TPC Benchmark™ H
Full Disclosure Report

SPARC T4-4 Server
Using
Oracle Database 11g Release 2 Enterprise Edition
with Partitioning

Submitted for Review
September 26, 2011

First Printing September 26, 2011

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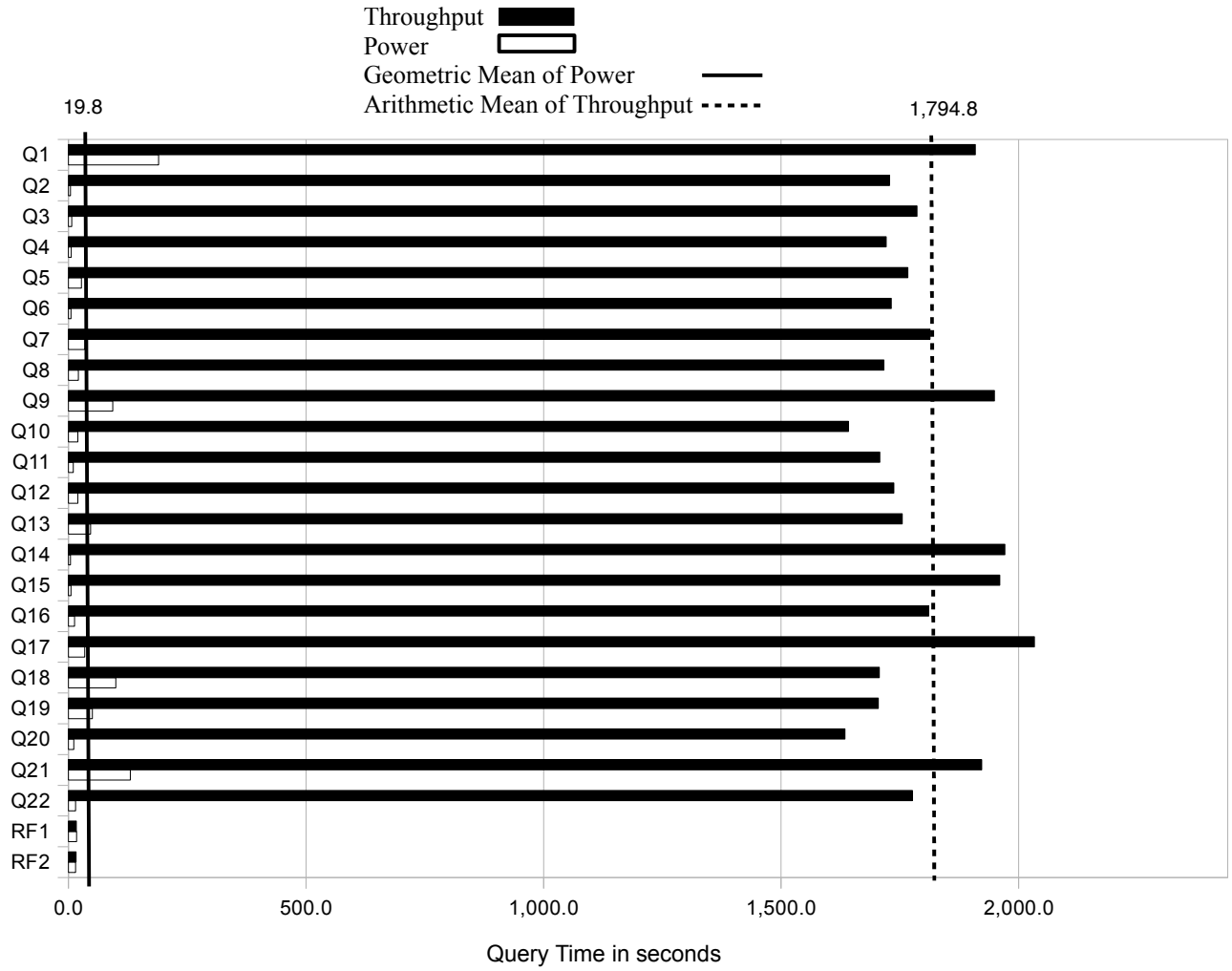
SPARC T4-4 Server with Oracle Database 11g Release 2

TPC-H Rev. 2.14.2
TPC-Pricing 1.6.0

Report Date:
September 26, 2011

Total System Cost	Composite Query per Hour Metric	Price / Performance
$925,525 USD	**201,487 QphH@1000GB**	**$4.60/QphH@1000GB**

Database Size	Database Manager	Operating System	Other Software	Availability Date
1000GB	Oracle Database 11g Release 2 Enterprise Edition with Partitioning	Oracle Solaris 10 8/11	None	October 30, 2011



Database Load Time = 1:22:39
Load Includes Backup: N
Total Data Storage / Database Size = 10.8
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 T4-4 Server
Processors:	4 SPARC T4 3GHz Processors, 32 cores, 256 threads
Memory:	512GB
Disks:	4 Sun Storage F5100 Flash Arrays w/ 80 24GB FMODs each 8 300GB 10K SAS Internal
Total Storage:	10,080GB (GB = 1024*1024*1024 bytes)

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Description	Part Number	Source	Unit Price	Qty	Ext. Price	3 Yr. Maint.
Server Hardware						
SPARC T4-4 Server, base chassis	7100674	1	19,000	1	19,000	
Power Jumper Cables, 2.5m x 1	SR-JUMP-1MC13	1	29	4	116	
300GB 10K RPM 2.5" SAS-2 HDD	SE6Y3G12Z	1	689	8	5,512	
2 x SPARC T4 3GHz	7100641	1	22000	2	44,000	
16GB (2 x 8GB) DDR3 Memory	7100653	1	1,360	32	43,520	
Sun Storage 6Gb SAS EM HBA: 6 port	SGX-SAS6-EM-Z	1	649	16	10,384	
Sun Fire X4170 M2 Server	X4170M2-H1-AA	1	2,375	1	2,375	
Oracle Solaris 10 Pre-Install	5894A-N	1	0	1	0	
US PC Peripheral Kit (Keyboard/Mouse)	3701A-PC	1	50	1	50	
4GB (1x4GB) DDR3-1333	4910A	1	151	2	302	
6 Gb/s SAS HBA, Internal ATO	SG-SAS6-INT-Z	1	419	1	419	
300GB 10K RPM 2.5" SAS-2 Disk	RB-SS2CF-300G10K2	1	689	1	689	
DVD+/-RW SATA-based drive ATO	8325A-N	1	134	1	134	
1 x Intel Xeon E5620 ATO	5924A	1	683	1	683	
X4170 CPU Heatsink, XATO	5879A-N	1	0	1	0	
17" TFT Monitor	X7204A-N	1	219	1	219	
Server Hardware Subtotal					**127,403**	**0**
Storage						
Sun Storage F5100 Flash Array (w/ 2 SAS cables)	TA-F5100-M2SA	1	19,995	4	79,980	
20 24GB SATA SLC flash modules	TA-24GBSTSF-20FM	1	33,750	16	540,000	
0.5M, mini, shielded, SAS cable	XTA-0.5M-SAS	1	95	8	760	
Sun Rack II 42U	XSR-1242E	1	2,849	1	2,849	
PDU 15kVA, Single Phase, LV	XSR-15K-L630-N	1	1,200	2	2,400	
Storage Subtotal					**625,989**	**0**
Server Software						
Oracle Solaris 10 8/11, Oracle Solaris Studio 12	SESY9SG1Z	1	0	1	0	
Software Support for Solaris Development Tools		1	1,200	3		3,600
Oracle Database 11g Release 2 Enterprise Edition, Per Processor for 3 years (for 16 processors)		1	23,750	16	380,000	
Partitioning, Per Processor for 3 years (for 16 processors)		1	5,750	16	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	90,460	3		271,224
			Total		**1,225,392**	**281,724**
Total Oracle Software, Hardware and Maintenance Discount		1			(581,591)	
Notes (Source):			**3 Yr. Cost**		**$925,525**	
1. Oracle Corp.			**QphH @1000GB**		**201,487**	
S. Substituted Component			**$/QphH @1000GB**		**$4.60**	

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 38.59% 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.

Numerical Quantities

Measurement Results:

Database Scale Factor	= 1000GB
Total Data Storage / Database Size	= 10.8
Start of database load time	= 07-28-2011 11:47:27
End of database load time	= 07-28-2011 13:10:06
Database Load Time	= 1:22:39
Query Streams for Throughput Test	= 128
TPC-H Power	= 181,760.6
TPC-H Throughput	= 223,354.2
TPC-H Composite Query-per-Hour Rating (QphH@1000GB)	= 201,487
Total System Price Over 3 Years	= $925,525
TPC-H Price/Performance Metric ($/QphH@1000GB)	= $4.60

Measurement Intervals:

Measurement Interval in Throughput Test (Ts)	= 45,388 seconds

Duration of Stream Execution:

Power Run	Seed	RF1 Start RF1 End	Query Start Query End	RF2 Start RF2 End	Duration
	0728131006	07/29/2011 02:01:57	07/29/2011 02:02:14	07/29/2011 02:16:19	00:14:37
		07/29/2011 02:02:14	07/29/2011 02:16:19	07/29/2011 02:16:34	

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
1	0728131007	07/29/2011 02:16:40	10:48:38	07/29/2011 13:43:27	07/29/2011 13:43:44
		07/29/2011 13:05:18		07/29/2011 13:43:44	07/29/2011 13:44:01
2	0728131008	07/29/2011 02:16:40	10:28:27	07/29/2011 13:44:01	07/29/2011 13:44:18
		07/29/2011 12:45:07		07/29/2011 13:44:18	07/29/2011 13:44:34
3	0728131009	07/29/2011 02:16:40	10:44:07	07/29/2011 13:44:34	07/29/2011 13:44:50
		07/29/2011 13:00:47		07/29/2011 13:44:50	07/29/2011 13:45:06
4	0728131010	07/29/2011 02:16:40	10:45:14	07/29/2011 13:45:06	07/29/2011 13:45:22
		07/29/2011 13:01:54		07/29/2011 13:45:22	07/29/2011 13:45:37
5	0728131011	07/29/2011 02:16:40	10:48:31	07/29/2011 13:45:37	07/29/2011 13:45:54
		07/29/2011 13:05:10		07/29/2011 13:45:54	07/29/2011 13:46:09
6	0728131012	07/29/2011 02:16:40	10:38:37	07/29/2011 13:46:09	07/29/2011 13:46:26
		07/29/2011 12:55:17		07/29/2011 13:46:26	07/29/2011 13:46:44
7	0728131013	07/29/2011 02:16:40	10:50:47	07/29/2011 13:46:44	07/29/2011 13:47:00
		07/29/2011 13:07:27		07/29/2011 13:47:00	07/29/2011 13:47:15
8	0728131014	07/29/2011 02:16:40	10:44:24	07/29/2011 13:47:15	07/29/2011 13:47:32
		07/29/2011 13:01:04		07/29/2011 13:47:32	07/29/2011 13:47:50
9	0728131015	07/29/2011 02:16:40	10:43:49	07/29/2011 13:47:50	07/29/2011 13:48:07
		07/29/2011 13:00:29		07/29/2011 13:48:07	07/29/2011 13:48:24
10	0728131016	07/29/2011 02:16:40	10:48:38	07/29/2011 13:48:24	07/29/2011 13:48:42
		07/29/2011 13:05:18		07/29/2011 13:48:42	07/29/2011 13:48:57
11	0728131017	07/29/2011 02:16:40	10:43:08	07/29/2011 13:48:57	07/29/2011 13:49:14

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
		07/29/2011 12:59:48		07/29/2011 13:49:14	07/29/2011 13:49:29
12	0728131018	07/29/2011 02:16:40	10:42:50	07/29/2011 13:49:29	07/29/2011 13:49:46
		07/29/2011 12:59:30		07/29/2011 13:49:46	07/29/2011 13:50:02
13	0728131019	07/29/2011 02:16:40	10:48:27	07/29/2011 13:50:02	07/29/2011 13:50:19
		07/29/2011 13:05:07		07/29/2011 13:50:19	07/29/2011 13:50:35
14	0728131020	07/29/2011 02:16:40	10:50:18	07/29/2011 13:50:35	07/29/2011 13:50:52
		07/29/2011 13:06:58		07/29/2011 13:50:52	07/29/2011 13:51:07
15	0728131021	07/29/2011 02:16:40	10:41:23	07/29/2011 13:51:07	07/29/2011 13:51:24
		07/29/2011 12:58:03		07/29/2011 13:51:24	07/29/2011 13:51:39
16	0728131022	07/29/2011 02:16:40	10:53:38	07/29/2011 13:51:39	07/29/2011 13:51:56
		07/29/2011 13:10:18		07/29/2011 13:51:56	07/29/2011 13:52:11
17	0728131023	07/29/2011 02:16:40	10:43:07	07/29/2011 13:52:11	07/29/2011 13:52:27
		07/29/2011 12:59:47		07/29/2011 13:52:27	07/29/2011 13:52:43
18	0728131024	07/29/2011 02:16:41	10:55:12	07/29/2011 13:52:43	07/29/2011 13:52:59
		07/29/2011 13:11:53		07/29/2011 13:52:59	07/29/2011 13:53:16
19	0728131025	07/29/2011 02:16:41	10:44:23	07/29/2011 13:53:16	07/29/2011 13:53:32
		07/29/2011 13:01:04		07/29/2011 13:53:32	07/29/2011 13:53:48
20	0728131026	07/29/2011 02:16:41	10:38:08	07/29/2011 13:53:48	07/29/2011 13:54:04
		07/29/2011 12:54:49		07/29/2011 13:54:04	07/29/2011 13:54:19
21	0728131027	07/29/2011 02:16:41	10:44:28	07/29/2011 13:54:19	07/29/2011 13:54:36
		07/29/2011 13:01:08		07/29/2011 13:54:36	07/29/2011 13:54:53
22	0728131028	07/29/2011 02:16:41	10:47:39	07/29/2011 13:54:53	07/29/2011 13:55:10
		07/29/2011 13:04:19		07/29/2011 13:55:10	07/29/2011 13:55:28
23	0728131029	07/29/2011 02:16:41	10:53:38	07/29/2011 13:55:28	07/29/2011 13:55:45
		07/29/2011 13:10:19		07/29/2011 13:55:45	07/29/2011 13:56:00
24	0728131030	07/29/2011 02:16:41	10:59:44	07/29/2011 13:56:00	07/29/2011 13:56:17
		07/29/2011 13:16:25		07/29/2011 13:56:17	07/29/2011 13:56:33
25	0728131031	07/29/2011 02:16:41	10:48:38	07/29/2011 13:56:33	07/29/2011 13:56:49
		07/29/2011 13:05:19		07/29/2011 13:56:49	07/29/2011 13:57:05
26	0728131032	07/29/2011 02:16:41	10:51:43	07/29/2011 13:57:05	07/29/2011 13:57:21
		07/29/2011 13:08:24		07/29/2011 13:57:21	07/29/2011 13:57:39
27	0728131033	07/29/2011 02:16:41	11:05:24	07/29/2011 13:57:39	07/29/2011 13:57:56
		07/29/2011 13:22:05		07/29/2011 13:57:56	07/29/2011 13:58:11
28	0728131034	07/29/2011 02:16:41	10:48:40	07/29/2011 13:58:11	07/29/2011 13:58:28
		07/29/2011 13:05:21		07/29/2011 13:58:28	07/29/2011 13:58:43
29	0728131035	07/29/2011 02:16:41	10:48:37	07/29/2011 13:58:43	07/29/2011 13:59:00
		07/29/2011 13:05:18		07/29/2011 13:59:00	07/29/2011 13:59:17
30	0728131036	07/29/2011 02:16:41	10:50:28	07/29/2011 13:59:17	07/29/2011 13:59:34
		07/29/2011 13:07:09		07/29/2011 13:59:34	07/29/2011 13:59:51
31	0728131037	07/29/2011 02:16:41	10:56:13	07/29/2011 13:59:51	07/29/2011 14:00:08
		07/29/2011 13:12:54		07/29/2011 14:00:08	07/29/2011 14:00:23
32	0728131038	07/29/2011 02:16:41	10:50:59	07/29/2011 14:00:23	07/29/2011 14:00:40
		07/29/2011 13:07:41		07/29/2011 14:00:40	07/29/2011 14:00:56
33	0728131039	07/29/2011 02:16:42	10:44:14	07/29/2011 14:00:56	07/29/2011 14:01:13
		07/29/2011 13:00:55		07/29/2011 14:01:13	07/29/2011 14:01:28
34	0728131040	07/29/2011 02:16:42	10:47:44	07/29/2011 14:01:28	07/29/2011 14:01:45
		07/29/2011 13:04:26		07/29/2011 14:01:45	07/29/2011 14:02:00
35	0728131041	07/29/2011 02:16:42	10:48:09	07/29/2011 14:02:00	07/29/2011 14:02:17
		07/29/2011 13:04:51		07/29/2011 14:02:17	07/29/2011 14:02:38
36	0728131042	07/29/2011 02:16:42	10:45:21	07/29/2011 14:02:38	07/29/2011 14:02:55
		07/29/2011 13:02:03		07/29/2011 14:02:55	07/29/2011 14:03:10

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
37	0728131043	07/29/2011 02:16:42 07/29/2011 13:00:57	10:44:15	07/29/2011 14:03:10 07/29/2011 14:03:26	07/29/2011 14:03:26 07/29/2011 14:03:42
38	0728131044	07/29/2011 02:16:42 07/29/2011 13:07:32	10:50:50	07/29/2011 14:03:42 07/29/2011 14:03:59	07/29/2011 14:03:59 07/29/2011 14:04:14
39	0728131045	07/29/2011 02:16:42 07/29/2011 13:00:47	10:44:05	07/29/2011 14:04:14 07/29/2011 14:04:30	07/29/2011 14:04:30 07/29/2011 14:04:48
40	0728131046	07/29/2011 02:16:42 07/29/2011 13:00:47	10:44:05	07/29/2011 14:04:48 07/29/2011 14:05:05	07/29/2011 14:05:05 07/29/2011 14:05:20
41	0728131047	07/29/2011 02:16:42 07/29/2011 13:06:59	10:50:17	07/29/2011 14:05:20 07/29/2011 14:05:36	07/29/2011 14:05:36 07/29/2011 14:05:52
42	0728131048	07/29/2011 02:16:42 07/29/2011 13:04:51	10:48:09	07/29/2011 14:05:52 07/29/2011 14:06:08	07/29/2011 14:06:08 07/29/2011 14:06:23
43	0728131049	07/29/2011 02:16:42 07/29/2011 13:08:23	10:51:41	07/29/2011 14:06:23 07/29/2011 14:06:40	07/29/2011 14:06:40 07/29/2011 14:06:55
44	0728131050	07/29/2011 02:16:42 07/29/2011 13:04:19	10:47:37	07/29/2011 14:06:55 07/29/2011 14:07:12	07/29/2011 14:07:12 07/29/2011 14:07:28
45	0728131051	07/29/2011 02:16:42 07/29/2011 13:05:19	10:48:37	07/29/2011 14:07:28 07/29/2011 14:07:45	07/29/2011 14:07:45 07/29/2011 14:08:00
46	0728131052	07/29/2011 02:16:42 07/29/2011 13:05:18	10:48:36	07/29/2011 14:08:00 07/29/2011 14:08:16	07/29/2011 14:08:16 07/29/2011 14:08:33
47	0728131053	07/29/2011 02:16:42 07/29/2011 13:07:03	10:50:21	07/29/2011 14:08:33 07/29/2011 14:08:49	07/29/2011 14:08:49 07/29/2011 14:09:04
48	0728131054	07/29/2011 02:16:43 07/29/2011 13:09:46	10:53:03	07/29/2011 14:09:04 07/29/2011 14:09:21	07/29/2011 14:09:21 07/29/2011 14:09:36
49	0728131055	07/29/2011 02:16:43 07/29/2011 13:08:23	10:51:40	07/29/2011 14:09:36 07/29/2011 14:09:52	07/29/2011 14:09:52 07/29/2011 14:10:07
50	0728131056	07/29/2011 02:16:43 07/29/2011 13:02:25	10:45:42	07/29/2011 14:10:08 07/29/2011 14:10:24	07/29/2011 14:10:24 07/29/2011 14:10:39
51	0728131057	07/29/2011 02:16:43 07/29/2011 13:02:24	10:45:41	07/29/2011 14:10:39 07/29/2011 14:10:56	07/29/2011 14:10:56 07/29/2011 14:11:11
52	0728131058	07/29/2011 02:16:43 07/29/2011 13:07:56	10:51:13	07/29/2011 14:11:11 07/29/2011 14:11:28	07/29/2011 14:11:28 07/29/2011 14:11:43
53	0728131059	07/29/2011 02:16:43 07/29/2011 13:08:23	10:51:40	07/29/2011 14:11:43 07/29/2011 14:12:00	07/29/2011 14:12:00 07/29/2011 14:12:17
54	0728131060	07/29/2011 02:16:43 07/29/2011 13:08:01	10:51:18	07/29/2011 14:12:17 07/29/2011 14:12:34	07/29/2011 14:12:34 07/29/2011 14:12:49
55	0728131061	07/29/2011 02:16:43 07/29/2011 13:07:33	10:50:50	07/29/2011 14:12:49 07/29/2011 14:13:06	07/29/2011 14:13:06 07/29/2011 14:13:21
56	0728131062	07/29/2011 02:16:43 07/29/2011 13:01:03	10:44:20	07/29/2011 14:13:21 07/29/2011 14:13:38	07/29/2011 14:13:38 07/29/2011 14:13:55
57	0728131063	07/29/2011 02:16:43 07/29/2011 13:16:57	11:00:14	07/29/2011 14:13:55 07/29/2011 14:14:12	07/29/2011 14:14:12 07/29/2011 14:14:27
58	0728131064	07/29/2011 02:16:43 07/29/2011 13:06:54	10:50:11	07/29/2011 14:14:27 07/29/2011 14:14:44	07/29/2011 14:14:44 07/29/2011 14:14:59
59	0728131065	07/29/2011 02:16:43 07/29/2011 13:10:34	10:53:51	07/29/2011 14:14:59 07/29/2011 14:15:16	07/29/2011 14:15:16 07/29/2011 14:15:31
60	0728131066	07/29/2011 02:16:43 07/29/2011 13:06:54	10:50:11	07/29/2011 14:15:31 07/29/2011 14:15:48	07/29/2011 14:15:48 07/29/2011 14:16:03
61	0728131067	07/29/2011 02:16:43 07/29/2011 13:18:11	11:01:28	07/29/2011 14:16:03 07/29/2011 14:16:20	07/29/2011 14:16:20 07/29/2011 14:16:38
62	0728131068	07/29/2011 02:16:43	10:58:36	07/29/2011 14:16:38	07/29/2011 14:16:55

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
		07/29/2011 13:15:20		07/29/2011 14:16:54	07/29/2011 14:17:11
63	0728131069	07/29/2011 02:16:44	10:58:03	07/29/2011 14:17:11	07/29/2011 14:17:28
		07/29/2011 13:14:47		07/29/2011 14:17:28	07/29/2011 14:17:43
64	0728131070	07/29/2011 02:16:44	10:55:54	07/29/2011 14:17:43	07/29/2011 14:18:00
		07/29/2011 13:12:38		07/29/2011 14:18:00	07/29/2011 14:18:15
65	0728131071	07/29/2011 02:16:44	11:03:10	07/29/2011 14:18:15	07/29/2011 14:18:32
		07/29/2011 13:19:54		07/29/2011 14:18:32	07/29/2011 14:18:47
66	0728131072	07/29/2011 02:16:44	11:00:10	07/29/2011 14:18:47	07/29/2011 14:19:04
		07/29/2011 13:16:53		07/29/2011 14:19:04	07/29/2011 14:19:19
67	0728131073	07/29/2011 02:16:44	10:51:13	07/29/2011 14:19:19	07/29/2011 14:19:36
		07/29/2011 13:07:57		07/29/2011 14:19:36	07/29/2011 14:19:51
68	0728131074	07/29/2011 02:16:44	10:58:32	07/29/2011 14:19:51	07/29/2011 14:20:08
		07/29/2011 13:15:16		07/29/2011 14:20:08	07/29/2011 14:20:28
69	0728131075	07/29/2011 02:16:44	11:04:11	07/29/2011 14:20:28	07/29/2011 14:20:45
		07/29/2011 13:20:55		07/29/2011 14:20:45	07/29/2011 14:21:00
70	0728131076	07/29/2011 02:16:45	11:00:13	07/29/2011 14:21:00	07/29/2011 14:21:17
		07/29/2011 13:16:58		07/29/2011 14:21:17	07/29/2011 14:21:32
71	0728131077	07/29/2011 02:16:45	11:04:28	07/29/2011 14:21:32	07/29/2011 14:21:49
		07/29/2011 13:21:13		07/29/2011 14:21:49	07/29/2011 14:22:04
72	0728131078	07/29/2011 02:16:45	10:50:50	07/29/2011 14:22:04	07/29/2011 14:22:21
		07/29/2011 13:07:35		07/29/2011 14:22:21	07/29/2011 14:22:36
73	0728131079	07/29/2011 02:16:45	10:50:47	07/29/2011 14:22:36	07/29/2011 14:22:53
		07/29/2011 13:07:32		07/29/2011 14:22:53	07/29/2011 14:23:08
74	0728131080	07/29/2011 02:16:45	11:05:17	07/29/2011 14:23:08	07/29/2011 14:23:25
		07/29/2011 13:22:03		07/29/2011 14:23:25	07/29/2011 14:23:42
75	0728131081	07/29/2011 02:16:46	11:06:09	07/29/2011 14:23:42	07/29/2011 14:23:59
		07/29/2011 13:22:55		07/29/2011 14:23:59	07/29/2011 14:24:14
76	0728131082	07/29/2011 02:16:46	10:50:48	07/29/2011 14:24:14	07/29/2011 14:24:31
		07/29/2011 13:07:33		07/29/2011 14:24:31	07/29/2011 14:24:50
77	0728131083	07/29/2011 02:16:46	11:09:03	07/29/2011 14:24:50	07/29/2011 14:25:07
		07/29/2011 13:25:49		07/29/2011 14:25:07	07/29/2011 14:25:22
78	0728131084	07/29/2011 02:16:46	10:54:18	07/29/2011 14:25:23	07/29/2011 14:25:39
		07/29/2011 13:11:04		07/29/2011 14:25:39	07/29/2011 14:25:55
79	0728131085	07/29/2011 02:16:46	11:05:50	07/29/2011 14:25:55	07/29/2011 14:26:12
		07/29/2011 13:22:36		07/29/2011 14:26:12	07/29/2011 14:26:27
80	0728131086	07/29/2011 02:16:46	10:59:46	07/29/2011 14:26:27	07/29/2011 14:26:44
		07/29/2011 13:16:32		07/29/2011 14:26:44	07/29/2011 14:26:59
81	0728131087	07/29/2011 02:16:46	11:02:18	07/29/2011 14:26:59	07/29/2011 14:27:16
		07/29/2011 13:19:05		07/29/2011 14:27:15	07/29/2011 14:27:31
82	0728131088	07/29/2011 02:16:46	10:59:56	07/29/2011 14:27:31	07/29/2011 14:27:48
		07/29/2011 13:16:42		07/29/2011 14:27:48	07/29/2011 14:28:03
83	0728131089	07/29/2011 02:16:46	11:06:54	07/29/2011 14:28:03	07/29/2011 14:28:19
		07/29/2011 13:23:41		07/29/2011 14:28:19	07/29/2011 14:28:35
84	0728131090	07/29/2011 02:16:46	11:05:16	07/29/2011 14:28:35	07/29/2011 14:28:51
		07/29/2011 13:22:03		07/29/2011 14:28:51	07/29/2011 14:29:09
85	0728131091	07/29/2011 02:16:47	11:15:17	07/29/2011 14:29:09	07/29/2011 14:29:25
		07/29/2011 13:32:03		07/29/2011 14:29:25	07/29/2011 14:29:40
86	0728131092	07/29/2011 02:16:47	10:54:07	07/29/2011 14:29:40	07/29/2011 14:29:57
		07/29/2011 13:10:54		07/29/2011 14:29:57	07/29/2011 14:30:13
87	0728131093	07/29/2011 02:16:47	10:58:55	07/29/2011 14:30:13	07/29/2011 14:30:30
		07/29/2011 13:15:42		07/29/2011 14:30:30	07/29/2011 14:30:45

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
88	0728131094	07/29/2011 02:16:47 07/29/2011 13:31:55	11:15:08	07/29/2011 14:30:46 07/29/2011 14:31:02	07/29/2011 14:31:02 07/29/2011 14:31:19
89	0728131095	07/29/2011 02:16:47 07/29/2011 13:15:14	10:58:27	07/29/2011 14:31:19 07/29/2011 14:31:36	07/29/2011 14:31:36 07/29/2011 14:31:56
90	0728131096	07/29/2011 02:16:47 07/29/2011 13:18:36	11:01:49	07/29/2011 14:31:56 07/29/2011 14:32:13	07/29/2011 14:32:13 07/29/2011 14:32:28
91	0728131097	07/29/2011 02:16:47 07/29/2011 13:15:51	10:59:04	07/29/2011 14:32:28 07/29/2011 14:32:45	07/29/2011 14:32:45 07/29/2011 14:33:00
92	0728131098	07/29/2011 02:16:47 07/29/2011 13:35:59	11:19:12	07/29/2011 14:33:00 07/29/2011 14:33:17	07/29/2011 14:33:17 07/29/2011 14:33:32
93	0728131099	07/29/2011 02:16:47 07/29/2011 13:15:54	10:59:06	07/29/2011 14:33:32 07/29/2011 14:33:49	07/29/2011 14:33:49 07/29/2011 14:34:05
94	0728131100	07/29/2011 02:16:47 07/29/2011 13:22:53	11:06:06	07/29/2011 14:34:05 07/29/2011 14:34:22	07/29/2011 14:34:22 07/29/2011 14:34:39
95	0728131101	07/29/2011 02:16:48 07/29/2011 13:10:50	10:54:02	07/29/2011 14:34:39 07/29/2011 14:34:55	07/29/2011 14:34:55 07/29/2011 14:35:13
96	0728131102	07/29/2011 02:16:48 07/29/2011 13:31:53	11:15:06	07/29/2011 14:35:13 07/29/2011 14:35:30	07/29/2011 14:35:30 07/29/2011 14:35:49
97	0728131103	07/29/2011 02:16:48 07/29/2011 13:23:23	11:06:35	07/29/2011 14:35:49 07/29/2011 14:36:06	07/29/2011 14:36:06 07/29/2011 14:36:24
98	0728131104	07/29/2011 02:16:48 07/29/2011 13:43:27	11:26:39	07/29/2011 14:36:24 07/29/2011 14:36:40	07/29/2011 14:36:40 07/29/2011 14:36:55
99	0728131105	07/29/2011 02:16:48 07/29/2011 13:36:00	11:19:12	07/29/2011 14:36:56 07/29/2011 14:37:12	07/29/2011 14:37:12 07/29/2011 14:37:28
100	0728131106	07/29/2011 02:16:48 07/29/2011 13:30:19	11:13:31	07/29/2011 14:37:28 07/29/2011 14:37:44	07/29/2011 14:37:44 07/29/2011 14:38:02
101	0728131107	07/29/2011 02:16:48 07/29/2011 13:33:11	11:16:23	07/29/2011 14:38:02 07/29/2011 14:38:19	07/29/2011 14:38:19 07/29/2011 14:38:34
102	0728131108	07/29/2011 02:16:49 07/29/2011 13:25:08	11:08:19	07/29/2011 14:38:34 07/29/2011 14:38:50	07/29/2011 14:38:50 07/29/2011 14:39:05
103	0728131109	07/29/2011 02:16:49 07/29/2011 13:24:03	11:07:14	07/29/2011 14:39:05 07/29/2011 14:39:22	07/29/2011 14:39:22 07/29/2011 14:39:37
104	0728131110	07/29/2011 02:16:49 07/29/2011 13:33:30	11:16:40	07/29/2011 14:39:37 07/29/2011 14:39:54	07/29/2011 14:39:54 07/29/2011 14:40:09
105	0728131111	07/29/2011 02:16:50 07/29/2011 13:31:46	11:14:57	07/29/2011 14:40:09 07/29/2011 14:40:25	07/29/2011 14:40:25 07/29/2011 14:40:41
106	0728131112	07/29/2011 02:16:51 07/29/2011 13:36:40	11:19:49	07/29/2011 14:40:41 07/29/2011 14:40:57	07/29/2011 14:40:57 07/29/2011 14:41:12
107	0728131113	07/29/2011 02:16:51 07/29/2011 13:41:16	11:24:25	07/29/2011 14:41:12 07/29/2011 14:41:29	07/29/2011 14:41:29 07/29/2011 14:41:45
108	0728131114	07/29/2011 02:16:52 07/29/2011 13:26:28	11:09:36	07/29/2011 14:41:45 07/29/2011 14:42:01	07/29/2011 14:42:01 07/29/2011 14:42:19
109	0728131115	07/29/2011 02:16:52 07/29/2011 13:15:54	10:59:01	07/29/2011 14:42:19 07/29/2011 14:42:35	07/29/2011 14:42:35 07/29/2011 14:42:51
110	0728131116	07/29/2011 02:16:52 07/29/2011 13:22:22	11:05:29	07/29/2011 14:42:51 07/29/2011 14:43:07	07/29/2011 14:43:07 07/29/2011 14:43:23
111	0728131117	07/29/2011 02:16:53 07/29/2011 13:25:28	11:08:35	07/29/2011 14:43:23 07/29/2011 14:43:40	07/29/2011 14:43:40 07/29/2011 14:43:55
112	0728131118	07/29/2011 02:16:54 07/29/2011 13:25:13	11:08:19	07/29/2011 14:43:55 07/29/2011 14:44:12	07/29/2011 14:44:12 07/29/2011 14:44:27
113	0728131119	07/29/2011 02:16:55	11:04:19	07/29/2011 14:44:27	07/29/2011 14:44:44

Throughput Stream	Seed	Query Start Query End	Duration	RF1 Start RF1 End	RF2 Start RF2 End
		07/29/2011 13:21:14		07/29/2011 14:44:44	07/29/2011 14:44:58
114	0728131120	07/29/2011 02:16:55	11:06:05	07/29/2011 14:44:59	07/29/2011 14:45:15
		07/29/2011 13:23:00		07/29/2011 14:45:15	07/29/2011 14:45:30
115	0728131121	07/29/2011 02:16:55	11:25:13	07/29/2011 14:45:30	07/29/2011 14:45:47
		07/29/2011 13:42:08		07/29/2011 14:45:47	07/29/2011 14:46:02
116	0728131122	07/29/2011 02:16:55	11:15:38	07/29/2011 14:46:02	07/29/2011 14:46:19
		07/29/2011 13:32:33		07/29/2011 14:46:18	07/29/2011 14:46:34
117	0728131123	07/29/2011 02:16:55	11:00:34	07/29/2011 14:46:34	07/29/2011 14:46:51
		07/29/2011 13:17:29		07/29/2011 14:46:51	07/29/2011 14:47:06
118	0728131124	07/29/2011 02:16:56	11:19:13	07/29/2011 14:47:06	07/29/2011 14:47:23
		07/29/2011 13:36:09		07/29/2011 14:47:23	07/29/2011 14:47:39
119	0728131125	07/29/2011 02:16:57	11:05:42	07/29/2011 14:47:39	07/29/2011 14:47:56
		07/29/2011 13:22:40		07/29/2011 14:47:56	07/29/2011 14:48:11
120	0728131126	07/29/2011 02:16:58	11:23:34	07/29/2011 14:48:11	07/29/2011 14:48:27
		07/29/2011 13:40:31		07/29/2011 14:48:27	07/29/2011 14:48:44
121	0728131127	07/29/2011 02:16:59	11:05:08	07/29/2011 14:48:44	07/29/2011 14:49:00
		07/29/2011 13:22:07		07/29/2011 14:49:00	07/29/2011 14:49:15
122	0728131128	07/29/2011 02:16:59	11:10:32	07/29/2011 14:49:15	07/29/2011 14:49:32
		07/29/2011 13:27:32		07/29/2011 14:49:32	07/29/2011 14:49:47
123	0728131129	07/29/2011 02:17:00	11:06:57	07/29/2011 14:49:47	07/29/2011 14:50:04
		07/29/2011 13:23:57		07/29/2011 14:50:04	07/29/2011 14:50:19
124	0728131130	07/29/2011 02:17:01	11:08:28	07/29/2011 14:50:19	07/29/2011 14:50:35
		07/29/2011 13:25:29		07/29/2011 14:50:35	07/29/2011 14:50:50
125	0728131131	07/29/2011 02:17:02	11:20:31	07/29/2011 14:50:50	07/29/2011 14:51:07
		07/29/2011 13:37:33		07/29/2011 14:51:07	07/29/2011 14:51:26
126	0728131132	07/29/2011 02:17:03	11:15:53	07/29/2011 14:51:26	07/29/2011 14:51:43
		07/29/2011 13:32:55		07/29/2011 14:51:43	07/29/2011 14:52:02
127	0728131133	07/29/2011 02:17:04	11:07:17	07/29/2011 14:52:02	07/29/2011 14:52:19
		07/29/2011 13:24:21		07/29/2011 14:52:19	07/29/2011 14:52:36
128	0728131134	07/29/2011 02:17:05	11:12:39	07/29/2011 14:52:36	07/29/2011 14:52:52
		07/29/2011 13:29:44		07/29/2011 14:52:52	07/29/2011 14:53:07

TPC-H Timing Intervals (in seconds):

Stream ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
0	189.5	4.4	6.8	5.7	27.1	5.1	34.3	20.7	93.4	19.8	10.1	19.7
1	1,475.0	1,228.2	4,069.5	1,245.3	1,991.5	2,641.7	1,629.5	1,184.6	1,534.9	930.7	1,865.7	1,936.2
2	980.4	2,391.4	1,329.8	1,391.3	1,805.9	5.9	1,954.6	1,590.5	2,387.6	1,957.0	1,173.4	1,687.9
3	2,686.6	1,066.2	1,302.9	2,872.6	4,337.6	1,905.4	1,707.2	113.4	2,046.2	1,255.9	1,174.7	1,373.9
4	1,241.6	1,070.4	1,330.7	976.9	60.0	2,746.3	1,430.8	2,084.6	2,071.9	1,270.2	2,161.1	2,458.4
5	922.1	1,195.4	2,400.2	2,801.7	1,177.3	1,988.7	1,921.8	1,284.8	1,516.0	1,370.3	2,202.7	1,313.9
6	1,329.5	1,151.0	4,294.4	1,139.8	1,162.7	1,878.9	2,649.2	1,703.3	2,816.3	171.9	1,872.2	2,340.2
7	1,350.3	1,660.8	1,974.4	2,014.2	1,213.5	1,297.6	980.4	4,069.6	2,235.1	1,391.3	1,813.6	1,368.3
8	4,561.2	1,315.4	1,592.9	1,937.6	1,958.1	1,233.6	1,794.3	1,749.6	2,673.9	1,335.8	1,283.9	2,610.7
9	1,063.5	2,829.0	1,625.5	1,134.8	1,307.6	2,635.0	1,324.7	469.7	1,517.4	1,343.9	1,826.7	1,340.3
10	2,103.6	2,716.2	1,274.8	1,021.4	1,260.3	423.6	2,467.4	1,576.8	1,143.3	1,424.9	1,385.4	1,926.1
11	954.8	1,196.7	1,200.8	2,007.5	2,352.9	1,231.7	1,382.2	1,871.7	1,283.8	1,819.3	2,878.8	1,144.2
12	943.3	2,165.6	1,227.1	1,593.0	1,067.7	2,812.3	4,035.8	1,023.0	2,109.3	1,149.1	1,995.7	2,442.4
13	2,392.1	2,229.1	2,072.4	1,034.2	1,206.4	1,896.5	2,710.3	1,384.5	1,453.7	1,658.5	1,439.7	2,699.6
14	1,668.7	561.0	1,180.7	2,077.0	2,613.3	1,200.1	2,155.3	1,158.3	4,279.8	1,324.4	1,244.3	1,502.6
15	1,162.0	1,252.4	1,301.0	1,442.5	1,144.2	969.3	2,106.0	2,122.3	4,279.8	2,421.5	2,050.5	2,760.5

Stream ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
16	1,157.4	1,778.1	3,854.5	1,986.1	2,198.1	2,487.9	1,626.3	1,170.9	1,708.3	2,249.2	1,041.1	1,439.1
17	1,279.0	2,328.8	818.8	1,209.0	2,578.3	1,305.9	1,345.3	2,338.2	1,987.9	995.7	2,117.5	1,352.2
18	2,275.0	2,076.0	977.2	4,041.9	2,023.4	2,773.4	1,266.7	2,427.2	1,384.9	1,212.2	1,787.9	1,405.8
19	1,260.7	2,808.7	1,168.8	831.4	1,657.2	1,122.7	1,051.9	1,011.1	1,544.5	1,806.3	1,264.2	4,149.1
20	1,808.1	1,228.5	1,035.3	1,800.0	2,310.6	1,181.8	1,044.5	1,391.0	1,370.8	1,139.2	1,382.9	2,007.5
21	1,767.6	1,265.3	1,329.3	2,519.7	1,073.7	1,081.8	1,164.9	1,336.8	1,573.8	1,806.4	2,149.2	2,055.1
22	1,203.5	1,962.2	1,209.0	2,601.6	1,041.4	1,278.7	1,320.7	1,191.1	1,688.2	1,603.9	2,657.6	1,391.9
23	1,939.7	1,656.9	1,593.6	1,137.0	1,255.1	2,116.7	1,252.5	2,470.8	2,848.3	1,016.6	2,725.6	2,012.3
24	1,559.9	1,220.2	3,970.8	1,828.3	1,383.1	2,627.6	1,026.0	1,394.2	2,106.1	2,487.8	1,524.2	1,313.8
25	4,542.5	2,501.1	1,179.9	1,297.8	1,811.7	1,370.3	1,771.7	1,264.8	1,524.6	1,619.4	1,589.1	1,187.5
26	1,738.3	3,841.5	1,143.9	2,030.7	2,182.8	1,195.3	945.6	1,253.8	1,557.0	1,826.7	1,679.9	1,220.8
27	1,750.2	2,029.2	1,059.7	2,509.1	1,298.7	2,450.3	1,563.4	1,941.3	1,919.4	1,530.3	1,092.7	1,190.4
28	2,432.9	973.6	1,139.2	1,297.9	1,252.6	1,294.0	1,285.0	1,248.4	1,618.5	1,189.2	1,288.6	2,211.3
29	2,917.3	1,113.1	1,029.8	1,245.3	2,526.7	1,887.4	1,428.1	3,930.2	2,536.6	1,202.9	1,748.2	1,774.1
30	2,265.5	1,131.0	2,042.9	1,552.2	1,824.1	1,149.1	1,568.0	1,410.1	1,168.7	1,673.2	1,339.9	1,134.7
31	2,603.1	1,162.1	1,783.1	2,042.1	1,750.3	1,058.0	1,677.1	1,214.4	4,102.4	1,434.2	2,505.6	1,235.7
32	1,071.2	1,137.2	1,772.3	1,841.7	1,592.5	2,144.3	1,937.6	2,629.0	1,534.7	1,185.8	1,044.6	4,081.8
33	1,270.9	2,426.3	1,510.0	1,938.5	2,440.8	1,149.1	1,814.4	1,197.2	930.7	2,306.3	2,207.4	1,293.2
34	1,729.2	1,271.7	1,797.7	2,048.3	1,053.1	2,545.5	2,277.5	1,223.5	1,476.8	1,165.9	2,583.1	1,356.8
35	949.3	2,163.3	1,251.5	1,270.5	2,397.0	1,359.8	1,202.8	1,940.7	1,037.8	2,810.7	1,258.9	2,384.7
36	1,572.3	1,213.3	1,945.4	1,753.0	2,017.4	2,167.8	2,586.5	1,330.2	1,426.4	1,178.2	978.1	1,329.7
37	1,178.2	1,175.9	1,270.1	1,071.0	2,466.8	2,499.1	2,277.5	2,120.2	2,646.6	1,476.6	1,671.8	1,404.2
38	2,125.1	2,235.5	1,567.6	2,621.2	3,994.0	2,212.6	2,009.9	1,286.4	1,131.9	1,333.4	2,046.1	1,171.1
39	930.7	1,339.1	1,335.0	2,143.0	1,872.2	1,773.0	4,009.4	1,265.2	1,177.3	1,849.9	1,270.1	1,286.1
40	1,783.4	1,157.1	2,452.8	2,718.7	1,331.3	1,179.1	950.2	1,071.2	2,277.5	1,209.6	1,637.2	1,357.5
41	1,312.1	3,968.6	1,981.0	1,025.6	1,155.4	2,043.4	1,403.1	2,497.8	2,769.1	1,244.6	1,223.9	1,325.8
42	1,498.0	1,152.2	3,777.2	1,258.8	1,769.9	2,613.6	1,679.9	1,226.5	1,384.1	1,040.9	2,042.8	1,847.6
43	1,301.4	2,281.4	1,164.4	1,242.1	1,865.0	1,499.0	1,160.4	1,852.0	2,372.3	2,191.3	1,577.4	2,241.2
44	2,613.4	1,162.3	1,266.9	2,561.8	3,739.9	1,840.3	1,708.6	1,624.9	2,059.2	1,537.5	978.1	1,515.7
45	1,407.8	1,117.7	1,487.5	1,255.7	1,566.5	2,296.0	1,365.5	1,924.4	1,952.4	1,226.0	2,204.9	2,332.7
46	1,038.0	1,270.6	2,164.8	2,529.2	1,116.1	1,781.1	2,124.6	1,303.4	1,260.4	1,503.4	2,036.9	1,432.0
47	1,041.0	1,347.5	3,735.9	1,224.9	1,206.4	2,046.7	2,357.0	2,049.1	2,447.7	1,786.4	1,748.8	2,261.2
48	1,500.5	1,916.8	2,027.9	2,105.2	1,177.3	1,373.6	1,140.7	3,495.5	1,655.8	1,384.5	1,831.5	1,266.1
49	4,117.7	1,333.4	1,917.7	1,565.5	1,980.5	1,195.2	1,862.5	2,163.6	2,517.9	1,429.2	1,160.8	2,239.7
50	1,158.3	2,543.7	2,049.4	1,023.0	1,394.5	2,205.2	1,312.1	1,865.7	1,362.7	1,475.1	1,816.6	1,312.1
51	2,011.1	2,464.2	1,148.5	1,062.4	1,272.7	1,882.4	2,241.6	1,395.3	1,067.8	1,620.3	1,398.7	2,040.5
52	1,553.5	1,286.4	1,239.2	1,859.9	2,103.7	1,150.5	1,135.8	1,684.7	980.2	2,083.6	2,284.1	1,236.6
53	2,482.2	2,147.1	1,095.8	1,527.7	1,114.0	2,210.7	3,556.6	1,400.6	1,813.1	1,205.6	1,916.4	2,387.4
54	2,040.1	2,121.3	1,793.2	1,047.3	1,250.6	1,840.4	2,436.8	1,436.4	1,579.0	2,067.7	1,541.3	2,332.3
55	2,155.8	2,114.5	1,193.2	1,791.1	2,309.2	1,133.3	2,047.4	1,047.4	3,692.6	1,317.9	1,217.7	1,592.4
56	1,305.9	1,209.7	1,620.3	1,375.0	1,040.9	1,224.8	1,941.5	1,763.7	3,706.8	2,191.5	2,130.1	2,496.8
57	2,710.5	1,892.9	3,474.2	1,632.1	1,649.3	2,325.4	1,339.2	1,190.6	1,899.2	1,819.5	1,166.6	1,512.4
58	1,407.8	2,198.9	2,304.1	1,205.7	2,261.7	1,405.3	1,555.2	2,231.0	2,009.8	1,259.4	1,808.9	1,321.4
59	2,126.0	1,766.9	1,560.9	3,524.9	1,790.5	2,191.2	1,154.0	2,350.8	1,070.3	1,217.1	2,086.1	1,500.4
60	1,307.3	2,459.2	1,227.6	2,316.5	2,030.3	1,133.6	1,117.4	1,267.6	1,490.8	1,749.8	1,337.5	3,628.0
61	2,135.4	1,193.7	1,113.0	2,031.0	1,713.9	1,339.0	1,371.2	1,585.5	1,650.7	1,153.8	1,436.5	1,744.6
62	2,105.3	1,458.8	1,500.1	2,317.8	1,231.0	1,039.2	1,132.0	1,515.3	1,495.0	1,809.3	1,678.7	1,871.0
63	1,718.2	1,738.4	1,087.0	2,399.9	1,219.5	1,446.5	1,116.8	1,155.8	1,503.0	2,200.2	2,210.0	1,747.4
64	1,562.9	2,143.5	1,646.7	1,138.5	1,221.4	2,133.1	1,338.5	2,362.7	2,533.5	980.4	2,246.2	2,045.0
65	1,128.4	1,197.6	3,465.6	1,673.9	1,394.6	2,272.1	2,478.1	1,638.4	1,802.0	2,277.7	1,303.8	1,262.9
66	4,032.0	1,945.1	1,114.2	1,477.1	1,801.4	1,335.8	1,959.9	1,246.5	1,507.8	2,323.9	1,951.3	1,239.3

Stream ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
67	1,381.2	3,485.2	1,169.6	1,963.7	1,726.6	1,223.9	1,224.9	1,246.8	1,598.2	1,725.4	1,959.2	1,190.6
68	1,199.8	1,867.2	1,146.6	2,120.5	1,565.4	2,231.8	1,614.3	1,821.5	2,307.1	1,325.7	1,293.4	1,280.4
69	2,223.4	1,591.6	1,166.6	1,177.3	1,468.4	1,401.6	1,897.0	1,260.5	1,295.2	2,527.6	1,726.7	1,861.5
70	2,803.5	1,233.9	1,268.2	1,512.2	1,601.4	2,230.5	1,340.8	3,533.9	2,505.8	2,589.1	1,859.1	1,972.9
71	2,137.8	1,744.6	2,007.2	1,259.3	1,613.7	1,175.3	2,671.2	1,388.3	1,607.7	2,150.1	1,429.2	1,292.8
72	2,209.1	2,601.1	1,747.2	1,965.2	1,707.7	1,171.0	2,184.3	1,147.0	3,479.6	1,384.9	2,417.2	1,147.2
73	1,028.3	1,153.9	1,672.1	1,672.7	1,539.1	2,121.3	1,802.8	2,305.1	1,269.7	1,205.7	1,119.1	3,480.1
74	1,731.2	2,283.6	1,559.0	1,816.3	2,350.5	1,186.6	2,082.6	1,279.0	1,452.4	2,150.0	1,727.0	1,163.9
75	3,207.3	1,746.8	1,973.2	1,883.9	1,158.8	2,380.4	1,763.6	1,044.4	1,974.4	1,165.9	2,323.3	1,501.8
76	1,521.1	1,795.6	1,410.6	1,213.5	2,197.5	1,294.0	1,270.6	1,897.1	1,199.3	2,125.7	1,155.4	2,198.3
77	2,453.3	1,244.2	1,852.9	1,951.9	1,943.5	1,442.1	2,305.5	1,533.7	2,941.7	1,102.9	1,641.2	1,395.9
78	1,100.2	1,025.2	1,460.9	1,158.8	2,319.4	1,952.4	1,764.1	1,646.8	2,410.3	1,925.0	2,278.4	1,537.7
79	2,647.5	1,663.8	2,034.7	2,285.0	3,405.1	2,373.5	1,523.9	1,823.0	1,730.1	1,237.8	2,026.2	1,334.0
80	1,158.8	1,501.6	2,816.2	1,859.2	2,133.5	2,022.2	3,454.8	1,459.8	1,128.5	1,632.0	1,550.7	1,058.0
81	2,230.6	1,169.6	2,568.2	1,570.8	1,473.0	1,099.4	1,936.8	1,232.8	1,652.6	1,504.4	2,413.9	1,134.7
82	1,471.8	3,430.2	1,538.7	1,231.5	1,052.7	1,936.8	1,500.1	2,271.4	2,284.2	1,083.0	1,165.0	1,541.7
83	1,356.8	1,099.0	3,127.7	1,732.2	1,670.0	2,298.0	2,082.8	1,226.5	1,446.9	1,237.9	2,010.1	1,937.8
84	1,462.4	1,658.3	1,068.5	1,100.2	1,510.5	2,858.9	1,245.1	1,741.4	2,589.6	2,339.7	1,520.4	1,705.8
85	2,852.5	1,152.0	2,094.1	2,243.8	3,165.2	1,858.2	2,349.4	3,217.6	1,791.2	2,338.5	1,162.7	1,440.2
86	1,440.9	1,159.4	1,569.6	1,566.1	3,005.0	2,119.3	1,376.5	1,666.9	1,888.4	1,227.3	1,784.2	2,372.0
87	1,158.8	1,213.1	1,764.1	2,248.1	1,099.6	1,955.2	1,911.8	1,443.7	1,524.0	1,513.5	1,523.0	1,496.3
88	1,213.9	1,454.6	3,104.9	1,768.1	1,096.7	1,848.4	2,020.6	2,175.5	2,601.7	3,205.5	1,740.9	1,711.4
89	1,828.3	1,630.4	1,587.1	2,420.3	1,010.7	1,492.8	1,233.7	2,884.3	1,465.5	1,370.5	1,646.8	1,453.3
90	3,510.2	1,417.4	2,256.6	1,413.5	1,607.4	1,055.7	1,817.9	2,448.9	2,781.1	1,367.4	1,602.5	1,627.6
91	1,232.1	2,255.3	2,461.3	1,244.0	1,473.3	2,574.2	1,342.5	3,297.6	1,477.8	2,215.0	1,605.1	1,102.9
92	2,326.5	1,860.3	1,092.3	1,336.7	2,109.6	3,313.6	2,359.6	1,414.5	1,438.1	1,917.7	1,309.6	1,916.0
93	1,491.8	1,141.8	1,234.2	1,616.3	2,035.7	1,139.4	1,491.7	1,883.9	1,078.1	1,781.8	2,163.6	1,257.9
94	3,967.8	1,292.9	1,178.2	2,271.5	1,273.0	1,514.1	2,919.4	1,917.5	1,858.8	1,186.6	1,573.3	2,623.7
95	1,863.7	1,808.1	1,918.7	1,158.2	1,177.3	1,534.2	2,176.5	1,343.4	1,561.2	2,318.9	1,917.7	2,367.6
96	2,636.6	3,559.2	1,437.0	1,949.8	1,986.7	2,078.5	1,583.9	1,240.8	3,122.5	1,251.9	1,357.2	1,240.5
97	1,468.7	1,168.7	2,015.8	1,407.0	1,173.5	1,868.7	1,554.5	1,889.3	3,091.4	2,369.6	2,330.6	1,963.2
98	4,083.7	1,669.1	3,030.1	1,329.4	1,926.6	2,069.6	1,267.2	1,381.6	2,770.4	1,017.0	1,246.2	1,307.7
99	1,149.1	2,428.3	3,677.3	1,221.5	2,102.5	1,364.3	2,513.4	1,207.9	2,870.5	1,871.3	2,070.8	2,157.1
100	1,652.6	1,517.1	1,616.4	3,023.0	2,012.1	1,603.3	1,350.9	2,618.7	1,144.7	1,055.9	2,361.2	1,495.6
101	2,307.2	1,567.6	1,077.3	3,690.7	1,681.9	1,198.1	1,279.8	1,876.3	2,008.7	1,630.4	1,549.9	3,102.6
102	2,317.4	1,347.7	1,310.6	1,694.0	892.9	1,230.2	1,947.8	1,790.7	1,240.0	1,226.1	1,234.4	1,433.1
103	2,638.3	1,735.9	1,385.8	2,518.8	1,209.3	1,196.0	1,242.7	1,377.2	1,224.0	1,528.2	1,597.8	2,003.6
104	2,133.1	2,012.6	1,228.5	1,564.9	1,191.4	1,249.4	1,182.2	1,316.2	1,234.7	2,422.8	2,595.1	2,300.8
105	2,645.0	2,477.2	1,176.4	1,298.6	1,009.0	1,172.6	2,135.8	2,576.0	2,335.4	1,172.4	1,556.4	1,749.8
106	1,677.9	1,079.9	2,926.4	1,878.1	1,209.0	1,855.5	3,863.9	2,057.3	1,772.9	2,080.9	1,282.9	1,209.6
107	3,507.9	1,211.4	1,393.1	1,043.5	2,181.6	1,320.8	1,915.0	1,178.1	2,062.0	2,661.2	2,424.5	1,612.6
108	1,342.5	2,902.2	1,196.1	1,519.9	1,975.1	1,075.7	1,768.4	1,187.4	2,150.1	1,740.5	1,641.2	1,327.9
109	1,116.8	1,605.7	1,192.6	1,533.4	1,813.7	2,397.0	2,033.6	1,894.7	2,647.8	1,436.4	1,126.8	1,149.2
110	1,947.0	1,893.9	1,227.5	1,063.1	1,376.0	1,429.5	2,169.4	1,209.0	1,253.8	3,999.4	1,804.2	2,123.0
111	3,033.5	1,331.2	1,231.1	1,811.2	1,288.2	2,469.7	1,156.8	2,901.7	2,200.0	4,048.7	2,011.1	1,692.6
112	2,080.9	1,796.3	1,604.7	1,152.4	1,807.4	1,334.9	4,076.2	1,262.0	1,889.8	2,402.1	1,236.1	1,347.8
113	2,518.6	4,051.5	1,817.9	1,613.7	1,604.2	1,158.3	2,499.9	1,298.5	3,144.4	1,361.2	1,599.3	1,231.9
114	1,227.5	1,696.9	1,549.8	1,843.3	2,164.6	1,425.9	1,635.4	2,076.3	1,065.2	1,065.4	1,145.1	2,983.8
115	2,552.1	2,055.1	2,075.2	1,594.5	2,431.2	1,335.4	2,624.1	1,371.8	1,484.3	1,584.4	1,895.9	1,082.4
116	4,579.3	2,069.8	1,870.2	1,665.0	1,227.5	2,357.2	1,501.3	1,240.8	2,144.7	1,063.1	1,942.5	1,535.5
117	1,866.2	1,597.4	1,342.5	1,076.6	2,622.8	1,468.8	1,102.9	1,715.1	1,164.4	1,203.6	1,543.8	1,573.8

Stream ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
118	2,865.7	1,408.1	1,835.0	1,835.4	1,656.0	937.7	1,979.0	1,287.2	4,303.4	1,306.1	1,886.0	1,370.0
119	1,352.9	1,200.4	1,378.5	1,281.2	2,064.1	1,232.2	1,398.0	1,648.5	2,658.0	2,208.9	2,660.0	1,314.6
120	2,953.2	1,053.2	2,277.5	2,016.7	3,079.6	2,840.9	1,502.3	1,878.5	2,363.4	1,062.4	1,639.0	1,276.0
121	1,196.0	1,723.2	4,120.8	1,597.8	2,617.0	1,683.2	3,150.6	1,402.4	1,144.7	1,528.2	1,314.6	1,194.0
122	1,859.4	1,143.4	2,652.1	1,232.9	1,156.8	1,244.3	1,862.8	1,302.2	1,552.2	1,248.2	2,661.6	1,403.0
123	1,376.0	3,067.0	1,465.5	1,235.7	1,196.8	1,568.2	1,246.0	1,616.3	1,970.2	1,035.6	1,081.0	1,899.9
124	1,161.2	1,059.3	2,889.5	1,811.9	1,866.8	2,483.9	2,489.2	1,206.4	1,236.1	1,176.2	1,616.5	2,019.5
125	1,248.8	979.9	1,424.6	1,257.0	1,319.5	4,140.2	1,194.4	2,178.7	2,923.6	2,641.9	1,249.1	1,236.8
126	2,428.0	1,174.4	2,061.3	1,900.9	2,908.1	1,851.6	2,629.7	4,358.4	1,830.2	2,481.1	1,200.8	1,318.3
127	1,195.3	1,269.6	1,333.4	1,812.9	4,295.5	1,135.3	1,237.8	1,424.8	1,887.7	1,053.2	1,158.1	2,712.8
128	1,281.2	1,019.7	1,398.6	1,907.6	1,224.6	1,876.6	1,709.0	1,421.8	2,066.7	1,141.3	1,621.9	1,523.1
Min	189.5	4.4	6.8	5.7	27.1	5.1	34.3	20.7	93.4	19.8	10.1	19.7
Avg	1,895.5	1,714.8	1,772.5	1,708.1	1,753.2	1,718.6	1,799.9	1,703.0	1,934.9	1,629.3	1,694.5	1,724.0
Max	4,579.3	4,051.5	4,294.4	4,041.9	4,337.6	4,140.2	4,076.2	4,358.4	4,303.4	4,048.7	2,878.8	4,149.1

Stream ID	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	RF1	RF2
0	46.7	4.1	5.2	12.5	34.4	99.4	50.3	11.1	130.2	14.6	16.8	15.0
1	2,402.8	1,261.1	1,447.1	2,166.5	1,607.2	2,859.0	1,507.2	2,397.4	413.2	1,124.2	17.2	17.1
2	1,197.0	3,450.5	1,948.5	2,322.1	2,723.5	1,221.4	1,864.8	1,293.9	1,399.0	1,631.2	16.6	15.6
3	1,359.8	1,828.2	2,492.0	1,205.8	1,992.2	2,570.3	1,490.2	1,281.0	1,331.1	1,254.3	16.5	15.4
4	1,203.0	2,924.0	1,906.4	1,625.2	2,051.8	1,116.3	2,115.1	1,310.7	4,321.6	1,237.1	16.5	14.9
5	1,435.9	945.8	4,139.5	1,653.2	1,399.9	2,784.9	2,822.8	1,310.9	416.1	1,906.6	16.7	15.2
6	1,876.0	1,394.6	2,875.3	1,107.1	1,414.5	1,334.2	1,435.7	1,281.7	1,173.9	1,915.1	16.7	17.8
7	1,177.3	1,066.8	1,516.8	1,286.2	2,871.3	551.3	1,748.4	2,754.7	2,297.2	2,407.7	16.5	15.1
8	1,178.3	1,246.5	2,544.0	1,123.8	2,242.5	1,360.6	398.3	2,176.8	1,205.0	1,141.2	16.5	18.4
9	4,047.7	1,162.2	2,230.1	1,393.6	1,944.3	959.2	2,228.6	2,002.5	2,959.3	1,283.6	16.7	16.9
10	1,933.4	2,400.2	4,151.1	1,113.8	2,042.5	2,771.3	1,408.4	1,314.2	2,060.0	999.1	17.5	15.3
11	1,328.7	4,077.2	505.1	2,716.3	2,055.3	2,763.7	1,469.6	1,701.2	1,263.8	1,382.9	16.8	15.3
12	1,308.9	1,307.3	1,334.7	2,507.1	2,167.8	1,672.4	1,395.2	1,208.5	1,114.6	1,989.0	17.1	15.5
13	1,368.5	1,134.6	1,394.5	1,855.6	3,932.2	1,039.1	1,437.2	1,269.9	801.5	2,497.0	16.9	16.6
14	2,171.9	1,075.0	2,848.5	1,034.9	1,970.8	1,795.0	1,436.1	2,685.8	1,588.0	1,446.2	16.6	15.1
15	1,351.3	1,719.0	2,336.3	592.0	2,624.4	1,279.1	1,480.2	1,031.8	1,804.0	1,253.1	16.6	15.3
16	1,145.8	2,384.2	1,206.4	1,907.4	1,190.5	1,369.2	1,360.8	1,866.1	1,227.2	2,863.0	16.6	15.2
17	1,154.7	1,169.3	2,869.0	4,064.1	2,182.6	1,835.7	1,284.0	1,374.9	1,747.4	1,248.8	16.7	15.4
18	2,526.4	813.2	1,318.8	1,273.6	1,974.0	1,168.1	1,238.5	1,542.7	2,189.3	1,616.1	16.4	16.5
19	1,261.2	2,167.6	2,011.7	2,379.4	2,216.0	1,231.6	1,523.4	1,352.6	2,322.7	2,520.6	16.6	15.2
20	2,083.1	2,536.4	4,040.6	865.6	1,435.1	2,632.1	2,853.9	1,260.0	1,202.5	1,678.5	16.6	14.9
21	1,002.7	4,007.3	1,828.0	2,190.4	1,790.9	1,158.2	2,897.4	897.5	2,537.7	1,233.7	16.5	17.5
22	2,538.3	3,976.8	1,203.7	927.4	1,371.0	2,023.5	2,543.7	1,290.8	1,909.1	1,924.4	16.5	18.4
23	1,128.3	1,892.1	3,857.9	2,072.7	1,168.6	1,157.5	1,596.9	1,406.9	1,927.6	984.6	16.7	15.3
24	1,800.8	2,040.1	1,104.7	1,524.2	1,083.6	2,368.4	1,681.5	1,195.9	1,942.2	2,400.7	16.7	15.5
25	2,515.0	2,614.3	1,036.8	2,048.3	1,194.7	1,025.0	1,312.8	1,373.9	1,926.4	2,210.2	16.8	15.2
26	1,146.8	2,795.2	1,332.8	1,161.7	1,626.7	1,002.5	2,542.0	2,384.1	1,970.5	2,524.3	16.6	17.9
27	1,771.8	1,036.9	2,155.2	1,492.7	4,057.4	1,073.2	1,808.2	1,424.8	2,763.8	2,005.5	16.6	15.0
28	1,926.4	1,812.4	2,307.9	2,147.8	1,212.6	1,753.4	1,472.9	2,812.8	2,374.8	3,868.1	16.6	15.3
29	1,268.3	1,342.6	1,385.1	2,227.5	2,140.9	2,025.6	1,208.1	1,254.4	1,234.3	1,490.5	16.8	17.6
30	2,559.9	1,897.2	1,419.7	1,260.4	3,940.0	2,474.6	1,230.9	1,189.3	2,242.1	2,554.2	16.6	17.1
31	1,042.4	1,491.2	1,531.6	1,397.0	1,331.9	2,131.0	1,773.7	2,027.9	2,754.7	1,323.1	16.9	15.3
32	1,671.3	1,378.5	1,217.2	2,642.1	2,597.8	1,243.9	1,728.0	1,123.0	1,404.3	2,080.5	16.7	15.6
33	1,308.8	2,711.1	1,190.6	3,893.8	1,910.4	1,221.5	1,452.8	999.7	2,076.0	1,404.3	16.8	15.2
34	3,792.0	2,490.9	1,181.8	1,206.6	1,445.9	1,999.6	1,561.6	1,152.8	1,651.5	1,852.7	17.1	15.1

Stream ID	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	RF1	RF2
35	1,887.0	1,240.4	1,504.2	1,752.3	4,012.6	1,106.6	1,363.5	2,014.4	1,530.6	2,450.8	16.6	21.4
36	1,679.9	1,093.6	1,271.6	1,097.5	4,058.0	2,495.0	1,487.6	1,292.9	2,613.7	2,133.1	16.5	15.3
37	1,316.2	3,947.7	1,939.3	1,142.0	1,272.6	983.1	2,074.6	1,417.2	1,297.8	2,006.9	16.4	16.0
38	1,106.8	1,790.7	1,145.8	2,512.5	1,506.0	1,555.2	1,263.2	1,372.0	1,231.6	1,831.5	16.5	14.9
39	1,179.6	2,523.8	1,848.1	1,347.4	1,362.7	973.2	2,526.3	2,856.9	2,366.6	1,409.2	16.6	17.4
40	1,486.9	2,164.5	3,861.6	1,308.9	2,635.1	1,161.1	1,442.8	1,889.6	1,526.8	2,041.9	16.6	15.1
41	1,725.4	1,380.1	1,153.2	2,265.2	2,126.5	2,215.3	1,528.3	1,826.8	1,223.8	1,621.9	16.6	15.4
42	2,142.9	1,280.6	1,618.5	1,953.2	1,263.9	2,520.4	1,422.4	2,521.0	1,730.7	1,143.6	16.5	15.0
43	1,177.3	2,511.3	1,408.6	1,808.5	3,989.1	1,113.0	2,208.2	1,400.2	1,160.2	1,576.5	16.6	14.9
44	1,383.1	1,907.1	2,276.1	1,143.5	2,045.5	2,495.1	1,453.7	1,250.5	1,279.0	1,015.3	16.6	16.5
45	1,205.6	2,603.0	2,056.0	1,488.1	2,214.6	1,071.0	1,970.9	1,287.1	3,798.2	1,085.0	16.5	14.9
46	1,529.9	1,224.9	3,568.3	2,150.9	1,220.5	2,315.6	2,364.5	1,238.4	1,992.1	1,750.0	16.6	16.3
47	1,797.3	1,244.5	2,606.0	1,135.3	1,582.7	1,502.6	1,528.0	1,158.2	1,147.9	2,065.4	16.6	15.0
48	1,165.3	1,139.4	1,561.7	1,175.8	2,325.6	2,112.0	1,748.3	2,559.1	2,170.8	2,349.8	16.5	15.0
49	1,091.3	1,572.3	2,235.5	1,209.7	1,863.8	1,569.3	1,961.3	1,832.6	1,154.0	1,127.0	16.5	15.1
50	3,653.5	1,039.1	2,225.8	1,274.8	2,099.1	1,254.3	2,126.6	1,794.5	2,494.3	1,262.0	16.7	15.1
51	1,763.4	2,116.1	3,669.9	1,175.0	1,874.5	2,526.6	1,418.6	1,347.9	1,941.5	1,302.1	16.5	15.0
52	1,333.8	3,581.2	1,945.6	2,338.6	1,873.7	2,552.0	1,655.1	2,223.4	1,394.8	1,576.8	16.6	15.2
53	1,407.8	1,578.9	1,151.1	2,237.6	1,805.7	1,941.6	1,583.2	1,234.5	1,068.4	2,234.1	16.7	17.2
54	1,332.6	1,113.1	1,408.0	1,720.9	3,437.9	1,150.5	1,387.9	1,291.0	2,285.7	2,464.0	16.7	15.3
55	2,222.1	1,046.6	2,506.5	1,290.9	1,790.8	2,048.7	1,464.8	2,219.3	1,439.5	1,408.7	16.9	15.0
56	1,178.2	1,984.2	2,142.9	2,149.2	2,403.5	1,268.4	1,447.7	1,138.1	1,725.4	1,215.3	16.8	17.4
57	1,193.6	2,313.2	1,177.4	2,210.9	1,709.8	1,402.6	1,323.1	1,809.6	1,511.4	2,350.6	16.7	15.5
58	1,071.0	1,222.3	2,535.1	3,550.3	2,053.3	1,799.5	1,185.9	1,154.7	2,031.0	1,439.1	16.6	15.3
59	2,294.2	2,296.9	1,333.4	1,248.9	1,748.0	1,094.2	1,292.0	1,582.4	2,389.6	1,612.6	16.6	15.4
60	1,330.9	1,690.1	2,086.2	2,219.5	2,100.6	1,154.4	1,629.5	1,241.0	2,164.8	2,328.5	16.7	15.3
61	1,799.1	2,270.3	3,508.1	2,347.3	2,018.4	2,185.4	2,673.2	1,209.1	1,185.3	2,023.3	16.8	17.8
62	1,509.8	3,486.9	1,976.4	1,748.5	2,267.3	1,147.0	2,432.7	2,377.5	2,295.2	1,121.4	16.5	16.8
63	2,421.9	3,470.4	1,519.4	2,405.7	1,435.8	1,633.5	2,115.6	1,058.7	1,970.6	1,909.2	16.6	15.3
64	1,151.6	1,705.0	3,450.6	1,891.8	1,206.3	2,404.6	1,579.8	1,383.6	1,648.1	1,581.0	16.7	15.3
65	2,040.6	1,731.1	1,189.6	1,665.6	1,277.0	2,287.8	1,617.6	1,599.8	2,370.8	2,115.6	16.6	15.2
66	2,195.7	2,361.3	1,167.7	1,831.0	1,219.4	2,404.6	1,750.3	1,432.1	1,503.2	1,810.2	16.5	15.5
67	2,596.7	2,291.8	1,378.4	1,211.8	1,602.3	1,012.2	2,319.6	2,317.0	2,175.8	2,272.6	16.7	15.4
68	1,672.1	2,489.0	2,070.5	1,435.0	3,579.4	1,022.5	1,468.1	1,632.6	2,542.5	1,826.5	16.6	20.0
69	2,068.5	1,799.5	1,820.6	1,635.7	1,234.4	2,105.4	1,324.3	2,088.9	2,630.4	3,546.3	16.7	15.5
70	1,038.5	1,468.8	1,384.2	1,682.5	1,673.9	1,872.5	1,243.3	1,649.9	1,102.9	2,045.2	16.8	14.7
71	2,310.0	1,554.3	1,952.6	1,133.8	3,579.6	2,236.8	1,355.4	1,268.8	1,688.1	2,311.6	16.9	15.4
72	1,106.2	1,490.0	1,339.9	1,259.0	1,319.9	2,133.1	1,691.0	2,082.8	2,229.2	1,237.2	17.2	15.0
73	2,177.6	1,342.6	2,655.3	2,307.1	2,396.3	1,565.1	1,750.6	1,110.9	1,407.8	1,963.7	16.8	14.8
74	1,342.2	2,206.7	2,665.4	3,494.9	2,126.3	1,394.1	1,341.7	1,588.3	1,655.9	1,319.3	16.6	17.6
75	3,103.8	1,926.9	1,583.8	1,133.9	1,520.1	1,600.0	1,735.1	1,148.5	2,252.8	1,840.6	16.8	15.2
76	1,672.1	2,681.5	1,569.2	2,307.7	3,584.1	980.4	1,234.2	1,860.3	1,532.2	2,347.6	16.6	19.5
77	2,390.4	1,212.7	1,342.4	1,292.8	3,433.6	1,561.8	1,922.4	1,062.3	2,580.3	1,535.5	16.6	15.4
78	2,800.2	3,387.8	1,828.7	1,125.2	1,284.2	1,587.1	2,214.2	1,245.7	1,506.3	1,699.4	16.8	15.6
79	1,377.9	1,625.3	1,175.2	1,896.0	1,493.6	1,325.7	1,302.3	2,851.0	1,096.5	1,722.4	16.8	15.2
80	1,165.9	2,320.7	1,583.3	1,526.5	1,218.5	1,563.1	2,310.1	2,280.9	2,311.2	1,530.8	16.7	15.0
81	2,815.1	1,478.8	3,365.9	1,474.2	2,425.1	1,094.2	1,683.9	1,639.9	2,035.7	1,739.1	16.6	15.5
82	1,740.1	2,825.8	1,099.3	1,716.8	2,232.0	2,300.8	1,578.0	1,719.9	1,875.9	2,000.5	16.5	15.2
83	1,760.4	1,393.5	2,032.2	1,577.3	1,726.1	2,302.0	1,292.0	2,285.6	3,162.7	1,257.0	16.6	15.1
84	1,096.0	2,243.4	1,819.1	1,882.9	3,515.4	1,073.2	2,024.5	1,542.8	1,842.5	2,075.7	16.7	17.4
85	1,226.6	1,644.1	1,329.8	1,263.9	1,950.3	1,558.4	1,487.2	1,106.6	1,394.2	1,890.4	16.6	14.7

Stream ID	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	RF1	RF2
86	1,110.6	2,322.2	1,840.1	1,957.9	2,168.1	1,078.8	1,863.8	1,258.1	3,264.9	1,207.0	16.7	16.4
87	1,927.0	1,570.1	3,040.8	2,308.1	1,119.1	1,804.4	2,486.2	1,154.4	3,352.6	1,921.3	16.8	15.3
88	1,854.8	1,086.8	2,296.6	1,115.0	1,429.2	2,074.2	1,704.9	1,239.3	2,171.4	1,593.8	16.8	16.4
89	1,280.9	1,039.2	1,500.1	1,092.8	1,645.4	3,556.5	2,262.7	2,231.4	2,236.8	2,637.7	16.9	20.3
90	1,162.7	1,812.5	1,945.7	1,209.6	2,102.5	1,283.6	3,424.3	1,444.2	1,238.9	1,179.4	16.9	15.3
91	3,076.1	1,057.1	1,426.0	1,490.5	1,973.5	1,870.6	1,725.9	1,988.8	1,546.8	1,107.9	16.7	15.1
92	1,858.2	1,812.6	3,074.5	1,266.8	1,970.3	2,237.9	1,558.3	1,420.2	1,528.9	1,630.0	16.7	15.0
93	1,376.4	3,021.1	3,359.9	2,228.7	1,960.6	2,244.9	1,703.6	2,278.3	1,409.8	1,646.9	16.8	16.3
94	1,342.3	1,325.7	1,746.9	1,993.6	2,100.8	1,592.4	1,585.9	1,099.7	1,186.8	2,414.8	16.9	16.7
95	1,377.6	1,113.0	1,558.8	1,877.3	2,894.8	1,145.8	1,326.3	1,240.7	3,658.0	1,904.5	16.7	17.4
96	1,284.7	1,281.2	1,594.6	1,861.3	1,737.8	1,889.1	1,212.4	2,525.6	2,300.5	1,373.9	16.6	19.9
97	1,083.0	1,812.1	1,629.4	3,596.4	2,122.3	1,897.1	1,600.4	1,117.6	1,579.0	1,257.0	16.8	17.5
98	1,578.9	2,400.1	1,147.0	2,640.0	2,036.0	1,073.4	1,544.5	2,175.4	1,987.8	1,517.5	16.6	15.0
99	1,308.9	1,119.1	1,558.5	3,035.0	1,663.4	1,650.0	1,433.8	1,364.4	1,638.0	1,347.1	16.7	15.3
100	2,130.0	3,669.6	1,240.6	2,055.7	1,942.6	1,382.6	1,430.3	2,135.4	1,688.4	1,284.8	16.8	17.4
101	1,409.2	1,966.9	2,371.9	2,649.8	1,685.9	1,035.6	1,660.1	1,102.5	1,649.2	2,081.3	16.7	15.1
102	2,003.2	2,066.0	3,024.1	3,723.3	2,406.2	2,574.9	1,848.5	1,086.6	1,335.4	2,366.2	16.7	14.7
103	1,886.6	2,942.3	1,710.8	1,220.2	2,580.3	1,040.1	1,725.3	3,787.8	2,082.7	1,400.0	16.7	15.1
104	2,118.1	2,954.6	1,247.9	3,755.3	2,174.9	1,612.1	1,586.3	1,442.6	1,681.8	1,595.1	16.6	14.9
105	1,433.4	1,850.2	2,947.2	1,613.7	1,295.4	3,785.9	1,533.6	1,256.1	1,592.9	1,884.3	16.5	15.3
106	1,676.5	1,973.0	1,283.7	2,137.1	1,445.3	2,361.1	1,419.3	1,623.6	2,326.8	1,648.3	16.6	15.2
107	2,019.1	2,579.2	1,247.5	1,637.0	1,408.7	3,863.4	2,008.0	1,267.8	1,424.6	1,098.3	16.6	15.5
108	3,985.8	1,562.2	1,435.7	1,846.6	1,440.4	1,158.1	1,884.0	2,585.8	2,410.9	2,039.3	16.6	17.2
109	1,646.8	3,873.8	1,679.8	1,446.8	3,045.9	1,094.4	1,501.0	1,518.4	2,253.7	1,533.2	16.8	15.2
110	1,606.0	1,658.9	1,500.7	1,616.0	1,246.3	2,443.3	1,309.4	1,564.4	2,560.2	2,928.5	16.7	15.7
111	1,050.6	1,220.3	1,255.1	1,177.4	1,399.5	1,825.2	1,435.2	1,866.9	1,335.4	2,373.4	16.7	15.2
112	2,556.8	1,413.5	2,256.5	1,051.6	2,987.3	1,561.9	1,337.7	1,423.9	1,415.8	2,104.1	16.6	15.5
113	1,168.9	1,295.5	1,431.4	1,897.6	1,159.7	1,476.0	2,244.2	1,566.4	1,974.7	1,745.4	16.6	14.7
114	2,553.8	1,519.4	4,067.1	2,566.7	1,613.2	1,866.2	1,720.9	1,072.6	1,443.6	1,662.3	16.6	15.0
115	1,219.5	1,478.9	4,076.2	3,008.4	1,724.1	1,231.7	1,495.9	1,862.2	1,586.3	1,343.4	16.6	15.0
116	2,751.5	1,460.6	1,844.9	1,210.4	1,535.5	1,595.8	1,531.7	1,115.9	2,645.9	1,648.8	16.6	15.5
117	1,537.0	4,081.8	1,345.8	2,682.1	3,127.3	1,195.3	1,238.3	1,912.8	2,215.4	2,020.4	16.6	15.4
118	2,646.1	1,246.6	1,199.7	1,224.2	3,033.5	1,203.1	2,199.2	1,170.8	2,708.4	1,451.8	16.5	16.3
119	4,074.0	2,986.3	1,537.0	1,175.2	1,155.4	1,869.2	1,837.5	1,733.7	1,328.2	1,848.8	16.6	15.1
120	1,384.4	1,875.5	1,327.6	1,012.2	1,284.3	1,264.9	1,469.4	4,106.2	1,117.7	2,229.3	16.5	16.2
121	1,057.4	1,922.8	1,885.7	2,130.0	1,371.3	1,893.5	1,707.8	1,527.0	2,428.2	1,312.3	16.5	15.0
122	4,119.6	1,558.1	3,063.5	1,265.7	2,092.2	1,246.1	1,934.4	1,680.3	2,256.6	1,696.7	16.5	15.1
123	1,646.8	4,127.9	1,228.4	1,691.6	2,526.3	2,492.8	1,723.3	1,862.7	1,826.3	2,133.0	16.6	15.1
124	1,158.2	1,354.2	2,502.3	1,257.4	1,982.4	1,886.0	1,477.7	1,626.4	4,432.4	1,415.0	16.6	15.1
125	1,143.7	1,891.8	1,832.4	1,904.8	3,179.1	1,229.4	1,857.4	1,266.5	2,407.7	2,323.7	16.5	19.3
126	1,248.2	1,602.7	1,144.2	1,438.4	1,727.5	1,460.6	1,479.9	1,071.8	1,351.2	1,885.4	16.6	19.1
127	1,377.9	1,960.8	1,670.2	2,522.6	2,752.1	1,331.2	1,998.6	1,772.2	2,905.4	1,230.0	16.5	17.2
128	2,186.5	1,869.2	2,931.0	2,665.3	1,439.2	1,352.2	2,555.2	1,226.4	4,356.7	1,585.4	16.6	14.9
Min	46.7	4.1	5.2	12.5	34.4	99.4	50.3	11.1	130.2	14.6	16.4	14.7
Avg	1,741.7	1,955.8	1,945.2	1,797.0	2,018.0	1,694.1	1,691.8	1,622.0	1,908.5	1,762.8	16.7	15.9
Max	4,119.6	4,127.9	4,151.1	4,064.1	4,058.0	3,863.4	3,424.3	4,106.2	4,432.4	3,868.1	17.5	21.4

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

August 11, 2011

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

Platform: **SPARC T4-4 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 T4-4 Server			
4 x SPARC T4 (3.00GHz)	512GB	320 x 24GB FMODs 8 x 300GB 10Krpm (internal)	**201,487.0**

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:

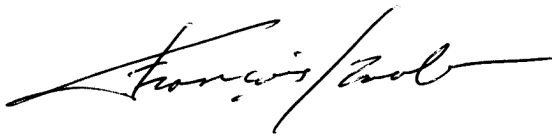
- The database records were defined with the proper layout and size
- The database population was generated using DBGEN
- The database was properly scaled to 1,000GB and populated accordingly
- The compliance of the database auxiliary data structures was verified
- The database load time was correctly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

None.

Respectfully Yours,



François Raab
President

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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 T4-4 Server Server, was configured with:

- 4 SPARC T4 3GHz processors
- 512 GB memory
- 1 Ethernet controller
- 8 300GB internal SAS disk drives
- 16 6Gb SAS controllers
- 4 Sun Storage F5100 Flash Arrays, each containing 80 24GB FMODs

Priced Configuration:

SPARC T4-4 Server Server, was configured with:

- 4 SPARC T4 3GHz processors
- 512 GB memory
- 1 Ethernet controller
- 8 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

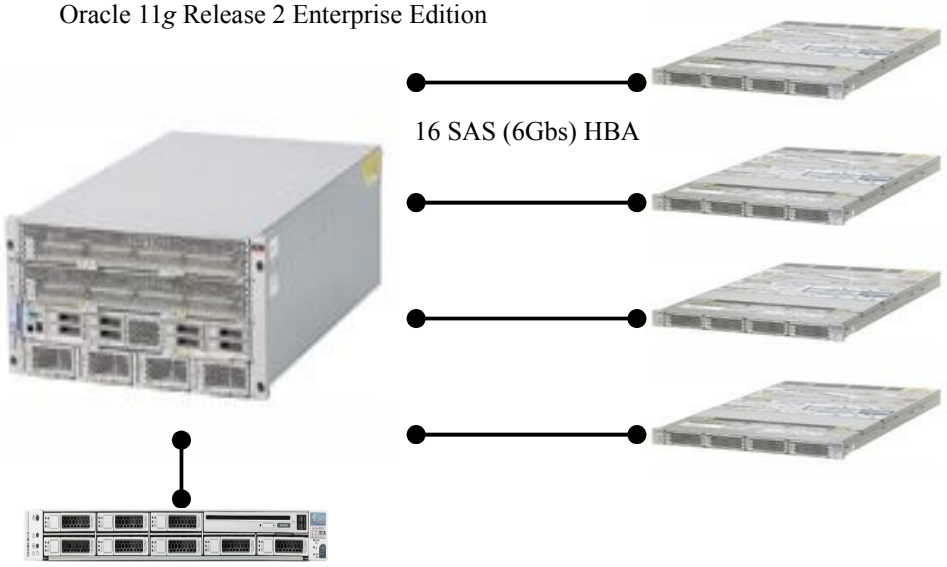
Differences in Configurations:

Priced Configuration includes 1 Sun Fire X4170 M2 Server as the system console.

System Under Test

SPARC T4-4 Server
4 SPARC T4 3.0 GHz processors
512 GB Memory
8 300GB SAS Internal disks
Oracle Solaris 10 8/11
Oracle 11*g* Release 2 Enterprise Edition

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



16 SAS (6Gbs) HBA

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. 2.14.2 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 and indexes are mirrored across the F5100 arrays using Oracle ASM while the 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 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. Oracle ASM is used for mirroring of the tables and indexes across s0 and for the striping of temp table across s1. 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. 2.14.2 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 1:22:39.

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:

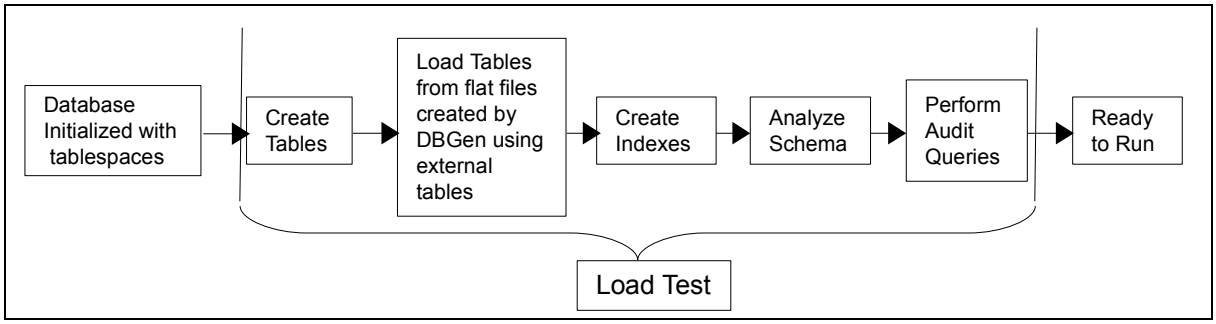
Disk Type	# Of Disks	Space Per Disk*	Sub-Total Disk Space**
F5100 FMOD	320	24GB	7,680 GB
Internal SAS	8	300GB	2,400 GB
		Total Space	**10,080**
		Data Storage Ratio	**10.8**

** 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:

Run ID	QppH@1000GB	QthH@1000GB	QphH@1000GB
Run 1	191,728.5	224,875.2	207,641.5
Run 2	181,760.6	223,354.2	201,487

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 38.59% 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:

MaryBeth 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 T4-4 Server with SPARC T4 3GHz which will be available by October 30, 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*
201,487 QphH@1000GB	$4.60/QphH@1000GB	$925,525 USD	October 30, 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.