

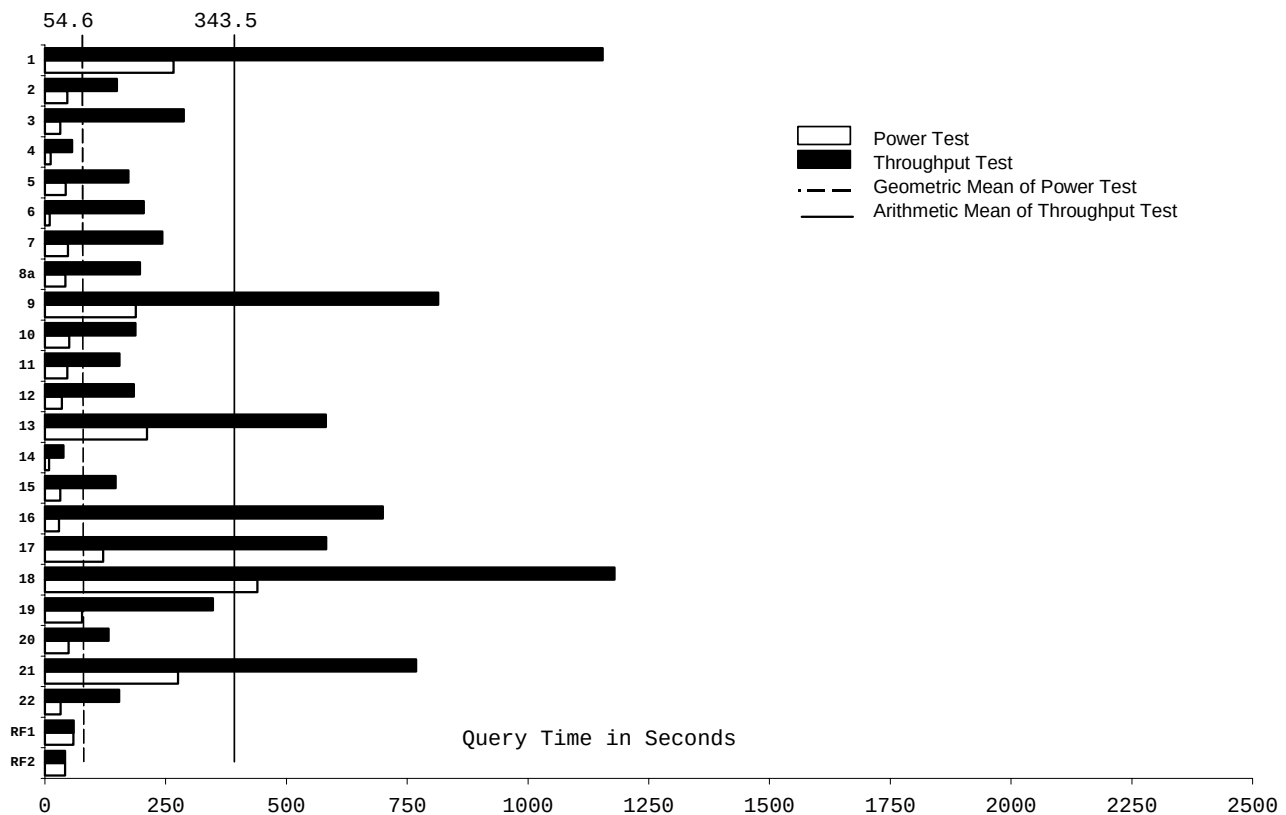


HP AlphaServer ES45 Cluster Using Oracle9i Release 2 with Real Application Clusters

TPC-H Rev. 2.0

Report Date:
November 18, 2002

Total System Cost		Composite Query per Hour Metric		Price / Performance
\$1,991,562		5578.4 QphH@100GB		\$357.01 \$/QphH@100GB
Database Size	Database Manager	Operating System	Other Software	Availability Date
100GB	Oracle9i Enterprise Edition Release 2 with Real Application Clusters	HP Tru64 UNIX V5.1A/IPK	None	July 15, 2002



Database Load Time = 1:10:42	Load Included Backup: N	Total Data Storage / Database Size = 56.48
RAID (Base tables only): N	RAID (Base tables and auxiliary data structures): N	RAID (All): Y

System Configuration: (4 Node Cluster Aggregate)

Processors: 16 Alpha EV 68/1000 MHz CPUs with 8 MB cache

Memory: 128 GB memory

Disks: 336 Drives

Total Disk Storage: 5,647.7 GB



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Description	Part Number	Third Party Brand	Unit Price	Qty	Extended Price	3 yr. Maint. Price
Server Hardware						
Compaq AS ES45 68/1000 M2 4GB Unix	DA-68DAA-DA	1	50,809	4	203,236	71,584
ES45 Tower Enclosure	BA61M-CT	1	325	4	1,300	Inc.
ES45 68/1000 SMP CPU Unix	KN610-DB	1	10,400	12	124,800	Inc.
ES45 4GB Memory Option	MS620-DA	1	17,306	28	484,568	Inc.
Optional Power Supply, Self Sensing	H7906-A9	1	813	4	3,252	Inc.
18.2GB 10K RPM Ultra3 SCSI	3R-A0585-AA	1	207	13	2,691	Inc.
Power Cord	BN18J-1K	1	8	8	64	Inc.
SCSI Drive Cage, 6 Slot	BA610-6D	1	488	4	1,952	Inc.
1 CH Wide Ultra-2 (LVD) Adapter	3X-KZPCA-AA	1	246	4	984	Inc.
PCI to Dual-Prt FE TX NIC	3X-DE602-AA	1	246	4	984	Inc.
Memory Channel Hub (w/4 line cards)	CCMHB-AA	1	6,365	1	6,365	Inc.
PCI MC2 Controller	CCMAB-AA	1	1,944	4	7,776	Inc.
10 Meter Cable for MC2	BN39B-10	1	273	4	1,092	Inc.
64 Bit FC HBA T64/VMS	DS-KGP5A-CA	1	2,209	16	35,344	Inc.
D Shelf 180W 1Doc BLW Metric Blue	DS-BA356-JD	1	919	2	1,838	Inc.
PCI to UltraSCSI Adapter UW SE	KZPBA-CA	1	299	2	598	Inc.
Ultra 68VHD 3M Cable Assembly	BN37A-03	1	91	2	182	Inc.
VT510;W hite; North Amer; No key	VT510-AA	1	397	4	1,588	0
US/CANADA W95 KYBD WHIT	PCXLA-NA	1	16	4	64	0
Subtotal					878,678	71,584
STORAGE:						
USA Model 914 Storage Shelf	DS-SWXEB-AA	1	46,406	4	185,624	68,424
Controller w/o ECB Cable Kit	DS-HSG80-BK	1	8,793	24	211,032	Inc.
16-Port SAN Switch	DS-DSGGB-AB	1	18,525	4	74,100	Inc.
Short-W ave Optical GBICs	DS-DXGGA-SA	1	241	40	9,640	Inc.
Model 2200 ECB	DS-SE2CS-CB	1	369	24	8,856	Inc.
Fibre Channel Cables	BNGBX-30	1	246	40	9,840	Inc.
12/24gb 4MM Dat 5.25 Tape Drive	TLZ10-LB	1	444	4	1,776	3,448
9.1GB 7200RPM Disk**	DS-RZ1DA-VW	1	423	6	2,538	Spared
18.2GB 10K RPM Ultra3 SCSI	3R-A0585-AA	1	206	317	65,302	Spared
Subtotal					568,708	71,872
Software						
3YR, AS ES40/45 UNIX BRNZ24X7	FM-E4WUS-36	1	1,896	4		7,584
3YR Digital Unix O/S & LP	FM-CDDST-36	1	6,765	4		27,060
TRU64 UNIX AlphaCDROM	QA-MT4AA-H8	1	293	4	1,172	
3YR AS ES45 UNIX SMP	FM-62USM-36	1	214	12		2,568
3YR 7X24 HS*80 Platform SW	FM-PLAT2-36	1	414	24		9,936
HSG80 ACSsf All Lic/PCRM Pkg	QB-6BUAA-SB	1	4,550	24	109,200	
Oracle9i Database Enterprise Edition Release 2, Named User Plus for 3 years	Oracle	2	10,000	16	160,000	
Real Application Clusters, Named User Plus for 3 Years	Oracle	2	5,000	16	80,000	
Partitioning, Named User Plus for 3 years	Oracle	2	2,500	16	40,000	
Oracle DB Server Support Pkg. for 3 years	Oracle	2	6,000	4		24,000
Oracle Mandatory E-Business Discount (license and support)*	Oracle	2	(\$60,800)	1	(\$60,800)	
Subtotal					329,572	71,148

Notes:** 10% Spares

1=IC System Solutions 2=Oracle(Herve
Lejeune; herve.lejeune@oracle.com 650 560-
1894 (Please see Appendix G))

Subtotal \$1,776,958 \$214,604
Three-Year Cost of Ownership: \$1,991,562
QphH 5,578.40
\$/QphH \$357.01

Audited by InfoSizing

All prices are based on similar quantities and configurations.

Prices used in TPC benchmarks reflect the actual prices a customer would pay for a one-time purchase of the stated components. Individually negotiated discounts are not permitted. Special prices based on assumptions about past or future purchases are not permitted. All discounts reflect standard pricing policies for the listed components. For complete details, see the pricing sections of the TPC benchmark specifications. If you find that the stated prices are not available according to these terms, please inform the TPC at pricing@tpc.org. Thank you.



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Numerical Quantities

Measurement Results:

Database Scale Factor	= 100
Total Data Storage / Database Size	= 56.48
Start of Database Load	= 2002-06-24 16:53:24
End of Database Load	= 2002-06-24 18:04:06
Database Load Time	= 01:10:42
Query Streams for Throughput Test	= 5
TPC-H Power	= 6596.2 @100GB
TPC-H Throughput	= 4717.7 @100GB
TPC-H Composite Query-per-Hour Metric (<u>QphH@Size</u>)	= 5578.4 @100GB
Total System Price Over 5 Years	= \$1,991,562
TPC-H Price/ Performance Metric (<u>\$/QphH@Size</u>)	= \$357.01

Measurement Intervals:

Measurement Interval in Throughput Test (Ts)	= 8,394.0 seconds
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Duration of Stream Execution:

Stream ID	Seed	Start Date	Start Time	End Date	End Time	Duration
Stream 0:	624180406	6/24/2002	21:00:31	6/24/2002	21:37:08	0:36:37
Stream 1:	624180407	6/24/2002	21:37:10	6/24/2002	23:41:28	2:04:18
Stream 2:	624180408	6/24/2002	21:37:10	6/24/2002	23:48:35	2:11:25
Stream 3:	624180409	6/24/2002	21:37:10	6/24/2002	23:44:08	2:06:58
Stream 4:	624180410	6/24/2002	21:37:10	6/24/2002	23:43:31	2:06:21
Stream 5:	624180411	6/24/2002	21:37:10	6/24/2002	23:37:56	2:00:46
Refresh		6/24/2002	23:48:35	6/24/2002	23:57:04	0:08:29



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TPC-H Timing Intervals (in seconds)

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8a	Q9	Q10	Q11	Q12
Stream 00	266.4	46.3	31.5	11.9	43.2	9.9	47.7	42.1	188.3	50.4	46.6	35.4
Stream 01	1144.2	151.9	122.3	36.7	217.3	46.9	231.9	179.7	757.9	198.4	193.7	119.1
Stream 02	1452.4	138.2	83.6	55.9	134.0	36.4	284.7	230.2	1092.2	154.1	91.4	240.4
Stream 03	941.1	144.2	77.7	48.1	167.4	39.1	243.1	189.7	827.7	250.6	188.5	118.6
Stream 04	1133.1	153.5	80.9	69.8	141.1	34.2	234.6	220.2	745.2	189.4	132.1	201.2
Stream 05	1102.9	157.7	157.9	71.0	205.7	53.6	220.7	164.7	646.9	146.1	165.6	241.8
Minimum	941.1	138.2	77.7	36.7	134.0	34.2	220.7	164.7	646.9	146.1	91.4	118.6
Average	1154.7	149.1	287.9	56.3	173.1	204.6	243.0	196.9	814.0	187.7	154.3	184.2
Maximum	1452.4	157.7	157.9	71.0	217.3	53.6	284.7	230.2	1092.2	250.6	193.7	241.8

	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	RF1	RF2
Stream 00	211.3	8.9	31.6	29.7	120.8	440.0	76.9	48.6	275.9	32.5	59.0	42.0
Stream 01	687.6	21.6	81.7	229.8	354.9	1212.4	268.7	156.7	916.3	128.6	62.0	44.0
Stream 02	672.5	52.2	181.4	175.1	894.2	1019.7	354.6	126.0	287.7	128.6	57.0	38.0
Stream 03	499.9	45.4	181.7	114.4	783.9	1135.6	385.7	137.2	848.9	249.5	59.0	44.0
Stream 04	640.7	38.2	183.8	123.2	457.4	1372.9	365.9	80.0	859.3	124.1	59.0	42.0
Stream 05	408.9	33.3	102.6	200.7	421.4	1154.6	364.5	158.8	928.2	136.9	61.0	42.0
Minimum	408.9	21.6	81.7	114.4	354.9	1019.7	268.7	80.0	287.7	124.1	57.0	38.0
Average	581.9	38.1	146.2	699.6	582.4	1179.0	347.9	131.7	768.1	153.5	59.6	42.0
Maximum	687.6	52.2	183.8	229.8	894.2	1372.9	385.7	158.8	928.2	249.5	62.0	44.0