TPC Benchmark™ H
Full Disclosure Report

SPARC Enterprise M8000
Using
Oracle Database 11g Release 2 Enterprise Edition with Partitioning

Submitted for Review
June 3, 2011

First Revision
September 14, 2011

First Printing June 3, 2011

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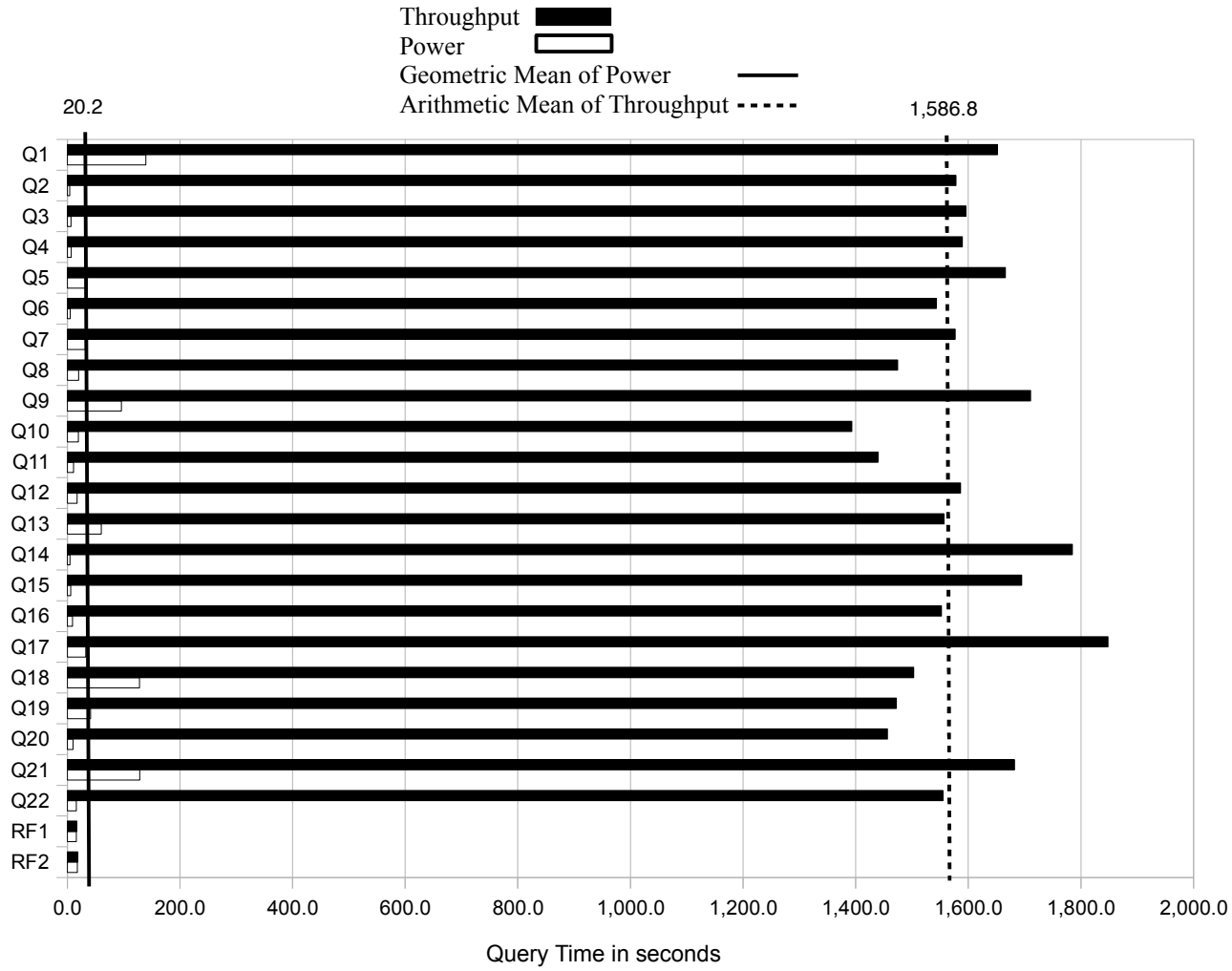
SPARC Enterprise M8000 Server with Oracle Database 11g Release 2

TPC-H Rev. 2.14.1
TPC-Pricing 1.6.0

Report Date: June 3, 2011
Revised: September 14, 2011

Total System Cost	Composite Query per Hour Metric	Price / Performance
$1,995,715 USD	**209,533.6 QphH@1000GB**	**$9.53/QphH@1000GB**

Database Size	Database Manager	Operating System	Other Software	Availability Date
1000GB	Oracle Database 11g Release 2 Enterprise Edition with Partitioning	Solaris 10 8/11	None	September 22, 2011



Database Load Time = 1:27:12
Load Includes Backup: N
Total Data Storage / Database Size = 11.2
Memory to Database Size Percentage = 51.2

Storage Redundancy Levels:
Base Tables: Level Three
Auxiliary Data Structures: Level Three
DBMS Temporary Space: Level Zero
OS and DBMS Software: Level One

System Configuration:	SPARC Enterprise M8000 Server
Processors:	16 SPARC64 VII+ 3000 MHz Processors, 64 cores, 128 threads
Memory:	512GB
Disks:	4 Sun Storage F5100 Flash Arrays w/ 80 24GB FMODs each 12 300GB 10K SAS Internal
Total Storage:	11,280GB (GB = 1024*1024*1024 bytes)

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Description	Part Number	Source	Unit Price	Qty	Ext. Price	3 Yr. Maint.
Server Hardware						
Sun SE M8000-16 Base 1ph	SEGASY12Z	1	448,479	1	448,479	
SE_CMU:4*SPARCVII+ 3.0w/128GB	SEMY4KG1Z	1	252,327	4	1,009,308	
SE_PCI_E IO Unit: 8*slots	7101643	1	59,520	4	238,080	
PWR Cord 1PHs M8000-9000 USA	SEMX9P31Z-N	1	3,039	9	25,351	
PCI-E Base IO Card	SEMY7BS1Z-N	1	3,840	6	23,040	
300GB 10K RPM 2.5" SAS	SEMX3C11Z-N	1S	1,481	12	17,772	
Sun Storage 6Gb SAS PCIe HBA: 8port	SG-SAS6-EXT-Z	1	599	16	9,584	
Sun Fire X4170 M2 Server	X4170M2-H1-AA	1	2,699	1	2,699	
Solaris 10 Pre-Install	5894A-N	1	0	1	0	
US PC Peripheral Kit (Keyboard/Mouse)	3701A-PC	1	50	1	50	
Express Slide Rail Kit	6326A-N	1	150	1	150	
4GB (1x4GB) DDR3-1333	4910A	1	255	2	510	
6 Gb/s SAS HBA, Internal ATO	SG-SAS6-INT-Z	1	419	1	419	
300GB 10K RPM 2.5" SAS Disk	RB-SS2CF-300G10K-N	1	689	1	689	
DVD+/-RW SATA-based drive ATO	8325A-N	1	145	1	145	
1 x Intel Xeon E5620 ATO	5924A	1	599	1	599	
X4170 CPU Heatsink, XATO	5879A-N	1	0	1	0	
17" TFT Monitor	X7204A-N	1	219	1	219	
Server Hardware Subtotal					**1,779,094**	**0**
Storage						
Sun Storage F5100 Flash Array	TA-F5100-M2SA	1	19,995	4	79,980	
20 24GB SATA SLC flash modules	TA-24GBSTSF-20FM	1	33,750	16	540,000	
Express Slide Rail Kit	6326A-N	1	150	4	600	
Jumper Cable Kit: 1 x 1m C13	XSR-JUMP-1MC13	1	29	8	232	
Sun Storage 3M, mini, shielded, SAS cable	XTA-3.0M-SAS-N	1	175	16	2,800	
Storage Subtotal					**623,612**	**0**
Server Software						
Solaris 10 8/11 Pre-install	SOLZS-10M9A9S-FI-N	1	0	1	0	
Oracle Solaris Studio 12		1	0	1	0	
Oracle Solars Studio 12 Support, Named User	B59320	1	1,200	3		3,600
Oracle Database 11g Release 2 Enterprise Edition, Named User Plus for 3 years (for 32 processors)		1	11,875	32	380,000	
Partitioning, Named User Plus for 3 years (for 32 processors)		1	2,875	32	92,000	
Incident Server Support for 3 years		1	2,300	3		6,900
Server Software Subtotal					**472,000**	**10,500**
Oracle Premier Hardware Support	Q-PREM-SPRT-SYS	1	288,325	3		864,974
			Total		**2,874,706**	**875,474**
Total Oracle Software, Hardware and Maintenance Discount		1			(1,754,465)	
Notes (Source):			**3 Yr. Cost**		**$1,995,715**	
1. Oracle Corp.			**QphH @1000GB**		**209,533.6**	
S. Substituted Component			**$/QphH @1000GB**		**$9.53**	

Audited by Francois Raab of InfoSizing, Inc.

Oracle's discounts are based upon US list prices and for similar quantities and configurations. A total discount of 46.71% has been applied to all Oracle hardware, software and services based on the total value and quantities of the components of the configuration, including full payment of all components and maintenance.

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 section of the TPC benchmark specifications. If you find that 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	= 1000GB
Total Data Storage / Database Size	= 11.2
Start of database load time	= 05-13-2011 14:55:04
End of database load time	= 05-13-2011 16:22:16
Database Load Time	= 1:27:12
Query Streams for Throughput Test	= 128
TPC-H Power	= 177,845.9
TPC-H Throughput	= 246,867.2
TPC-H Composite Query-per-Hour Rating (QphH@1000GB)	= 209,533.6
Total System Price Over 3 Years	= $1,995,715
TPC-H Price/Performance Metric ($/QphH@1000GB)	= $9.53

Measurement Intervals:

Measurement Interval in Throughput Test (Ts)	= 41,065 seconds

Duration of Stream Execution:

Power Run	Seed	RF1 Start RF1 End	Query Start Query End	RF2 Start RF2 End	Duration
	513162216	05/14/2011 03:48:30	05/14/2011 03:48:48	05/14/2011 04:02:40	00:14:29
		05/14/2011 03:48:47	05/14/2011 04:02:40	05/14/2011 04:02:59	

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
1	513162217	05/14/2011 04:03:06	09:26:33	05/14/2011 14:10:44	05/14/2011 14:11:45
		05/14/2011 13:29:39		05/14/2011 14:11:45	05/14/2011 14:12:05
2	513162218	05/14/2011 04:03:06	09:19:18	05/14/2011 14:12:05	05/14/2011 14:12:28
		05/14/2011 13:22:24		05/14/2011 14:12:28	05/14/2011 14:12:47
3	513162219	05/14/2011 04:03:06	09:24:59	05/14/2011 14:12:47	05/14/2011 14:13:06
		05/14/2011 13:28:05		05/14/2011 14:13:06	05/14/2011 14:13:25
4	513162220	05/14/2011 04:03:06	09:28:43	05/14/2011 14:13:25	05/14/2011 14:13:43
		05/14/2011 13:31:49		05/14/2011 14:13:43	05/14/2011 14:14:02
5	513162221	05/14/2011 04:03:06	09:42:20	05/14/2011 14:14:02	05/14/2011 14:14:19
		05/14/2011 13:45:26		05/14/2011 14:14:18	05/14/2011 14:14:37
6	513162222	05/14/2011 04:03:06	09:38:33	05/14/2011 14:14:37	05/14/2011 14:14:54
		05/14/2011 13:41:39		05/14/2011 14:14:54	05/14/2011 14:15:13
7	513162223	05/14/2011 04:03:06	09:37:05	05/14/2011 14:15:13	05/14/2011 14:15:29
		05/14/2011 13:40:11		05/14/2011 14:15:29	05/14/2011 14:15:48
8	513162224	05/14/2011 04:03:06	09:26:44	05/14/2011 14:15:48	05/14/2011 14:16:04
		05/14/2011 13:29:50		05/14/2011 14:16:04	05/14/2011 14:16:22
9	513162225	05/14/2011 04:03:06	09:23:36	05/14/2011 14:16:22	05/14/2011 14:16:39
		05/14/2011 13:26:42		05/14/2011 14:16:39	05/14/2011 14:16:57
10	513162226	05/14/2011 04:03:06	09:28:41	05/14/2011 14:16:57	05/14/2011 14:17:15
		05/14/2011 13:31:47		05/14/2011 14:17:15	05/14/2011 14:17:36

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
11	513162227	05/14/2011 04:03:06 05/14/2011 13:29:26	09:26:20	05/14/2011 14:17:36 05/14/2011 14:17:53	05/14/2011 14:17:53 05/14/2011 14:18:12
12	513162228	05/14/2011 04:03:06 05/14/2011 13:31:56	09:28:50	05/14/2011 14:18:12 05/14/2011 14:18:28	05/14/2011 14:18:28 05/14/2011 14:18:46
13	513162229	05/14/2011 04:03:06 05/14/2011 13:31:26	09:28:20	05/14/2011 14:18:46 05/14/2011 14:19:04	05/14/2011 14:19:04 05/14/2011 14:19:23
14	513162230	05/14/2011 04:03:06 05/14/2011 13:31:56	09:28:50	05/14/2011 14:19:23 05/14/2011 14:19:40	05/14/2011 14:19:40 05/14/2011 14:20:01
15	513162231	05/14/2011 04:03:06 05/14/2011 13:29:26	09:26:20	05/14/2011 14:20:01 05/14/2011 14:20:18	05/14/2011 14:20:18 05/14/2011 14:20:39
16	513162232	05/14/2011 04:03:06 05/14/2011 13:34:38	09:31:31	05/14/2011 14:20:39 05/14/2011 14:20:56	05/14/2011 14:20:56 05/14/2011 14:21:17
17	513162233	05/14/2011 04:03:06 05/14/2011 13:34:02	09:30:56	05/14/2011 14:21:17 05/14/2011 14:21:34	05/14/2011 14:21:34 05/14/2011 14:21:53
18	513162234	05/14/2011 04:03:06 05/14/2011 13:29:24	09:26:17	05/14/2011 14:21:53 05/14/2011 14:22:09	05/14/2011 14:22:10 05/14/2011 14:22:29
19	513162235	05/14/2011 04:03:06 05/14/2011 13:29:30	09:26:24	05/14/2011 14:22:29 05/14/2011 14:22:46	05/14/2011 14:22:46 05/14/2011 14:23:07
20	513162236	05/14/2011 04:03:07 05/14/2011 13:30:48	09:27:41	05/14/2011 14:23:07 05/14/2011 14:23:23	05/14/2011 14:23:23 05/14/2011 14:23:42
21	513162237	05/14/2011 04:03:07 05/14/2011 13:31:56	09:28:49	05/14/2011 14:23:42 05/14/2011 14:23:59	05/14/2011 14:23:59 05/14/2011 14:24:17
22	513162238	05/14/2011 04:03:07 05/14/2011 13:29:26	09:26:19	05/14/2011 14:24:17 05/14/2011 14:24:34	05/14/2011 14:24:34 05/14/2011 14:24:53
23	513162239	05/14/2011 04:03:07 05/14/2011 13:32:42	09:29:35	05/14/2011 14:24:53 05/14/2011 14:25:09	05/14/2011 14:25:09 05/14/2011 14:25:28
24	513162240	05/14/2011 04:03:07 05/14/2011 13:37:30	09:34:23	05/14/2011 14:25:28 05/14/2011 14:25:45	05/14/2011 14:25:45 05/14/2011 14:26:03
25	513162241	05/14/2011 04:03:07 05/14/2011 13:40:09	09:37:03	05/14/2011 14:26:03 05/14/2011 14:26:20	05/14/2011 14:26:20 05/14/2011 14:26:41
26	513162242	05/14/2011 04:03:07 05/14/2011 13:29:51	09:26:45	05/14/2011 14:26:41 05/14/2011 14:26:58	05/14/2011 14:26:58 05/14/2011 14:27:16
27	513162243	05/14/2011 04:03:07 05/14/2011 13:34:39	09:31:32	05/14/2011 14:27:16 05/14/2011 14:27:33	05/14/2011 14:27:33 05/14/2011 14:27:51
28	513162244	05/14/2011 04:03:07 05/14/2011 13:32:42	09:29:35	05/14/2011 14:27:51 05/14/2011 14:28:08	05/14/2011 14:28:08 05/14/2011 14:28:27
29	513162245	05/14/2011 04:03:07 05/14/2011 13:37:30	09:34:23	05/14/2011 14:28:27 05/14/2011 14:28:43	05/14/2011 14:28:43 05/14/2011 14:29:02
30	513162246	05/14/2011 04:03:07 05/14/2011 13:41:04	09:37:57	05/14/2011 14:29:02 05/14/2011 14:29:18	05/14/2011 14:29:18 05/14/2011 14:29:36
31	513162247	05/14/2011 04:03:07 05/14/2011 13:30:24	09:27:17	05/14/2011 14:29:36 05/14/2011 14:29:53	05/14/2011 14:29:53 05/14/2011 14:30:13
32	513162248	05/14/2011 04:03:07 05/14/2011 13:32:20	09:29:13	05/14/2011 14:30:13 05/14/2011 14:30:30	05/14/2011 14:30:30 05/14/2011 14:30:48
33	513162249	05/14/2011 04:03:07 05/14/2011 13:34:34	09:31:26	05/14/2011 14:30:48 05/14/2011 14:31:04	05/14/2011 14:31:04 05/14/2011 14:31:23
34	513162250	05/14/2011 04:03:07 05/14/2011 13:36:05	09:32:58	05/14/2011 14:31:23 05/14/2011 14:31:39	05/14/2011 14:31:39 05/14/2011 14:31:58
35	513162251	05/14/2011 04:03:07 05/14/2011 13:29:31	09:26:24	05/14/2011 14:31:58 05/14/2011 14:32:14	05/14/2011 14:32:14 05/14/2011 14:32:35
36	513162252	05/14/2011 04:03:07	09:28:37	05/14/2011 14:32:35	05/14/2011 14:32:52

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
		05/14/2011 13:31:45		05/14/2011 14:32:52	05/14/2011 14:33:10
37	513162253	05/14/2011 04:03:07	09:29:27	05/14/2011 14:33:10	05/14/2011 14:33:27
		05/14/2011 13:32:35		05/14/2011 14:33:27	05/14/2011 14:33:45
38	513162254	05/14/2011 04:03:07	09:35:04	05/14/2011 14:33:45	05/14/2011 14:34:02
		05/14/2011 13:38:12		05/14/2011 14:34:02	05/14/2011 14:34:20
39	513162255	05/14/2011 04:03:07	09:31:26	05/14/2011 14:34:20	05/14/2011 14:34:37
		05/14/2011 13:34:34		05/14/2011 14:34:37	05/14/2011 14:34:55
40	513162256	05/14/2011 04:03:08	09:31:26	05/14/2011 14:34:55	05/14/2011 14:35:12
		05/14/2011 13:34:33		05/14/2011 14:35:12	05/14/2011 14:35:30
41	513162257	05/14/2011 04:03:08	09:33:12	05/14/2011 14:35:30	05/14/2011 14:35:47
		05/14/2011 13:36:19		05/14/2011 14:35:47	05/14/2011 14:36:05
42	513162258	05/14/2011 04:03:08	09:31:26	05/14/2011 14:36:05	05/14/2011 14:36:22
		05/14/2011 13:34:33		05/14/2011 14:36:22	05/14/2011 14:36:41
43	513162259	05/14/2011 04:03:08	09:30:55	05/14/2011 14:36:41	05/14/2011 14:36:57
		05/14/2011 13:34:02		05/14/2011 14:36:57	05/14/2011 14:37:15
44	513162260	05/14/2011 04:03:09	09:40:11	05/14/2011 14:37:15	05/14/2011 14:37:32
		05/14/2011 13:43:20		05/14/2011 14:37:32	05/14/2011 14:37:51
45	513162261	05/14/2011 04:03:09	09:33:35	05/14/2011 14:37:51	05/14/2011 14:38:08
		05/14/2011 13:36:44		05/14/2011 14:38:08	05/14/2011 14:38:26
46	513162262	05/14/2011 04:03:09	09:52:47	05/14/2011 14:38:26	05/14/2011 14:38:44
		05/14/2011 13:55:56		05/14/2011 14:38:44	05/14/2011 14:39:02
47	513162263	05/14/2011 04:03:10	09:37:56	05/14/2011 14:39:02	05/14/2011 14:39:19
		05/14/2011 13:41:06		05/14/2011 14:39:19	05/14/2011 14:39:40
48	513162264	05/14/2011 04:03:10	09:32:41	05/14/2011 14:39:40	05/14/2011 14:39:57
		05/14/2011 13:35:51		05/14/2011 14:39:57	05/14/2011 14:40:15
49	513162265	05/14/2011 04:03:10	09:31:27	05/14/2011 14:40:15	05/14/2011 14:40:32
		05/14/2011 13:34:38		05/14/2011 14:40:32	05/14/2011 14:40:50
50	513162266	05/14/2011 04:03:10	09:31:40	05/14/2011 14:40:50	05/14/2011 14:41:07
		05/14/2011 13:34:50		05/14/2011 14:41:07	05/14/2011 14:41:25
51	513162267	05/14/2011 04:03:10	09:32:40	05/14/2011 14:41:25	05/14/2011 14:41:42
		05/14/2011 13:35:50		05/14/2011 14:41:42	05/14/2011 14:42:00
52	513162268	05/14/2011 04:03:10	09:35:59	05/14/2011 14:42:00	05/14/2011 14:42:17
		05/14/2011 13:39:10		05/14/2011 14:42:17	05/14/2011 14:42:35
53	513162269	05/14/2011 04:03:10	09:37:18	05/14/2011 14:42:35	05/14/2011 14:42:51
		05/14/2011 13:40:29		05/14/2011 14:42:51	05/14/2011 14:43:10
54	513162270	05/14/2011 04:03:10	09:31:15	05/14/2011 14:43:10	05/14/2011 14:43:26
		05/14/2011 13:34:25		05/14/2011 14:43:26	05/14/2011 14:43:45
55	513162271	05/14/2011 04:03:10	09:37:09	05/14/2011 14:43:45	05/14/2011 14:44:02
		05/14/2011 13:40:19		05/14/2011 14:44:02	05/14/2011 14:44:20
56	513162272	05/14/2011 04:03:11	09:31:23	05/14/2011 14:44:20	05/14/2011 14:44:37
		05/14/2011 13:34:33		05/14/2011 14:44:37	05/14/2011 14:44:58
57	513162273	05/14/2011 04:03:11	09:48:00	05/14/2011 14:44:58	05/14/2011 14:45:14
		05/14/2011 13:51:11		05/14/2011 14:45:14	05/14/2011 14:45:32
58	513162274	05/14/2011 04:03:11	09:30:52	05/14/2011 14:45:32	05/14/2011 14:45:49
		05/14/2011 13:34:03		05/14/2011 14:45:49	05/14/2011 14:46:07
59	513162275	05/14/2011 04:03:11	09:32:55	05/14/2011 14:46:07	05/14/2011 14:46:24
		05/14/2011 13:36:06		05/14/2011 14:46:24	05/14/2011 14:46:42
60	513162276	05/14/2011 04:03:11	09:28:45	05/14/2011 14:46:42	05/14/2011 14:46:59
		05/14/2011 13:31:56		05/14/2011 14:46:59	05/14/2011 14:47:17
61	513162277	05/14/2011 04:03:12	09:35:00	05/14/2011 14:47:17	05/14/2011 14:47:34
		05/14/2011 13:38:12		05/14/2011 14:47:34	05/14/2011 14:47:52

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
62	513162278	05/14/2011 04:03:12 05/14/2011 13:41:55	09:38:43	05/14/2011 14:47:52 05/14/2011 14:48:09	05/14/2011 14:48:09 05/14/2011 14:48:27
63	513162279	05/14/2011 04:03:12 05/14/2011 13:42:41	09:39:28	05/14/2011 14:48:27 05/14/2011 14:48:44	05/14/2011 14:48:44 05/14/2011 14:49:04
64	513162280	05/14/2011 04:03:12 05/14/2011 13:43:47	09:40:35	05/14/2011 14:49:04 05/14/2011 14:49:20	05/14/2011 14:49:20 05/14/2011 14:49:38
65	513162281	05/14/2011 04:03:12 05/14/2011 13:55:01	09:51:48	05/14/2011 14:49:38 05/14/2011 14:49:55	05/14/2011 14:49:55 05/14/2011 14:50:14
66	513162282	05/14/2011 04:03:13 05/14/2011 14:02:02	09:58:49	05/14/2011 14:50:14 05/14/2011 14:50:31	05/14/2011 14:50:31 05/14/2011 14:50:49
67	513162283	05/14/2011 04:03:13 05/14/2011 13:41:40	09:38:27	05/14/2011 14:50:49 05/14/2011 14:51:06	05/14/2011 14:51:06 05/14/2011 14:51:25
68	513162284	05/14/2011 04:03:13 05/14/2011 13:37:59	09:34:46	05/14/2011 14:51:25 05/14/2011 14:51:42	05/14/2011 14:51:42 05/14/2011 14:52:00
69	513162285	05/14/2011 04:03:13 05/14/2011 13:40:25	09:37:13	05/14/2011 14:52:00 05/14/2011 14:52:17	05/14/2011 14:52:17 05/14/2011 14:52:36
70	513162286	05/14/2011 04:03:13 05/14/2011 13:49:35	09:46:22	05/14/2011 14:52:36 05/14/2011 14:52:53	05/14/2011 14:52:53 05/14/2011 14:53:11
71	513162287	05/14/2011 04:03:13 05/14/2011 13:54:05	09:50:52	05/14/2011 14:53:11 05/14/2011 14:53:28	05/14/2011 14:53:28 05/14/2011 14:53:47
72	513162288	05/14/2011 04:03:13 05/14/2011 13:54:24	09:51:11	05/14/2011 14:53:47 05/14/2011 14:54:03	05/14/2011 14:54:04 05/14/2011 14:54:25
73	513162289	05/14/2011 04:03:13 05/14/2011 13:41:14	09:38:01	05/14/2011 14:54:25 05/14/2011 14:54:42	05/14/2011 14:54:42 05/14/2011 14:55:00
74	513162290	05/14/2011 04:03:13 05/14/2011 13:51:11	09:47:57	05/14/2011 14:55:00 05/14/2011 14:55:17	05/14/2011 14:55:17 05/14/2011 14:55:36
75	513162291	05/14/2011 04:03:13 05/14/2011 13:49:21	09:46:07	05/14/2011 14:55:36 05/14/2011 14:55:53	05/14/2011 14:55:53 05/14/2011 14:56:12
76	513162292	05/14/2011 04:03:13 05/14/2011 13:34:41	09:31:27	05/14/2011 14:56:12 05/14/2011 14:56:28	05/14/2011 14:56:28 05/14/2011 14:56:48
77	513162293	05/14/2011 04:03:14 05/14/2011 13:53:46	09:50:33	05/14/2011 14:56:48 05/14/2011 14:57:04	05/14/2011 14:57:04 05/14/2011 14:57:23
78	513162294	05/14/2011 04:03:14 05/14/2011 13:51:40	09:48:27	05/14/2011 14:57:23 05/14/2011 14:57:39	05/14/2011 14:57:39 05/14/2011 14:57:57
79	513162295	05/14/2011 04:03:14 05/14/2011 13:51:09	09:47:56	05/14/2011 14:57:57 05/14/2011 14:58:14	05/14/2011 14:58:14 05/14/2011 14:58:32
80	513162296	05/14/2011 04:03:14 05/14/2011 13:45:38	09:42:24	05/14/2011 14:58:32 05/14/2011 14:58:49	05/14/2011 14:58:49 05/14/2011 14:59:09
81	513162297	05/14/2011 04:03:14 05/14/2011 14:08:42	10:05:28	05/14/2011 14:59:09 05/14/2011 14:59:26	05/14/2011 14:59:26 05/14/2011 14:59:46
82	513162298	05/14/2011 04:03:14 05/14/2011 13:46:47	09:43:33	05/14/2011 14:59:46 05/14/2011 15:00:03	05/14/2011 15:00:03 05/14/2011 15:00:22
83	513162299	05/14/2011 04:03:14 05/14/2011 13:45:33	09:42:19	05/14/2011 15:00:22 05/14/2011 15:00:38	05/14/2011 15:00:38 05/14/2011 15:00:56
84	513162300	05/14/2011 04:03:14 05/14/2011 13:45:23	09:42:09	05/14/2011 15:00:56 05/14/2011 15:01:13	05/14/2011 15:01:13 05/14/2011 15:01:31
85	513162301	05/14/2011 04:03:14 05/14/2011 13:52:21	09:49:07	05/14/2011 15:01:31 05/14/2011 15:01:47	05/14/2011 15:01:47 05/14/2011 15:02:06
86	513162302	05/14/2011 04:03:14 05/14/2011 14:02:35	09:59:21	05/14/2011 15:02:06 05/14/2011 15:02:22	05/14/2011 15:02:22 05/14/2011 15:02:41
87	513162303	05/14/2011 04:03:14	10:05:14	05/14/2011 15:02:41	05/14/2011 15:02:57

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
		05/14/2011 14:08:28		05/14/2011 15:02:57	05/14/2011 15:03:17
88	513162304	05/14/2011 04:03:14	09:46:08	05/14/2011 15:03:17	05/14/2011 15:03:34
		05/14/2011 13:49:22		05/14/2011 15:03:34	05/14/2011 15:03:52
89	513162305	05/14/2011 04:03:14	09:47:57	05/14/2011 15:03:52	05/14/2011 15:04:09
		05/14/2011 13:51:11		05/14/2011 15:04:09	05/14/2011 15:04:27
90	513162306	05/14/2011 04:03:15	09:42:11	05/14/2011 15:04:27	05/14/2011 15:04:44
		05/14/2011 13:45:26		05/14/2011 15:04:44	05/14/2011 15:05:02
91	513162307	05/14/2011 04:03:15	09:39:48	05/14/2011 15:05:02	05/14/2011 15:05:19
		05/14/2011 13:43:03		05/14/2011 15:05:19	05/14/2011 15:05:39
92	513162308	05/14/2011 04:03:15	09:52:41	05/14/2011 15:05:39	05/14/2011 15:05:56
		05/14/2011 13:55:56		05/14/2011 15:05:56	05/14/2011 15:06:18
93	513162309	05/14/2011 04:03:15	09:38:01	05/14/2011 15:06:18	05/14/2011 15:06:34
		05/14/2011 13:41:16		05/14/2011 15:06:34	05/14/2011 15:06:53
94	513162310	05/14/2011 04:03:15	09:38:00	05/14/2011 15:06:53	05/14/2011 15:07:09
		05/14/2011 13:41:15		05/14/2011 15:07:09	05/14/2011 15:07:28
95	513162311	05/14/2011 04:03:15	09:41:39	05/14/2011 15:07:28	05/14/2011 15:07:45
		05/14/2011 13:44:54		05/14/2011 15:07:45	05/14/2011 15:08:05
96	513162312	05/14/2011 04:03:15	09:48:44	05/14/2011 15:08:05	05/14/2011 15:08:22
		05/14/2011 13:51:59		05/14/2011 15:08:22	05/14/2011 15:08:41
97	513162313	05/14/2011 04:03:15	09:42:18	05/14/2011 15:08:41	05/14/2011 15:08:57
		05/14/2011 13:45:33		05/14/2011 15:08:57	05/14/2011 15:09:16
98	513162314	05/14/2011 04:03:16	09:58:46	05/14/2011 15:09:16	05/14/2011 15:09:32
		05/14/2011 14:02:02		05/14/2011 15:09:32	05/14/2011 15:09:50
99	513162315	05/14/2011 04:03:16	09:45:52	05/14/2011 15:09:50	05/14/2011 15:10:07
		05/14/2011 13:49:08		05/14/2011 15:10:07	05/14/2011 15:10:25
100	513162316	05/14/2011 04:03:16	09:48:43	05/14/2011 15:10:25	05/14/2011 15:10:42
		05/14/2011 13:51:59		05/14/2011 15:10:42	05/14/2011 15:11:02
101	513162317	05/14/2011 04:03:16	09:58:44	05/14/2011 15:11:02	05/14/2011 15:11:18
		05/14/2011 14:02:00		05/14/2011 15:11:18	05/14/2011 15:11:37
102	513162318	05/14/2011 04:03:16	10:00:18	05/14/2011 15:11:37	05/14/2011 15:11:54
		05/14/2011 14:03:35		05/14/2011 15:11:54	05/14/2011 15:12:12
103	513162319	05/14/2011 04:03:16	10:00:32	05/14/2011 15:12:12	05/14/2011 15:12:29
		05/14/2011 14:03:48		05/14/2011 15:12:29	05/14/2011 15:12:49
104	513162320	05/14/2011 04:03:16	09:51:09	05/14/2011 15:12:49	05/14/2011 15:13:06
		05/14/2011 13:54:25		05/14/2011 15:13:06	05/14/2011 15:13:24
105	513162321	05/14/2011 04:03:16	09:53:56	05/14/2011 15:13:24	05/14/2011 15:13:41
		05/14/2011 13:57:12		05/14/2011 15:13:41	05/14/2011 15:13:59
106	513162322	05/14/2011 04:03:17	09:43:47	05/14/2011 15:14:00	05/14/2011 15:14:16
		05/14/2011 13:47:03		05/14/2011 15:14:16	05/14/2011 15:14:34
107	513162323	05/14/2011 04:03:17	10:03:05	05/14/2011 15:14:34	05/14/2011 15:14:51
		05/14/2011 14:06:22		05/14/2011 15:14:51	05/14/2011 15:15:09
108	513162324	05/14/2011 04:03:17	09:49:36	05/14/2011 15:15:09	05/14/2011 15:15:26
		05/14/2011 13:52:52		05/14/2011 15:15:26	05/14/2011 15:15:44
109	513162325	05/14/2011 04:03:17	09:40:30	05/14/2011 15:15:44	05/14/2011 15:16:01
		05/14/2011 13:43:47		05/14/2011 15:16:01	05/14/2011 15:16:19
110	513162326	05/14/2011 04:03:17	09:59:32	05/14/2011 15:16:19	05/14/2011 15:16:35
		05/14/2011 14:02:49		05/14/2011 15:16:35	05/14/2011 15:16:54
111	513162327	05/14/2011 04:03:18	09:59:33	05/14/2011 15:16:54	05/14/2011 15:17:10
		05/14/2011 14:02:51		05/14/2011 15:17:10	05/14/2011 15:17:28
112	513162328	05/14/2011 04:03:18	10:06:05	05/14/2011 15:17:28	05/14/2011 15:17:45
		05/14/2011 14:09:23		05/14/2011 15:17:45	05/14/2011 15:18:03

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
113	513162329	05/14/2011 04:03:19 05/14/2011 14:02:37	09:59:18	05/14/2011 15:18:03 05/14/2011 15:18:20	05/14/2011 15:18:20 05/14/2011 15:18:38
114	513162330	05/14/2011 04:03:19 05/14/2011 13:56:07	09:52:48	05/14/2011 15:18:38 05/14/2011 15:18:55	05/14/2011 15:18:55 05/14/2011 15:19:13
115	513162331	05/14/2011 04:03:19 05/14/2011 14:01:39	09:58:20	05/14/2011 15:19:13 05/14/2011 15:19:29	05/14/2011 15:19:29 05/14/2011 15:19:49
116	513162332	05/14/2011 04:03:19 05/14/2011 13:57:24	09:54:05	05/14/2011 15:19:49 05/14/2011 15:20:06	05/14/2011 15:20:06 05/14/2011 15:20:24
117	513162333	05/14/2011 04:03:20 05/14/2011 13:55:27	09:52:07	05/14/2011 15:20:24 05/14/2011 15:20:41	05/14/2011 15:20:41 05/14/2011 15:20:59
118	513162334	05/14/2011 04:03:20 05/14/2011 14:09:02	10:05:42	05/14/2011 15:20:59 05/14/2011 15:21:16	05/14/2011 15:21:16 05/14/2011 15:21:34
119	513162335	05/14/2011 04:03:20 05/14/2011 14:03:22	10:00:02	05/14/2011 15:21:34 05/14/2011 15:21:50	05/14/2011 15:21:51 05/14/2011 15:22:10
120	513162336	05/14/2011 04:03:21 05/14/2011 14:10:43	10:07:22	05/14/2011 15:22:10 05/14/2011 15:22:26	05/14/2011 15:22:26 05/14/2011 15:22:46
121	513162337	05/14/2011 04:03:21 05/14/2011 14:08:56	10:05:35	05/14/2011 15:22:46 05/14/2011 15:23:03	05/14/2011 15:23:03 05/14/2011 15:23:21
122	513162338	05/14/2011 04:03:21 05/14/2011 14:05:57	10:02:36	05/14/2011 15:23:21 05/14/2011 15:23:38	05/14/2011 15:23:38 05/14/2011 15:23:57
123	513162339	05/14/2011 04:03:21 05/14/2011 13:53:41	09:50:19	05/14/2011 15:23:57 05/14/2011 15:24:13	05/14/2011 15:24:13 05/14/2011 15:24:32
124	513162340	05/14/2011 04:03:23 05/14/2011 14:04:33	10:01:11	05/14/2011 15:24:32 05/14/2011 15:24:48	05/14/2011 15:24:48 05/14/2011 15:25:07
125	513162341	05/14/2011 04:03:24 05/14/2011 13:54:56	09:51:32	05/14/2011 15:25:07 05/14/2011 15:25:24	05/14/2011 15:25:24 05/14/2011 15:25:42
126	513162342	05/14/2011 04:03:25 05/14/2011 14:04:13	10:00:48	05/14/2011 15:25:42 05/14/2011 15:25:59	05/14/2011 15:25:59 05/14/2011 15:26:19
127	513162343	05/14/2011 04:03:25 05/14/2011 14:08:58	10:05:32	05/14/2011 15:26:19 05/14/2011 15:26:35	05/14/2011 15:26:35 05/14/2011 15:26:53
128	513162344	05/14/2011 04:03:26 05/14/2011 14:09:13	10:05:47	05/14/2011 15:26:53 05/14/2011 15:27:10	05/14/2011 15:27:10 05/14/2011 15:27:30

TPC-H Timing Intervals (in seconds):

Stream ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
0	139.7	4.4	6.5	7.0	35.2	5.1	31.7	20.0	97.2	19.9	10.9	17.2
1	1,332.8	1,734.2	3,923.4	1,042.4	2,271.6	2,303.9	1,520.5	992.2	1,123.2	856.8	1,683.6	1,206.7
2	737.6	2,282.5	987.4	884.5	1,063.7	10.9	1,047.9	1,137.1	2,377.8	1,539.5	1,240.8	1,442.7
3	2,239.3	1,056.2	1,196.9	2,740.6	4,224.6	2,156.3	1,606.0	52.0	1,407.5	1,031.1	1,060.4	1,223.4
4	1,195.9	1,118.5	1,329.1	958.5	100.6	2,550.4	1,139.4	1,413.3	1,186.2	1,575.0	1,489.0	2,295.8
5	1,641.8	1,283.2	1,354.9	2,749.9	772.5	2,249.1	1,752.9	963.8	1,246.7	1,222.5	1,642.2	1,114.9
6	1,385.1	916.4	4,136.8	956.3	1,461.7	1,673.3	2,351.9	1,637.9	2,491.4	156.9	1,207.5	1,958.5
7	1,343.4	1,895.8	1,271.4	1,446.8	1,466.6	1,088.6	741.3	3,732.1	1,570.0	906.7	961.2	1,394.1
8	4,310.2	1,165.5	1,120.2	1,413.1	1,821.2	1,705.1	1,192.0	1,512.0	2,456.6	928.2	1,054.0	2,345.6
9	1,026.4	2,703.2	1,592.2	1,196.2	1,246.0	2,219.6	822.4	428.0	1,252.7	1,060.3	1,167.6	1,066.8
10	2,013.2	2,354.3	1,702.8	1,039.9	1,095.5	396.2	2,277.2	1,364.8	1,049.3	1,082.4	1,141.9	1,672.8
11	1,158.5	1,044.1	1,712.1	1,405.5	1,527.5	1,024.4	1,180.4	1,234.3	864.5	1,673.4	2,375.1	1,154.0
12	811.7	1,629.7	1,069.3	1,095.6	1,021.0	2,313.3	3,939.4	1,028.3	1,150.0	912.2	1,437.0	2,369.7
13	2,209.4	1,432.9	2,280.5	1,011.4	1,692.3	1,518.1	2,592.1	938.5	968.0	1,475.8	1,209.7	2,390.8
14	1,501.3	659.3	1,069.2	2,223.4	2,581.6	977.8	1,403.0	890.7	3,940.5	1,130.0	991.7	1,444.3

Stream ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
15	836.7	1,053.9	1,051.6	1,300.6	1,183.4	958.5	1,438.6	2,205.9	3,950.7	2,216.0	1,453.2	2,550.5
16	1,079.5	1,790.6	3,639.5	1,484.1	2,312.9	2,524.3	1,279.8	897.2	1,232.8	1,441.1	1,024.6	1,024.6
17	935.3	2,119.4	719.8	953.8	2,723.7	1,331.8	1,244.0	1,470.9	1,616.9	1,033.1	2,247.7	1,035.1
18	1,558.4	1,416.8	997.9	3,896.0	2,249.1	2,346.4	1,027.4	2,324.9	864.5	1,650.0	1,520.8	883.7
19	1,056.0	2,527.6	1,705.3	732.1	1,782.5	827.9	1,008.5	1,048.4	1,048.2	1,201.2	1,120.6	3,937.3
20	1,096.8	1,031.8	743.4	1,780.4	1,380.8	1,305.0	1,025.6	1,106.5	919.3	1,096.4	1,139.4	1,527.6
21	1,415.7	1,074.4	1,347.9	2,194.0	1,063.7	1,069.2	753.5	1,005.7	1,094.5	1,192.6	1,446.5	2,248.2
22	970.5	2,183.1	1,016.2	2,489.5	900.4	856.7	1,665.1	1,039.9	1,230.5	1,501.5	2,239.5	1,113.3
23	1,232.3	1,448.2	1,323.3	993.3	1,673.6	1,436.0	981.6	2,315.1	2,825.3	814.7	2,340.1	1,914.8
24	707.2	1,778.4	3,809.1	1,096.2	955.8	2,326.8	882.0	1,238.4	1,527.4	2,551.8	1,297.5	1,045.5
25	4,239.9	2,273.4	977.1	1,106.7	1,032.9	1,290.5	1,885.3	1,736.5	1,065.6	1,619.6	1,225.8	1,556.4
26	821.9	3,687.7	924.2	1,440.0	2,284.2	1,726.7	962.0	1,041.3	1,036.6	1,165.3	1,781.7	1,147.4
27	1,701.1	1,903.5	1,021.2	2,328.2	960.1	2,082.8	1,045.1	2,078.2	1,668.3	1,136.3	952.2	1,401.3
28	2,549.1	1,004.0	1,054.4	1,700.3	928.5	1,096.5	1,119.0	1,181.6	1,315.4	1,055.5	1,006.4	2,358.7
29	2,598.3	776.8	1,447.9	1,027.0	2,034.6	1,556.8	1,296.7	3,723.1	3,052.8	1,096.2	1,209.9	2,084.0
30	1,354.7	1,108.9	1,981.5	1,263.7	2,117.3	1,176.3	1,152.7	985.9	1,225.4	1,617.4	1,051.5	815.3
31	2,286.1	1,121.9	2,066.3	1,725.5	1,166.7	1,049.8	1,534.4	947.5	3,628.3	883.5	2,313.8	1,105.0
32	1,134.1	988.9	913.8	2,044.6	1,158.3	1,370.1	1,731.8	2,804.9	1,634.1	949.7	718.9	3,713.9
33	1,001.1	2,778.5	1,119.4	1,148.3	2,280.4	998.5	1,381.8	781.6	1,238.9	1,549.9	2,056.3	1,837.0
34	1,501.7	999.4	1,919.6	1,944.3	1,134.1	1,955.5	1,378.8	1,117.3	1,425.8	1,634.1	2,759.9	936.8
35	961.4	1,448.6	880.0	1,705.3	2,280.0	1,109.0	967.4	1,924.9	1,008.4	2,326.8	1,138.7	1,622.5
36	1,225.1	1,043.6	1,134.0	1,907.3	1,944.4	1,391.8	2,794.2	1,152.6	1,467.1	965.9	975.0	1,326.3
37	969.7	1,143.9	936.4	1,058.2	2,883.7	2,110.5	1,377.4	1,571.1	2,347.9	1,225.7	1,610.7	1,159.7
38	1,797.4	1,469.2	1,210.5	2,779.2	3,633.0	2,247.8	1,600.8	1,065.3	1,069.1	972.9	1,895.8	1,056.9
39	1,007.1	1,027.7	1,351.3	1,505.5	1,432.4	1,862.6	3,629.6	999.8	707.2	1,042.4	1,149.4	1,049.5
40	1,949.7	1,767.2	2,131.0	2,327.3	1,317.3	953.3	1,039.9	1,056.5	1,415.5	1,119.6	1,605.1	1,186.9
41	907.6	3,621.4	1,653.8	1,336.8	1,106.4	1,774.6	1,262.6	1,928.7	3,084.9	976.0	1,466.6	1,103.7
42	1,294.0	1,701.6	3,437.3	1,052.9	1,887.8	2,059.2	1,595.1	819.9	1,132.0	1,067.4	1,937.9	1,108.8
43	938.1	1,839.8	1,159.3	950.9	1,537.2	1,373.5	1,330.6	979.1	2,279.9	1,990.8	1,344.3	1,330.2
44	1,963.2	727.4	1,159.4	2,736.6	3,637.8	1,901.4	1,845.0	1,510.2	1,571.0	1,225.8	1,080.8	1,670.0
45	880.4	1,433.9	1,322.8	1,041.1	1,499.7	1,717.3	974.1	1,448.6	1,229.2	1,298.2	1,151.7	2,452.6
46	1,336.3	1,475.2	1,342.8	2,706.5	859.8	1,936.2	2,061.7	977.6	1,592.3	1,207.8	1,520.3	1,389.3
47	1,405.2	939.7	3,579.5	1,128.0	1,473.2	1,927.7	2,194.8	1,605.1	2,310.2	1,555.8	922.7	1,415.5
48	1,048.2	1,711.2	1,306.5	1,995.3	1,294.9	984.3	775.1	3,180.5	1,295.1	841.1	1,153.4	1,075.0
49	3,792.9	1,036.5	1,212.2	1,613.1	1,905.2	1,426.9	1,010.8	1,878.6	2,208.7	860.1	1,002.0	1,992.4
50	721.4	2,744.2	1,867.8	1,346.2	1,263.1	2,041.5	908.9	1,774.4	1,037.4	1,191.5	910.2	1,220.2
51	1,878.4	2,052.4	1,586.8	1,092.0	1,074.9	1,741.7	2,014.5	1,279.9	1,213.6	1,151.7	1,092.9	1,987.4
52	1,129.1	1,229.7	1,298.7	1,660.4	1,369.4	1,114.0	1,106.7	976.5	718.2	1,985.2	1,907.9	1,577.6
53	2,167.5	1,389.3	1,213.6	1,157.6	1,330.5	1,891.1	3,381.9	1,117.0	984.6	986.8	1,601.1	2,159.1
54	1,857.5	1,451.0	2,027.8	984.0	1,733.6	1,643.0	2,714.2	971.9	1,084.4	1,880.5	1,117.1	2,130.3
55	1,903.2	2,023.2	1,205.7	1,938.2	2,473.3	1,075.2	1,578.4	781.2	3,421.7	976.4	1,243.8	1,366.9
56	960.0	1,024.4	1,108.8	1,332.7	1,020.1	1,083.9	1,680.5	2,043.0	3,403.7	2,152.2	1,878.3	1,953.6
57	2,434.8	1,706.6	3,200.3	1,379.8	2,124.3	2,438.1	1,183.5	810.7	1,586.6	1,030.1	1,448.3	1,006.7
58	961.3	2,038.8	2,143.2	953.8	2,444.1	1,321.6	1,134.1	1,458.3	1,787.6	1,089.8	1,917.3	1,045.4
59	1,381.6	1,643.1	1,031.6	3,315.0	2,081.3	2,063.3	1,106.4	1,999.2	717.6	1,586.8	1,863.1	1,004.5
60	995.8	2,105.0	1,756.0	2,154.7	1,874.8	707.2	1,002.0	1,130.2	1,169.2	918.1	1,124.7	3,366.5
61	1,346.3	1,206.2	771.0	1,874.8	1,159.7	1,288.5	1,023.1	1,069.1	884.5	1,434.4	972.9	1,395.5
62	1,522.3	1,135.7	1,285.8	2,105.8	1,433.9	1,173.8	776.6	957.3	1,064.2	979.1	1,546.6	2,056.6
63	1,140.4	1,997.8	1,195.8	1,919.5	1,411.4	951.3	1,272.5	785.2	1,264.3	1,867.0	2,139.3	1,508.5
64	1,427.0	2,248.5	1,305.8	1,276.6	1,021.3	1,183.4	1,148.4	2,360.6	2,797.0	770.0	1,278.7	2,208.0
65	745.0	1,469.2	3,309.4	915.2	908.9	2,042.9	2,253.8	1,144.9	1,680.2	2,498.1	1,206.2	1,624.1

Stream ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
66	3,714.1	1,499.4	1,433.0	1,046.5	1,072.3	1,137.5	1,977.0	1,345.2	1,951.3	2,035.2	1,423.9	1,368.6
67	884.5	3,266.3	754.6	1,553.1	2,008.6	1,262.6	1,112.1	1,271.8	1,201.4	980.7	1,729.7	1,235.2
68	1,306.7	1,783.4	1,488.8	1,480.3	1,075.3	2,405.9	1,337.8	2,042.2	2,339.7	974.1	1,240.4	1,213.8
69	2,475.9	1,104.8	1,332.0	1,473.5	886.8	969.5	1,202.4	1,221.4	1,320.1	2,298.9	1,140.3	2,078.0
70	2,579.2	780.7	1,419.4	1,479.3	1,375.2	2,042.7	1,328.6	3,276.4	2,771.3	2,344.5	1,155.1	1,797.1
71	1,598.2	1,601.9	1,706.6	1,181.8	1,975.1	1,121.9	2,414.6	1,097.6	1,380.0	1,984.2	1,027.4	909.4
72	2,274.5	2,380.4	1,949.7	1,548.7	1,279.8	1,229.3	2,391.2	1,577.7	3,551.6	1,041.2	1,295.1	1,178.4
73	1,473.7	1,116.2	1,153.4	2,016.1	1,416.6	1,195.0	1,298.5	2,496.5	1,272.1	1,220.1	750.2	3,247.0
74	1,520.4	2,490.5	1,416.4	1,151.9	2,258.9	1,220.9	2,127.2	843.5	1,504.0	1,195.0	2,020.1	1,352.9
75	2,890.5	1,468.0	1,980.7	1,791.6	1,324.3	2,391.3	1,271.4	1,242.2	1,271.7	1,466.6	2,340.3	972.5
76	1,095.0	1,301.2	914.2	1,415.4	2,433.9	1,089.5	1,136.9	1,800.4	1,326.3	1,460.7	1,005.4	1,329.6
77	1,675.2	1,204.9	1,217.9	1,915.9	1,845.1	1,174.8	2,454.9	1,043.2	2,639.3	1,327.4	1,070.1	1,286.3
78	1,288.3	1,203.0	940.3	1,488.7	2,503.2	1,460.6	1,195.0	1,392.0	2,454.8	1,322.9	2,105.1	1,146.8
79	2,316.3	1,061.5	1,480.6	2,503.2	3,158.3	2,410.5	1,409.8	1,121.1	1,578.0	1,057.5	1,723.9	1,482.7
80	1,441.8	1,248.9	2,596.8	1,546.6	1,962.2	1,743.4	3,229.3	953.5	757.2	979.1	1,119.0	1,172.8
81	2,326.8	844.9	2,337.8	1,294.1	1,034.5	1,136.4	1,173.7	1,689.2	1,467.1	1,042.6	2,388.9	1,750.5
82	841.1	3,233.6	1,310.4	1,488.3	1,173.8	1,713.5	1,267.0	1,906.8	2,434.6	1,229.6	1,294.9	1,446.5
83	1,218.2	1,288.8	3,046.4	1,254.4	1,886.3	2,135.9	2,037.4	833.3	976.5	1,395.2	1,735.0	1,434.4
84	951.7	1,342.5	1,189.1	1,195.8	1,423.0	2,615.4	1,376.6	1,159.6	2,624.9	2,089.7	1,267.0	1,139.0
85	2,482.0	809.1	1,536.1	2,378.7	3,235.8	1,925.1	2,056.0	2,683.9	1,655.4	1,405.5	1,387.1	1,315.8
86	1,083.9	1,578.4	1,208.8	1,114.3	2,763.0	1,298.2	1,036.8	1,355.8	1,285.1	1,069.8	1,194.1	2,616.8
87	1,973.9	852.2	1,207.4	2,290.9	942.7	1,989.2	1,863.3	975.5	2,200.8	1,084.8	1,330.7	1,077.6
88	1,420.0	934.0	3,024.2	1,062.4	1,272.5	1,703.5	1,751.4	2,005.0	2,425.1	2,940.7	1,151.0	1,235.5
89	1,166.2	1,511.7	1,081.4	2,375.0	1,032.4	936.5	842.9	2,862.4	1,186.0	850.0	1,297.1	1,568.2
90	3,388.5	1,034.5	1,421.4	1,240.4	1,754.6	1,162.2	1,308.6	2,027.5	2,629.4	809.4	1,246.7	1,432.5
91	797.7	2,299.3	2,123.3	1,429.8	1,273.3	2,516.1	883.0	3,006.9	1,074.0	1,424.7	1,117.6	1,267.8
92	2,100.7	1,304.8	1,143.3	1,244.0	1,681.9	3,019.2	2,541.2	1,319.6	1,676.2	1,412.4	924.9	1,837.2
93	1,061.8	1,272.7	1,304.0	1,429.8	1,115.2	1,162.8	1,120.4	1,166.4	737.5	1,829.0	1,498.5	1,468.8
94	3,461.0	1,210.3	1,190.3	1,299.8	1,468.1	1,326.9	3,065.5	1,106.2	1,117.6	1,227.0	1,385.8	2,519.2
95	1,542.2	1,069.4	2,057.8	1,429.6	1,241.1	1,300.3	2,118.6	985.5	1,143.9	2,100.7	1,425.1	2,542.7
96	2,386.3	3,352.2	1,270.7	1,995.4	1,974.9	1,514.5	1,275.0	857.6	3,084.8	906.6	1,394.2	1,228.9
97	951.1	1,174.8	1,361.8	1,310.3	1,434.4	1,111.9	1,415.1	1,987.8	3,095.3	2,402.9	2,024.8	1,516.5
98	3,786.1	1,500.7	3,089.3	1,195.3	1,888.5	2,024.7	1,137.7	878.6	1,415.1	1,201.2	1,402.4	895.8
99	883.0	2,348.5	3,409.6	1,267.8	2,073.5	1,222.3	1,411.7	1,106.6	2,303.0	1,118.0	1,990.5	1,468.8
100	1,064.0	1,434.8	1,117.3	3,062.4	1,980.8	1,296.7	1,246.0	2,541.4	843.1	1,215.2	2,100.7	1,064.5
101	1,982.8	1,294.1	1,032.7	3,422.4	1,500.7	842.5	1,560.2	1,137.1	1,561.1	1,233.6	970.5	3,422.2
102	1,630.9	1,314.1	893.9	1,687.2	1,018.9	1,091.5	1,141.1	1,967.0	1,012.7	1,698.4	1,037.6	1,434.3
103	1,891.7	1,898.8	991.6	2,264.0	1,698.6	1,422.4	934.8	1,024.7	1,065.7	1,393.1	1,036.8	2,103.4
104	1,109.2	1,955.1	1,158.3	1,287.4	1,571.4	1,028.4	1,094.3	858.4	1,213.0	2,322.0	2,313.3	1,490.4
105	1,558.5	2,315.8	1,133.4	1,146.0	998.5	1,057.8	1,666.4	2,323.1	2,350.7	809.9	1,329.9	1,597.0
106	767.0	1,261.4	2,996.4	1,079.9	951.3	1,299.4	3,564.0	1,412.5	1,420.9	2,228.6	1,227.1	1,195.8
107	3,408.9	1,294.6	1,133.3	1,053.0	1,357.8	1,132.4	1,915.5	1,097.8	2,211.8	2,307.7	1,426.2	1,366.0
108	920.5	2,929.0	807.2	1,423.1	1,969.7	1,236.6	1,116.8	1,267.8	1,467.9	1,078.2	1,506.7	1,325.2
109	1,282.7	1,499.0	1,440.7	1,313.3	1,115.2	2,255.2	1,458.4	2,012.6	2,356.0	974.0	1,242.5	1,322.2
110	2,156.8	1,122.1	1,389.8	1,147.2	891.8	1,043.2	1,483.7	1,384.1	1,054.6	3,609.6	1,978.2	2,054.7
111	2,676.4	946.9	1,662.2	1,923.2	1,096.0	2,214.0	1,102.3	2,980.7	2,497.2	3,651.3	1,459.2	1,664.1
112	1,817.9	1,753.7	1,460.7	1,123.3	1,999.6	964.4	3,714.9	1,299.9	1,446.5	2,335.5	1,211.1	985.0
113	2,267.3	3,661.0	1,733.0	1,540.7	1,331.1	1,357.7	2,270.2	1,726.8	3,142.0	986.0	1,293.0	1,193.4
114	1,724.2	1,601.5	1,466.1	1,854.5	1,595.4	866.2	1,120.6	2,103.2	923.0	1,158.3	825.0	3,160.5
115	2,007.3	2,042.8	1,417.0	1,309.9	2,268.9	1,255.5	2,343.2	869.2	1,389.3	1,207.2	1,936.4	1,204.7
116	4,169.2	1,675.2	1,765.8	1,565.0	1,423.0	2,267.0	1,173.6	1,250.2	1,421.3	1,111.0	2,192.7	881.8

Stream ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
117	1,077.0	1,327.7	886.9	1,050.0	2,266.5	965.9	1,359.8	1,554.1	1,628.1	1,286.9	1,609.1	1,184.0
118	1,793.4	1,233.0	1,296.3	1,787.4	1,535.0	864.8	2,155.4	1,056.8	3,923.4	1,114.6	1,098.4	1,647.4
119	1,232.8	1,338.9	1,008.6	1,535.8	2,020.4	1,184.3	1,120.8	1,223.9	2,518.5	1,475.3	2,250.6	1,204.2
120	2,679.9	1,049.4	1,559.3	2,210.0	3,061.0	2,353.4	1,093.7	1,208.4	1,744.7	1,159.9	1,566.6	2,115.4
121	1,776.0	1,744.3	3,937.9	1,417.5	2,317.6	1,460.8	3,032.0	994.6	1,076.2	1,113.4	1,068.8	1,747.2
122	2,215.9	748.8	2,480.0	1,000.4	1,072.6	1,117.2	1,245.4	1,739.7	1,235.8	1,037.6	2,207.8	1,396.4
123	986.8	2,948.0	1,031.1	1,553.6	1,176.5	1,600.0	1,249.9	1,353.3	2,418.0	1,255.1	1,069.8	1,616.3
124	971.7	829.7	2,729.0	1,911.5	1,733.1	2,248.3	2,308.3	909.9	1,187.9	1,669.8	1,550.6	1,478.8
125	869.8	981.2	1,189.4	1,281.5	1,037.4	3,953.0	1,578.3	1,443.5	2,550.6	2,250.8	1,212.3	1,067.5
126	2,630.2	876.4	1,922.6	2,155.4	2,974.1	1,777.9	2,360.2	3,993.0	1,237.5	1,550.8	1,700.3	1,175.7
127	1,311.2	1,473.4	1,018.8	1,133.8	3,992.0	961.2	1,107.7	1,181.7	1,770.3	742.2	1,335.0	2,404.2
128	2,051.6	754.5	874.0	2,275.2	919.1	1,739.4	1,630.0	1,044.0	2,191.6	969.3	1,128.6	1,134.6
Min	139.7	4.4	6.5	7	35.2	5.1	31.7	20	97.2	19.9	10.9	17.2
Avg	1,640.0	1,565.7	1,583.6	1,577.3	1,653.0	1,531.3	1,564.7	1,463.2	1,697.9	1,382.4	1,428.4	1,574.1
Max	4,310.2	3,687.7	4,136.8	3,896	4,224.6	3,953	3,939.4	3,993	3,950.7	3,651.3	2,759.9	3,937.3

Stream ID	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	RF1	RF2
0	60.3	4.9	6.1	9.2	32.9	128.3	41.6	10.1	128.8	16.0	17.4	18.4
1	1,577.8	880.6	1,128.0	1,476.4	1,400.5	2,712.7	1,113.0	2,270.5	387.8	1,054.6	61.2	19.2
2	1,440.5	2,965.0	1,309.1	2,061.3	3,559.9	1,279.7	2,107.0	1,265.0	1,331.6	1,486.9	23.4	18.8
3	1,116.8	1,199.1	1,566.4	1,047.1	1,836.0	2,239.1	1,144.5	1,584.6	809.8	1,361.6	18.7	19.4
4	1,012.7	2,723.3	1,694.5	1,078.6	1,605.0	997.4	2,308.6	1,097.6	4,175.8	1,078.1	18.0	18.3
5	1,209.9	956.3	3,929.8	1,587.2	1,267.4	2,442.1	2,370.2	1,237.4	409.5	1,535.9	16.9	18.5
6	2,266.2	1,159.4	2,776.2	748.1	1,251.4	1,075.9	1,278.2	1,265.9	1,119.5	1,438.6	17.3	18.4
7	1,324.2	1,017.3	1,325.9	1,170.3	2,389.0	646.7	1,308.0	2,680.0	2,635.3	2,310.1	16.6	18.5
8	984.9	946.5	2,530.4	1,071.0	2,311.3	1,326.3	355.1	1,567.3	1,011.6	876.6	16.4	17.9
9	3,908.2	906.5	1,426.2	1,250.9	1,725.0	1,148.5	1,457.0	2,288.0	2,363.7	1,560.5	16.6	18.3
10	1,149.0	1,559.3	3,951.5	854.8	2,297.0	2,691.7	1,071.2	920.4	1,450.0	985.9	17.2	21.7
11	1,142.7	3,890.1	446.0	2,232.9	2,300.6	2,699.1	1,362.9	1,636.6	827.6	1,087.8	17.0	18.1
12	942.8	1,349.5	1,072.6	2,554.4	2,351.3	1,706.9	1,273.8	1,702.1	835.6	1,563.6	16.5	18.4
13	1,149.7	836.3	1,380.7	1,106.4	3,763.3	1,043.2	1,160.1	918.8	702.1	2,320.4	17.2	19.7
14	1,577.1	878.7	2,554.4	1,000.4	1,249.8	1,829.2	1,877.4	2,229.7	1,113.1	1,006.9	16.6	21.2
15	803.4	1,848.5	1,411.5	685.2	2,543.7	1,193.5	1,535.9	1,124.0	1,186.2	1,448.6	16.5	21.0
16	1,100.0	2,301.8	1,692.3	1,544.3	1,032.6	1,085.0	1,229.8	1,160.0	1,002.0	2,412.6	16.7	21.1
17	717.6	1,514.8	2,344.7	3,913.8	1,608.9	1,009.5	1,285.6	1,158.0	2,086.1	1,186.0	17.4	18.6
18	2,476.0	716.6	1,114.6	1,215.1	1,241.0	1,016.2	1,020.3	1,118.1	2,000.8	1,323.0	16.5	19.3
19	870.3	2,223.2	1,509.6	2,259.8	1,492.4	967.6	1,424.5	1,060.2	1,622.4	2,558.6	16.7	20.9
20	2,365.5	2,516.6	3,920.8	754.9	1,285.1	2,302.2	2,492.7	1,710.0	1,016.8	1,543.8	16.8	18.6
21	929.7	3,864.3	1,804.5	1,382.9	1,582.6	1,666.9	2,647.7	779.5	2,537.2	1,028.5	16.6	18.1
22	2,527.8	3,851.8	1,114.6	801.3	1,299.8	1,406.0	1,650.7	1,037.4	1,869.6	1,214.5	17.4	18.4
23	1,151.9	2,032.4	3,625.8	1,486.0	1,116.4	1,188.4	1,055.2	1,114.7	1,096.3	1,009.9	16.7	18.2
24	1,821.1	2,263.2	1,077.0	1,027.4	1,210.1	2,302.4	1,324.7	1,026.2	1,720.1	1,475.0	17.2	18.4
25	2,745.3	2,098.4	1,020.7	1,972.1	821.7	881.8	1,107.7	967.0	1,571.0	1,427.6	16.6	21.3
26	1,020.8	2,441.4	1,178.3	1,059.7	1,386.0	1,046.6	1,584.7	2,203.4	1,501.9	2,563.0	16.7	18.2
27	1,150.0	893.3	1,629.7	895.6	3,868.0	812.4	1,080.9	1,341.2	2,855.4	1,487.5	16.7	18.4
28	1,861.4	1,140.2	1,549.9	1,513.5	915.8	1,390.7	1,113.8	2,352.0	2,268.4	3,699.7	16.6	18.6
29	1,293.0	951.7	899.3	1,208.1	1,409.1	1,902.1	1,219.2	1,077.3	1,235.8	1,362.8	16.6	18.3
30	2,267.7	1,311.9	1,203.1	1,439.6	3,678.7	2,093.9	1,419.4	1,241.2	1,341.7	2,829.4	16.3	18.2
31	864.5	1,362.1	1,130.0	1,015.7	1,722.8	1,566.2	1,176.4	1,439.8	2,820.9	1,110.0	16.3	20.4
32	1,590.4	1,130.1	1,188.7	2,268.1	2,194.3	1,124.3	1,440.9	1,085.6	933.0	2,034.4	16.4	18.2
33	907.6	2,319.8	1,230.9	3,630.3	1,991.1	1,246.6	1,136.4	962.3	1,413.1	1,276.7	16.5	18.2

Stream ID	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	RF1	RF2
34	3,633.9	2,080.3	1,052.4	995.1	1,319.8	1,483.7	1,352.8	751.1	1,956.6	1,045.0	16.1	18.8
35	1,150.0	1,224.0	1,288.2	1,399.7	3,678.9	818.4	1,126.4	1,981.9	1,083.9	2,859.7	16.4	21.0
36	1,588.5	770.4	934.8	1,079.0	3,605.2	2,276.6	1,168.5	1,687.6	2,106.0	1,573.8	16.5	18.3
37	1,313.7	3,564.4	1,042.4	784.8	1,725.3	1,010.3	1,992.9	999.3	1,360.1	1,979.2	16.4	17.9
38	1,235.8	1,953.1	1,206.3	2,094.4	986.3	1,288.5	839.9	1,338.1	1,712.2	1,051.8	17.0	18.4
39	1,756.1	2,806.5	1,964.1	1,236.5	1,135.2	1,016.9	1,533.5	2,125.0	2,624.8	1,323.0	16.8	18.3
40	1,351.1	1,614.5	3,551.1	961.8	2,899.6	723.7	1,118.1	1,045.1	1,193.6	1,958.4	17.0	18.3
41	942.1	1,363.4	740.4	1,392.2	1,995.1	2,088.5	1,316.4	2,050.1	1,090.6	1,189.9	16.4	18.4
42	1,363.7	938.4	1,208.8	1,601.9	1,031.9	2,735.3	1,196.5	2,349.2	1,712.9	1,053.3	16.9	18.3
43	1,450.7	2,713.4	1,083.1	1,991.4	3,696.1	717.6	2,124.2	1,166.0	1,041.3	1,217.4	16.4	18.3
44	1,099.0	1,012.2	1,377.6	1,075.1	2,088.3	2,089.4	1,252.0	1,763.5	955.6	1,070.2	16.9	18.7
45	1,232.6	2,779.5	2,010.4	1,385.2	2,029.9	763.1	2,106.7	998.4	3,483.5	1,176.3	16.4	18.5
46	1,203.1	1,033.6	3,348.6	2,017.4	1,333.0	1,802.5	2,349.2	1,221.2	1,840.8	1,011.8	17.4	18.4
47	1,902.2	975.9	2,733.8	726.9	1,382.6	1,111.0	1,314.4	1,110.8	1,268.2	1,693.2	16.6	21.3
48	1,477.9	1,106.4	1,262.6	1,275.2	1,937.4	2,011.4	1,319.3	2,729.2	2,297.3	2,283.7	16.5	18.4
49	1,220.1	1,040.6	2,428.0	1,353.2	2,019.9	1,279.8	1,728.5	1,386.3	1,092.0	799.7	17.0	18.2
50	3,372.5	1,107.8	1,341.7	1,014.9	2,072.6	1,148.7	1,770.1	1,928.1	2,009.1	1,508.2	16.3	18.6
51	1,007.8	1,376.8	3,417.6	719.0	2,003.9	2,723.8	1,203.7	963.2	1,600.4	1,178.1	16.6	18.3
52	1,029.8	3,367.5	1,790.1	2,163.0	2,006.1	2,725.4	1,422.3	1,886.0	908.9	1,186.7	16.4	18.2
53	942.3	1,290.6	1,085.0	2,462.3	2,089.5	1,777.0	1,464.4	1,474.8	697.0	1,975.4	16.6	18.4
54	1,124.8	742.3	1,360.2	951.4	3,151.5	1,136.9	1,109.7	988.6	2,127.0	1,987.0	16.5	18.4
55	1,376.8	1,134.2	2,087.1	1,115.5	1,032.5	1,998.1	1,766.2	2,034.6	1,151.7	944.9	16.9	18.2
56	953.8	1,817.8	1,415.5	2,048.4	2,579.3	1,057.1	1,327.7	746.0	913.8	1,782.6	16.8	20.8
57	1,215.1	2,217.0	1,260.6	2,004.7	1,171.1	963.3	1,461.3	1,167.8	1,567.9	1,901.7	16.6	18.0
58	710.3	1,647.5	2,119.1	3,330.7	1,676.6	962.8	1,146.8	1,154.0	2,019.0	1,189.9	16.4	18.2
59	2,461.5	2,141.2	984.6	1,049.3	1,100.4	1,274.8	1,213.6	1,177.8	1,874.7	1,303.2	16.7	18.3
60	955.8	1,999.5	1,860.4	1,966.6	1,712.5	946.9	1,434.9	1,068.8	1,397.0	2,478.1	16.6	18.3
61	2,028.1	2,429.6	3,368.1	2,172.3	1,415.2	2,087.0	2,048.6	1,327.5	1,235.8	1,961.7	16.6	18.3
62	1,057.7	3,352.0	1,870.8	1,188.1	1,991.4	1,293.1	2,056.4	2,183.8	2,413.3	1,278.6	16.5	18.3
63	2,582.3	3,326.4	1,017.9	2,221.3	1,181.6	1,650.4	1,362.8	1,264.5	1,762.6	945.7	16.8	19.9
64	1,152.3	1,862.2	3,404.6	1,208.3	1,527.8	2,182.7	964.9	990.7	1,291.5	1,224.7	16.4	18.0
65	1,838.7	1,976.1	1,361.9	1,615.7	1,313.0	2,009.3	1,094.5	1,149.3	1,879.6	1,472.3	16.6	19.2
66	2,450.3	2,395.8	1,415.1	1,804.4	929.7	2,220.3	1,238.0	892.4	1,420.8	1,158.3	16.6	18.4
67	2,367.0	1,830.2	980.4	1,125.2	1,368.1	1,440.5	1,556.2	2,244.4	1,981.2	2,553.7	16.5	18.9
68	1,153.4	2,233.3	1,195.1	886.1	3,380.1	763.2	1,061.3	1,297.4	2,451.1	1,377.2	16.9	18.2
69	1,705.4	979.1	1,333.8	1,559.3	800.2	1,984.4	1,327.1	1,868.0	2,208.3	3,363.7	16.6	19.2
70	1,251.6	1,007.1	951.7	1,066.4	1,523.9	1,969.1	1,327.5	1,063.4	1,195.8	1,476.1	16.6	18.3
71	2,208.8	1,107.1	1,415.2	1,050.5	3,304.6	1,854.2	1,555.4	1,235.9	1,201.0	2,520.8	16.6	19.1
72	816.4	1,188.5	1,027.4	1,156.5	1,113.7	1,120.9	1,597.1	1,308.2	2,824.2	1,621.0	16.7	21.1
73	1,973.3	1,050.3	2,453.2	2,260.8	1,932.0	1,091.8	1,423.0	1,217.0	903.7	1,720.2	17.1	18.3
74	904.8	1,662.7	2,486.0	3,238.2	1,810.5	1,046.2	1,350.7	1,098.1	1,298.4	1,280.0	16.5	19.0
75	3,180.0	1,483.7	1,040.8	1,249.2	1,081.8	1,296.0	1,413.4	767.2	2,017.6	1,226.7	16.8	18.8
76	1,147.2	2,501.2	1,263.1	2,118.1	3,311.8	757.3	1,139.2	1,982.0	1,271.7	2,487.5	16.5	19.6
77	2,055.7	786.5	914.2	1,400.4	3,289.6	1,493.3	1,661.4	1,168.3	2,381.6	1,426.5	16.4	18.4
78	2,553.2	3,185.6	1,153.5	791.5	1,384.7	1,095.0	1,828.9	1,597.3	1,212.1	2,004.2	16.6	18.0
79	1,281.5	1,972.6	1,190.6	1,499.4	886.1	1,212.9	941.7	2,580.4	1,235.1	1,171.9	16.8	18.1
80	1,260.6	2,448.7	1,940.6	1,199.8	1,302.3	1,068.5	1,554.7	1,854.4	2,242.4	1,321.9	16.6	19.8
81	2,596.5	1,204.9	3,142.0	996.7	2,621.1	894.1	2,048.5	1,348.2	1,417.1	1,572.8	16.7	20.7
82	1,187.2	2,606.4	775.1	1,309.1	2,041.2	2,175.6	1,242.9	1,963.2	1,066.0	1,306.3	16.8	18.4
83	1,064.9	902.7	1,444.2	1,297.7	1,137.2	2,435.2	1,375.2	1,882.3	2,901.6	1,256.5	16.3	17.9
84	1,241.1	2,378.7	1,117.1	1,971.5	3,304.2	768.4	1,840.3	1,071.8	1,362.3	1,499.0	16.6	18.1

Stream ID	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	RF1	RF2
85	1,057.5	1,154.2	1,106.6	1,201.2	1,820.1	1,493.2	1,377.6	1,270.8	884.3	1,110.7	16.5	18.4
86	1,158.0	2,186.1	1,693.9	1,486.0	2,108.2	827.6	2,116.9	1,985.1	3,468.3	1,326.5	16.7	18.2
87	1,423.0	1,107.4	3,005.8	2,375.3	1,394.6	1,275.6	2,363.2	1,136.3	3,116.0	1,327.4	16.8	19.0
88	1,886.3	1,205.5	2,418.0	757.5	1,335.9	1,379.4	1,171.8	1,184.8	1,472.8	1,431.0	17.1	18.4
89	1,560.2	1,186.2	1,212.3	1,383.6	1,389.9	3,340.6	1,617.0	2,231.2	2,330.6	2,315.6	16.8	18.5
90	1,288.3	1,135.5	1,974.9	1,383.3	2,041.0	1,305.8	3,068.7	1,237.1	1,168.9	871.8	16.4	18.1
91	3,098.4	1,172.8	1,069.3	1,142.7	1,840.4	1,093.4	1,579.8	1,985.2	1,296.9	1,296.3	16.9	20.1
92	1,073.9	1,105.3	3,069.8	822.7	2,000.3	2,301.1	1,502.9	902.6	1,420.9	1,156.4	16.5	22.1
93	979.4	3,002.3	3,081.4	2,432.4	1,983.0	2,306.3	1,421.1	2,021.3	884.5	1,402.1	16.6	18.2
94	885.9	1,267.0	1,114.9	2,090.1	2,013.9	1,596.9	1,170.7	1,321.5	762.0	2,079.9	16.4	18.8
95	1,033.2	768.3	1,283.2	1,291.3	3,112.1	1,164.5	1,241.8	1,300.7	3,396.6	1,350.1	16.5	20.6
96	1,083.8	1,374.3	1,294.2	1,152.3	1,360.5	1,820.0	1,401.2	2,305.5	1,421.3	869.7	16.6	19.1
97	1,195.8	1,696.5	1,152.5	3,377.7	2,069.9	1,254.2	1,161.5	785.1	1,093.8	1,364.4	16.3	18.2
98	1,325.7	2,266.9	1,134.6	2,375.1	1,221.3	1,051.3	1,481.0	1,326.7	1,951.3	1,376.7	16.5	18.3
99	769.3	1,163.7	1,367.9	3,065.5	1,357.3	1,265.9	1,535.4	1,235.6	1,687.2	1,100.7	16.6	18.0
100	2,107.2	3,388.9	906.5	1,537.4	1,177.8	1,255.0	1,587.8	1,477.5	1,687.2	1,231.1	16.8	19.7
101	850.0	1,838.4	2,404.5	2,311.6	1,413.8	1,350.1	1,385.5	1,247.1	1,057.8	2,105.4	16.7	18.5
102	1,953.4	2,052.2	3,089.9	3,443.5	1,556.8	2,515.9	1,440.4	771.9	1,139.4	2,127.4	16.8	18.2
103	1,180.1	3,086.0	1,542.9	1,099.6	2,496.1	738.8	1,446.0	3,463.7	2,076.3	1,177.1	16.6	20.3
104	2,209.8	3,069.0	1,024.4	3,484.5	1,633.0	1,401.5	1,362.7	1,196.8	1,532.7	1,153.7	16.5	18.4
105	1,324.8	1,887.3	3,075.6	1,084.7	1,649.2	3,462.4	1,153.2	1,052.2	1,412.8	1,246.6	17.0	18.2
106	1,521.1	1,952.9	1,464.4	1,332.3	1,272.9	2,274.2	1,158.6	1,137.2	2,349.0	1,160.0	16.5	18.2
107	2,106.4	2,245.8	1,560.0	1,562.8	904.5	3,483.6	1,262.5	1,024.3	1,104.9	1,225.7	16.7	18.2
108	3,652.4	1,322.2	1,073.9	1,540.0	1,312.9	1,381.9	1,177.6	2,291.6	2,363.4	2,211.2	16.4	18.1
109	1,081.2	3,574.6	1,047.9	920.2	3,058.0	734.4	1,218.2	1,315.7	2,137.0	1,471.4	16.6	18.2
110	1,463.9	1,289.1	1,201.1	1,320.7	892.1	2,353.6	1,524.8	1,333.5	2,274.5	3,002.9	16.5	18.2
111	824.9	1,043.2	971.5	1,046.9	1,139.6	1,783.8	1,399.7	1,214.1	1,088.6	1,587.3	16.5	18.2
112	2,274.3	1,181.0	1,440.2	721.7	2,977.2	1,288.3	1,859.6	1,347.2	1,003.3	2,159.5	16.4	18.3
113	861.4	1,056.0	1,054.1	1,162.4	1,029.1	1,052.4	1,604.3	1,254.4	2,395.1	1,986.7	16.4	18.3
114	2,468.6	1,024.4	3,720.1	2,258.1	1,397.3	1,189.5	1,356.3	1,186.7	1,052.8	1,516.0	16.6	18.1
115	886.7	1,266.8	3,773.5	3,099.2	1,594.9	1,057.5	1,367.3	1,172.2	1,193.5	1,237.1	16.5	20.0
116	2,803.4	1,265.8	1,125.4	1,288.6	1,163.1	1,202.1	1,414.1	845.8	2,293.7	1,347.0	16.4	18.3
117	1,285.8	3,767.7	1,252.9	2,292.0	3,113.7	831.0	1,364.4	1,858.6	1,409.0	2,155.5	16.8	18.1
118	2,246.0	881.4	1,016.2	1,686.9	3,048.2	1,272.9	2,006.2	993.4	2,305.3	1,379.1	16.5	18.1
119	3,923.0	2,948.0	1,320.9	841.0	1,109.3	1,131.6	1,625.8	1,954.3	1,106.2	1,927.5	16.5	19.4
120	1,099.9	1,710.6	1,228.2	1,028.3	1,294.3	1,119.6	990.9	3,947.6	774.8	1,446.8	16.4	19.8
121	922.9	2,057.5	1,838.9	1,504.7	1,213.6	1,116.0	1,267.9	1,323.8	2,274.3	1,128.7	16.7	18.3
122	3,937.6	1,111.8	2,940.9	990.6	2,124.7	928.0	2,041.3	1,437.6	1,577.2	1,568.6	16.2	18.9
123	1,407.5	3,946.7	827.6	1,079.1	2,209.9	2,239.1	979.7	1,716.4	1,207.5	1,547.4	16.8	18.3
124	1,051.9	988.0	1,676.8	1,062.5	1,278.9	2,187.5	1,299.4	1,317.4	4,277.9	1,402.0	16.5	18.2
125	997.4	2,171.9	1,176.9	1,781.7	3,036.1	822.4	1,692.0	1,071.1	1,793.2	1,534.4	16.9	18.7
126	1,026.2	1,420.8	1,053.3	1,326.9	1,575.3	962.0	1,292.4	843.2	985.8	1,208.3	16.6	19.6
127	981.1	2,281.5	1,460.9	1,429.5	2,315.6	907.6	1,946.4	1,972.5	3,273.6	1,332.1	16.5	18.2
128	1,577.1	1,109.0	2,749.6	2,212.3	1,406.8	961.3	2,677.3	1,159.1	4,306.8	1,476.6	16.3	20.3
Min	60.3	4.9	6.1	9.2	32.9	128.3	41.6	10.1	128.8	16	16.1	17.9
Avg	1,574.1	1,545.0	1,771.1	1,681.9	1,5,40.2	1,834.1	1,460.9	1,445.2	1,670.2	1,543.1	17.1	18.8
Max	3,937.6	3,946.7	3,951.5	3,913.8	3,868	3,483.6	3,068.7	3,947.6	4,306.8	3,699.7	61.2	22.1

INFO SIZING

TPC TRANSACTION PROCESSING PERFORMANCE COUNCIL CERTIFIED AUDITOR

Benchmark Sponsor: Brad Carlile
Dir. Strategic Applications Engineering (SAE)
Oracle
3295 NW 211th Terrace
Hillsboro OR 97124

May 26, 2011 (updated 9/12/11 – see Additional Audit Notes below)

I verified the TPC Benchmark™ H performance of the following configuration:

Platform: **SPARC Enterprise M8000 Server**

Database Manager: **Oracle Database 11g Release 2 Enterprise Edition with Partitioning**

Operating System: **Oracle Solaris 10 8/11**

The results were:

CPU (Speed)	Memory	Disks	**QphH@1,000GB**
SPARC Enterprise M8000 Server			
16 x SPARC64 VII+ (3.00GHz)	512GB	320 x 24GB FMODs 12 x 300GB 10Krpm (internal)	**209,533.6**

In my opinion, this performance result was produced in compliance with the TPC's requirements for the benchmark. The following verification items were given special attention:

- The database records were defined with the proper layout and size
- The database population was generated using DBGEN
- The database was properly scaled to 1,000GB and populated accordingly
- The compliance of the database auxiliary data structures was verified
- The database load time was correctly measured and reported
- The required ACID properties were verified and met

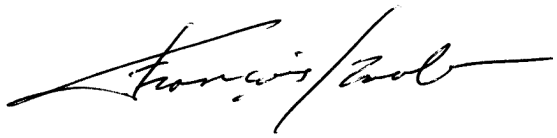
- The query input variables were generated by QGEN
- The query text was produced using minor modifications and one query variant
- The execution of the queries against the SF1 database produced compliant answers
- A compliant implementation specific layer was used to drive the tests
- The throughput tests involved 128 query streams
- The ratio between the longest and the shortest query was such that no query timings were adjusted
- The execution times for queries and refresh functions were correctly measured and reported
- The repeatability of the measured results was verified
- The system pricing was verified for major components and maintenance
- The major pages from the FDR were verified for accuracy

Additional Audit Notes:

The measured system included (4) 73GB disk drives and (8) 146GB disk drives that were substituted by (12) 300GB disk drives in the priced configuration. Based on the specifications of these disks and on performance data collected during testing, it is my opinion that this substitution has no significant effect on performance.

Update 9/12/2011: Since original publication of this result, the part number for a hardware component in the priced configuration changed. While the part number of the component changed, the hardware makeup of the component did not change. Therefore, it is my opinion that this substitution has no effect on performance.

Respectfully Yours,



François Raab
President

Table of Contents

TPC Benchmark H Overview

The TPC BenchmarkTM H (TPC-H) is a Decision Support benchmark. It is a suite of business-oriented ad-hoc queries and concurrent modifications. The queries and the data populating the database have been chosen to have broad industry-wide relevance while maintaining a sufficient degree of ease of implementation. This benchmark illustrates Decision Support systems that:

- Examine large volumes of data
- Execute queries with a high degree of complexity
- Give answers to critical business questions

TPC-H evaluates the performance of various Decision Support systems by the execution of sets of queries against a standard database under controlled conditions. The TPC-H queries:

- Give answers to real-world business questions
- Simulate generated ad-hoc queries
- Are far more complex than most OLTP transactions
- Include a rich breadth of operators and selectivity constraints
- Generate intensive activity on the part of the database server component of the system under test
- Are executed against a database complying to specific population and scaling requirements
- Are implemented with constraints derived from staying closely synchronized with an on-line production database

0 General Items

0.1 Benchmark Sponsor

A statement identifying the benchmark sponsor(s) and other participating companies must be provided.

Oracle Corporation is the sponsor of this TPC-H benchmark.

0.2 Parameter Settings

Settings must be provided for all customer-tunable parameters and options that have been changed from the defaults found in actual products, including but not limited to:

- *Database Tuning Options*
- *Optimizer/Query execution options*
- *Query processing tool/language configuration parameters*
- *Recovery/commit options*
- *Consistency/locking options*
- *Operating system and configuration parameters*
- *Configuration parameters and options for any other software component incorporated into the pricing structure*
- *Compiler optimization options*

The Supporting Files Archive contains the system and Oracle parameters used in this benchmark.

0.3 Configuration Diagram

Provide diagrams of both the measured and priced configurations, accompanied by a description of the differences.

Measured Configuration:

SPARC Enterprise M8000 Server, was configured with:

- 64 SPARC64 VII+ 3000 MHz processors
- 512 GB memory
- 1 Ethernet controller
- 4 73GB internal SAS disk drives
- 8 146GB internal SAS disk drives
- 16 6Gb SAS controllers
- 4 Sun Storage F5100 Flash Arrays, each containing 80 24GB FMODs

Priced Configuration:

SPARC Enterprise M8000 Server, was configured with:

- 64 SPARC64 VII+ 3000 MHz processors
- 512 GB memory
- 1 Ethernet controller
- 12 300GB internal SAS disk drives
- 16 6Gb SAS controllers
- 4 Sun Storage F5100 Flash Arrays, each containing 80 24GB FMODs
- Sun Fire X4170 M2 Server

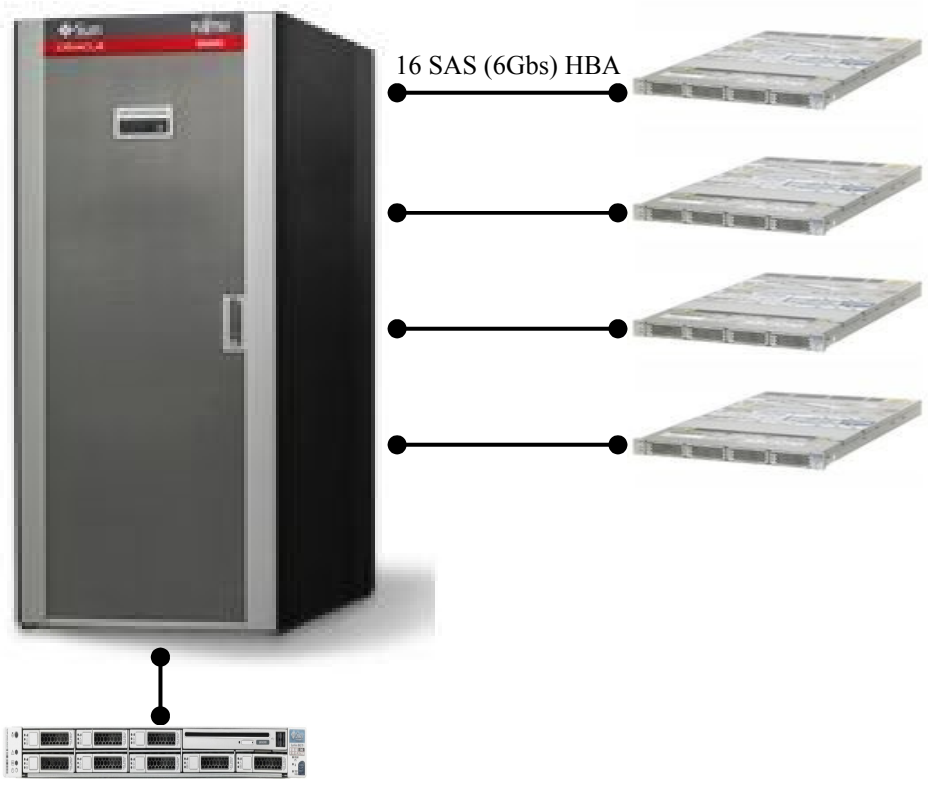
Differences in Configurations:

Priced Configuration includes 1 Sun Fire X4170 M2 Server as the system console and substitution of the 73GB and 146GB SAS disks with 300GB SAS disks. Product documentation along with additional measurements were used to demonstrate that the substitution of the 300G disks for the OS boot and swap files do not impact performance of the SPARC Enterprise M8000.

System Under Test

SPARC Enterprise M8000 Server
16 SPARC64 VII+ 3.0 GHz processor
512 GB Memory
12 300GB SAS Internal disks

4 Sun Storage F5100 Flash Array
Each F5100
- 80 24 GB Flash Modules
- 4 ports to host



1 Sun Fire X4170-M2 Server

1 Clause 1 - Logical Database Design

1.1 Database Definition Statements

Listings must be provided for all table definition statements and all other statements used to set up the test and qualification databases. All listings must be reported in the supporting files archive.

The Supporting Files Archive contains the programs and scripts that create and analyze the tables and indexes for the TPC-H database.

1.2 Physical Organization

The physical organization of tables and indices within the test and qualification databases must be disclosed. If the column ordering of any table is different from that specified in Clause 1.4, it must be noted. The physical organization of tables must be reported in the supporting files archive.

No record clustering or index clustering was used. Column ordering was changed for some tables. Refer to the table create statements in the Supporting Files Archive for further details.

1.3 Horizontal Partitioning

Horizontal partitioning of tables and rows in the test and qualification databases (see Clause 1.5.4) must be disclosed. Scripts to perform horizontal partitioning must be reported in the supporting files archive.

Horizontal partitioning was used for all tables except NATION and REGION. Refer to the table/index create statements in the Supporting Files Archive for more details.

1.4 Replication

Any replication of physical objects must be disclosed and must conform to the requirements of Clause 1.5.7. Scripts to perform any replication must be reported in the supporting files archive.

No replication was used.

1.5 Tunable Parameters

Script or text for all hardware and software tunable parameters must be reported in the supporting files archive.

All hardware and software parameters changed from their defaults are reported in the Supporting Files Archive.

2 Clause 2 - Queries and Refresh Functions

2.1 Query Language

The query language used to implement the queries must be identified.

SQL was the query language used to implement all queries.

2.2 QGen Version Verification

*The version number, release number, modification number, and patch level of **QGen** must be disclosed. Any modifications to the **QGen** (see Clause 2.1.4) source code (see Appendix D) must be reported in the supporting files archive.*

QGen from TPC-H Rev. 2.14.1 was used for this publication.

2.3 Query Text and Output Data from Qualification Database

The executable query text used for query validation must be disclosed along with the corresponding output data generated during the execution of the query text against the qualification database. If minor modifications (see Clause 2.2.3) have been applied to any functional query definitions or approved variants in order to obtain executable query text, these modifications must be disclosed and justified. The justification for a particular minor query modification can apply collectively to all queries for which it has been used. The output data for the power and throughput tests must be made available electronically upon request.

The Supporting Files Archive contains the executable query text and query output.

2.4 Query Substitution Parameters and Seeds Used

The query substitution parameters used for all performance tests must be disclosed in tabular format, along with the seeds used to generate these parameters.

The Supporting Files Archive contains the seed and query substitution parameters.

2.5 Query Isolation Level

The isolation level used to run the queries must be disclosed. If the isolation level does not map closely to the levels defined in Clause 3.4, additional descriptive detail must be provided.

The queries and transactions were run with isolation Level 3 (repeatable read).

2.6 Source Code of Refresh Functions

The details of how the refresh functions were implemented must be disclosed (including source code of any non-commercial program used).

The refresh functions are in Clause8/RF_source in the Supporting Files Archive.

3 Clause 3 - Database System Properties Related Items

3.1 ACID Properties

The results of the ACID tests must be disclosed along with a description of how the ACID requirements were met. All code (including queries, stored procedures etc.) used to test the ACID requirements and their entire output must be reported in the supporting files archive.

Tests conducted to demonstrate compliance for each of the ACID requirements is detailed in the following section. Source code for the ACID test is included in the Supporting Files Archive.

3.2 Atomicity

The system under test must guarantee that transactions are atomic; the system will either perform all individual operations on the data, or will assure that no partially-completed operations leave any effects on the data.

3.2.1 Completed Transaction

Perform the ACID Transaction for a randomly selected set of input data and verify that the appropriate rows have been changed in the ORDERS, LINEITEM, and HISTORY tables

1. The total price from the ORDERS table and the extended price from the LINEITEM table were retrieved for a randomly selected order key.
2. The ACID Transaction was performed using the order key from step 1.
3. The ACID Transaction committed.
4. The total price from the ORDERS table and the extended price from the LINEITEM table were retrieved for the same order key. It was verified that the appropriate rows had been changed.

3.2.2 Aborted Transaction

Perform the ACID Transaction for a randomly selected set of input data, substituting a ROLLBACK of the transaction for the COMMIT of the transaction. Verify that the appropriate rows have not been changed in the ORDERS, LINEITEM, and HISTORY tables.

1. The total price from the ORDERS table and the extended price from the LINEITEM table were retrieved for a randomly selected order key.
2. The ACID Transaction was performed using the order key from step 1. The transaction was stopped prior to the commit.
3. The ACID Transaction was ROLLED BACK.
4. The total price from the ORDERS table and the extended price from the LINEITEM table were retrieved for the same order key. It was verified that the appropriate rows had not been changed.

3.3 Consistency

Consistency is the property of the application that requires any execution of transactions to take the database from one consistent state to another.

3.3.1 Consistency Test

Verify that ORDERS and LINEITEM tables are initially consistent, submit the prescribed number of ACID Transactions with randomly selected input parameters, and re-verify the consistency of the ORDERS and LINEITEM.

1. The consistency of the ORDERS and LINEITEM tables was verified based on a sample of order keys.
2. 100 ACID Transactions were submitted by each of 129 execution streams.

3. The consistency of the ORDERS and LINEITEM tables was re-verified.

3.4 Isolation

Operations of concurrent transactions must yield results which are indistinguishable from the results which would be obtained by forcing each transaction to be serially executed to completion in the proper order.

3.4.1 Read-Write Conflict with Commit

Demonstrate isolation for the read-write conflict of a read-write transaction and a read-only transaction when the read-write transaction is committed.

1. An ACID Transaction was started for a randomly selected O_KEY, L_KEY, and DELTA. The ACID Transaction was suspended prior to COMMIT.
2. An ACID Query was started for the same O_KEY used in step 1. The ACID Query blocked and did not see the uncommitted changes made by the ACID Transaction.
3. The ACID Transaction was resumed and COMMITTED.
4. The ACID Query completed. It returned the data as committed by the ACID Transaction.

3.4.2 Read-Write Conflict with Rollback

Demonstrate isolation for the read-write conflict of a read-write transaction and a read-only transaction when the read-write transaction is rolled back.

1. An ACID Transaction was started for a randomly selected O_KEY, L_KEY, and DELTA. The ACID Transaction was suspended prior to ROLLBACK.
2. An ACID Query was started for the same O_KEY used in step 1. The ACID Query did not see the uncommitted changes made by the ACID Transaction.
3. The ACID Transaction was ROLLED BACK.
4. The ACID Query completed.

3.4.3 Write-Write Conflict with Commit

Demonstrate isolation for the write-write conflict of two update transactions when the first transaction is committed.

1. An ACID Transaction, T1, was started for a randomly selected O_KEY, L_KEY, and DELTA. T1 was suspended prior to COMMIT.
2. Another ACID Transaction, T2, was started using the same O_KEY and L_KEY and a randomly selected DELTA.
3. T2 waited.
4. T1 was allowed to COMMIT and T2 completed.
5. It was verified that T2.L_EXTENDEDPRICE = T1.L_EXTENDEDPRICE + (DELTA1*(T1.L_EXTENDEDPRICE/T1.L_QUANTITY))

3.4.4 Write-Write Conflict with Rollback

Demonstrate isolation for the write-write conflict of two update transactions when the first transaction is rolled back.

1. An ACID Transaction, T1, was started for a randomly selected O_KEY, L_KEY, and DELTA. T1 was suspended prior to ROLLBACK.
2. Another ACID Transaction, T2, was started using the same O_KEY and L_KEY and a randomly selected DELTA.
3. T2 waited.
4. T1 was allowed to ROLLBACK and T2 completed.
5. It was verified that T2.L_EXTENDEDPRICE = T1.L_EXTENDEDPRICE.

3.4.5 Concurrent Progress of Read and Write Transactions

Demonstrate the ability of read and write transactions affecting different database tables to make progress concurrently.

1. An ACID Transaction, T1, was started for a randomly selected O_KEY, L_KEY, and DELTA. T1 was suspended prior to ROLLBACK.
2. Another Transaction, T2, was started which did the following:

   For random values of PS_PARTKEY and PS_SUPPKEY, all columns of the PARTSUPP table for which PS_PARTKEY and PS_SUPPKEY are equal, are returned.
3. T2 completed.
4. T1 was allowed to COMMIT.
5. It was verified that appropriate rows in ORDERS, LINEITEM and HISTORY tables were changed.

3.4.6 Read-Only Query Conflict with Update Transaction

Demonstrate that the continuous submission of arbitrary (read-only) queries against one or more tables of the database does not indefinitely delay update transactions affecting those tables from making progress.

1. A Transaction, T1, executing Q1 against the qualification database, was started using a randomly selected DELTA.
2. An ACID Transaction T2, was started for a randomly selected O_KEY, L_KEY and DELTA.
3. T2 completed and appropriate rows in the ORDERS, LINEITEM and HISTORY tables had been changed.
4. Transaction T1 completed executing Q1.

3.5 Durability

The SUT must guarantee durability: the ability to preserve the effects of committed transactions and insure database consistency after recovery from any one of the failures listed in Clause 3.5.3.

3.5.1 Failure of a Durable Medium

Guarantee the database and committed updates are preserved across a permanent irrecoverable failure of any single durable medium containing TPC-H database tables or recovery log tables.

The FMODs containing the TPC-H tables, indexes and log files are mirrored across the F5100 arrays using Solaris Volume Manager (SVM).

The following steps were performed to induce a “disk” (FMOD) failure and an array controller failure.

1. The ORDERS and LINEITEM tables were verified to be consistent.
2. 129 streams of the ACID transactions were started.
3. After more than 100 transactions from each stream completed, the connection between the host and the controller in the array was disconnected to simulate a controller failure. That caused the failure to the FMODs associated with the controller.
4. Because SVM mirroring was used across the arrays the transactions continued without any interruption.
5. A sample from the durability success file was matched against the contents for the HISTORY table and it was verified that no committed transactions had been lost.
6. The ORDERS and LINEITEM tables were verified to be consistent.

3.5.2 System Crash / Memory Failure / Loss of External Power

System Crash: Guarantee the database and committed updates are preserved across an instantaneous

interruption (system crash/system hang) in processing which requires the system to reboot to recover.

Memory Failure: Guarantee the database and committed updates are preserved across failure of all or part of memory (loss of contents).

Loss of External Power: Guarantee the database and committed updates are preserved during the loss of all external power for an indefinite time period

Each of these requirements were satisfied in a single test. The following steps were performed.

1. The ORDERS and LINEITEM tables are verified to be consistent.
2. 129 streams of the ACID transactions are started
3. After more than 100 transactions from each stream has completed, the power breakers to the SUT are turned off thus halting processing immediately and indefinitely.
4. Power was restored to the SUT, the system was started, along with the database.
5. A sample from the durability success file was matched against the contents for the HISTORY table and it was verified that no committed transactions had been lost.
6. The ORDERS and LINEITEM tables were verified to be consistent.

4 Clause 4 - Scaling and Database Population

4.1 Ending Cardinality of Tables

The cardinality (i.e., the number of rows) of each table of the test database, as it existed at the completion of the database load (see clause 4.2.5) must be disclosed.

Table	Rows
Lineitem	5,999,989,709
Orders	1,500,000,000
Partsupp	800,000,000
Part	200,000,000
Customer	150,000,000
Supplier	10,000,000
Nation	25
Region	5

4.2 Distribution of Tables and Logs Across Media

The distribution of tables and logs across all media must be explicitly described.

The TPC-H tables, indexes, logs and temporary tables are distributed across the Sun Storage F5100 Flash Arrays. Each F5100 array has 80 24GB FMODs. Four FMODs from each array are formatted to have two slices, s0 and s6. These FMODs are then mirrored using Solaris Volume Manager and then s0 is used for the DMBS logs and s6 for Oracle control files. The remaining 76 FMODs from each array are formatted to have two slices, s0 and s1. Slice s0 is mirrored across the arrays using Solaris Volume Manager and the TPC-H tables and indexes are distributed across. Slice s1 is for the database temporary tables and a stripe across all FMOD s1 devices is created using Solaris Volume Manager. Please see the scripts to generate the disk groups in the Supporting Files Archive in Clause2/DB_creation_scripts.

4.3 Database partition/replication mapping

The mapping of database partitions/replications must be explicitly described.

The database was not replicated.

Horizontal partitioning was used for base tables LINEITEM, ORDERS, PARTSUPP, PART, SUPPLIER and CUSTOMER. The details for this partitioning can be understood by examining the syntax of the table and index definition statements in Supporting Files Archive.

4.4 Data redundancy mechanisms

Implementations may use data redundancy mechanism(s). The type of data redundancy mechanisms(s) and any configuration parameters, i.e., RAID level must be disclosed for each device.

Items	Storage Redundancy Levels
Base Tables	Level Three
Auxiliary Data Structures	Level Three
DBMS Temporary Space	Level Zero
OS and DBMS Software	Level One
Oracle Redo Logs	Level Three

4.5 Modifications to the DBGEN

*The version number, release number, modification number, and patch level of **DBGen** must be disclosed. Any modifications to the **DBGen** (see Clause 4.2.1) source code (see Appendix D) must be reported in the supporting files archive.*

DBGen from TPC-H Rev. 2.14.1 was used for this result.

4.6 Database Load Time

The database load time for the test database (see clause 4.3) must be disclosed.

The database load time was 1:27:12.

4.7 Data Storage Ratio

The data storage ratio must be disclosed. It is computed as the ratio between the total amount of priced disk space, and the chosen test database size as defined in Clause 4.1.3.

The data storage ratio is computed from the following information:

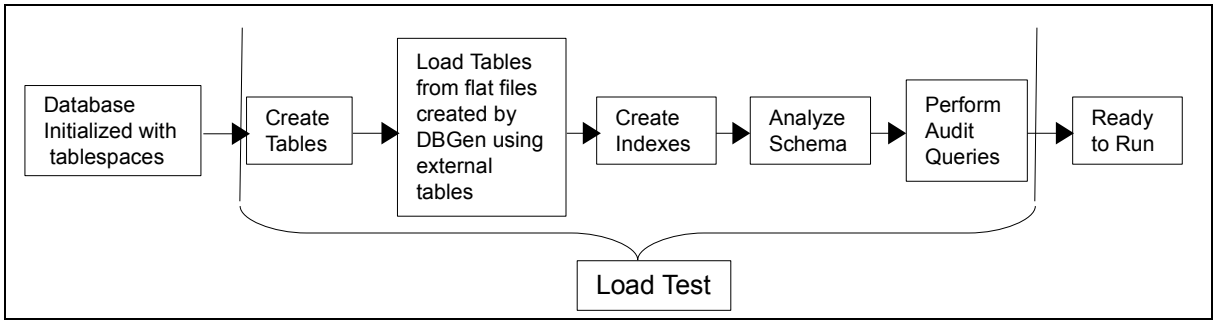
Disk Type	# Of Disks	Space Per Disk*	Sub-Total Disk Space**
F5100 FMOD	320	24GB	7,680 GB
Internal SAS	12	300GB	3,600 GB
		Total Space	**11,280**
		Data Storage Ratio	**11.2**

** Disk manufacturer definition of one GB is 10^9 bytes*
***In this calculation one GB is defined as 2^30 bytes*

4.8 Database Load Mechanism Details and Illustration

The details of the database load must be reported in the supporting files archive . Disclosure of the load procedure includes all steps, scripts, input and configuration files required to completely reproduce the test and qualification databases. A block diagram illustrating the overall process must be disclosed.

The database was loaded using data stored on flat files that are all on the tested and priced configurations. Oracle created external tables using the files that were created by the DBGEN program.



4.9 Qualification Database Configuration

Any differences between the configuration of the qualification database and the test database must be disclosed.

The qualification database used the same scripts to create and load the data with adjustments for the size difference between the test database and the qualification database.

4.10 Memory Ratio

The memory to database size ratio must be disclosed.

The memory to database size ratio is 51.2.

5 Clause 5 - Performance Metrics and Execution Rules

5.1 System Activity Between Load and Performance Tests

*Any system activity on the SUT that takes place between the conclusion of the load test and the beginning of the performance test must be fully reported in the **supporting files archive** including listings of scripts, command logs and system activity .*

There was no system activity on the SUT between the conclusion of the load and the beginning of the performance test.

5.2 Steps in the Power Test

*The details of the steps followed to implement the power test (.e.g., system boot, database restart, etc.) must be reported in the **supporting files archive**.*

The following steps were used to implement the power test:

1. RF1 Refresh Transaction
2. Stream 00 Execution
3. RF2 Refresh Transaction

5.3 Timing Intervals for Each Query and Refresh Functions

*The timing intervals (see Clause 5.3.7) for each query and for both refresh functions must be reported for the power test. The output for each query and for both refresh functions must be reported in the **supporting files archive**.*

The timing intervals for each query and for both refresh functions are contained in the Numerical Quantities section of the Executive Summary, located at the beginning of this document.

5.4 Number of Streams for the Throughput Test

The number of execution streams used for the throughput test must be disclosed.

128 streams were used for the throughput test.

5.5 Start and End Date/Times for Each Query Stream

*The start time and finish time for each query stream for the throughput test must be disclosed. The output for each query stream for the throughput test must be reported in the **supporting files archive**..*

The throughput test start time and finish time for each stream are contained in the Numerical Quantities section of the Executive Summary, located at the beginning of this document.

5.6 Total Elapsed Time of the Measurement Interval

The total elapsed time of the measurement interval (see Clause 5.3.6) must be reported for the throughput test.

The total elapsed time of the throughput test is contained in the Numerical Quantities section of Executive Summary, located at the beginning of this document.

5.7 Refresh Function Start Date/Time and Finish Date/Time

The start time and, finish time for each refresh function in the refresh stream for the throughput test must be

*disclosed. The output of each refresh function in the refresh stream for the throughput test must be reported in the **supporting files archive**. .*

The start and finish times for each refresh function in the refresh stream are contained in the Numerical Quantities section of the Executive Summary, located at the beginning of this document.

5.8 Performance Metrics

The computed performance metric, related numerical quantities and price performance metric must be reported.

The performance metrics, and the numbers on which they are based, are contained in the Numerical Quantities section of the Executive Summary, located at the beginning of this document.

5.9 The Performance Metric and Numerical Quantities from Both Runs

The performance metric and numerical quantities from both runs must be disclosed.

Performance results from the first two executions of the TPC-H benchmark indicated the following percent difference for the metric points:

Run ID	QppH@1000GB	QthH@1000GB	QphH@1000GB
Run 1	183,283.3	253,662.0	215,620.1
Run 2	177,845.9	246,867.2	209,533.6

5.10 System Activity Between Performance Tests

Any activity on the SUT that takes place between the conclusion of Run1 and the beginning of Run2 must be fully disclosed including system activity, listings of scripts or command logs along with any system reboots or database restarts.

There was no activity on the SUT between Run1 and Run 2.

5.11 Query Output validation

The output of the Query Output Validation Test must reported in the supporting files archive.

The Supporting Files Archive contains the documentation.

6 Clause 6 - SUT and Driver Implementation

6.1 Driver

A detailed textual description of how the driver performs its functions, how its various components interact and any product functionalities or environmental settings on which it relies and all related source code, scripts and configuration files must be reported in the supporting files archive. The information provided should be sufficient for an independent reconstruction of the driver .

The Power Test and Throughput Test are performed by executing a shell script called runTPCHpt. QGEN is first called with a stream id of 0 to generate the queries for the Power Test. Then script runTPCHpus is executed asynchronously to control the refresh functions RF1 and RF2. The script then continues to the query portion of the Power Test (qexecpl.c ISL), which waits until RF1 is completed. After the query portion of the power run has finished the refresh function RF2 is executed by the same refresh stream that previously executed refresh function RF1.

Following the Power Test, QGEN is again executed with the subsequent stream ids and seeds to generate new queries for each stream. Then qexecpl.c is called asynchronously to execute each streams concurrently. Then runTPCHus is executed to control the throughput test refresh function's pairs of RF1 and RF2.

Both wall-clock and high-resolution times are collected for all measurement intervals.

6.2 Implementation-Specific Layer

If an implementation specific layer is used, then a detailed description of how it performs its functions, how its var-ious components interact and any product functionalities or environmental setting on which it relies must be disclosed. All related source code, scripts and configuration files must be reported in the supporting files archive. The information provided should be sufficient for an independent reconstruction of the implementation specific layer .

Query execution text generated by QGEN is picked up by the ISL program which submits the query to the SUT.

The ISL program (qexecpl.c) utilizes the Oracle Call Interface (OCI) to communicate with the Oracle database on the SUT. EQTs directly generated by QGEN are read and submitted to the SUT via the ISL program (qexecpl.c) as dynamic SQL statements. The ISL program then fetches the query execution output and reports it to the user. Timings are taken at intervals specified in Section 5.3.7 of the TPC-H benchmark specification.

6.3 Profile-Directed Optimization

If profile-directed optimization as described in Clause 5.2.9 is used, such use must be disclosed. In particular, the procedure and any scripts used to perform the optimization must be reported in the supporting files archive .

Profile-directed optimization was not used.

7 Clause 7 - Pricing

7.1 Hardware and Software Used

A detailed list of hardware and software used in the Priced Configuration must be reported. The listing for each separately Orderable item must have vendor Part Number, description, and applicable release/revision level, price source, unit price, quantity, extended price, applicable Discounted price and 3-year maintenance price. If package-pricing is used, the vendor Part Number of the package and a description uniquely identifying each of the Components of the package must be disclosed to a sufficient level of detail to meet the requirements of 1.4.1.1.

The Executive Summary contains a list of the priced hardware and software, including maintenance for 3-years, and any applicable discounts.

7.2 Total Three-Year Price

The total 3-year price of the Priced Configuration must be reported, including: hardware, software, and maintenance charges. The justification of any Discounts applied must be disclosed in the price sheet. Sufficient detail of what items are being discounted and by how much they are being discounted must be provided so that the Discount amount used in the computation of the total system cost can be independently reproduced.

The Executive Summary contains the details for the total 3-year pricing of the configuration. Oracle's discounts are based upon US list prices and for similar quantities and configurations. A discount of 46.71% has been applied to all Oracle hardware, software and services based on the total value and quantities of the components of the configuration, including full payment of all components and maintenance.

For assistance with any of these prices or their applicability to any customer's requirements please contact:

Mary Beth Pierantoni mary.beth.pierantoni@oracle.com

7.3 Availability Date

The committed Availability Date of Components used in the price calculations must be reported. The Availability Date must be reported on the first page of the Executive Summary and with a precision of one day. When the priced system includes products with different availability dates, the reported Availability Date for the priced system must be a date at which all Components are committed to be Generally Available. Each Component used in the Priced Configuration is considered to be Available on the Availability Date unless an earlier date is specified.

All components of the Priced Configuration are available now, with the exception of SPARC Enterprise M8000 with SPARC64 VII+ which will be available by September 22, 2011.

7.4 Benchmark Performance Metric

A statement of the benchmark performance metric, as well as the respective calculations for 3-year pricing, price/performance, and the availability date must be included.

Performance Metric	*Price/Performance Metric*	*Total 3-year Cost*	*Availability Date*
209,533.6 QphH@1000GB	$9.53/QphH@1000GB	$1,995,715 USD	September 22, 2011

8 Supporting Files Index Table

An index for all files included in the supporting files archive as required by Clause 8.3.2 through 8.3.8 must be provided in the report.

Clause	Description	Archive File	Pathname
Clause 1	OS and DB parameter settings	benchmark_scripts.zip	SupportingFiles/Clause1/OS_DB_parameters
Clause 2	DB creation scripts	benchmark_scripts.zip	SupportingFiles/Clause2/DB_creation_scripts
Clause 3	ACID scripts	benchmark_scripts.zip	SupportingFiles/Clause3/ACID_scripts
	ACID output	benchmark_scripts.zip	SupportingFiles/Clause3/ACID_output
Clause 4	DB Load scripts	benchmark_scripts.zip	SupportingFiles/Clause4/DB_load_scripts
	Qualification output	benchmark_scripts.zip	SupportingFiles/Clause4/QUAL_output
Clause 5	Query output results	run1results.zip run2results.zip	
Clause 6	Implementation Specific layer source code	benchmark_scripts.zip	SupportingFiles/Clause6/Implementation_code
Clause 8	Query substitution parameters	benchmark_scripts.zip	SupportingFiles/Claues8/QueryParms
	RF function source	benchmark_scripts.zip	SupportingFiles/Clause8/RF_source

9 Auditor's Information and Attestation Letter

The auditor's agency name, address, phone number, and Attestation letter with a brief audit summary report indicating compliance must be included in the full disclosure report. A statement should be included specifying who to contact in order to obtain further information regarding the audit process.

The auditor's attestation letter is included at the front of this report, just after the Executive Summary.