



Supermicro A+ Server 2123BT-HNC0R

TPC-DS 2.11.0
TPC-Pricing 2.4.0

Report Date:
07-Aug-2019

Total System Cost

Composite Query per Hour Metric

Price / Performance

\$487,232
USD

4,418,054
QphDS@10000GB

\$0.12 USD
\$ / QphDS@10000GB

Database Size ¹

Database Manager

Operating System

Other Software

Availability date

Clustered Or Not

10,000GB

Transwarp
ArgoDB v1.2.1

Red Hat Enterprise
Linux Server
Release 7.6

No

31-Aug-2019

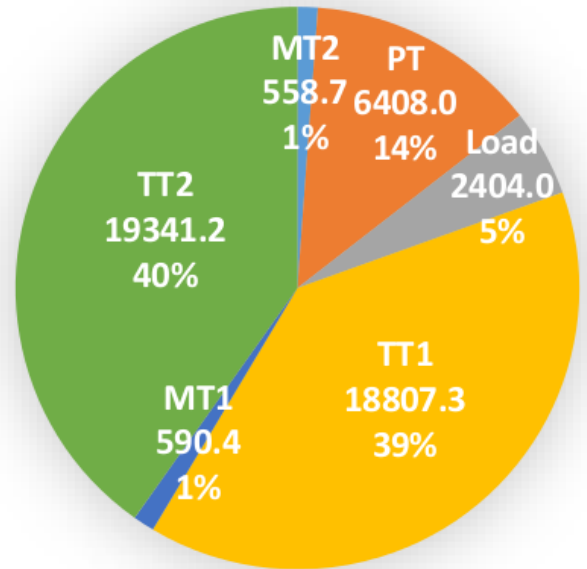
Yes

4x Supermicro A+ Server AS-2123BT-HNC0R
BigTwin™ with 4x 217BH-22H12 Nodes, each with:
2x AMD EPYC 7502 32-Core Processor
256 GB (16x16GB RDIMM 2666MT/s Dual Rank)
1x 960GB M.2 PCIe Gen3
2x 3.5TB NVMe Drive
2x 2TB NVMe Drive
1x Mellanox MT27800 ConnectX-5 25GbE SFP28 NIC



Mellanox MSB7800-ES2F
Infiniband Switch
(36 QSFP28 Ports)

Benchmarked Configuration



Elapsed Time

Load includes backup = No

RAID = No

System Configuration:

Supermicro A+ Server AS-2123BT-HNC0R

Servers:

16 x Supermicro A+ Server

Total Processors/Cores/Threads:

32/1024/2048

Total Memory:

4096GB

Total Storage²:

195,584 GB

Storage Ratio³:

19.56

Connectivity:

1 x Mellanox MSB7800-ES2F Switch-IB 2 Based EDR Infiniband 1U Switch 36 QSFP28 Ports

Server Configuration:

Per node

Processors:

2 x AMD EPYC 7502 32-Core Processor

Memory:

256GB

Network:

1 x Mellanox MT27800 Family [ConnectX-5] Network Adapter 25GbE

Storage Device:

2 x 3.5 TB NVMe Drive (data nodes and tablet servers)
2 x 2 TB NVMe Drive (data nodes and tablet servers)
1 x 960 GB M.2 PCIe Gen3 (all nodes, boot disk)

¹ Database Size includes only raw data (i.e., no temp, index, redundant storage space, etc.).

² Total Storage = 16 x DataNode & TabletServer + 16 x BootDisk (i.e. 16 x (2 x 3.5 x 1024 + 2 x 2 x 1024 + 1 x 960) GB)

³ Storage Ratio = TotalStorage / SF (i.e. 195,584 GB / 10000 GB)



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Description	Part Number	Src	Unit Price	Qty	Extended Price	3 Year Maint. Price	
HARDWARE COMPONENTS							
Supermicro Model 217BH-22H12 - Rail, Power Cord (included)	AS-2123BT-HNC0R		\$4,778.00	4	\$19,112.00		
AMD EPYC™ 7502 2.5GHz, 32C/64T 180W		1	\$1,850.00	32	\$59,200.00		
Hynix 16GB PC4-2666 HMA82GR7CJR8N-VK	HMA82GR7CJR8N-VK	1	\$67.90	256	\$17,382.40		
M.2 Model : MZ-1LW9600 (SAMSUNG MZ1LW960HMJP-00003)	MZ1LW960HMJP-00003	1	\$145.00	16	\$2,320.00		
Micron_9200_MTFDHAL3T8TCT 3.5TB	MTFDHAL3T8TCT	1	\$272.50	32	\$8,720.00		
Intel DC P4510 2TB NVMe PCI-E 3.1 x4 3D TLC 2.5" 15mm 1DWPD	HDS-IUN2-SSDPE2KX020T8	1,S	\$331.50	32	\$10,608.00		
Mellanox MT27800 Family [ConnectX-5] Network Adapter 25GbE	AOC-MH25G-m2S2TM	1	\$249.90	16	\$3,998.40		
Supermicro 4-hour 7x24 On-site Service 3years	OS4HR3	1	\$1,310.92	4		\$5,243.68	
Mellanox MSB7800-ES2F Switch-IB 2 Based EDR Infiniband 1U Switch 36 QSFP28 Ports	MPN: MSB7800-ES2F	2	\$25,633.00	1	\$25,633.00		
Mellanox SUP-SB7800-3S Technical Support and Warranty - Silver 3 Year for SB7800 Series Switch	SUP-SB7800-3S	2	\$2,815.00	1	\$2,815.00		
Mellanox MCP2M00-A001E30N Ethernet Passive Copper Cable 25GbE SFP28 1m Black 30AWG CA-N	MCP2M00-A001E30N	2	\$52.00	20	\$1,040.00		
12U Open Frame Server Rack - Adjustable Depth - 4-Post Data Rack	4POSTRACK12U	2	\$195.99	1	\$195.99		
NEMA 5-15P to IEC320 C15 14AWG 125V/15A	P515C15-15ABE-10	2	\$10.00	4	\$40.00		
24" LED Monitor		2	\$79.00	1	\$79.00		
Keyboard and Mouse		2	\$14.56	1	\$14.56		
Subtotal					\$151,158.35	\$5,243.68	
HARDWARE COMPONENTS					Subtotal	\$151,158.35	\$5,243.68
Description	Part Number	Src	Unit Price	Qty	Extended Price	3 Year Maint. Price	
SOFTWARE COMPONENTS							
Transwarp high performance Data Mart for Online Analysis Version 1.2.1 with 3years 24x7 support		3	\$17,400.00	16	\$278,400.00		
Red Hat Enterprise Linux 7.6, 3yr Premium Subscription		1	\$3,276.86	16		\$52,429.76	
SOFTWARE COMPONENTS					Subtotal	\$278,400.00	\$52,429.76
Total						\$429,558.35	\$57,673.44

Pricing : 1 Supermicro (based upon total system cost as purchased by a regular customer). Pricing : 2 Obtained from third-party or online. Pricing : 3 Transwarp. Pricing : S One or more components of the Measured Configuration have been substituted in the Priced Configuration. See FDR for details.	Three-Year Cost of Ownership:	\$487,232
Audited by Francois Raab, InfoSizing		QphDS@10000GB: 4,418,054
		\$ / QphDS@10000GB: \$0.12 USD

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



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Metrics Details:

Name	Value	Unit
Scale Factor (SF)	10,000	GB
Streams	4	Stream
Queries (Q)	396	Queries
T_load	2,404.0	Second
T_ld	0.0268	Hour
T_power	6,408.0	Second
T_pt	7.1200	Hour
T_tt1	18,807.3	Second
T_tt2	19,341.2	Second
T_dm1	590.4	Second
T_dm2	558.7	Second
T_tt	10.5969	Hour
T_dm	0.3192	Hour

Load Step	Start	End	(sec.)	(hh:mm:ss)
Build	07/25/19 19:01:39.	07/25/19 19:38:29.	2,209.58	0:36:50
Audit	07/25/19 19:38:29.	07/25/19 20:02:19.	1,430.45	0:23:50
Get Stats	07/25/19 20:02:19.	07/25/19 20:05:33.	194.33	0:03:14
Reported	07/25/19 19:01:39.	07/25/19 20:05:33.	2,403.91	0:40:04

Test	Start	End	(sec.)	(hh:mm:ss)
Power	07/25/19 20:14:36.	07/25/19 22:01:24.	6,407.98	1:46:48
Thruput-1	07/25/19 22:01:24.	07/26/19 03:14:52.	18,807.21	5:13:27
Thruput-2	07/26/19 03:24:42.	07/26/19 08:47:03.	19,341.12	5:22:21
DM-1	07/26/19 03:14:52.	07/26/19 03:24:42.	590.35	0:09:50
DM-2	07/26/19 08:47:03.	07/26/19 08:56:22.	558.70	0:09:19

Stream	Start	End	(sec.)	(hh:mm:ss)
Pt - 0	07/25/19 20:14:36.	07/25/19 22:01:24.	6,407.98	1:46:48
Tt1 - 1	07/25/19 22:01:24.	07/26/19 03:13:35.	18,730.34	5:12:10
Tt1 - 2	07/25/19 22:01:24.	07/26/19 03:14:52.	18,807.20	5:13:27
Tt1 - 3	07/25/19 22:01:24.	07/26/19 03:05:30.	18,245.34	5:04:05
Tt1 - 4	07/25/19 22:01:24.	07/26/19 03:10:22.	18,537.68	5:08:58
Tt2 - 5	07/26/19 03:24:42.	07/26/19 08:44:58.	19,216.49	5:20:16
Tt2 - 6	07/26/19 03:24:42.	07/26/19 08:47:03.	19,341.12	5:22:21
Tt2 - 7	07/26/19 03:24:42.	07/26/19 08:43:28.	19,125.82	5:18:46
Tt2 - 8	07/26/19 03:24:42.	07/26/19 08:43:31.	19,129.18	5:18:49
DMt1 - 1	07/26/19 03:14:52.	07/26/19 03:20:02.	310.85	0:05:11
DMt1 - 2	07/26/19 03:20:02.	07/26/19 03:24:42.	279.49	0:04:39
DMt2 - 3	07/26/19 08:47:03.	07/26/19 08:51:50.	287.07	0:04:47
DMt2 - 4	07/26/19 08:51:50.	07/26/19 08:56:22.	271.62	0:04:32

Timing Intervals for Each Query (In Seconds)

Query	Stream0	Stream1	Stream2	Stream3	Stream4	Min	25%tile	Median	75%tile	Max	Stream5	Stream6	Stream7	Stream8	Min	25%tile	Median	75%tile	Max
1	18.8	368.4	65.1	104.1	56.4	56.4	62.9	84.6	170.2	368.4	46.7	84.1	303.0	54.4	46.7	52.5	69.3	138.8	303.0
2	29.7	48.1	48.5	418.7	590.4	48.1	48.4	233.6	461.6	590.4	72.3	133.0	83.7	241.4	72.3	80.9	108.4	160.1	241.4
3	34.0	67.9	135.8	98.4	49.0	49.0	63.2	83.2	107.8	135.8	44.7	86.1	190.0	178.7	44.7	75.8	132.4	181.5	190.0
4	336.4	395.1	601.4	396.1	545.5	395.1	395.9	470.8	559.5	601.4	562.0	448.6	429.8	454.8	429.8	443.9	451.7	481.6	562.0
5	40.5	58.4	63.0	72.1	81.8	58.4	61.9	67.6	74.5	81.8	141.6	63.4	206.8	77.3	63.4	73.8	109.5	157.9	206.8
6	14.1	128.4	19.8	50.5	40.2	19.8	35.1	45.4	70.0	128.4	23.9	19.5	86.4	118.6	19.5	22.8	55.2	94.5	118.6
7	27.8	60.7	38.1	135.2	109.3	38.1	55.1	85.0	115.8	135.2	145.3	32.0	46.2	50.8	32.0	42.7	48.5	74.4	145.3
8	7.5	52.1	339.2	81.5	59.7	52.1	57.8	70.6	145.9	339.2	27.1	210.3	332.1	138.3	27.1	110.5	174.3	240.8	332.1
9	95.8	265.9	185.6	495.4	159.2	159.2	179.0	225.8	323.3	495.4	430.9	563.9	314.7	538.0	314.7	401.9	484.5	544.5	563.9
10	28.7	93.8	145.9	67.8	75.7	67.8	73.7	84.8	106.8	145.9	30.3	135.8	789.2	79.1	30.3	66.9	107.5	299.2	789.2
11	200.3	418.0	230.6	450.6	368.2	230.6	333.8	393.1	426.2	450.6	495.5	249.1	539.1	280.1	249.1	272.4	387.8	506.4	539.1
12	3.2	143.6	8.7	17.0	56.3	8.7	14.9	36.7	78.1	143.6	8.5	60.0	51.7	11.5	8.5	10.8	31.6	53.8	60.0
13	143.6	214.2	340.2	130.2	360.0	130.2	193.2	277.2	345.2	360.0	200.8	152.4	224.2	446.7	152.4	188.7	212.5	279.8	446.7
14	206.2	676.8	722.7	1,110.8	1,010.8	676.8	711.2	866.8	1,035.8	1,110.8	1,158.9	831.3	964.3	660.2	660.2	788.5	897.8	1,013.0	1,158.9
15	9.0	13.8	326.2	16.5	73.6	13.8	15.8	45.1	136.8	326.2	123.9	15.2	17.1	47.2	15.2	16.6	32.2	66.4	123.9
16	74.1	168.1	351.7	146.1	239.8	146.1	162.6	204.0	267.8	351.7	99.9	122.9	87.0	91.8	87.0	90.6	95.9	105.7	122.9
17	50.2	243.0	174.2	110.5	191.9	110.5	158.3	183.1	204.7	243.0	76.9	89.2	119.0	295.3	76.9	86.1	104.1	163.1	295.3
18	24.3	355.8	91.4	38.3	67.6	38.3	60.3	79.5	157.5	355.8	202.6	65.8	612.5	102.9	65.8	93.6	152.8	305.1	612.5
19	6.1	71.9	23.3	152.6	140.3	23.3	59.8	106.1	143.4	152.6	21.3	358.4	28.3	98.3	21.3	26.6	63.3	163.3	358.4
20	6.2	65.5	5.8	15.0	325.5	5.8	12.7	40.3	130.5	325.5	169.5	15.7	229.4	16.1	15.7	16.0	92.8	184.5	229.4
21	4.2	8.1	15.0	6.9	10.3	6.9	7.8	9.2	11.5	15.0	158.2	291.6	29.5	41.8	29.5	38.7	100.0	191.6	291.6
22	23.3	42.6	67.5	333.2	123.3	42.6	61.3	95.4	175.8	333.2	44.8	36.4	31.3	162.3	31.3	35.1	40.6	74.2	162.3
23	456.8	940.3	804.7	995.2	1,010.8	804.7	906.4	967.8	999.1	1,010.8	1,118.1	882.8	830.3	1,255.0	830.3	869.7	1,000.5	1,152.3	1,255.0
24	143.9	513.1	364.0	573.1	173.1	173.1	316.3	438.6	528.1	573.1	421.6	834.8	263.6	479.4	263.6	382.1	450.5	568.3	834.8
25	22.5	62.6	76.3	80.1	124.6	62.6	72.9	78.2	91.2	124.6	24.5	67.2	125.9	83.4	24.5	56.5	75.3	94.0	125.9
26	12.6	130.1	140.7	32.5	21.0	21.0	29.6	81.3	132.8	140.7	15.8	167.4	48.2	55.2	15.8	40.1	51.7	83.3	167.4
27	25.3	155.8	231.6	275.4	366.1	155.8	212.7	253.5	298.1	366.1	68.3	75.1	45.5	104.7	45.5	62.6	71.7	82.5	104.7
28	132.4	276.4	176.0	202.5	176.2	176.0	176.2	189.4	221.0	276.4	425.3	178.7	218.5	280.6	178.7	208.6	249.6	316.8	425.3
29	60.2	316.6	90.7	103.6	148.4	90.7	100.4	126.0	190.5	316.6	83.6	157.4	113.9	169.6	83.6	106.3	135.7	160.5	169.6
30	24.4	179.1	39.3	42.4	69.7	39.3	41.6	56.1	97.1	179.1	183.1	417.8	45.3	367.5	45.3	148.7	275.3	380.1	417.8
31	40.8	427.9	453.8	166.0	397.0	166.0	339.3	412.5	434.4	453.8	193.3	357.6	90.1	184.6	90.1	161.0	189.0	234.4	357.6
32	14.0	58.1	157.0	90.2	161.9	58.1	82.2	123.6	158.2	161.9	70.7	27.7	34.4	40.5	27.7	32.7	37.5	48.1	70.7
33	73.1	393.8	19.6	343.6	21.2	19.6	20.8	182.4	356.2	393.8	35.0	237.7	32.7	50.7	32.7	34.4	42.9	97.5	237.7
34	28.6	77.8	141.1	51.2	53.1	51.2	52.6	65.5	93.6	141.1	49.9	110.5	55.5	620.4	49.9	54.1	83.0	238.0	620.4
35	28.8	164.3	428.1	109.4	135.9	109.4	129.3	150.1	230.3	428.1	124.6	38.9	249.8	221.4	38.9	103.2	173.0	228.5	428.1
36	63.7	114.6	355.4	49.3	241.7	49.3	98.3	178.2	270.1	355.4	227.1	68.5	182.2	87.3	68.5	82.6	134.8	193.4	227.1
37	5.4	73.0	106.6	23.3	30.9	23.3	29.0	52.0	81.4	106.6	305.4	18.6	119.1	84.7	18.6	68.2	101.9	165.7	305.4
38	46.0	57.3	143.8	277.7	229.2	57.3	122.2	186.5	241.3	277.7	160.4	173.9	321.0	77.7	77.7	139.7	167.2	210.7	321.0
39	38.8	321.9	180.0	140.5	260.2	140.5	170.1	220.1	275.6	321.9	188.4	139.6	271.5	229.7	139.6	176.2	209.1	240.2	321.9
40	9.5	30.5	280.4	344.6	76.3	30.5	64.9	178.4	296.5	344.6	14.9	87.3	67.3	32.1	14.9	27.8	49.7	72.3	87.3
41	5.1	10.7	21.7	17.3	11.8	10.7	11.5	14.6	18.4	21.7	84.6	18.0	40.9	8.0	8.0	15.5	29.5	51.8	84.6
42	3.5	14.2	25.6	13.3	41.2	13.3	14.0	19.9	29.5	41.2	6.8	163.8	96.0	7.6	6.8	7.4	51.8	113.0	163.8
43	43.7	126.4	95.6	116.6	29.4	29.4	79.1	106.1	119.1	126.4	47.4	64.3	79.4	365.3	47.4	60.1	71.9	150.9	365.3
44	44.3	382.8	502.1	121.4	380.2	121.4	315.5	381.5	412.6	502.1	152.2	84.0	58.3	165.3	58.3	77.6	118.1	155.5	165.3
45	15.1	43.3	114.3	42.6	184.6	42.6	43.1	78.8	131.9	184.6	136.0	78.1	27.2	142.5	27.2	65.4	107.1	137.6	142.5

46	99.4	82.8	45.6	61.6	273.8	45.6	57.6	72.2	130.6	273.8	55.0	66.0	194.6	50.6	50.6	53.9	60.5	98.2	194.6
47	113.3	502.7	147.7	242.4	145.7	145.7	147.2	195.1	307.5	502.7	676.0	120.0	454.8	399.3	120.0	329.5	427.1	510.1	676.0
48	87.3	432.1	95.9	213.8	193.5	95.9	169.1	203.7	268.4	432.1	341.0	162.0	115.8	196.2	115.8	150.5	179.1	232.4	341.0
49	25.7	75.2	53.9	46.1	101.7	46.1	52.0	64.6	81.8	101.7	53.4	73.6	295.6	55.9	53.4	55.3	64.8	129.1	295.6
50	83.1	164.6	143.5	127.6	93.0	93.0	119.0	135.6	148.8	164.6	774.6	122.8	89.3	341.2	89.3	114.4	232.0	449.6	774.6
51	57.4	122.8	325.4	161.6	247.3	122.8	151.9	204.5	266.8	325.4	87.8	108.8	146.8	107.4	87.8	102.5	108.1	118.3	146.8
52	3.3	7.8	3.3	5.1	98.4	3.3	4.7	6.5	30.5	98.4	97.7	102.6	12.6	79.5	12.6	62.8	88.6	98.9	102.6
53	11.6	195.8	109.6	174.0	168.7	109.6	153.9	171.4	179.5	195.8	72.8	23.7	20.0	116.6	20.0	22.8	48.3	83.8	116.6
54	24.1	155.2	239.0	123.2	128.2	123.2	127.0	141.7	176.2	239.0	75.0	33.1	249.6	249.7	33.1	64.5	162.3	249.6	249.7
55	2.8	16.0	4.8	6.3	16.9	4.8	5.9	11.2	16.2	16.9	287.0	6.9	52.5	83.3	6.9	41.1	67.9	134.2	287.0
56	9.1	53.3	64.3	47.8	151.9	47.8	51.9	58.8	86.2	151.9	27.1	53.1	104.9	47.7	27.1	42.6	50.4	66.1	104.9
57	75.8	385.3	151.5	433.3	170.8	151.5	166.0	278.1	397.3	433.3	583.5	220.7	122.2	128.3	122.2	126.8	174.5	311.4	583.5
58	21.0	90.6	229.6	183.7	155.0	90.6	138.9	169.4	195.2	229.6	148.8	113.9	226.2	235.4	113.9	140.1	187.5	228.5	235.4
59	50.5	95.1	56.1	208.6	143.5	56.1	85.4	119.3	159.8	208.6	433.5	192.7	101.3	185.5	101.3	164.5	189.1	252.9	433.5
60	14.5	26.9	238.3	103.6	51.9	26.9	45.7	78.8	138.8	238.3	26.3	13.1	51.7	61.9	13.1	23.0	39.0	54.3	61.9
61	8.1	251.9	49.8	75.4	155.6	49.8	69.0	115.5	179.7	251.9	375.3	152.2	17.7	107.0	17.7	84.7	129.6	208.0	375.3
62	22.0	49.6	96.6	58.2	61.1	49.6	56.1	59.7	70.0	96.6	76.0	43.2	105.7	339.9	43.2	67.8	90.9	164.3	339.9
63	10.6	61.9	40.1	69.3	21.5	21.5	35.5	51.0	63.8	69.3	75.8	99.8	70.7	91.5	70.7	74.5	83.7	93.6	99.8
64	212.8	412.1	504.5	664.3	444.2	412.1	436.2	474.4	544.5	664.3	646.4	801.0	481.3	545.1	481.3	529.2	595.8	685.1	801.0
65	59.9	196.4	130.0	124.6	173.7	124.6	128.7	151.9	179.4	196.4	125.6	115.0	139.4	307.5	115.0	123.0	132.5	181.4	307.5
66	19.6	29.5	27.4	107.9	29.6	27.4	29.0	29.6	49.2	107.9	28.2	31.5	144.4	26.7	26.7	27.8	29.9	59.7	144.4
67	338.1	645.1	577.9	498.7	453.6	453.6	487.4	538.3	594.7	645.1	476.2	389.8	620.9	530.0	389.8	454.6	503.1	552.7	620.9
68	49.4	142.8	63.5	93.7	70.1	63.5	68.5	81.9	106.0	142.8	148.8	79.3	437.2	179.7	79.3	131.4	164.3	244.1	437.2
69	39.1	264.0	320.8	67.8	213.5	67.8	177.1	238.8	278.2	320.8	164.8	43.3	34.6	50.8	34.6	41.1	47.1	79.3	164.8
70	45.9	529.5	412.0	344.4	381.9	344.4	372.5	397.0	441.4	529.5	388.4	120.3	118.0	375.0	118.0	119.7	247.7	378.4	388.4
71	19.5	55.0	57.3	85.8	38.2	38.2	50.8	56.2	64.4	85.8	26.3	414.0	221.2	43.3	26.3	39.1	132.3	269.4	414.0
72	84.8	178.1	69.0	53.3	46.7	46.7	51.7	61.2	96.3	178.1	115.5	199.0	233.1	67.8	67.8	103.6	157.3	207.5	233.1
73	72.2	97.8	95.4	38.9	131.5	38.9	81.3	96.6	106.2	131.5	100.0	85.8	66.6	66.4	66.4	66.6	76.2	89.4	100.0
74	182.2	184.1	264.3	428.9	288.3	184.1	244.3	276.3	323.5	428.9	249.6	455.2	256.2	299.3	249.6	254.6	277.8	338.3	455.2
75	129.4	279.5	255.4	323.4	274.5	255.4	269.7	277.0	290.5	323.4	245.8	466.1	357.2	201.7	201.7	234.8	301.5	384.4	466.1
76	53.5	273.9	121.7	285.0	435.2	121.7	235.9	279.5	322.6	435.2	415.2	152.7	297.9	137.4	137.4	148.9	225.3	327.2	415.2
77	19.9	64.7	212.5	96.4	117.0	64.7	88.5	106.7	140.9	212.5	153.6	118.6	104.7	134.6	104.7	115.1	126.6	139.4	153.6
78	355.4	608.0	551.3	443.0	547.5	443.0	521.4	549.4	565.5	608.0	551.9	692.9	475.1	1,317.4	475.1	532.7	622.4	849.0	1,317.4
79	109.7	127.9	111.5	246.6	65.0	65.0	99.9	119.7	157.6	246.6	82.2	84.7	167.4	74.2	74.2	80.2	83.5	105.4	167.4
80	40.9	128.7	605.1	116.8	510.9	116.8	125.7	319.8	534.5	605.1	45.1	285.2	168.8	111.4	45.1	94.8	140.1	197.9	285.2
81	22.1	69.7	74.1	279.1	65.5	65.5	68.7	71.9	125.4	279.1	133.7	132.5	41.1	181.0	41.1	109.7	133.1	145.5	181.0
82	9.8	88.1	113.9	189.9	15.5	15.5	70.0	101.0	132.9	189.9	97.9	95.9	111.2	16.9	16.9	76.2	96.9	101.2	111.2
83	7.5	97.5	424.0	125.7	69.1	69.1	90.4	111.6	200.3	424.0	305.7	159.7	127.7	31.0	31.0	103.5	143.7	196.2	305.7
84	7.5	24.7	87.3	143.3	41.4	24.7	37.2	64.4	101.3	143.3	17.5	157.6	35.4	22.8	17.5	21.5	29.1	66.0	157.6
85	50.1	61.7	168.1	145.4	371.6	61.7	124.5	156.8	219.0	371.6	140.3	287.5	73.2	109.8	73.2	100.7	125.1	177.1	287.5
86	16.0	112.4	57.0	137.0	300.1	57.0	98.6	124.7	177.8	300.1	39.8	105.2	35.8	61.8	35.8	38.8	50.8	72.7	105.2
87	42.5	71.3	111.7	80.3	56.9	56.9	67.7	75.8	88.2	111.7	68.6	69.7	251.4	80.2	68.6	69.4	75.0	123.0	251.4
88	108.3	263.0	290.2	524.2	391.0	263.0	283.4	340.6	424.3	524.2	198.0	620.3	437.9	509.9	198.0	377.9	473.9	537.5	620.3
89	17.3	53.8	16.3	25.2	91.3	16.3	23.0	39.5	63.2	91.3	21.4	27.0	81.3	48.4	21.4	25.6	37.7	56.6	81.3
90	10.5	283.8	319.0	194.2	31.5	31.5	153.5	239.0	292.6	319.0	85.0	297.0	34.7	125.1	34.7	72.4	105.1	168.1	297.0
91	7.8	111.6	76.3	13.3	55.9	13.3	45.3	66.1	85.1	111.6	190.2	11.8	56.0	12.4	11.8	12.3	34.2	89.6	190.2
92	6.1	134.9	32.6	73.8	19.9	19.9	29.4	53.2	89.1	134.9	121.0	27.3	399.9	28.9	27.3	28.5	75.0	190.7	399.9
93	122.9	102.4	339.7	182.4	140.0	102.4	130.6	161.2	221.7	339.7	131.1	182.0	163.8	199.7	131.1	155.6	172.9	186.4	199.7
94	68.9	262.4	343.1	105.5	156.2	105.5	143.5	209.3	282.6	343.1	200.8	64.5	94.5	107.7	64.5	87.0	101.1	131.0	200.8
95	434.9	708.4	414.7	513.1	478.0	414.7	462.2	495.6	561.9	708.4	457.1	741.3	848.2	566.6	457.1	539.2	654.0	768.0	848.2
96	15.8	41.3	76.0	164.0	100.2	41.3	67.3	88.1	116.2	164.0	27.4	306.5	35.2	32.7	27.4	31.4	34.0	103.0	306.5
97	142.5	352.4	312.1	167.3	317.6	167.3	275.9	314.9	326.3	352.4	236.6	591.7	183.7	159.8	159.8	177.7	210.2	325.4	591.7
98	10.0	11.2	37.4	16.5	95.1	11.2	15.2	27.0	51.8	95.1	25.3	325.6	39.9	25.4	25.3	25.4	32.7	111.3	325.6
99	34.9	64.3	93.0	144.8	63.1	63.1	64.0	78.7	106.0	144.8	68.5	383.2	189.5	167.4	68.5	142.7	178.5	237.9	383.2

Timing Intervals for Each Refresh Function (In Seconds)

DM Fx	R-Run1	R-Run2	R-Run3	R-Run4	Min	25%tile	Median	75%tile	Max
LF_CR	35.0	34.1	37.1	40.2	34.1	34.8	36.1	37.9	40.2
LF_CS	59.4	58.4	64.3	48.1	48.1	55.8	58.9	60.6	64.3
LF_I	27.0	26.7	19.0	20.9	19.0	20.4	23.8	26.8	27.0
LF_SR	32.2	33.1	35.8	37.3	32.2	32.9	34.5	36.2	37.3
LF_SS	87.5	60.4	64.1	51.7	51.7	58.2	62.3	70.0	87.5
LF_WR	32.5	29.5	36.0	34.7	29.5	31.8	33.6	35.0	36.0
LF_WS	36.8	36.4	43.6	43.9	36.4	36.7	40.2	43.7	43.9
DF_CS	217.0	212.0	215.4	212.9	212.0	212.7	214.2	215.8	217.0
DF_SS	187.3	172.2	188.6	189.6	172.2	183.5	188.0	188.9	189.6
DF_WS	124.6	135.8	131.1	152.5	124.6	129.5	133.5	140.0	152.5
DF_I	64.9	95.1	102.5	62.8	62.8	64.4	80.0	97.0	102.5