.600E+01	3.901E-02	1.392E+05	0.000E+00	297
	3	SRV-11	1	2	1	1	1	0	99	6.550E+06	5.200E+01	3.777E-02	2.851E+05	2.000E+00	302
	4	SRV-11	1	4	1	2	1	0	98	1.297E+07	1.040E+02	3.816E-02	5.642E+05	2.000E+00	303
	5	SRV-11	1	8	1	3	2	0	97	2.612E+07	2.090E+02	3.770E-02	1.136E+06	3.000E+00	305
	6	SRV-11	1	16	1	5	5	0	95	5.474E+07	4.380E+02	3.600E-02	2.378E+06	6.000E+00	305
	7	SRV-11	1	32	1	9	9	0	91	8.789E+07	7.030E+02	4.480E-02	3.815E+06	4.000E+01	304
	8	SRV-11	1	64	1	13	13	0	87	1.038E+08	8.300E+02	7.518E-02	4.503E+06	5.500E+01	306
	9	SRV-11	2	64	1	17	17	0	83	1.781E+08	1.425E+03	4.417E-02	7.732E+06	0.000E+00	304
	10	SRV-11	2	128	1	25	25	0	75	2.053E+08	1.642E+03	7.599E-02	8.908E+06	0.000E+00	306
	11	SRV-11	4	128	1	34	33	0	66	3.570E+08	2.856E+03	4.392E-02	1.550E+07	0.000E+00	305
	12	SRV-11	4	256	1	49	49	1	51	4.062E+08	3.250E+03	7.645E-02	1.762E+07	0.000E+00	307
	13	SRV-11	8	256	1	67	66	1	33	7.206E+08	5.765E+03	4.351E-02	3.128E+07	1.000E+00	305
	14	SRV-11	8	512	1	98	97	1	2	8.107E+08	6.485E+03	7.663E-02	3.517E+07	0.000E+00	307

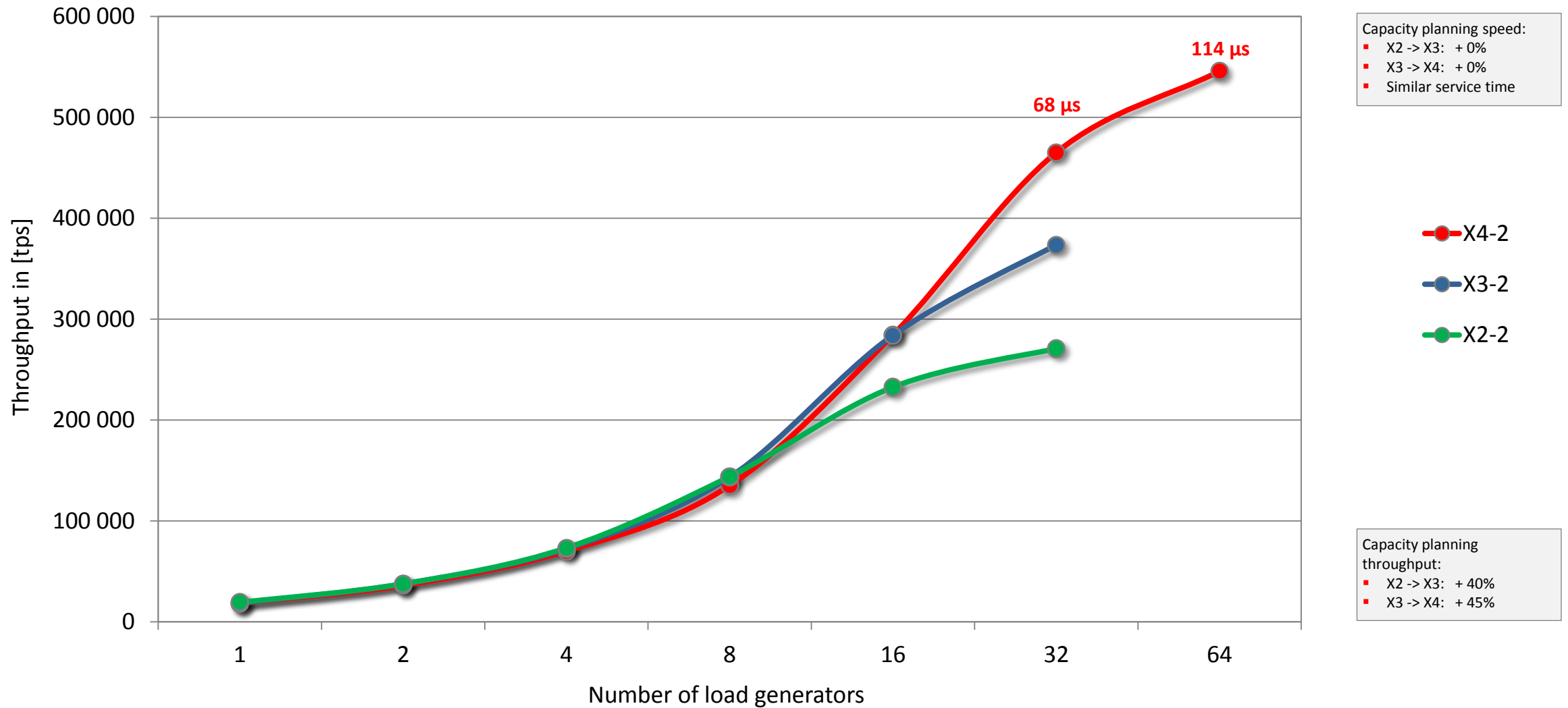
Legend:

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

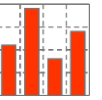
Server Benchmark Results



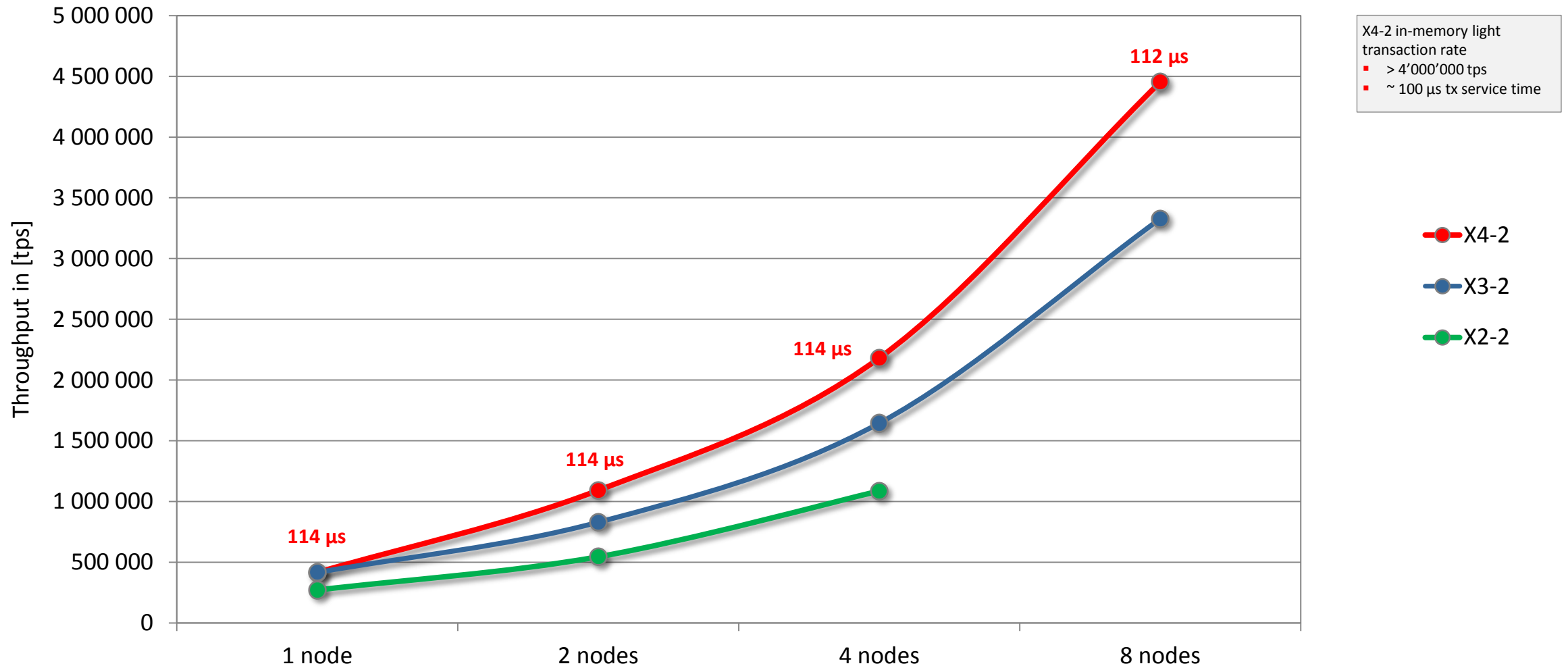
Oracle in-memory SQL: primary key access, 1 row per transaction, 1 DB Server



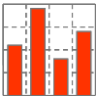
Server Benchmark Results



Oracle in-memory SQL: primary key access, 1 row per transaction, Cluster



Server Benchmark Results



Oracle in-memory SQL: primary key access, 1 row per transaction, 1 DB Server

Exadata X4-2 FR

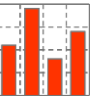
Run	Tst	Code	#N	#J	#T	CPU busy [%]	CPU user [%]	CPU sys [%]	CPU idle [%]	Throughput rows/sec [rps]	Throughput txn/sec [tps]	SQL service time [s]	Buffer lread [dbps]	Buffer pread [dbps]	Elap time [s]
6	15	SRV-21	1	1	1	1	1	0	99	1.815E+04	1.815E+04	5.485E-05	5.457E+04	1.000E+00	303
	16	SRV-21	1	2	1	1	1	0	99	3.581E+04	3.581E+04	5.543E-05	1.075E+05	3.000E+00	301
	17	SRV-21	1	4	1	2	1	1	98	7.003E+04	7.003E+04	5.674E-05	2.102E+05	4.000E+00	300
	18	SRV-21	1	8	1	3	2	1	97	1.353E+05	1.353E+05	5.845E-05	4.061E+05	4.400E+01	304
	19	SRV-21	1	16	1	5	4	1	95	2.843E+05	2.843E+05	5.566E-05	8.523E+05	1.400E+01	303
	20	SRV-21	1	32	1	9	7	2	91	4.651E+05	4.651E+05	6.799E-05	1.387E+06	2.700E+01	303
	21	SRV-21	1	64	1	13	11	2	87	5.457E+05	5.457E+05	1.147E-04	1.611E+06	5.300E+01	305
	22	SRV-21	2	64	1	17	14	3	83	9.301E+05	9.301E+05	6.800E-05	2.774E+06	3.000E+01	303
	23	SRV-21	2	128	1	25	21	4	75	1.092E+06	1.092E+06	1.141E-04	3.241E+06	5.900E+01	306
	24	SRV-21	4	128	1	34	28	6	66	1.863E+06	1.863E+06	6.771E-05	5.558E+06	3.000E+01	304
	25	SRV-21	4	256	1	49	41	9	51	2.181E+06	2.181E+06	1.140E-04	6.488E+06	1.180E+02	307
	26	SRV-21	8	256	1	67	56	11	33	3.722E+06	3.722E+06	6.759E-05	1.111E+07	8.900E+01	305
	27	SRV-21	8	512	1	98	81	17	2	4.453E+06	4.453E+06	1.119E-04	1.328E+07	8.300E+01	307

Legend:

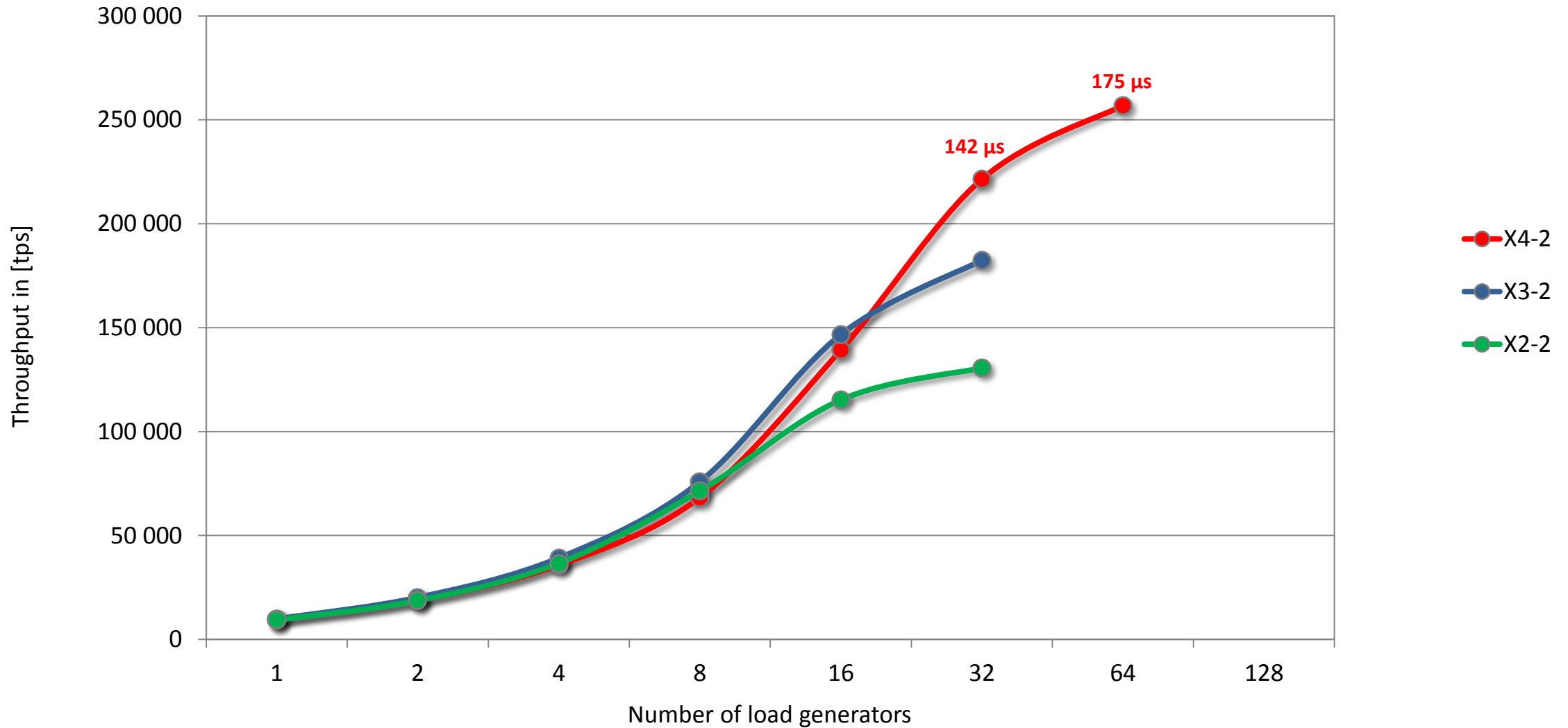
Run	benchmark run id	#N	number of RAC nodes	[rps]	rows per second	[iops]	i/o operations per second	[s]	time in seconds
Tst	benchmark test id	#J	number of load generators (jobs)	[tps]	transactions per second	[dbps]	database blocks per second	[ms]	time in milli seconds
Code	benchmark test code	#T	number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

Take a look at transaction service time versus transaction throughput!

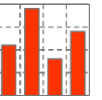
Server Benchmark Results



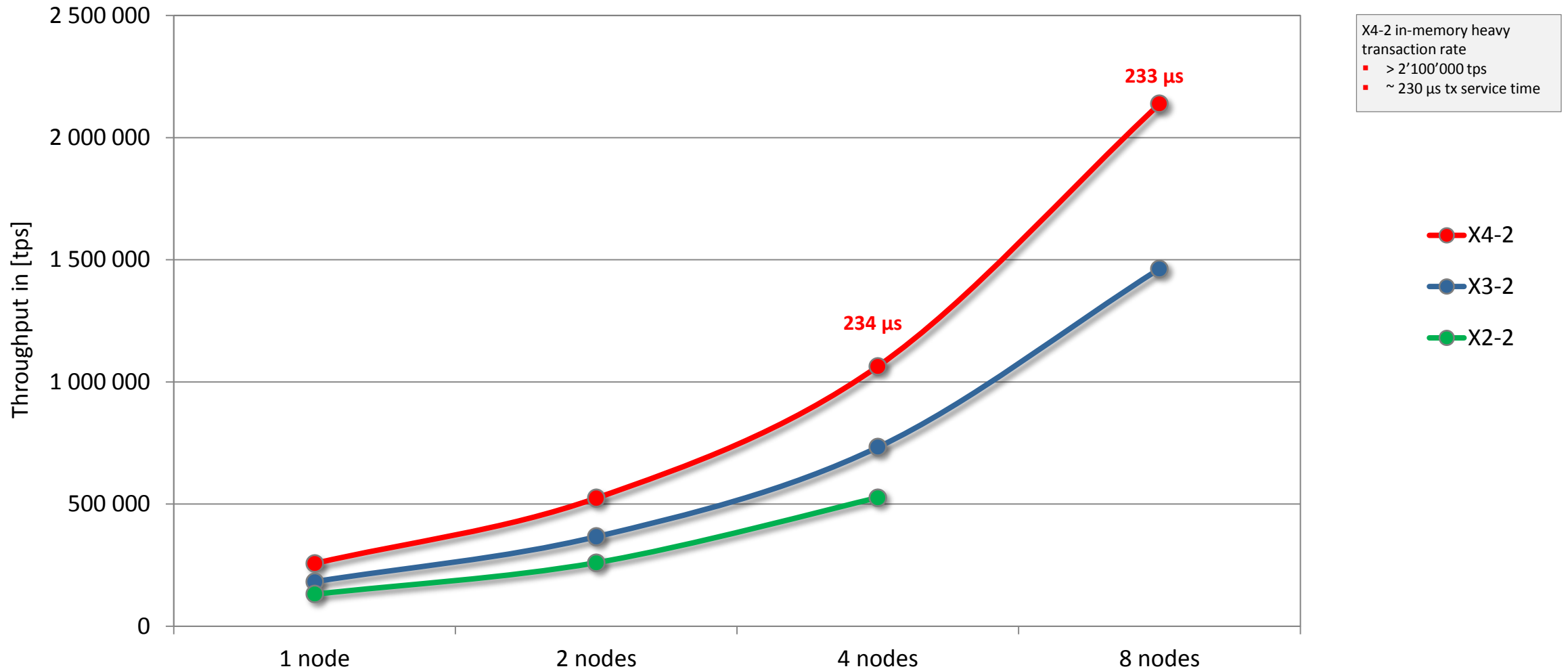
Oracle in-memory SQL: primary key access, Ø 25 rows per transaction, 1 DB Server



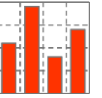
Server Benchmark Results



Oracle in-memory SQL: primary key access, Ø 25 rows per transaction, Cluster



Server Benchmark Results



Oracle in-memory SQL: primary key access, Ø 25 rows per transaction, Cluster

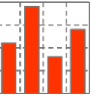
Exadata X4-2 FR

Run	Tst	Code	#N	#J	#T	CPU busy [%]	CPU user [%]	CPU sys [%]	CPU idle [%]	Throughput rows/sec [rps]	Throughput txn/sec [tps]	SQL service time [s]	Buffer lread [dbps]	Buffer pread [dbps]	Elap time [s]
6	28	SRV-31	1	1	1	1	1	0	99	2.413E+05	9.652E+03	1.034E-04	2.608E+05	1.000E+00	302
	29	SRV-31	1	2	1	1	1	0	99	4.690E+05	1.876E+04	1.057E-04	5.066E+05	1.000E+00	302
	30	SRV-31	1	4	1	2	1	0	98	8.941E+05	3.576E+04	1.112E-04	9.654E+05	2.000E+00	303
	31	SRV-31	1	8	1	3	2	1	97	1.706E+06	6.825E+04	1.158E-04	1.842E+06	4.000E+00	303
	32	SRV-31	1	16	1	5	4	1	95	3.480E+06	1.392E+05	1.138E-04	3.751E+06	8.000E+00	303
	33	SRV-31	1	32	1	9	8	1	91	5.537E+06	2.214E+05	1.423E-04	5.957E+06	1.500E+01	304
	34	SRV-31	1	64	1	13	12	1	87	6.424E+06	2.568E+05	2.431E-04	6.901E+06	3.000E+01	306
	35	SRV-31	2	64	1	17	16	2	83	1.127E+07	4.507E+05	1.397E-04	1.213E+07	3.000E+01	304
	36	SRV-31	2	128	1	25	23	2	75	1.311E+07	5.243E+05	2.381E-04	1.409E+07	5.900E+01	306
	37	SRV-31	4	128	1	34	31	3	66	2.274E+07	9.094E+05	1.383E-04	2.448E+07	6.000E+01	305
	38	SRV-31	4	256	1	50	45	4	50	2.659E+07	1.064E+06	2.346E-04	2.860E+07	8.900E+01	306
	39	SRV-31	8	256	1	67	61	6	33	4.600E+07	1.840E+06	1.371E-04	4.952E+07	6.000E+01	304
	40	SRV-31	8	512	1	98	90	8	2	5.346E+07	2.138E+06	2.330E-04	5.749E+07	5.900E+01	307

Legend:

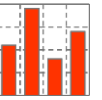
Run	benchmark run id	#N	number of RAC nodes	[rps]	rows per second	[iops]	i/o operations per second	[s]	time in seconds
Tst	benchmark test id	#J	number of load generators (jobs)	[tps]	transactions per second	[dbps]	database blocks per second	[ms]	time in milli seconds
Code	benchmark test code	#T	number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

Take a look at transaction service time versus transaction throughput!



- 1 Introduction to Server (SRV) Performance Tests
- 2 CPU and Server Configuration
- 3 Server Benchmark Results – In-Memory SQL Operations
- 4 Reviewing Server Benchmark Results**

Summary



Reviewing Server Performance

	Metric	X2-2	X3-2	X4-2
#cores		12	16	24
#threads		24	32	48
In-memory SQL operations	Metric	X2-2	X3-2	X4-2
Single thread speed				
▪ Full table scan	[Mrps]	2.6	3.3	3.2
▪ Light transaction (primary key access)	[tps]	19'160	18'380	18'150
	[μs]	58	48	54
▪ Heavy transaction (secondary key access)	[tps]	9'256	9'782	9'652
	[μs]	108	102	103
Throughput				
▪ Full table scan	[Mrps]	35	68	103
▪ Light transaction (primary key access)	[tps]	270'600	373'400	545'700
	[μs]	117	85	115
▪ Heavy transaction (secondary key access)	[tps]	130'600	182'400	256'800
	[μs]	245	170	175

BENCHWARE

swiss precision in performance measurement

www.benchmarkware.ch

info@benchmarkware.ch